ENVIRONMENTAL PREVIEW REPORT PURSUANT TO THE NEWFOUNDLAND AND LABRADOR *ENVIRONMENTAL PROTECTION ACT*

AGS Fluorspar Project
St. Lawrence, NL
Volume 2, Appendix E-1

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Newfoundland and Labrador Department of Environment and Conservation, Environmental Assessment Division

Submitted by:
Canada Fluorspar (NL) Inc.

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APPENDIX E-1

Phase 1 Hydrogeology Program

REPORT

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PROPOSED AGS MINE PROJECT

Phase 1 Hydrogeology Study Canada Fluorspar Inc. St. Lawrence, NL (Rev 0)

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Golder Associates

Executive Summary

This report presents the results of an initial phase (Phase 1) of hydrogeological and hydrological site investigations to provide the data necessary to support an Environmental Impact Assessment (EIA) for the AGS Mine Project (the Project), a proposed fluorite mine to be located on the Burin Peninsula 1 km south of the Town of St. Lawrence, Newfoundland (Figure 1), owned by Canada Fluorspar (NL) Inc. (CFI).

The mining concept being developed will likely comprise:

- Shallow surface mining with the later development of an underground mine; or
- Underground mining only

Given that the hydrogeological program to assess inflows and environmental effects will be quite different for these two mining concepts, Phase 1 program focused on information requirements generally applicable to both mining concepts with a later phase of the program tailored more specifically the proposed mining plan when developed.

The study area targeted an assumed general outline of the surface mine as shown on Figure 2, considering a project footprint in which Grebes Nest pond would be removed during mining and John Fitzpatrick Pond to the north and Upper Island Pond to the east would not be disturbed.

The scope of work can be summarized as follows:

- Limited hydrological measurements and limited sampling of surface water and groundwater including
  - Test pit excavation and shallow upper bedrock borehole drilling completed with monitoring well installations;
  - Monitoring well development, groundwater sampling and in-situ hydraulic conductivity testing;
  - Staff gauge stream flow measurements and surface water sampling;
  - Collection of relevant climate data and the locations of nearby municipal water wells sources; and
  - General geology information.

The report text presents the results of these investigations including with limited interpretations. Supporting factual data are provided in Appendices A through I.

Table of Contents

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

This report presents the results of an initial phase of hydrogeological and hydrological site investigations to provide the data necessary to support an Environmental Impact Assessment (EIA) for the AGS Mine Project (the Project), a proposed fluorite mine located on the Burin Peninsula 1 km south of the Town of St. Lawrence, Newfoundland (Figure 1), owned by Canada Fluorspar (NL) Inc. (CFI).

2.0 SCOPE OF WORK

CFI retained Golder Associates Ltd (Golder) to carry out these investigations. The scope of work is outlined in Golder's Hydrogeology field work – Memorandum dated October 1, 2014 and can be summarized as follows.

- Limited hydrological measurements and limited sampling of surface water and groundwater.
- For the purpose of developing this program we have assumed a general outline of the surface mine as shown on Figure 2; wherein Grebes Nest pond would be removed during mining and John Fitzpatrick Pond to the north and Upper Island Pond to the east would not be disturbed.
- Thus the focus of this program is the hydrogeological and hydrological conditions in the vicinity of these ponds located immediately down gradient of the assumed surface mine footprint.

3.0 BACKGROUND

The granite hosted veins have been operated by several owners over the past seven decades; before 1957 by the St. Lawrence Corporation and between 1940 and 1978 by Alcan. During the period 1979 to 1984 the mine was idle until operation was resumed in 1986 by St. Lawrence Fluorspar Limited, a subsidiary of Minworth. The mine has been out of operation since 1991 (Scott, 2009).

The site is a former Aluminum Company of Canada (ALCAN) fluorspar mine which closed down its operations in 1977. Limited production was reported between 1986 and 1991 by St. Lawrence Fluorspar.

The mineralized rock at the AGS vein is hosted in meta-sediments and rhyolites, in a ratio of approximately 70:30 meta-sediments to rhyolite that are variably fractured with some fine-grained intrusive(s) of granitic composition (i.e. rhyolites). The mineralized zone is subvertical with thicknesses ranging from about 3 to 25 metres (m). Groundwater levels are reported to be close to ground surface and drill water circulation is lost close to surface in many boreholes. Drillers report some indication of drill water reporting to surface at nearby boreholes prior to these being grouted. Further east, the previously mined deposits comprising the Tarefare, Director and Blue Beach veins, are hosted predominantly in granites with limited occurrences of meta-sedimentary rocks. These mines were each reported to have groundwater inflows of about 2,000 to 3,000 gallons per minute (gpm).

In parallel, Golder has completed water quality sampling at various water courses and streams at the Project site. Several of the groundwater monitoring installations were completed to integrate the assessment of groundwater / surface water interactions.

4.0 FIELD INVESTIGATION

This phase of the program comprises the limited assessment of baseline hydrogeological, limited hydrological conditions and baseline water quality. It can be summarized as follows.

- Four (4) test pit excavation of overburden materials, completed with 38.1 millimetres (mm) Inner diameter (ID) standpipes placed in the backfill.
  - Soil sampling for grain size analysis from test pit samples.
- Borehole drilling and rock core logging at four (4) locations adjacent to the test pits completed with ID 38.1 mm standpipe shallow bedrock monitoring wells.
- Well development, water level measurements, hydraulic response (slug) testing at all 8 monitoring wells.
- Hydraulic response (slug) testing and pumps testing at two existing exploration boreholes.
- Completion of three river staff gauge installations.
- Water quality sampling at 8 streams and 4 ponds.
- Groundwater sampling from 4 monitoring wells and two exploration boreholes (open holes).

Monitoring well, staff gauge locations along with surface water sampling locations are shown on Figure 1. A summary of monitoring well details is provided in Table 1. Borehole logs are provided in Appendix A.

The test pit and borehole locations were selected according to the assumed footprint of a possible open pit. The test pits were excavated to refusal. The shallow drilling depths of 3 m into rock was with specific purpose to compare overburden and near surface bedrock water levels and water quality for hydraulic connection and gradients.

Table 1: Monitoring Well Summary Details

Well ID	GPS Easting WGS84	GPS Northing WGS84	Hole Diameter (mm) Or test pit	Well Depth (mbgs)	Screen Top (mbgs)	Top of Bedrock	Screened Geologic Unit	Water Level (mbgs)	Vertical Gradient (m/m)
MW14-01A	617,458	5,195,561	96	6.4	4.9	6.8	Overburden	0.28	-0.03
MW14-01B	617,465	5,195,550	Test pit	1.9	0.4	-	Overburden	0.41	
MW14-02A	617,096	5,196,293	75.7	8.5	7.0	4.8	Meta-sediments	2.90	0.32
MW14-02B	617,101	5,196,293	Test pit	1.8	0.3	-	Overburden	0.74	
MW14-03A	616,285	5,196,552	75.7	5.5	4.0	2.4	Meta-sediments	0.60	0.12
MW14-03B	616,284	5,196,552	Test pit	1.8	0.3	-	Overburden	0.14	
MW14-04A	615,673	5,196,695	75.7	6.4	4.9	2.0	Meta-sediments	0.49	0.10
MW14-04B	615,671	5,196,693	Test pit	1.6	0.1	-	Overburden	0.03	

Note: "A" denotes well in borehole and
"B" refers to well in test pit

The following subsections provide details on the rationale, methodology, and results of the field investigation.

4.1 Rationale

The field investigation was developed to support the estimate of groundwater inflows to the proposed AGS mine and the assessment of effects on the surface environment.

We understand the mining concept being developed will likely comprise:

- Shallow surface mining with the later development of an underground mine; or
- Underground mining only.

Given that the hydrogeological program to assess inflows and environmental effects will be quite different for these two mining concepts, we have proposed a staged program with the Phase 1 program focusing on information requirements generally applicable to both mining concepts with a later phase of the program tailored more specifically the proposed mining plan when developed.

The Phase 1 program was established to assess baseline hydrogeological conditions generally at the assumed perimeter of the surface mine footprint, the limited hydrogeology studies were conducted in the following areas:

- At the assumed perimeter of the surface mine footprint (MW14-4, MW-14-3, PGS-93b, PGS-124). See Figure 2.
- In the vicinity of John Fitzpatrick Pond and Upper Island Pond located immediately down-gradient of the assumed surface mine footprint (MW14-1, MW14-2).

In order to assess the interaction of the surface water features with the shallow table and to augment the bioscience work program, we have included:

- The installation of three staff gauges and collection of flow measurements in local streams at locations shown on Figure 1.
- Limited hydrological sampling of surface water bodies WQ STA-1, WQ STA-7, WQ STA-3, WQ STA-4, WQ STA-8, and WQ STA-9, shown on Figure 1.
- Due to overlapping aquatic and water quality programs with this Phase 1 program, additional sampling was carried out at the following locations: WS-2, WS-5, WS-10, WQ STA-5, WQ STA-6, and WQ STA-2.

In order to assess these areas, a total of four well clusters consisting of two monitoring wells ("deep" – A-series and "shallow" – B-series) were completed, resulting in total of 8 wells (Figure 1). Table 1 provides a specific location and construction detail for each well cluster. Prior to drilling, each location was first visited and approved by CFI staff.

4.2 Methodology

4.2.1 Test pit Excavation and Borehole Drilling

Test pit and borehole drilling activities occurred between October 20, 2014 and October 24, 2014. Excavation and drilling was undertaken by Springdale Diamond Drilling contractor, an affiliate of Springdale Forest Resources, Inc. Test pit excavation of overburden materials and adjacent borehole drilled to approximately 3 m into rock were completed; for a total of four test pits and four adjacent boreholes. All test pit excavation and drilling activities were overseen by a Golder field geologist.

Test pit locations were selected in the field to avoid shallow depths to rock so as to characterize the overburden materials below the organic soil cover. Test pits were excavated by Springdale Drilling using a CAT 320B backhoe. The pits ranged in depth from 1.6 to 2.0 m and were in back filled with cutting the same day. Overburden samples were recovered from the excavator bucket and examined at surface and one sample of granular material from each excavation submitted for grain size analysis.

Boreholes were drilled by Springdale Drilling using a track mounted, Duralite 800 diamond drill. The boreholes ranged in depth from 5.5 m to 8.8 m with a total of 27.8 m drilled. Borehole was drilled with NQ rods with a nominal hole diameter of approximately 76 mm. A continuous core of bedrock was obtained by Springdale Drilling. After drilling, the core was stored in CFI core shack and logged and photographed by Golder.

Springdale Drilling used a biodegradable drilling additive, called Poly-Plus, while drilling the boreholes to raise drill cuttings and to maintain stability of borehole wall during drilling. Immediately after drilling to depth, fresh and clean water was circulated for about 30 minutes to wash any additive out of the borehole.

Borehole logs are presented in Appendix A. Test pit logs and images are presented in Appendix B.

4.2.2 Monitoring Well Installation

All well installations were completed by Springdale Drilling and overseen by a Golder field geologist. A total of four monitoring well clusters consisting of two holes (“deep” – A-series and “shallow” – B-series) were completed, resulting in a total of eight monitoring well standpipe piezometers.

A typical well installation involved the following procedure:

Following the excavation of the test pit a standpipe piezometer was placed into the excavation backfilled with nominal compaction of the excavated materials. The “shallow” – B-series monitoring well consists of a 1.5m long PVC well screen (number 10 slot size, 38.1 mm diameter), with riser pipe extending about 1 m above ground surface.

At the completion of the drilled borehole, the NQ rods were removed and a 1.5 m long PVC well screen (number 10 slot size, 38.1 mm diameter), was lowered down the borehole. About 1 m of riser pipe was left extending above ground surface. Silica filter sand was used to fill the annular space to a selected depth above the screen, followed by bentonite pellets (hole plug) and completed with an above ground protective steel casing. With the exception of MW14-01, the HQ surface casing was left in the borehole to provide an anchor for the protective surface casing.

Monitoring well installation record along with photos of completed well installations is presented in Appendix C.

4.2.3 Well Development

The screened intervals in each of the B-series monitoring well were developed by air-lifting for about one hour to improve the hydraulic connection between the well intake screen and the surrounding host unit by removing sediment and residual materials from drilling and well installation activities.

The water level in the well was allowed to rise to a static condition following to well development (air lift), whereupon a depth to water measurement was recorded.

A full round of stabilized groundwater levels were manually measured by Golder on November 1, 2014. Water levels are presented in Table 1. A water level probe was utilized for all water level measurement events.

4.2.4 Groundwater Sampling

Groundwater samples were collected from the 4 monitoring wells installed in bedrock and the 2 exploration boreholes for a total of six groundwater sample suites. With the exception of MW14-04A which was sampled with a disposable bailer, samples were collected using air lift techniques.

Groundwater quality sample were collected from monitoring wells:

- MW14-01A, MW14-02A, MW14-03A, immediately following well development on October 24, 2014.
- MW14-04A, on November 4, 2104. The following day after well was purged dry.
- PGS-93b, and PGS-124, immediately following constant rate pump test on October 25 and 26, 2014.

Field measurements were collected at the time the sample was taken with a pH/temperature metre and a conductivity/temperature metre. The results are outlined in section 5.

Sampling was conducted in accordance with standard practices to obtain a representative sample and to avoid cross contamination between monitoring locations. Chemical analysis was carried out by Maxxam and one blind duplicate sample was taken for QA/QC purposes.

The groundwater samples were analyzed for a general suite of inorganic parameters including pH, conductivity, major ions and heavy metals, TDS, TSS, nitrates, nitrites and ammonia following the same suite as for surface water. The test results were compared to the Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, 2014. These analytical results will provide a limited and general characterization of the bulk hydrogeological conditions of the rock encountered over the length of each borehole.

Maxxam's Laboratory water quality analysis report can be found in Appendix D.

4.2.5 Monitoring Well Coordinates

Well locations were obtained Golder using a hand-held Garmin Geographical positioning Device Model No 60Sx. The average accuracy of this device is within 3 m (Garmin, 2014). Well locations were surveyed on November 19, 2014, by Edward and Associates Ltd. under contract with Canada Fluorspar Inc. Well coordinates are presented in Table 1 and Appendix C and well locations shown in Figure 1.

4.2.6 Hydraulic Conductivity Testing

Hydraulic conductivity testing is used to characterize groundwater flow through soil or rock. Hydraulic conductivity (K) describes the ease with which groundwater can move through pore spaces or fractures. Localized estimates of hydraulic conductivity may be obtained through the analysis of in-situ hydraulic response tests or pumping tests of groundwater wells.

In-situ rising or falling head tests were completed at each well by Golder to estimate the hydraulic conductivity of screened units at the site. In some cases multiple (confirmatory) tests were performed. The hydraulic testing involved establishing a static water level depth and then instantaneously removing or adding a known volume (a “slug”) to the well to observe the hydraulic head response over time. Recovering water levels were measured using automatic groundwater data loggers set to record time, pressure and temperature at a time interval selected based on the rate of recovery during well development. Water levels were measured manually to determine the end of the test and the data logger removed and downloaded. The hydraulic response data was processed in the software package Aqtesolv Pro (HydroSOLVE Inc., 2014) and interpreted using the Hvorslev mathematical solution (Hvorslev, 1951). Details of these tests are presented in Appendix E.

The open hole pumping tests were conducted in two exploration holes that were at least 150m deep, with the pump set no deeper than 15m downhole. Exploration hole pGS-93b (GS-14-113) was pumped at approximately 2 L/min for about 75 minutes. While exploration hole pGS-124 (GS-14-94) was pumped at approximately 9 L/min for about 140 minutes. These short-term pumping tests were evaluated using the Thiem (1906) solution for steady-state flow to a well, which is a high-level hydrogeological method used to provide preliminary quantitative characterization. Details of these tests are presented in Appendix E.

4.2.7 Surface Water Monitoring (Staff Gauges and Stream Flow Measurements)

The surface water monitoring program was undertaken to assess the interaction of the surface water features with the shallow groundwater table and to augment the bioscience work program. The limited baseline surface water program consisted of two components:

1) Water level monitoring at the outlet from each pond (Fitzpatrick Pond, Upper Island Pond, and un-named pond) via periodic staff gauge measurements.

2) Field stream surveys for stream characterization.

The locations of the surface water monitoring have been selected to coincide with the monitoring locations in the aquatics program as appropriate.

4.2.7.1 Staff Gauge

Three staff gauges SW-1, SW-2, and SW-3 with locations coinciding with surface monitoring stations WQ STA-1, WQ STA-3, and WQ STA-9 were installed on October 29, 2014, by Golder field staff in local streams at locations shown on Figure 1. A data logger was installed in the stream, adjacent to each staff gauge to develop a continuous record of water levels and water temperatures at these locations. Data loggers were installed on October 29th and removed on November 20, 2014, before streams begin freezing.

Each station involved stakes (T-Posts) installed at the approximate channel mid-point with a pressure transducer data logger (Schlumberger DIVER DI501) attached near the base of the T-Posts using a karabiner and eye bolt, and a stainless steel cable, to secure the data logger at a fixed position above the channel bed. A level survey was completed to reference these stations. A removable acrylonitrile butadiene styrene (ABS) plastic casing was fitted to the T-Posts at both stations to prevent water level disturbance (by turbulence and/or debris).

Photographs of staff gauge completion are presented in Appendix F and surface water hydrographs are shown in Appendix G.

4.2.7.2 Stream Flow Measurements

Stream surveys were carried out by Golder field staff, with the assistance of CFI personnel on October 31, 2014.

The stream flow surveys were carried out the following surface monitoring stations, which were established downstream of the corresponding Ponds (Figure 1):

- WQ STA-1: The surface monitoring station is located about 86 m downstream of Upper Island Pond. One transect, or cross-section, located 13 m downstream of staff gauge SW-1 was surveyed.
- WQ STA-3: The surface monitoring station is located about 36 m downstream of John Fitzpatrick Pond. Two transects, were surveyed: One transect positioned at staff gauge SW-2 and the second transect at approximately 18 m downstream of staff gauge SW-2.
- WQ STA-9: The surface monitoring station is located about 41 m downstream of the pond inlet. Two transects, were surveyed: One transect positioned at staff gauge SW-3 and the second transect at approximately 3.4 m downstream of staff gauge SW-2.

Streamflow measurements were estimated using the velocity-area method. A tape measure was extended the length of a representative cross-section during measurement. Streamflow velocities and corresponding water depths were collected at various intervals along the cross-section (0.1 m to 0.2 m). Current velocities were recorded using a Flo-Mate2000 Electromagnetic Flow Meter (EM Flow Meter) at 60% of the total water depth (for water depths less than 0.50 m) or at the 20% and 80% depths and then averaged (for water depths greater than 0.50 m). The sum of the flows in all segments yields the total flow at the station at the time of each measurement. Stream flow transect photos and discharge calculations are presented in Appendix H.

4.2.8 Surface Water Sampling

Surface water quality sampling was conducted from November 3 to 4, 2014 to provide a limited baseline of the existing surface water quality against future potential impacts to the surface water as a result of the proposed mining operations. As part of the hydrogeological phase 1 investigation, sampling occurred at six locations: WQ STA-1, WQ STA-7, WQ STA-3, WQ STA-4, WQ STA-8, and WQ STA-9. Due to overlapping aquatic and water quality programs, additional sampling was carried out at the following locations: WS-2, WS-5, WS-10, WQ STA-5, WQ STA-6, and WQ STA-2. Sampling locations are shown on Figure 1 and sampling location images are presented in Appendix I.

Field measurements were collected at the time sample was taken with a pH/temperature metre and a conductivity/temperature metre. The results are outlined in Section 5.

Sampling was conducted in accordance with standard practices to obtain a representative sample and to avoid cross contamination between monitoring locations. As with the groundwater sampling, chemical analysis was carried out by Maxxam.

The surface water samples were analyzed for a broad suite of inorganic parameters including pH, conductivity, major ions and heavy metals, TDS, TSS, nitrates, nitrites and ammonia following the same suite as for groundwater. The test results were compared to the Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, 2014.

Maxxam's Laboratory water quality analysis report can be found in Appendix D.

4.2.9 Long Term Groundwater Monitoring

Golder installed pressure transducer data logger (Schlumberger DIVER DI502) in four monitoring wells completed in bedrock and two exploration boreholes to collect a continuous record of water levels: MW14-01A, MW14-02A, MW14-03A, MW14-04A PGS-93a and PGS-124. Loggers were installed in their corresponding wells on November 1, 2014, and then removed from the well on November 20, 2015, the data uploaded and then placed back in the corresponding wells the following day. A barometric pressure data logger (Schlumberger DIVER DI500) was installed inside the protective casing of MW14-01A to provide atmospheric pressure compensation for the water level loggers.

The loggers were set to record data every hour, which allows for more than a year data collection between data logger downloads. Given that loggers can sometimes fail, it is advisable to download the loggers quarterly as access allows.

Daily precipitation and temperature records for the monitoring period were obtained from the Environment Canada meteorological station, which is located approximately 1 km east of the town of St. Lawrence. Results are presented along with the hydrographs in Appendix G.

5.0 RESULTS

5.1 Physiography

The Project topography is generally controlled by underlying bedrock geology and the effects of glaciation and associated soil deposits, ranging from 80 m above sea level (masl) to over 150 masl (Figure 3). The majority of the area is hummocky with small ponds and drainage systems with relatively low gradients over much of their lengths.

The area surrounding the Site is covered with hummocks of grasses, many ponds and drainage brooks. There are abundant outcrops and peat bogs in the low lying areas.

With the exception of the Project access road and exploration drill roads, the surrounding countryside is accessible only by footpaths and/or All-Terrain Vehicle (ATV).

5.2 Climate

The Project area climate is marked by foggy, cool summers and short relatively moderate winters. The mean annual temperature is approximately 5.5°C. The mean summer temperature is 11.5°C and the mean winter temperature is -1°C. The mean annual precipitation ranges 1200 to over 1600 mm (Transport Canada, 2010).

Environment Canada meteorological station, which is located approximately 1 km east of the town of St. Lawrence, and assumes to be the nearest source of suitable precipitation data. Meteorological records are available-online:
http://climate.weather.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=NL%20%20&StationID=45567&dlyRange=2006-12-01|2014-09-18&Year=2014&Month=7&Day=18

The monthly mean precipitation normal for St. Lawrence are provided in Table 2-1. Based on 2014 precipitation data, a total of 1350.3 mm of precipitation fell up to November 23rd. Precipitation occurs all year round as rain with some snow in winter. The long term average rainfall (1971-2000) over the area was 1564.1 mm ranging between 1000 mm and 1650 mm per year (Scott, 2009).

Table 2-1: Monthly Mean Total Precipitation for the Environment Canada meteorological station near St. Lawrence, NL

Month	Total Precip. (mm)	Days Missing
Jan-14	227.9	1
Feb-14	118.3	0
Mar-14	148.8	0
Apr-14	91.3	1
May-14	143.2	0
Jun-14	131.1	0
Jul-14	86.3	0
Aug-14	108.7	0
Sep-14	31	0
Oct-14	119	1
Nov-14	144.7	8
Dec-14	0	31

Table 2-2: Monthly Mean Total Precipitation (mm) for the Environment Canada Meteorological Station

Station	Code [1]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean Annual
St. Lawrence	A	140.2	121.6	122.7	118.9	118.5	133.1	109.4	106.1	157.4	157.4	146.4	132.4	1564.0

Note:

1. The minimum number of years used to calculate normals are indicated by a "code" defined as:

- "A": No more than 3 consecutive or 5 total missing years between 1971 to 2000.

Source: Environment Canada Meteorological Data website, date modified 08/08/14.

5.3 Water use

The St. Lawrence potable water supply system draws from the intake (WS-S-0699) in the St. Lawrence River located approximately 7 km northeast of the AGS Site, as shown on Figure 4. The nearby communities of Lawn and Little St. Lawrence obtain their potable water from intakes at Brazil Pond and Butler's Brook, respectively. Brazil Pond intake (WS-S-0406) is located approximately 9 km northwest of the AGS Site while two intakes exists for Butler's Brook (WS-S-0421) located about 7 km east of the AGS Site (refer to Figure 4).

Source data

Community	LGP Number	Serviced A	SA Number	Source Name	WS Number
Little St. Lawrence	2885	Little St. Lawrence	Sa-0433	Butler's Brook	WS-S-0421
Little St. Lawrence	2885	Little St. Lawrence	Sa-0433	Butler's Brook	WS-S-0421
Lawn	2745	Lawn – PWDU	SA-0936	Brazil Pond	WS-S-0406
Lawn	2745	Lawn – PWDU	SA-0936	Brazil Pond	WS-S-0406
Little St. Lawrence	4435	Little St. Lawrence – PWDU	SA-0910	St. Lawrence River	WS-S-0699
Little St. Lawrence	4435	Little St. Lawrence	SA-0724	St. Lawrence River	WS-S-0699

5.4 Geology

5.4.1 Regional Geology

The St. Lawrence fluorspar deposits are situated within the Avalonian belt of the Appalachian mountain system which is more than 200 km wide on land and extends more than 400 km offshore. The bedrock is characterized by widespread sections of thick volcanic rocks and marine to terrestrial clastic sedimentary rocks of Pre-Cambrian age. These are locally overlain by predominantly shallow marine sedimentary rocks of Cambrian age. Both sequences are locally overlain with angular unconformity by Carboniferous age sedimentary and volcanic rocks. There are several Late Precambrian and Late Devonian to Carboniferous granite intrusions throughout the Avalonian belt system in eastern Newfoundland (Scott, April 2009).

The geology of the area is described in detail by the Mineral Development Division of Newfoundland and Labrador's Department of Mines and Energy (Scott, 2009).

5.4.2 Site Geology

Geological reports and maps indicate that the Site is underlain by gravel and sand deposits of glacial outwash and fluvial origin and Till veneer (refer to Figure 3). The geological sequence in the overburden typically consists of a thin layer (~1m) of surficial organic soils, underlain by glacial till comprised of silty sand and gravel with varying percentages of cobbles and boulders. Based on the results of the subsurface investigation, superficial material is observed to be up to 5 metres in thickness and absent in places where the bedrock is exposed.

Shallow rock types observed at the AGS Site are typically meta-sedimentary rocks and some fine-grained intrusive(s) of granitic composition (i.e. rhyolites). These rocks form part of the Pre-Cambrian Burin Group which is comprised of sedimentary and meta-sedimentary rocks and subordinate volcanic flows consisting of pillowed and massive basaltic and andesitic flows and aquagene tuffs (Howse A, et all, 1983).

Outcrops of felsic rocks of the intrusive St. Lawrence batholith were observed at the AGS Site but only metasediments were intercepted in the investigation boreholes. The St Lawrence batholith is comprised of leucocratic granites (Scott, Oct. 2009). Figure 5 shows the bedrock geology which includes a 200 to 500 m wide belt of Plutonic Felsic rock consisting mainly of rhyolite of the St. Lawrence batholith, trending northwest through Gerbes Nest Pond and flanked by siliciclasitic marine shale or meta-sediments of the Burin Group.

Geological cross section along NE-SW direction is presented in Figure 6. The fluorite veins at the AGS Site are hosted in meta-sediments and are genetically and spatially associated with the rhyolite sills which form part of the St. Lawrence batholith (refer to Figure 6) As shown in Figure 6, the mineralized zone, veins, are subvertical and tend to follow fault system.

St. Lawrence Fluorspar occurs as a hydrothermic deposit in the fissures in the fine-grained intrusives of granitic composition. The veins were reported to persist for many hundreds of metres with lengths ranging from less than 100 m to over 2,100 m and thicknesses of several metres, averaging 11 m (Harris A, et al. 1999).

5.4.3 Borehole Stratigraphy

Test pit log records (including test pit images) and gradation curves are provided in Appendix B.

Surficial soil conditions observed during excavation of test pits are summarized as follows:

- A layer of organic soil ranging in thickness from 0.5 to 1.0 m was encountered in all four test pits. The organic soil comprised of dark brown silty clay with rootlets, moss and/or peat. Test pit, TP-01, also contained some cobbles and sparse boulders.
- This was underlain by glacial outwash deposits (observed in TP-03 and TP-04) composed of varying proportions of sand and gravel (~30% to 90% gravel), with less than 10% silt. The unit thickness varied between 1 to 1.5 m.
- In test pits, TP-01 and TP-02, a compact till was encountered underlying the organic soil. The till layer is at least 1 mr thick and contains 30% to 80% matrix (sand size or finer), and 80% to 20% clasts (greater than sand size).

Gradation analysis carried out on 4 representative samples generally confirmed the interpretation of the main stratigraphic units. Laboratory testing used the Unified Soils Classification System (USCS) to label the soil. The till material obtained from TP-01 and TP-02 labelled SM contained 32.6% to 40.4% gravel, 40.8% to 41.6% sand and 18.8% to 25.8% fines (silt/Clay). The till material obtained from TP-03 and TP-04, labelled GP-GM and GW respectively, contained 67.4% to 68.9% gravel, 23.8% to 29.6% sand and 1.5% to 8.5% fines (silt/Clay).

It should be noted that both TP-03 and TP-04 had a visually estimated larger rate of groundwater seepage into the pit than TP-01 and TP-02. This can be attributed to the coarser grained material exposed.

Borehole log records, including rock core photos and geophysical logs of selected exploration wells are provided in Appendix A.

The bedrock geology at the four new monitoring wells consisted of Grey-green, fresh, medium strong, Meta-sediment rock with weak chlorite alteration. The depth to top of bedrock ranges from 2.0 m to 6.8 m below ground surface.

At borehole BH14-01, large cobbles and boulders in the surficial material made drilling difficult and drilling was terminated after drilling 20 centimeters (cm) into bedrock. Bedrock was observed to contain numerous fractures within the first 2 m with fractures becoming less frequent with depth. The Rock Quality Designation (RQD) presented in the borehole field logs is a quantitative index of the rock quality with 100% RQD representing the highest quality (little to no fractures). The RQD values for the first 1.5 metre run in boreholes BH14-02, BH14-03, and BH14-04 are 50%, 77%, and 88%, respectively.

The geophysical log results for PGS-93b and PGS-124 are provided on the borehole records in Appendix A. The logs generally confirmed the stratigraphy and identified depth of large fractures along with fracture frequency. There significant rock fractures effect on the caliper and televiewer log response at 6.06 and 7 metres below surface and in the very near surface in borehole PGS-93b. Similarly, log shows significant rock fractures in borehole PGS-124, from 5.6 to 13.6 metres below surface.

5.4.4 Hydraulic Response Testing

This section provides a summary of the shallow overburden and bedrock hydraulic conductivity in the area of the AGS mine. These hydraulic conductivities are from 8 single well response tests and also from 4 grain size analysis which were completed that were also used to determine the hydraulic conductivity via the Hazen method.

The hydraulic parameter used to characterize groundwater flow through soil or rock is hydraulic conductivity. Hydraulic conductivity (K) describes the ease with which groundwater can move through pore spaces or fractures. Localized estimates of these parameters may be obtained through the analysis of in-situ hydraulic response tests, or slug tests, of groundwater monitoring wells.

In-situ rising and falling head tests were completed at each monitoring well to estimate the hydraulic conductivity of screened units at the site. In some cases multiple (confirmatory) tests were performed. The hydraulic testing involved establishing a static water level and then instantaneously removing or adding a known volume (a "slug") to the well to observe the water level response over time. Recovering water levels were measured using data loggers set to record pressure at a 0.5 or 10 second time interval. In addition, water levels were manually measured to determine the end of the test; afterwards the data logger was removed and the data uploaded to a computer. Golder conducted slug testing on the four monitoring wells installed in October 2014 and in two existing exploration boreholes. The hydraulic response data was processed in the software package Aqtesolv Pro (HydroSOLV Inc., 2014) and interpreted using the Hvorslev Solution.

The pumping test was conducted for the two exploration holes PGS-93b and PGS-124. Short-term pumping tests were evaluated using the Thiem (1906) solution for steady-state flow to a well, which is a high-level hydrogeological method used to provide preliminary quantitative characterization. To account for uncertainties in the length of the borehole that contributes flow (b) and the radius of influence from pumping (R), these parameters were varied in a sensitivity analysis. Corrections for borehole inclination were also used to test the sensitivity of the results. Estimates of hydraulic conductivity were corrected for input parameters and associated estimates of K for PGS-93b and PGS-124 are presented in Table 3.

Table 3: Input Parameters and Hydraulic Conductivity Estimates

Parameter	Borehole PGS-93b	Borehole PGS-124
Flow Rate (Q), in m^3/s	$3.3*10^{-5}$	$1.5*10^{-4}$
Constant Head Drawdown (s), in m	0.93	4.8
Radius of Well (R_w), in m	0.03785	0.03785
Borehole Length Contributing Flow (b), in m	10 – 20	10 – 20
Radius of Influence (R), in m	1 – 100	1 – 100
Hydraulic Conductivity (K), in m/s	$8*10^{-7}$ – $4*10^{-6}$	$7*10^{-7}$ – $4*10^{-6}$

After cessation of airlifting / pumping, there were several occasions where water was heard to be entering the borehole from above, possibly at the base of the surface casing. If this is the case, and water was recharging the borehole from the bedrock / overburden interface, the above hydraulic conductivity estimates would be invalid.

The core logging and geophysics records shown in Appendix A, indicate that the permeability of the bedrock is primarily related to open, near surface, bedding/joint partings within the rock. Therefore, the hydraulic conductivity values determined during slug tests are considered to primarily reflect a secondary permeability along the open bedding/joint partings.

Table 4 summarizes the hydraulic conductivities estimated from the results of the rising and falling head tests, the pumping test of the two exploration holes. Table 5 summarizes the Hazen method hydraulic conductivities estimated from the results of the grain size analysis. The complete pumping test and rising head test results can be found in Appendix E.

Table 4: Hydraulic Conductivity Estimates

Borehole ID	Screened Material	Single well response test Estimated Hydraulic Conductivity (m/s)	Pumping test Estimated Hydraulic Conductivity (m/s)
MW14-01a	Gravel and cobbles	2×10^{-5}	-
MW14-02a	Bedrock	2×10^{-5}	-
MW14-03a	Bedrock	5×10^{-5}	-
MW14-04a	Bedrock	6×10^{-9}	-
PGS-93b	Bedrock	-	8×10^{-7} to 4×10^{-6}
PGS-124	Bedrock	-	7×10^{-7} to 4×10^{-8}

Table 5: Hydraulic Conductivity Estimates based upon Hazen Method

Borehole ID	Screened Material	Hazen Method Estimated Hydraulic Conductivity (m/s)
MW14-01b	SAND & GRAVEL; some silt (SM)	3×10^{-6}
MW14-02b	Gravelly; silty SAND (SM)	2×10^{-7}
MW14-03b	Sandy GRAVEL; trace silt (GP-GM)	2×10^{-4}
MW14-04b	Sandy GRAVEL; trace silt (GW)	6×10^{-3}

5.4.5 Groundwater Elevations

Top of standpipe at each groundwater monitoring well location were surveyed and ground surface elevation calculated. Water levels in each monitoring well were recorded on November 1, 2014 after well installation and well development.

The reference and ground surface elevations of the monitoring wells are listed in Table 9. These elevations were used, along with depths to water measured by Golder, to calculate groundwater elevations.

Table 6: Groundwater Elevations

Monitoring Well ID	Top of Pipe Elevation (m asl)	Ground Surface Elevation (m asl)	Sample Date (dd/mm/yy)	Water Level (m bgs)	Groundwater Elevation (m asl)
MW14-1A	113.534	112.924	1/11/14	0.28	112.644
MW14-1B	113.918	112.768	1/11/14	0.41	112.358
MW14-2A	111.874	111.074	1/11/14	2.90	108.174
MW14-2B	111.976	110.726	1/11/14	0.74	109.986
MW14-3A	119.554	118.564	1/11/14	0.06	118.504
MW14-3B	119.554	118.304	1/11/14	0.14	118.164
MW14-4A	94.857	93.887	1/11/14	0.49	93.397
MW14-4B	94.915	93.515	1/11/14	0.03	93.485
PGS-93b	123.190	122.80	1/11/14	3.43	119.761
PGS-124	123.347	122.567	1/11/14	1.76	120.807

Note:
m asl = metres above sea level

m btop = metres below top of pipe

Groundwater levels in monitoring wells were observed to be near ground surface and groundwater levels of the ponds likely represent groundwater levels to a certain extent.

5.4.6 Groundwater Flow Directions

Insufficient data were collected to determine the deep ground water flow directions. The working assumption is that shallow bedrock flow directions are same as surface water flows (Figure 7).

5.4.7 Surface Water Flow Monitoring

Limited surface water flow monitoring was conducted at a total of 3 locations as described in Section 4 and shown on Figure 1. The instantaneous flow measurements were compiled to provide a baseline characterization of the stream flows at the AGS Site.

Stream flow survey data is contained in Appendix H which includes discharge estimates at five transects locations. Table 7 presents field measured water level at staff gauge and flow at the monitoring stations, during the October 31, 2014 monitoring period.

Table 7: Measured Water Level and Stream flow

Station	Staff Gauge (m)	Flow (L/s)
WQ STA-1	0.44	30
WQ STA-3	0.38	77
WQ STA-9	0.32	3

Note: 1. Water Flows based on October 31, 2014, survey.

Monitoring locations WQ STA-1, WQ STA-3 and WQ STA-9 are all located downstream of a lake or water body. A lake/water body can cause a decrease (attenuation) in flow from upstream to downstream depending on the available storage within the water body; therefore, the flows measured at WQ STA-1, WQ STA-3 and WQ STA-9 may be influenced by the upstream lakes.

5.4.8 Shallow groundwater-surface water interaction

The majority of the bedrock within the study area contains little if any primary permeability. In crystalline rock, the primary porosity may be as low as 0.05% while a typical sand aquifer usually has a porosity of 30% or greater (Novakiowski, 2000). Therefore, bedrock with secondary permeability through fracture systems generally predominates. Water levels shown in Table 1 indicate a downward gradient from the shallow groundwater system (overburden) to the fractured bedrock groundwater system.

Groundwater levels are fairly close to ground surface in both the bedrock and overburden (refer to Table 1). The shallow aquifer system will be largely controlled by surface runoff and local recharge.

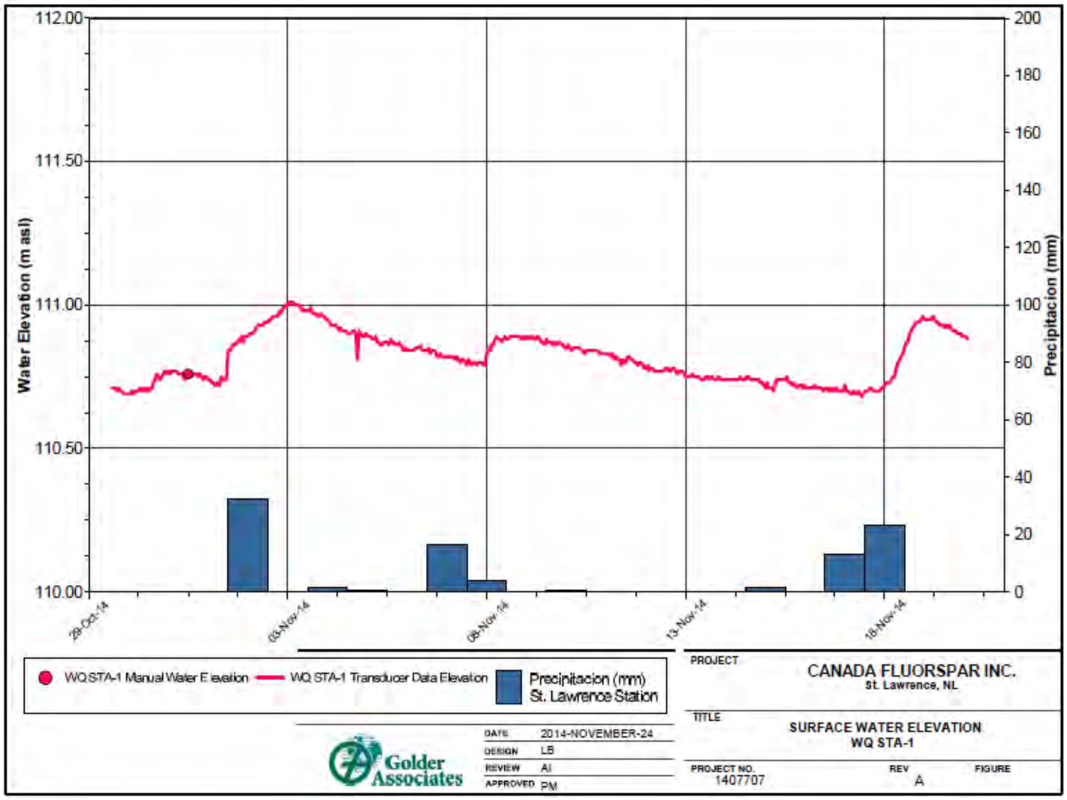
Hydrographs for the groundwater monitoring wells (MW14-01A, MW14-02A, MW14-03A, and MW14-04A) and surface water stations (WQ STA-7, WQ STA-3, and WQ STA-9) are presented in Appendix G for the period of November 1 to 20, 2014. Data loggers were re-installed in their corresponding wells on November 21, 2014, in continuation with monitoring program. The graph also plots daily precipitation, using data provided by the Environment Canada meteorological station.

With reference to groundwater hydrograph figures in Appendix G, the following is noted:

- Groundwater fluctuations generally reflect climatic conditions suggesting hydraulic connection between systems. Three rain events on November 2, 7, and 17 had a direct correlation with peaks in the groundwater system. Further evidence of the hydraulic connectivity between shallow bedrock aquifer and highly permeable overburden aquifer system is likely the result of the abundant fractures from the shallow bedrock observed within the top 10 m of the geophysics logs (refer to Appendix A). In order to quantify the magnitude of the hydraulic gradient on the bedrock groundwater system, further testing is necessary through pump test.
- The highest influence occurred in monitoring well PGS-124 with a groundwater elevation spike of about 0.75 m and lowest groundwater elevation spike in MW-02A. Topography may be driving groundwater flows in which groundwater flows from higher-elevation recharge to lower-elevation discharge areas resulting in higher groundwater spikes following a storm event.
- The exception of MW14-02A, all hydrographs for monitoring wells show that there is a slight downward groundwater trend during non-rain events.
- Large rhythmic fluctuations was observed in the hydrograph fro well PGS-93b (Figure G-2). These groundwater fluctuations are not observed in any of the other monitoring wells and are likely due to a malfunction of the data logger.
- Based on the observed groundwater elevations at the monitoring wells located near ponds where water elevation in the pond is near that of the groundwater, the pond appears to provide a moderate hydraulic buffer that can influence local groundwater levels.

With reference to surface water hydrograph figures in Appendix G, the following is noted:

- Surface water level fluctuations are reflective of climatic conditions.
- Water levels at WQ STA-1, WQ STA-3 and WQ STA-9 showed similar responses to precipitation events. Following a 32.7 mm rainfall event on November 2, 2014 water levels at STA-1, STA-3, and STA-9, increased by 0.30m, 0.30m, and 0.24m following the start of the rain event, peaking at elevations 111.01 masl, 108.25 masl, and 116.18 masl, respectively. A smaller peak occurred on November 8, 2014, following a rainfall of 16.7 mm, resulting in water levels at STA-1, STA-3, and STA-9 peaking at 110.89 masl, 108.12 masl, and 116.11 masl. A large peak occurred on November 18, 2014, following a two day rainfall of 23.5 mm, resulting in water levels at STA-1, STA-3, and STA-9 peaking at 110.96 masl, 108.14 masl, and 116.15 masl.
- An example from Appendix G illustrating this response is shown below:



- Following precipitation events, water levels at STA-1 returned to an elevation of approximately 110.7 masl. Likewise, water levels at STA-3 typically returned to an elevation of approximately 108 masl. Water levels at STA-09 returned to an elevation of approximately 116 masl.
- 16.7 mm rainfall event on November 7 and a 23.5 mm rainfall event on November 18.
- Surface water level fluctuations mirrors that of the groundwater indicating that groundwater flow systems in the study area are closely tied to surface water systems.
- The close connection between surface water and groundwater, with lack of substantial storage, make groundwater levels very sensitive to dry periods.

5.4.9 Groundwater Quality

Water quality results are provided below and compared to Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ). Under Aesthetic Objectives (AO), water quality results showed elevated concentrations of colour, aluminium, iron and total manganese in deep bedrock wells. Shallow wells screened in the overburden were not sampled.

Groundwater sample collected from MW14-04A has a pH value of 6.22 which is below the guideline for drinking water of 6.5-8.5 pH units (Health Canada, 2014).

Field measurements were collected at the time the sample was taken with a pH/temperature metre and a conductivity/temperature metre. The results are shown in Table 8 and compared to laboratory results.

Table 8: Groundwater Quality Field Measurements

Station	Field Measurements		Laboratory Results	
	pH	Conductivity (mS)	pH	Conductivity (mS)
MW14-01A	7.38	0.10	7.36	0.12
MW14-02A	7.69	0.17	7.63	0.18
MW14-03A	6.65	0.07	6.51	0.08
MW14-04A	6.22	0.22	6.22	0.25
PGS-93b	8.05	0.16	8.02	0.18
PGS-124	6.50	0.12	6.80	0.13

The physical quality of the water with regards to colour exceeded (SGCDWQ) acceptable concentrations of 15 true colour units (TCU) in MW14-03A and PGS-124. Colour value recorded for MW14-03A and PGS-124 is 160 TCU and 95 TCU, respectively.

Samples from all monitoring wells exceeded the 0.3 mg/L drinking water guideline for iron. Bedrock wells MW14-02A, MW14-03A and MW14-04A, open in the Meta-sediment rock, showed elevated iron concentrations above SGCDWQ, ranging from 0.49 to 15.0 milligrams per liter (mg/L). Deep exploration bedrock boreholes PGS-93a and PGS-124 showed elevated concentrations of iron of 0.58 mg/L and 39 mg/L, respectively. Iron concentrations are primarily an aesthetic objective and do not present a health concern unless in excessive concentrations.

With the exception of MW14-01A and PGS-93b, all monitoring wells exceeded the 0.05 mg/L drinking water guideline for manganese. Elevated manganese concentrations range from 0.12 mg/L to 1.1 mg/L. Manganese concentrations are primarily an aesthetic objective and do not present a health concern unless in excessive concentrations.

Samples from all monitoring wells exceeded the 0.1 mg/L drinking water guideline for aluminium. Elevated aluminum concentrations range from 0.18 mg/L to 39.0 mg/L.

5.4.10 Surface water Quality

Water quality results are provided below and compared to Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ). Under Aesthetic Objectives (AO), water quality results showed elevated concentrations of colour, aluminium, iron and total manganese.

Field measurements were collected at the time the sample was taken with a pH/temperature metre and a conductivity/temperature metre. The results are shown in Table 9 and compared to laboratory results.

Table 9: Surface Water Quality Field Measurements

Station	Field Measurements		Laboratory Results	
	pH	Conductivity (mS)	pH	Conductivity (mS)
WS-2	6.00	0.10	7.29	0.099
WS-5	6.23	0.13	7.28	0.110
WS-10	6.11	0.06	6.50	0.055
WQ STA-1	5.92	0.04	5.88	0.056
WQ STA-2	5.95	0.04	6.15	0.054
WQ STA-3	4.69	0.04	5.65	0.092
WQ STA-4	4.76	0.02	5.65	0.052
WQ STA-5	5.53	0.01	6.03	0.039
WQ STA-6	5.68	0.01	6.02	0.040
WQ STA-7	5.94	0.04	5.92	0.054
WQ STA-8	3.94	0.04	4.98	0.053
WQ STA-9	3.70	0.04	5.16	0.054

Note: Highlighted results were collected as part of the Phase 1 Hydrogeological Investigation. The remainder, collected at the same time for the concurrent surface water program, are also presented for completeness.

Nine of the thirteen surface water samples collected had pH values below the guideline for drinking water of 6.5-8.5 pH units (Health Canada, 2014). Low pH values are typical of surface waters in Newfoundland and Labrador, due to large amounts of organic materials produced by bogs, swamps and boreal forest (Amec 2013). Low pH values can also be attributed to granitic rocks that tend to make groundwater slightly acidic and the lack of limestone to buffer the acidity.

The physical quality of the water with regards to colour exceeded (SGCDWQ) acceptable concentrations of 15 TCU in all surface water samples. Concentration values ranged from 31 to 160 TCU. High colour values are typical of surface waters near wetlands in Newfoundland. High levels of colour to surface runoff is contributed by wetland drainage; whereas exposed bedrock in a basin or less organic soils contribute little to no colour.

Surface samples from WQ STA-1 and WQ STA-7 out of the six WQ stations in the phase 1 study have iron concentrations of exceeded the 0.3 mg/L drinking water guideline for iron ranging from 0.52 to 0.66 mg/L. With the exception of W2, surface samples collected outside the phase 1 program showed elevated iron concentrations above SGCDWQ, ranging from 0.13 to 0.62 mg/L.

Only two surface samples from outside the phase 1 program, W5 and W10, showed elevated manganese concentrations of 0.64 mg/L and 0.75 mg/L , above the 0.05 mg/L drinking water guideline.

All surface water samples exceeded the 0.1 mg/L drinking water guideline for aluminium. The results for aluminum ranged from 0.17 mg/L to 0.61 mg/L for samples collected within the phase 1 program. The remainder of the samples showed aluminum concentrations ranging from 0.13 mg/L to 0.43 mg/L.

6.0 CLOSURE

The report presented the factual results of the Phase 1 hydrogeological investigation. We trust that this report meets your requirements. If you have any questions, please do not hesitate to contact the undersigned.

Report Signature Page

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Associate, Senior Hydrogeologist

Marc Rougier, P.Eng (NFLD)
Principal

ADI/PMMC/MR/lag

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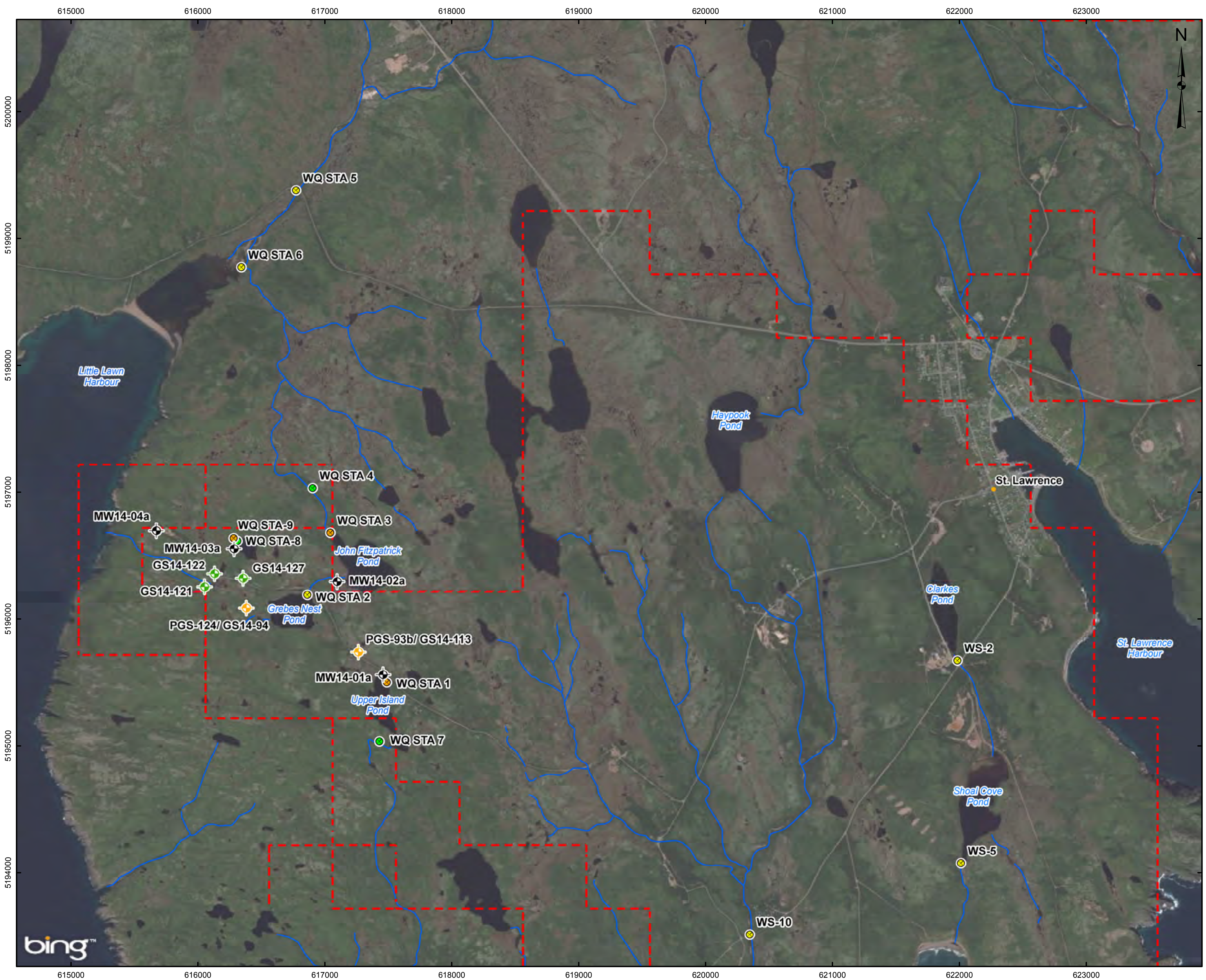
FIGURES



LEGEND

- Town

Sampling Locations

- Surface Water Gauge
- Water Quality
- Water Quality and Aquatic
- Vertical Borehole, Test Pit and Monitoring Well
- Exploration Hole for Groundwater Sampling and Geophysics Hole
- Geophysics Hole
- Mineral Licenses Existing
- River/Stream

INDEX MAP

REFERENCE

Surface Plan provided by the Client (August 2014)
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 21N

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PROJECT

AGS PROPERTY
NEWFOUNDLAND

TITLE

SITE PLAN

Golder Associates
Mississauga, Ontario

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REVIEW	PM	10 Dec. 2014		

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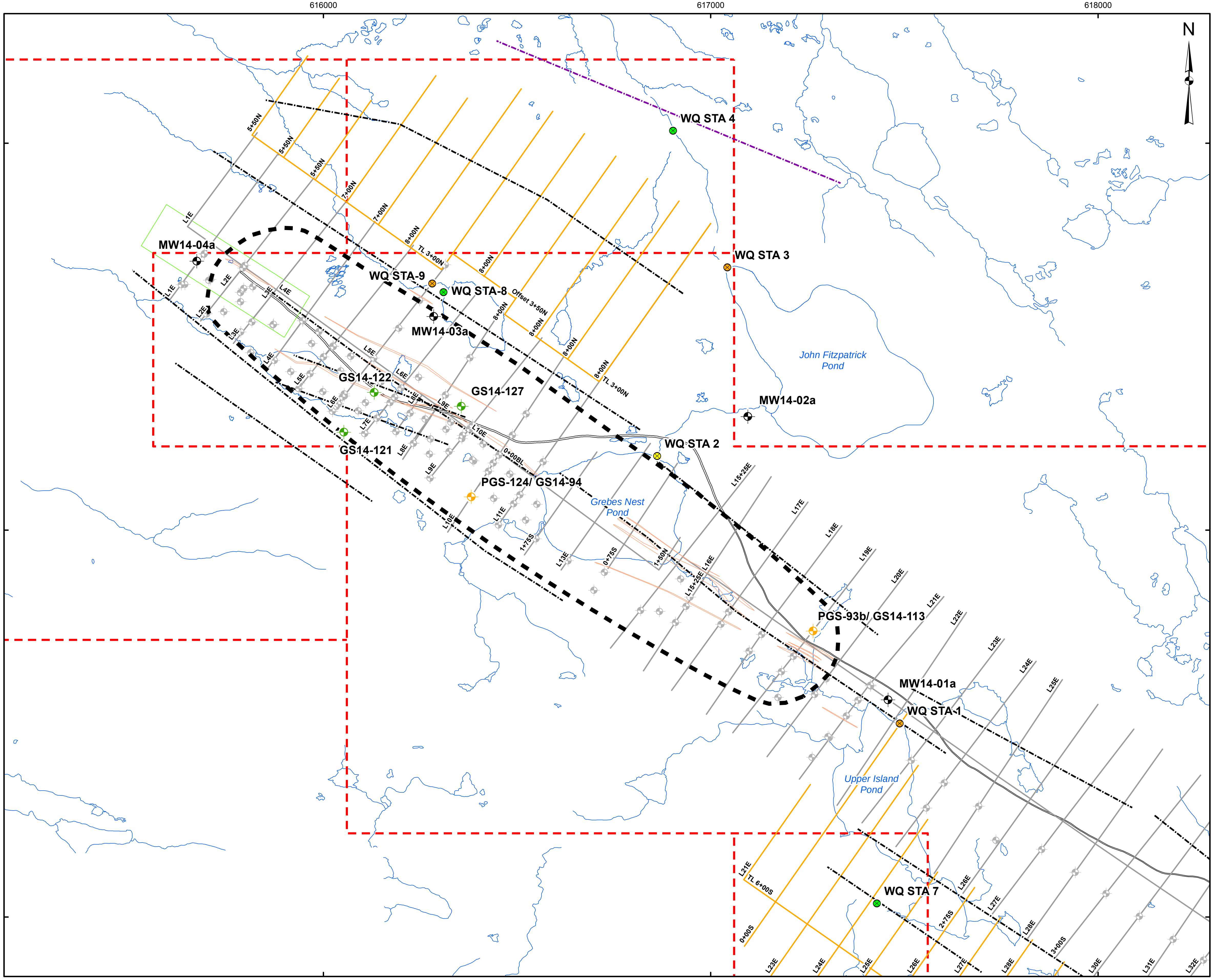

LEGEND

Sampling Locations

- Surface Water Gauge
- Water Quality
- Water Quality and Aquatic
- Vertical Borehole, Test Pit and Monitoring Well
- Exploration Hole for Groundwater Sampling and Geophysics Hole
- Geophysics Hole
- Drillhole Other
- AGS 2013 Grid Extension
- AGS Magnetic Linears Targets 2014
- GN Field Grid
- GN Veins Surface
- Mine Cove Vein Linear
- Mine Lease Boundary
- Minerial Licenses Existing
- Road
- Water Feature
- Assumed Surface Mine Footprint

REFERENCE

Surface Plan provided by the Client (August 2014)
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PROJECT
AGS PROPERTY
NEWFOUNDLAND

TITLE
PHASE I HYDROGEOLOGICAL
WORK PLAN

Golder Associates
Mississauga, Ontario

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CHECK	PM	10 Dec. 2014		
REVIEW	PM	10 Dec. 2014		

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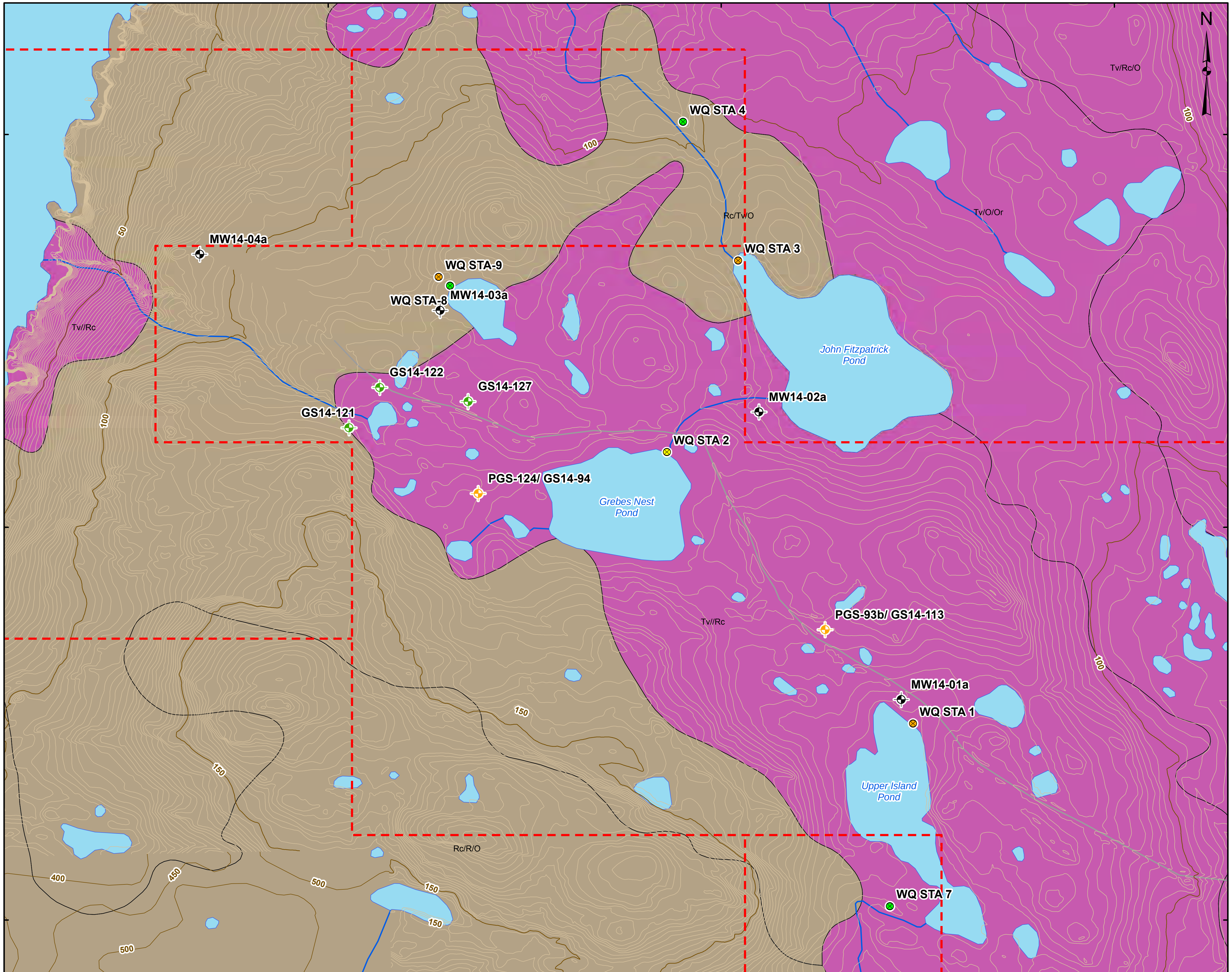

LEGEND

Sampling Locations

- Surface Water Gauge
- Water Quality
- Water Quality and Aquatic
- Vertical Borehole, Test Pit and Monitoring Well
- Exploration Hole for Groundwater Sampling and Geophysics Hole
- Geophysics Hole
- Minerial Licenses Existing
- Roads
- Contour - 50m Interval
- Contour - 2m Inverval
- River/Stream
- Waterbody

Surficial Geology

- RC, Rock Concealed
- TV, Till Veneer

REFERENCE

Basedata - CanVec 2009, Government of
Newfoundland Geoscience Atlas (http://geoatlas.gov.nl.ca/Default.htm)
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PROJECT

AGS PROPERTY
NEWFOUNDLAND

TITLE

SURFICIAL GEOLOGY

Golder Associates
Mississauga, Ontario

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FIGURE: 3

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LEGEND

- Town
- Public Water Intakes/Wellheads
- Exploration Hole for Groundwater Sampling and Geophysics Hole
- Geophysics Hole
- Mineral Licenses Existing
- River/Stream

REFERENCE

Surface Plan provided by the Client (August 2014)
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NEWFOUNDLAND

TITLE
MUNICIPAL WATER SOURCES

Golder Associates
Mississauga, Ontario

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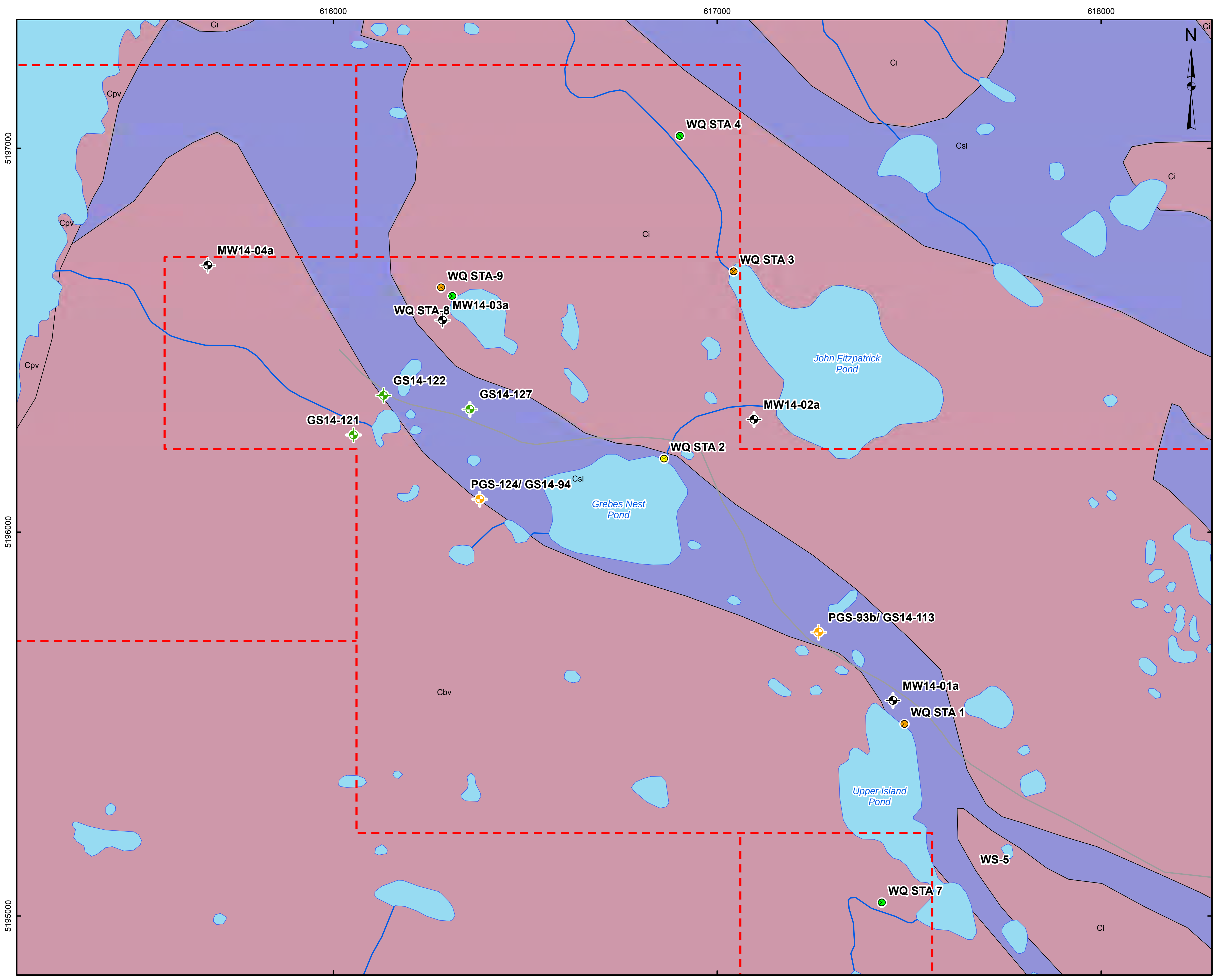

LEGEND

Sampling Locations

- Surface Water Gauge
- Water Quality
- Water Quality and Aquatic
- Vertical Borehole, Test Pit and Monitoring Well
- Exploration Hole for Groundwater Sampling and Geophysics Hole
- Geophysics Hole
- Mineral Licenses Existing
- Roads
- River/Stream
- Waterbody

Bedrock Geology

- Plutonic felsic (includes rhyolitic rock of the St.Lawrence batholith
- Siliciclastic marine shale (includes meta-sediments)

REFERENCE

Basedata - CanVec 2009, Government of Newfoundland Geoscience Atlas (http://geoatlas.gov.nl.ca/Default.htm)
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PROJECT
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NEWFOUNDLAND

TITLE
BEDROCK GEOLOGY

Golder Associates
Mississauga, Ontario

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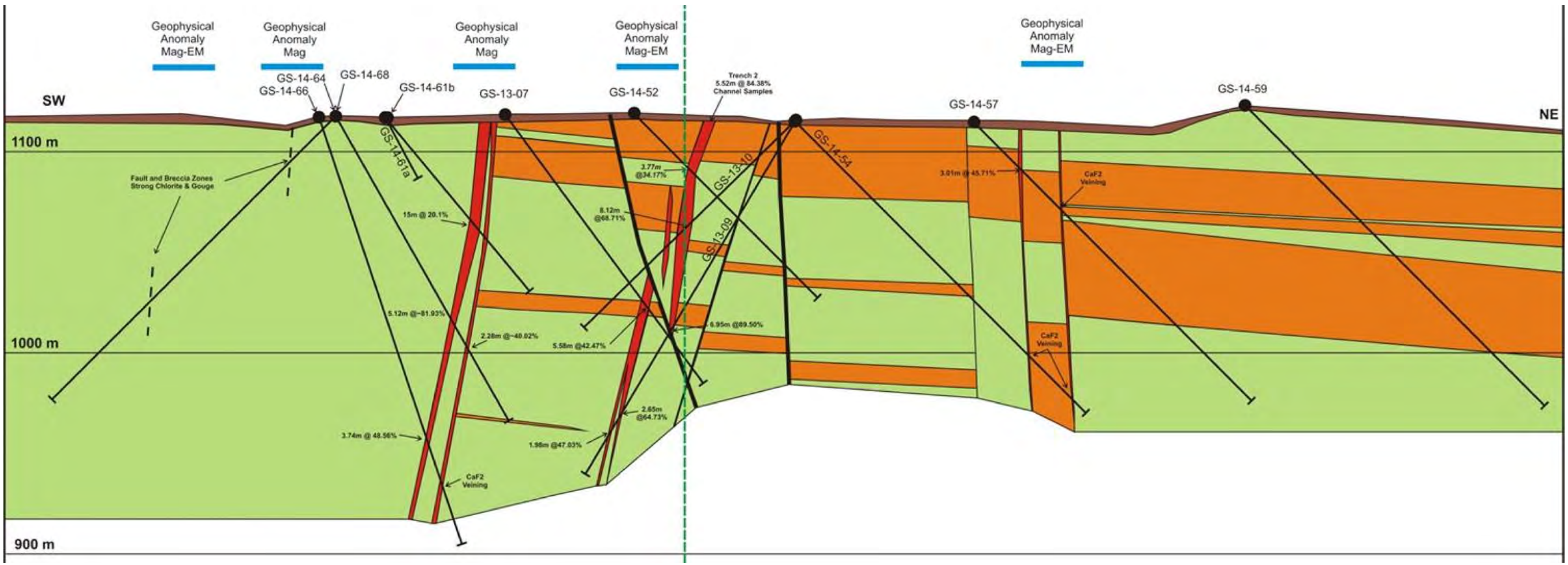

LEGEND

- Diamond Drill Hole (Complete)
- Diamond Drill Hole (Planned)
- Geophysical Anomaly
- Rhyolite Sills
- Fluorite Veins
- Meta-sediments
- Fault Zones

REFERENCE

Cross-section of line 6 recieved via email from CFI October 8, 2014

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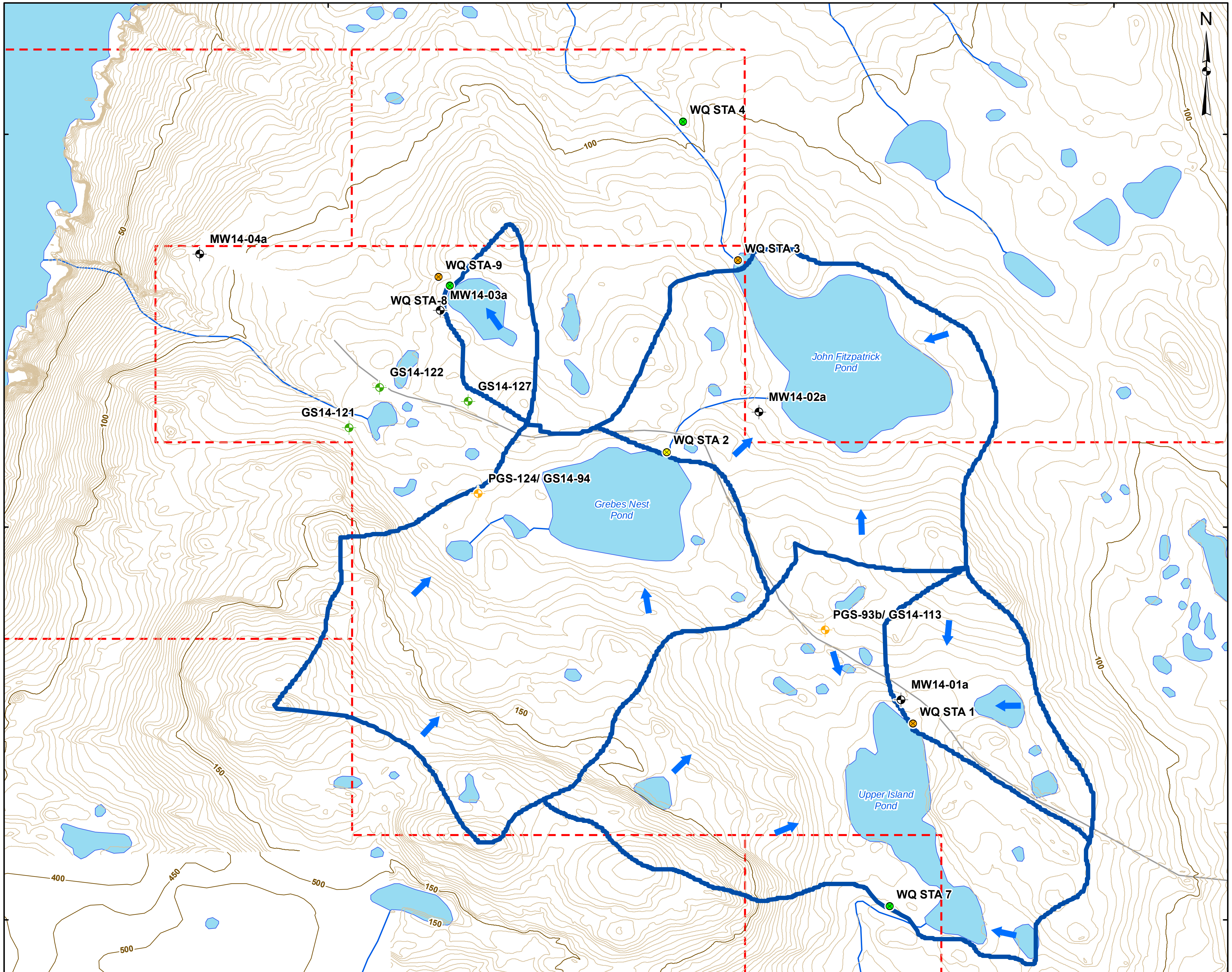
TITLE	
GEOLOGICAL CROSS-SECTION	

Golder Associates Mississauga, Ontario	PROJECT No. 1407707		NOT TO SCALE	REV. 0.0
	DESIGN	SO	26 Nov. 2014	FIGURE: 6
	GIS	SO	4 Dec. 2014	
	CHECK	PM	4 Dec. 2014	
	REVIEW	PM	4 Dec. 2014	



LEGEND

Sampling Locations

- Surface Water Gauge
- Water Quality
- Water Quality and Aquatic
- Vertical Borehole, Test Pit and Monitoring Well
- Exploration Hole for Groundwater Sampling and Geophysics Hole
- Geophysics Hole
- Flow Direction
- Mineral Licenses Existing
- Roads
- Contour - 50m Interval
- Contour - 2m Inverval
- River/Stream
- Waterbody
- Watershed Boundary

REFERENCE

Basedata - CanVec 2009, Government of
Newfoundland Geoscience Atlas (http://geoatlas.gov.nl.ca/Default.htm)
Contours (2m Interval) provided by the CIF
(Filename: St.Lawrenece property map_v14.dwg)
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 21N

250 0 250
SCALE 1:10,000 METRES

PROJECT
AGS PROPERTY
NEWFOUNDLAND

TITLE
WATERSHED BOUNDARIES

Golder Associates
Mississauga, Ontario

PROJECT NO. 1407707			SCALE AS SHOWN	REV. 0.0
DESIGN	SO	2 Sep. 2014	FIGURE: 7	
GIS	SO	10 Dec. 2014		
CHECK	PM	10 Dec. 2014		
REVIEW	PM	10 Dec. 2014		

S:\Clients\Canada_Fluorspar\AGS_Mine\99_PROJ\1407077_AGS_EA\40_PROD\0005_PhaseI\1407077_0005_CS_0007.mxd

APPENDIX A

Borehole Record; Rock Core Images; Geophysics Borehole Survey

FIELD DRILLHOLE LOG

Job No. 1407707 Job Name Canada Fluorspar Inc Phase I Date Oct 20/14 Drillhole No. BH14-01

DH Location .... Elevation .... (Obtained From ....) Datum WGS-84

Inclination 90° Azimuth .... Along Hole Total Length ....

Type of Drilling Diamond Type of Rig Duralite 800 Flush Water Feed ....

Type of Core Barrel Single Tube Bit Design .... Bit No. ....

Drillhole Dia. NQ - 76mm Drillcore Dia. 60 mm Casing Dia. 89 mm

Contractor Springdale Drilling Driller ....

Temperature ~8 °C. Weather overcast Engineer A. Ivanoff

R.Q.D. – Rock Quality Designation (Σ Core Run > 0.1m Long)
S.C.R. – Solid Core Recovery (% Cylindrical)
T.C.R. – Total Core Recovery
F.I. – Fracture Index (Fractures / ____)

F.R. – Fracture (Undifferentiated)
S.A. – Sample
C.A. – Casing
W.L. – Water Level
B.C. – Broken Core

B. – Bedding
F.O. – Foliation / Schistosity
CL. – Cleavage
SH. – Shear Plane / Zone
VN. – Vein CO. – Contact
F. – Fault J. – Joint

P. – Polished
S. – Slickensided
SM – Smooth
R. – Ridged / Rough
ST. – Stepped
PL. – Planar

F.L. – Flexured
UE. – Uneven
W. – Wavy
C. – Curved

Date / Time Core Ø, Depth	Date / Time Casing Ø, Depth	Water Levels am & pm	Percent Flush Return	Penetration: Time For Run, min	Penetration: Rate (/min)		Depth	Drilling Run No. & Length	T.C.R. Length	T.C.R. %	S.C.R. Length	S.C.R. %	R.Q.D. Length	R.Q.D. %	Fractures Per	Dip° W.R.T. Core Axis	Type & Surface Description	Formation	CORE DESCRIPTION – ROCK MATERIAL (DEPTH FROM : TO – Weathering ; Structure (Bedding Foliation, Jointing) Colour ; Grain Size & Texture ; Alteration State ; Cementation ; Rock Name ; Rock Formation)
Ground Surface							0												0-1m dark brown organic soil.
							1												1 To 6.8m. Silty sand and gravel with varying percentages of cobbles and boulders.
							4	① overburden											from 4 To 6.8m cored through cobbles and boulders composed of metasediments and ryolite (volcanics) → very unstable borehole wall.
							5–6	② overburden											
						6.8m		3 overburden											Bedrock from 6.8 To 7.0m.
BEDROCK.							7		0.2		0.17		0.2					EOH 7.0m	RQD: 100% SCR: 85% TCR: 100% } 20cm section. Rock Type Grey Metasediment fresh, medium strong rock.
							8												

SPECIAL NOTES / SKETCHES

Monitoring Well Construction details found in Excel document.

CONSUMABLE MATERIALS USED

RESULTS OF IN SITU .... TESTING

No.	TIME	DATE	DEPTHS	RESULTS

DEPTH – From .... to ...., Dates .... TIME – Moving & Set-Up .... hrs.

Drilling .... hrs, Testing etc. .... hrs, Delayed .... Stand-by .... hrs., Productive .... hrs.

Golder Associates

FORM UPDATED BY D.P.C. OCTOBER, 2009, FROM FORM G-F-1

JOB No. 1407707
DRILLHOLE No. BH 14-01
DEPTH 0 TO 7m.

FIELD DRILLHOLE LOG

Job No. 1407707 Job Name Canada Fluorspar Inc. Phase I Date Oct 21, 2014 Drillhole No. BH14-02

DH Location .... Elevation .... (Obtained From ....) Datum WGS 82

Inclination 90 Azimuth .... Along Hole Total Length ....

Type of Drilling Diamond Type of Rig Duralite 800 Flush water Feed 1.5m

Type of Core Barrel Single tube Bit Design .... Bit No. ....

Drillhole Dia. NQ - 76mm Drillcore Dia. ~~76mm~~ 60mm Casing Dia. 89 mm

Contractor Springdale Drilling Driller ....

Temperature 6 °C. Weather overcast Engineer A. IVANOFF

R.Q.D. – Rock Quality Designation (% Core Run > 0.1m Long)
S.C.R. – Solid Core Recovery (% Cylindrical)
T.C.R. – Total Core Recovery
F.I. – Fracture Index (Fractures / ____)

F.R. – Fracture (Undifferentiated)
S.A. – Sample
C.A. – Casing
W.L. – Water Level
B.C. – Broken Core

B. – Bedding
F.O. – Foliation / Schistosity
CL. – Cleavage
SH. – Shear Plane / Zone
VN. – Vein
F. – Fault
CO. – Contact
J. – Joint

P. – Polished
S. – Slickensided
SM – Smooth
R. – Ridged / Rough
ST. – Stepped
PL. – Planar

F.L. – Flexured
UE. – Uneven
W. – Wavy
C. – Curved

Date/Time Core Ø, Depth	Date/Time Casing Ø, Depth	Water Levels am & pm	Percent Flush Return	Time For Run, min.	Rate (/min)		Depth	Drilling Run No. & Length	T.C.R. Length	T.C.R. %	S.C.R. Length	S.C.R. %	R.Q.D. Length	R.Q.D. %	Fractures Per 0.25	DIP° W.R.T. Core Axis	Type & Surface Description	Formation
						4.8 / 5.2	5	(1)							10 / 10 / 10	BC / BC		
							6	(2)	1.5 / 1.5	100	0.71 / 1.5	47	0.75 / 1.5	50		6.0m	14°	
						6.7	7	(3)	1.5 / 1.5	100	1.04 / 1.5	69	1.02 / 1.5	68	1	7.07	35°	
						8.2	8	(4)	0.6 / 0.6	100	0.6 / 0.6	100	0.6 / 0.6	100	1 / 1	8.0 / 8.16	14° / 65°	EOH 8.8m
						8.8												

CORE DESCRIPTION

ROCK MATERIAL

DEPTH FROM : TO – Weathering ; Structure (Bedding Foliation, Jointing) Colour ; Grain Size & Texture ; Alteration State ; Cementation ; Rock Name ; Rock Formation

0 - 4.8m Overburden

4.8 - 5.2 : Lost core → Damaged

5.25 - 5.75 BC

6.0m JN, UN, RO, PL - 3mm silt.

7.07 JN, IR

8.0 HVN, IR, R, CC IN - crystals white

8.16 JN, IR, RO, PC grey-white silt.

Rock Type:

Grey-green, Metasediment fresh, medium strong rock.

Monitoring Well Construction Details in Excel document.

SPECIAL NOTES / SKETCHES

CONSUMABLE MATERIALS USED

RESULTS OF IN SITU .... TESTING

No.	TIME	DATE	DEPTHS	RESULTS

DEPTH – From .... to .... Dates .... TIME – Moving & Set-Up .... hrs.

Drilling .... hrs, Testing etc. .... hrs, Delayed .... Stand-by .... hrs., Productive .... hrs.

Golder Associates

JOB No. 1407707
DRILLHOLE No. BH14-02
DEPTH 0 TO 8.8m

FIELD DRILLHOLE LOG

Job No. 1407707 Job Name Canada Fluorspar Inc - Phase 1 Date Oct 22, 2014 Drillhole No. BH14-03

DH Location .... Elevation .... (Obtained From Garmin - GPS) Datum WGS 84

Inclination 90° Azimuth .... Along Hole Total Length ....

Type of Drilling Diamond Type of Rig Duralite 800 Flush Water Feed ....

Type of Core Barrel Single Tube Bit Design .... Bit No. ....

Drillhole Dia. NQ - 76mm Drillcore Dia. ~~76mm~~ 60mm Casing Dia. 89mm

Contractor Springdale Drilling Driller ....

Temperature ~6° °C. Weather overcast / Engineer A. IVANOFF

R.Q.D. – Rock Quality Designation (% Core Run > 0.1m Long)
S.C.R. – Solid Core Recovery (% Cylindrical)
T.C.R. – Total Core Recovery
F.I. – Fracture Index (Fractures / ____)

F.R. – Fracture (Undifferentiated)
S.A. – Sample
C.A. – Casing
W.L. – Water Level
B.C. – Broken Core

B. – Bedding
F.O. – Foliation / Schistosity
CL. – Cleavage
SH. – Shear Plane / Zone
VN. – Vein
CO. – Contact
F. – Fault
J. – Joint

P. – Polished
S. – Slickensided
SM – Smooth
R. – Ridged / Rough
ST. – Stepped
PL. – Planar

F.L. – Flexured
UE. – Uneven
W. – Wavy
C. – Curved

Depth	Drilling Run No.	Length	T.C.R. Length	T.C.R. %	S.C.R. Length	S.C.R. %	R.Q.D. Length	R.Q.D. %
0 (Ground Surface)								
2.44–4.0	①	~~1.56~~ 1.5	1.56/1.56	100%	1.08/1.56	69%	1.20/1.56	77%
4.0–5.54	②	1.5	1.5/1.5	100%	1.25/1.50	83%	1.47/1.50	98%

Fractures Per: 2, 1, 2, 1, 0, 1, 0, 1, 1, 0, 0, 0, 0, 0, 0

Discontinuity depth	Dip W.R.T. Core Axis
2.81	45°
2.92	40°
2.98	70°
3.05	60°
3.20	32°
3.48	90°
3.82	28°
4.25	28°
4.42	75°

Formation: EOH 5.54m

CORE DESCRIPTION

ROCK MATERIAL

DEPTH FROM : TO – Weathering ; Structure (Bedding Foliation, Jointing) Colour ; Grain Size & Texture ; Alteration State ; Cementation ; Rock Name ; Rock Formation

0 – 2.44 Overburden.

Run① 2.44 – 4.0m.

2.81m JN UN, RO, PC – silt

2.92m JN IR, RO, CC – silt – white.

2.98 JN IR, RO, ST – reddish-orange

3.05 JN IR, RO, CC – silt – white infill 1mm

3.20 JN UN, PL, PC

3.48 F, UN, RO, IN – clay/silt

3.82 JN PL, RO, IN – 1mm silt.

4.25 JN, PL, RO, IN – 1mm silt powder.

4.42 JN, PL, SM, SA, ST – reddish

Rock Type

Grey-green Metasediment fresh, medium strong rock

Monitoring Well Construction details found in Excel document.

SPECIAL NOTES / SKETCHES

CONSUMABLE MATERIALS USED

RESULTS OF IN SITU .... TESTING

No.	TIME	DATE	DEPTHS	RESULTS

DEPTH – From .... to .... Dates .... TIME – Moving & Set-Up .... hrs.

Drilling .... hrs, Testing etc. .... hrs, Delayed .... Stand-by .... hrs., Productive .... hrs.

Golder Associates

JOB No. 1407707
DRILLHOLE No. BH14-03
DEPTH 0 TO 5.54m

FIELD DRILLHOLE LOG

Job No. 1407707 Job Name Canada Fluorspar Inc - Phase I Date Oct 23, 2014 Drillhole No. BH14-04

DH Location 615673mE / 5196695mN Elevation .... (Obtained From Garmin GPS) Datum WGS 84

Inclination 90° Azimuth .... Along Hole Total Length ....

Type of Drilling diamond Type of Rig Duralite 800 Flush Water Feed ....

Type of Core Barrel Single Tube Bit Design .... Bit No. ....

Drillhole Dia. NQ - 76 mm Drillcore Dia. ~~76mm~~ 60mm Casing Dia. HQ - surface casing - 89 mm

Contractor Springdale Drilling Driller ....

Temperature ~6 °C. Weather overcast / windy Engineer A. IVANOFF

R.Q.D. – Rock Quality Designation (% Core Run > 0.1m Long)
S.C.R. – Solid Core Recovery (% Cylindrical)
T.C.R. – Total Core Recovery
F.I. – Fracture Index (Fractures / ___)

F.R. – Fracture (Undifferentiated)
S.A. – Sample
C.A. – Casing
W.L. – Water Level
B.C. – Broken Core

B. – Bedding
F.O. – Foliation / Schistosity
CL. – Cleavage
SH. – Shear Plane / Zone
VN. – Vein
CO. – Contact
F. – Fault
J. – Joint

P. – Polished
S. – Slickensided
SM – Smooth
R. – Ridged / Rough
ST. – Stepped
PL. – Planar

F.L. – Flexured
UE. – Uneven
W. – Wavy
C. – Curved

Date / Time Core Ø, Depth	Date / Time Casing Ø, Depth	Water Levels am & pm	Percent Flush Return	Penetration: Time For Run, min.	Penetration: Rate (___/min)	Depth	Drilling Run No. & Length	T.C.R. LENGTH	T.C.R. %	S.C.R. LENGTH	S.C.R. %	R.Q.D. LENGTH	R.Q.D. %	Fractures Per	DIP° W.R.T. Core Axis	Type & Surface Description	Formation
Ground Surface						0m											Overburden
						2 – 2.14								0			
			100%			2 – 3.5	①	1.36 / 1.5	91%	0.51 / 1.36	38%	1.20 / 1.36	88%	1, 1, 1, 1, 0, 0	2.17m 14°; 2.42 40°; 2.82 30°; 3.36 45°	UN/SM	R3 to R4 W1/A1
			100%			3.5 – 5	②	1.5 / 1.5	100%	1.5 / 1.5	100%	1.5 / 1.5	100%	0, 1, 0	3.67 14°		R3 W1/A1
			100%			5 – 6.5	③	1.5 / 1.5	100%	1.5 / 1.5	100%	1.5 / 1.5	100%	0, 1, 1, 0, 0, 0, 0, 1, 1	5.20 20°; 5.25 83°; 6.17 14°; 6.28 14°		R3 W1/A1
						6.5											EOH 6.5m

CORE DESCRIPTION

ROCK MATERIAL

DEPTH FROM : TO – Weathering ; Structure (Bedding Foliation, Jointing) Colour ; Grain Size & Texture ; Alteration State ; Cementation ; Rock Name ; Rock Formation

0 – 2.0m overburden.

RUN#1 (2m to 3.5m)

2.-2.14m Lost core Rubble - Jams core barrel.

2.17m JN UN/SM; SA Jr = 2.0 Ja = 2 JCR = 16 - green chlorite infill.

2.42m JN PL, SM, ST - reddish-brown. Jr = 1.0, Ja = 1, JCR = 16

2.82m JN PL, SM, ST - chlorite Jr = 1.0, Ja = 1, JCR = 16

3.36m JN St, RO, CL Jr = 3, Ja = 1, JCR = 25.

3.67m JN PL, SM, PC - chlorite. Jr = 1.0, Ja = 2, JCR = 16

5.20m JN, PL, RO, PC - chlorite. Jr = 3, Ja = 2, JCR = 20.

5.25m JN UN, RO, ST - yellowish-brown. Jr = 1.5, Ja = 1, JCR = 25

6.17m ~~UN, RO, ST - yellowish Jr = 1.5, Ja = 1, JCR = 25~~

6.17 JN, PL, SM, PC - green chlorite Jr = 1.0 Ja = 2 JCR = 16.

6.28 Same as above.

Rock Type ⇒ grey-green Metasediment. - fresh, strong rock.

SPECIAL NOTES / SKETCHES

CONSUMABLE MATERIALS USED

RESULTS OF IN SITU .... TESTING

No.	TIME	DATE	DEPTHS	RESULTS ....

DEPTH – From .... to .... Dates .... TIME – Moving & Set-Up .... hrs.

Drilling .... hrs. Testing etc. .... hrs. Delayed .... Stand-by .... hrs. Productive .... hrs.

Golder Associates

JOB No. 1407707
DRILLHOLE No. BH14-04
DEPTH 0 TO 6.5m

PROJECT

CANADA FLUORSPAR INC. PROJECT

TITLE

MW14-01 ROCK CORE

	PROJECT #: 1407707			SCALE: N/A	REV. 1
Golder Associates	DESIGN	ADI	NOVEMBER 2014	**FIGURE A1**	
	CHECK	PM	NOVEMBER 2014		
	REVIEW	JMP	NOVEMBER 2014		

PROJECT

CANADA FLUORSPAR INC. PROJECT

TITLE

MW14-02 ROCK CORE

Golder Associates	PROJECT #: 1407707			SCALE: N/A	REV. 1
	DESIGN	ADI	NOVEMBER 2014	**FIGURE A2**	
	CHECK	PM	NOVEMBER 2014		
	REVIEW	JMP	NOVEMBER 2014		

PROJECT
CANADA FLUORSPAR INC. PROJECT

TITLE
MW14-03 ROCK CORE

Golder Associates	PROJECT #: 1407707			SCALE: N/A	REV. 1
	DESIGN	ADI	NOVEMBER 2014	**FIGURE A3**	
	CHECK	PM	NOVEMBER 2014		
	REVIEW	JMP	NOVEMBER 2014		

PROJECT

CANADA FLUORSPAR INC. PROJECT

TITLE

MW14-04 ROCK CORE

	PROJECT #: 1407707			SCALE: N/A	REV. 1
Golder Associates	DESIGN	ADI	NOVEMBER 2014	**FIGURE A4**	
	CHECK	PM	NOVEMBER 2014		
	REVIEW	JMP	NOVEMBER 2014		

ACOUSTIC and OPTICAL TELEVIEWER PLOT

DGI GEOSCIENCE INC.

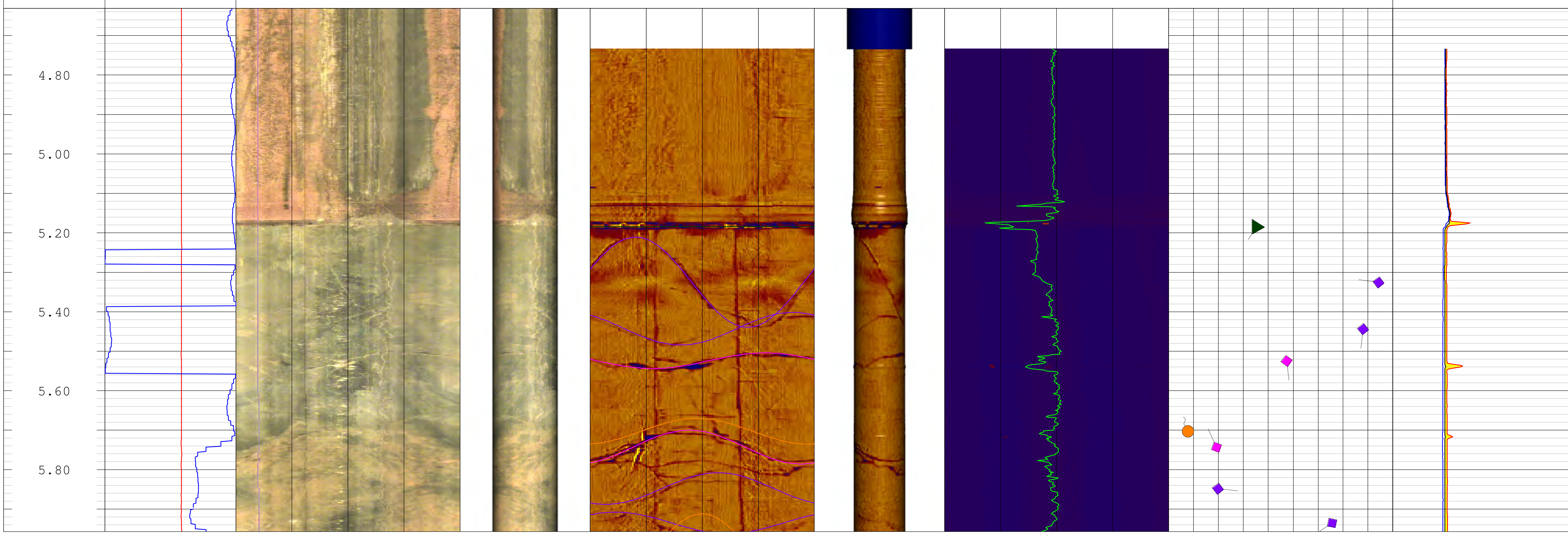
Company:	Canada Fluorspar	**Total Depth:**	110 m	**UTM X (Easting):**	N/A	**Notes:**	
Hole ID:	GS-14-94	**Surveyed Depth:**	108 m	**UTM Y (Northing):**	N/A		
Acquisition date(s):	Nov. 05, 2014	**Hole Diameter:**	NQ	**UTM Z (Elevation):**	N/A		
Field Personnel:	J. Smith, R. Morrison	**Hole Type:**	Core				
Legal Location:	Saint Lawrence, NFLD	**Casing Depth:**	5 m				
Survey Day(s):	1	**Fluid Type:**	Water				

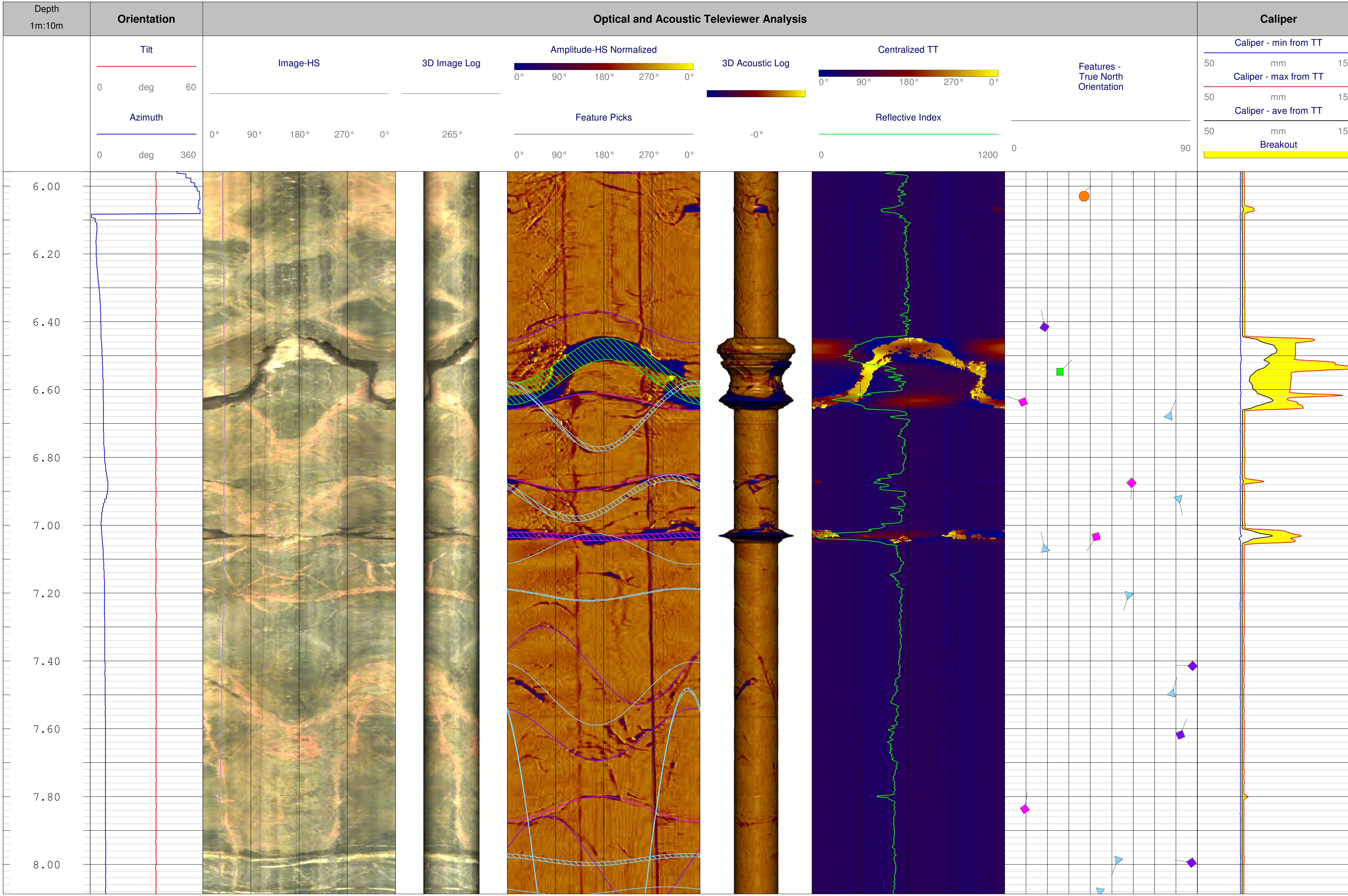
DGI Geoscience Inc.
119 Spadina Avenue,
Suite 405
Toronto, Ontario
Canada, M5V 2L1
416.361.3191

LEGEND - STRUCTURE TYPE

Btm of Casing | Major Open Joint/Fracture | Partially Open Joint/Fracture | Minor Joint/Fracture | Bedding/ Banding/ Foliation | Vein - Group 1 | Lithology Contact

Depth 1m:10m	Orientation	Optical and Acoustic Televiewer Analysis						Caliper
	Tilt (0 deg 60); Azimuth (0 deg 360)	Image-HS (0° 90° 180° 270° 0°)	3D Image Log (265°)	Amplitude-HS Normalized (0° 90° 180° 270° 0°); Feature Picks (0° 90° 180° 270° 0°)	3D Acoustic Log (-0°)	Centralized TT (0° 90° 180° 270° 0°); Reflective Index (0 1200)	Features - True North Orientation (0 90)	Caliper - min from TT (50 mm 150); Caliper - max from TT (50 mm 150); Caliper - ave from TT (50 mm 150); Breakout

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1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
6.00
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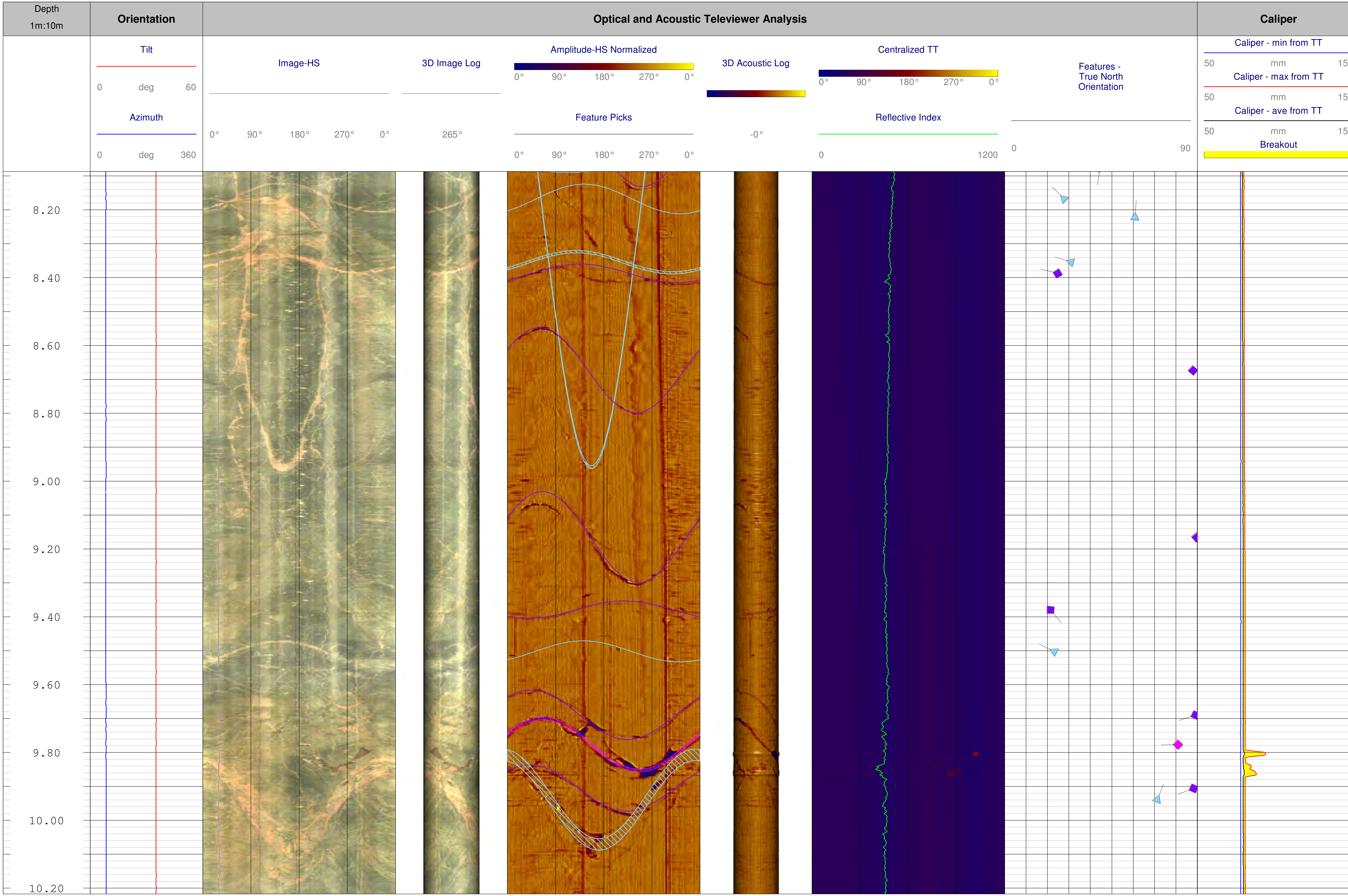
7.60
7.80
8.00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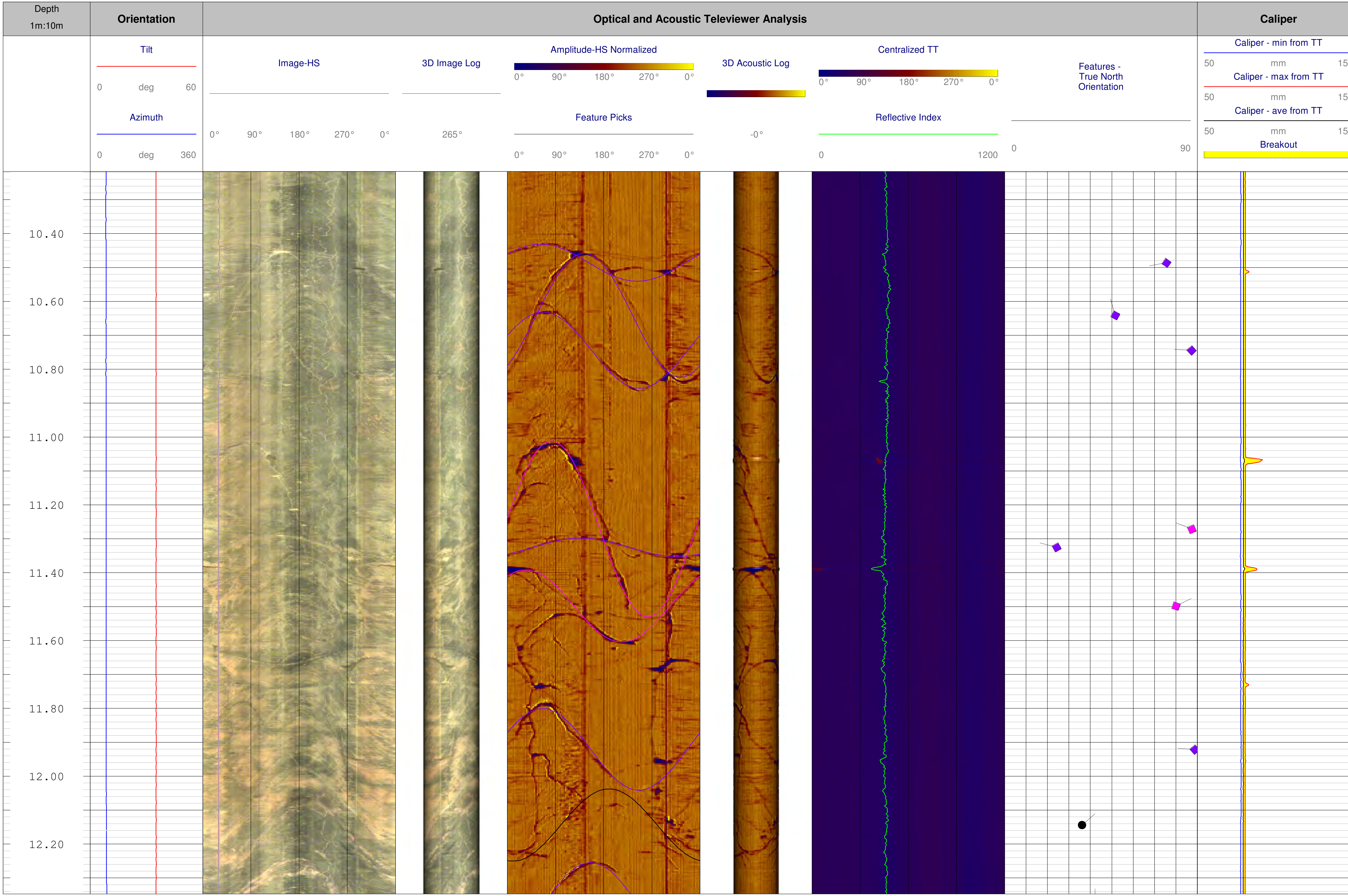
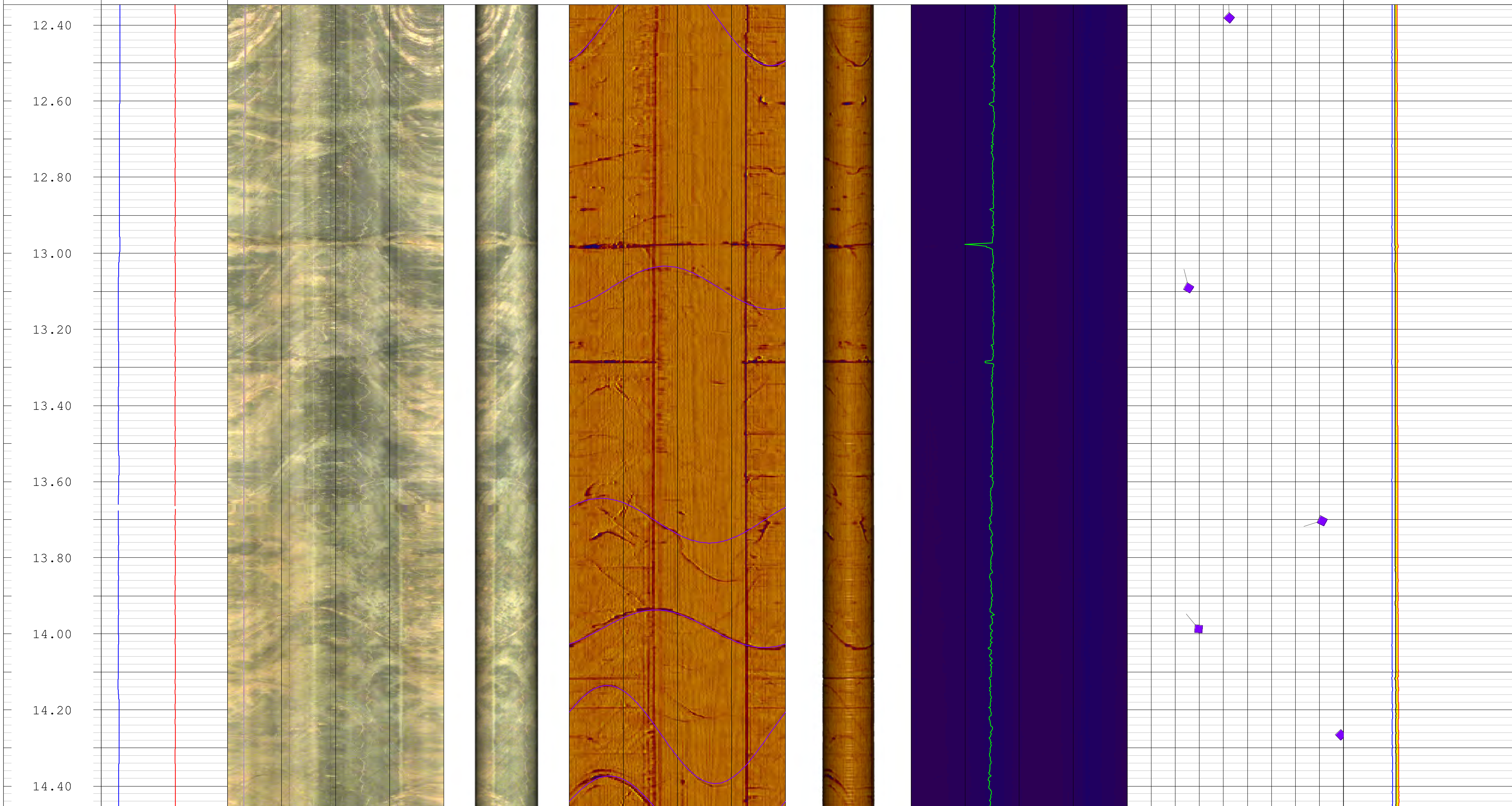
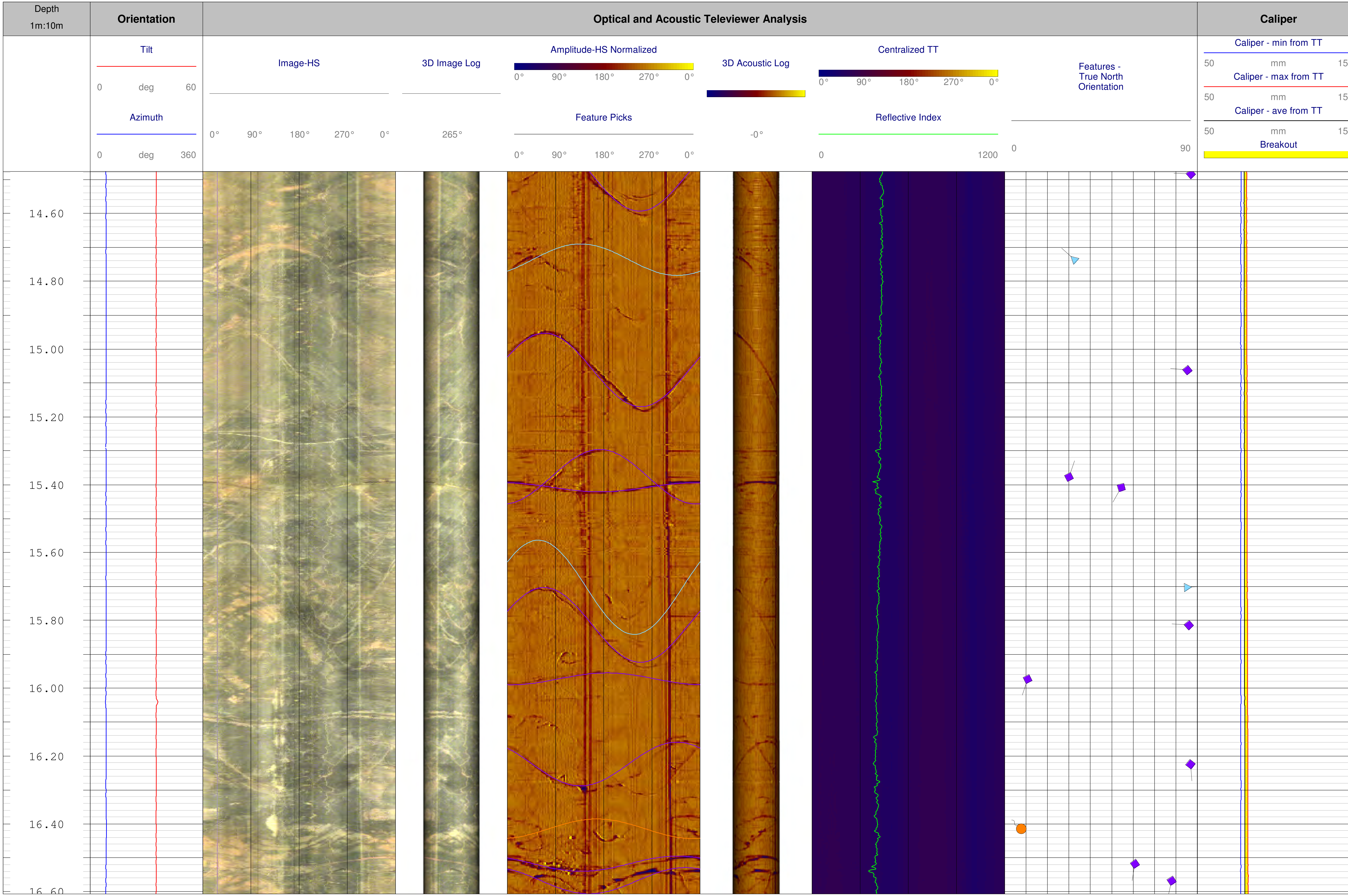
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
8.20
8.40
8.60
8.80
9.00
9.20
9.40
9.60
9.80
10.00
10.20

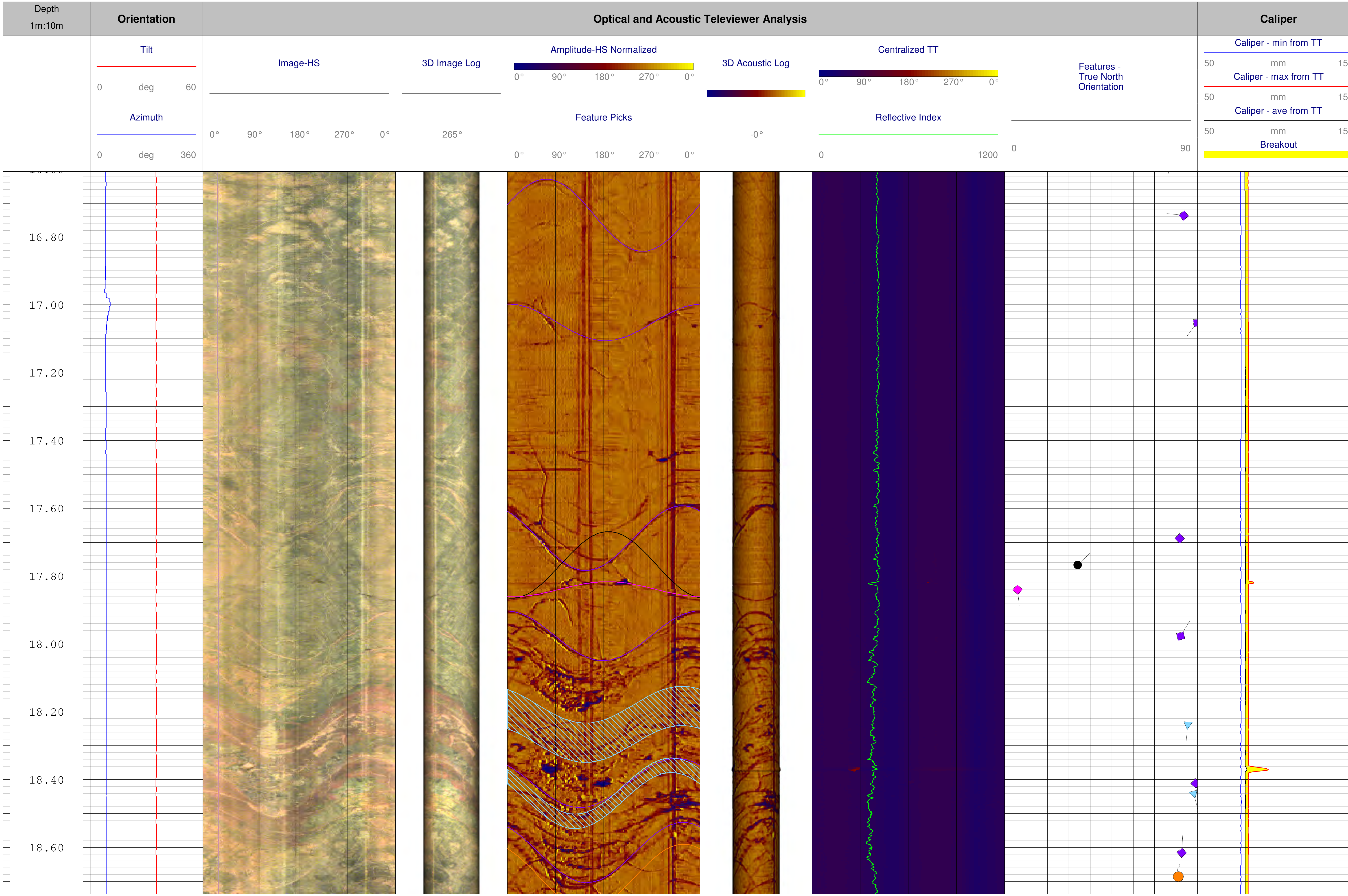

Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
10.40
10.60
10.80
11.00
11.20
11.40
11.60
11.80
12.00
12.20

Depth 1m:10m	Orientation	Optical and Acoustic Televiewer Analysis	Caliper
	Tilt: 0 deg 60 Azimuth: 0 deg 360	Image-HS: 0° 90° 180° 270° 0° 3D Image Log: 265° Amplitude-HS Normalized: 0° 90° 180° 270° 0° Feature Picks: 0° 90° 180° 270° 0° 3D Acoustic Log: -0° Centralized TT: 0° 90° 180° 270° 0° Reflective Index: 0 1200 Features - True North Orientation: 0 90	Caliper - min from TT: 50 mm 150 Caliper - max from TT: 50 mm 150 Caliper - ave from TT: 50 mm 150 Breakout





Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
14.60
14.80
15.00
15.20
15.40
15.60
15.80
16.00
16.20
16.40
16.60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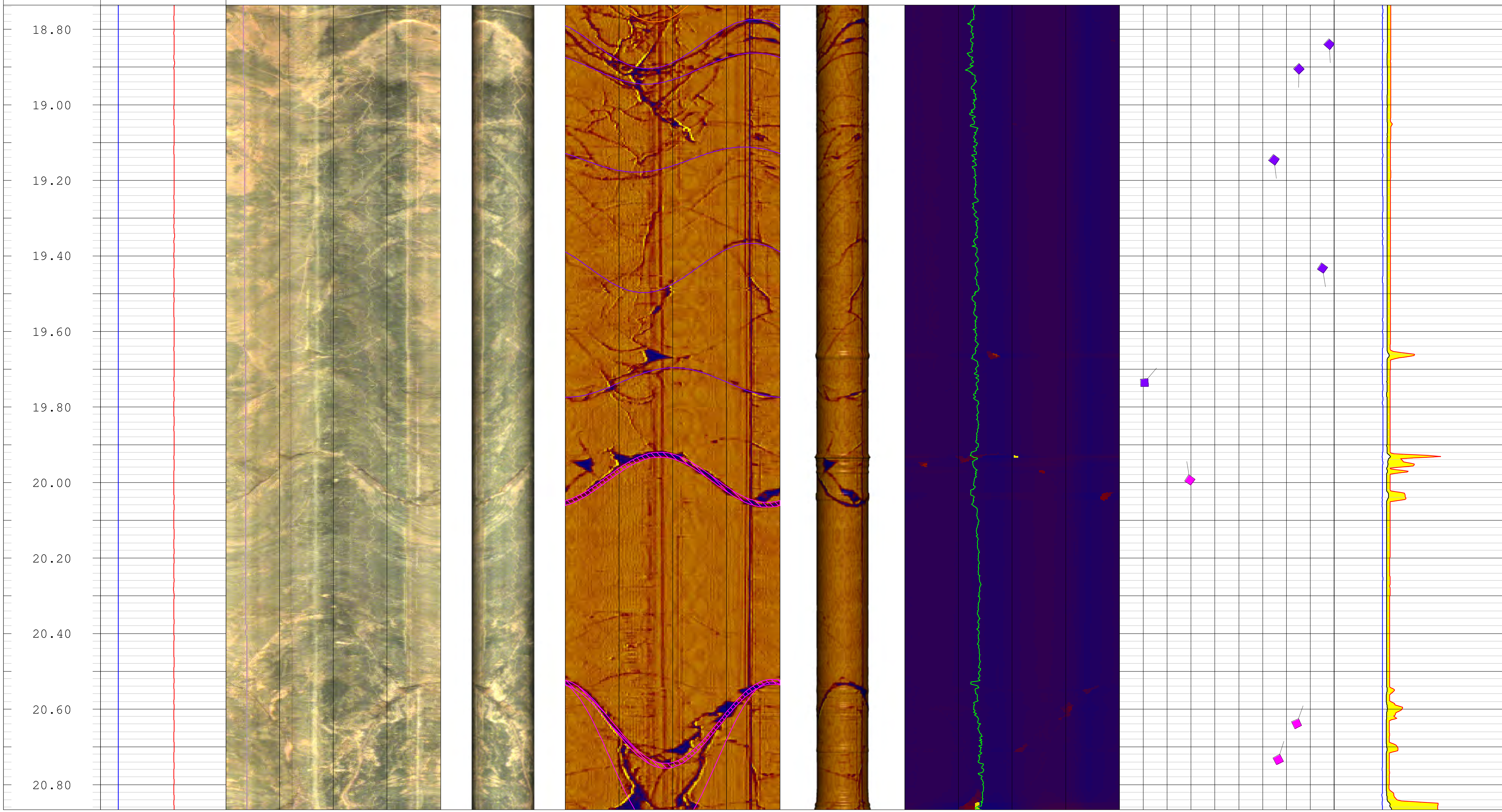
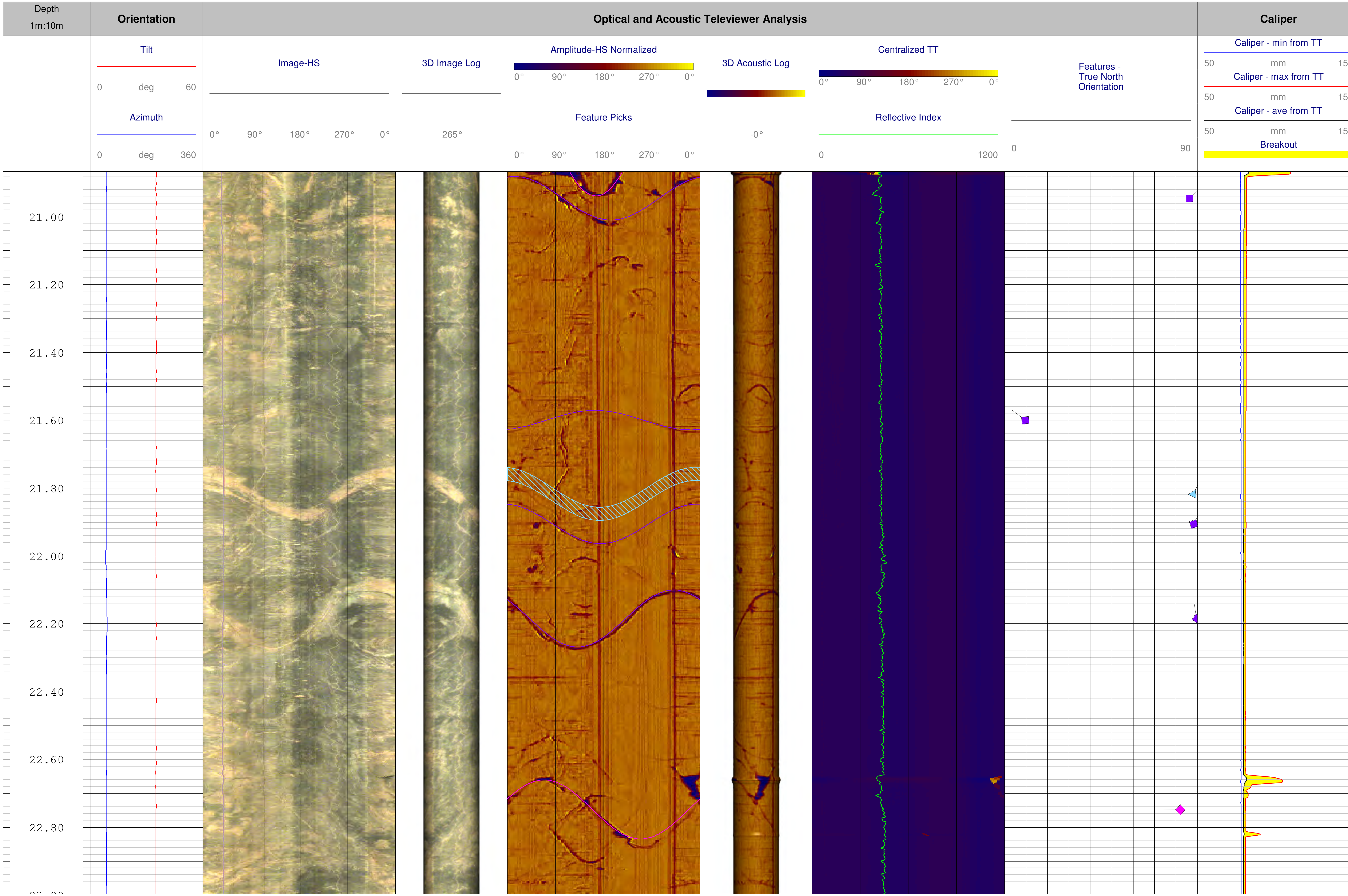
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
16.80
17.00
17.20
17.40
17.60
17.80
18.00
18.20
18.40
18.60

Depth 1m:10m	Orientation	Optical and Acoustic Televiewer Analysis							Caliper
	Tilt 0 deg 60 / Azimuth 0 deg 360	Image-HS 0° 90° 180° 270° 0°	3D Image Log 265°	Amplitude-HS Normalized 0° 90° 180° 270° 0° / Feature Picks 0° 90° 180° 270° 0°	3D Acoustic Log -0°	Centralized TT 0° 90° 180° 270° 0° / Reflective Index 0 1200	Features - True North Orientation 0 90		Caliper - min from TT 50 mm 150 / Caliper - max from TT 50 mm 150 / Caliper - ave from TT 50 mm 150 / Breakout

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Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
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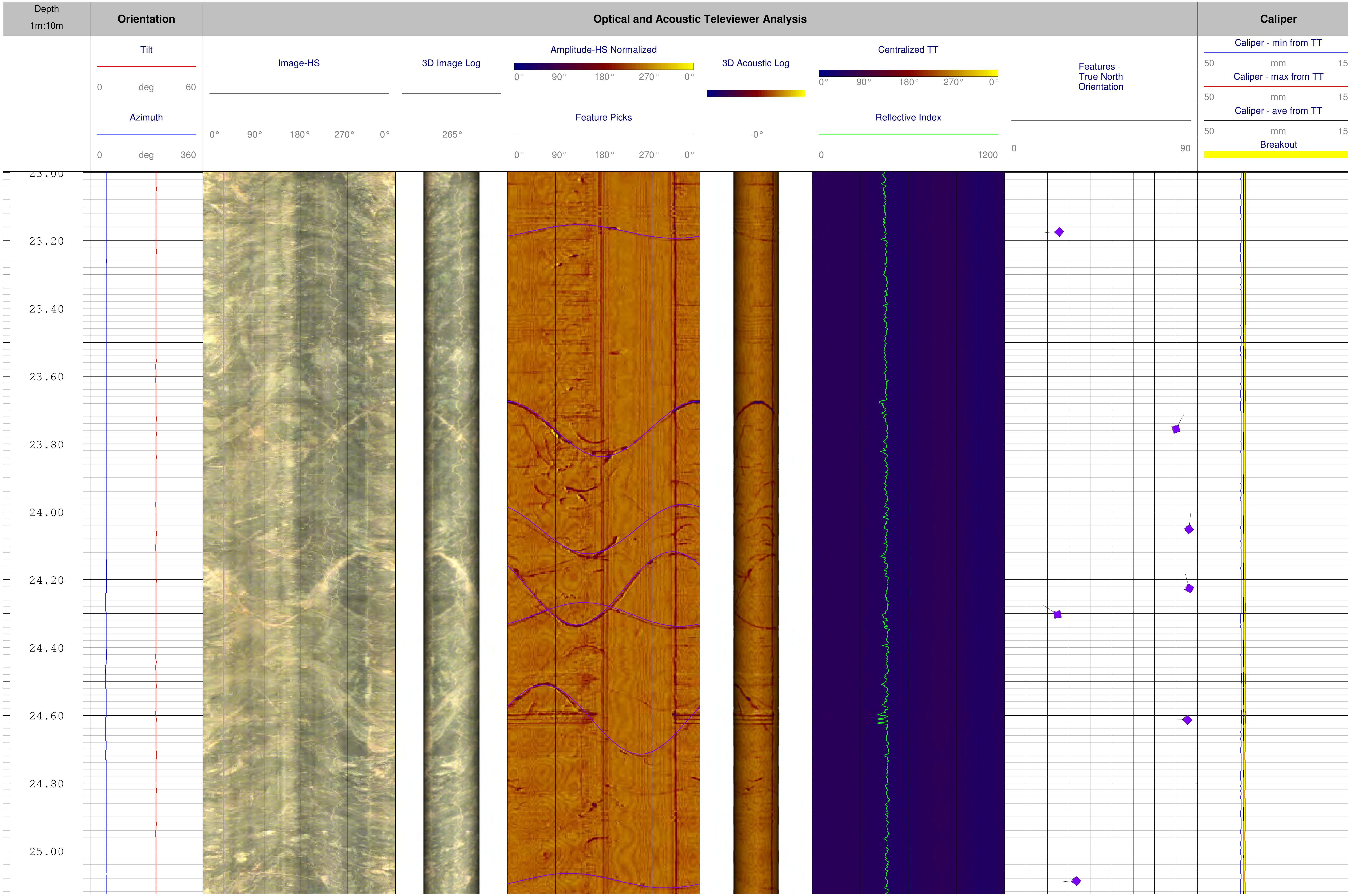
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
21.00
21.20
21.40
21.60
21.80
22.00
22.20
22.40
22.60
22.80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Orientation
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Caliper
Tilt
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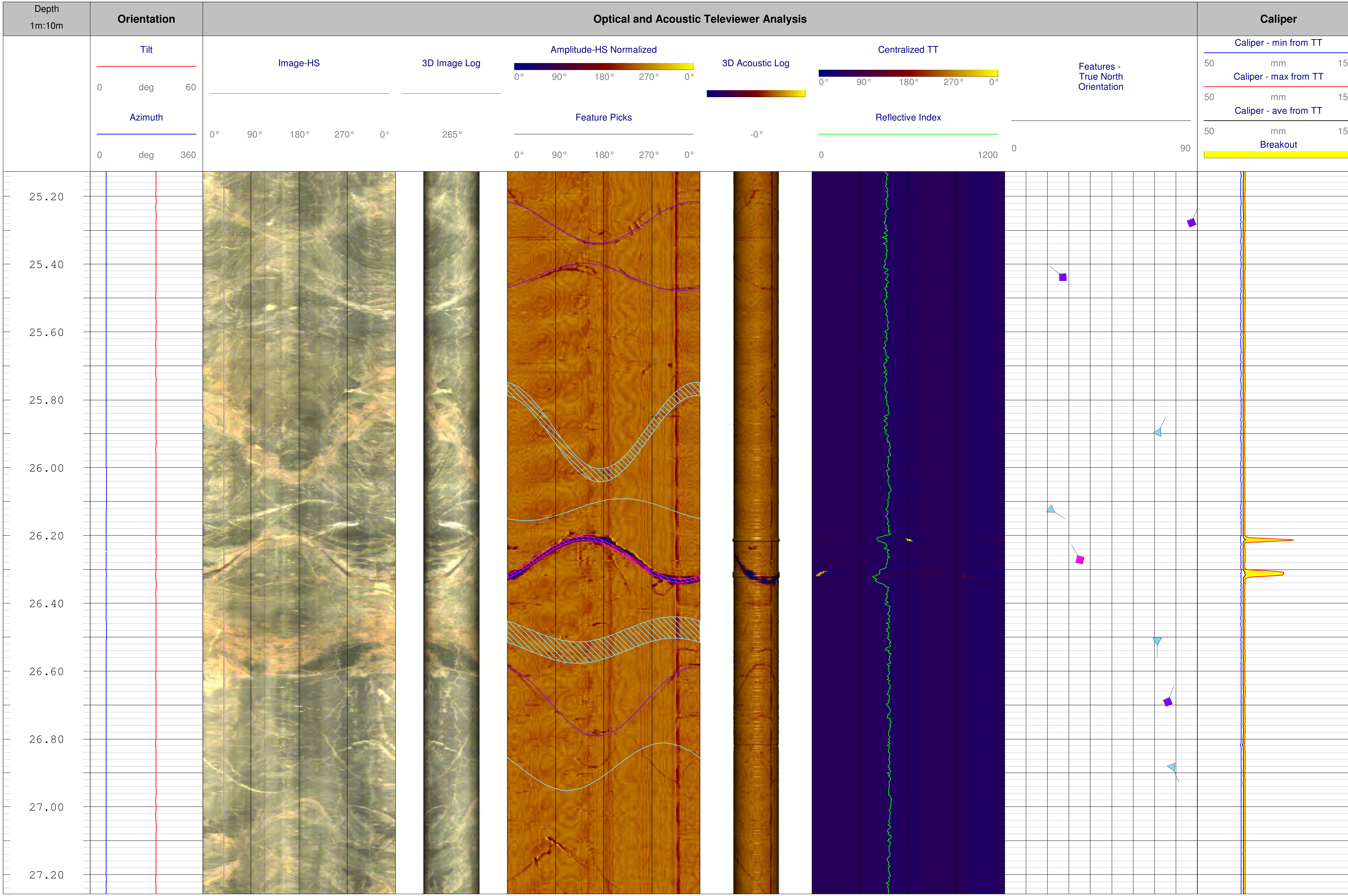
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
23.00
23.20
23.40
23.60
23.80
24.00
24.20
24.40
24.60
24.80
25.00



Depth
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Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
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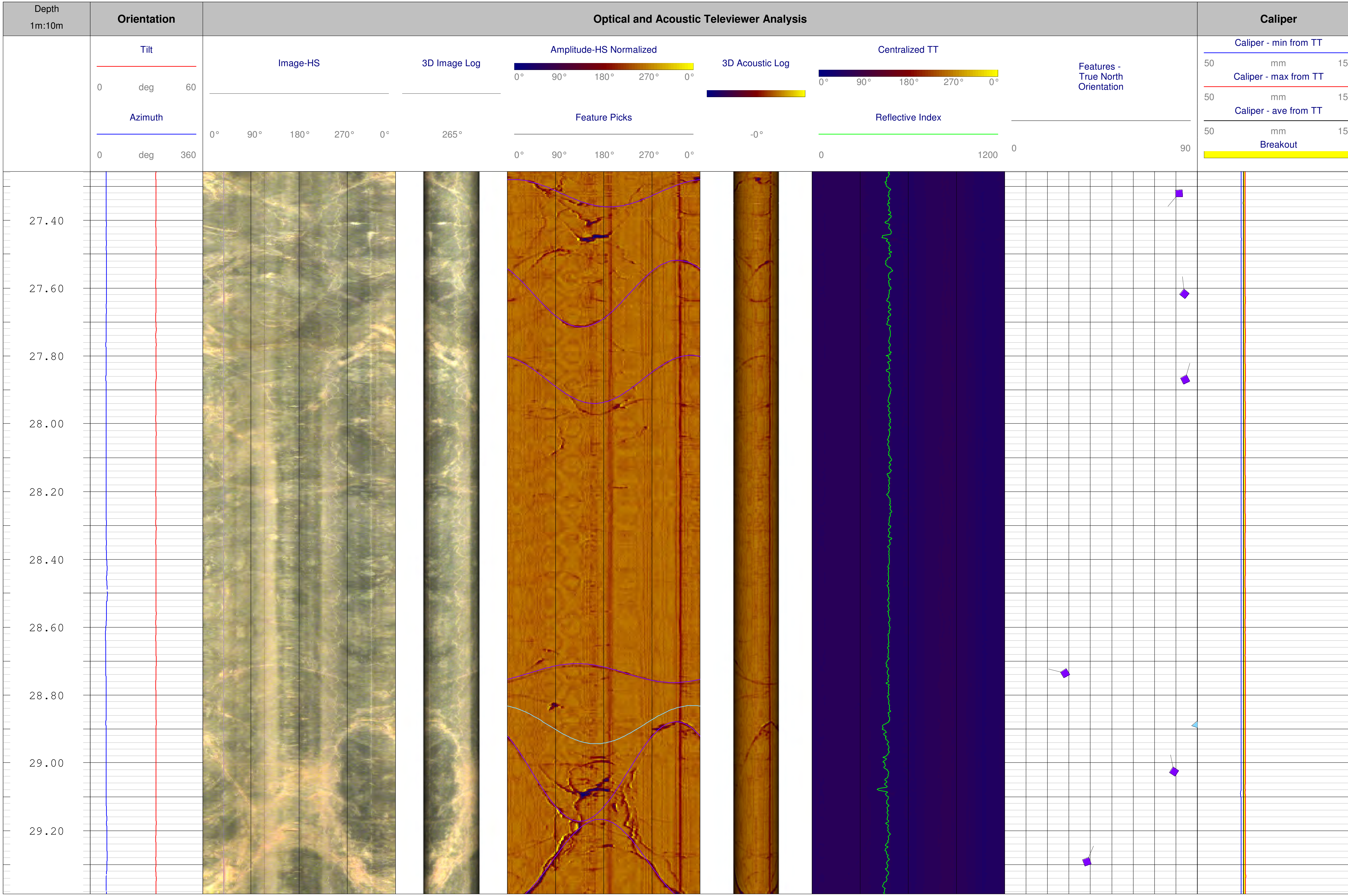
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
25.20
25.40
25.60
25.80
26.00
26.20
26.40
26.60
26.80
27.00
27.20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Tilt
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Azimuth
0 deg 360
Image-HS
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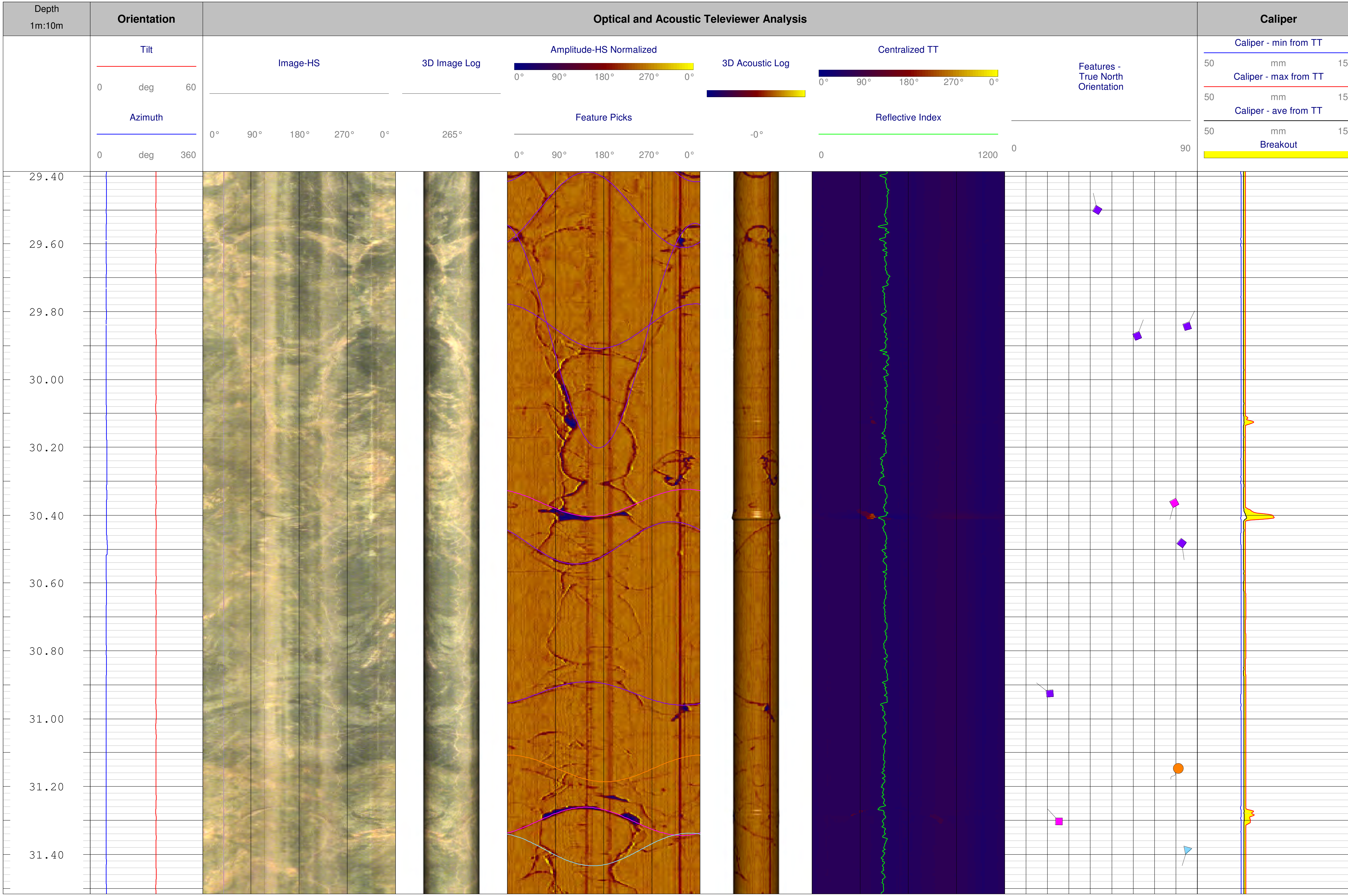
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
27.40
27.60
27.80
28.00
28.20
28.40
28.60
28.80
29.00
29.20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Azimuth
0 deg 360
Image-HS
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3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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29.60
29.80
30.00
30.20
30.40
30.60
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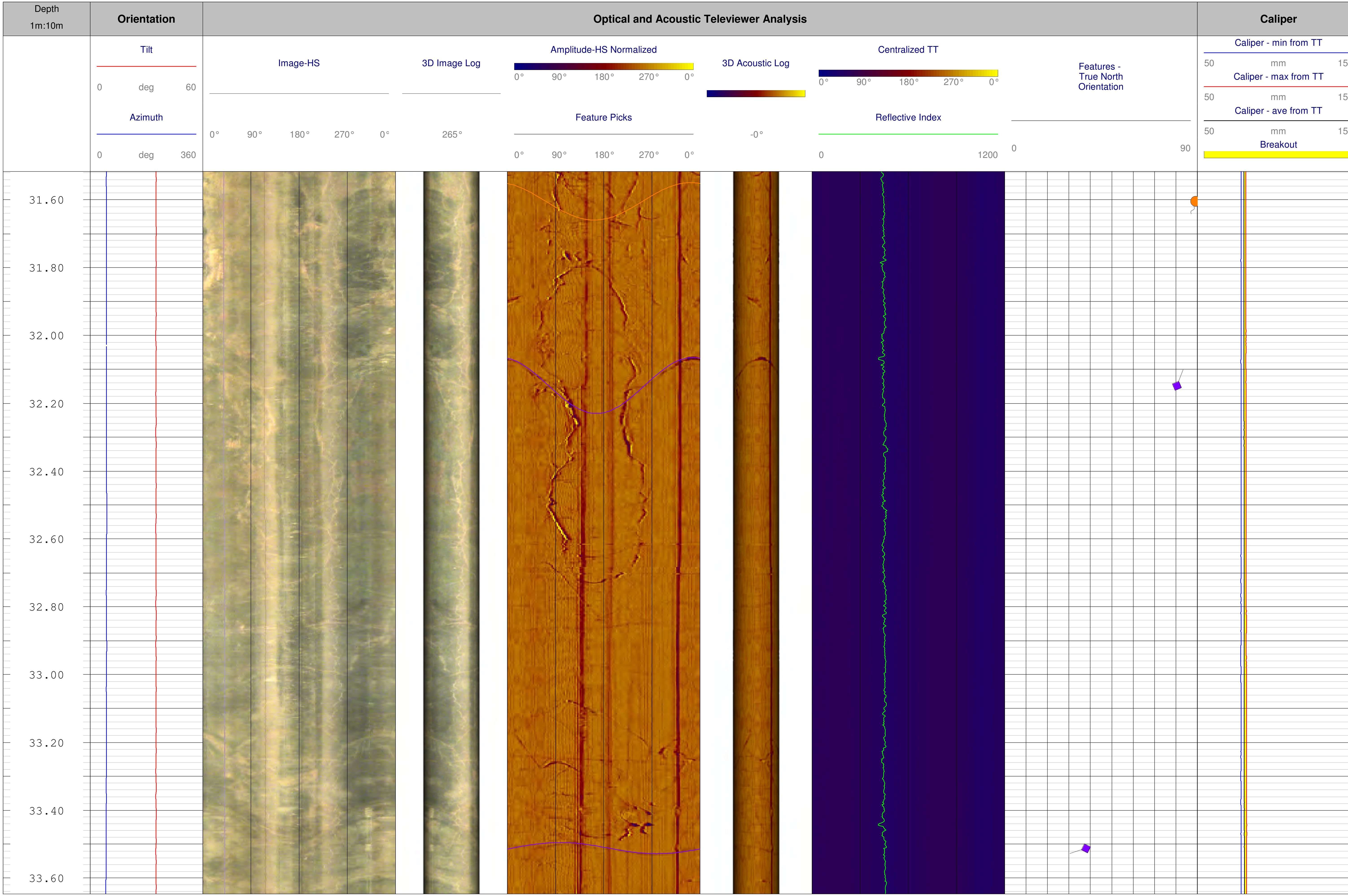
31.00
31.20
31.40



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Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
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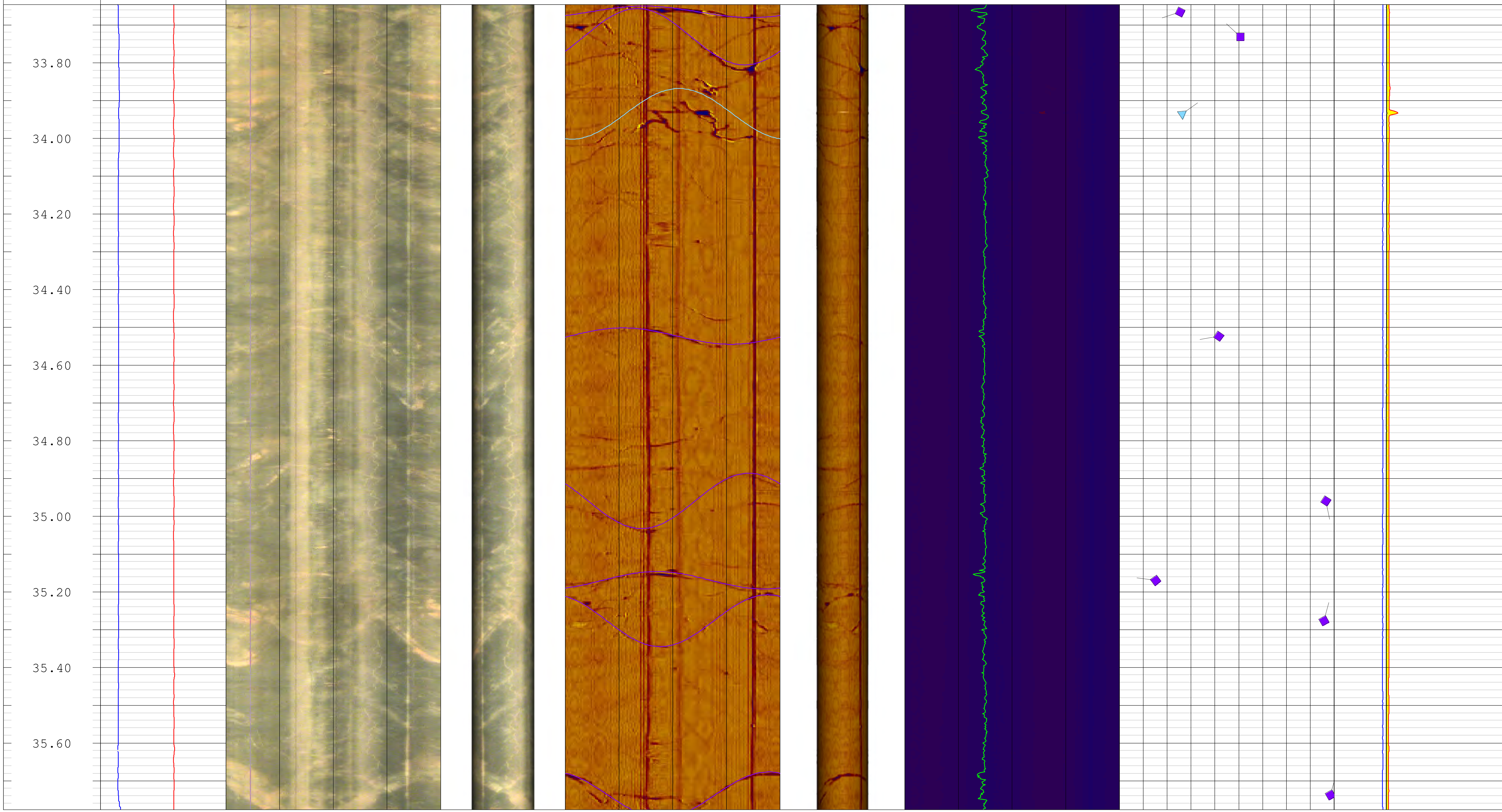
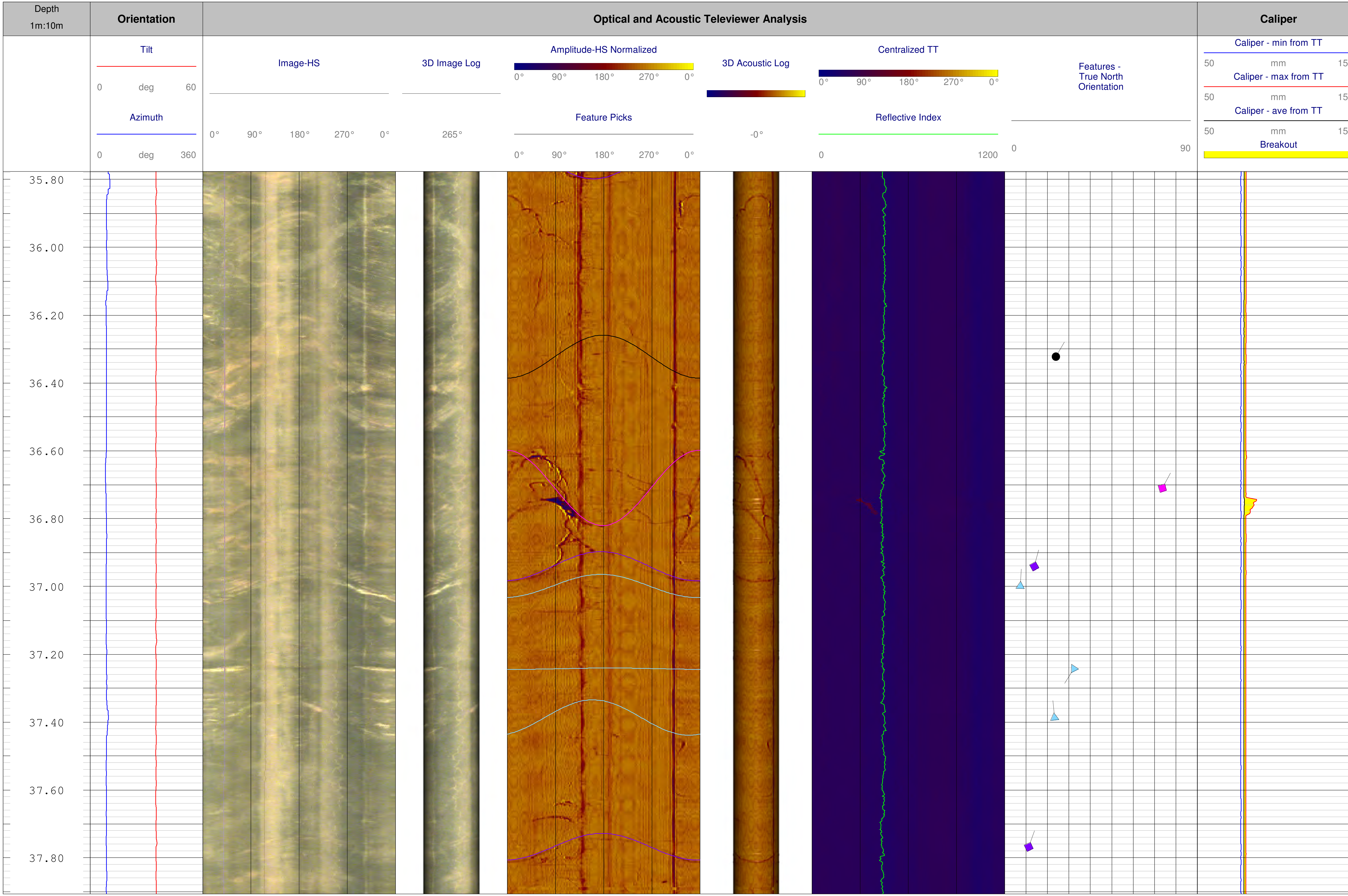
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
31.60
31.80
32.00
32.20
32.40
32.60
32.80
33.00
33.20
33.40
33.60

Depth 1m:10m	Orientation	Optical and Acoustic Televiewer Analysis	Caliper
	Tilt 0 deg 60 Azimuth 0 deg 360	Image-HS 0° 90° 180° 270° 0° 3D Image Log 265° Amplitude-HS Normalized 0° 90° 180° 270° 0° Feature Picks 0° 90° 180° 270° 0° 3D Acoustic Log -0° Centralized TT 0° 90° 180° 270° 0° Reflective Index 0 1200 Features - True North Orientation 0 90	Caliper - min from TT 50 mm 150 Caliper - max from TT 50 mm 150 Caliper - ave from TT 50 mm 150 Breakout

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Tilt
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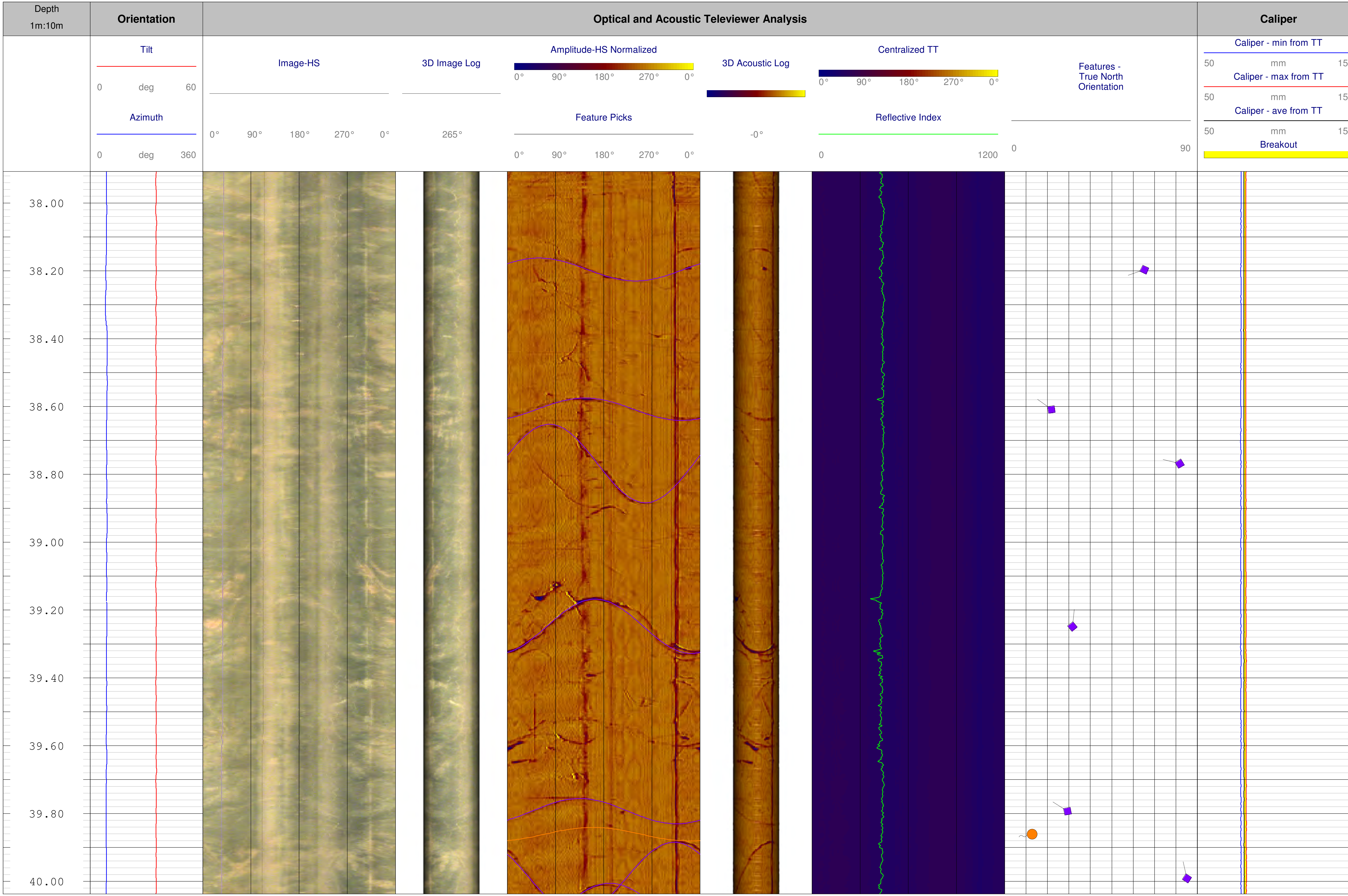
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features -
True North
Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
35.80
36.00
36.20
36.40
36.60
36.80
37.00
37.20
37.40
37.60
37.80



Depth
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Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
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Azimuth
0 deg 360
Image-HS
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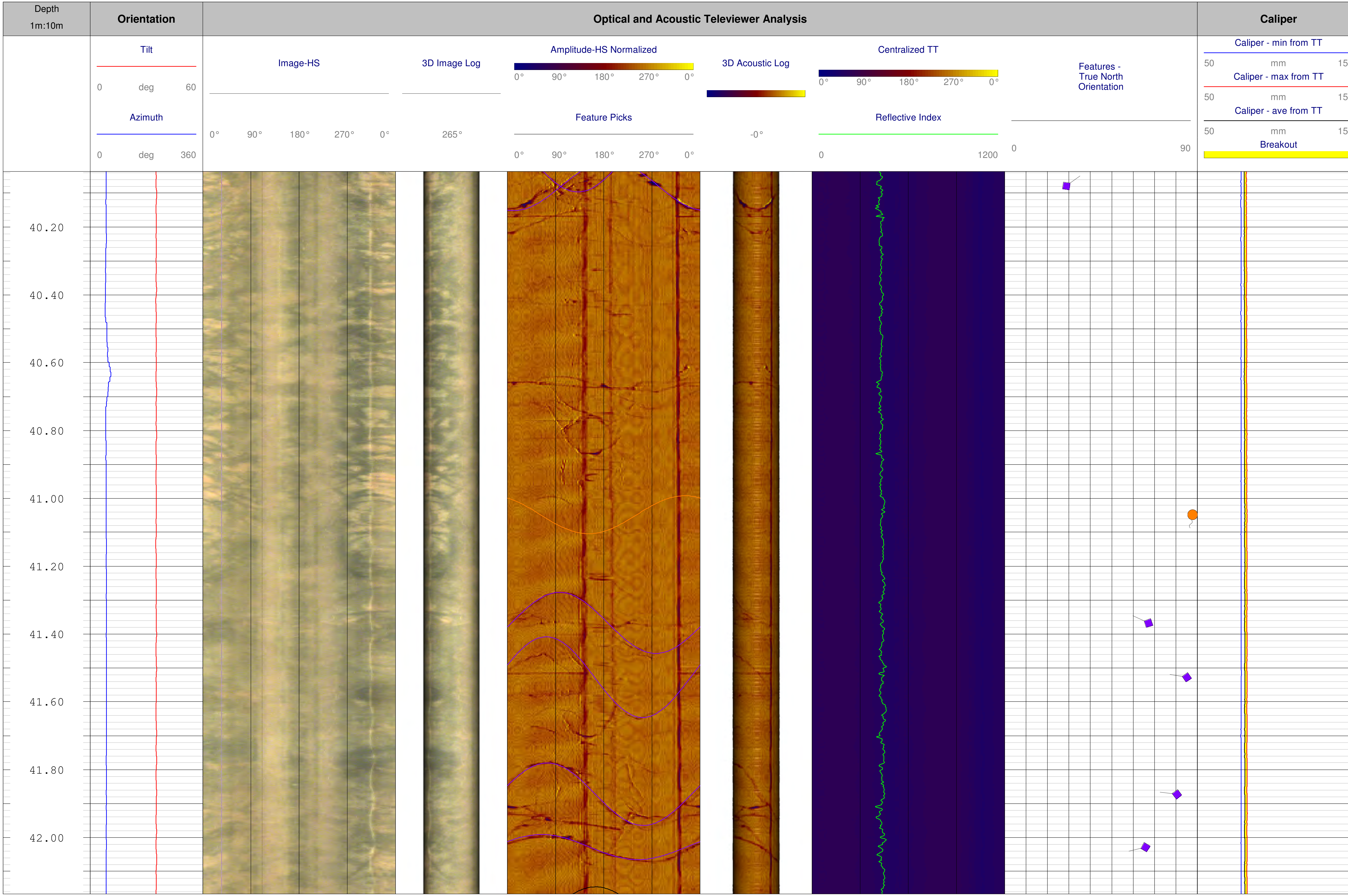
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
38.00
38.20
38.40
38.60
38.80
39.00
39.20
39.40
39.60
39.80
40.00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3D Image Log
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Amplitude-HS Normalized
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Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features -
True North
Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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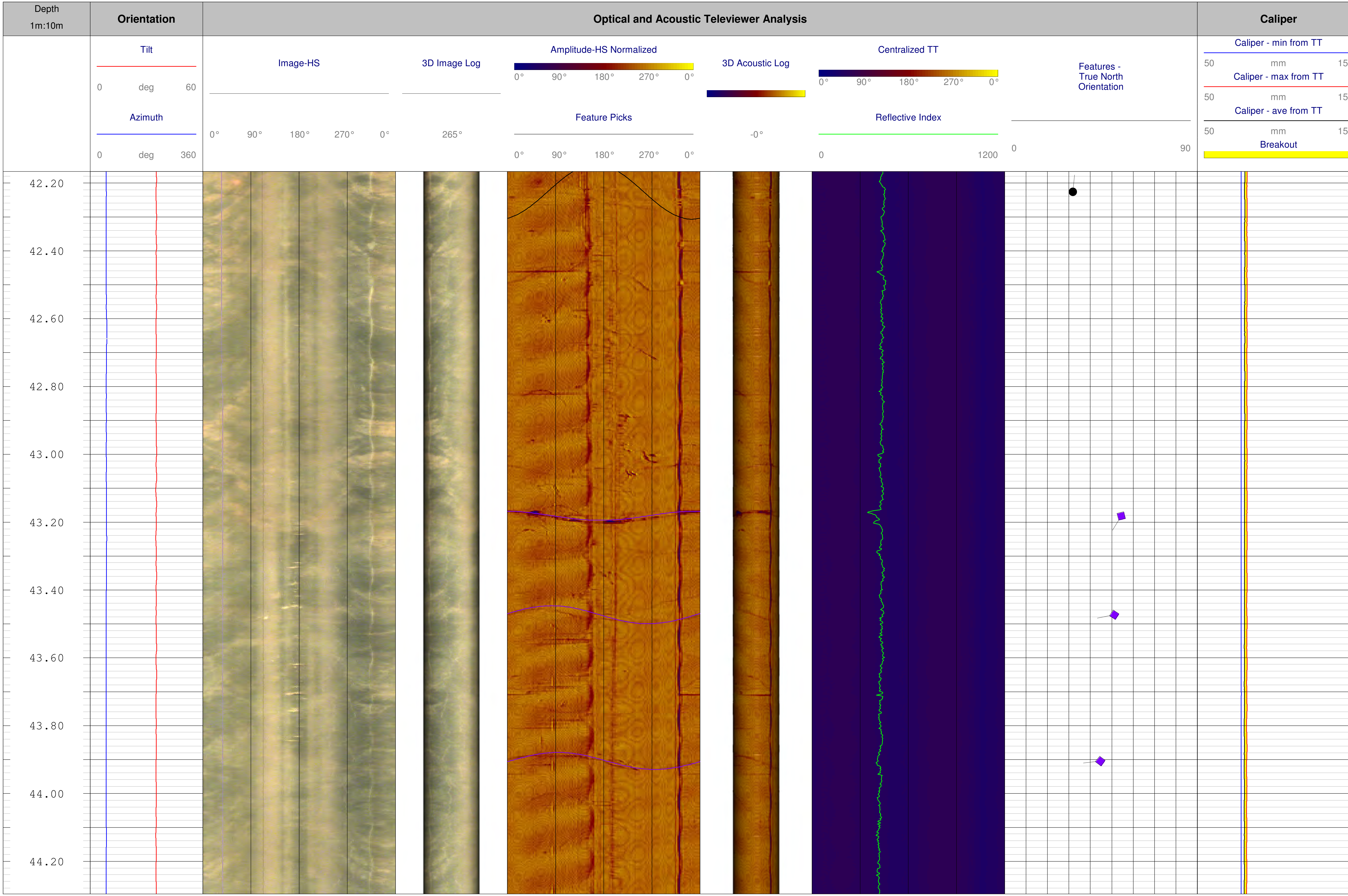
40.40
40.60
40.80
41.00
41.20
41.40
41.60
41.80
42.00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3D Image Log
265°
Amplitude-HS Normalized
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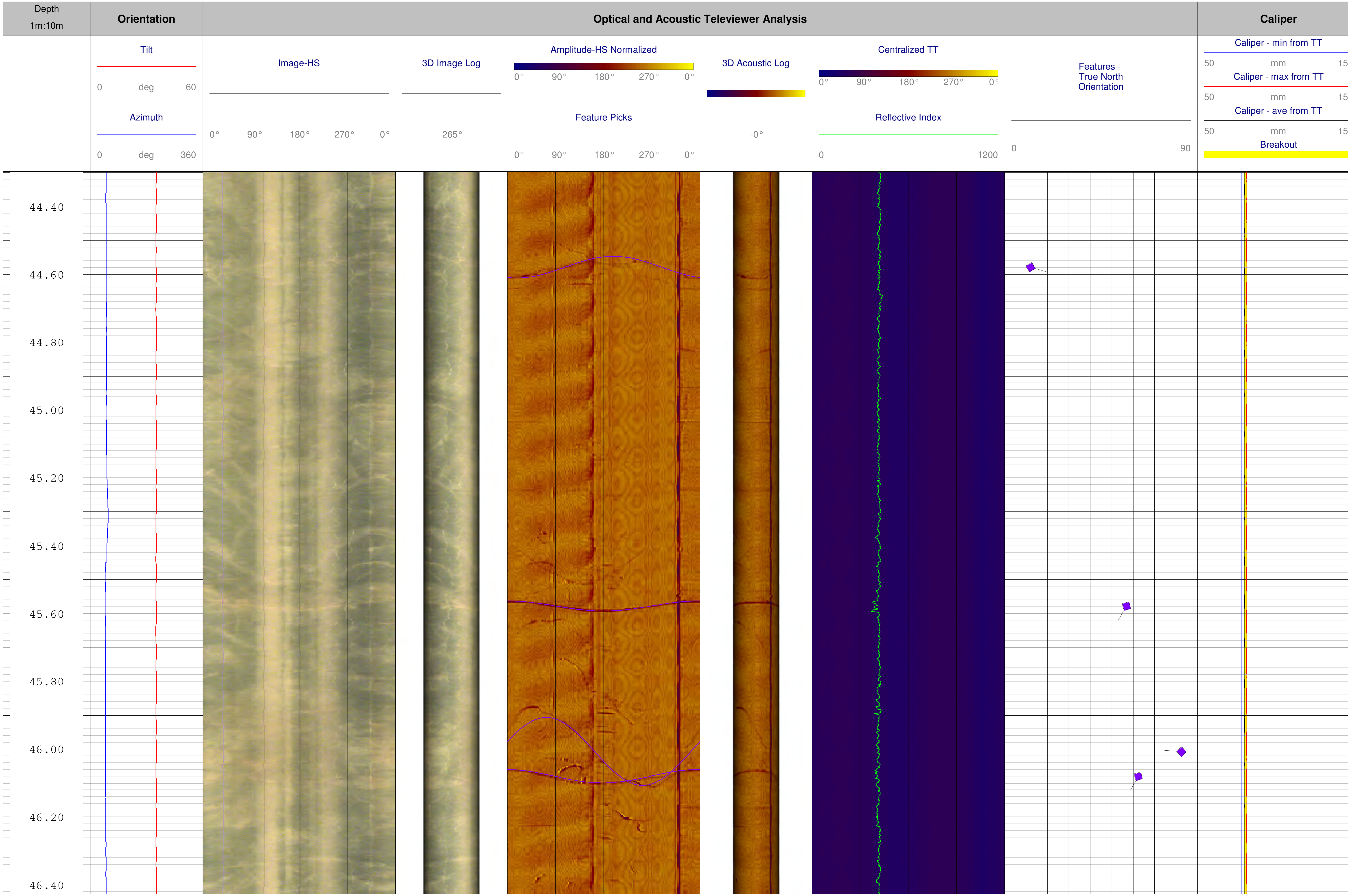
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
42.20
42.40
42.60
42.80
43.00
43.20
43.40
43.60
43.80
44.00
44.20



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Tilt
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Amplitude-HS Normalized
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Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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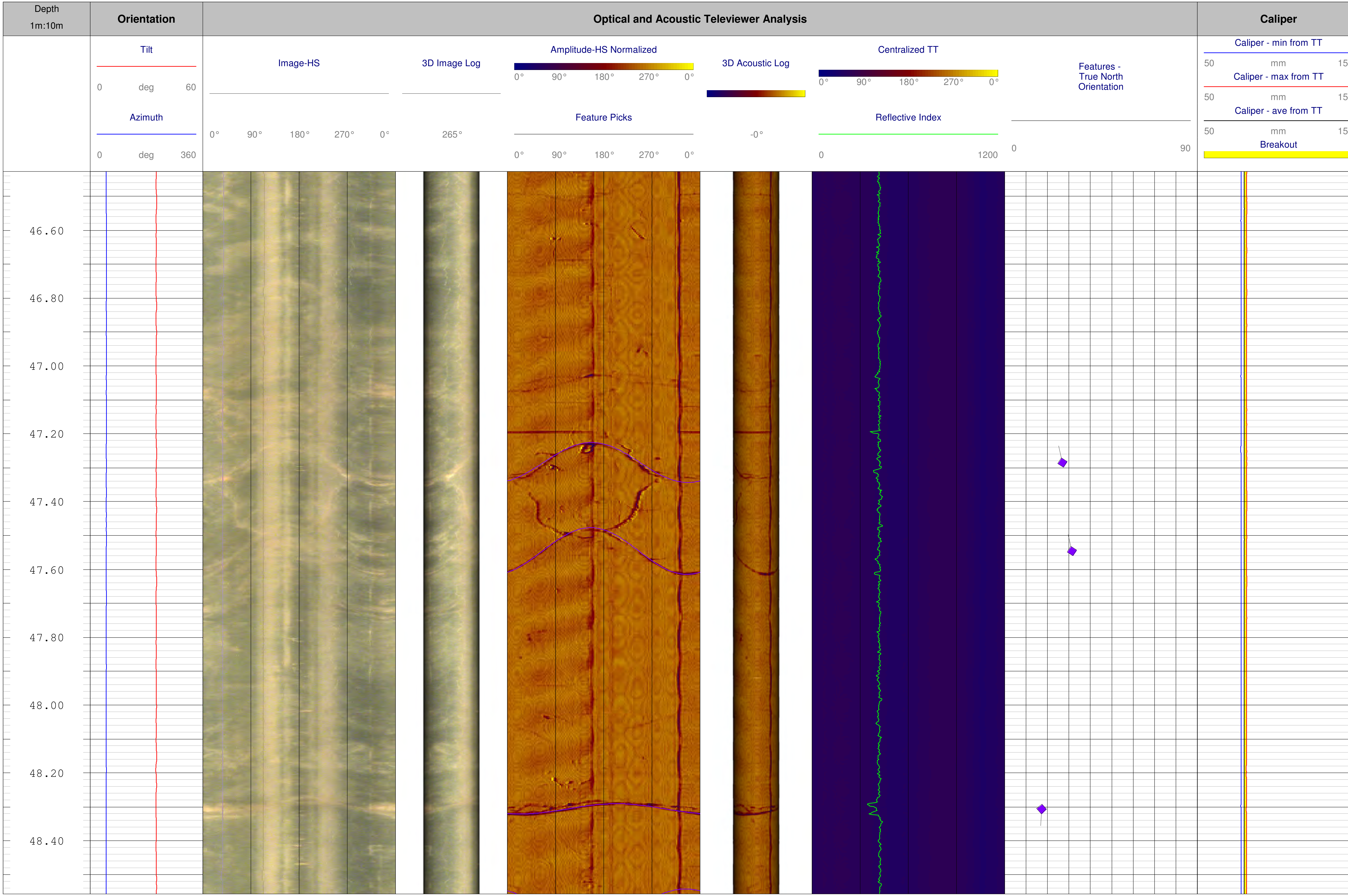
44.60
44.80
45.00
45.20
45.40
45.60
45.80
46.00
46.20
46.40



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3D Image Log
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Amplitude-HS Normalized
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Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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46.80
47.00
47.20
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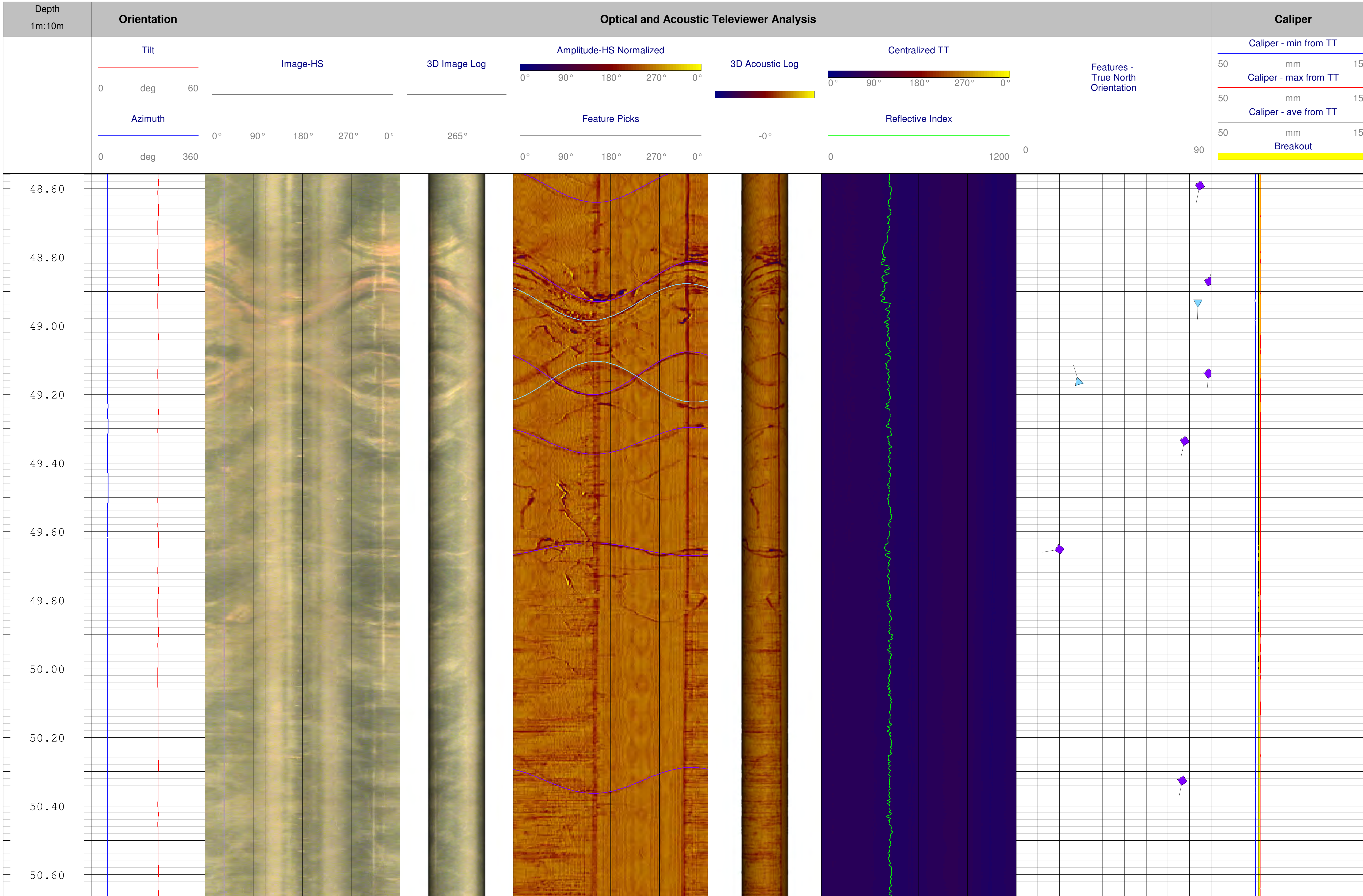
47.60
47.80
48.00
48.20
48.40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3D Image Log
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Amplitude-HS Normalized
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Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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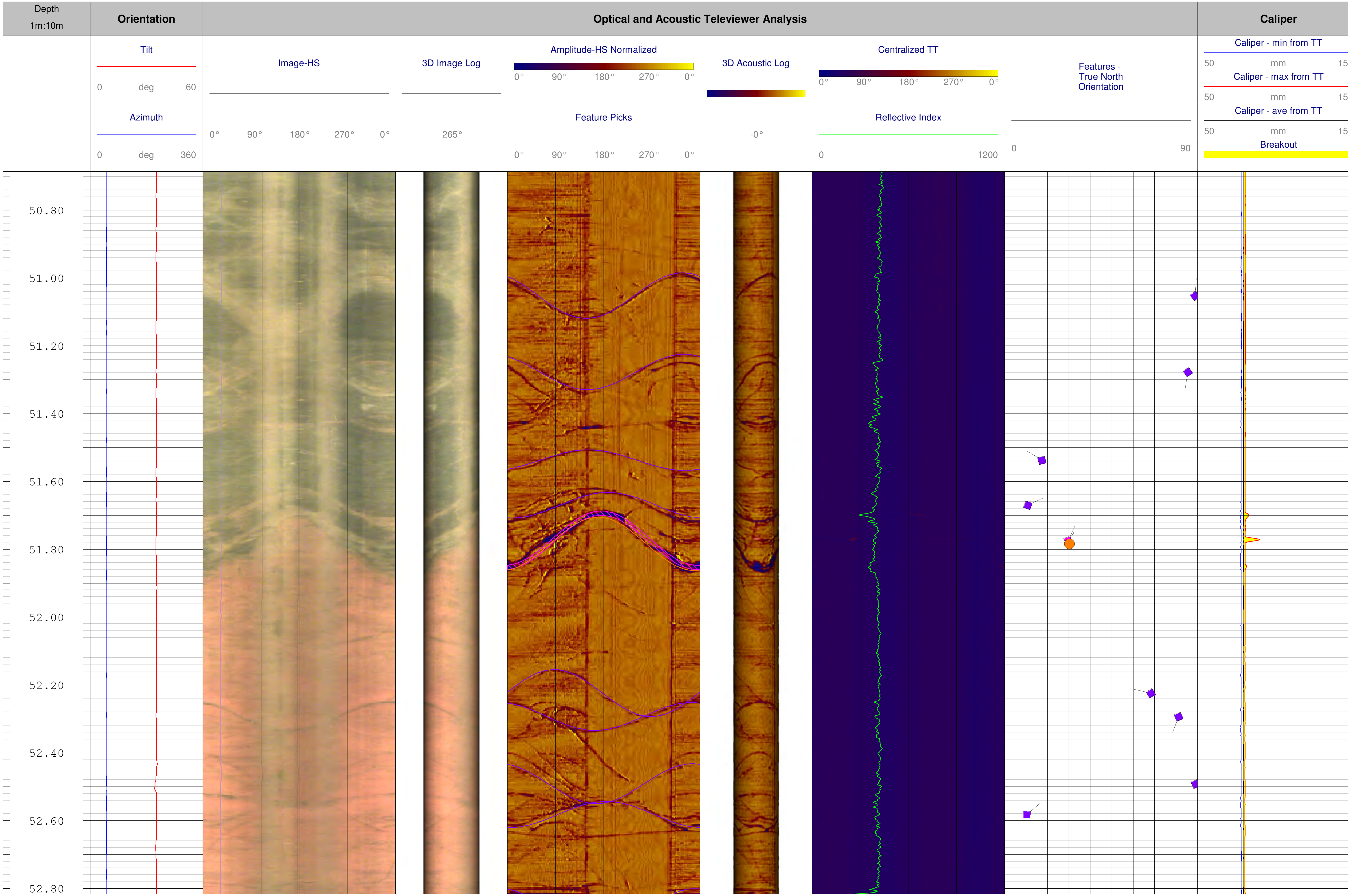
48.80
49.00
49.20
49.40
49.60
49.80
50.00
50.20
50.40
50.60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Azimuth
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3D Image Log
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Amplitude-HS Normalized
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Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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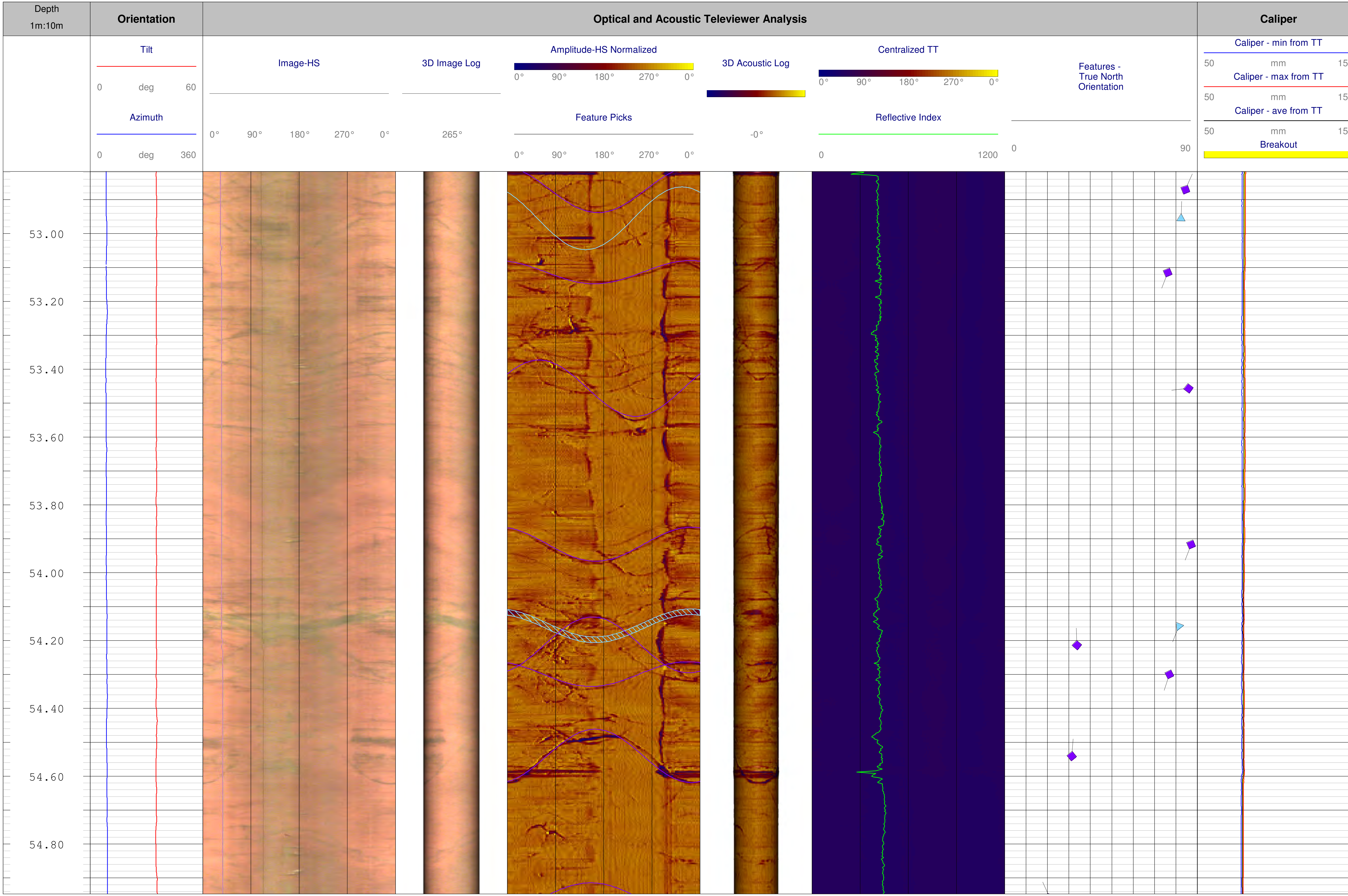
52.40
52.60
52.80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3D Image Log
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Amplitude-HS Normalized
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Feature Picks
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3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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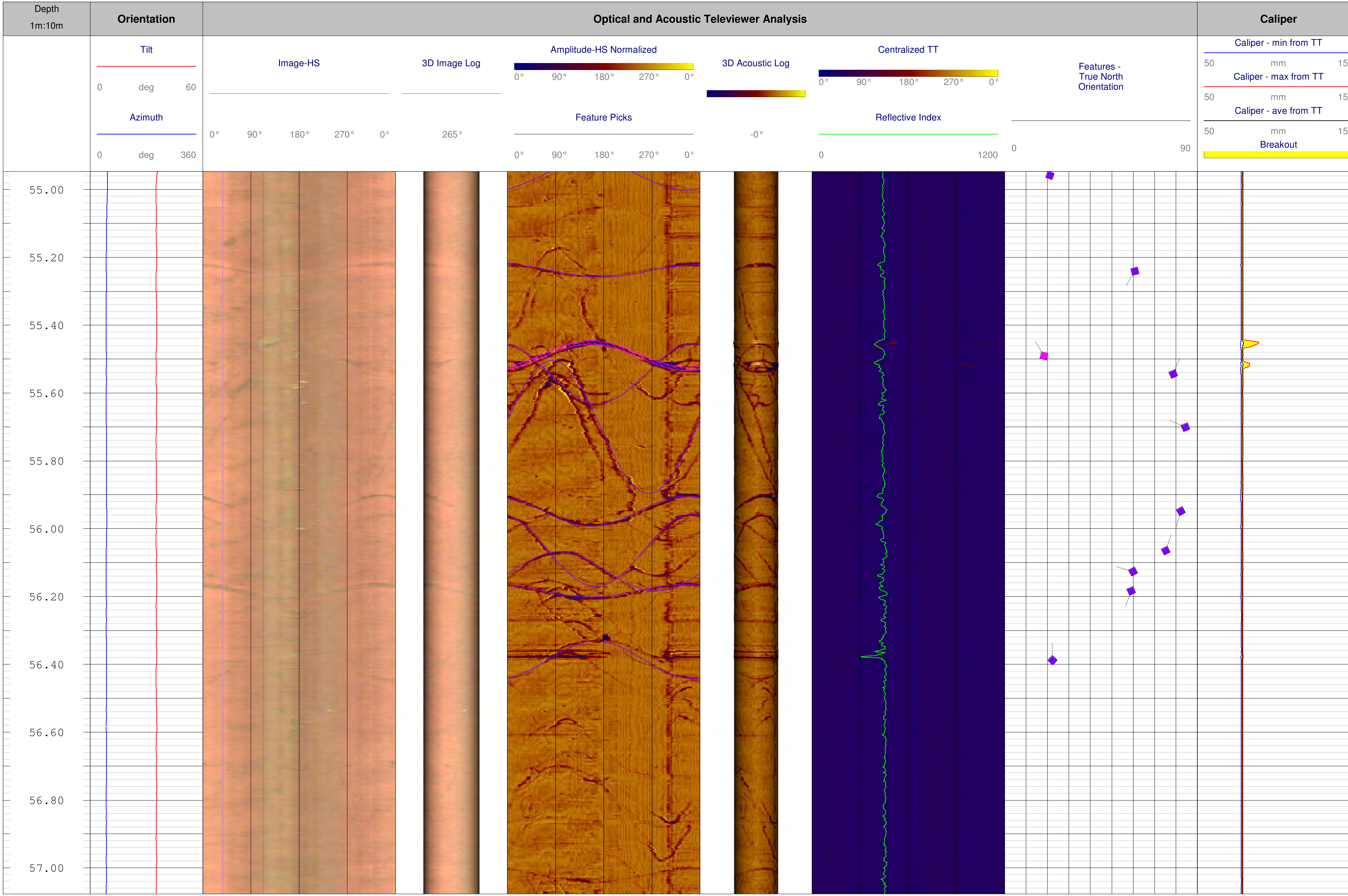
53.20
53.40
53.60
53.80
54.00
54.20
54.40
54.60
54.80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3D Image Log
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Feature Picks
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3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features -
True North
Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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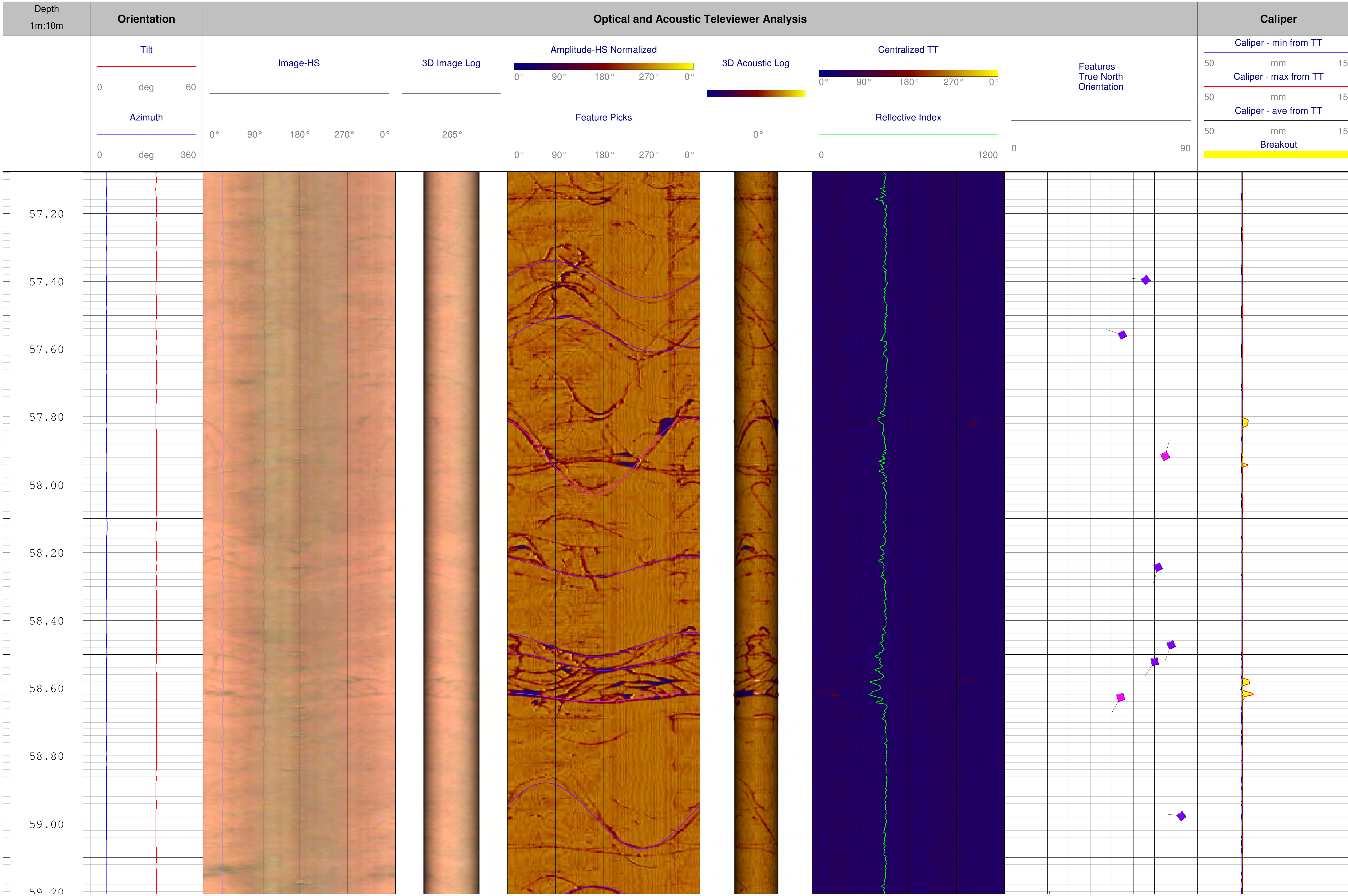
56.00
56.20
56.40
56.60
56.80
57.00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Feature Picks
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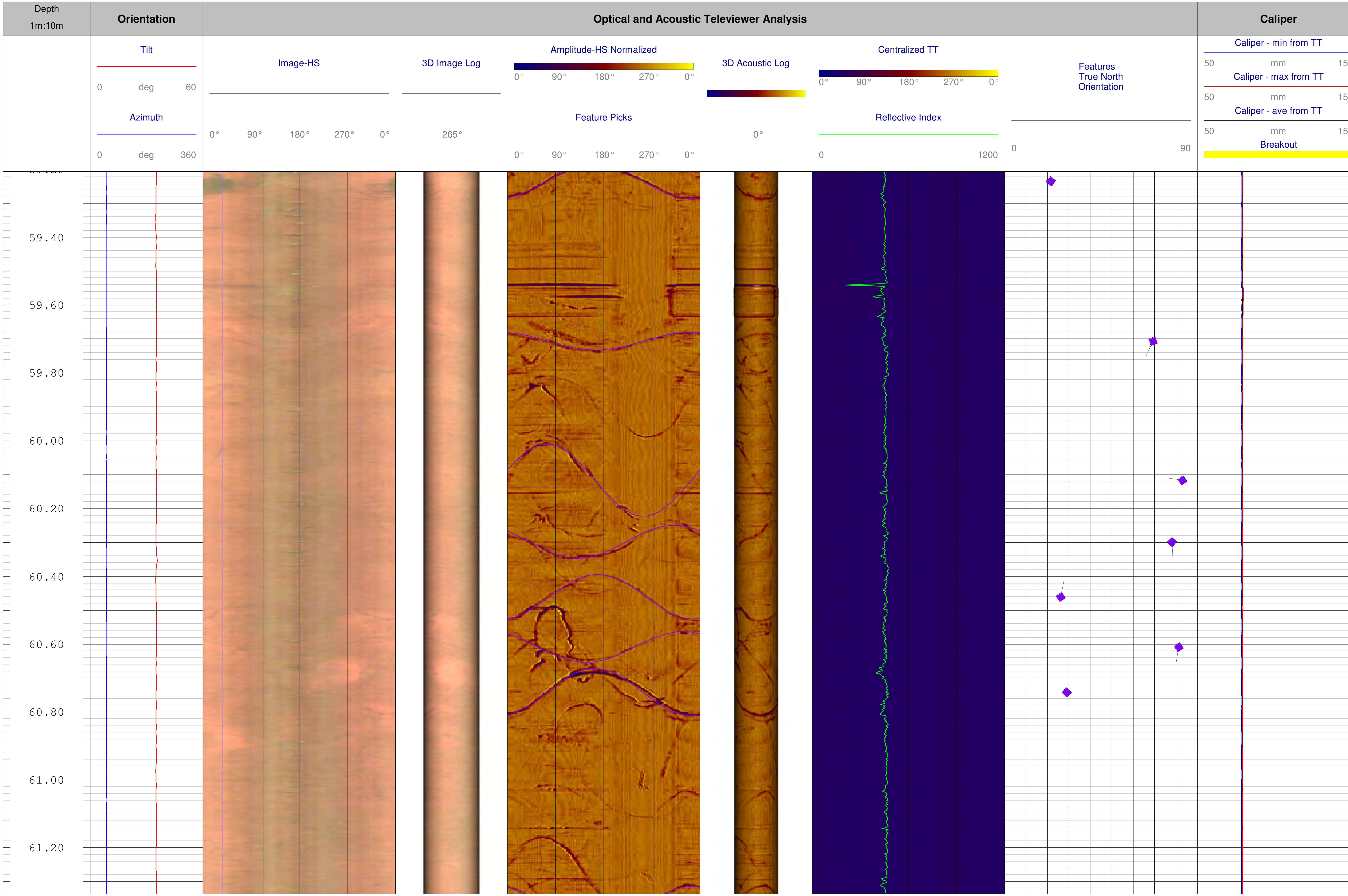
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
57.20
57.40
57.60
57.80
58.00
58.20
58.40
58.60
58.80
59.00
59.20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3D Image Log
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Amplitude-HS Normalized
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Feature Picks
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3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
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Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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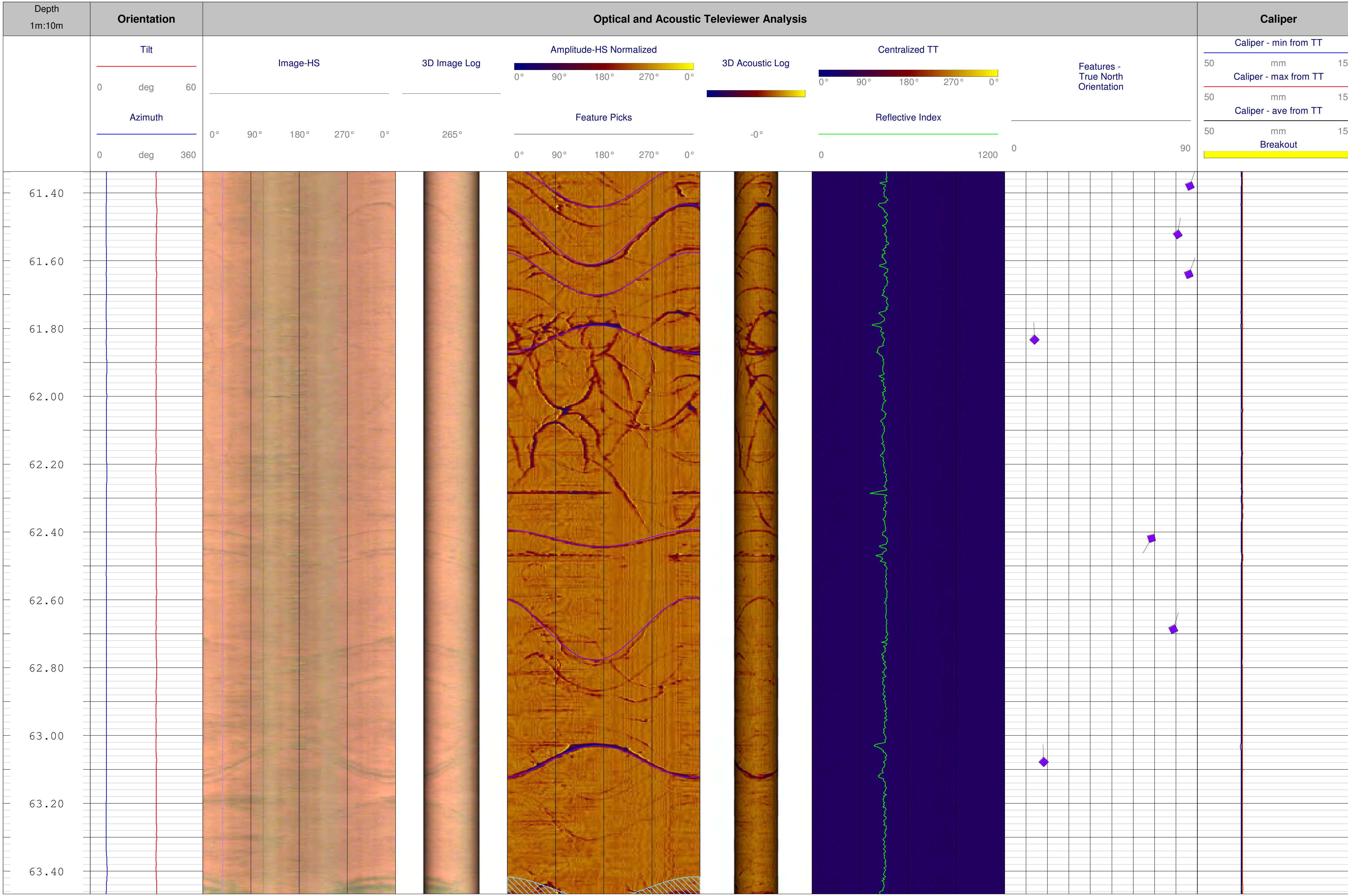
59.60
59.80
60.00
60.20
60.40
60.60
60.80
61.00
61.20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Optical and Acoustic Televiewer Analysis
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Image-HS
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3D Image Log
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Amplitude-HS Normalized
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Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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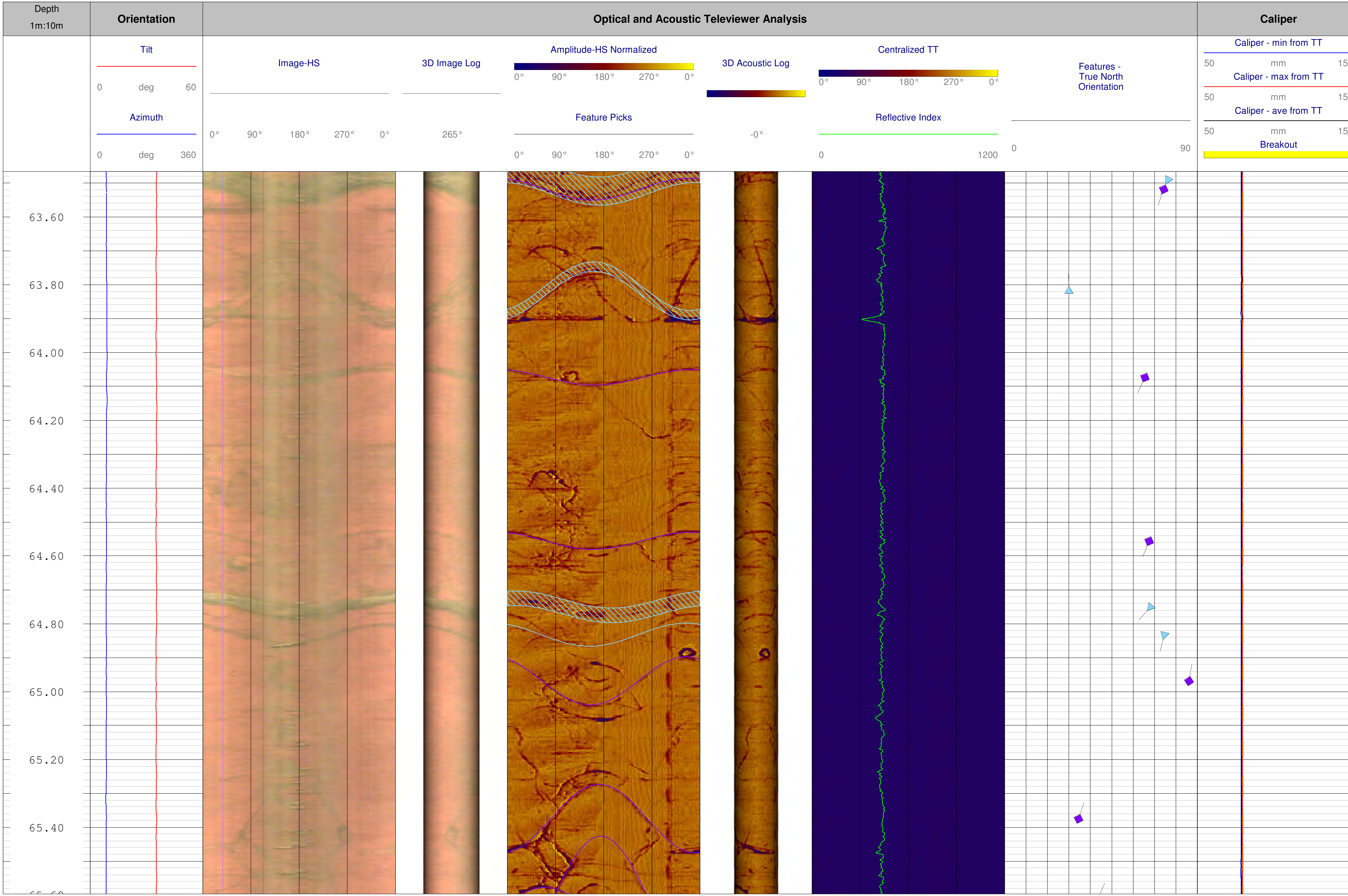
61.60
61.80
62.00
62.20
62.40
62.60
62.80
63.00
63.20
63.40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Caliper
Tilt
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Image-HS
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3D Image Log
265°
Amplitude-HS Normalized
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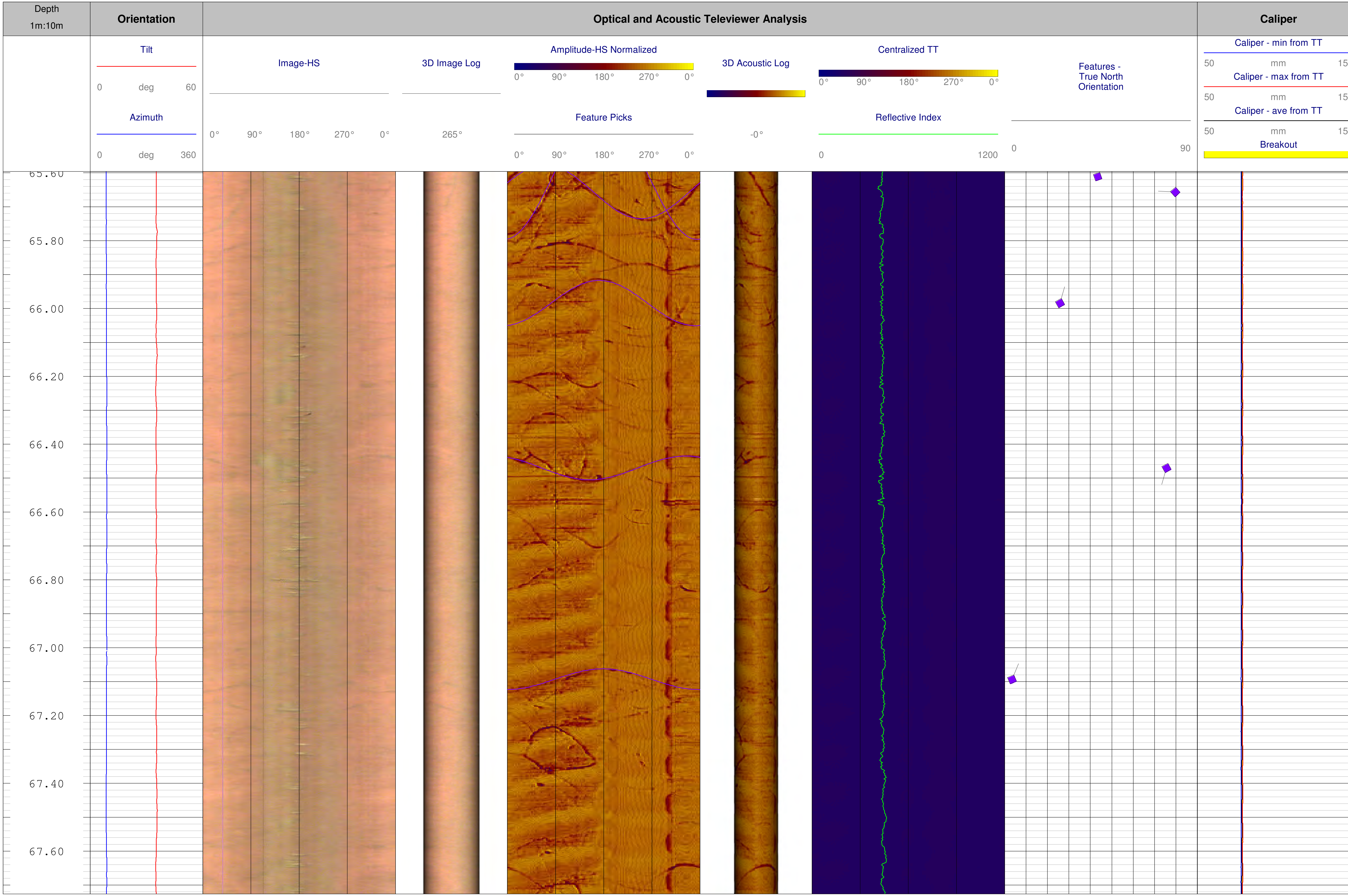
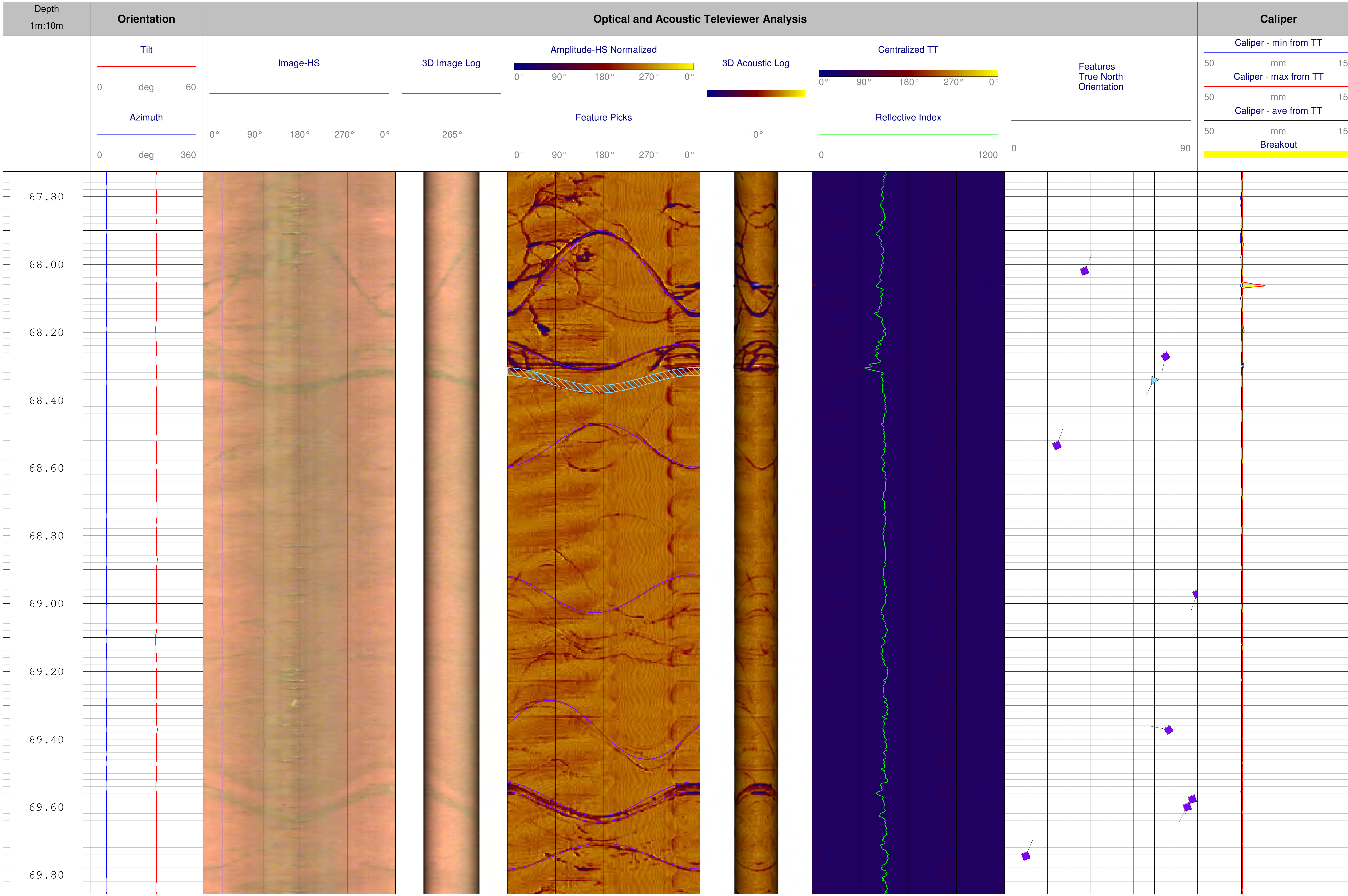
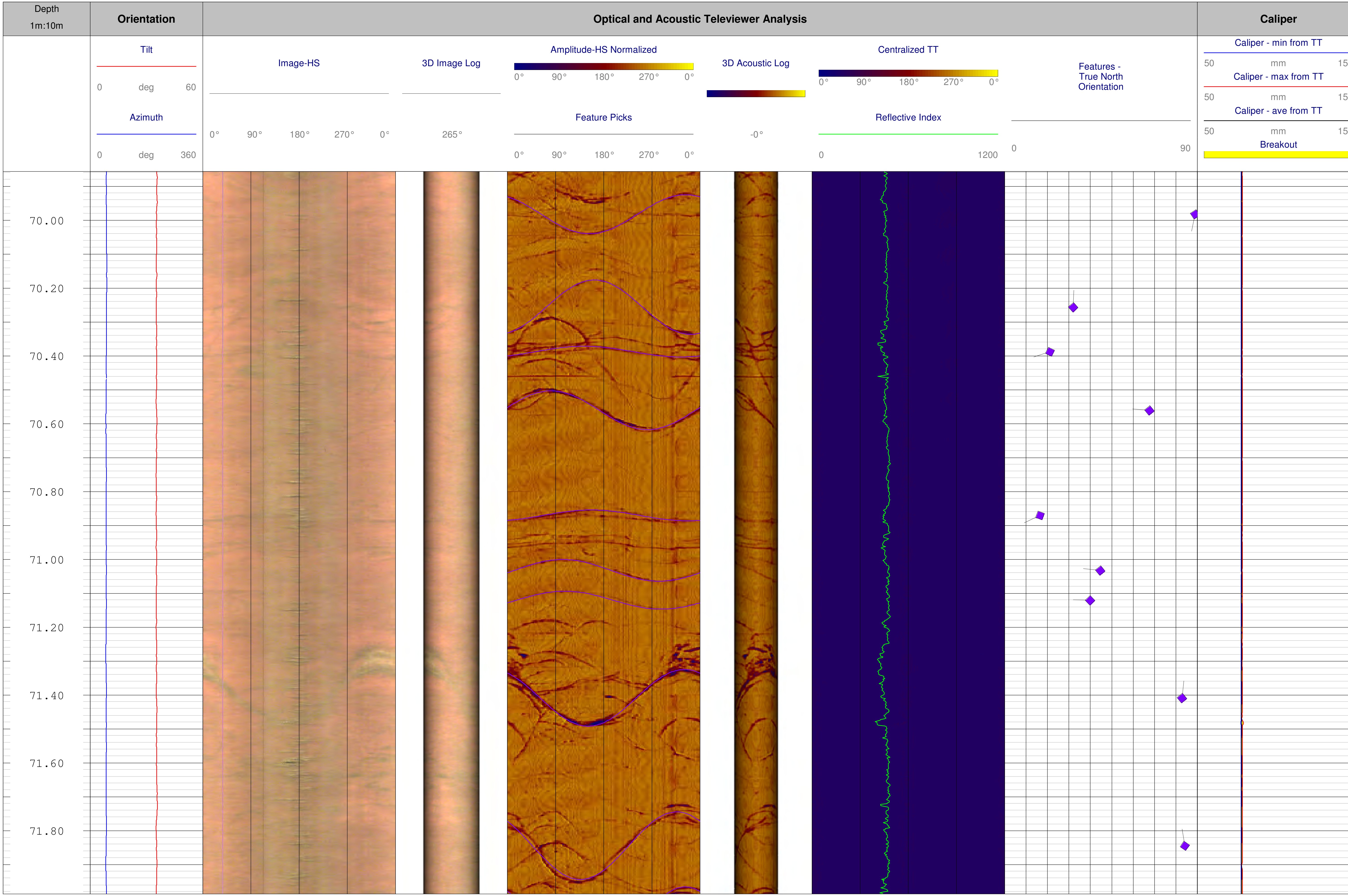
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
63.60
63.80
64.00
64.20
64.40
64.60
64.80
65.00
65.20
65.40


Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
65.60
65.80
66.00
66.20
66.40
66.60
66.80
67.00
67.20
67.40
67.60



Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
67.80
68.00
68.20
68.40
68.60
68.80
69.00
69.20
69.40
69.60
69.80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Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
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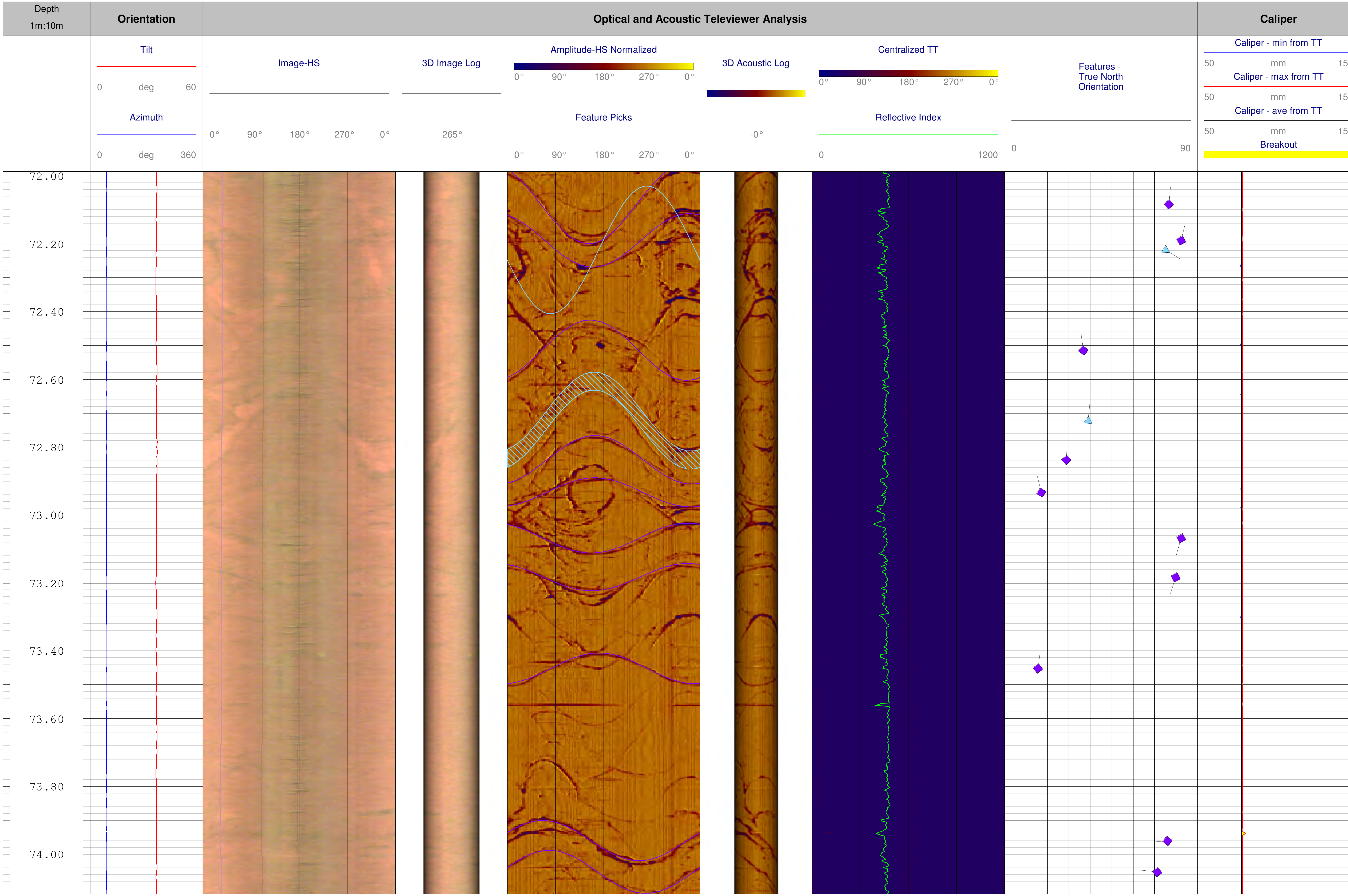
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
70.00
70.20
70.40
70.60
70.80
71.00
71.20
71.40
71.60
71.80


Depth
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Orientation
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Caliper
Tilt
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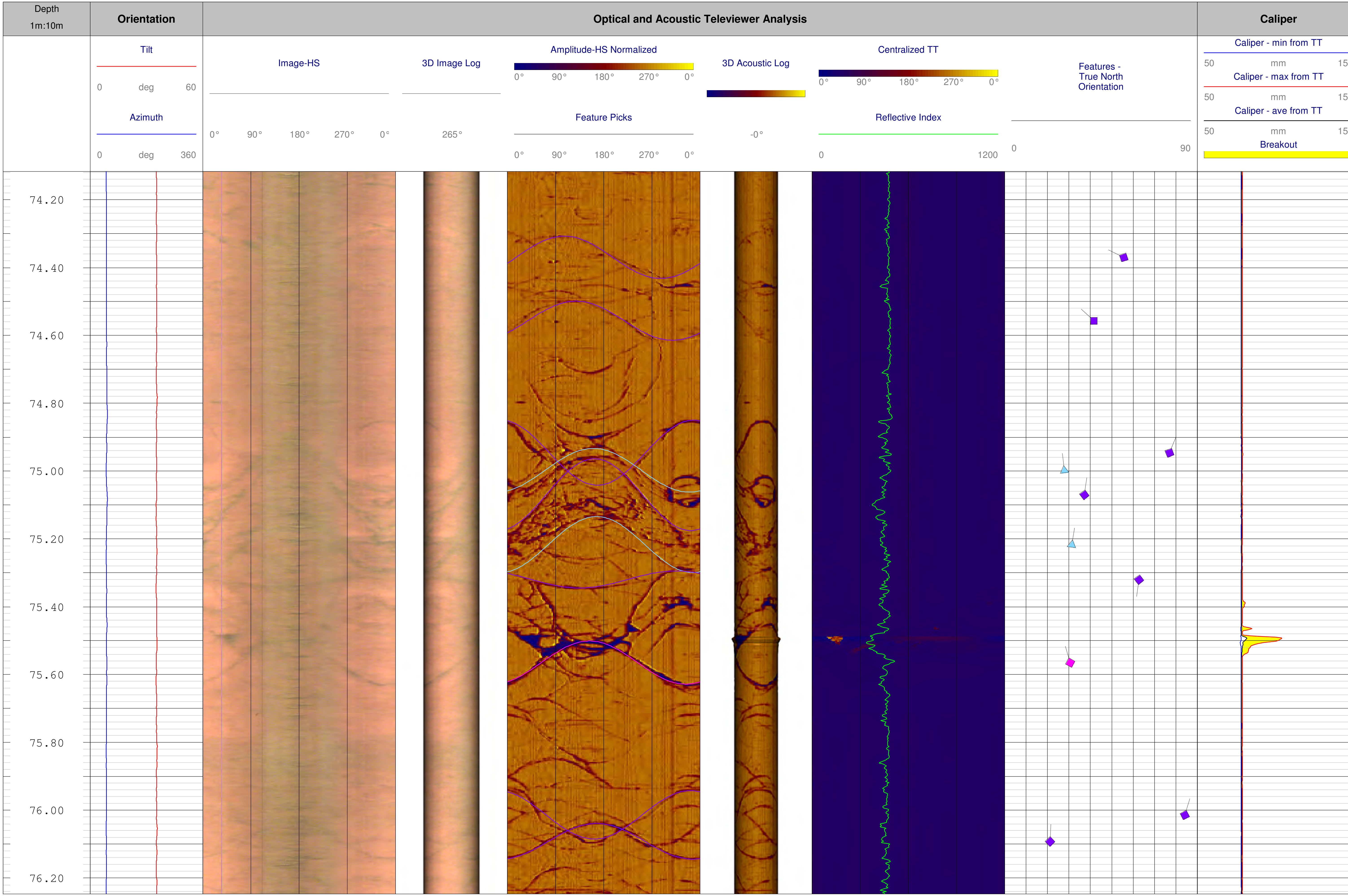
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features -
True North
Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
72.00
72.20
72.40
72.60
72.80
73.00
73.20
73.40
73.60
73.80
74.00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Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
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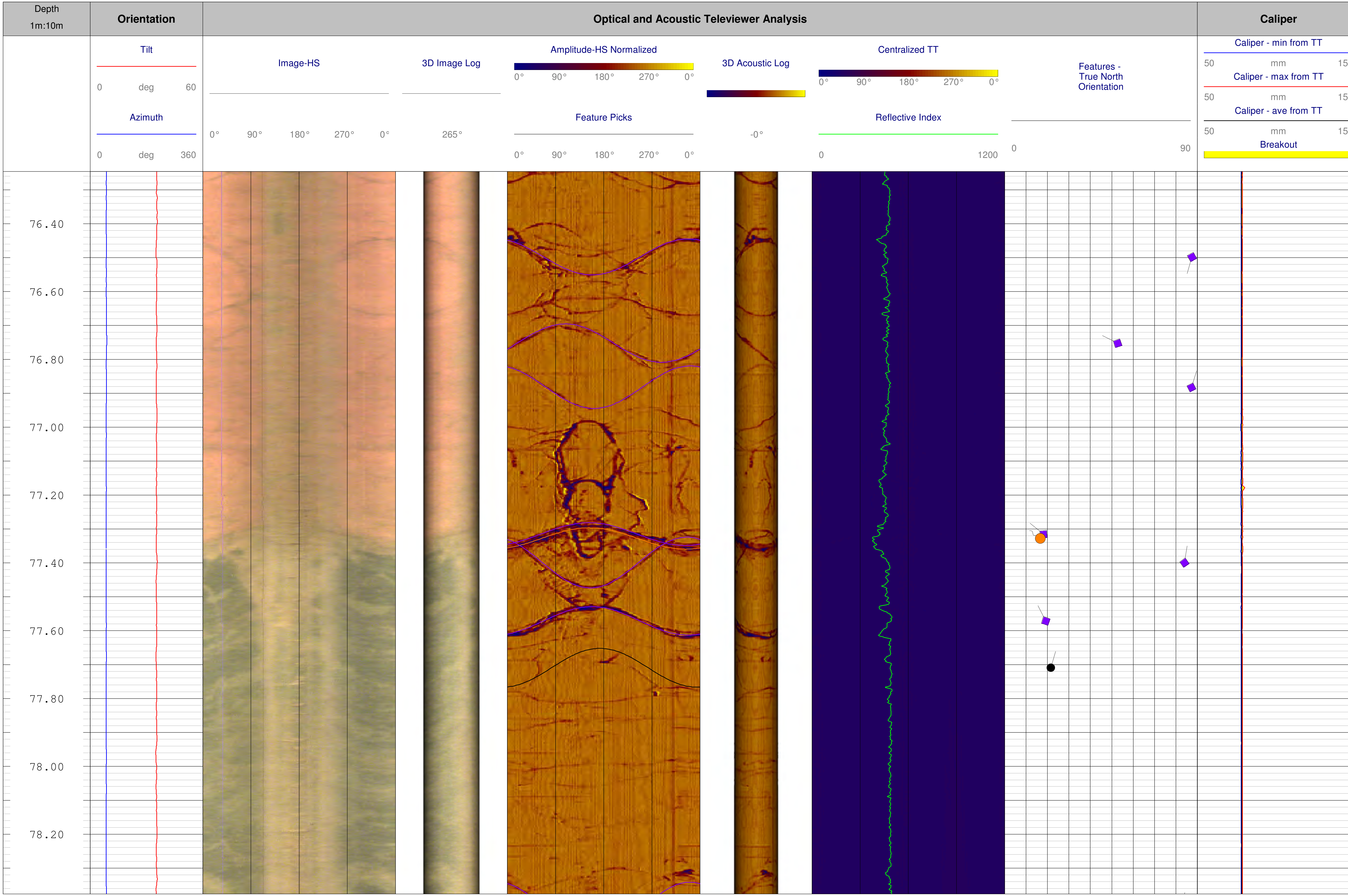
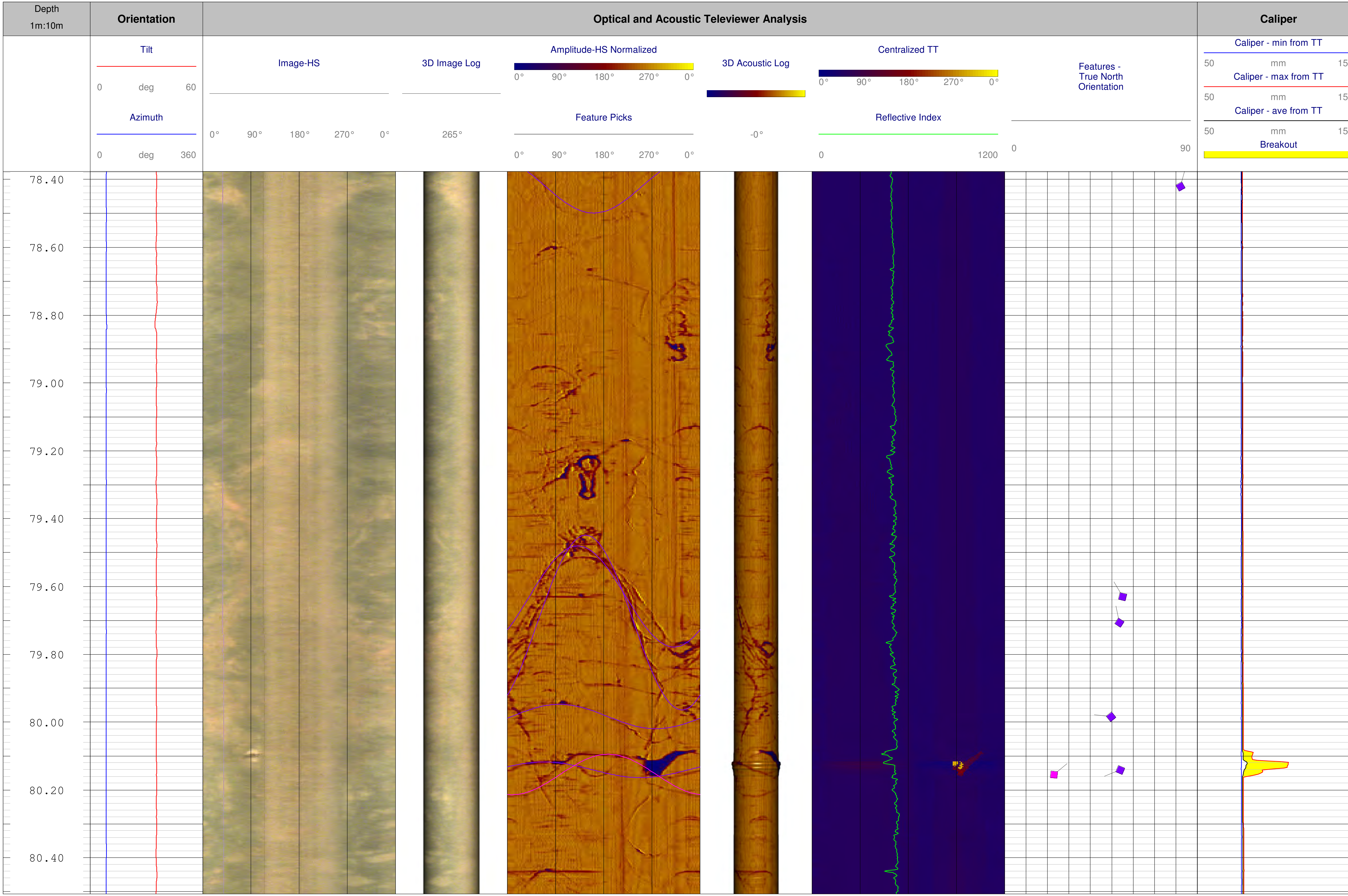
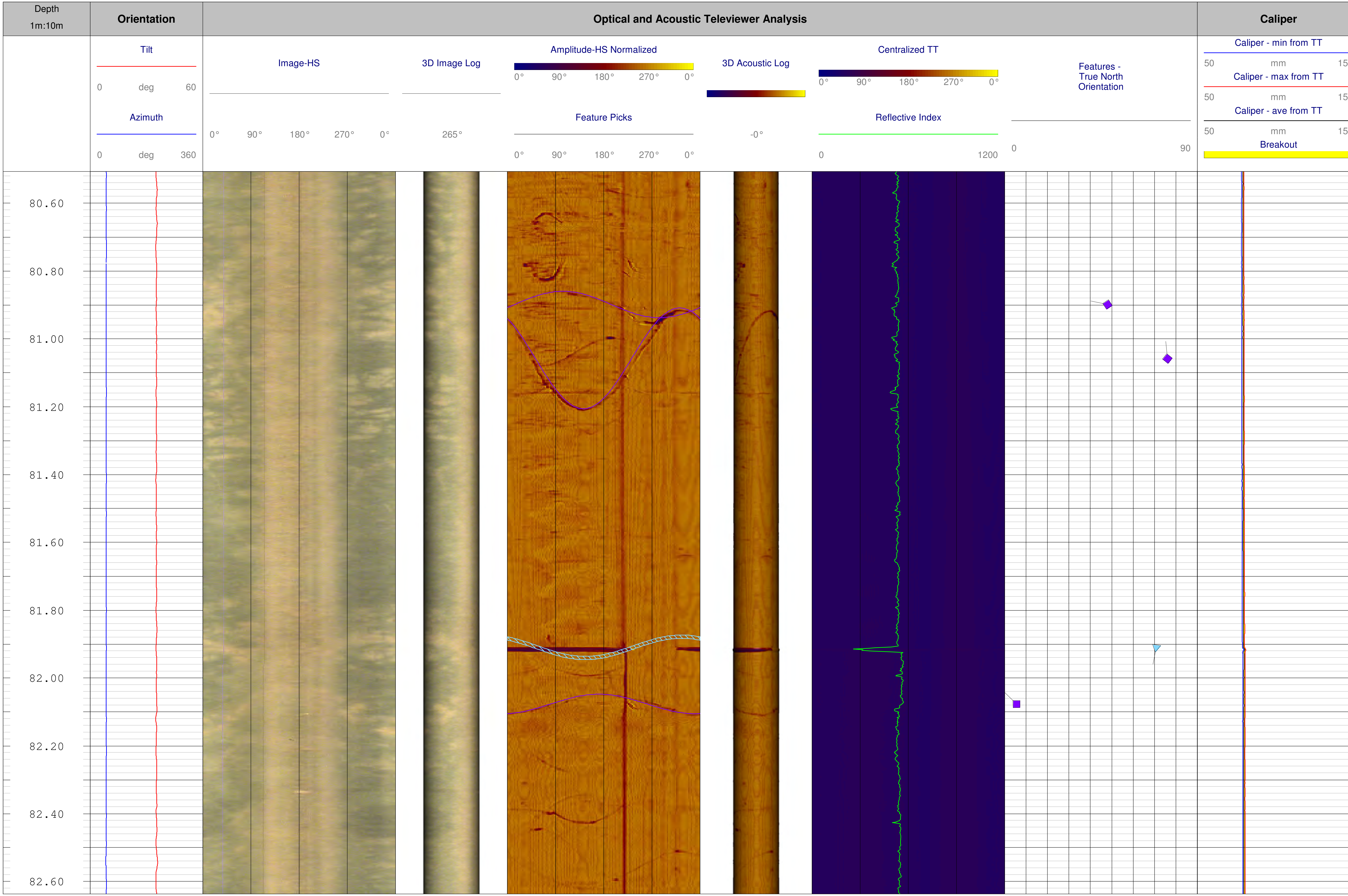
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
74.20
74.40
74.60
74.80
75.00
75.20
75.40
75.60
75.80
76.00
76.20



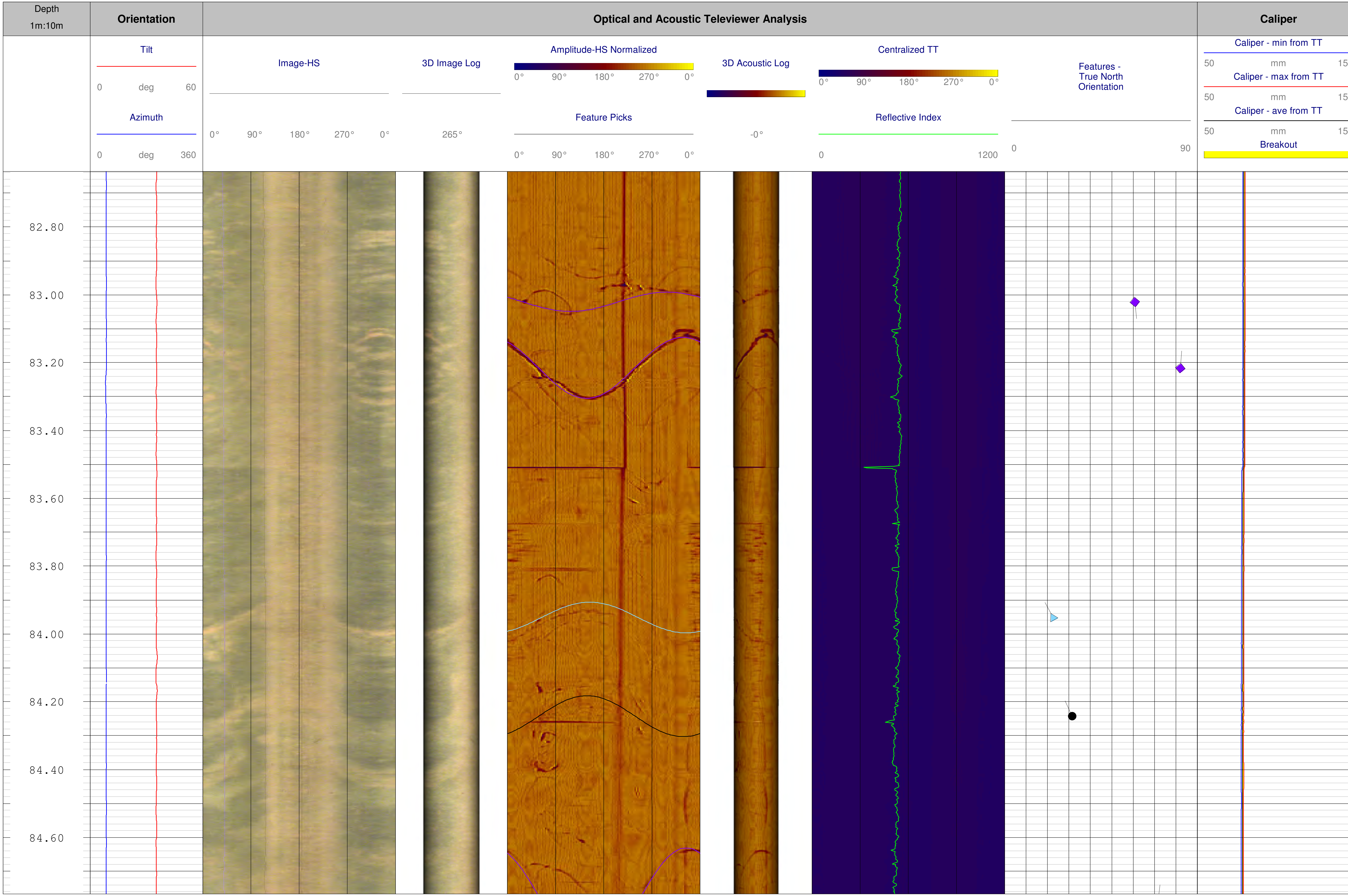
Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
76.40
76.60
76.80
77.00
77.20
77.40
77.60
77.80
78.00
78.20



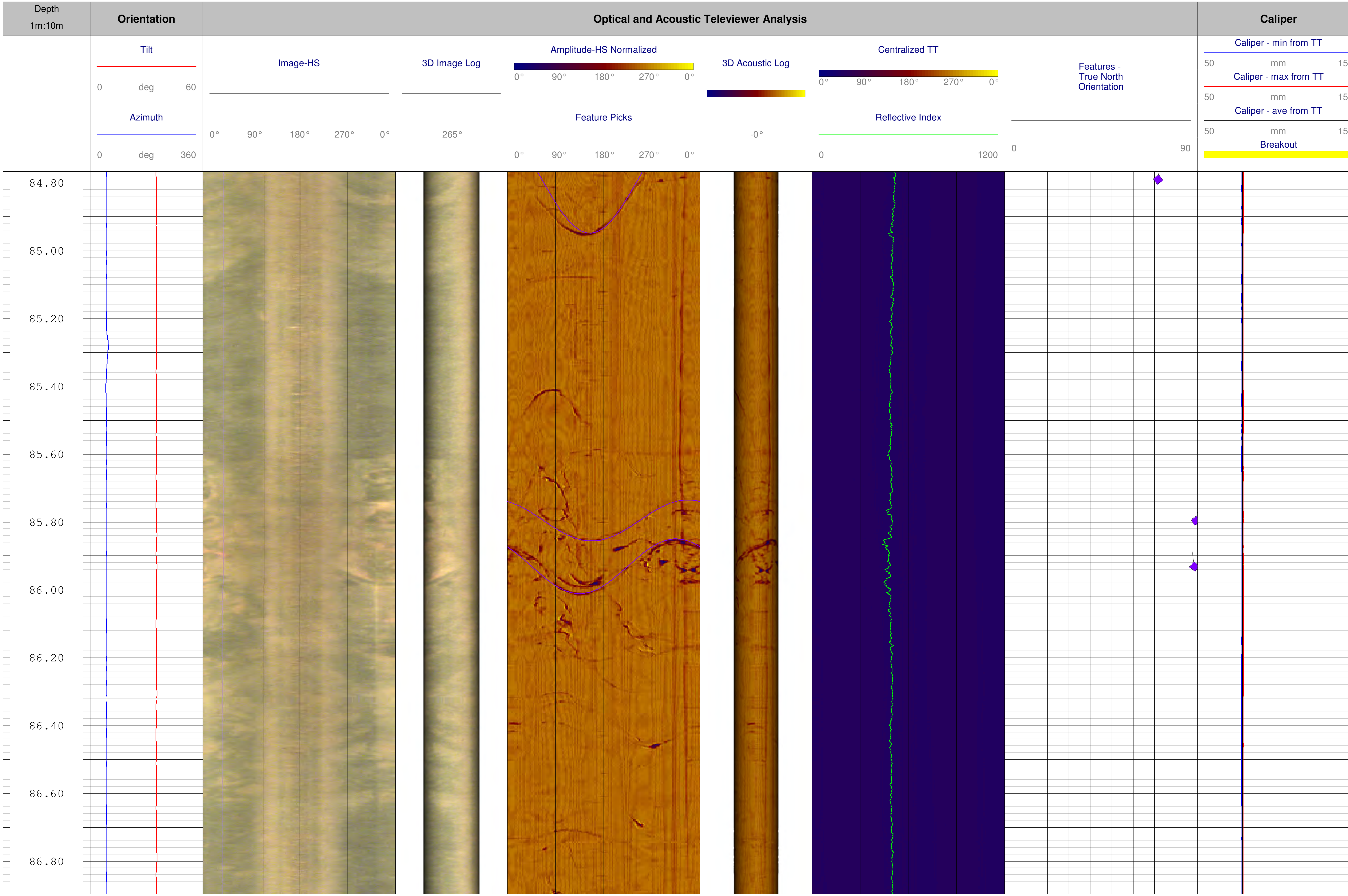
Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
78.40
78.60
78.80
79.00
79.20
79.40
79.60
79.80
80.00
80.20
80.40



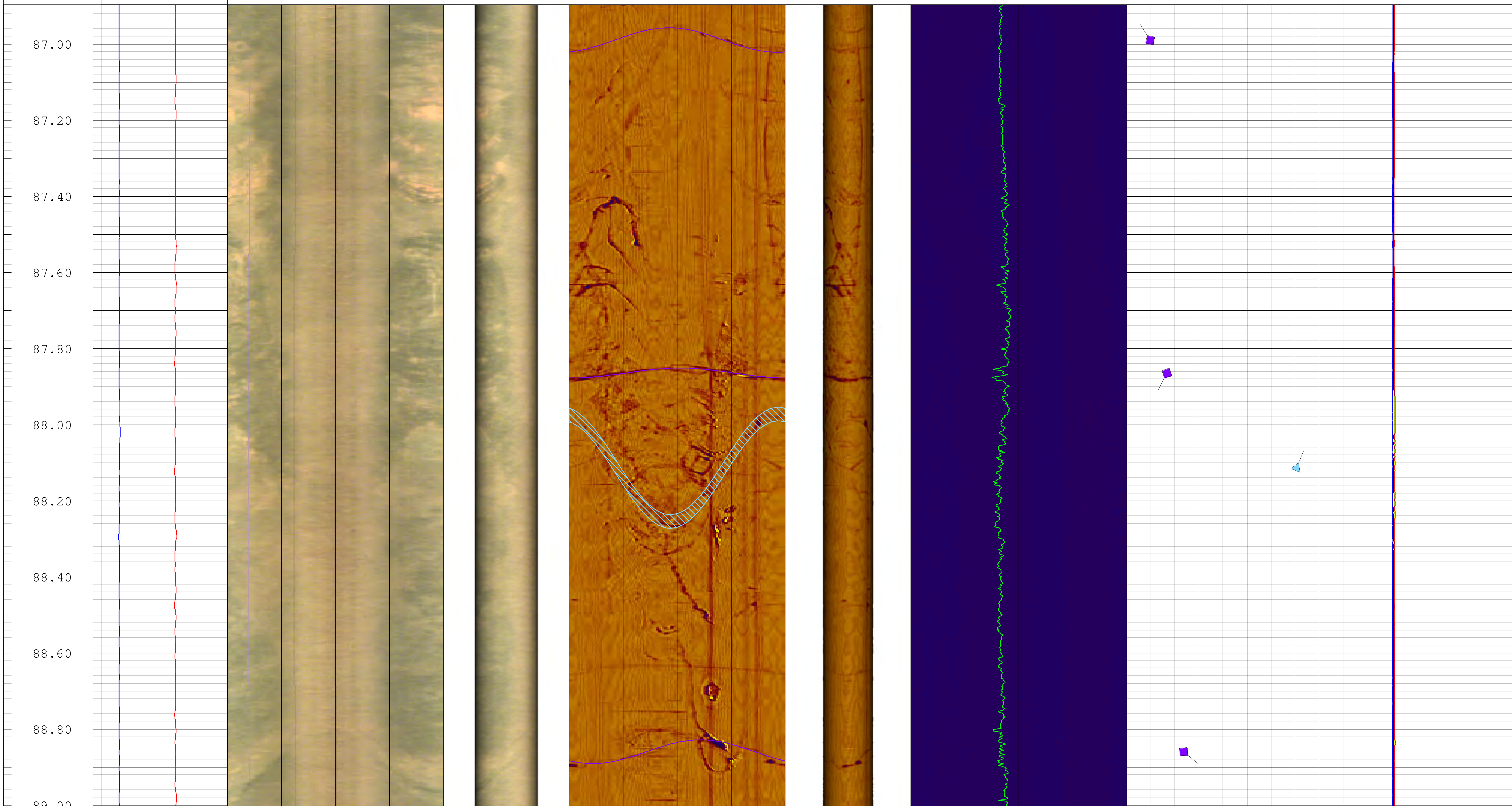
Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
80.60
80.80
81.00
81.20
81.40
81.60
81.80
82.00
82.20
82.40
82.60

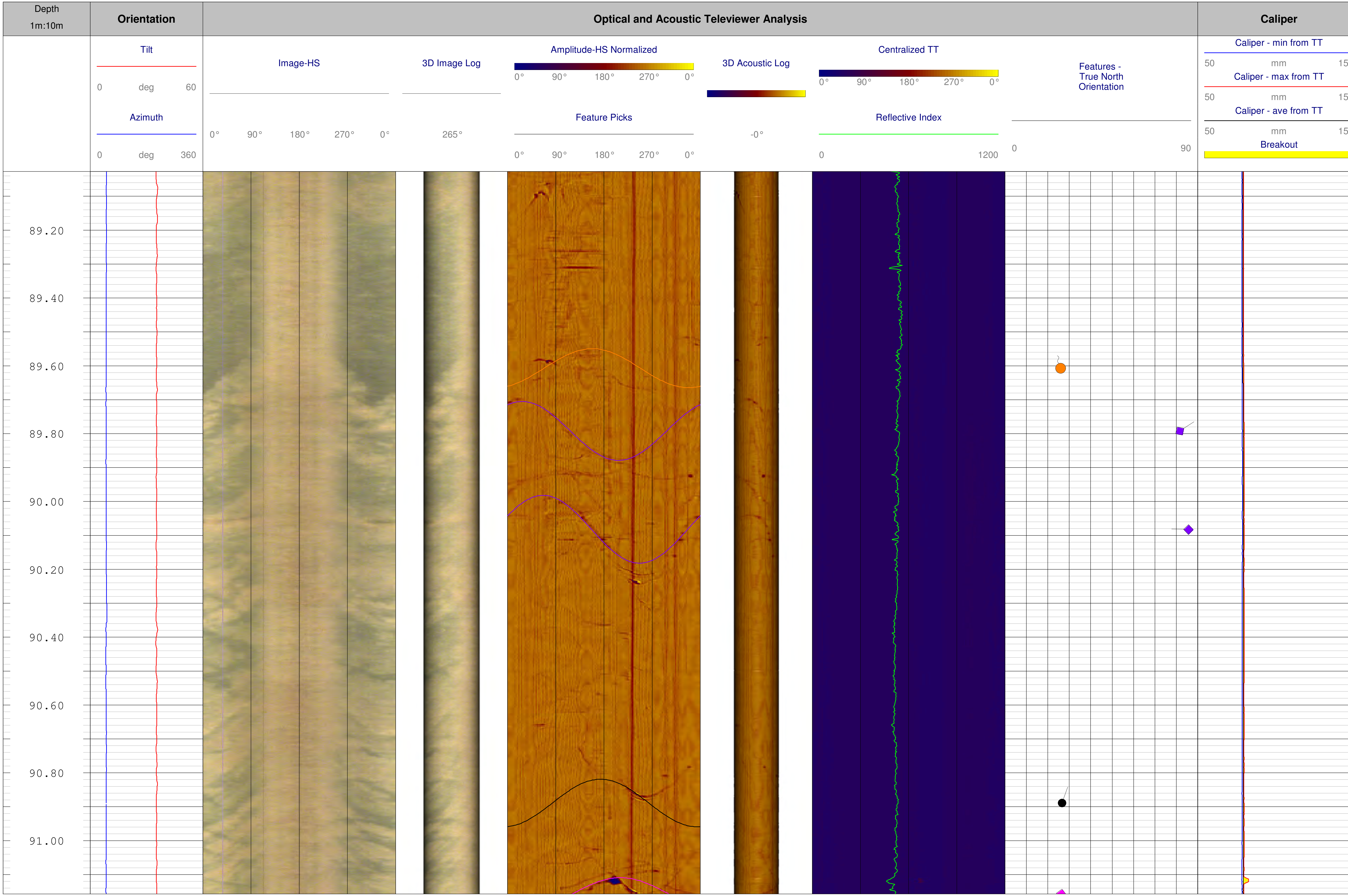


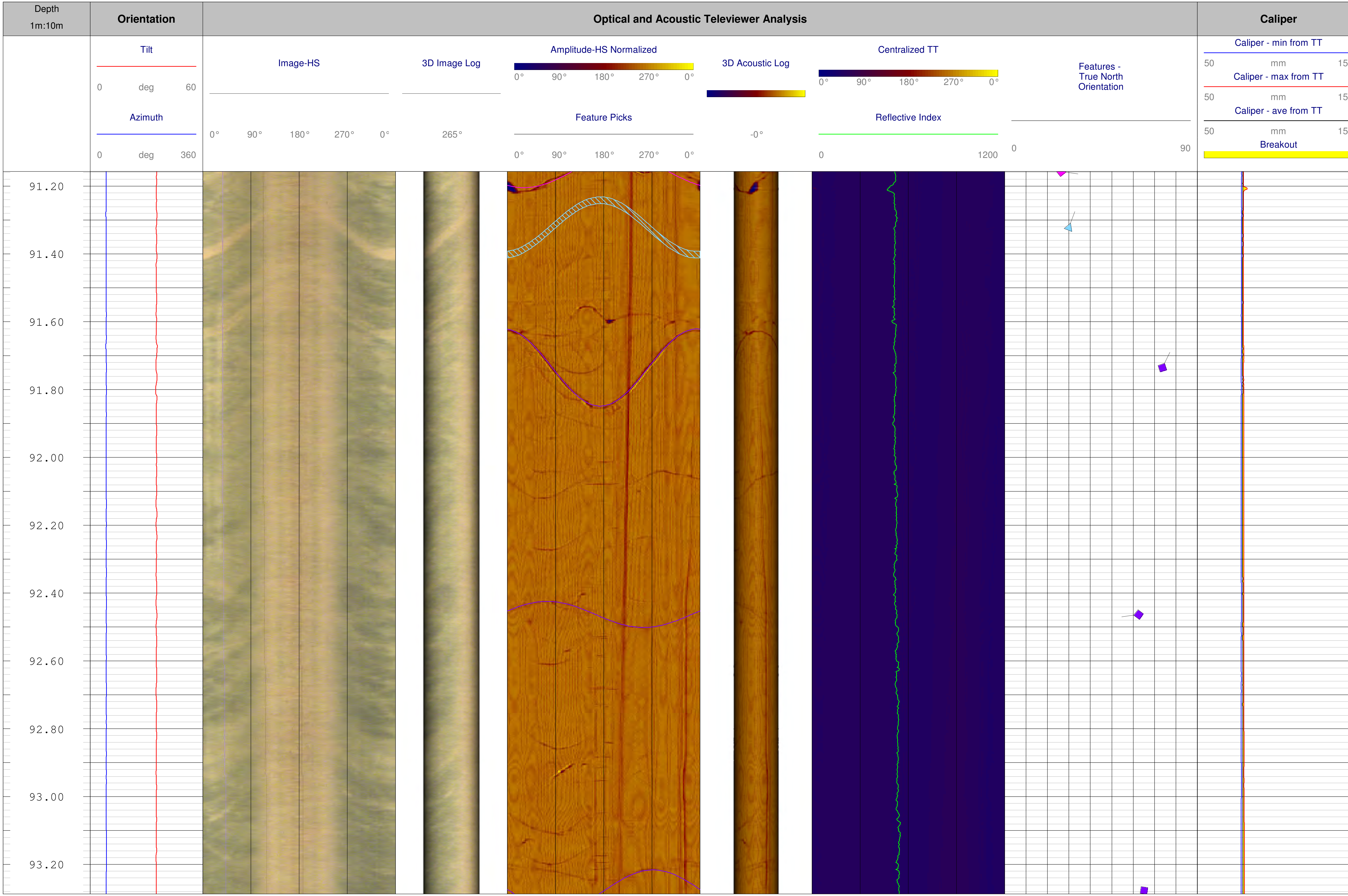
Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
82.80
83.00
83.20
83.40
83.60
83.80
84.00
84.20
84.40
84.60

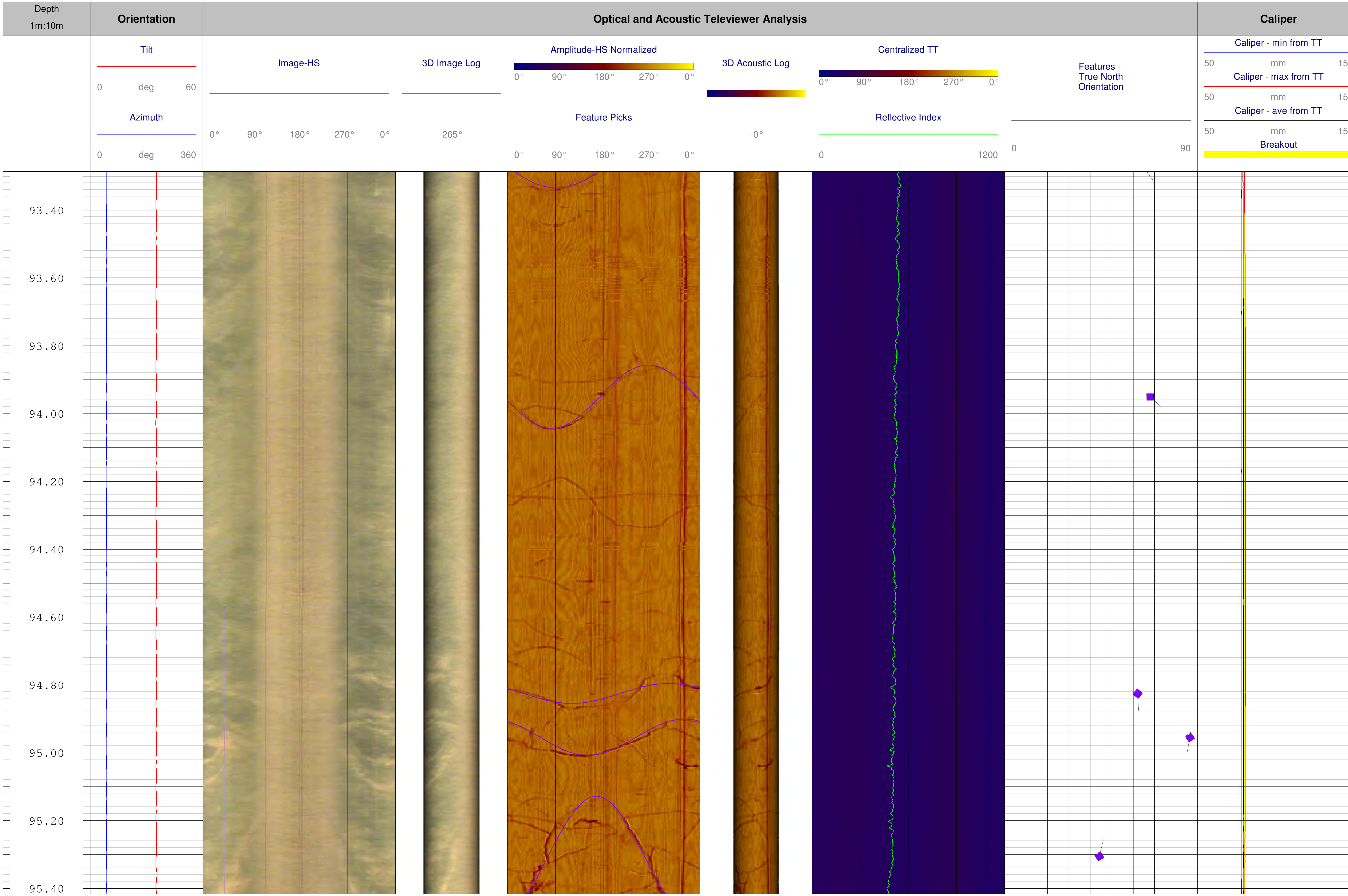

Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
84.80
85.00
85.20
85.40
85.60
85.80
86.00
86.20
86.40
86.60
86.80

Depth 1m:10m	Orientation	Optical and Acoustic Televiewer Analysis	Caliper
	Tilt 0 deg 60; Azimuth 0 deg 360	Image-HS (0° 90° 180° 270° 0°); 3D Image Log (265°); Amplitude-HS Normalized (0° 90° 180° 270° 0°); Feature Picks (0° 90° 180° 270° 0°); 3D Acoustic Log (-0°); Centralized TT (0° 90° 180° 270° 0°); Reflective Index (0 1200); Features - True North Orientation (0 90)	Caliper - min from TT 50 mm 150; Caliper - max from TT 50 mm 150; Caliper - ave from TT 50 mm 150; Breakout

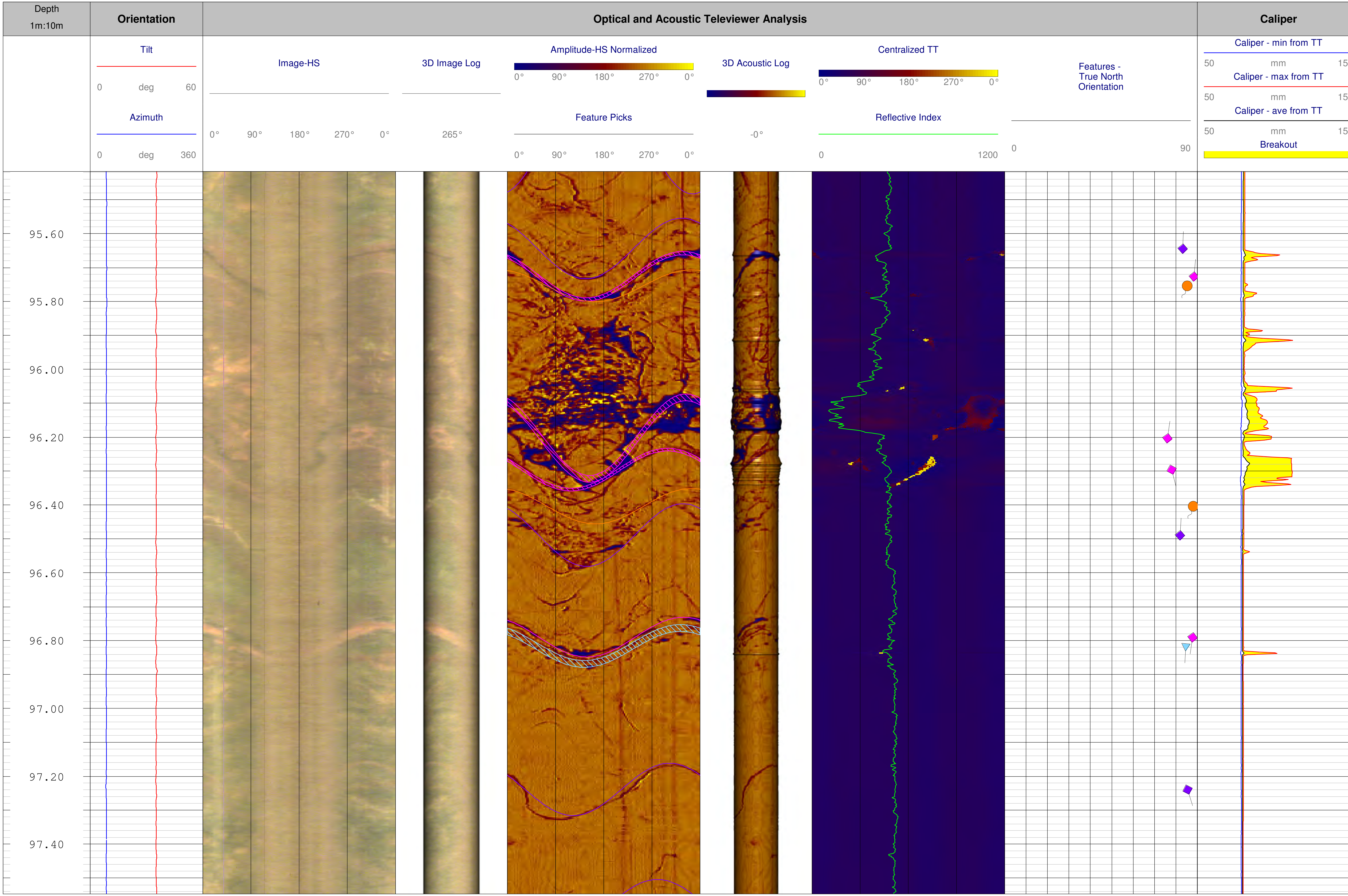



Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
89.20
89.40
89.60
89.80
90.00
90.20
90.40
90.60
90.80
91.00

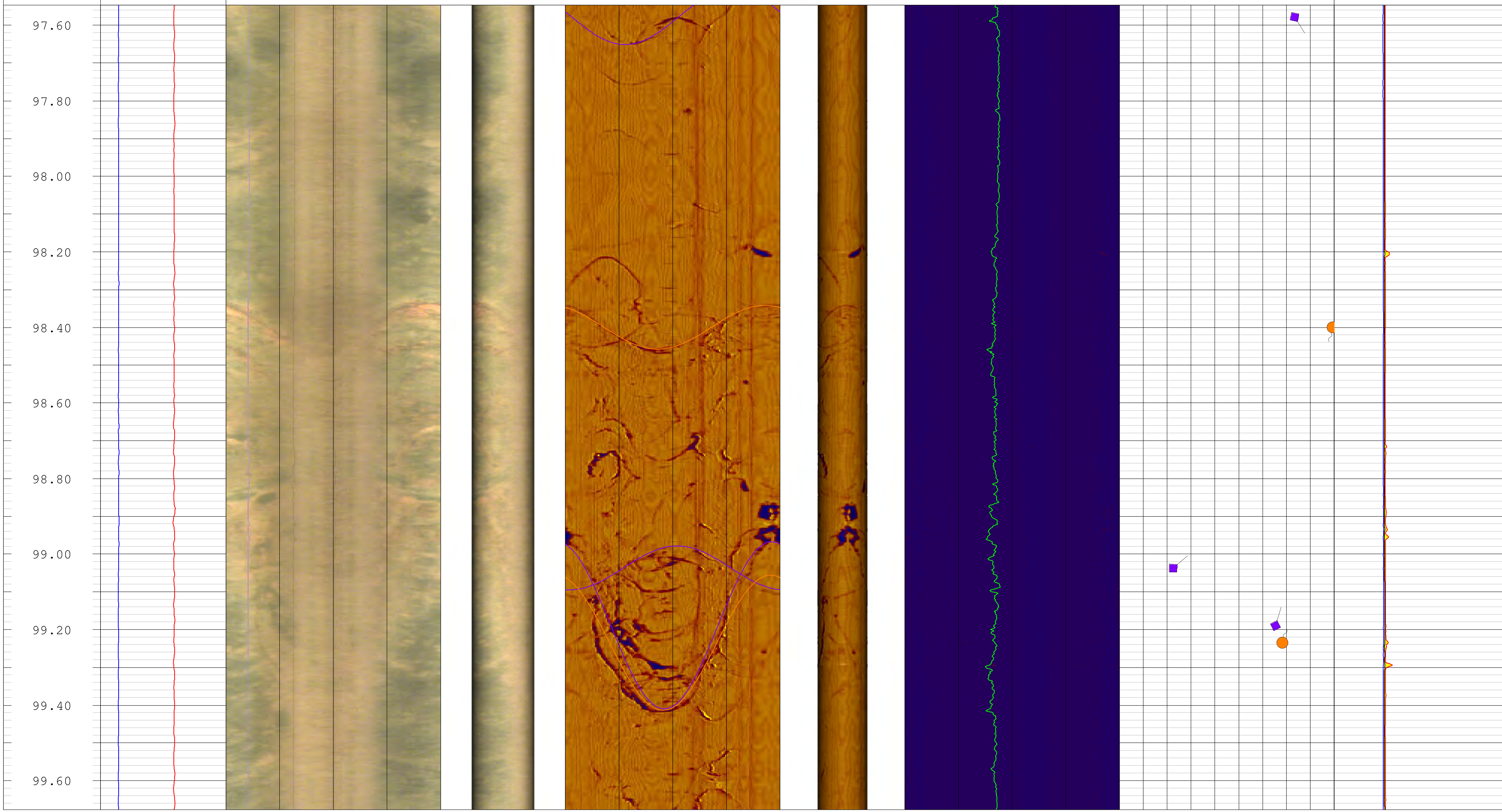

Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
91.20
91.40
91.60
91.80
92.00
92.20
92.40
92.60
92.80
93.00
93.20

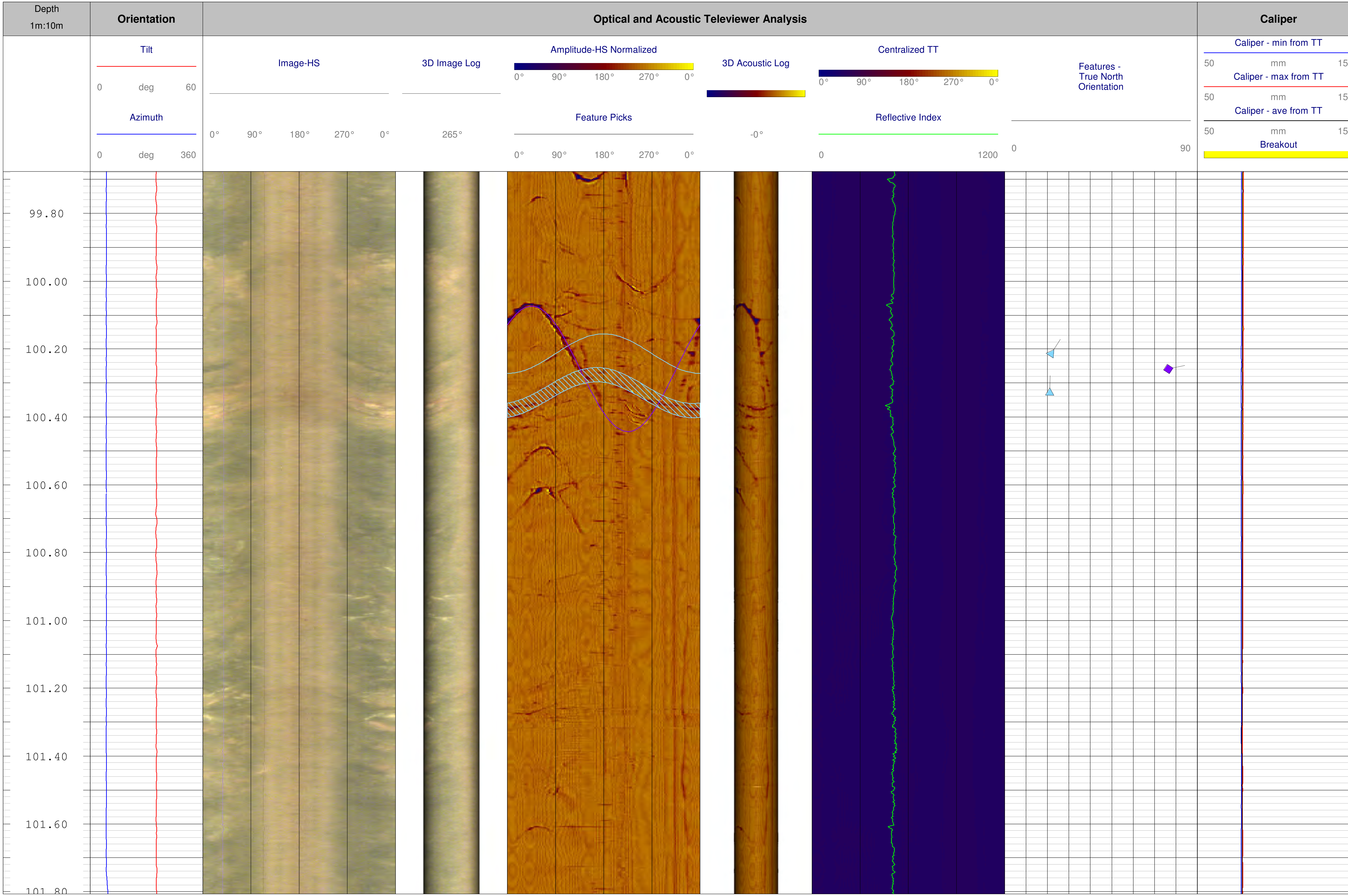


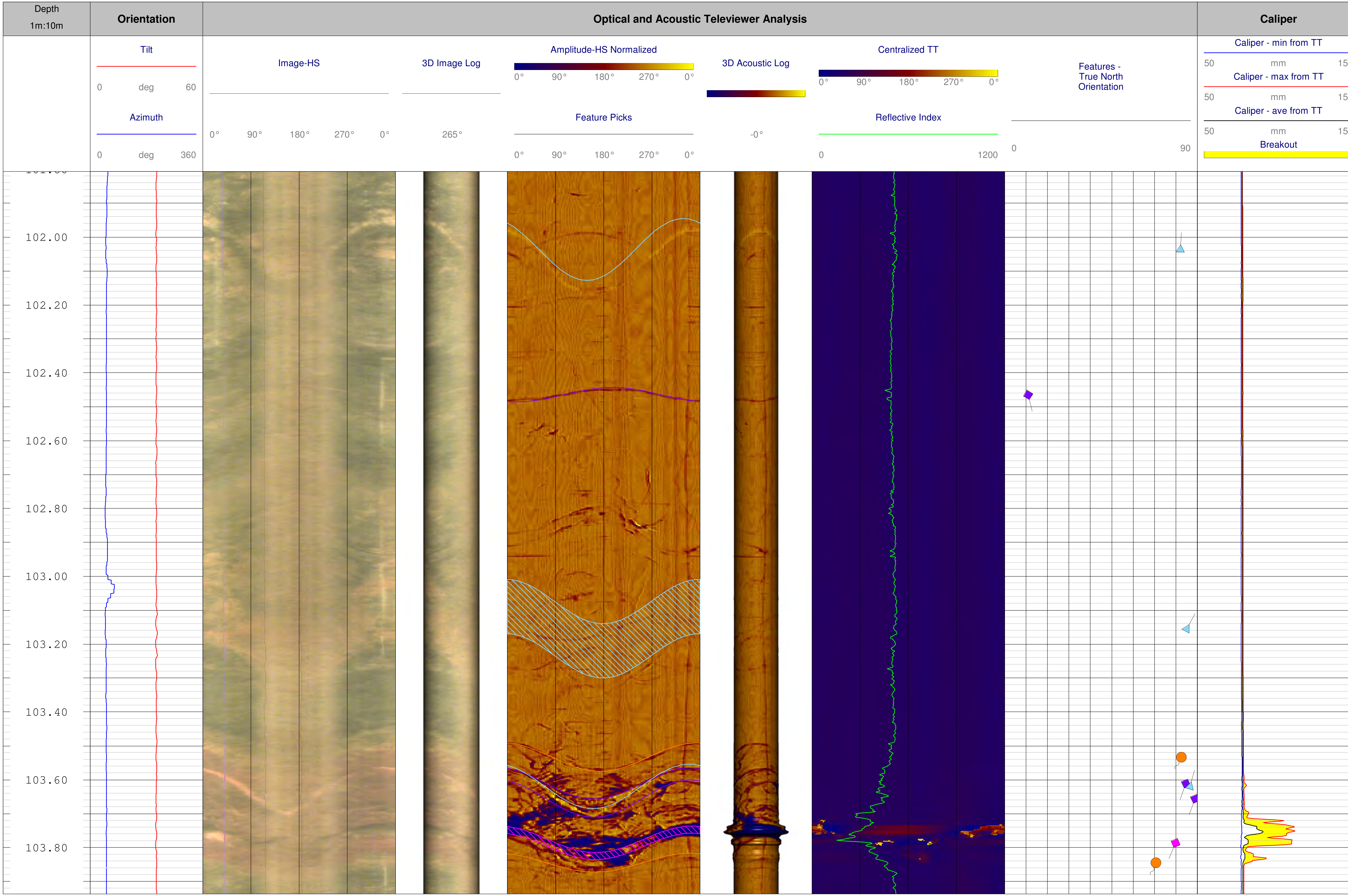
Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
93.40
93.60
93.80
94.00
94.20
94.40
94.60
94.80
95.00
95.20
95.40


Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
95.60
95.80
96.00
96.20
96.40
96.60
96.80
97.00
97.20
97.40

Depth 1m:10m	Orientation	Optical and Acoustic Televiewer Analysis	Caliper
	Tilt: 0 deg 60; Azimuth: 0 deg 360	Image-HS: 0° 90° 180° 270° 0°; 3D Image Log: 265°; Amplitude-HS Normalized: 0° 90° 180° 270° 0°; Feature Picks: 0° 90° 180° 270° 0°; 3D Acoustic Log: -0°; Centralized TT: 0° 90° 180° 270° 0°; Reflective Index: 0 1200; Features - True North Orientation: 0 90	Caliper - min from TT: 50 mm 150; Caliper - max from TT: 50 mm 150; Caliper - ave from TT: 50 mm 150; Breakout




Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
99.80
100.00
100.20
100.40
100.60
100.80
101.00
101.20
101.40
101.60
101.80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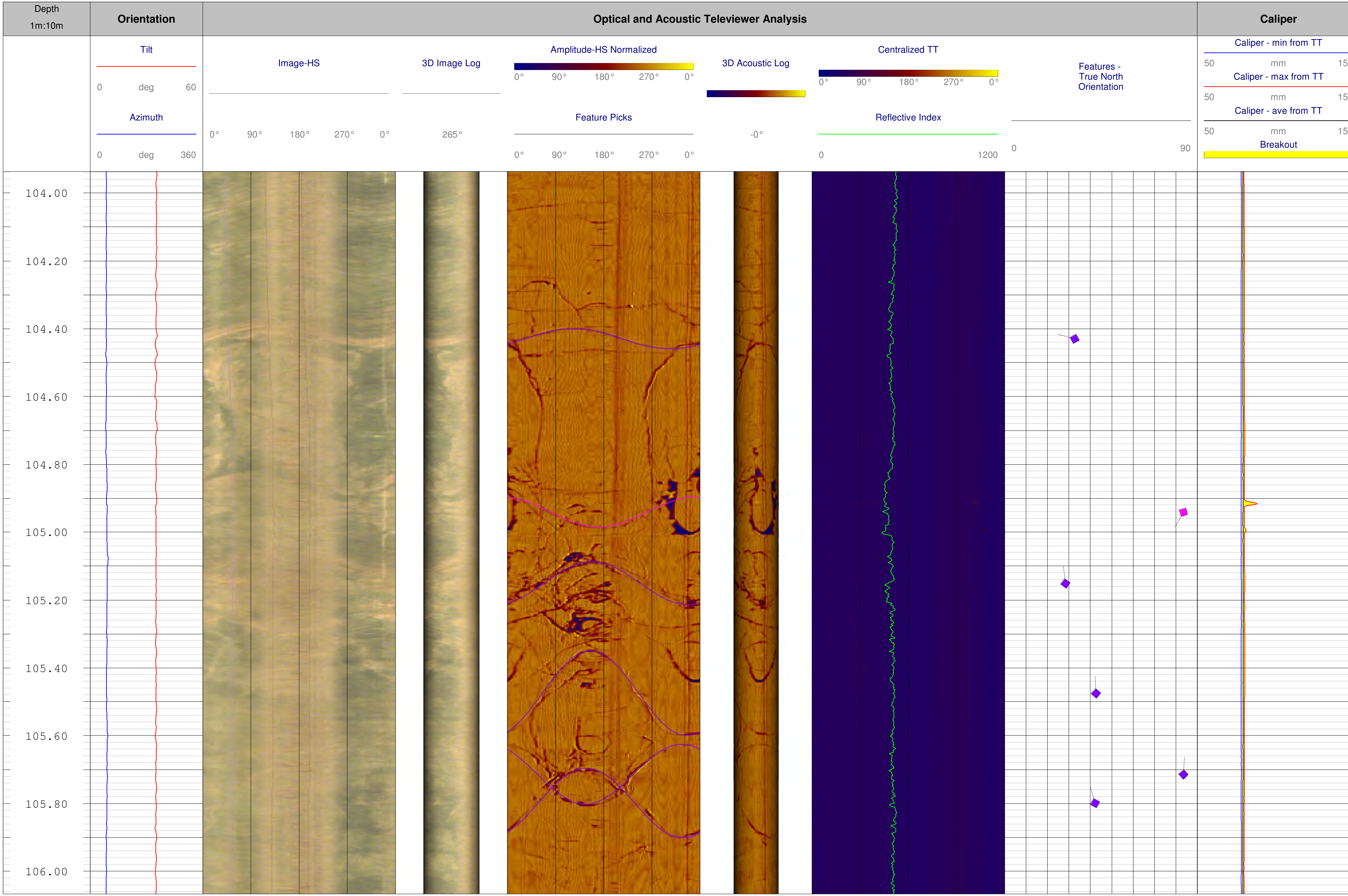
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
102.00
102.20
102.40
102.60
102.80
103.00
103.20
103.40
103.60
103.80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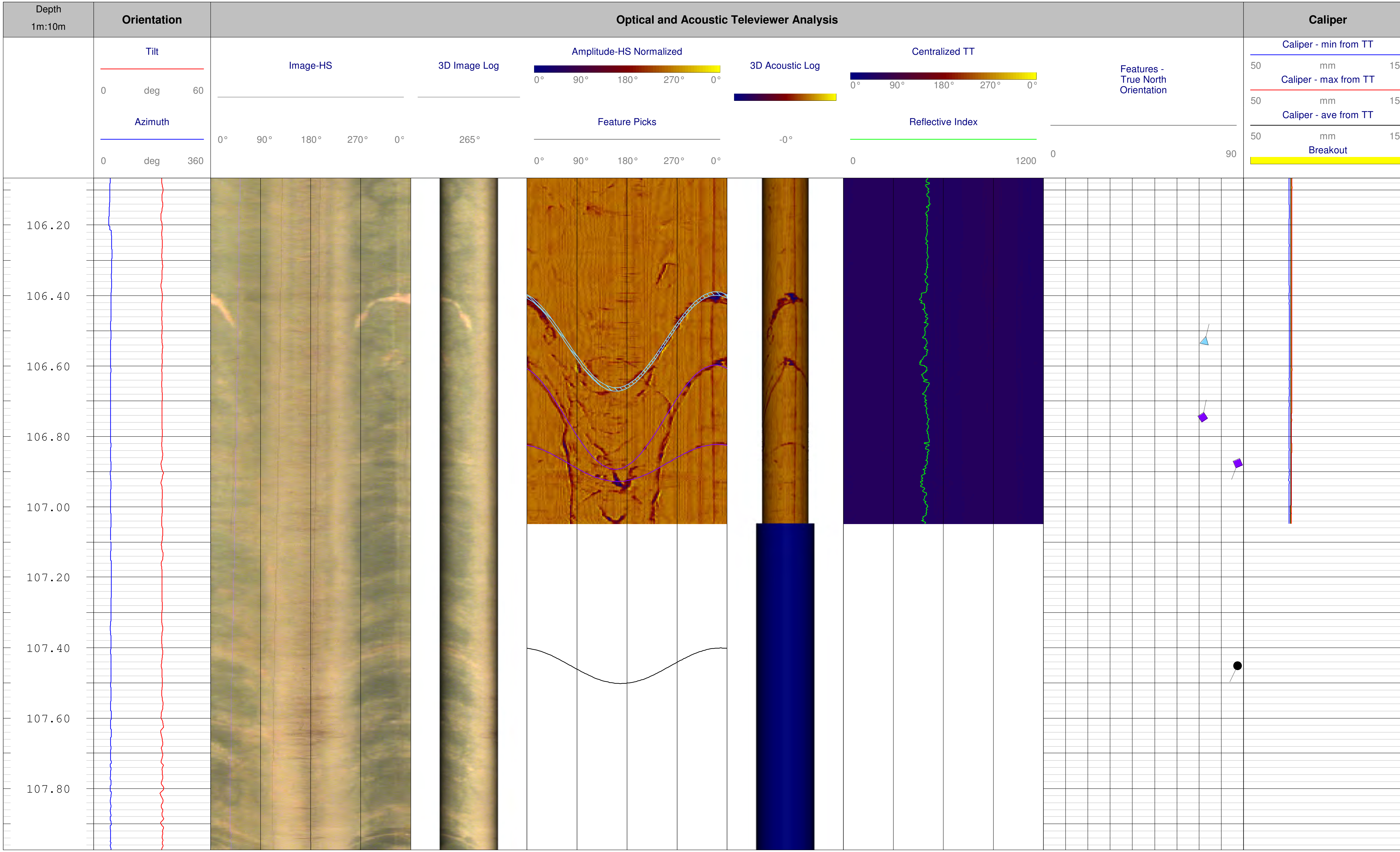
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
104.00
104.20
104.40
104.60
104.80
105.00
105.20
105.40
105.60
105.80
106.00


Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
106.20
106.40
106.60
106.80
107.00
107.20
107.40
107.60
107.80

ACOUSTIC and OPTICAL TELEVIEWER PLOT

DGI GEOSCIENCE INC.

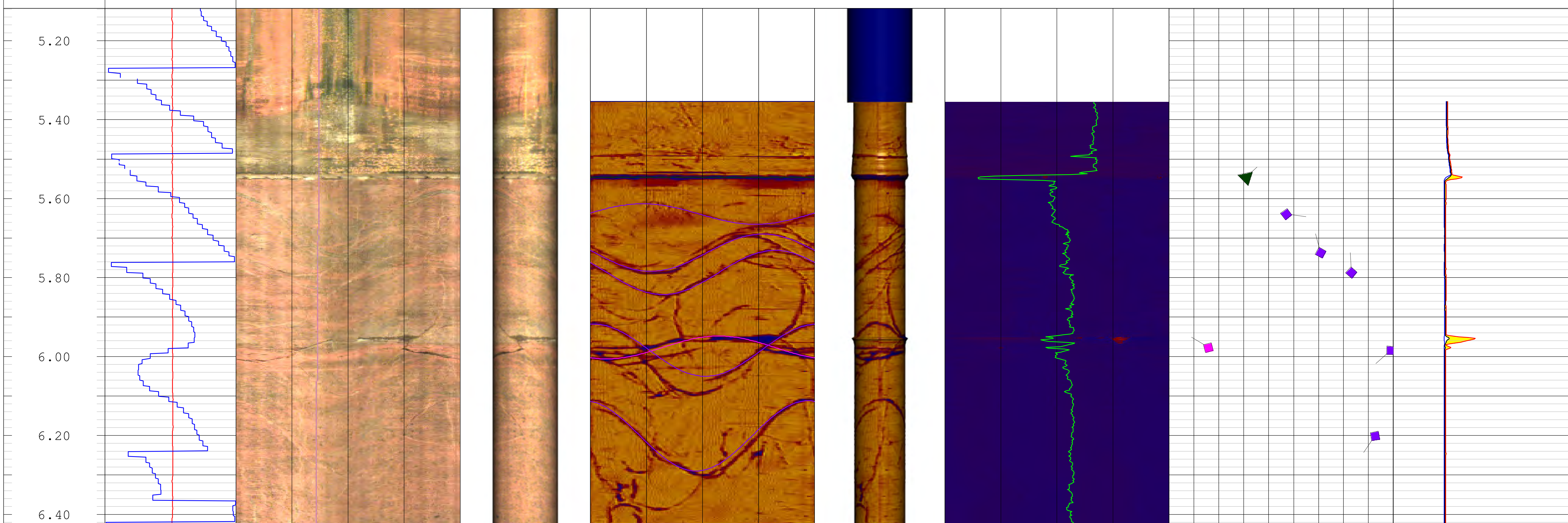
Company:	Canada Fluorspar	**Total Depth:**	110 m	**UTM X (Easting):**	N/A	**Notes:**
Hole ID:	GS-14-113	**Surveyed Depth:**	108 m	**UTM Y (Northing):**	N/A	
Acquisition date(s):	Nov. 05, 2014	**Hole Diameter:**	NQ	**UTM Z (Elevation):**	N/A	
Field Personnel:	J. Smith, R. Morrison	**Hole Type:**	Core			
Legal Location:	Saint Lawrence, NFLD	**Casing Depth:**	5.5 m			
Survey Day(s):	1	**Fluid Type:**	Water			

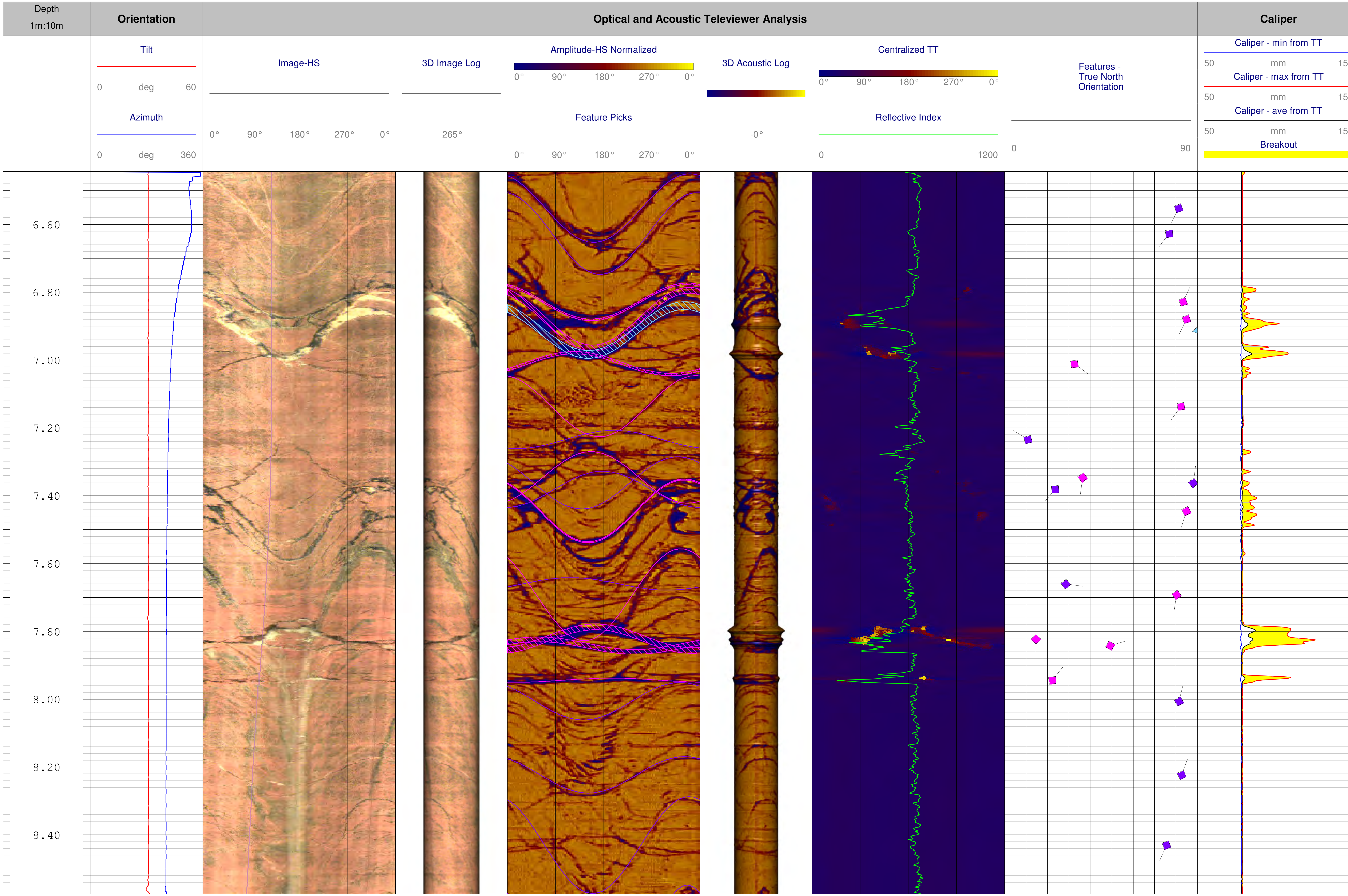
DGI Geoscience Inc.
119 Spadina Avenue,
Suite 405
Toronto, Ontario
Canada, M5V 2L1
416.361.3191

LEGEND - STRUCTURE TYPE

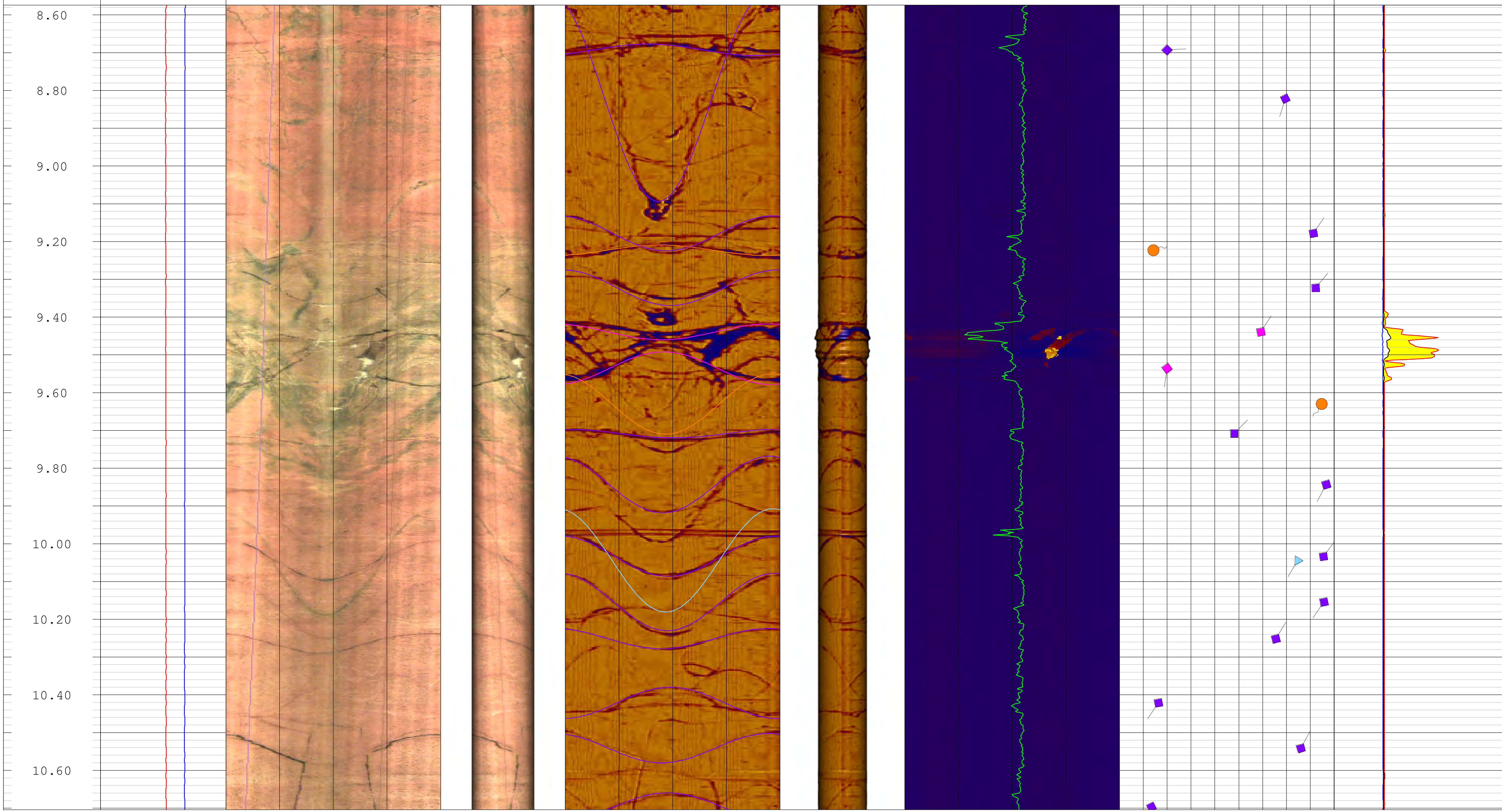
Btm of Casing · Major Open Joint/Fracture · Partially Open Joint/Fracture · Minor Joint/Fracture · Bedding/ Banding/ Foliation · Vein - Group 1 · Lithology Contact

Depth 1m:10m	Orientation	Optical and Acoustic Televiewer Analysis	Caliper
	Tilt (0 deg 60); Azimuth (0 deg 360)	Image-HS (0° 90° 180° 270° 0°); 3D Image Log (265°); Amplitude-HS Normalized (0° 90° 180° 270° 0°); Feature Picks (0° 90° 180° 270° 0°); 3D Acoustic Log (-0°); Centralized TT (0° 90° 180° 270° 0°); Reflective Index (0 1200); Features - True North Orientation (0 90)	Caliper - min from TT (50 mm 150); Caliper - max from TT (50 mm 150); Caliper - ave from TT (50 mm 150); Breakout

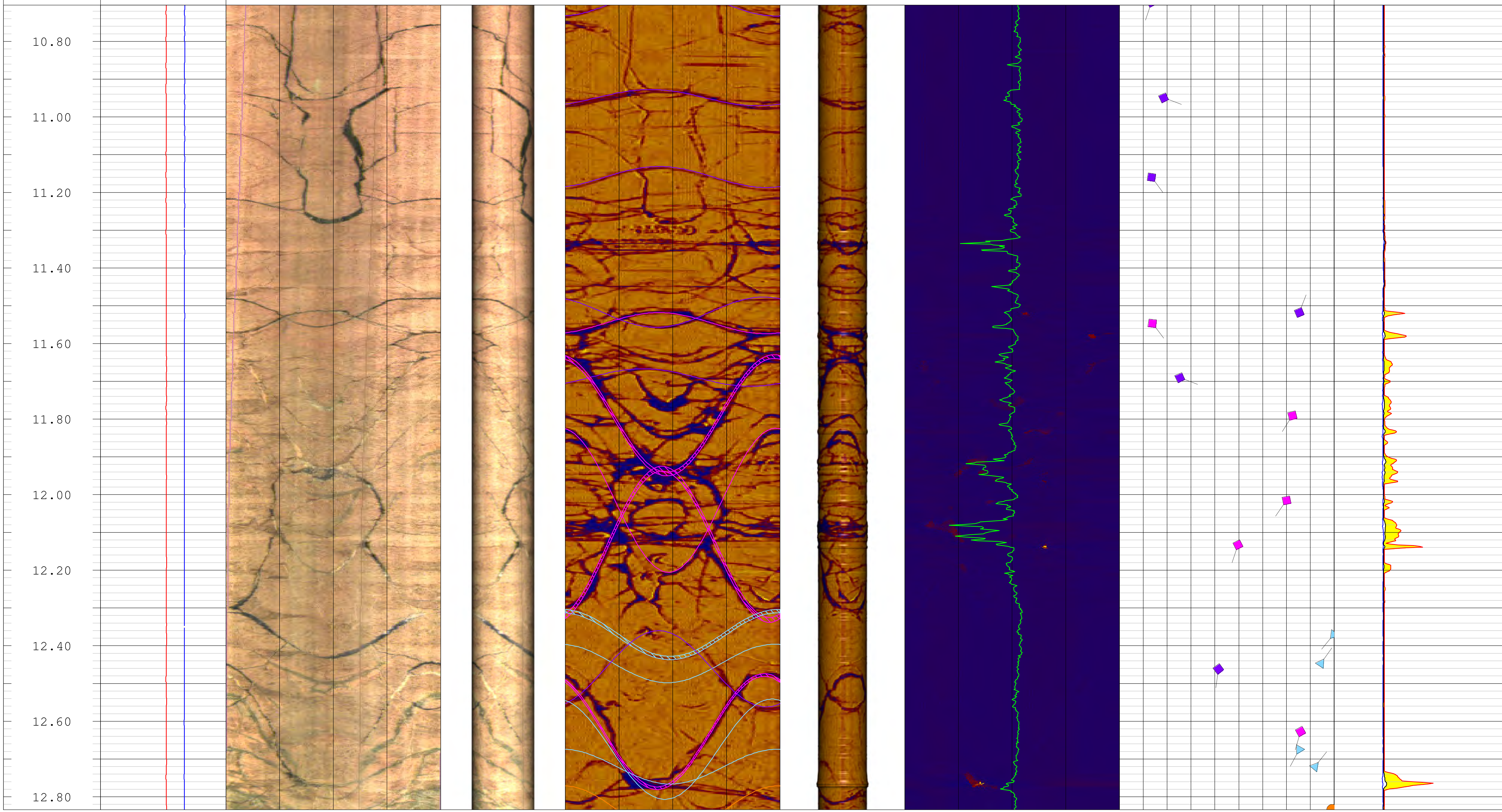


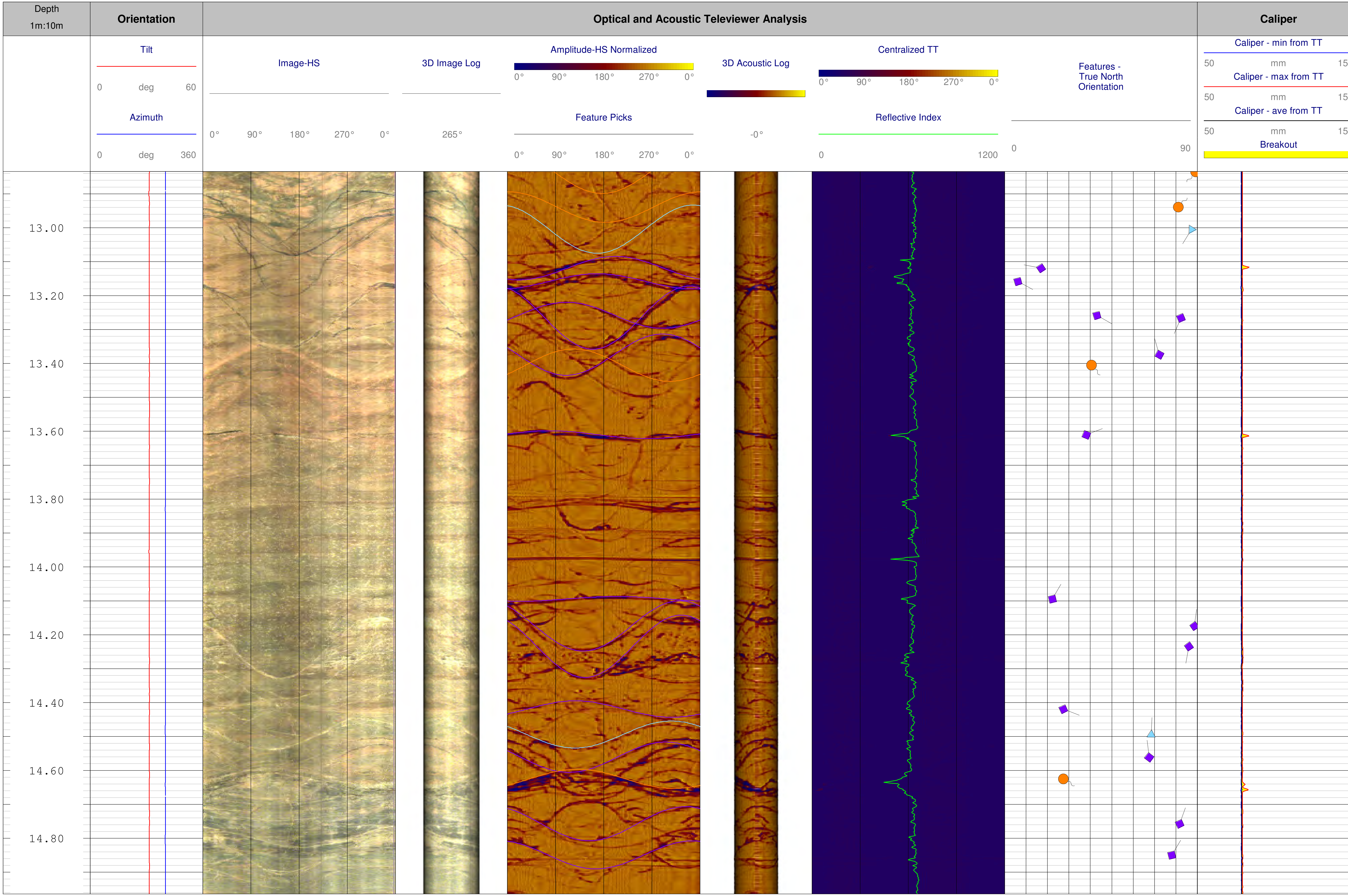

Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
6.60
6.80
7.00
7.20
7.40
7.60
7.80
8.00
8.20
8.40

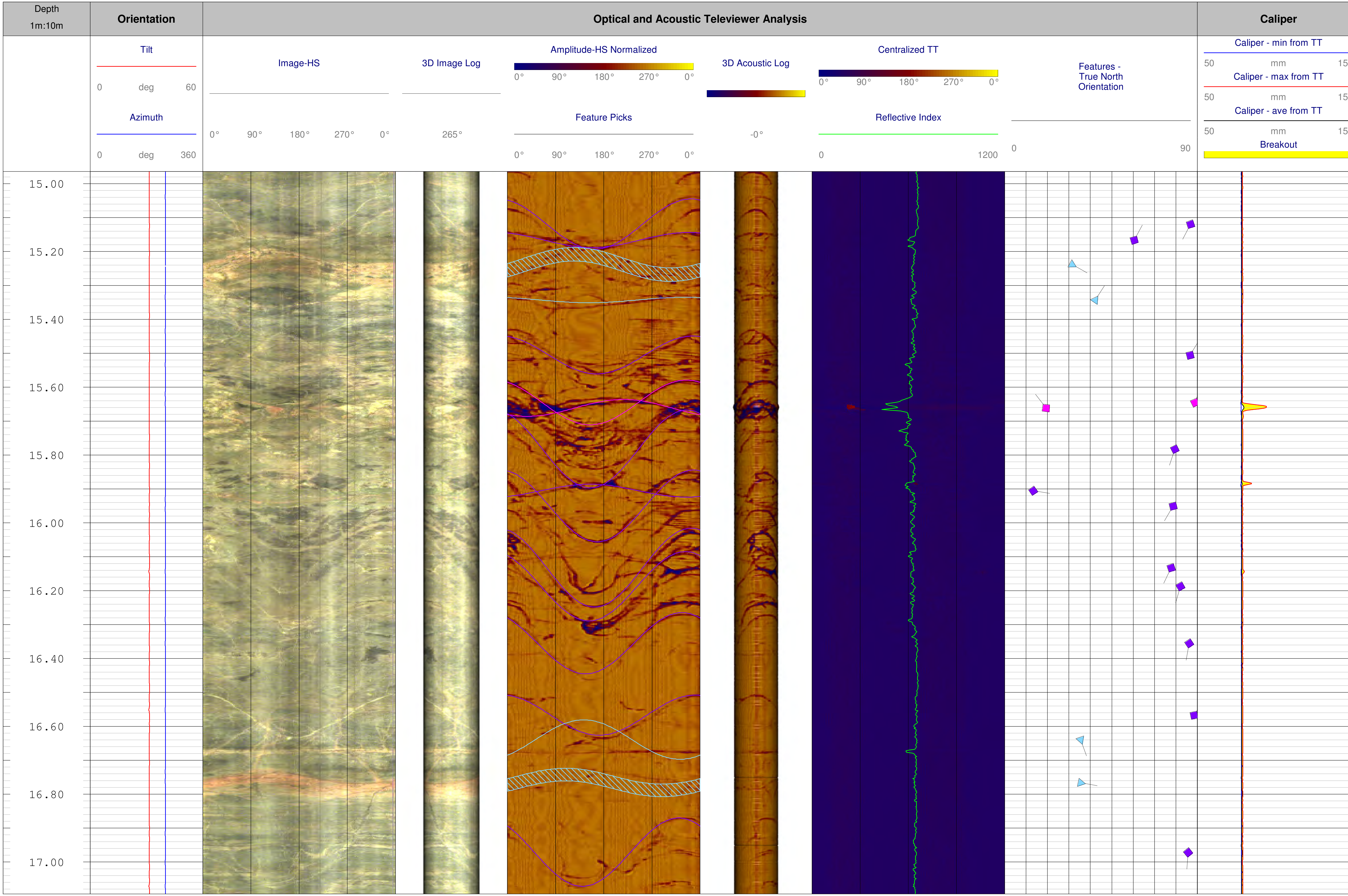
Depth 1m:10m	Orientation	Optical and Acoustic Televiewer Analysis	Caliper
	Tilt (0 – deg – 60); Azimuth (0 – deg – 360)	Image-HS (0° 90° 180° 270° 0°); 3D Image Log (265°); Amplitude-HS Normalized (0° 90° 180° 270° 0°); Feature Picks (0° 90° 180° 270° 0°); 3D Acoustic Log (-0°); Centralized TT (0° 90° 180° 270° 0°); Reflective Index (0 – 1200); Features - True North Orientation (0 – 90)	Caliper - min from TT (50 – mm – 150); Caliper - max from TT (50 – mm – 150); Caliper - ave from TT (50 – mm – 150); Breakout



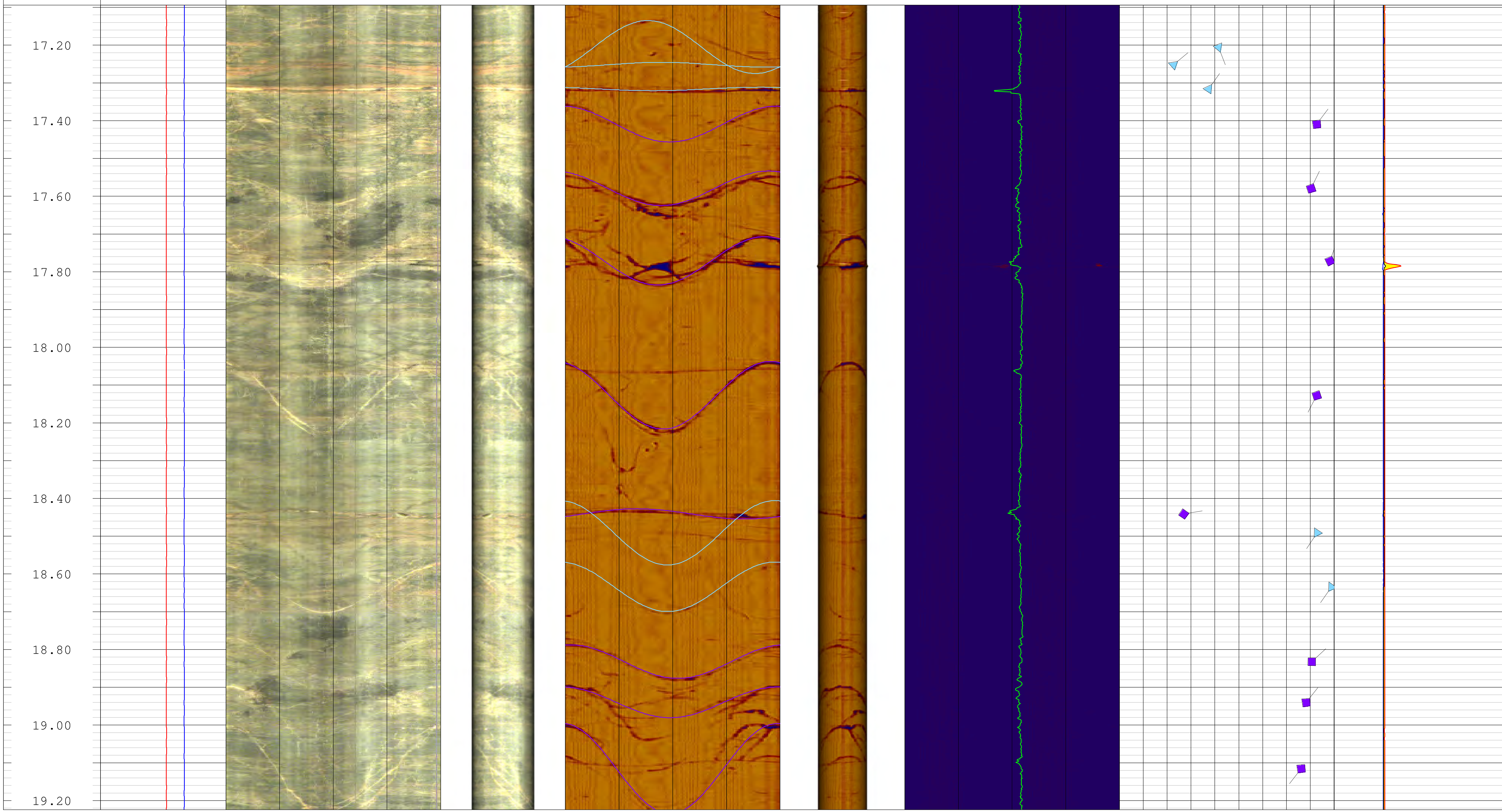
Depth 1m:10m	Orientation	Optical and Acoustic Televiewer Analysis							Caliper
	Tilt (0 deg 60); Azimuth (0 deg 360)	Image-HS (0° 90° 180° 270° 0°)	3D Image Log (265°)	Amplitude-HS Normalized (0° 90° 180° 270° 0°); Feature Picks (0° 90° 180° 270° 0°)	3D Acoustic Log (-0°)	Centralized TT (0° 90° 180° 270° 0°); Reflective Index (0 1200)	Features - True North Orientation (0 90)		Caliper - min from TT (50 mm 150); Caliper - max from TT (50 mm 150); Caliper - ave from TT (50 mm 150); Breakout

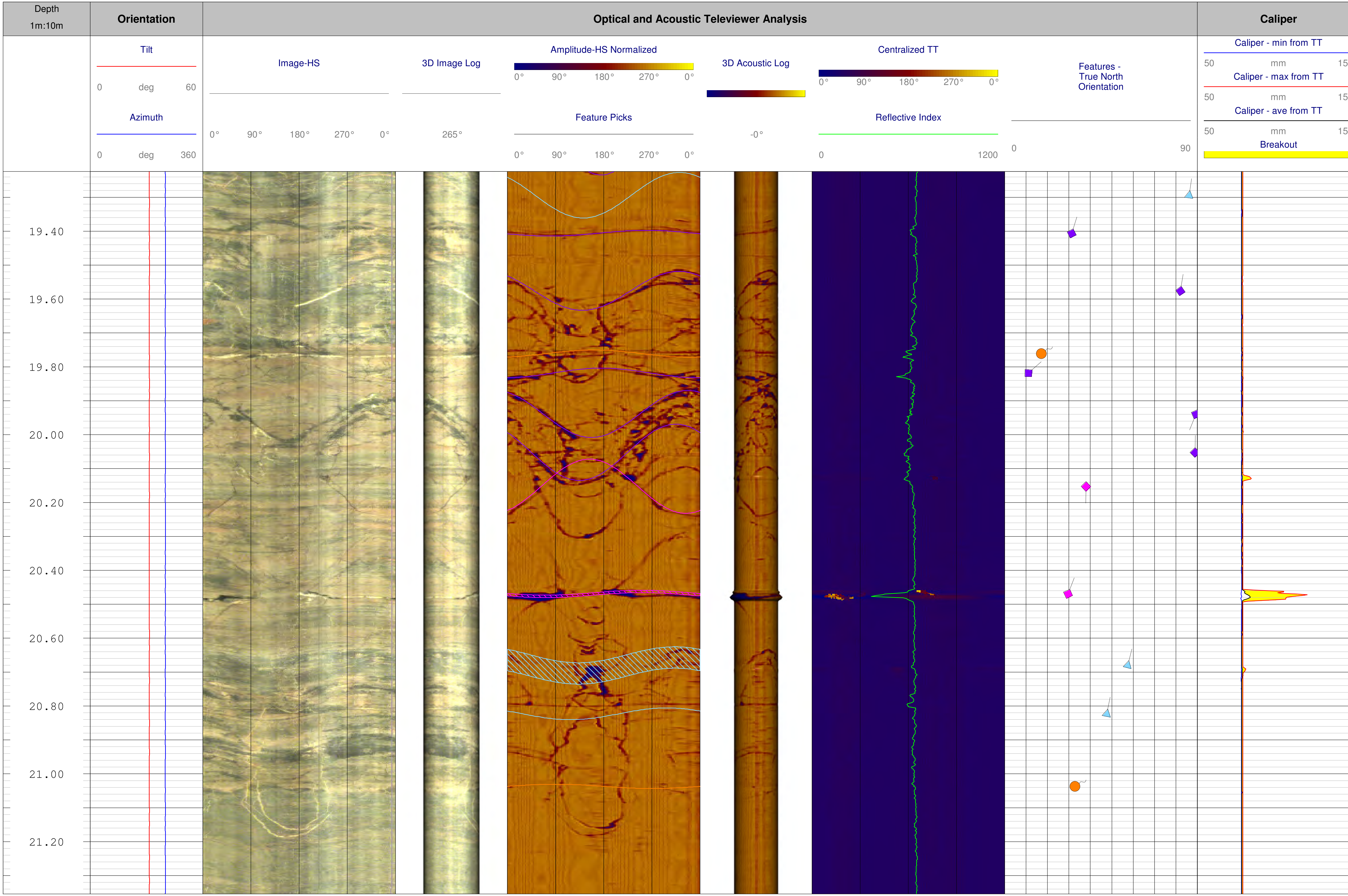



Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
13.00
13.20
13.40
13.60
13.80
14.00
14.20
14.40
14.60
14.80

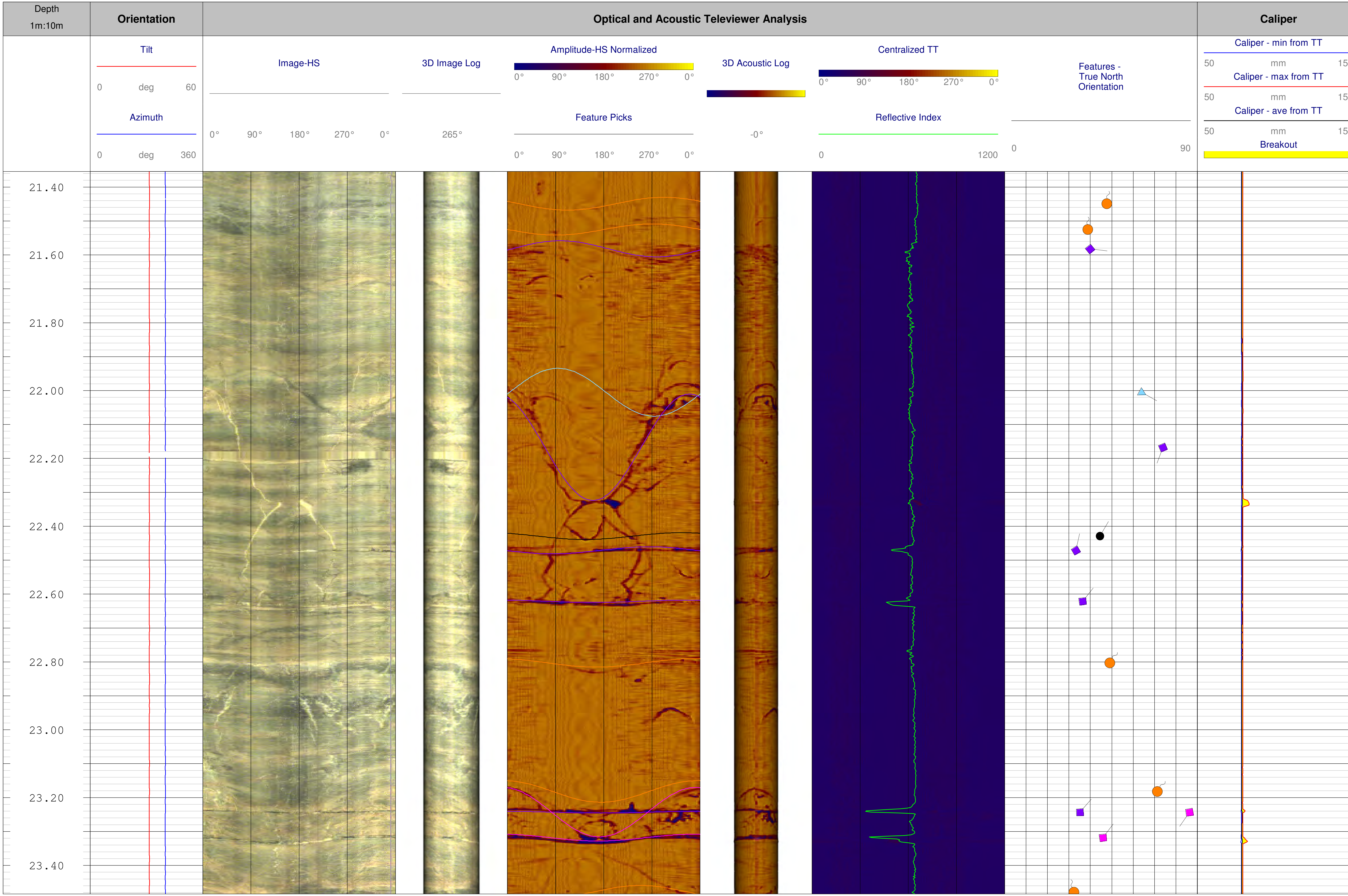

Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
15.00
15.20
15.40
15.60
15.80
16.00
16.20
16.40
16.60
16.80
17.00

Depth 1m:10m	Orientation	Optical and Acoustic Televiewer Analysis							Caliper
	Tilt 0 deg 60 Azimuth 0 deg 360	Image-HS 0° 90° 180° 270° 0°	3D Image Log 265°	Amplitude-HS Normalized 0° 90° 180° 270° 0° Feature Picks 0° 90° 180° 270° 0°	3D Acoustic Log -0°	Centralized TT 0° 90° 180° 270° 0° Reflective Index 0 1200	Features - True North Orientation 0 90		Caliper - min from TT 50 mm 150 Caliper - max from TT 50 mm 150 Caliper - ave from TT 50 mm 150 Breakout





Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
19.40
19.60
19.80
20.00
20.20
20.40
20.60
20.80
21.00
21.20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1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
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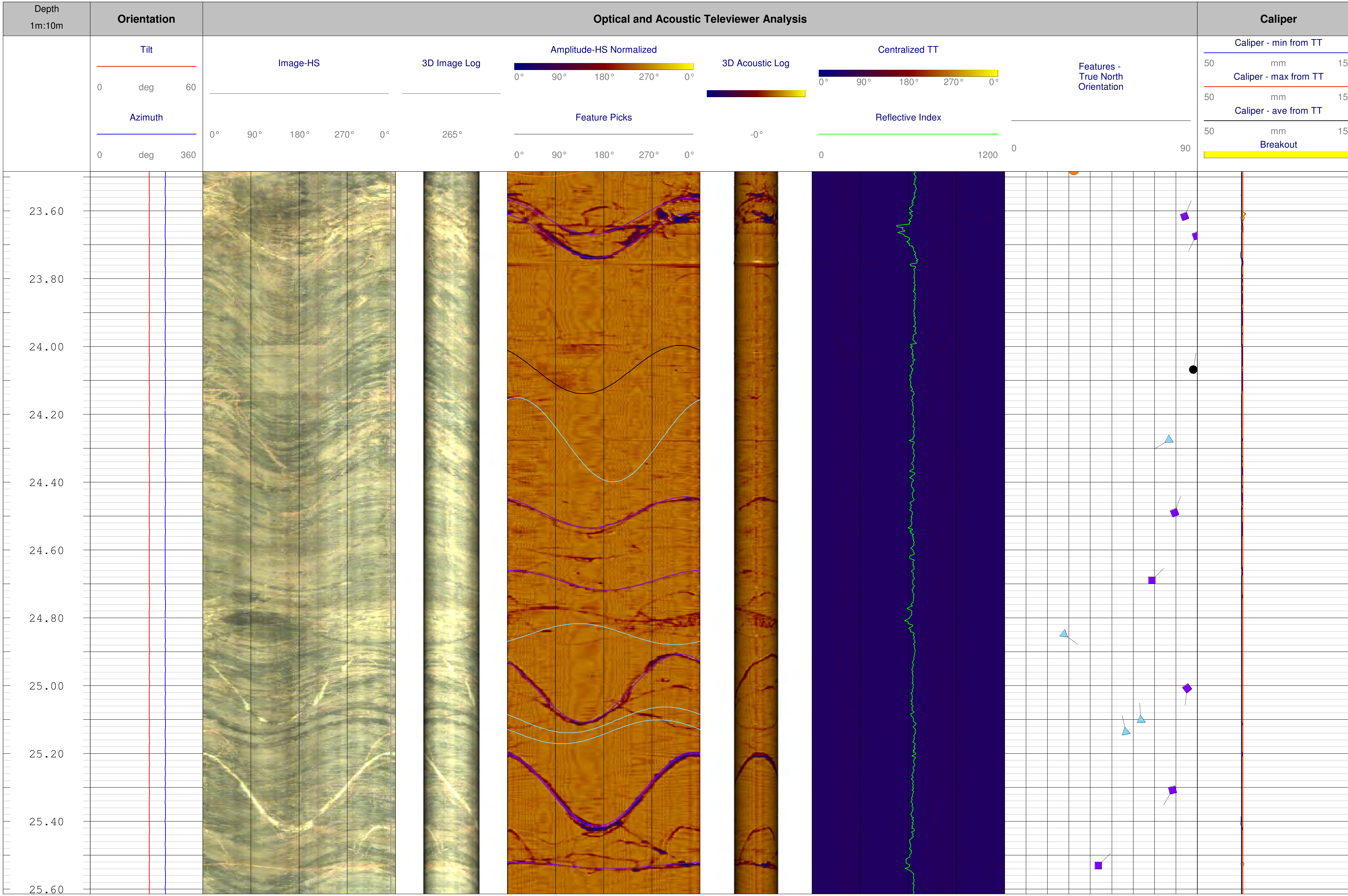
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
21.40
21.60
21.80
22.00
22.20
22.40
22.60
22.80
23.00
23.20
23.40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1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
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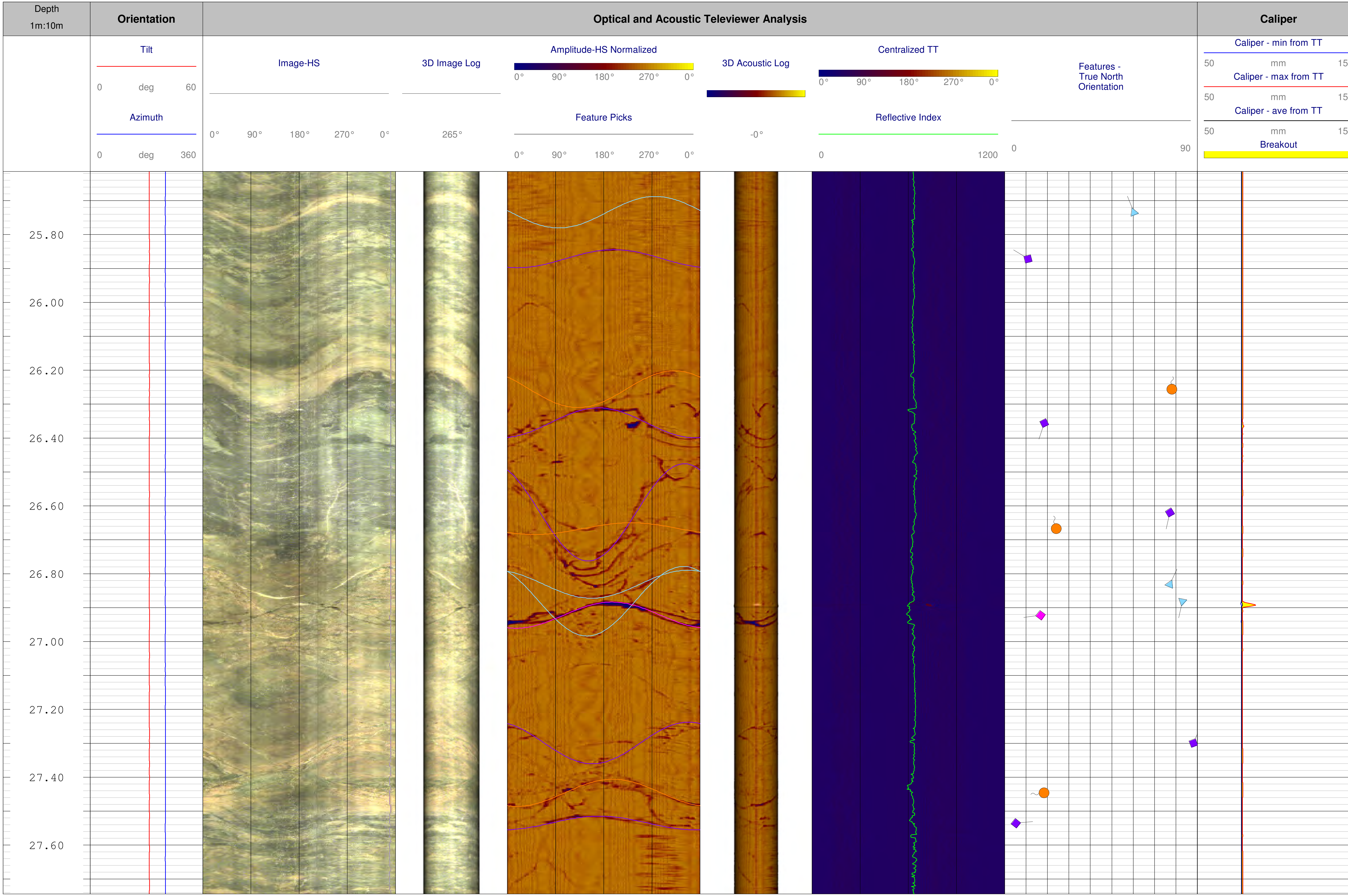
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
23.60
23.80
24.00
24.20
24.40
24.60
24.80
25.00
25.20
25.40
25.60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1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
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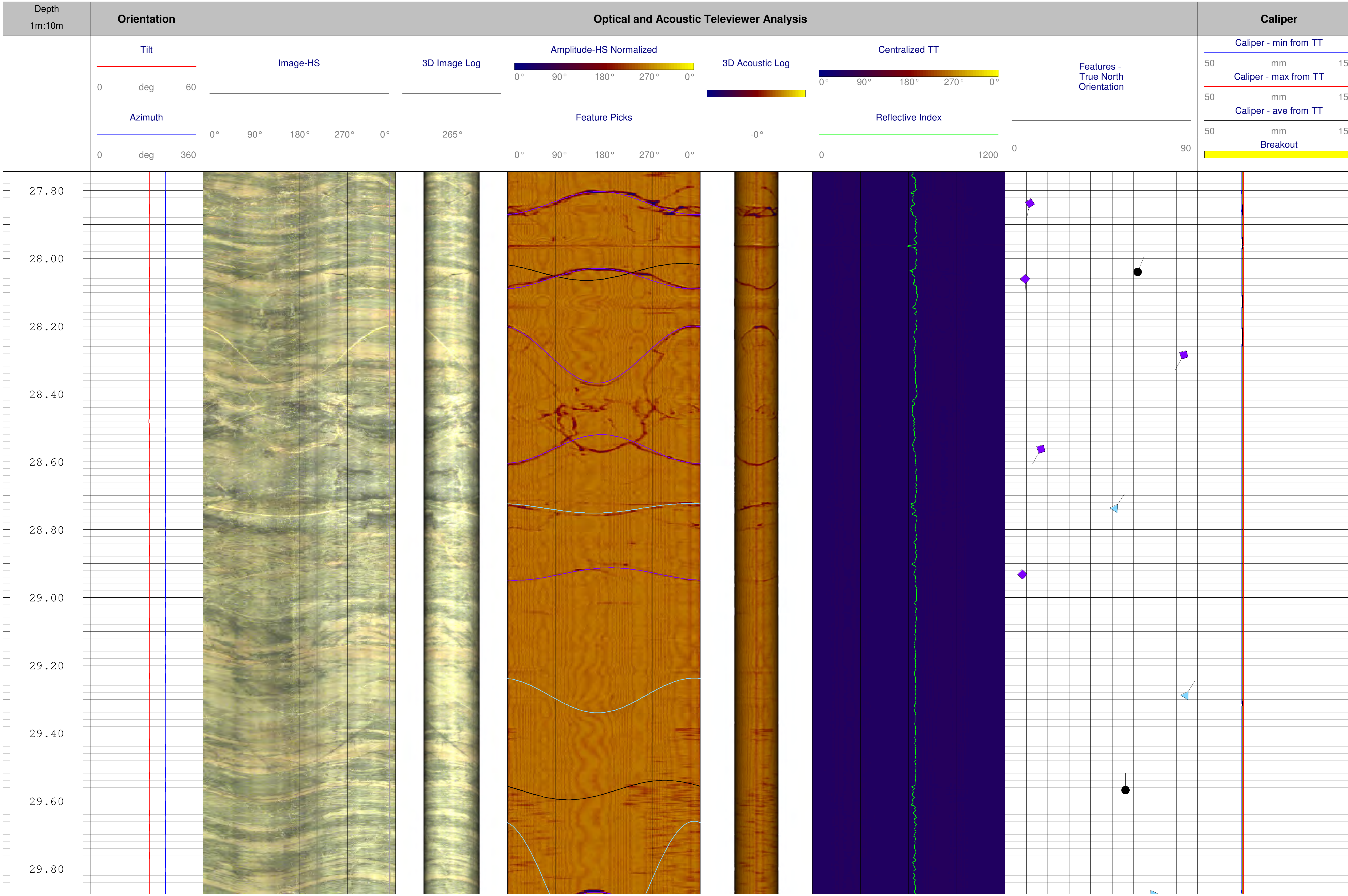
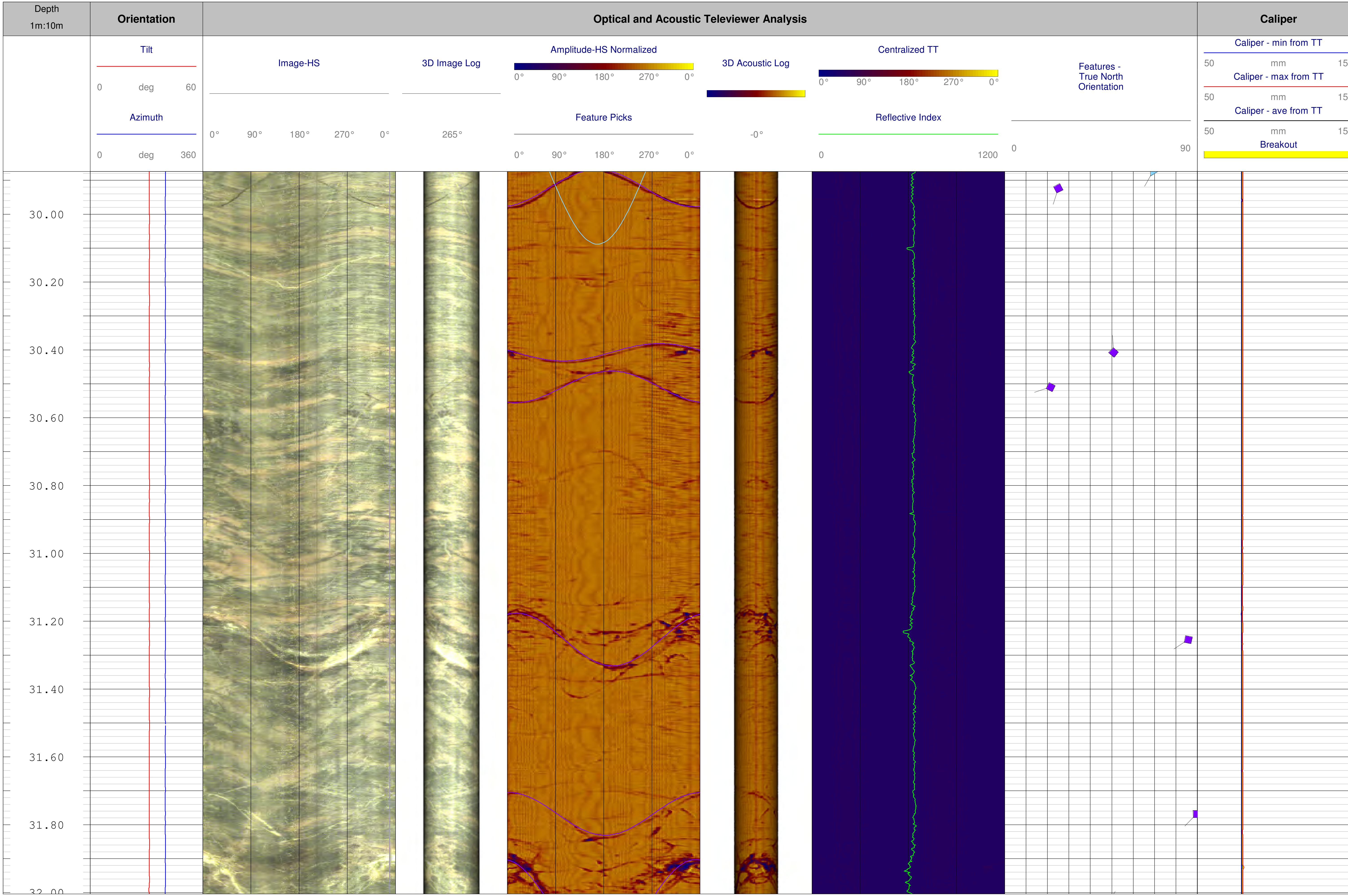
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
25.80
26.00
26.20
26.40
26.60
26.80
27.00
27.20
27.40
27.60



Depth
1m:10m
Orientation
Tilt
0 deg 60
Azimuth
0 deg 360
Optical and Acoustic Televiewer Analysis
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
27.80
28.00
28.20
28.40
28.60
28.80
29.00
29.20
29.40
29.60
29.80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Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
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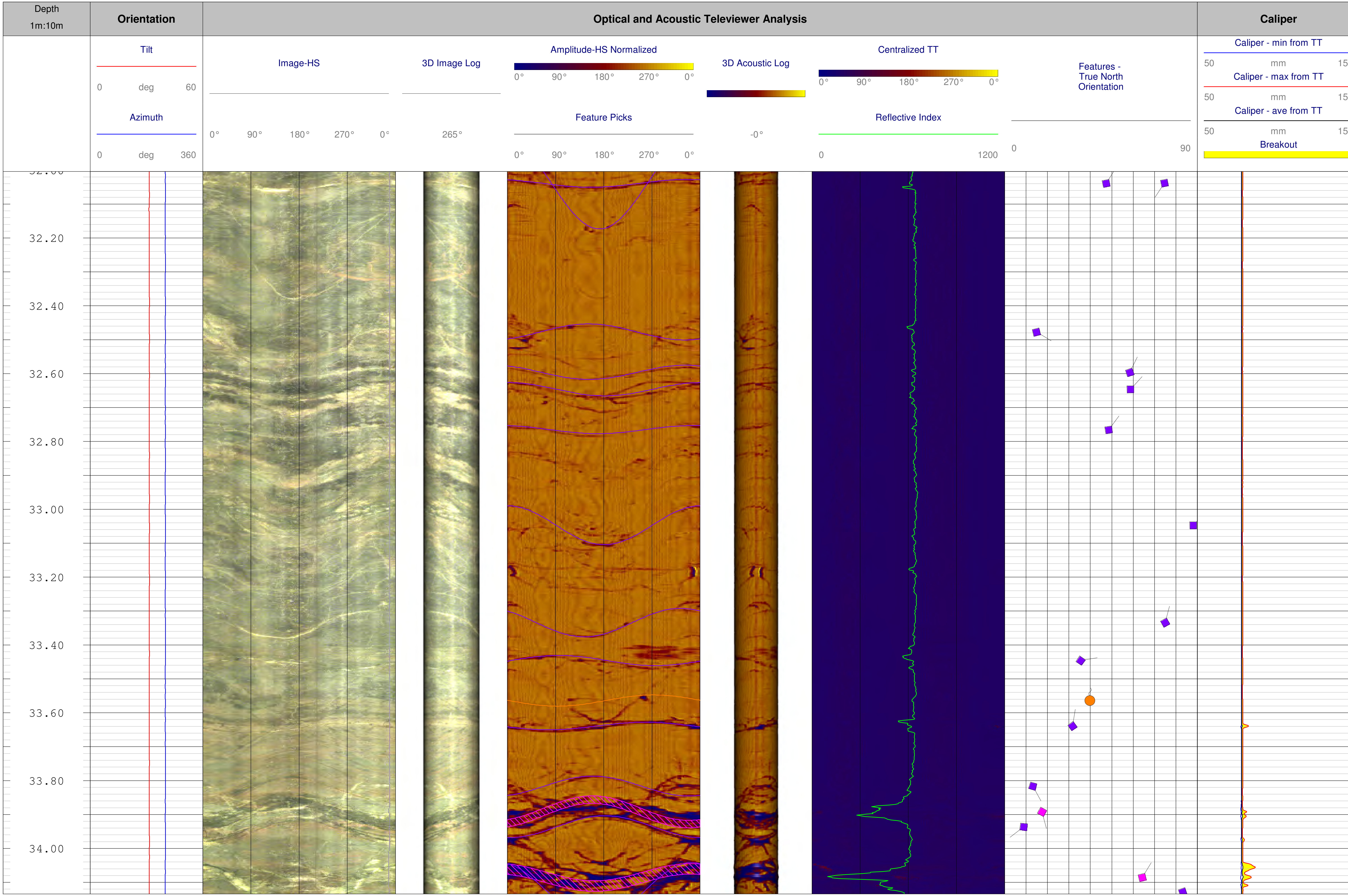
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
30.00
30.20
30.40
30.60
30.80
31.00
31.20
31.40
31.60
31.80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Orientation
Optical and Acoustic Televiewer Analysis
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Tilt
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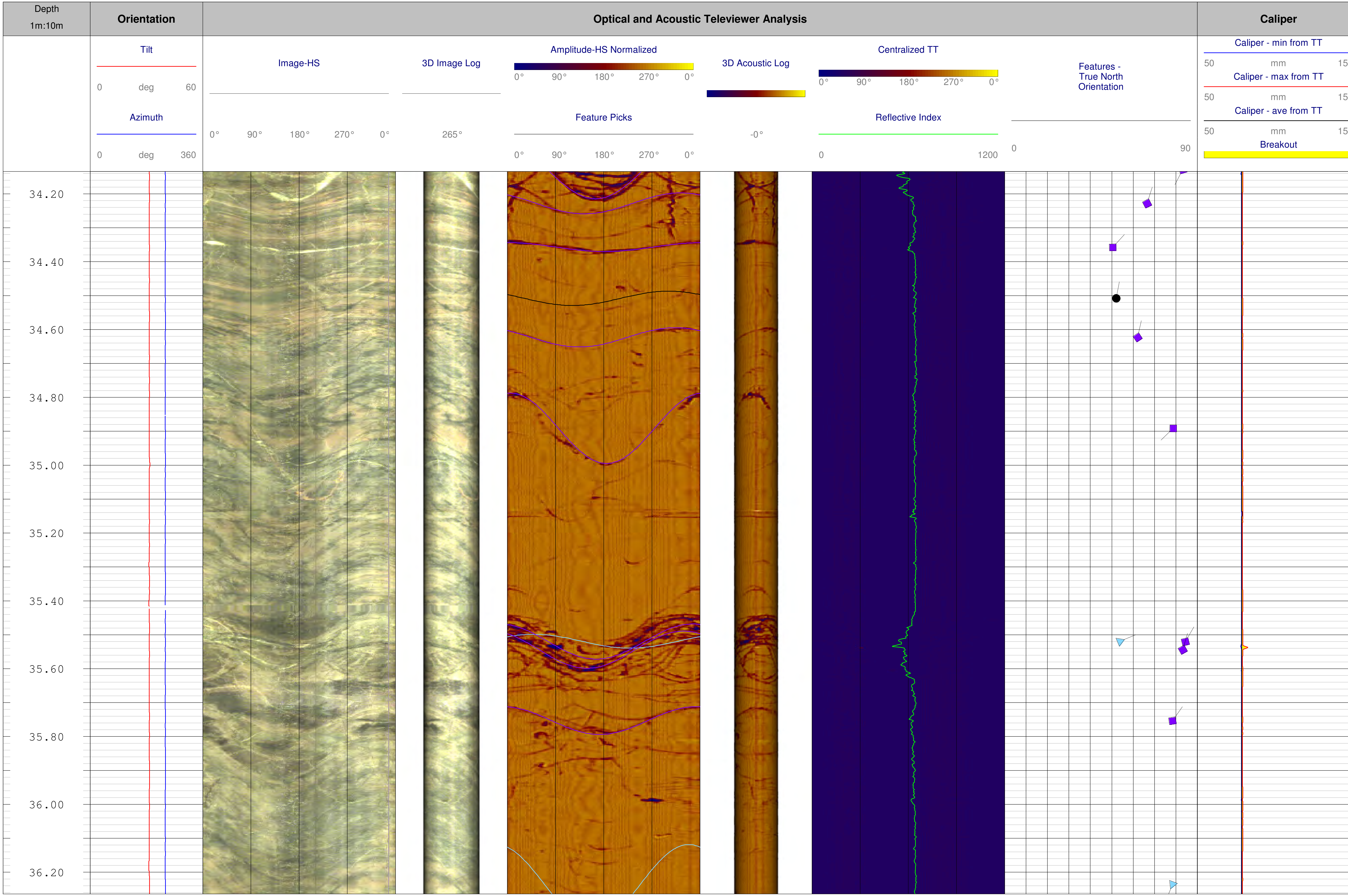
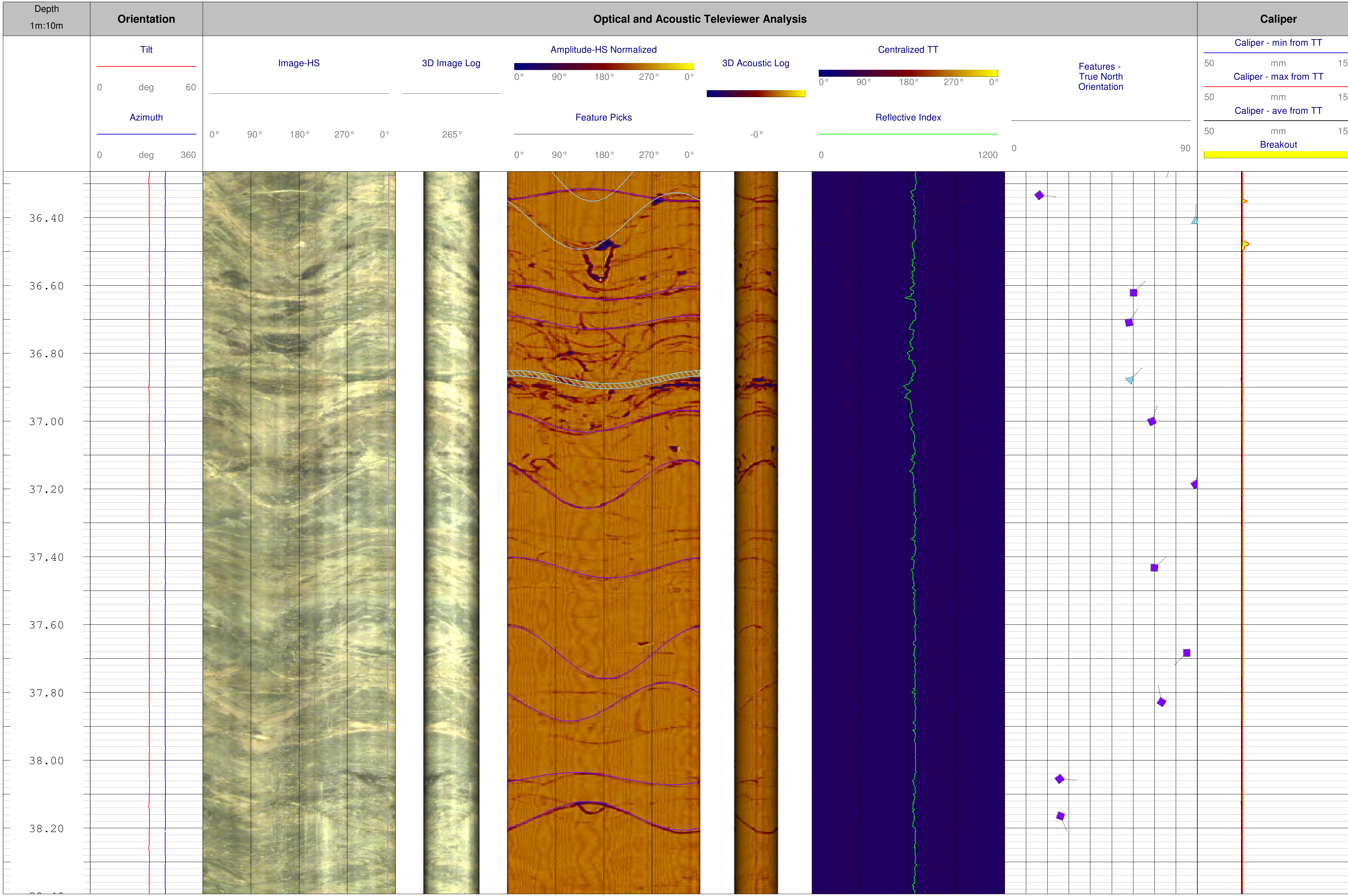
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features -
True North
Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
32.20
32.40
32.60
32.80
33.00
33.20
33.40
33.60
33.80
34.00



Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
34.20
34.40
34.60
34.80
35.00
35.20
35.40
35.60
35.80
36.00
36.20



Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
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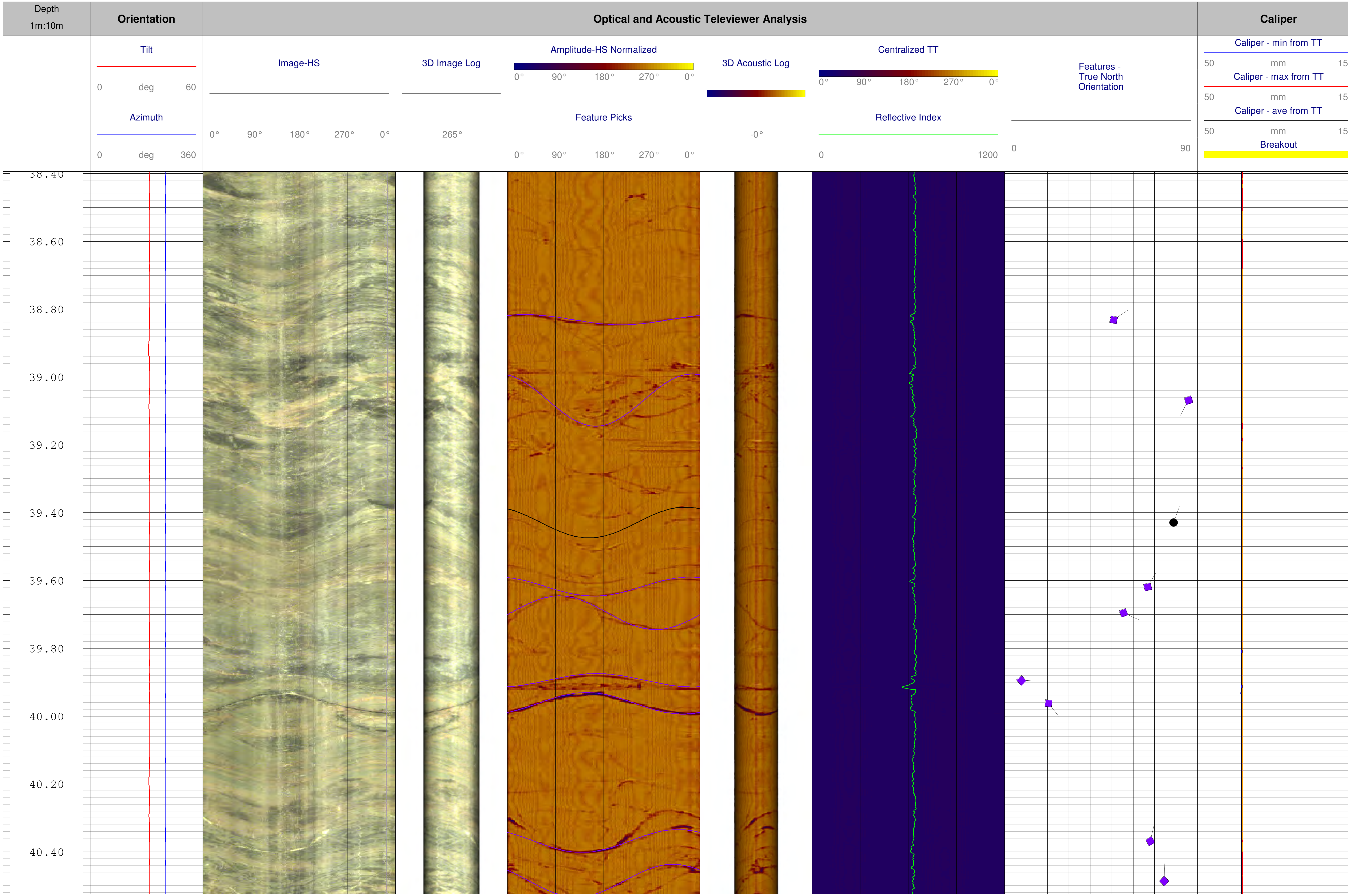
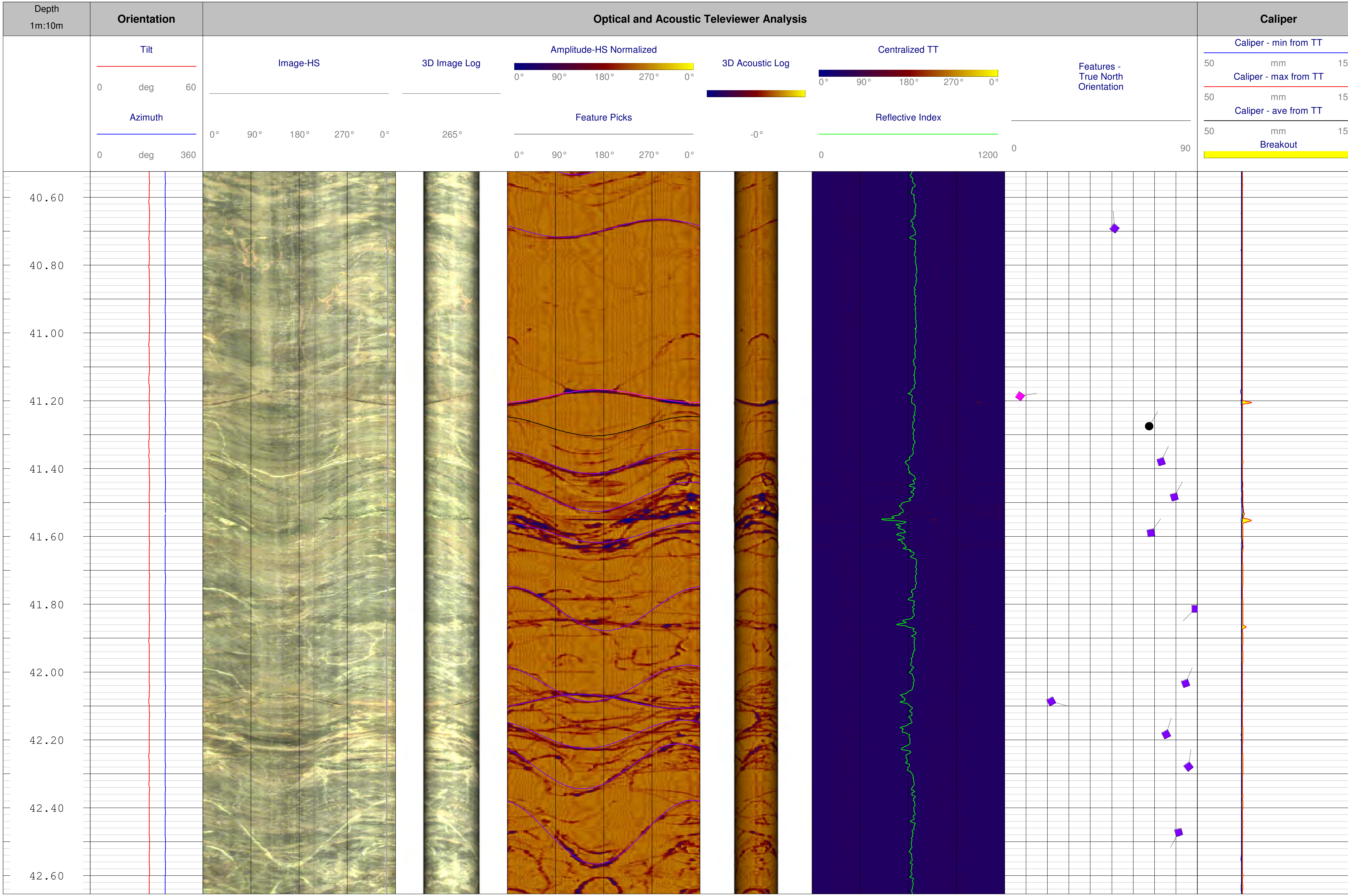
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
36.40
36.60
36.80
37.00
37.20
37.40
37.60
37.80
38.00
38.20



Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
38.40
38.60
38.80
39.00
39.20
39.40
39.60
39.80
40.00
40.20
40.40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Tilt
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Azimuth
0 deg 360
Image-HS
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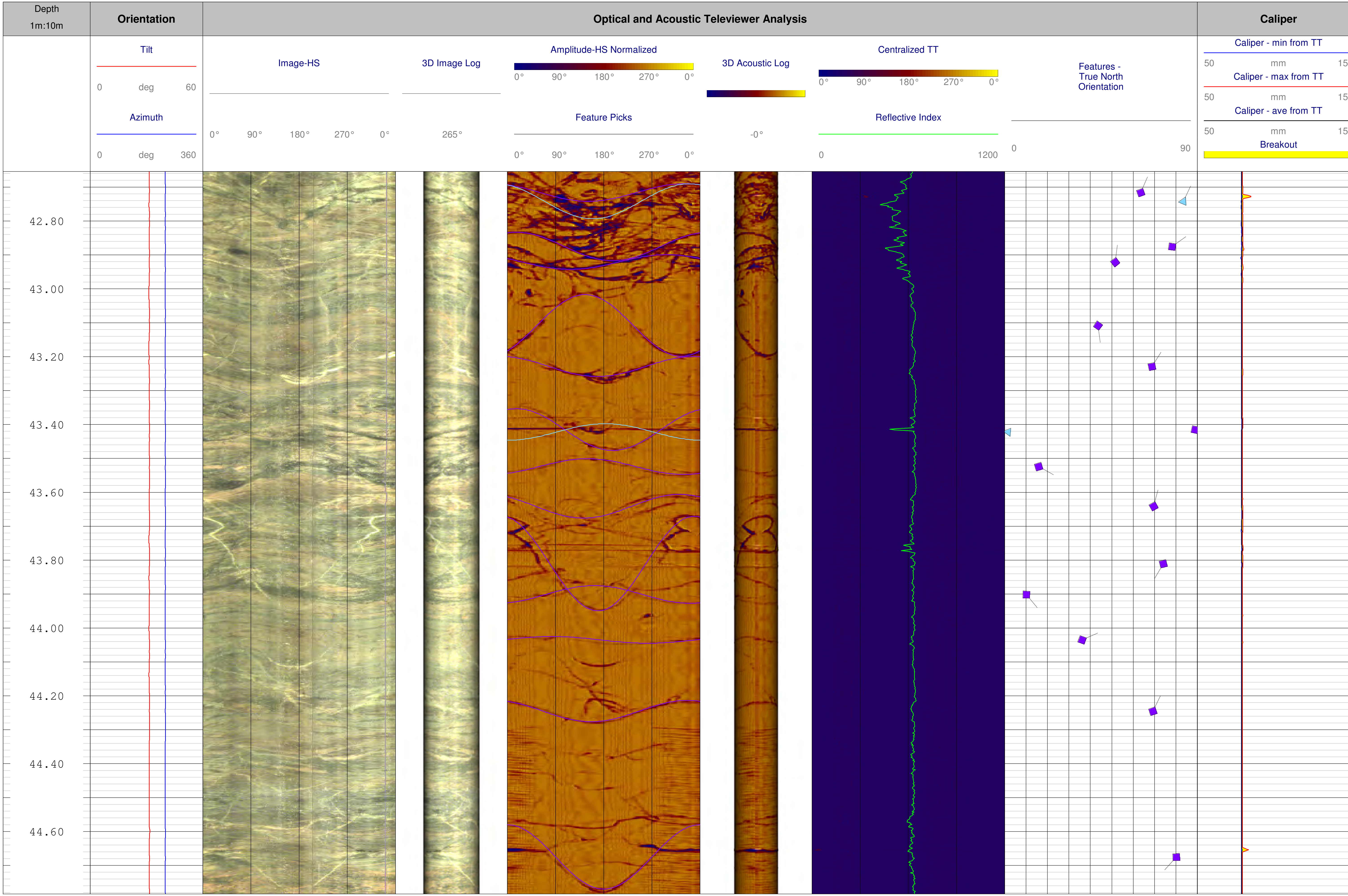
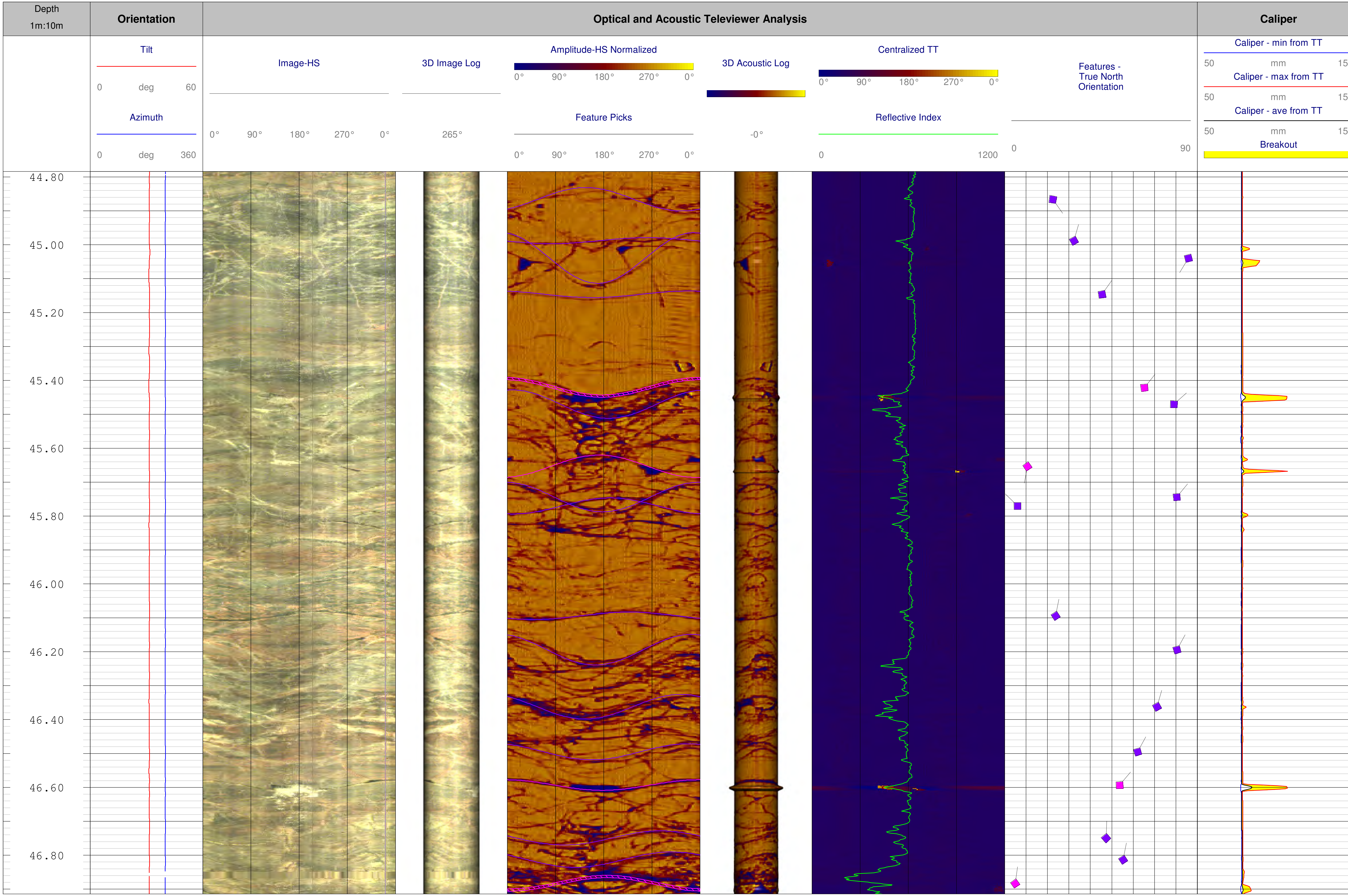
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
40.60
40.80
41.00
41.20
41.40
41.60
41.80
42.00
42.20
42.40
42.60



Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
42.80
43.00
43.20
43.40
43.60
43.80
44.00
44.20
44.40
44.60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1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
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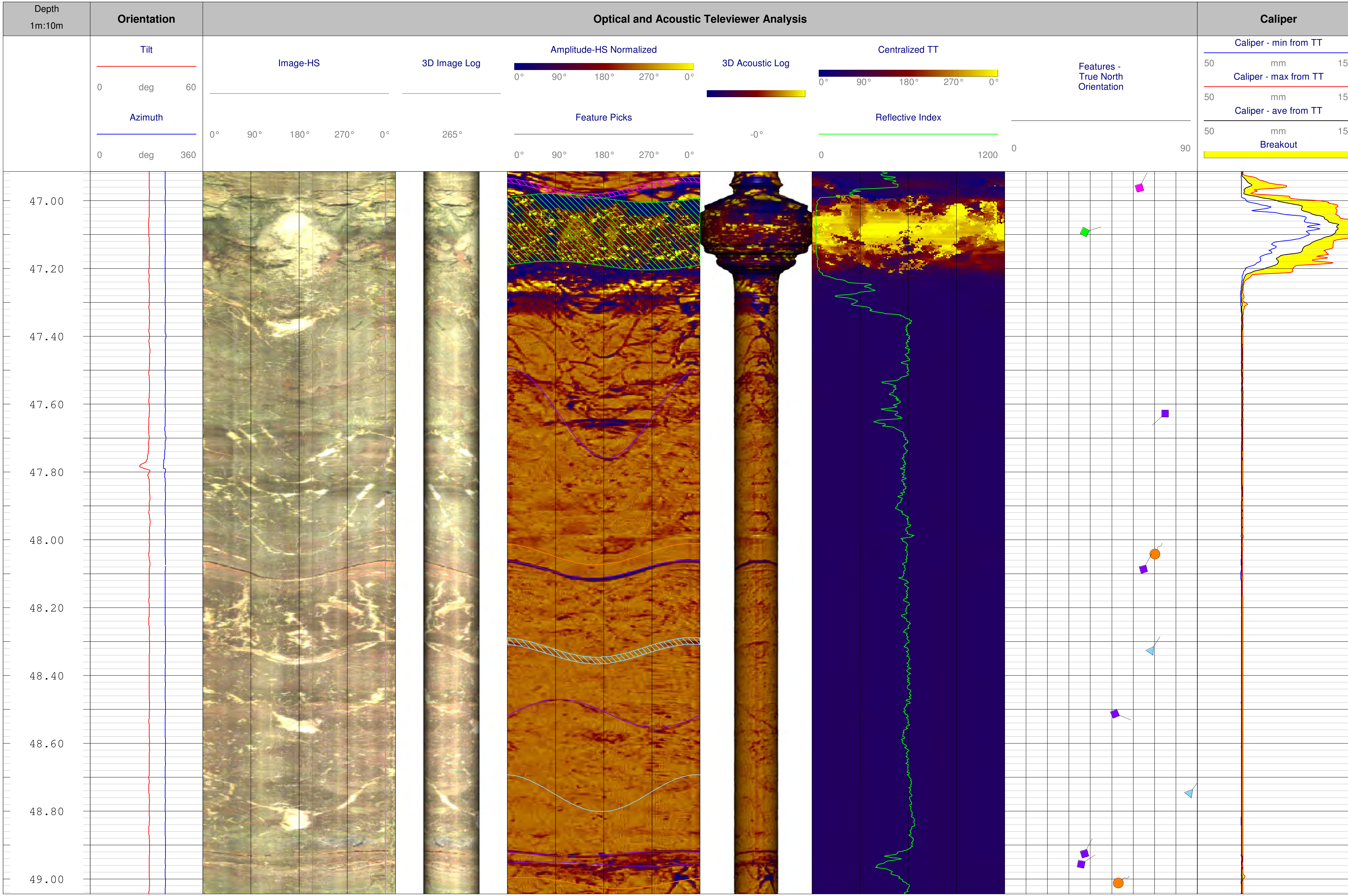
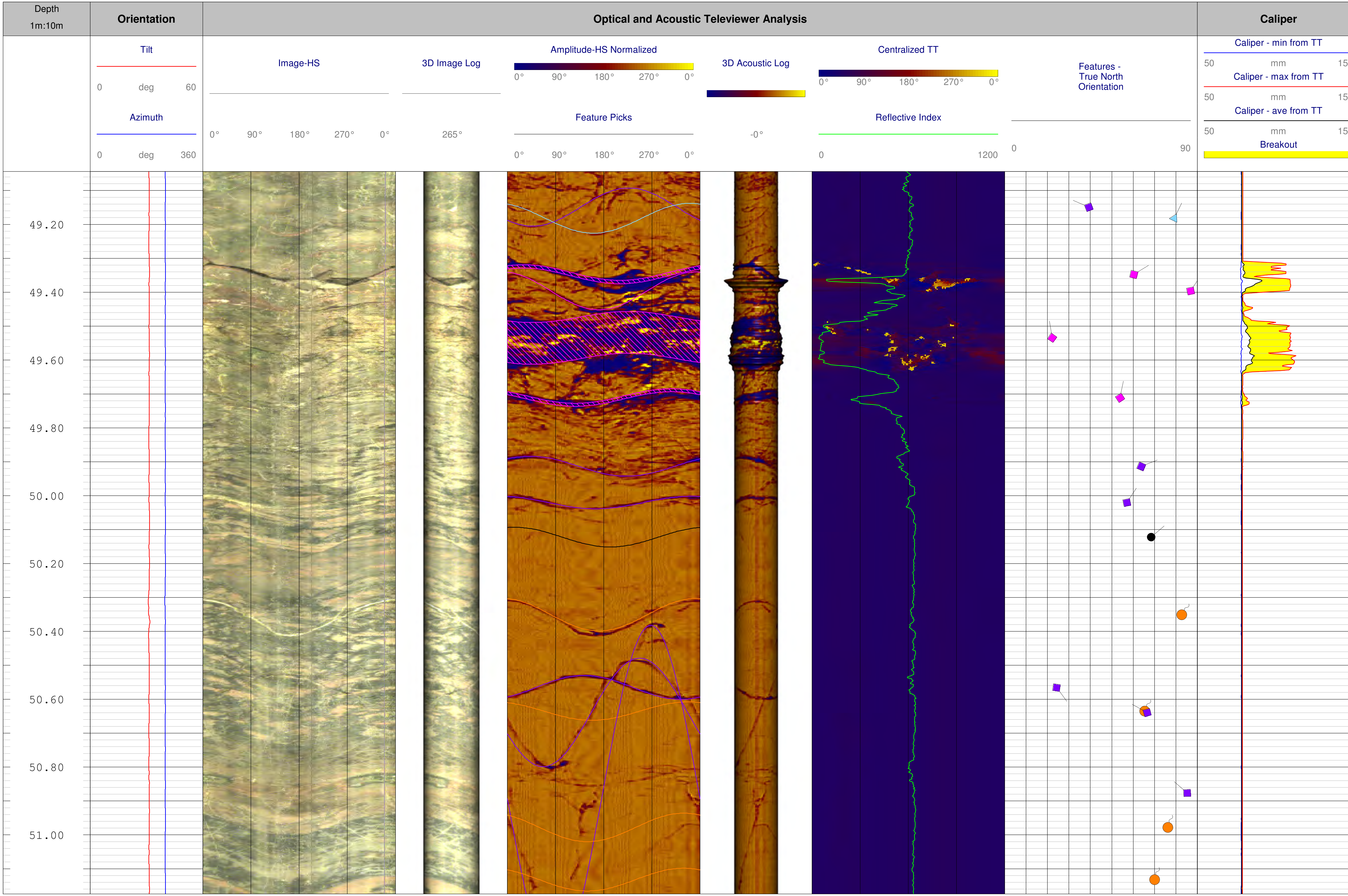
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
44.80
45.00
45.20
45.40
45.60
45.80
46.00
46.20
46.40
46.60
46.80



Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
47.00
47.20
47.40
47.60
47.80
48.00
48.20
48.40
48.60
48.80
49.00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1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
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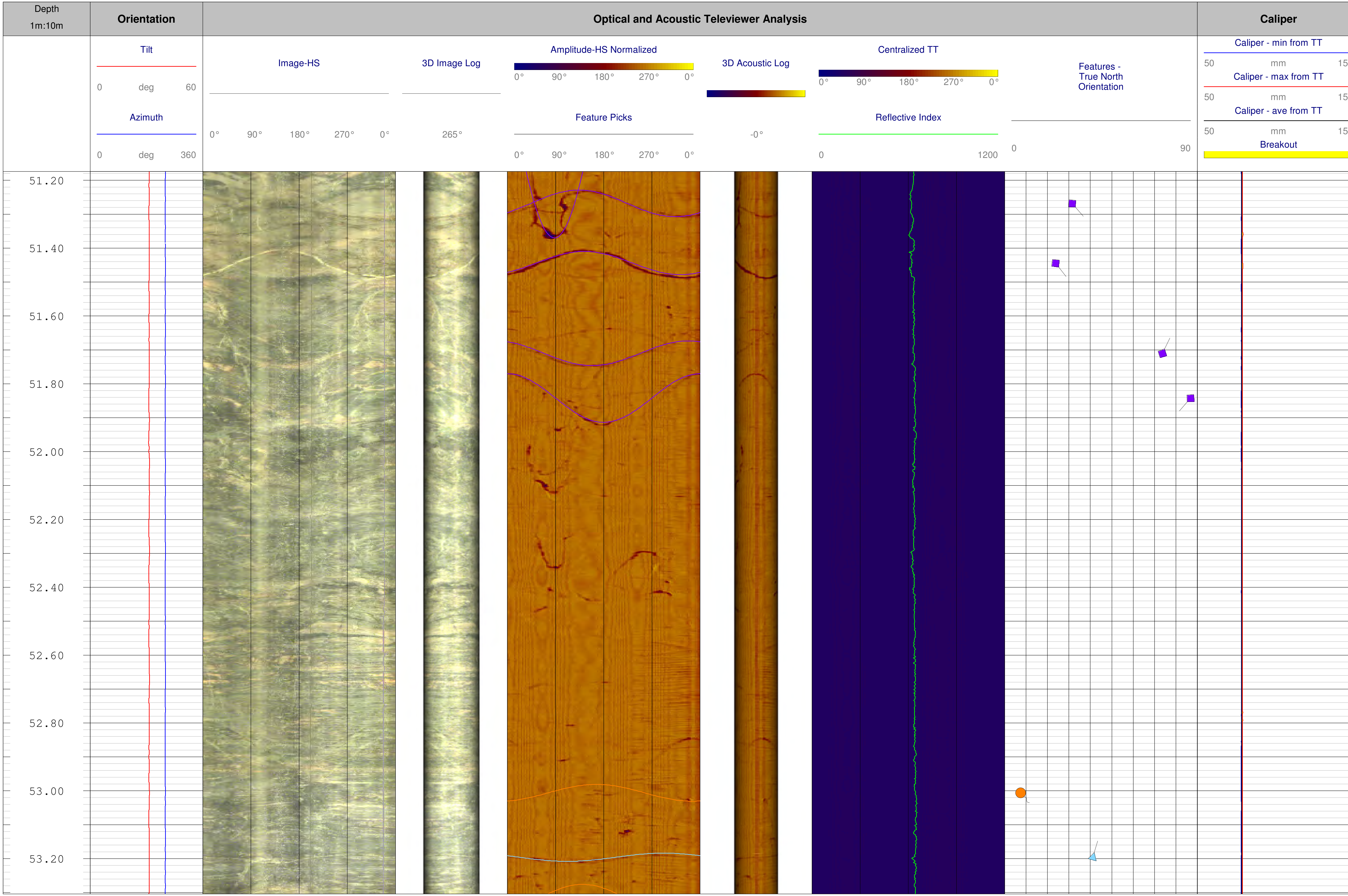
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
49.20
49.40
49.60
49.80
50.00
50.20
50.40
50.60
50.80
51.00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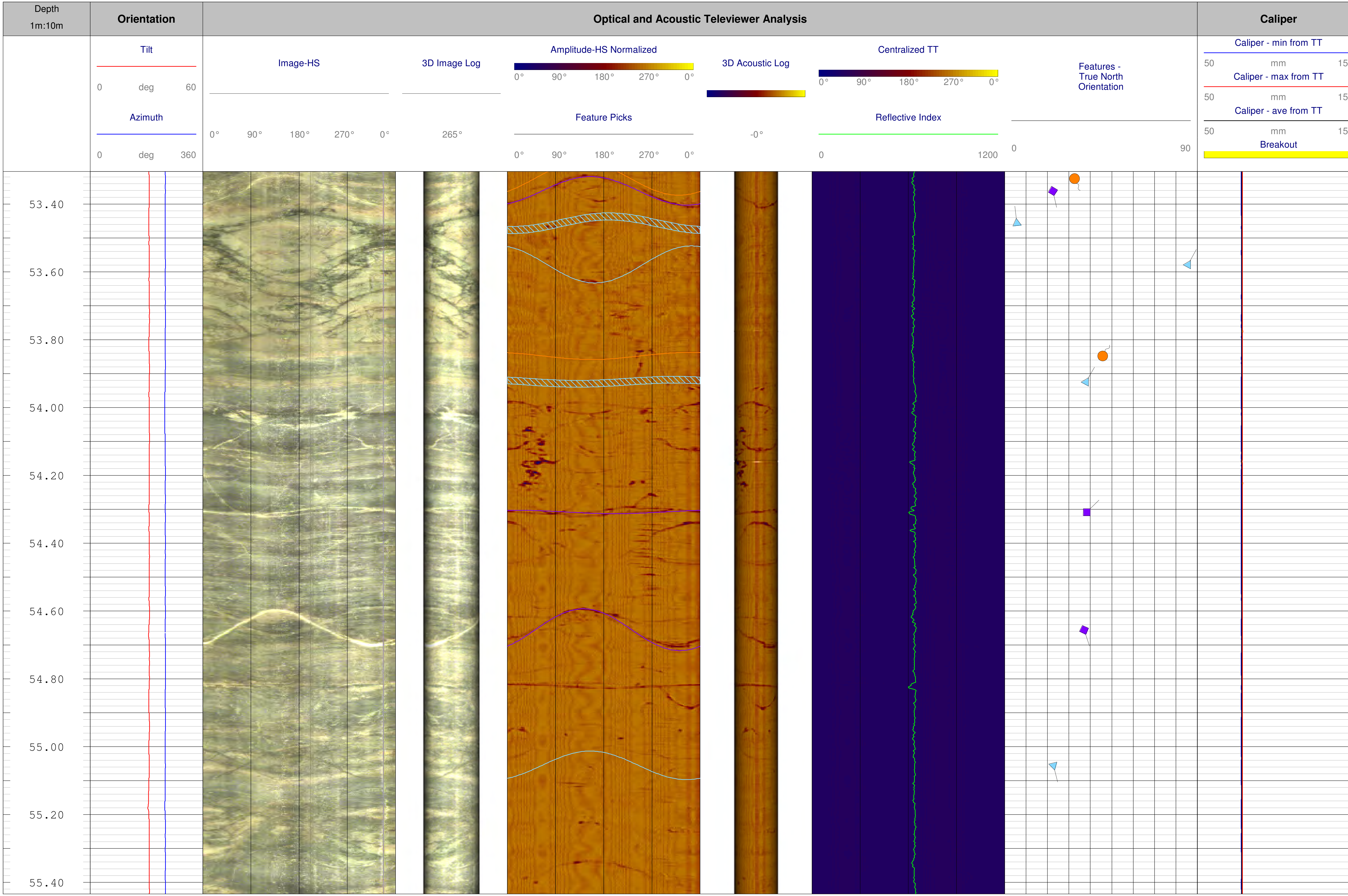
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
51.20
51.40
51.60
51.80
52.00
52.20
52.40
52.60
52.80
53.00
53.20


Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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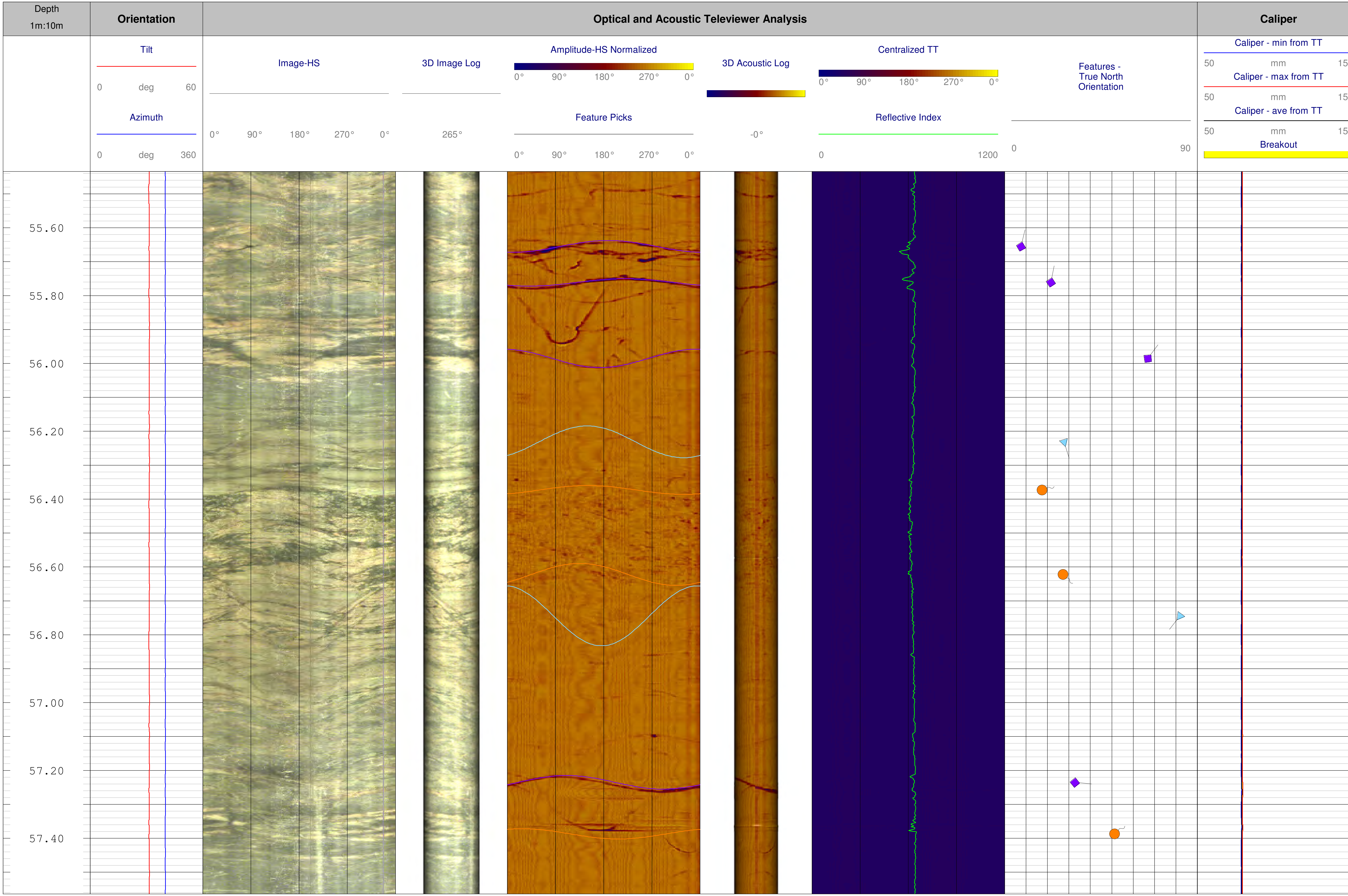
55.00
55.20
55.40


Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
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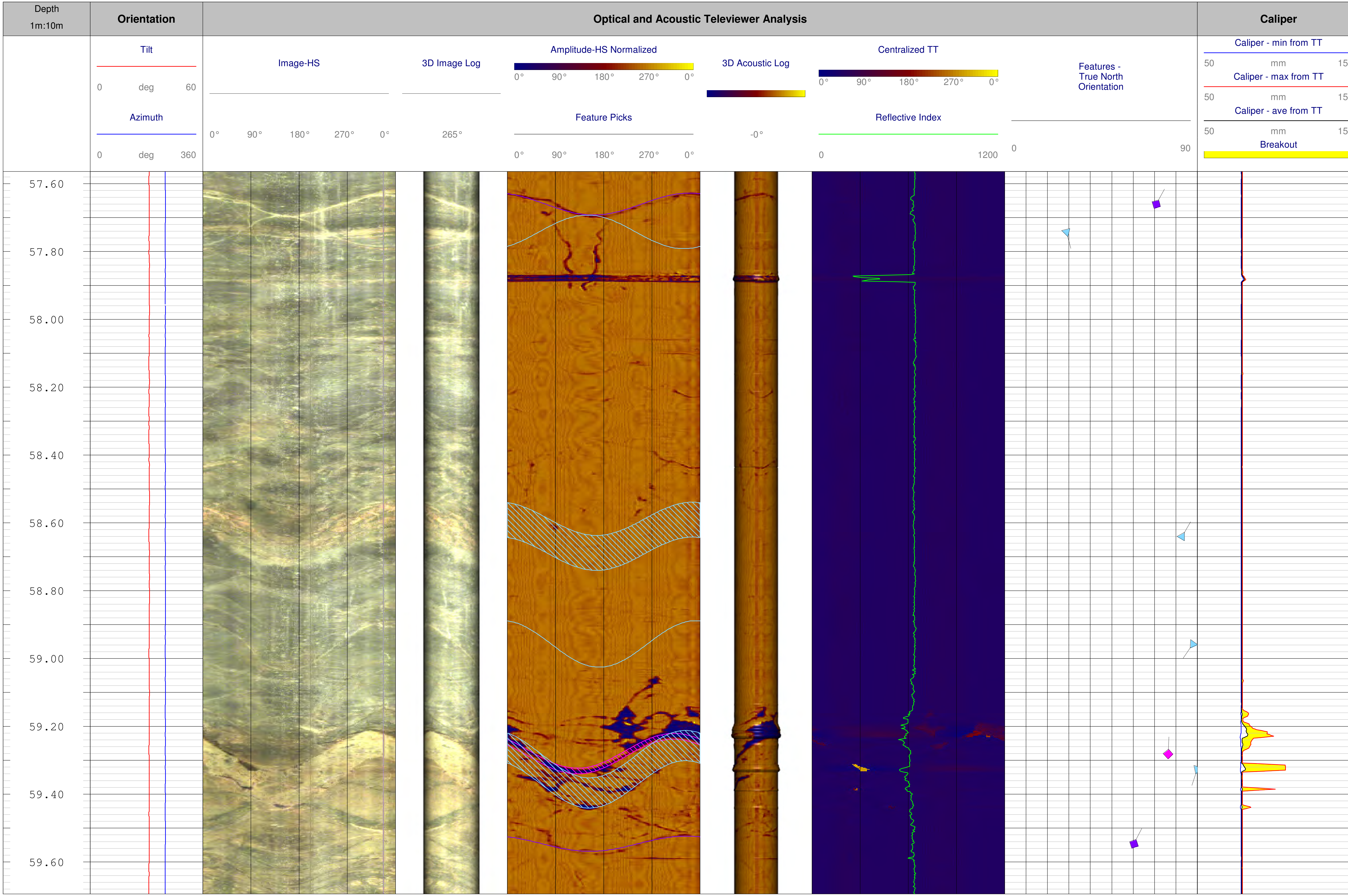
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
55.60
55.80
56.00
56.20
56.40
56.60
56.80
57.00
57.20
57.40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Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
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Azimuth
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Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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58.00
58.20
58.40
58.60
58.80
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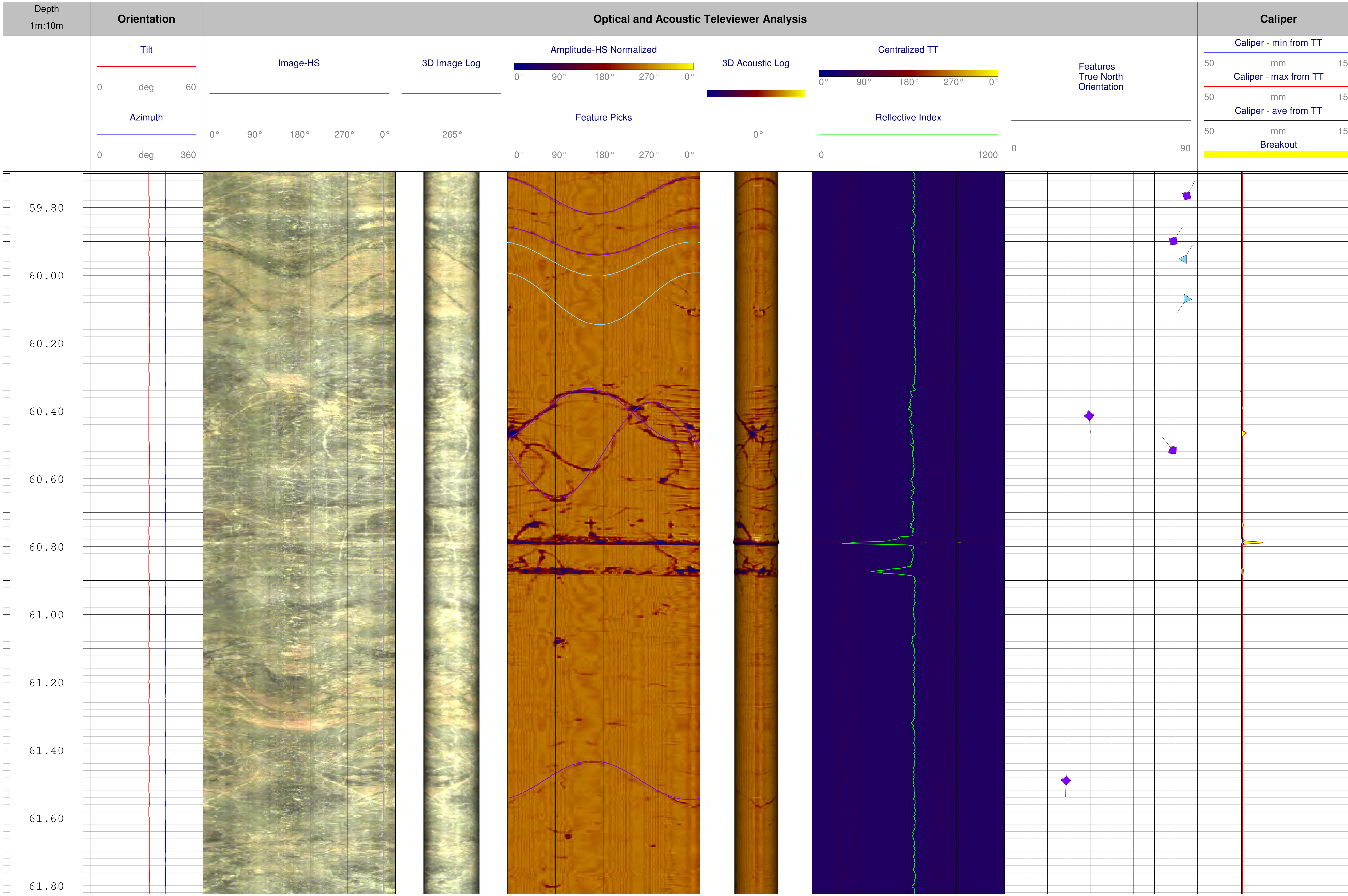
59.20
59.40
59.60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Feature Picks
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3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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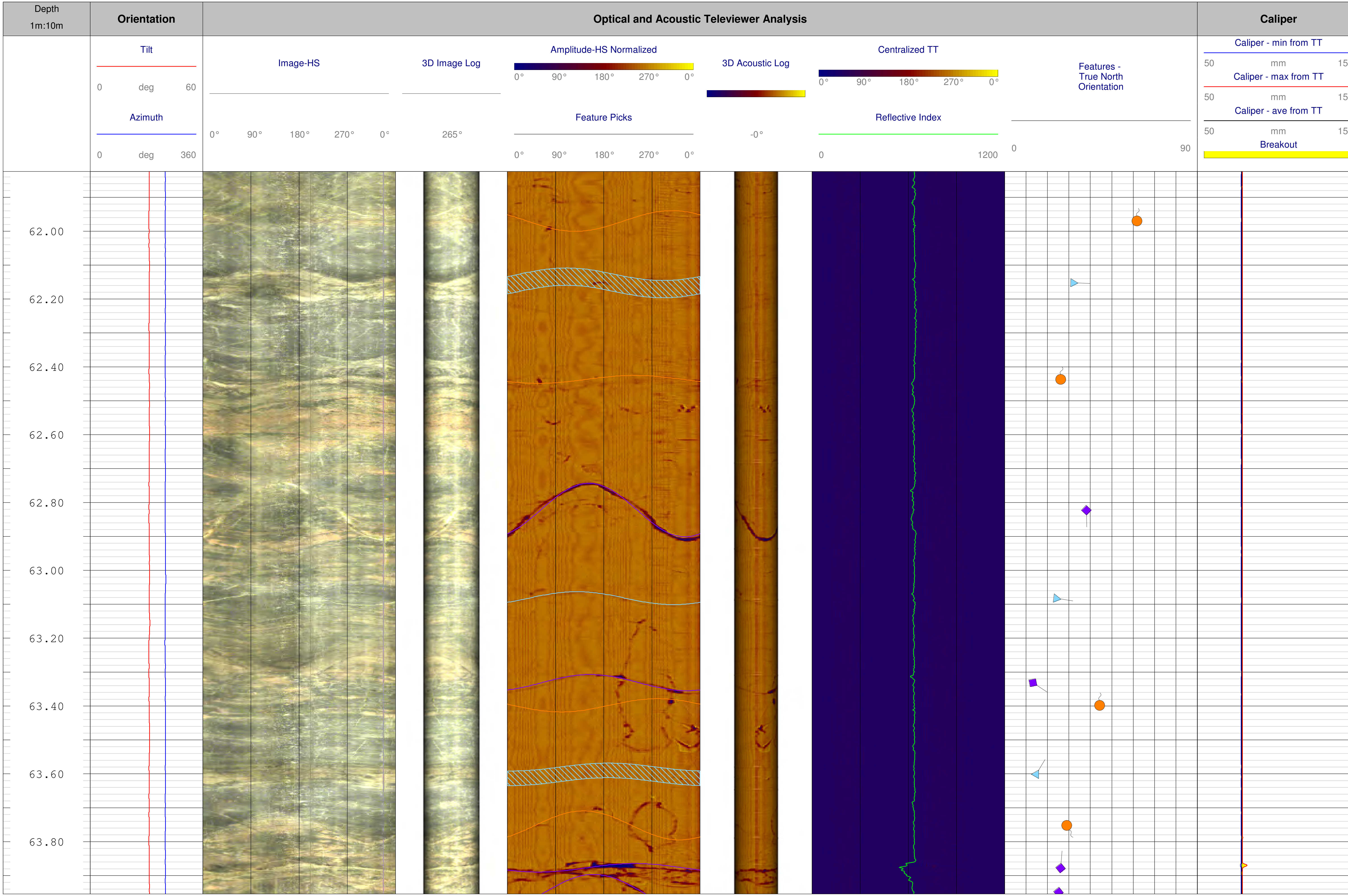
60.40
60.60
60.80
61.00
61.20
61.40
61.60
61.80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Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
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Breakout
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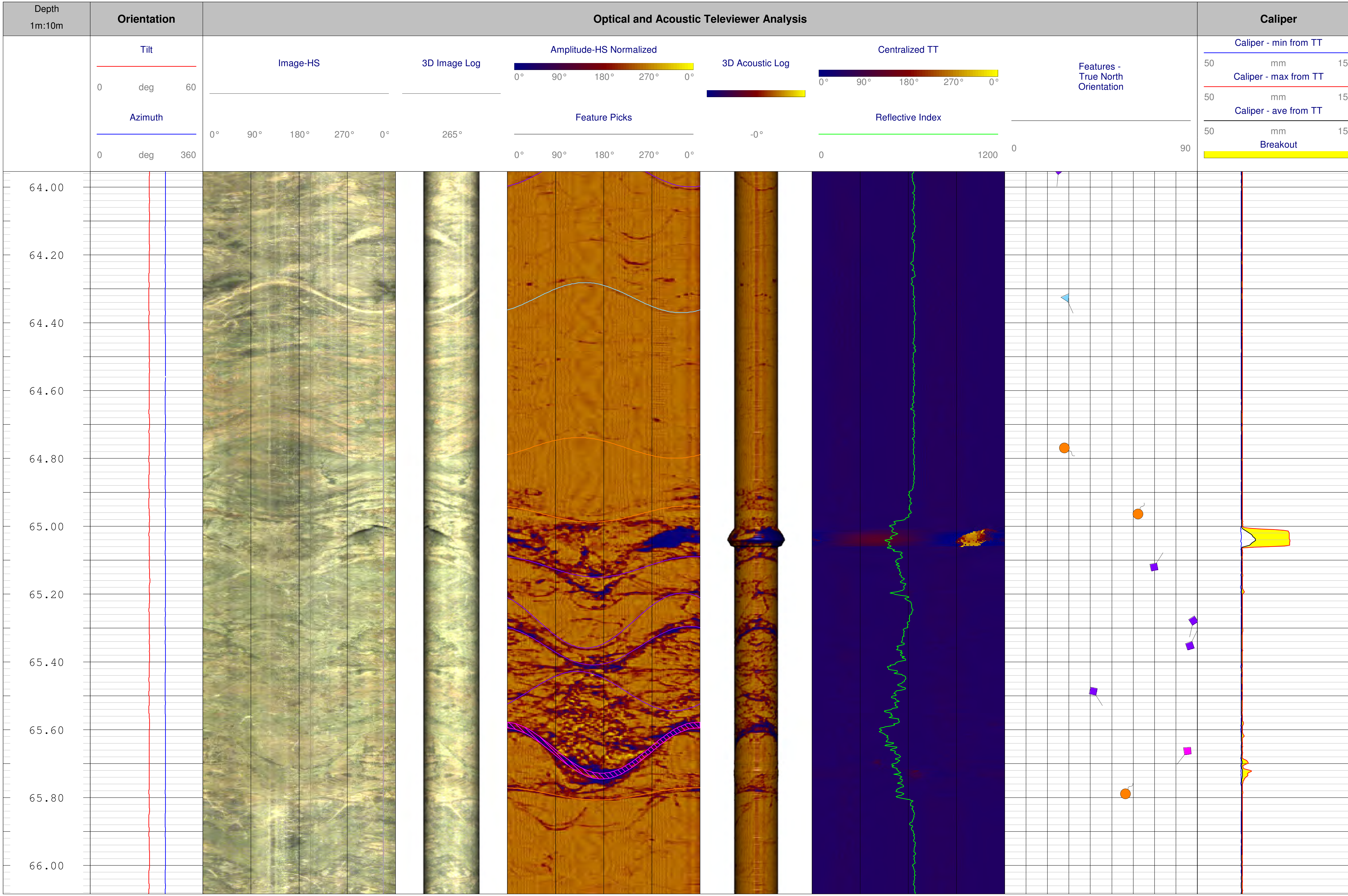
62.20
62.40
62.60
62.80
63.00
63.20
63.40
63.60
63.80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Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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64.40
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64.80
65.00
65.20
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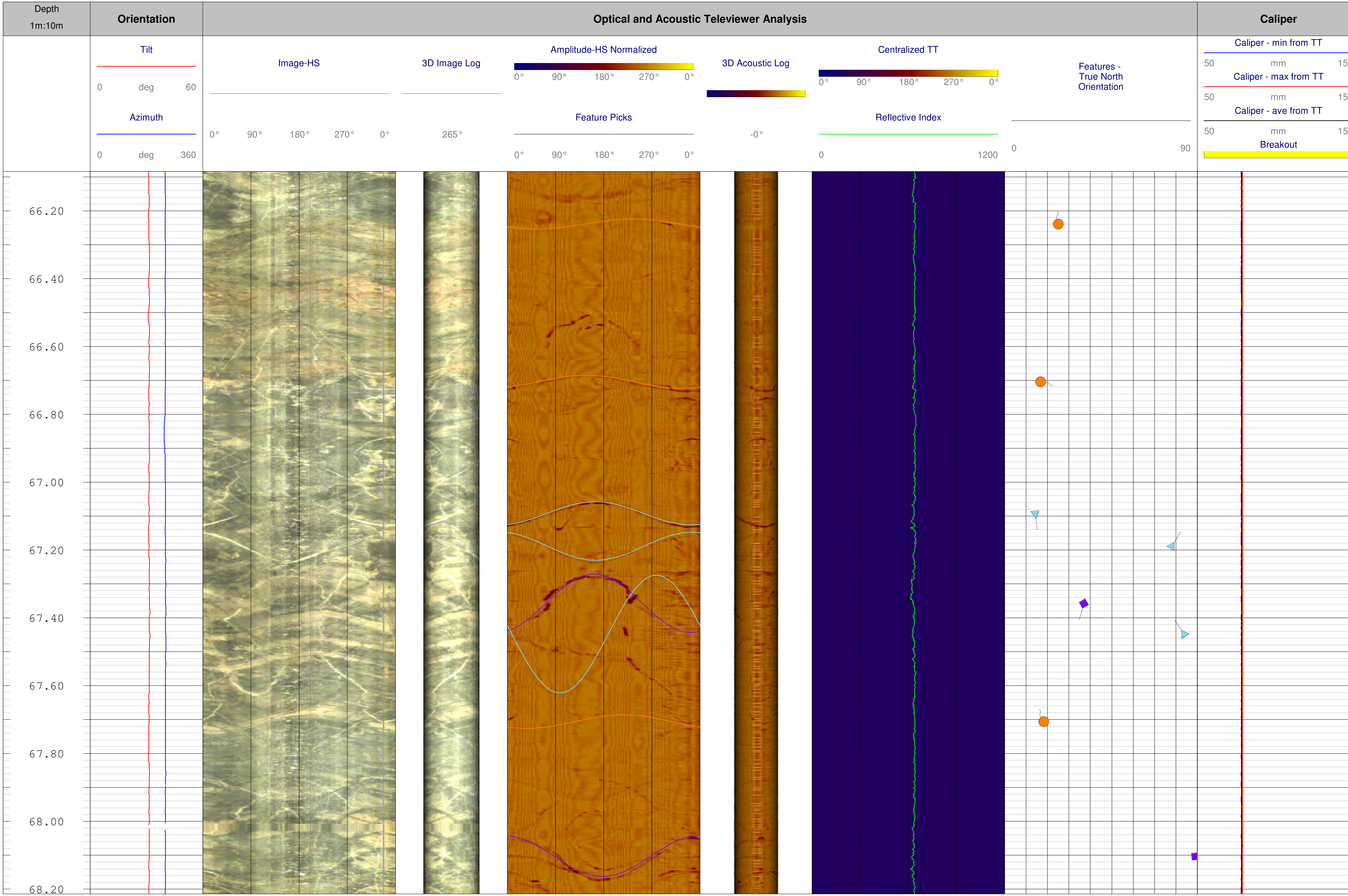
65.80
66.00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Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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66.60
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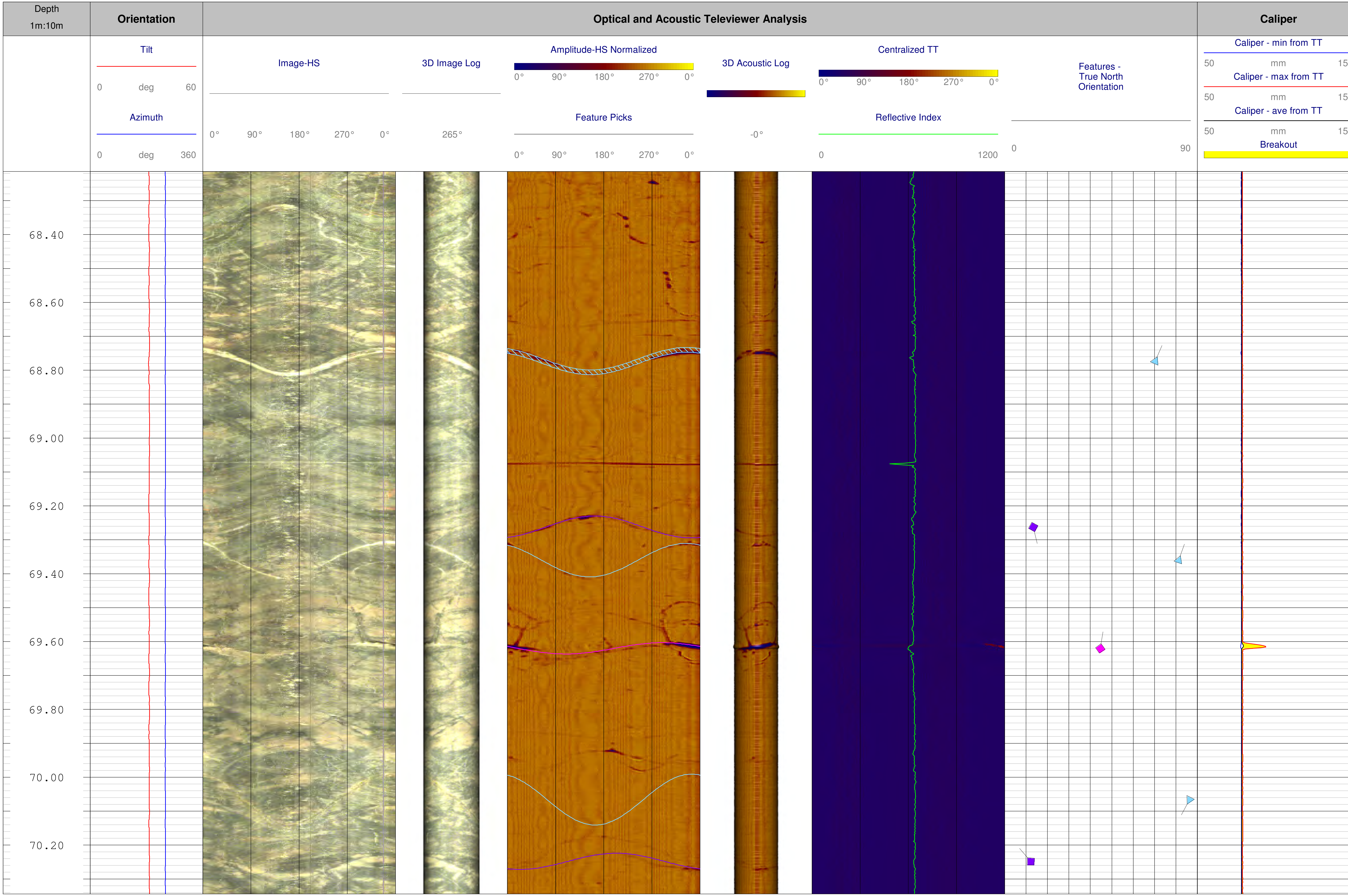
67.00
67.20
67.40
67.60
67.80
68.00
68.20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3D Image Log
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Feature Picks
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3D Acoustic Log
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Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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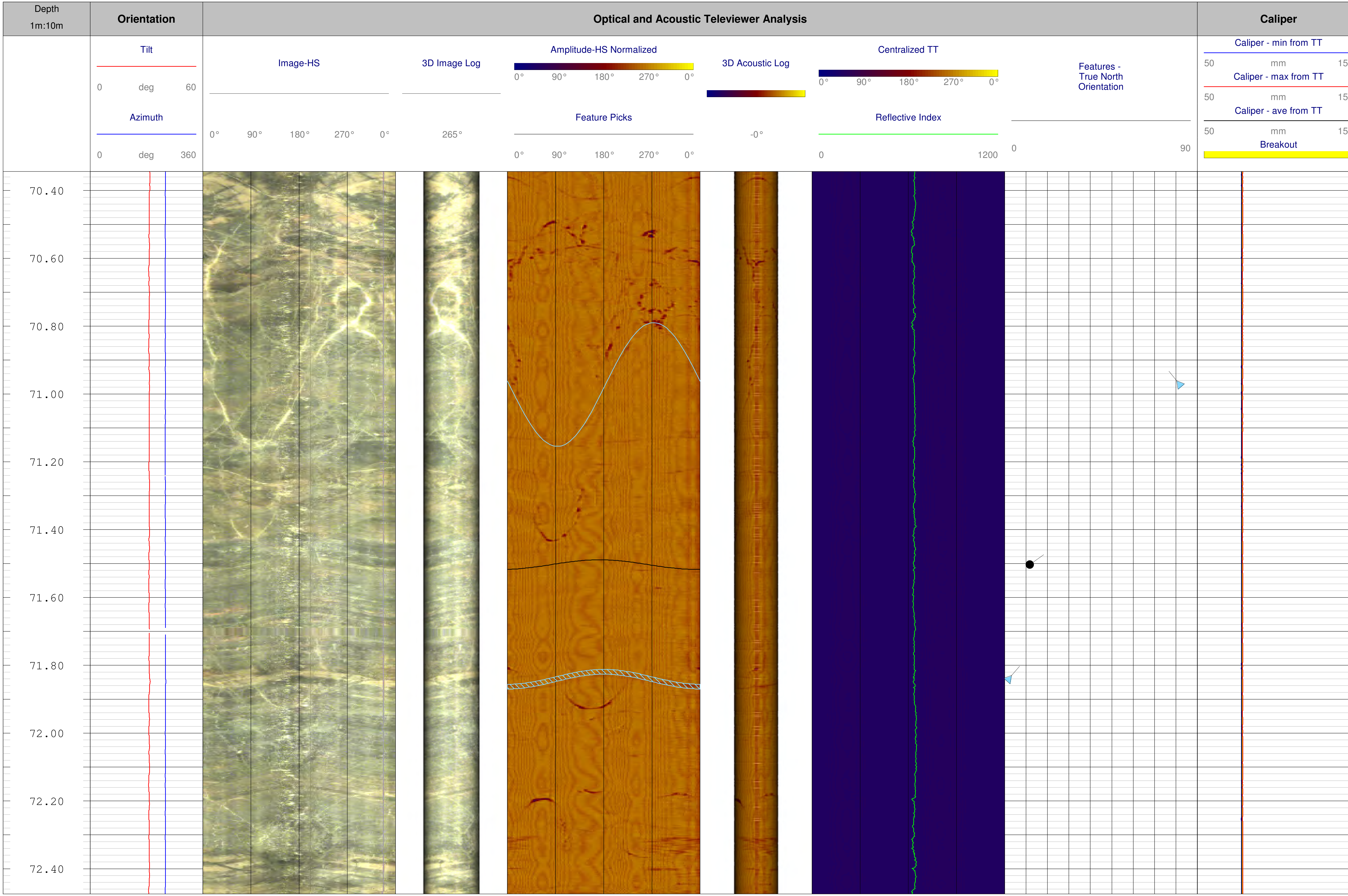
68.60
68.80
69.00
69.20
69.40
69.60
69.80
70.00
70.20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3D Image Log
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Amplitude-HS Normalized
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Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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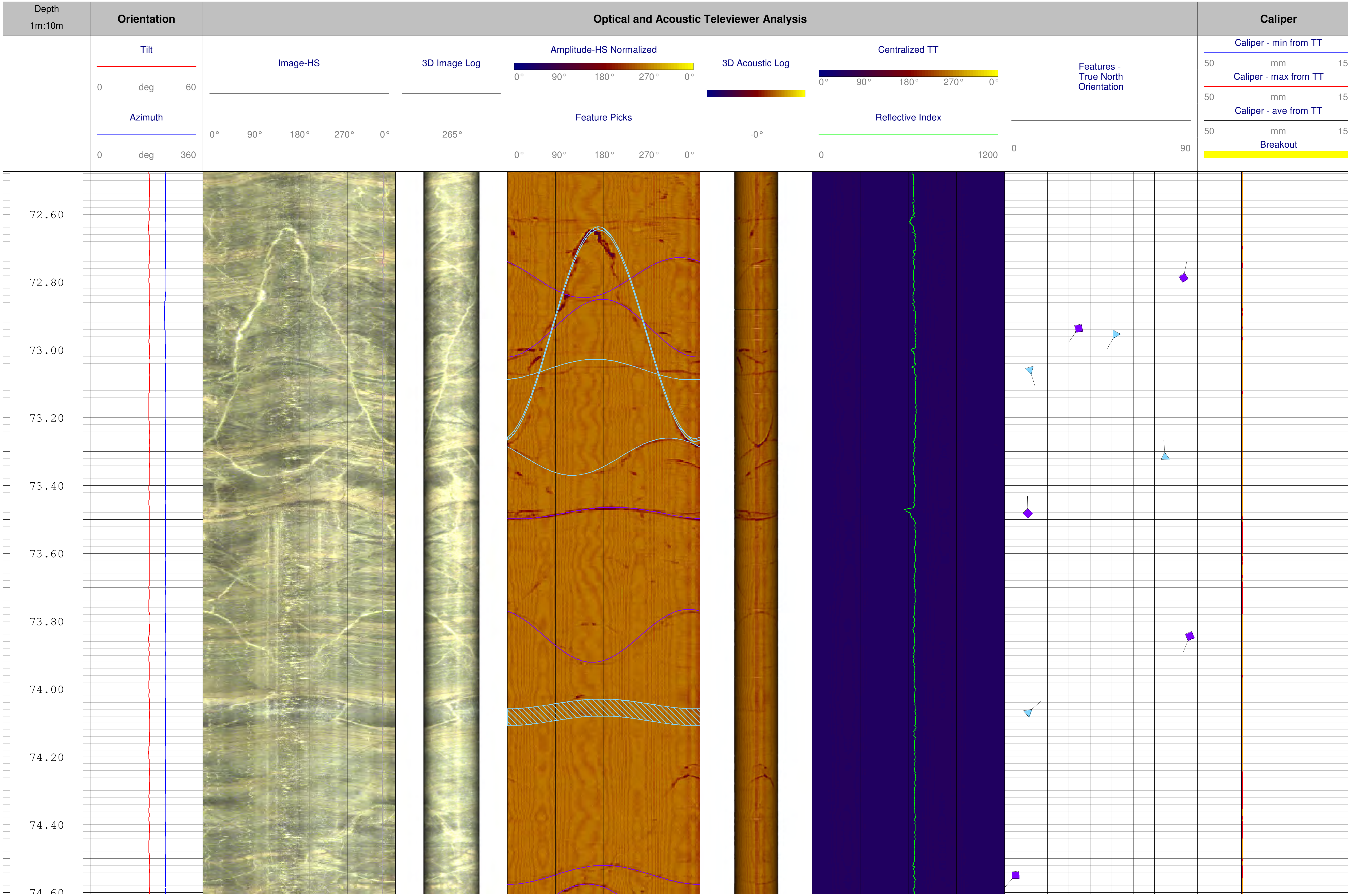
70.80
71.00
71.20
71.40
71.60
71.80
72.00
72.20
72.40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Amplitude-HS Normalized
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Feature Picks
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3D Acoustic Log
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Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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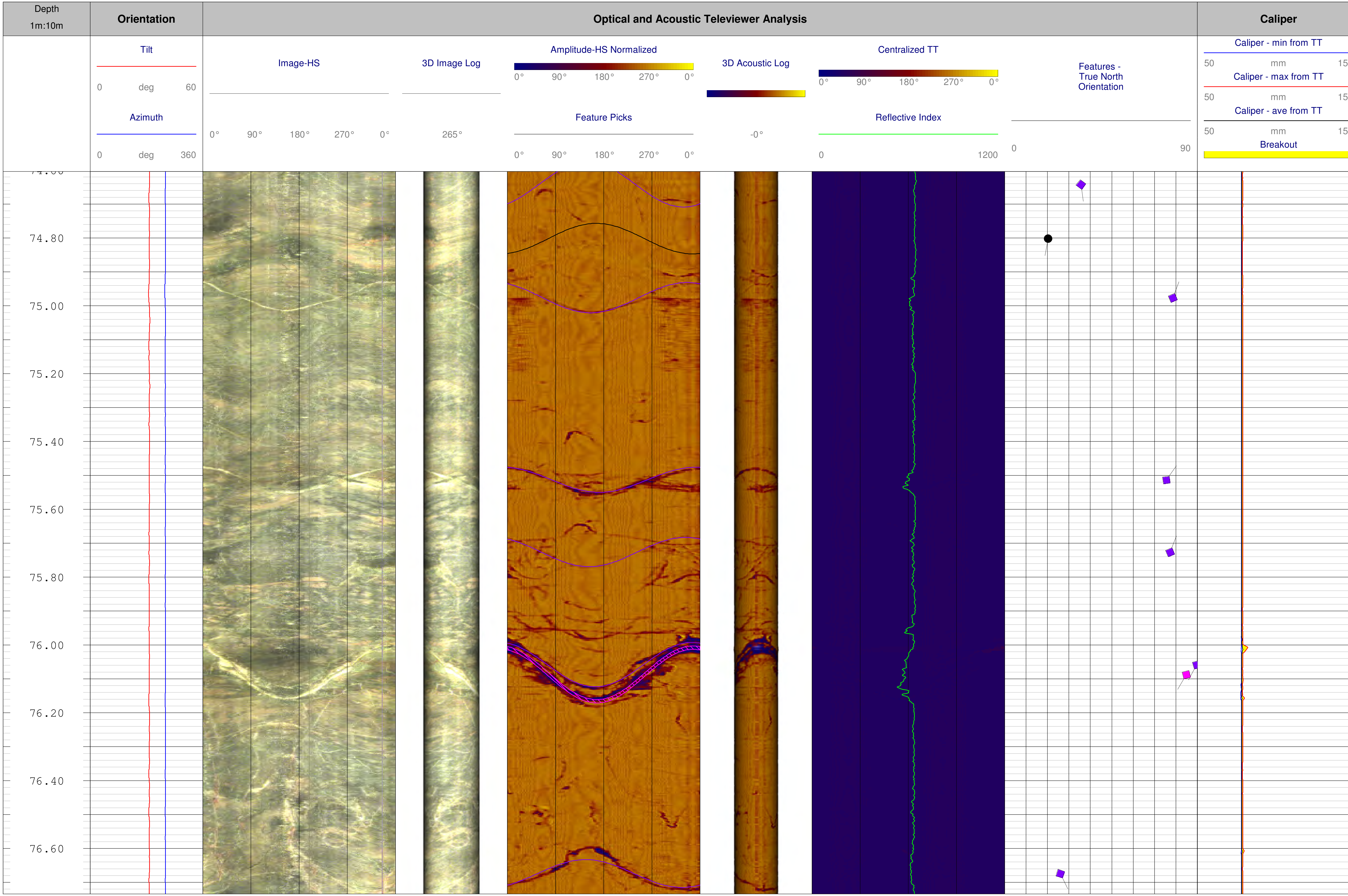
73.00
73.20
73.40
73.60
73.80
74.00
74.20
74.40
74.60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Azimuth
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3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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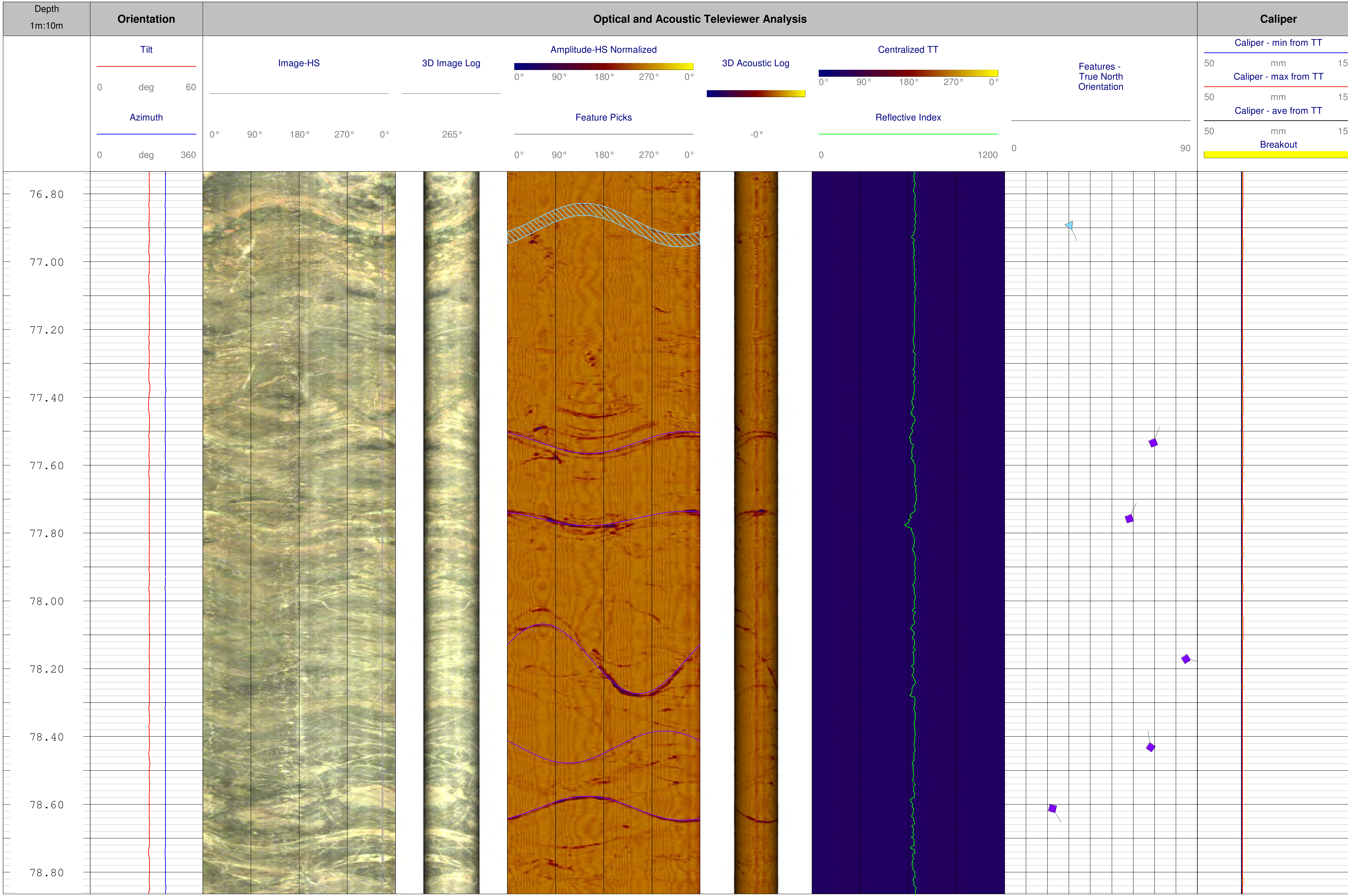
75.00
75.20
75.40
75.60
75.80
76.00
76.20
76.40
76.60



Depth
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Orientation
Optical and Acoustic Televiewer Analysis
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Tilt
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Azimuth
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Image-HS
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3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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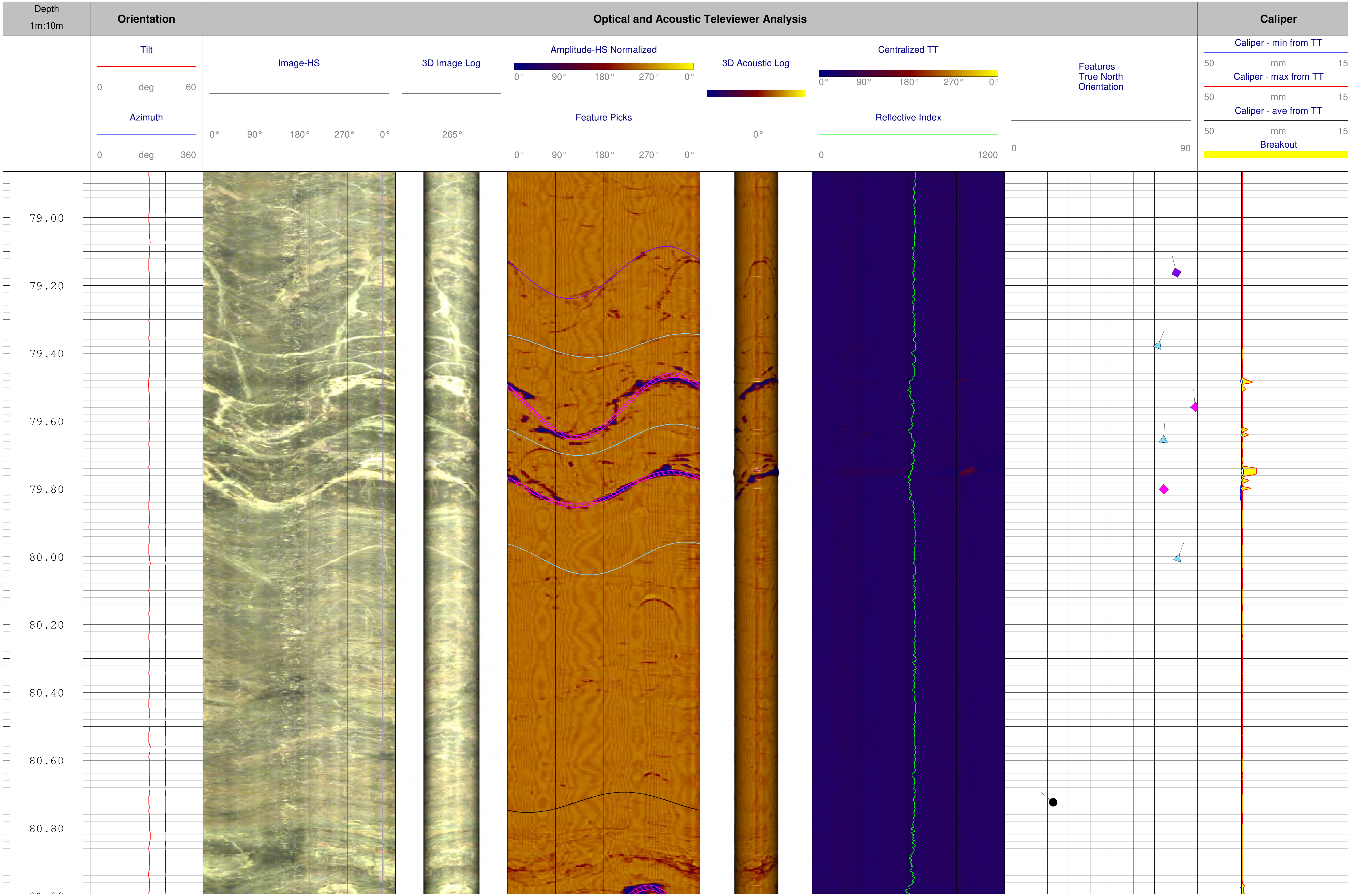
77.00
77.20
77.40
77.60
77.80
78.00
78.20
78.40
78.60
78.80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Azimuth
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Image-HS
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3D Image Log
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Amplitude-HS Normalized
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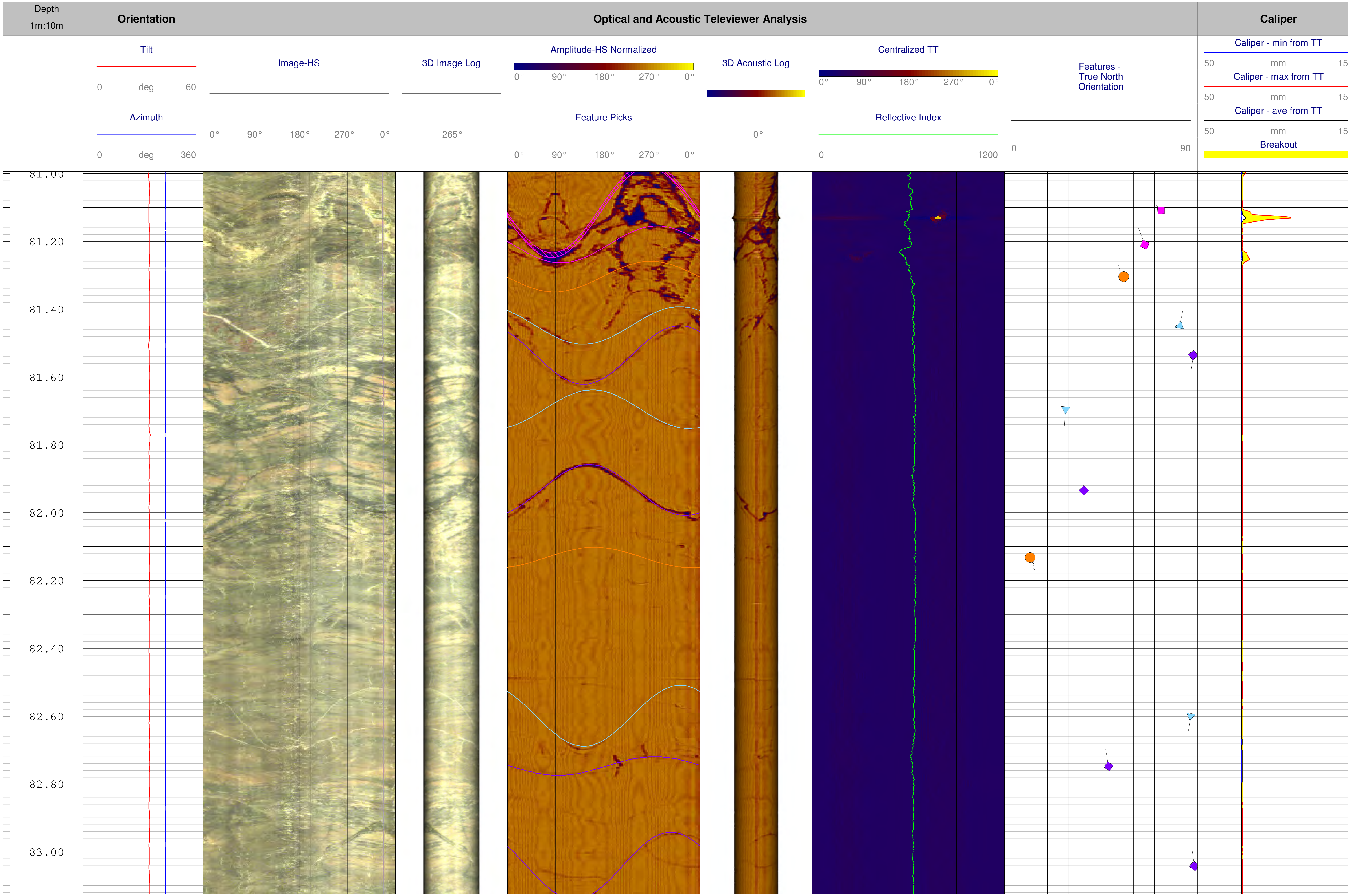
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
79.00
79.20
79.40
79.60
79.80
80.00
80.20
80.40
80.60
80.80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Orientation
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Azimuth
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3D Image Log
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Amplitude-HS Normalized
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Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
81.00
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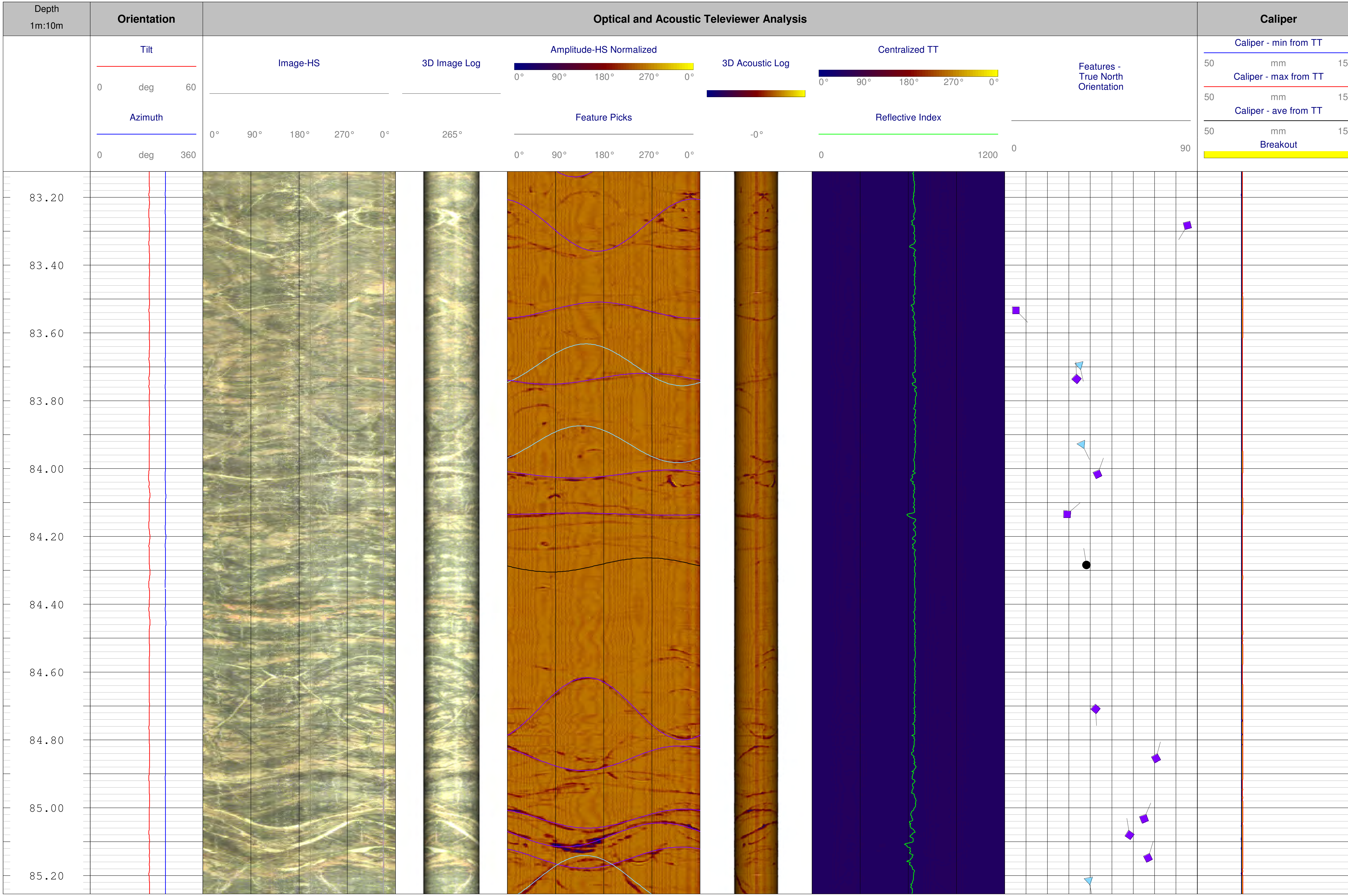
82.60
82.80
83.00



Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
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Azimuth
0 deg 360
Image-HS
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3D Image Log
265°
Amplitude-HS Normalized
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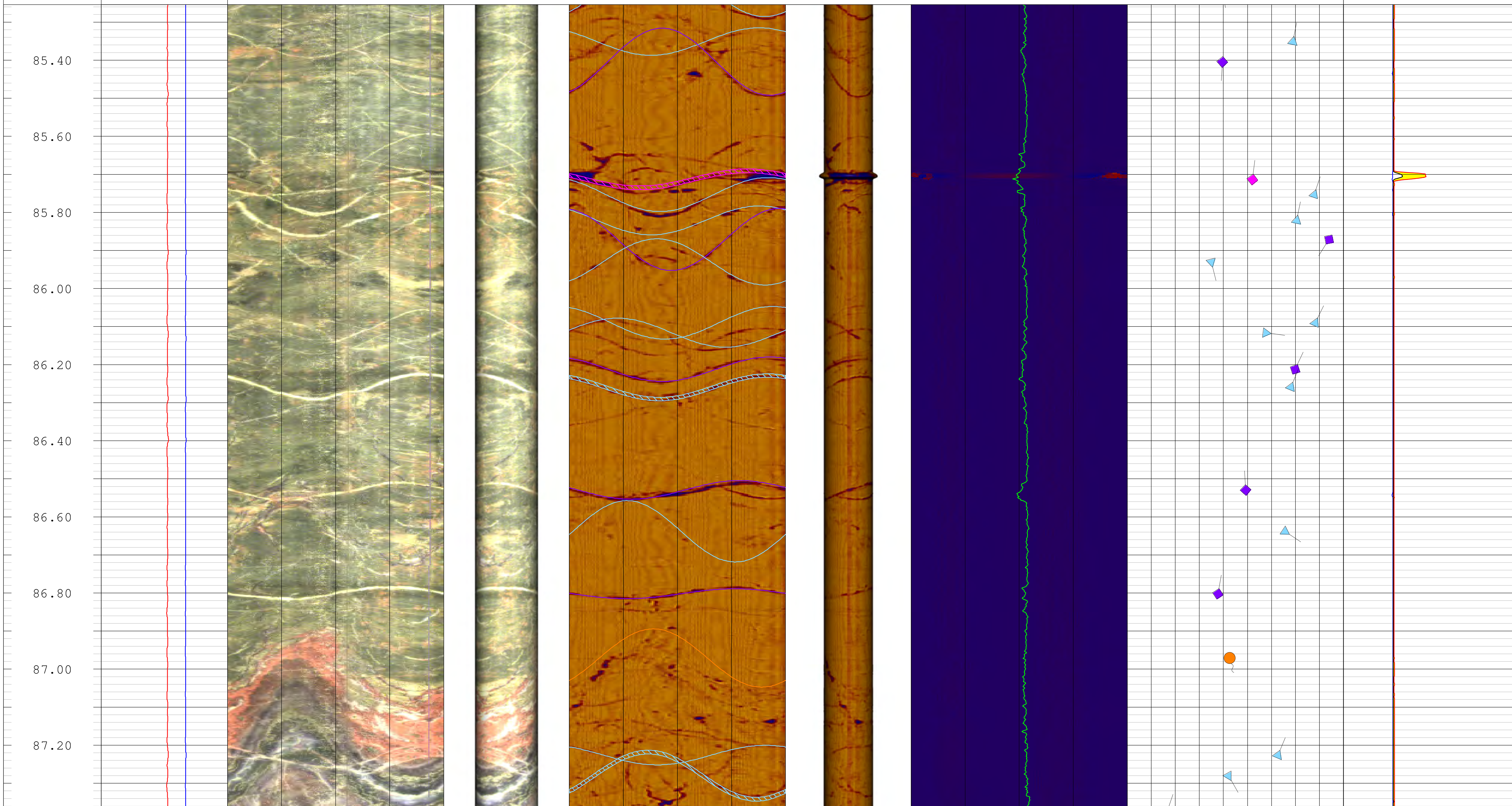
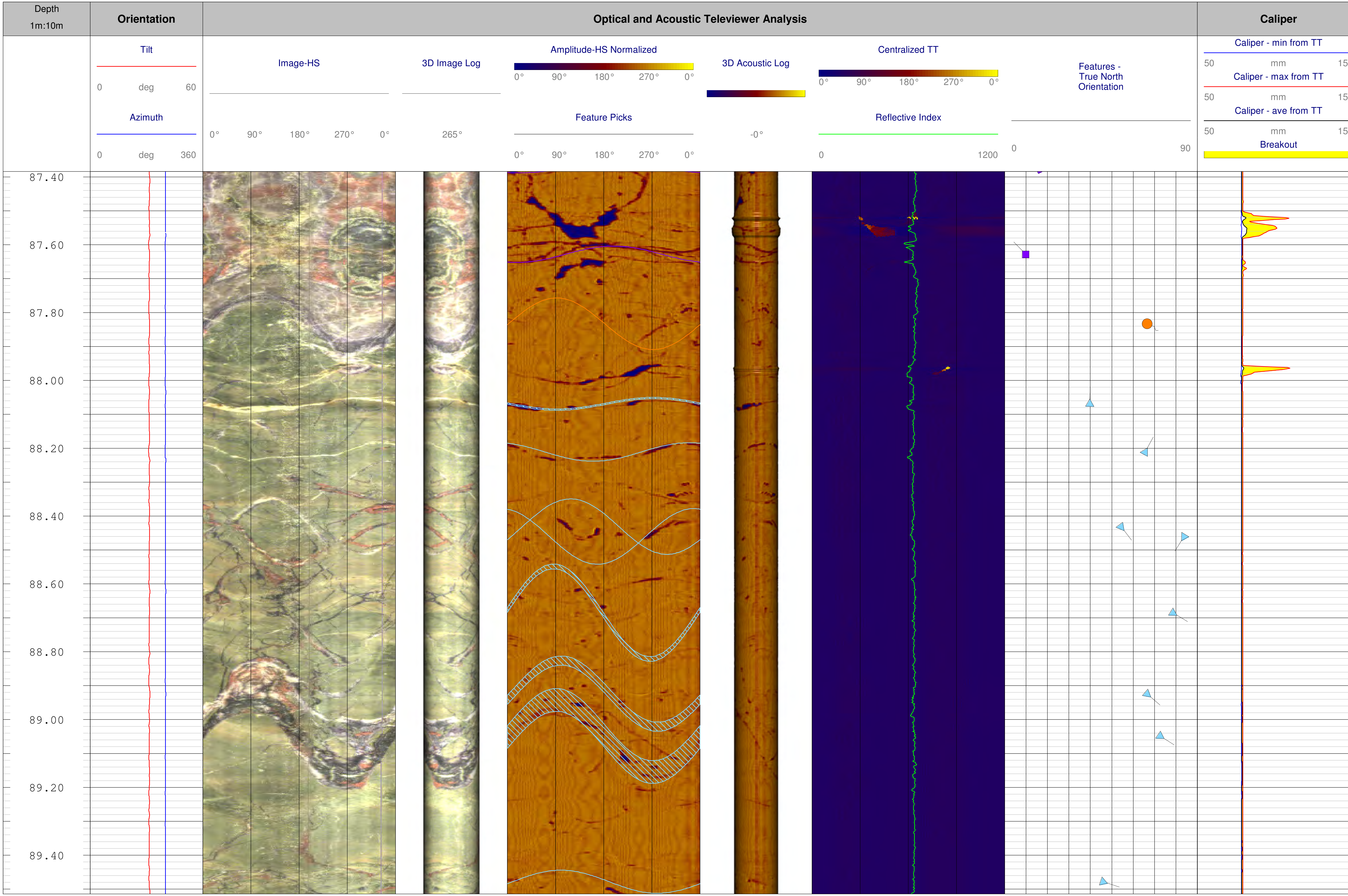
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
83.20
83.40
83.60
83.80
84.00
84.20
84.40
84.60
84.80
85.00
85.20

Depth 1m:10m	Orientation	Optical and Acoustic Televiewer Analysis	Caliper
	Tilt (0 deg 60); Azimuth (0 deg 360)	Image-HS (0° 90° 180° 270° 0°); 3D Image Log (265°); Amplitude-HS Normalized (0° 90° 180° 270° 0°); Feature Picks (0° 90° 180° 270° 0°); 3D Acoustic Log (-0°); Centralized TT (0° 90° 180° 270° 0°); Reflective Index (0 1200); Features - True North Orientation (0 90)	Caliper - min from TT (50 mm 150); Caliper - max from TT (50 mm 150); Caliper - ave from TT (50 mm 150); Breakout

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Tilt
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Azimuth
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Image-HS
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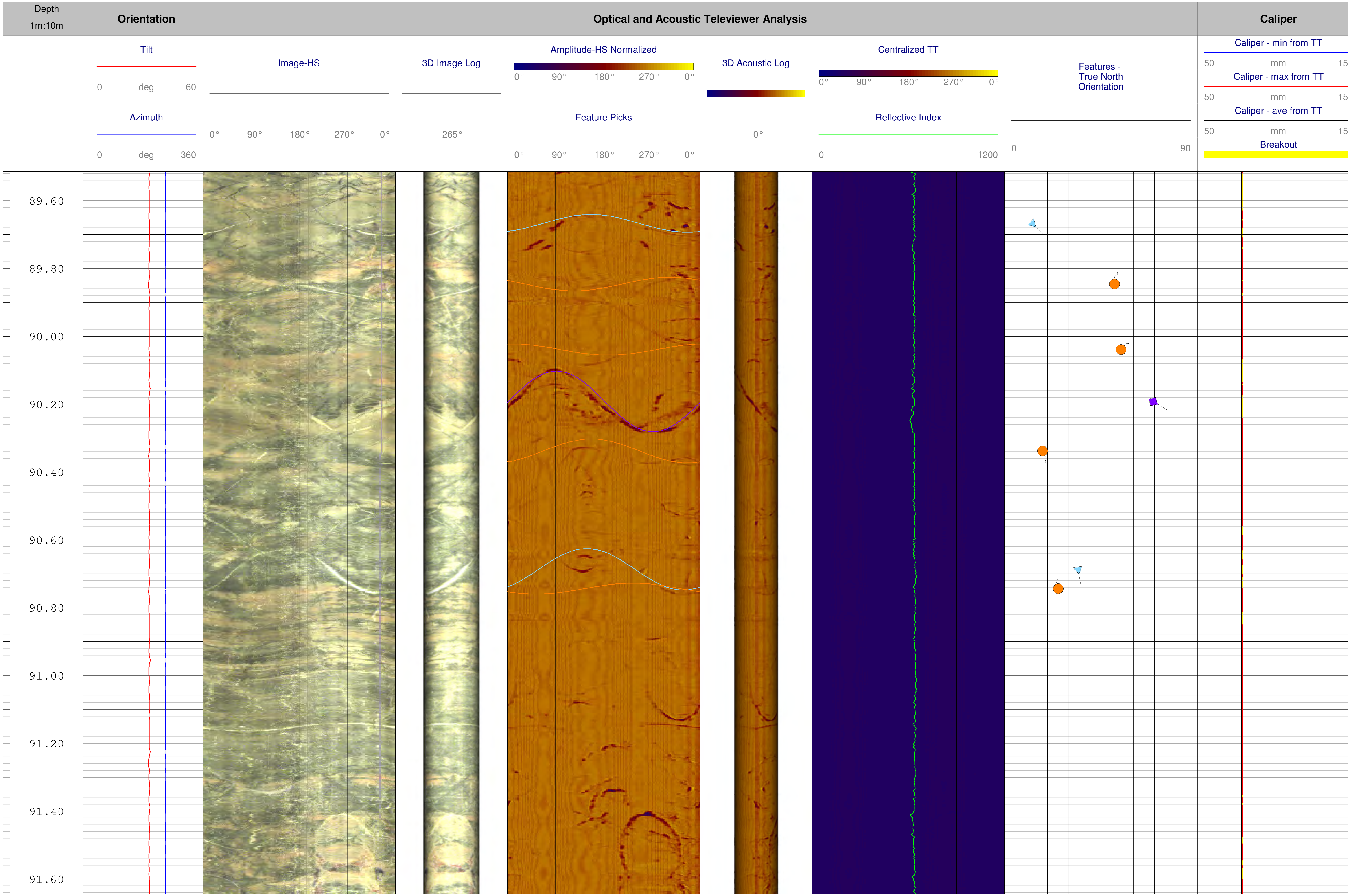
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
87.40
87.60
87.80
88.00
88.20
88.40
88.60
88.80
89.00
89.20
89.40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Amplitude-HS Normalized
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Feature Picks
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3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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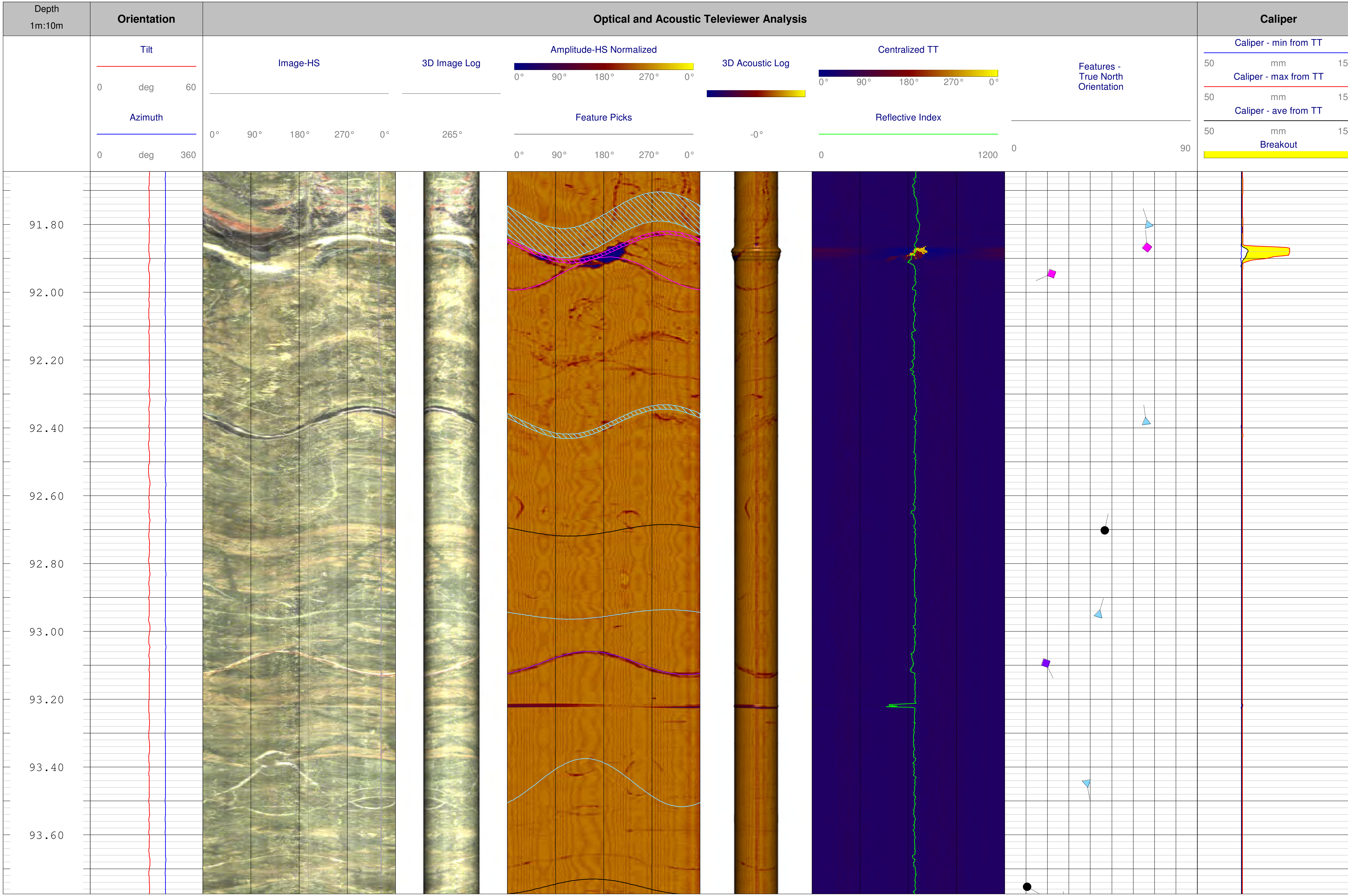
91.20
91.40
91.60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Feature Picks
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3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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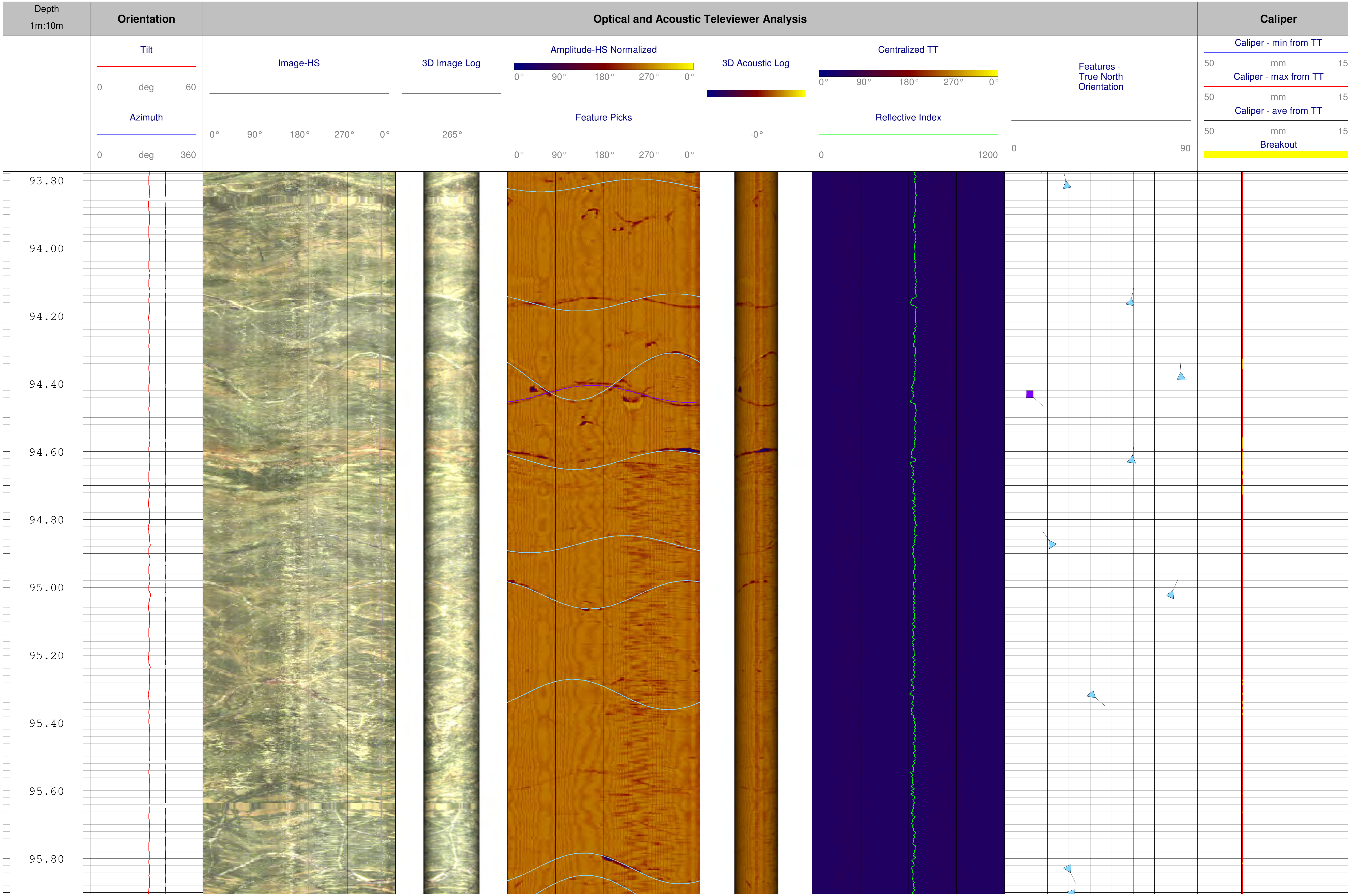
92.00
92.20
92.40
92.60
92.80
93.00
93.20
93.40
93.60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Amplitude-HS Normalized
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Feature Picks
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3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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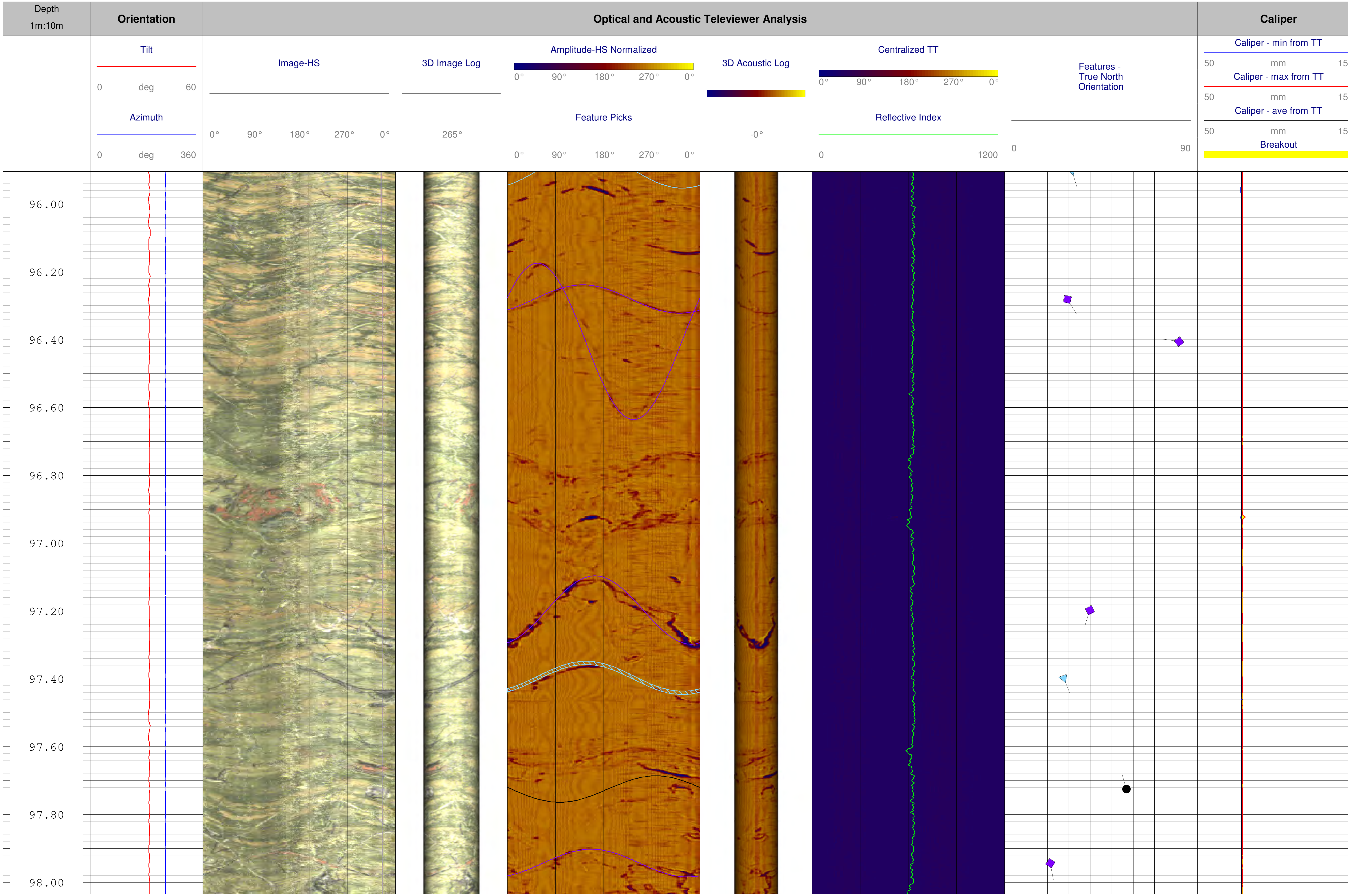
95.40
95.60
95.80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Amplitude-HS Normalized
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Feature Picks
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3D Acoustic Log
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Centralized TT
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Reflective Index
0 1200
Features -
True North
Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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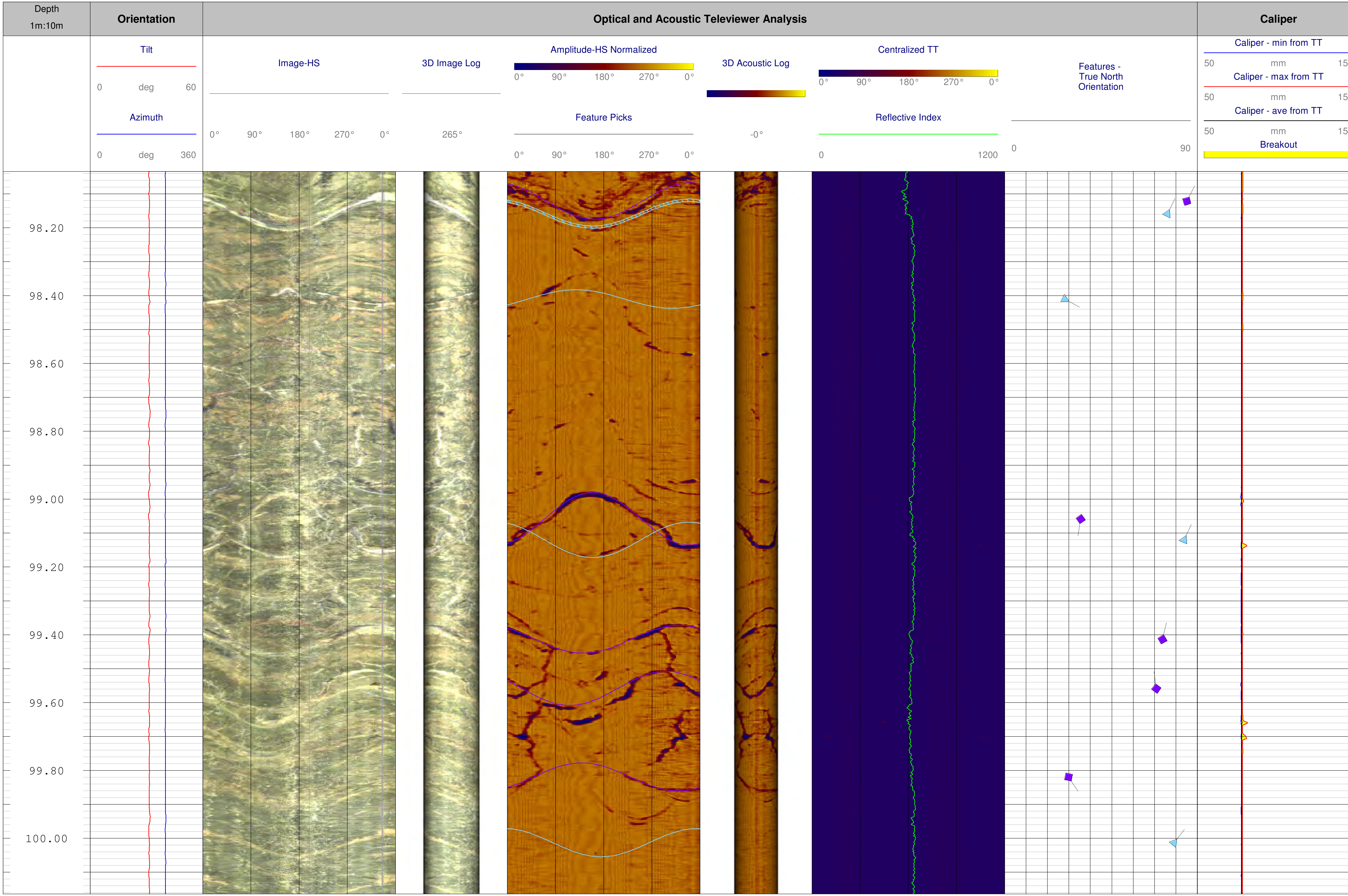
96.20
96.40
96.60
96.80
97.00
97.20
97.40
97.60
97.80
98.00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Amplitude-HS Normalized
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Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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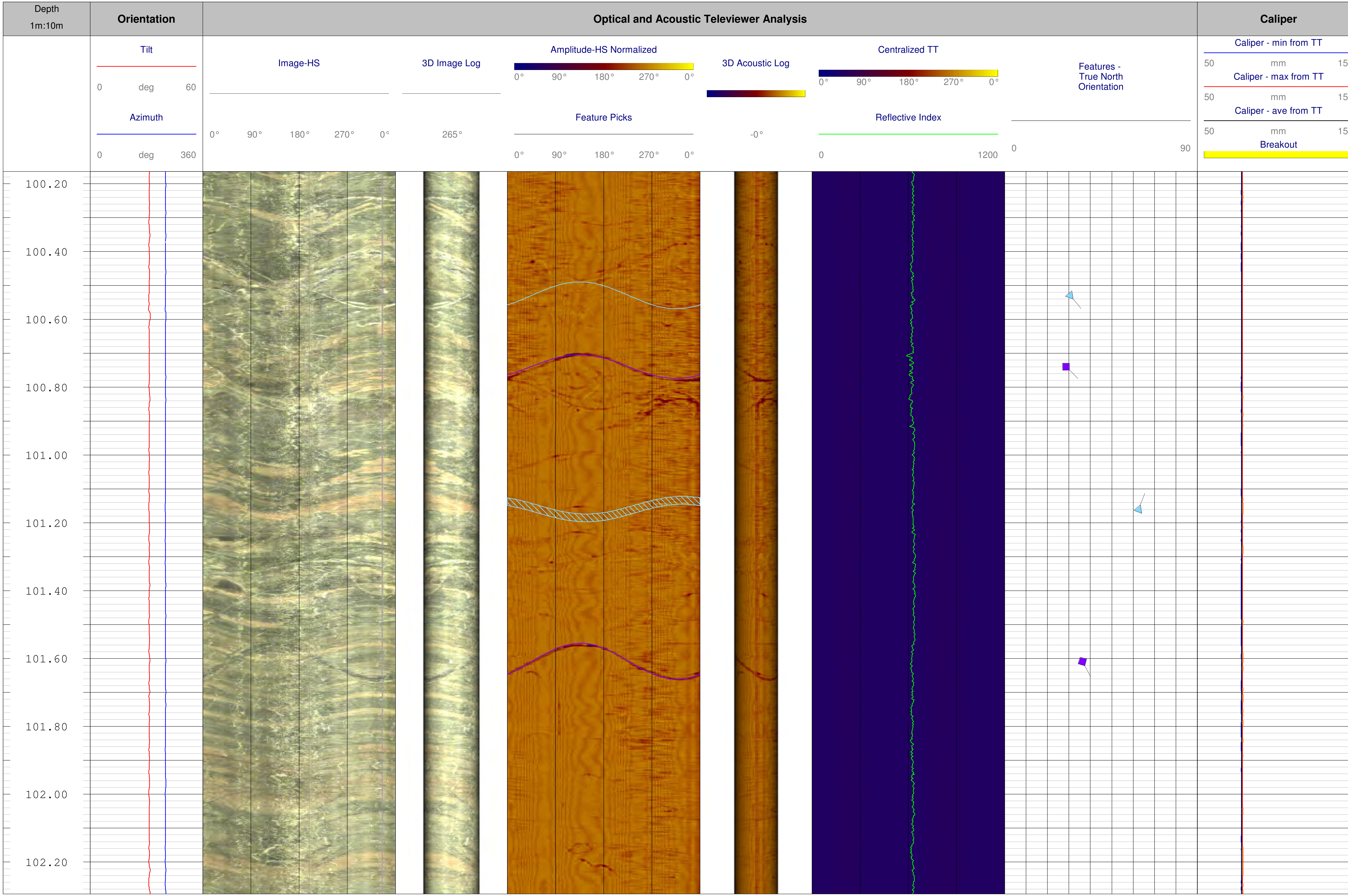
98.40
98.60
98.80
99.00
99.20
99.40
99.60
99.80
100.00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Feature Picks
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3D Acoustic Log
-0°
Centralized TT
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Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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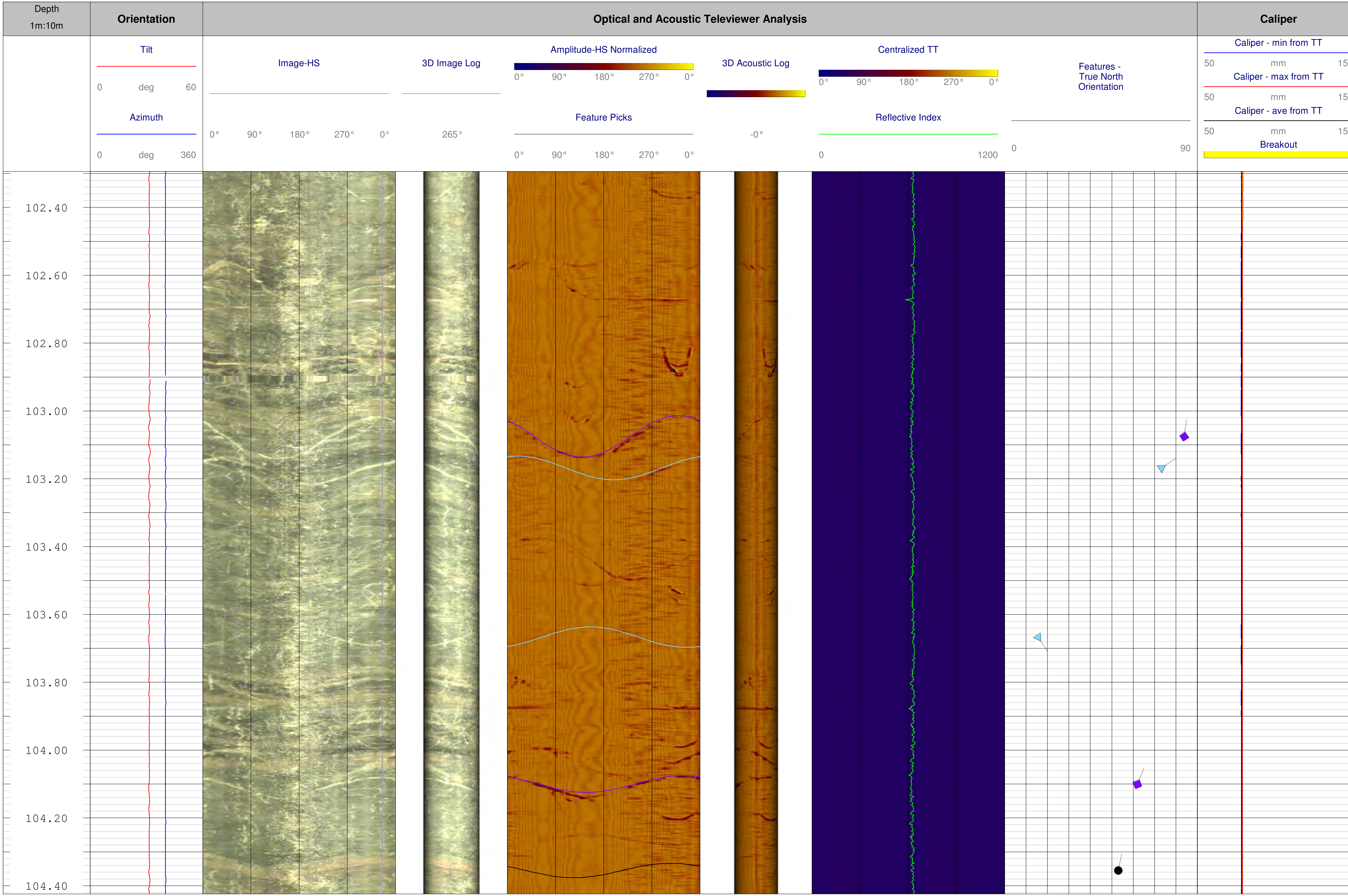
100.60
100.80
101.00
101.20
101.40
101.60
101.80
102.00
102.20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Feature Picks
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3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
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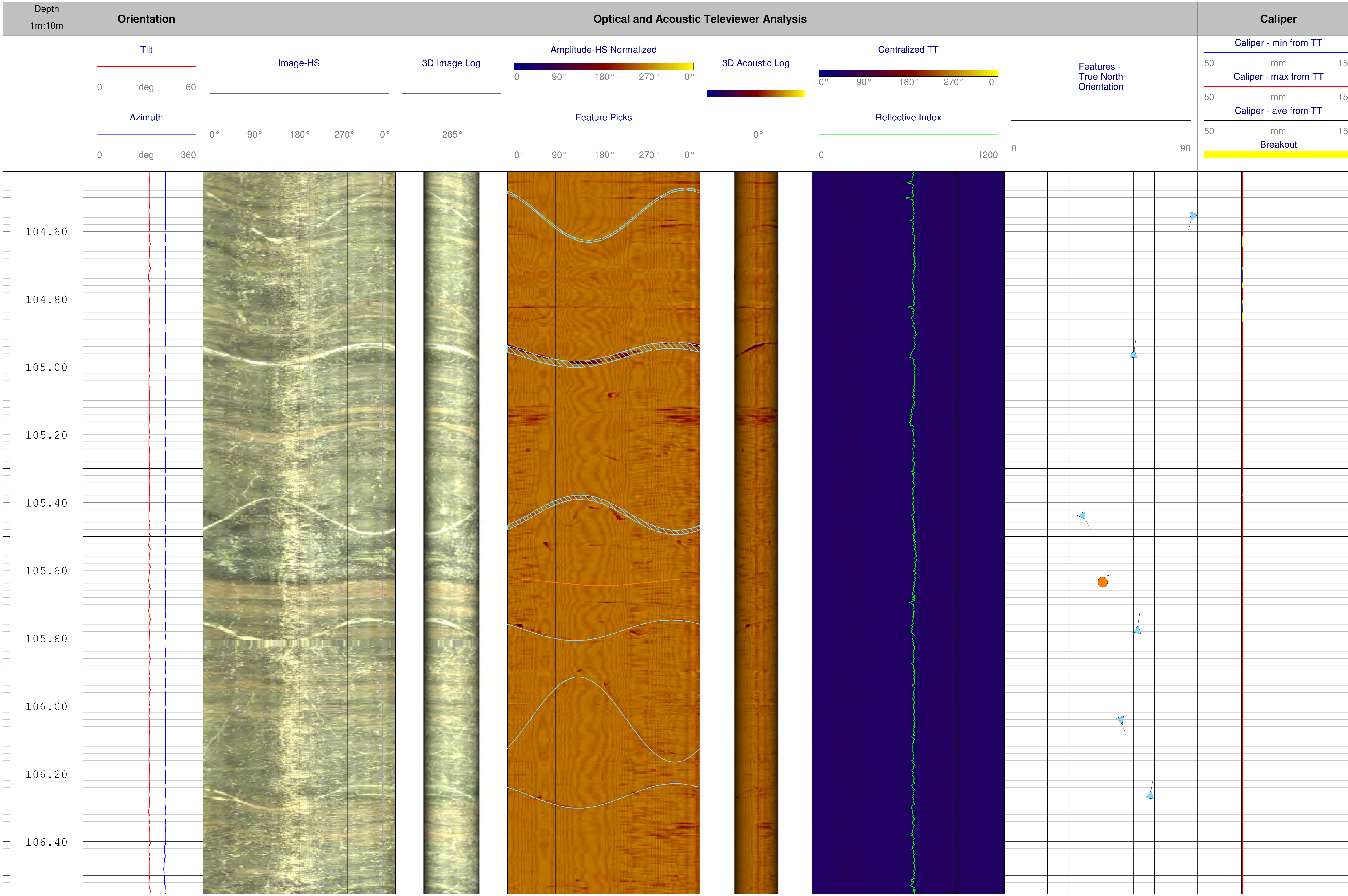
102.60
102.80
103.00
103.20
103.40
103.60
103.80
104.00
104.20
104.40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Feature Picks
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3D Acoustic Log
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Centralized TT
0° 90° 180° 270° 0°
Reflective Index
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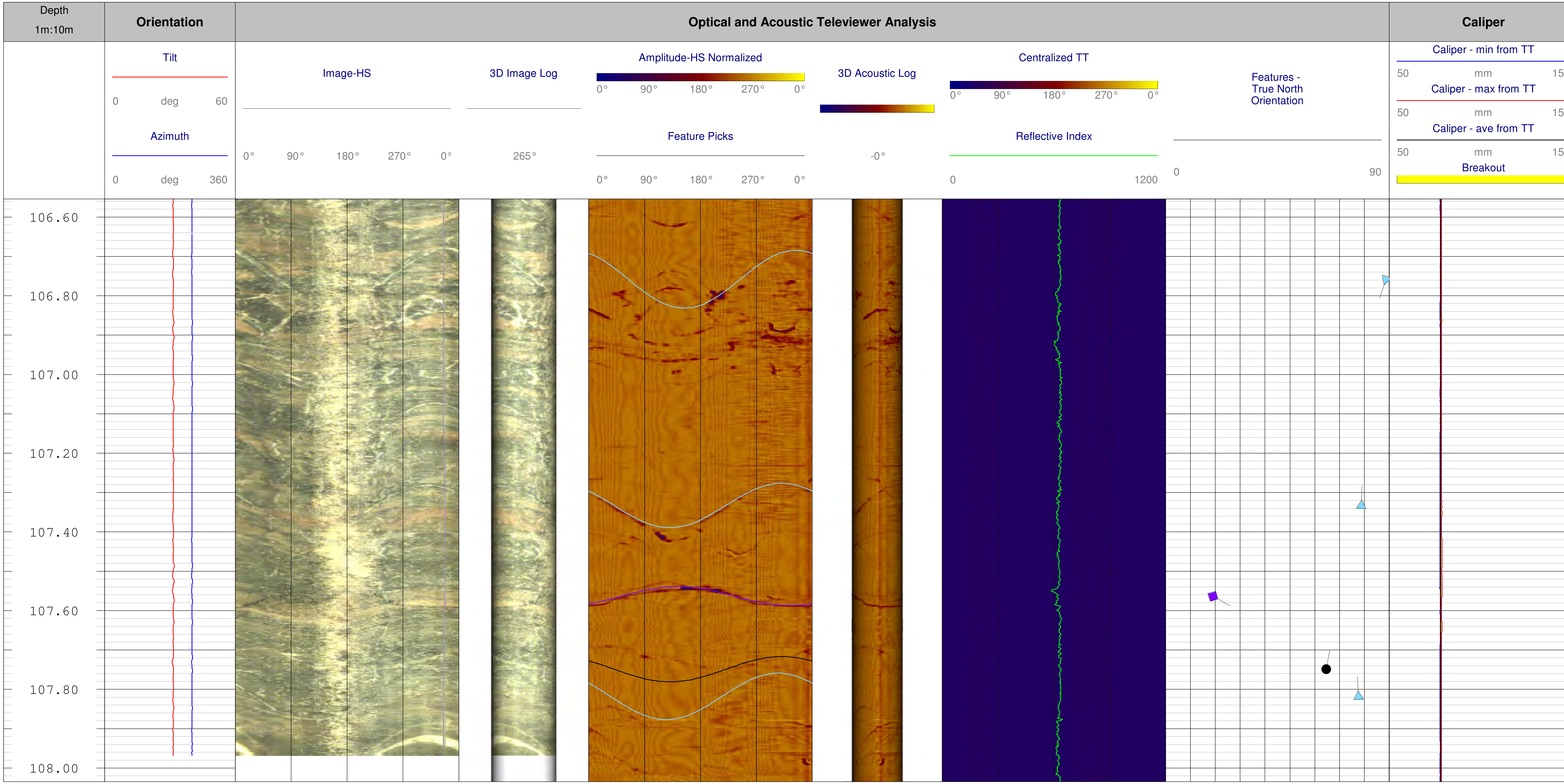
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
104.60
104.80
105.00
105.20
105.40
105.60
105.80
106.00
106.20
106.40


Depth
1m:10m
Orientation
Optical and Acoustic Televiewer Analysis
Caliper
Tilt
0 deg 60
Azimuth
0 deg 360
Image-HS
0° 90° 180° 270° 0°
3D Image Log
265°
Amplitude-HS Normalized
0° 90° 180° 270° 0°
Feature Picks
0° 90° 180° 270° 0°
3D Acoustic Log
-0°
Centralized TT
0° 90° 180° 270° 0°
Reflective Index
0 1200
Features - True North Orientation
0 90
Caliper - min from TT
50 mm 150
Caliper - max from TT
50 mm 150
Caliper - ave from TT
50 mm 150
Breakout
106.60
106.80
107.00
107.20
107.40
107.60
107.80
108.00

Canada Fluorspar Incorporated Diamond Drill Log Sheet

Geological and Structural Logging

CFI

Drill Hole ID:	GS-14-92		UTM Coordinates	Units:	Remarks
Logged By:	Alex Chafe		Easting	616377.84	
Start Date:	20-Aug-14		Northing	5196081.59	
End Date:	26-Aug-14		Elevation	1123.72	
Contractor:	Springdale Drilling		**Grid North Coordinates**	**Units:**	**Remarks**
Drill #:	1		Northing		
Core Size:	NQ		Easting		
Final Depth:	400		Elevation		
Date Surveyed:			**Location**		
Casing:	UNREMOVED	6 m	Area	AGS Property	
		m	Section	Line 10+00E	

Hole Collar Oreintation

Azimuth:	34	UTM
Dip:	-55	
Mag North:	54.3	
Grid North:	0	
Recovery:		

Down the hole Surveys

	Depth (m)	Azimuth	Dip	Remarks
1	19	32.2	-56.2	
2	70	33.3	-55.7	
3	121	33.6	-56.0	
4	172	33.0	-56.1	
5	226	35.3	-56.5	
6	277	35.0	-56.3	
7	334	36.1	-56.3	
8	388	36.8	-56.1	
9				
10				

Planned Setup

Northing	5196086
Easting	616381
Elevation	1120
Azimuth	34
Dip	-55
	Grid North

Drillhole Header	Lithology From (m)	To (m)	Code	Alteration Code	Structural Code	Jn	Sub-code Jr	Jf	Width (mm)	Core Angle (Degrees)	RQD (%)	Infilling Code	Assays CaF_2 and ISE (%)	(%)			Tag #	Log Remarks
GS-14-94	0.00	5.56	OB															**Overburden.**
GS-14-94	5.56		MS	Chl, K	JT	1	0	3	-5560	25		Chl						**Metasediment.** Grey-green metasediment with weak chlorite alteration and m-sclae weak K alteration towards top of hole. Meter-scale zones of Jf=4, overall Jf=3 at 20-30°. Green brecciation and reworked CaF2 vein, associated with hematite alteration at 30°, surrounded by moderate chlorite alteration. Minor percentage of calcite veinlets throughout approximately parallel to jointing, actual orientations varibale.
GS-14-94	10.91	12.70			FZ			4	1790	25		Chl						**Fracture Zone.** Jf increases to 4, where fragments range from 10-50 mm. Chlorite infill.
GS-14-94	17.00	18.27			FZ			4	1270	25		Chl						**Fracture Zone.** Jf increases to 4, where fragments range from 10-30 mm. Chlorite infill.
GS-14-94	18.40	19.10		Chl, Hem	VN				700	30		Fl, Ca						**Green fluorite vein.** Reowkred green fluorite vein associated with moderate hemaitization and minor calcite veinlets. Weka shear surrounds vein associated with moderate chloritization. Fluorite vein ~120 mm thick. Detailed photo taken.
GS-14-94	52.23	52.26			CT				30	40								**Metasediment-rhyolite contact**. At 40°, sharp contact with cm-scale moderate chlorite alteration in metasediment. Rhyolite not altered.
GS-14-94	52.26	72.52	RHY	Chl	JT	2	0	3	20260	25, 5		Chl						**Pink-orange quartz-feldpsar porphyritic rhyolite.** Nil to weak chlorite alteration and chlorite infill along moderate-strong fracture and jointed rock. Cm- to dm-scale areas of Jf=4. Cm-scale areas of grey-brown shear and alteration at 60° throughout, trace concentration. Chlorite-filled veinlets throughout oriented at 60°.
GS-14-94	72.52	95.95	MS	Chl	JT	2	0	3	23430	50								**Gey-green metasediment with increased chlorite and K alteration from above unit.** Chlorite alteration is moderate and K-alteration is moderate and on dm-scale. Areas of K alteration are associated with mm- to cm-scale pyrite blebs. Bedding is at 40°. Alteration and breccia with moderate hematization on m-scale, from 95.95-97.35 m associated with minor green-blue fluorite in euhedral crystals (macro-photos taken). Below 230.50 m, percentage of calcite veins with nil to trace green fluorite, forming a low abundance of weak calcite stockwork within metasediment. Dm-scale weak hematite alteration within. Minor dm-scale moderate brecciation throughout.
GS-14-94	95.95	97.35	GZO		BX, VN				1400			Chl, Hem, Fl						**AGS Structure lacking significant fluorite.** Metasediment breccia associated with fracture and blue fluorite vein. Zone of alteration and brecciation within metasediment. Fracture reaches Jf=4 on dm-scale. Breccia is matrix-supported on cm-sclae and weak fragment-supported throughout. Calcite veinlets throughout. At end of alteration zone, 40 mm wide blue fluorite vein with euhedral crystals up to 5 mm. S0 between 20 and 50°. Core becomes Jf=2 moving downhole.
	97.35	357.27	MS	Chl	JT	2	0	3	259920	50								**Gey-green metasedimentdimilar to the above Metasediment unit.**
GS-14-94	104.10	104.45			FLT, Gg				350	35		Hem						**Faulting and gouge**. Faulting associated with hematite alteration and ~20 mm calcite vein with clay to fine sand, hematite-coated gouge. Vein and fault oriented at 35°. Nearly perpendicular to bedding with S0=50° (photo taken).
GS-14-94	164.30	165.38			BX				1080	30								**Moderate-strong brecciation.** K-alteration of subangular fragments of fragment-supported breccia. Shear aprrozimately 30°. Interval moderate-strongly jointed with chlorite infill.
GS-14-94	172.72	173.05			VN				10	15								**Fluorite+calcite vein.** Grenn-clear fluorite vein with minor calcite, forming weal stockwork surrounding vein. Oriented at 15°, 10 mm thick.
GS-14-94	218.52	221.75			FZ, BX, FLT					30		Chl, Ca						**Fracture and fault zone above matrix-supported breccia with minor green fluorite.** Shear and faulting direction between 25-30° with chlorite+calcite infill and fragments of metasediment. Moderate-strong chlorite alteration throughout. Fragments range from 10 mm to 100 mm outside of breccia.
GS-14-94	220.78	221.56			BX					30		Chl, Ca, X						**Matrix-supported breccia.** Very fine-grained chlorite matrix and <1 mm to 5 mm subrounded calcite and metasediment fragments. Galena within <1 mm to 3 mm crystals in stringers ~ 20 mm thick.
GS-14-94	231.95	232.16			VN				210			Fl						**Green fluorite vein.** Green fluorite infills metasediment breccia, 1-3 mm thick. Variable orientations (Photo taken).
GS-14-94	241.05	241.52			BX				470	35		Chl, Ca, Fl						**Metasediment Breccia.** Predominantly fragment-supported with cm-scale matrix-supported breccia, with moderate chloritization and weakly hematized fragments of metasediment, subrounded to angular. ~10 mm wide vein of green fluorite vein parallel to shear (photo taken). At 35°.
GS-14-94	246.12	252.23			BX				6110			Chl, Ca						**Metasediment breccia**. Fragment- and matrix-supported with chlorite matrix, moderate chloritization, and weakly hematite altered fragments. Brecciation on m-scale. Only minor calcite and nil fluorite. Shear orientation unclear. Photo taken.
GS-14-94	253.00	253.10			VN				100	40		Fl, Ca						Anastomosing thin, 1-3 mm green fluorite vein with minor calcite, around 40°.
GS-14-94	279.24	279.30			VN				5			Ca						**Calcite vein.** Thin, 5 mm calcite vein with euhedral crystals along vuggy vein wall. Crystals ~3 mm.
GS-14-94	286.60	287.24			BX				640			Ca						**Metasedimnet breccia.** Minor calcite infills fragment-supported weak metasediment breccia.
GS-14-94	305.85	306.84			BX				990			Ca, Fl						**Matrix-supported metasediment breccia with calcite+fluorite infill**. Fragments are metasediment, 3-10 mm and subangular. Photo taken.
GS-14-94	310.17	310.70			BX				530			Ca, Fl						**Metasediment breccia.** Fragment-supported weak to moderate breccia with vuggy calcite+quartz and minor blue fluorite. Metasediment is weakly K-altered. Photo taken.
GS-14-94	314.43	314.79			VN				360	20		Ca, Chl, Fl						**Calcite+chlorite minor purple fluorite vein.** Clear and purple fluorite vein with minor calcite, 20 and 150 mm thick at top and bottom of interval. Weak metasediment breccia with calcite infill. Euhedral purple fluorite up to 5 mm covered in <3 mm calcite and quartz. Trace percentage of pyrite.
GS-14-94	318.57	319.19			BX				620	55		Fl, Ca, X						**Fluorite+calcite breccia and stock work.** Fragment-supported metasediment breccia with green-purple fluorite with minor calcite infill. Galena banding, 1-3 mm surrounding fluorite crystals. Vuggy green fluorite. Shear at 55°.

Canada Fluorspar Incorporated Diamond Drill Log Sheet

CFI

Geological and Structural Logging

Drill Hole ID:	GS-14-92		UTM Coordinates	Units:	Remarks
Logged By:	Alex Chafe		Easting	616377.84	
Start Date:	20-Aug-14		Northing	5196081.59	
End Date:	26-Aug-14		Elevation	1123.72	
Contractor:	Springdale Drilling		**Grid North Coordinates**	**Units:**	**Remarks**
Drill #:	1		Northing		
Core Size:	NQ		Easting		
Final Depth:	400		Elevation		
Date Surveyed:			**Location**		
Casing:	UNREMOVED	6 m	Area	AGS Property	
		m	Section	Line 10+00E	

Hole Collar Oreintation

Azimuth:	34	UTM
Dip:	-55	
Mag North:	54.3	
Grid North:	0	
Recovery:		

Down the hole Surveys

	Depth (m)	Azimuth	Dip	Remarks
1	19	32.2	-56.2	
2	70	33.3	-55.7	
3	121	33.6	-56.0	
4	172	33.0	-56.1	
5	226	35.3	-56.5	
6	277	35.0	-56.3	
7	334	36.1	-56.3	
8	388	36.8	-56.1	
9				
10				

Planned Setup

Northing	5196086
Easting	616381
Elevation	1120
Azimuth	34
Dip	-55
	Grid North

	Lithology				Structural								Assays					Log
Drillhole Header	From (m)	To (m)	Code	Alteration Code	Structural Code	Jn	Sub-code Jr	Jf	Width (mm)	Core Angle (Degrees)	RQD (%)	Infilling Code	CaF_2 and ISE (%)	(%)			Tag #	Remarks
GS-14-94	319.55	319.82			BX, VN				270	45		Fl, Ca						**Green-purple fluorite with metasediment breccia.** Green-purple fluorite infills fragment-supported breccia surrounding green fluorite+calcite vein. Shear ~45°.
GS-14-94	325.00	326.00			VN, BX				1000									**Massive calcite+red-green fluorite vein and metasediment breccia.** Massive calcite+fluorite vein surrounded by matrix-supported breccia with framents subangular, 5-50 mm. Vuggy wuth perfect houndstooth calcite. Trace pyrite. Towards bottom of interval percentage of metasediment increases. Trace pyrite.
GS-14-94	327.68	327.90			VN				220	40		Ca						**Vein with minor red-green fluorite - primarily calcite**. Oriented at 40° with compositional banding.
GS-14-94	342.13	344.93			BX				2800			Ca, Fl						**Calcite-fluorite infilled metasediment breccia.** Fragment-supported breccia and calcite+fluorite stock work. Calcite-fluorite veins reach 10 mm thick. 75% calcite, 25% green-clear fluorite. Overall <3% CaF2.
GS-14-94	346.63	349.51			BX				2880			Chl						**Chlorite-filled metasediment breccia.** Chlorite and weakly hematized infilled metasediment breccia with much less calcite than previous breccia. Microdefects cause incompetent core. Green-dark red in colour.
GS-14-94		361.00	GZ0						#VALUE!			Chl, Ca, Fl						**AGS Structure lacking significant fluorite.** Strongly chlorite altered and brecciated metasediment with ~5% calcite in breccia infill. Breccia continues to 359.27 where core becomes gravel with a major concnetration of calcite, minor yellow fluorite and bright green malachite staining. VOID/LOST CORE from 360.07 -360.67 m. Calcite-rich gravel-sized fragments continue to end of zone. Lower contact at 361.00 m is bound by gouge.
GS-14-94	357.27	359.27			BX, FLT				2000			Chl, Ca, Fl						**Metasediment-calcite breccia.** Strongly chlorite altered and brecciated metasediment with ~5% calcite in breccia infill.
GS-14-94	359.27	360.67			VN, FLT				1400			Ca, Fl, X						**Calcite-fluorite gravel.** Gravel with a major concnetration of calcite, minor yellow fluorite and bright green malachite staining.
GS-14-94	360.67	360.67	VOID						0									VOID/LOST CORE.
GS-14-94	360.67	361.00			BX, FZ, VN, Gg				330			Ca, Fl, X						**Calcite-fluorite gravel.** Gravel with a major concnetration of calcite, minor yellow fluorite and bright green malachite staining, as above void. Chloritized clay gouge at GZO-MS contact.
GS-14-94	361.00	400.00	MS	Chl, Ca	JT				39000			Ca, Fl, X						Grey-green weak-nil chlorite altered metasediment as described above AGS structure, with minor <5% calcite vein and veinlets as well as cm-scale matrix-supported breccia. Two coarse-grained rhyolite dykes and two fine-grained dykes on dm-scale. Cm-scale very fine-grained, aphanitix pink-orange glassy matrix in each with nil alteration and nil fluorite.
GS-14-94	368.35	368.45			Dyke				100									**Coare-grained rhyolite dyke.** Coarse-grained rhyolite duke with porphyritic quartz and feldspar 1-5 mm. Very fine-grained aphanitic pink-orange glassy matrix. Nil alterationa and nil fluorite.
GS-14-94	369.97	370.00			Dyke				30									**Coare-grained rhyolite dyke.** Coarse-grained rhyolite duke with porphyritic quartz and feldspar 1-5 mm. Very fine-grained aphanitic pink-orange glassy matrix. Nil alterationa and nil fluorite.
GS-14-94	391.80	392.95			BX				1150									**Metasediment breccia.** Matrix-supported breccia with subangular fragments sized 1-15 mm. Matrix is chloritized and weakly K altered and fine-grained.
GS-14-94	394.62	396.22			FLT, FZ, Gg				1600									**Faulting and blockiness.** Intense jointing and faults in blocky core with fragments sized 5-50 mm. Clay gouge up to 30 mm and chlorite infilled along joints. Weak K alteration thourghout.
GS-14-94																		
GS-14-94	**TD: 400 m**																	
GS-14-94																		
GS-14-94	**Samples**																	
GS-14-94	358.27	359.27											minor				121790	MS BX, Cc+CaF2, wallrock sample, minor CaF2
GS-14-94	359.27	360.07											15-20				121791	GZ0, qtz+Cc+CaF2 gravel, 15-20% CaF2
GS-14-94	360.07	360.67											n/a				121792	VOID/LOST CORE
GS-14-94	360.67	361.00											15-20				121793	GZ0, qtz+Cc+CaF2 gravel, 15-20% CaF2
GS-14-94	361.00	362.00											minor				121794	MS, Cc+qtz wall rock, minor CaF2
GS-14-94																		
GS-14-94																		
GS-14-94																		
GS-14-94																		

Canada Fluorspar Incorporated Diamond Drill Log Sheet

Geological and Structural Logging

CFI

Drill Hole ID:			UTM Coordinates	Units:	Remarks	Hole Collar Oreintation		
Logged By:	Tyler Power		Easting			Azimuth:	214	UTM
Start Date:	23-Sep-41		Northing			Dip:	-60	
End Date:	25-Sep-14		Elevation			Mag North:		
Contractor:	Springdale Drilling		**Grid North Coordinates**	**Units:**	**Remarks**	Grid North:		
Drill #:	Rig #1		Northing	0+70S				
Core Size:	NQ		Easting	19+00E				
Final Depth:	190.35		Elevation	1119		Recovery:		
Date Surveyed:			**Location**					
Casing:	NQ - Left in	m	Area	AGS Property				
		m	Section	Line 19+00E				

Down the hole Surveys

	Depth (m)	Azimuth	Dip	Remarks
1	19	225.7	-63.7	
2	70	218.2	-59.7	
3	121	219	-59.6	
4	172	219.4	-59.7	
5				
6				
7				
8				
9				
10				

Planned Setup

Northing	
Easting	
Elevation	
Azimuth	
Dip	
	Grid North

Drillhole Header	Lithology From (m)	To (m)	Code	Alteration Code	Structural Code	Jn	Sub-code Jr	Jf	Width (mm)	Core Angle (Degrees)	RQD (%)	Infilling Code	Assays CaF_2 and ISE (%)	(%)			Tag #	Log Remarks
GS-14-113	0.00	5.70	OB						5700									Overburden;
GS-14-113	5.70	14.75	RHY	Cl					9050			Ca, Fl, Mt						Mg pink-orange qtz-fsp porphyry rhyolite; blebby and stringer Mt within; variably gs and alteration/colour; stringers of purple-black in places- CaF_2 within; variably magnetic; chilled LC; LC is altered by MS unit below; unit starts out very dark and drastically changes to a pale pink-orange to a dark grey-orange colour; distinct, but broken LC;
GS-14-113	14.74	14.75			CT				10									RHY-MS contact; distinct but broken;
GS-14-113	14.75	153.00	MS	Cl, Hm, K					138250			Ca, Fl, X						Fg dark grey-green MS unit; variably altered; Cl + K altered; alteration conforms to bedding and is controlled by micro-deformation; multiple episodes of micro-deformation within; very blocky unit; incompetence increases locally but overall unit is ~99% incompetent; multiple episodes of deformation within including: fracturing, BX'n, veining; variably magnetic; areas of increased siliciousness; Cl on fracture surfaces; bedding varies throughout; minor fg diss Py within; micro-deformation - offsetting, stringers, veinlet's, faulting - plus associated alteration leaves MS looking chaotic in places (up to 79.09m); **79.08m-128.37m:** Fg MS continues; largely similar to MS seen above; stockwork CaF_2 mineralization increases; seeing sections reaching 5% CaF_2 over ~7m in BX, infill and stockwork; bedding = 50°-70° TCA with sections reaching 85°-90° TCA; localized sections (minor) of incompetence, 99% competent; **128.37m-153.00m:** Fg MS unit continues; distinct increases in amount and infill of BX'n; fg diss Py throughout; Cl alteration, K alteration and Hm alteration within; CaF_2, $CaCO_3$ and Qtz infill throughout; distinct LC with GZ0 - based on degree of BX'n change;
GS-14-113	14.75	23.00			So				8250	90°								90° TCA;
GS-14-113	23.00	24.00			So				1000	80°								75°-80° TCA;
GS-14-113	24.00	45.00			So				21000	45°								45° TCA;
GS-14-113	45.59	50.14		Cl, Hm, K	BX				4550			Ca, Fl, Cl						Area of BX in MS unit; Chl + $CaCO_3$ + Ca infill in BX; very brittle; semi-solid Gg in areas; hematization over majority of interval; multiple episodes of micro-deformation; rotation on MS clasts; web-like mineralization; Chl + K + Hm alteration; 45° TCA UC; large sections/areas of in filled $CaCO_3$ + Ca within (5cm-8cm zone); puggy in areas;
GS-14-113	56.73	57.17		Cl, K	ALT				440			Cl						Area of favourable alteration in MS unit; Cl + K alteration makes section look BX'd; alteration is favouring planes/sections of weakness in MS clasts; alteration is rimming clasts, along fracture surfaces and weakness areas; alteration is very micro-deformation controlled;
GS-14-113	59.41	59.50		Cl	BX				90	50°		Ca, Fl, Cl						Area of BX'n in Cal + CaF_2 vein; cg MS clasts in $CaCO_3$ vein; 50° TCA; vuggy;
GS-14-113	65.10	66.07		Cl, Hm	BX				970	30°, 45°		Ca, Fl, Cl						Area of BX'n in MS unit; Cl + Hm alteration; $CaCO_3$ within; semi-solid in places; 30° TCA UC and 45° TCA LC;
GS-14-113	68.43	68.48		Cl	BX				50	45°		Ca						$CaCO_3$ veinlet's surrounding BX'd MS; 45° TCA; minor-trace CaF_2 within;
GS-14-113	76.27	78.17		Cl, Hm, K	ALT				1900	1°		Ca, Fl						Area of increased CaF_2 stockwork/veinlet's; mostly //° TCA; Cl + K + Hm alteration; semi-solid BX within; 1%-2% CaF_2; multiple episodes of micro-deformation as well;
GS-14-113	79.82	80.19		Cl, K	BX				370	45°		Ca, Fl						Area of BX'n in MS unit; sulphides - Py within; fg MS clasts surrounded by $CaCO_3$ + CaF_2; large MS clasts within as well; vuggy; qtz within; 45° TCA U & L contacts;
GS-14-113	81.45	81.86		Ck, K, Hm	BX				410			Ca, Fl, Qtz						Area of BX'n in MS unit; Cl, $CaCO_3$, Qtz and Ca within infill; ± chocolate brown CaF_2; purple + GWB CaF_2 within as well; alteration is controlled by micro-deformation throughout - giving unit a chaotic appearance; Cl + K + Hm;
GS-14-113	87.41	88.20		Cl	VN				790	45°		Ca, Fl, Qtz						CaF_2 + $CaCO_3$ + Qtz vein; 75%-85% CaF_2; GWB>RYC>P; banded sulphides between variations in CaF_2 (i.e., GWB-RYC boundary); Py, Ccp, Gn and sphalerite (spread throughout); ~2%-3% sulphides; visible zoning; distinct U & L contacts - UC is chaotic and LC @ 45° TCA; MS clasts/fragments within; minor $CaCO_3$ within; vuggy; chocolate brown CaF_2 within;
GS-14-113	88.60	89.16			VN				560			Ca, Fl						Area of increased stockwork veining; P>RYC>GWB CaF_2; $CaCO_3$ within; sulphide bearing - Py;
GS-14-113	89.22	89.47			VN				250	35°		Ca, Fl						Area of multiple veins; CaF_2>$CaCO_3$; P>RYC>GWB; 35° TCA; Py throughout;
GS-14-113	92.09	92.37			VN				280			Ca, Fl						Locally semi-massive CaF_2 vein; 40° TCA; P>GWB>RYC; clay mineral within; $CaCO_3$ within; Py + sphalerite as well; chaotic in places; fracture filling purple CaF_2 + sphalerite above and below;
GS-14-113	92.71	92.75			VN				40	45°		Ca, Fl						CaF_2>$CaCO_3$ vein; purple; minor red; 45° TCA;
GS-14-113	92.75	108.00		Cl, K	VN				15250			Ca, Fl, Cl						Entire interval exhibits stockwork veining; BX within; increase in CaF_2 infill throughout P>RYC>GWB; sphalerite throughout; variably altered; fg diss Py throughout; Cl + K alteration; chaotic veining/veinlet's; ~5% overall;
GS-14-113	108.90	108.95			VN				50	50°		Ca, Fl						$CaCO_3$ vein; + CaF_2; 50° TCA;
GS-14-113	132.92	133.30		Cl	BX				380			Ca, Qtz, Fl						$CaCO_3$ + Qtz + Ca cement; BX'd throughout; mg MS clasts in main vein;
GS-14-113	133.85	134.81		Cl	BX				960			Ca, Qtz, Fl						$CaCO_3$ + Qtz + Ca cement; as seen above with greater MS component; vuggy; GWB>RYC>P;
GS-14-113	134.34	134.47		Cl	BX				130			Ca, Qtz, Fl						$CaCO_3$ + Qtz + Ca cement;
GS-14-113	152.99	153.00			CT				10									MS-GZ0 contact;
GS-14-113	153.00	179.62	GZ0	Cl, Hm, K					26620			Ca, Fl, Qtz, X						AGS Structure; BX'd MS unit; $CaCO_3$ + CaF_2 infill; sulphide bearing - Py, Gn, Ccp, sphalerite; sericite alteration in places; hematized in places; very brittle in more BX'd/altered sections; one locally massive RYC>P>GWB CaF2 vein; overall ~30% CaF_2; more of intensely BX'd and in filled mineralized zone than veining; puggy and Gg like in places; hard to decipher beginning and end of unit/zone; chocolate brown CaF_2 within; localized fracture zones; visible zoning and BX'n in main vein;
GS-14-113	179.62	190.35	MS						10730									Fg dark grey-green MS unit; not a lot to say since the majority is cave in and <<<10cm; Potential VOID;
GS-14-113	190.35	190.35	TD															Total Depth 190.35m; terminated due to poor ground;
GS-14-113	190.35	190.35	EOH															End Of Hole 190.35m; terminated due to poor ground;
	Samples																	
GS-14-113	86.41	87.41							1.00								92939	MS unit; 1m wallrock sample; 2%-5% CaF_2;
GS-14-113	87.41	88.20							0.79								92940	VN unit; 75%-85% CaF_2; GWB>RYC>P;
GS-14-113	88.20	89.16							0.96								92941	MS unit; 15%-25% CaF_2; P>RYC>GWB; stockwork veining;
GS-14-113	89.16	89.47							0.31								92942	MS unit; 20%-30% CaF_2; P>RYC>GWB;
GS-14-113	89.47	90.47							1.00								92943	MS unit; 1m wallrock sample; 2%-5% CaF_2;
GS-14-113	152.00	153.00							1.00								92944	MS unit; 1m wallrock sample; 2%-3% CaF_2;

Canada Fluorspar Incorporated Diamond Drill Log Sheet

Geological and Structural Logging

CFI

Drill Hole ID:		UTM Coordinates	Units:	Remarks
Logged By:	Tyler Power	Easting		
Start Date:	23-Sep-41	Northing		
End Date:	25-Sep-14	Elevation		
Contractor:	Springdale Drilling	**Grid North Coordinates**	**Units:**	**Remarks**
Drill #:	Rig #1	Northing	0+70S	
Core Size:	NQ	Easting	19+00E	
Final Depth:	190.35	Elevation	1119	
Date Surveyed:		**Location**		
Casing:	NQ - Left in m	Area	AGS Property	
	m	Section	Line 19+00E	

Hole Collar Oreintation

Azimuth:	214	UTM
Dip:	-60	
Mag North:		
Grid North:		
Recovery:		

Down the hole Surveys

	Depth (m)	Azimuth	Dip	Remarks
1	19	225.7	-63.7	
2	70	218.2	-59.7	
3	121	219	-59.6	
4	172	219.4	-59.7	
5				
6				
7				
8				
9				
10				

Planned Setup

Northing	
Easting	
Elevation	
Azimuth	
Dip	
	Grid North

Drillhole Header	Lithology From (m)	To (m)	Code	Alteration Code	Structural Code	Jn	Sub-code Jr	Jf	Width (mm)	Core Angle (Degrees)	RQD (%)	Infilling Code	Assays CaF_2 and ISE (%)	(%)			Tag #	Log Remarks
GS-14-113	153.00	154.00							1.00								92945	BX/MS unit; 2%-5% CaF_2; P>RYC>GWB; hematized within; mg BX within in filled by cement/$CaCO_3$ + Qtz; minor Py/sulphides within;
GS-14-113	154.00	154.57							0.57								92946	BX/MS unit; 3%-5% CaF_2; P>RYC>GWB; infill/fracture filling mineralization; altered (Cl + K); trace sphalerite;
GS-14-113	154.57	155.00							0.43								92947	BX/MS unit; 10%-18% CaF_2; RYC>GWB>P; chocolate brown CaF_2 within; fracture filling and infill; $CaCO_3$ + sulphides in unit; vuggy; mg rotated angular MS clasts suspended in CaF_2-rich matrix; majority of structure/vein is running //° TCA;
GS-14-113	155.00	156.00							1.00								92948	BX/MS/VN unit; 20%-23% CaF_2; GWB>RYC>P; sulphide bearing; Py, Gn, and sphalerite; vuggy; Cl altered; vein is //° TCA; continued from above;
GS-14-113	156.00	157.00							1.00								92949	BX/MS unit; 5%-10% CaF_2; RYC>GWB>P; infill and fracture filling CaF_2; chocolate brown CaF_2 within;
GS-14-113	157.00	158.00							1.00								92950	MS/BX unit; 10%-20% CaF_2; RYC>GWB>P; $CaCO_3$ within; chocolate brown in areas; fracture filling mineralization;
GS-14-113	158.00	159.00							1.00								138551	MS/BX unit; 4%-8% CaF_2; RYC>GWB>P; hematized throughout; fracture fill CaF_2 mineralization; minor sericite alteration within;
GS-14-113	159.00	160.00							1.00								138552	MS/BX unit; 5% CaF_2; P>GWB>RYC; fracture filling CaF_2 mineralization; weakly hematized; $CaCO_3$ within;
GS-14-113	160.00	161.00							1.00								138553	MS/BX unit; 2%-3% CaF_2; RYC>GWB>P; $CaCO_3$ + CaF_2 + Qtz BX @ upper limit;
GS-14-113	161.00	161.58							0.58								138554	MS/BX unit; 2%-3% CaF2; RYC>GWB>P; continued from above;
GS-14-113	161.58	162.00							0.42								138555	MS unit; 1%-2% CaF_2;
GS-14-113	162.00	163.00							1.00								138556	MS unit; 3%-5% CaF_2; RYC>GWB>P;
GS-14-113	163.00	164.00							1.00								138557	MS unit; 5%-10% CaF_2; P>RYC>GWB; stockwork and fracture filling mineralization;
GS-14-113	164.00	165.00							1.00								138558	MS/BX unit; 5%-10% CaF_2; P>RYC>GWB; stockwork and fracture filling mineralization;
GS-14-113	165.00	166.00							1.00								138559	MS/BX unit; 10%-15% CaF_2; P>RYC>GWB; infill and fracture filling mineralization;
GS-14-113	166.00	166.47							0.47								138560	MS unit; <2% CaF_2;
GS-14-113	166.47	167.52							1.05								138561	BX unit; 3%-5% CaF_2; P>RYC>GWB; hematized; fracture filling mineralization;
GS-14-113	167.52	168.20							0.68								138562	MS/BX unit; 15% CaF_2; P>RYC>GWB; fracture filling $CaCO_3$ + CaF_2; sphalerite + Py within;
GS-14-113	168.20	168.60							0.40								138563	MS/BX unit; 5%-10% CaF_2; P>RYC>GWB; sphalerite within;
GS-14-113	168.60	169.00							0.40								138564	MS unit; 3%-5% CaF_2; P>RYC>GWB; fracture filling mineralization;
GS-14-113									0.00								138565	STANDARD
GS-14-113	169.00	170.00							1.00								138566	MS/BX unit; 2%-3% CaF_2; P; Cl + K + Hm alteration within;
GS-14-113	170.00	171.00							1.00								138567	MS unit; 5%-8% CaF_2; P>RYC>GWB; one vein @ 25° TCA; fracture filling CaF_2;
GS-14-113									0.00								138568	BLANK
GS-14-113	171.00	172.00							1.00								138569	MS unit; 5%-10% CaF_2; P>RYC>GWB; fracture filling mineralization; BX'd in places;
GS-14-113	172.00	173.00							1.00								138570	MS unit; 20%-25% CaF_2; P>RYC>GWB; fracture filling and chaotic veining throughout; chocolate brown CaF_2 within; $CaCO_3$ within as well;
GS-14-113	173.00	173.40							0.40								138571	BX/MS unit; 25%-30% CaF_2; RYC>GWB>P; mg sub-angular rotated clasts of MS in CaF_2 + $CaCO_3$-rich matrix;
GS-14-113	173.40	174.40							1.00								138572	VN unit; 75%-90% CaF_2; GWB>RYC>P; MS clasts/fragments within; sulphide bearing; $CaCO_3$ within; visible zoning within; chocolate CaF_2 within; Py + sphalerite as well;
GS-14-113	174.40	174.88							0.48								138573	VN unit; 95+% CaF_2; RYC>GWB>P; visible zoning; sulphide bearing;
GS-14-113	174.88	175.23							0.35								138574	VN/BX unit; 70%-80% CaF_2; P>GWB>RYC; MS fragments within; Cl altered; $CaCO_3$ within;
GS-14-113	175.23	176.21							0.98								138575	MS/BX unit; 20%-25% CaF_2; cg rotated angular MS fragments; chocolate brown CaF_2 within; 20%-25% CaF_2; fg BX as well; $CaCO_3$ within;
GS-14-113									0.00								138576	DUPLICATE OF 138575
GS-14-113	176.21	177.21							1.00								138577	MS/BX unit; 2%-5% CaF_2; RYC>GWB>P; chocolate brown CaF_2 within; cl altered;
GS-14-113	177.21	178.25							1.04								138578	MS/BX unit; 4%-8% CaF_2; RYC>GWB>P; fracture fill mineralization; $CaCO_3$ within;
GS-14-113	178.25	179.25							1.00								138579	MS/BX unit; 10%-12% CaF_2; P>RYC>GWB;
GS-14-113	179.25	179.62							0.37								138580	MS/BX unit; 5% CaF_2; P>RYC>GWB;
GS-14-113	179.62	180.62							1.00								138581	MS unit; 1m wallrock sample; 3%-4% CaF_2;