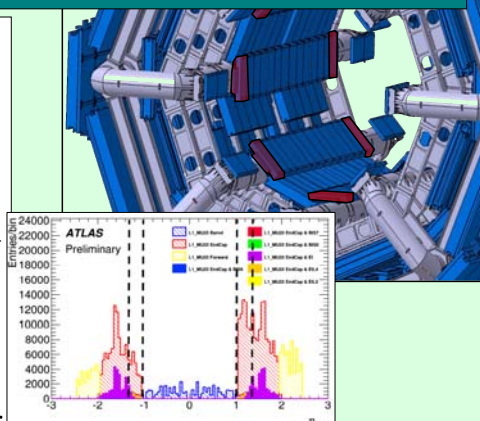


New ATLAS Muon Chambers for LHC Run-3

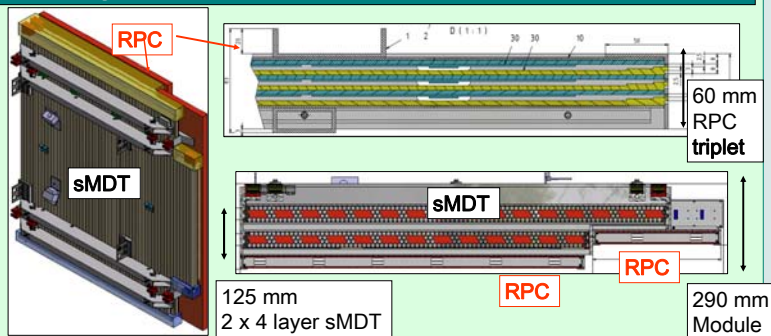
Installation of **32 new Resistive Plate (RPC) muon trigger chambers** in combination with **16 new sMDT precision muon tracking detectors ("BIS 7 & 8")** on the toroid magnet coils at the ends of the barrel inner layer (red) in the Long Shutdown 2 of the LHC in 2019-2020.

Goal: Improvement of the trigger selectivity and fake trigger suppression in the region $1.0 < |\eta| < 1.3$ combined with the endcap trigger chambers for Phase-I and Phase-II.

Pilot project for the Phase-II upgrade of the barrel inner layer.

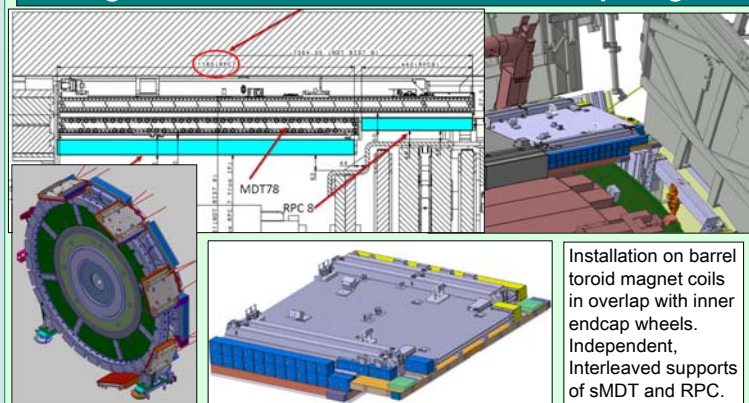


Integrated sMDT and Thin-Gap RPC Chambers



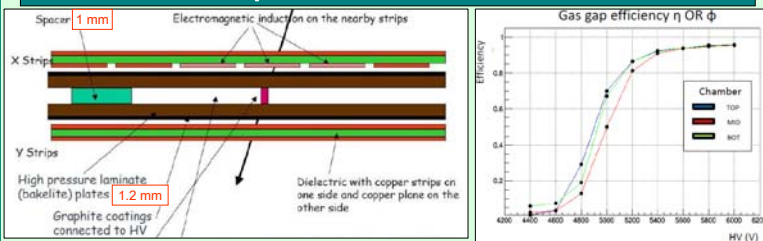
New RPC chambers require replacement of existing MDT chambers by sMDT chambers to provide sufficient radial space. Nevertheless tight spatial constraints on new detectors. Optical sensors for global alignment system on top and bottom of sMDT drift tube layers.

Integration into the Muon Barrel-Endcap Region



Installation on barrel toroid magnet coils in overlap with inner endcap wheels. Independent, interleaved supports of sMDT and RPC.

Thin-Gap Resistive Plate Chambers



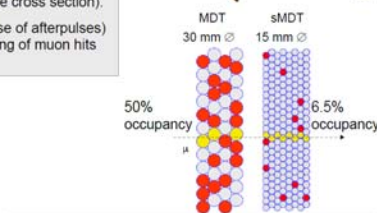
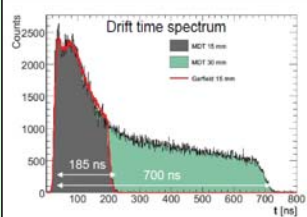
Twice thinner gas gaps (1 mm) and thinner HPL electrodes + new highly sensitive amplifiers

- improve the time resolution from 1 ns to 0.4 ns,
 - allow for operation at substantially lower voltage, 5.8 kV instead of 9.6 kV, and ~15 x lower gas gain and avalanche charge.
- ⇒ rate capability up to 10 kHz/cm² and lifetime well beyond 10 years at HL-LHC

Small-Diameter Drift Tube (sMDT) Chambers

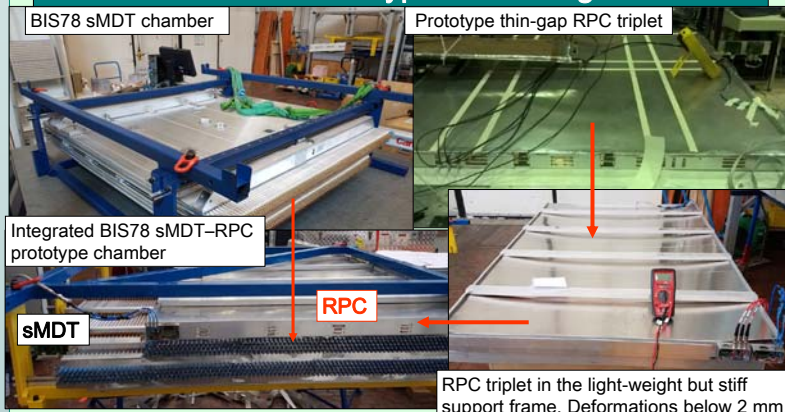
By reducing the drift tube diameter from 30 mm (MDT) to 15 mm (sMDT) at otherwise the unchanged operating conditions and while keeping all advantages of the MDTs as well as their services:

- 8 x lower background occupancy (4 x shorter maximum drift time, 2 x smaller tube cross section).
- Electronics deadtime (≈ max. drift time because of afterpulses) can be reduced by a factor of 4, thus the masking of muon hits by preceding background hits.

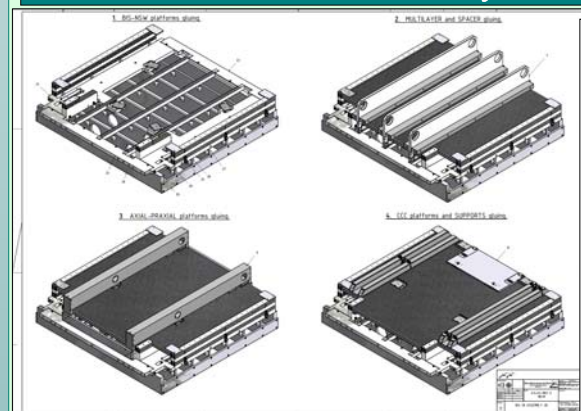


- Also, space for twice as many tube layers within the same available detector volume, allowing for additional increase in muon tracking efficiency and resolution.

sMDT-RPC Prototypes and Integration



sMDT Chamber Assembly Procedure



High-precision assembly jig:

- 1 Glueing of bottom alignment sensors
- 2 Assembly of 8 drift tube layers, only two working days
- 3 Glueing of top alignment sensors
- 4 Mounting and calibration of optical chamber planarity monitoring system.

⇒ Wire positioning accuracy 10 μm rms

sMDT Chamber Construction 2018

