# Passive Material Description

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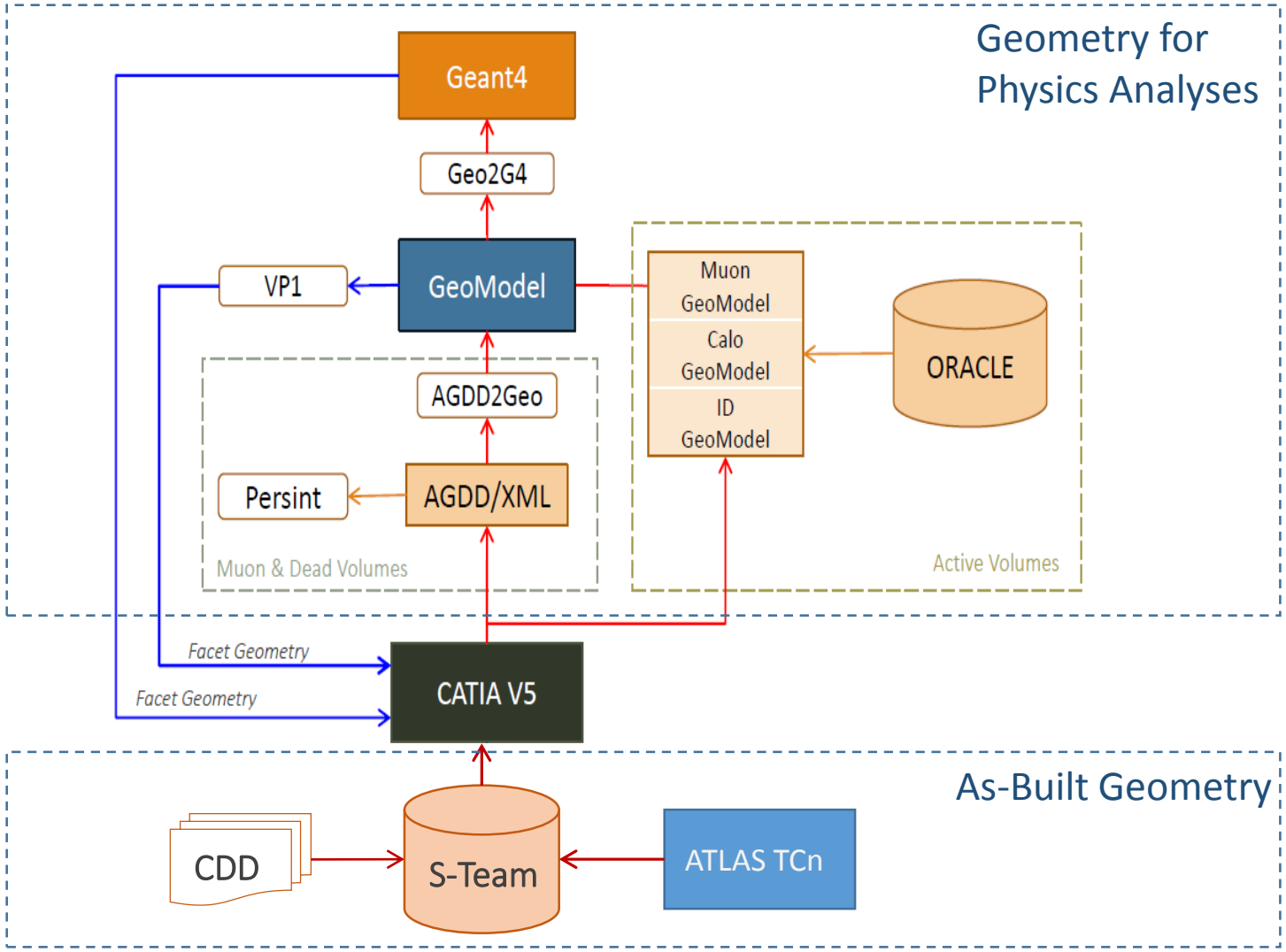
# Duties of Georgian Team



- Passive materials description development workflow on the base of CATIA




1. Adding New volumes into the Geant based on as-build descriptions

2. Compare of existing volumes on conformity with as-build descriptions

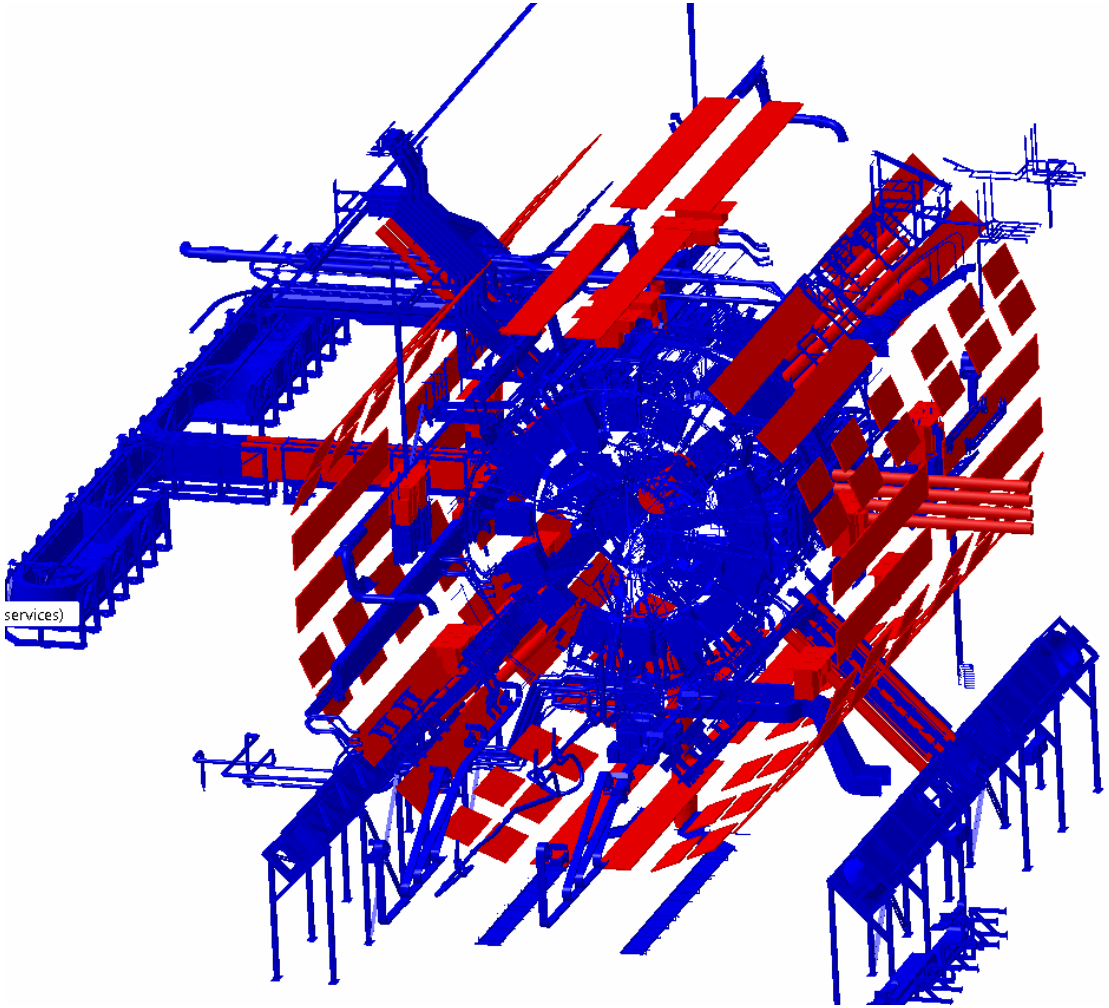
- We are using CATIA as a hub to collect geometries from various platforms

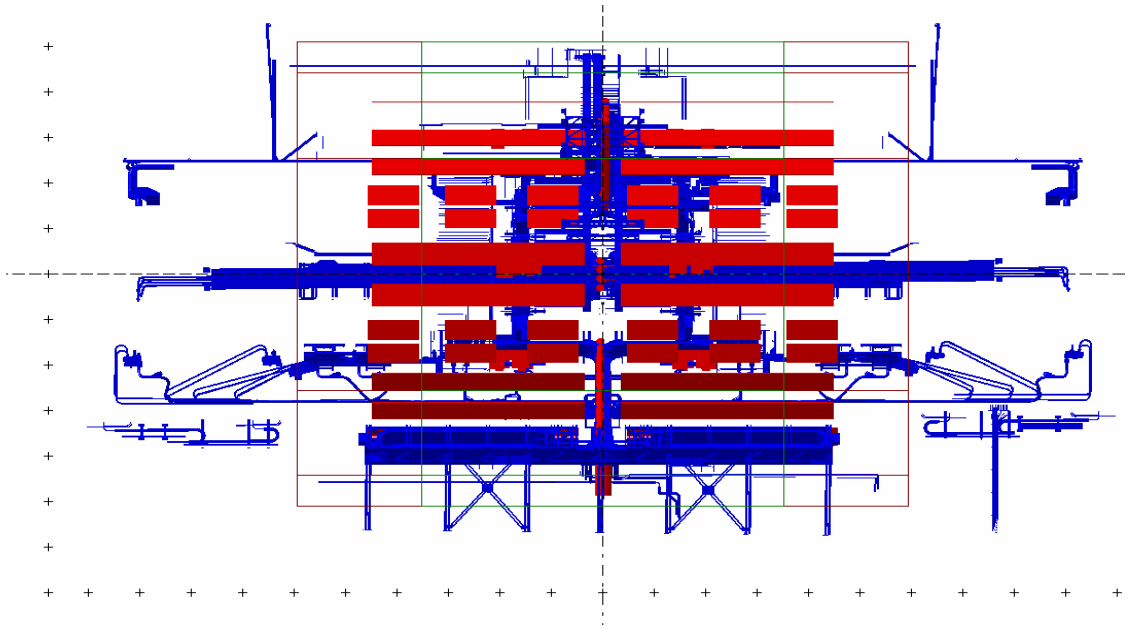
# I. Current status of Passive Materials Description in GEANT

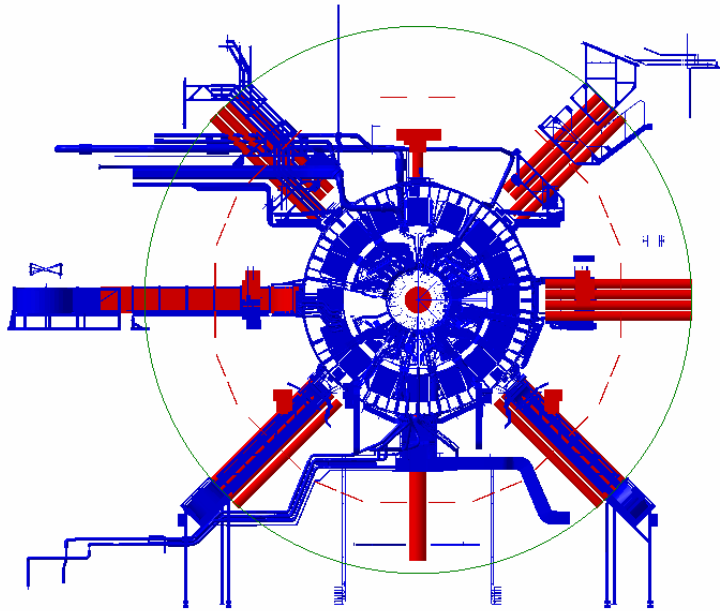
# Current Status of Passive Materials



- Calorimeter Services



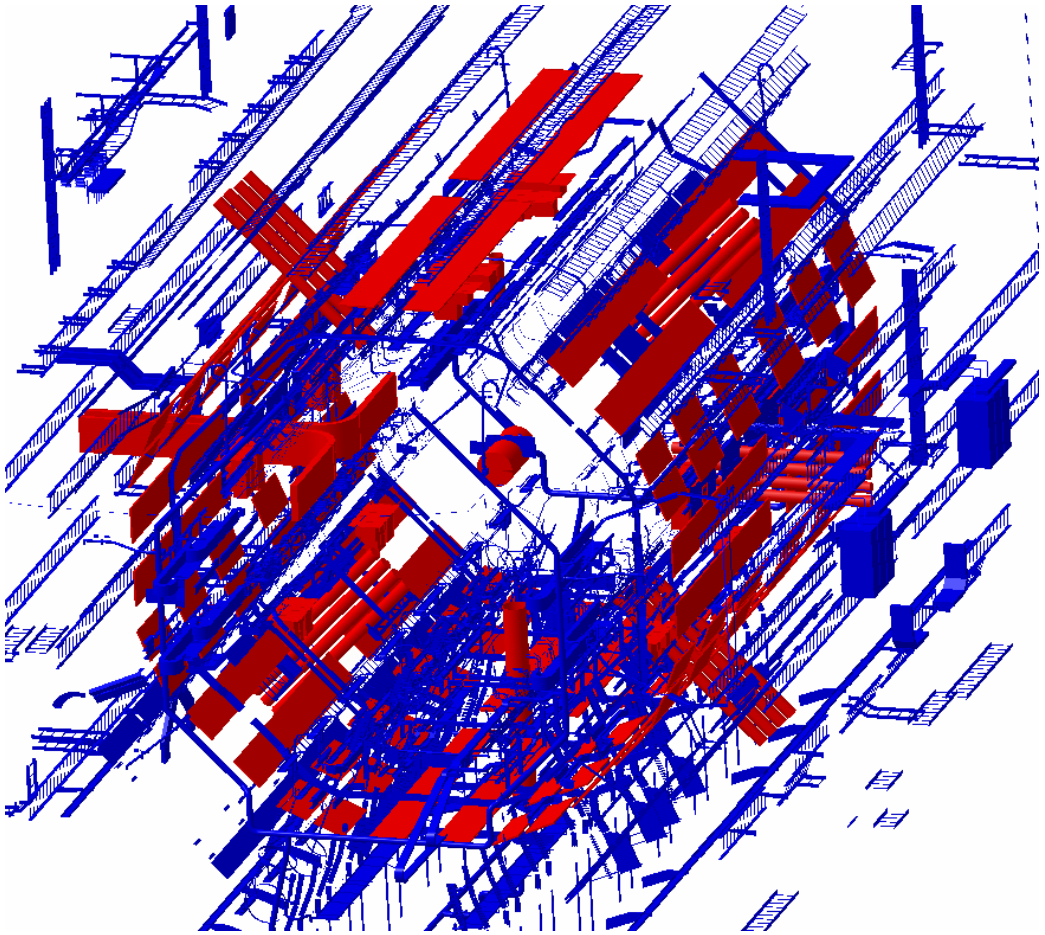



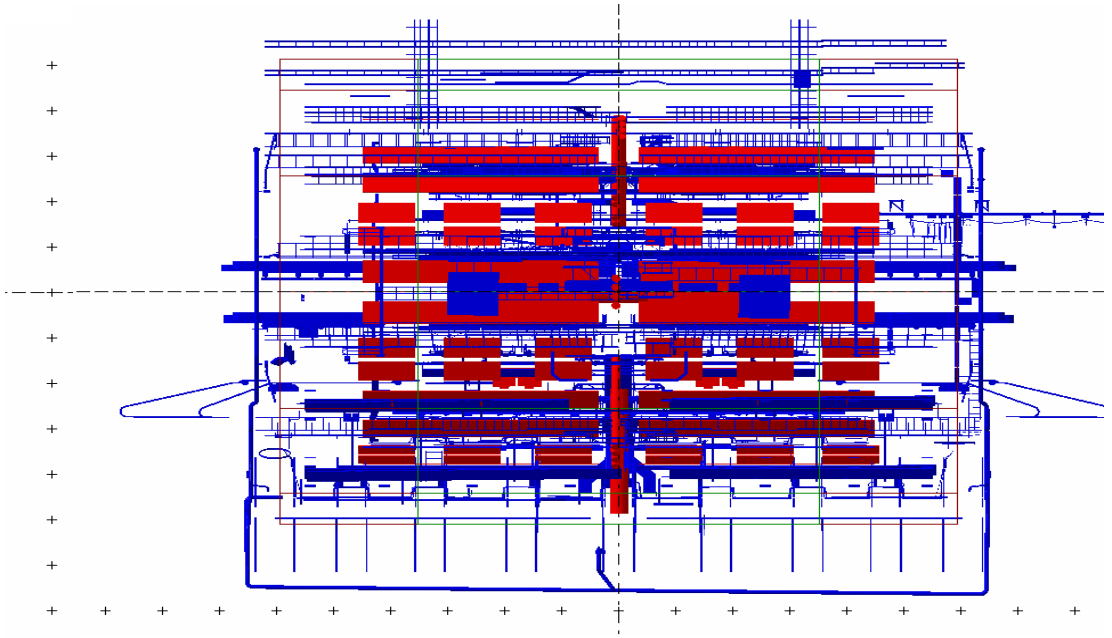


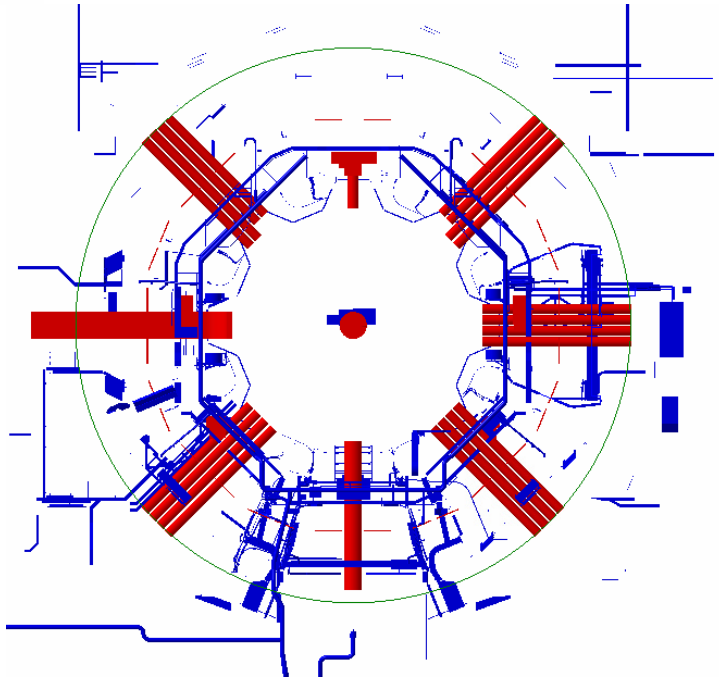
# Current Status of Passive Materials



- Muon Services



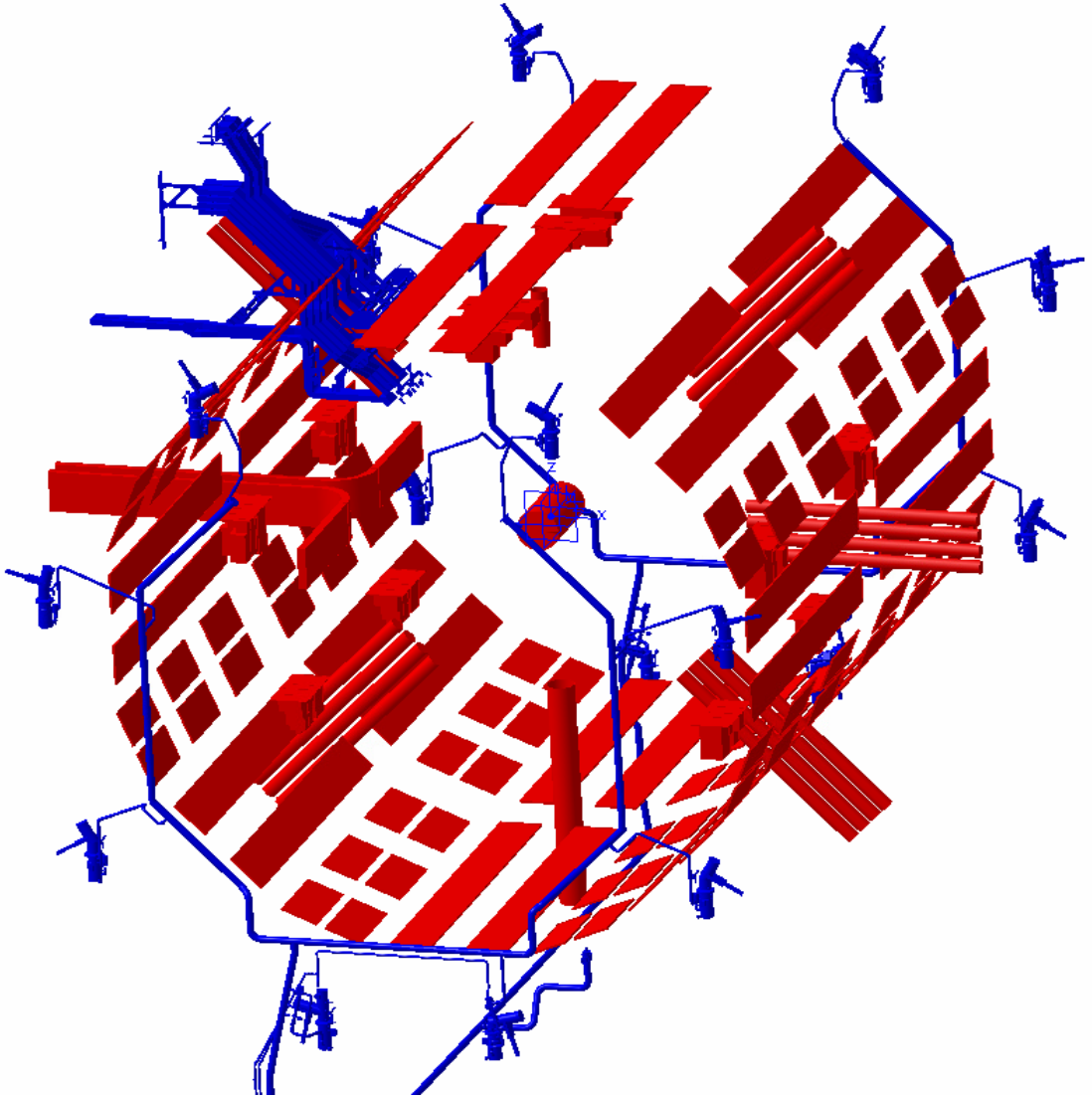


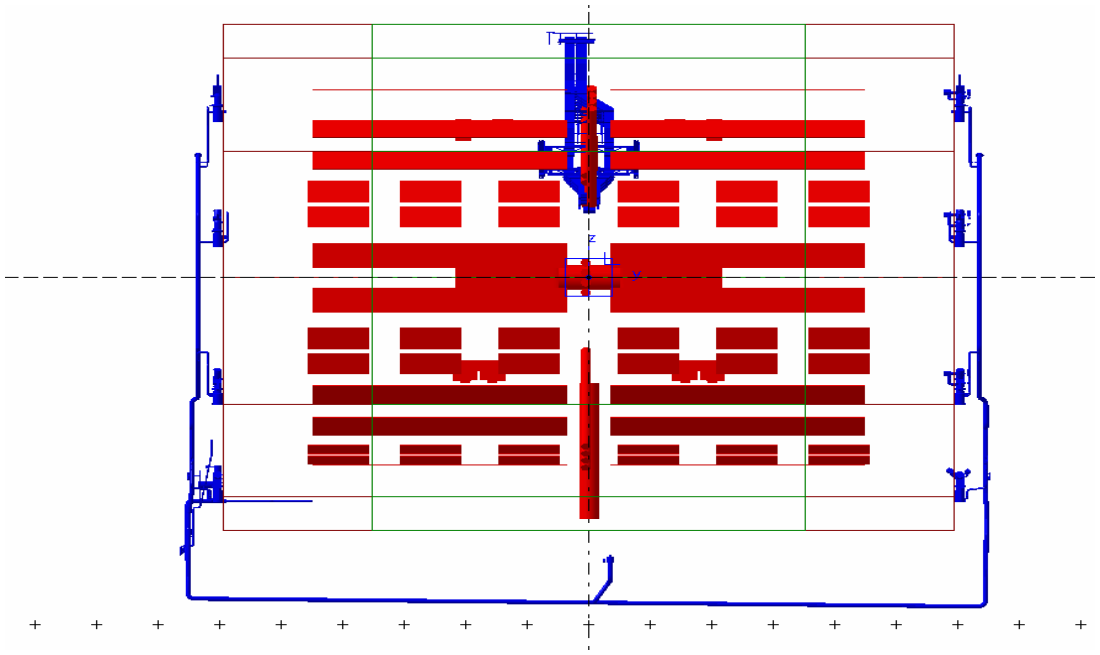


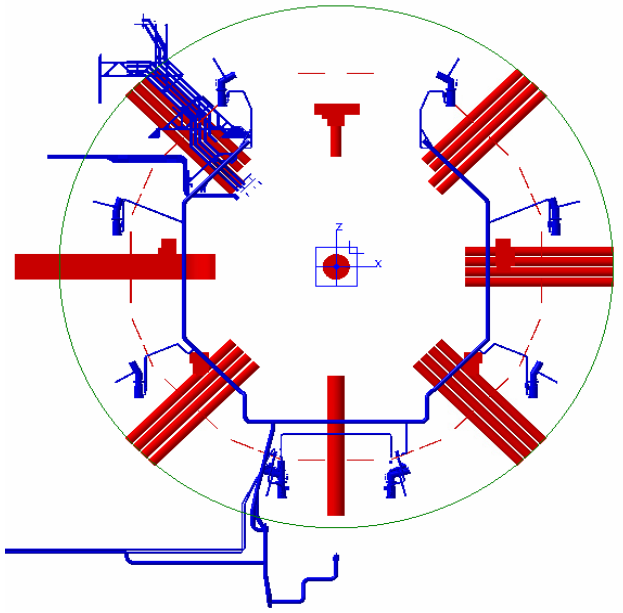
# Current Status of Passive Materials



- Magnet Services



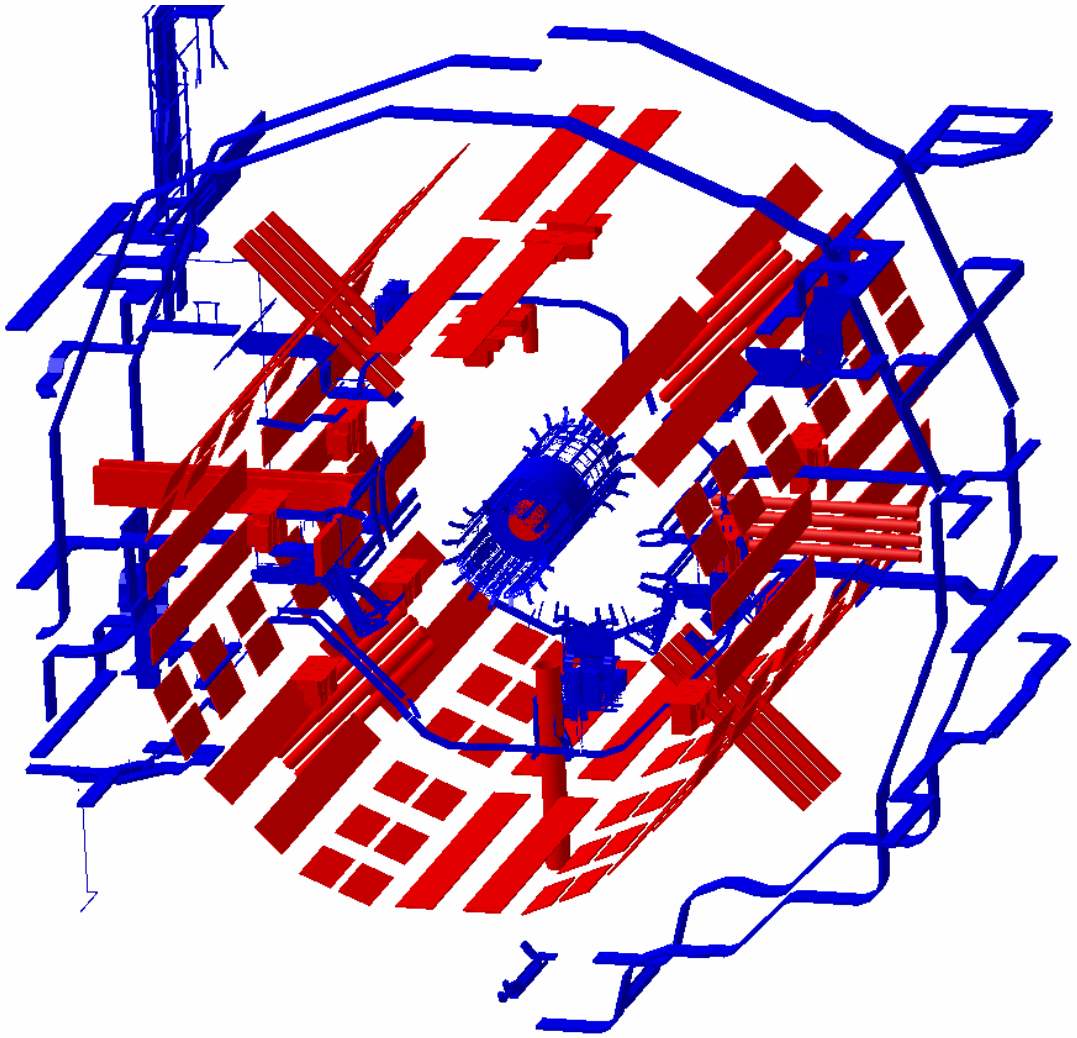


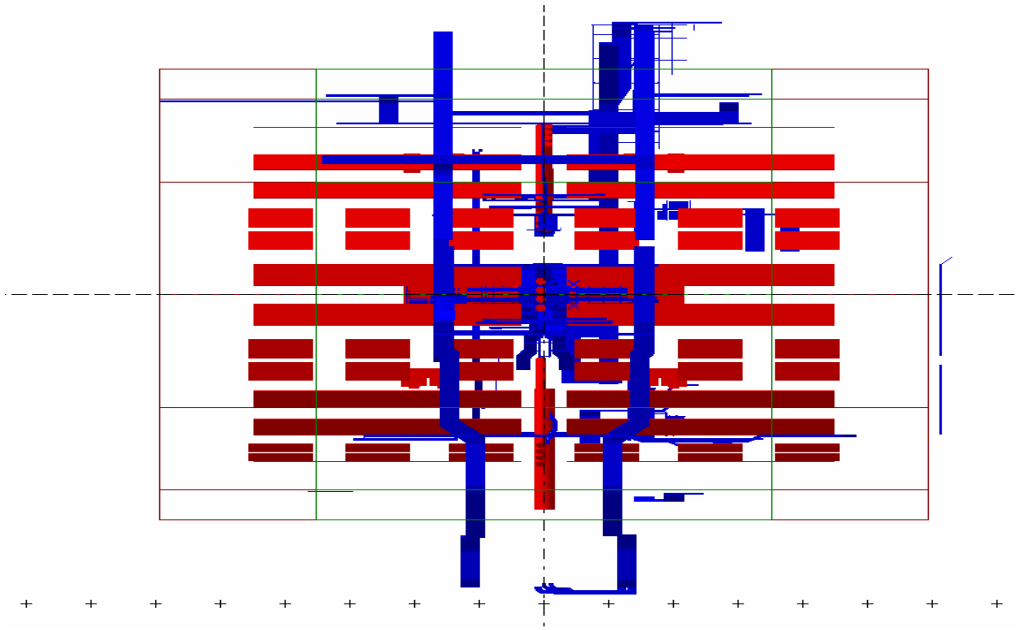


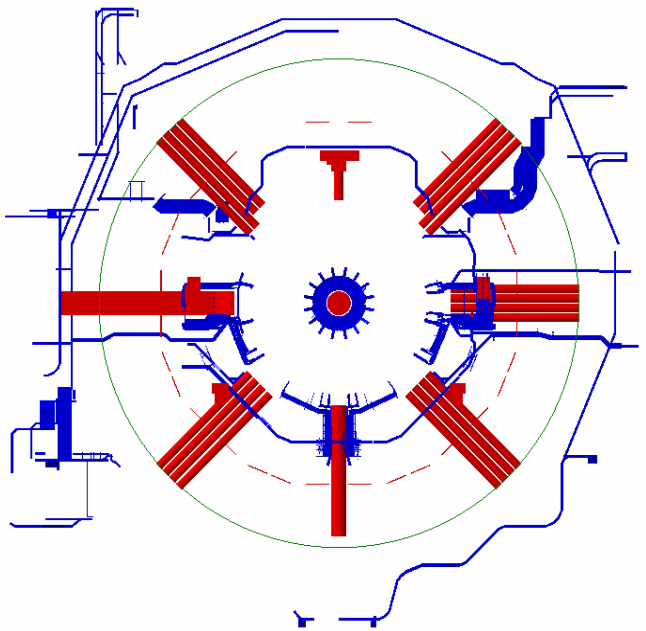
# Current Status of Passive Materials



- JD Services



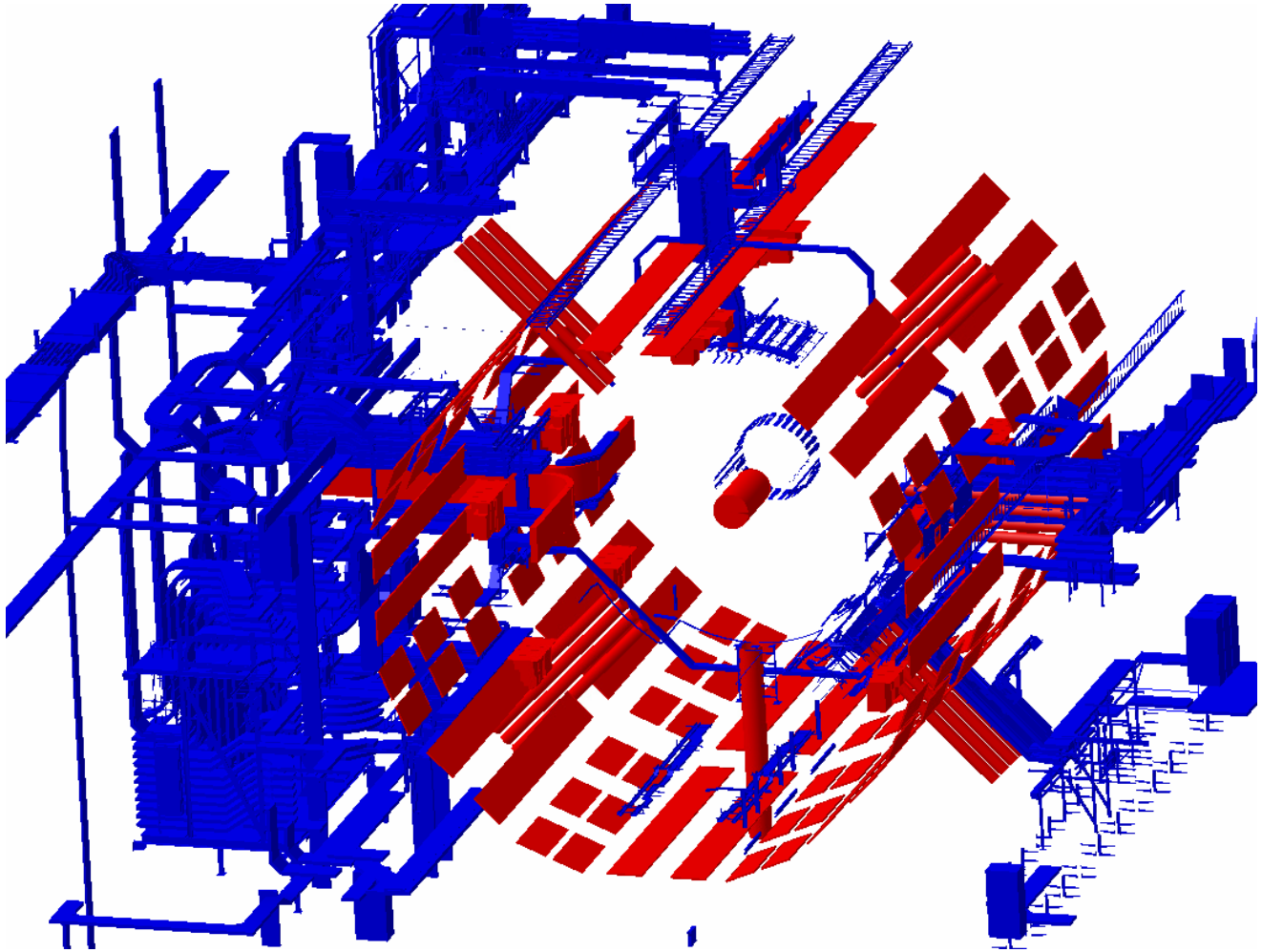


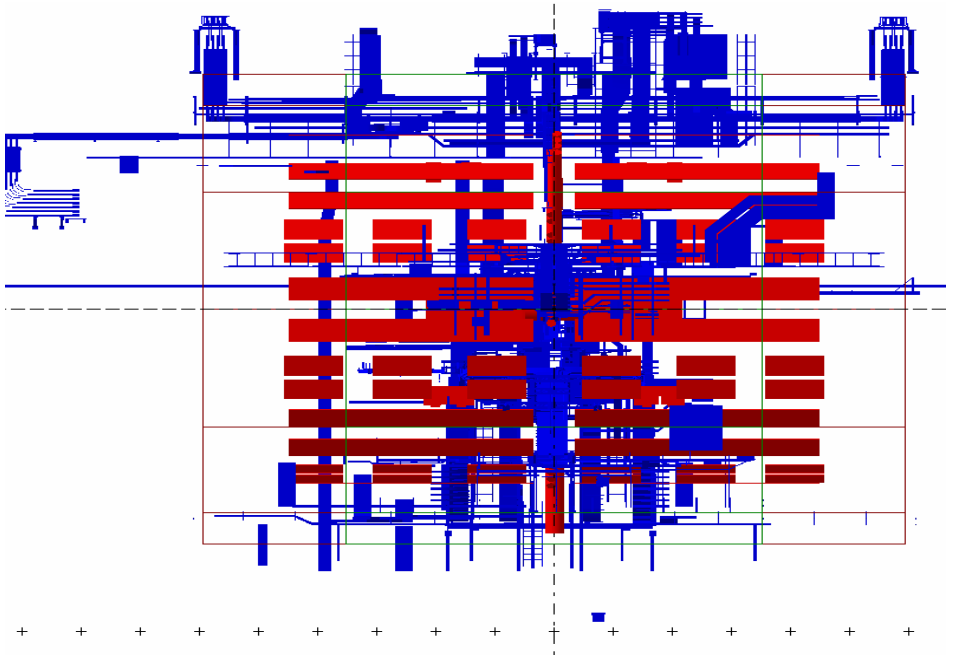


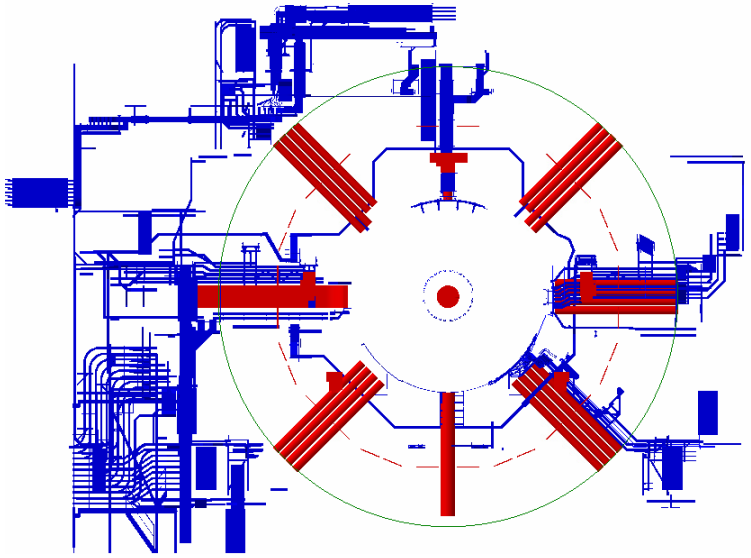
# Current Status of Passive Materials



- Racks, Cable Trays



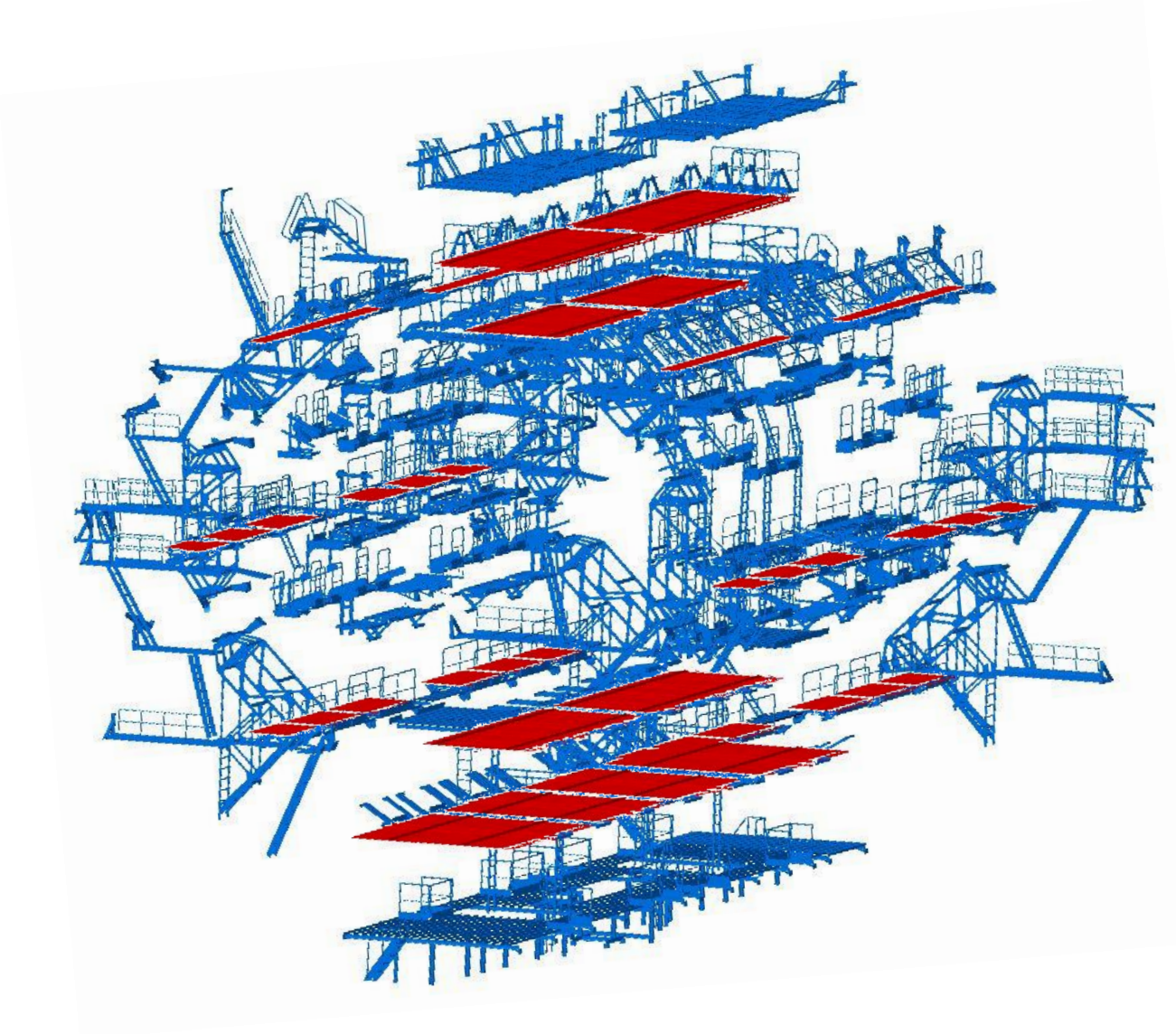


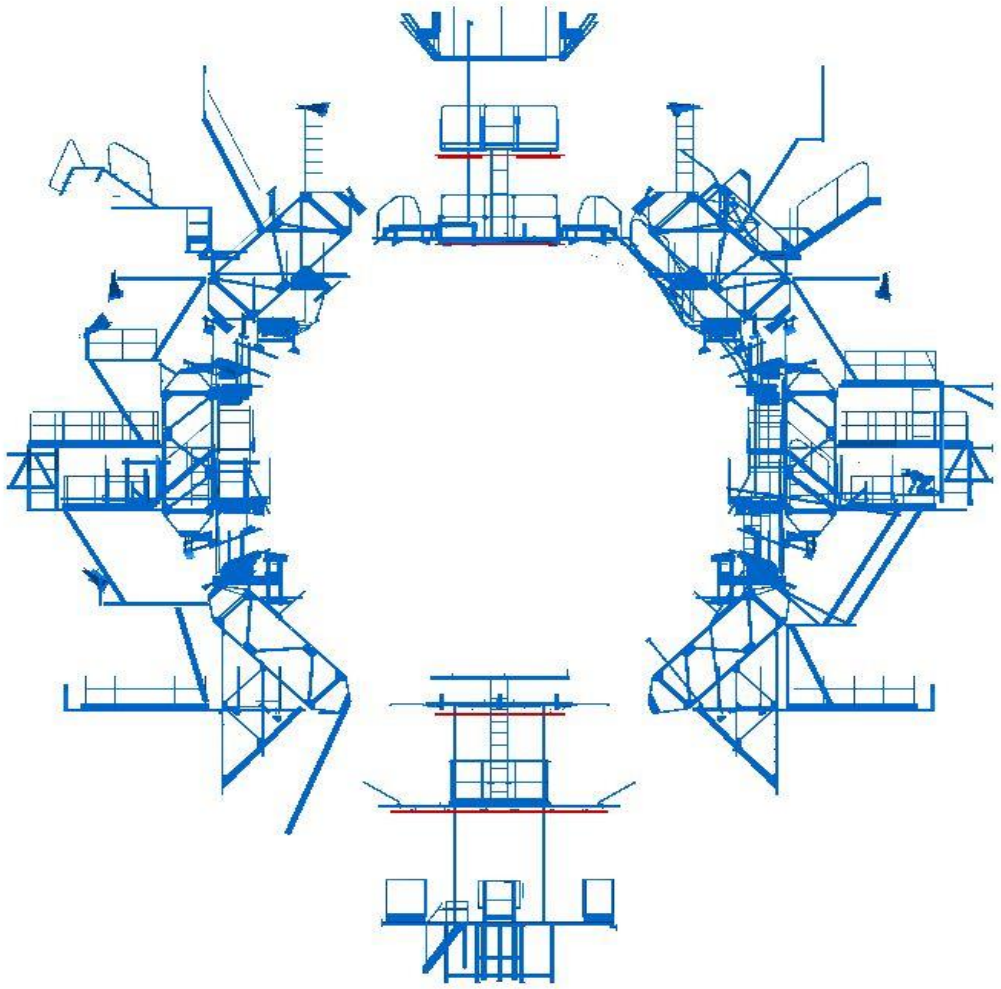


# Current Status of Passive Materials



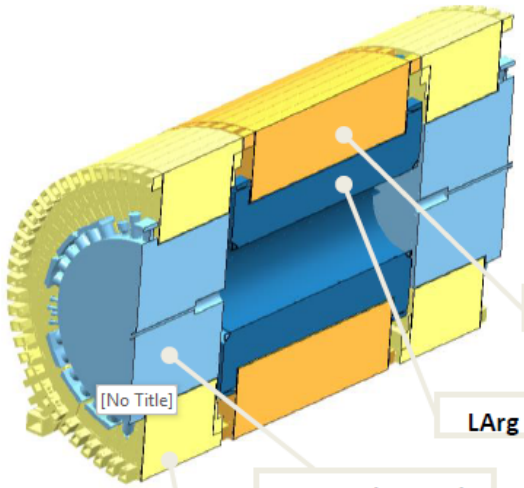
- Platforms





# Current Status of Passive Materials

- GAP Region Services



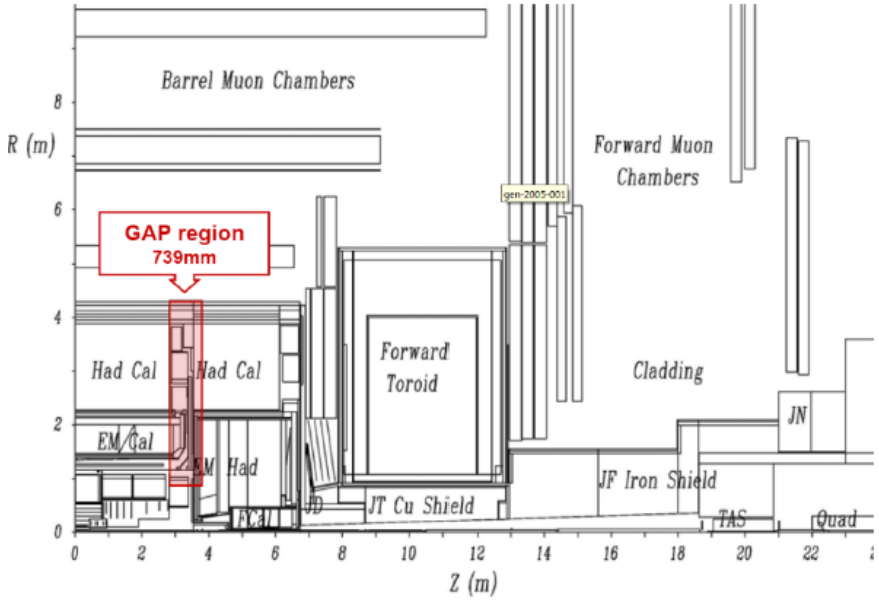

Tile Barrel Cal.

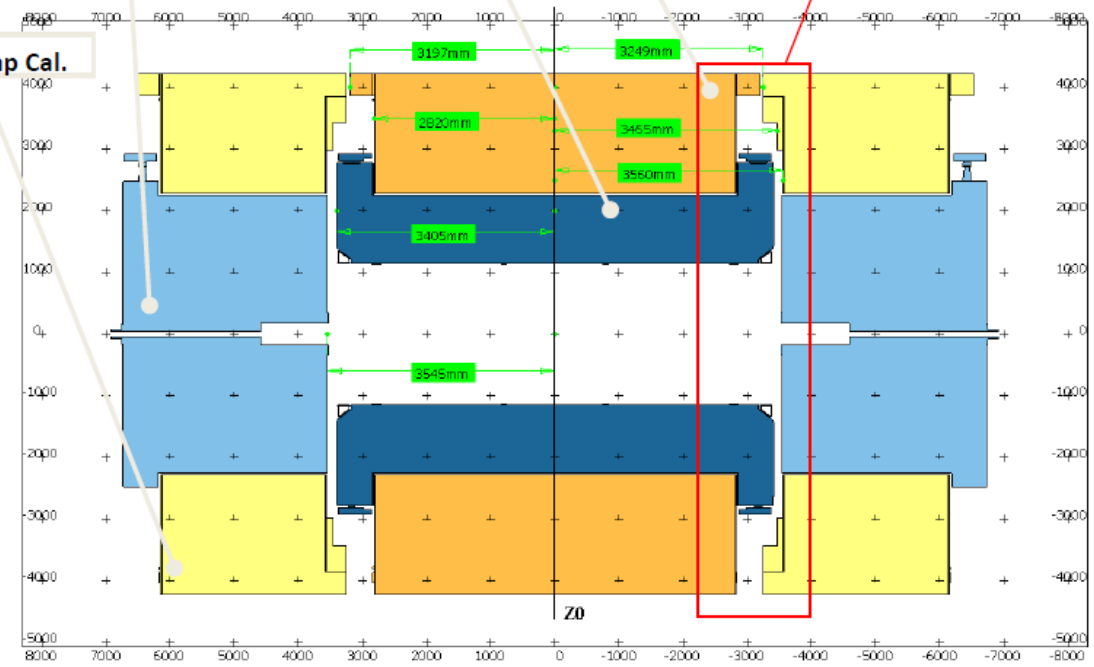
LArg Barrel Cal.

LArg EndCap Cal.

Tile EndCap Cal.

GAP region
Zmin=~2.25 m
Zmax=~4 m



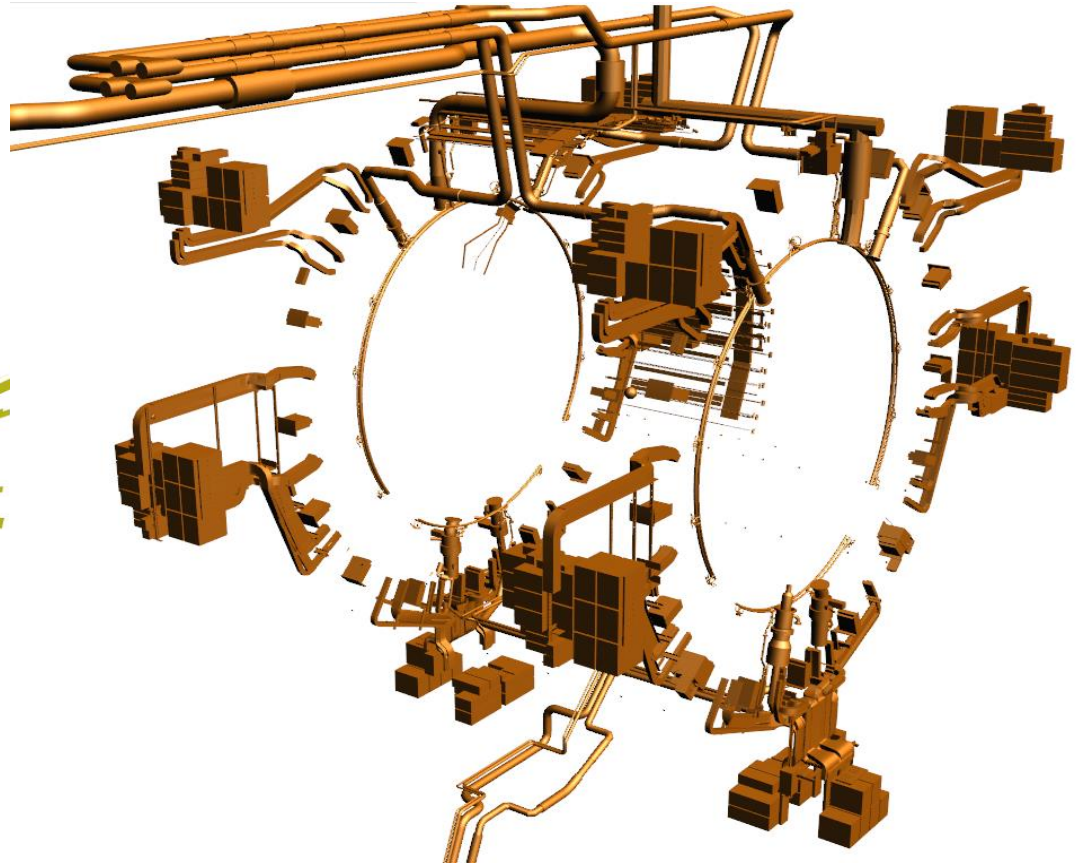
# Current Status of Passive Materials

- GAP Region Services

1. R08 : Electronic Boxes
2. R09 : LA Drain Line
3. R10 : LA Pump
4. R11 : By Pass Tube
5. R13 : LN2-GN2 Lines
6. R14 : Cryostat Safety Line
7. R15 : Solenoid Line
8. R16 : Middle Services – S1 Supports
9. R17 : Middle Services – S1 Cabels
10. R18 : Middle Services – S1 Pipes

- Middle Services

- Outer Services



# Current Status of Passive Materials



- Considering above described status we have todo list for both activities

I. Adding New Descriptions:

- #01: Outer Services in GAP region
- #02: JD Services in Sector 13
- #03: Middle Services in GAP region
- #04: CALO Services
- #05: Flexible Chain in Sectors 11
- #06: Flexible Chain in Sectors 15
- #07: Platforms in missing Sectors
- #08: NSW Passive Materials

II. Compare Existing Descriptions:

- #01: Warm Structure
- #02: Flexible Chain in Sector 9
- #03: Feet's
- #04: Services of Magnet System in S.7
- #05: JD Services in Sectors 7 and 9
- #06: Platforms in Sector 5 and 13
- #07: CALO Services

# II. Recent Compare Checking project of ATLAS Feet's

Project Summary:

- Started 1st of March, 2019 and finished 5th of June, 2019.
- 1.5FTE involved
- 16 working tasks were executed
- 63 CDD drawings converted into 3D geometry and added to existing CATIA geometry in order to reproduce as-built description of Feet's

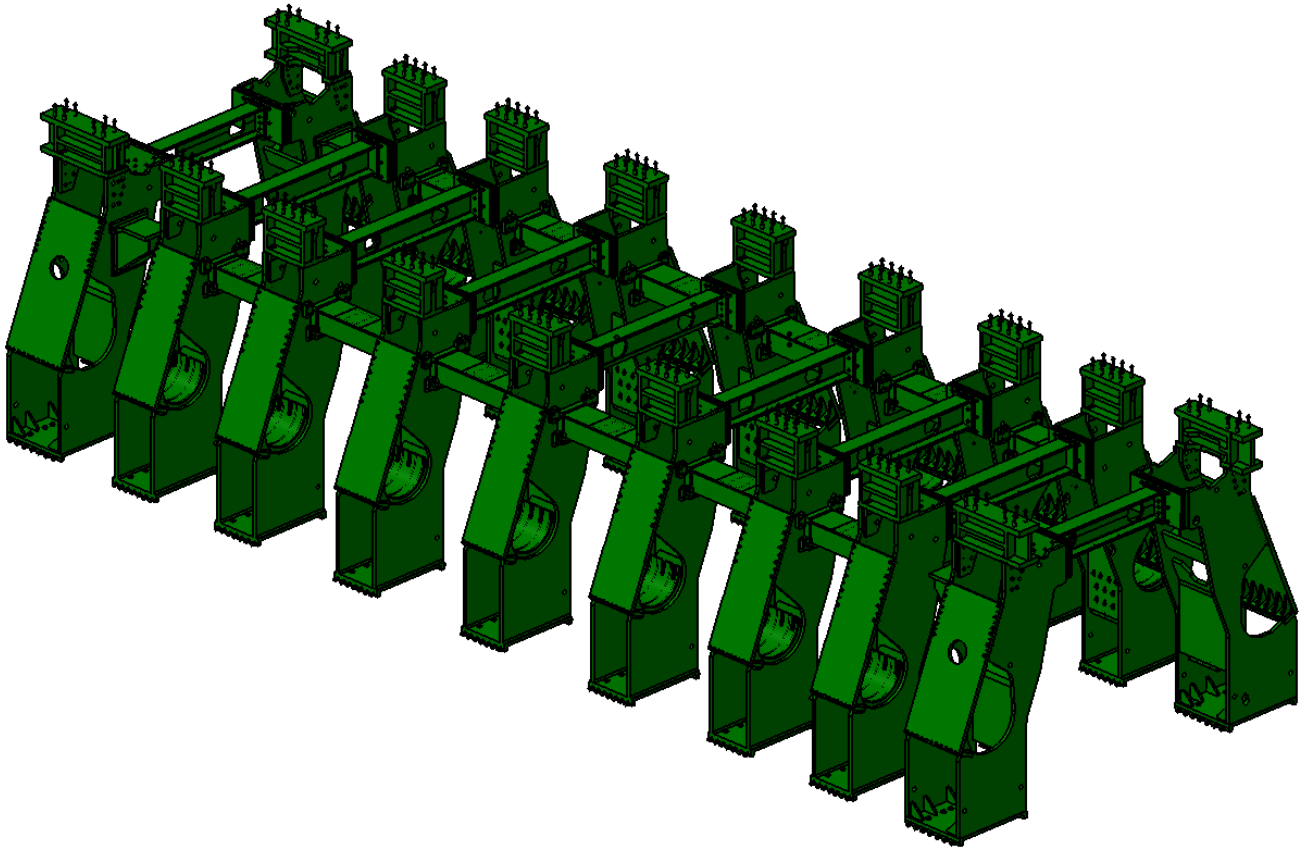
# Compare Checking of Feet's



GEANT

VS

CATIA



499 Volumes

| | |
|---|---|
| Volume ($m^3$) | 43.457 |
| Mass (kg) | 331'307 |
| Material | Iron/Aluminum |
| Density ($kg/m^3$) | 7'870/2700 |

371 Volumes

| | |
|---|---|
| Volume ($m^3$) | 48.575 |
| Mass (kg) | 367'060 |
| Material | Stainless Steel/Aluminum |
| Density ($kg/m^3$) | 8'000/2'700 |

# Compare Checking of Feet's



- Whole GEANT geometry split into 10 sub volumes for Analyses:

1. Standard Foot
2. Extremity Foot
3. Rail Support
4. Extremity Rail Support
5. Girder
6. Extremity Girder
7. FEET_Standard Strut
8. FEET_Extremity Strut
9. Bolts
10. Slanted ConnPlate Bracket

- CATIA vs GEANT comparison final results:

| | | CATIA | Geant4 | Difference |
|---|---|---|---|---|
| 1 | Standard Foot | 213'248 kgs | 186'401 kgs | -12.6 % |
| 2 | Extremity Foot | 66'864 kgs | 58'647 kgs | -12.3 % |
| | | | | |
| 3 | Rail Support | 31'944 kgs | 31'448 kgs | -1.6 % |
| 4 | Extremity Rail Support | 11'040 kgs | 10'900 kgs | -1.3 % |
| | | | | |
| 5 | Girder | 24'096 kgs | 18'305 kgs | -24 % |
| 6 | Extremity Girder | 4'576 kgs | 4'430 kgs | -3.2 % |
| | | | | |
| 7 | FEET_Standard Strut | 8'523.9 kgs | 16'611 kgs | +48.7 % |
| 8 | FEET_Extremity Strut | 2'448.9 kgs | 4'427.5 kgs | +44.7 % |
| | | | | |
| 9 | Bolts | 4'320 kgs | - kgs | - 100 % |
| | | | | |
| 10 | Slanted ConnPlate Bracket | - kgs | 138 kgs | + 100 % |
| | Total | **367'060 kgs** | **331'307 kgs** | **34.84 %** |

# Phase II.

Simplification of CATIA detailed geometry

# Simplification

- Final results of Simplification

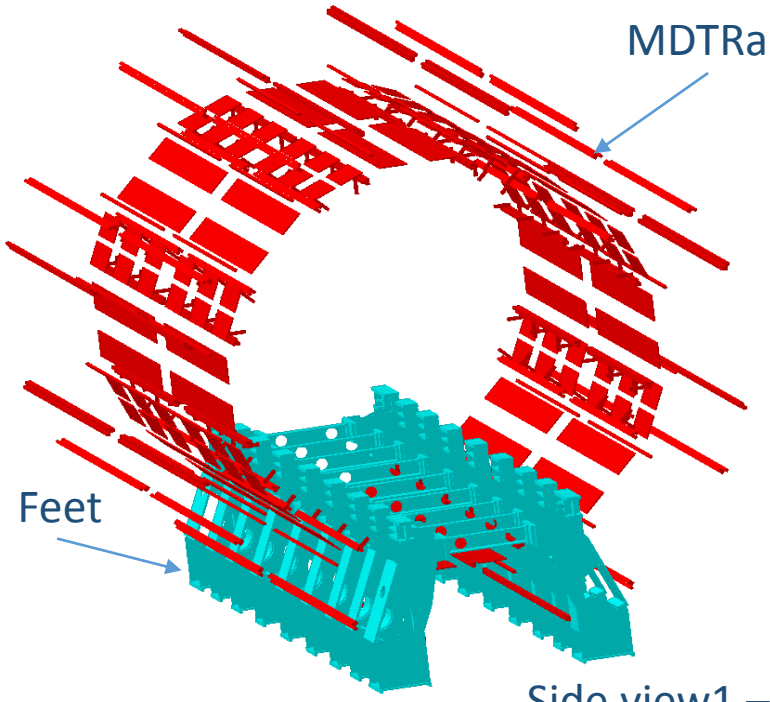
| | | Detailed | Simplified | Difference |
|---|---|---|---|---|
| 1 | Standard Foot | 215’600 kgs | 215’600 kgs | 0 kgs |
| 2 | Extremity Foot | 67’488 kgs | 67’480 kgs | -8 kgs |
| | | | | |
| 3 | Rail Support | 32’672 kgs | 32’672 kgs | 0 kgs |
| 4 | Extremity Rail Support | 11’248 kgs | 11’248 kgs | 0 kgs |
| | | | | |
| 5 | Girder | 24’497.6 kgs | 24’500.8 kgs | +3.2 kgs |
| 6 | Extremity Girder | 4’576 kgs | 4’576 kgs | 0 kgs |
| | | | | |
| 7 | FEET_Standard Strut | 8’523.9 kgs | 8’525.3 kgs | +1.4 kgs |
| 8 | FEET_Extremity Strut | 2’448.9 kgs | 2’448.9 kgs | 0 kgs |
| | | | | |
| | | | | |
| | | | | |
| | Total | **367’054 kgs** | **367’051 kgs** | **-3 kgs** |

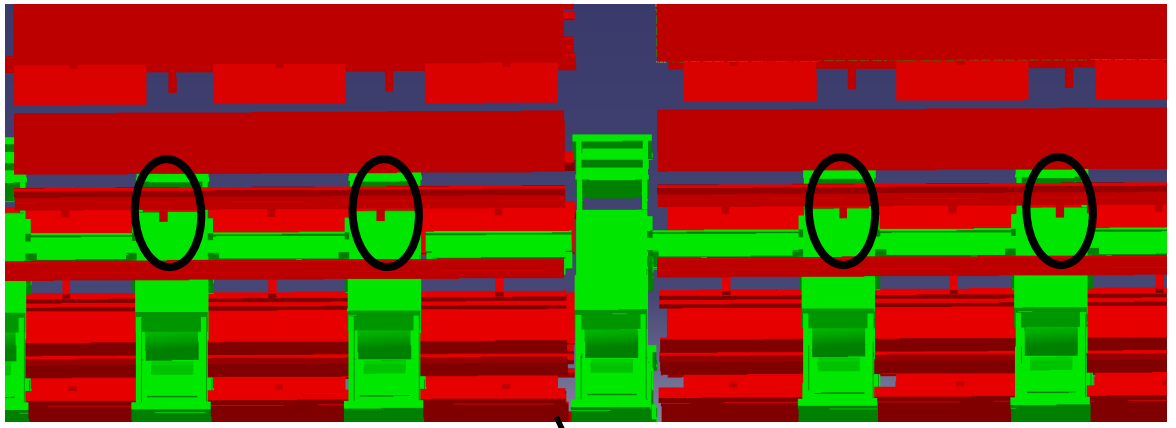
# Phase III.

## Integration Conflicts Checking

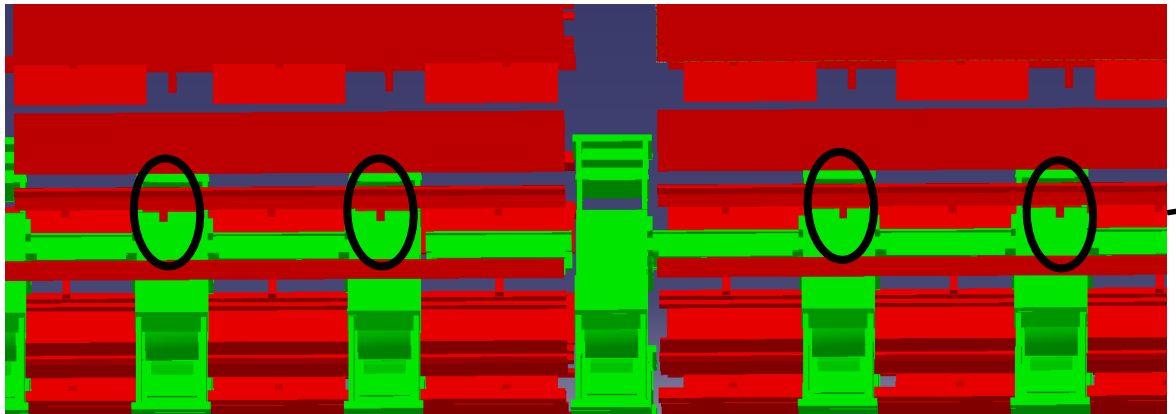
# Integration Conflicts Checking

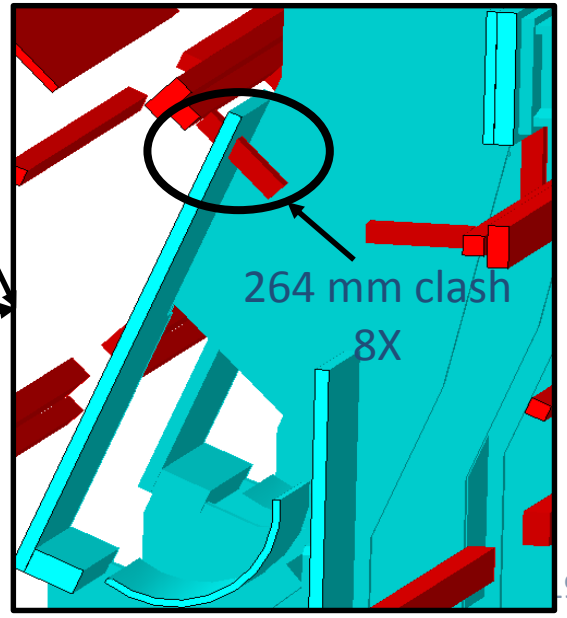
- Overlap #01: Feet vs MDT Rails



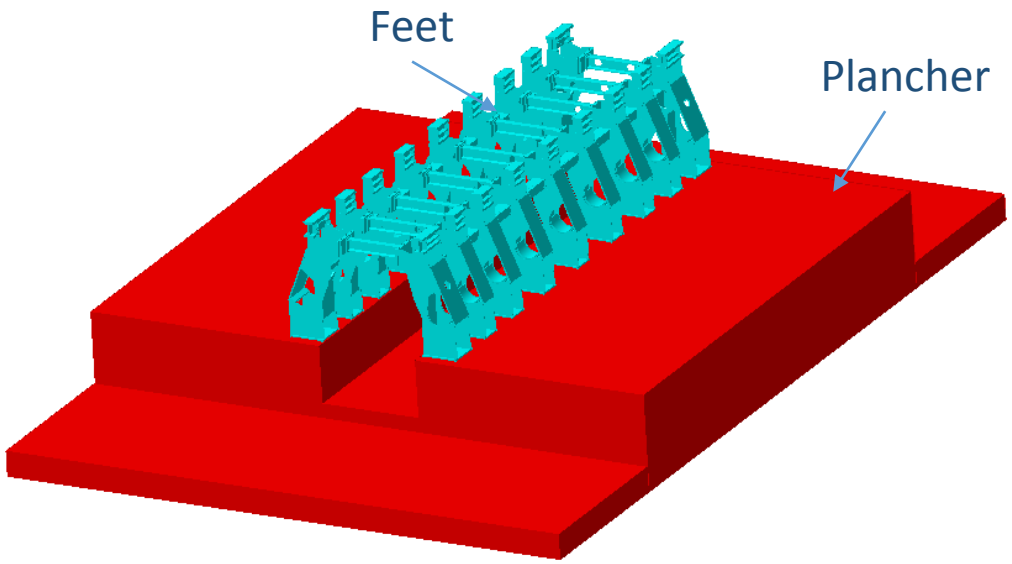
Side view1 – 4X Clashes

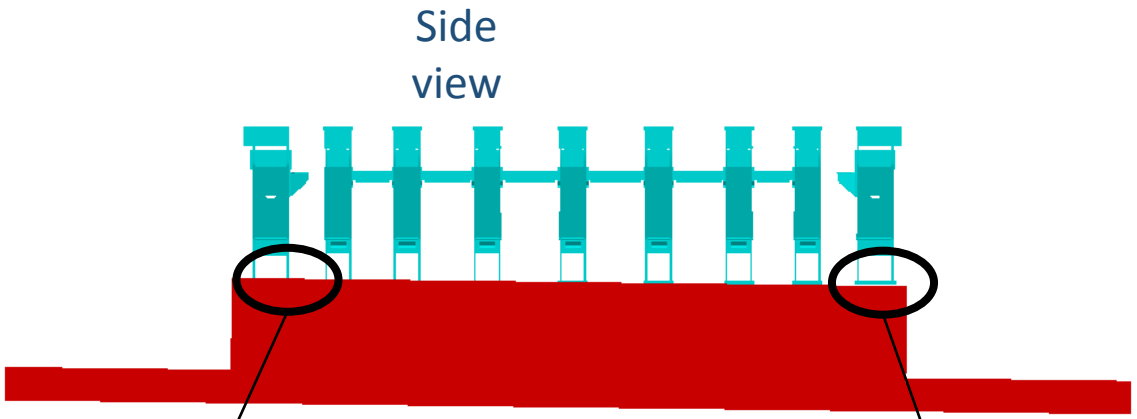




# Integration Conflicts Checking

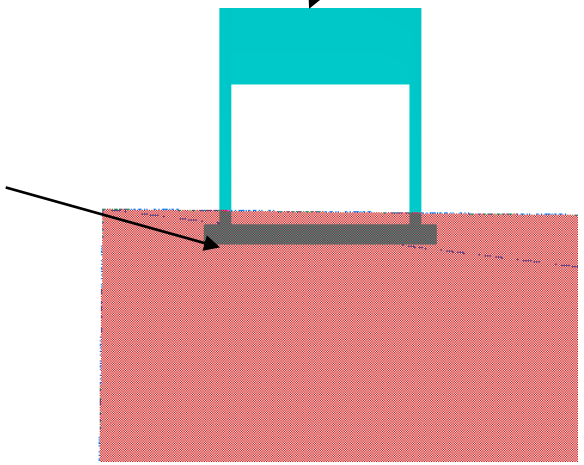
- Overlap #02: Feet vs Plancher



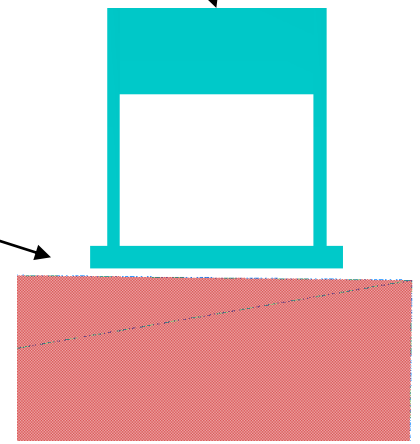




Plancher is not flat but angled on 0.708˚

249 mm
***clash***



65 mm
***Gap***



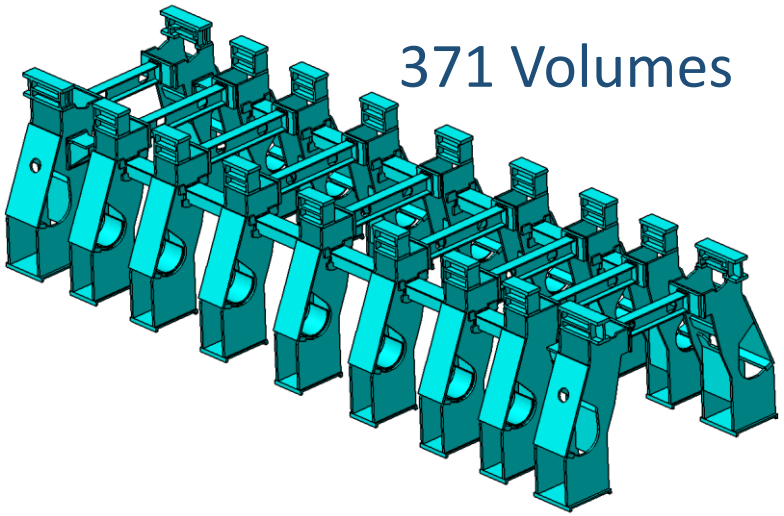
# Phase IV.

XML coding

# XML Coding

- 371 volumes where separated for amdb structure which is less then baseline geometry volumes number – 499. So FEET new description will perform faster

371 Volumes

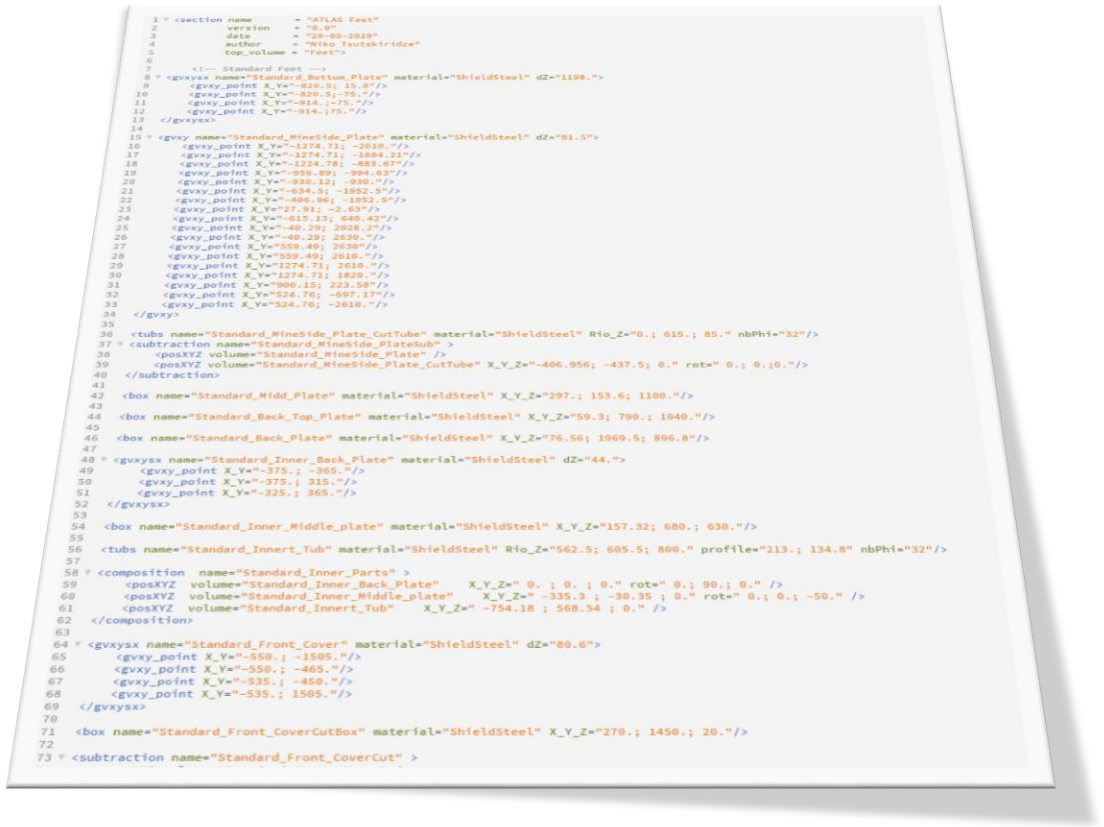


VS

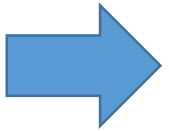
499 Volumes

# XML Coding

- XML code produced and Merge Request generated on Gitlab



365 lines



atlas g4-xml

# Project Conclusions



1. We reproduced existing description of Feet in Smarteam DB by adding 65 CDD drawings
2. Compare analyses shows big difference between Geant-4 description of feet and as-built geometry - 35% overall difference
3. Decision for generation of new description + XML has been made
4. We received good result of simplification of detailed CATIA description – lose just 3 Kg
5. We have discovered 2 overlaps between Feet and other volumes. They are existing for both new and baseline geometries of Feet
6. For Overlap-#01 we propose to remove wrong parts from MDT Rails – modification in baseline Geant-4 description will needed
7. For Overlap-#02 we propose to change position of “Plancher” and make it flat (no $0.708^{O}$)– modification in baseline Geant-4 description will needed

Comments are welcome,

Thanks!