

PRY Base - Contents



Jason Tarrant – Integration Engineering

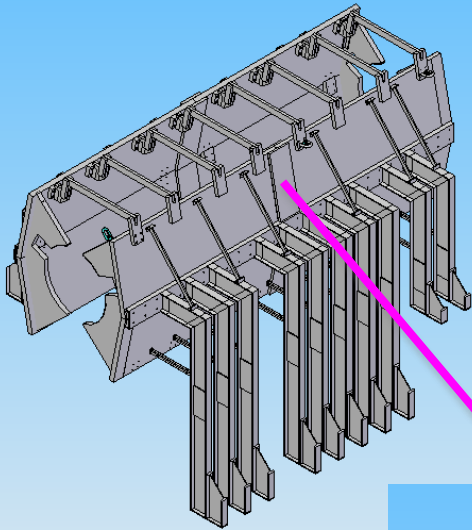
- PRY Support/Base/Platform in the MICE Hall
 - History
 - Requirements
 - Environment
 - Design
 - Structural Integrity
 - Preparation
 - Installation
 - Absorber Change
 - Schedule
 - Conclusion
 - Step V CONCEPT – Initial Look



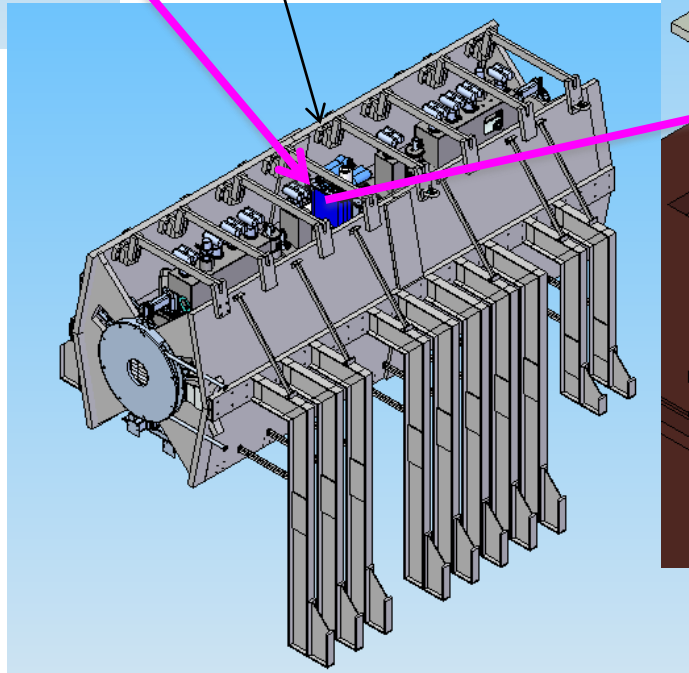
PRY @ Pre-September 2013 Review



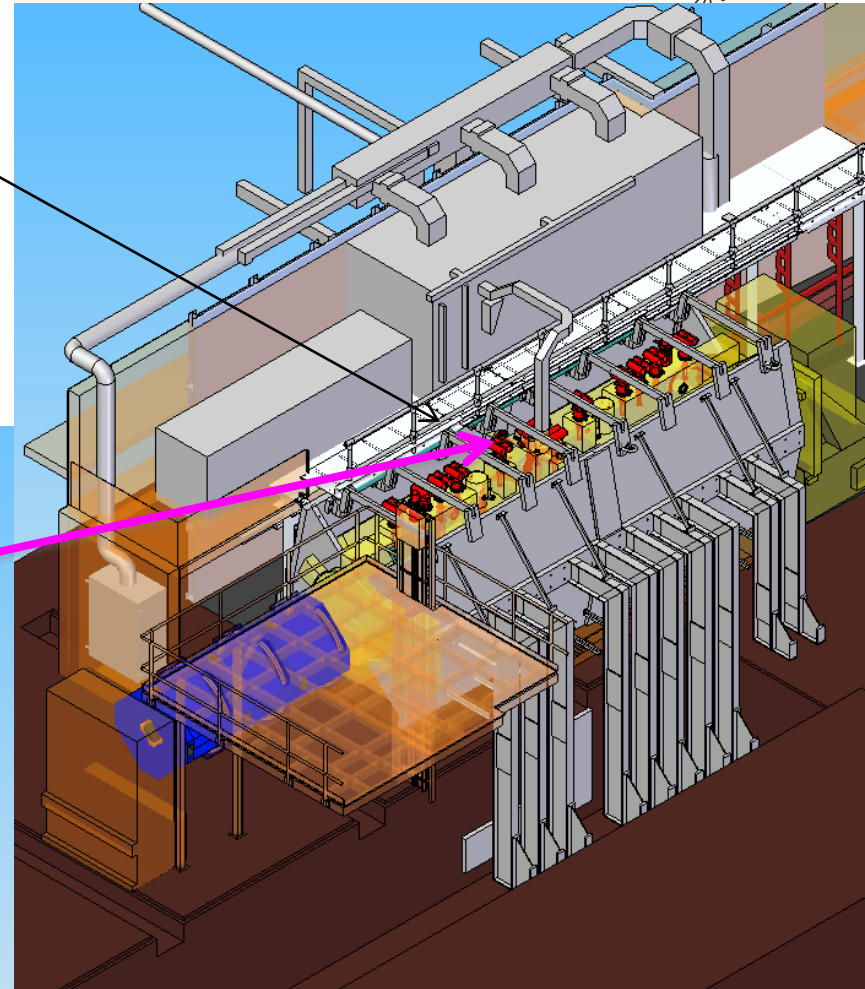
Brookhaven Yoke Design (H Witte, S Plate)



Integrated
with Step IV
Devices

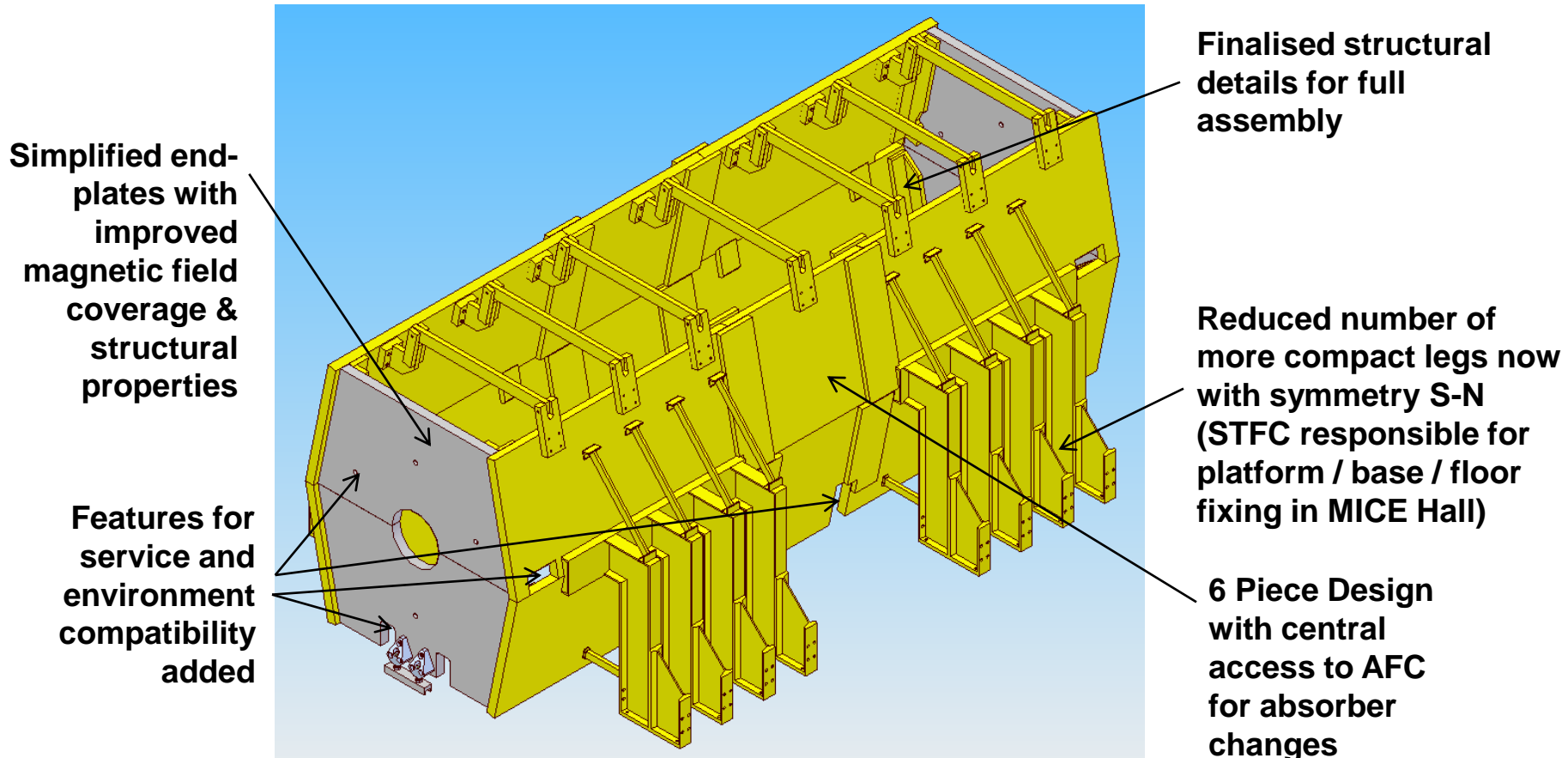


Integrated
into the
MICE Hall



PRY - April 2014

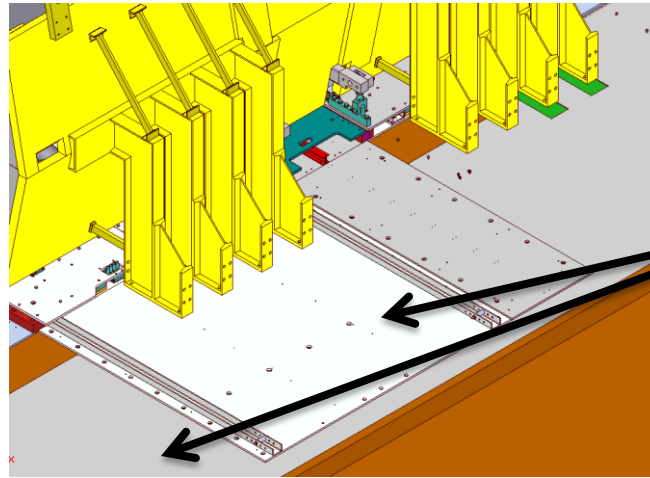
Brookhaven Yoke Design (H Witte, S Plate)



PRY Base - Environment

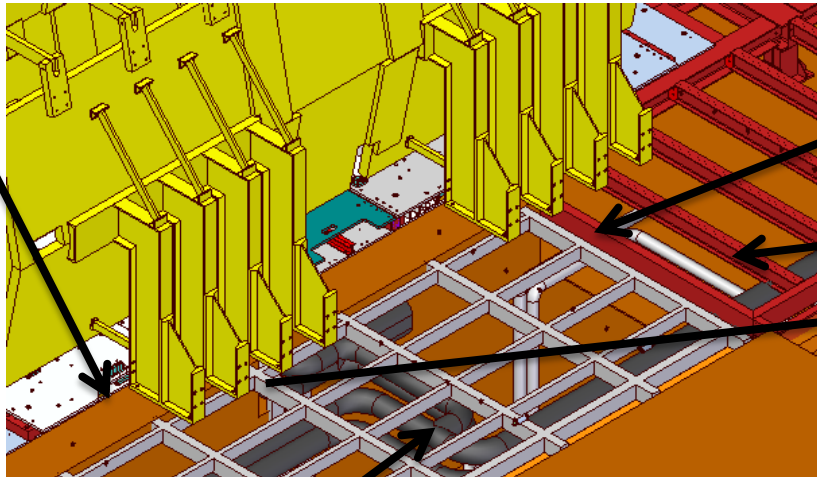


- Requirements
– North side

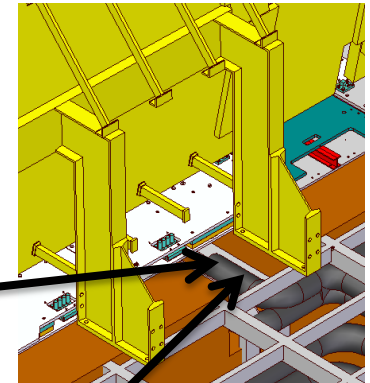


Plates &
trench
roof on
north side

Edge of
main
concrete
floor /
trench



Trench
ends
False
floor



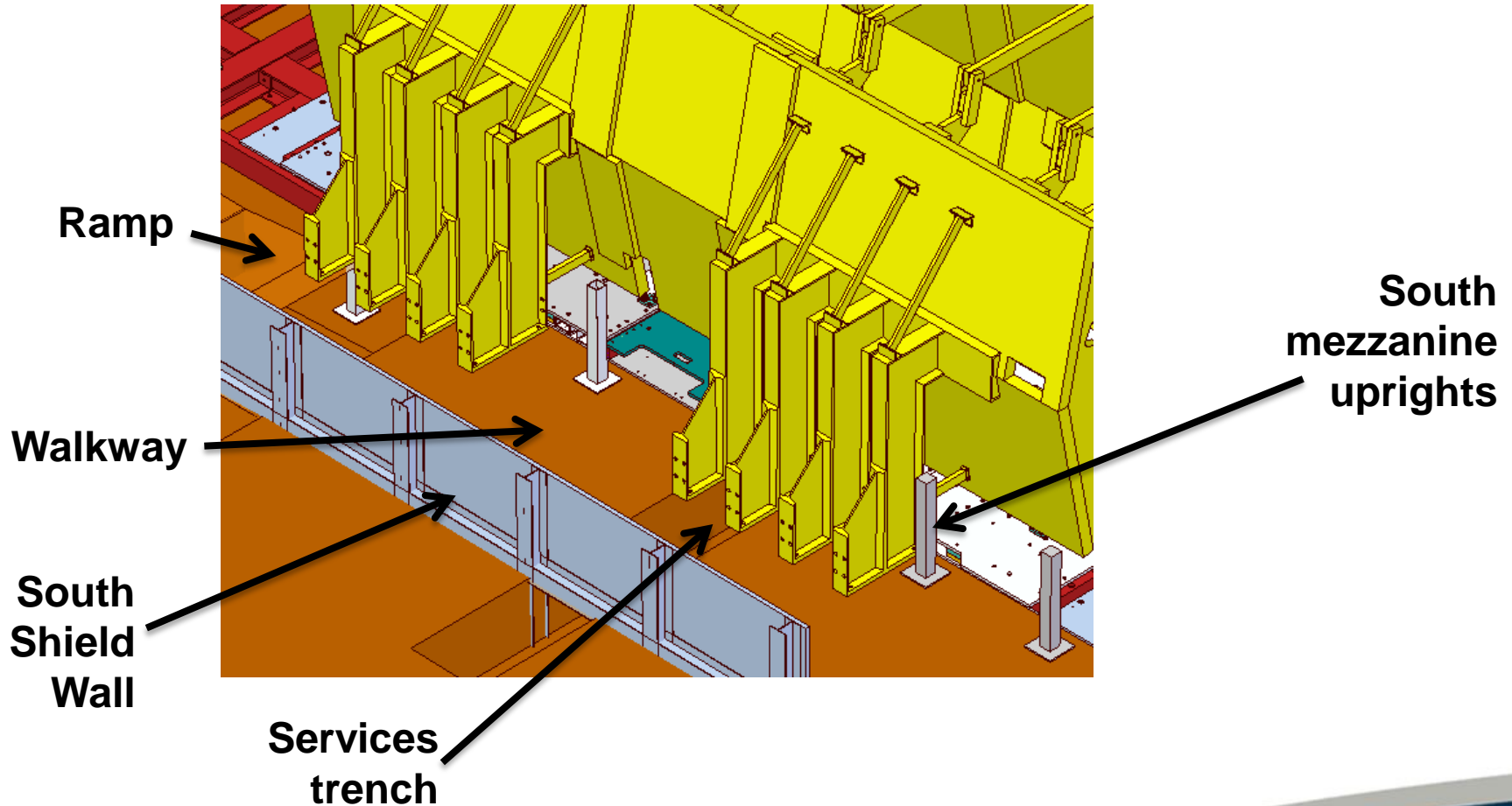
Services trench
directly under leg

Services in trench
on wall and
ceiling

PRY Base - Environment



- Requirements
 - South side

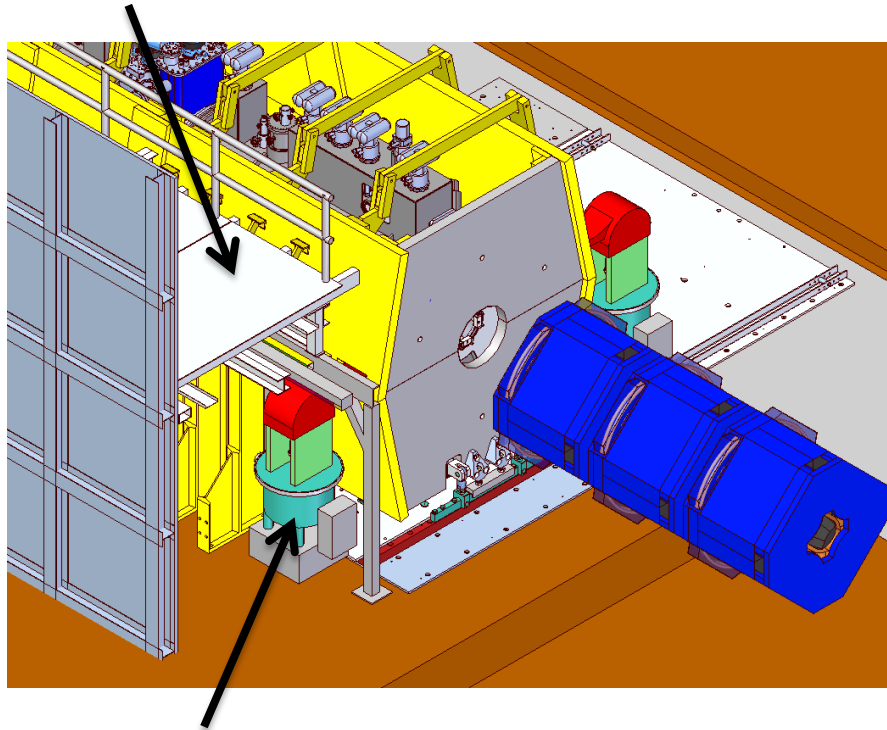


PRY Base - Environment



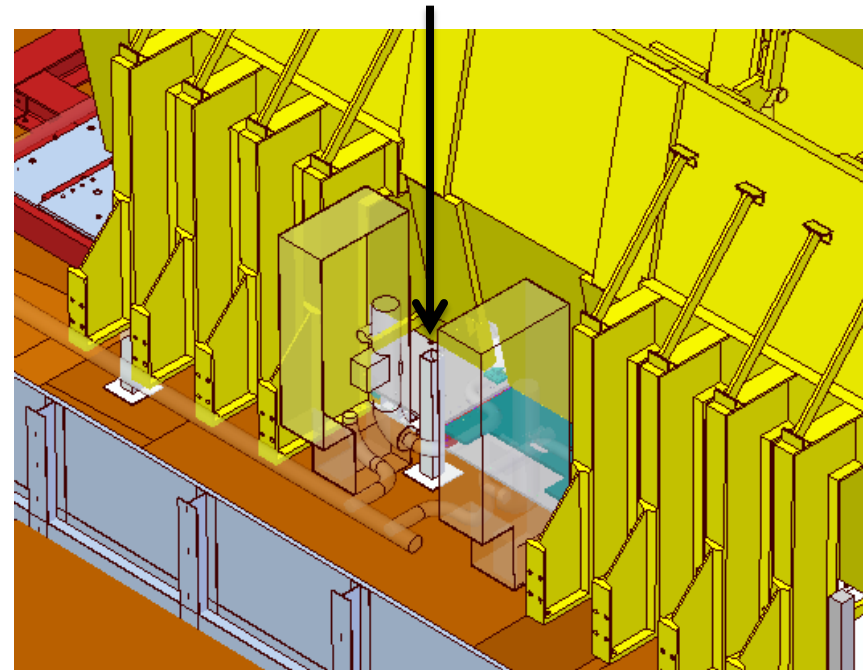
- Requirements
- Services

South mezzanine



Tracker Cryo

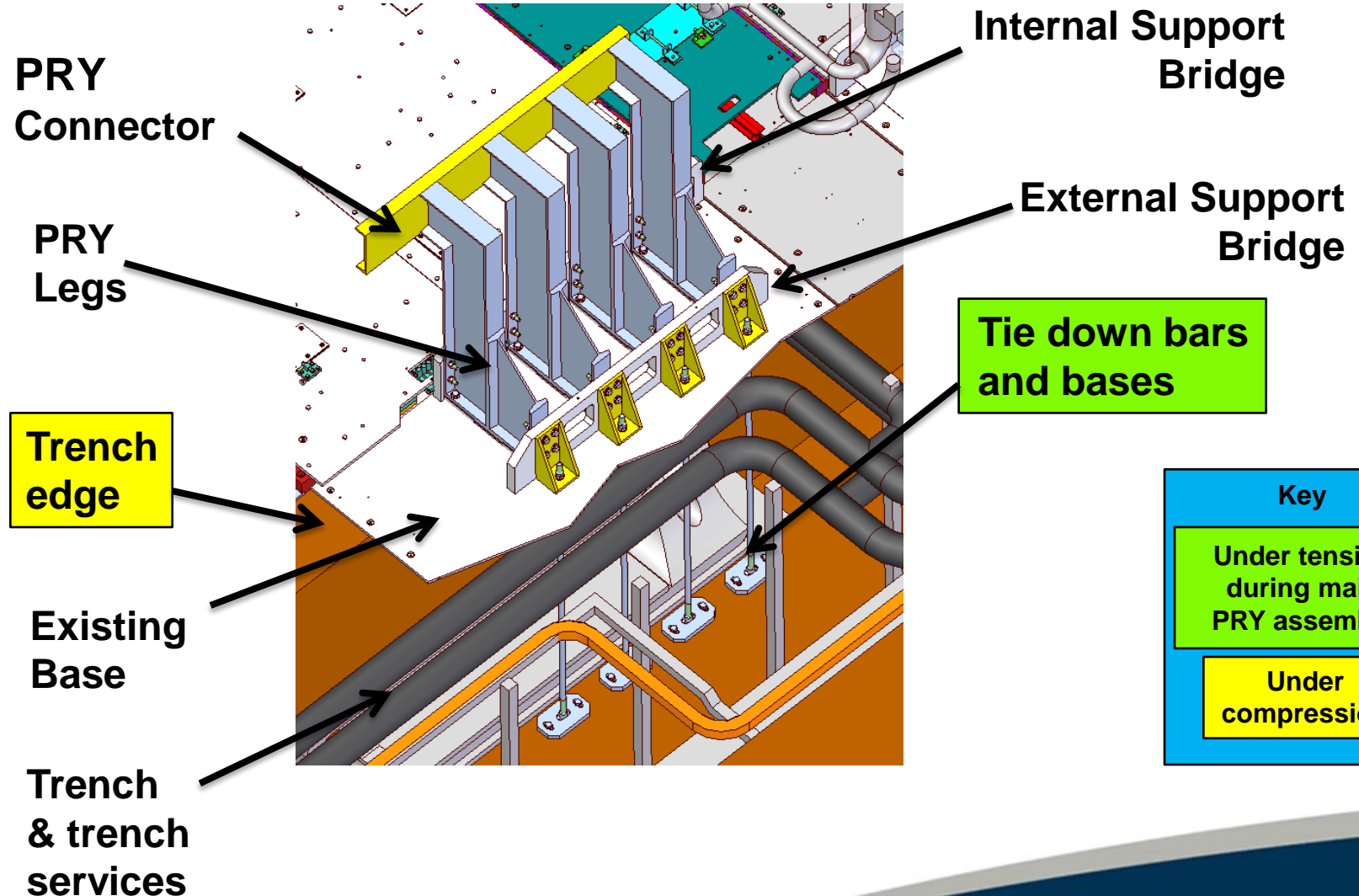
Vacuum system



PRY Base - Design



- TD-1189-2090 - North East Quadrant



PRY Base - Design



- TD-1189-2090 – North West Quadrant

PRY
Connector

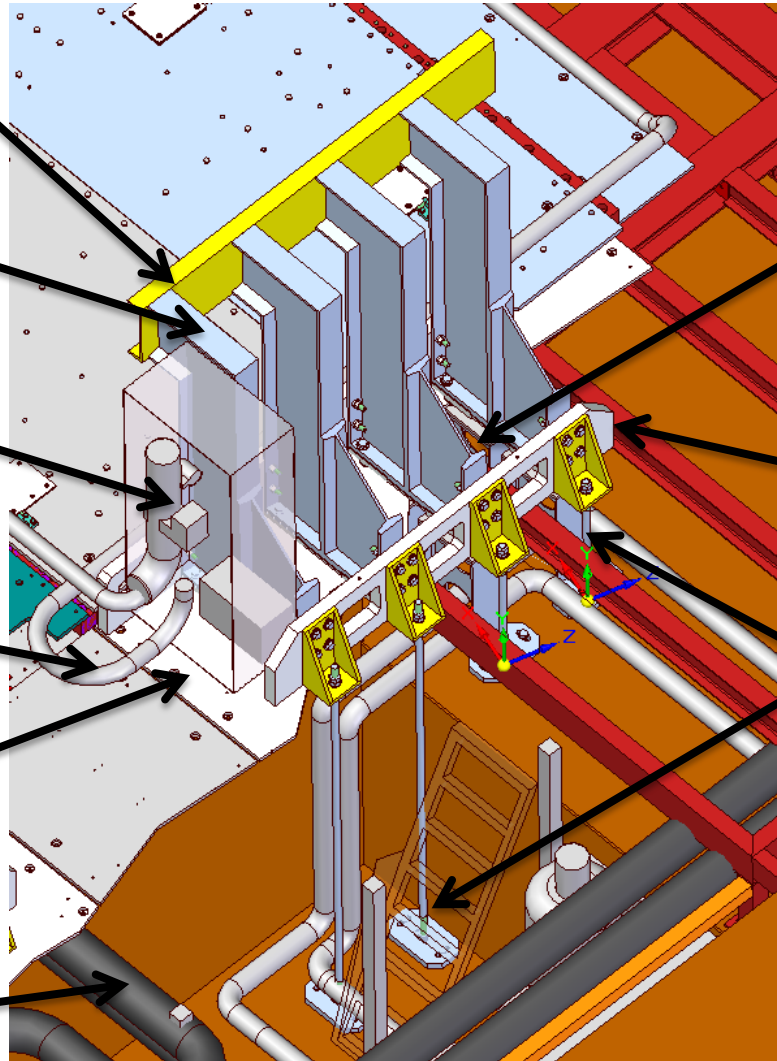
PRY
Legs

Vacuum
system
(installed
later)

Trench
edge

Modified
Base
(cutaway)

Trench
& trench
services



Short
columns
where
raised
floor ends

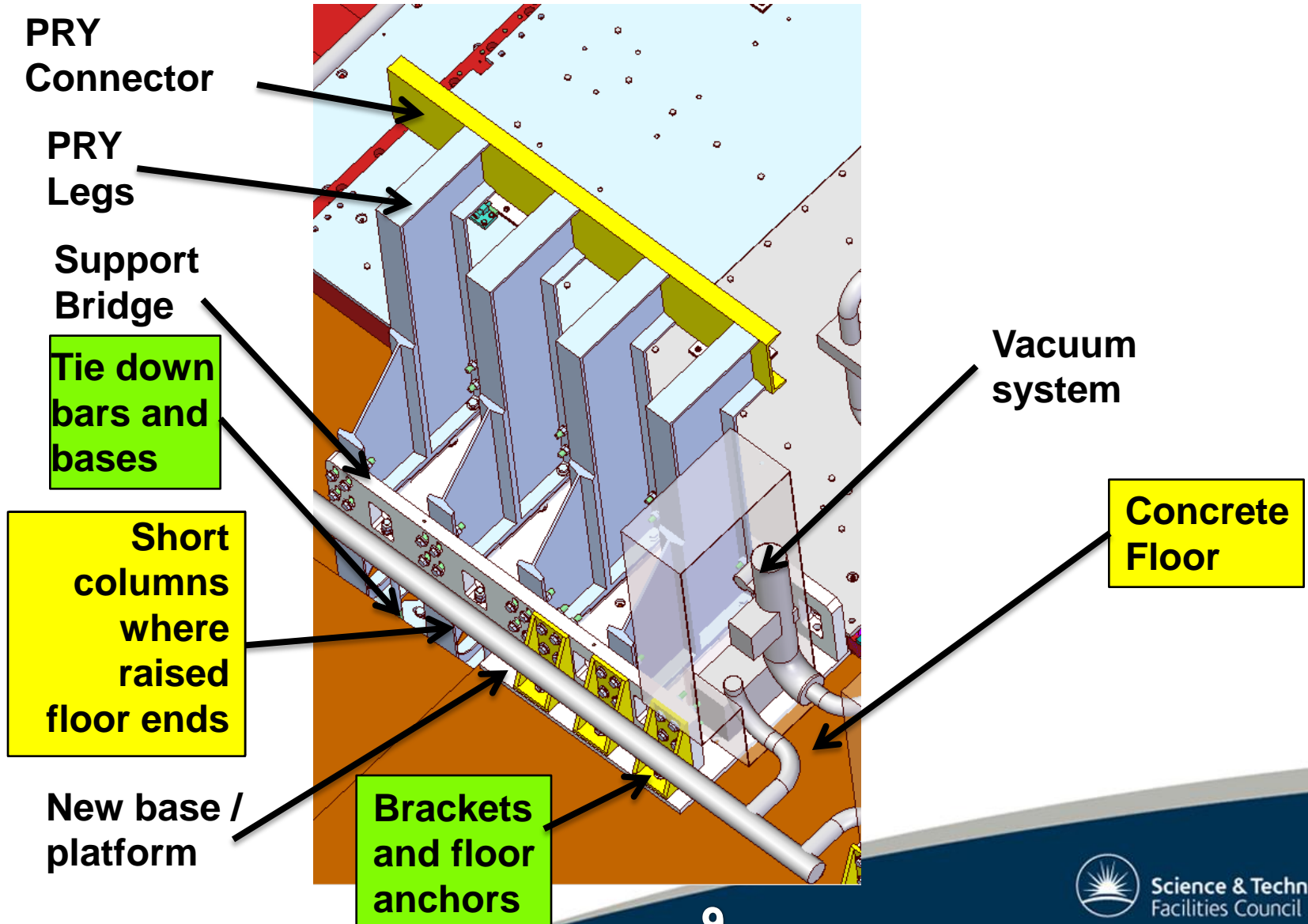
Support
Bridge

Tie down bars
and bases

PRY Base - Design



- TD-1189-2090 – South West Quadrant



PRY Base - Design



- TD-1189-2090 – South East Quadrant

PRY
Connector

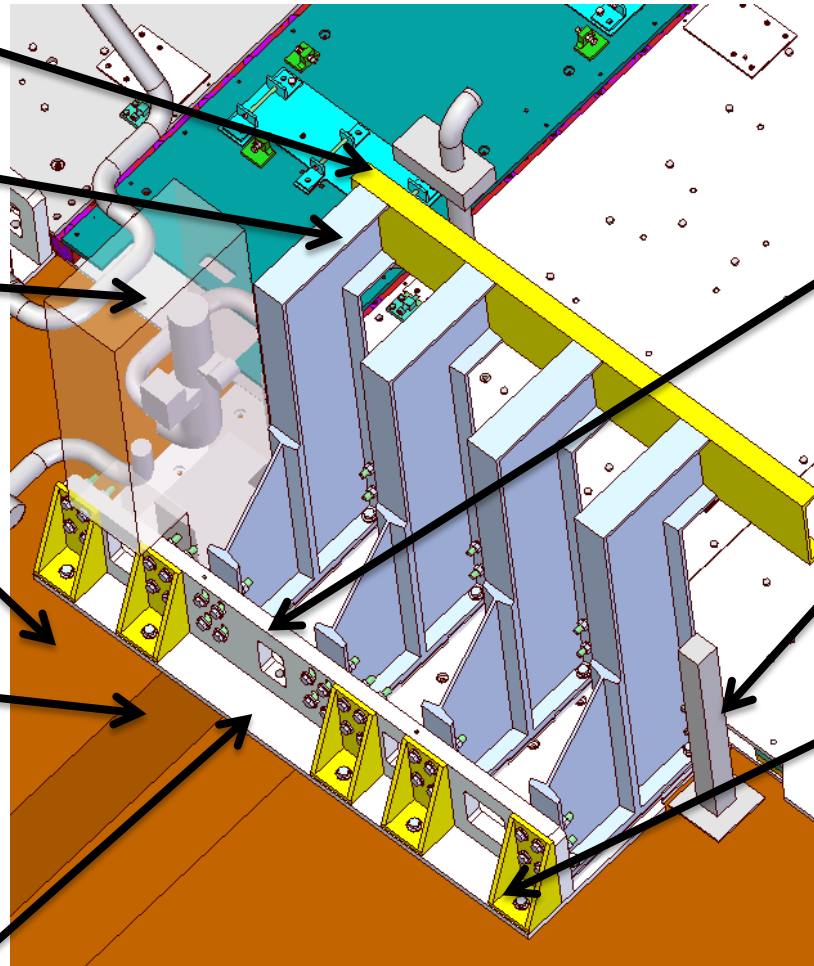
PRY
Legs

Vacuum
system

Concrete
Floor

Services
trench

New base /
platform



Support
Bridge

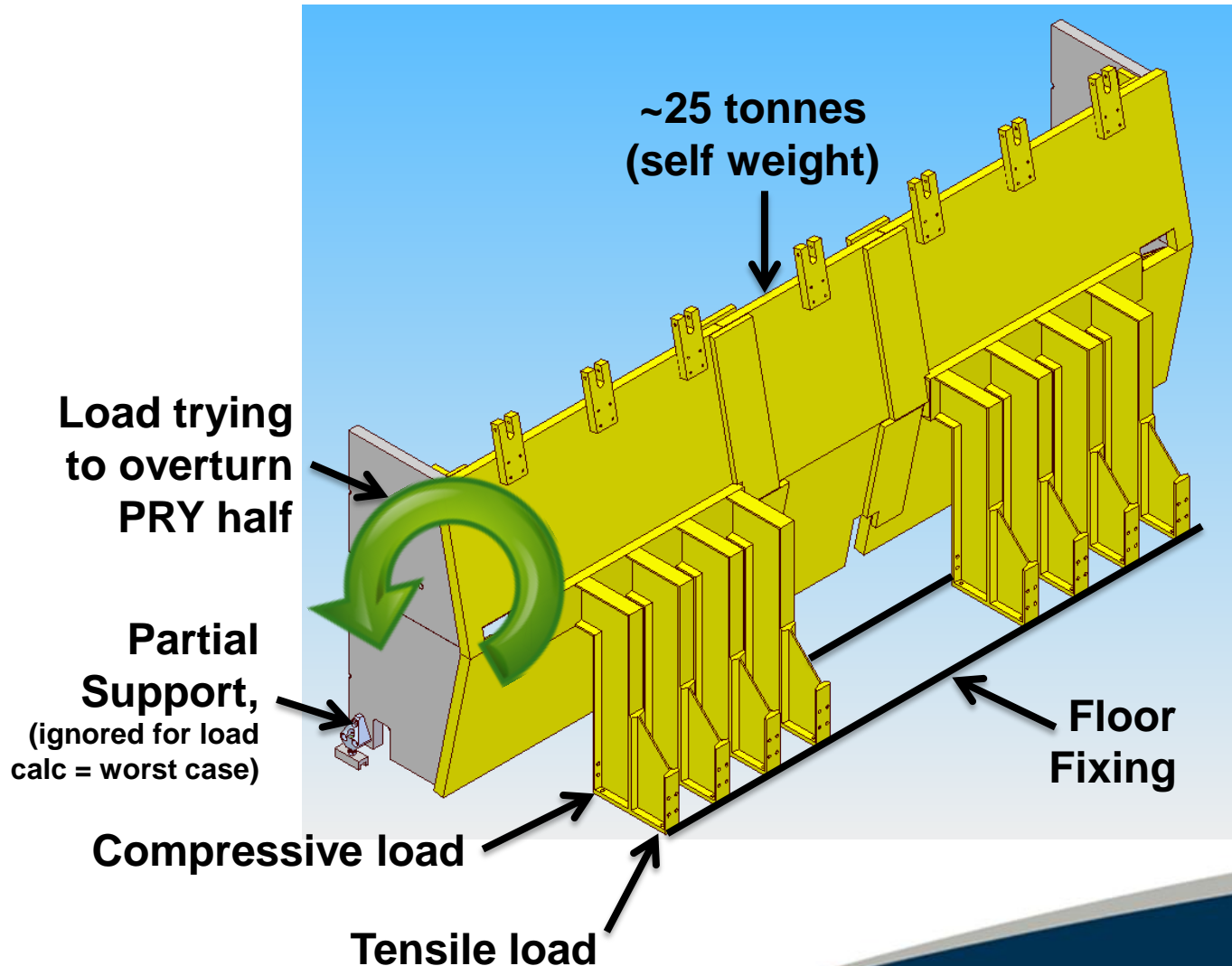
South
mezzanine
supports

Brackets
and floor
anchors

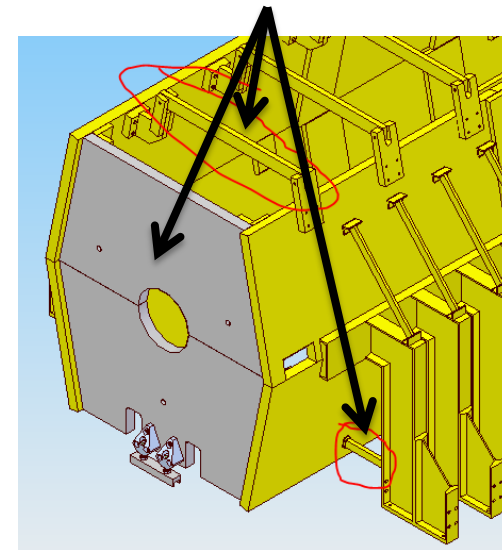
PRY Base - Requirements



- Requirements – Assembly load for floor fixing



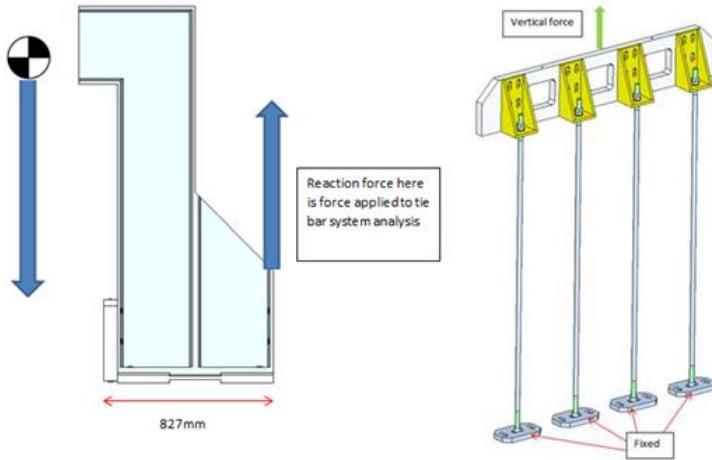
NO CAPACITY FOR SIGNIFICANT MAGNETIC LOAD IN FLOOR FIXING:
Cross-bars, leg ties & link plates will take magnetic loads



PRY Base – Structural Integrity



- Analysis & calculation



$moment_{prybase} = (1.808 \cdot 10^5) \text{ N} \cdot \text{m}$

$n = 8$ but there are 8 legs so the load can be subdivided

$moment_{perleg} = \frac{moment_{prybase}}{n} = (2.26 \cdot 10^4) \text{ N} \cdot \text{m}$

$Force_{interface} = \frac{moment_{perleg}}{0.762 \cdot \text{m}} = (2.966 \cdot 10^4) \text{ N}$

$\mu_{steebar} = 0.3$ 0.3-0.61 book figures

$Pre_{load} = \frac{Force_{interface}}{\mu_{steebar}} = (9.887 \cdot 10^4) \text{ N}$

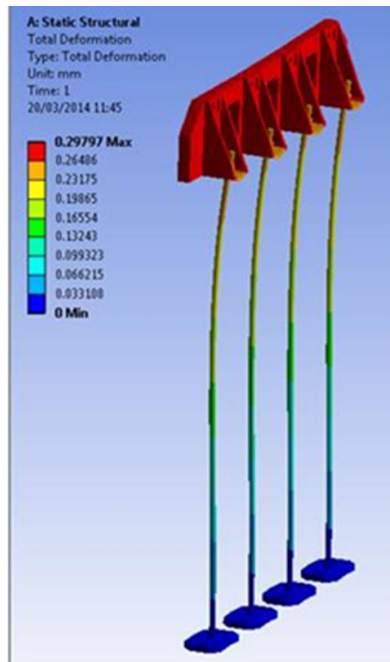
Using yield stress of 660 MPa (high tensile > dia 16)

$\sigma_{max} = 660 \cdot \text{MPa}$

$A_{boltfrict} = \frac{Pre_{load}}{\sigma_{max}} = (1.498 \cdot 10^{-4}) \text{ m}^2$

$Dia_{boltmin\ effective} = 2 \cdot \sqrt{\frac{A_{boltfrict}}{\pi}} = 0.014 \text{ m}$

$Dia_{boltmin\ effective} = 13.811 \text{ mm}$



Extension of Tie Bars (with actual load as per analysis)

$F2_{actual} = 24333 \cdot \text{kg} \cdot g = (2.386 \cdot 10^5) \text{ N}$

$D2_n = 0.4917 \cdot \text{m}$ $D1_n = 0.867 \text{ m}$

$F1_n = \frac{F2_{actual} \cdot D2_n}{D1_n} = (1.353 \cdot 10^5) \text{ N}$

$F1_n = (1.353 \cdot 10^5) \text{ N}$ $Tiebar_{diam} = 30 \cdot 10^{-3} \cdot \text{m}$ $N_{tiebars} = 8$

$F_{tiebar} = \frac{F1_n}{N_{tiebars}} = (1.692 \cdot 10^4) \text{ N}$

$L_{tiebar} = 2.31 \cdot \text{m}$ Assumes all long as worst case

$E_{tiebar} = 196 \cdot 10^9 \cdot \frac{\text{N}}{\text{m}^2} = (1.96 \cdot 10^{11}) \text{ Pa}$

$A_{tiebar} = \left(\frac{Tiebar_{diam}}{2} \right)^2 \cdot \pi = (7.069 \cdot 10^{-4}) \text{ m}^2$

$\sigma_{tiebar} = \frac{F_{tiebar}}{A_{tiebar}} = (2.393 \cdot 10^7) \text{ Pa}$ $E = \frac{\sigma_{tiebar}}{\epsilon}$

$\epsilon = \frac{\sigma_{tiebar}}{E_{tiebar}} = 1.221 \cdot 10^{-4}$

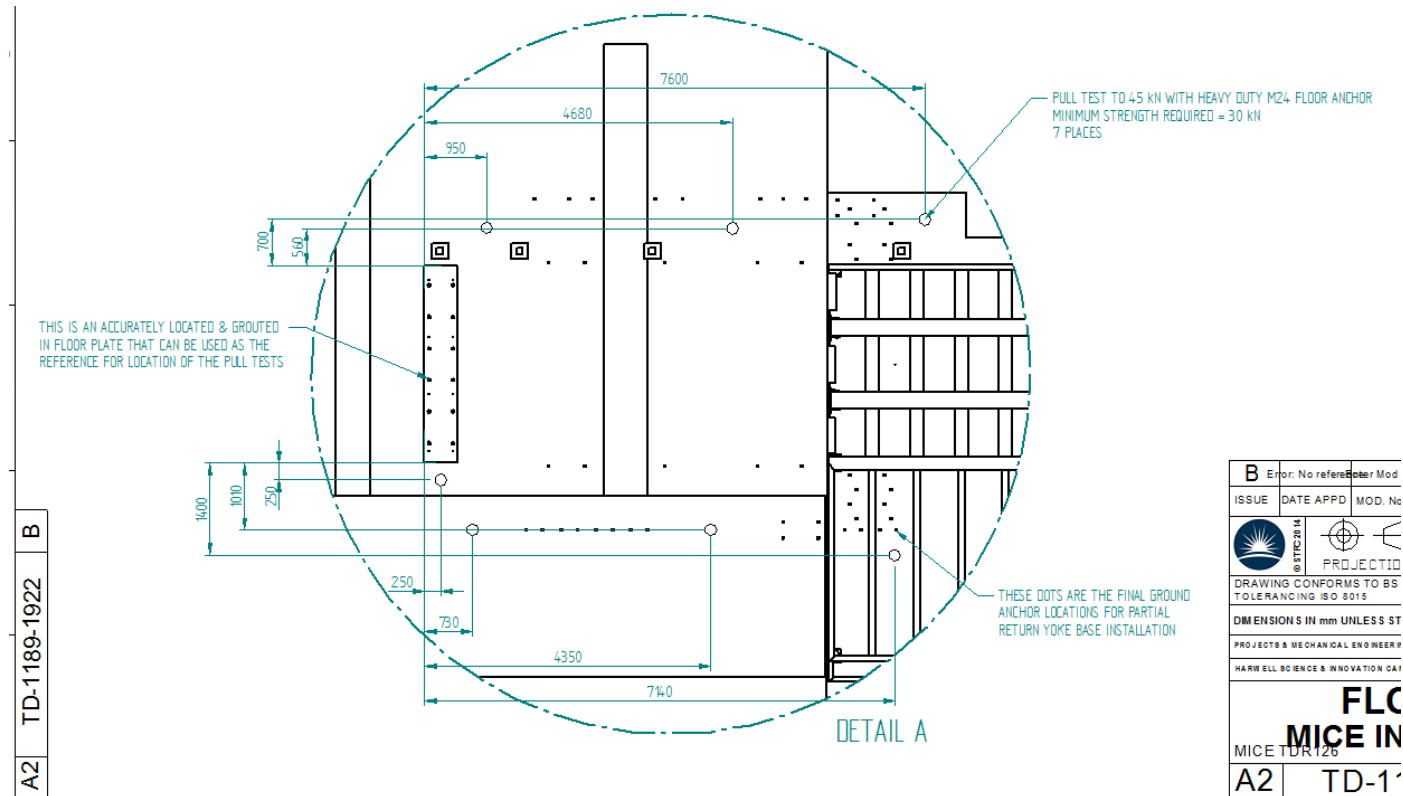
$\Delta L = L_{tiebar} \cdot \epsilon = (2.821 \cdot 10^{-2}) \text{ m}$

$\Delta L = 0.282 \text{ mm}$

PRY Base – Structural Integrity



Testing



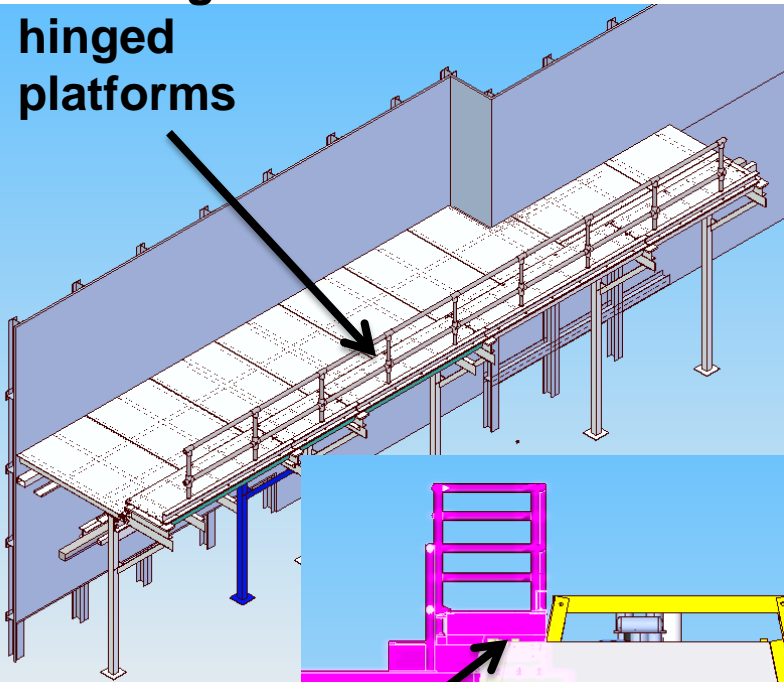
Floor anchor pull out (TD-1189-1922)

PRY Base - Preparation



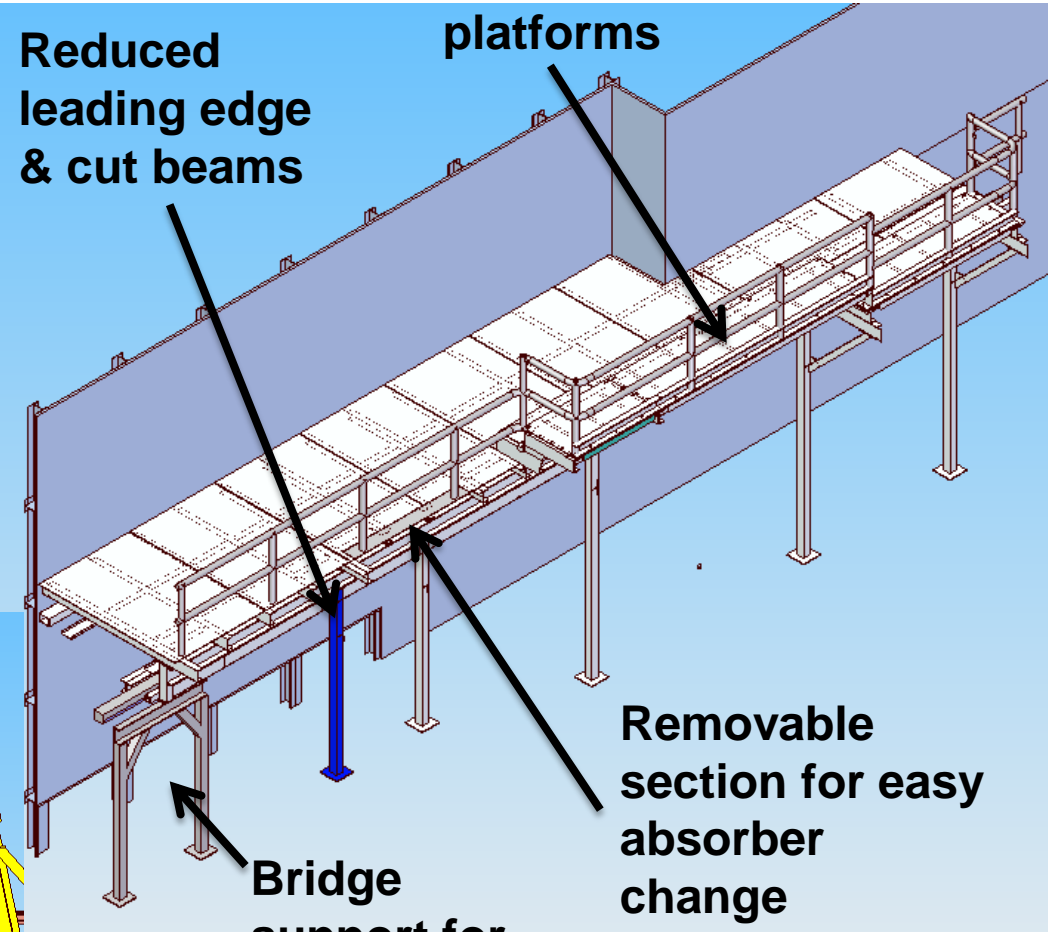
- South Mezzanine

Full length of hinged platforms



Reduced leading edge & cut beams

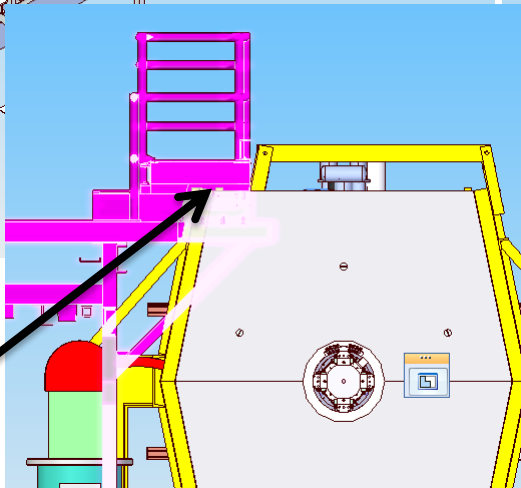
Raised platforms



Removable section for easy absorber change

Bridge support for Tracker Cryo

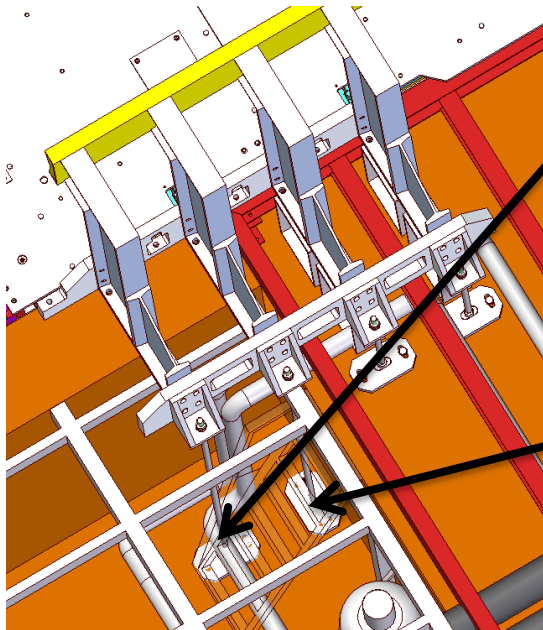
Fit around PRY



PRY Base - Preparation

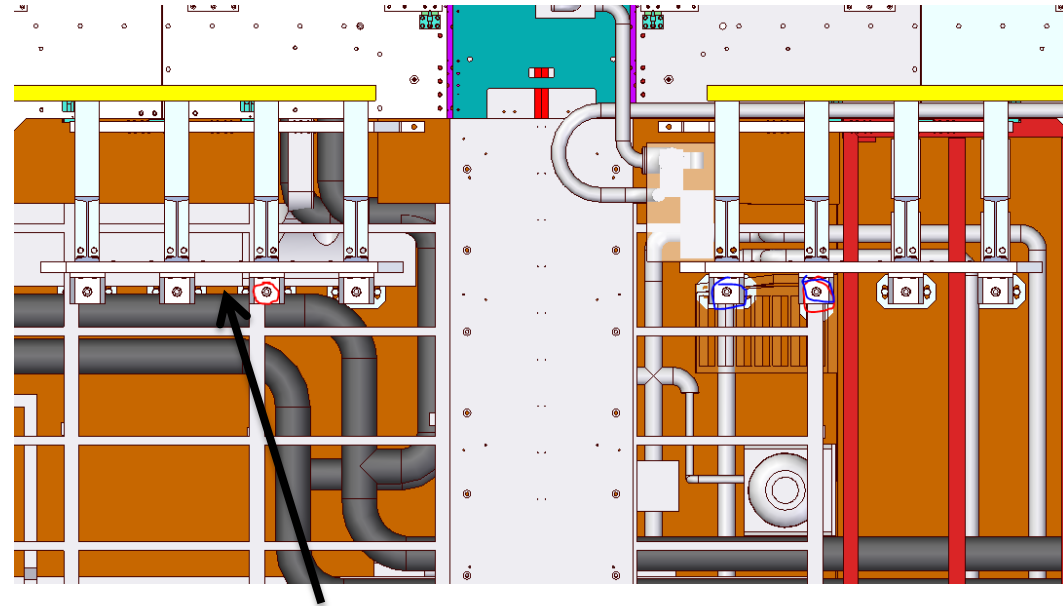


- Trench



**Water
circuit
move**

**Ladder
move
and
change**



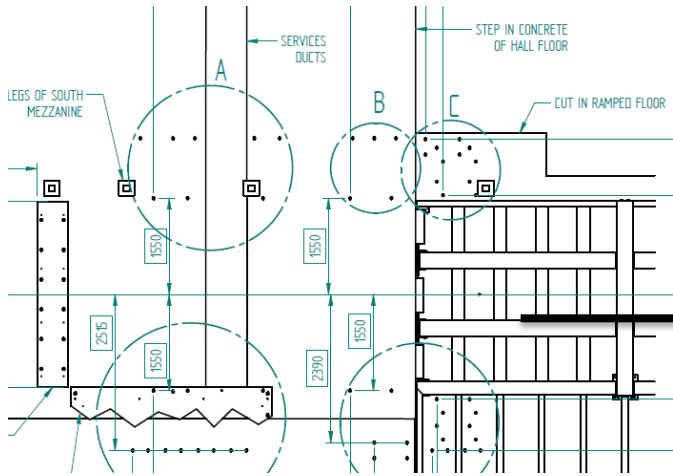
**North-east tie bars
pass between trench
services (water and
ISIS cables)**



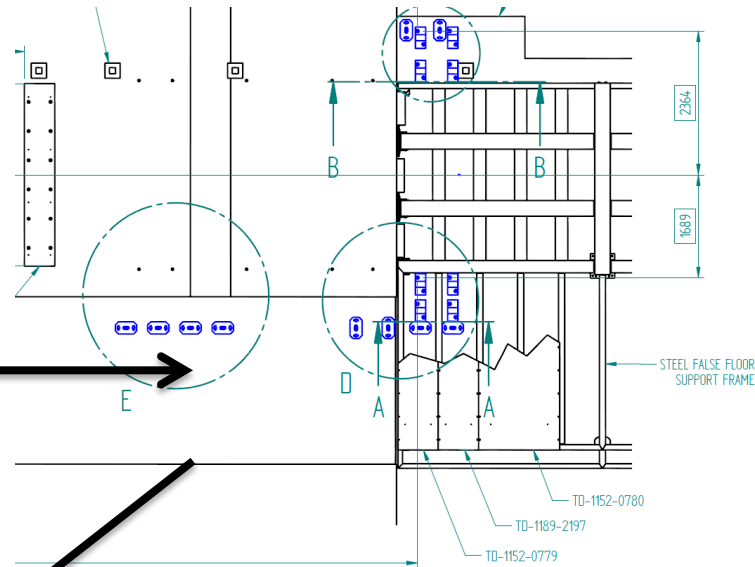
PRY Base - Installation



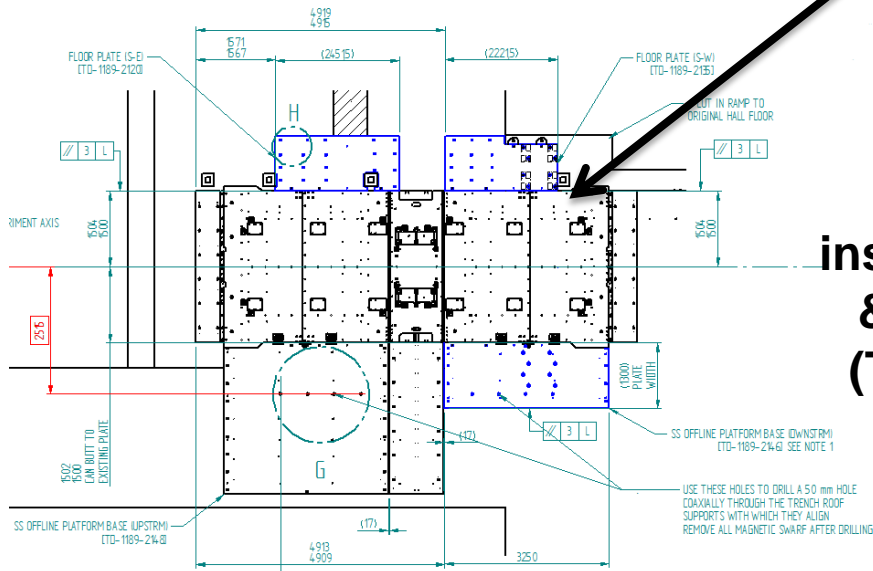
- Installation - Bases



Floor anchors (TD-1189-2152)



Pillars, tie plates (TD-1189-2153)



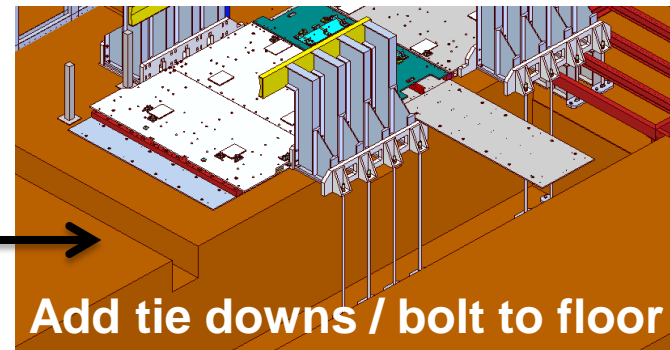
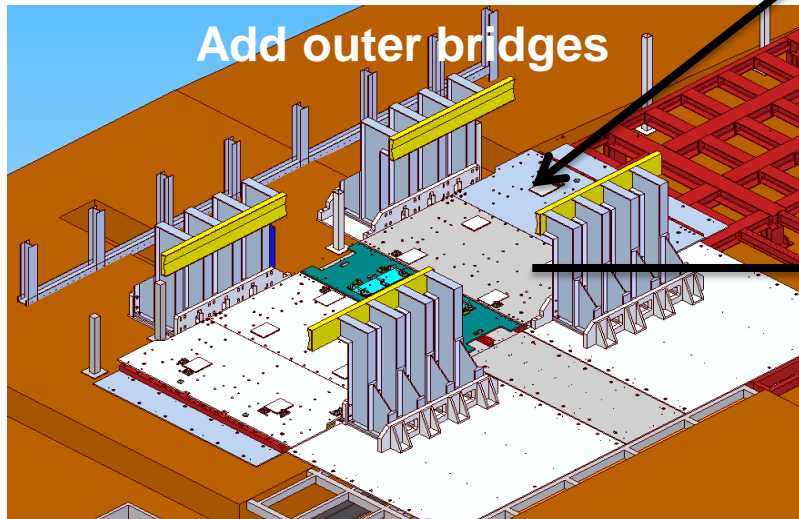
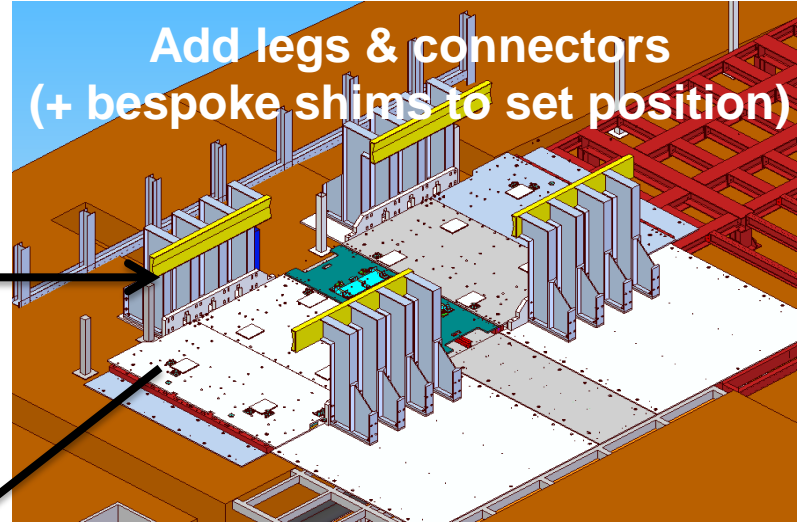
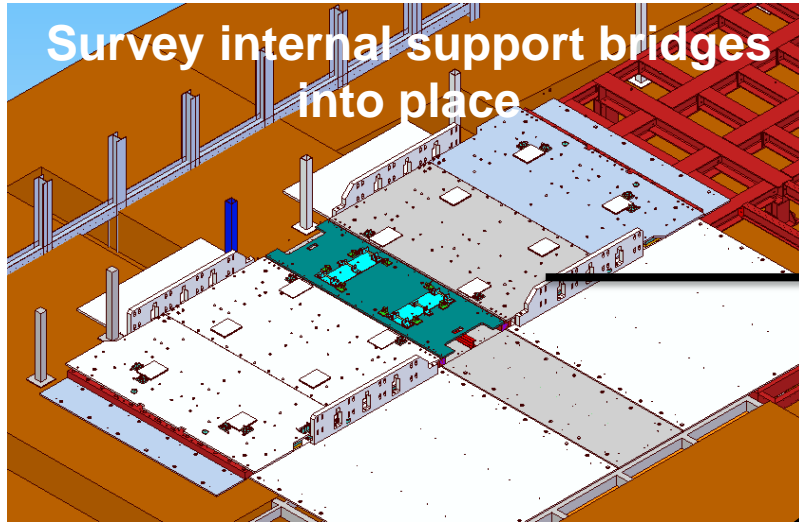
Top plate installation (blue) & hole drilling (TD-1189-2136)



PRY Base - Installation



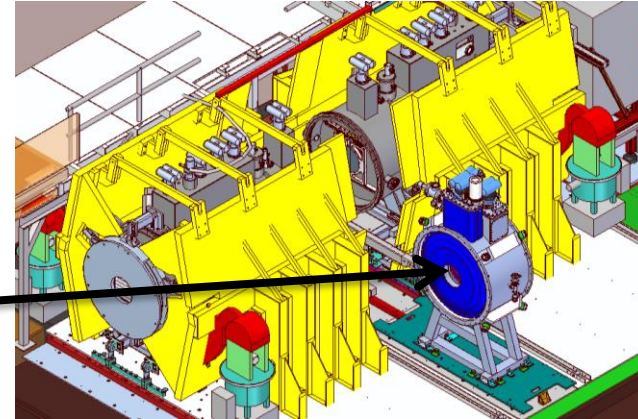
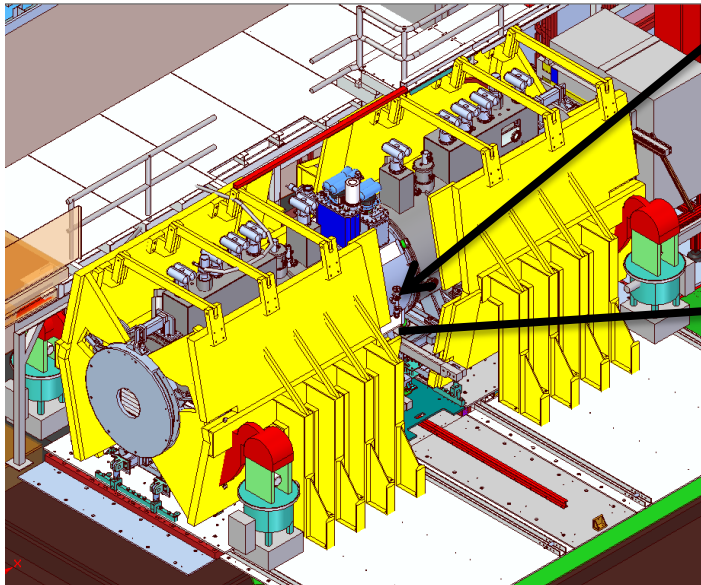
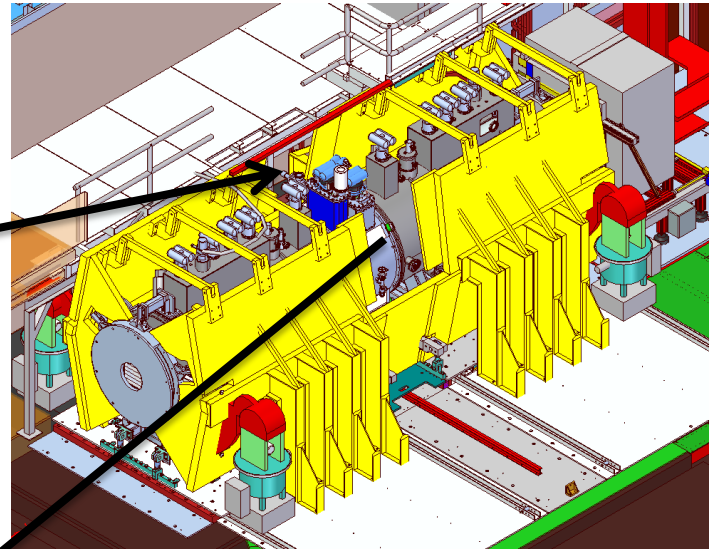
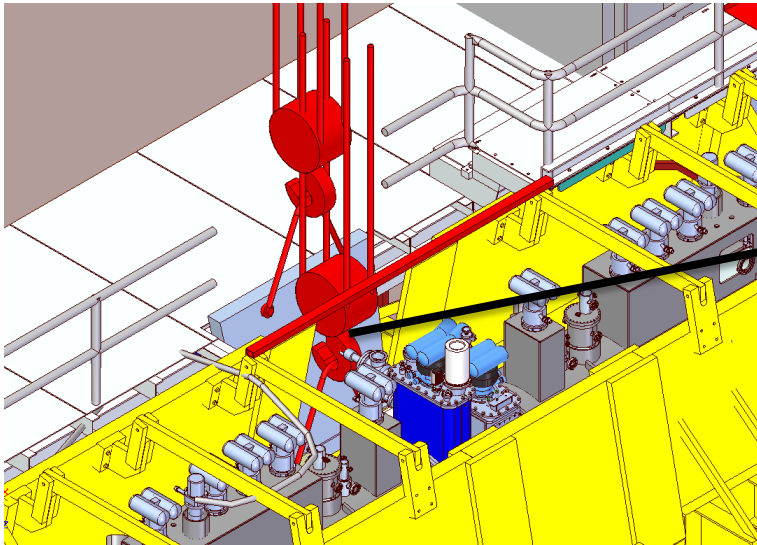
- Installation – PRY Frame



PRY Base - Absorber Change



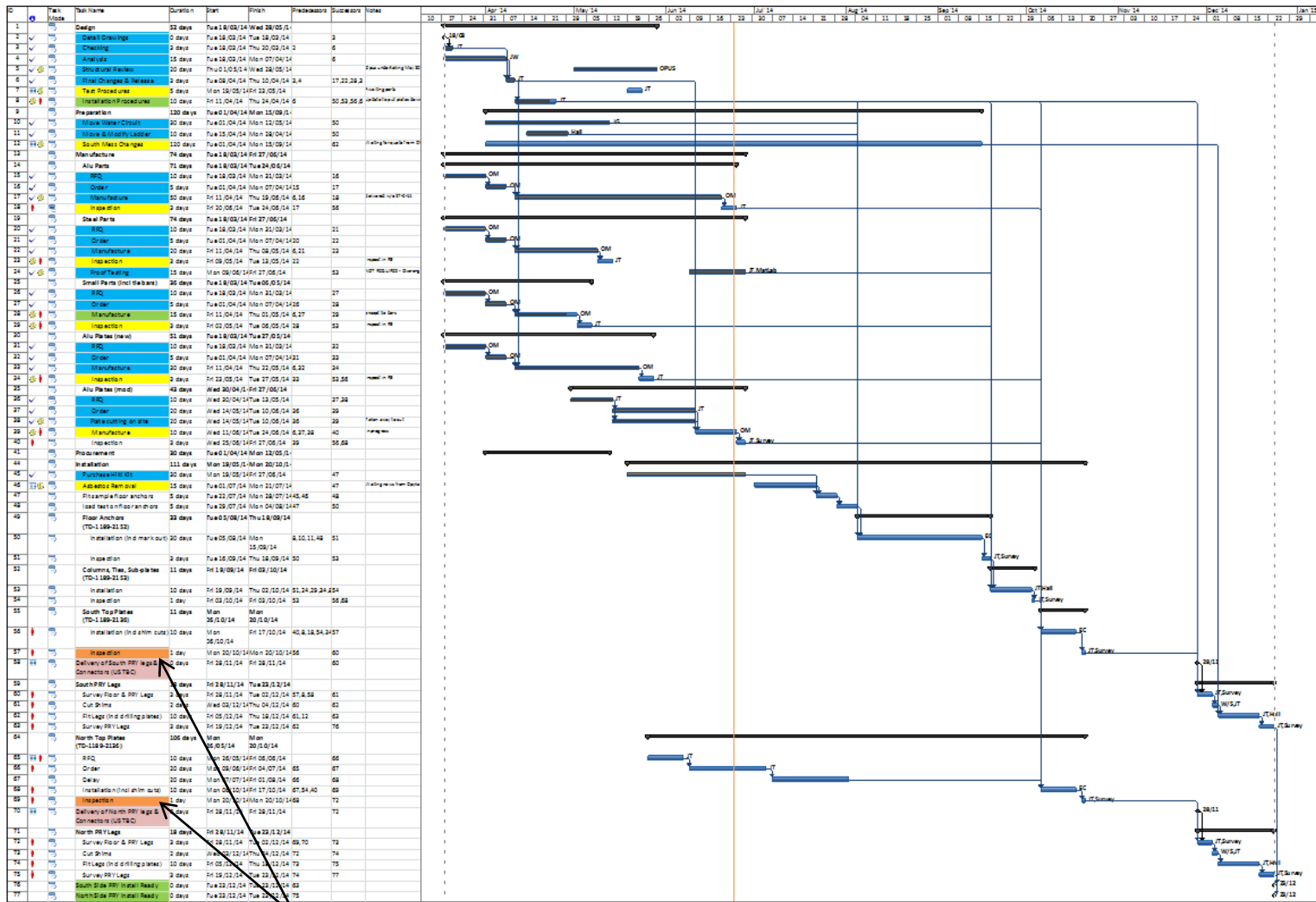
- Absorber change



PRY Base - Schedule



Schedule

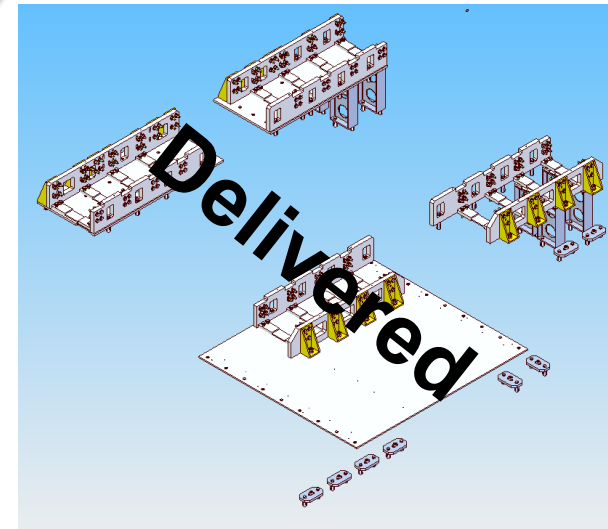
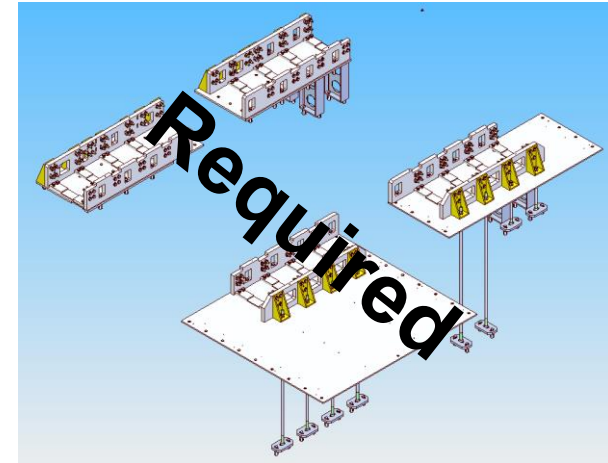


Prep for South & North Bases
by October 2014 then await
PRY Frames

Conclusion – Step IV PRY Base

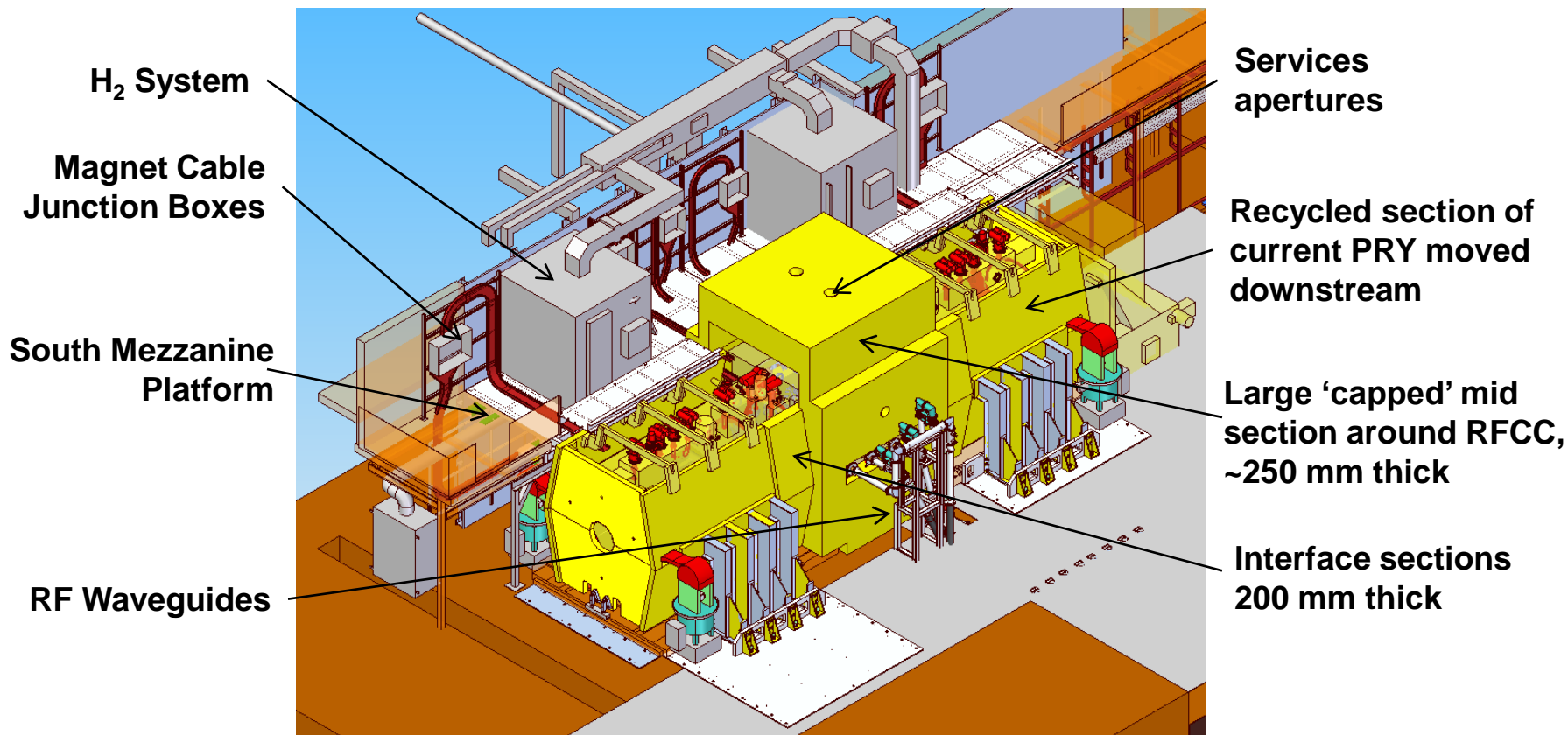


- Production Readiness Review (PRR) for PRY Monday 28th April, all OK to continue.
- Calculation and analysis show design of bases / platforms is OK for self weight during installation (not magnetic load) both stress & strain
- PRY Base / Platform design done & all parts drawings complete & released (top level = TD-1189-2152,2153,2136 & 2090).
- 90% Piece parts have been delivered, remainder imminent.
- Floor anchors and fitting kit delivered.
- South mezzanine structural changes being quoted for.
- Awaiting asbestos removal to start marking out
- Schedule currently predicting manufacture, prep and install of bases ahead of PRY delivery



Step V PRY - CONCEPT

Conceptual Step V Partial Return Yoke
(H Witte, S Plate, J Tarrant)

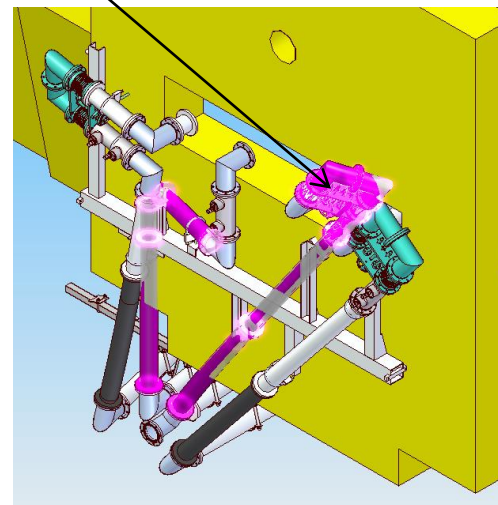
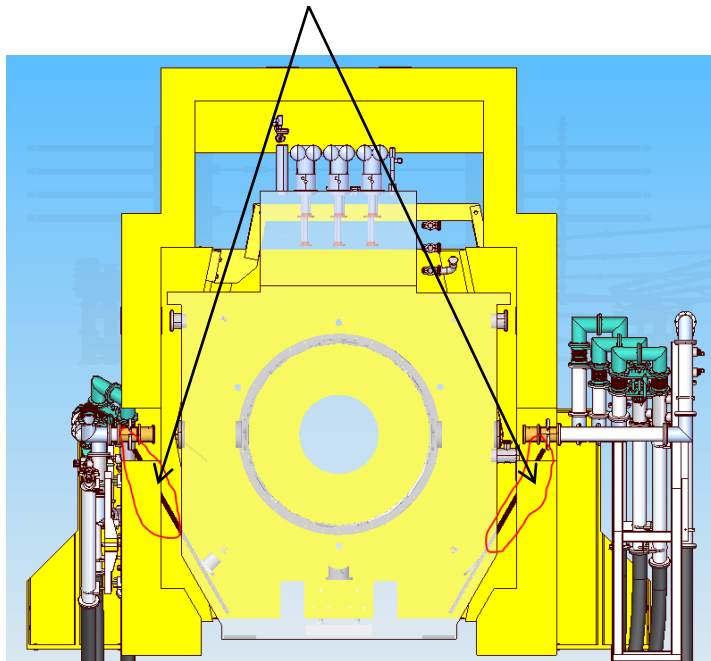
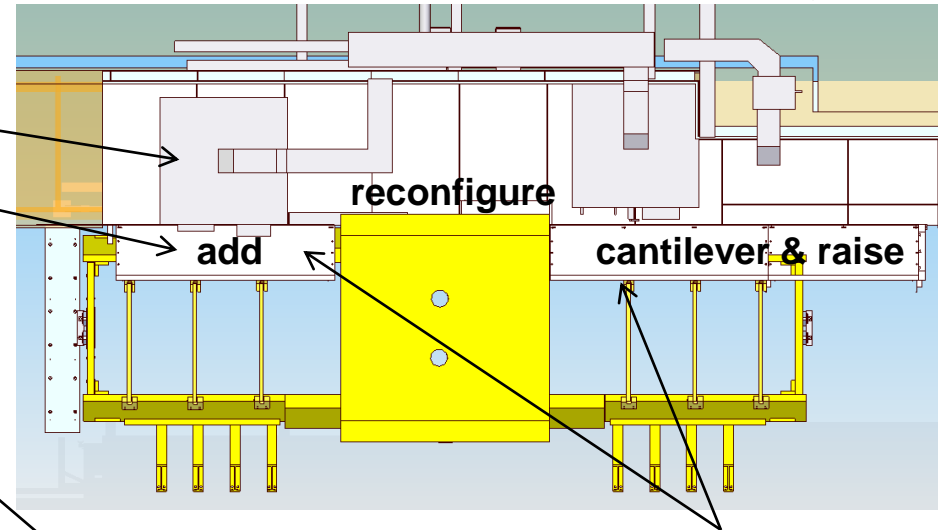


Step V PRY - CONCEPT



- Step V PRY Specific Modifications

- H2 System
- South Mezzanine
- RF Waveguides
- False floor support
- RFCC RF supports



**H2 system
access and Step
V PRY
configuration
will make
absorber
changes slow!**