

# T050048-00-K – Report on Visit to CalTech (February 21<sup>st</sup> – March 5<sup>th</sup>, 2005)

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The goals of this visit were as follows:

- **Mock build of Quad**
  - Follow/Test/Verify the 3&1 Assembly Procedure ([T050034-00-D](#))
  
- **Advancement of the detailed design of the Lower Structure (for the Controls Prototype)**
  - Implementation Ring Range ([see T050033-00-D](#))
  - Safety Stop Design (for the Controls Prototype) *\*CRUCIAL!\**
  - Testing of Teflon pad concept
  - Interface with machinists to progress detailed drawings

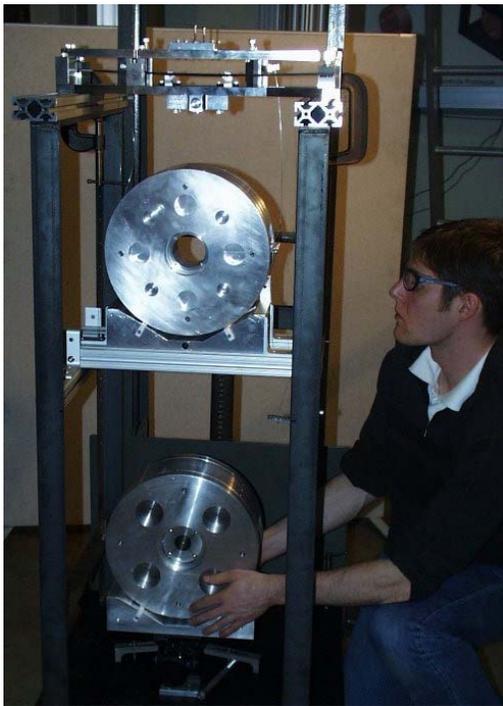
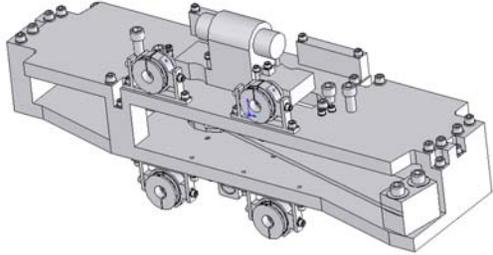
These goals were successfully accomplished.

Many thanks to all who worked with me during those two weeks.

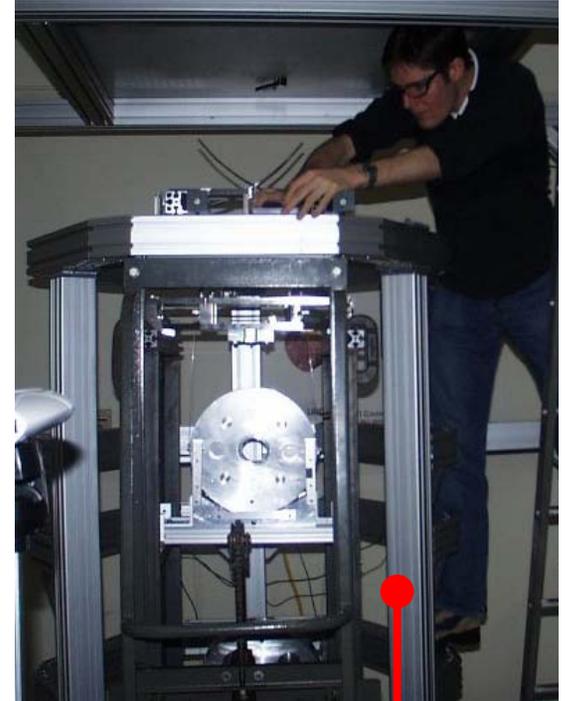
The slides that follow form more of a visual history of work covered on the trip, than a written report.

## MOCK BUILD OF QUAD (CIET, RAJ, NAR, JHR, HA, DC)

- **Suspending a Triple pendulum from the Top Mass down**
  - Acting through 3&1 Assembly procedures ([T050034-00-D](#))

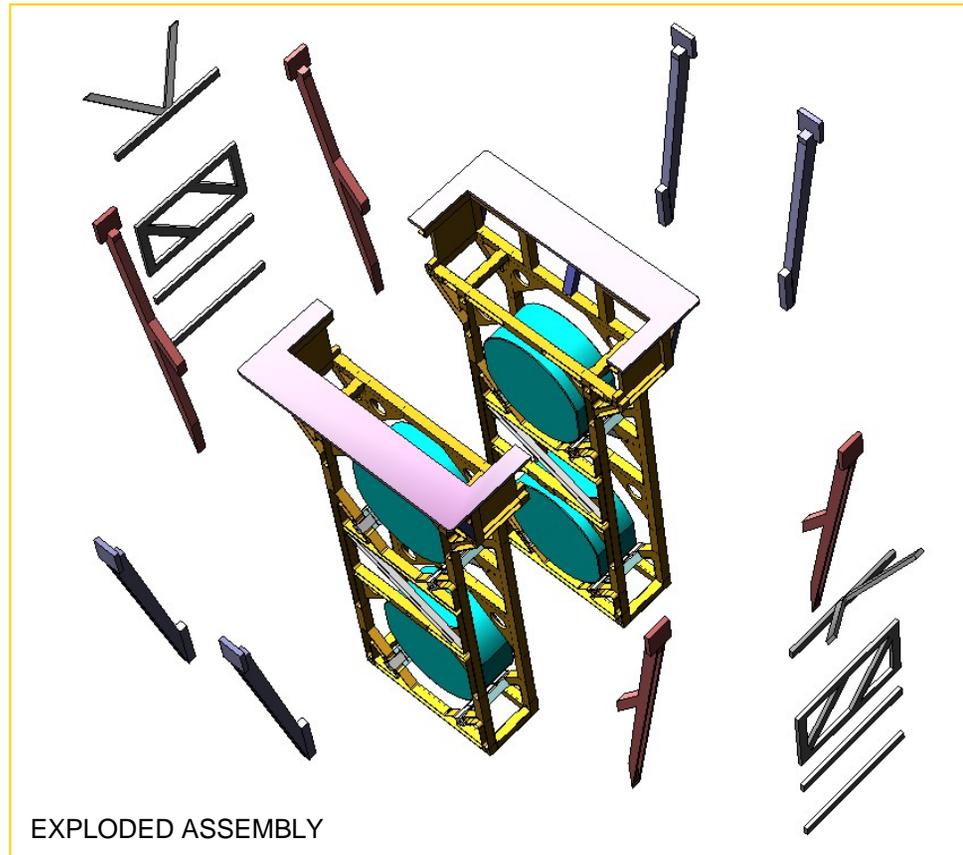
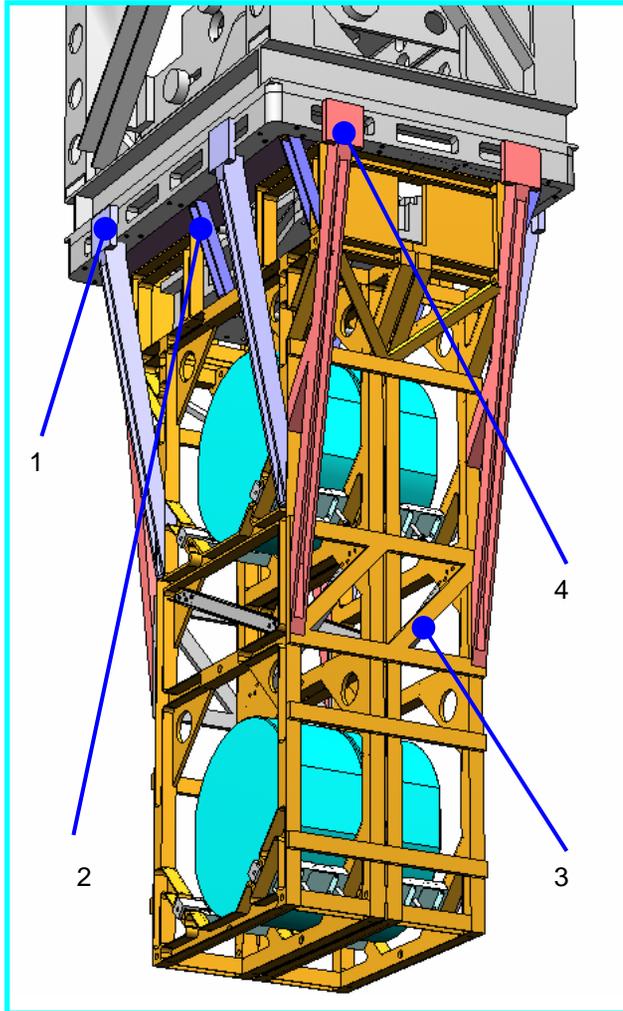


NOTE: Construction of a 'gallows' structure (incorporating a lab-jack to interface with/lift the UI mass) adjacent to the 3&1 Assembly setup



NOTE: Successful recycling of the MIT Quad structure to assist in the mock-up

## Considering component parts and interfaces during final stages of assembly

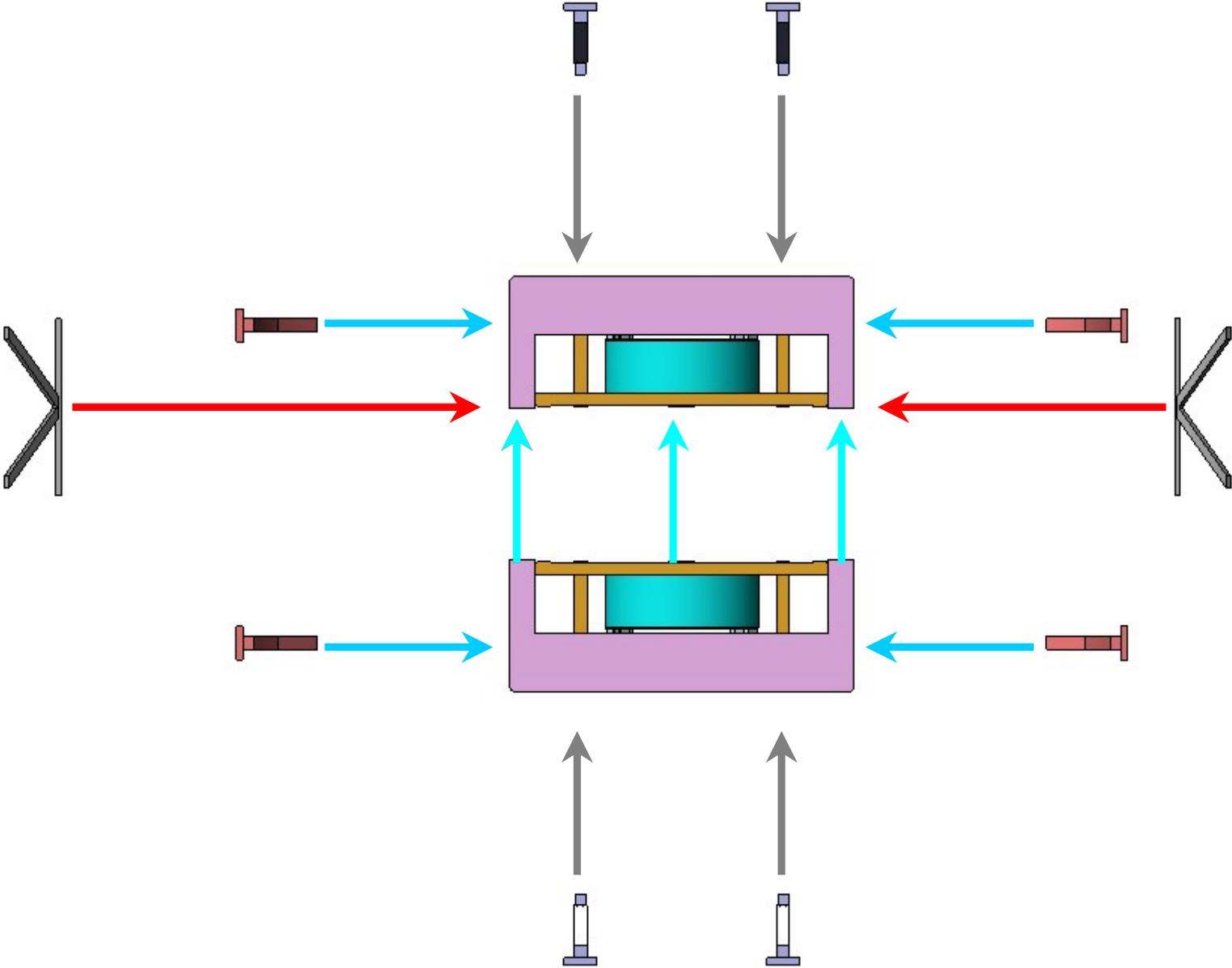


...thinking about where amendments to current lower structure are required, in terms of adding material for bolted connections etc.

Detailing of stiffening concepts!

1 & 2 Longitudinal bracing, 3 side straps, 4 Transverse bracing

Considering component parts and interfaces during final stages of assembly...(cont)

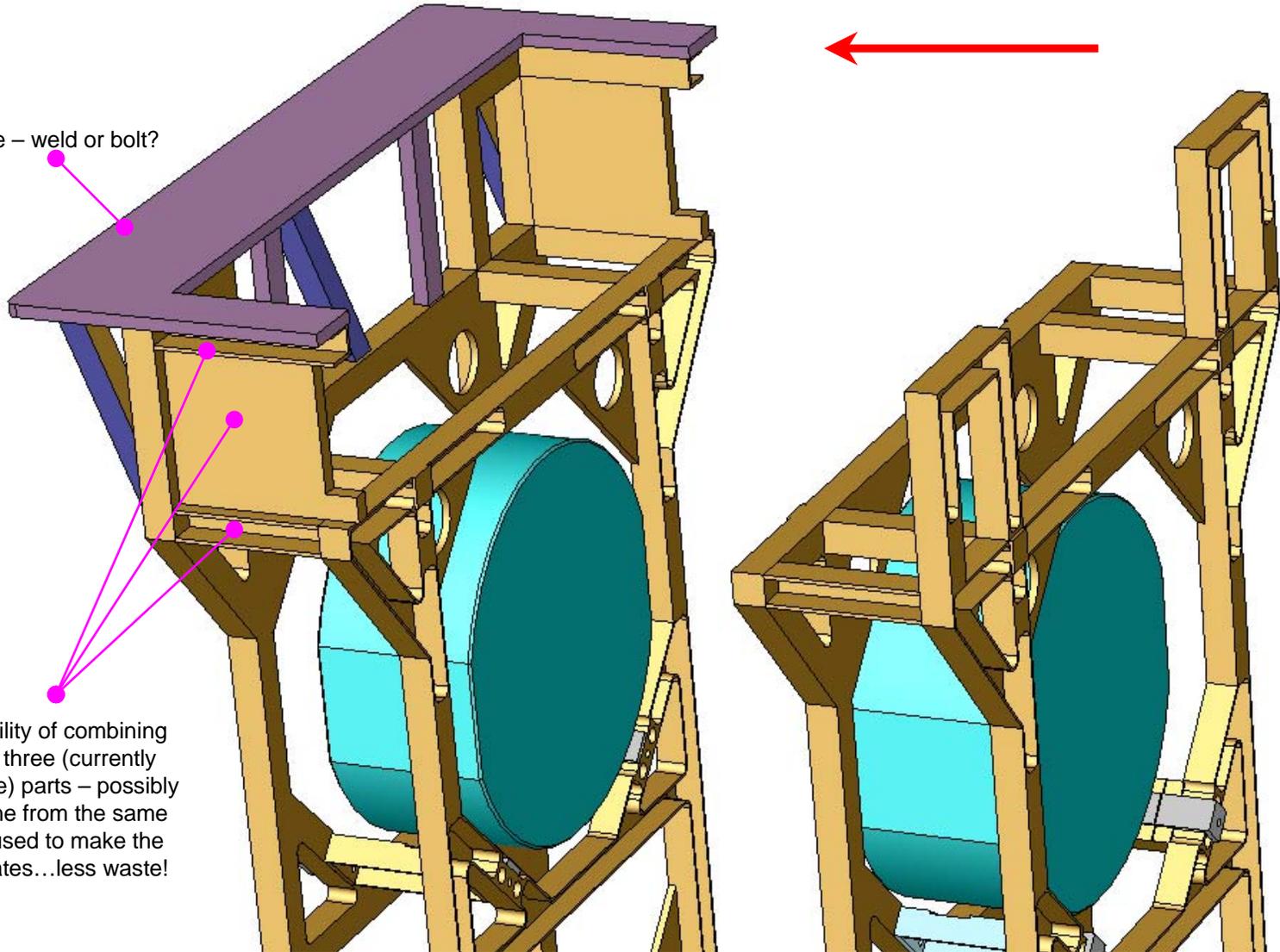


# Detailed Design Activity: Considering how to get to a fully assembled lower structure

*(Pictures printed out and used for note taking/sketching)*

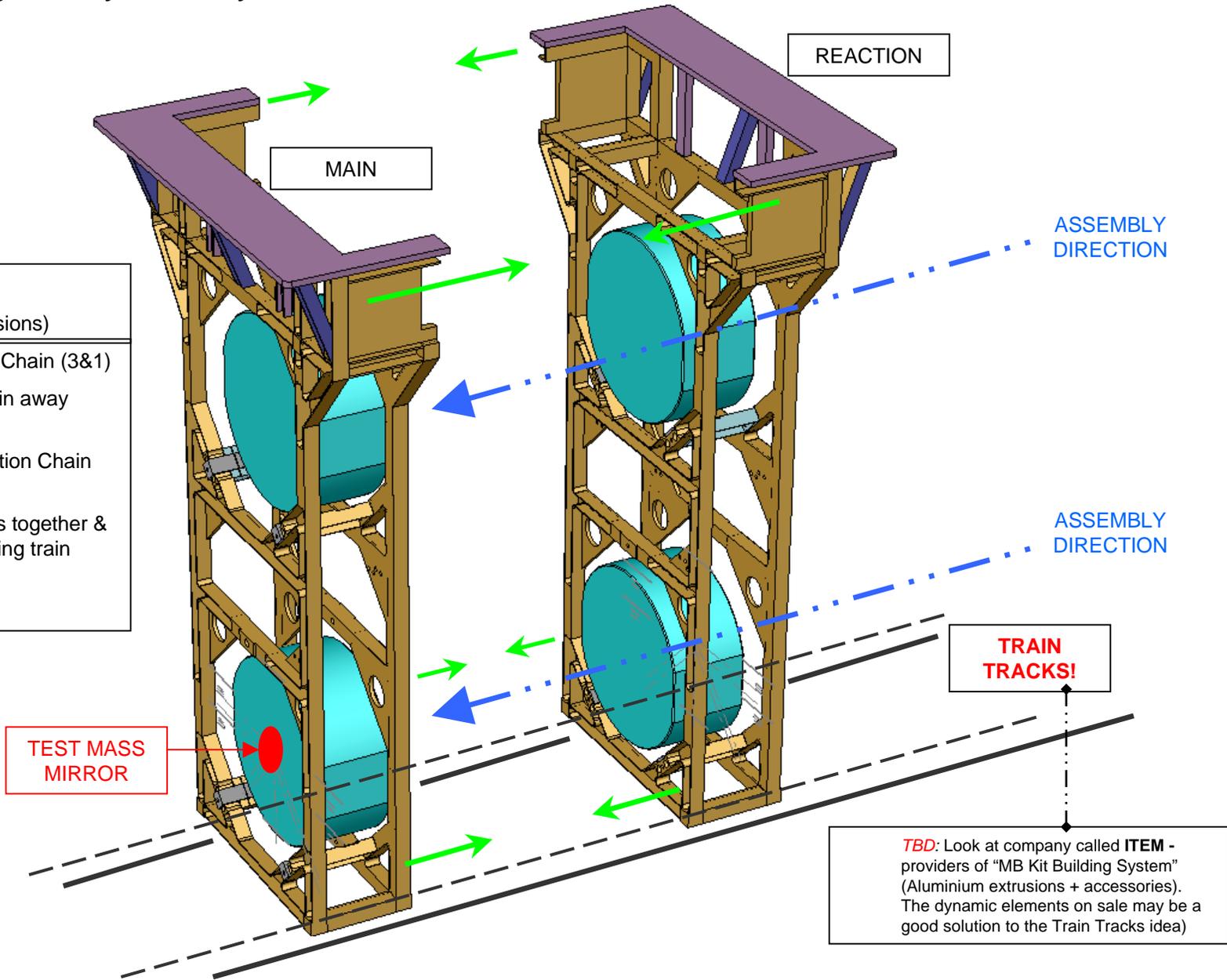
Top plate – weld or bolt?

Possibility of combining these three (currently separate) parts – possibly machine from the same plate used to make the faceplates...less waste!



# Detailed Design Activity: Assembly directions

- Possibility/Suggestion  
(CIET/RAJ lab discussions)
1. Assemble Main Chain (3&1)
  2. Move Main Chain away (train tracks)
  3. Assemble Reaction Chain (3&1)
  4. Bring the Chains together & JOIN! (again using train tracks)

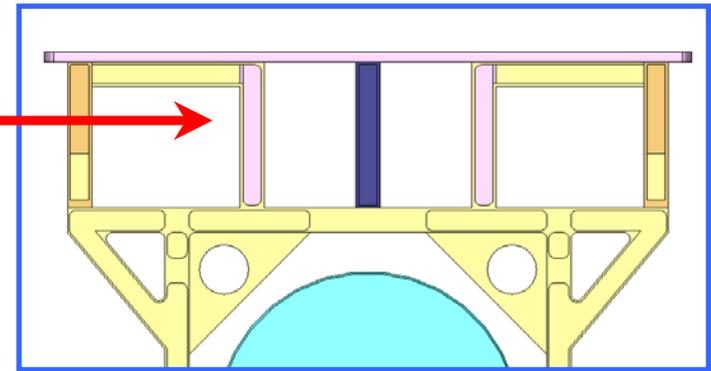
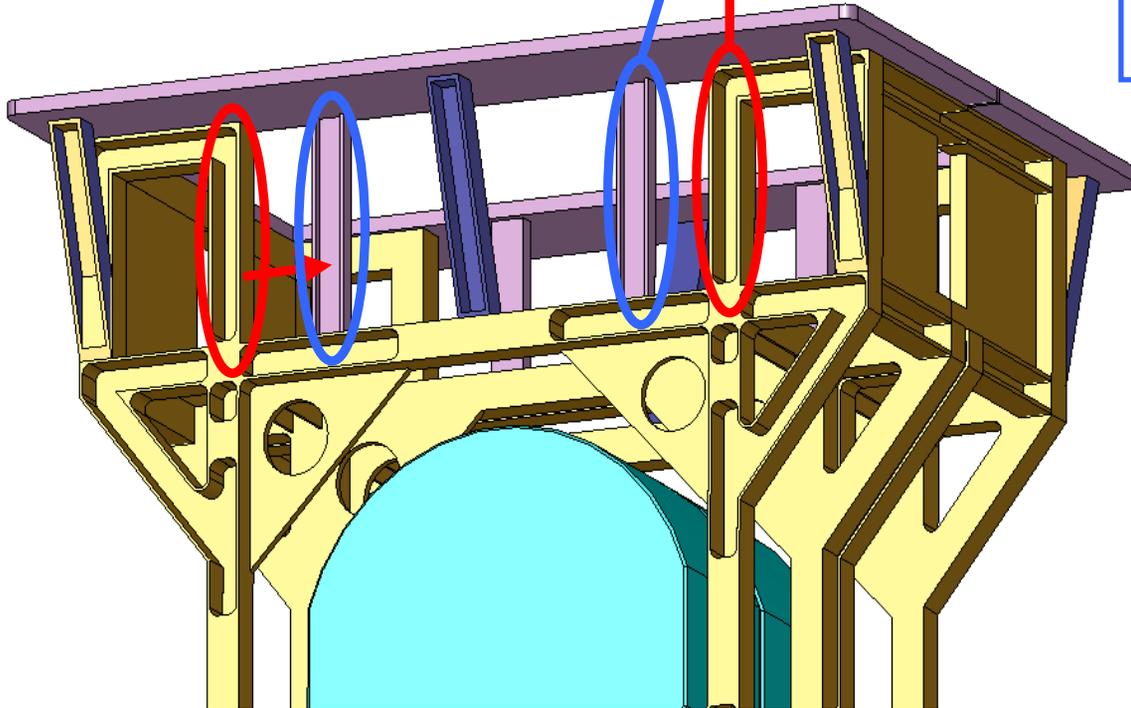


**TBD:** Look at company called **ITEM** - providers of "MB Kit Building System" (Aluminium extrusions + accessories). The dynamic elements on sale may be a good solution to the Train Tracks idea)

## Detailed Design Activity: Attempts to streamline the design

Q for MPL: Is it feasible that red and blue could become one?

\*NEED TO ASSESS IN FEA\*



### NOTE:

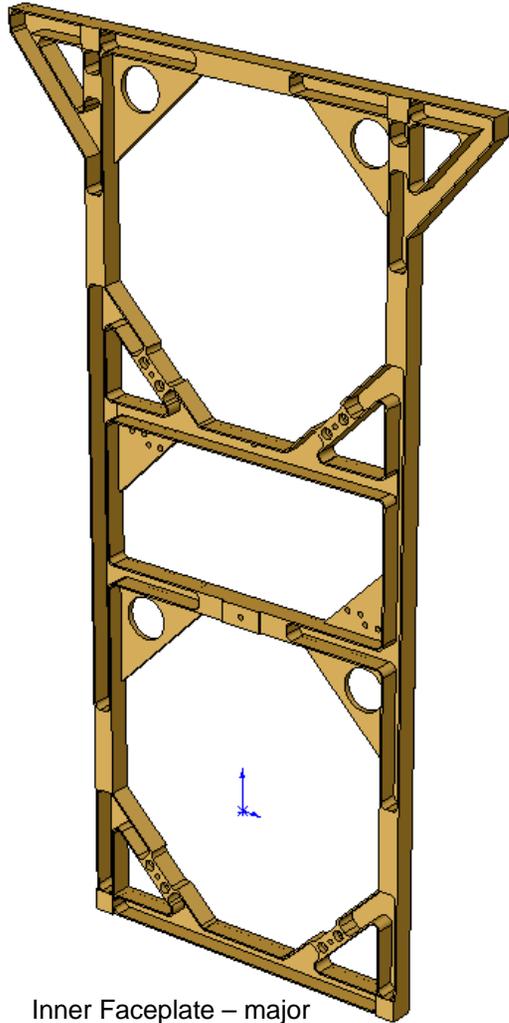
Mike P-L created the initial form of the lower structure around the location of the Upper Intermediate mass (i.e. the predominantly purple region in this picture) so that the following was the focus:

- Optimised access to critical regions of the UI mass within the Lower Structure
- Correct positioning of Safety Stops and fixing locations

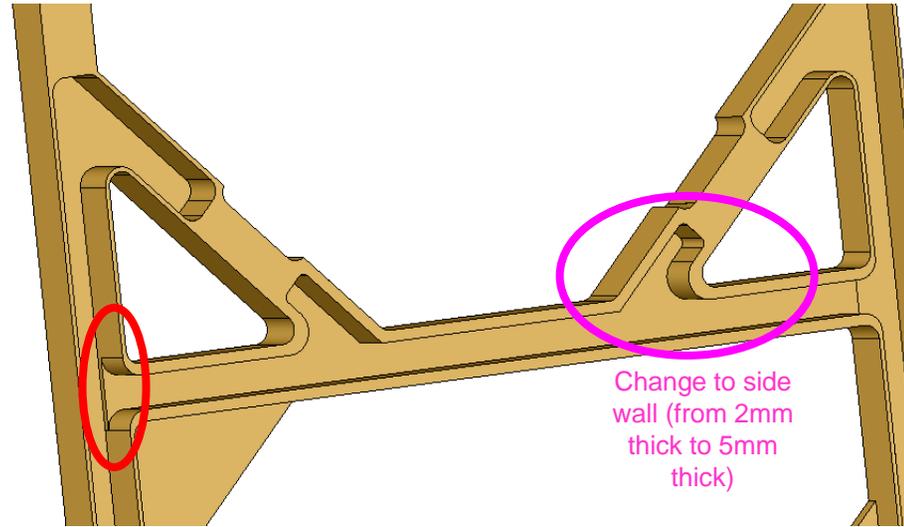
Answer to question (from email reply – MPL to RAJ & CIET...25/02/05)

"Maybe?! An analysis would need to be done with a structure that only has one or other of these supports. **(TBD!)** Certainly, the supports continuing up from your mass perform no function other than attaching the lower to the U-I bit of the structure. Thinking about it now though - I think if we combined the 'red' and the 'blue' we would restrict access to the removable magnet mounts in the U-I Mass. Need to double check though! **(TBD!)**

## Detailed Design Activity: Example of working dialogue between CalTech (CIET & RAJ) and Glasgow (MPL)



Inner Faceplate – major component in lower structure



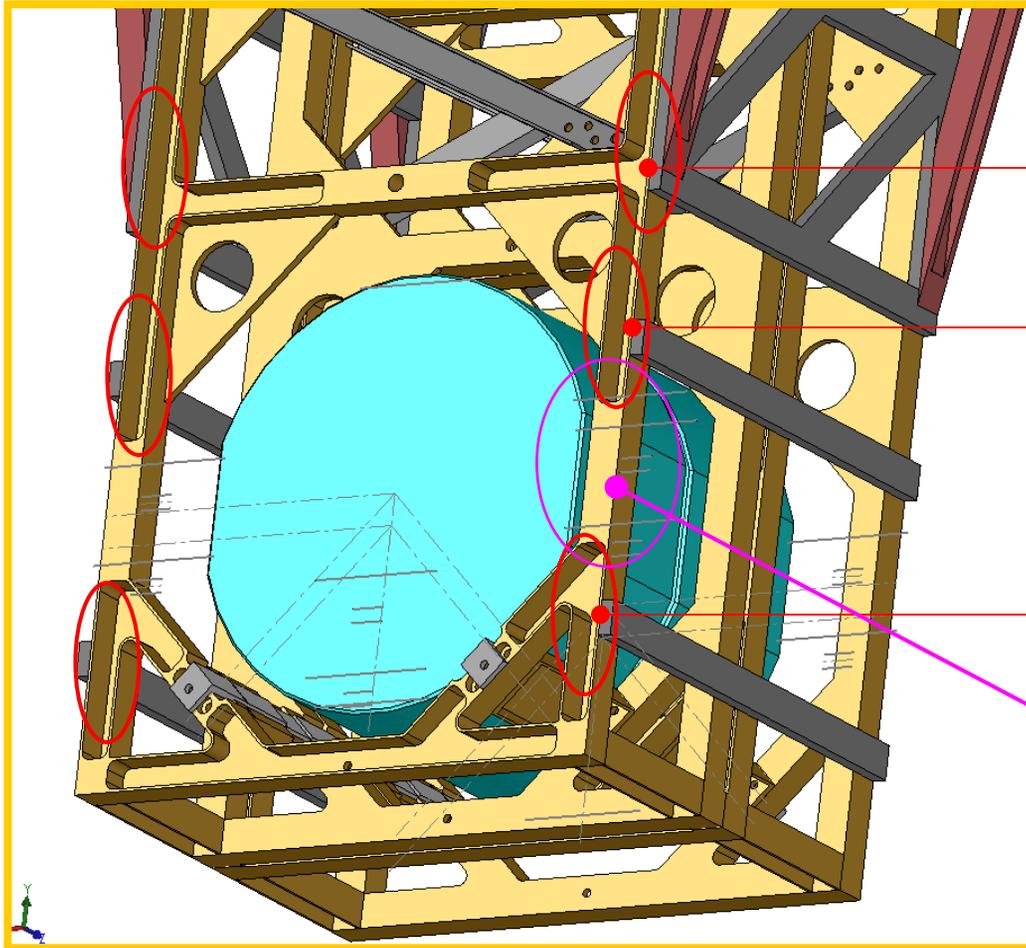
Change to depth of machine cut

Change to side wall (from 2mm thick to 5mm thick)

**Q for MPL:** When the additional material was added under the Penultimate mass, was it done in two phases (w.r.t. the FEA results) or were all changes to wall thickness made simultaneously?

Answer: Simultaneously

## Detailed Design Activity: Additional material to be added



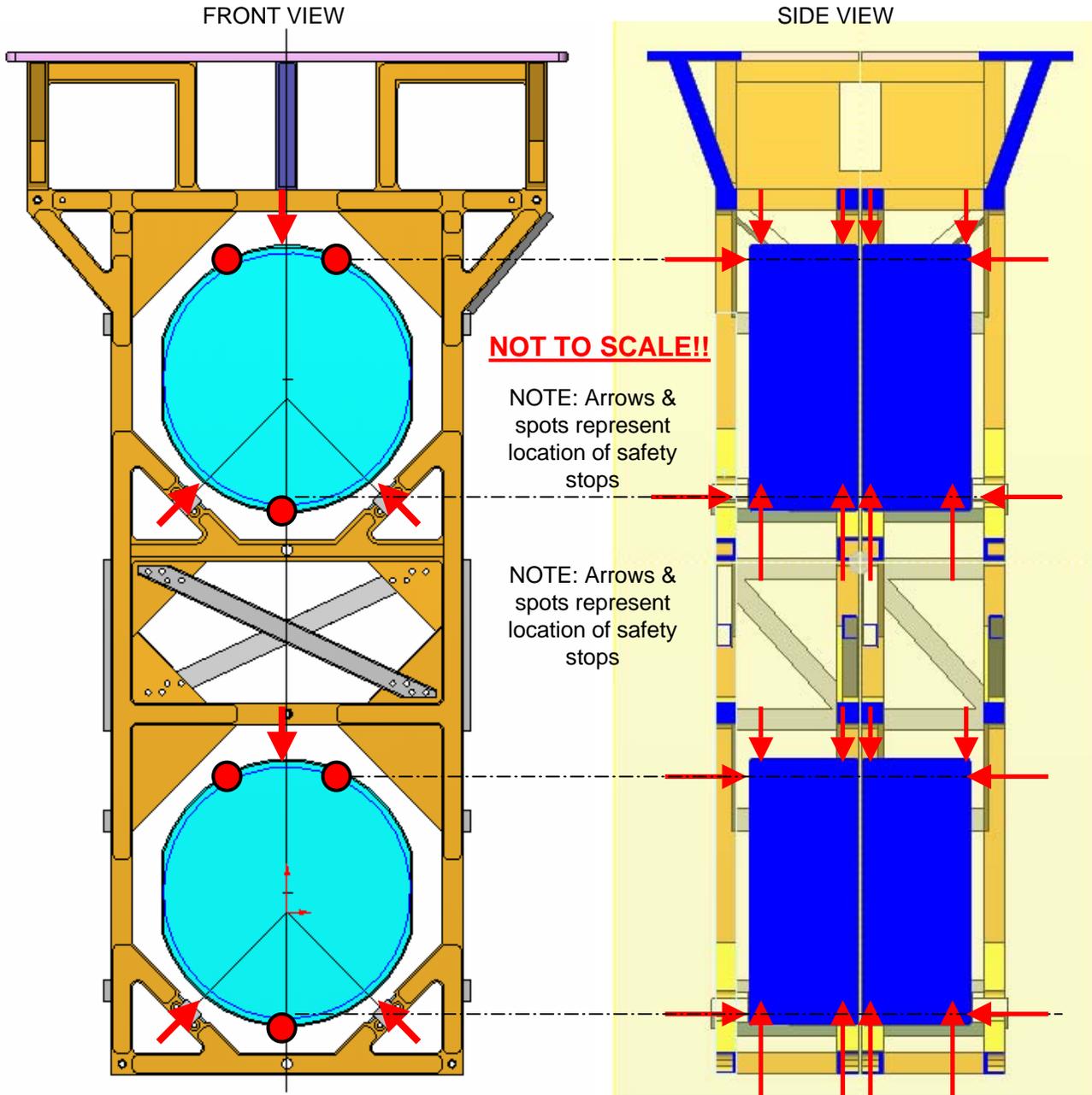
These regions of the lower structure require additional material to ensure more robust connection of stiffening member

(Nitronic 60 inserts must also to be incorporated\*)

Not all of this material will be required so the above step should not add much extra mass.

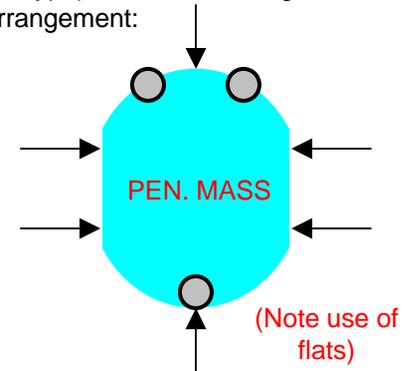


**Detailed Design Activity: SAFETY STOPS – suggestion for C-Ptype** (following brainstorming session (RAJ/CIET/JHR))

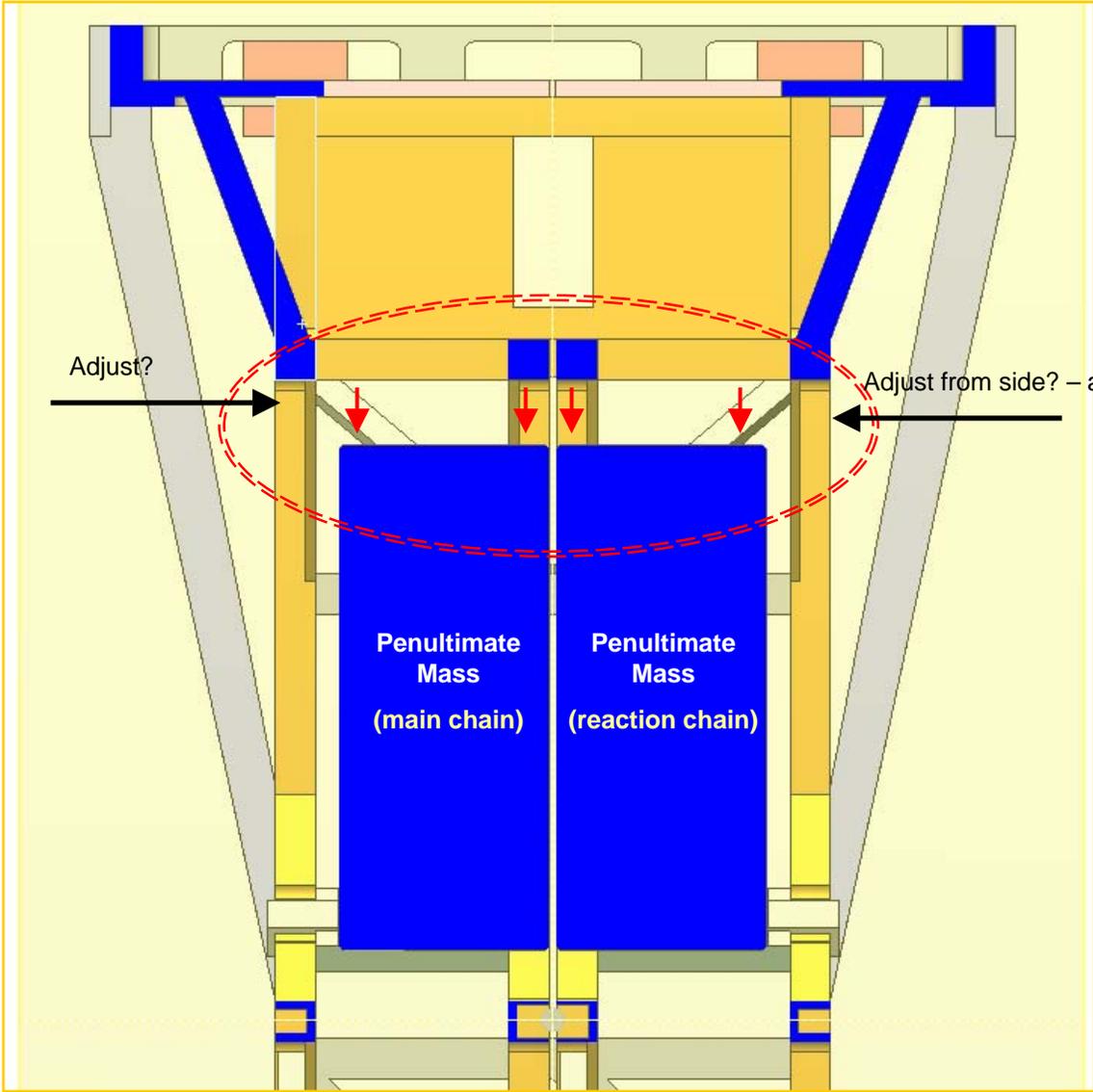


**18 stops per chain**

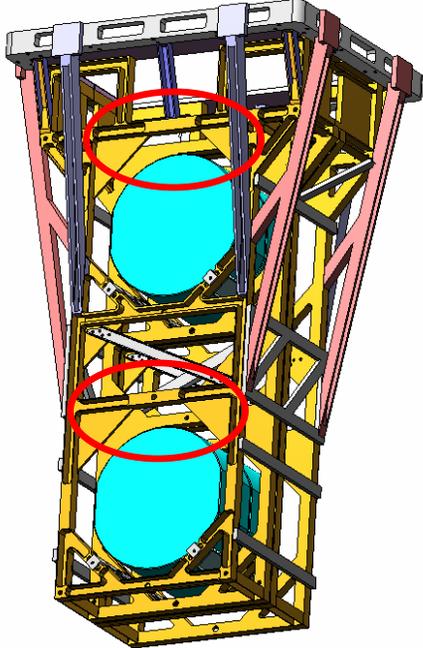
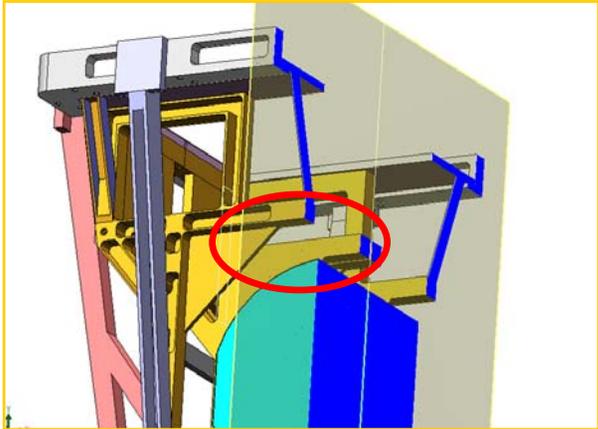
- 3 acting on face of each mass close to chamfer
- 6 acting on barrel – orientation shown in front view
- Also discussed (and rejected for the C-Ptype) was the following arrangement:



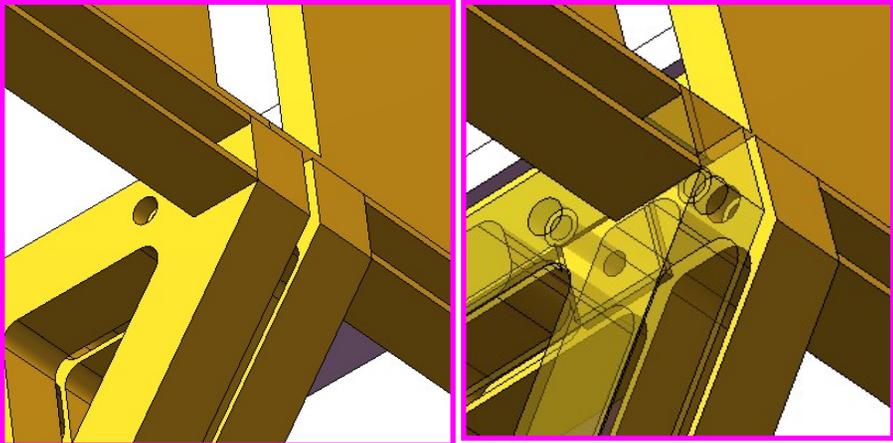
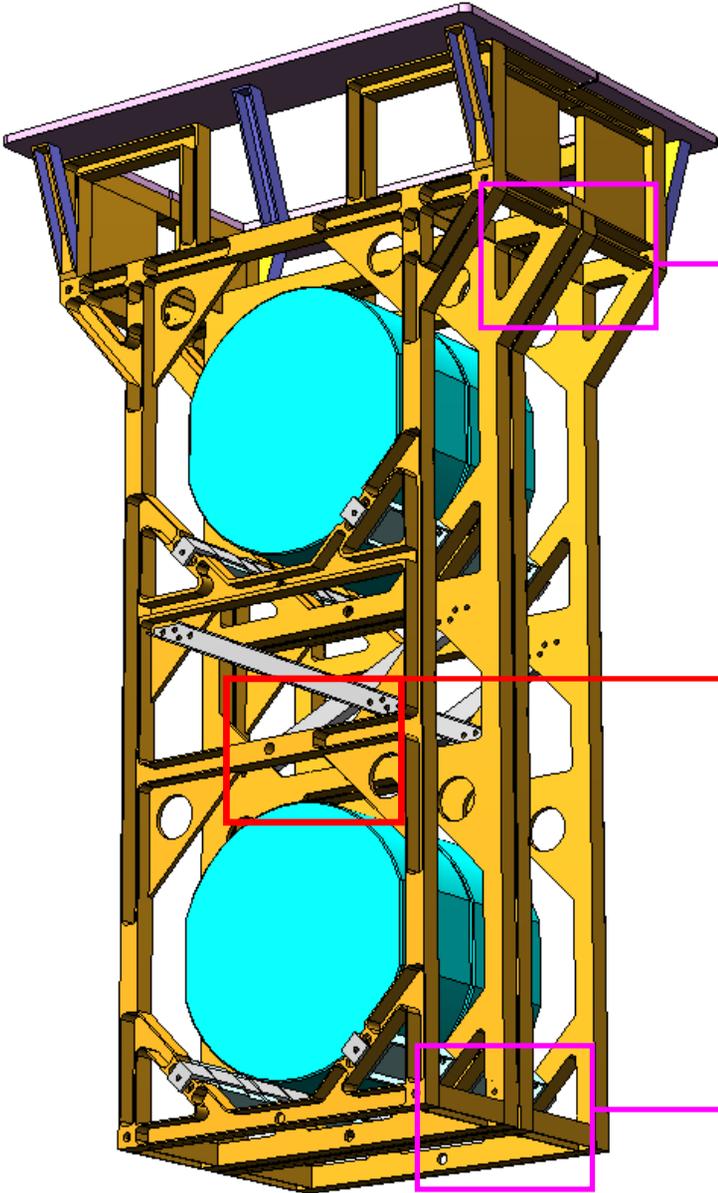
Detailed Design Activity: SAFETY STOPS – ABOVE THE MASSES



**SECTION**

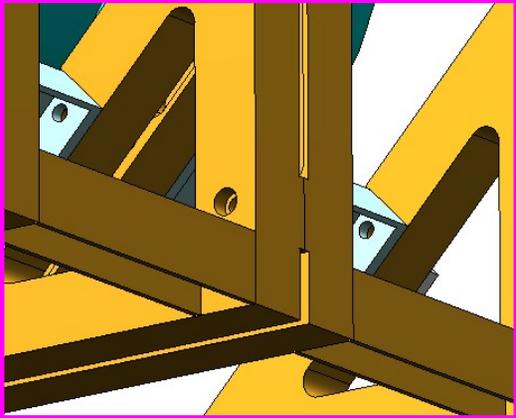
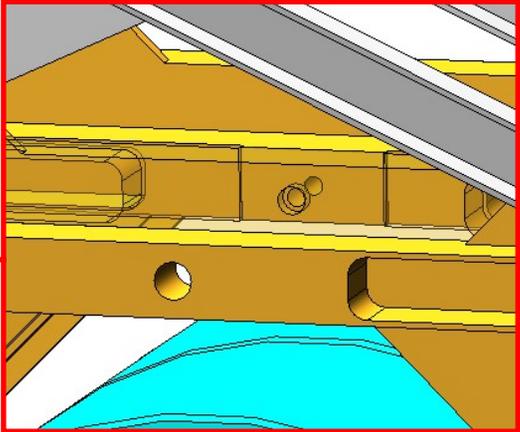


# Detailed Design Activity: Chain Separation

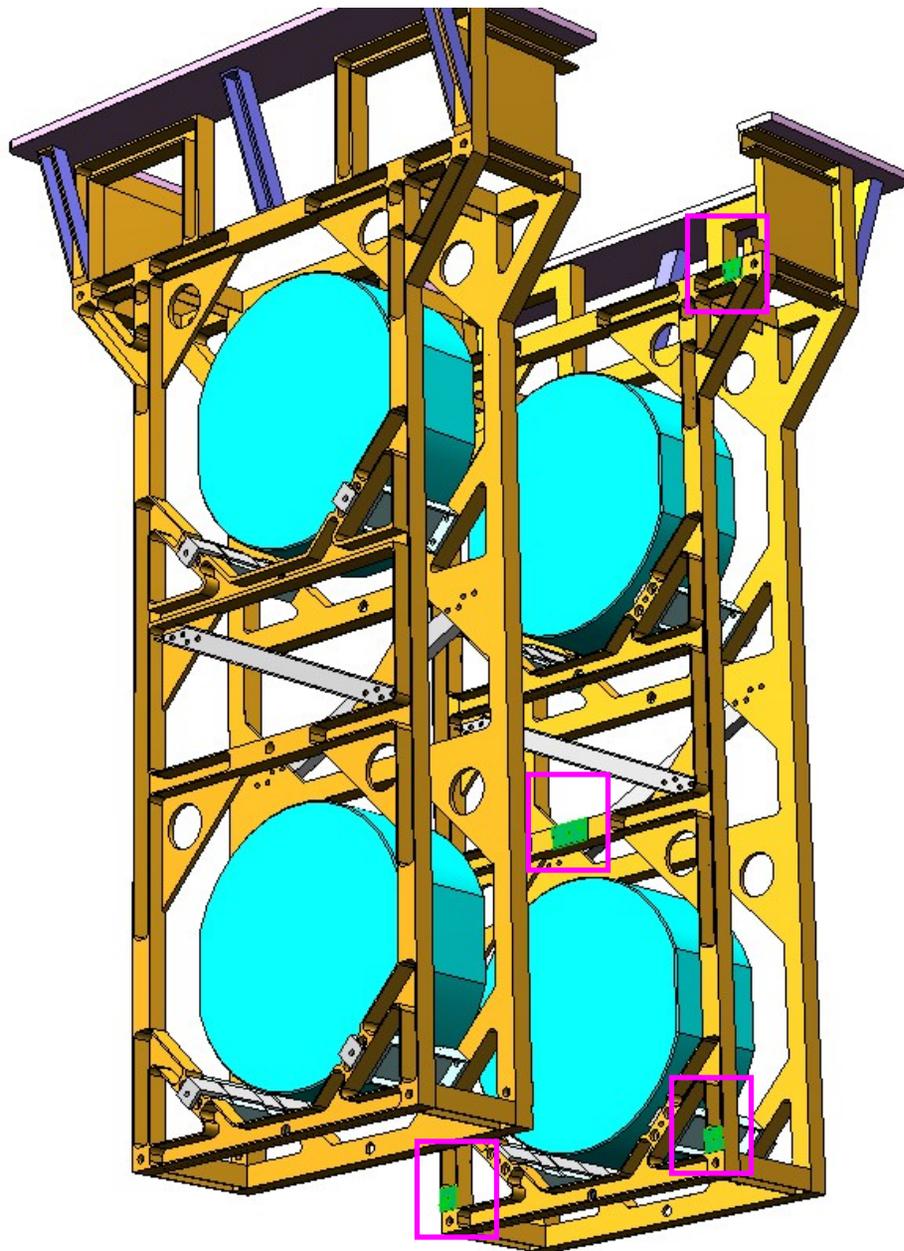


Mating of 2.5mm pads on respective Faceplates: sets 5mm separation

Central connection point: 1<sup>st</sup> stage of chain to chain alignment



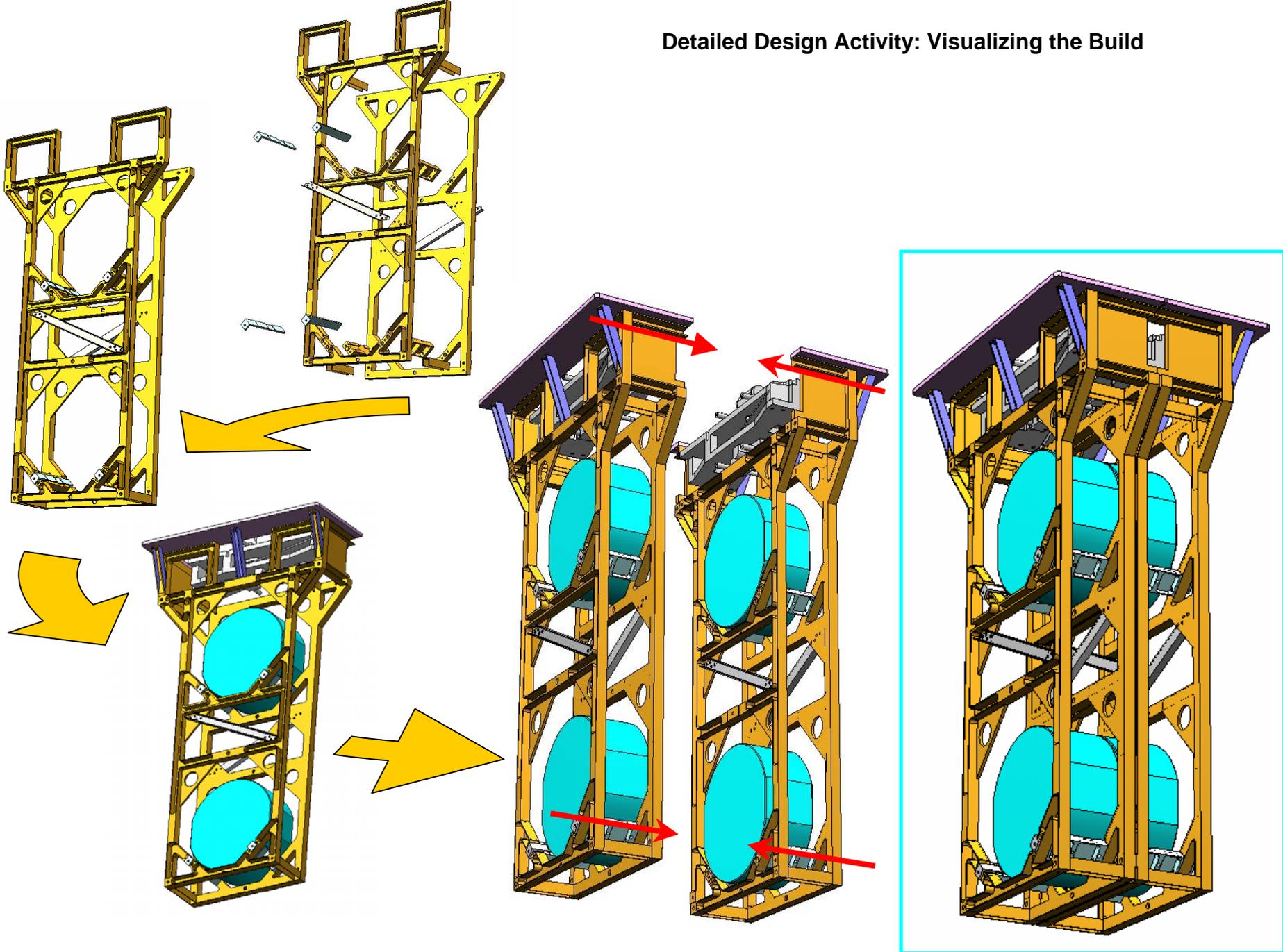
## Detailed Design Activity: Chain Separation (cont.)



### Positions of Catcher-to-Catcher connection locations/pads (in green)

- 5 x 2.5mm pads on each Catcher – to set the 5mm separation between respective chains
- ¼-20 bolts to join Catchers
- Nitronic-60 inserts required.....but what are their MINIMUM DIMENSIONS (in terms of thread depth required)...**TBC!**

# Detailed Design Activity: Visualizing the Build



Visualizing the Build...(cont.)

