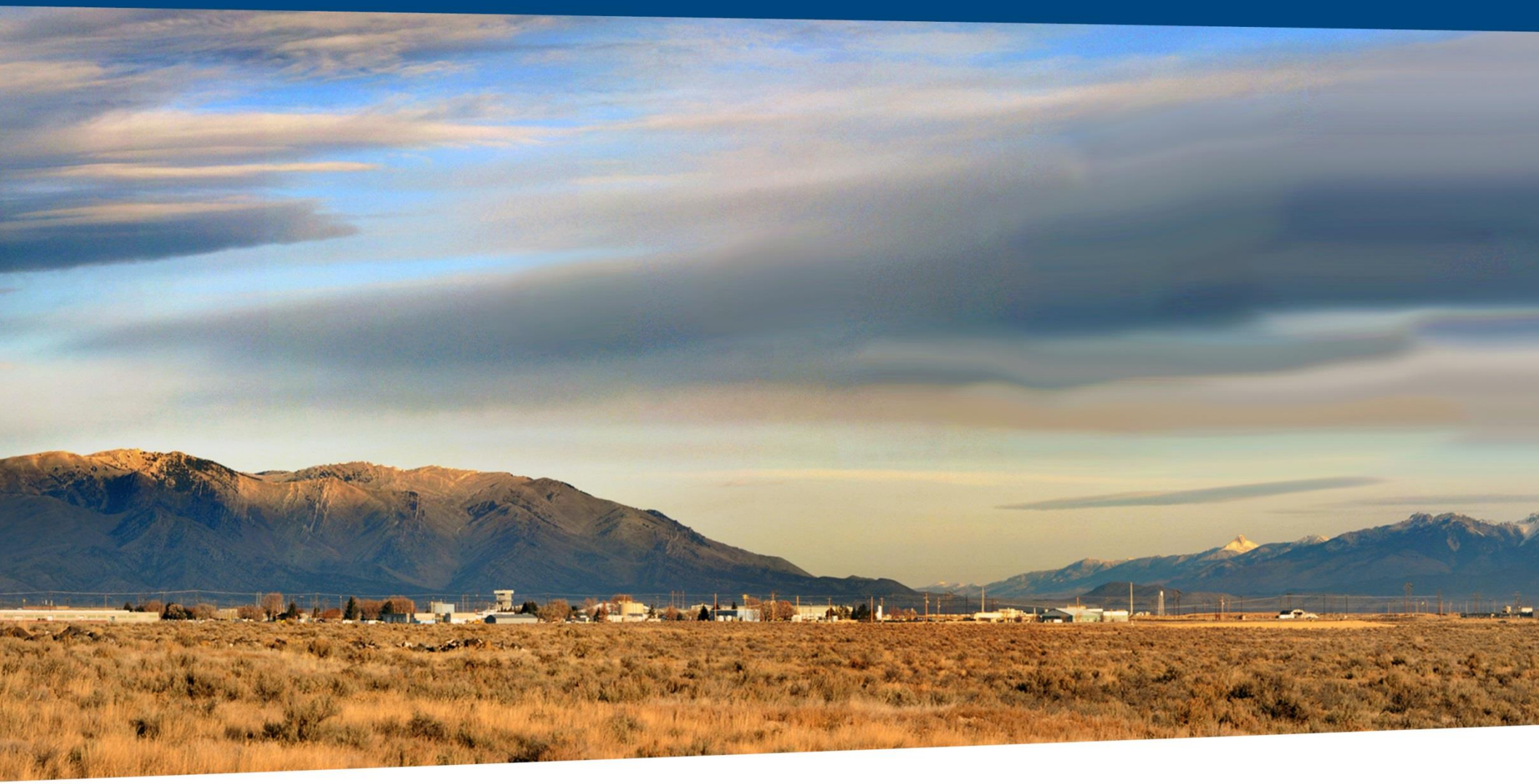
TRIGA FUEL EXAMINATION USING A GE EVEREST XLG3 VIDEOPROBE - WHAT IT MEANS FOR THE FUTURE OF FUEL INTEGRITY DETERMINATION (& OTHER POSSIBLE USES)



Fluor IDAHO

TRTR 2016 – Albuquerque, NM

Dale Luke & Alan Robb

August 22, 2016

SNF Examinations

- **Since 1998, ICP personnel have visually examined over 4,000 fuel elements. The examinations were performed at over 25 domestic and/or foreign research facilities**
- **Because storage at the INL is anticipated to be for a long period of time, knowledge of fuel condition is of utmost importance to prevent contaminate release in handling the fuel and while in storage and the ability to handle the fuel in the future**
- **Cladding thickness is an important consideration, in determining the integrity of the fuel.**
  - TRIGA fuel cladding thickness:
    - Aluminum is 0.03 in. (0.762 mm)
    - Stainless steel is 0.02 in. (0.508 mm)

Fluor IDAHO

Al-clad Element with Obvious Damaged Cladding

Fluor IDAHO

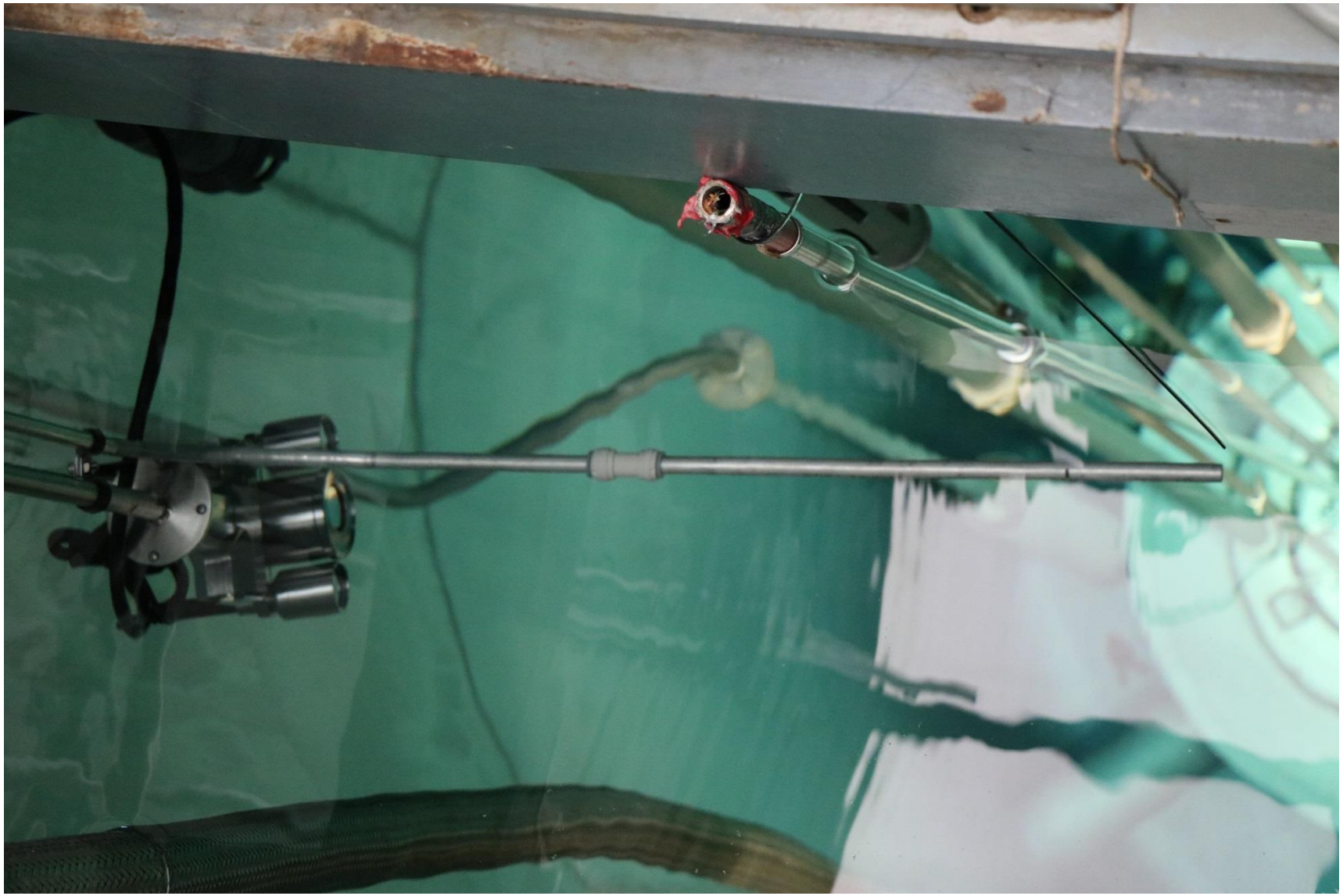
Al-clad Element with Peeled Cladding & Crack

Fluor IDAHO

Al-clad Element w/ Breached Cladding & Pinholes

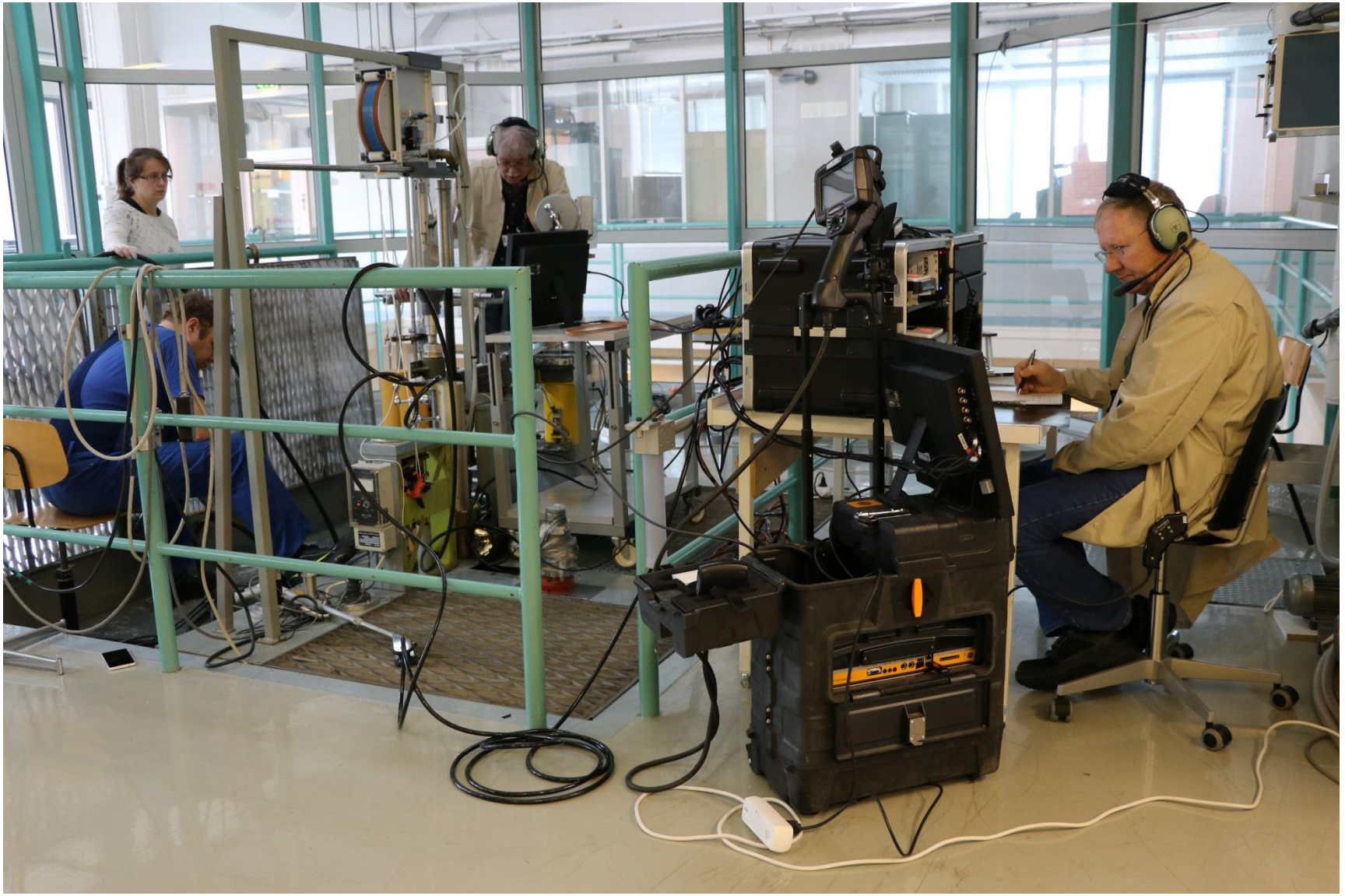
Fluor IDAHO

Set-up of Camera Systems in Reactor Pool



Fluor IDAHO

Set-up of Camera Systems Above Pool



Fluor IDAHO

GE 3D Phase Measurement Video-Probe System

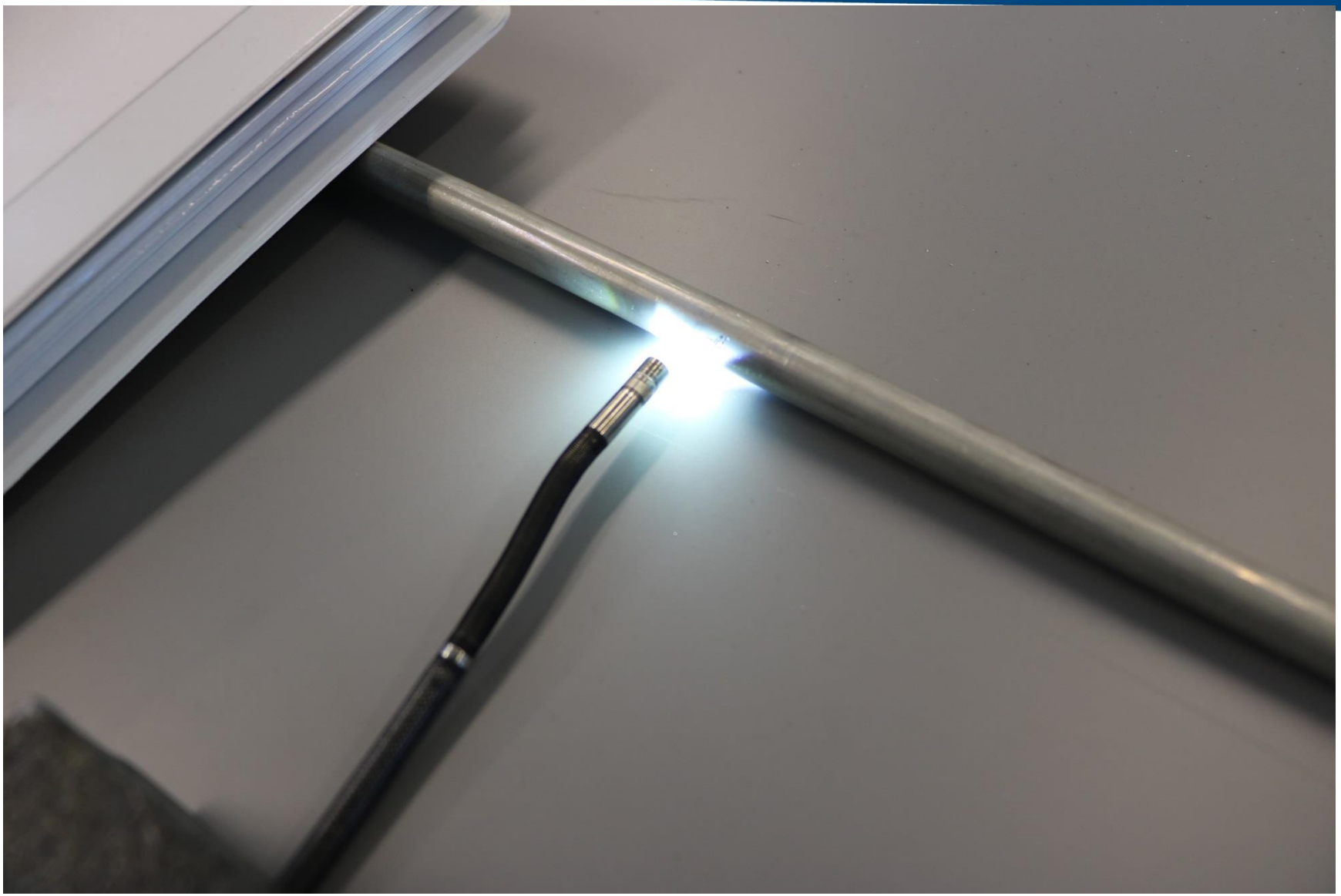
Fluor
IDAHO

Details About the Video-Probe

- The Video-Probe enables inspectors to both view and measure a defect
- The 3D Phase Measurement Video-Probe creates a 3D surface scan of the viewing area and can measure length, width, area, and depth of a defect or anomaly using the 3D scan
- The Video-Probe also serves as a general “boroscope” camera for taking “up close” photos and video of the anomaly
- The Video-Probe tip articulates via a joy-stick on the control panel to facilitate focusing on the anomaly

Fluor IDAHO

Video-Probe Tip – Light Used for Measurements



Fluor IDAHO

Anomaly on TRIGA Element – Underwater Camera

Fluor IDAHO

Same Anomaly on Element – Seen w/ Video-Probe

Fluor IDAHO

Details of Anomalies – Seen w/ Video-Probe

Fluor IDAHO

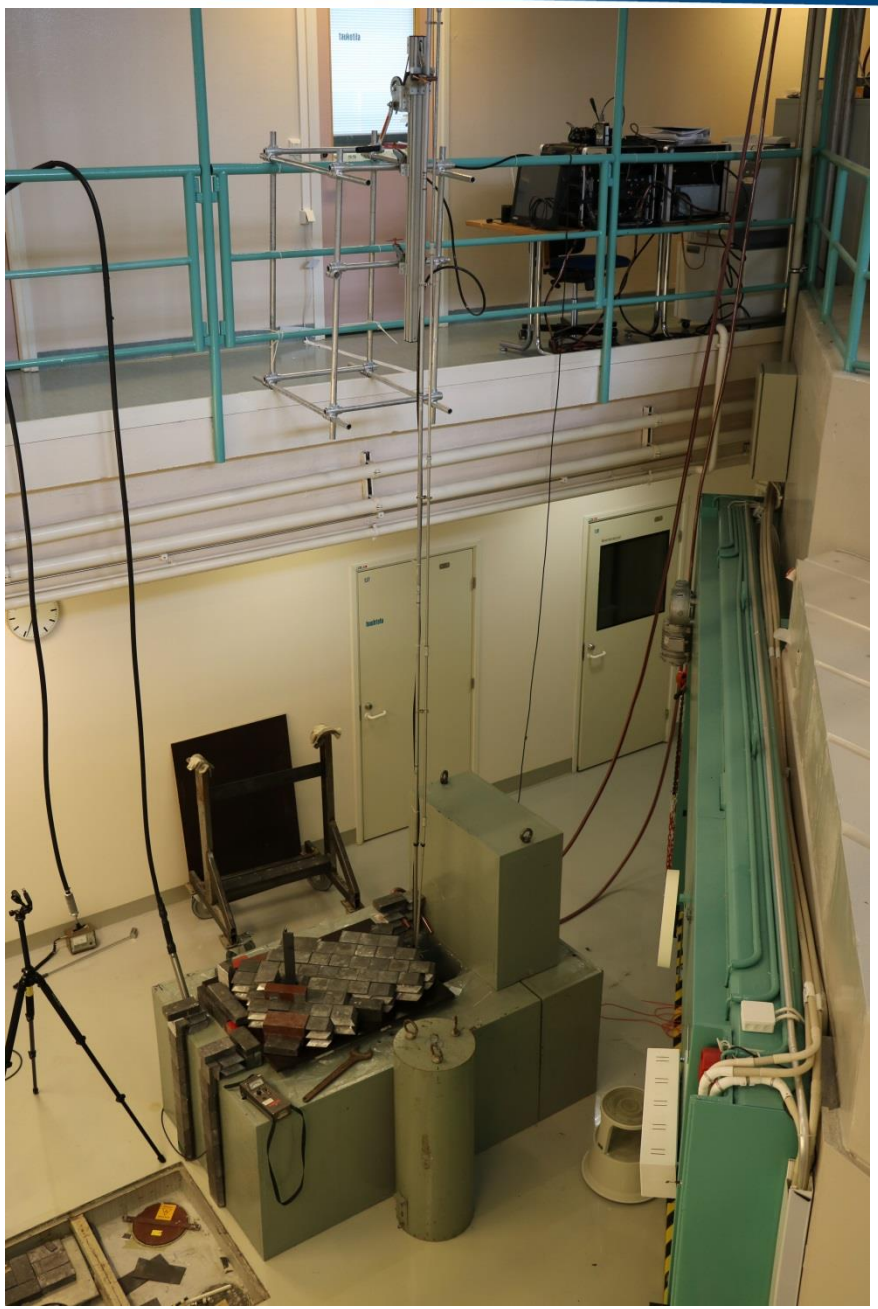
Anomaly on TRIGA Element – Underwater Camera

Fluor IDAHO

Same Anomaly on Element – Seen w/ Video-Probe

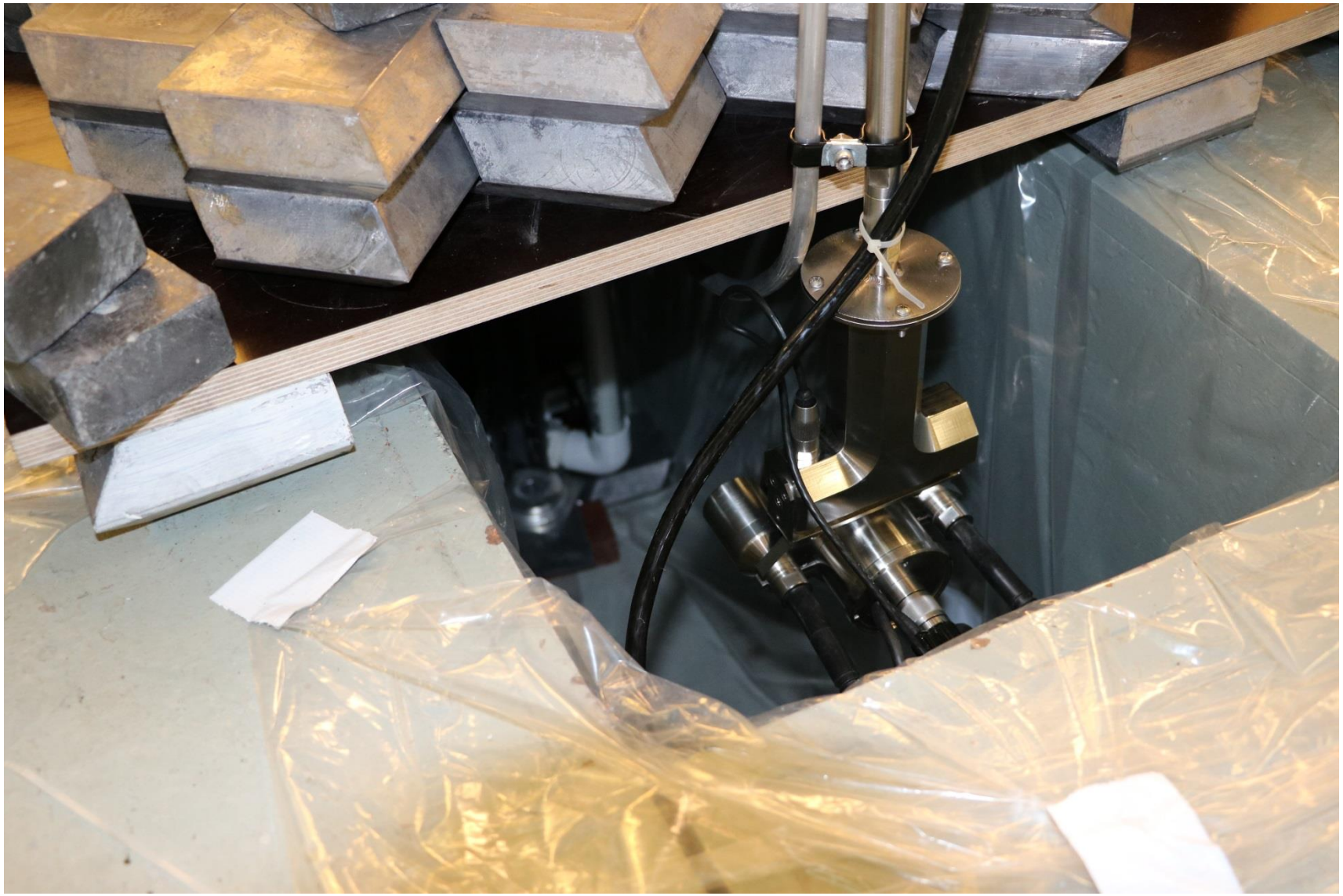
Fluor IDAHO

Temporary Shielding for Fuel Inspection – Dry Fuel



Fluor IDAHO

Camera Systems Used During Fuel Examination



Fluor IDAHO

Retrieving TRIGA Fuel from Dry Storage Wells

Fluor IDAHO

Placing Dry TRIGA Fuel in Shielding for Inspection

Fluor IDAHO

Jury-Rigging for Holding Video-Probe in Place

Fluor IDAHO

Anomaly Found with Regular Camera System

Fluor IDAHO

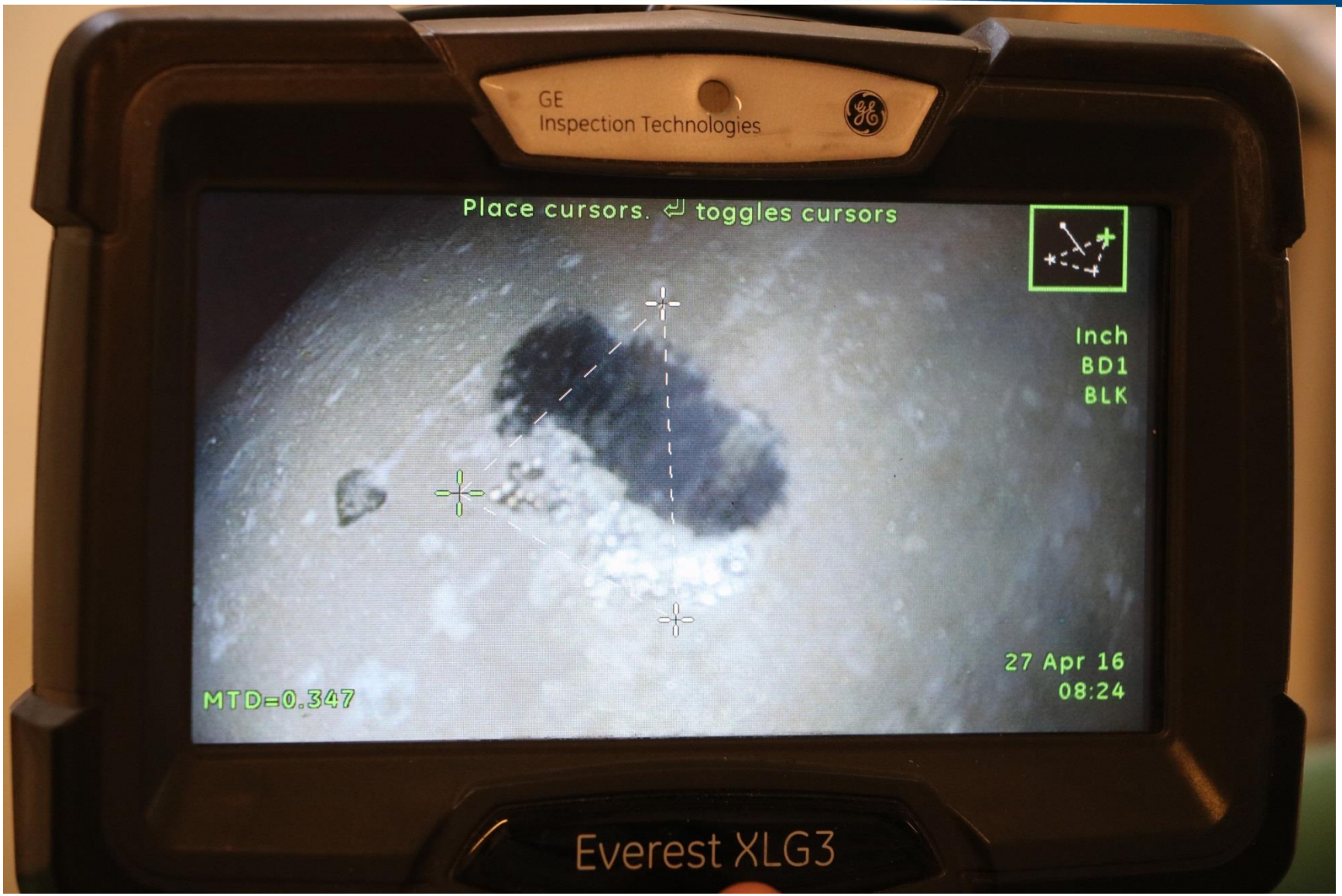
Anomaly (Zoomed in on Camera)

Fluor IDAHO

Anomaly Seen with Video-Probe

Fluor IDAHO

Setting the Video-Probe to Measure Depth of Spot

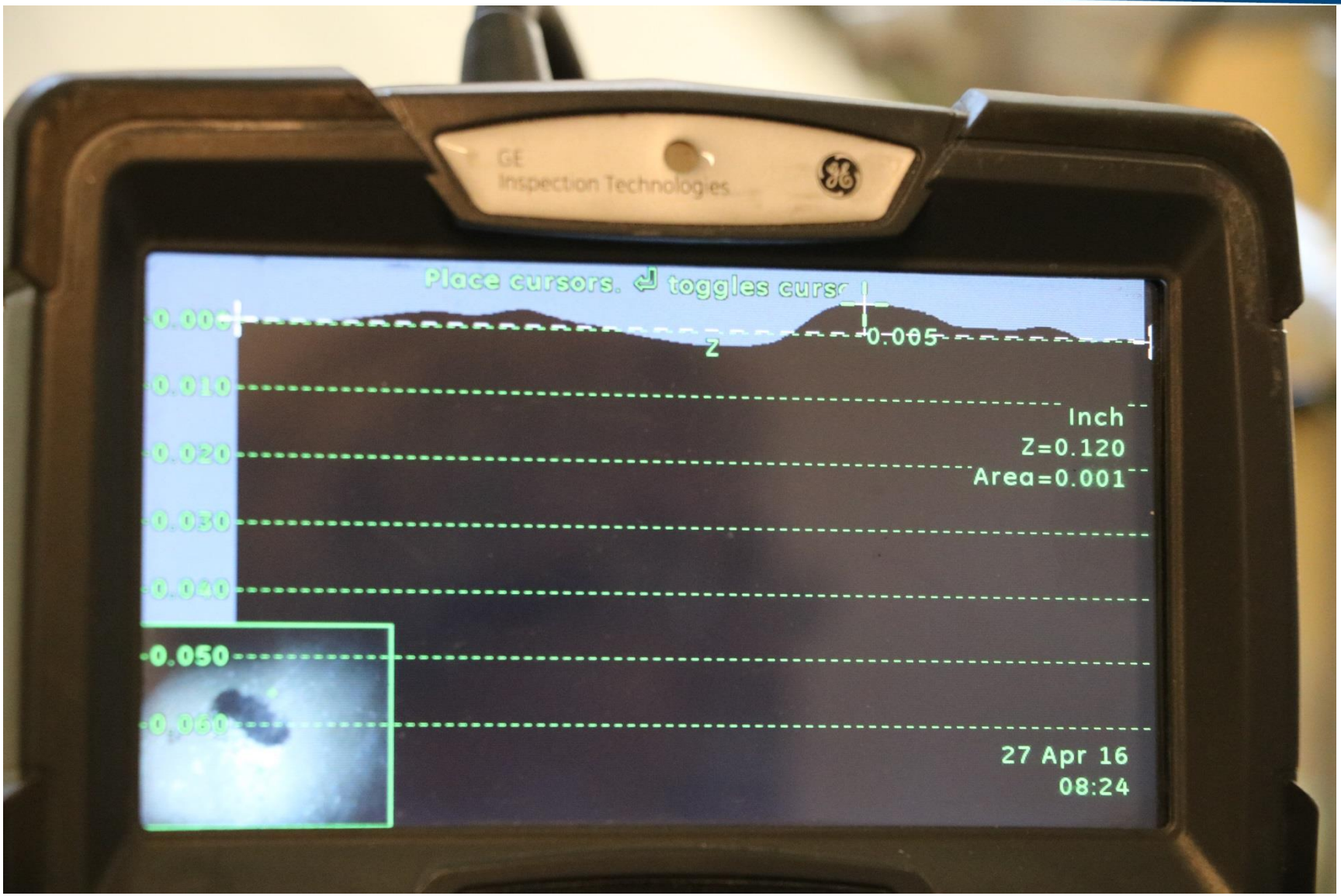


Fluor IDAHO

Setting the Video-Probe to Obtain a Depth Profile

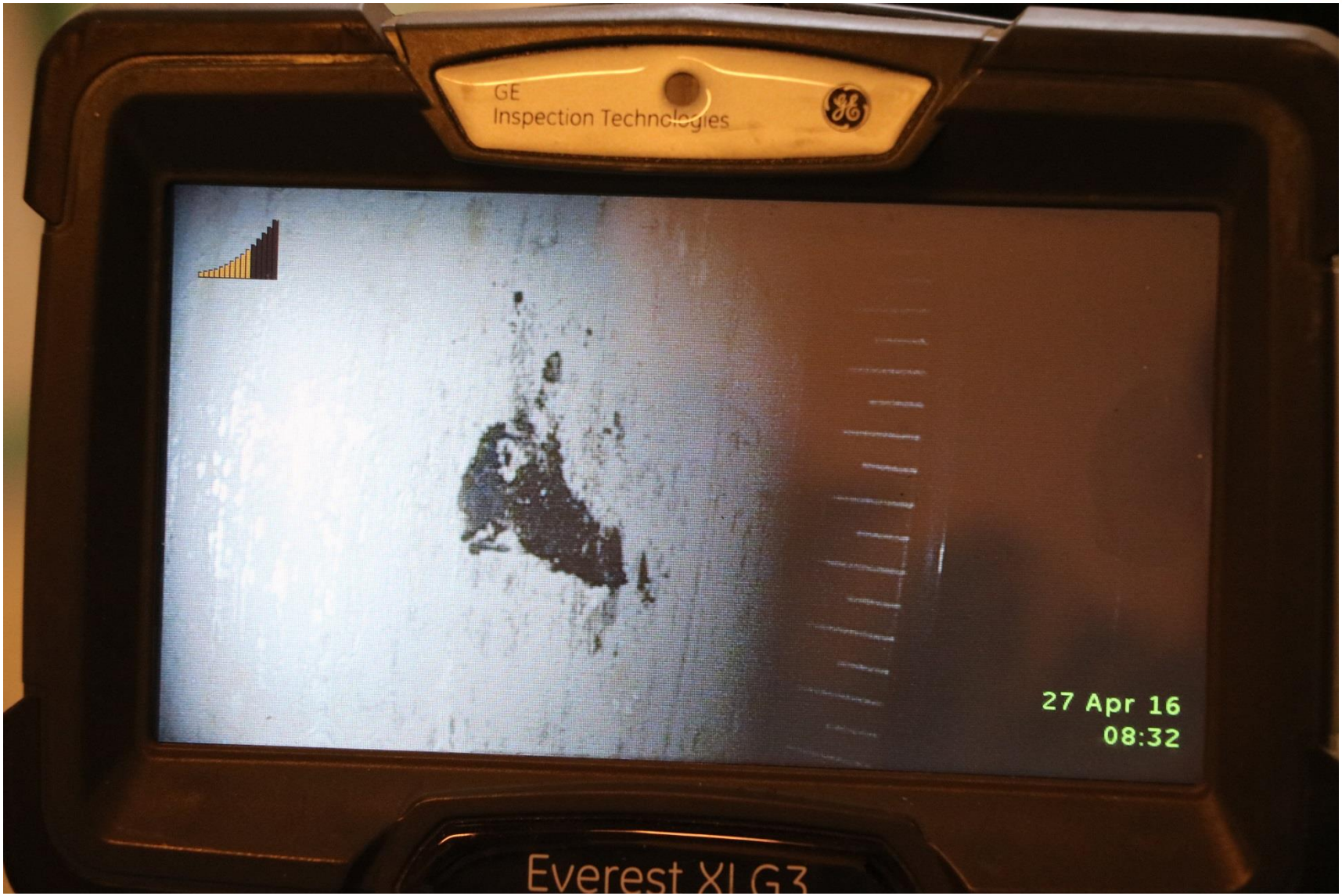
Fluor IDAHO

Depth Profile from the GE Video-Probe



Fluor IDAHO

Anomaly Found with Regular Camera System

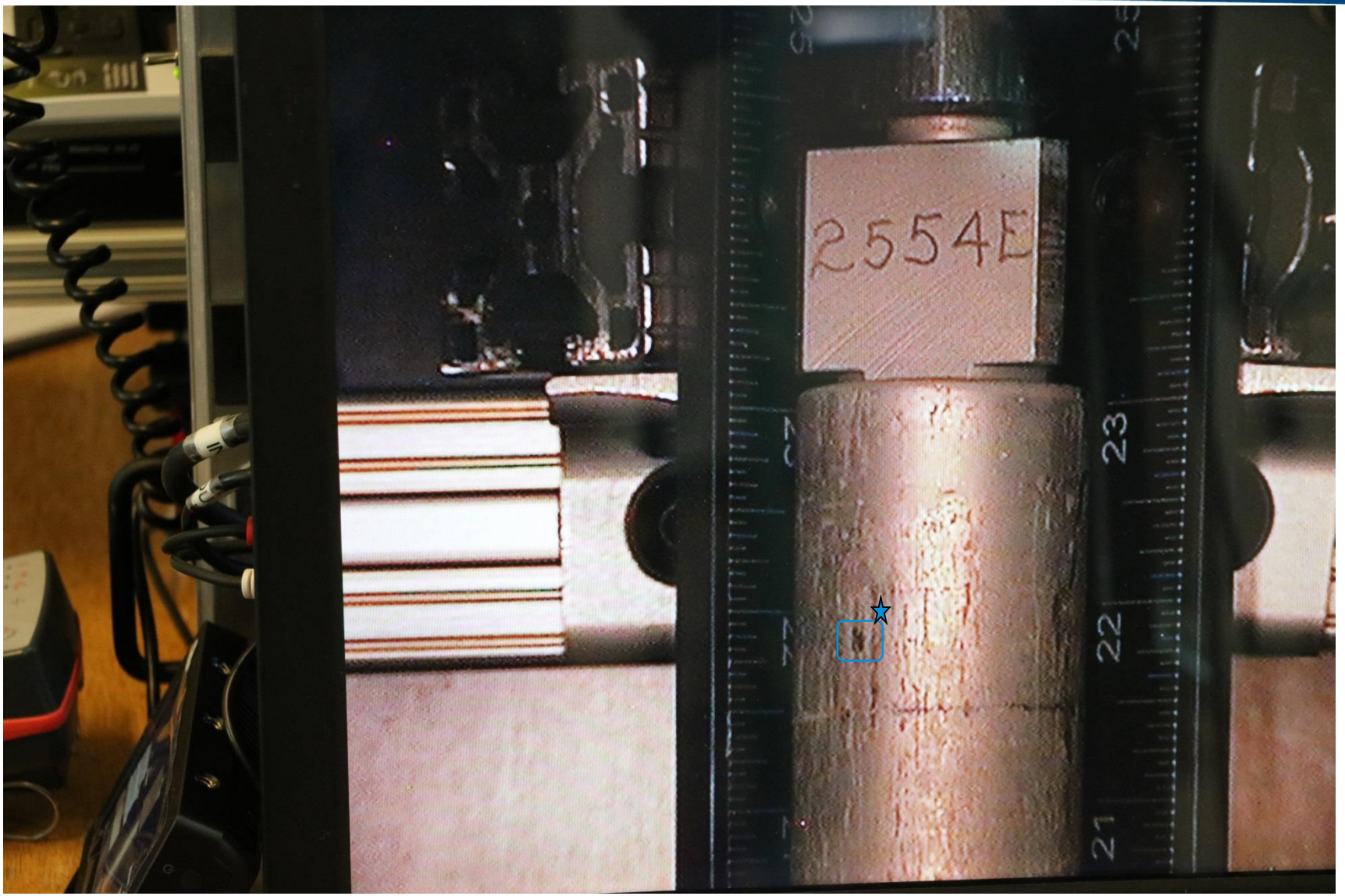


Fluor IDAHO

Anomaly Seen with Video-Probe

Fluor IDAHO

Anomaly Found with Regular Camera System

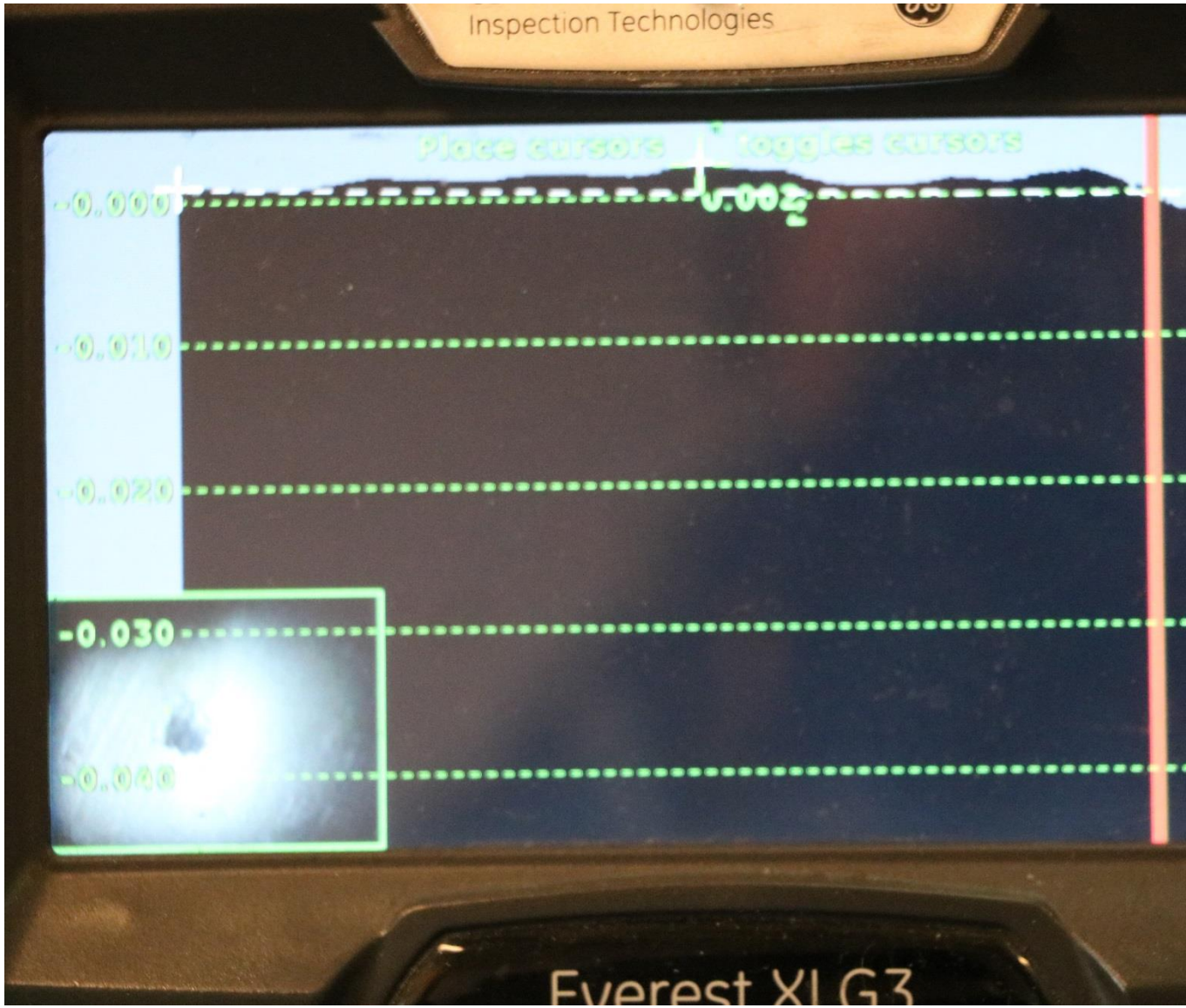


Fluor IDAHO

Anomaly Seen with Video-Probe

Fluor IDAHO

Depth Profile from the GE Video-Probe

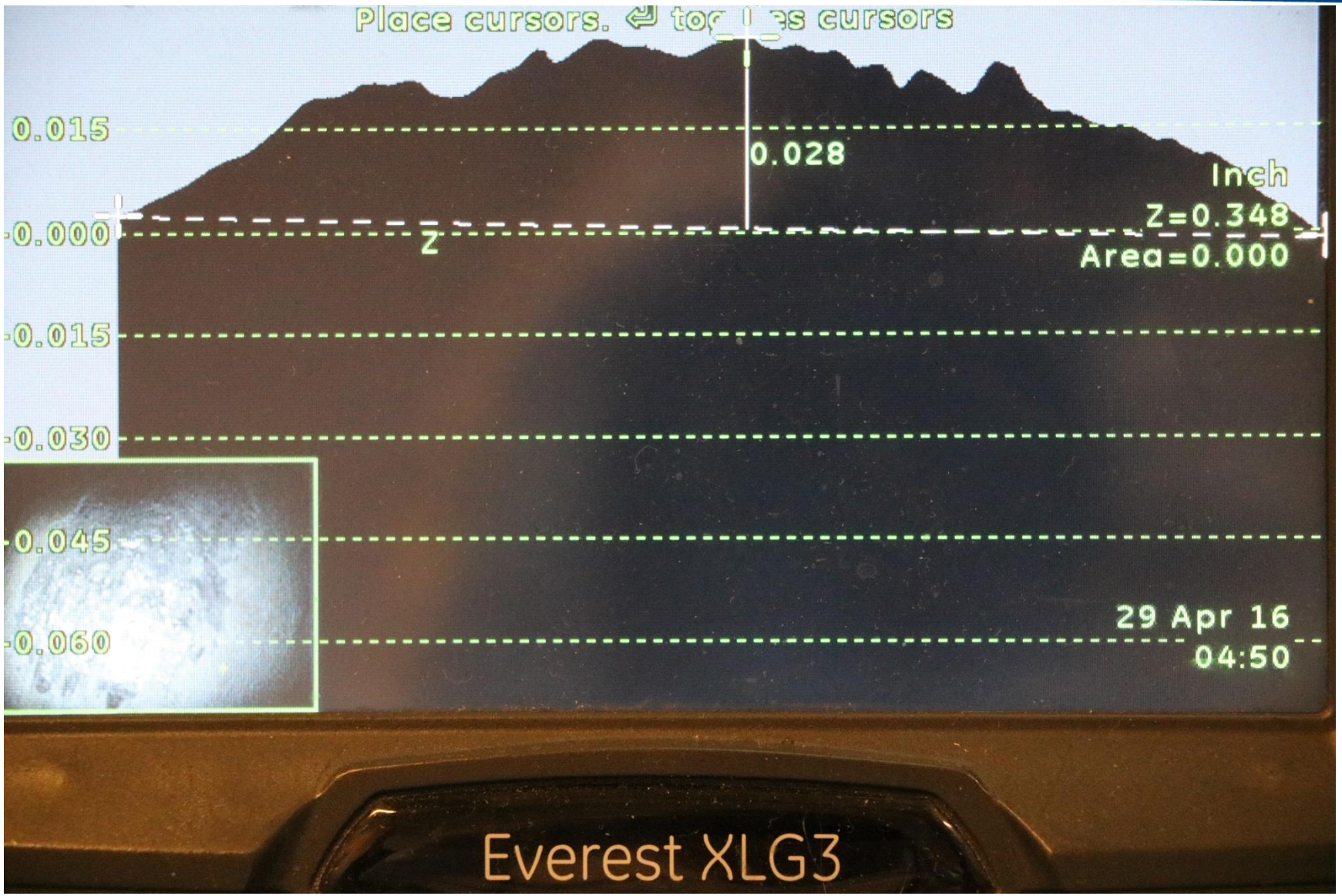


Fluor IDAHO

Swelled Cladding Found w/ Regular Camera System

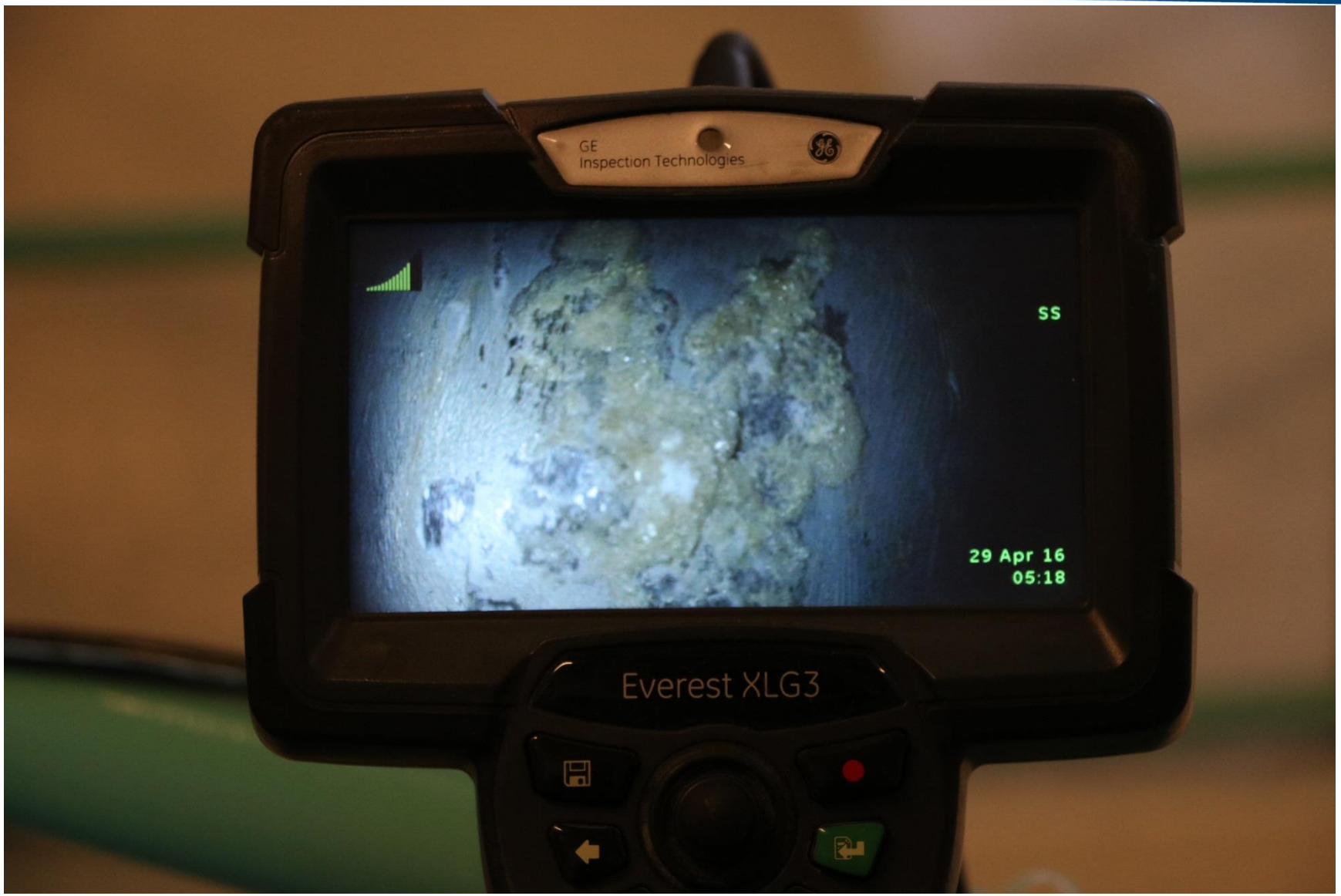
Fluor IDAHO

Swelled Cladding Depth Profile from Video-Probe



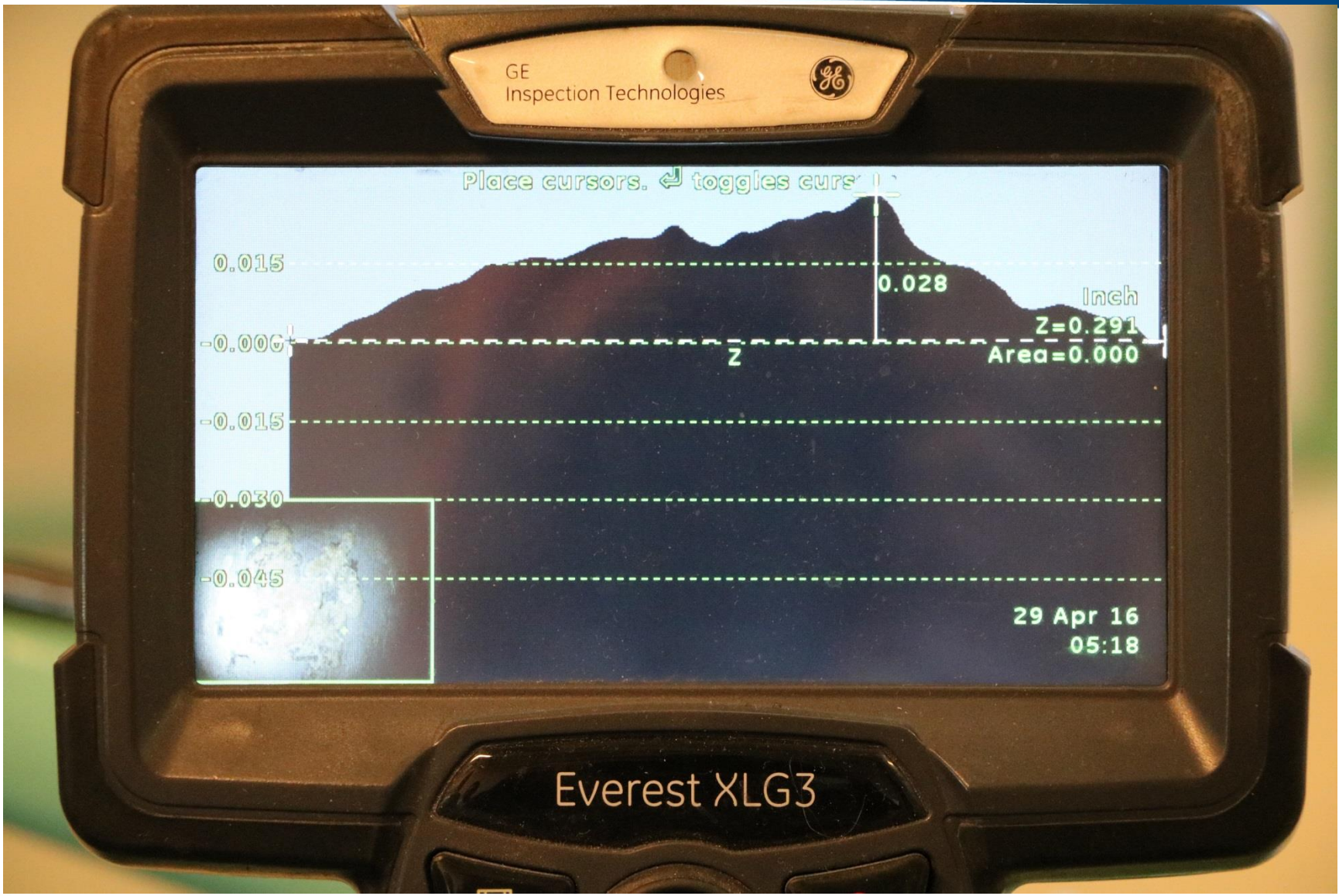
Fluor IDAHO

Section of Swelled Cladding Viewed w/ Video-Probe



Fluor IDAHO

Swelled Cladding Depth Profile from Video-Probe



Fluor IDAHO