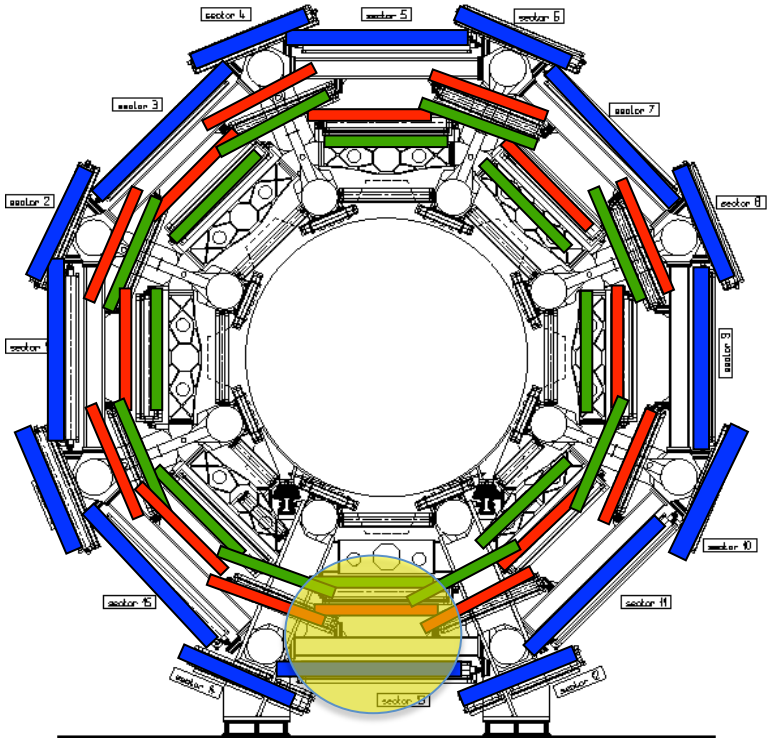
RPC upgrade in the elevator regions of the barrel muon spectrometer

D.Boscherini
on behalf of the RPC groups

Discussion triggered by TC and supported by Muon PL



ATLAS Italia - Milano, 17/05/2011

RPC LVL1 trigger description

Two trigger logics are implemented:

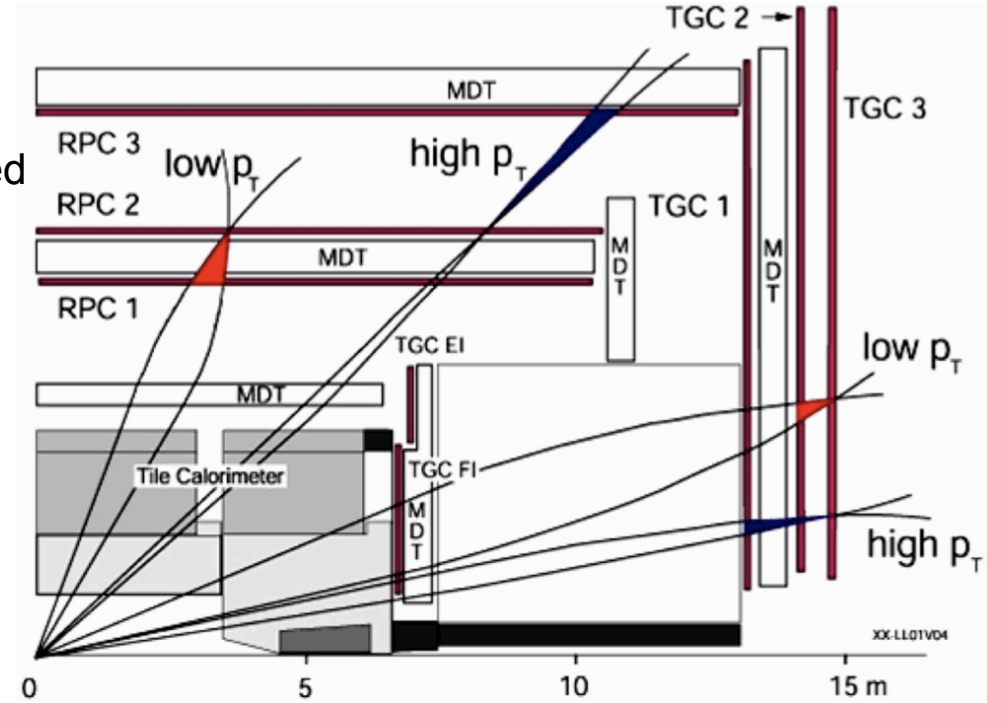
Low-p_T trigger

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

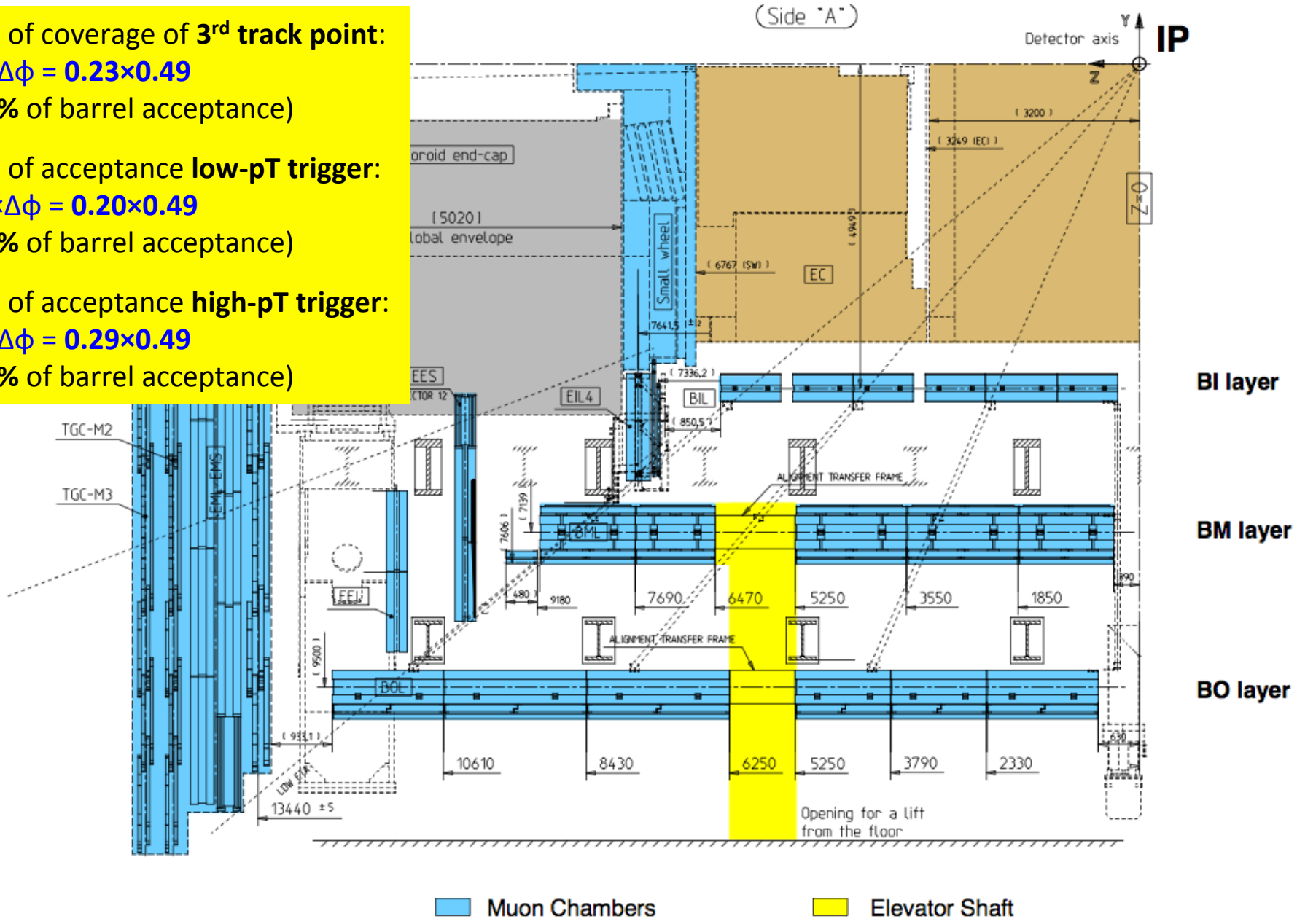
Moreover, RPCs provide the azimuthal coordinate (non-bending plane) for track reconstruction

Sector 13: current layout

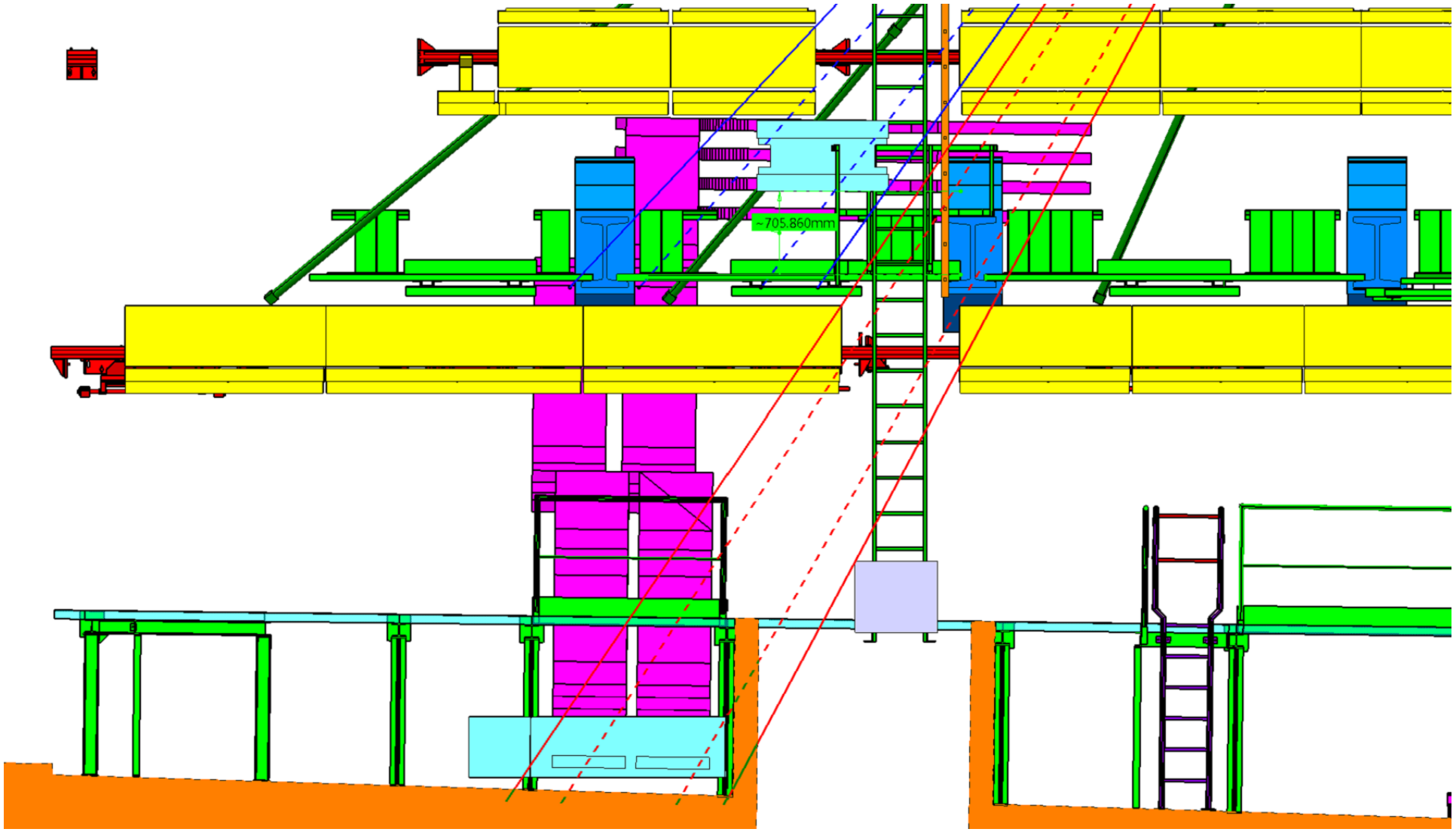
Loss of coverage of **3rd track point**:
$\Delta\eta\times\Delta\phi$ = **0.23×0.49**
(**1.6%** of barrel acceptance)

Loss of acceptance **low-pT trigger**:
$\Delta\eta\times\Delta\phi$ = **0.20×0.49**
(**1.4%** of barrel acceptance)

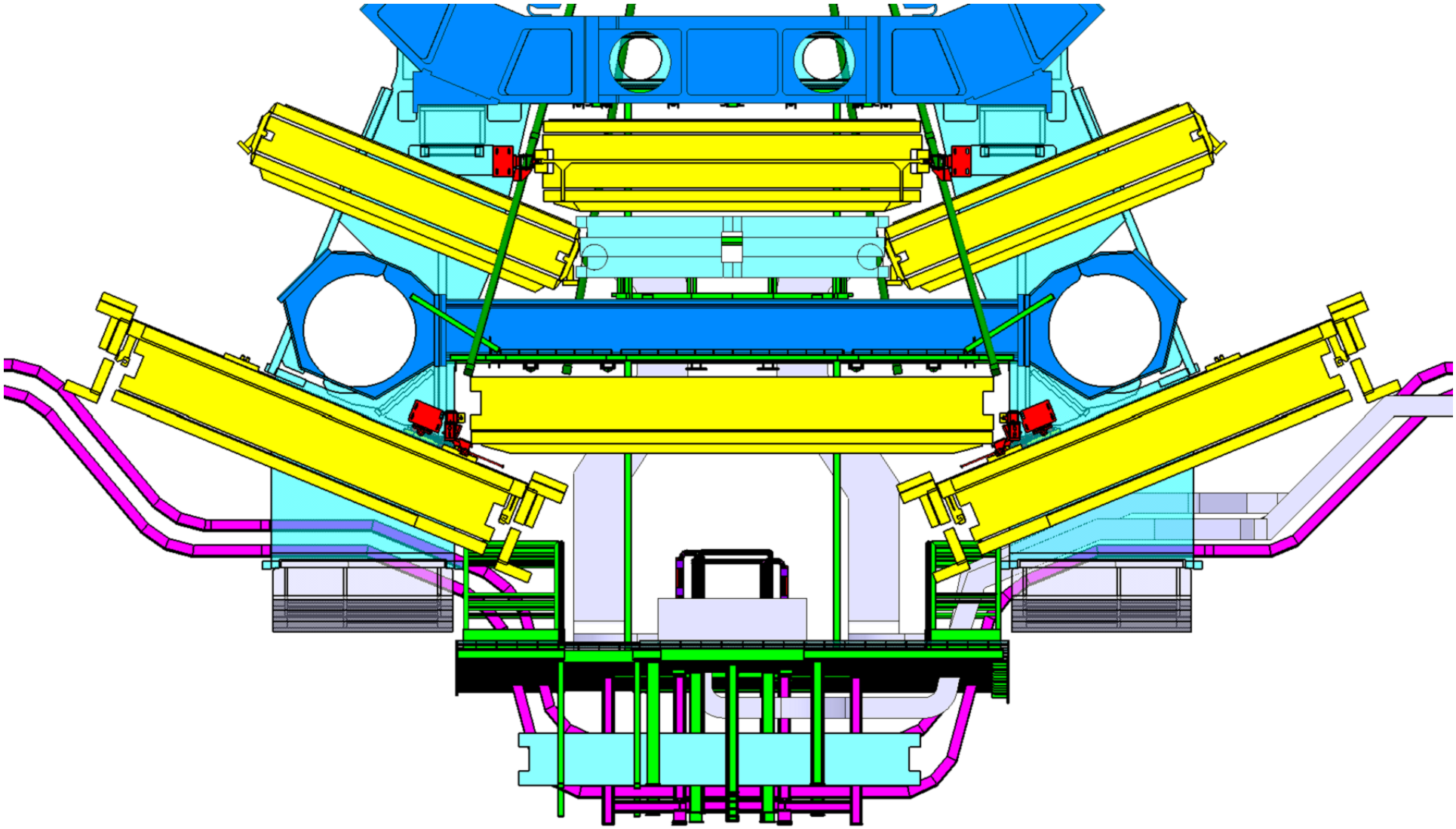
Loss of acceptance **high-pT trigger**:
$\Delta\eta\times\Delta\phi$ = **0.29×0.49**
(**2.1%** of barrel acceptance)



Sector 13: proposed layout



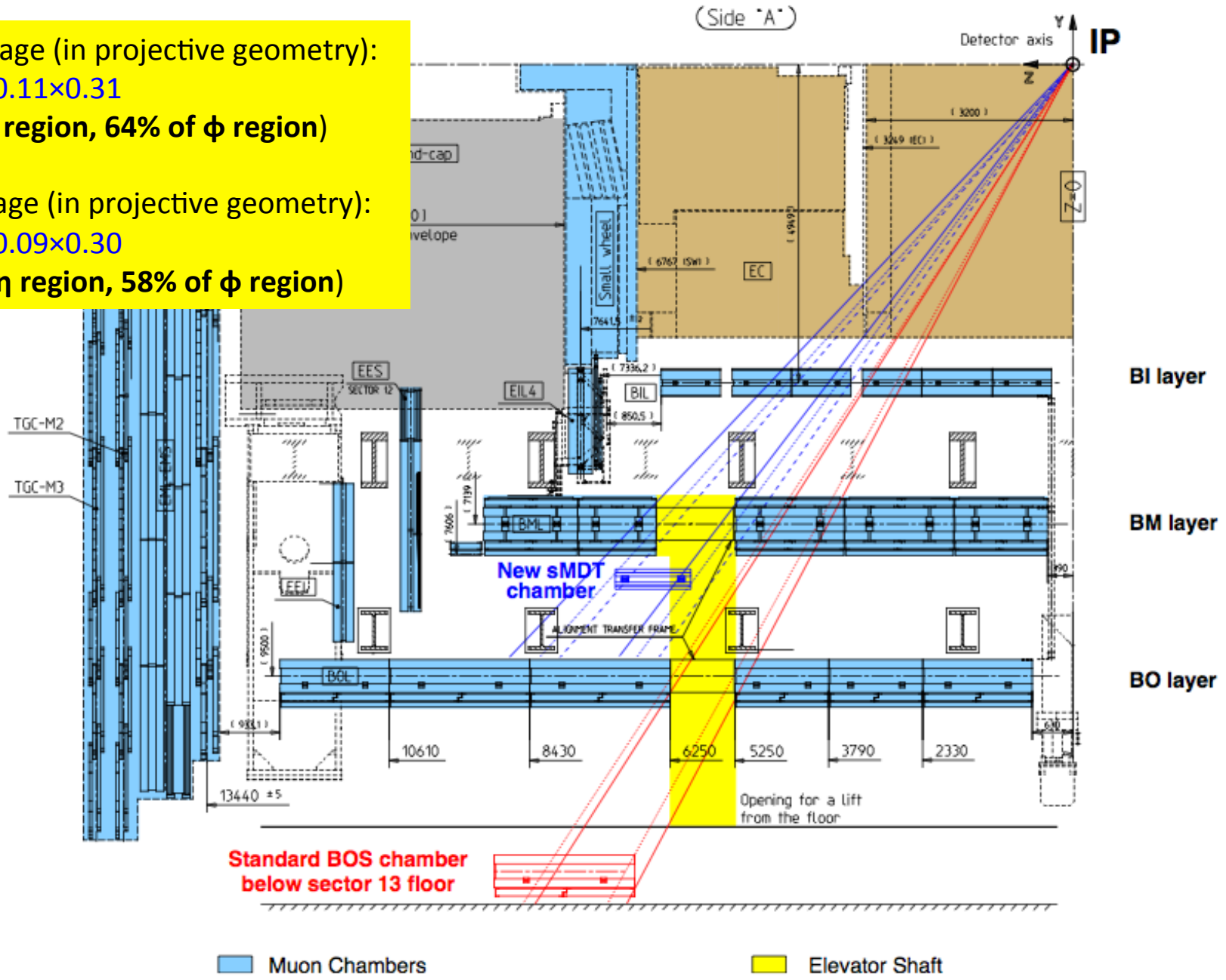
Sector 13: proposed layout



Sector 13: proposed layout

BM Coverage (in projective geometry):
$\Delta\eta \times \Delta\phi = 0.11 \times 0.31$
(**88% of η region, 64% of ϕ region**)

BO Coverage (in projective geometry):
$\Delta\eta \times \Delta\phi = 0.09 \times 0.30$
(**100% of η region, 58% of ϕ region**)



Tracking improvement: impact on physics

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

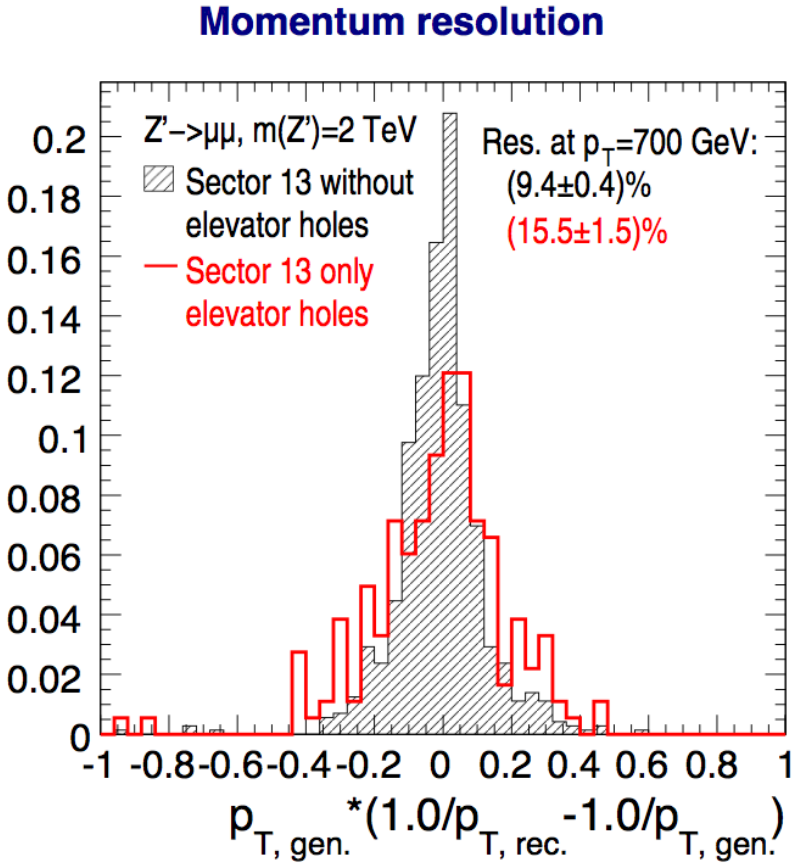
Layer	Tracking
BO	0.11 x 0.31 (0.51%)
BM	0.09 x 0.30 (0.40%)
Total	0.91%

Study of Z′ → μμ

ATLAS MC sample at m(Z′) = 2 TeV

Comparison of results in

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



Improvement of momentum resolution by factor 1.5

Acceptance improvements

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

Layer	Tracking	Low-p_T Trigger	High-p_T Trigger
BO	0.11 × 0.31 (0.51%)	-	0.10 × 0.29 (0.41%)
BM	0.09 × 0.30 (0.40%)	0.10 × 0.31 (0.45%)	0.10 × 0.31 (0.45%)
Total	0.91%	0.45%	0.86%

Improvement of trigger coverage by 0.86% of barrel region

Chambers needed

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

Mechanics and MDT covered by MPI

2 BO chambers:

standard BOS chambers
2 RPC layers equipped with η- and φ-readout
implementation of standard RPC read-out and trigger electronics

2 BM chambers:

BM chambers with 15mm diam. MDTs
2+2 RPC layers equipped with η- and φ-readout
implementation of standard RPC read-out and trigger electronics

If no funding from INFN, Rome2 University funding can cover:

Single RPC layer with φ-readout only
RPC read-out via the MDT CSMs
No trigger provided
Endorsed by the Muon Institute Board on Jan. 12th 2011

Funding

Trigger electronics already available (paid by muon M&O)

	kE
Gas volumes + readout panels + mechanics	45
Front-end electronics	45
Boards (1 HV, 1 LV, 1 48V PS)	24
Cables + connectors	10
Total	**124**