

# A Mine Mill Shell Weld Inspection



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Client	A Mining company	A Mine
Inspection Date		07/07/2020
Order Number		



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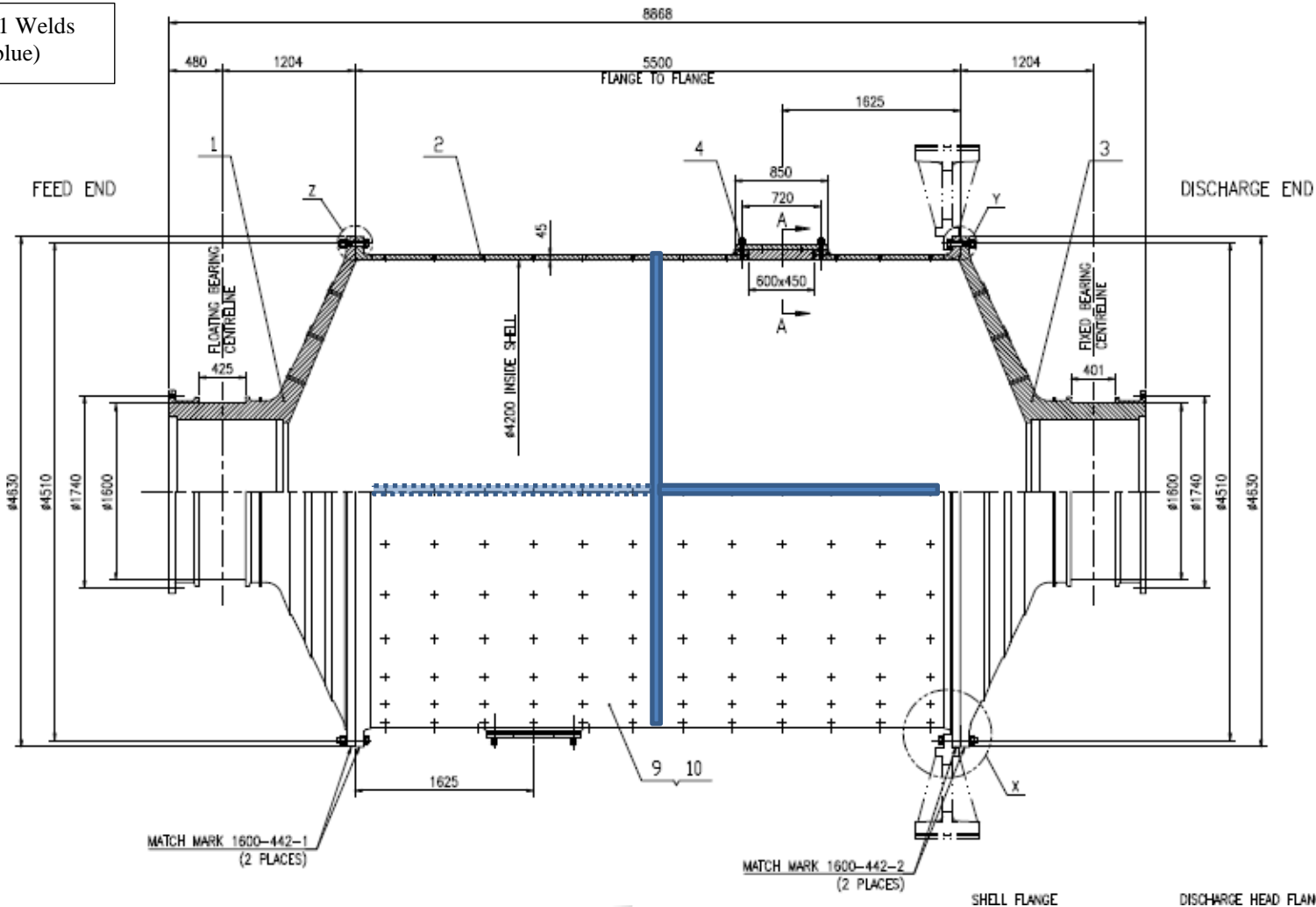
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# 1. Scope:

- a) Inspect Mill shell and central circumferential weld using eddy current array.
- b) Inspect axial welds on the feed and discharge ends of the shell using eddy current array.

Fig 1 Welds  
(in blue)



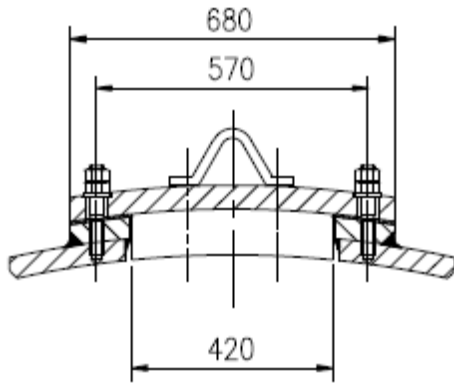
## Method:

Eddy current array inspection was carried out using a 053 Sharck eddy current array probe weld inspection probe. The mill shell paint remained in place for this inspection. The welds were inspected in lengths of around 1500mm with a maximum span of 2000 mm. The central circumferential weld was inspected over 10 contiguous inspection runs. The axial welds which are 180 degrees apart were each done in contiguous runs of approximately 1400 mm runs.

The welds around the hatches in the shell were requested to be inspected, however, the detail in the drawing provided (section A-A) shows that the shell plate continues below the stiffening / compensation plate that is welded to the shell surface.

SECTION A-A

1:12.5



## 2. Results:

Eddy current array signals display indicate a number of anomalies – some are apparent even with the paint in place. The exact nature of the anomalies cannot be determined from this inspection.

The stress intensity of the shell cylinder is unknown, however, based on studies done on other mill designs – it is likely to be very low in comparison to the endurance limit of the material.

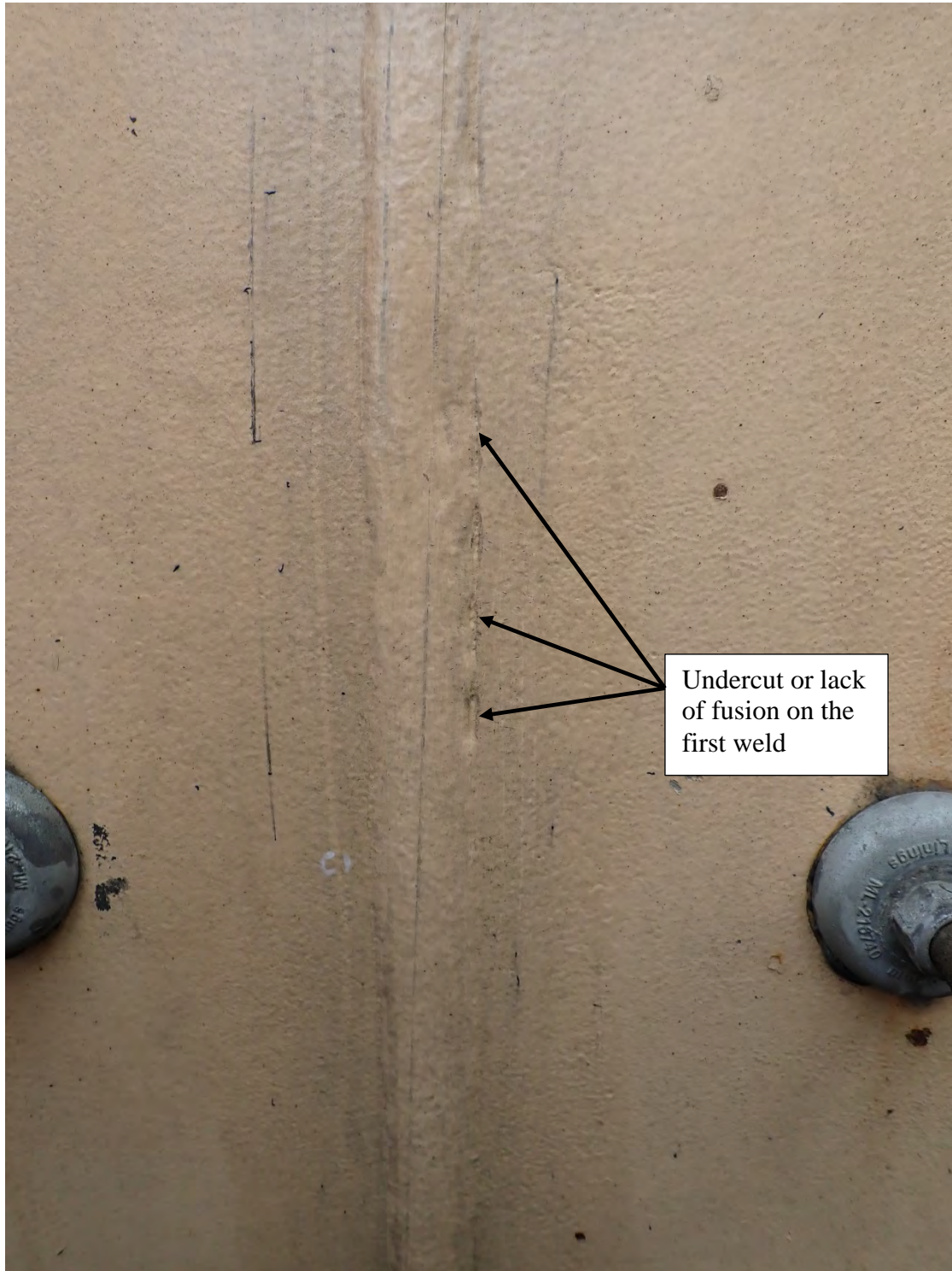
The Australian welding standard for structures subject to high levels of fatigue loading is AS 1554 part 5.

Table 6.1.2 in the Welding standard **AS 1554 Part 5** gives the following on the permissible levels of imperfections in butt welds as determined by visual and magnetic particle examination of the weld zone:

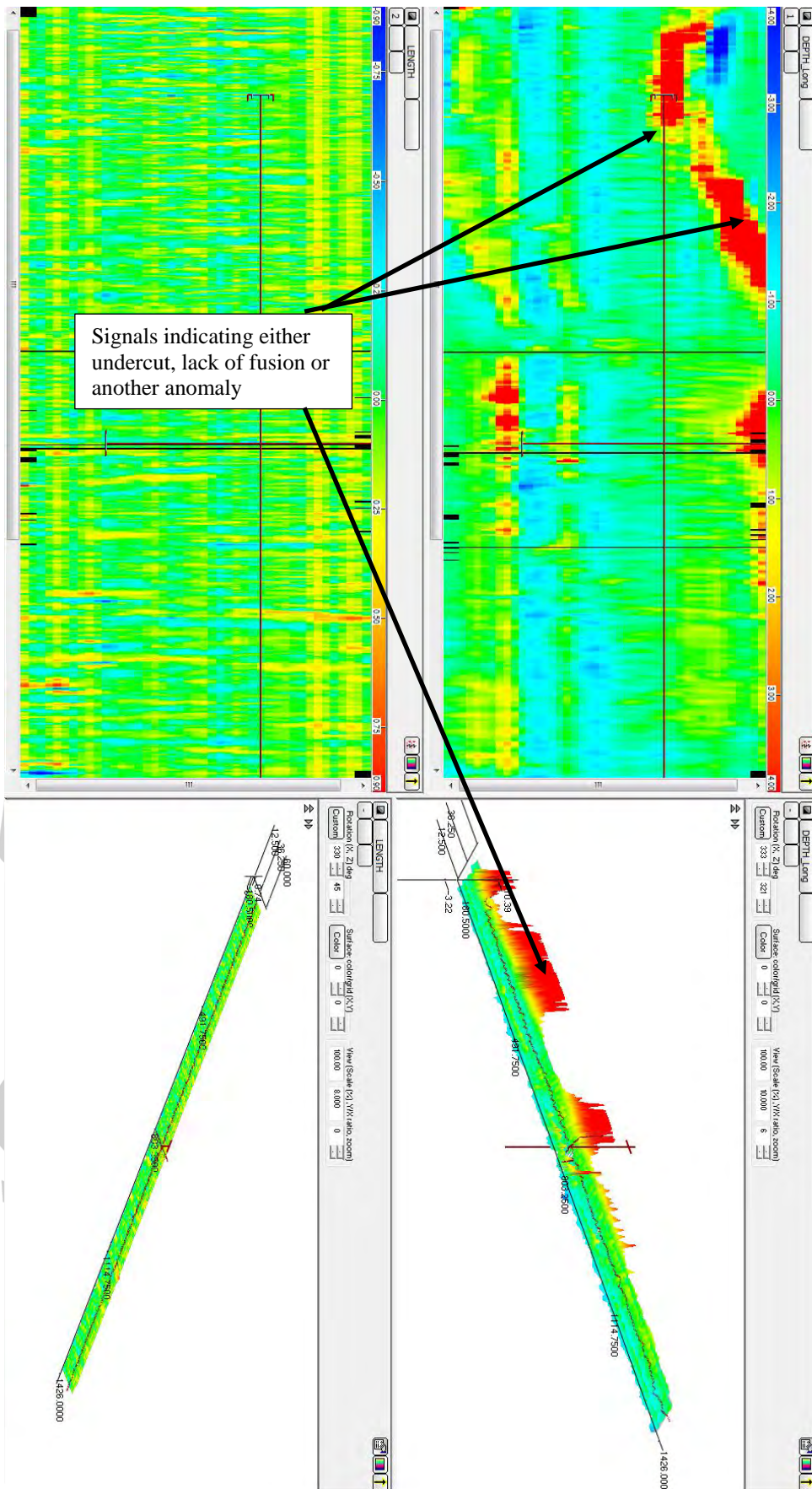
Cracks:	Not allowed
Lack of fusion or incomplete penetration:	Not allowed
Undercut – continuous:	Not allowed
Undercut intermittent:	Not allowed
Shrinkage grooves	
Root concavity:	Not allowed
Overlap:	Not allowed
Toe shape:	Smoothly blended
Surface pores:	Not allowed

### Recommendations:

AS 1554 part 5 is very onerous as it assumes both high fatigue cycles and high loading. Mill shells in general terms are not highly stressed; however, as a risk mitigation measure; a visual inspection and removal of stress concentrating features by hand grinding should be carried out.



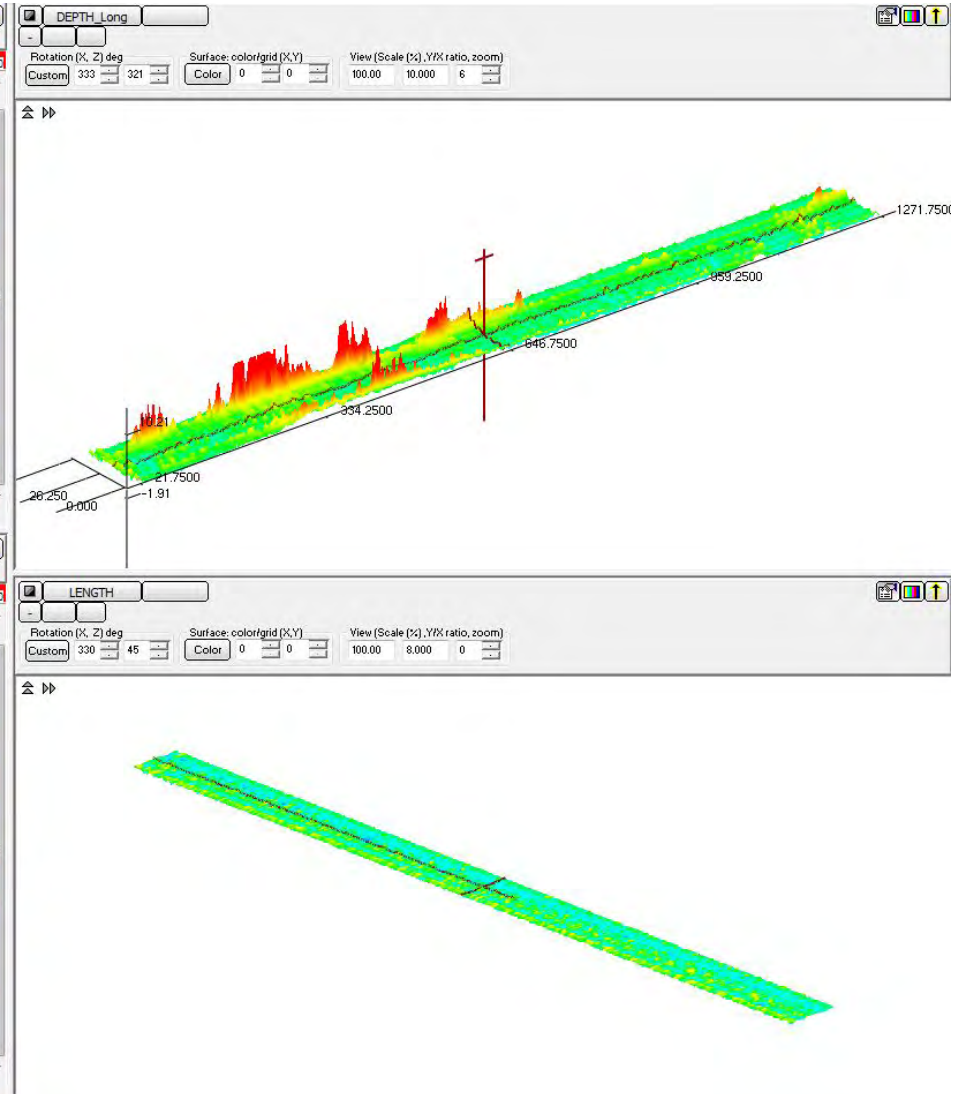
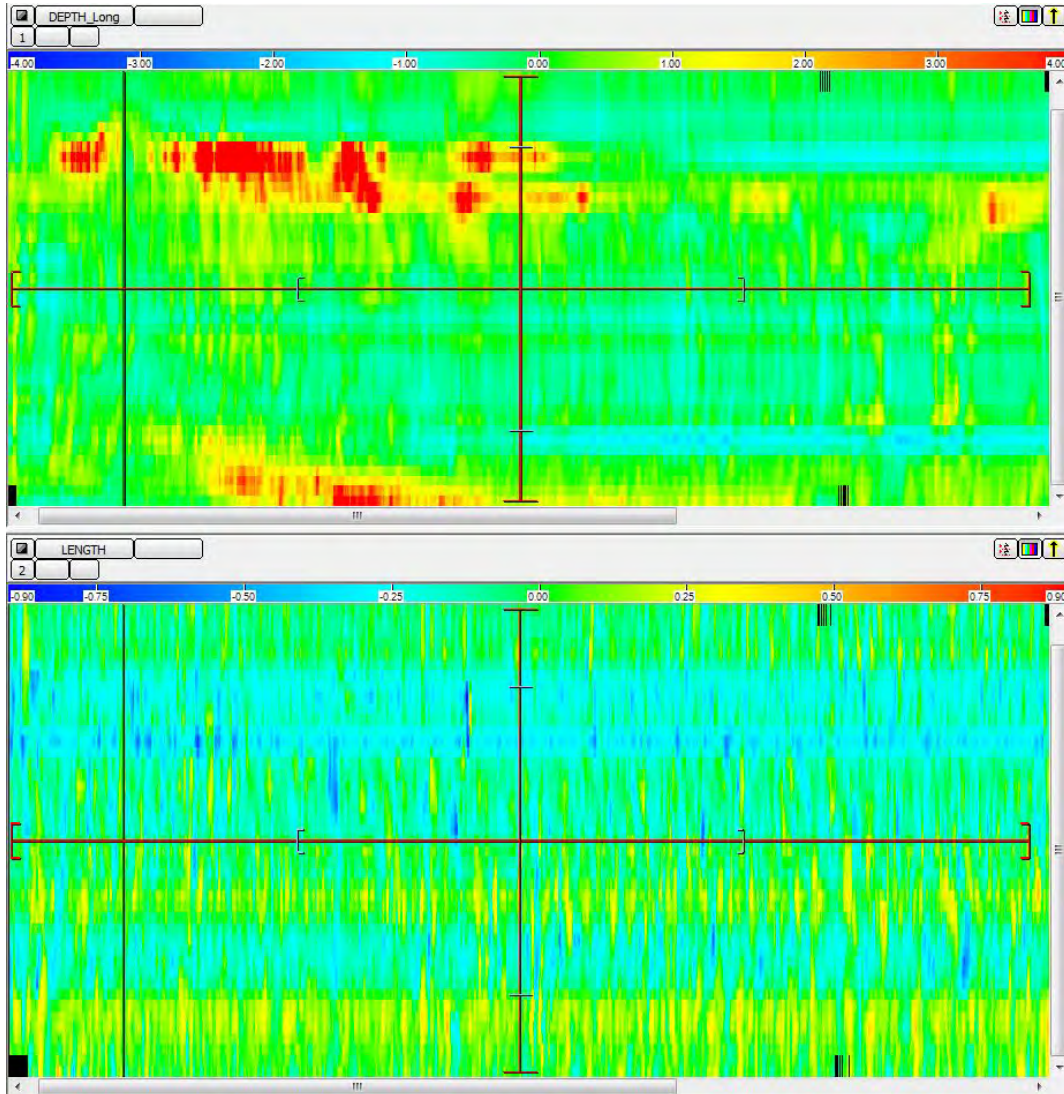
First circumferential weld section



Eddy current signal associated with the first Section of circumferential weld.



Axial weld feed end 1<sup>st</sup> run

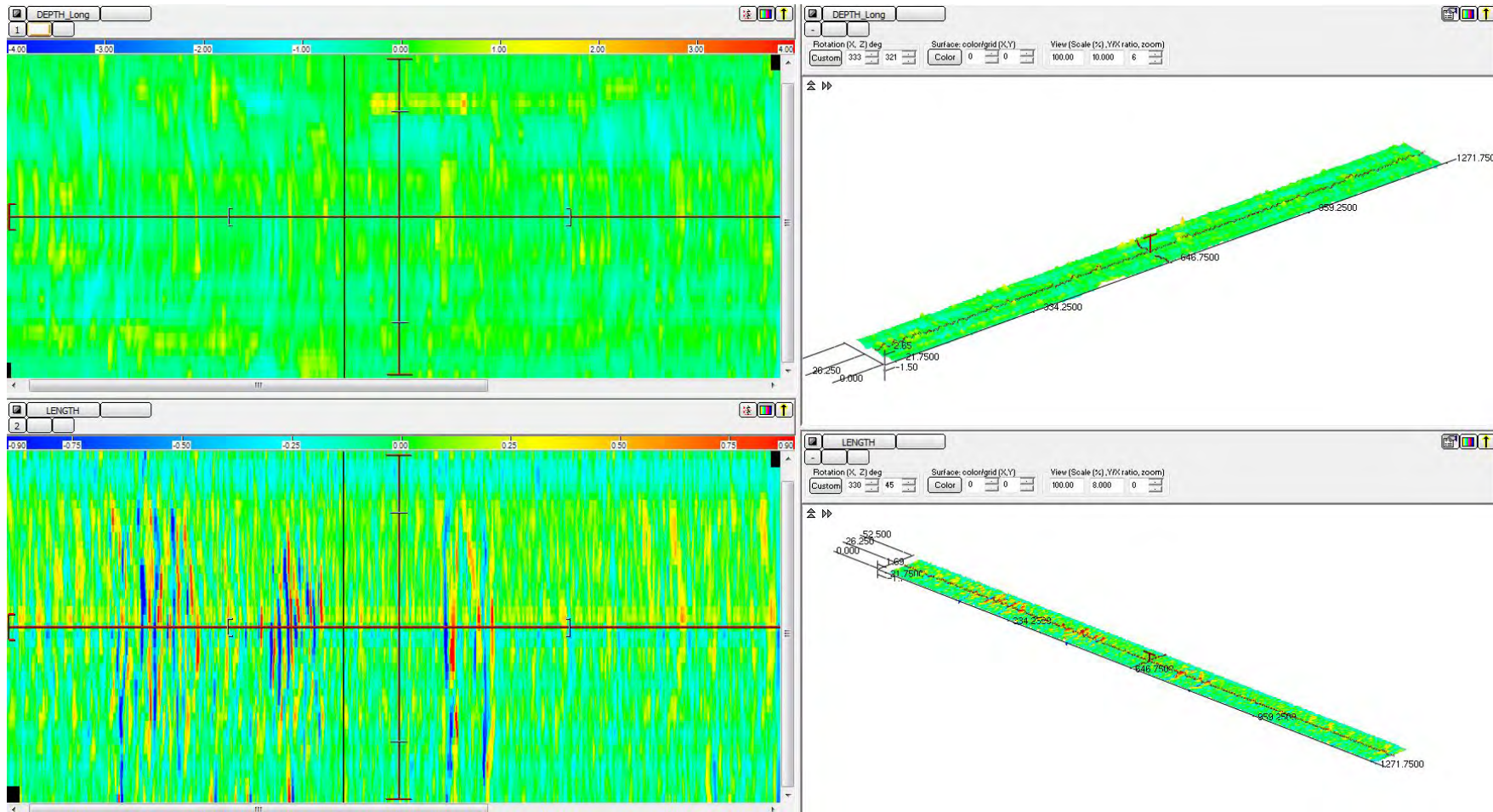


Axial Feed weld eddy current signal 1<sup>st</sup> run

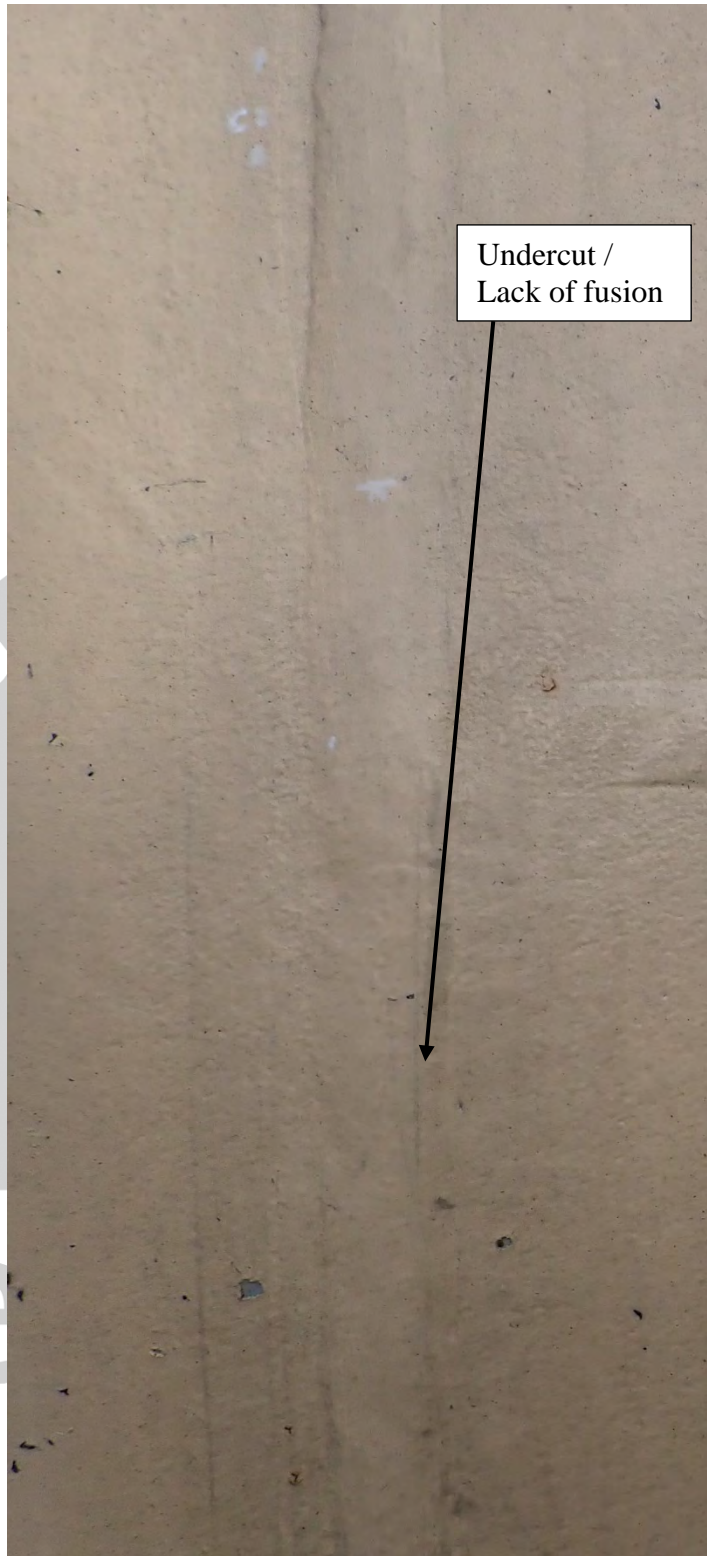




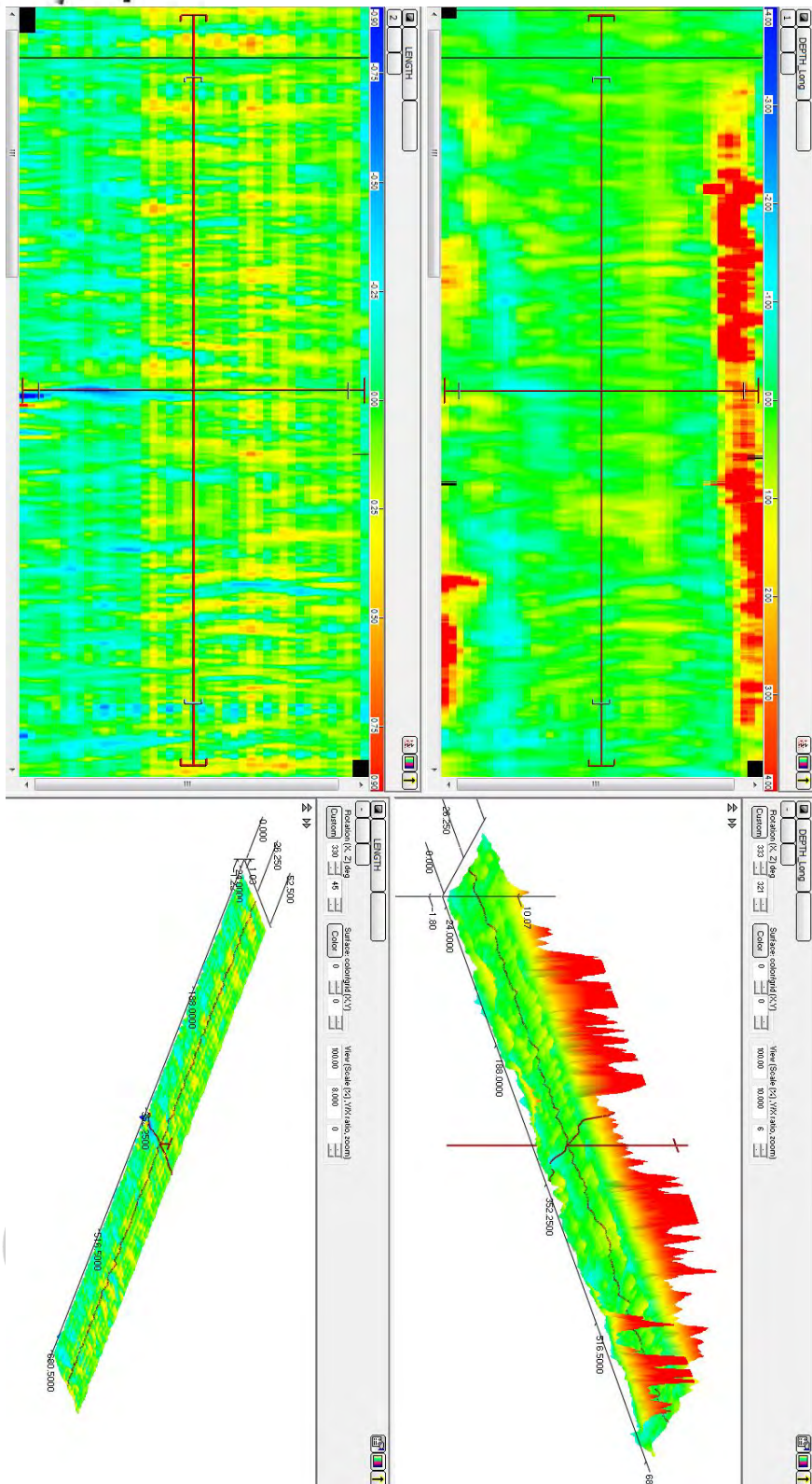
Axial weld feed end run 2



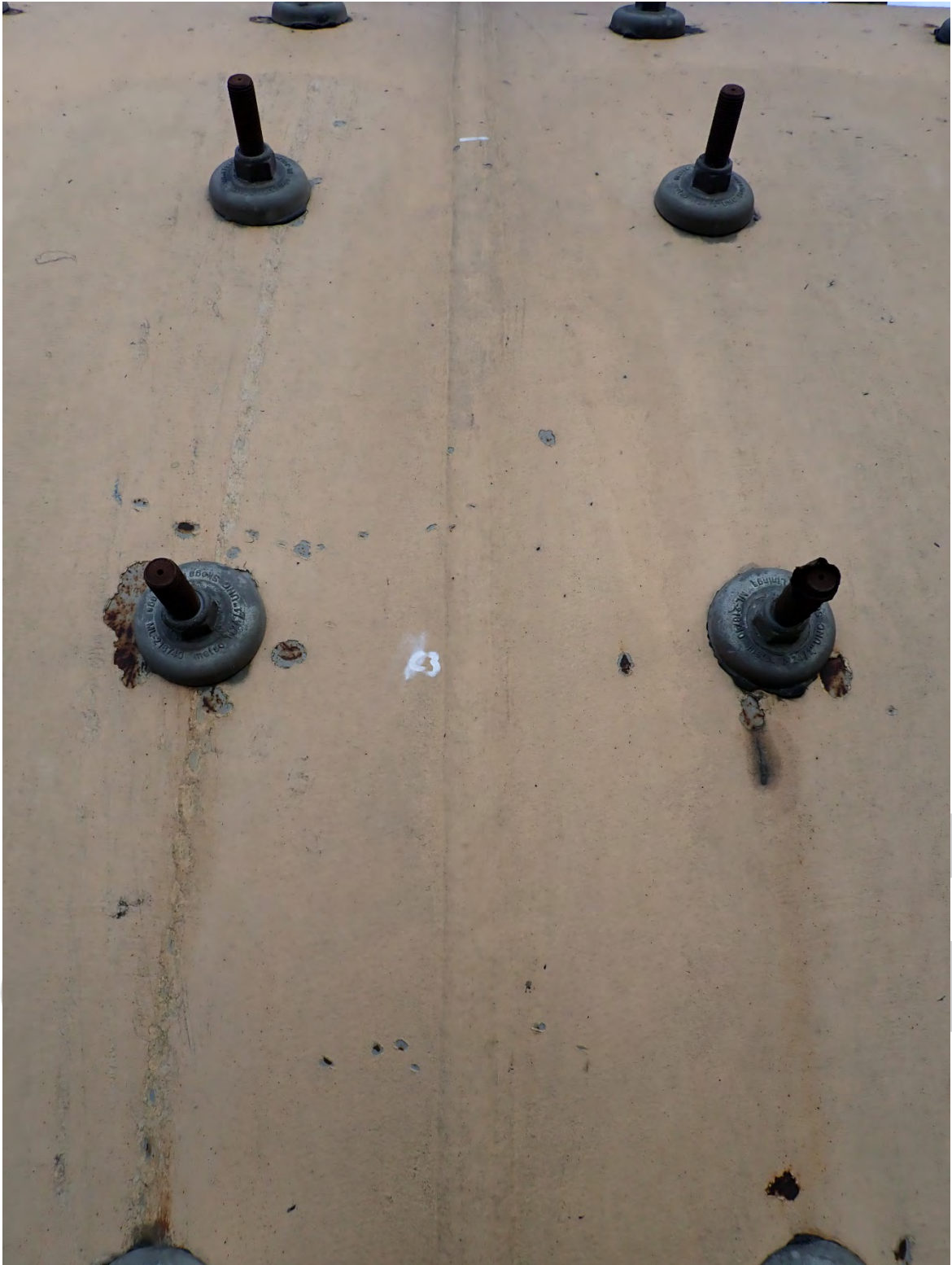
Eddy current signal of axial feed end weld run 2 – the weld looks clean and only appears to have some weld pattern grooves



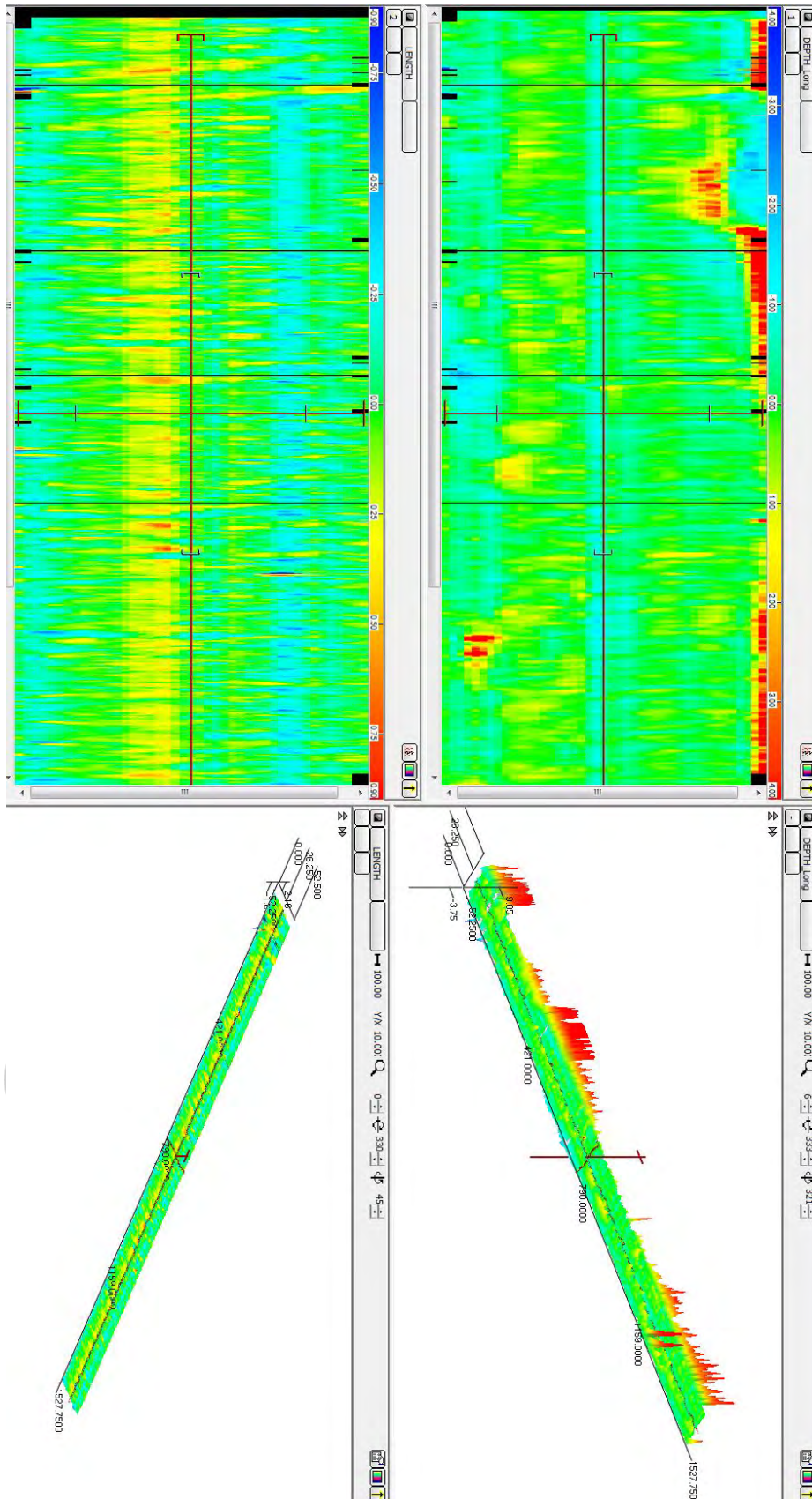
Circumferential weld 2



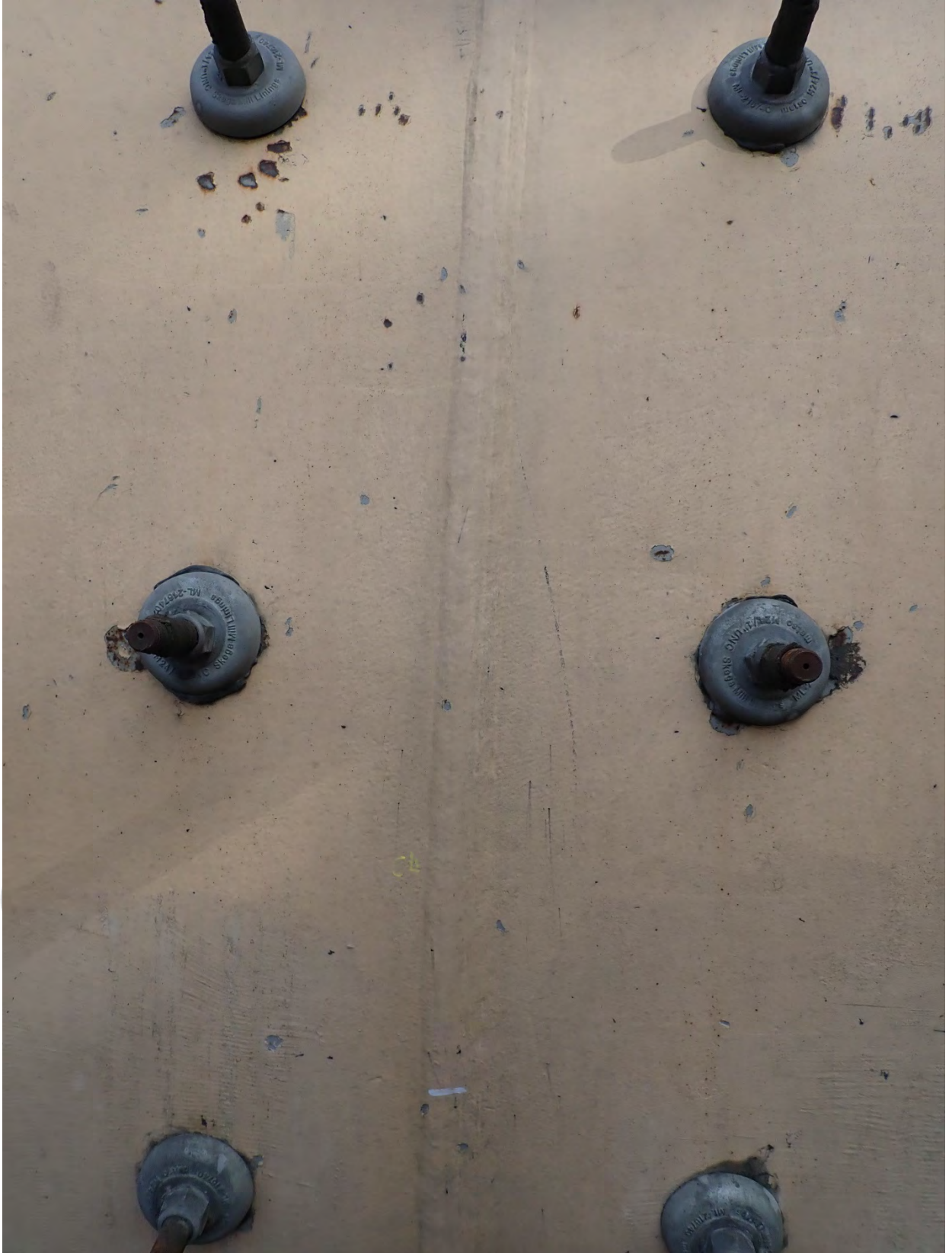
Eddy current array signal associated with the Circumferential weld 2



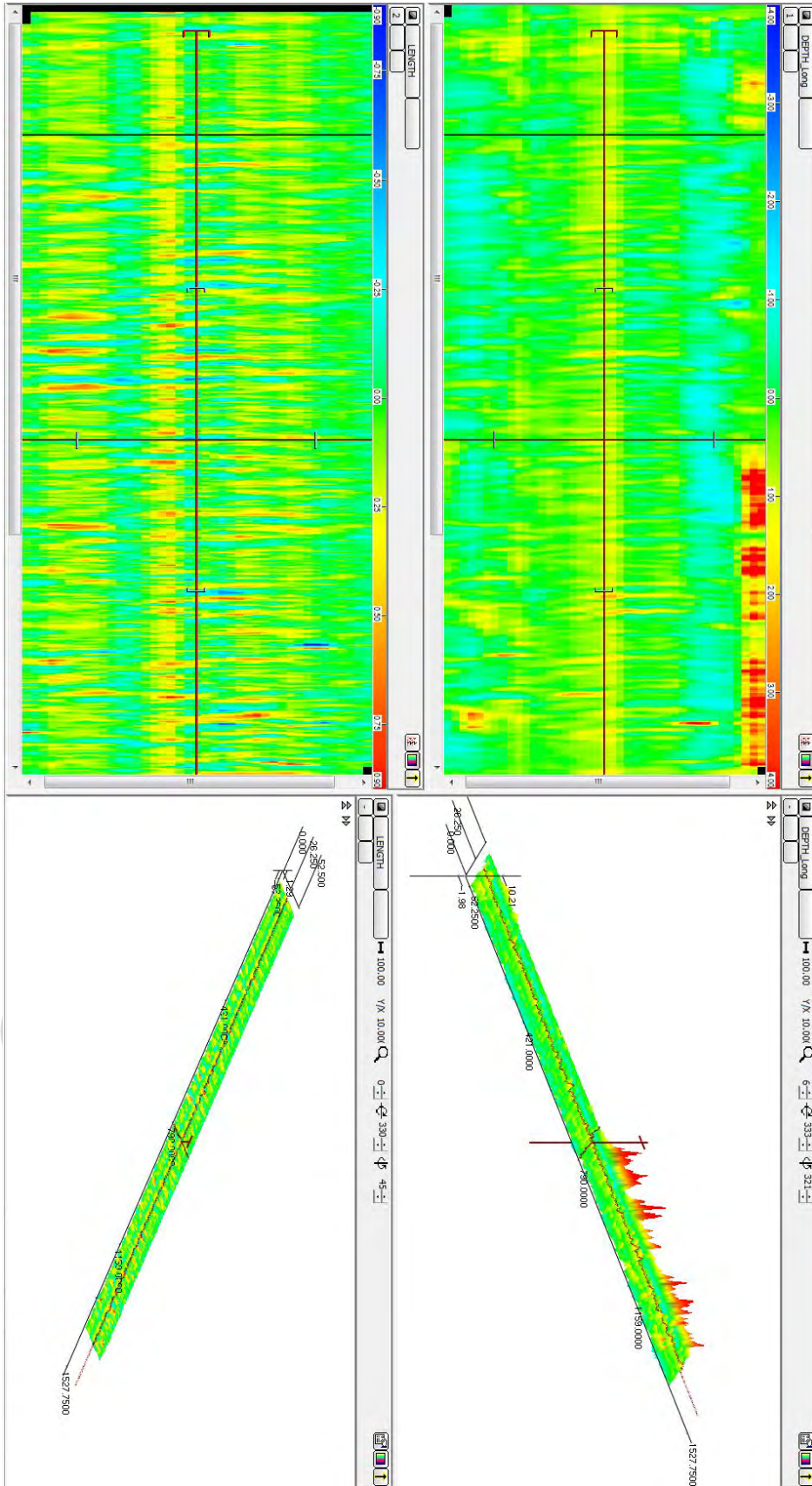
Circumferential weld 3



Eddy current signal associated with circumferential weld 3



Circumferential weld section 4

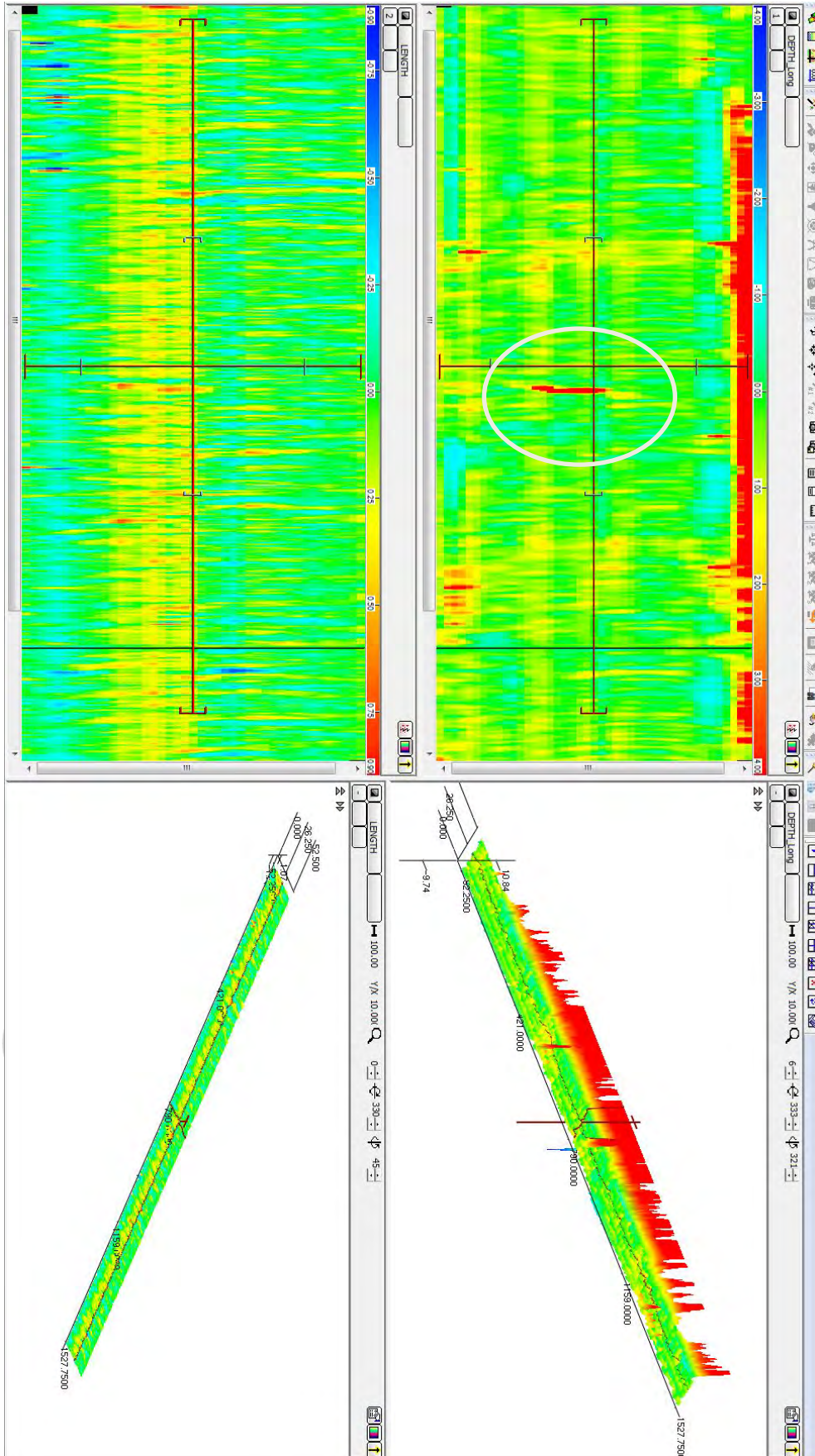




Eddy current array signal associated with weld section C4



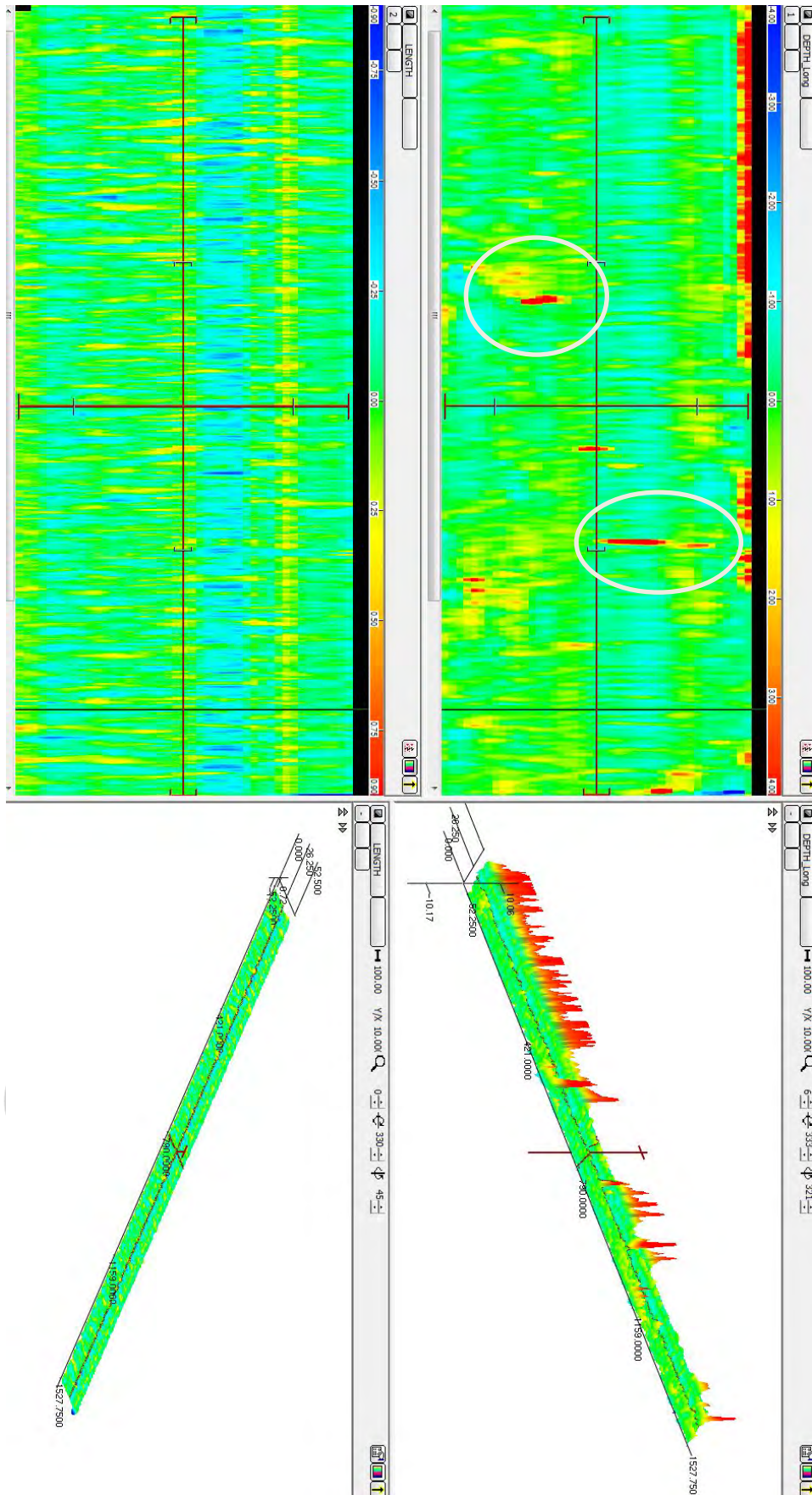
An indication at 825mm into the weld run



Eddy current array signal associated with circumferential weld run 5  
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Circumferential weld run 6

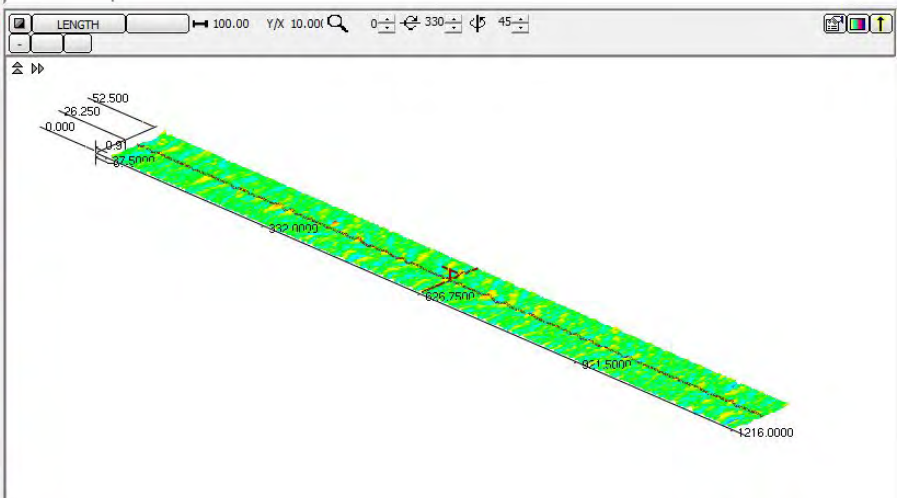
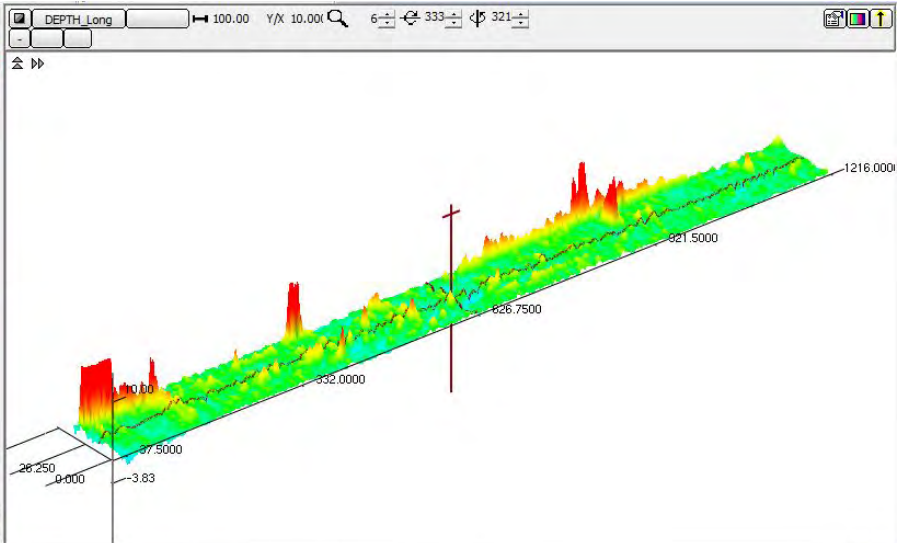
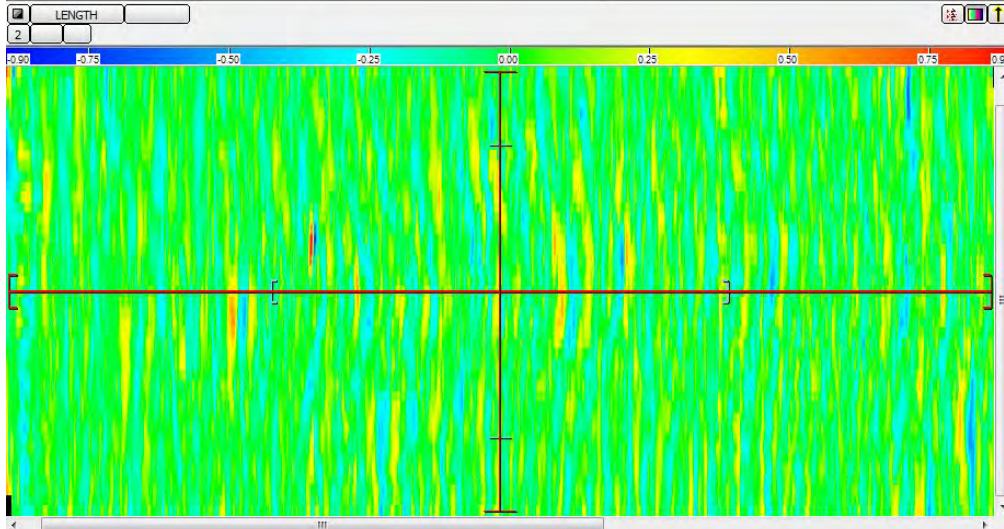
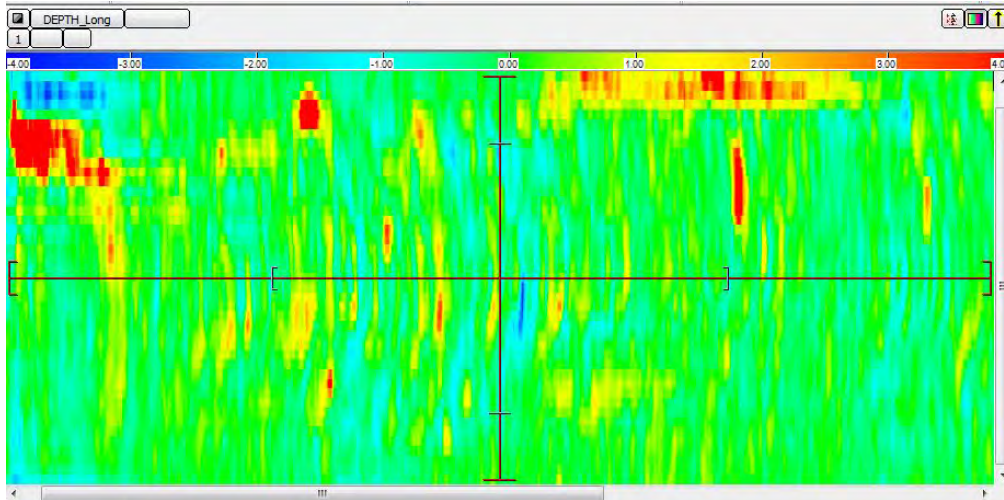


Eddy current array signal associated with circumferential weld inspection run 6





Axial weld discharge end

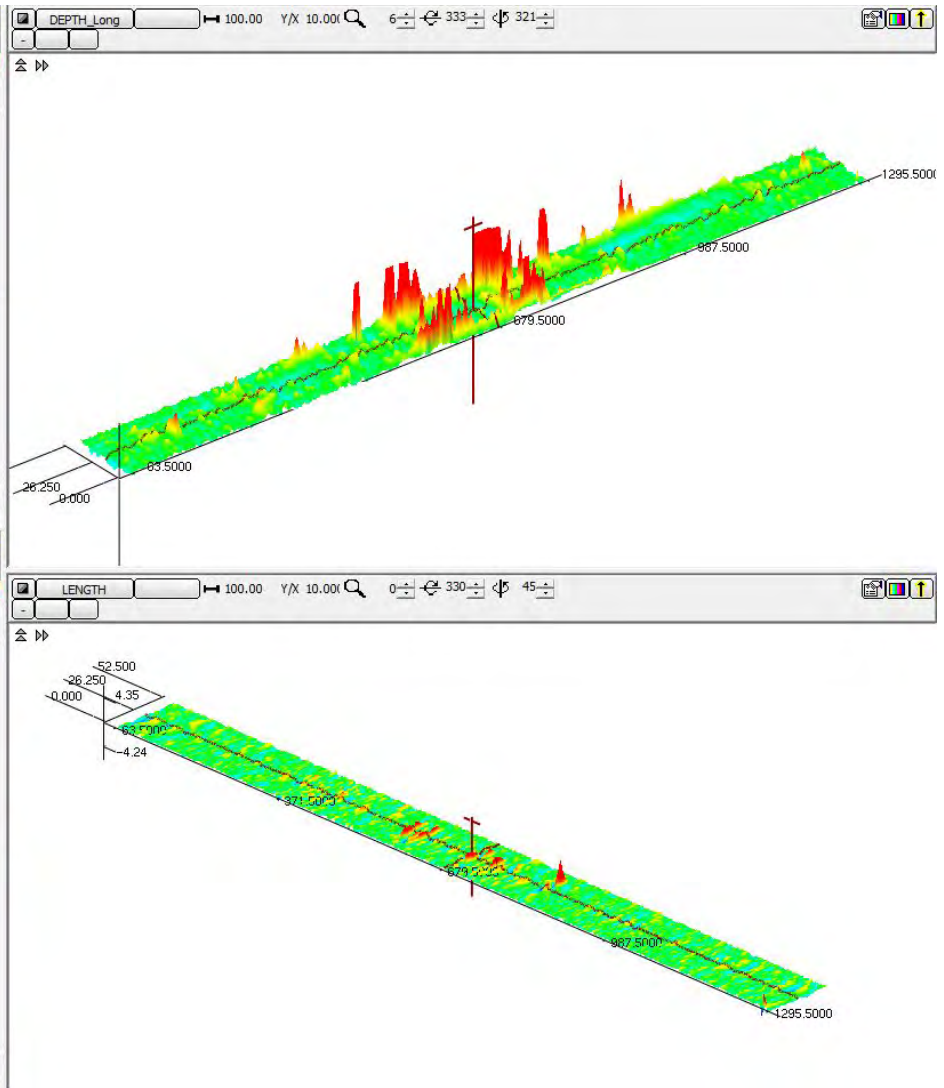
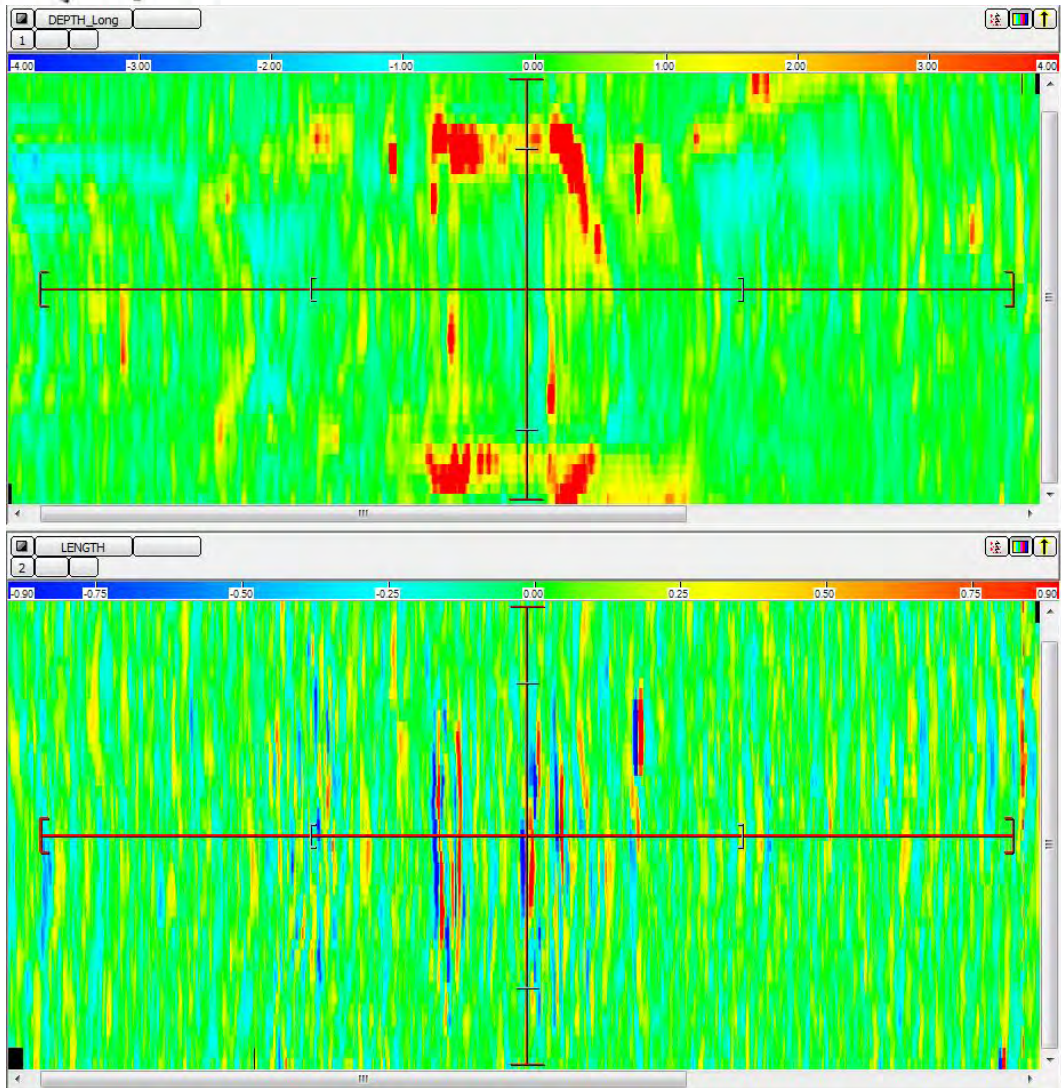


Eddy current signal – reversed from the photo above will change scan direction in future for consistency.



Axial weld discharge end 2<sup>nd</sup> run

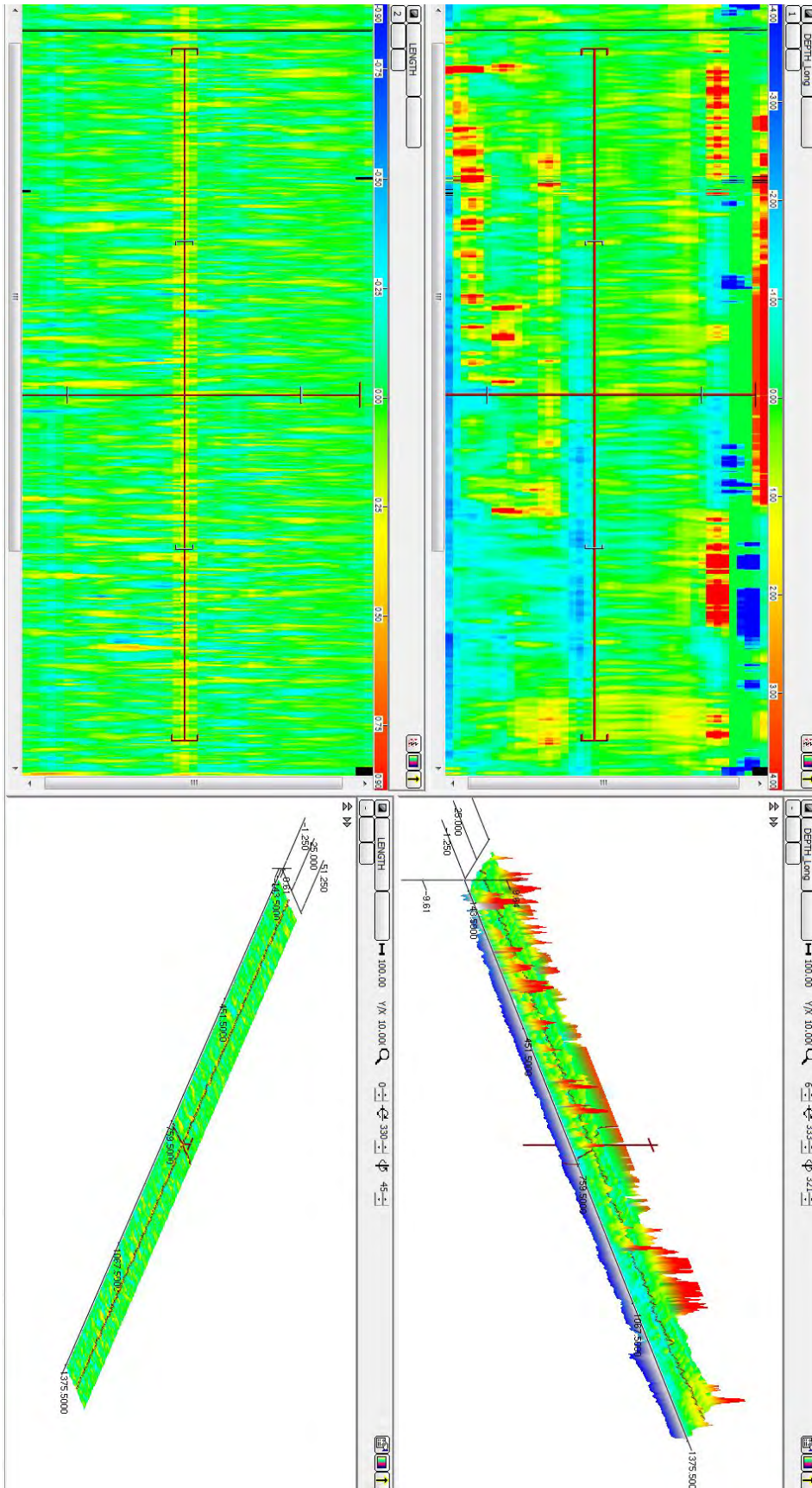




Eddy current signal associated with the weld at the discharge end of the mill.



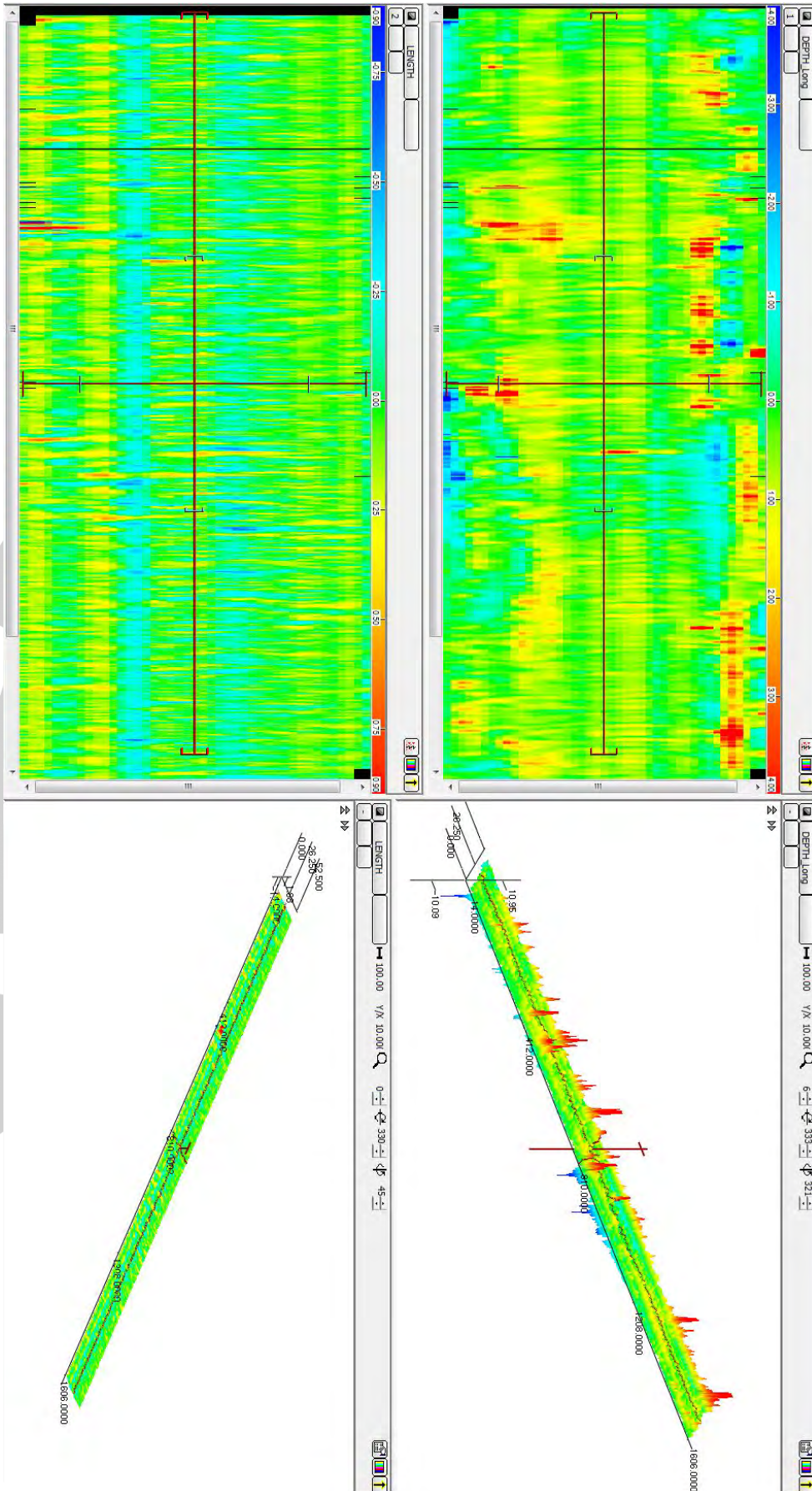
Circumferential weld inspection run 7



Eddy current signal associated with inspection run 7



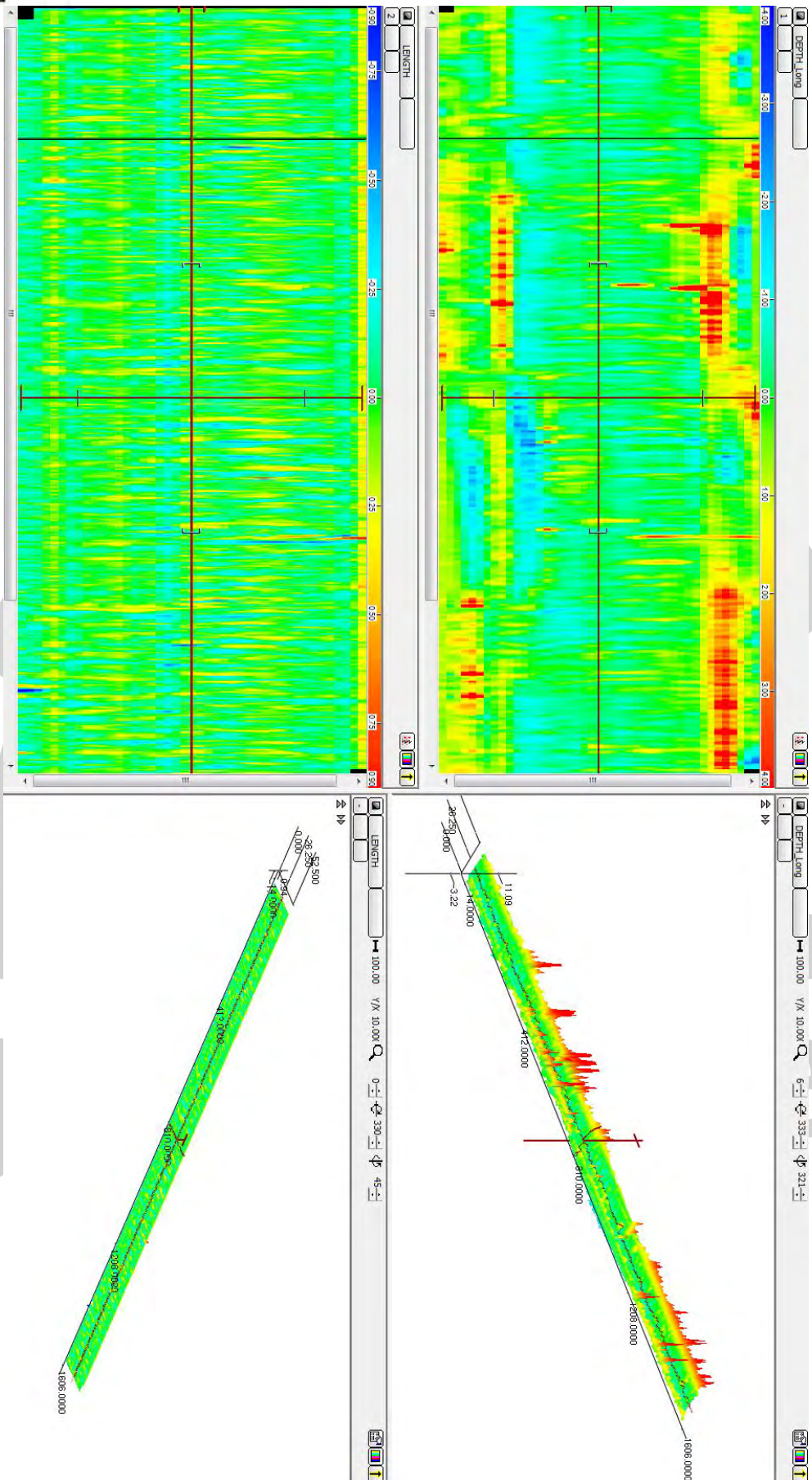
Circumferential weld at inspection run 8



Circumferential weld inspection run 8



Circumferential weld inspection run 9

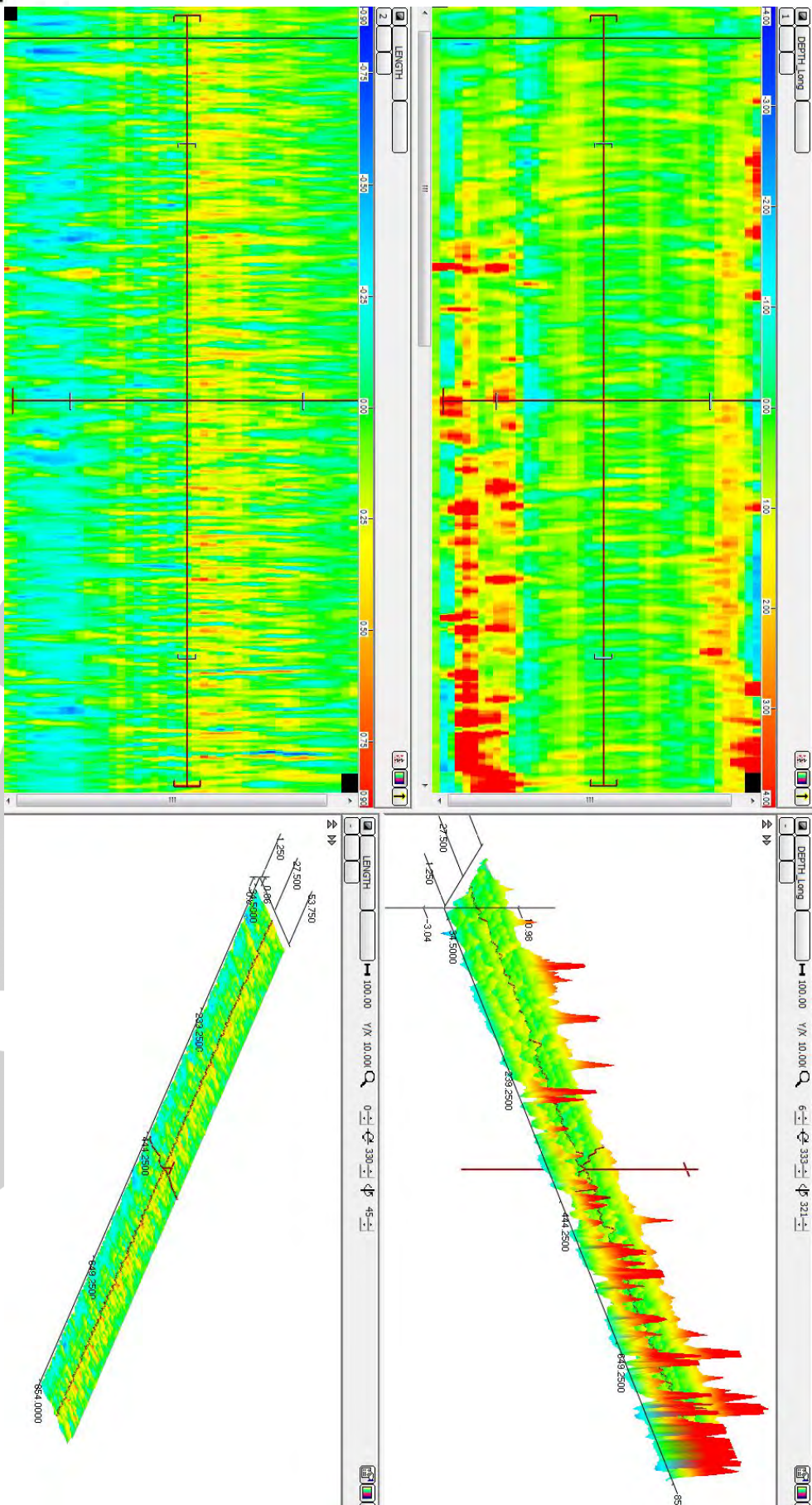


Eddy current signal showing some anomalies



Weld inspection run 10





Some anomalies at the beginning of the inspection.