Status of the ATLAS MM project

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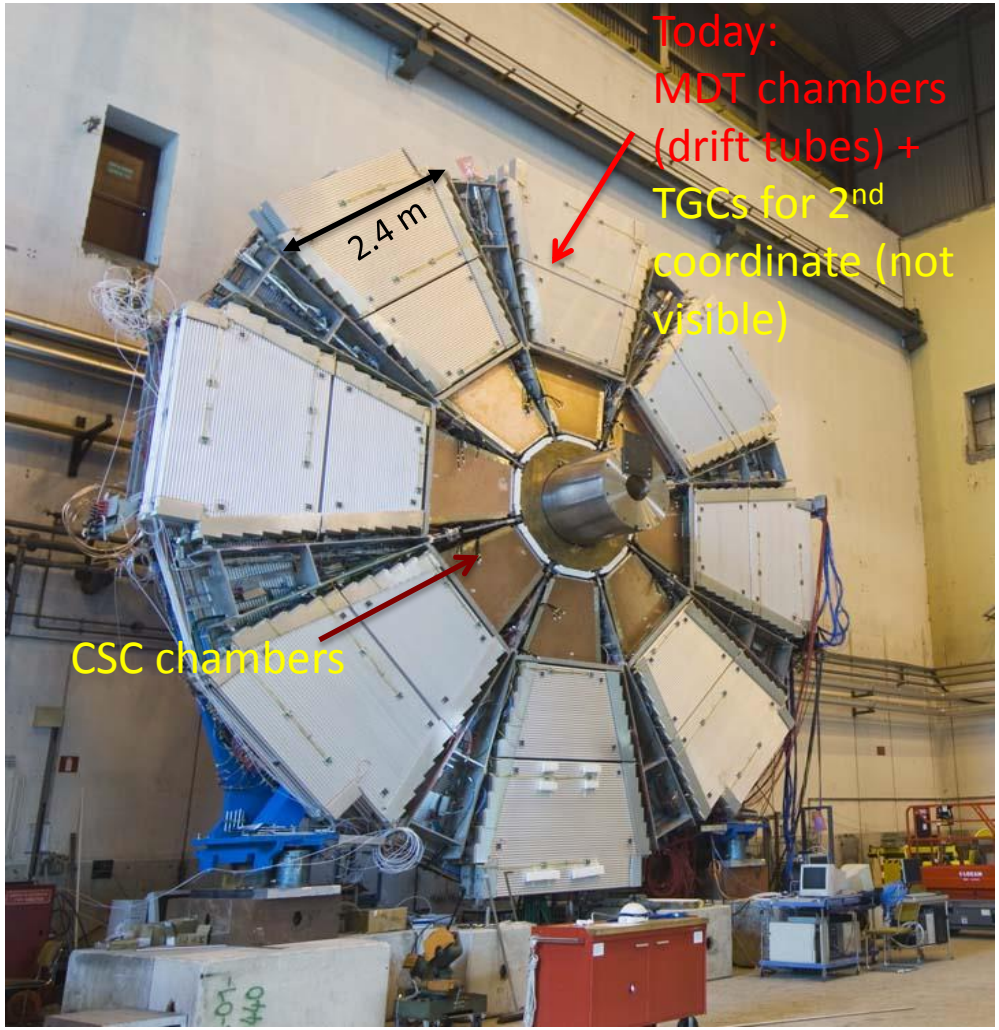
on behalf of the

MAMMA Collaboration

ATLAS Small Wheel upgrade project



Build two new Small Wheels and equip them with sTGCs and micromegas detectors, to be installed in 2018

- Redundant system where each technology combines precision and 2nd coord. measurement as well as trigger functionality in a single device
- Eight active layers per detector technology, i.e., a total of 16 measurement points along tracks
- MM strip pitch is ≈0.45 mm
  - ⇒ 2M readout channels
  - ⇒ 1200 m^2 of MM detectors

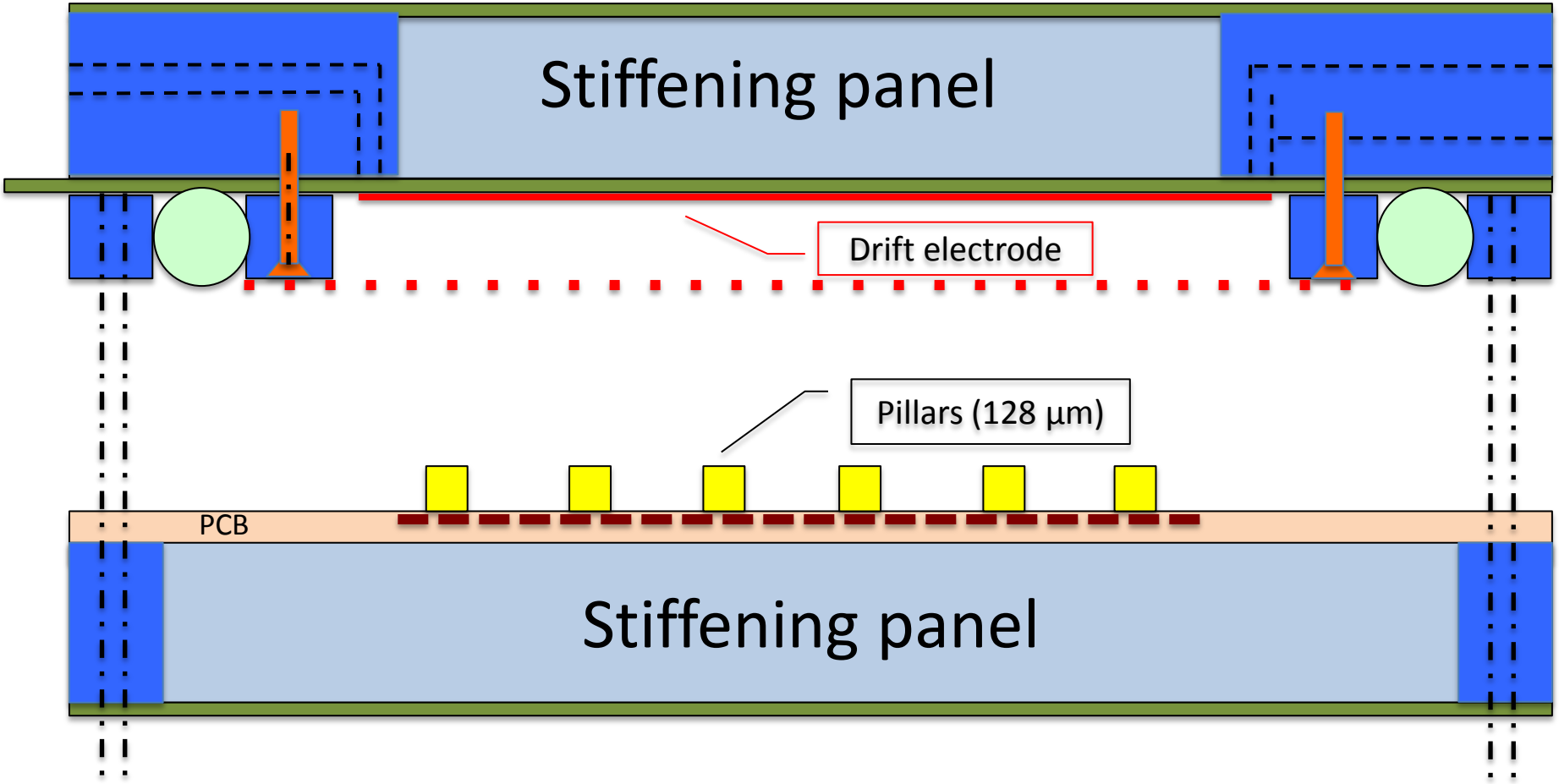
Status of the New Small Wheel project

- Early May 2012 the ATLAS Muon Collaboration decided to equip the New Small Wheels with two detector technologies, each covering the full detector area: thin-gap MWPCs (sTGC) and micromegas (MM)
  - The decision was subject to a number of milestones that had to be fulfilled by end of 2012
- Initial Design Review took place 29/30 August 2012
- ATLAS Collaboration Board (CB) approval in Oct 2012
- Milestone review: 17/18 Jan. 2013 – all milestones fulfilled
- Technical Design Report (TDR) due end of May 2012, to be submitted to the June LHCC
- NSW MoU in Fall 2013 (will settle who does what)

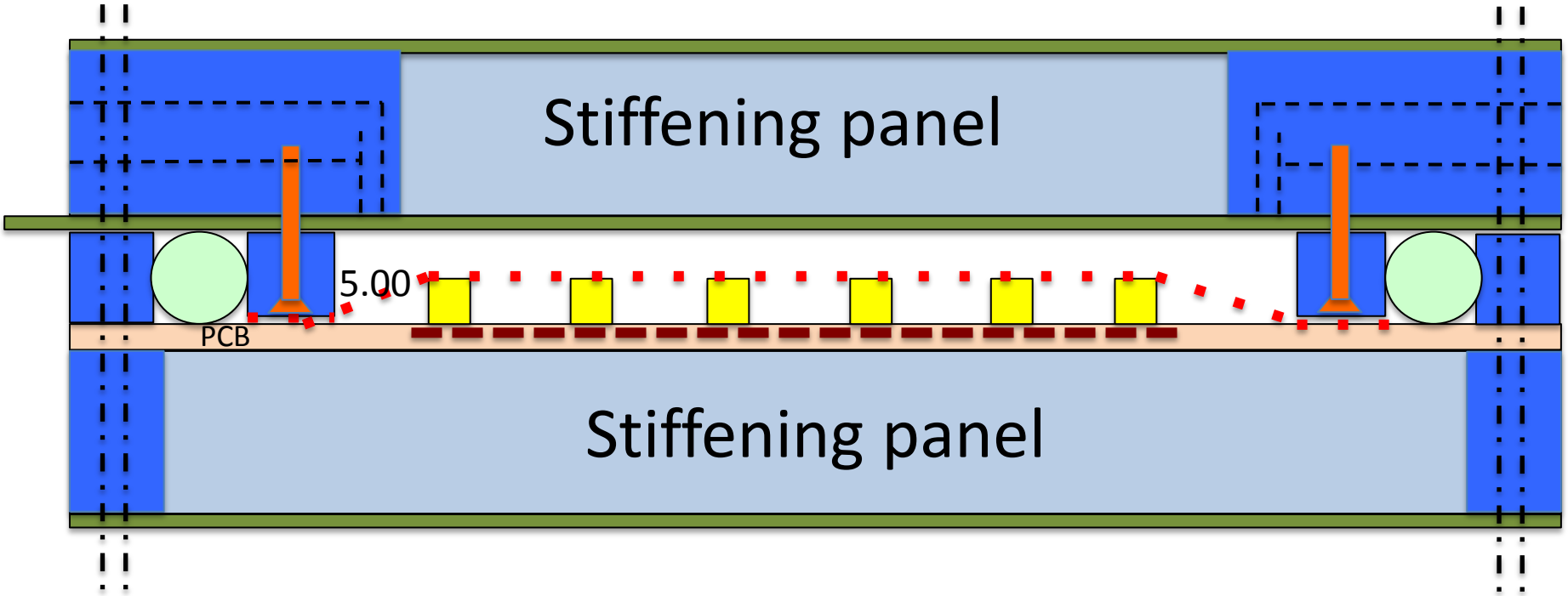
Where do we stand today?

- Detector structure is defined: MM r/o board and mesh separate
- MM board design is more or less settled
  - Readout board structure as for the 2 x 1 m^2 prototype chambers (see talk by M. Bianco in WG2, yesterday)
  - Some details to be settled, e.g. resistive strip deposition technology (screen printing or sputtering?, see talk by A. Ochi, WG6, tomorrow)
- Detector layout largely settled, module size still under discussion
  - Full sector or three modules/sector? to be decided in July
- Mechanical prototype construction underway in five consortia
  - CERN + Lecce + Saclay
  - CEA Saclay
  - INFN (Frascati, Pavia, Rome, et al.)
  - Boston (Harvard, BU, Brandeis)
  - LMU Munich

2 x 1 m² sketch (not to scale)

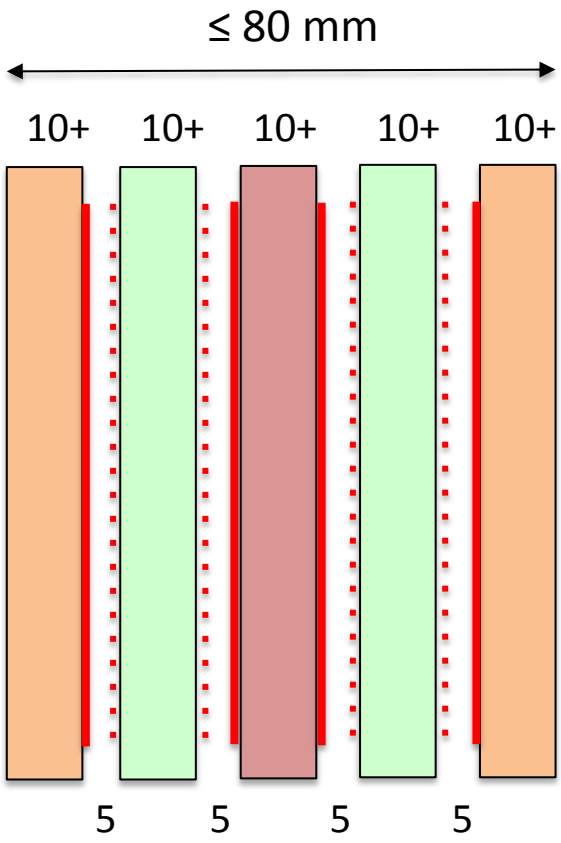


2 x 1 m² sketch (closed)



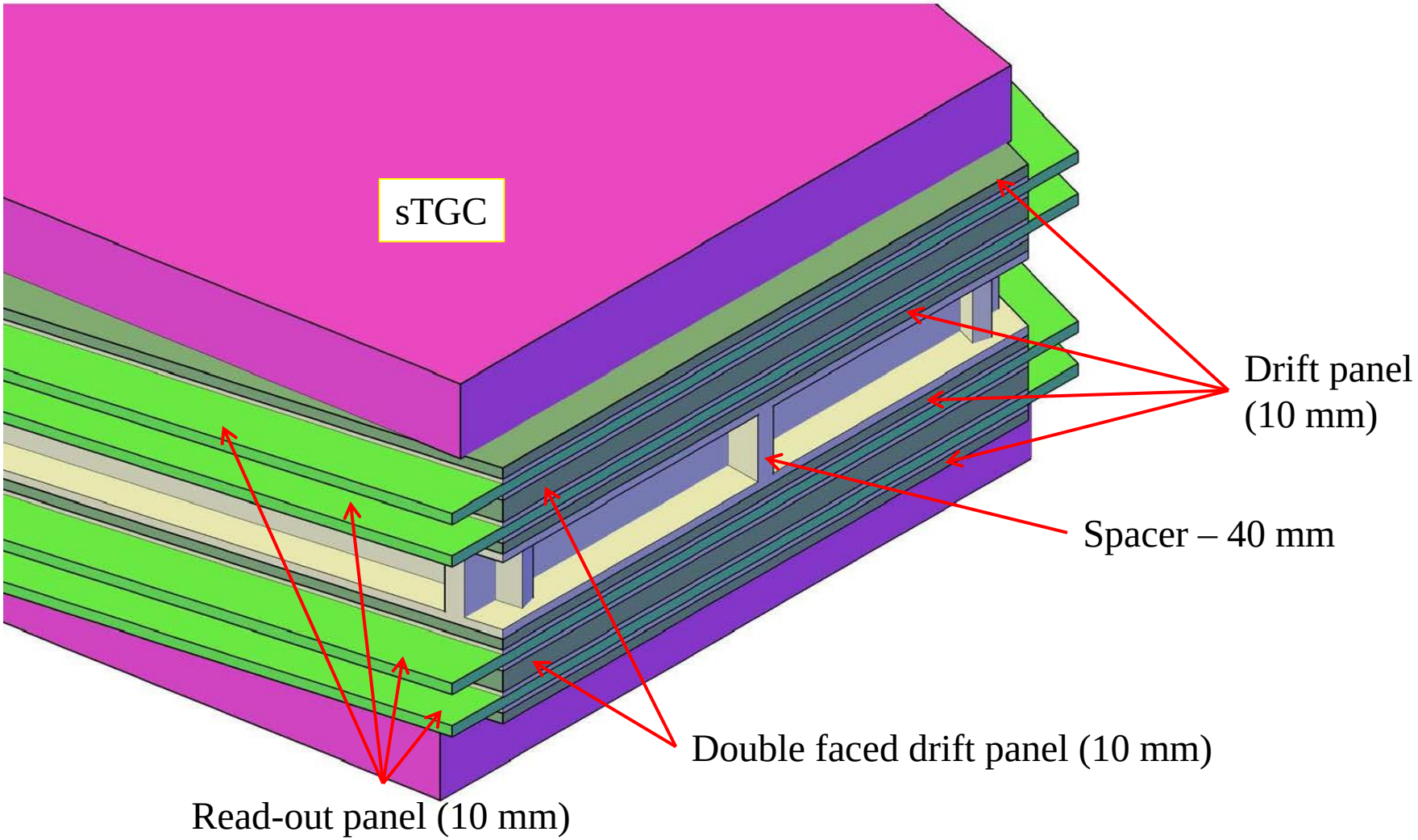
Detector layout

- Eight active layers, arranged in two quadruplets, separated by a spacer structure
- A quadruplet consists of two doublets, one with eta-strips (‘parallel’ to the drift tube wires) and one with 3° stereo strips)
- The MMs in each doublet are arranged back-to-back



MM quadruplet

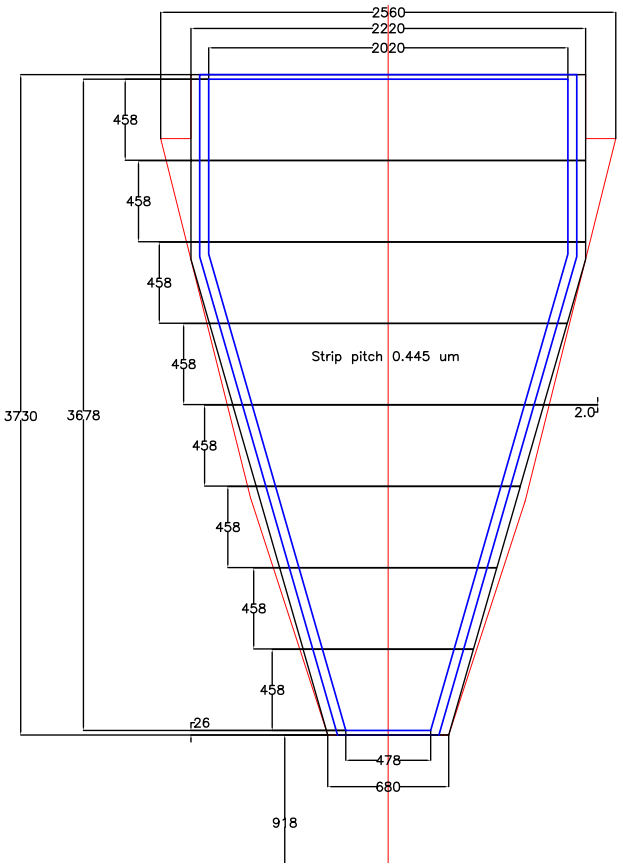
Large sector

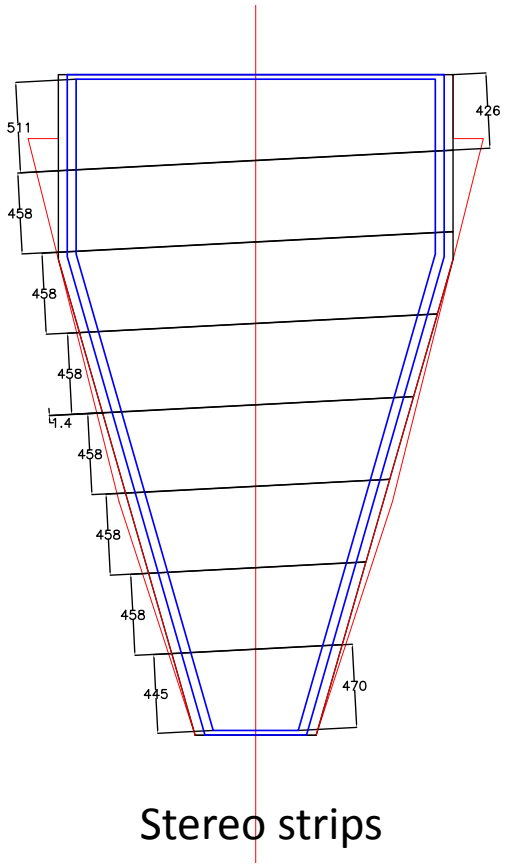


PCB MM readout boards I

- Limit width of PCBs to ≤600 mm (PCB industry equipment)
- Length is less of a problem
- 8 PCBs per sector
- 32 different shapes and layouts (=>24 PCBs 2220 mm long)
- 64 pieces/type
- Total of 1536 PCBs to be produced (+spares)

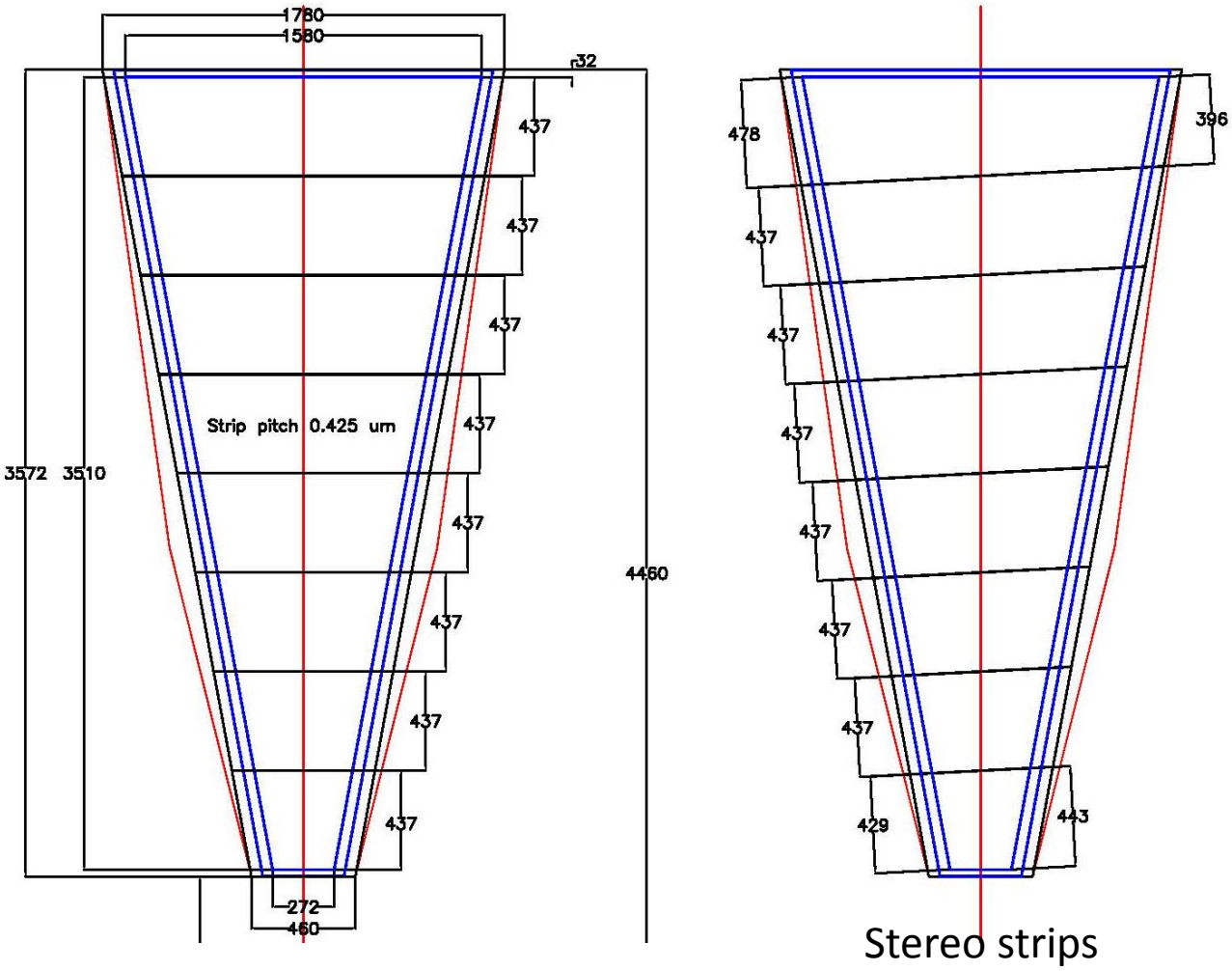
Large sector





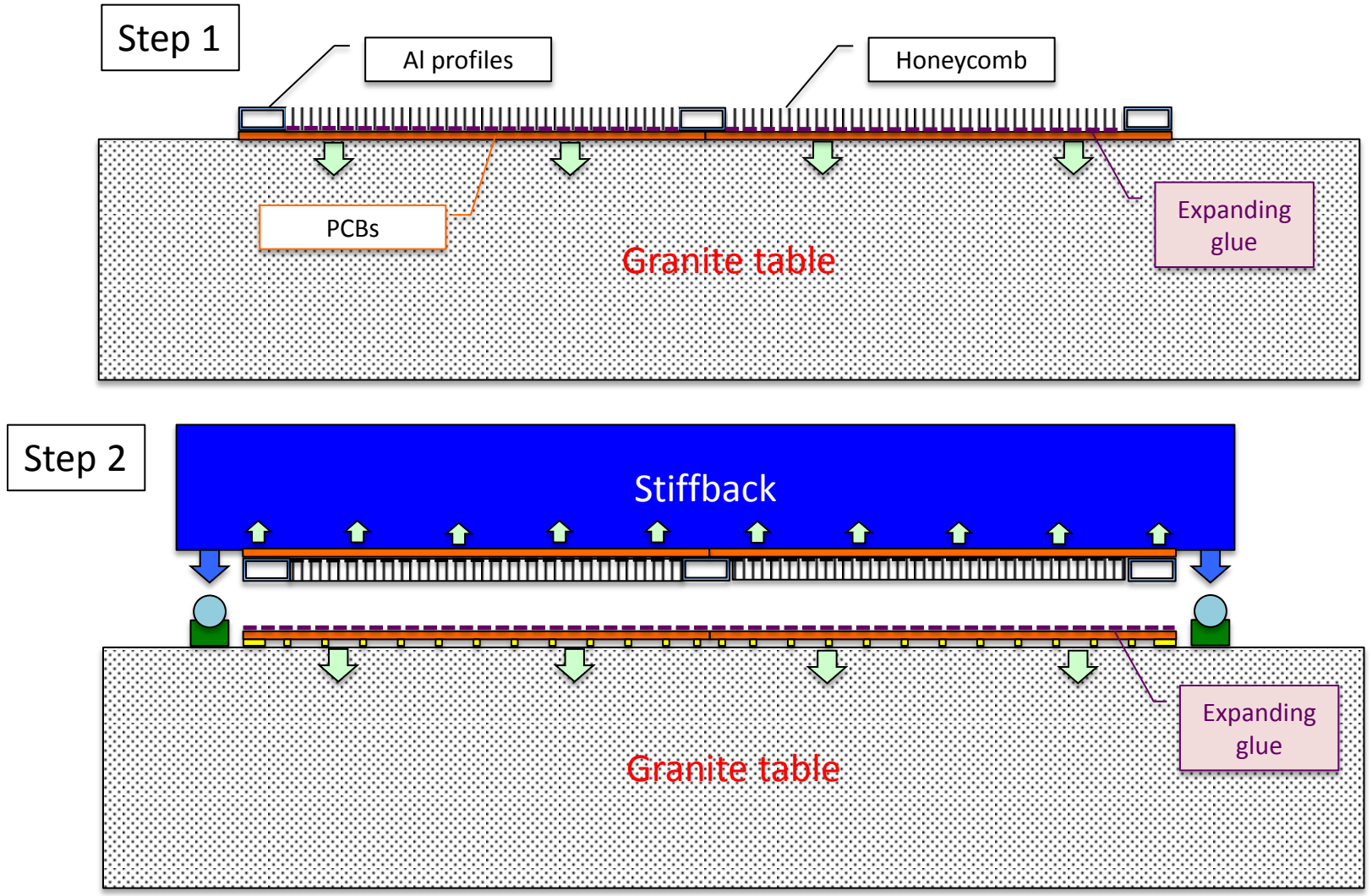
Stereo strips

PCB sizes (small sectors)

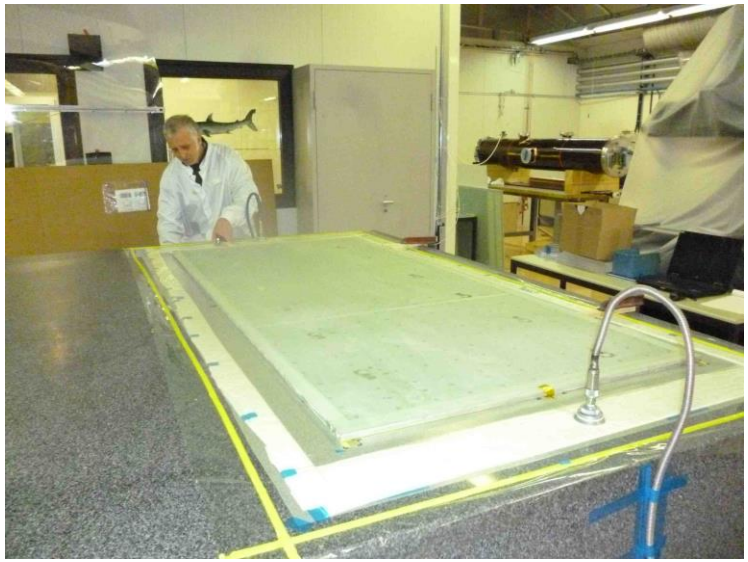


Stereo strips

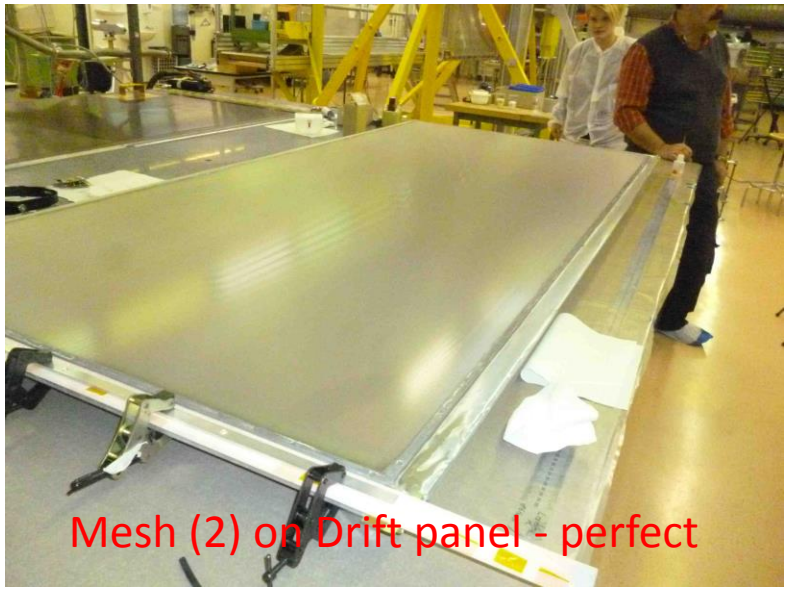
Assembly procedure



The glueing of the drift electrodes



The chamber assembly



The first 1x 2 m^2 MM chamber

- Dimension: 1 x 2.4 m^2 (0.92 x 2.12 m^2 active area)
- 2 x 2048 strips (0.45 mm pitch), separated in the middle
- Four PCBs (0.5 x 1.2 m^2, thickness 0.5 mm) glued to a 10 mm thick stiffening panel
- Floating mesh, integrated into drift-electrode panel (15 mm thick)

Construction plans for 2013+

- Jan – Apr: Construct second 2 x 1 m^2 chamber
- Jan – July:
  - Mechanical wedge prototypes with the goal to settle on a construction baseline in July (three modules/sector or full plane/sector)
  - Finalize PCB layout (2^{nd} coordinate, production method, …) & start transfer of know-how to industry
  - Define readout & services
- Jan – May: TDR
- Aug – Dec: Construction of functional prototype wedge (Mod-1) following the baseline design, including all features
- 2014: Construction of Module-0

Issues to be addressed during 2013

- Stiffening panel production, either in institutes or in industry; choice of materials, production method, etc …
- Plane-plane alignment and external alignment instrumentation
- Development of quality control methods and tools, e.g. acceptance tests for PCBs, doublets, quadruplets, …
- On-chamber electronics integration (readout & trigger)
  - Connectivity solutions (Zebra connectors)
- LV/HV
- Gas system
- …

Time line for MM production

- By mid 2013 settle on a baseline detector design
- Full-size prototype wedge in fall 2013, involving industry
- Module_0 in 2014, i.e. a full MM sector (2 wedges) to be coupled with a full sTGC sector
- In 2014 setup of production and assembly sites and procedures
- Production in 2015/16
- Installation on NSW as of 2016 possible
- Installation in ATLAS during LHC shutdown 2018