New Small Wheel Layout Overview

New Small Wheel

MicroMegas Mechanics and Layout Workshop

March 27th, 2013

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on behalf of the NSW layout and mechanics group

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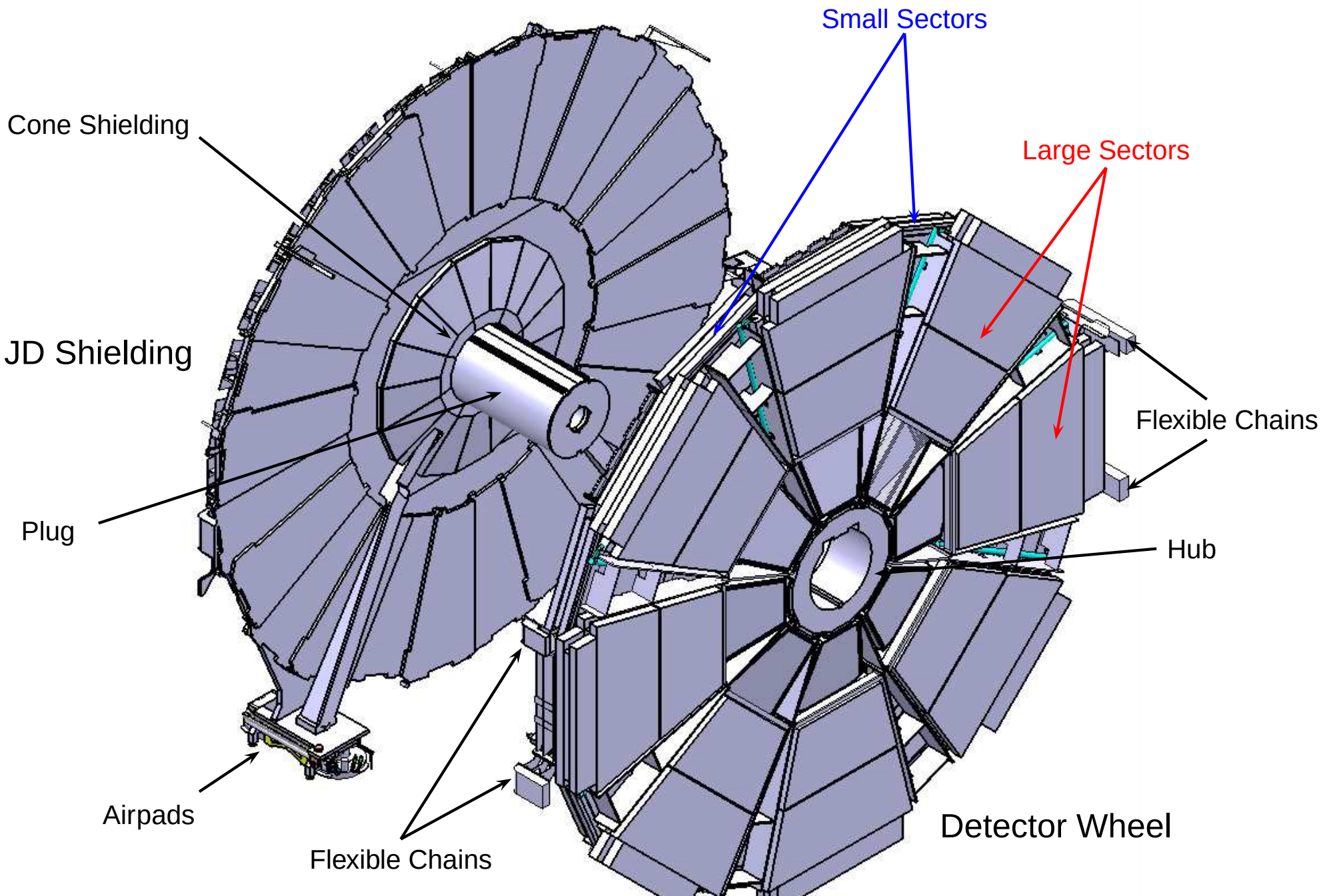
University of Michigan

Present Small Wheel



Baseline Layout

- sTGC as primary trigger, MM as primary precision detector
- Same acceptance as present SW
- 8 small and 8 large overlapping sectors — cover BW and EO sectors in projective geometry
- planar detector wheel, i.e. no inclined chambers like the present CSCs
- 8 detection layers of sTGC and 8 detection layers of MM
- internal station precision: 40 μm
- re-use of the JD shielding (cost)
- possibility to remove the detector wheel from the JD shielding for maintenance

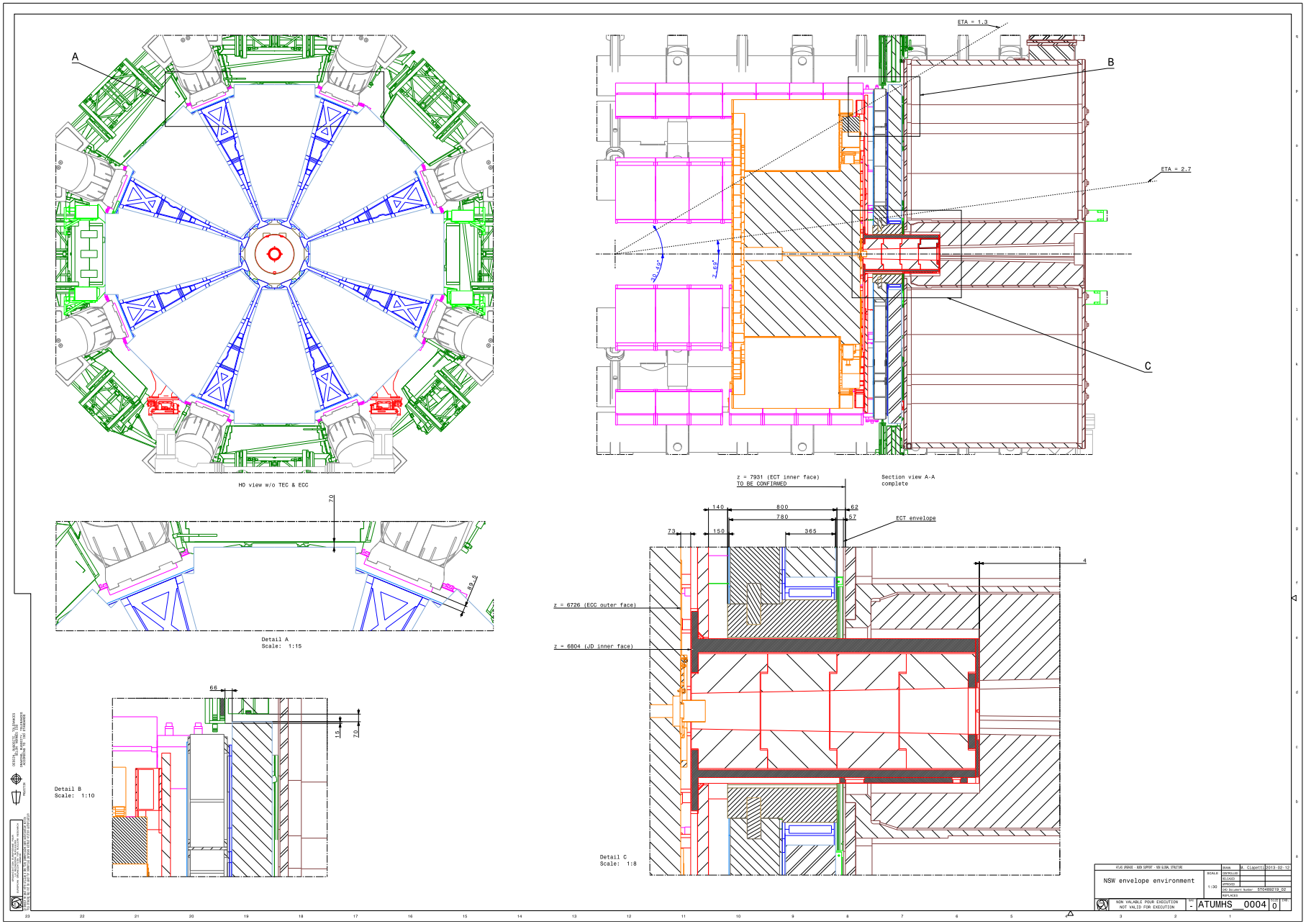
Current Layout

We have agreed and defined a layout which can be used for the TDR (and further on)...

- Detector order in z-direction: sTGC—MM—MM—sTGC
- MM multiplets mounted on spacer frame → MM chamber similar to an MDT chamber
- sTGC wedges kinematically mounted on MM spacer frame, but with fixed geometric relationship of sTGCs
- Integrated sTGC-MM station mounted kinematically on NSW structure
- **Drawback: most complicated alignment system, current ideas require 16 alignment bars (instead of 8) and a large increase in number of optical elements**

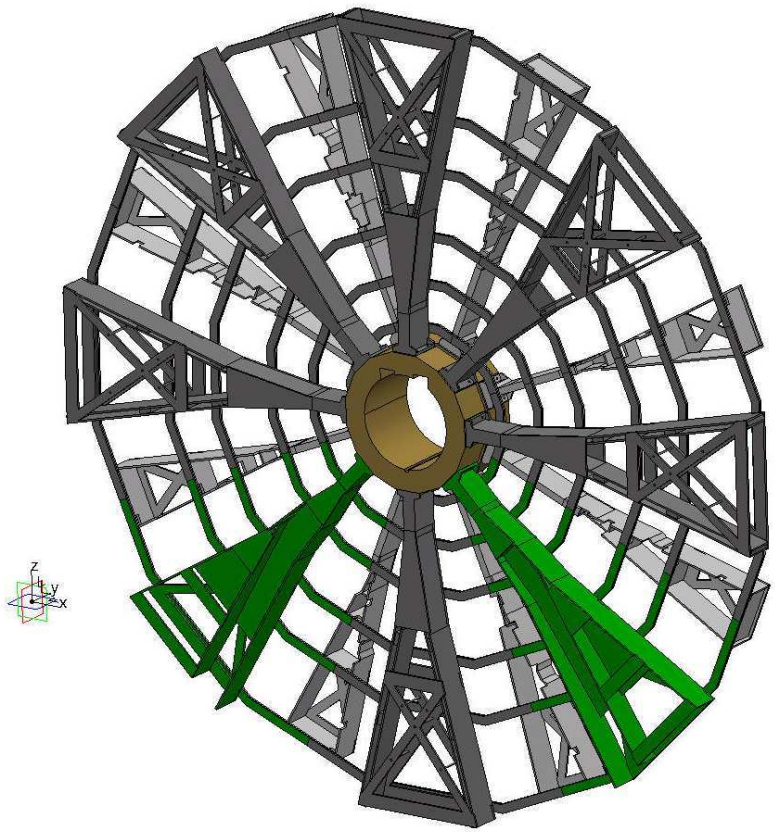
Thanks to the Saclay group (P. Ponsot et al.) who have developed this design

Environment

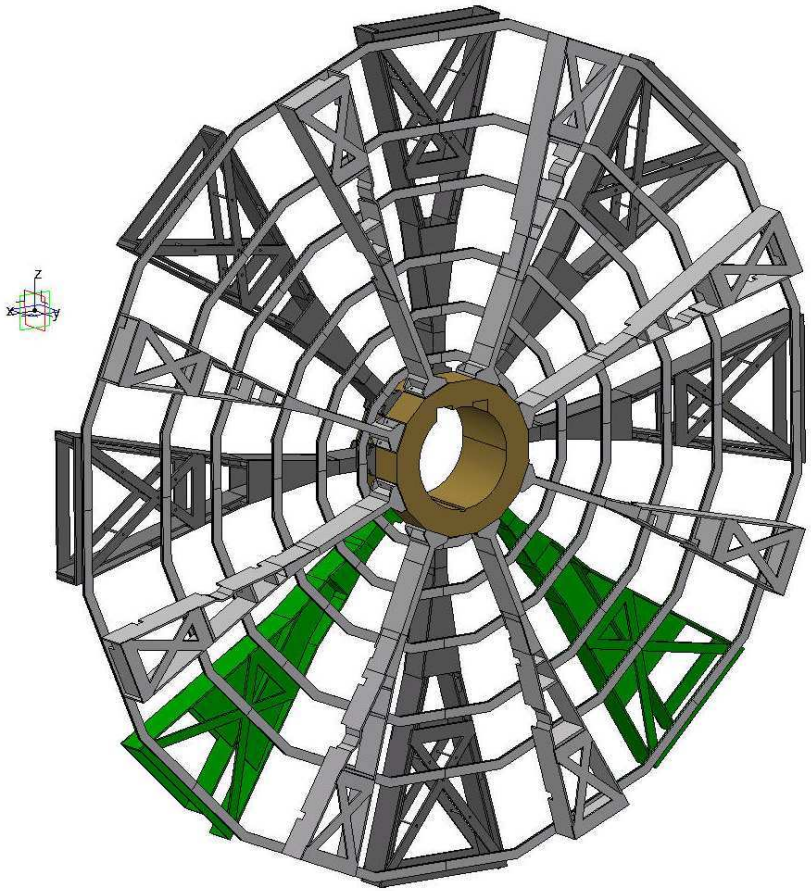


Mechanical Structure

IP view — Small Sectors



HO view — Large Sectors

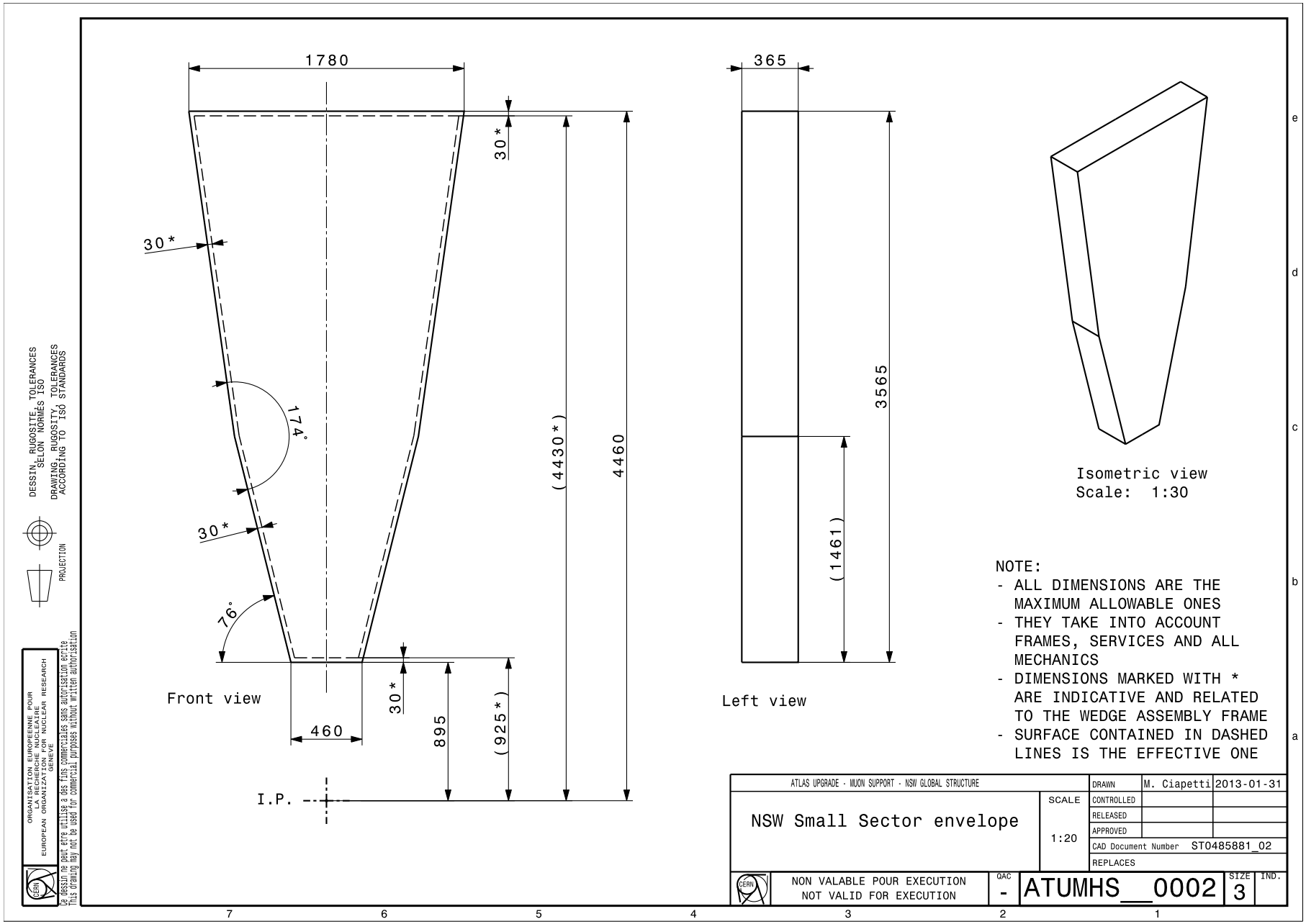


Preliminary, to be finalized once alignment system and detector weights are known

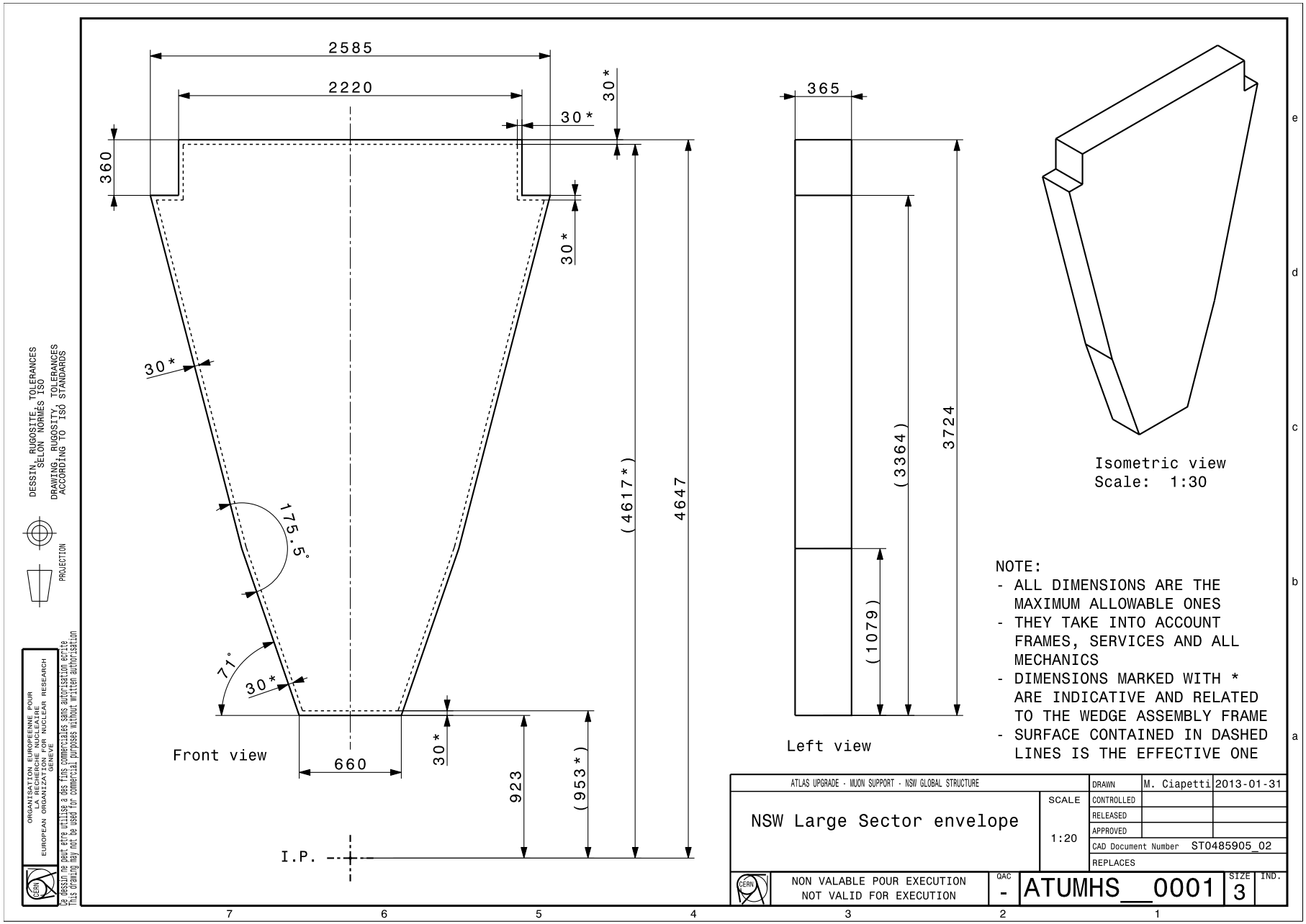
Envelopes

- Allow detector acceptance $1.3 \leq \eta < 2.7$
- Maximize overlap in ϕ
- Allocate space for kinematic station mounts and access for maintenance
  - aim for 100 mm (barely enough to get a hand in)
- Use currently available space in z between JD and ECT
  - still includes conical shielding
- Background simulations ongoing
  - Flat disk instead of conical shielding might be feasible, gaining space in z for detectors or alignment
  - 10–30% increase of background hits in EI and BI layer, no effect on EM
  - see presentation by Stefan Weber (JMU), Charlie Young (SLAC) et al.
  - further studies needed before a decision can be taken

Envelopes — Small Sector

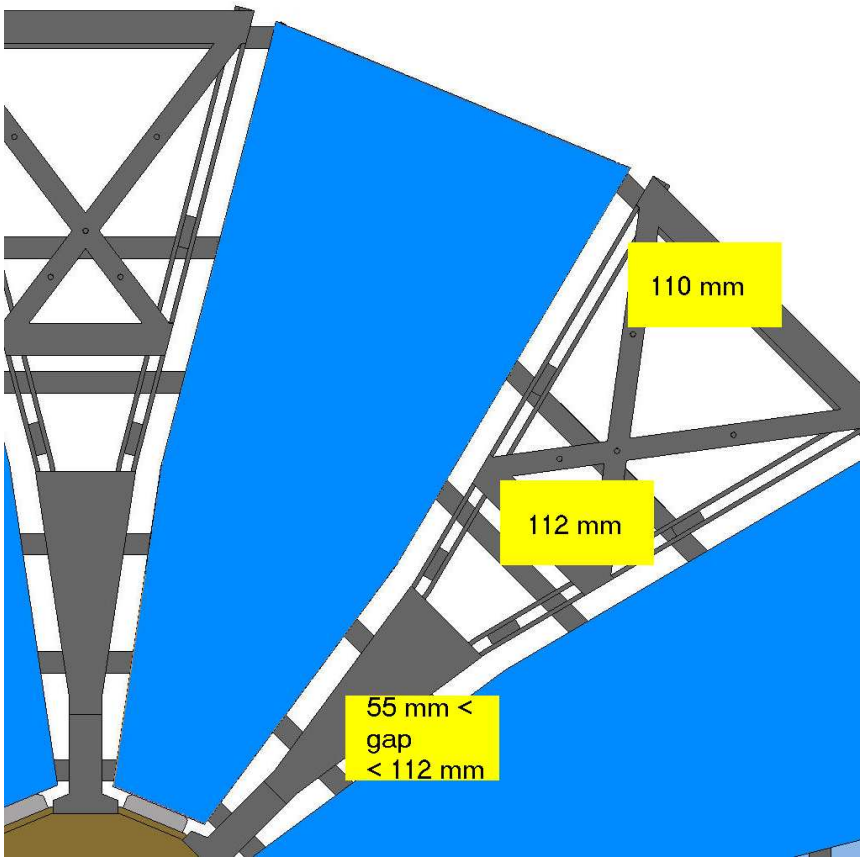


Envelopes — Large Sector

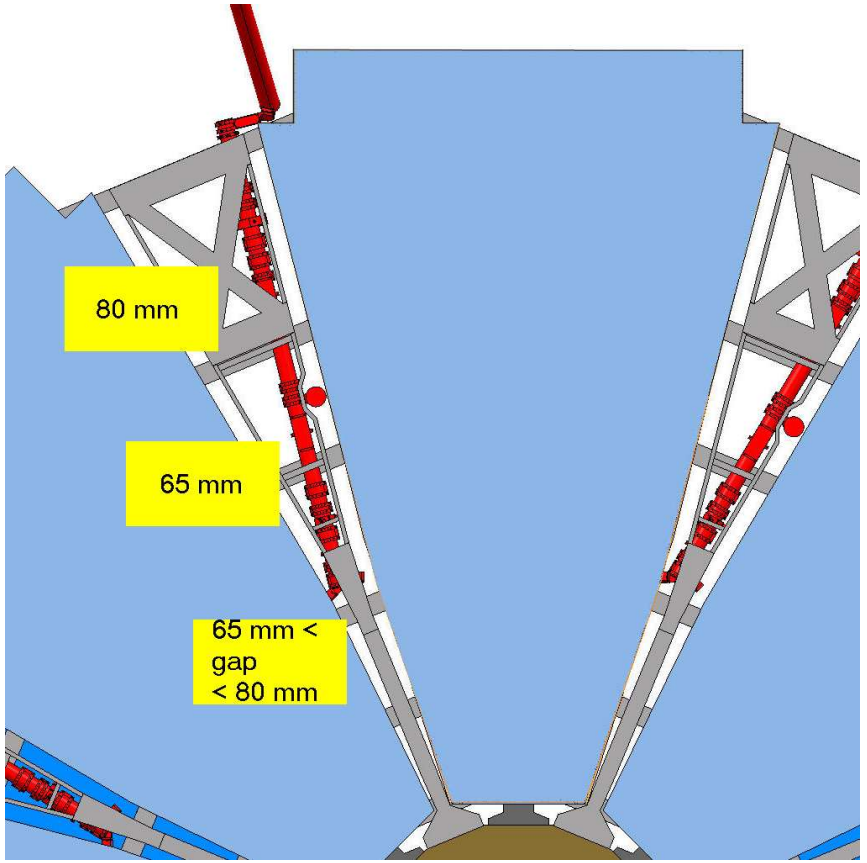


Envelopes

IP view — Small Sectors



HO view — Large Sectors

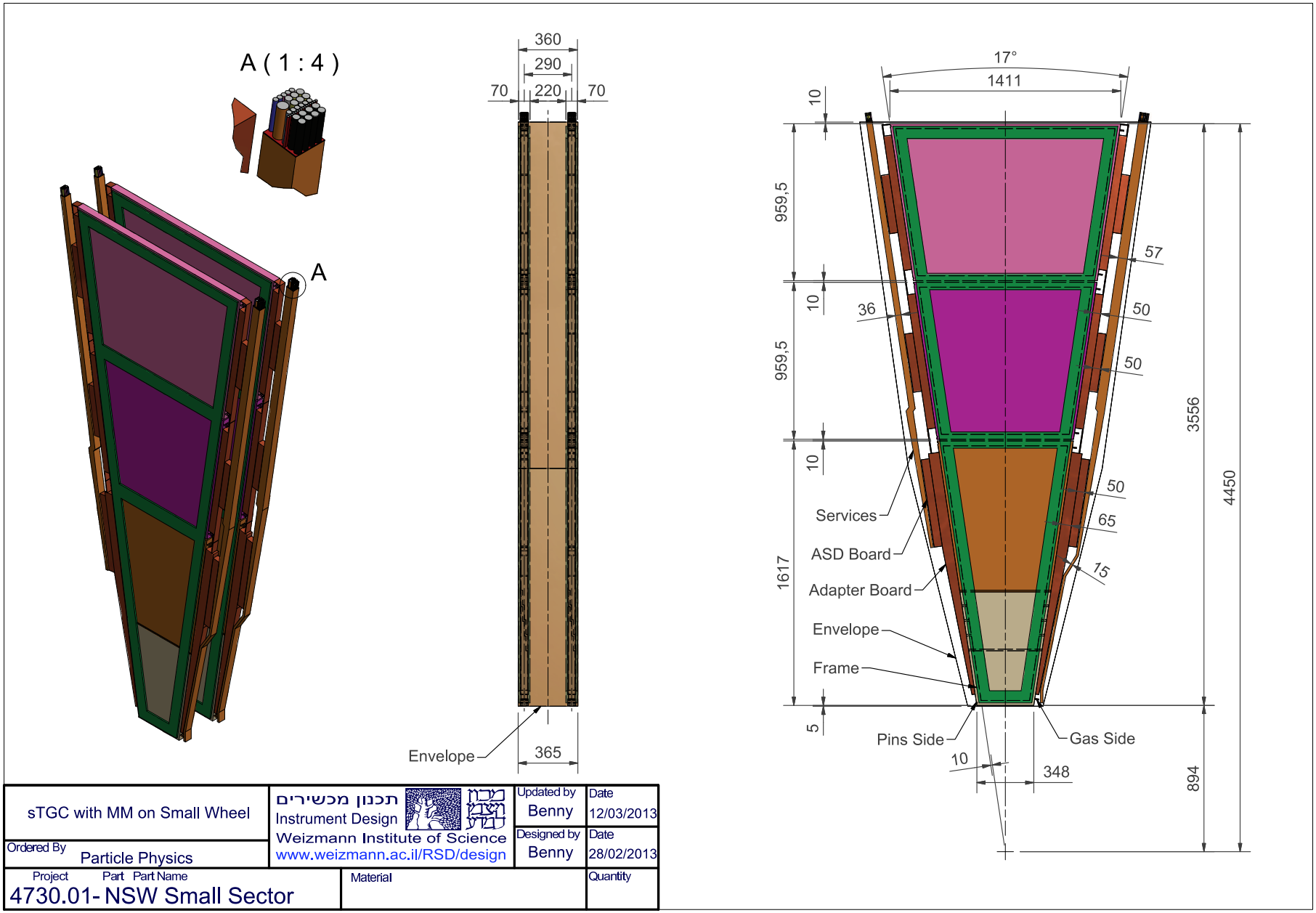


Note: Alignment bar (red) positions might change

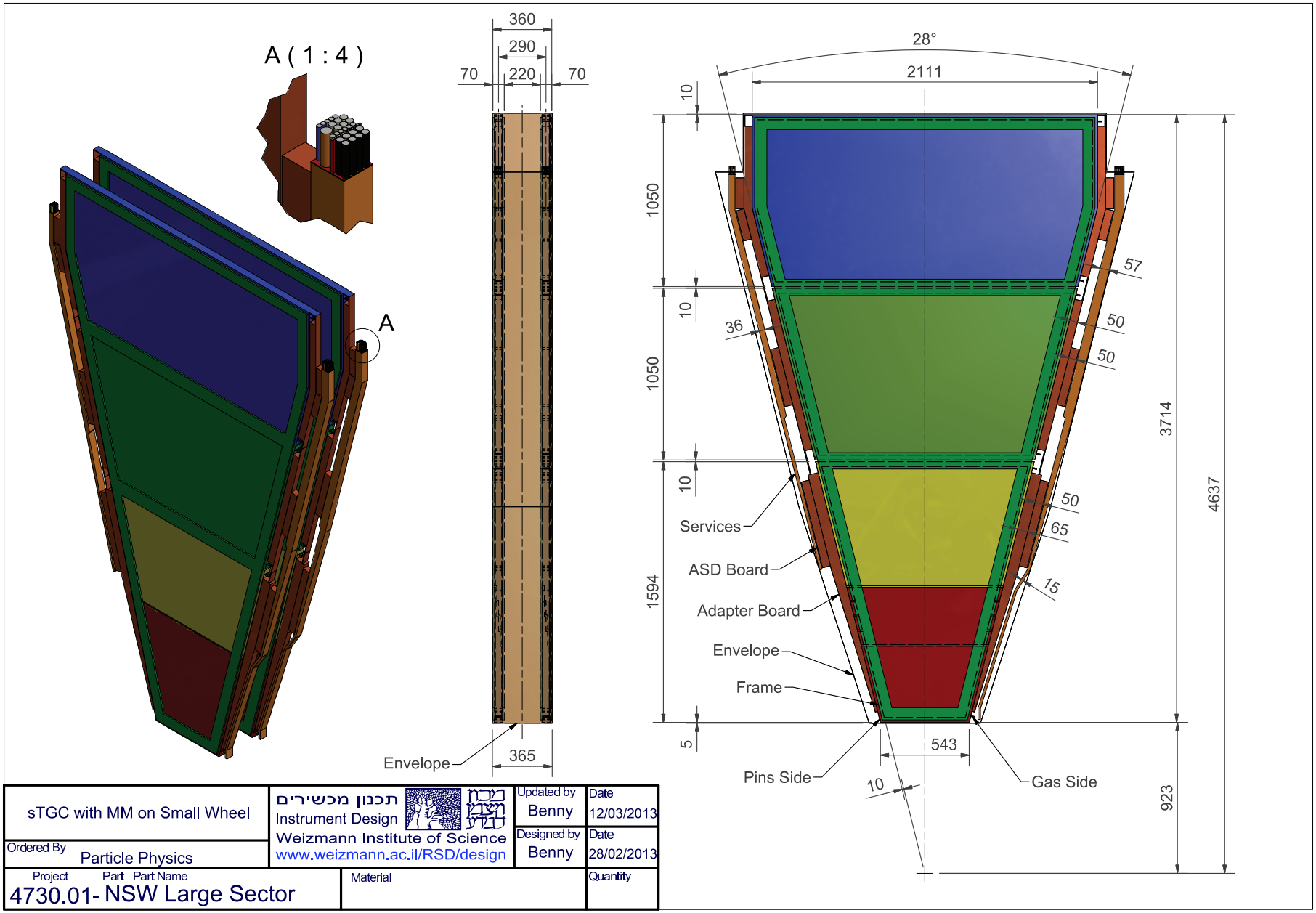
sTGC Layout

- 2 sector sized wedges per sector
  - 3 modules (innermost composed of 2 multiplets in r) each
  - glued to a sector frame
- Simplified shape without loss of acceptance
- Includes ideas on service distribution
  - better integration needed to not handicap access to MM services

sTGC Layout — Small Sector



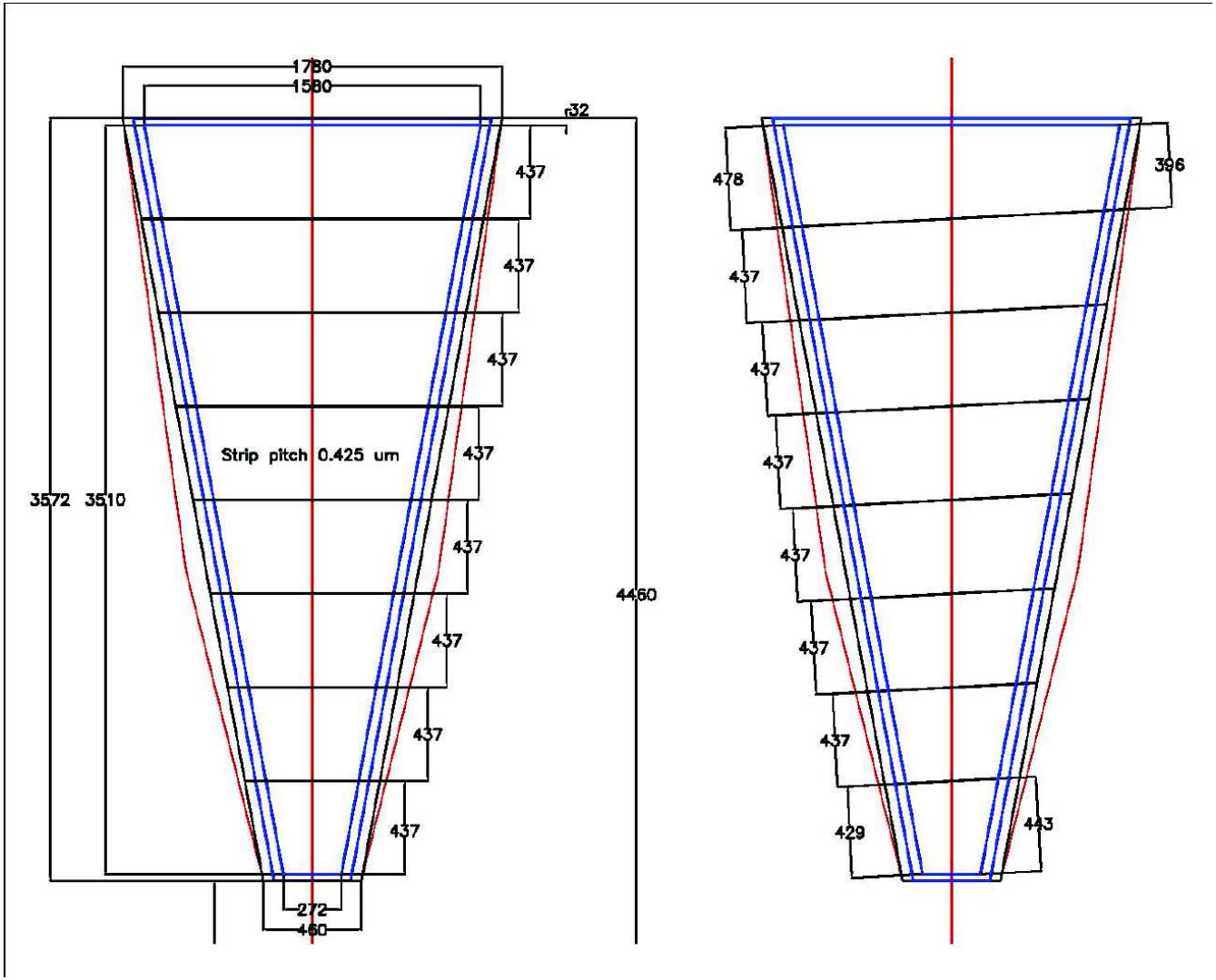
sTGC Layout — Large Sector



MM Layout

- Two possible main approaches under investigation
  - 2 sector sized modules per sector
  - 2 $\times$ 2–4 smaller modules per sector
  - see presentation by G. Sekhniaidze and by P. Ponsot
- Simplified shape without loss of acceptance
- MM chamber — two options
  - MM modules mounted kinematically to spacer frame
  - MM modules bolted (screwed) to spacer frame
  - see presentation by P. Ponsot for further details
- Ideas on service distribution

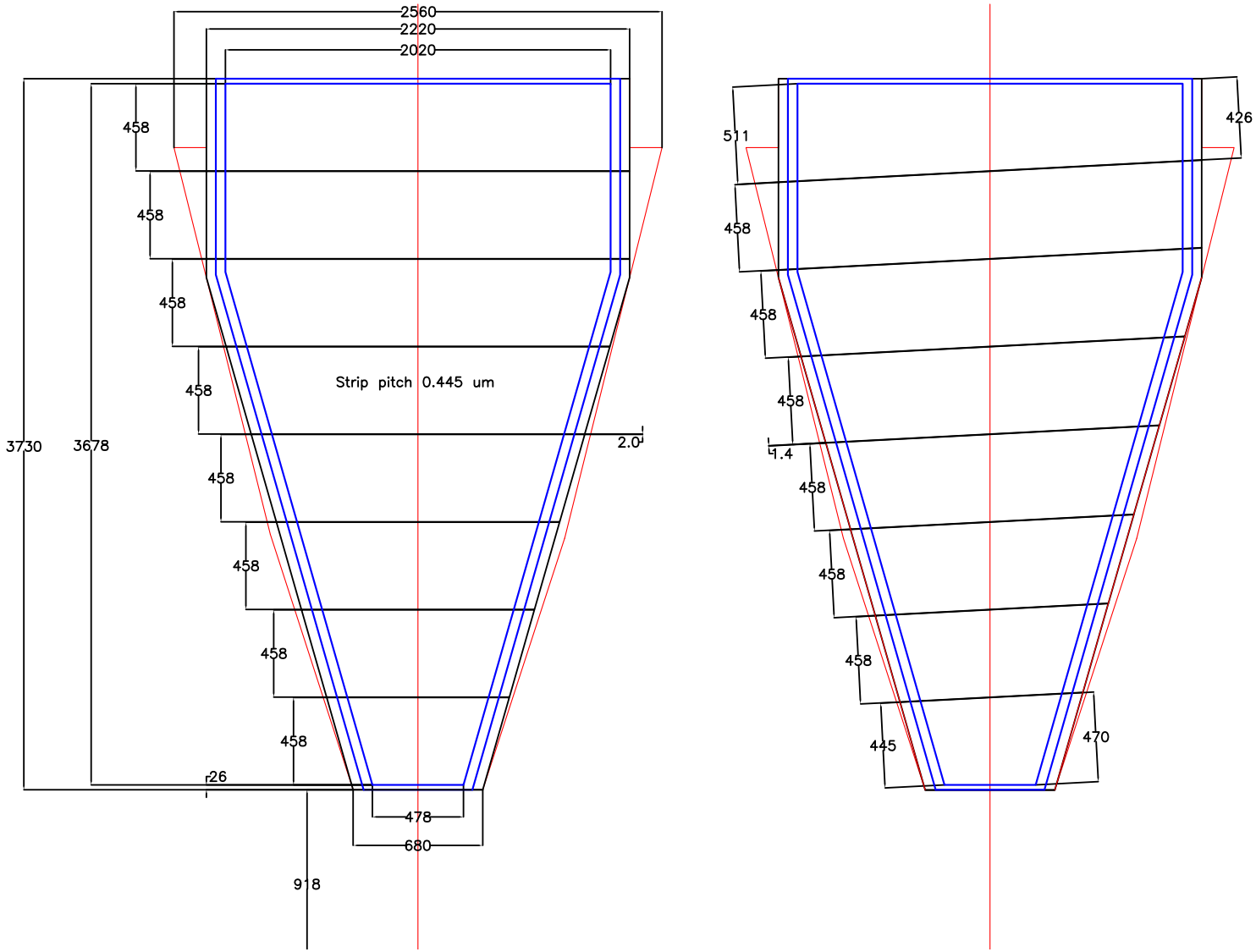
MM Layout — Small Sector



Example for sector sized module with PCB segmentation

from NSW TDR draft

MM Layout — Large Sector



Example for sector sized module with PCB segmentation

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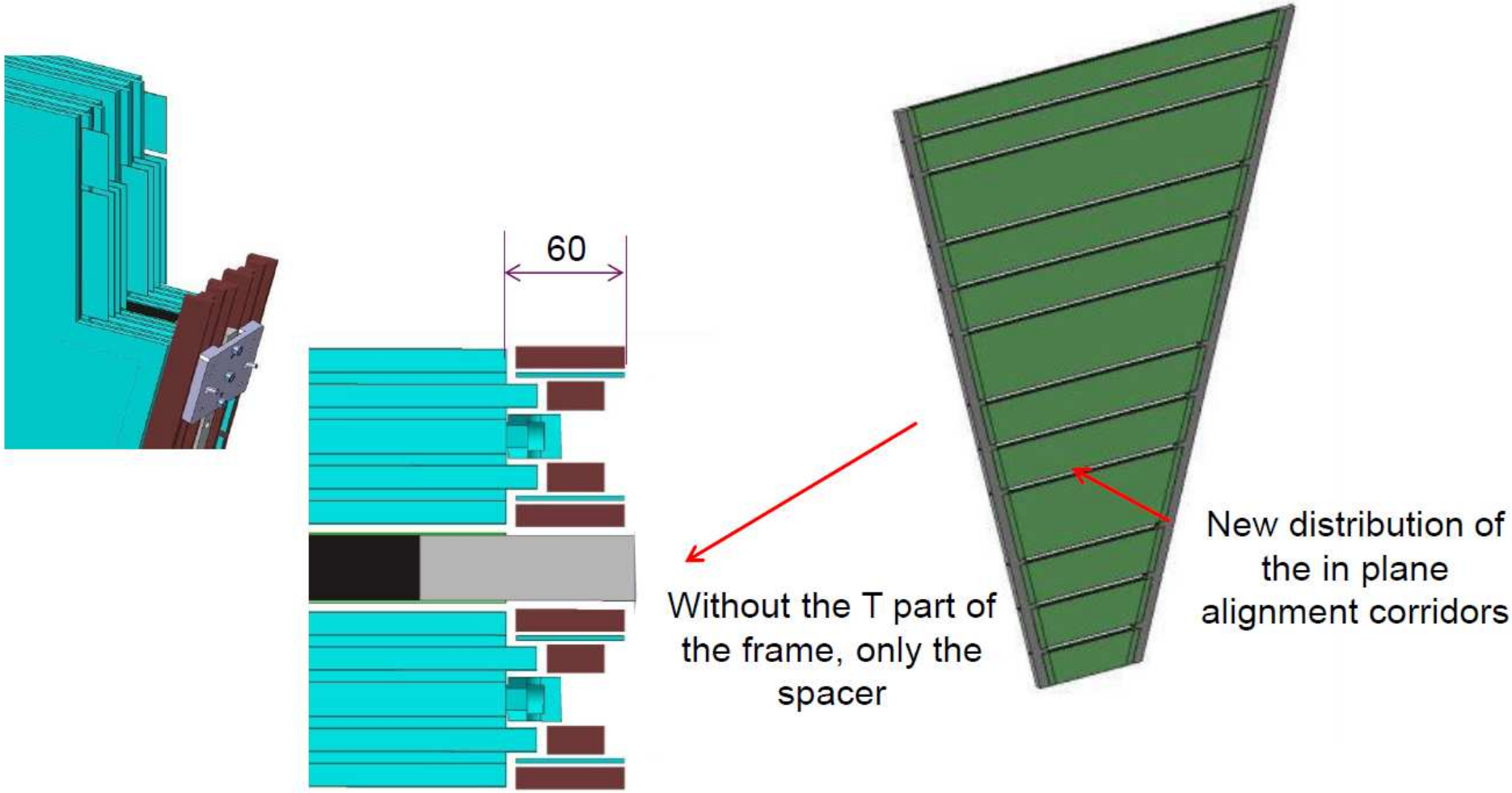
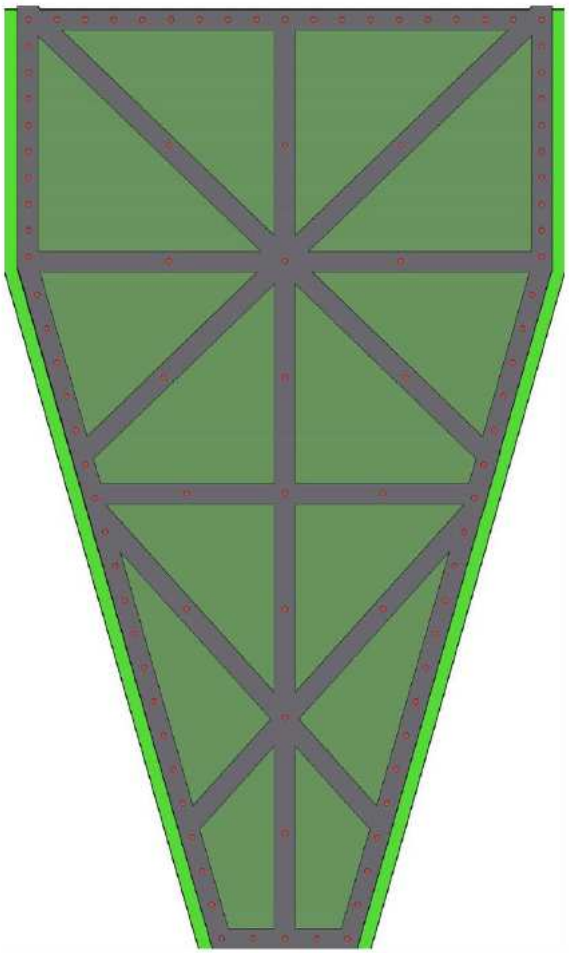
MM Spacer Frame

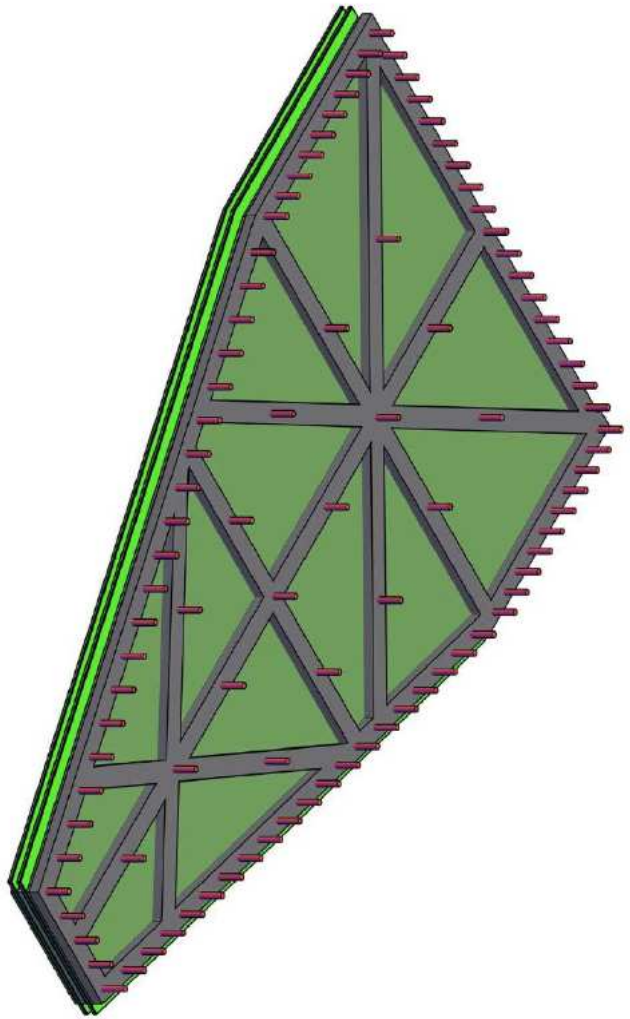


Composite frame — MM modules are mounted kinematically in frame

SACLAY FRAME - OPTION #3,P. Ponsot et al., NSW layout meeting, March 22, 2013

MM Spacer Frame

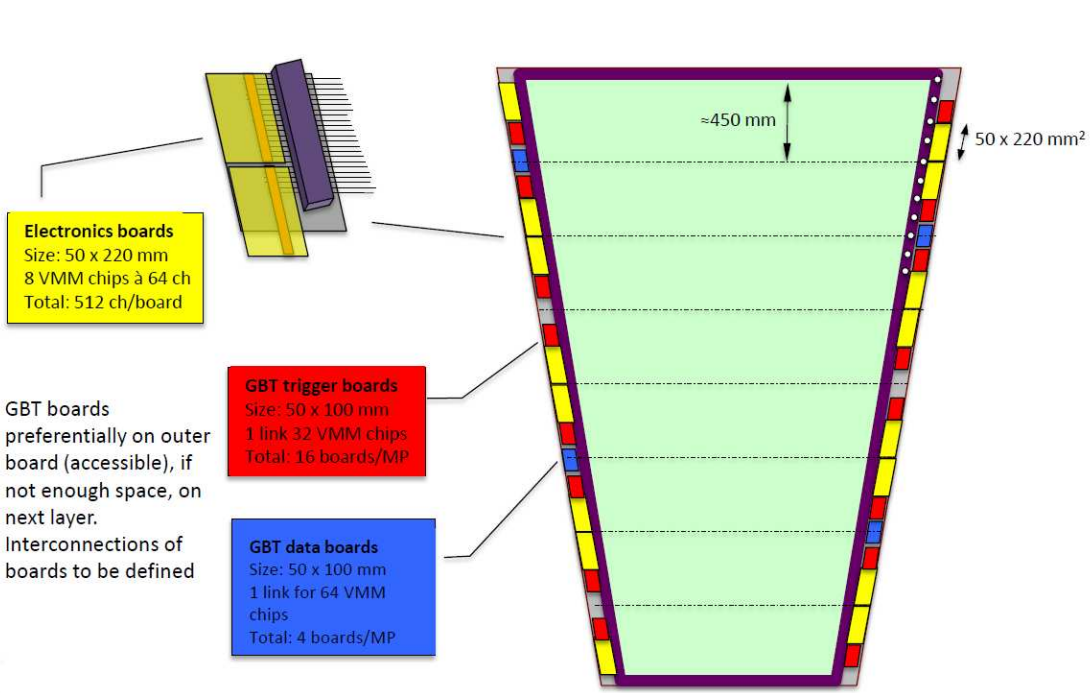


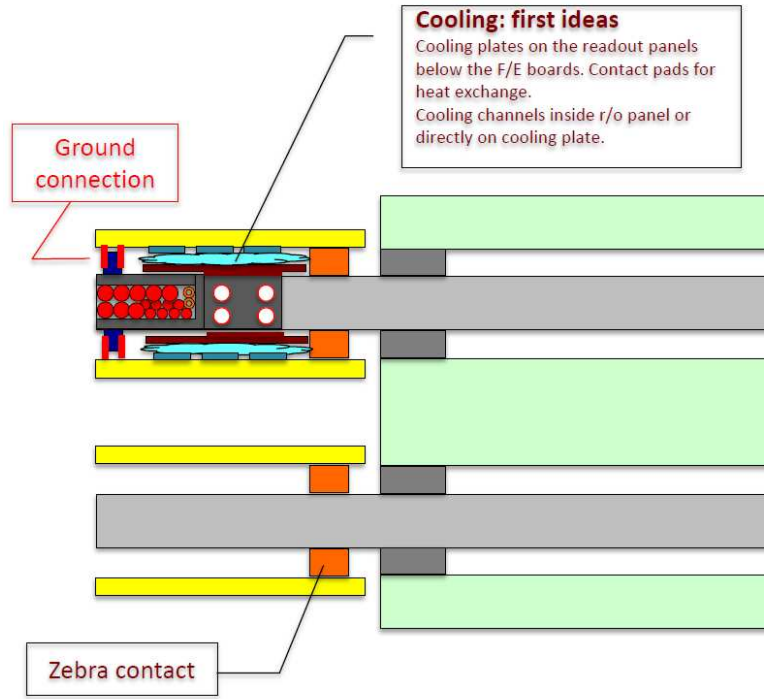


Aluminum or G10 frame — simpler approach — modules bolted to frame
preferred if deformations / forces can be controlled

Support structure for MM (and sTGC), G. Sekhniaidze and J. Wotschack, NSW layout meeting, March 15, 2013

MM Layout — Services





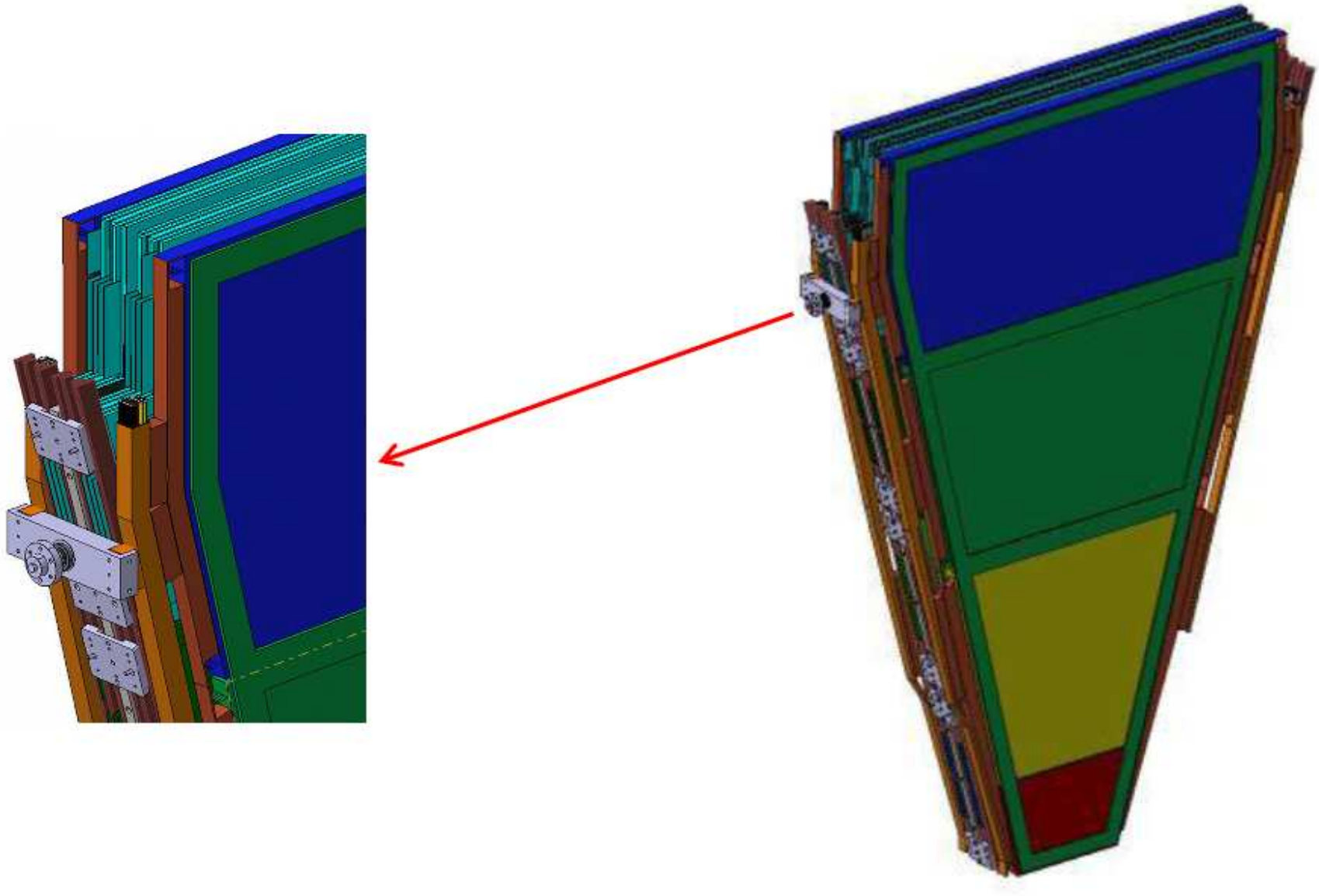
Summary of MM mechanics workshop, J. Wotschack, NSW layout meeting, March 15, 2013

See presentations by D. Amidei and U. Landgraf

sTGC-MM Integration

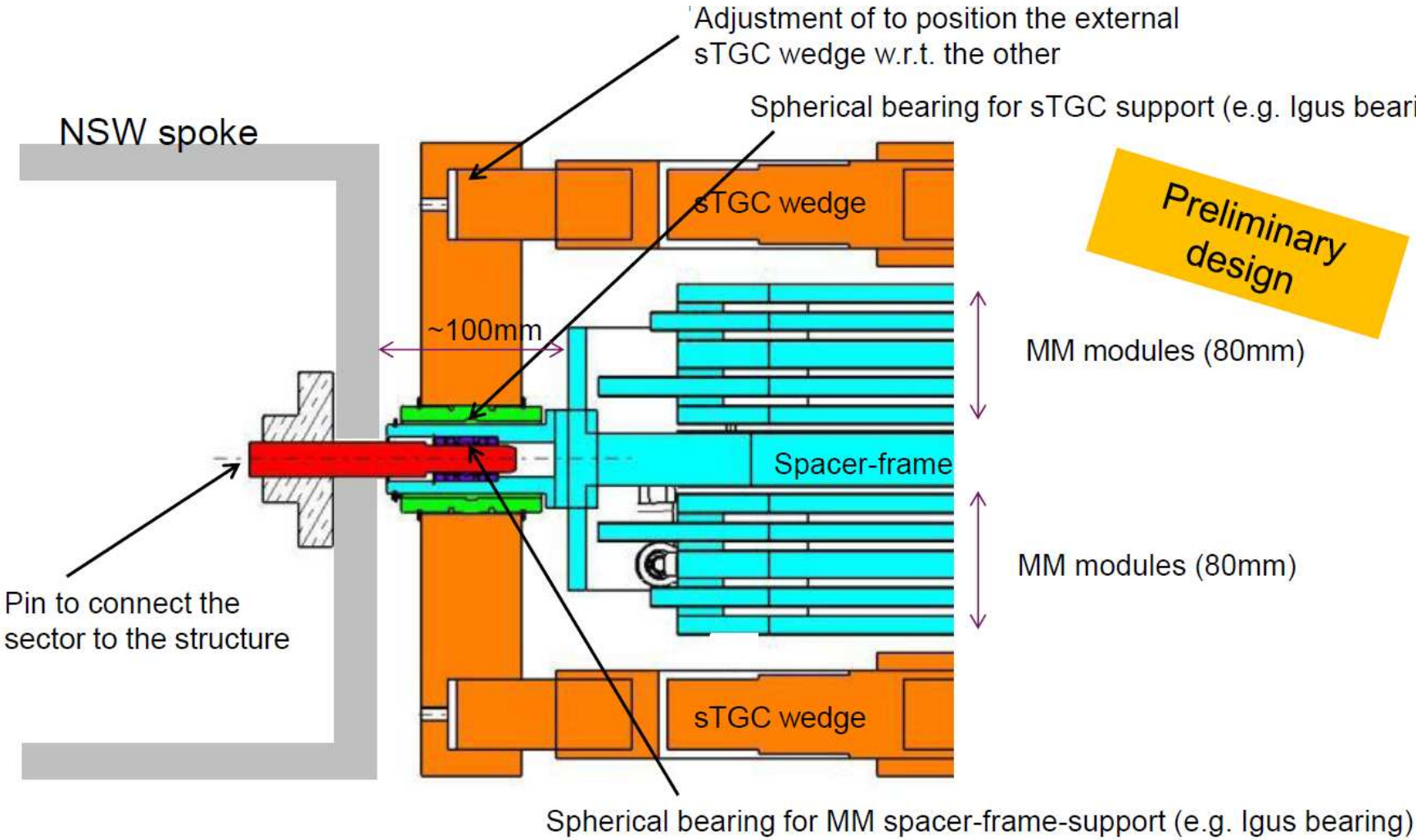
- sTGC wedges interconnected by 3 adjustable rigid bars
- sTGC support bars mounted kinematically on MM spacer frame
- MM spacer frame mounted kinematically on NSW structure
- Double kinematic bearings: same 3 points are used to mount sTGCs to MM and mount MM spacer frame on NSW structure

sTGC-MM Integration



SACLAY FRAME - OPTION #3,P. Ponsot et al., NSW layout meeting, March 22, 2013

sTGC-MM Integration



SACLAY FRAME - OPTION #3,P. Ponsot et al., NSW layout meeting, March 22, 2013

A Few Comments on the Alignment

Ongoing work by P.F. Giraud, C. Amelung, and H. Wellenstein to find a solution

- 16 alignment bars (first proposed by Shikma Bressler)
- Conflicts with mechanical structure
  - bars cannot reach innermost region
  - alignment lines cross frame
- Need inplane system on each sTGC wedge, at least 1 system on MM chamber (but probably 1 for each module)
  - space required in z
  - number of sensors
  - integration with detectors, assembly, and maintenance issues
- Large number of services (cables, fibers)

See presentation by P.F. Giraud)

Some Thoughts at the End

Option with MM modules bolted (screwed) to frame preferred

- Small number of kinematic bearings
- No adjustment of modules after installation
- Less dead space (in ϕ and r)
- If deformations of the two wedges are similar, reduced inplane systems
- Integrated sTGC/MM station (?)