ROI Needed: Reality Computing Trends for Industrial Facilities

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Class summary

This session will focus on how reality computing technology is assisting in cost reduction and better ROI for industrial facilities. Particular attention will be paid to real customers implementing 3D laser scanning within Autodesk software.

Key learning objectives

At the end of this class, you will:

- Discover how engineering firms and owner/operators are experiencing high returns from their investment in reality computing technology
- Learn the latest trends for extracting value from laser-scan data
- View practical demonstrations on how to create typically needed plant deliverables from point clouds
- Learn about reality computing workflow pains and solutions from peers actively using the technology today

Agenda

Operating Smarter
Hargrove Engineers & Constructors
Point cloud Meshing for Plant Design?
Visualizing Variance from Design
Questions

Operating Smarter with New Technology

Harsh Reality

- Crude prices have halved since mid-2014
- Budget cuts are in the billions
- Global upstream exploration and production spending dropped by $300 billion in 2015-2016
  - 2/3 comes from cost cuts rather than cancelling projects
- Owners facing reality of operating smarter to remain profitable and competitive

Operating Smarter

“Executives say the growing attention on technologies that have been around for some time shows how wasteful the global industry had been the years before the downturn when, with crude at above $100 a barrel, oil companies’ had little incentive to develop fields efficiently”

-Reuters 2016

Examples of New Tech: Drone Inspection

Before UAV:

- Plant shut-down
- 12 additional man power
- Climbing and hanging from ropes
- 2 separate trips, 2 weeks time
- 1/10th of the cost

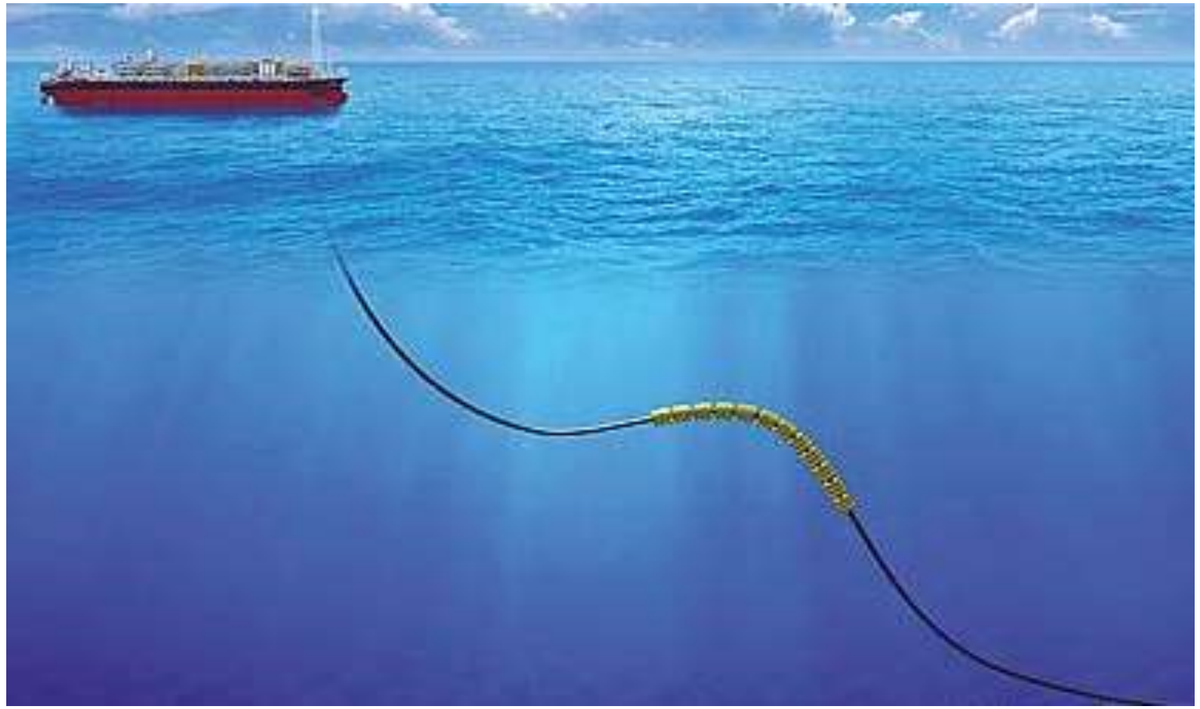
After UAV:

- No shut-down
- No additional man power
- Climbing and hanging from ropes
- 2 days total inspection time at a time

Cyberhawk at Shell Facility

Examples of New Tech: Motion of the Ocean

- Steel lazy wave riser
  - Pipe bends to absorb motion of sea and floating platform
  - Boosting production by operating smarter



Smarter Design: Statoil's Johan Sverdrup Field

- Production starts 2019
- Development costs cut in first stage by 1/5
- Design changes will make $41 a barrel profitable vs. $70 in 2013

"Savings have largely been made by focusing on the most efficient technology and designs from the beginning"

-Margareth Oevrum, Head of Technology

Operating Smarter: Use Your Data!

"Previously, it was industry standard to order 3-5 percent more materials than needed, which in a billion-dollar project is a lot of money"

-Patrick Holcomb,
Executive VP Intergraph

Operating Smarter: Use Your Data!

- Oil industry is one of the most digitalized industries
- Wealth of data that is not being maximized
- Shell/ExxonMobil/Statoil now investing in better software to manage waste in construction

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Customer Success Story:
Hargrove Engineers & Constructors

Hargrove Engineers & Constructors

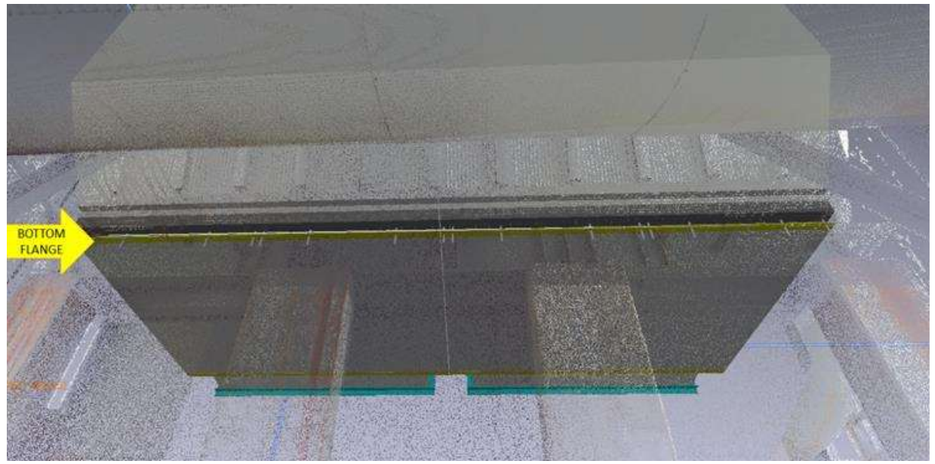
- Multiple locations across U.S.
- Utilizes scanning and modeling within AutoCAD
- Huge focus on new technology and safety

Heater Equipment Replacement Project

Heater Equipment Replacement Project

Project Overview

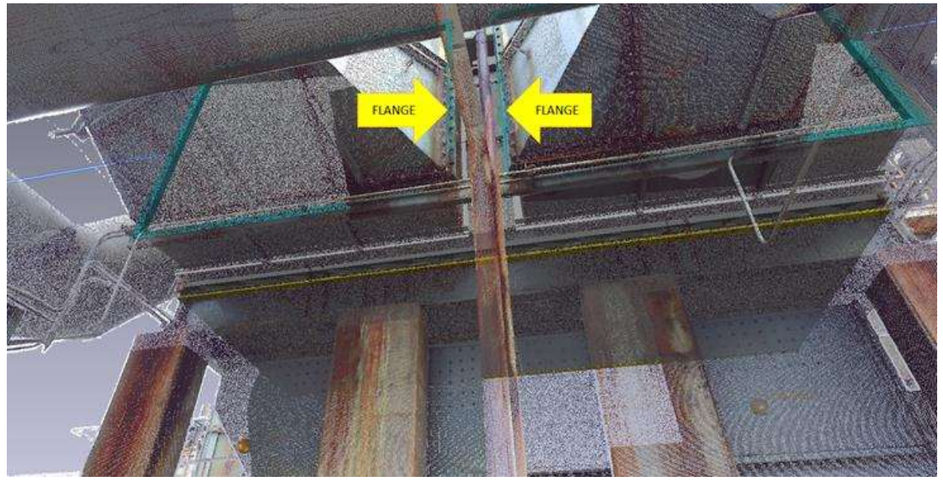
- New equipment was being built in Czech Republic
- Needed to verify fit before shipping
- Project began March 2016 and needed to be completed before August 2016 to avoid shutdown



Heater Equipment Replacement Project

Financial and Safety Concerns

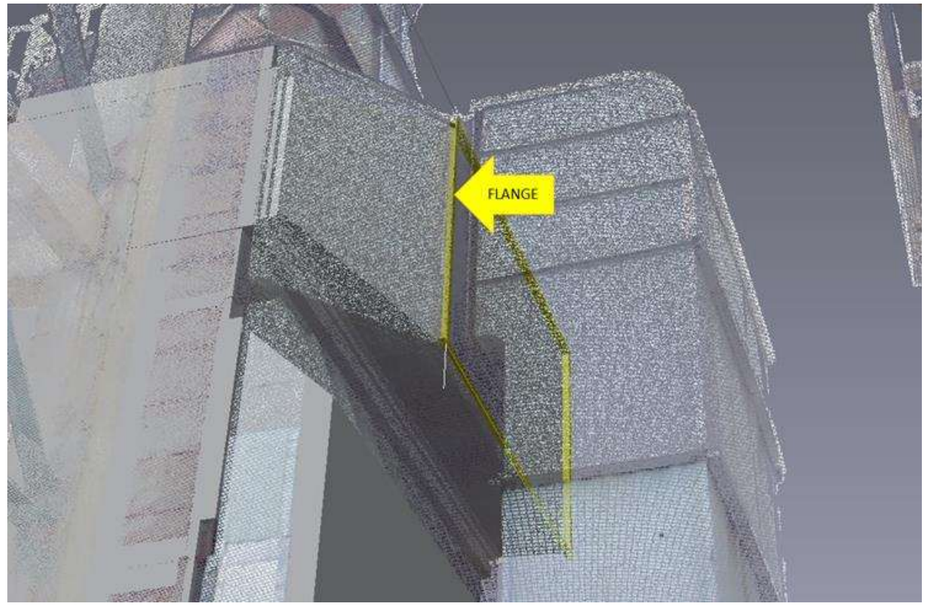
- Wanted to verify before shipping
- Crane time is very expensive, so they wanted to limit as much as possible
- Area of concern was 3 stories tall, so they preferred to use a ground method



Heater Equipment Replacement Project

Other Concerns

- Original equipment and concrete constructed 50 years ago
- Existing drawings were 50 year-old PDFs created from microfilm images of hand-drawn drawings
- Elevated foundation makes field work difficult

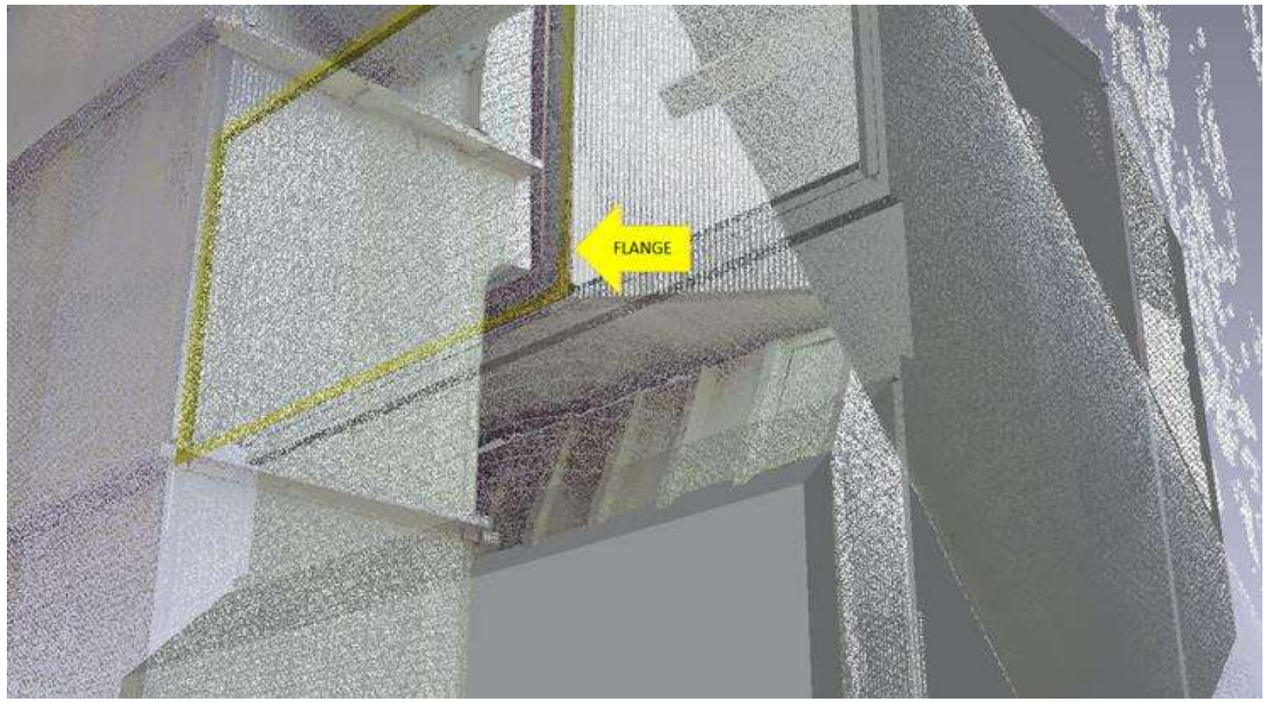


Heater Equipment Replacement Project

Heater Equipment Replacement Project

Materials Used

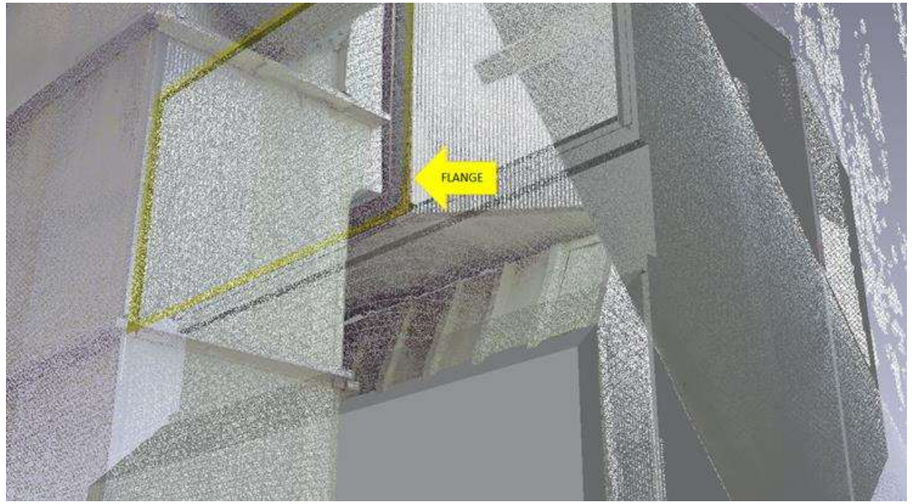
- FARO X330 Laser Scanner
- AutoCAD 2016 with CADWorx plug-in
- FARO SCENE
- PointSense Plant



Heater Equipment Replacement Project

Steps Taken to Complete

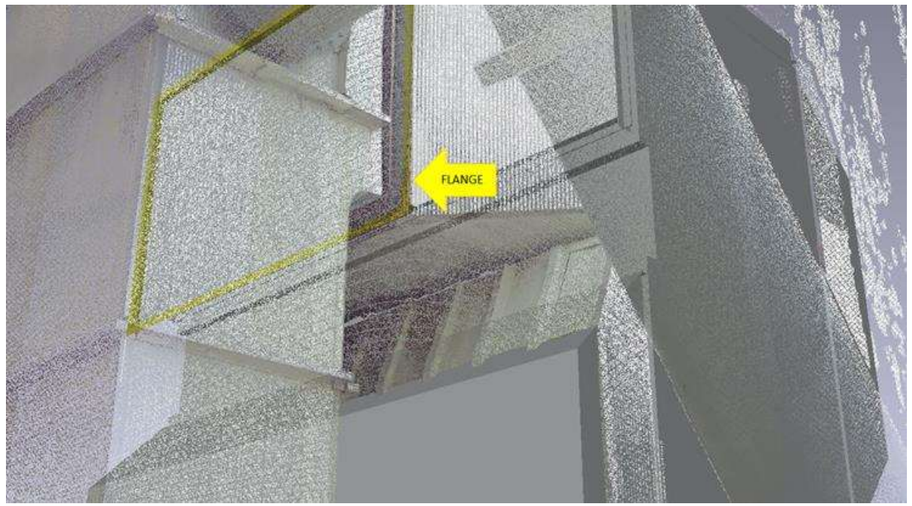
- Scanned out in the field
- Brought data into FARO SCENE for registration
- Used PointSense Plant to detect and model key areas in the ReCap engine
- Finished new design work with CADWorx plug-in



Heater Equipment Replacement Project

Completed Project Statistics

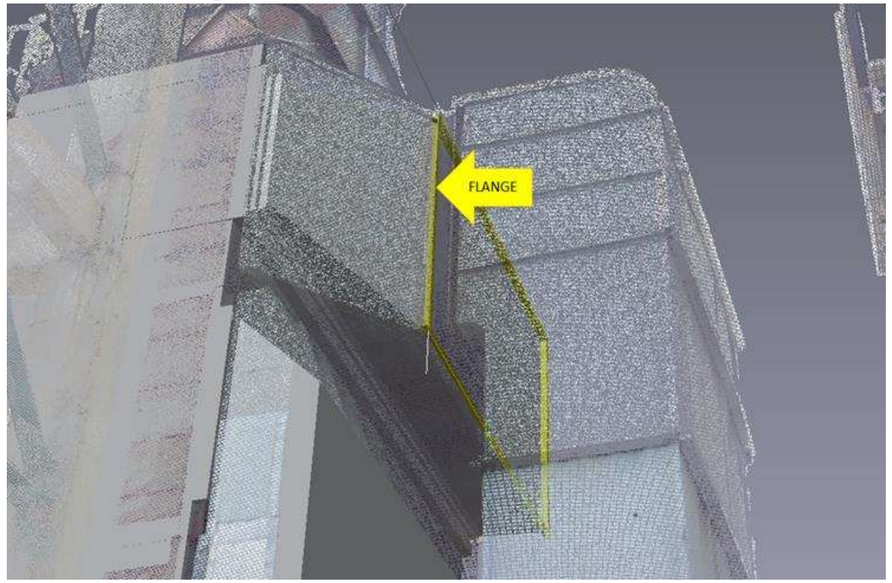
- Actual time to complete
  - Scanning and registration took 3 hours
  - Modeling took 3 days
- Actual Cost
  - Standard labor units for roughly 30 hours



Heater Equipment Replacement Project

Interesting Note

- With the scan data, they discovered the bolt pattern was backwards in the blower box (3 stories tall). They caught this before shipping and were able to save major time and money by addressing it before crane time



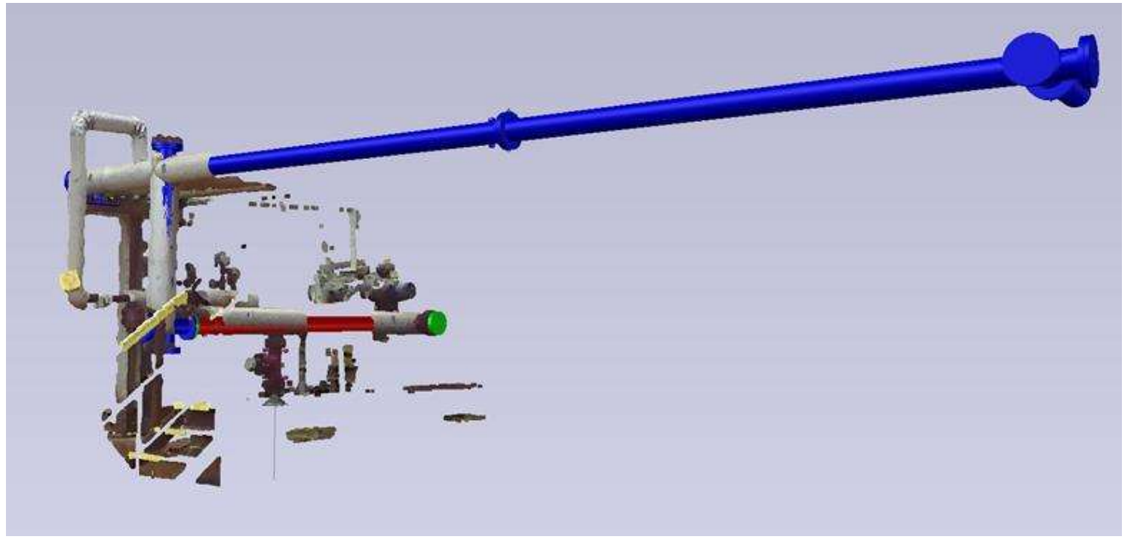
Heater Equipment Replacement Project

Return on Investment

- Saved $25,000 in crane time
- Saved roughly $2,000 in labor units
- Avoided safety concerns by staying on the ground
- Completed project well ahead of deadline

Emergency Jacketed Sulfur Pit Piping

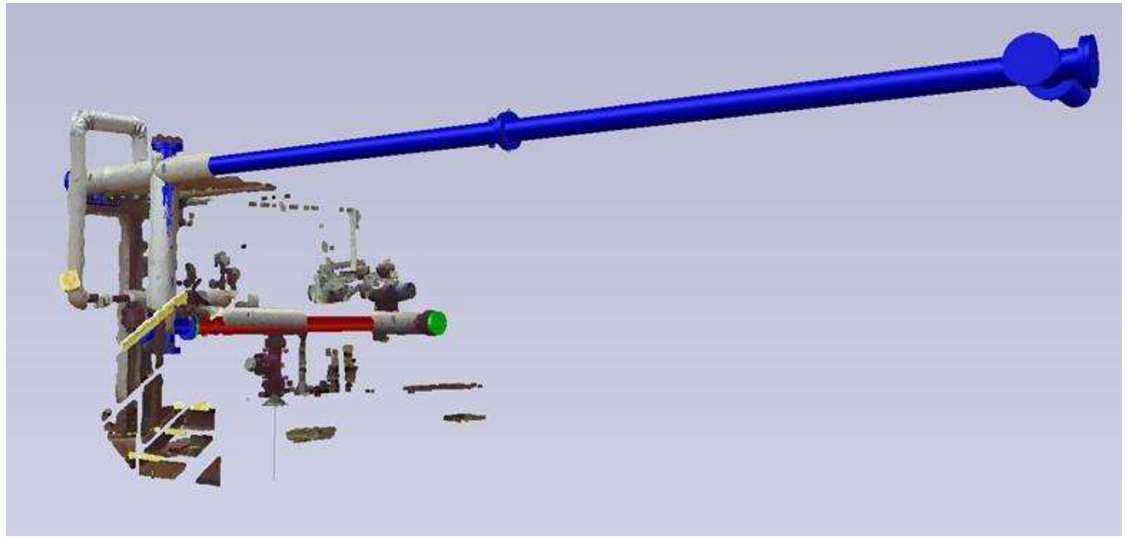
Emergency Jacketed Sulfur Pit Piping



Project Overview

- Leak in Sulfur Pit caused a steam pressure leak
- Very short window of time to diagnose and fix the issue
- If pressure got too low, there would be a complete shutdown
- 20-30 foot area to scan

Emergency Jacketed Sulfur Pit Piping



Project Concerns

- Very unsafe area
- Shutdown would cost $100,000 per day or more
- Needed fastest solution possible

Emergency Jacketed Sulfur Pit Piping

Materials Used

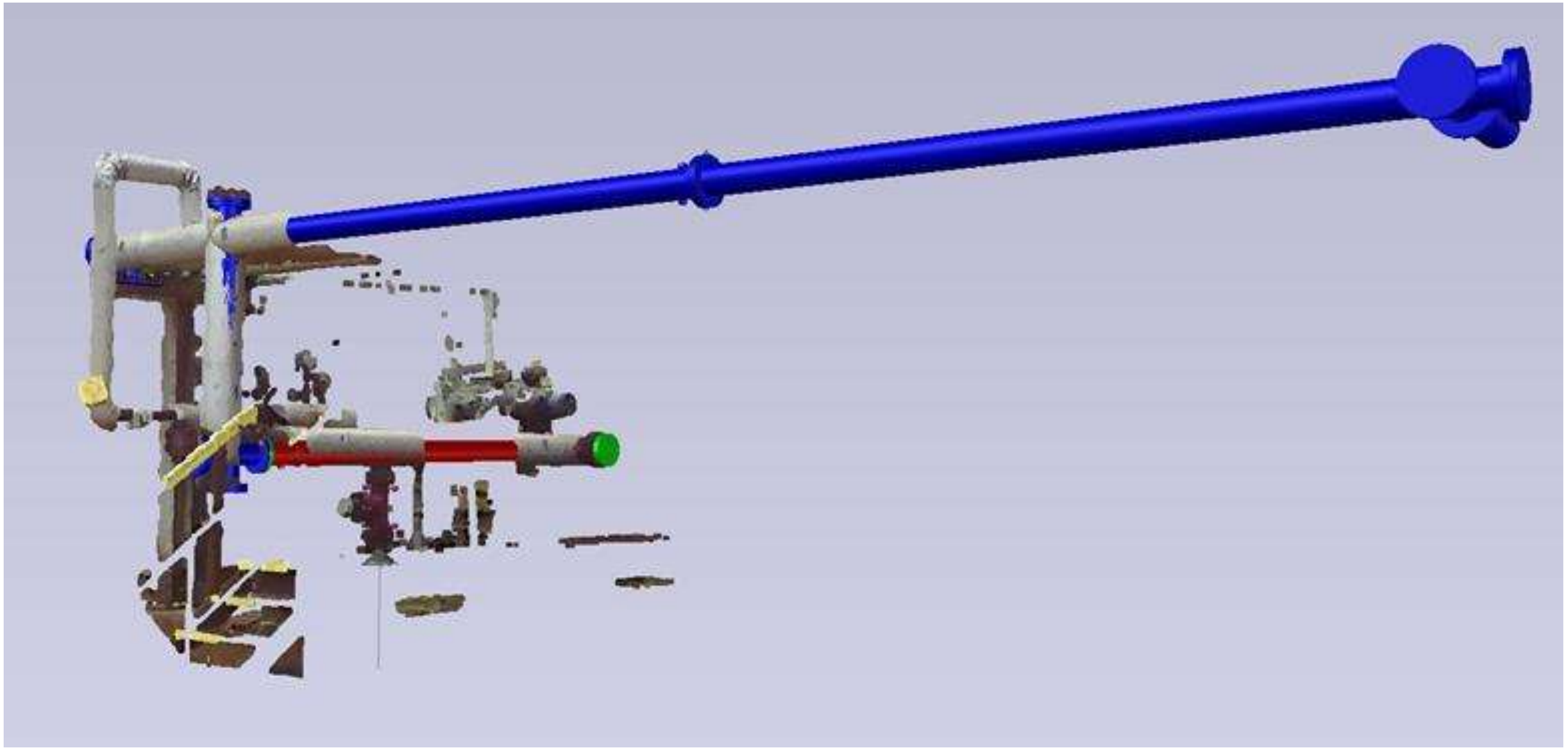
- FARO X330 Laser Scanner
- FARO SCENE
- AutoCAD 2016 with CADWorx plug-in
- PointSense Plant

Emergency Jacketed Sulfur Pit Piping

Completed Project Statistics

- Actual Time
  - Project was completed (issued for construction) in less than a week!
  - 3 spools completed for steam jacketed piping
  - Roughly 20 feet of piping designed going to and from a control valve and another pipe going downhill into the sulfur pit
- Actual Cost
  - Standard Labor Units for less than a week

Emergency Jacketed Sulfur Pit Piping



Emergency Jacketed Sulfur Pit Piping

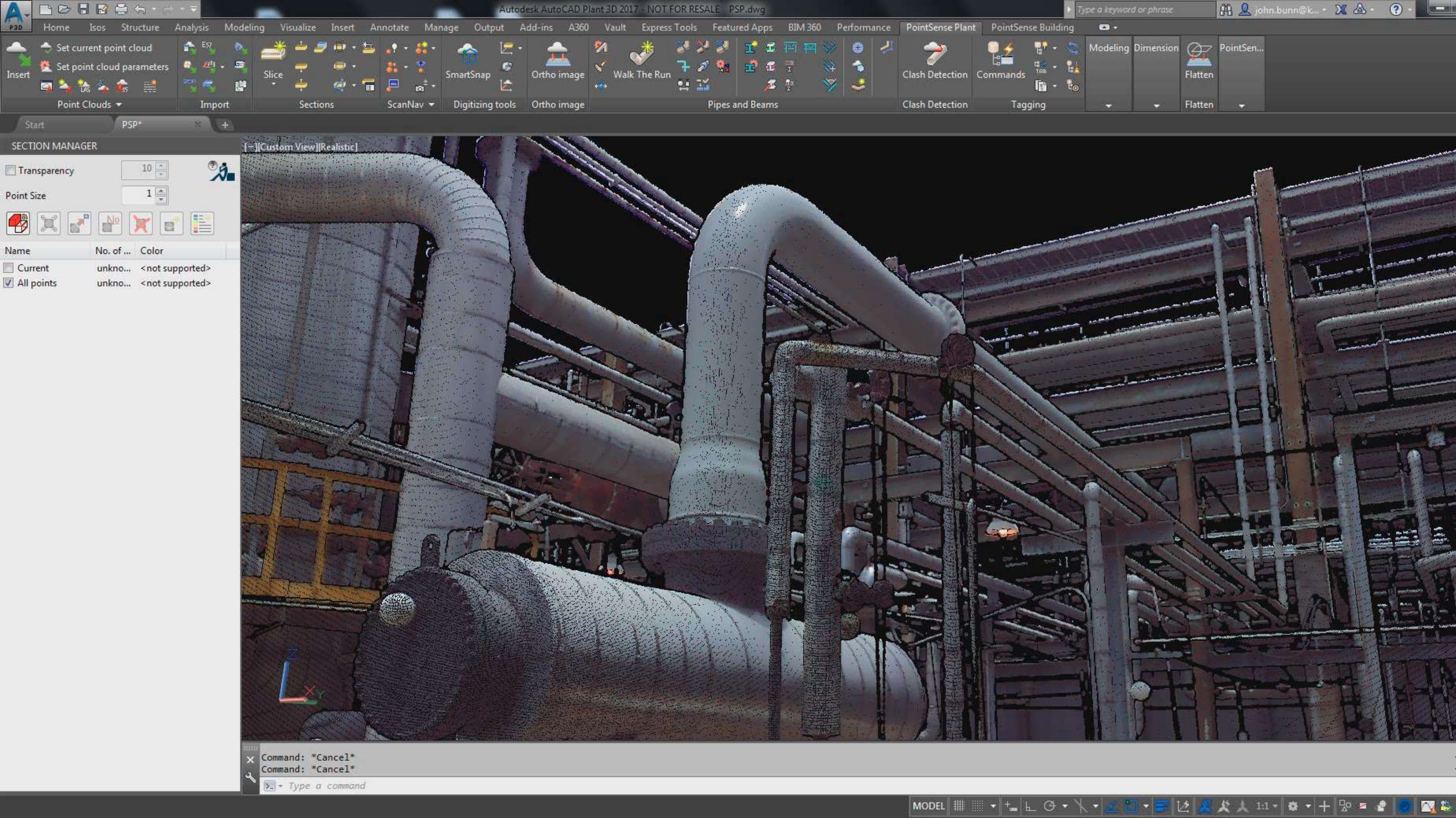
Interesting Notes

- Client was skeptical, so they brought extra materials and fittings to be safe
- Everything fit perfectly on the first try
- Client was so impressed, they came back almost immediately with two more projects!

Emergency Jacketed Sulfur Pit Piping

Return on Investment

- Saved money on not needing Fresh Air Certified personnel and Hazmat equipment
- 3 hour shutdown versus entire day - $16,000 versus $100,000!
- Avoided putting contractors in dangerous area
- Client came back with two more jobs!


Autodesk AutoCAD Plant 3D 2017 - NOT FOR RESALE PSP.dwg
Type a keyword or phrase
john.bunn@k...
Home Isos Structure Analysis Modeling Visualize Insert Annotate Manage Output Add-ins A360 Vault Express Tools Featured Apps BIM 360 Performance PointSense Plant PointSense Building
Insert
Set current point cloud
Set point cloud parameters
Point Clouds
Import
Slice
Sections
ScanNav
SmartSnap
Digitizing tools
Ortho image
Ortho image
Walk The Run
Pipes and Beams
Clash Detection
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Commands
Tagging
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Command: *Cancel*
Command: *Cancel*
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MODEL

Interview with Ron Burton, Hargrove

What does it take to prove laser scanning to upper management, especially given costs?

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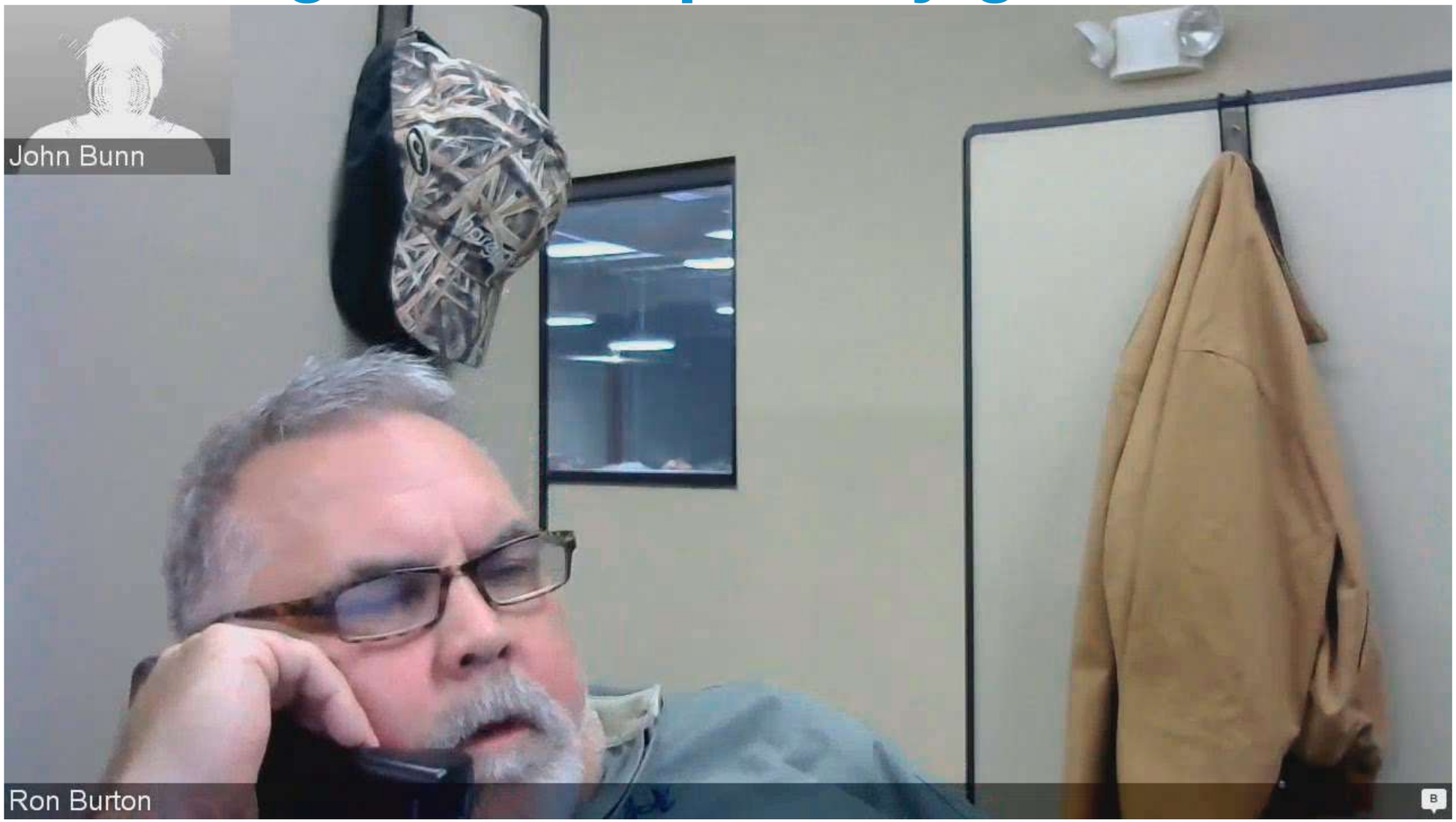

With the heater replacement project, what would the workflow have been without laser scanning?

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What made laser scanning the better choice?

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With the jacketed sulfur pit piping, what made this area difficult to access?

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How did the success of this project affect your relationship with this customer?

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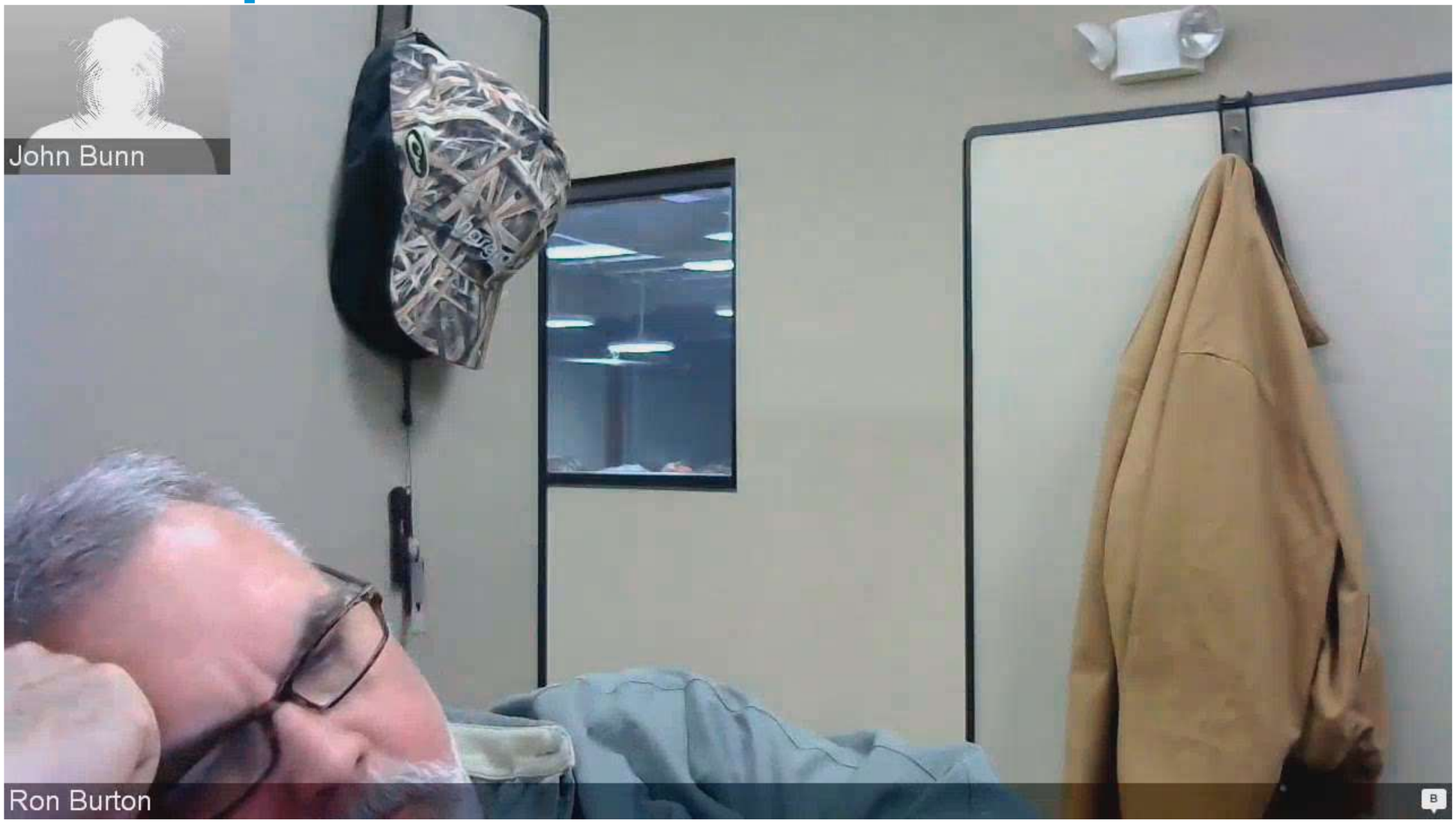

Which aspects of laser scanning that has helped make it more mainstream?

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What are key factors that would warrant a company to adopt laser scanning?

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Point Cloud Meshing for Plant Design?

Why Meshing?

- Typically generated automatically with minimal input
- Able to create complex contours
- Exportable to formats accepted by most modeling packages
- Generally very time-efficient

Plant Design Uses for Mesh

- Visualization
- Asset volumes
- Equipment for factory layout
- Tank Analysis
  - Tank volumes
  - Deadwood
  - Containment areas

Experimenting with Point Cloud Meshing

Tank Analysis Project

Experimenting with Point Cloud Meshing

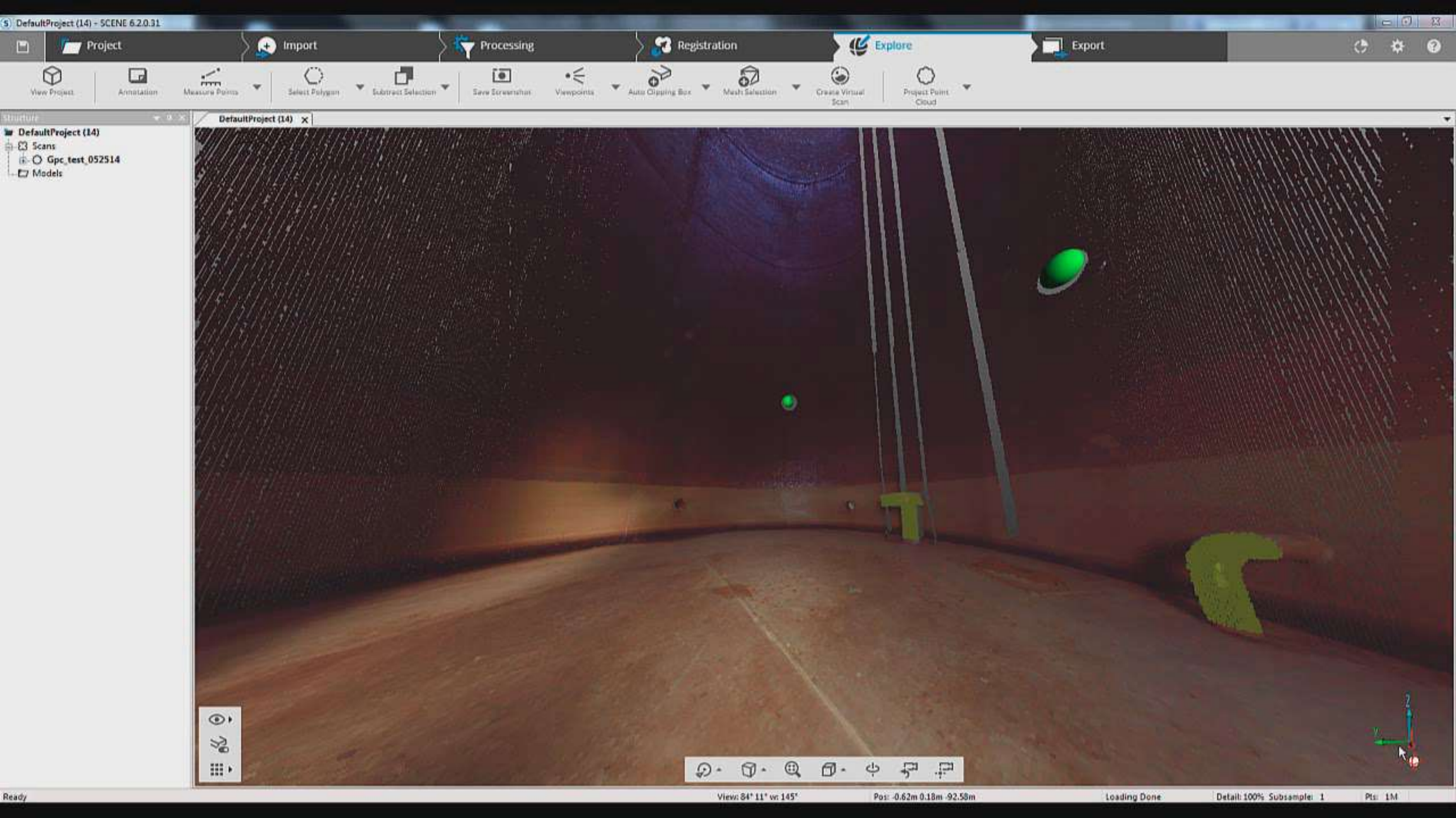
Products Used

- FARO X330 Laser Scanner
- FARO SCENE 6.2
- Autodesk FBX Converter
- AutoCAD 2017
- FARO PointSense Plant

Experimenting with Point Cloud Meshing

Steps Taken to Achieve Results

- Make selection in Scene and Mesh Selection
- Export Mesh to .OBJ
- Convert .OBJ to .FBX with Autodesk Utility
- Import FBX in AutoCAD
- Run third-party command to calculate volume and subtract deadwood

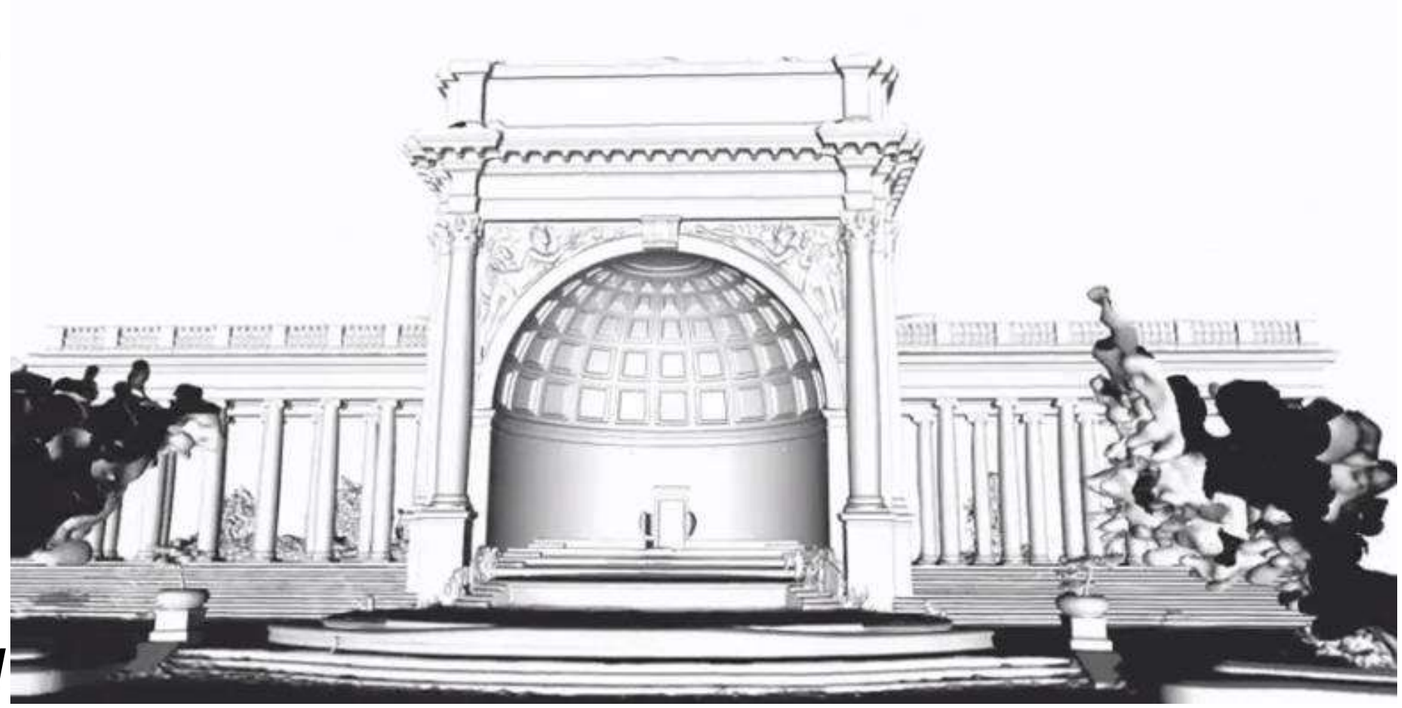

DefaultProject (14) - SCENE 6.2.0.31
Project
Import
Processing
Registration
Explore
Export
View Project
Annotation
Measure Points
Select Polygon
Subtract Selection
Save Screenshot
Viewpoints
Auto Clipping Box
Mesh Selection
Create Virtual Scan
Project Point Cloud
Structure
DefaultProject (14)
Scans
Gpc_test_052514
Models
DefaultProject (14)
Ready
View: 84° 11° w: 145°
Pos: -0.62m 0.18m -92.58m
Loading Done
Detail: 100% Subsample: 1
Pts: 1M

Experimenting with Point Cloud Meshing

In doing this project, my personal opinion is meshing is more accurate and faster when compared to physically modeling deadwood, as long as the scan data captures the objects from all angles. It accounts for all irregularities and it does not matter what type of object needs to be modeled.

ReCap 360 Scan-To-Mesh Service

Select the scans surrounding the object or asset you want to turn into a photo-textured mesh, such as equipment in a factory. Send this information to our new scan-to-mesh cloud service to create an accurate 3D model. You can then reuse this asset for various purposes. This service works with up to 20 laser scans chosen around the object or assets



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Customer Success Story: Visualizing Variance

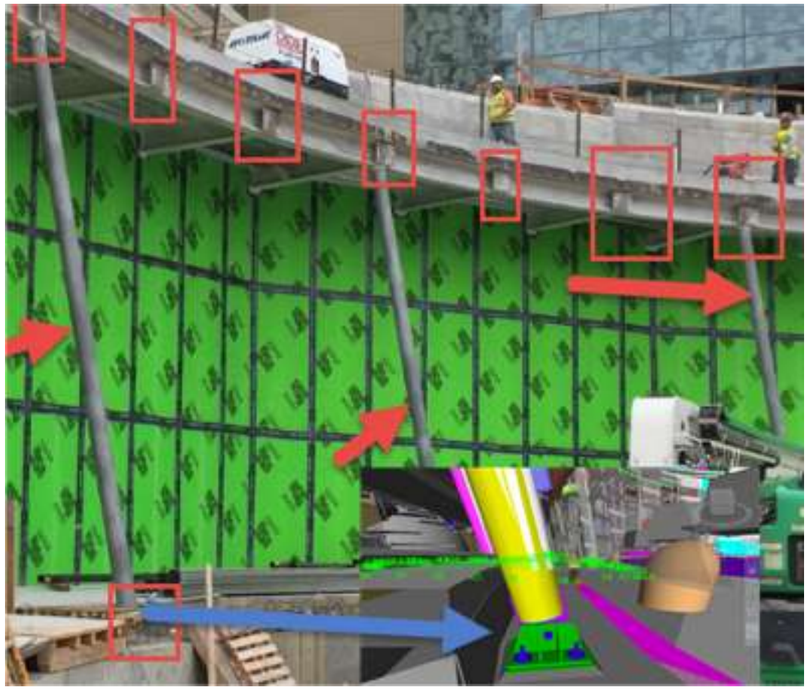
SKUR Use Cases

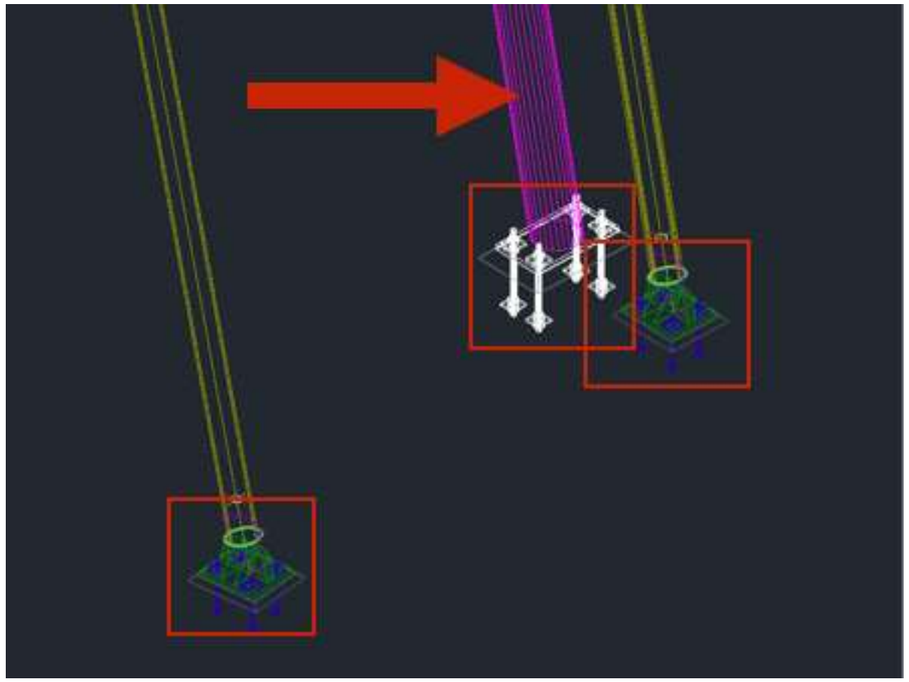
Green Field – Construction QC: how does reality compare to the design model?

Brown Field – Model QC: how does the (manually) generated model compare to reality ?

Use Case – Green Field

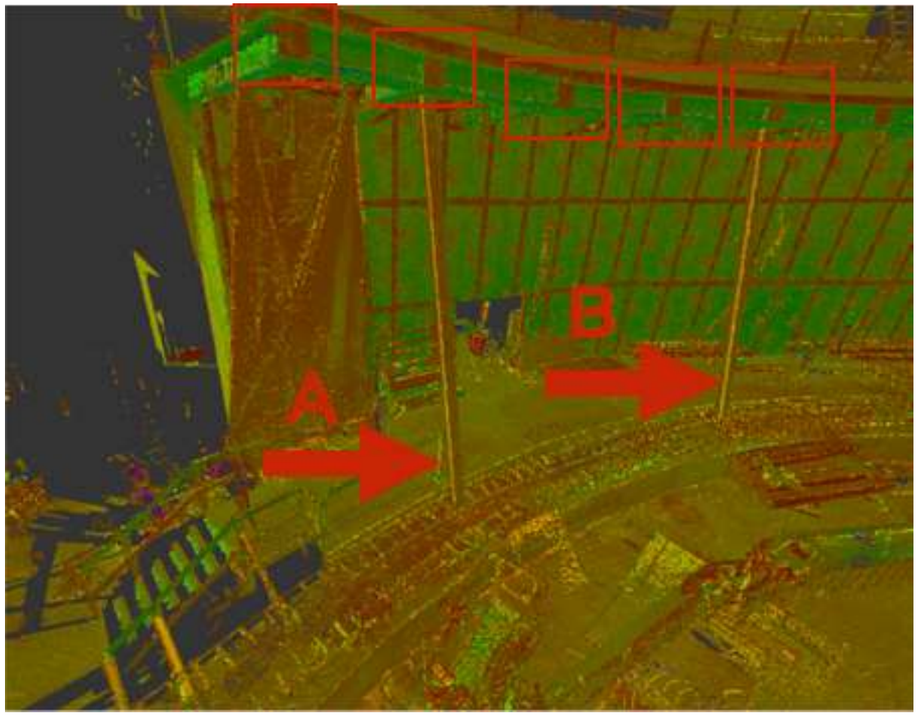
Customer question: how does structure compare to the design model? Where is it off and by how much?



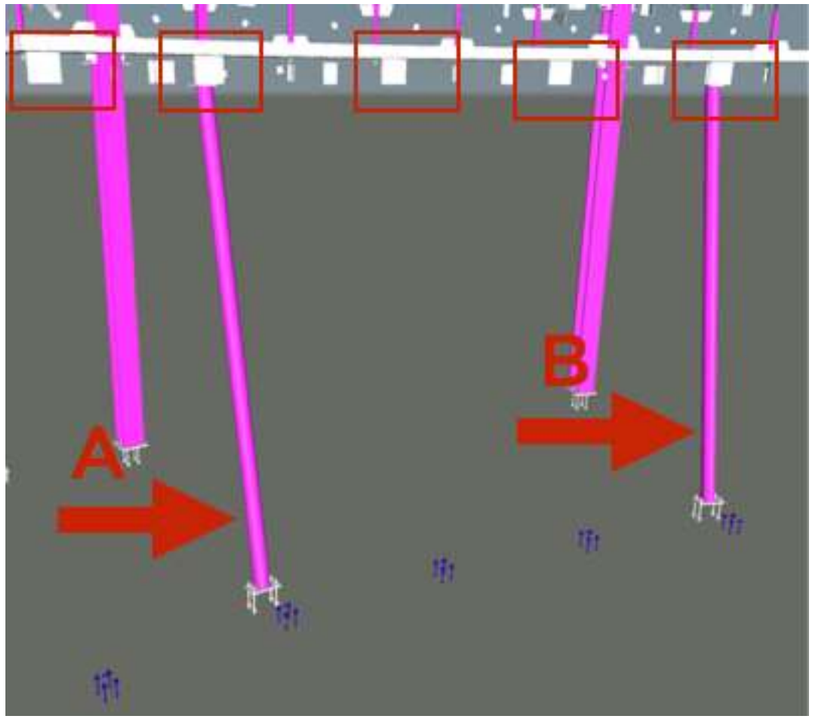


Use Case – Input

- Point Cloud

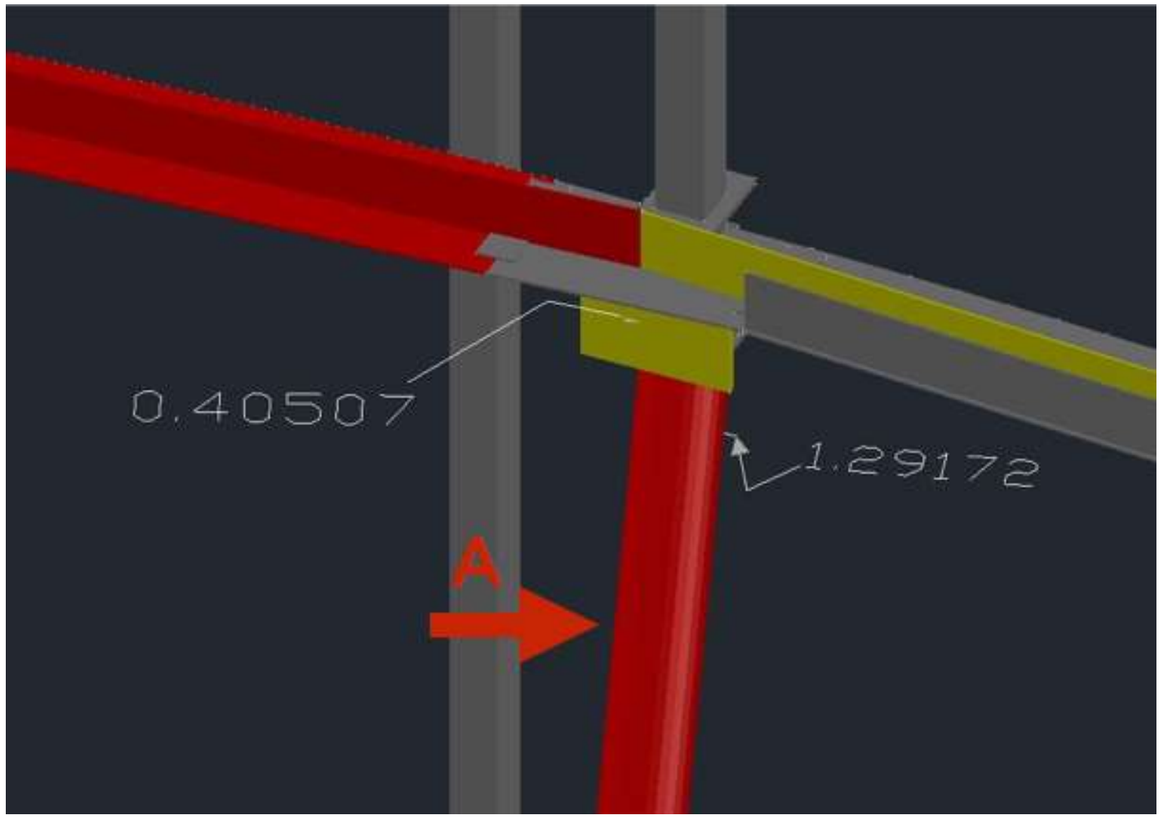


- Design File



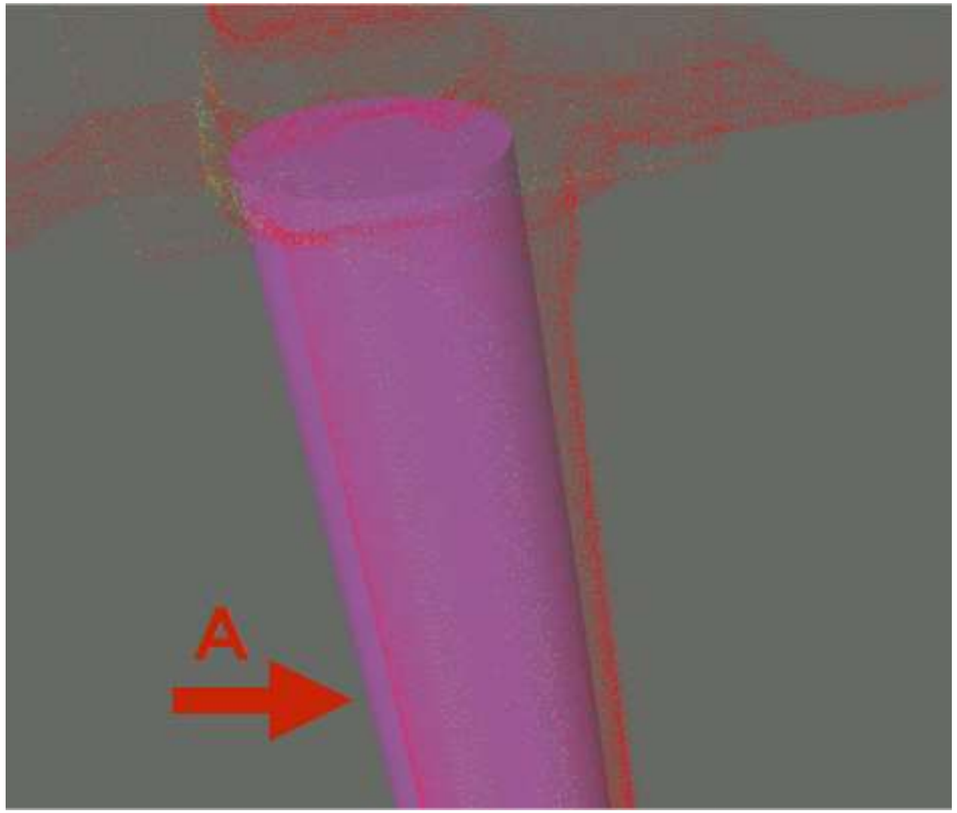
Use Case – Stoplight Color Model

- Augmented design file – variance and direction



Use Case – Variance Heatmap

- Augmented point cloud – SKUR heatmap



Use Case – Areas of Interest

Use Case – Reporting

10.1 Object visibility coverage

Percentage of object seen	Number of objects
0 - 25%	486
25 - 50%	75
50 - 100%	3

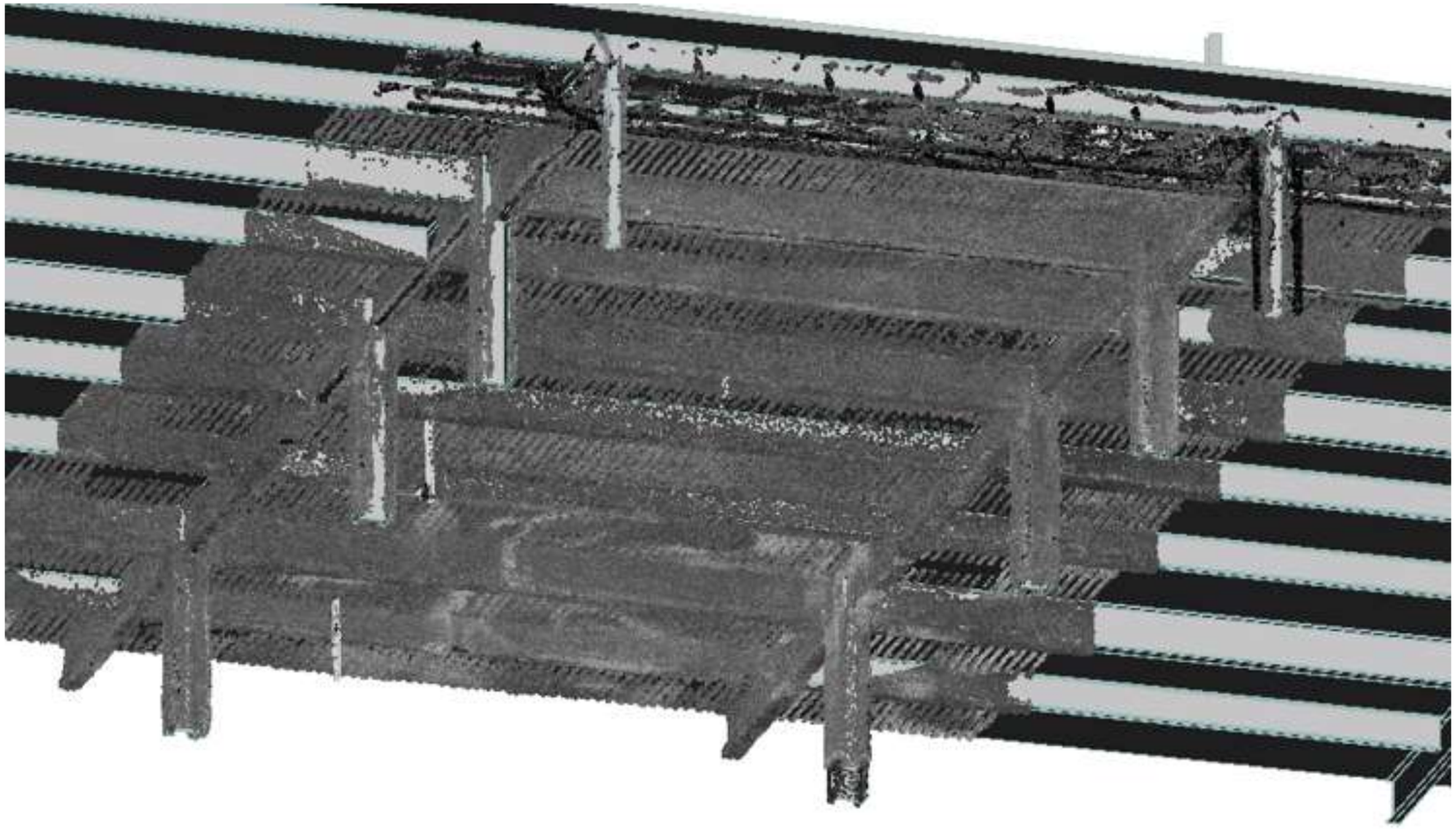
10.2 Object Analysis Results for 78 objects 78
Total objects seen by scanner: 564 - Units: Inches

Object ID	Distance of maximum discrepancy (inches)	Discrepancy in X direction (inches)	Discrepancy in Y direction (inches)	Discrepancy in Z direction (inches)	Percentage of object scanned	Percentage of object with small variation	Percentage of scanned object with small variation
17F96	0.295	0.045	0.291	0.017	54.41	1.22	2.23
B216A	1.125	-1.000	-0.504	0.116	83.70	3.01	3.60

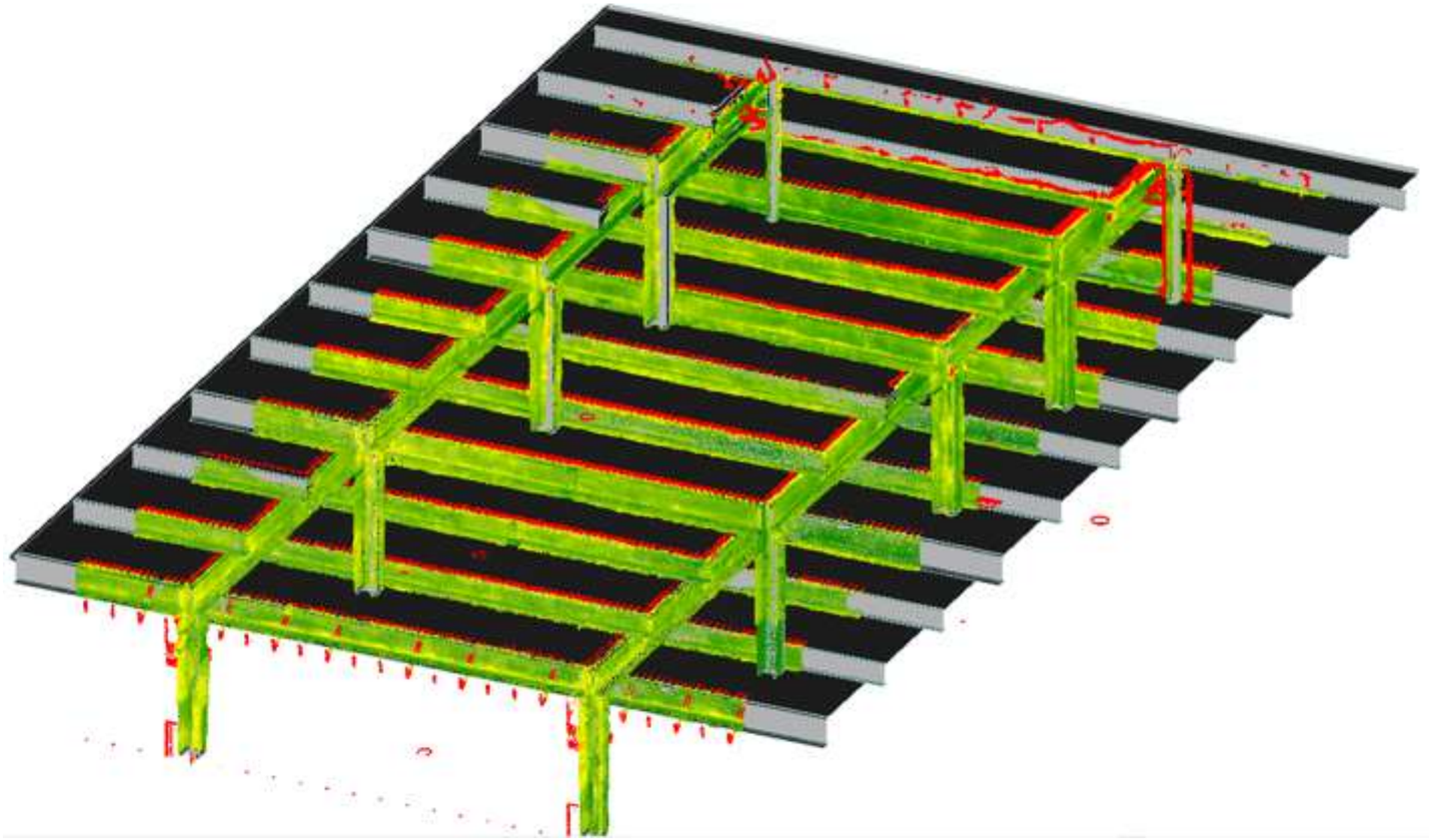
Construction QC – ROI

- Regular scanning and Diffing
- Estimated savings around 4% of cost overruns
- Relating this to scan and to SKUR,
  ROIs can be 10x

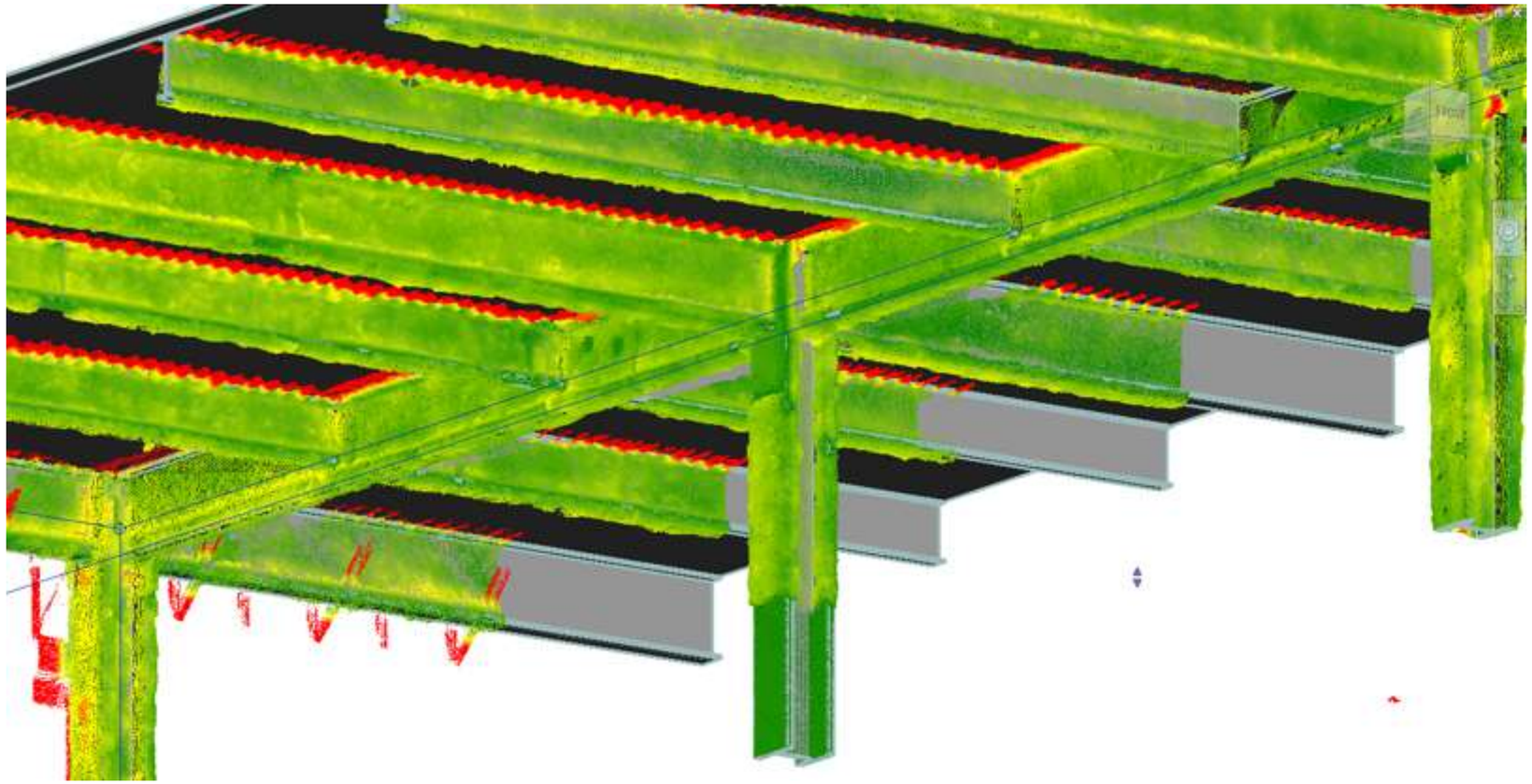
Model Quality Control – Input



Model Quality Control – Result



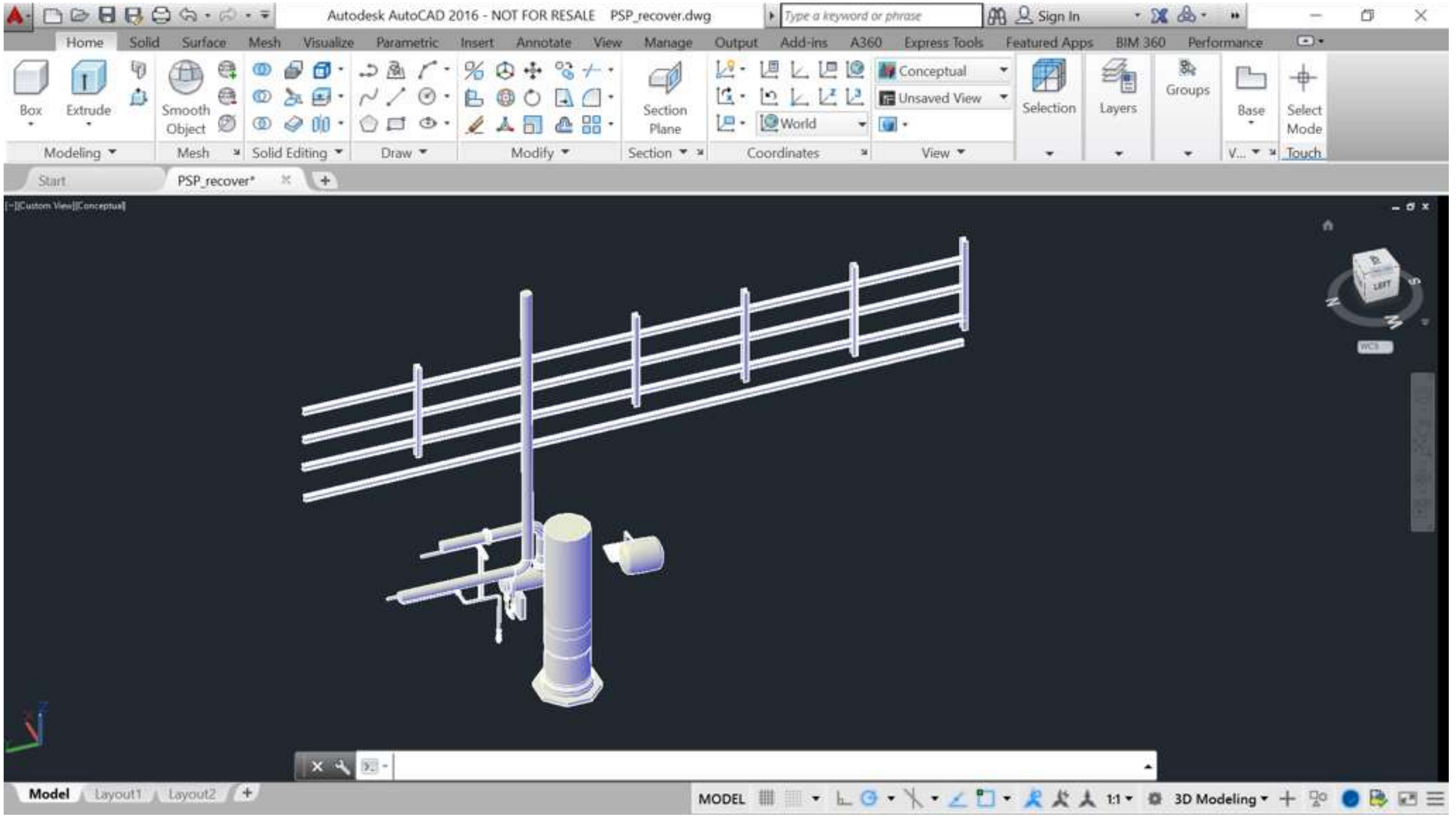
Model Quality Control – Result



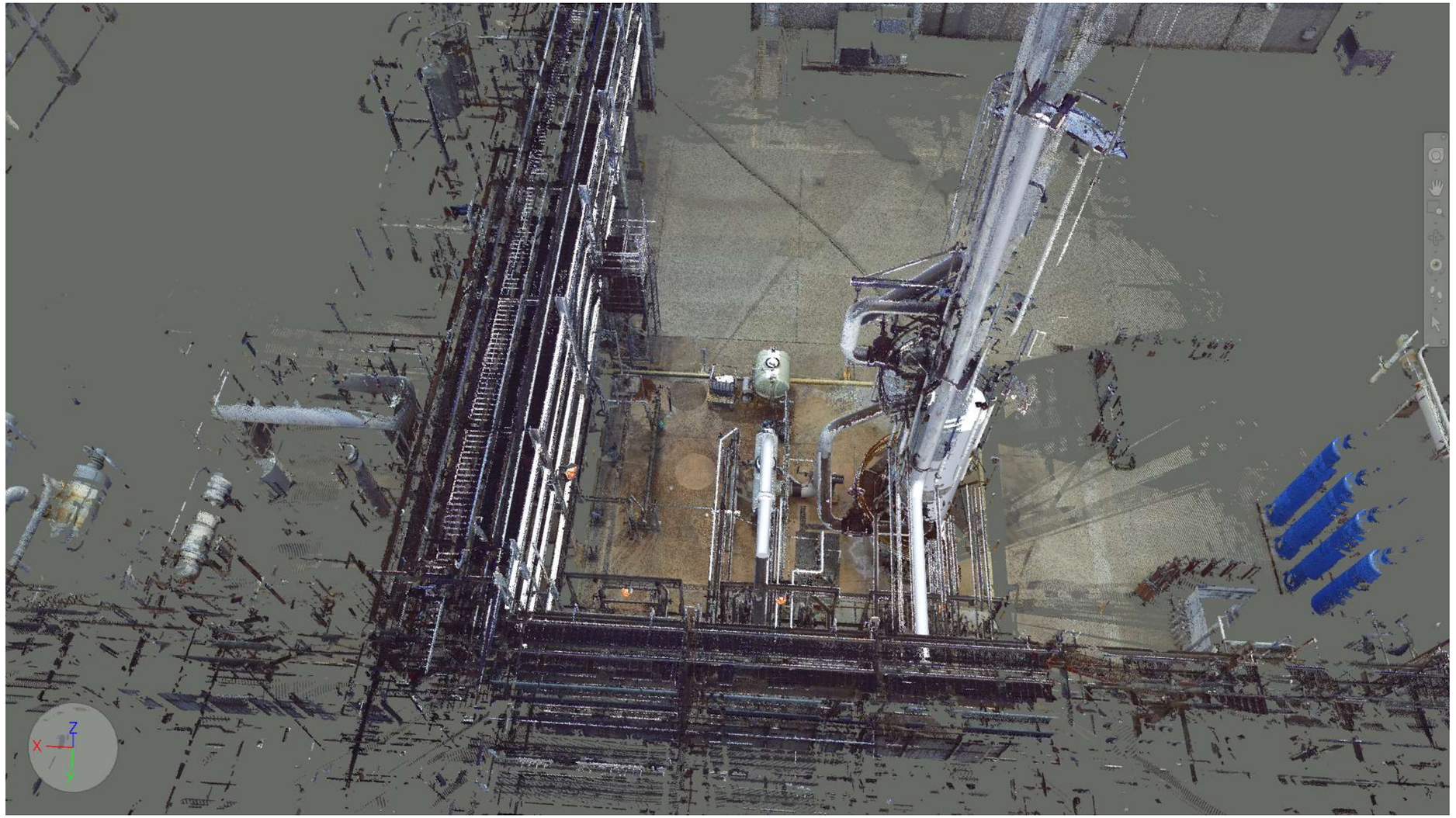
Model Quality Control – ROI

- Manual model QC of 11 story hospital building
- 2.5 person month to compare Revit model to point cloud
- With SKUR, the model QC could have been cut down to one week

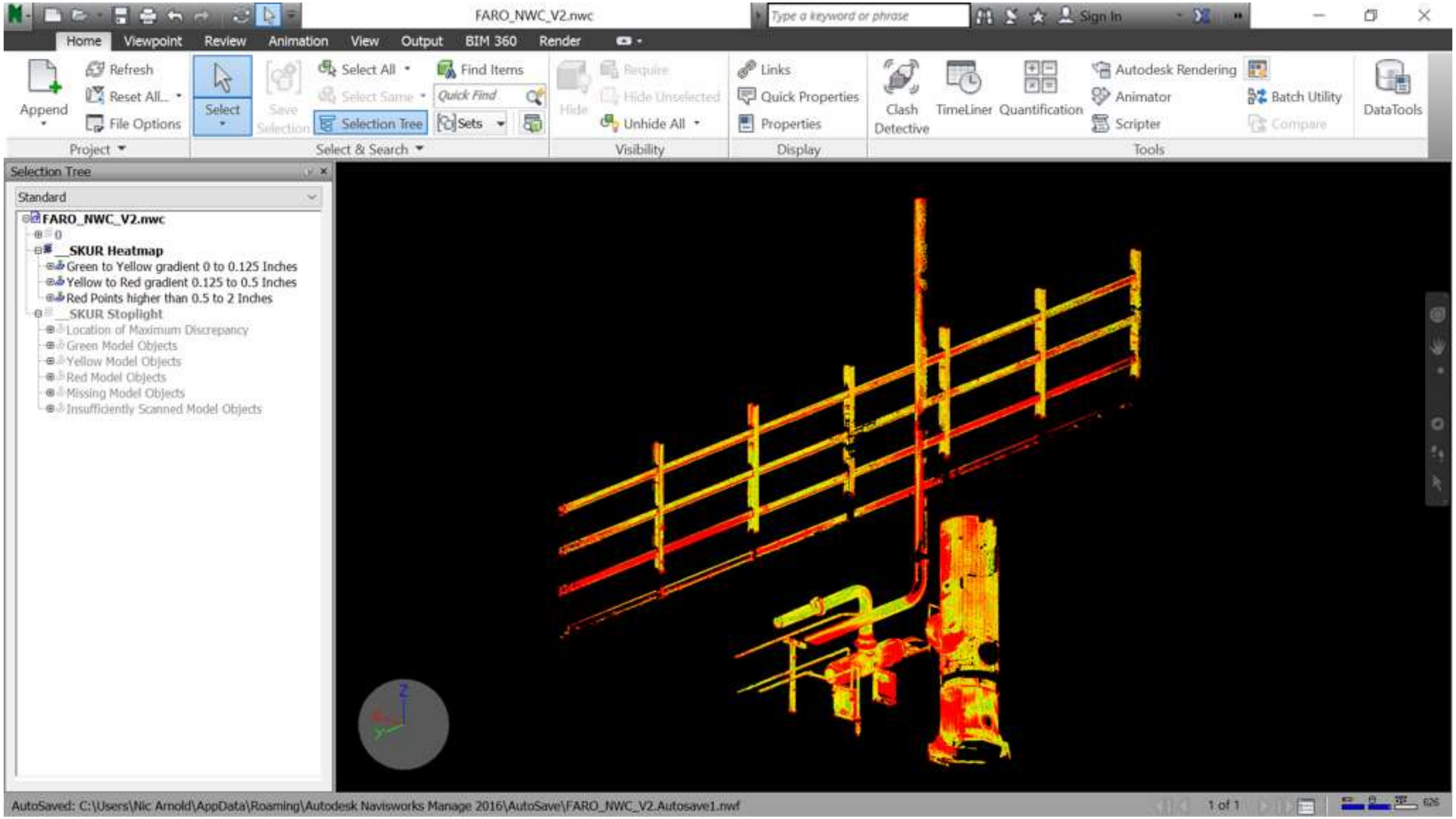
Piping & Structure – Model



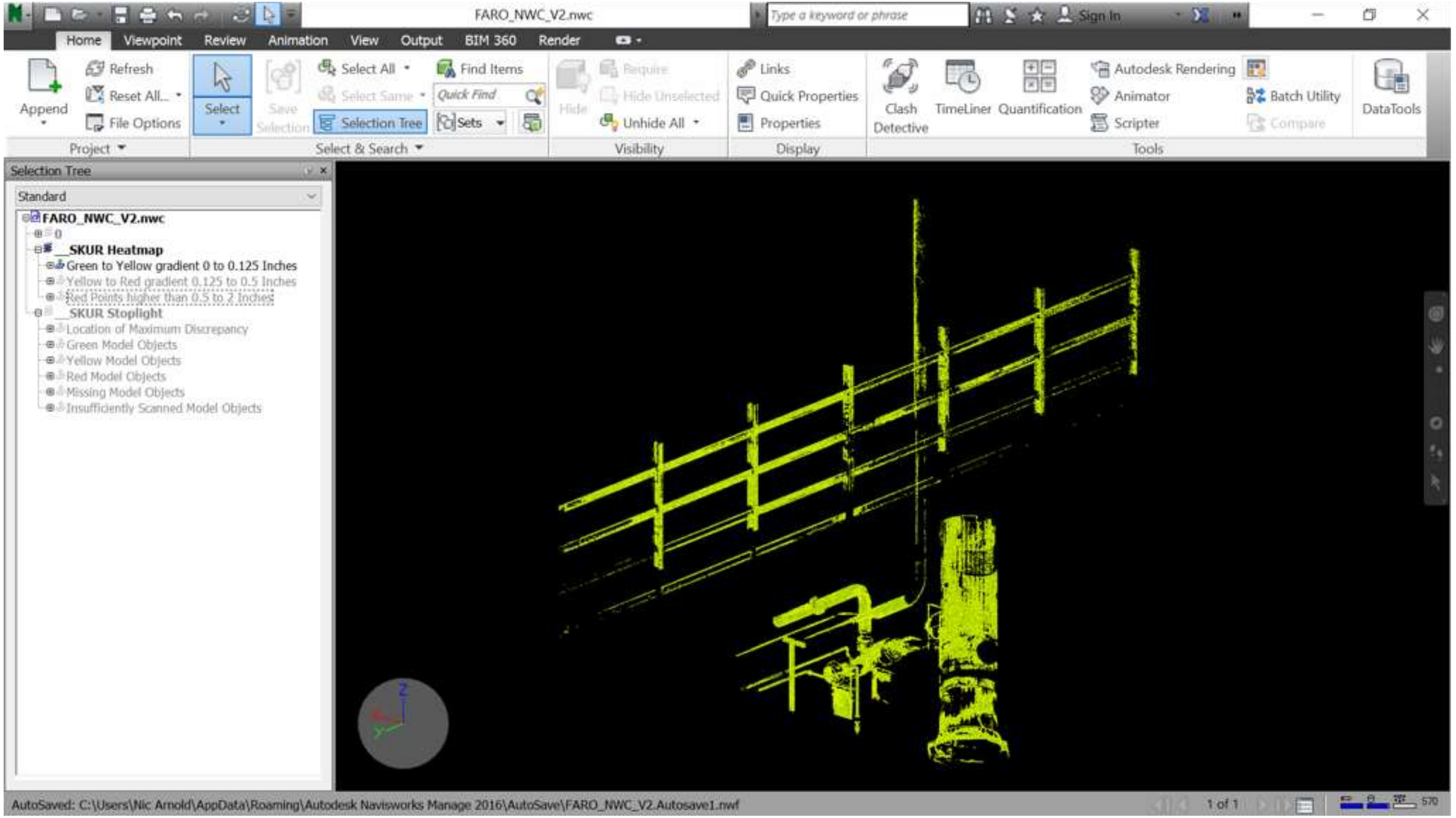
Piping & Structure – Model and Point Cloud



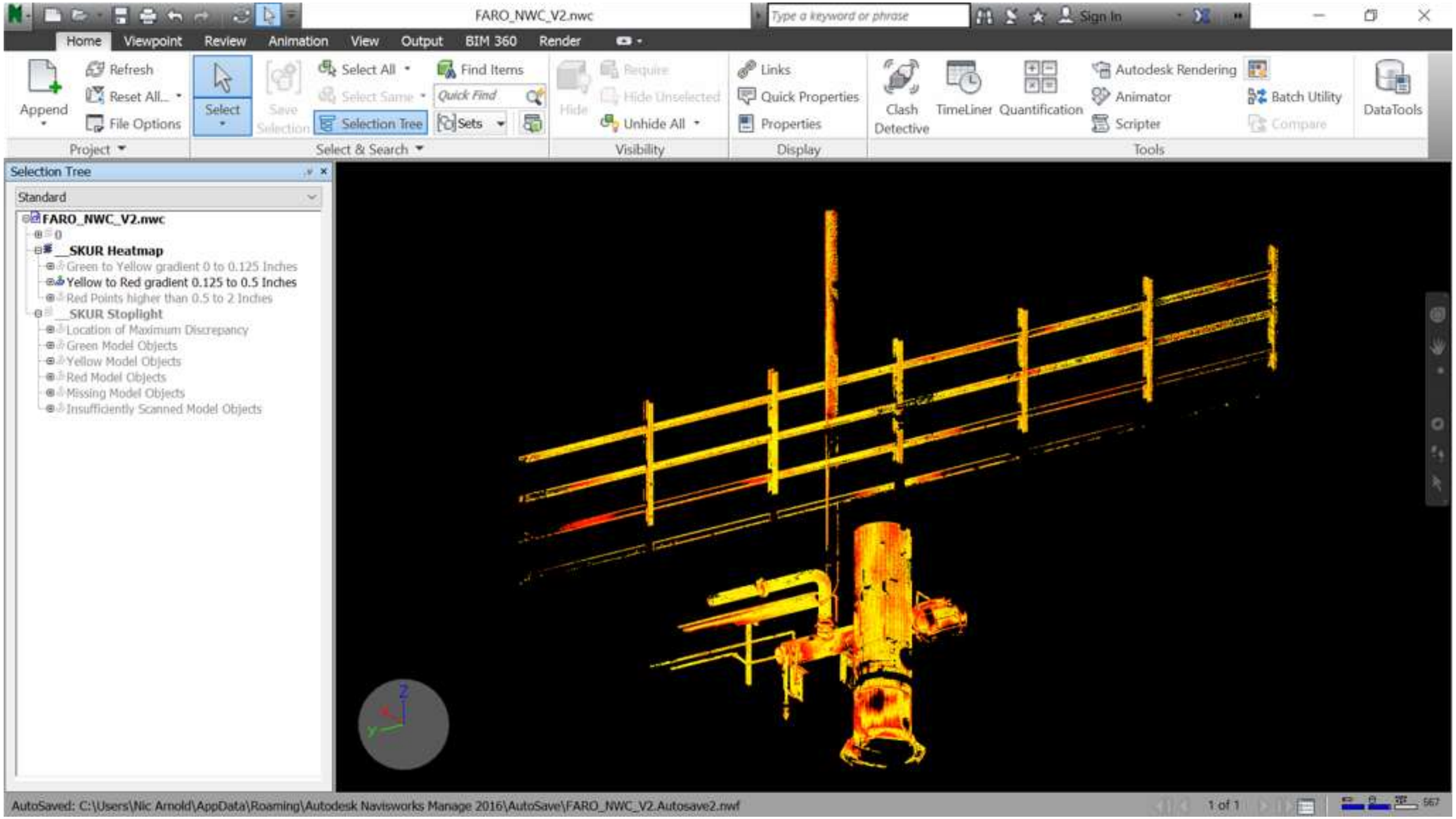
Piping & Structure – Heatmap



Piping & Structure – Filtered Heatmap



Piping & Structure – Filtered Heatmap



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