



Activity related CMS RPC

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5th Korea-CMS collaboration meeting



Summary of RPC activity by Korea university

RE1/1 project

- Summary of history
- Installation of 4 RE1/1s

Detector readiness for Heavy-Ion runs

- Purpose and issues
- Data volume estimation, calibration & etc

Future plan

Hardware

- RE1/1 project
 - ~April : Hyunchul, Now : Han-Bum(documentation)
- Research about high eta RPC
 - Bongsun, Minsu

Software

- Online(P5) and offline RPC shift
 - Prof. Kwang-Souk Sim
 - Dong Ho, Hyunchul, Han-Bum, Mihee, Seungsu, Eunsung
- RPC detector readiness for Heavy-ion runs
 - Hyunchul, Mihee, Dong Ho
- Data handling for RE1/1
 - Han-Bum, Eunsung

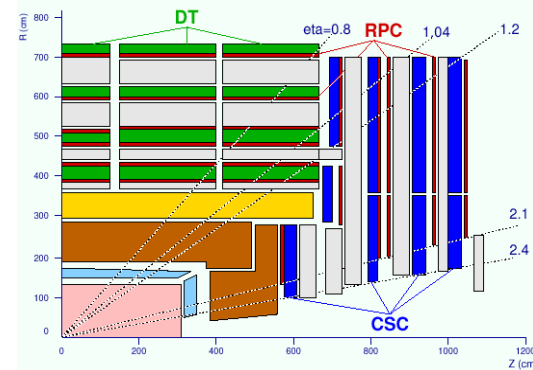


RE1/1 installation



Purpose of RE1/1 project

- Nearest Forward RPC to collision point
→ Highest particle rate in RPCs
- More possibility of aging
- Insert to nosecone
→ Different design with other forward RPCs



History until now (by Korea-CMS collaboration meeting)

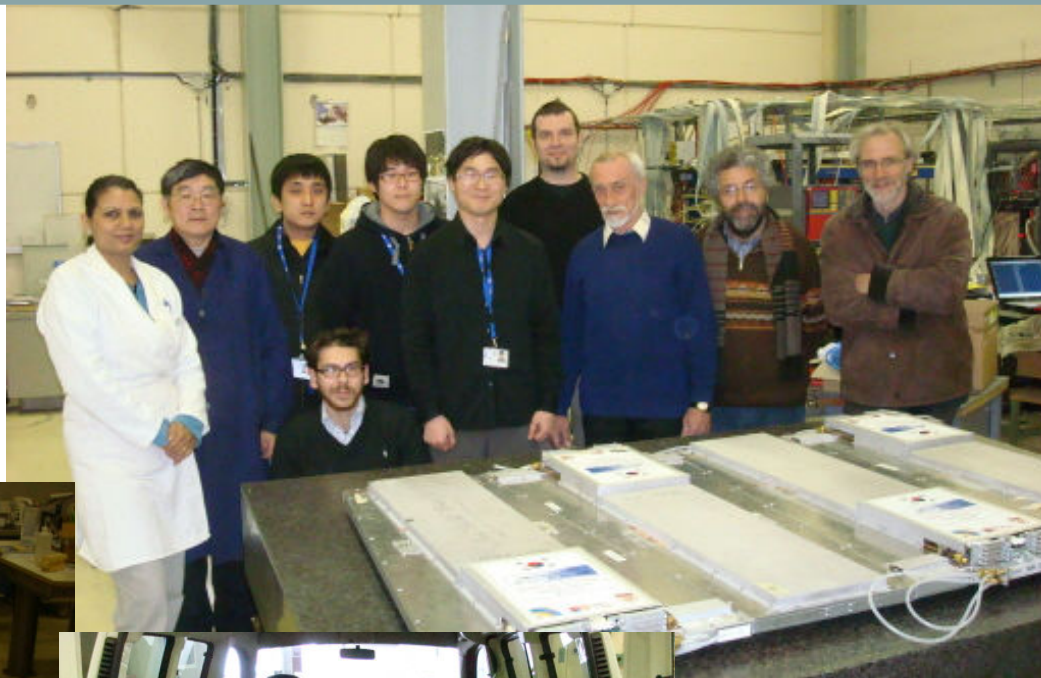
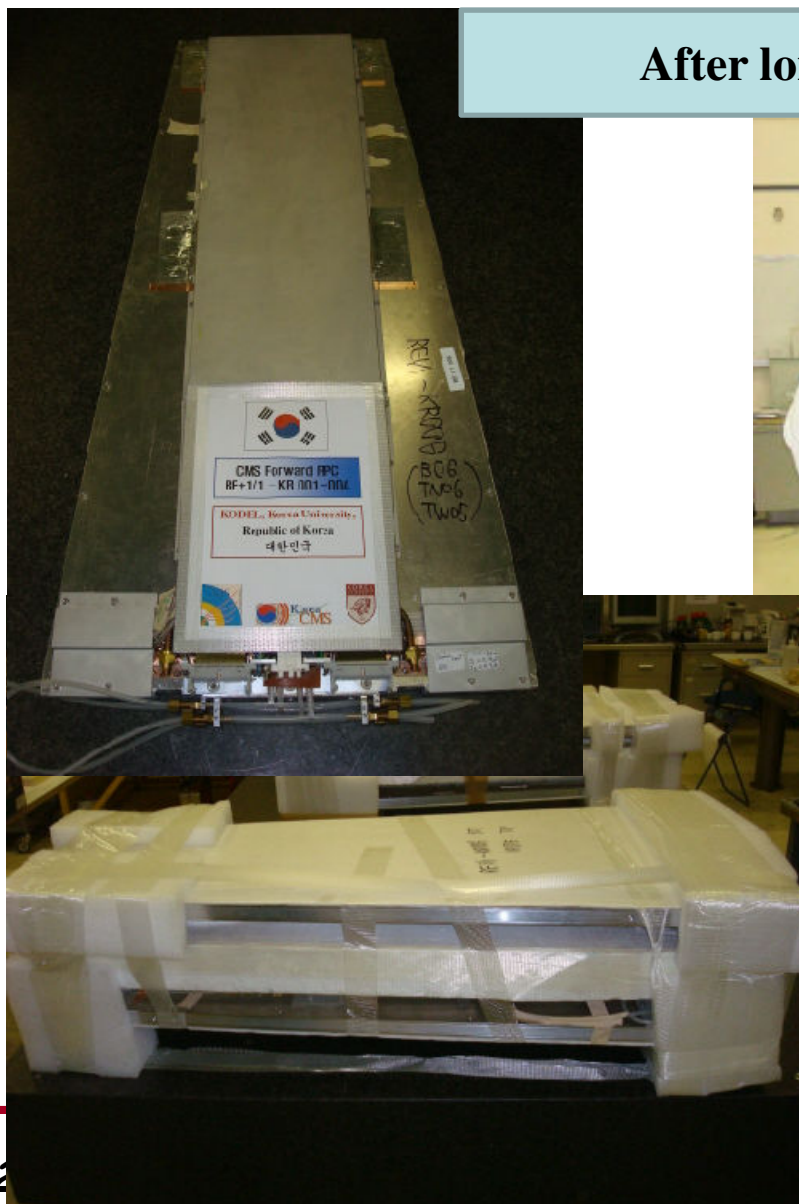
- 2nd : Making basic design, research of prototype
- 3rd : Modification about prototype design, preparation to assembly
- 4th : Change gas connection (2in-2out), finish assembly of 4 RE1/1s

Achievement by today

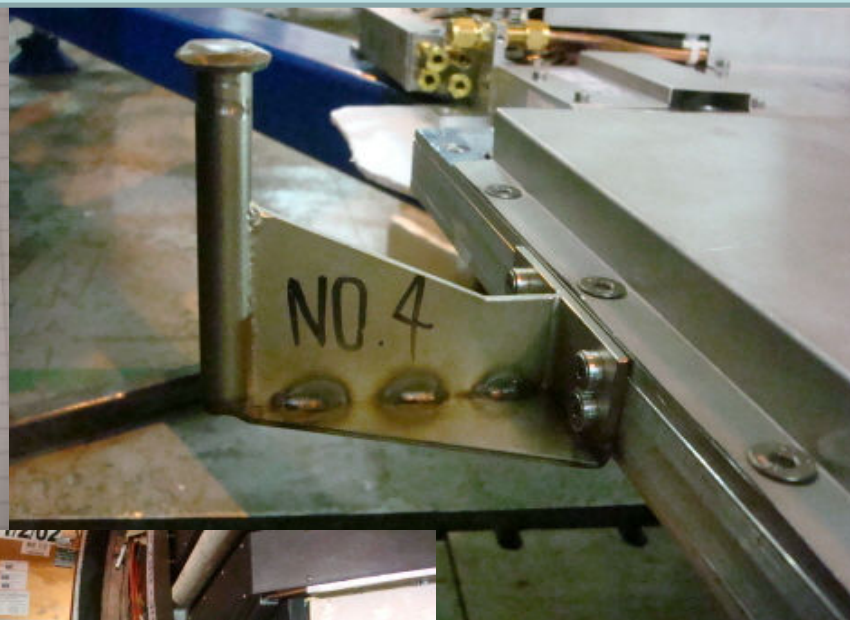
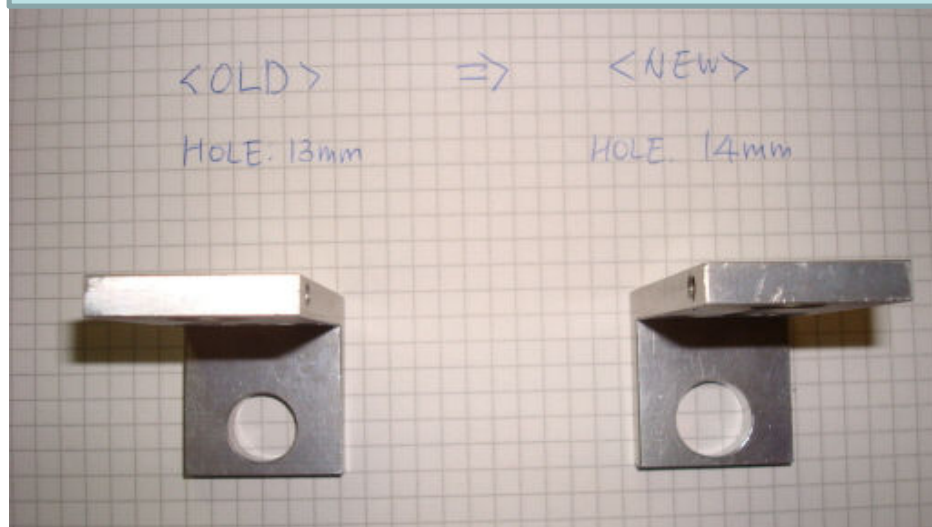
- Installation of 4 RE1/1 chamber finished
- Service systems are ready except link board and PVSS system
- Documentation about RE1/1 project (See Han-Bum's talk)

Assembly & shipping 4 RE1/1s (03/27)

After long term cosmic test, 4 RE1/1 were ready.



Modification of guiding pieces



Attach the special supporting bar for easy insertion



RE1/1 installation process (2)



Finish
~ Apr. 27th



RE1/1s should connect to whole CMS system

- Need connect to PVSS system

Installation link board

- Preparation special and upgraded link board
- Plan to install before run(November)

Documentation

- See Han-Bum's talk (co-work)

Upgrade high eta RPC

- See Minsu & Bongsun's talk



Detector readiness



Different condition between pp and PbPb run

- Collision rate : pp (1 GHz) \gg PbPb (3~8 kHz)
- Particle rate : PbPb $>$ pp

HI group worry about detector condition and operation during HI runs

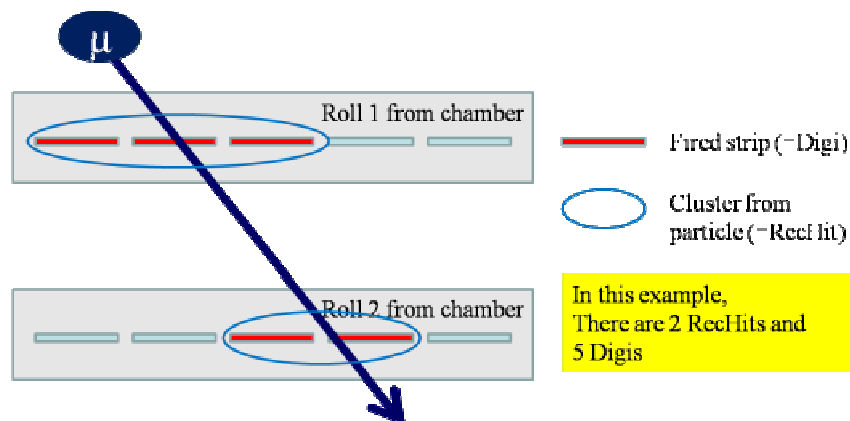
Focused issue for detector readiness

- Occupancy plot – See Mihee's talk
- Data volume estimation
- Calibration

Status of readout volume estimates (1)

Purpose : Check possibility of bottleneck by large data per event

Definition of parameters



Information about samples

	PbPb-b=0	PbPb-minbias	pp-minbias
Average cluster size (= average number of digi per RecHit)	1.891	1.890	1.864
Total no. of RecHits	2978	6349	44
Total no. of Digis	5631	12000	82
Total no. of Events	1998	19970	9000
261 Average digi per total event	2.818	0.6009	0.0091

Status of readout volume estimates (2)

Information for rough estimation of data volume

- CDF (CMS common data format) – multiple of 64 bit
- CDF is consist of header, payload, trailer
- Mandatory : $64\text{bit} \times 2(\text{header, trailer}) \times 3(\text{DCC}) = 384\text{bit}$
- Payload : No. of digi per event * 16bit per strip(=digi)
- Zero suppression is performed in Link Board
- By TDR, considering noise in pp, high luminosity, event size is ~300 Bytes
But from real data we can conclude data from noise is negligible.

Estimated readout data volume (<< Max. bandwidth limit 250MB/s)

	PbPb-b=0	PbPb-minbias	pp-minbias
Average digi per total event	2.818	0.6009	0.0091
Payload volume per event (16bit per digi)	45.09 →64 bit	9.614 →64 bit	0.1456 →64 bit
Total CDF volume per event (Payload+384bit)	448 bit =56 Byte	448 bit = 56 Byte	448 bit = 56 Byte
Total CDF volume per second (PbPb : 3kHz, pp : should be 100kHz)	168kB/s	168kB/s	5.6MB/s

Calibration for HI runs

In RPC group, No calibration is needed.

- Answer from Marcello Maggi
- Plan to discuss about that
- But need RPC performance monitoring (same as pp run)

Update result to wiki page

- <https://twiki.cern.ch/twiki/bin/view/CMS/RPCdetValidationHI>

Discussion with RPC people

- Ongoing to discuss with Marcello Maggi (Trigger expert)
- Plan to contact other experts in RPC group

Preparation Mini Workshop on Detector Readiness for Heavy Ion Beams at Oct. 14th

Work related with RPC group

- RE1/1 : Finish documentation (with Han-Bum)
- Shift : Offline(CAF) or Online(P5)

RPC readiness in Heavy-Ion group

- Oct. 14th : workshop
- Preparation for heavy-ion runs continuously

Analysis (B to Jpsi to dimuon channel)

- After Oct. will focus



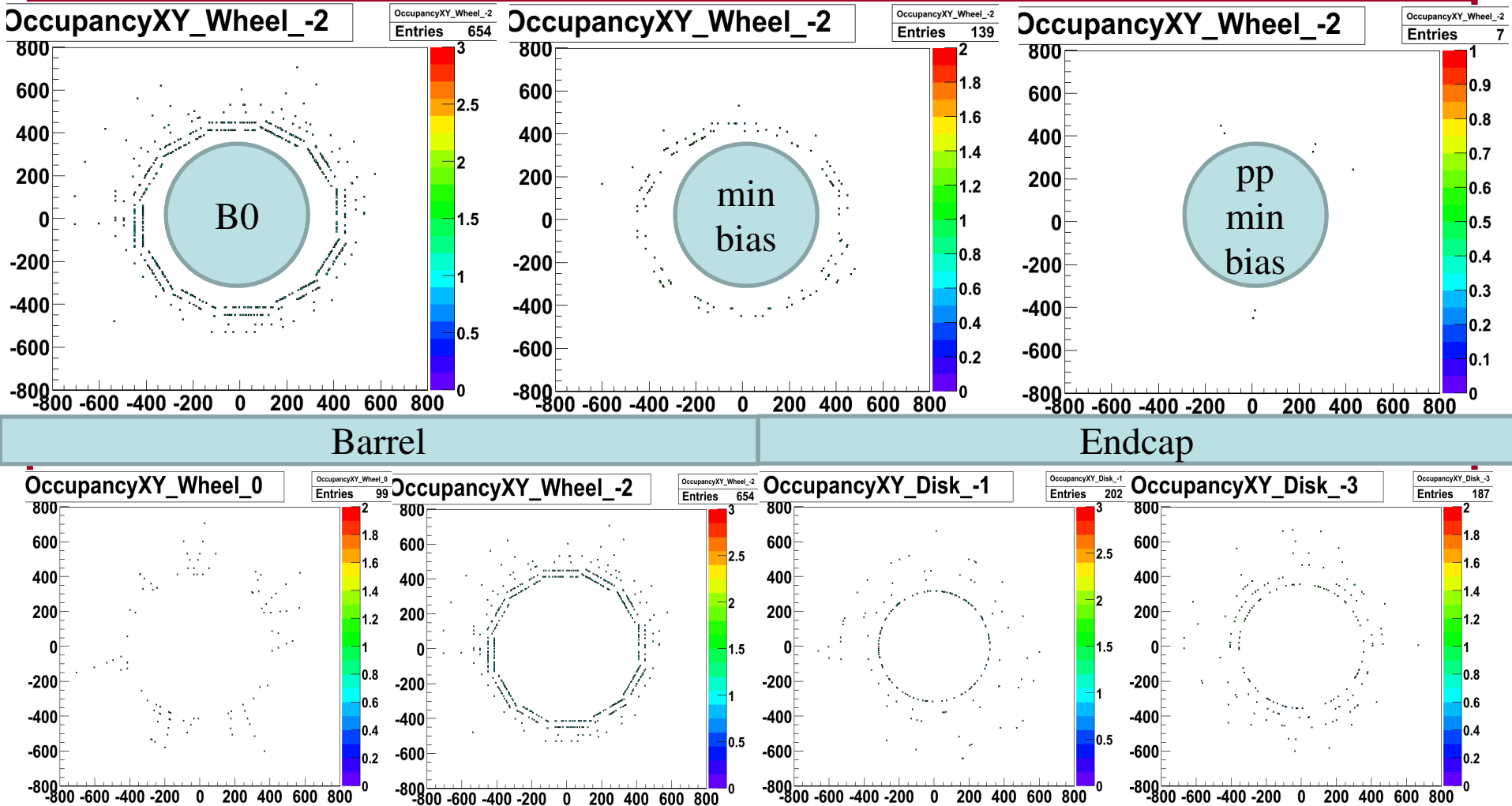
Backup slides



Question from detector readiness team

- What is still missing in terms of occupancy plots
 - No missing plot (I guess)
- What is the status of readout volume estimates
 - Get rough estimation, but need to check
- What is the status of known issues and proposed changes – until now I don't find
- What do we know about calibrations
 - Didn't find special calibration process for HI runs
 - First, prepare by general RPC calibration process
- Hyunchul will be giving the talk at the October 14
- Any other issues
 - Send first result to RPC trigger expert, need discussion

Trends of occupancy plots



In high eta region (very forward), occupancy is high.

In endcap, there are not high eta RPC(RE */1) so occupancy is smaller than barrel.

RPC DAQ system in the RPC PAC muon trigger

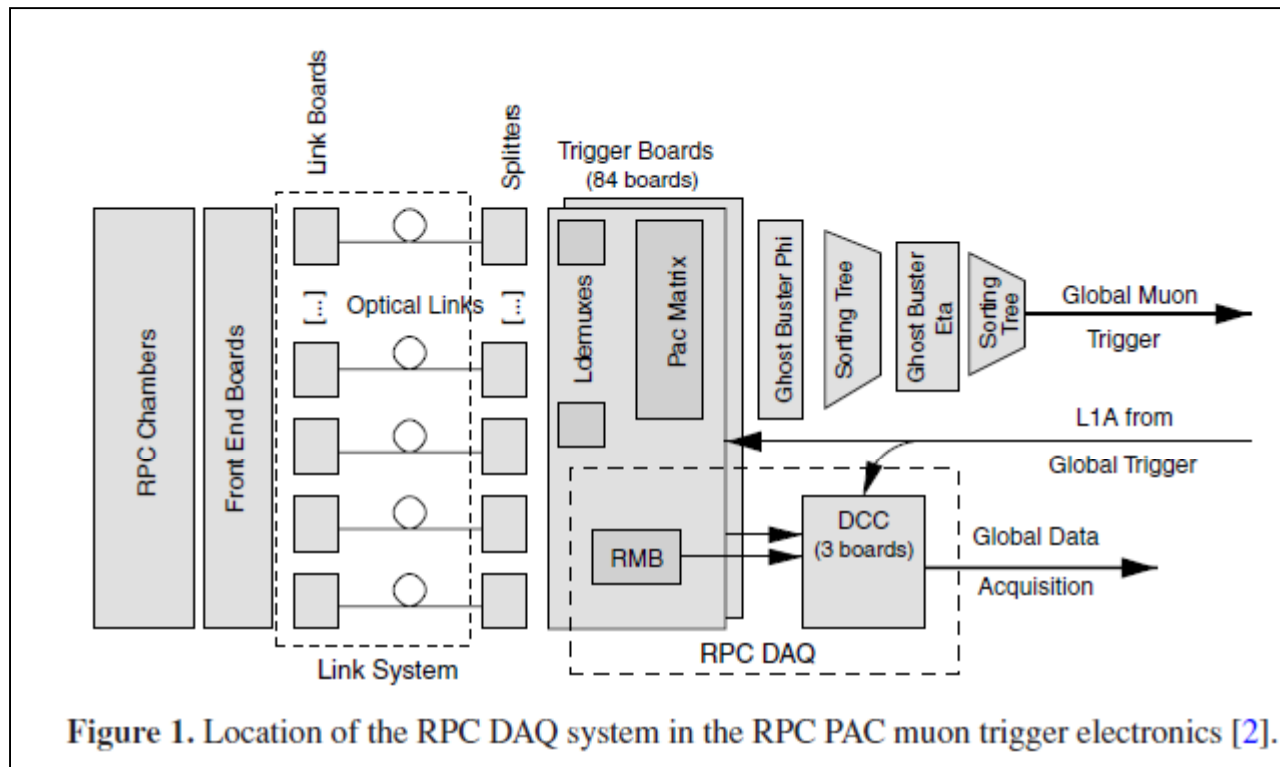
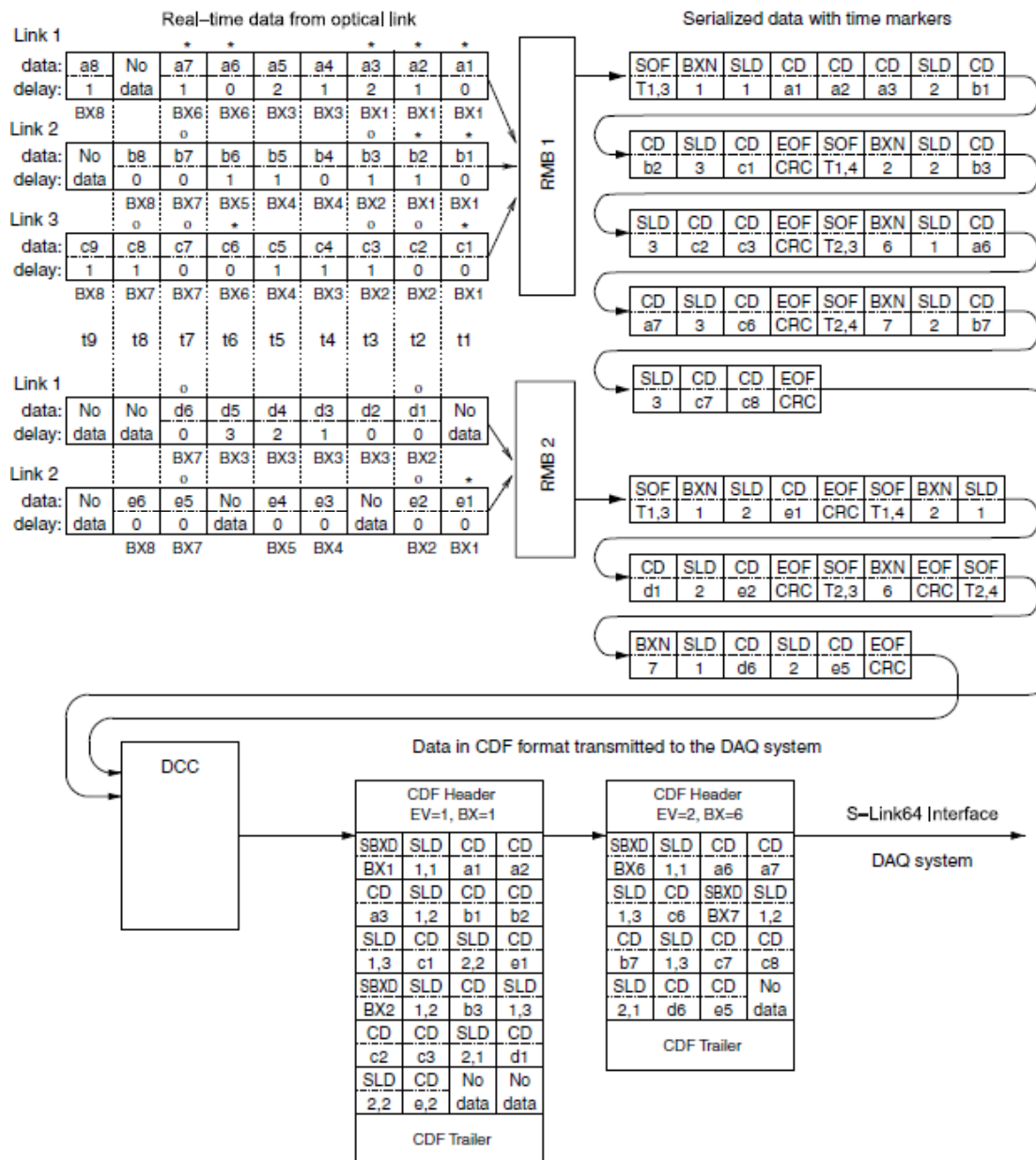


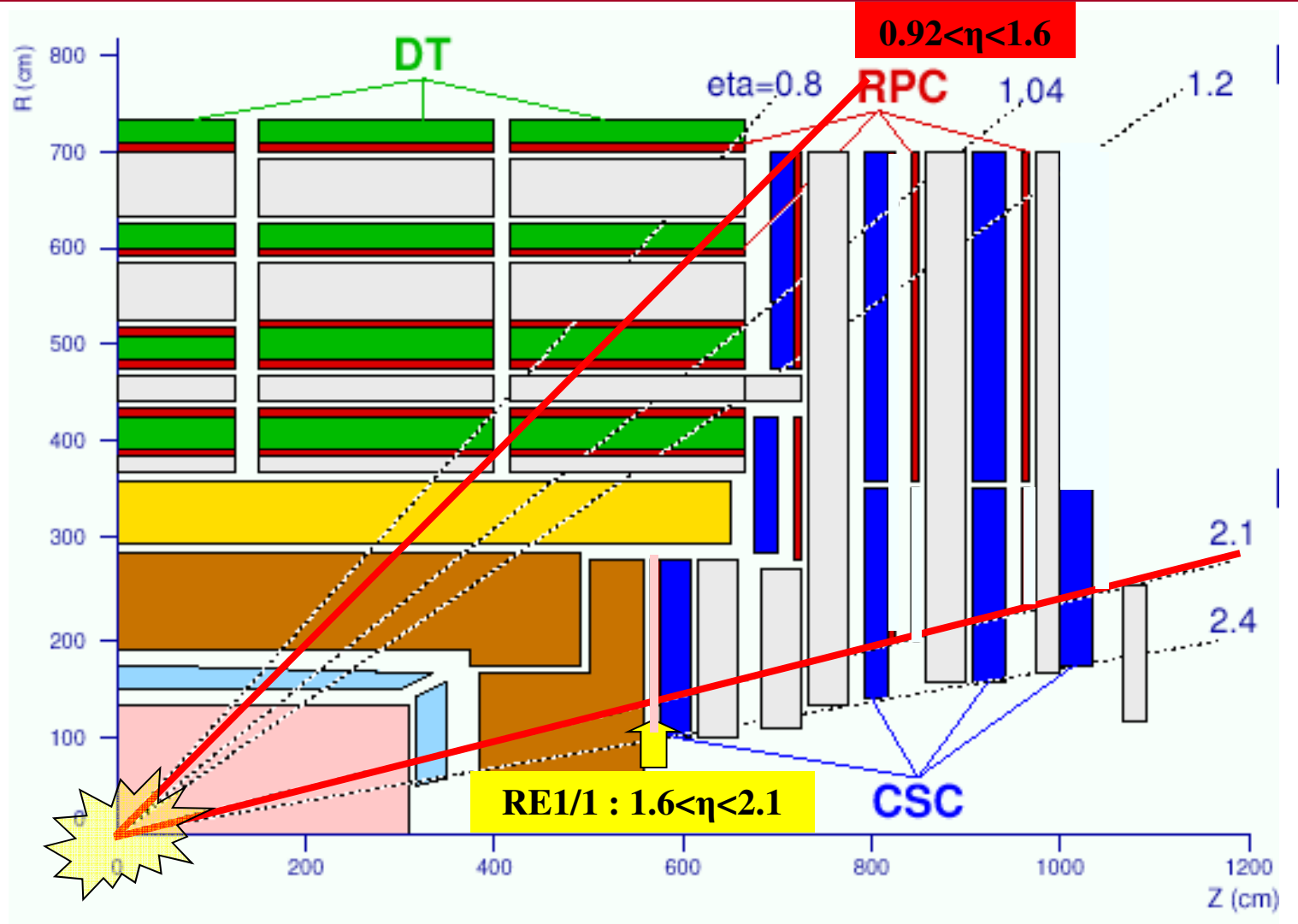
Figure 1. Location of the RPC DAQ system in the RPC PAC muon trigger electronics [2].

Ex. of data flow through the RPC DAQ system

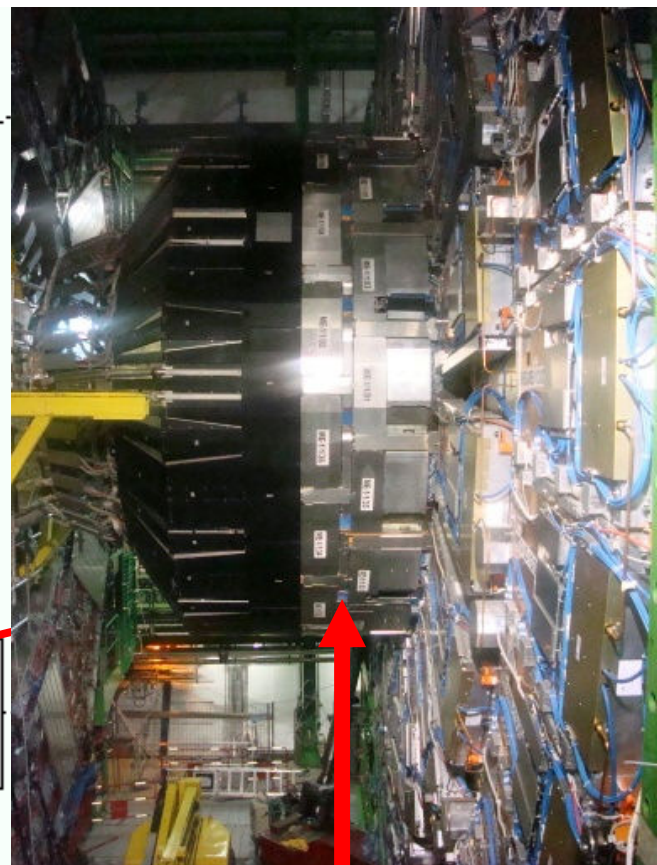
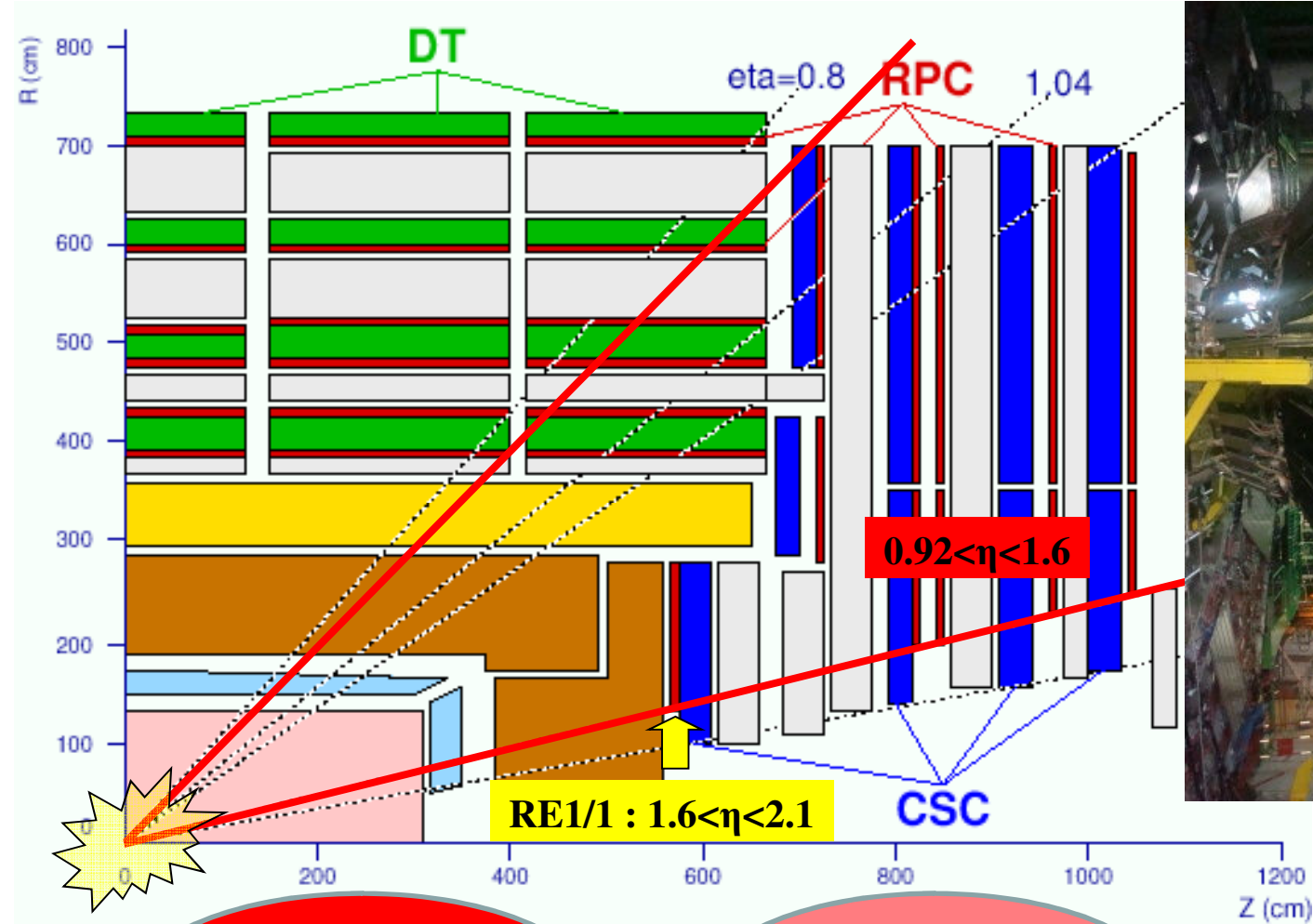


Barrel
RPC : 6
layers

Endcap
RPC : 3
layers



RE1/1 region of the CMS detector



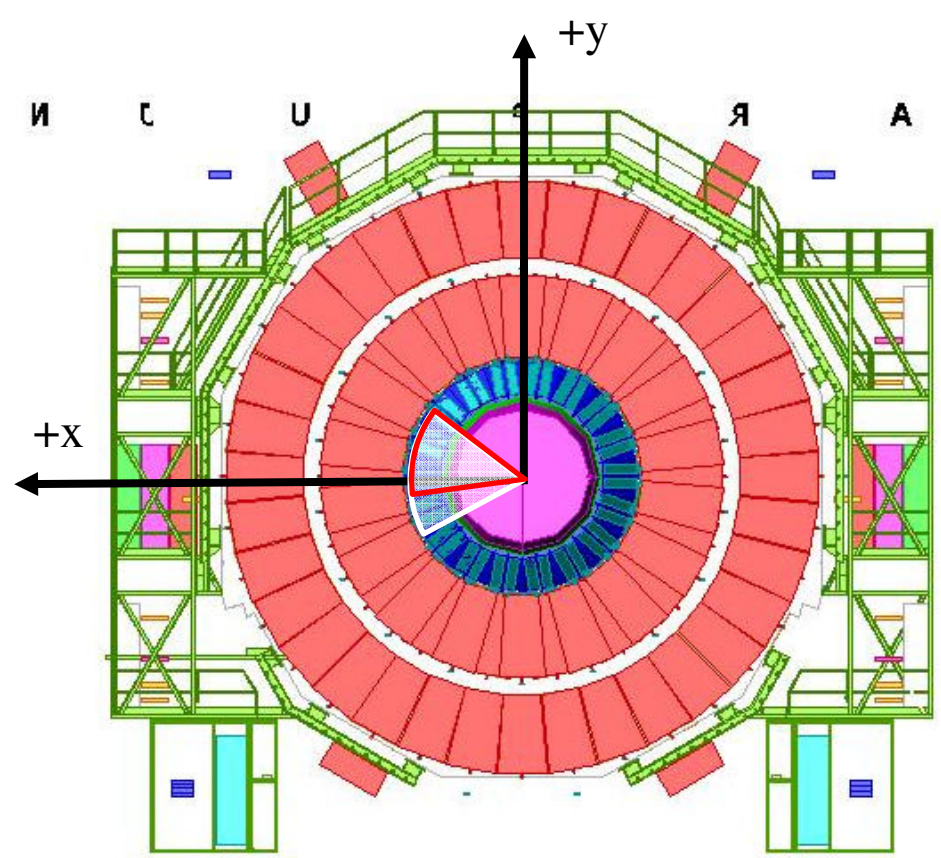
Highest particle rate of muon system

Large possibility of aging to RPCs

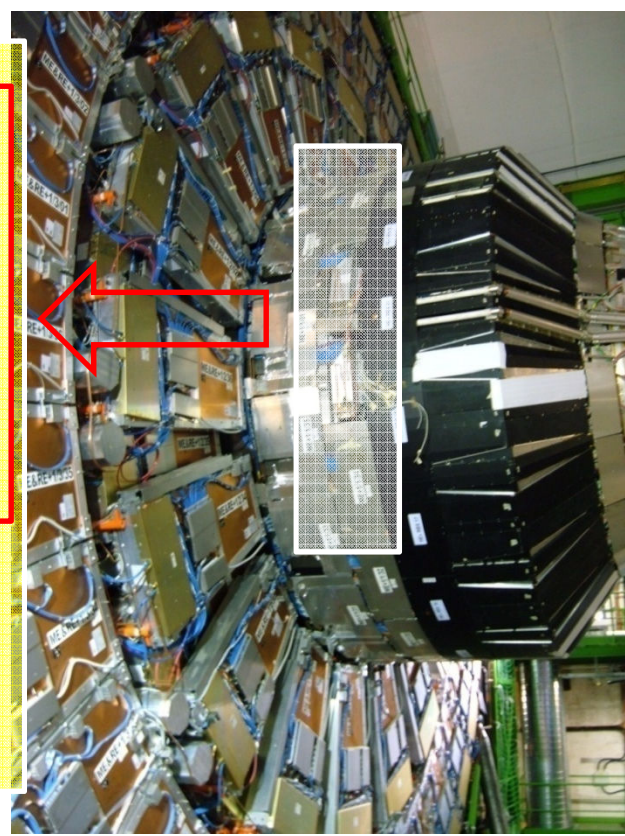
Different install type with others

RE1/1 region for install

6 chamber(RE+1/1 35~36~01~04) were planned to install, but 4 chambers(RE+1/1 01~04) were installed.



- 04
- 03
- 02
- 01
- 36
- 35



Result of cosmic test

Efficiency : ~95% plateau from 9.6kV (No corrections)

