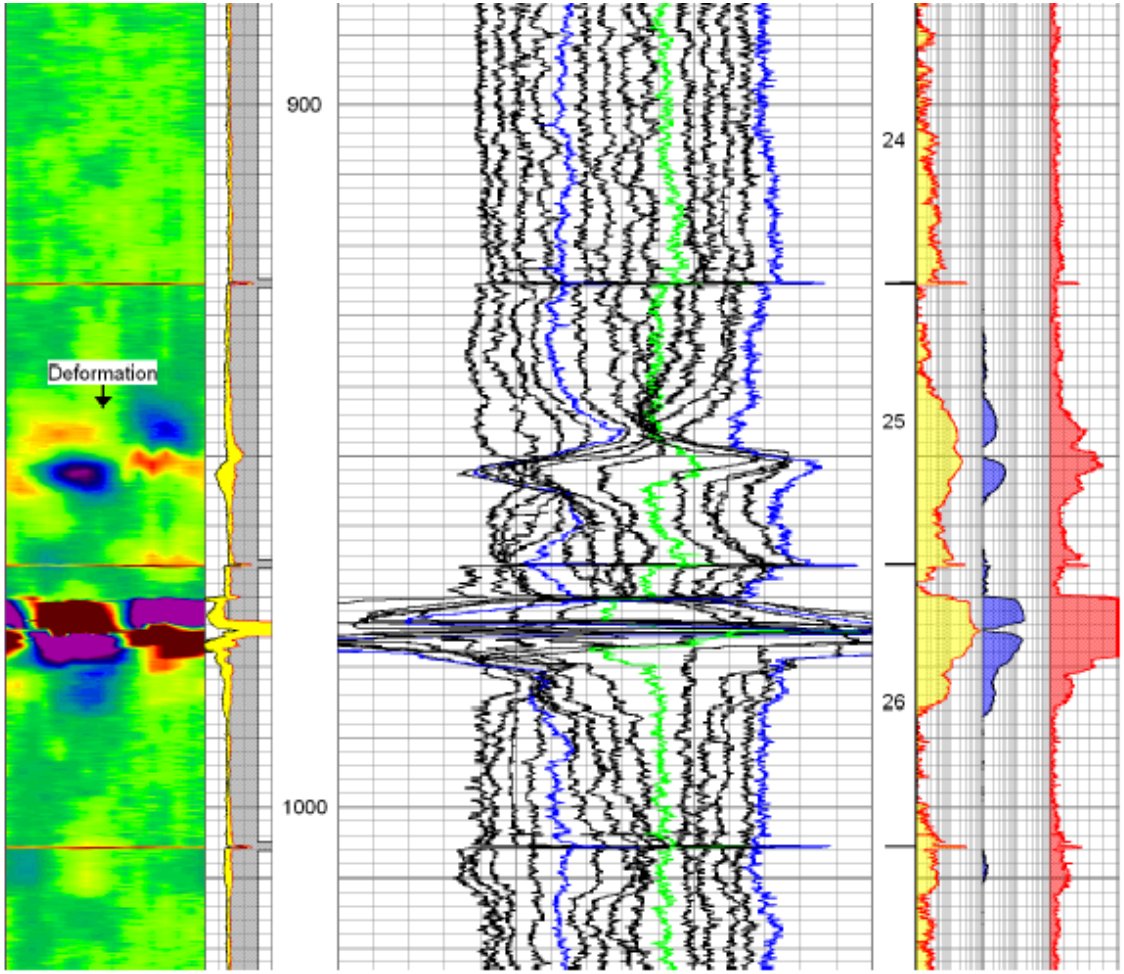
Geothermal Steam Field

Geo Steam Field P Site Well Casing Deformation

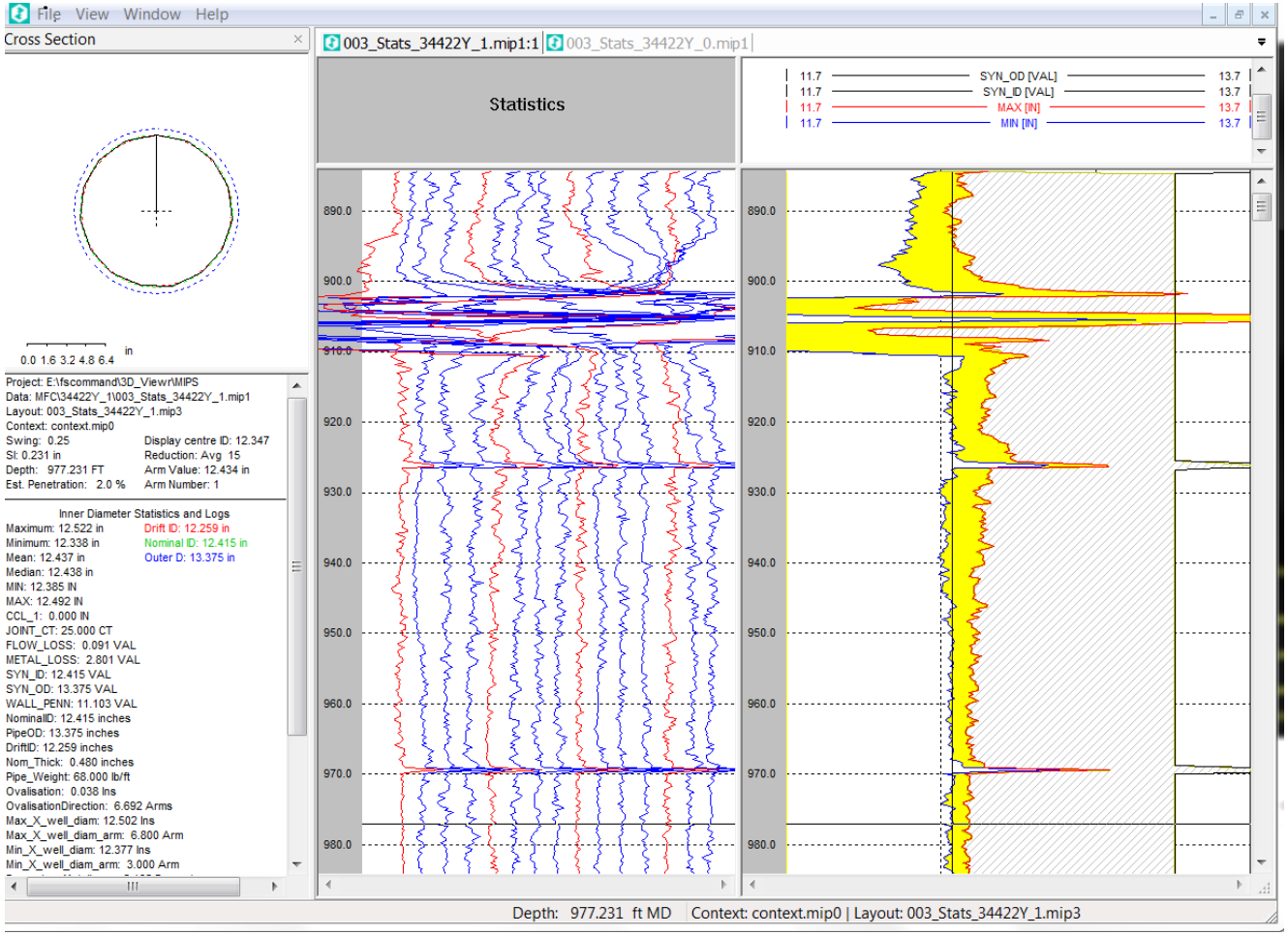
- 2014: Started a spot check on well casing conditions throughout the NCPA Field
- Most of the data did not show significant well casing issues except P Pad
- Data showed the two surveyed P site wells had deformation between 900'-1000'
- At present, the 8 production wells on P-site provide almost 1/3 of the total steam to Plant 2
- In 2015 &16 two other P Site wells were calipered and both had deformation in that same depth interval and showed well P-9 had deformed AND parted casing at 980', forcing us to discontinue injection into the well
- In 2017, other P wells were surveyed: P-1 and P-7 wells were also deformed
- The deformation of the P-7 was the most significant found to date as we were unable to get a 6" diameter ring gauge through the bad area of a 12.3" ID casing.
- At this time, the obstructed casing in P7 is not significantly diminishing the flow from the well (presently at 37kph), but any further restriction in the well bore could result in flow losses

Well P-1

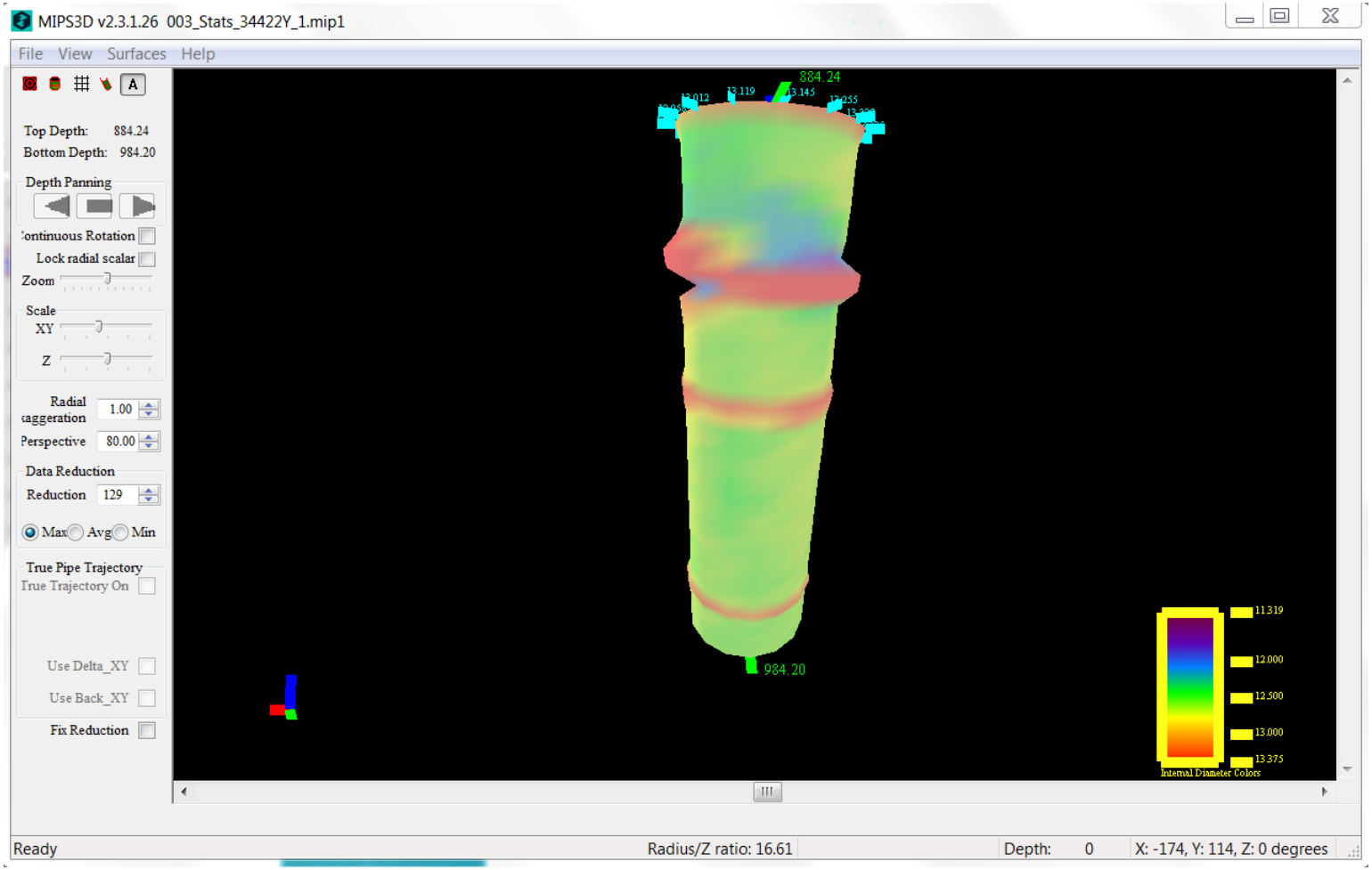


Typical casing deformation of P-site wells

Production Well P- 4, June 2016
Deformation is consistent with every well logged on P-Site

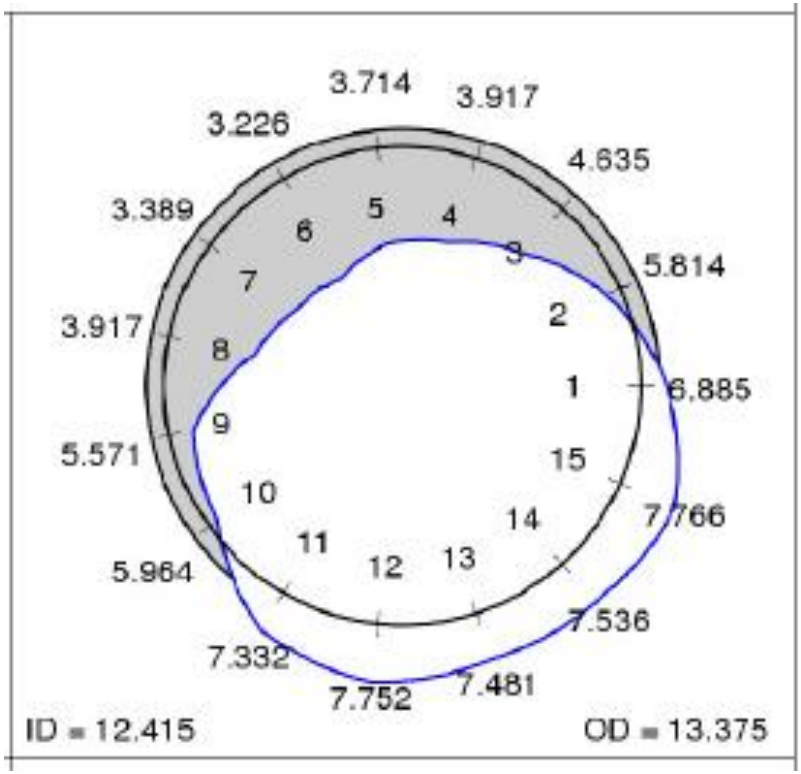


Production Well P-4, June 2016
3D Rendition of the same deformation as the previous slide

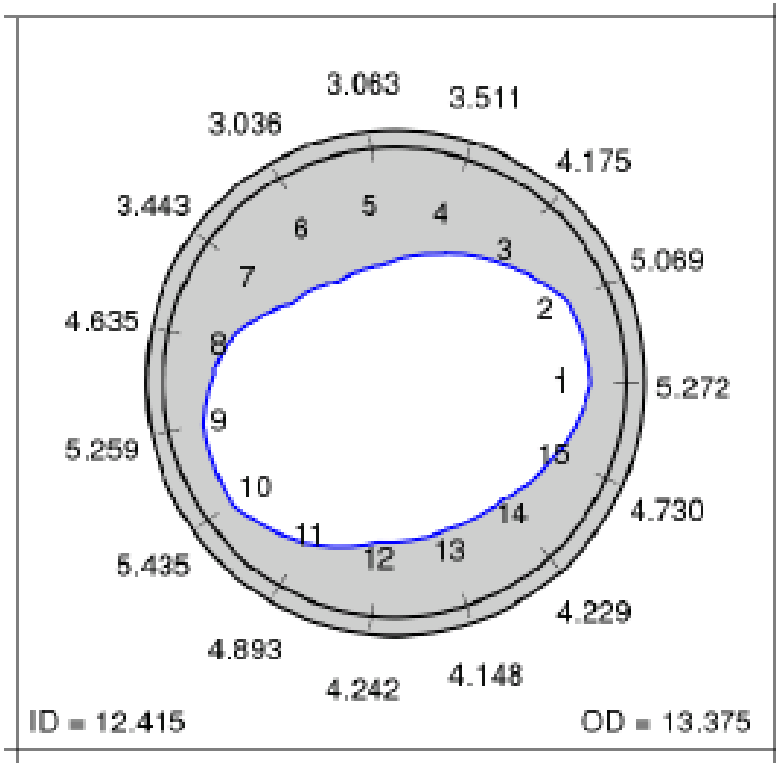


Comparison of Calculated Flow Loss in well P-4
The same deformation zone as previous two slides

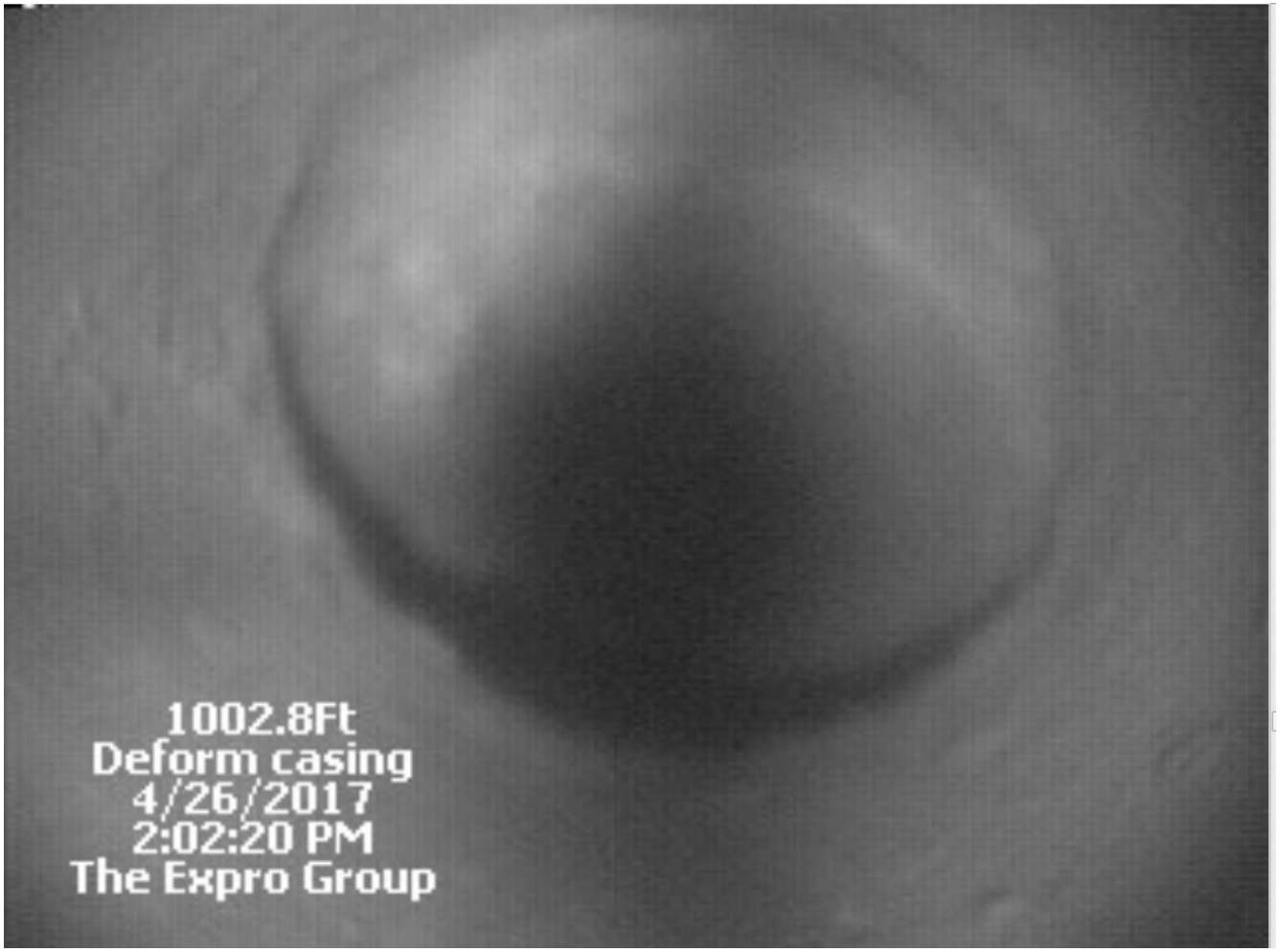
June 2016
25% Flow Loss



June 2017
49% Flow Loss



A camera was used to investigate P-1 and revealed a severe “dog-leg”. Note how far off-center the camera is pushed



Injector P9-Parted Casing

Casing Damage/Repair

- Repair for the damaged casing can be problematic: The greater the loss of minimum ID of the casing, the less likely that a repair of the original hole is possible
- Repair methods require a drilling rig, various shaped swedges and mills to attempt reopening the well bore
- If the casing can be opened up, a smaller casing would be cemented inside the existing casing establishing casing integrity- Cost~1.5million
- If that repair is not possible: We would plug the well back, mill an opening in the casing above the damaged zone and re-drill the well Cost ~ 4.5 million
- Before starting any of this work, a financial analysis for both case scenarios would be completed to determine the appropriate course of action, if any

Summary

- There are some significant casing issues with all of the wells on P site probably due to a change in rock type between 900'-1000' below the pad
- At this time, we plan on continuing to monitor the wells to be sure their casing Min IDs are not deteriorating beyond the point of repair
- If a well nears the point where we do not believe we would be able to repair it, a financial analysis for the repair vs. loss of flow and probability of success would be prepared for this committee to review and determine the best course of action