

Update on AIDA-2020 WP 13.4.1

Preparation for large series production:
large-detector size preserving mechanical precision

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**Associated M24 Milestone achieved 19/10/2017 as planned:
Mechanical Structure and Supports for Large Thin-Gap RPCs.**

Additional developments for ATLAS phase-1 and phase-2 upgrades

Thin Support Frame for Triple Thin-Gap RPCs for ATLAS Upgrades

Goal: Design of a support frame and Faraday cage for triplet of thin-gap RPCs with 1 mm gas gap width and 1.2 mm thick HPL electrodes with minimum material and thickness including gravitational deformations.

Envelope target: 60 mm in the inner layer of the ATLAS barrel muon spectrometer for the **phase-1 upgrade** in Long Shutdown 2 of the LHC 2019-20 (32 Triplets), and similar for the **phase-2 upgrade** in LS3 2024-26 (276 Triplets).

Detector thickness budget:

Readout panels: 3.8 mm

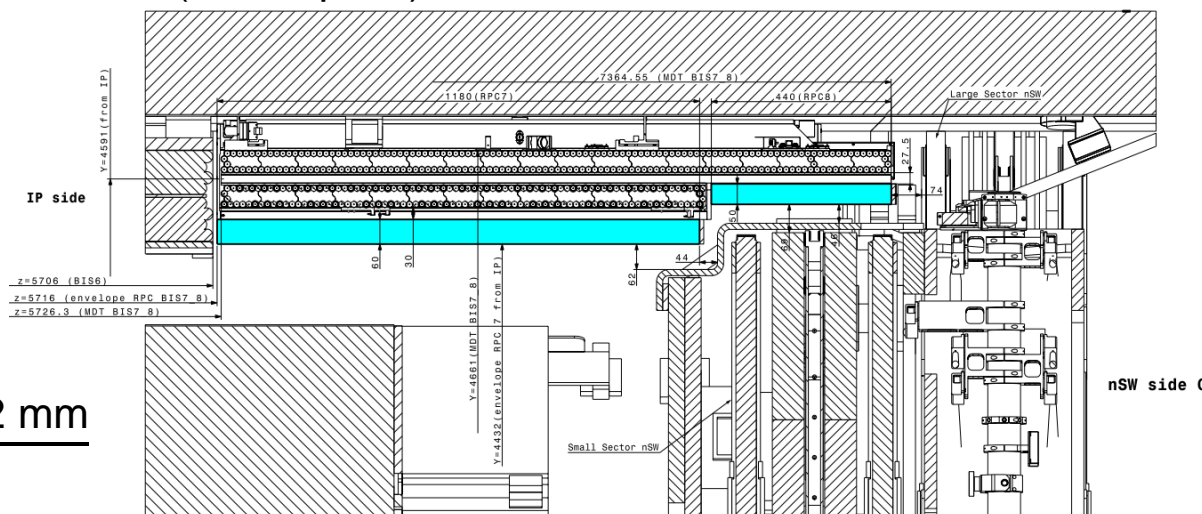
Gas gap: 4.6 mm

Singlet with two (η and ϕ) strip panels: 12.2 mm

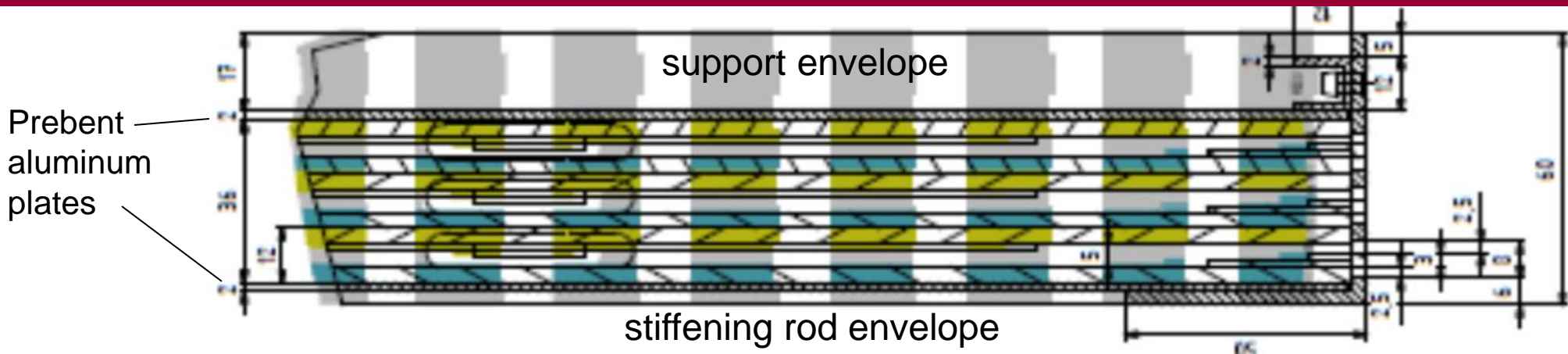
Triplet: 36.7 mm

Frame height: 60 mm at the edges and supports

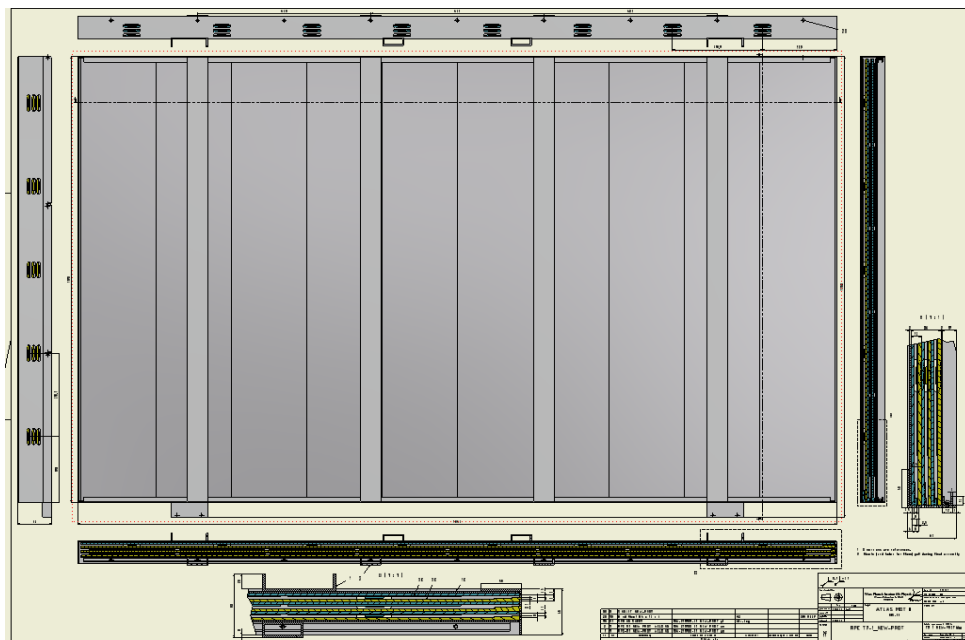
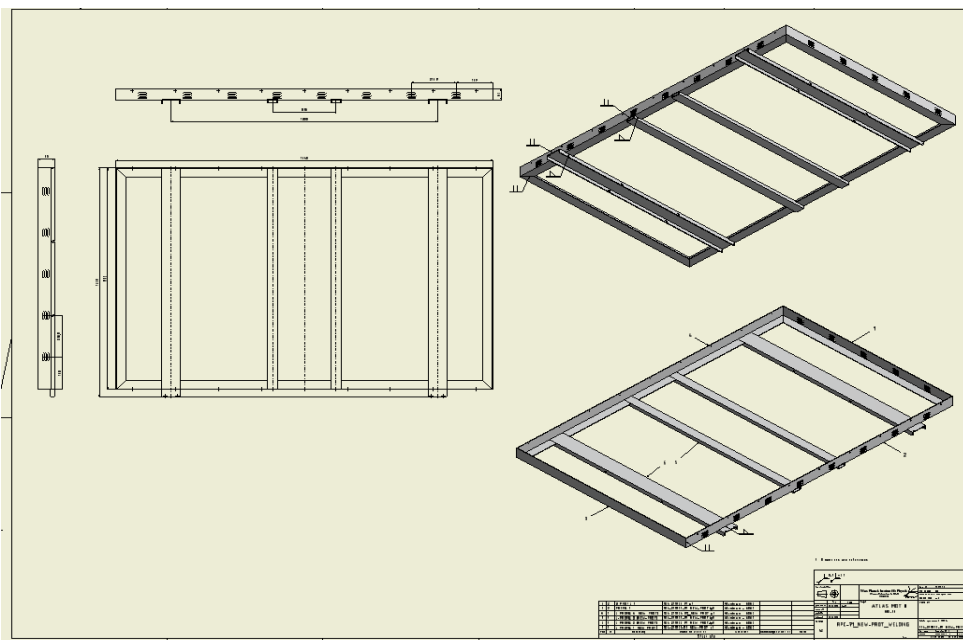
Max. gravitational sag: < 2 mm (FEM and measurement) at edges and supports, for 1.84 m x 1.17 m sized chambers and **detector weight 70 kg (phase-1) → 42 kg (phase-2)** due to RO panel material, **frame weight 45 kg**



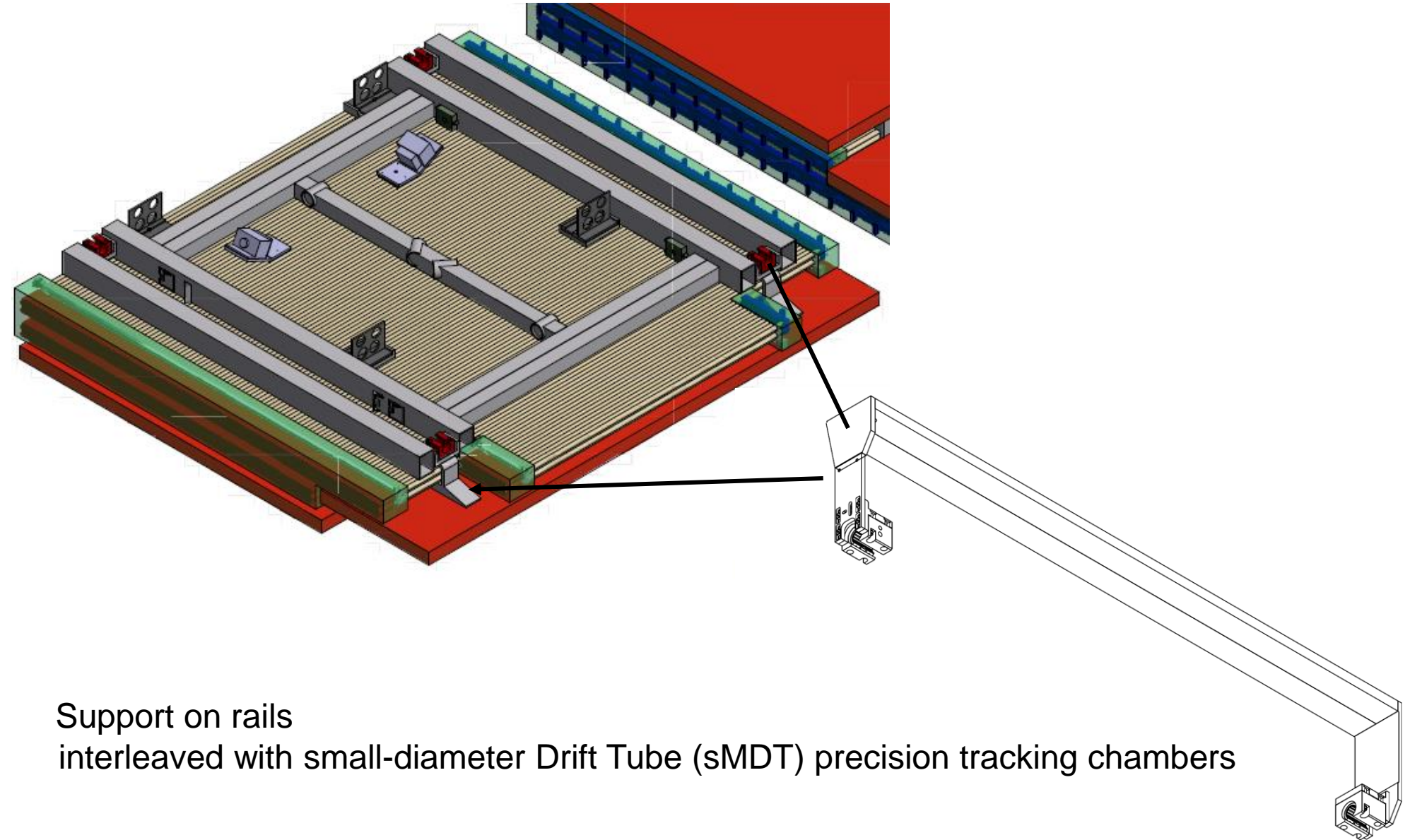
New ATLAS RPC Frame Design



- Welded frame for stiffness, top-bottom symm.
- Segmented prebent 2mm Al plates with stiffening rods hold triplets together
- Two parts for singlet insertions from top

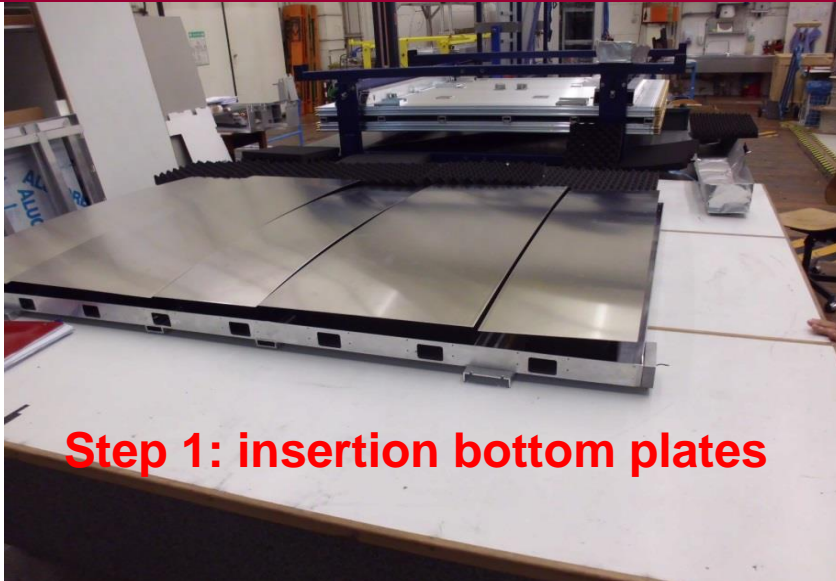


RPC Support Design

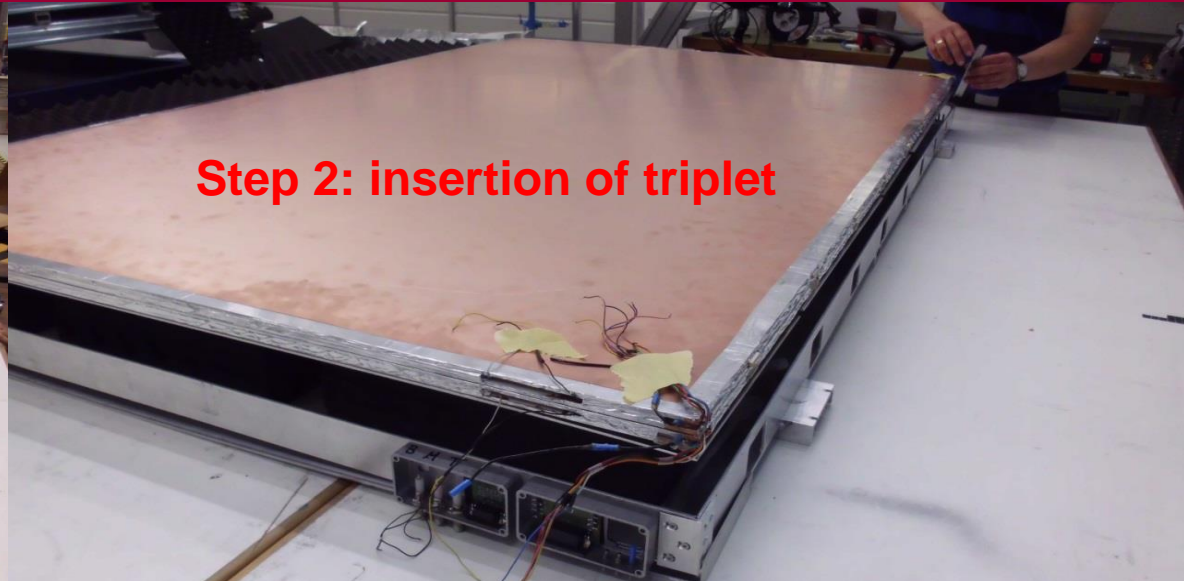


Support on rails
interleaved with small-diameter Drift Tube (sMDT) precision tracking chambers

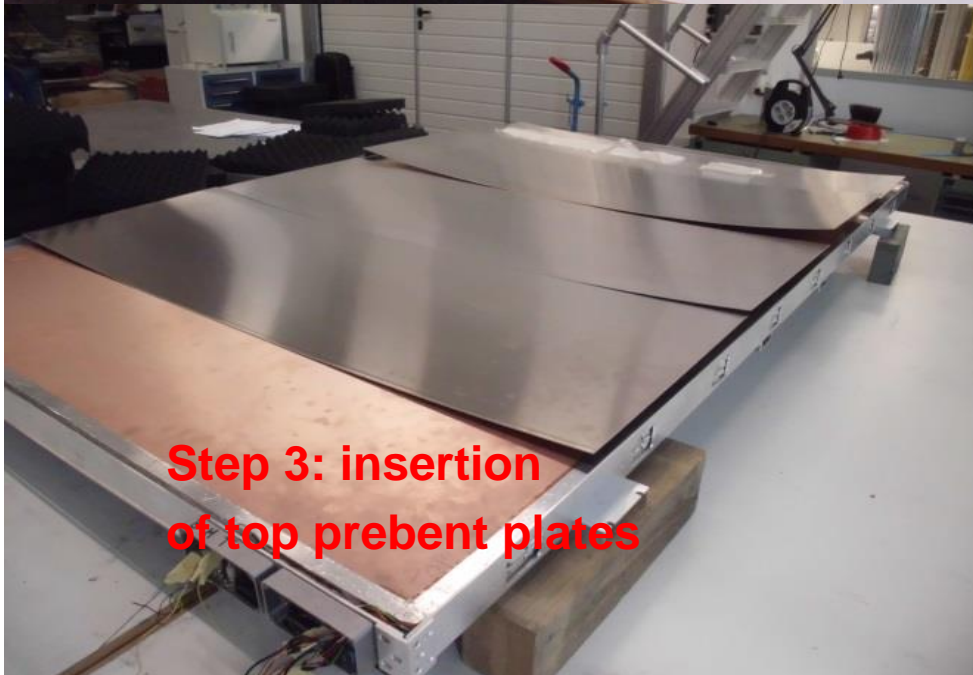
Prototype Assembly



Step 1: insertion bottom plates



Step 2: insertion of triplet

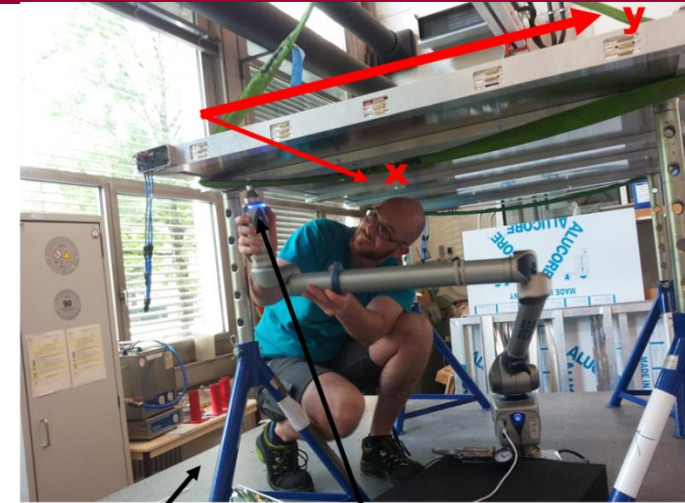
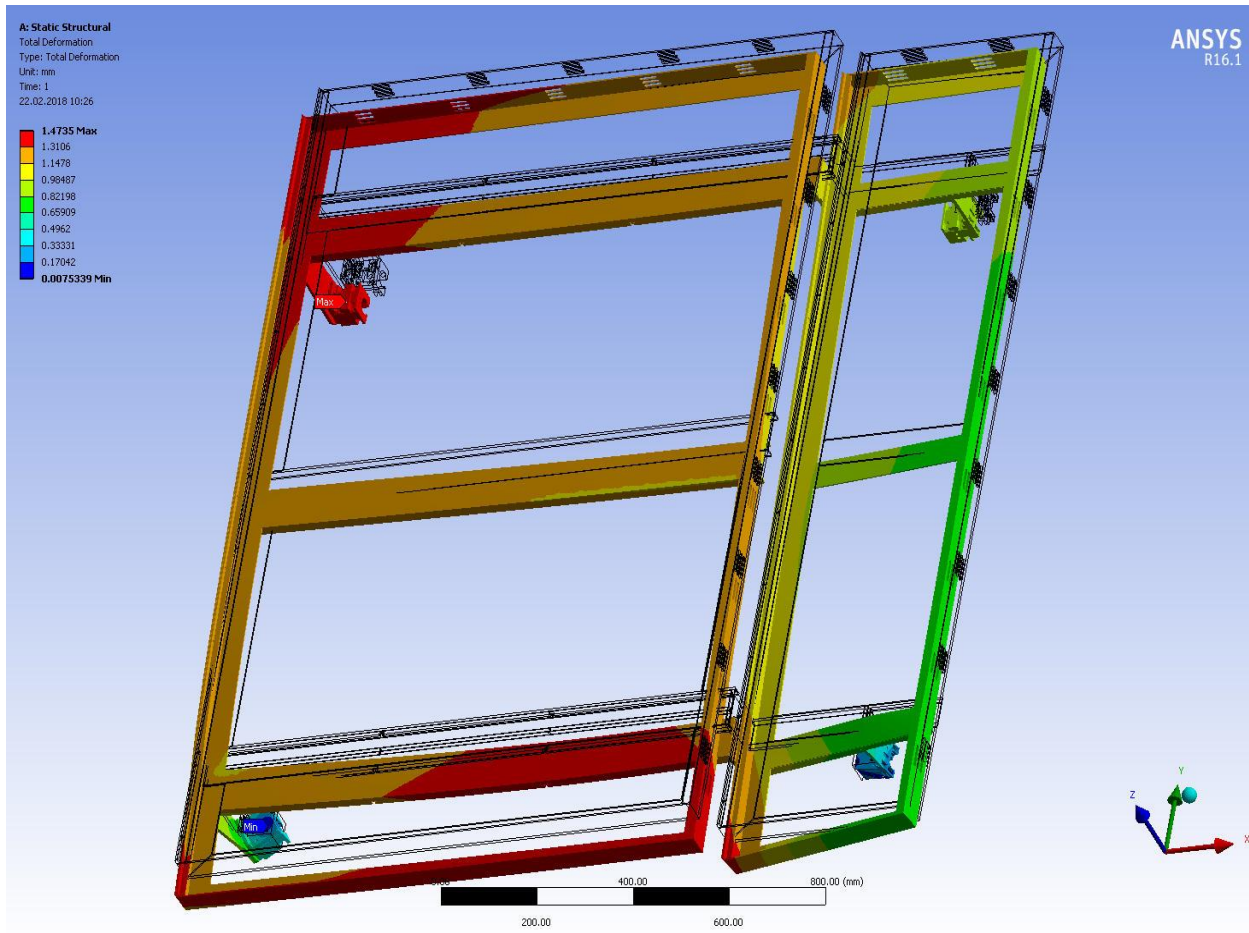


Step 3: insertion of top prebent plates



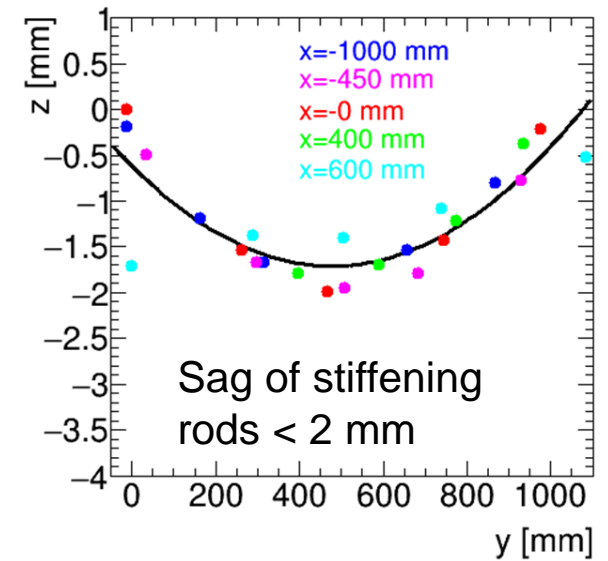
Step 4: Completed module closed with stiffening rods

Prototype Mechanical Test

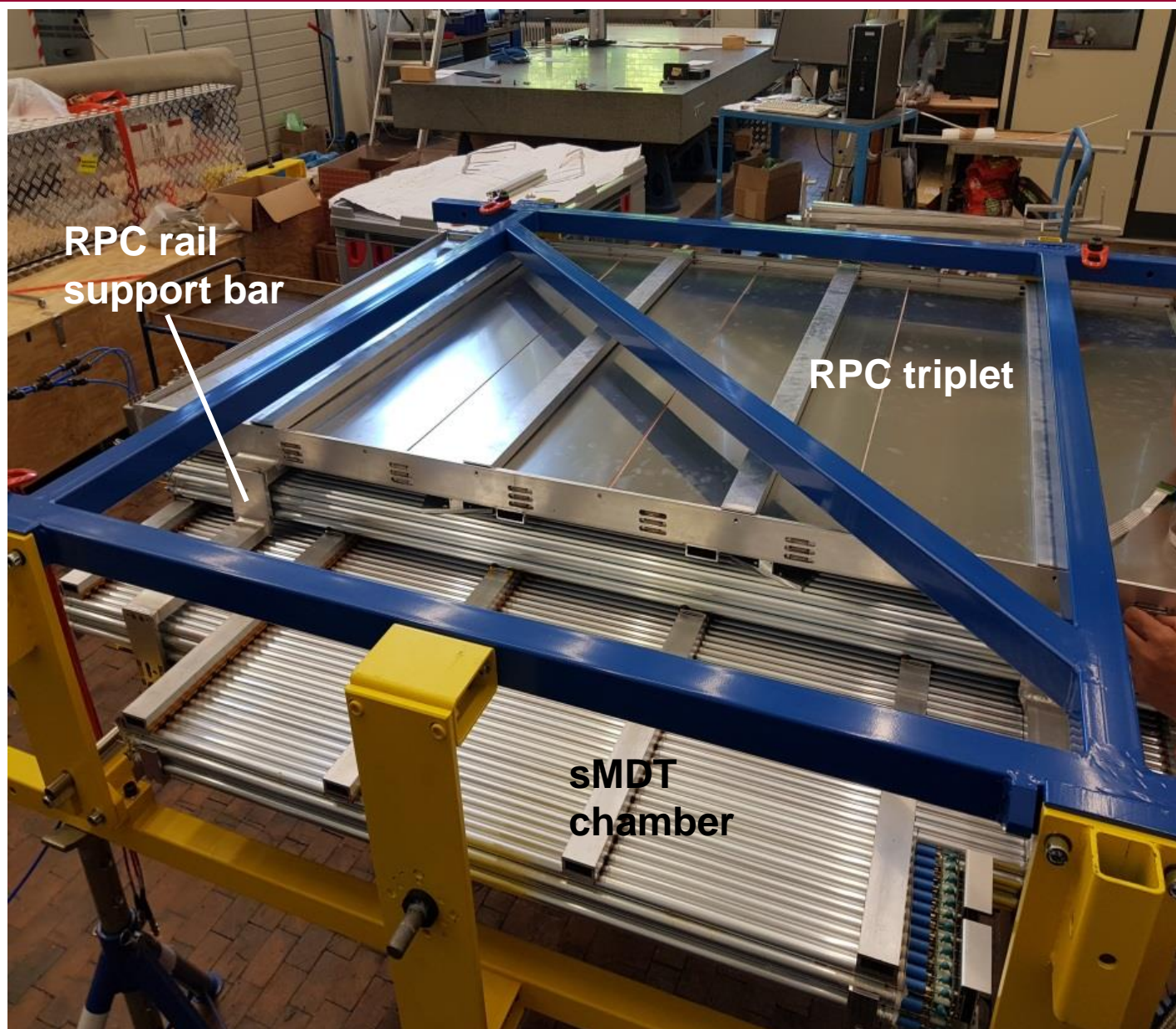


Granite table

FARO arm



Prototype RPC and sMDT Integration



Conclusions

- Mechanical structure and supports for large thin-gap RPCs
Milestone M24 achieved.
- Further developed design and fabrication of support frames for ATLAS
phase-1 upgrade (September 2019) completed; pilot project for phase-2.
- Design for phase-2 upgrade very similar;
mainly optimisation of services integration and cable routing