TDA flexure to fiber gap margin and interference problem Trade Study notes

Introduction - Michael Amato 10/18/03

Trade study notes, this is intended to document some summary information until a better trade study document can be created

What follows is a summary presentation from the lead mechanical engineer showing the problem and the chosen solutions to the problems and the status at the time

Other solutions were considered for the gap margin– moving all flexures changes all the detector designs which had started fab and required new analysis. - tapering many flexures might actually done in a few locations but was unneeded everywhere considering we had to do more anyway to create the required gap of no less than 5 mm. – Titanium flexures did shrink the flexures creating more gap but violated attenuation and mass

For the lower tile interference composite blade flexures where considered but were still large and required lots of time to design, analysis and test. There was no room to just move the flexures. Titanium down here had much lower attenuation issues and eventually passed the deorbit degradation req.

See summary that follows

Anti-Coincidence Detector

Tile Detector Assembly (TDA)
to
Tile Shell Assembly (TSA)
Mounting Issues –

Report to SLAC on Nov. 18, 2003

By

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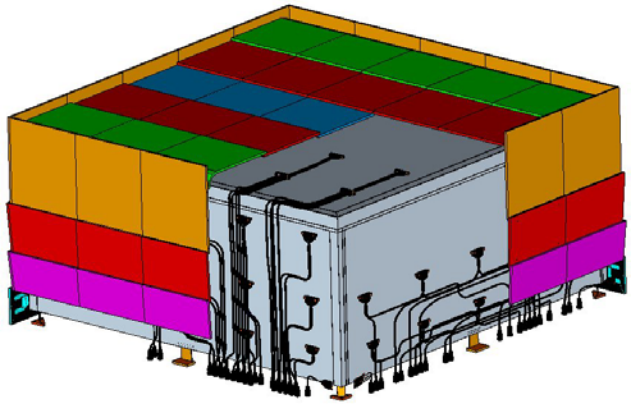
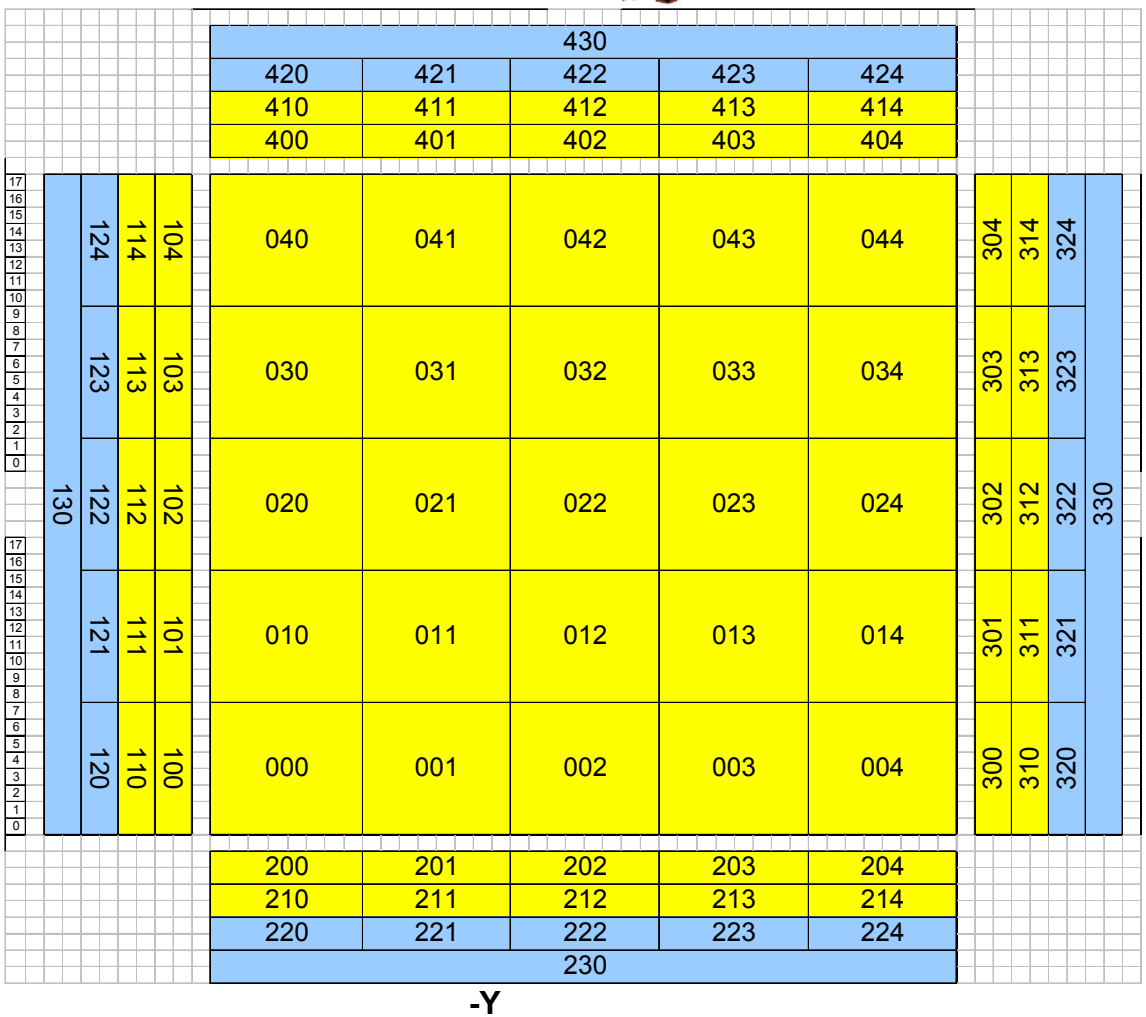
TDA- TSA Mount Issues Outlined



- ***TDA to TSA Mounting Issues***

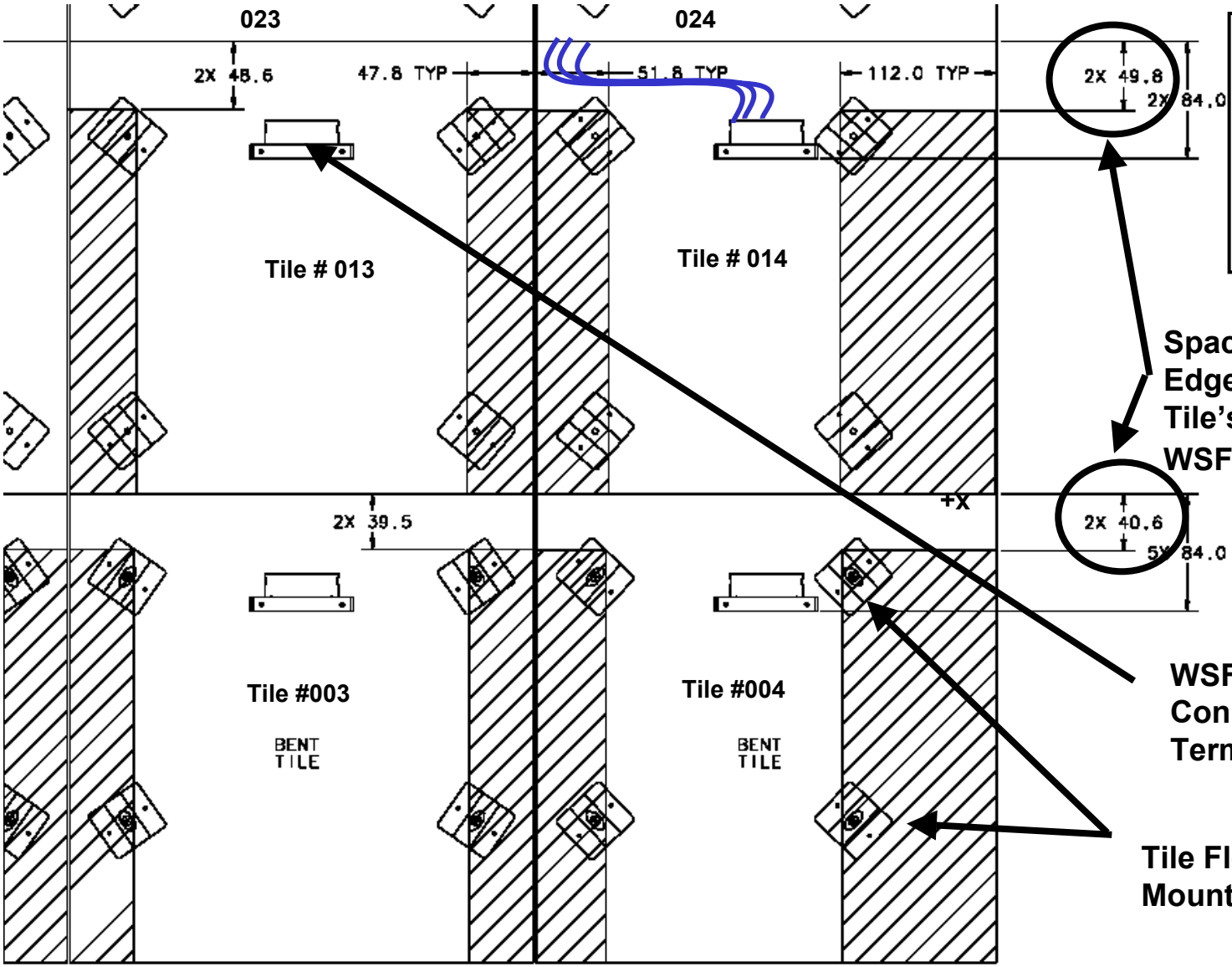
- **TDA Waveshift Fibers (WSF) to TSA Flexure Spacing Issue**
  - **Affects 65 of 89 tiles (Yellow)**
- **3rd Row TDA WSF to Bottom Tile Flexure Interference Issue**
  - **Affects Remaining 24 of 89 tiles (Blue)**



TDA / TSA Mount Issues - Today's Presentation

- **Look at Details of the TDA to TSA Spacing and Interference Issues**
  - **Illustrate Specific Problem Areas**
  - **Define Solutions Addressing the Problem Areas**
  - **Report Solution Implementation Status**

Tile *Spacing* Issue Defined (Top Tiles Shown)



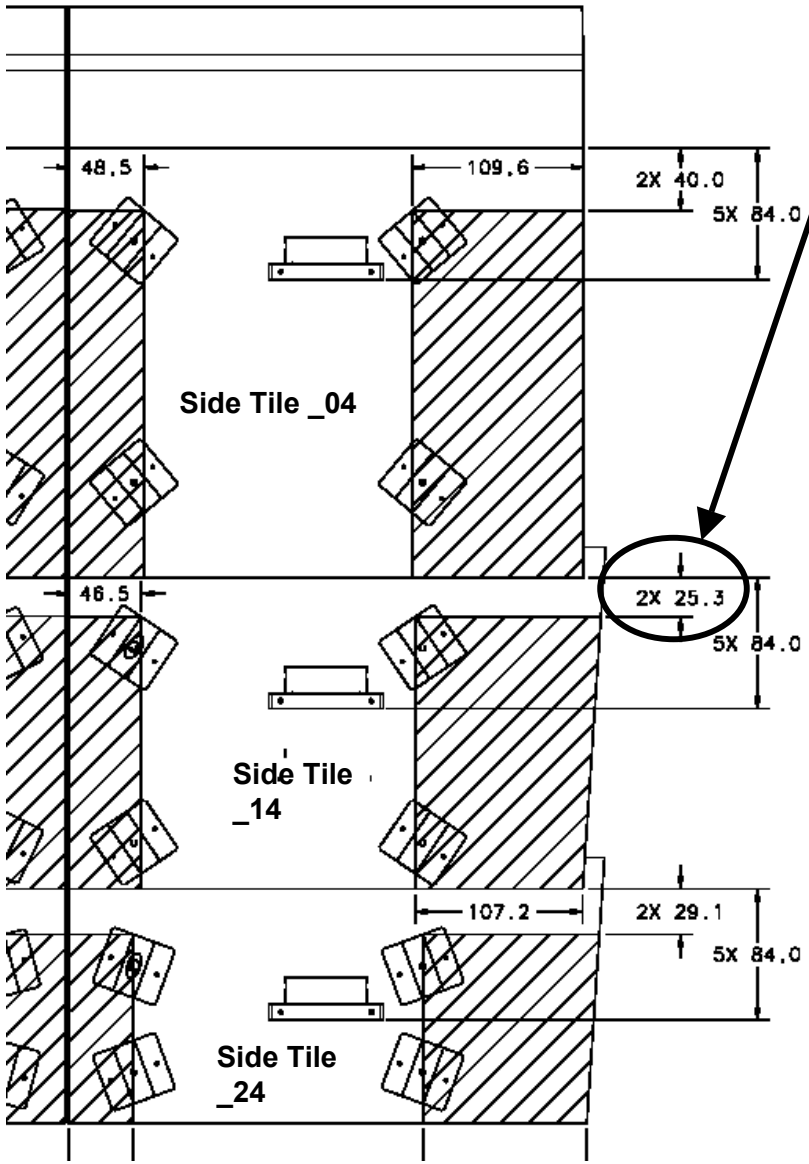
- ***TDA WSF Come Too Close the Tile Flexures***
  - ***Too Close Defined as < 5mm***

Space Between a TDA's Edge and a Adjacent Tile's Flexure Where the WSF get Routed

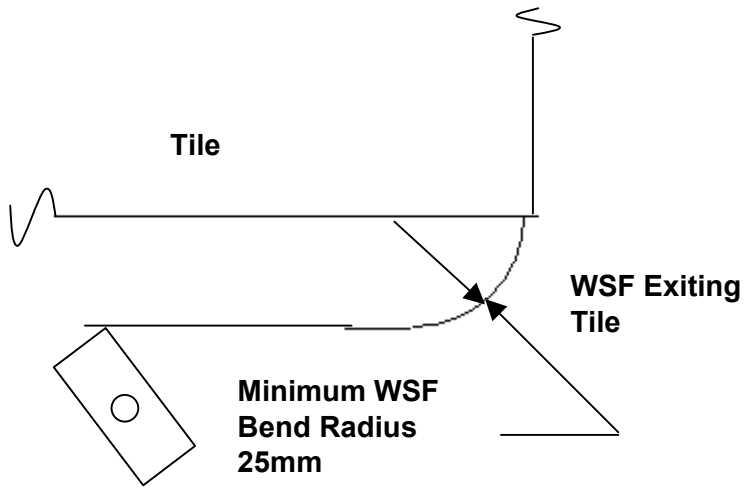
WSF Optical Connector (Fiber Termination)

Tile Flexures (TDA Mount Points)

Tile Spacing Issue – Worst Care



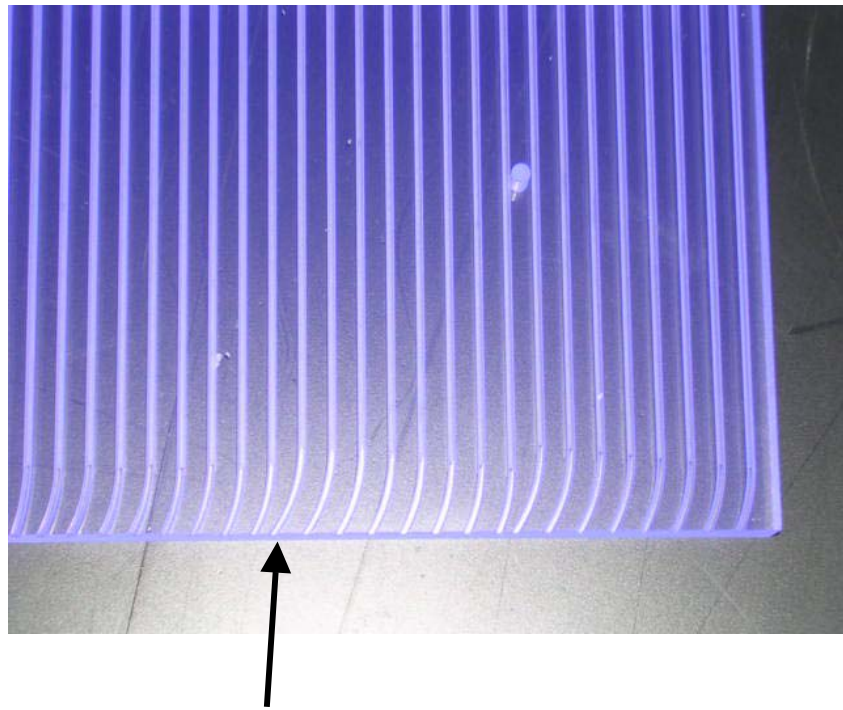
- ***BIGGEST CHALLENGE***
- **Spacing Between Crown Tile (Row 1) and Row 2 Tile Flexure (Upper) :**
  - **25mm WSF Bend Radius Spacing was the Design at the Time Issue Was Found**
    - **Brings the WSF too Close to Tile Flexures.**



Tile Flexure 'Hat'

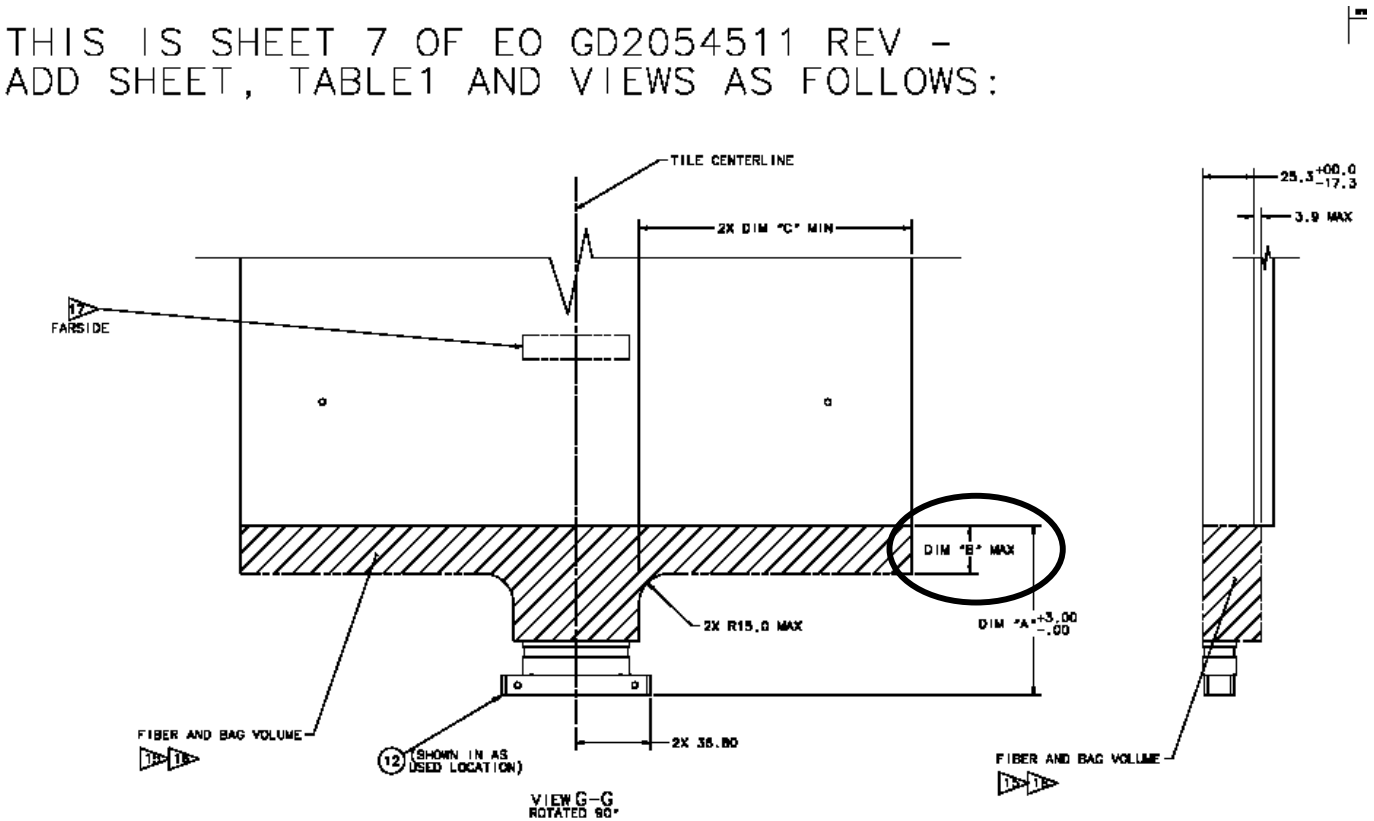
Tile Spacing Issue Solution

- **TDA to TSA MOUNT SPACING**
  - ***Solutions Implemented***
    - ✓ **Establish Design Envelope Between TDAs and TSA Mounts.**
      - ✓ **Worked With FERMI to Establish Acceptable TDA Envelope**
        - ✓ **FERMI Changed How the Fibers Exit the Tile**
    - ✓ **Moved Upper TSA Flexure Mounts 5mm for Row 3 TDAs**
      - ✓ **Tile Edge to Tile Flexure is Now 30.3mm**



Instead of WSFs Exiting Straight Out Tile Edge (Prior Design), a Groove in the Tile Initiates the WSF Curve 20mm Sooner.

TDA Envelope Drawing



- **Revised TDA Drawings to Define TDA / WSF Envelope**
- **Conforms the Numbers (Dim B) FERMI Demonstrated and Agreed with.**
- **TDAs Inspected Prior to Delivery.**

Current Design:

- **Smallest Tile to WSF Envelope (X-Hatch) Dim 'B' is now 23.7mm (MAX)**
  - **Smallest Tile Edge to Tile Flexure is now 29.1mm**
    - **Minimum of 5.6mm Clearance is now Achieved.**

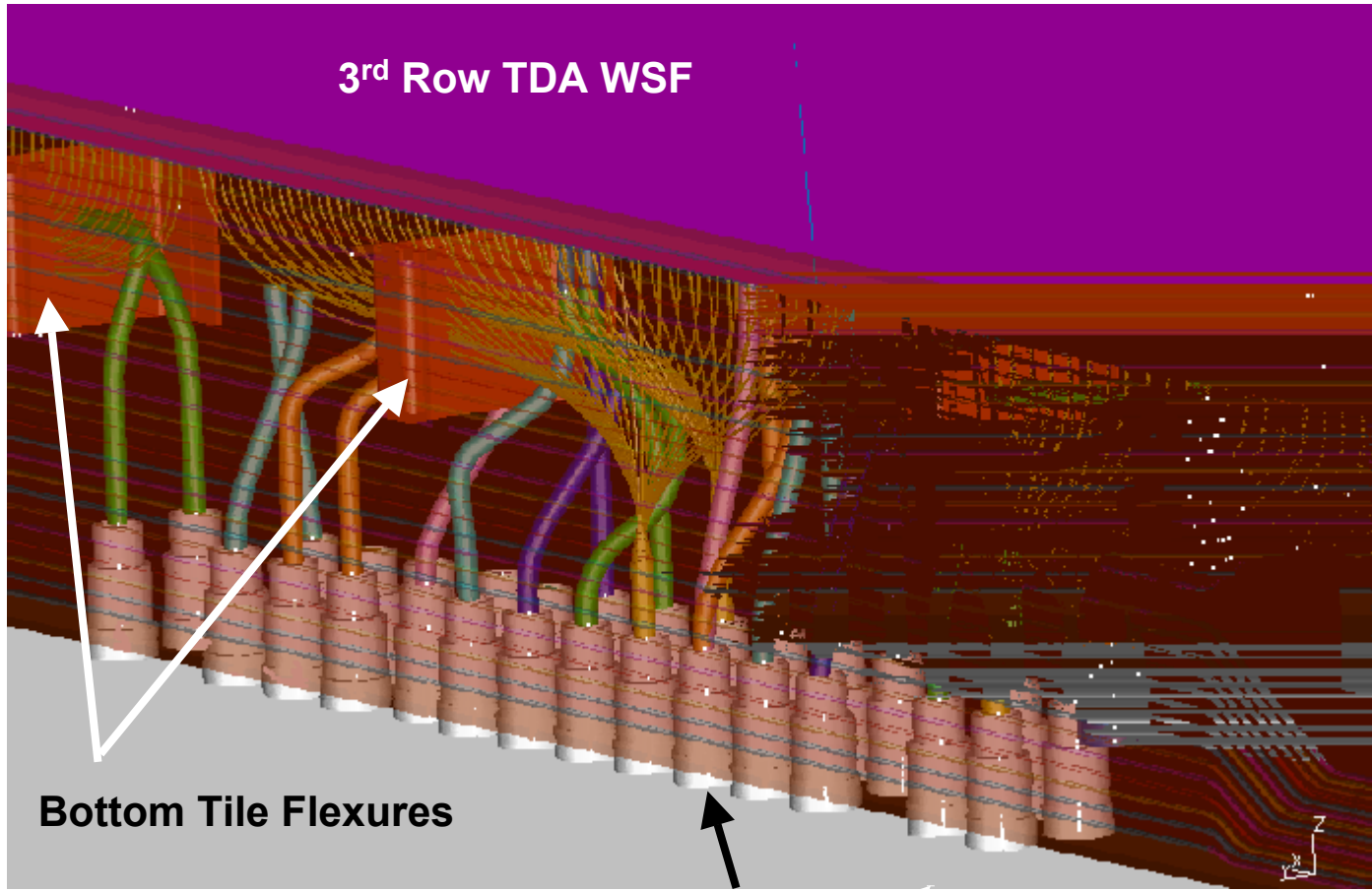
Tile Spacing Issue - Implementation Status

TDA to TSA MOUNT SPACING IMPLEMETATION STATUS		
Design	**Comments**	**Status**
2054496	Bent Tile Drawing	No Change Required
2054497	Flat Tile Drawing	EO - Released
2054498	Crown Tile Drawing	EO - Out for Signature
2054499	Right Diagonal Tile Drawing	EO - Out for Signature
2054501	Left Diagonal Tile Drawing	EO - Out for Signature
2054510	Bent TDA Drawing	EO - Released
2054511	Flat TDA Drawing	EO - Released
2054583	Right Diagonal TDA Drawing, Row 2	Planned Completion 11-19
2054611	Left Diagonal TDA Drawing, Row 2	Planned Completion 11-19
2054636	Side Panel Drawing	EO - Out for Signature
Analyses		
Tile Frequency	Flexures Changes Affects Tile Frequency and Deformations	DONE: Negligible Frequnccy Change. Deformation Grows by .02mm (within Allowable Tile Gap)

3rd Row TDA WSF to Bottom Tile Flexure Interference

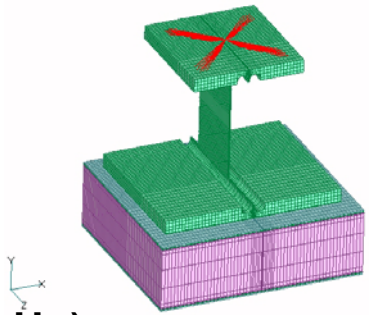
PROBLEM

- **The Bronze Colored WSF Interfere with the Bottom Tile Flexures Shown**
  - **Note: The WSF terminate directly into the PMTs**

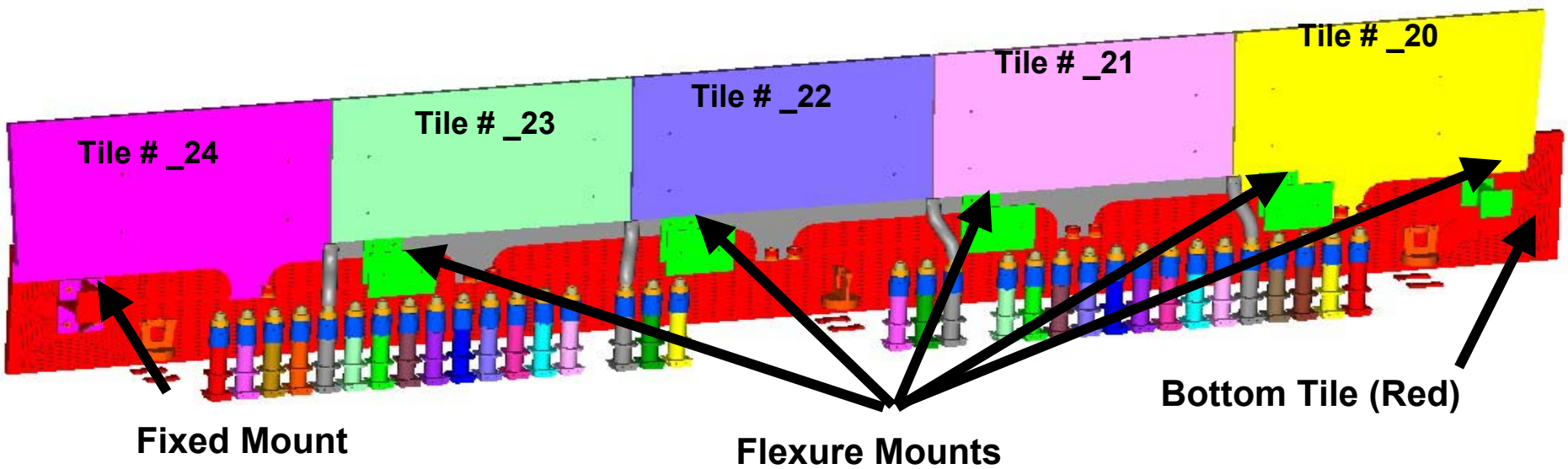


3rd Row TDA WSF to Bottom TSA Flexure Interference

- 3rd ROW TDA WSF to BOTTOM TILE FLEXURE INTERFERENCE
  - *Solutions Implemented*
    - Designed a Titanium Blade Flexure
      - Requires Less Space Than Prior Design's Hat Section
    - Relocated New Flexures to Less Obtrusive Areas
      - Kept Close to Tile Ends
      - Used Less Flexures (Frequency Goes Down, Deformations Up)



Looking From Inside ACD Box Out



3rd Row TDA WSF to Bottom TSA Flexure Interference

- 3rd ROW TDA WSF to BOTTOM TILE FLEXURE INTERFERENCE
  - *Solutions Being Implemented*
    - *Design*
      - Defining TDA to TSA Envelop Drawings for Tiles #_20 thru _24
      - Update Ribbon Detectors in the ACD Model
    - Updating ACD Mockup
      - Physical Model Will Be Used to Derive Final TDA Design Drawings
        - » Bottom Tile Area Hard To Model Well.
        - » Very Busy Area with 194 PMTs and Optical Cable Terminations
    - Analyses
      - Assess Bottom Tile with Reduced # of Mounts
        - Ensure Bottom Tile Gaps to Other Tiles and to PMTs are Sufficient
        - Frequency is at 54Hz (ACD is at 53Hz)
        - Being Reviewed for Potential Dynamic Coupling.

Bottom Tile Interference Issue - Implementation Status

3rd Row TDA to Bottom Tile Flexure Interference Implementation Status		
Design	**Comments**	**Status**
2054623	Rt Diagonal TDA Drawing Row 3	Planned Completion 12-5
2054622	Left Diagonal TDA Drawing, Row 3	Planned Completion 12-5
2054620	TDA Drawing, Row 3 Middle Tiles	Planned Completion 12-5
2054680	Bottom Tile TDA	Planned Completion 12-12
2054682	Bottom Tile	Planned Completion 12-12
2054633	Bottom Tile Fixed Mount	Planned Completion 11-25
2054635	Bottom Tile Flexure	Planned Completion 11-25
Mockup	Updates being Incorporated	Planned Completion 12-5
Ribbon Update	Reroute Ribbons with Updated Information	Completed
Analyses		
Tile Frequency	Need to Assess if Dynamic Coupling Exists with Tile Freq. @ 53Hz	In Progress, Planned Completion 11/21
Flexure	Checked for Strength, Deflection and Buckling.	Analyses Completed, Margins all >.20

SUMMARY

- ACD Team is Addressing Two Design Areas That Affect the Mechanical and Detector Areas:
  - TDA to TSA Spacing Issue is Resolved
    - Final Design Changes are Being Released
  - 3rd Row TDA WSF to Bottom Row Tile Flexure Interference Solution is Established
    - Design and Analyses Efforts are Being Worked with Completion Planned for 12-12