

RPC related upgrades for phase-II

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on behalf of the RPC / RPC-upgrade groups

ATLAS Italia Upgrade

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Improved spatial resolution via ToT

In Lol for phase-II upgrade

Goal: improve spatial resolution at L1 from 7mm to 3mm or better

- Width of the RPC front-end signal proportional to the charge on the strip
- Centroid of charge distribution used to estimate track position
- Sharpening of the LVL1 thresholds thanks to the higher spatial resolution

Current RPC chambers can be used

Profiting of the replacement of the trigger electronics to modify the logic in the trigger boxes

A R&D project has been started to evaluate the potential of this method in detail (RM2)

Institutes involved: RM1 + RM2 (+ BO under discussion)

Cost under evaluation

Precise timing info at L1

Not in Lol

Goal: provide a timing info at L1 with $<1\text{ns}$ resolution

R&D carried out by Lecce (G.Chiodini + S.Spagnolo)

Test of on-detector FPGA-based electronics implementing the current standalone offline monitoring algorithm to be used at L1

Main advantages:

- spatial and time resolution available real-time (virtual pad)
- reduce non-prompt hit and track multiplicity before L1
- possible mean-timer implementation reading strips from both sides

RPC trigger stations in the inner layer

Not in Lol

Expected peak luminosity in phase-2 is $L=7 \times 10^{34} \text{cm}^{-2}\text{s}^{-1}$

RPC ageing qualification assumed $L_{\text{peak}}=1 \times 10^{34} \text{cm}^{-2}\text{s}^{-1}$ with safety factor 5

Background rate from 2012 data at $L=0.7 \times 10^{34} \text{cm}^{-2}\text{s}^{-1}$ extrapolated to phase-2 luminosities will exceed the ageing test limits

Lowering of the operating voltage can help, but it will reduce the detector efficiency

The present muon trigger could become marginal at high luminosity

→ introduce redundancy

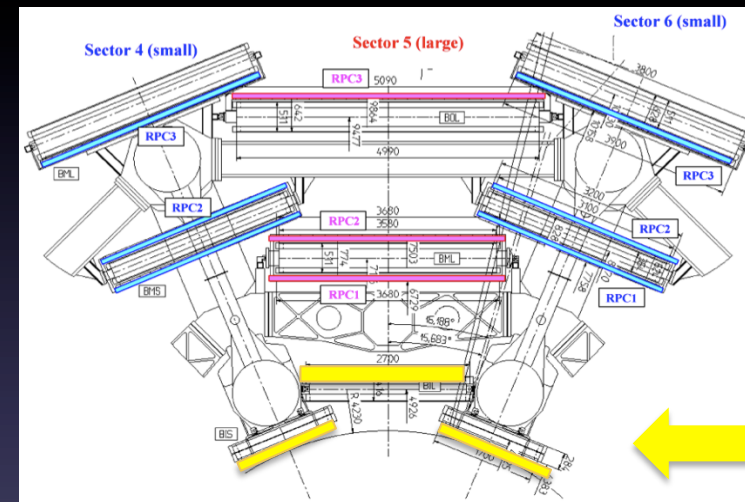
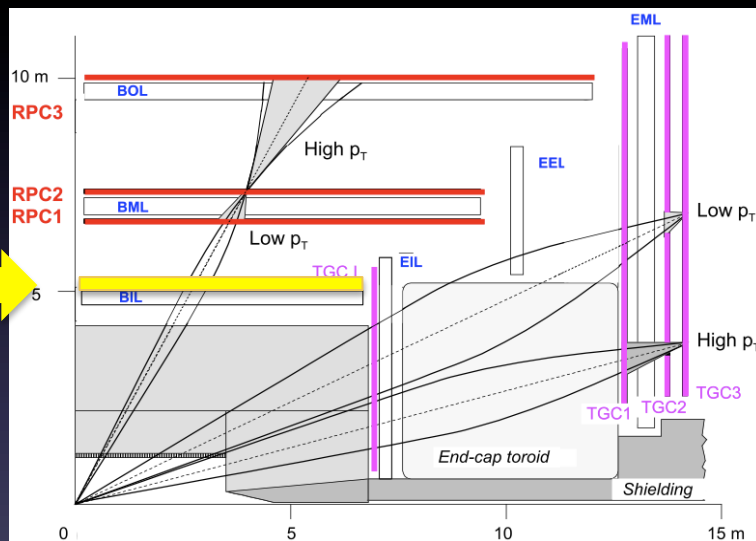
An inner RPC layer was already considered years ago in the original proposal
It would provide redundancy and increase the lever arm of the RPC trigger

Complementary to MDT L1 trigger whose electronics cannot be replaced in some of the inner chambers

RPC trigger stations in the inner layer

Challenging project due to the limited space available
Same problem as for the chambers in the transition region

Surface to cover: $\sim 500 \text{ m}^2$



Interested institutes: BO, RM1, RM2

Important side effect:

LVL1 barrel acceptance will be increased by covering the toroid holes in BM chambers of small sectors (72% $\rightarrow$ 81% or more)

R&D towards phase-2

In the past:

ATLAS, CMS, ALICE, BABAR, ARGO, OPERA, ... involved in joint activities concerning:

- ageing tests (at GIF)
- bakelite production (at Pan-Pla)
- gas volume production (at GT)

Current R&Ds:

- FE electronics (by R.Cardarelli) capable to handle smaller signals
(x8 tested on current RPCs)
CMS and ALICE interested
- tests on new gases (to replace TFE) and ageing at GIF
with CMS and ALICE
- qualification tests of new laminate production made by CMS following a protocol
shared by other experiments