T050033-00-D - **THE QUESTION OF MASS TO MASS SEPARATION WITHIN THE CATCHER / ASSEMBLY RIG**
(A conundrum of numbers)

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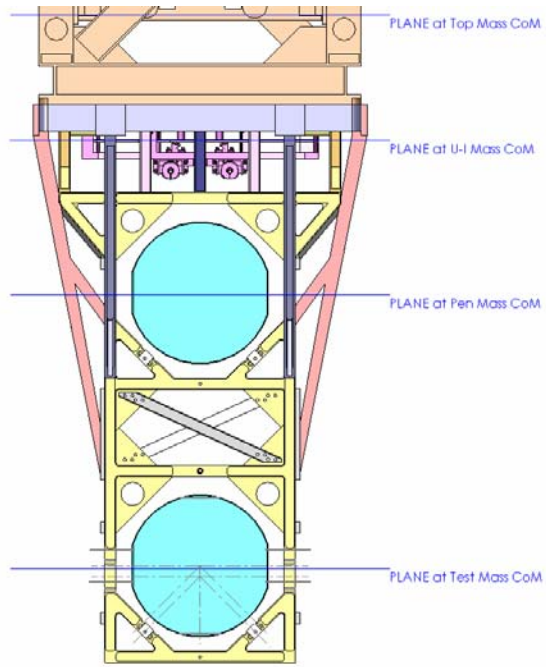
This short document follows the initial discussion in the Design Meeting of 21st February, 2005, and we hope will clarify any confusion that resulted from that initial discussion.

The goal of this document is to confirm the one of the most important dimensions within the Catcher, so that drawings (and manufacture) can be started as soon as possible on this aspect of the C Ptype.

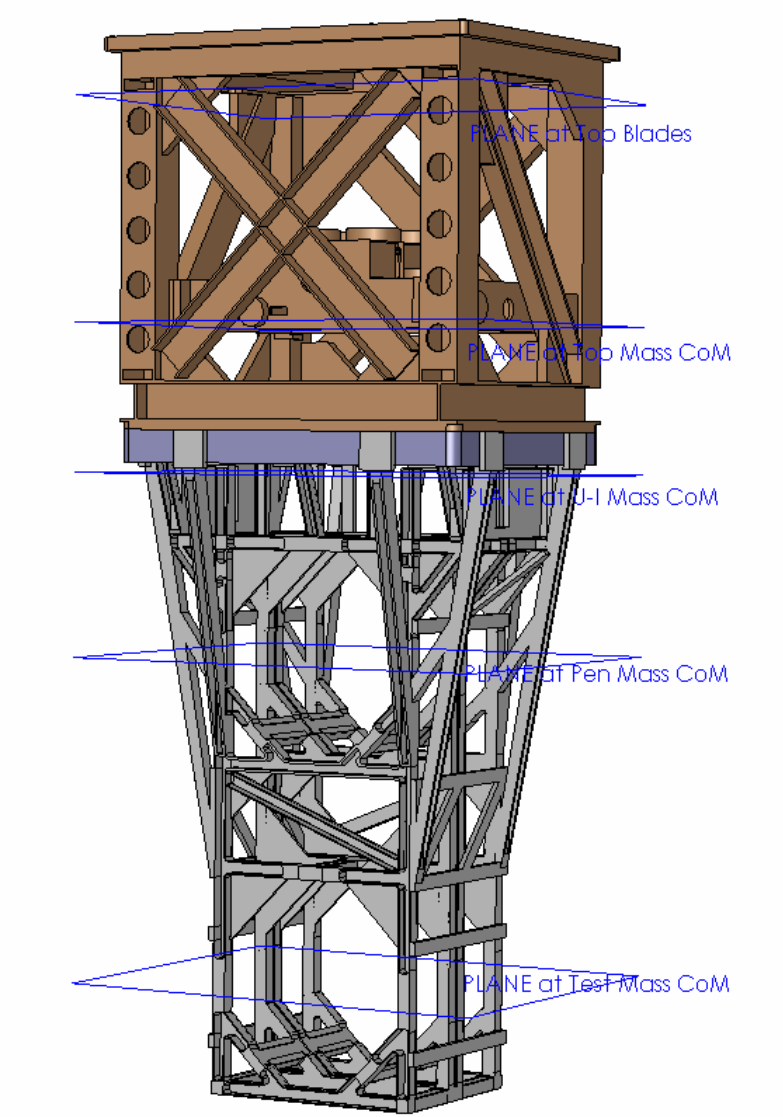
The range of lifting/lowering of the Lower Structure during installation is set by the Implementation Ring, and the numbers involved were discussed at the Monolithic SUS Workshop (in Glasgow, Jan. 2005,*ref. T050010-00-K Monolithic SUS Workshop Minutes & Actions, p.18 of 30).* This range has an important bearing on the choice of the mass to mass separation within the Catcher.

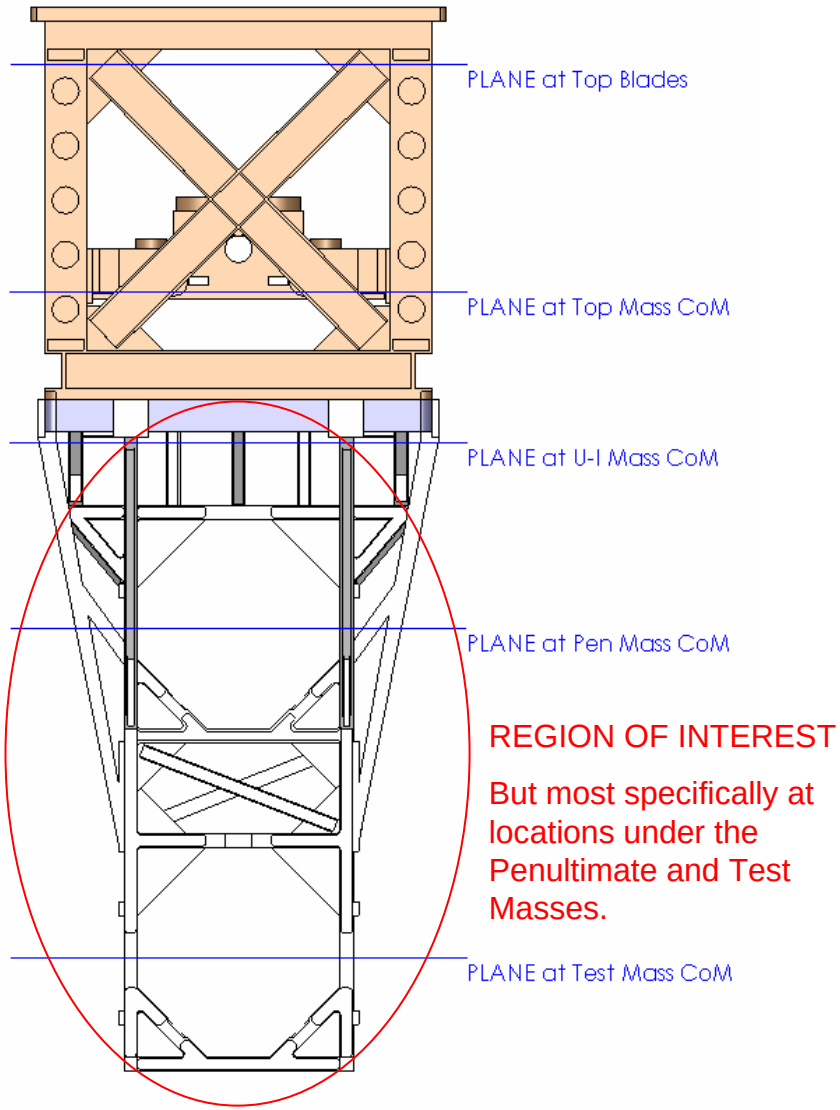
Note, assumptions in the material that follows:

- **Welding approach will be as per GEO 600 (our only reference at this stage), although the tools may not be the same (CO2 welding vs. Flame Welding)**
- **CP-Type and NP-type are treated as one and the same!**
  - **8mm fibre stretch is virtually equivalent to the process of connecting the Test Mass Wires in the C Ptype (~6mm required) plus the stretch of those wires(~2mm?)**
- It is also worth remembering Faceplate design for the N-Ptype will have subtly different dimensions from that in the C-Ptype - because of the difference in dimensions between Sapphire (314mm diameter) and Sapphire (340mm diameter**)**

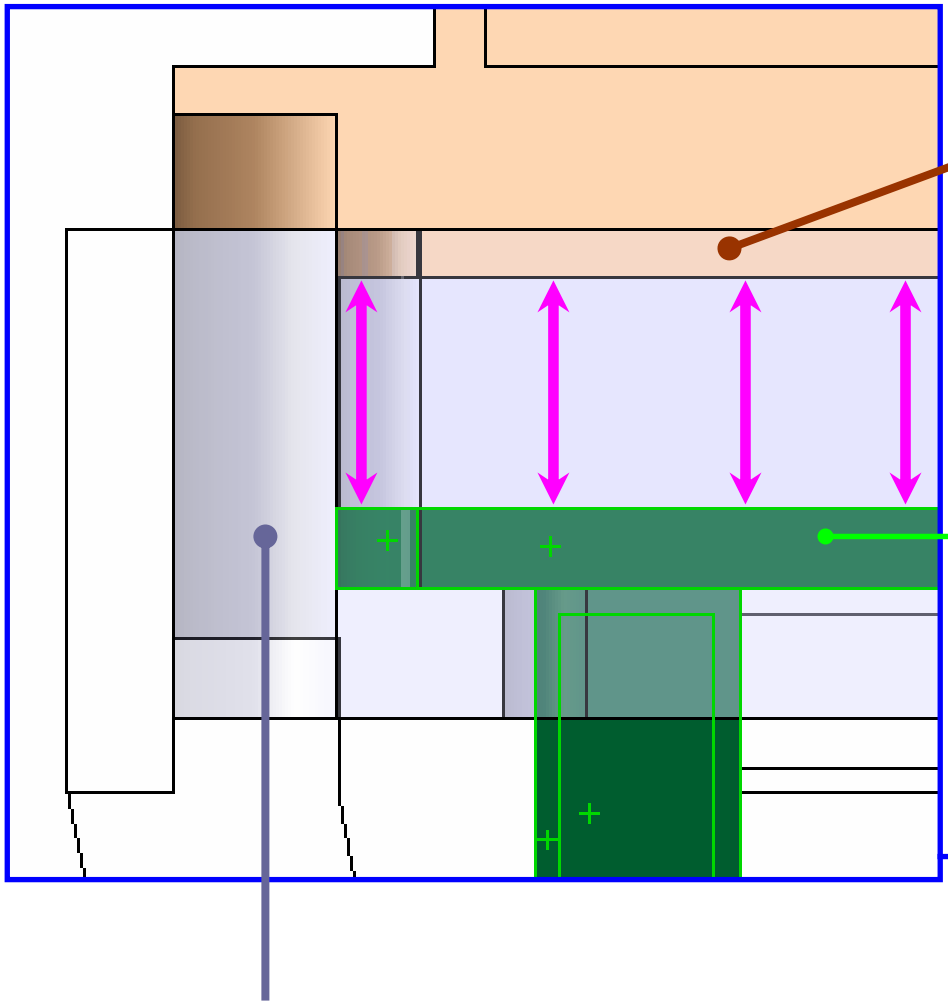


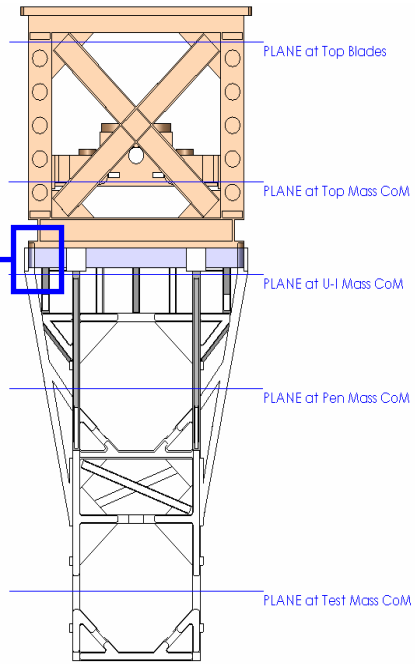
VIEWS OF AN EXISTING MODEL OF THE OVERALL STRUCTURE



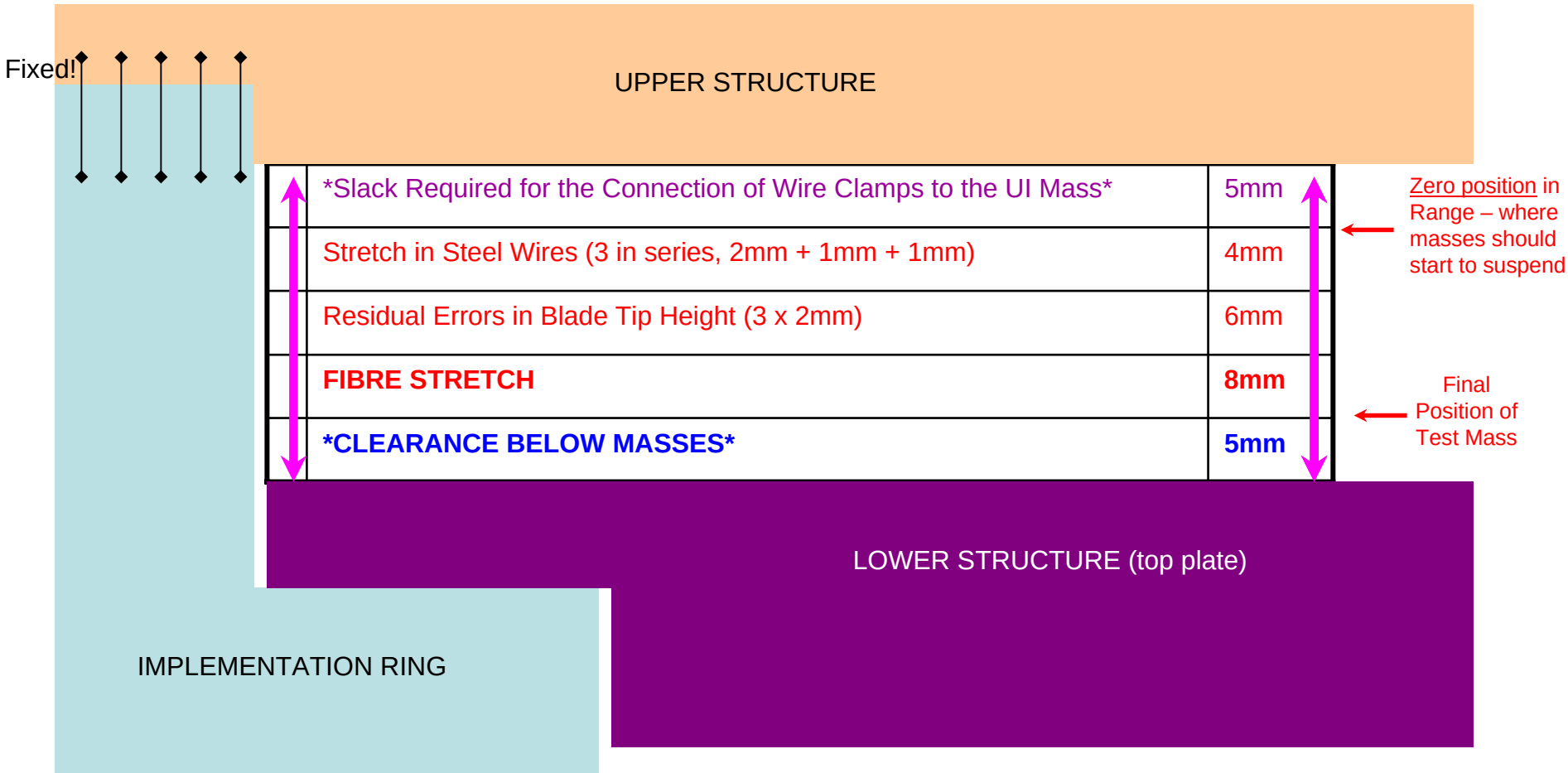


VISUALISING THE RANGE





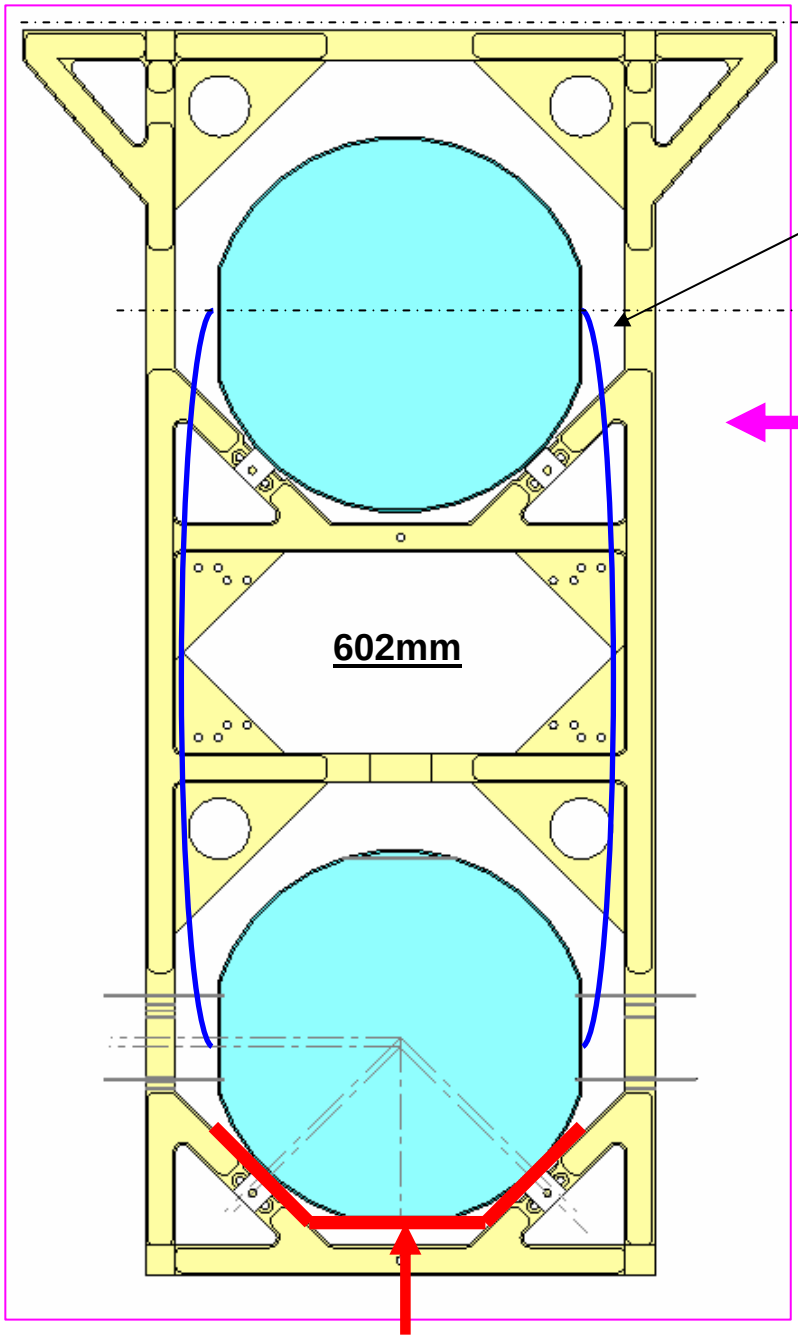
VISUALISING THE RANGE (cont.)….ZOOMING IN: TABULATED RANGE OF MOTION SET BY IMPLEMENTATION RING (TOTAL = 28mm)



OUR OPTIONS

NOTE: No stress in fibres

(ignore visual representation suggesting curvature!)



OPTION (1)

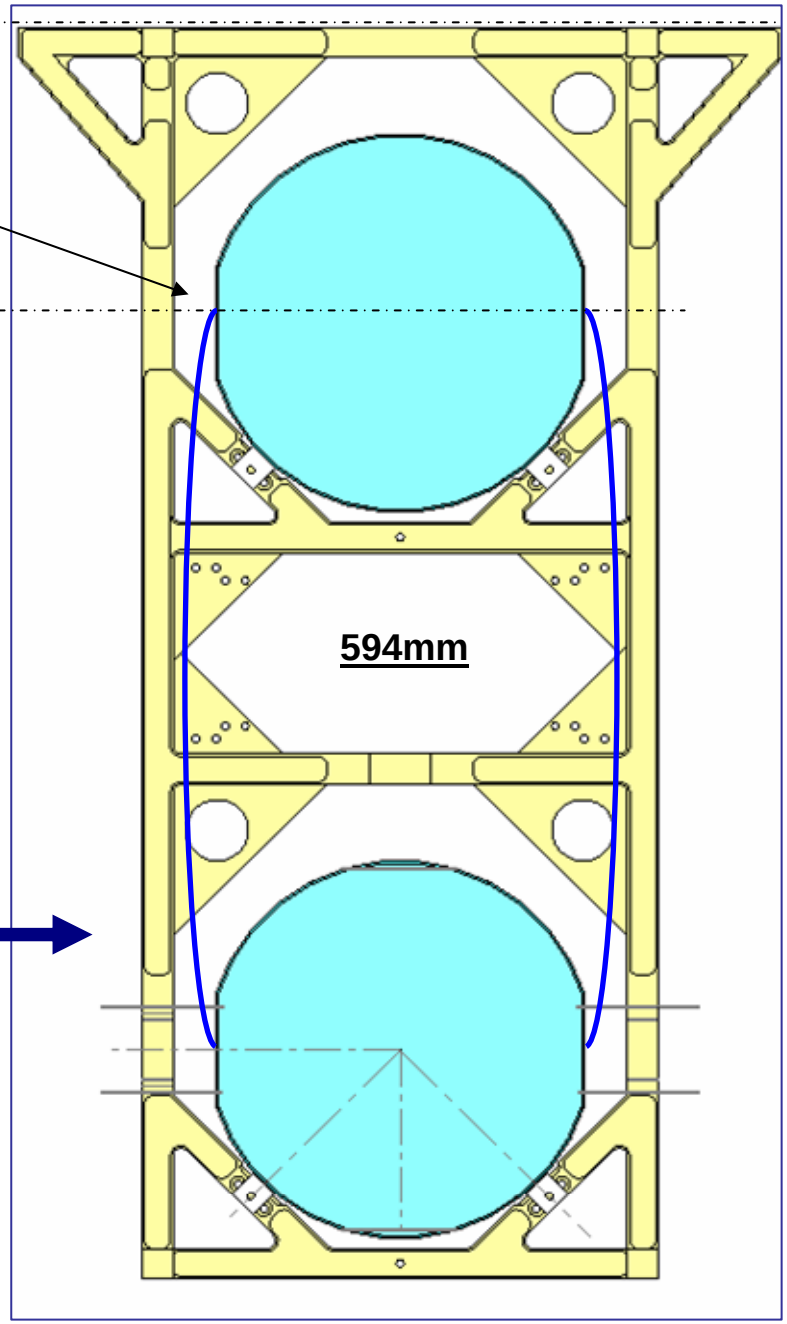
602mm Mass separation set in the Catcher – RED LINES represent a means of reducing that gap to ~594mm for welding.

This could be either by means of removable shims (which are in a way already part of the existing design), or the inclusion of micrometric adjustment. (under the Test Mass).

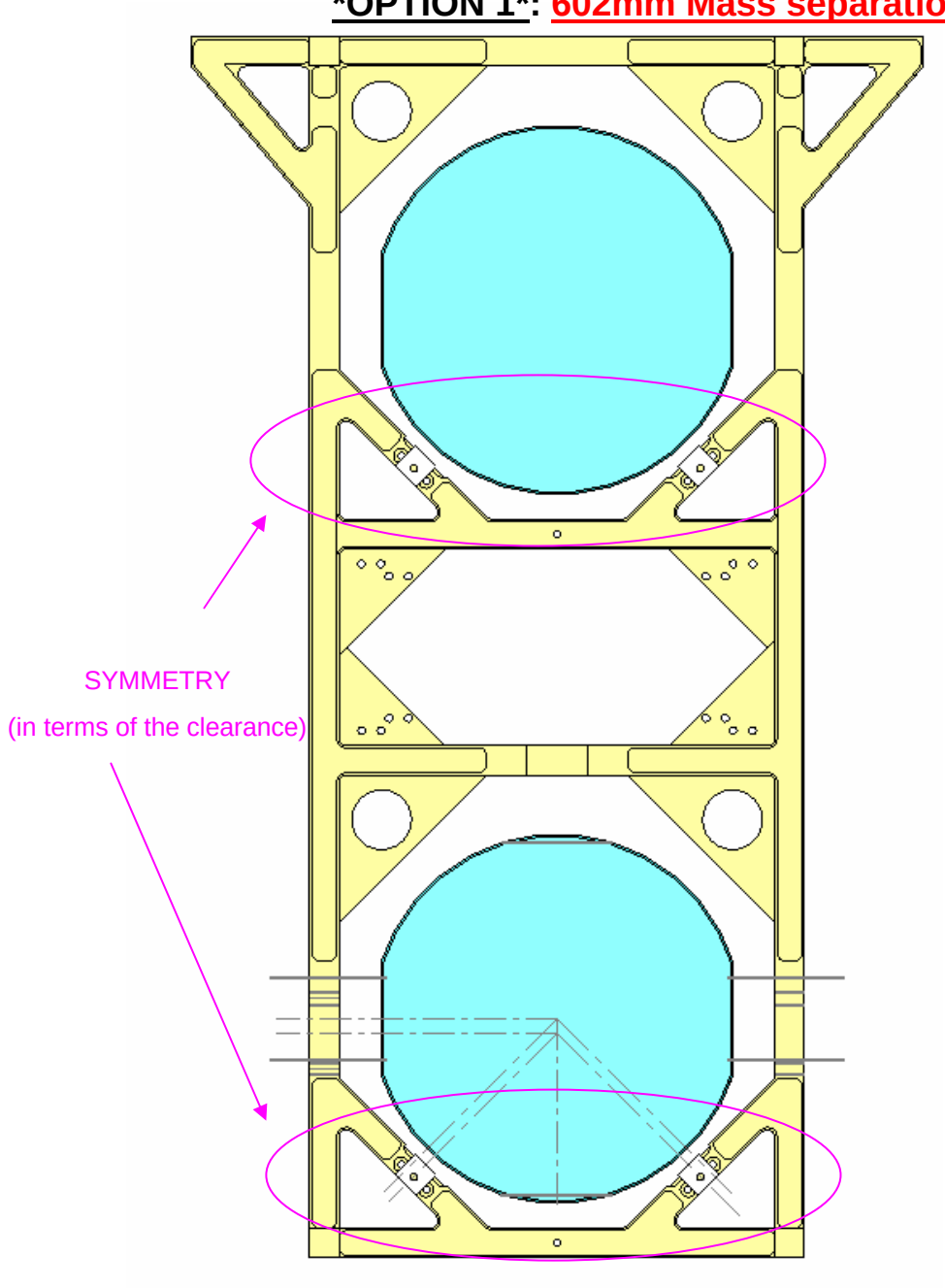
OPTION (2)

594mm mass separation set in the Catcher – where 594mm corresponds to 602mm minus the 8mm FIBRE STRETCH, assuming the exact same welding process used in GEO600 applies here.

(ref. to D030xxx_Process Diagram for GEO Catcher)



OPTION 1: 602mm Mass separation set by the Catcher / Assembly Rig



The lowest that we predict the pendulum could hang (given a **28mm** range in the Implementation Ring) would result in:

• a 13mm gap under both the Penultimate and Test Masses. This comes from:

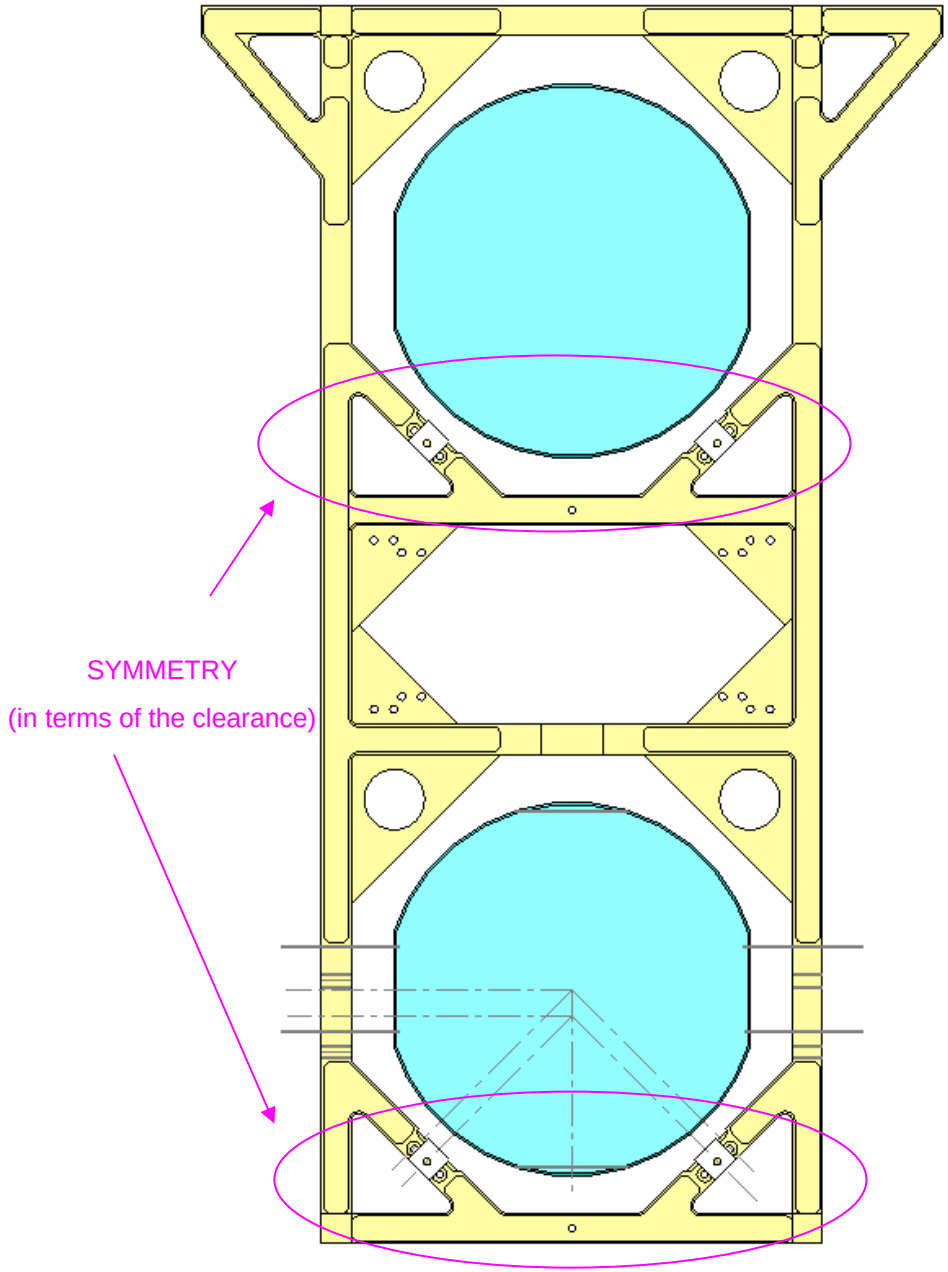
- the 5mm clearance chosen as part of the Range of the Implementation Ring

plus

- 8mm that accounts for the fibre stretch – once the *micrometric motion* device or *shims* under the Test Mass have been removed

** Some sort of shimming under the test mass is necessary to account for the 8mm fibre stretch, otherwise that range would not be appropriate

OPTION 1: 602mm Mass separation set by the Catcher / Assembly Rig (cont.)



If blade tip errors are negligible, and stretching of wires is dealt with during assembly (i.e. looking back to the range of the Implementation Ring, we will have lowered the structure by 10mm more than necessary – removing tip inaccuracy of 6mm and wire stretching of 4mm), we may see:

• a 23mm gap under both the Penultimate and Test Masses. This comes from:

- the 5mm clearance chosen as part of the Range of the Implementation Ring

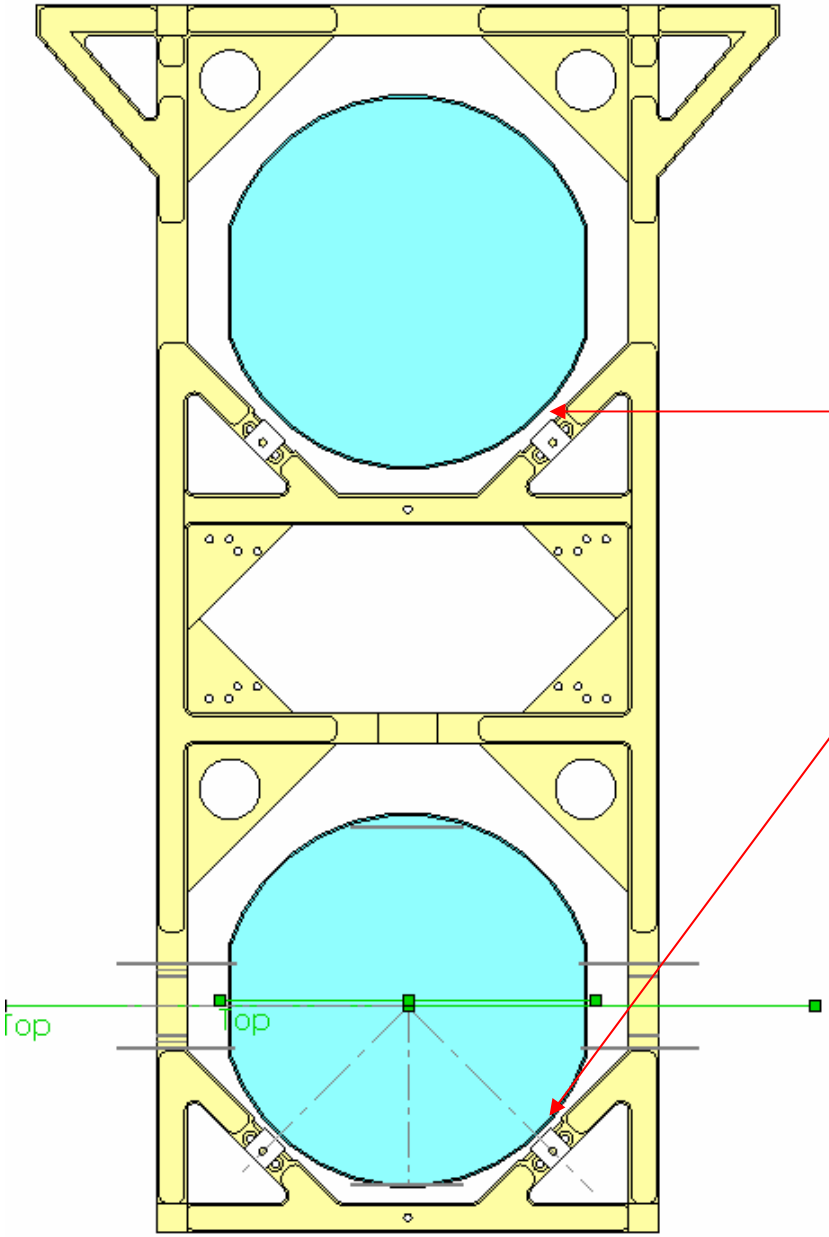
plus

- 8mm that accounts for the fibre stretch – once the *micrometric motion* device or *shims* under the Test Mass have been removed

plus

- the additional 10mm described above

OPTION 2: 594mm Mass separation set by the Catcher / Assembly Rig



The lowest that we think the pendulum could hang (given the a 28mm range in the Implementation Ring) would result in:

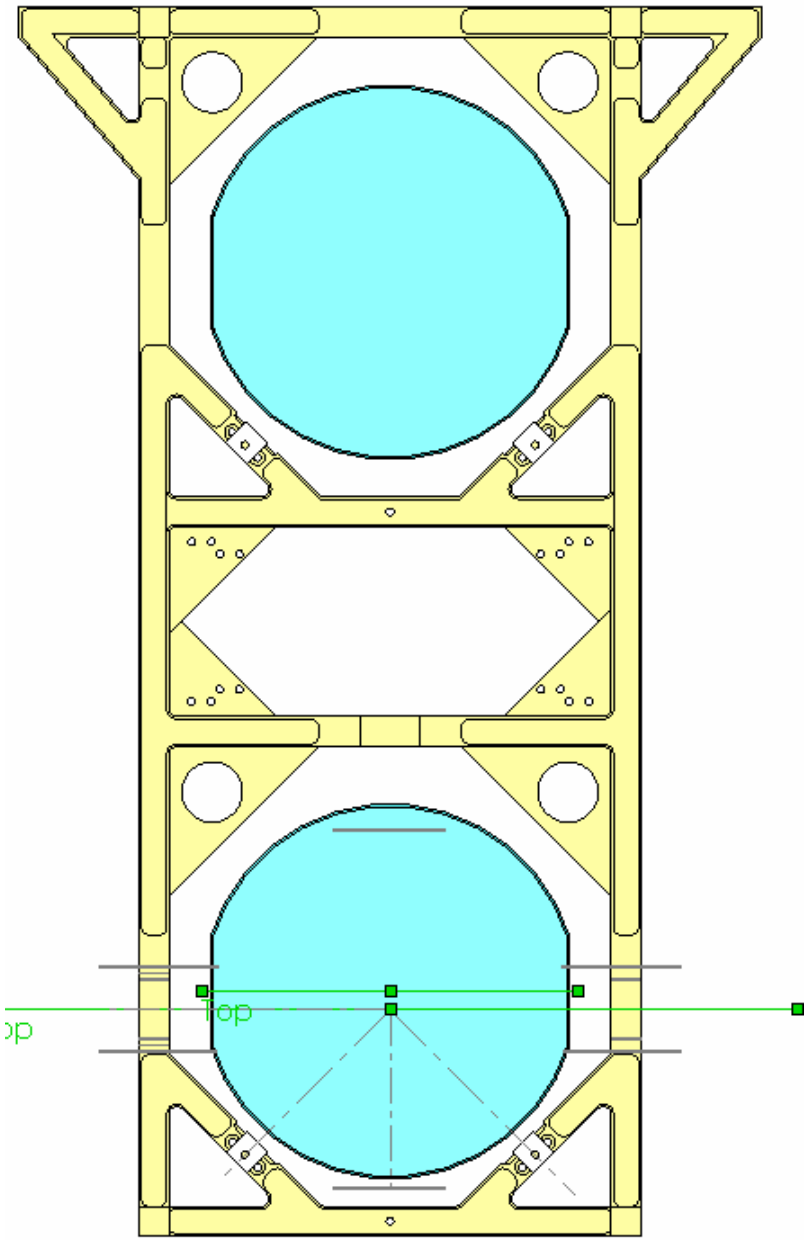
- a 13mm gap under the penultimate mass
    - (5mm clearance, plus the extra 8mm range required to deal with the fibre stretching)

&

- a 5mm gap under the test mass…….our choice of range in the implementation ring should ensure that 5mm is the smallest possible gap under the Test Mass.

NOTE: to state the obvious, this approach of having a permanent mass separation of less than 602mm (in the Catcher), eliminates symmetry from the design.

OPTION 2: 594mm Mass separation set by the Catcher / Assembly Rig (cont.)



If blade tip errors are negligible, and stretching of wires is dealt with during assembly (i.e. looking back to the range of the Implementation Ring, we will have lowered the structure by 10mm more than necessary – removing tip inaccuracy of 6mm and wire stretching of 4mm), we may see:

- a ~23mm gap under the penultimate mass
    - (5mm clearance, plus the extra 8mm range required to deal with the fibre stretching plus the 10mm noted above)

- a ~15mm gap under the test mass

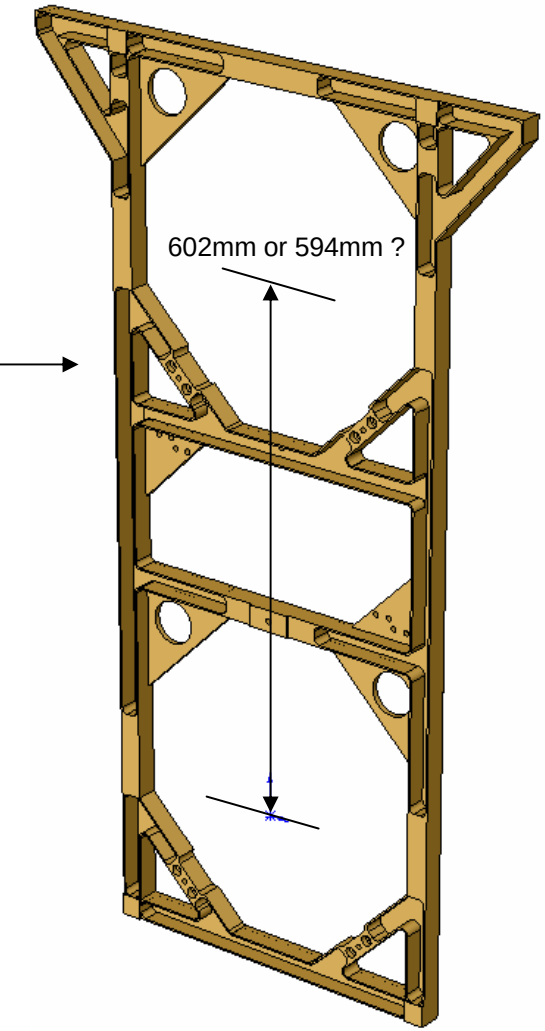
Conclusions

Comments by RAJ:

My preference is to go with 602mm *at this stage,* because of the extra factor of safety when we build the C-Ptype. I want to make sure that we get a pendulum!

Notes:

Neither choice will result in much extra effort at this stage – the *CAD model* of the Faceplate has been constructed in a way that adjustments to the mass to mass separation (within the Catcher model) are trivial.



Comments by CIET:

Russell wants the extra safety factor introduced by starting with 602mm. If this was to be applied to the 594mm concept the range of the ring would need to be increased to incorporate the safety factor. Therefore my vote is to go with 602mm, even although it adds another step. Further the 602mm allows the greatest adjustment for a not yet fully defined welding process, true?