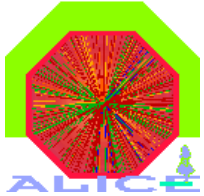

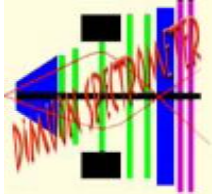

Muon Trigger System

Yongwook Baek

LPC, Clermont-Ferrand

& Kangnung University

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Members

- Collaboration of ALICE Muon Trigger System
  - INFN, Torino (Italy)
  - INFN, Alessandria (Italy)
  - Subatech, Nantes (France)
  - LPC, Clermont-Ferrand (France) + FKPPL (Korea)

- FKPPL
  - France (LPC, Clermont-Ferrand):

    Dr. Pascal Dupieux(Leader), Dr. Philippe Rosnet, Pr. Nicole Bastid, Dr. Philippe Crochet, Dr. Xavier Lopez
  - Korea (Kangnung, Konkuk)
    - Kangnung : Pr. Dowon Kim, Pr. Sungchul Lee, Dr. Yongwook Baek*(Leader, LPC Clermont-Ferrand+Kangnung)
    - Konkuk : Pr. Sunkun Oh, Ph.D St. Sangun Ahn(cotutelle 2009)*

- Activities in FKPPL(@CERN)
  - Y. Baek (LPC+Kangnung): Run coordinator of MTR (CDD of LPC)
  - S. Ahn (Konkuk): Support regular tests, shift and development of monitoring tools for shifter version

person* : @CERN

Physics Motivation

- Object : Quark Gluon Plasma (QGP)
- Goal : Systematic study of the formation, the properties and the hadronization of a system of deconfined quarks.
- Tool : ALICE experiment @LHC
  - Measure hadrons, photons and leptons

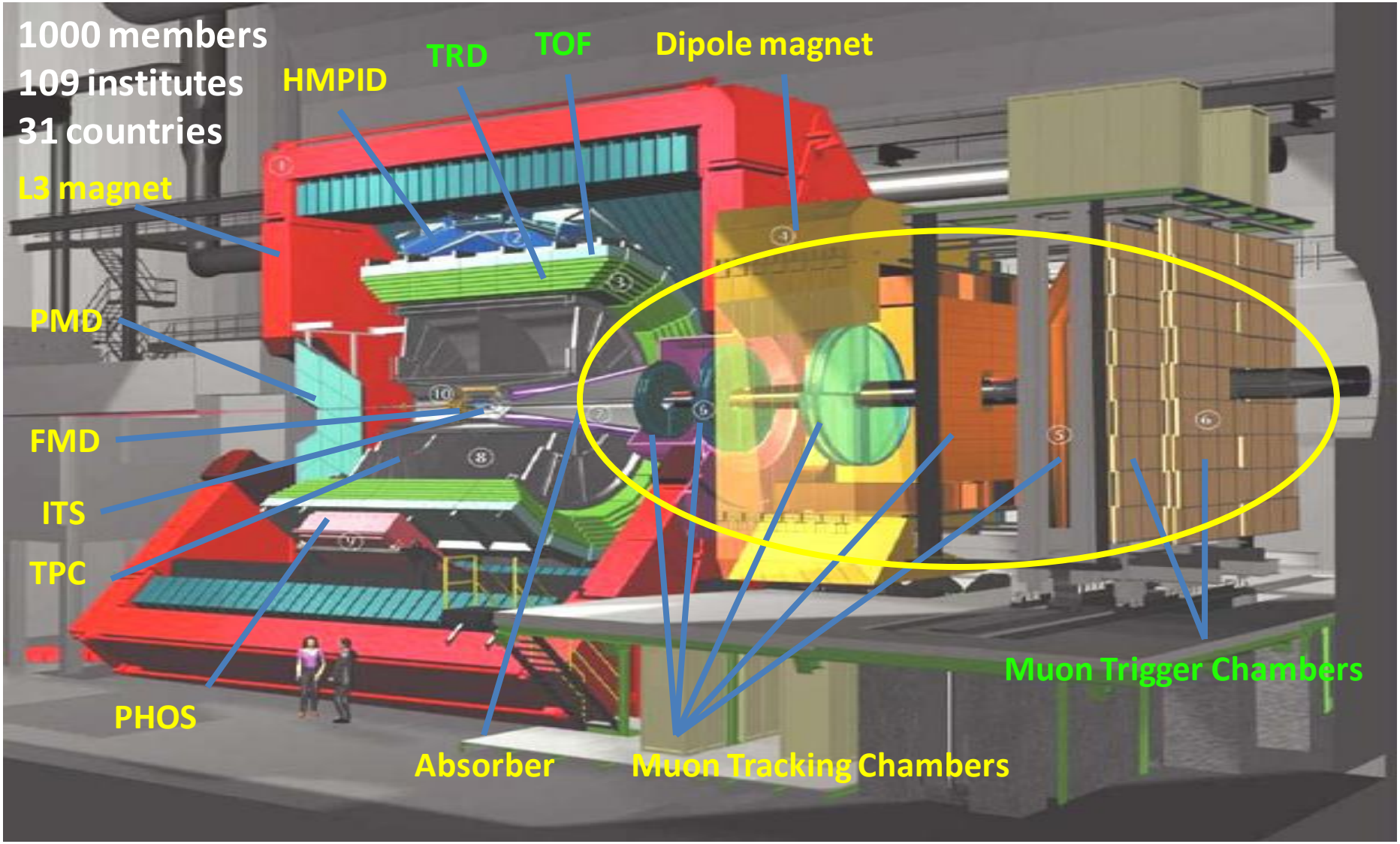
Favorable conditions for the study of QGP in central collision Pb-Pb (Au-Au)

machine	SPS	RHIC	LHC
$\sqrt{s}$ (GeV)	17	200	5500
$(dN/dy)_{y=0}$	500	850	2000-4000
τ^0_{QGP} (fm/c)	1	0.2	0.1
T_{QGP}/T_C	1.1	1.9	3.0-4.2
ε (GeV/fm^3)	3	5	15-60
τ_{QGP} (fm/c)	≤ 2	2 - 4	≥ 10

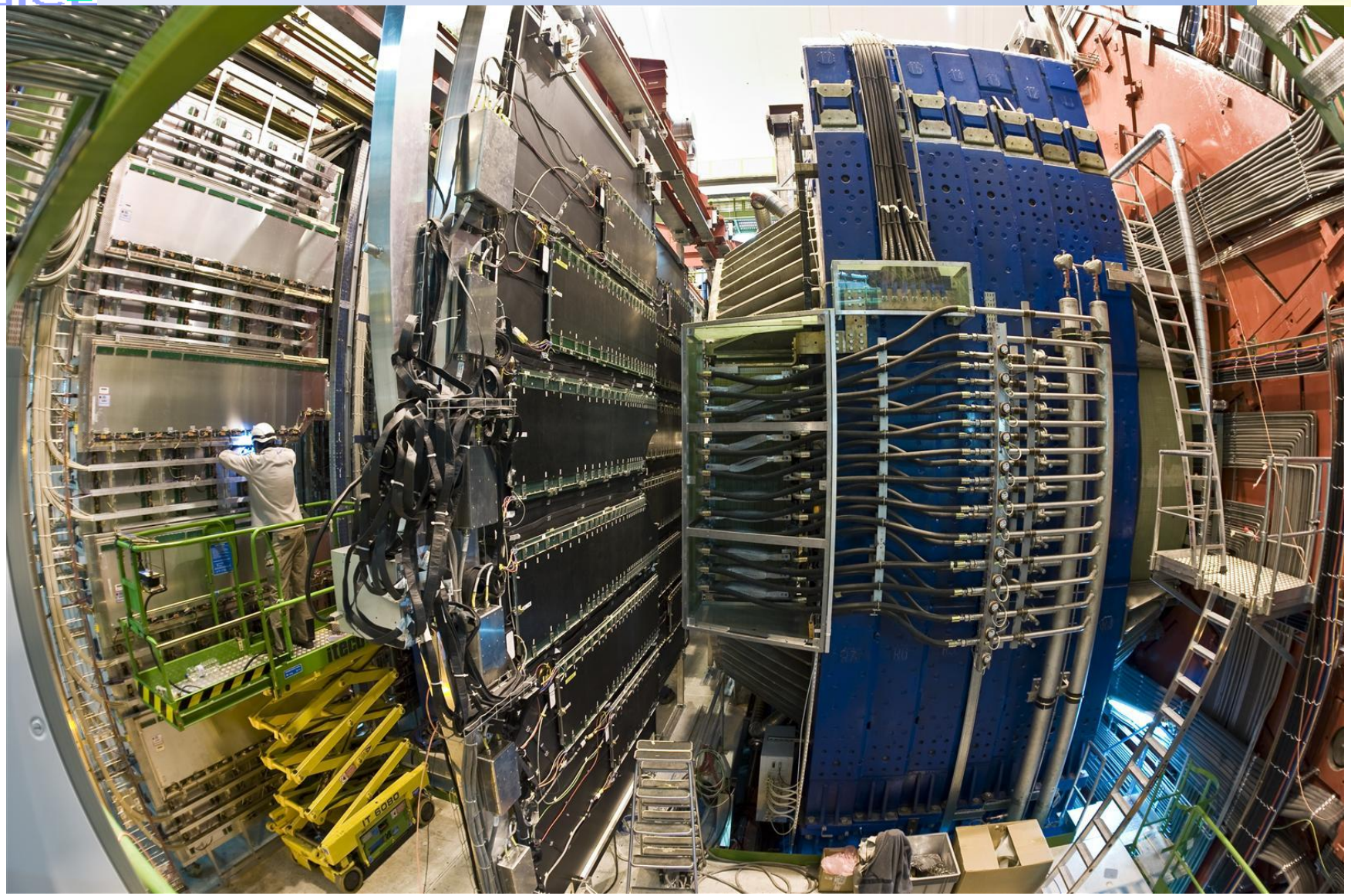
Measure (di-)muons from Quarkonia
J/ψ, ψ', $\Upsilon(1S)$, $\Upsilon(2S)$, $\Upsilon(3S)$

Muon spectrometer

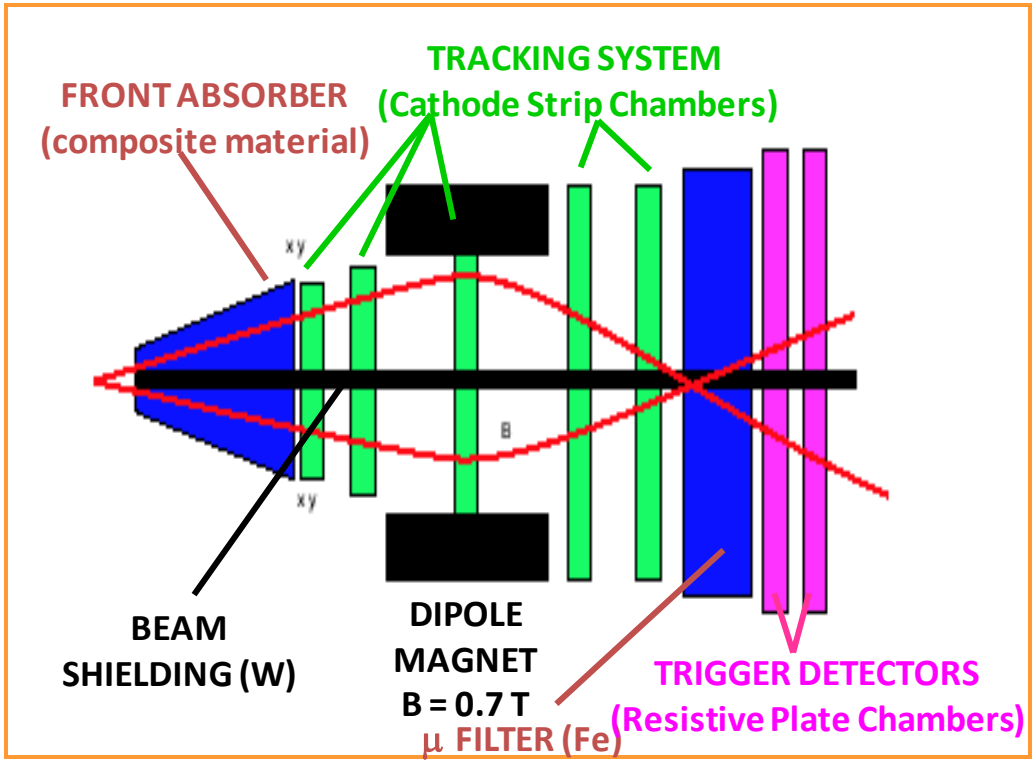
ALICE Experiment



Picture of Muon Spectrometer



Muon Spectrometer



❑ Absorbers

- Front absorber : Reducing charged particles and decreasing the hadronic muon background
- Beam shielding : Reducing low energy background from the pipe
- Iron wall : Reducing low energy background in the trigger chambers

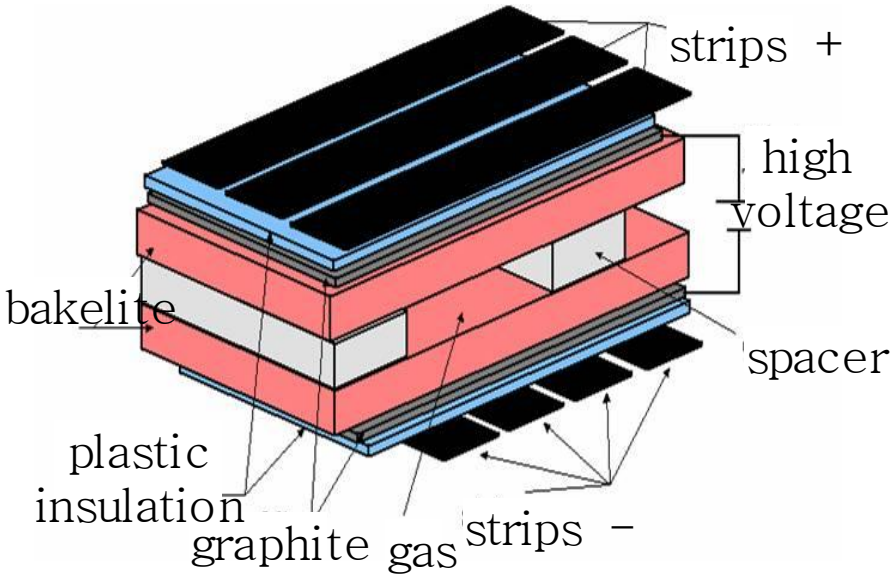
❑ Muon Tracking System

- 5 stations of CSC chambers

❑ Muon Trigger System

- 2 stations of RPC chambers

RPC & MTR system



RPC performances :

- Muon efficiency ≥ 95%
- Fast response < 2 ns
- Time resolution < 1 ns
- Rate capability > 100 Hz/cm²
- Spatial resolution : < 1 cm
- Bulk Resistivity ≈ 10^9 Ω.cm

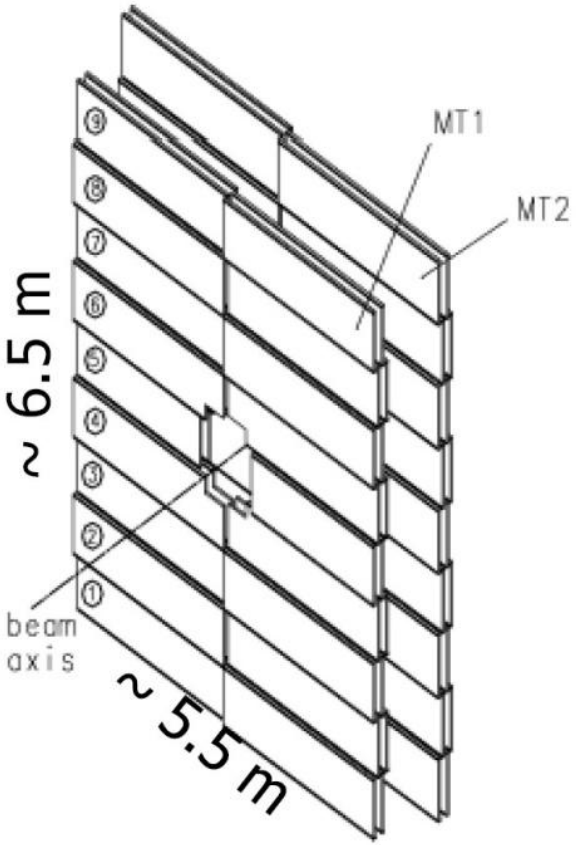
Streamer mode:

Ar(50.5%) + C2H2F4(41.3%) + iC4H10(7.2%) + SF6(1.0%)

Avalanche mode :

To allow a threshold of discrimination lower than streamer mode one, with a different gas mixture but the same front-end electronics.

RPC & MTR system



2 stations, 4 planes, 72 RPCs, 140 m²
~ 21,000 strip signals and Front-End channels

Goal : participate in L0 trigger decision

- Five trigger signals are delivered to CTP
- Less than 800 ns of latency after interaction
- Every 25 ns

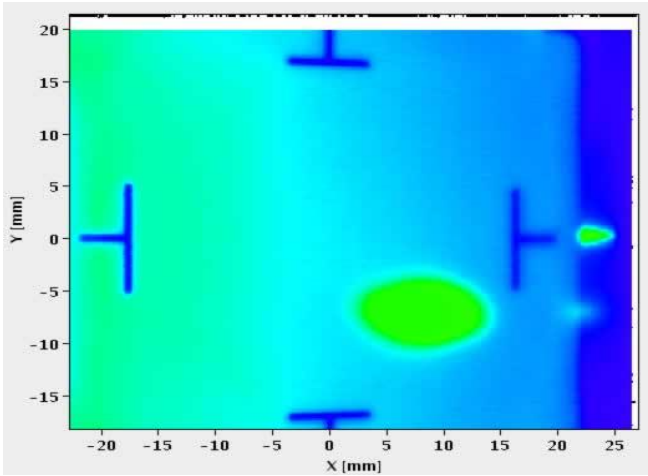
Trigger signals :

- Single muon low Pt(~1 GeV for J/ψ)
  or high Pt(~2 GeV for ϒ)
- Unlike-sign dimuon low & high Pt
- Like-sign dimuon low & high Pt

Beam Injection Test (Aug 10th)

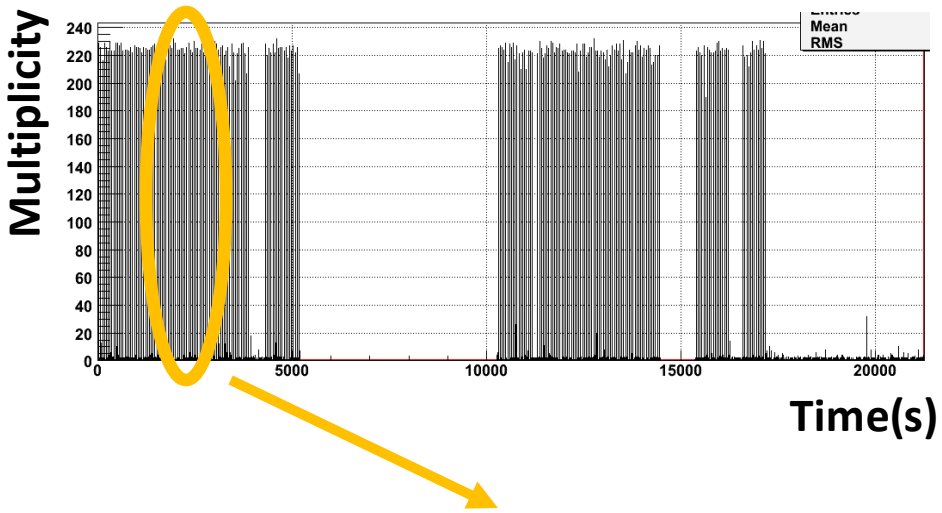
- 1 bunch (~ 2 x 10^9 p)/48s
- Beam with TI2 screens :

  => 1 ~ 2 particles/cm² @ALICE
- 2 hours of data taking : ~ 200 events
- 65/72 RPCs were in working condition
- MTR in Standalone mode :
  - Recording frequency : 1 event/s
  - Software sequences for scaler read-out



The number of Global and Local positive trigger decisions and number of hits per strip during 1 second.

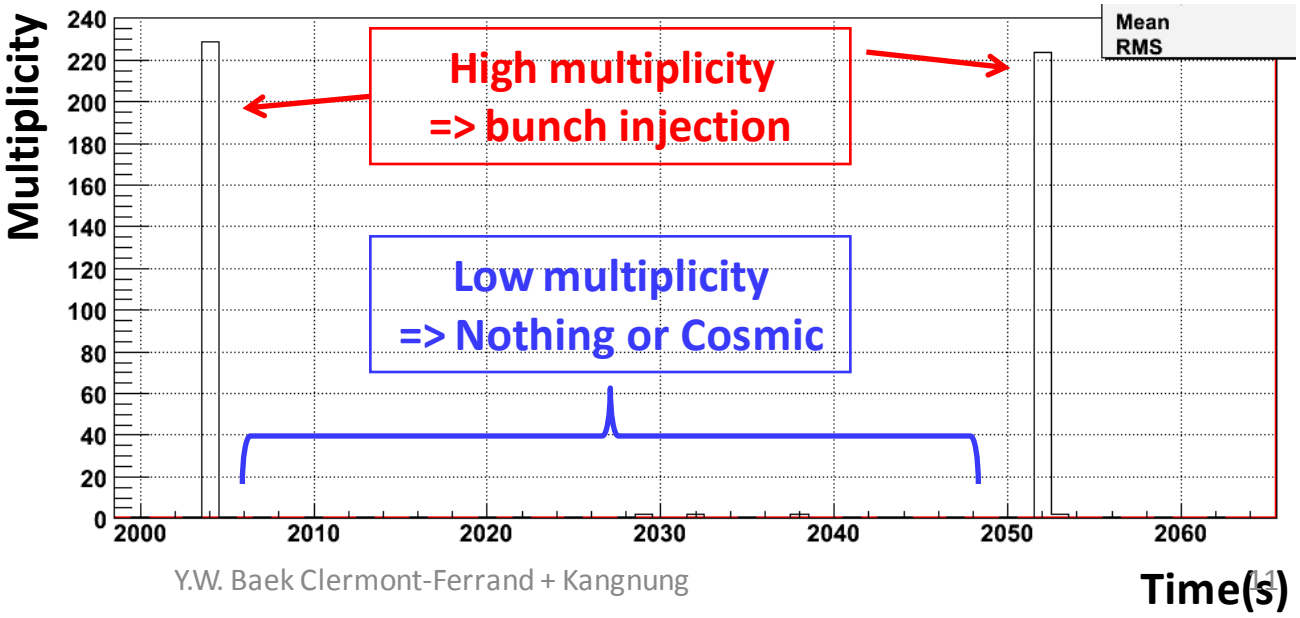
Local Trigger Level (Aug 10th)



Local trigger : single track by Pt cut
Multiplicity per event of Local boards giving a positive trigger decision vs time.

High multiplicity :
bunch injection, 1 bunch per 48s
Low multiplicity :
nothing or cosmic ray showers(~ 0.1 Hz)

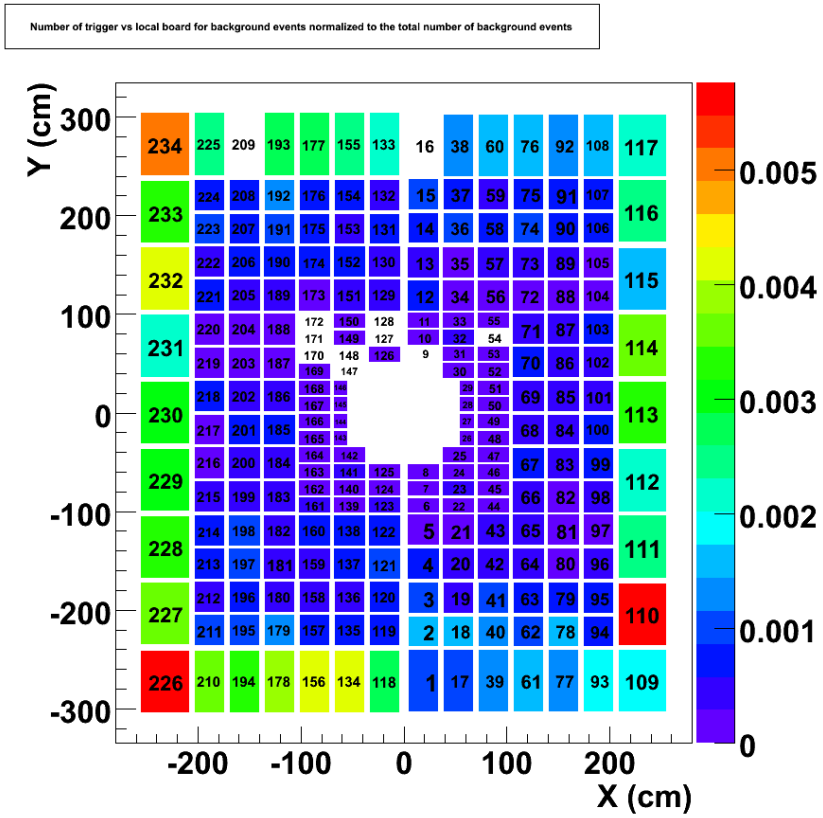
234 Local Trigger boards

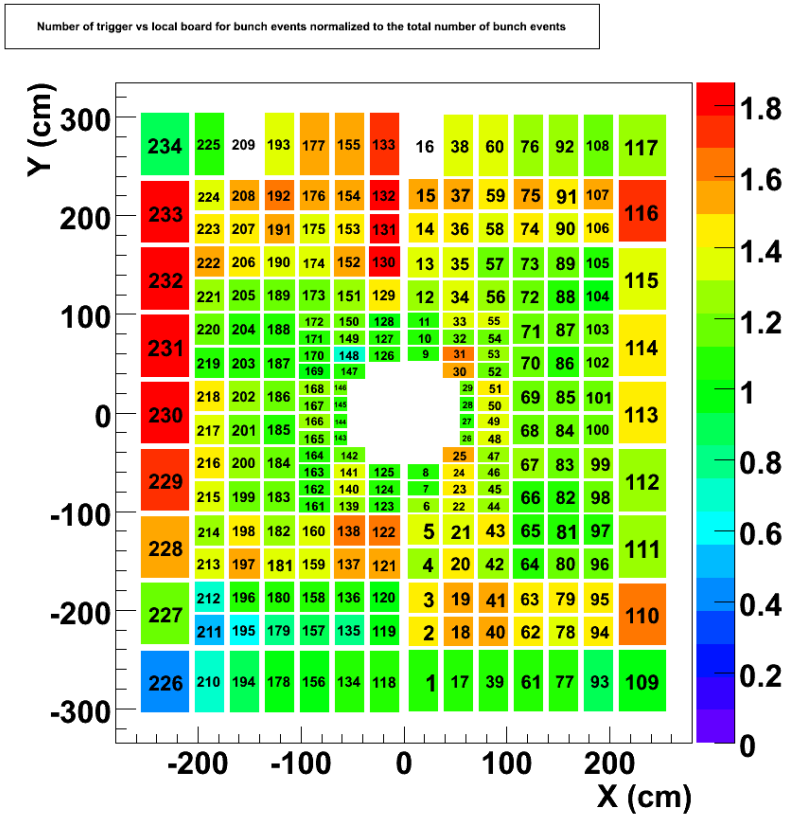


Local Trigger Level (Aug 10th)

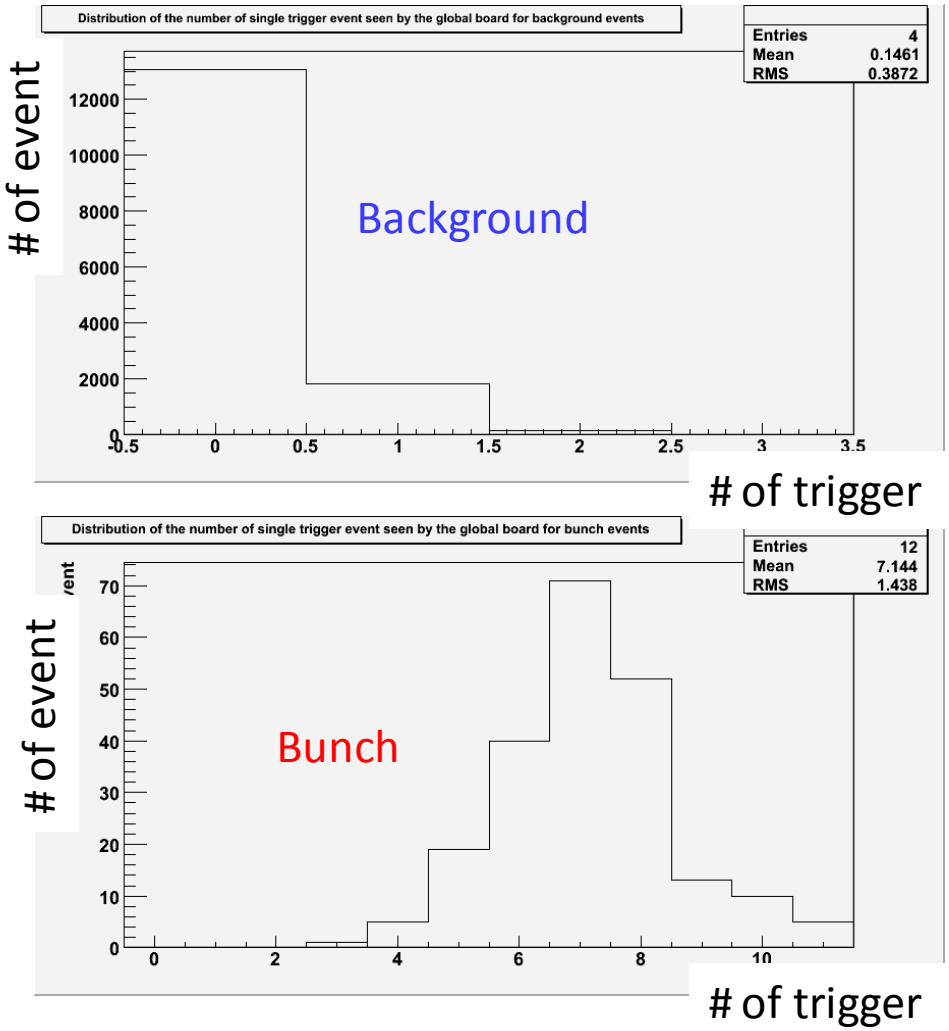
Hit rate of positive Local trigger decisions per Local boards for BACKGROUND events

Hit rate of positive Local trigger decisions per Local boards for BUNCH events





Global Trigger Level (Aug 10th)



- Distribution:

  # of events vs # of triggers

- Background events
  - 0 or no more than 3 positive trigger decisions

- Bunch events
  - Average trigger decision : 7
  - Correspond most probably to positive Global trigger decisions in the injection BC cycles and in a few adjacent BC cycles

➔ *Very large background particles have been observed each bunch injection*

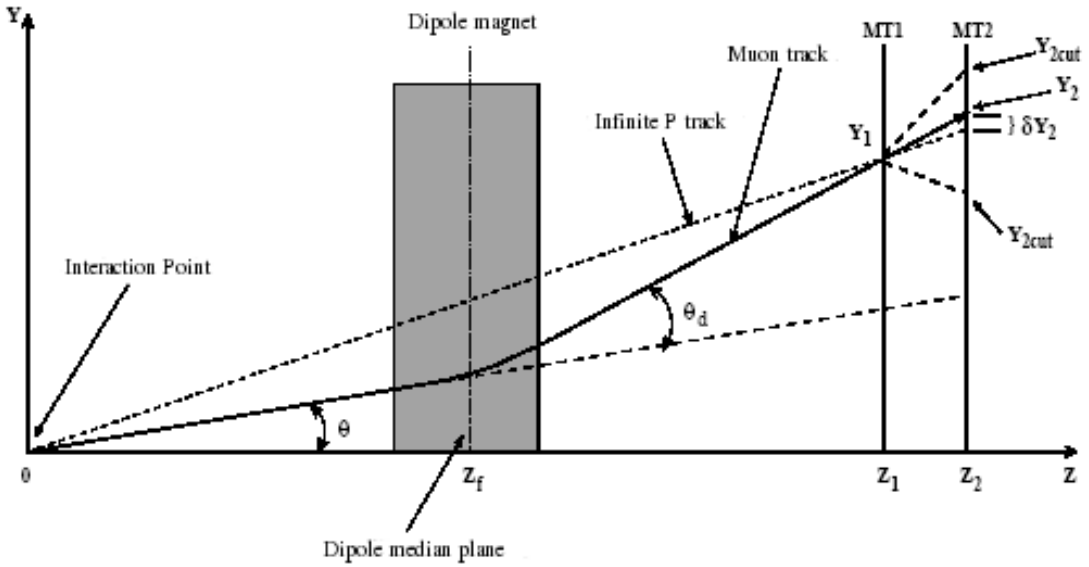
Summary

- Beam injection test
  - MTR was stable and running almost perfectly.
  - A large number of background events were detected at each beam injection.

- Regular tests & maintenance activities
  - New version of Global board has been installed and tested
  - Change of 2 bad trigger cables from regional to global boards.
  - Spare gaps are in construction at Torino

- Plans
  - 72 RPCs are ready for cosmic run on March
    - Efficiency measurement
    - Test in avalanche mode
  - S. Ahn will start the “Cotutelle” program (Blaise Pascal + Konkuk)
    - The procedure for an administrative agreement is in progress between institutes
    - Development of monitoring tools for MTR : MOOD and AMORE
    - Physics analysis : Upsilon(Υ) -> $\mu^-\mu^+$

Backup



The deviation δY2 between the 2jtrigger stations.
The measurement of δY2 I sused to perform Pt cut.
Low Pt cut ~ 1 GeV/c for optimized for J/Ψ
High Pt cut ~ 2 GeV/c for optimized for ϒ