

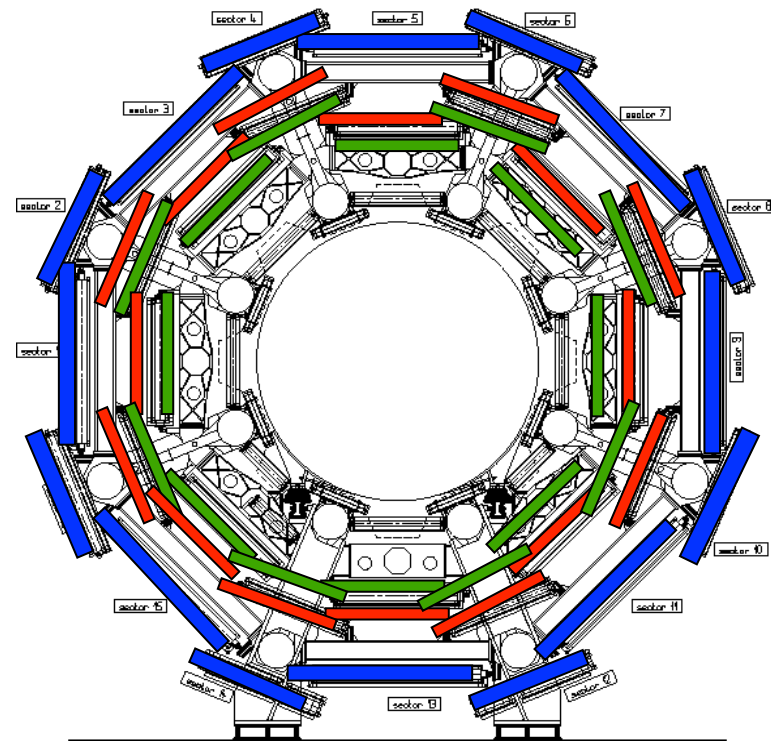
RPC upgrade in the elevator regions of the barrel muon spectrometer

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on behalf of the RPC groups of Bologna and Rome2

*Based on presentations
by J.Dubbert (MPI)
at Muon Institute Board and
Muon Upgrade meetings*

Discussion triggered by TC
and supported by Muon PL



RPC LVL1 trigger description

Two trigger logics are implemented:

Low- p_T trigger

RPC2 & RPC1

Hits in 3 of the 4 inner layers

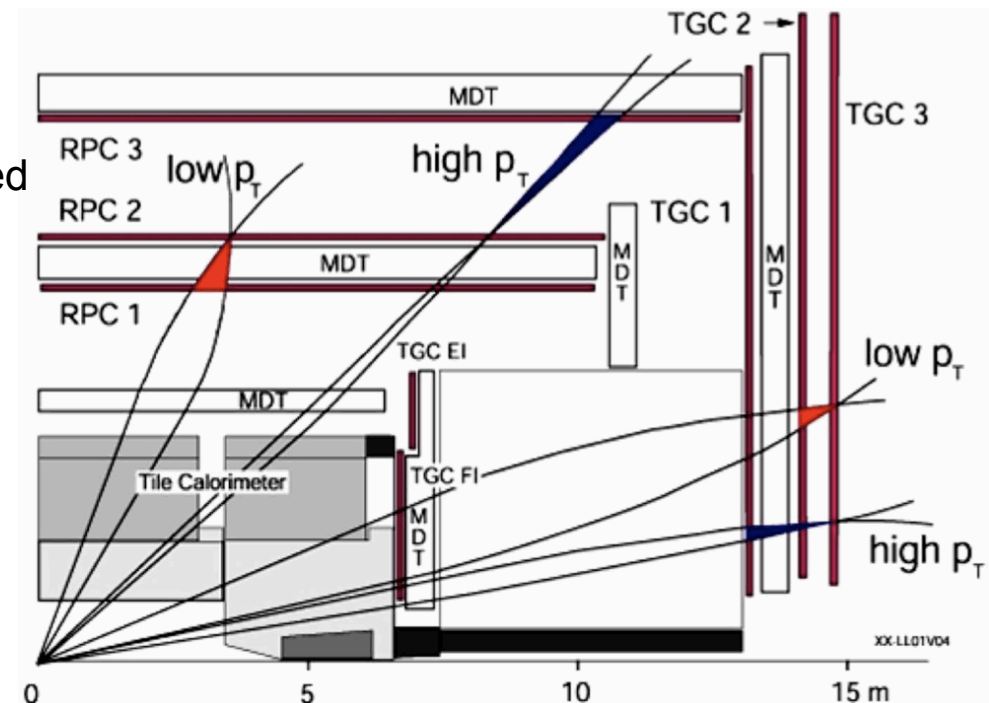
Hit in station RPC2 (BM pivot) extrapolated to station RPC1 (BM confirm) along a straight line through interaction point

Look for hit in station RPC1 within a coincidence window

High- p_T trigger

Low- p_T & RPC2 & RPC3

Logical AND of Low P_T and at least 1 of the 2 planes in station RPC3 (BO confirm) within a coincidence window



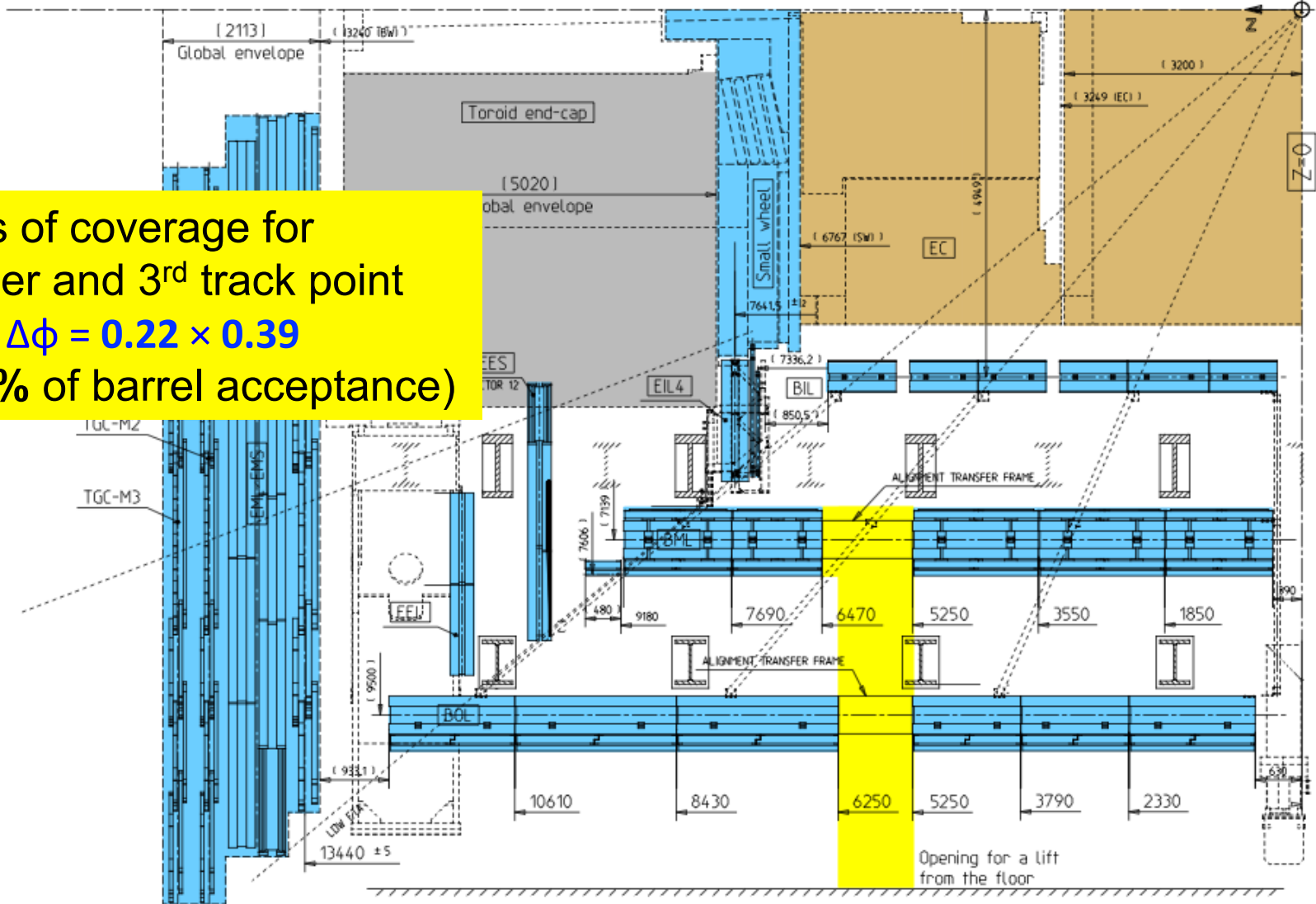
Moreover, RPCs provide the azimuthal coordinate (non-bending plane) for track reconstruction

Sector 13: current layout

(Side "A")

Detector axis
Y
Z
IP
Z=0

Loss of coverage for trigger and 3rd track point
 $\Delta\eta \times \Delta\phi = 0.22 \times 0.39$
 (1.4% of barrel acceptance)



■ Muon Chambers ■ Elevator Shaft

More on motivations

In addition to the improved detector acceptance,
it will allow **detector R&D for further upgrades**

MDT:

new 15mm diameter tubes (w.r.t. 30mm used so far)

RPC:

optimized detector (double 1mm-gap instead of single 2mm-gap?),
new readout electronics allowing integration of RPC signals
in MDT readout

Upgrade proposal

Staged trigger capabilities

Stage 1 guarantees full tracking (precision and 2nd coordinate)
Stage 1 funding of MDT chambers and RPCs already available

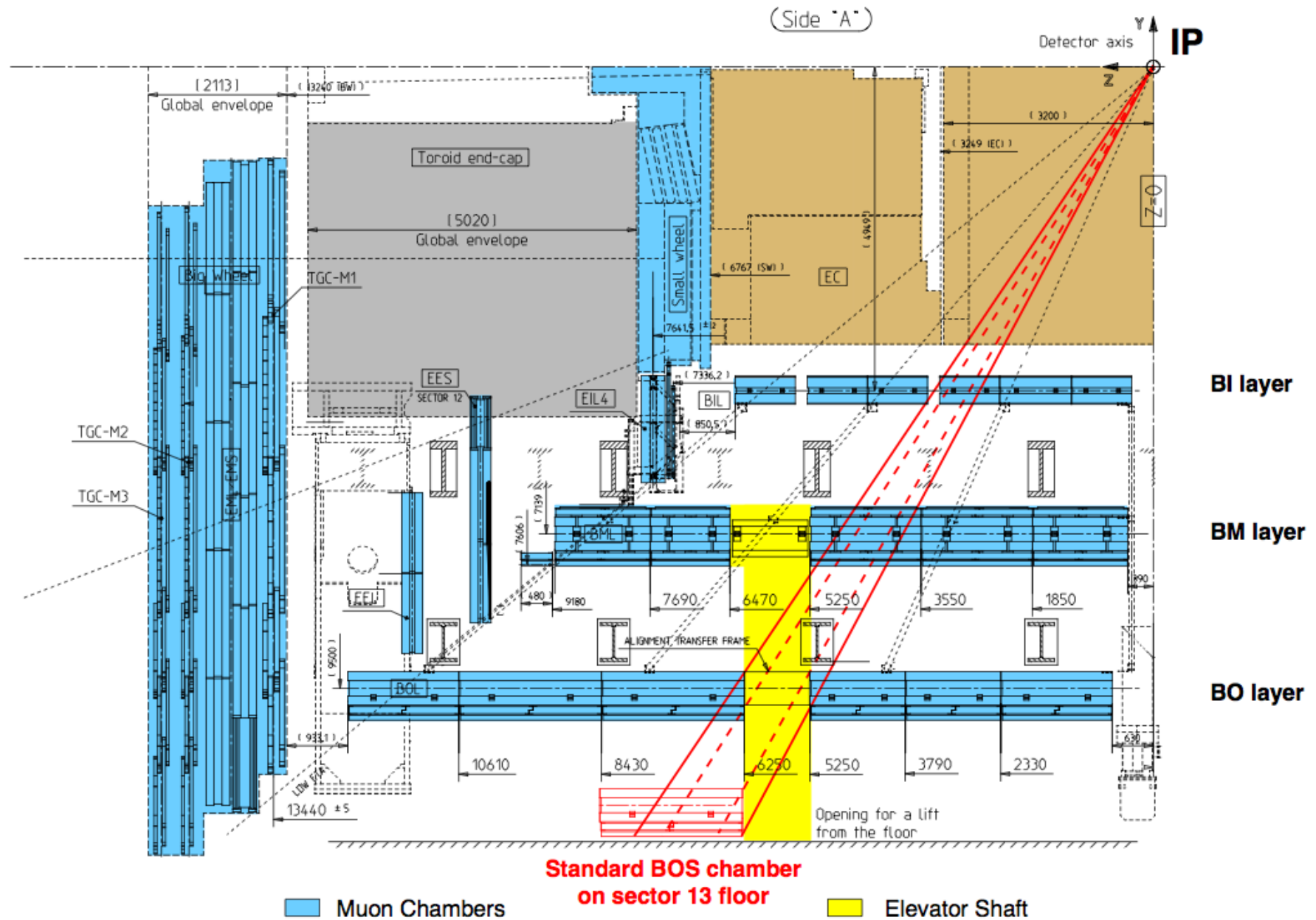
Project in tight collaboration with Max-Planck-Institute (Munich)

Mechanics and MDT covered by MPI

RPC stage 1 covered with Rome2 University funding

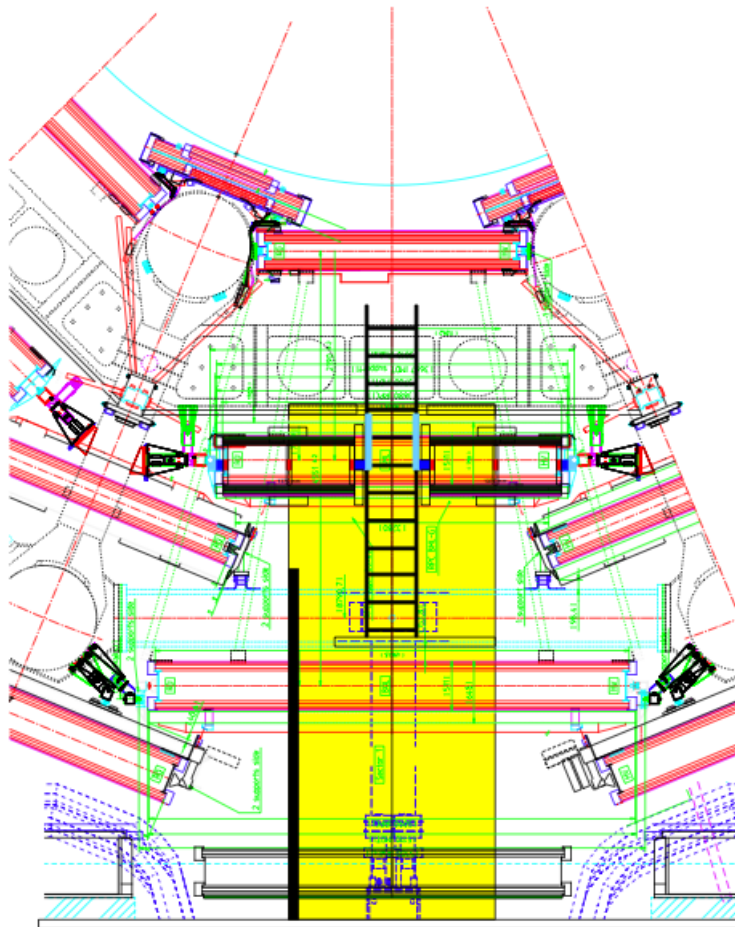
Stage 1 endorsed by the Muon Institute Board on Jan. 12th 2011

Sector 13: proposed layout

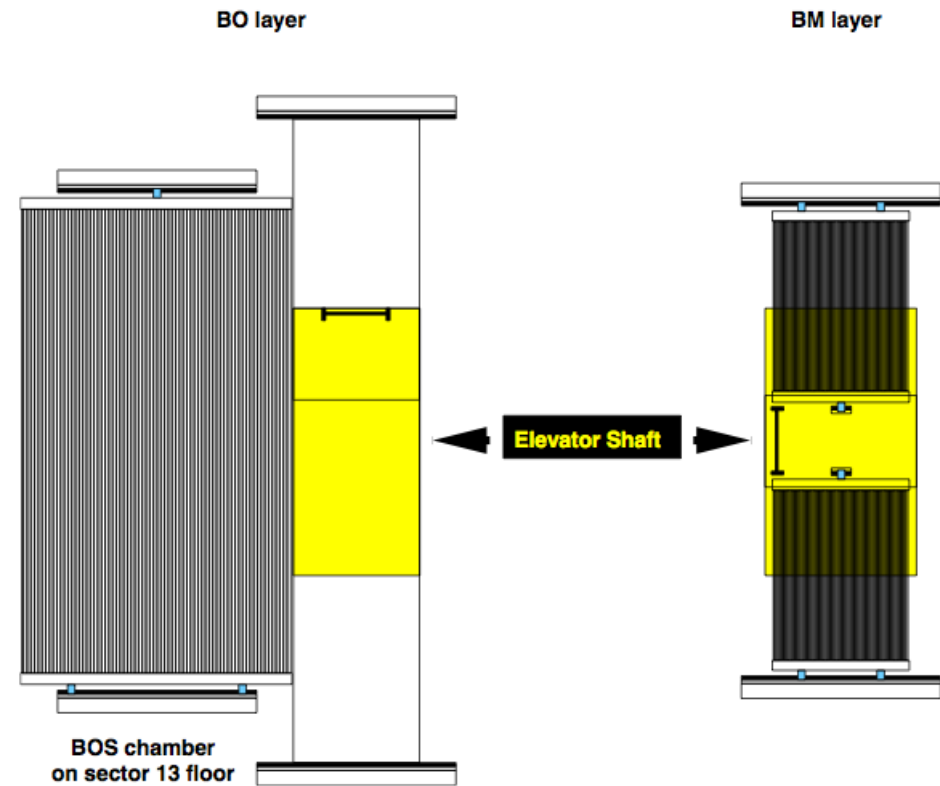


Sector 13: proposed layout

Cross Section



Top View



Upgrade: stage 1

BO Layer

- 1 standard BOS chamber
 - Mounted on floor in sector 13
- RPC on ML2 with 1 ϕ -gap (2nd coord.)
 - RPC read-out via MDT CSM

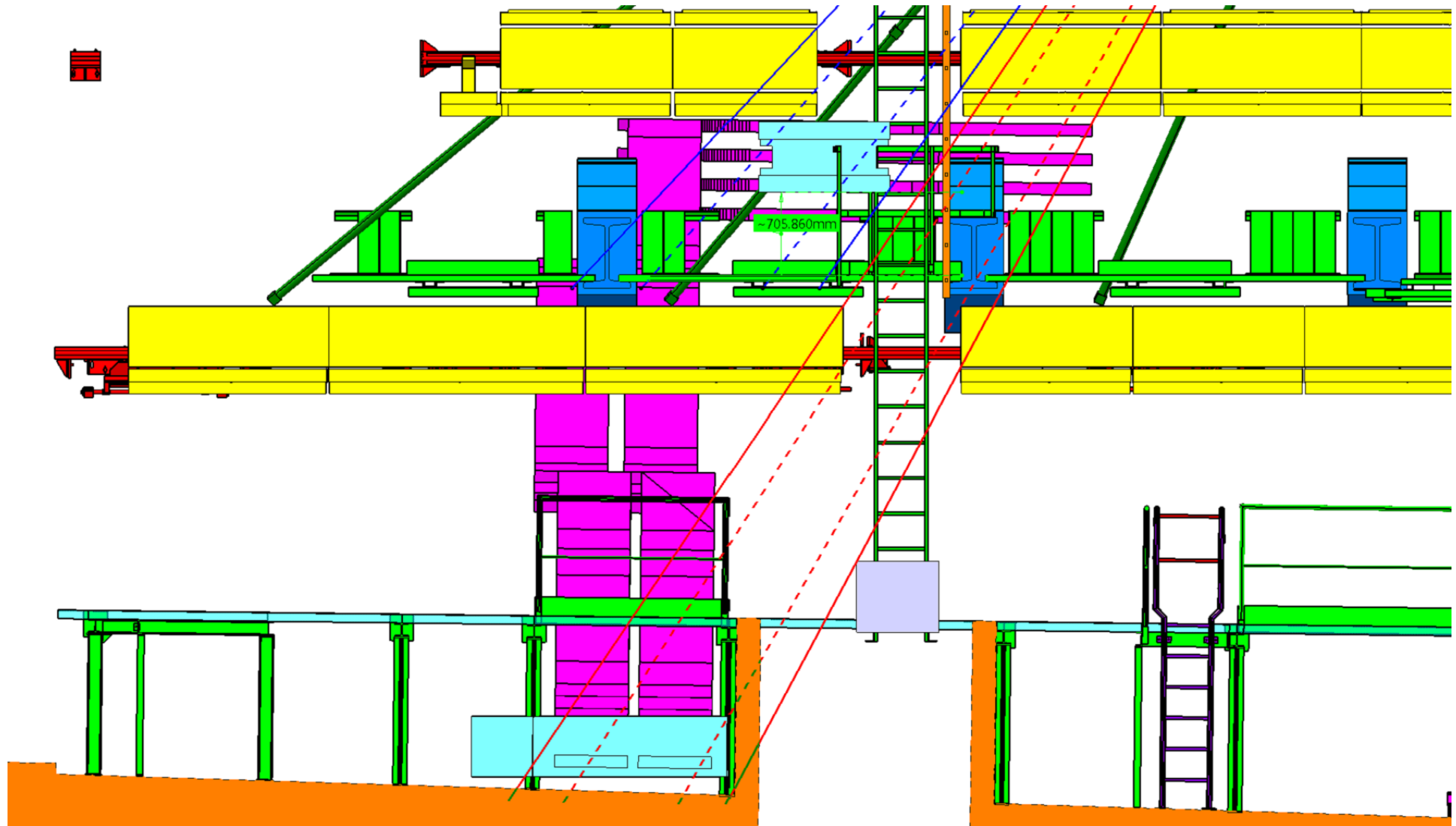
Coverage (in projective geometry):
 $\Delta\eta \times \Delta\phi = 0.09 \times 0.26$
(100% of η region, 65% of ϕ region)

BM Layer

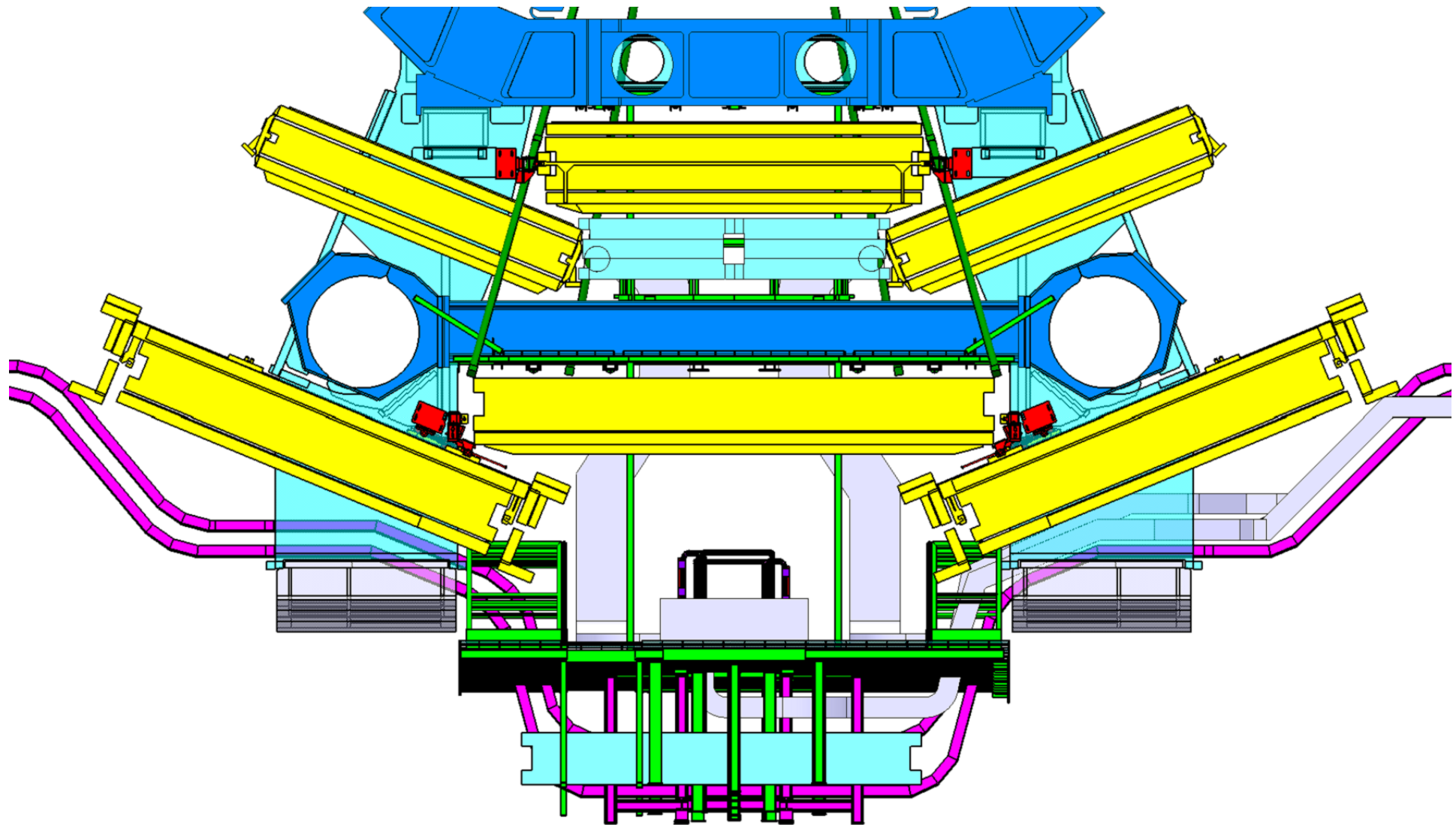
- 2 chambers (15mm diam. tubes) with 600mm gap
 - Mounted inside elevator shaft
- RPC on ML2 with 1 ϕ -doublet (2nd coord.)
 - RPC read-out via MDT CSM
- Access to BI level via ladder, dismount stations for elevator use

Coverage:
 $\Delta\eta \times \Delta\phi = 0.12 \times 0.31$
(90% of η region, 78% of ϕ region)

Sector 13: proposed layout from TC



Sector 13: proposed layout from TC



Staging scenario

A staging scenario matching with the available funding is foreseen:

Stage 1 Full 3-point tracking coverage:

2 standard BOS MDT chambers with 1 RPC ϕ -gap each,
4 BM MDT chambers with 15mm diam. drift tubes, each combined with 1 RPC ϕ -doublet,
RPC read-out via the MDT CSMs

Stage 2 Tracking consolidation and trigger preparation:

2nd RPC ϕ -doublet in the BM layer with read-out via MDT CSMs

Stage 3 Implementation of trigger option:

2 additional RPC η -doublets in the BM layer,
2nd RPC ϕ -gap and 1 additional RPC η -doublet in the BO layer,
implementation of standard RPC read-out and trigger electronics

Additional R&D Stage Extension for further upgrade tests (option for small wheel upgrade):

1 additional RPC η -gap with smaller strip pitch and with read-out via
MDT CSMs in the BM layer

Stage 1: impact on physics

Coverage in $\Delta\eta \times \Delta\phi$ per detector side
(percentage of barrel region)

Layer	Tracking
BO	0.09 x 0.26 (0.37%)
BM	0.12 x 0.31 (0.56%)
Total	0.93%

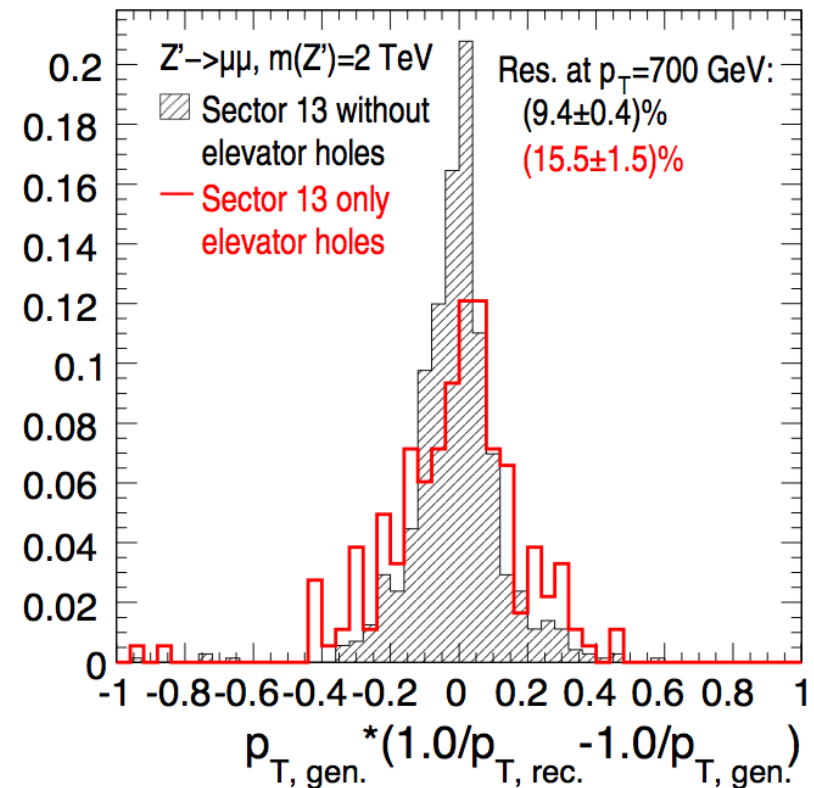
Study of $Z' \rightarrow \mu\mu$

ATLAS MC sample at $m(Z') = 2$ TeV

Comparison of results in

- **Elevator regions**
- **Sector 13 without elevator regions**

Momentum resolution



Improvement of momentum resolution by factor 1.5

Stage 3: impact on physics

Coverage in $\Delta\eta \times \Delta\phi$ per detector side (percentage of barrel region)

Layer	Tracking	Low- p_T Trigger	High- p_T Trigger
BO	0.09×0.26 (0.37%)	-	0.09×0.26 (0.37%)
BM	0.12×0.31 (0.56%)	0.12×0.31 (0.56%)	0.12×0.31 (0.56%)
Total	0.93%	0.56%	0.93%

Improvement of trigger coverage by 0.93% of barrel region