



Dose Rate Monitoring System of BESIII

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Outline

- Short Introduction
 - Dose rate monitoring near IP based on PIN Diodes
 - Integrated Dose Monitoring for CsI Crystals based on RadFETs
- Brief status of the radiation Detectors
- Background



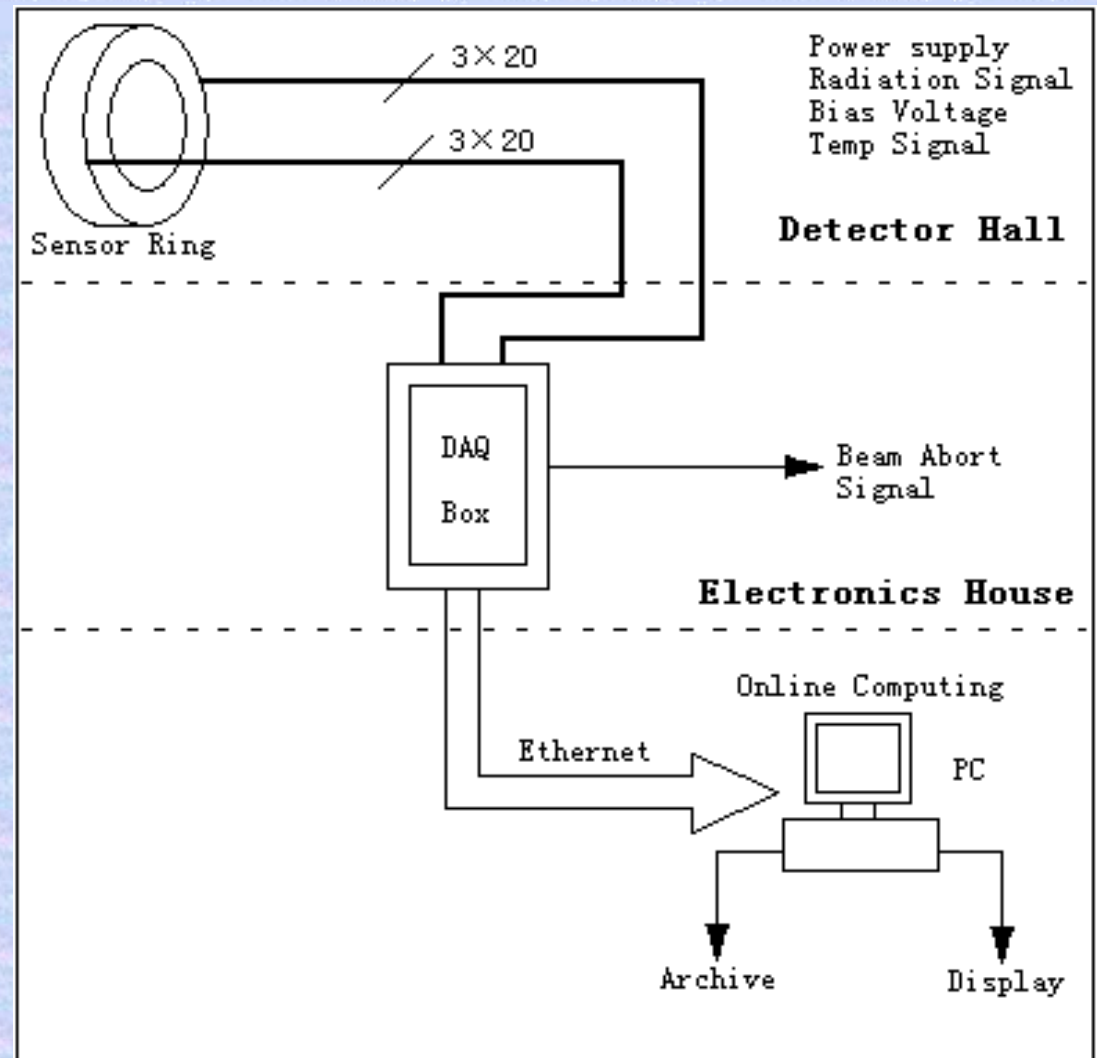
Background from

- Collision area near accelerator magnet synchrotron radiation photon
- Beam - gas inelastic bremsstrahlung, Coulomb scattering, Touschek effect (the particles loss caused by the elastic scattering within the bunch between charged particles)
- Injection efficiency (Injection cause loss of particles less than 100%)
- Catastrophic loss: such as a vacuum leak, the magnetic field, power-down, the beam instability caused by the loss of particles



Framework of Pin Diode Dose Rate Monitoring System

- PIN Diodes
 - IP: 12
 - Endcap EMC: 4
- Cables
- Readout Electronics
- Read out PC
- Database

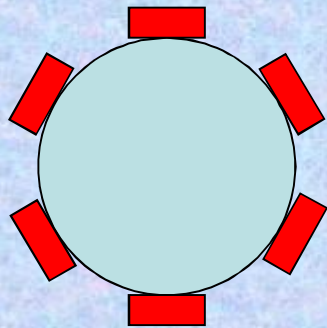




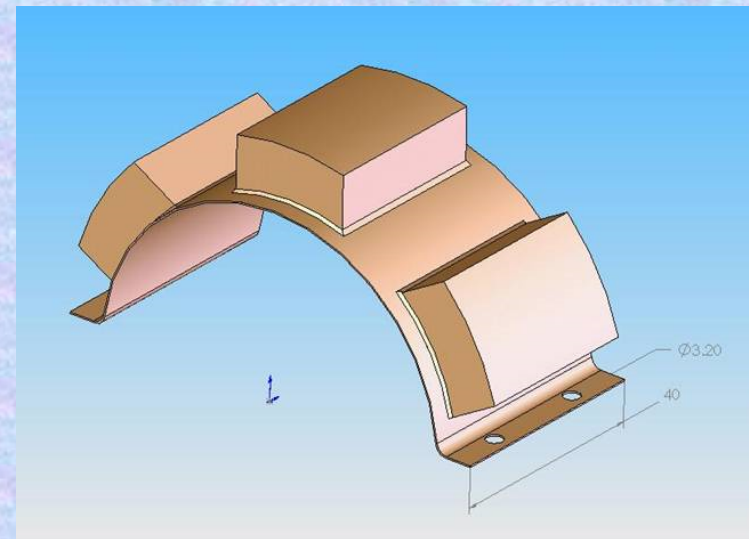
PIN Diodes installation at IP



- Size $< 50(z) \times 24(x) \times 15(y)$ mm
- 30cm near colliding point
- sensors are distributed isometricly in circumferential direction
- 6 each for East/West



30° 90° ... 330°





Readout Electronics



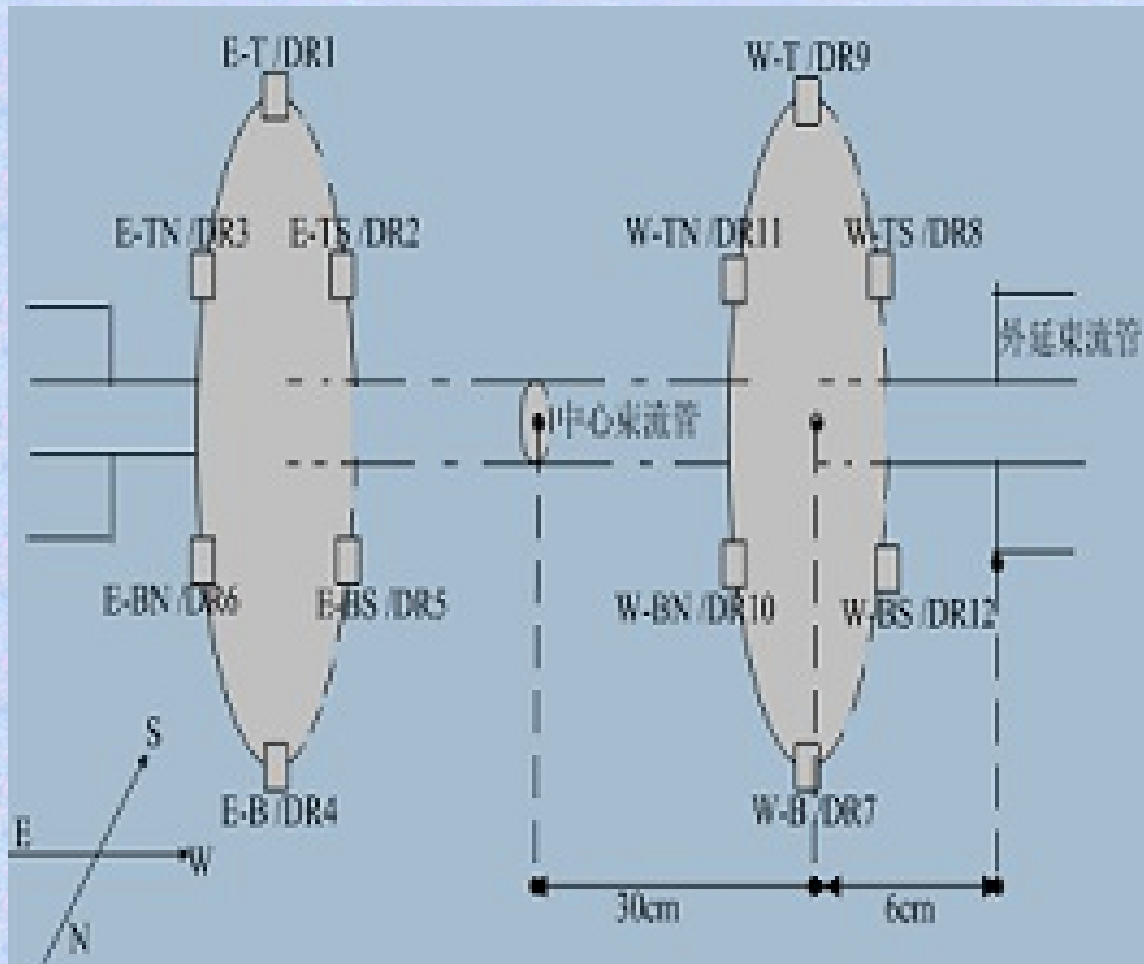
YE Mei @ Cylindrical GEM mini-Workshop

- 12 Detector input
- 1 Alarm out to Interlock
- ~220V power supply

2U Crate installed in 3rd floor of electronics hall
Communication with Ethernet



Naming Convention of the Sensor



- Readings are processed by
 - temperature compensation
 - pedestal cut
- Naming conventions
 - DR#[1-12]
 - **S** for second
 - **M** for minute
 - **D** for day



Snapshot from GUI

Pin Diode DoseRate Monitoring System

| mrad/min | | mrad/30min | | mrad/day | |
|----------|-------|------------|-------|----------|--------|
| DRM1 | 0 | DRH1 | 0.11 | DRD1 | 26.77 |
| DRM2 | 0.03 | DRH2 | 0.99 | DRD2 | 41.56 |
| DRM3 | -0.01 | DRH3 | -0.29 | DRD3 | 3.27 |
| DRM4 | 0 | DRH4 | 0.31 | DRD4 | 28.35 |
| DRM5 | 0.18 | DRH5 | 6.35 | DRD5 | 181.1 |
| DRM6 | 0.08 | DRH6 | 2.89 | DRD6 | 95.92 |
| DRM7 | 0.12 | DRH7 | 3.8 | DRD7 | 85.6 |
| DRM8 | 0.15 | DRH8 | 5.25 | DRD8 | 136.35 |
| DRM9 | 0.14 | DRH9 | 4.4 | DRD9 | 93.29 |
| DRM10 | 0.03 | DRH10 | 1.15 | DRD10 | 44.3 |
| DRM11 | 0.41 | DRH11 | 12.76 | DRD11 | 309.8 |
| DRM12 | 0.2 | DRH12 | 6.34 | DRD12 | 120.35 |

DoseRate_Status



BEPC_Status

Syn_Mode

Running

Normal_Stop

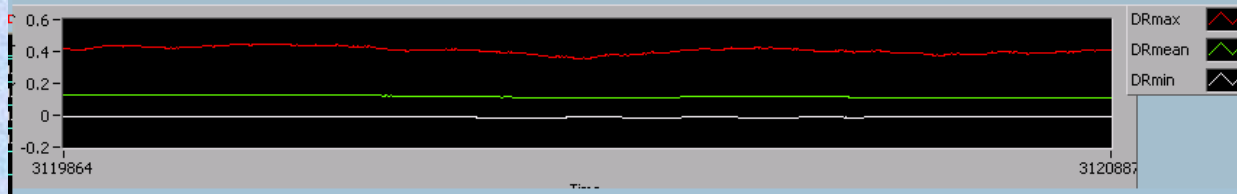
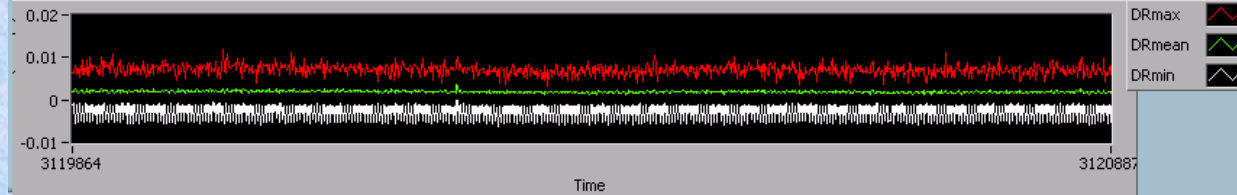
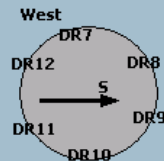
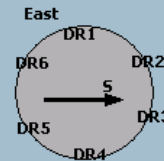
Emergent_Stop


Colliding



Injecting

Entrance Door

TCB1_State



 DoseRate Monitor 

DAQ Watch dog  DB Watch Dog 

Start Time: 2008-12-02 12:36:36

Last Update: 2009-01-07 15:32:30

Run Counter: 3120933

Error Sound Enable

Alarm Sound Enable

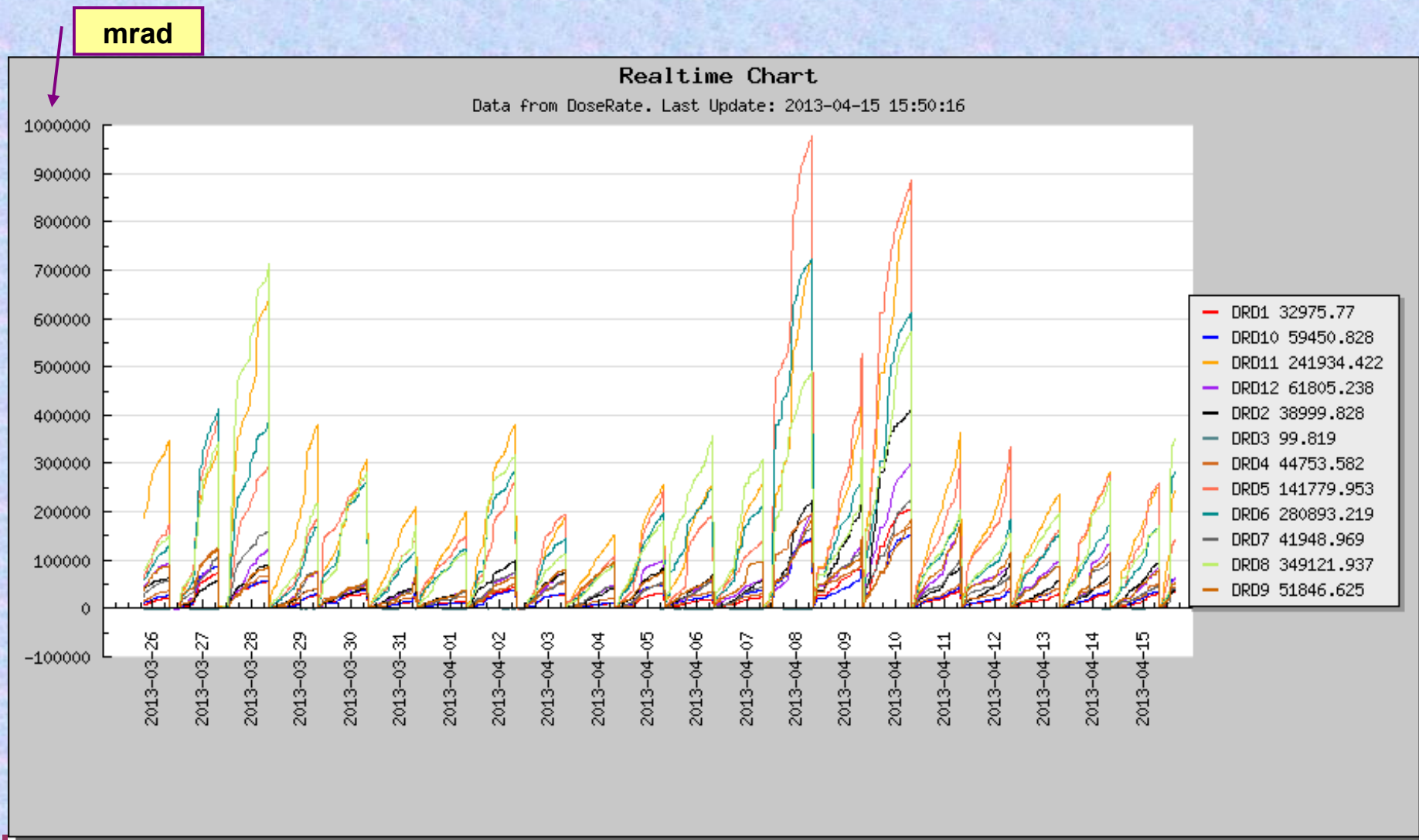
min  max

pedestal

STOP

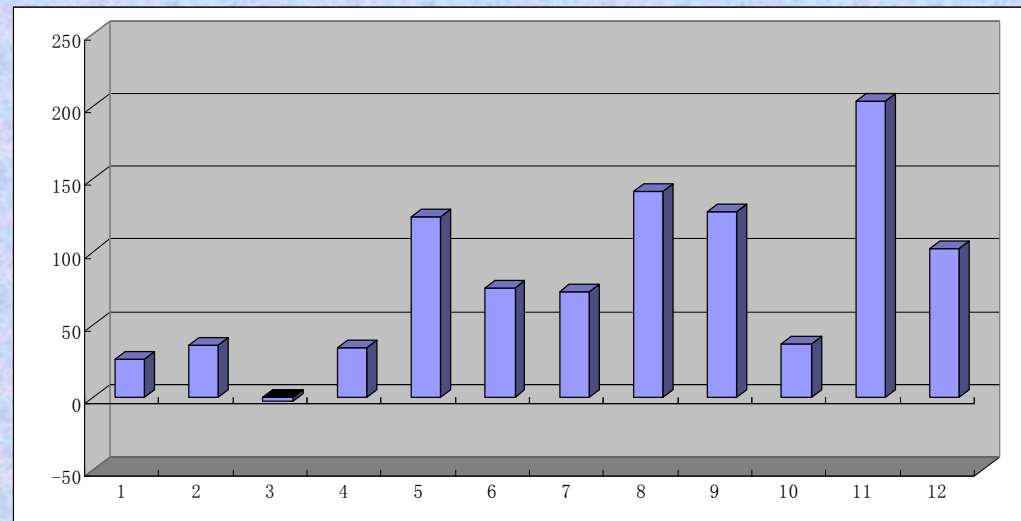
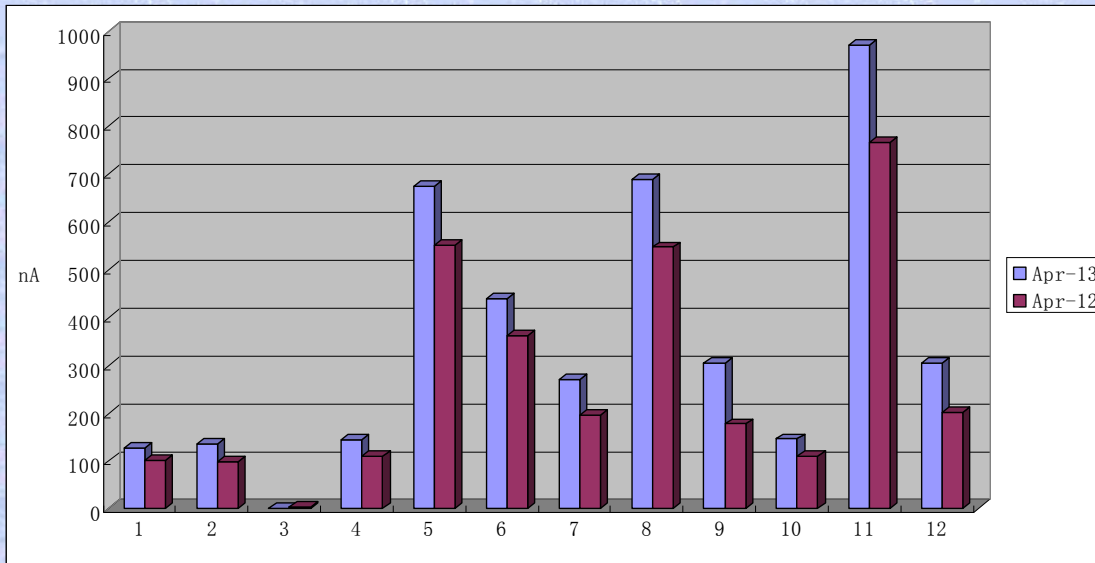


12 Pin Diodes Dose Rate per Day





Dark current DR#[1-12]

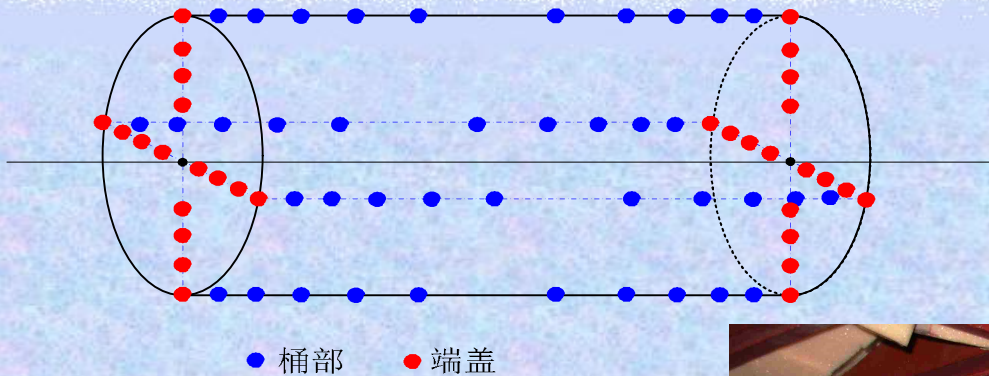


- Current comparison (nA)
 - DR#1-#12
 - 14 Apr. 2012
 - 14 Apr. 2013

- Difference
- The measurement accuracy is affected by radiation injury

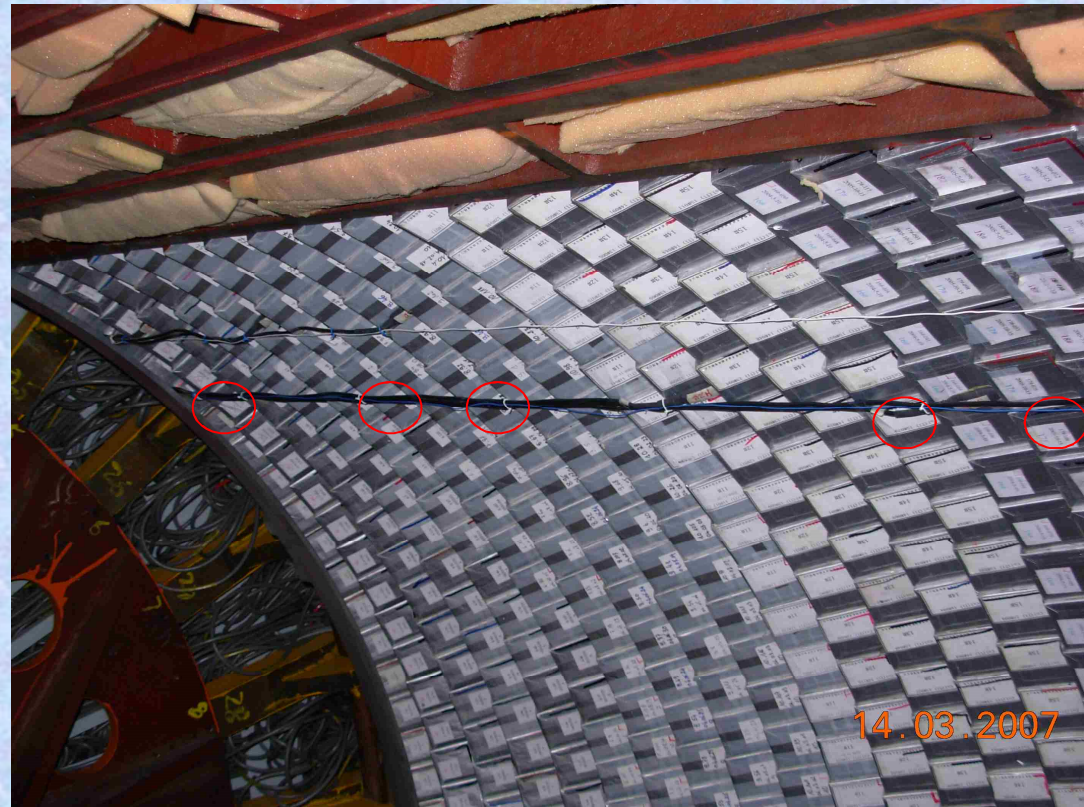


Integrated Dose Monitor - RadFETs



- Distribution of 72 RadFETs
 - 40 for barrel EMC
 - 32 for Endcap EMC

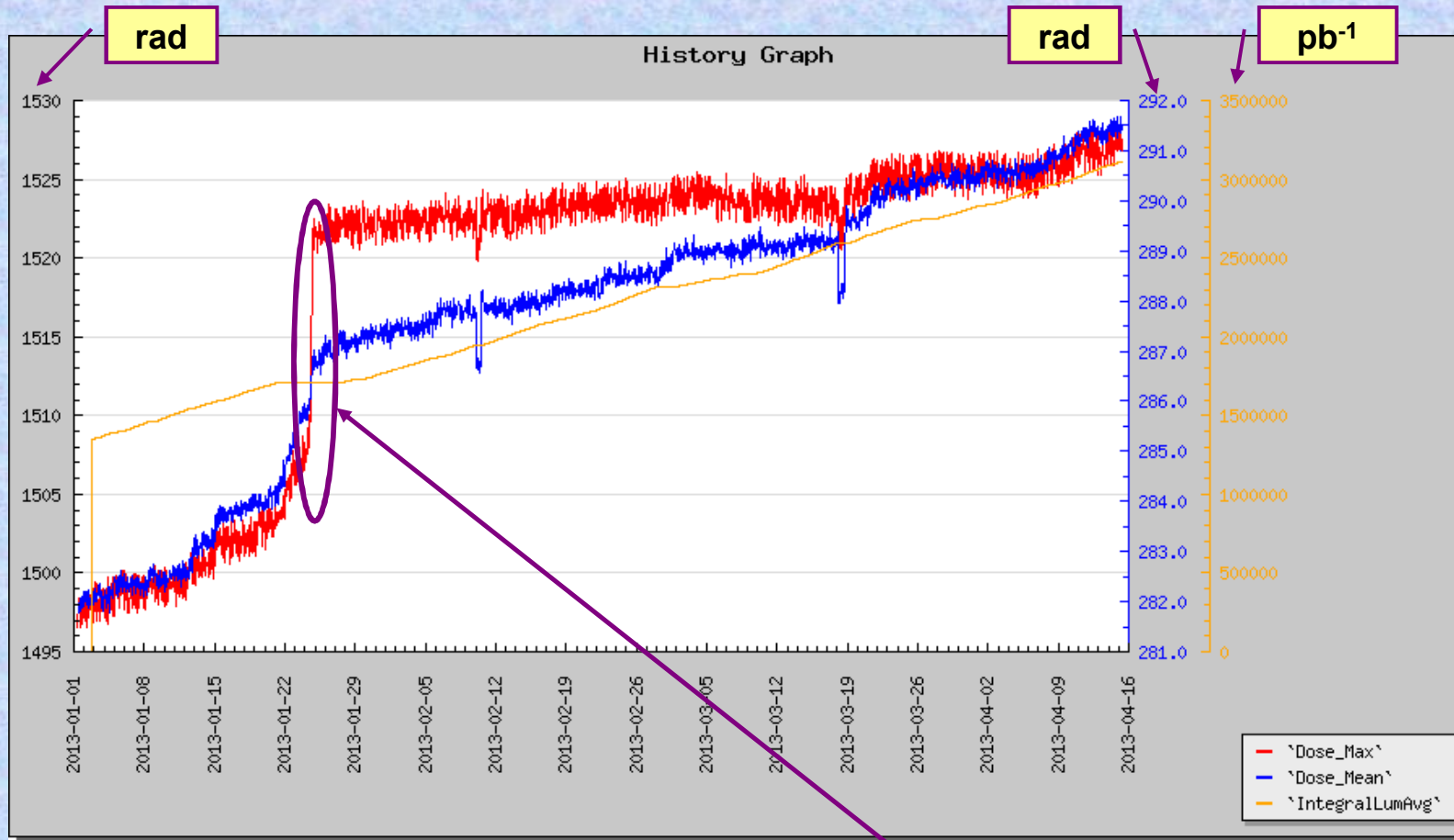
- Readout Electronics
 - 3U Crate
 - 8 boards, 10 channels each
 - ~220V Power Supply
- Communication with Ethernet





Integrated Dose Rate from RedFET

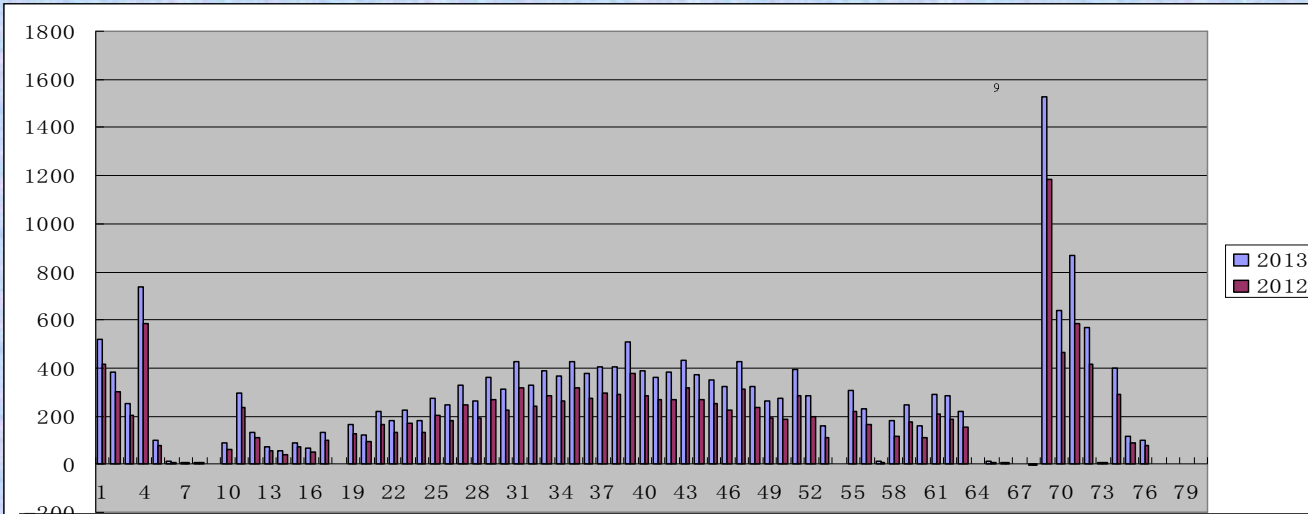
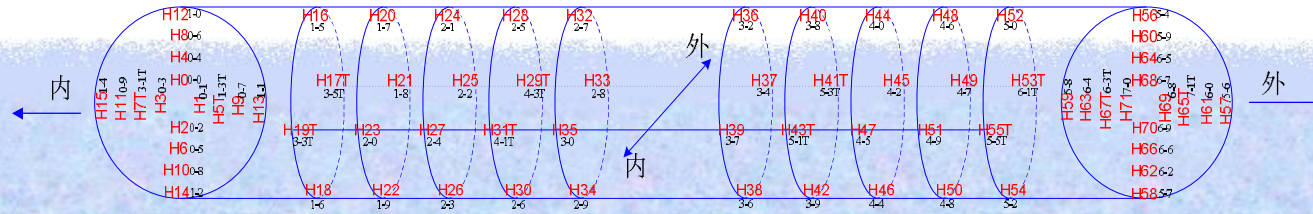
Integral luminosity average vs Dose_max and Dose_mean



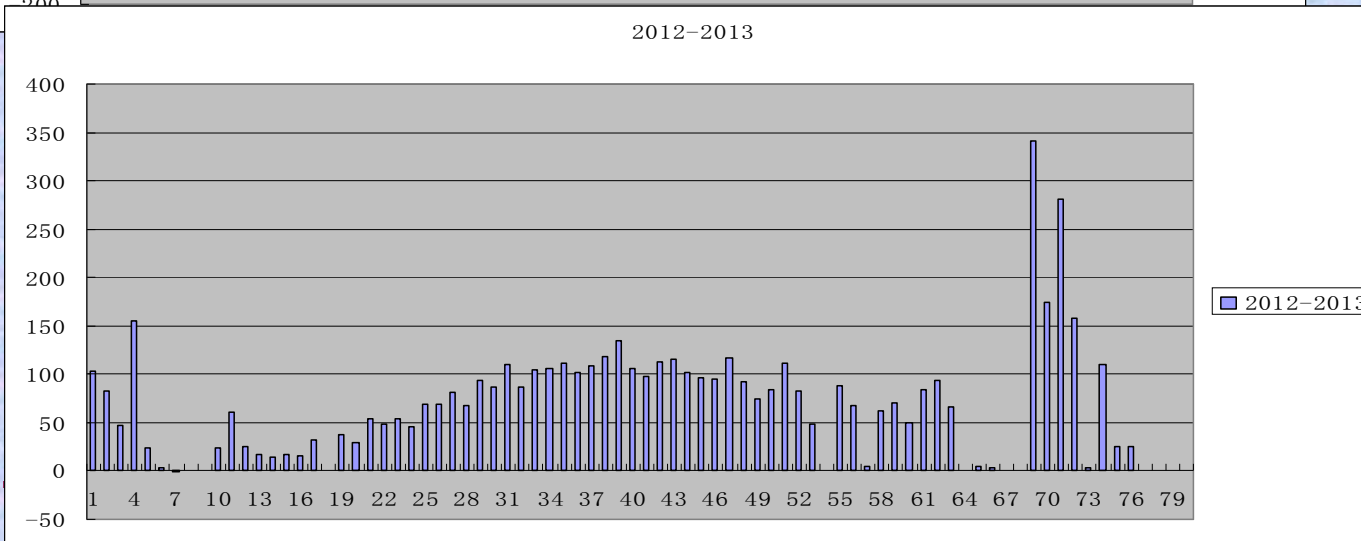
beam adjusting



Integral RedFETs for each point (14 Apr. 2012 –14 Apr. 2013)



2012-2013





Where to find the data

- The dose rate can be retrieved from the webpage of slow control
- Background → DoseRate → DRD, DRM, DRS
- Background → RedFET → Dose_max, Dose_mean
- DAQ RUN INFO → IntergralLumAvg
- Reference webpage
 - <http://bes3.ihep.ac.cn/> or Inner ip
<http://192.168.43.211/cxh/SlowWeb/index.php>
 - Historical data backup before Oct. 2011 retrieved from inner ip: <http://192.168.37.164/SlowWeb/index.php>



Background Study

- The background affected by many factors
 - synchrotron radiation
 - beam-gas interactions
 - Touschek effect
 - injection loss
- A lot of work have been done
 - Simulated background study
 - Count rate from MDC chamber
 - Circulating beam experiment
 - Trg rate & DAQ event rate?
- Running background



Requirement issues

- Current status
 - Real time monitoring from the local software
 - There are no measurement for integral dose rate near IP till now
- There are many work to do for background study



Thank You!



PIN Diodes at Endcap EMC

- Horizontal Inner/outer
- East/West

