Design and Optimization of the Mechanical Structure for Thin-Gap RPCs in the ATLAS inner Muon Spectrometer Barrel

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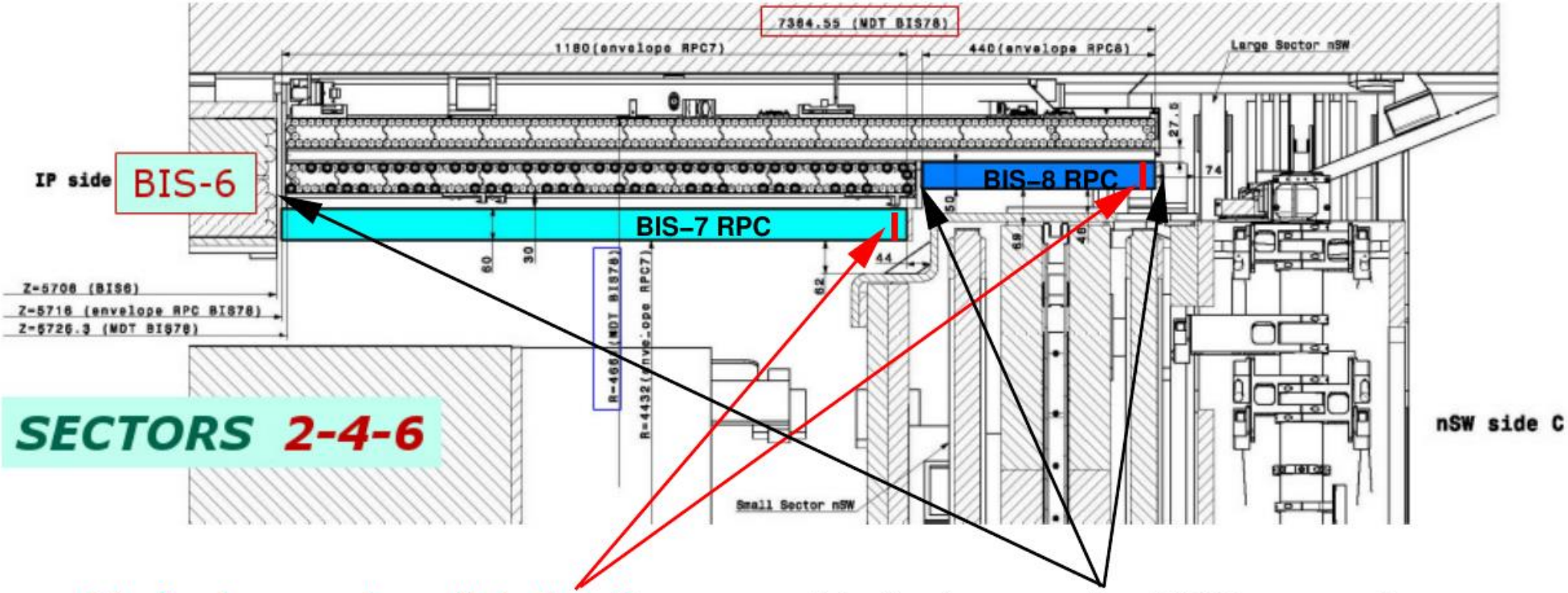
Challenges/requirements for the RPC mechanics

- 16 stations of sMDT and thin-gap RPCs will be installed in the ATLAS muon spectrometer during LS2 of the LHC.
- Very tight spatial constraints.



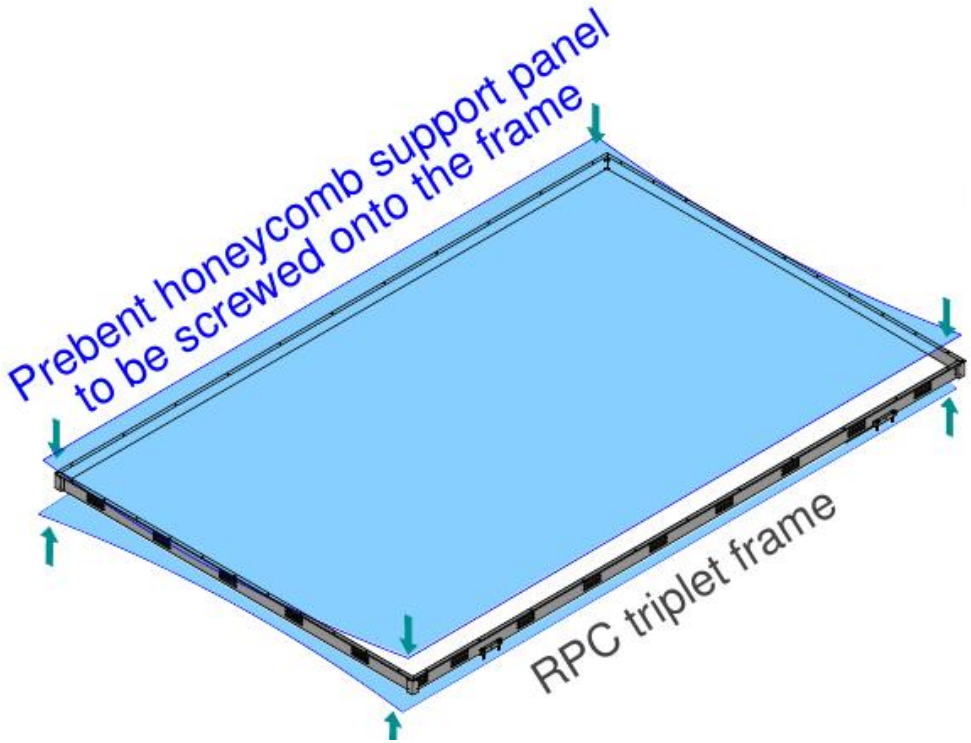
Limited space in radial direction

Limited space for RPC support structure in z direction

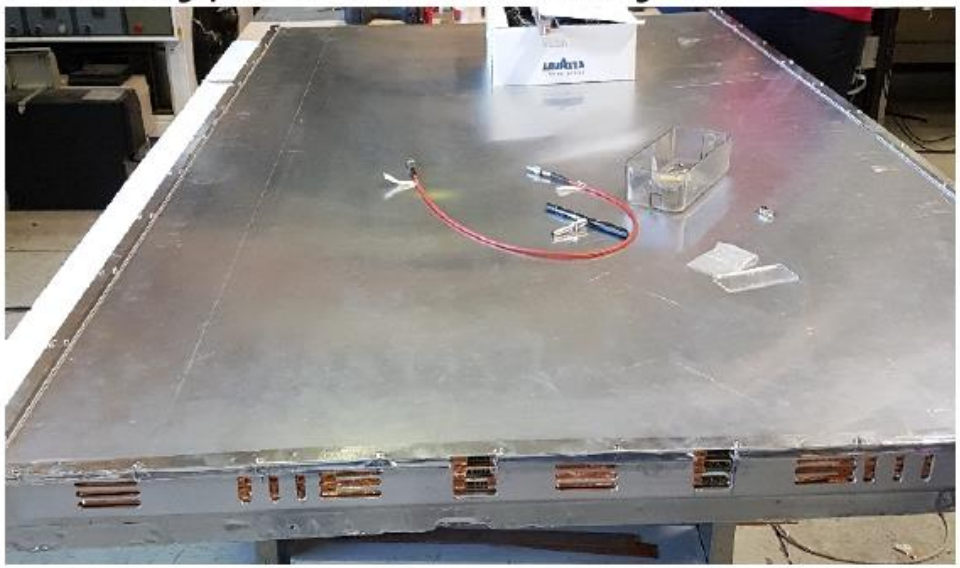
→ Very compact mechanical structure needed to fit into the limited available space.
→ Very rigid mechanical structure required in order to avoid clashes with the sMDT chamber.

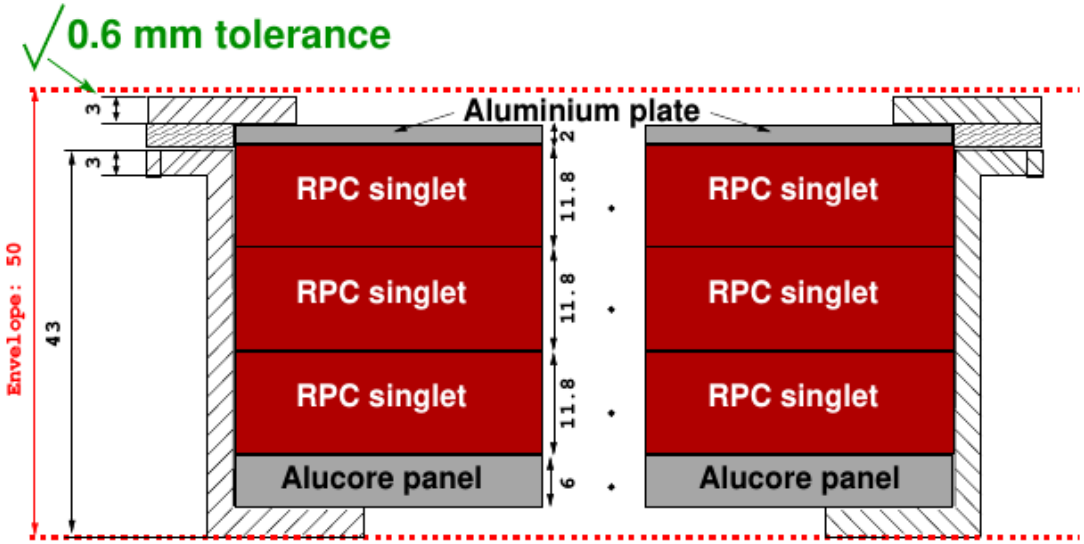
Mechanical frame for the first full-size BIS-7 RPC prototype

- A first full-size BIS-7 thin-gap RPC triplet prototype was successfully constructed in fall 2017.



Prototype after assembly in Rome II

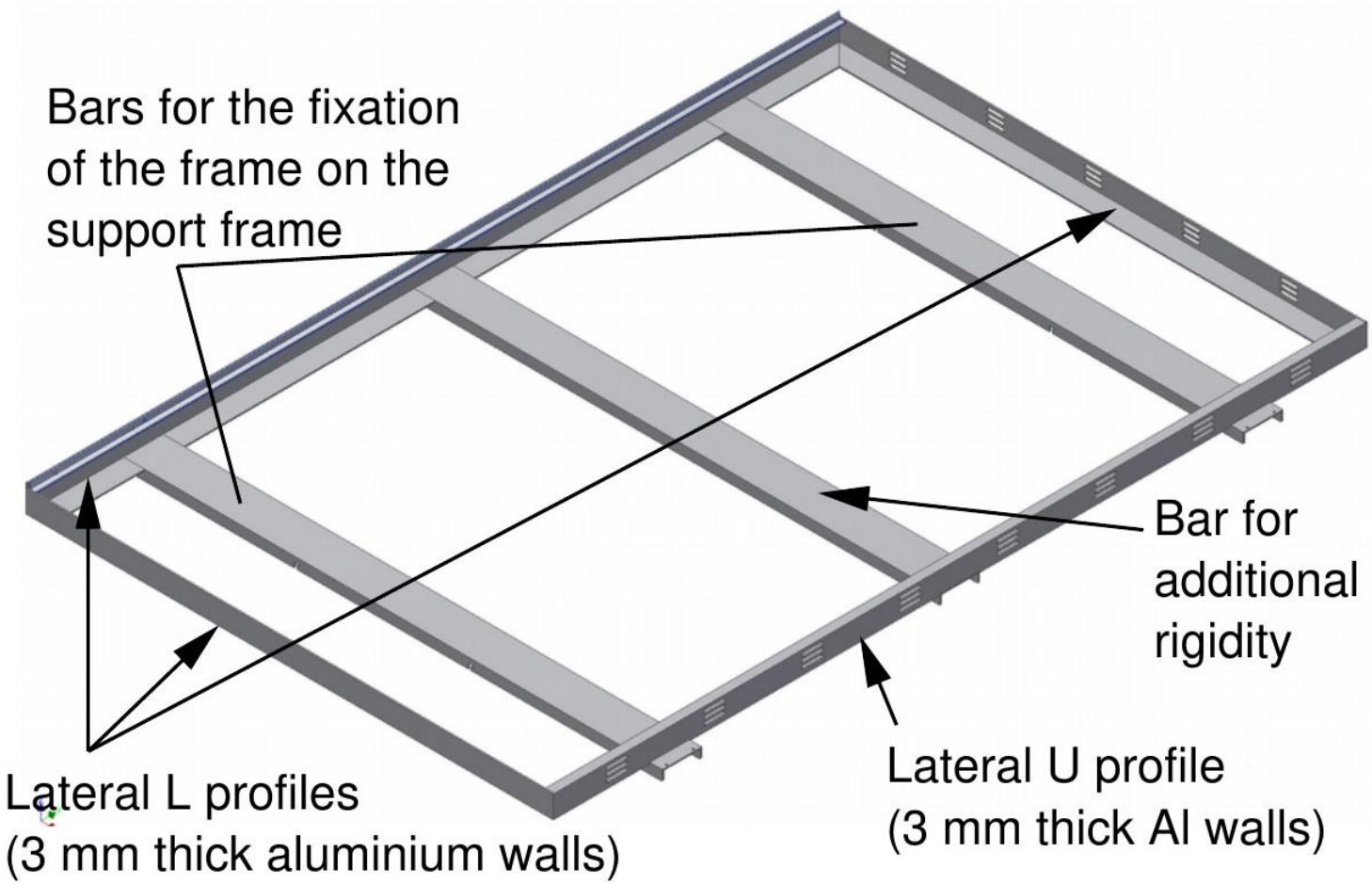




- Design compatible with the very tight envelope of 50 mm in height.
- However: Choice of lateral Z profiles reduces active area of the RPC.

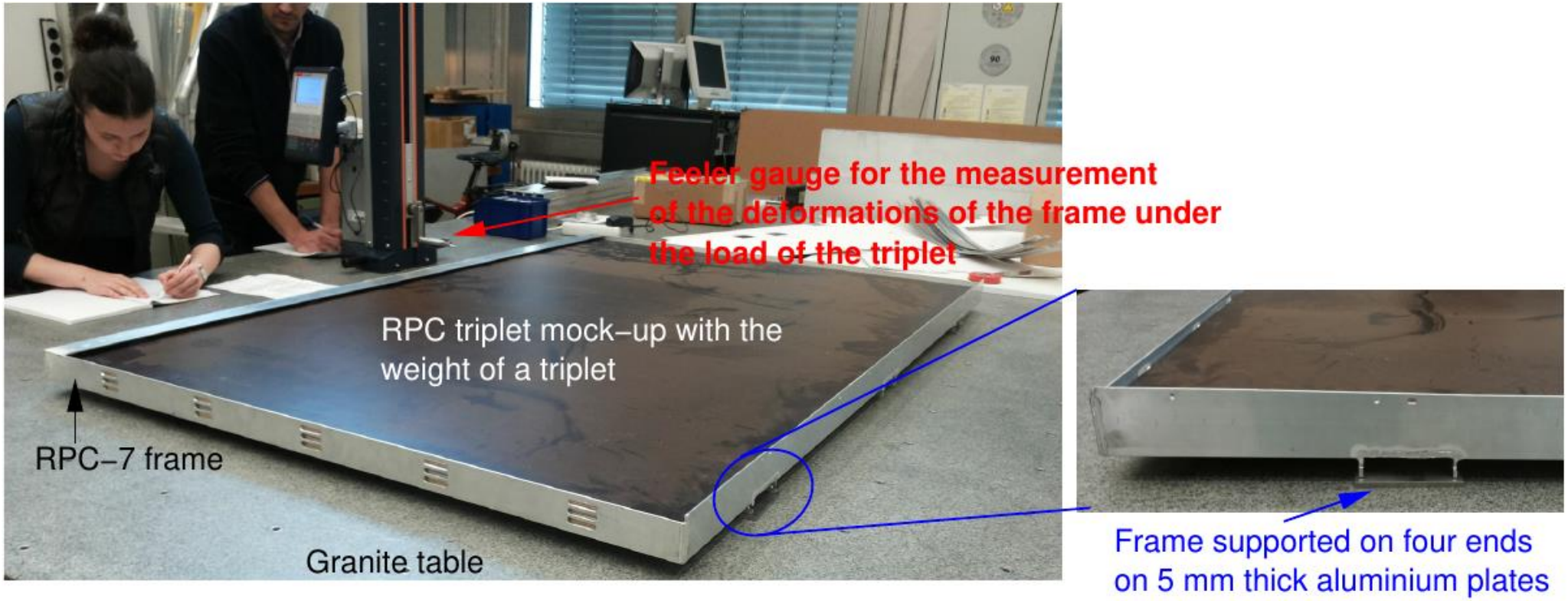
→New design which maximizes the acceptance was worked out.

Improved mechanical frame for the BIS-7 thin-gap RPC triplet



- New design allows for maximum active area by switching from Z profiles to L and U profiles.
- Rigidity of the frame increased by stiffening bars on the bottom of the frame.

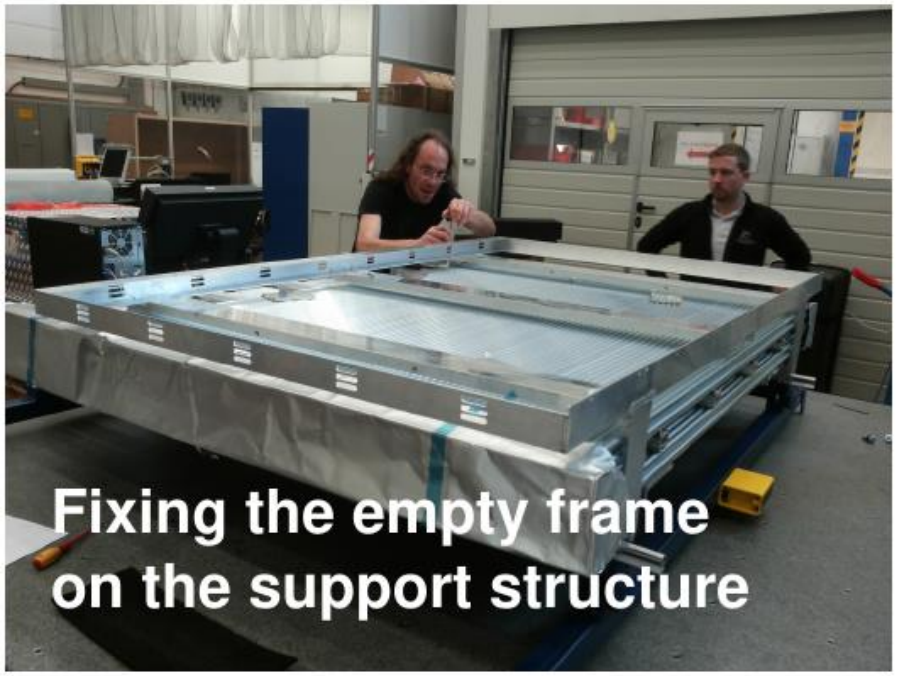
Mechanical test of the new frame

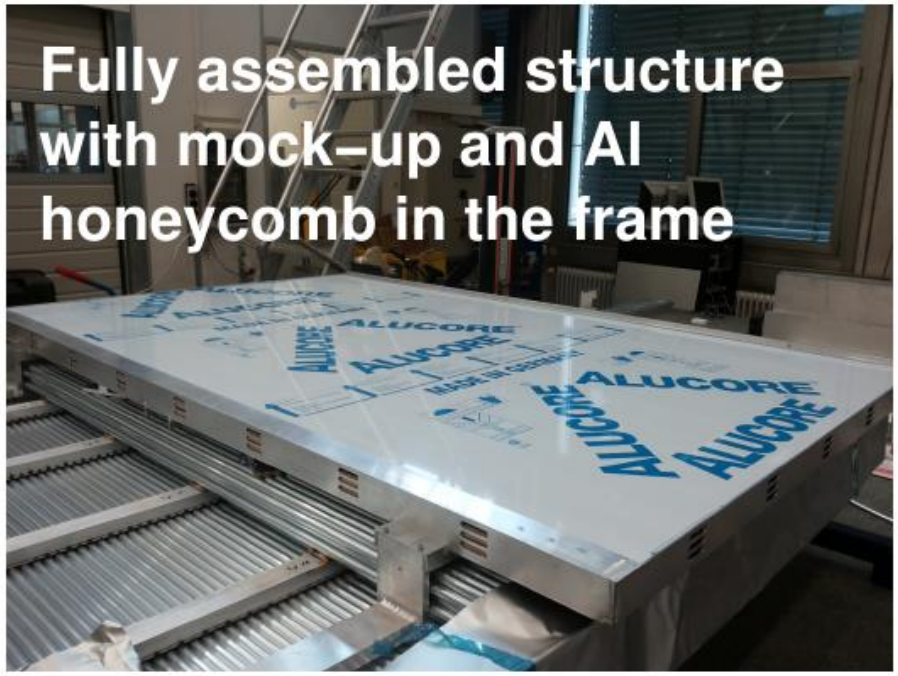


- The deformation of the frame under the load of the triplet was measured by comparing the height of the frame above the granite table with and without the load.
- Observed deformation <250 µm!

→ Frame can be considered rigid!

Test of the entire mechanical structure including supports





Test of the entire mechanical structure including supports

A rotation frame was used to check if the RPC structure remains detached from the sMDT chamber in all installation angles.

⇒ No clashes between the sMDT chamber and the RPC support structure observed!

Task 13.4.6
Preparation for large series production: production protocols of optimised RPC components for easy technology dissemination

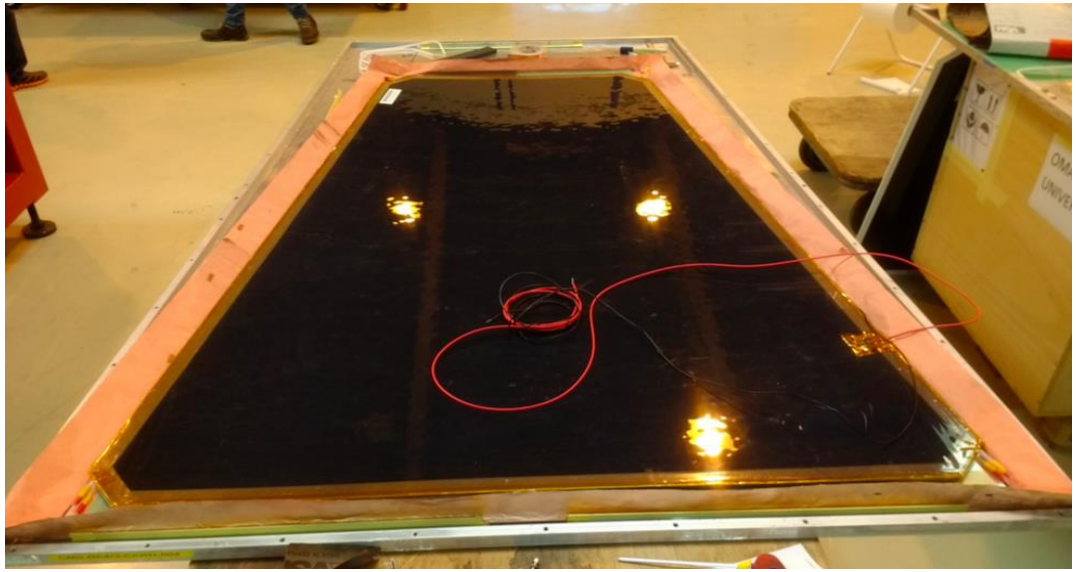
G. Pugliese on behalf of WP 13.4.6 partners

QC and QA on gap production

HPL Electrodes: HPL panels were produced in Italy
Quality Criteria applied:
•Thickness between 1 and 2 mm
•**Resistivity:** to be in the range 0.9-2.0 10^{10} ohm*cm. StDev.ρ/Av.ρ ≤ 0.5

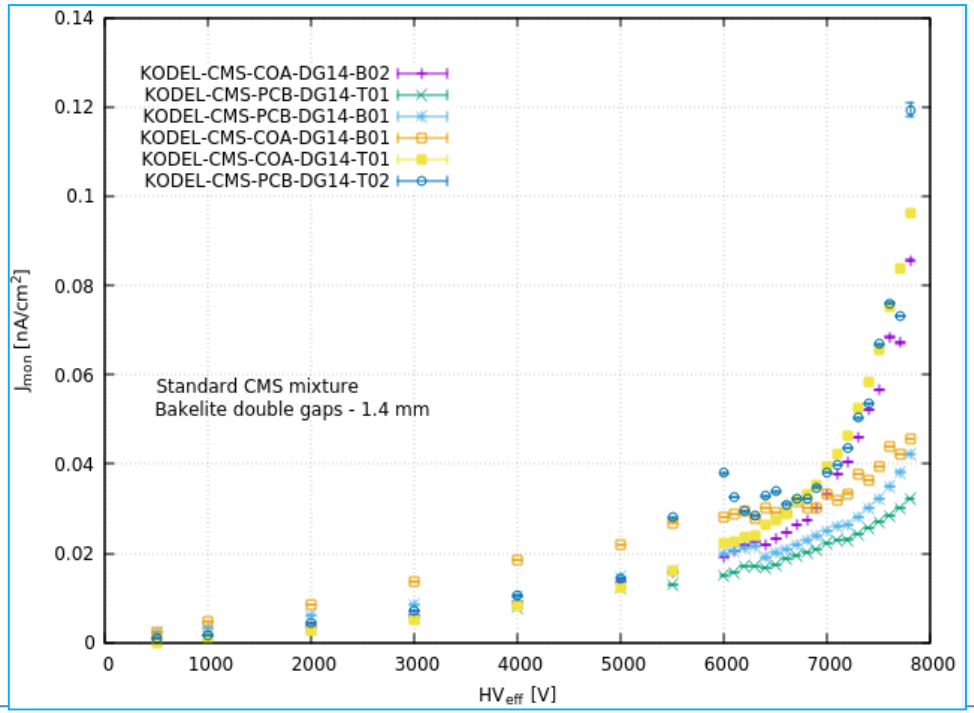
GAP production and tests:
Large size RPC gaps (1 m^2) were built in Korea. The construction of the gaps was performed following a well defined procedure (as described in the report).

QC and QA on gap production



Quality Control and Quality Acceptance criteria were applied during the production to ensure gas tightness and excellent quality of the electrodes.

HV scan test: example of the current as function of HV as measured in some gaps.



The accepted gaps were sent to production site to assemble the chambers

QC&QA on chamber production

The chambers were build at CERN laboratory

Quality control and quality acceptance applied during the construction: gas tightness and current and noise scans.

Final chambers are tested with cosmic muons to validate the performance (efficiency, cluster size, spatial resolution).