KIMS MUD data analysis

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2011/2/8

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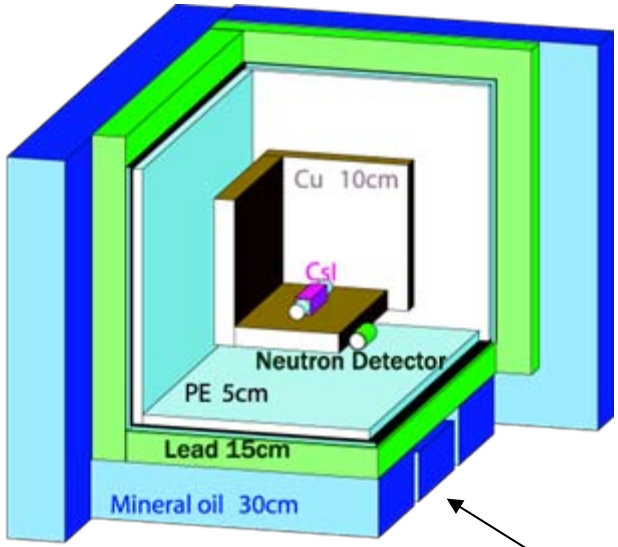
The KIMS Yangyang Underground Laboratory

Aim: Search for the dark matter candidate
(Weakly Interacting Massive Particles)

The method: Detect the recoiling signal
of WIMPs with PMT attached on CSI crystal

Background and rejection method
gamma: Pulse shape discrimination
neutron: Neutron detector and simulation
Muon: The MUD detector



Muon backgrounds in the laboratory

- The high energy muon can pass through an underground in depth.
- High energy muon can produce the neutron inside the shield structure of the detector
- High energy muon event has long tail, so this tail event can be detected as the low energy signal.
- Measured Muon flux ->2.7×10^{-7} /cm^2/s

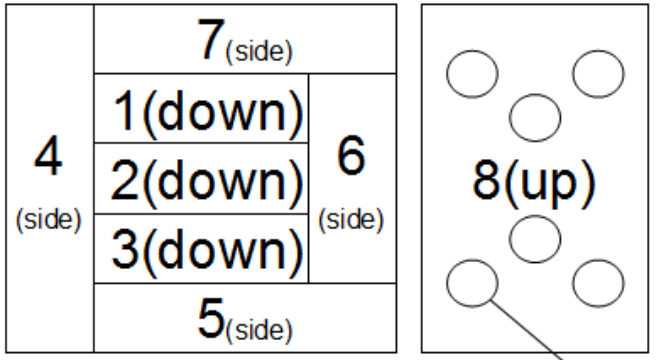
MUD Detector

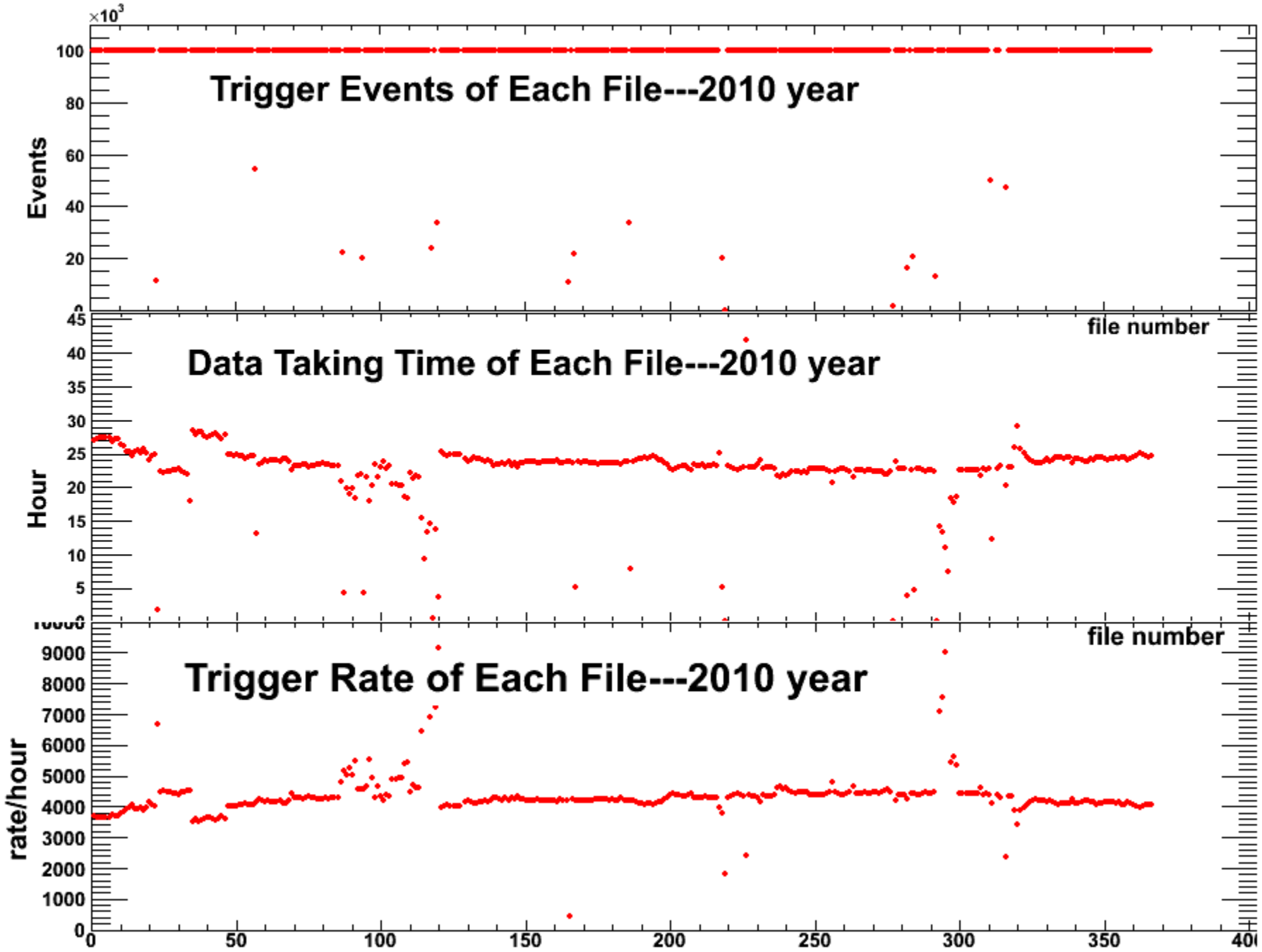
Component:
Liquid Scintillator 5% ,Mineral Oil 95%
8 muon modules , 28 signal channels,
2 PMT for each channel

The trigger: At least two channels in one detector have signal

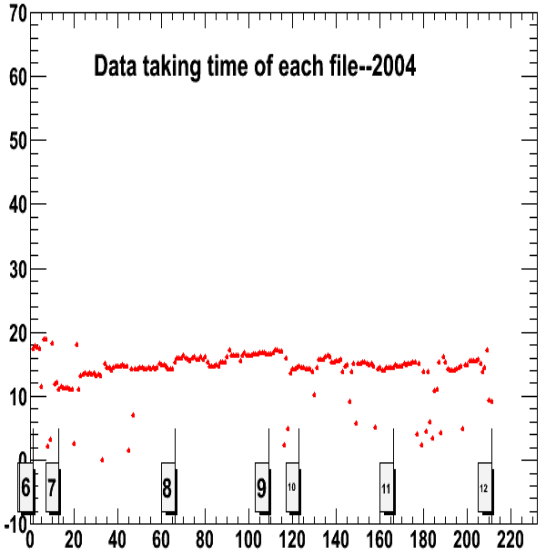
The readout:

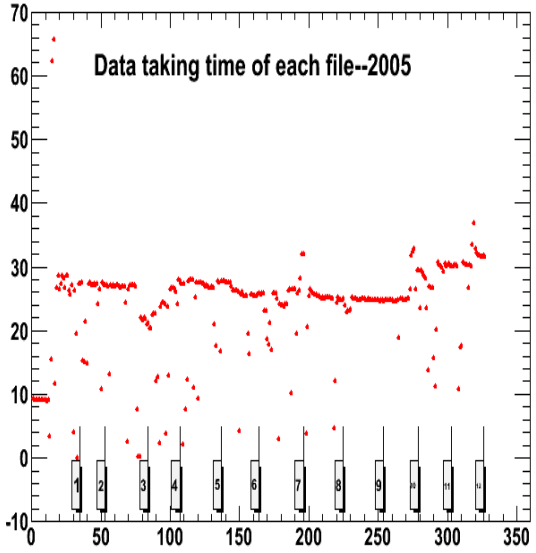
1(bottom): adc0~adc1
2(bottom): adc2~adc3
3(bottom): adc4~adc5
4(side): adc6~adc9
5(side): adc10~adc13
6(side): adc14~adc17
7(side): adc18~adc21
8(top): adc22~adc27

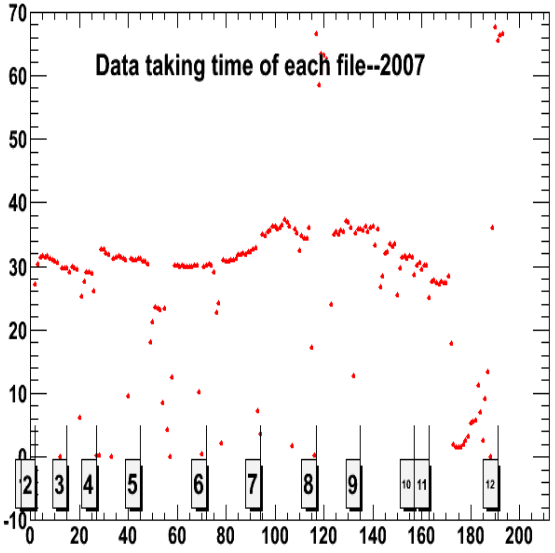


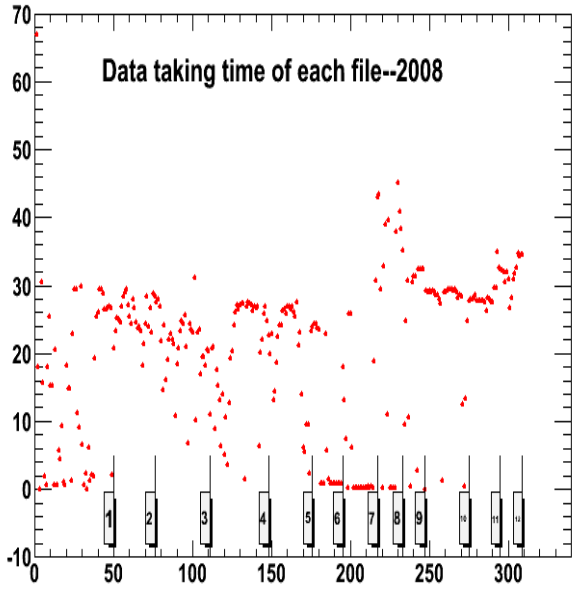

Trigger Events of Each File---2010 year
Events
×10^3
Data Taking Time of Each File---2010 year
Hour
file number
Trigger Rate of Each File---2010 year
rate/hour
file number

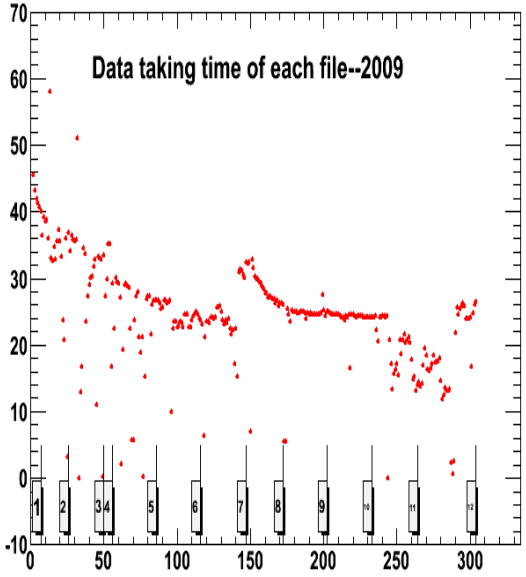
The data taking time(hour) of each file

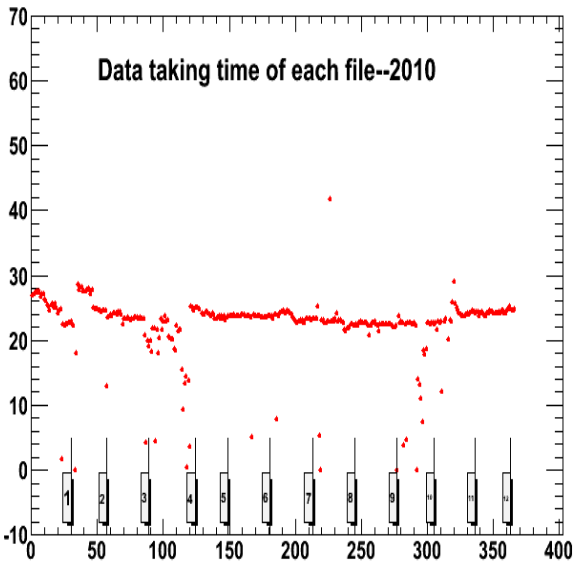






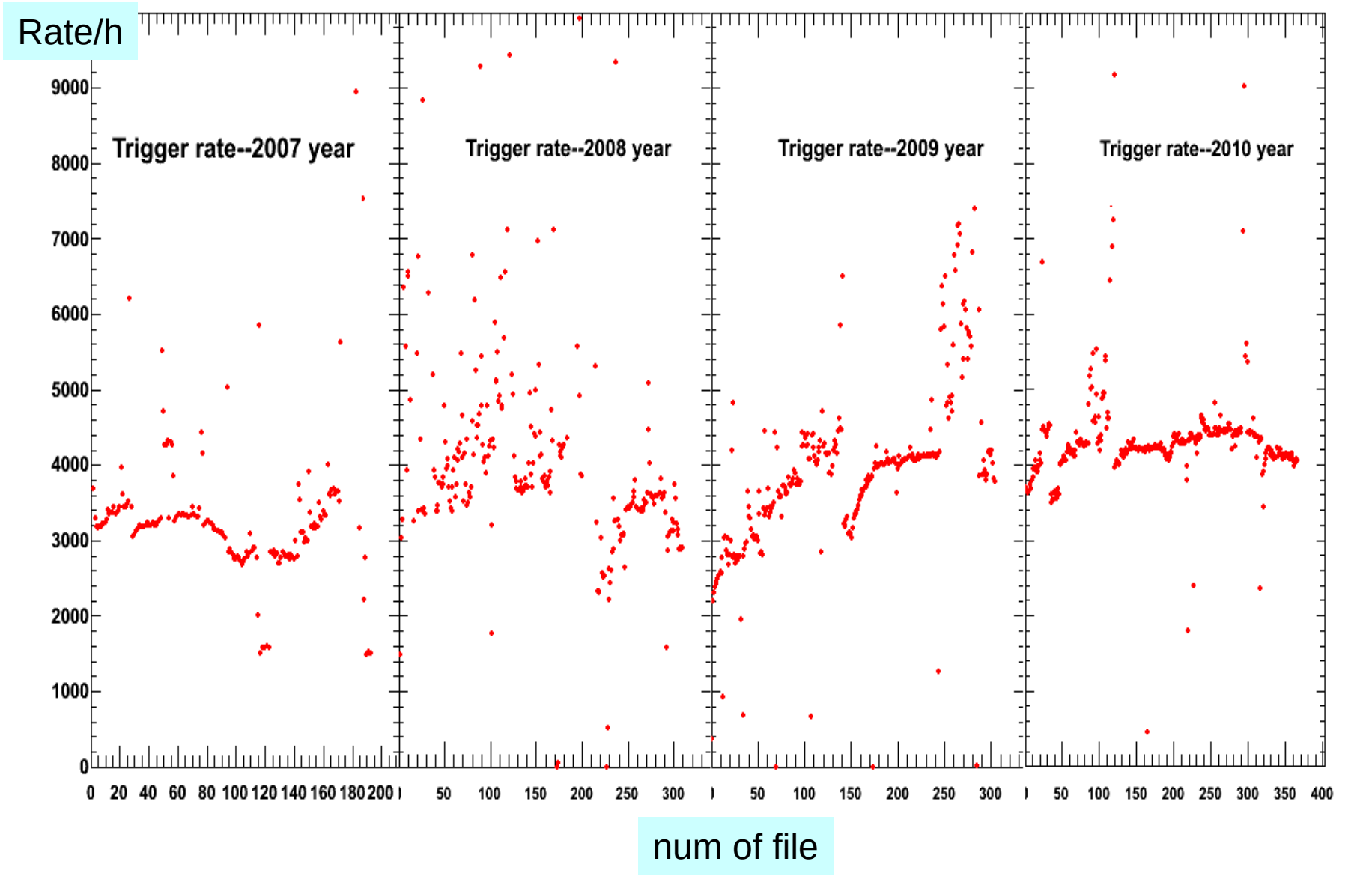






Xtit: num of file, ytit: hour

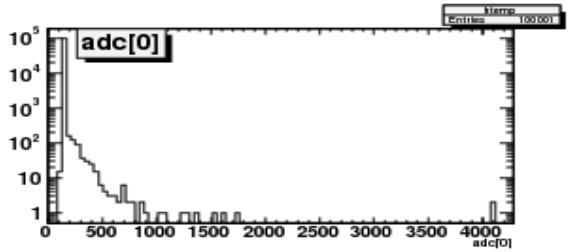
The trigger rate of every file

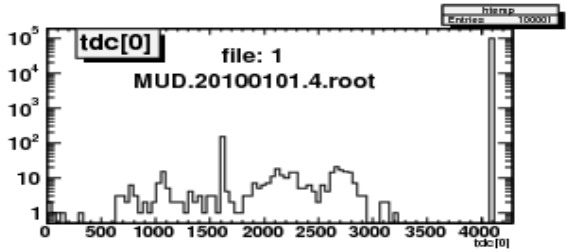


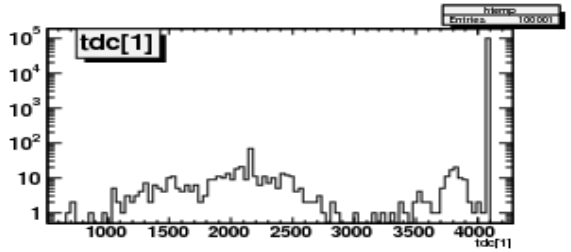
MUD data taking time of each year

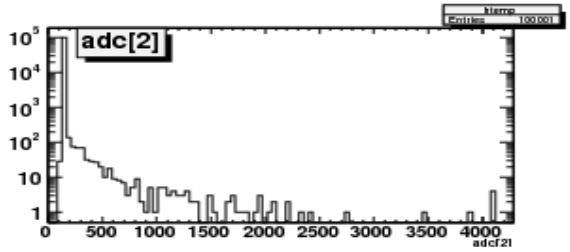
Year	month	Nfiles	Total time	File with too long time	File with too Short time	File with normal time
2004	7-12	211	2935.48 h 122.3 days	40.1147 h 1.37%	0	2895.36 h 98.63%
2005	1-12	326	7779.86 h 324.2 days	338.328 h 4.35%	128.04 h 1.645%	7313.5 h 94.00%
2006	1-12					
2007	3-11	191	5316.64 h 221.5 days	153.732 h 2.89%	579.90 h 10.907%	4583 h 86.201%
2008	1-12	309	6229.19 h 259.5 days	422.07 h 6.78%	239.2 h 3.84%	5567.92 h 89.38%
2009	1-12	304	7512.13 h 313.0 days	271.81 h 3.62%	530.04 h 7.06%	6710.29 h 89.33%
2010	1-12	363	8159.54 h 340.0 days	163.443 2.003%	41.8636 0.51306%	7954.23 97.49%

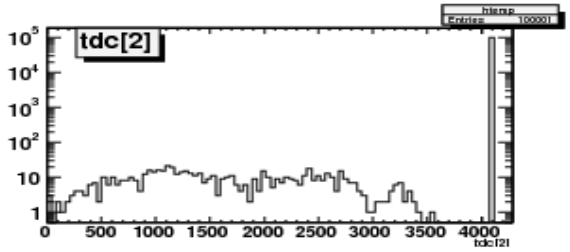
Monitor the condition of every file

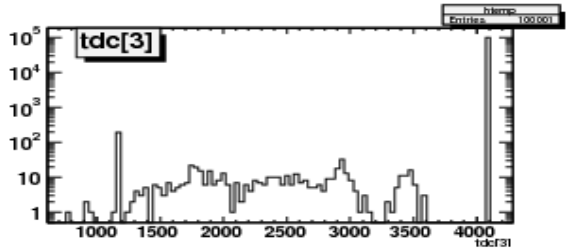


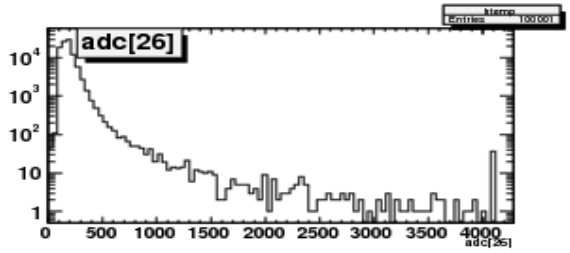


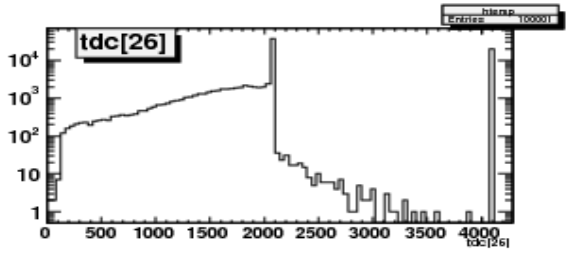


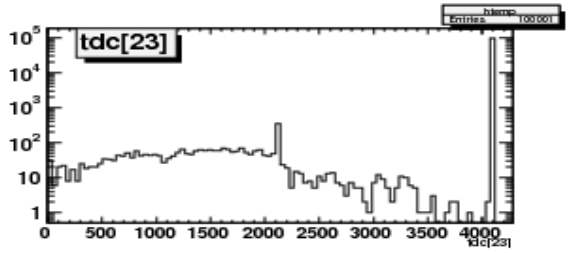


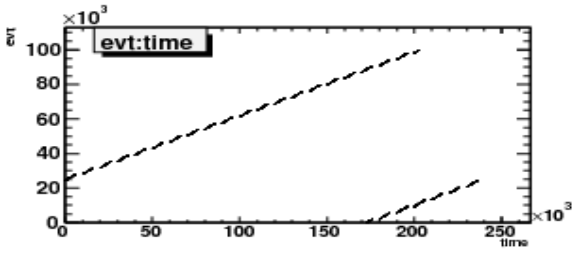


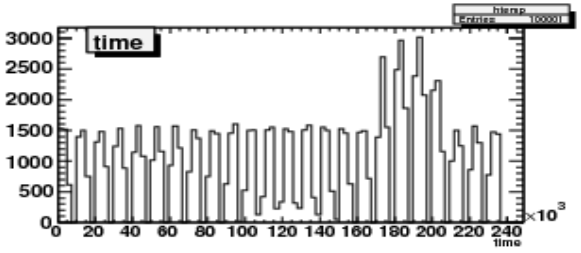












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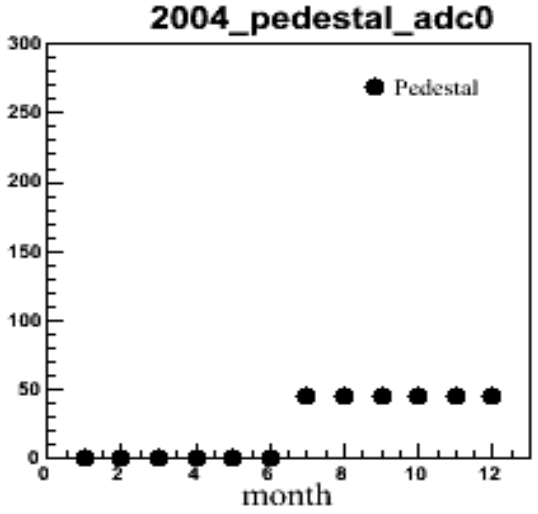
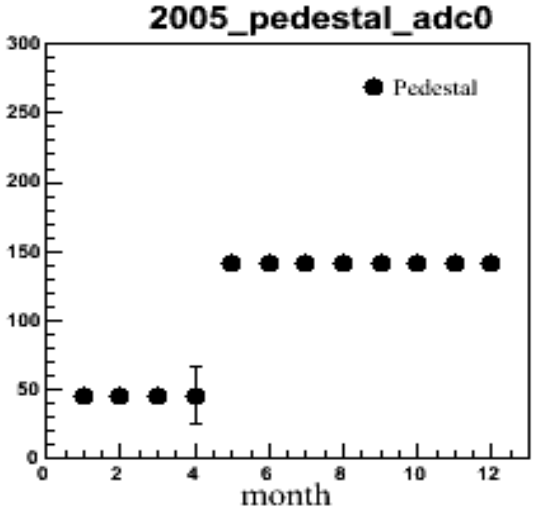
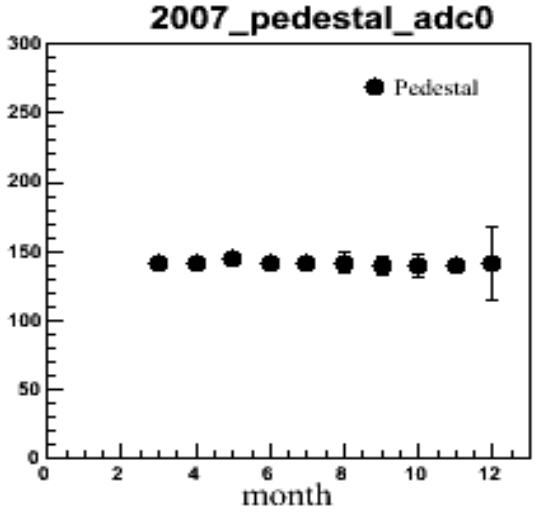
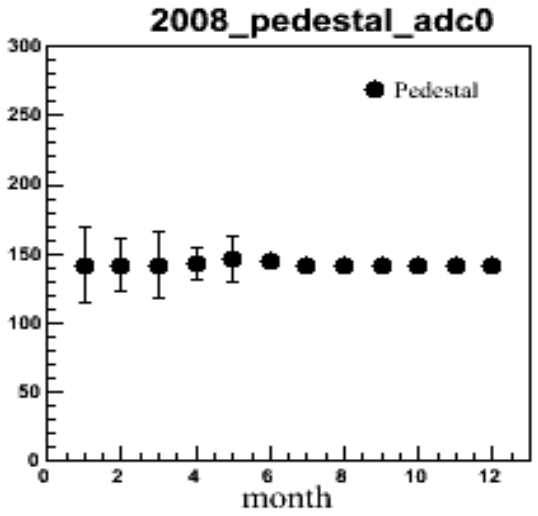
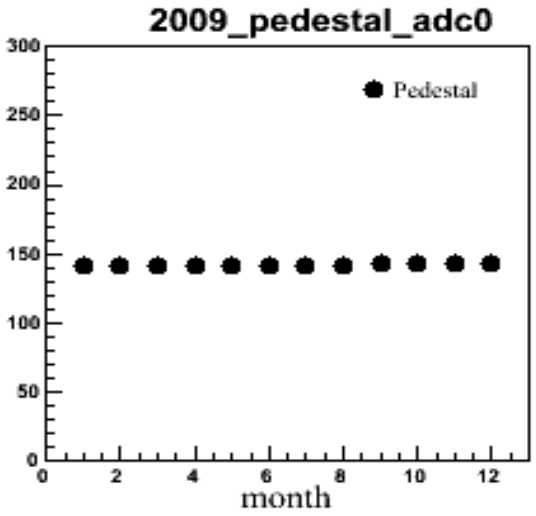
Monitor the Pedestal of adc0

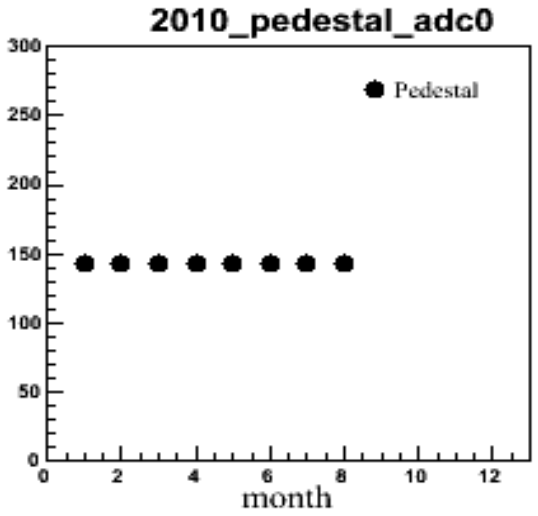




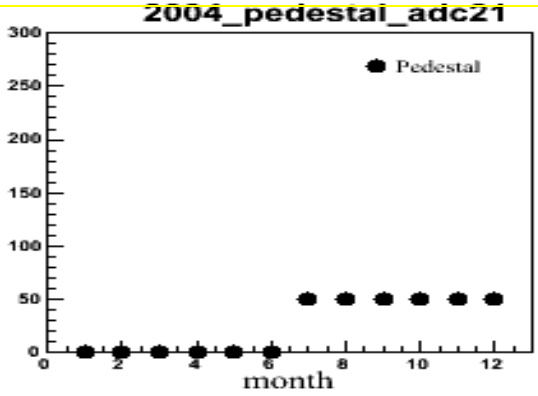


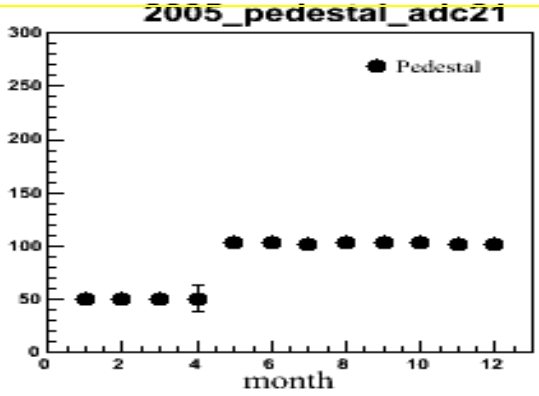


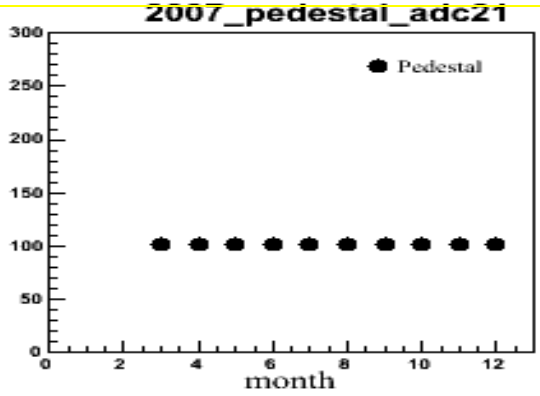


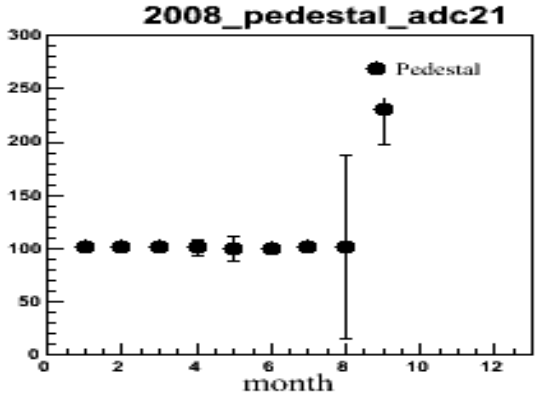


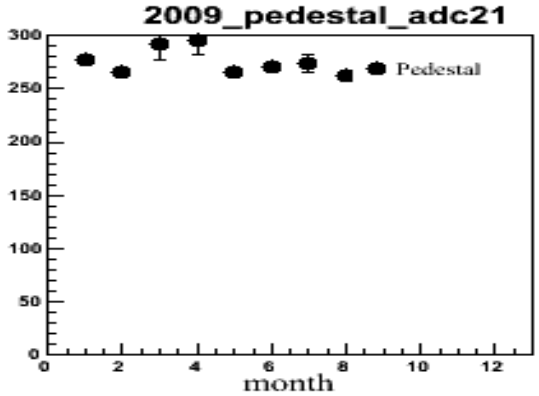
Monitor the Pedestal of adc21 - side

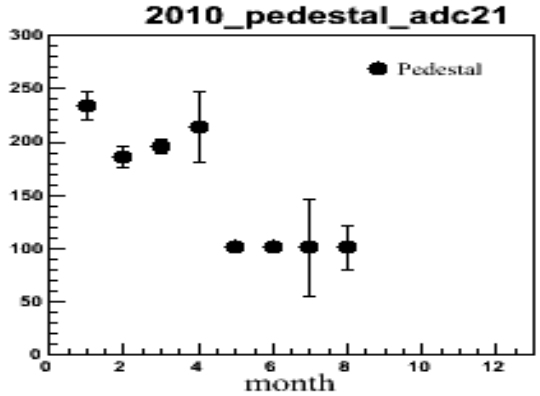


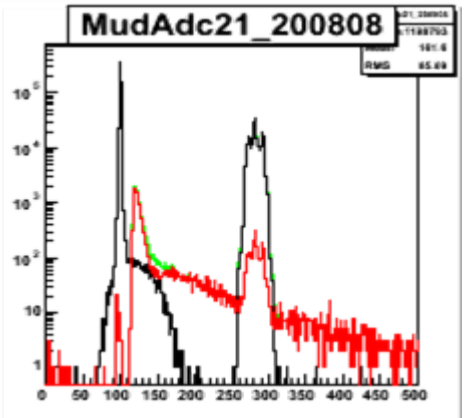


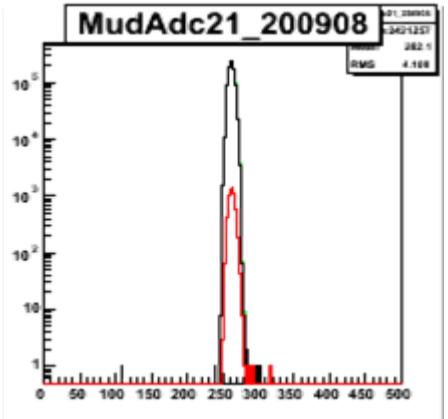


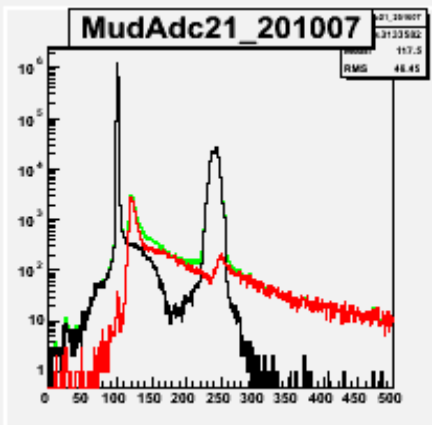




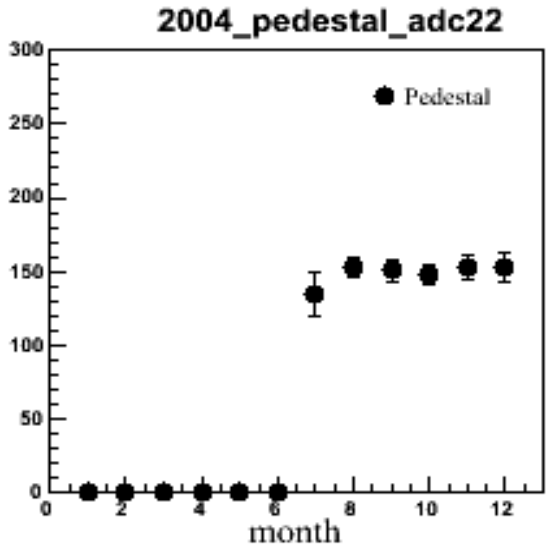


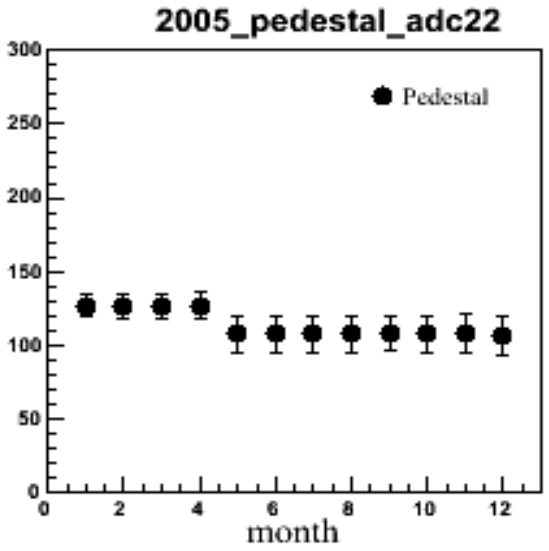


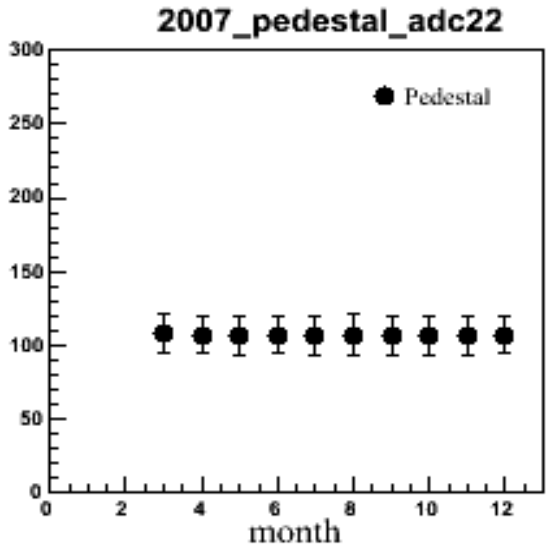


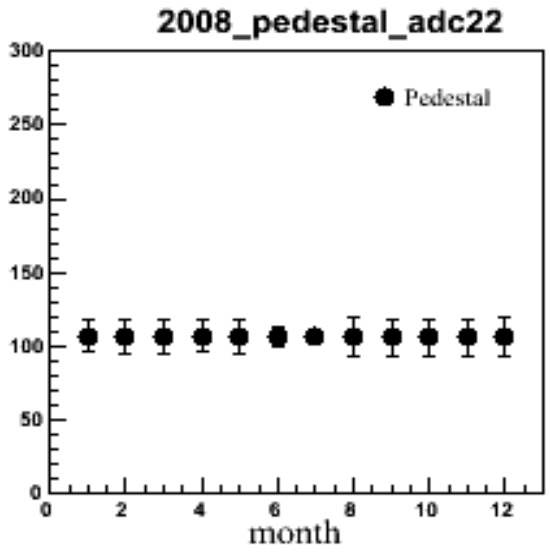


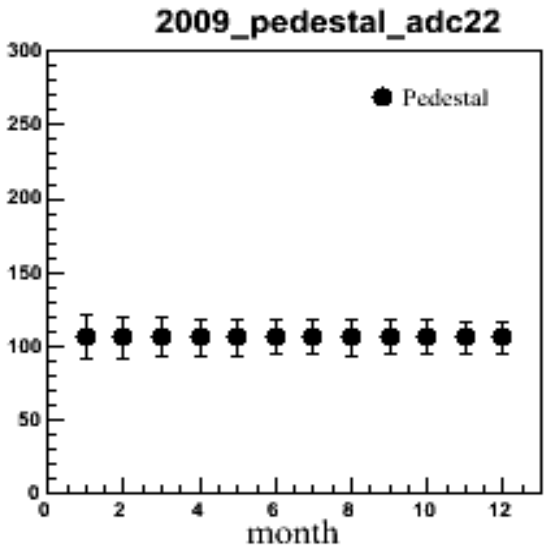
Monitor the Pedestal of adc22 - top

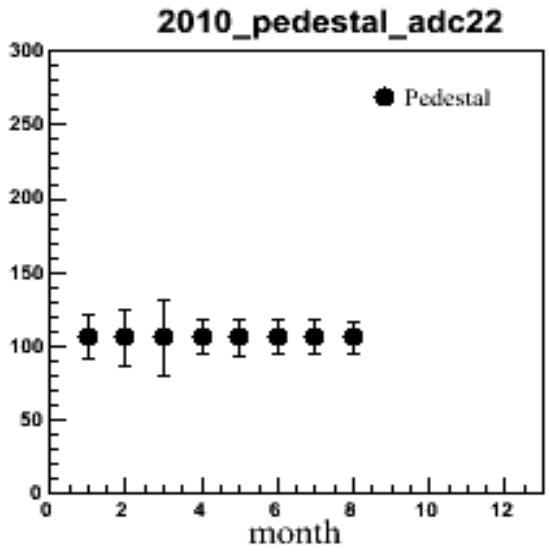




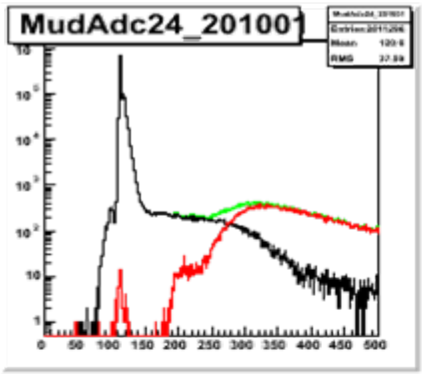


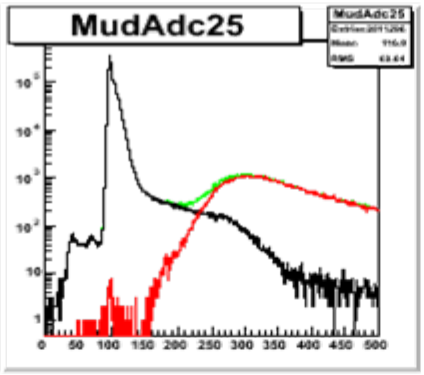


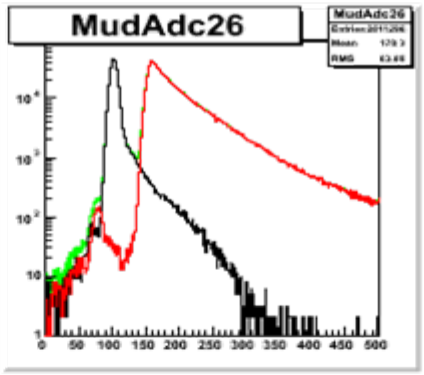


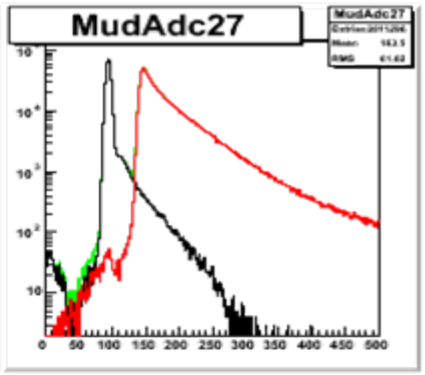


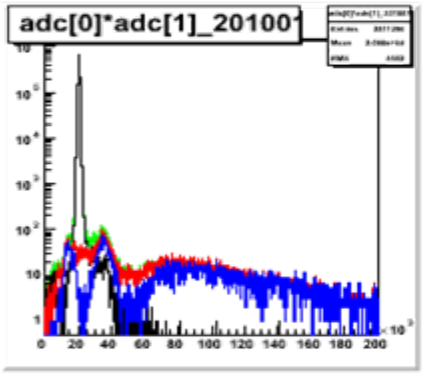
Optimize the selection criteria

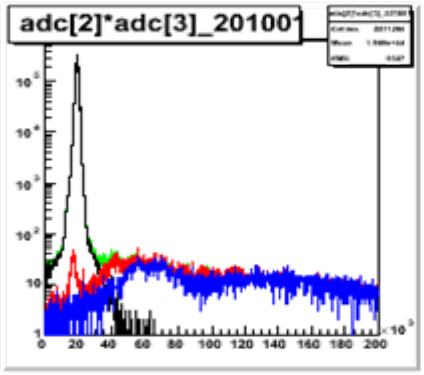


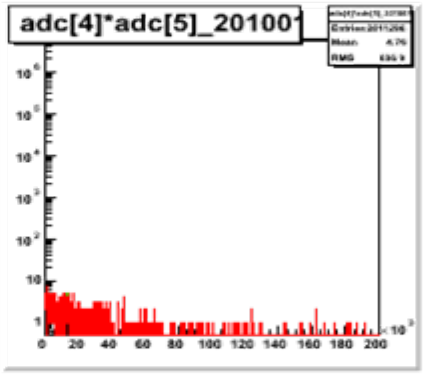


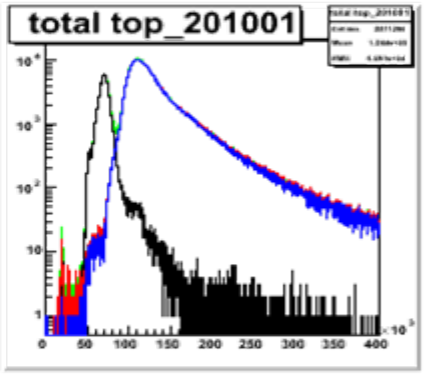


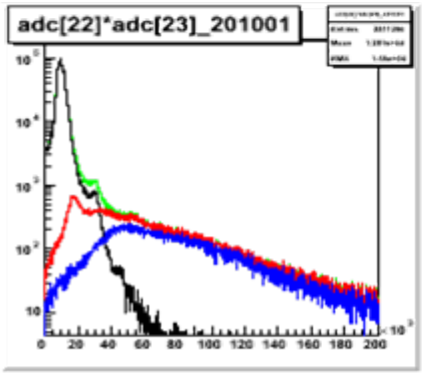


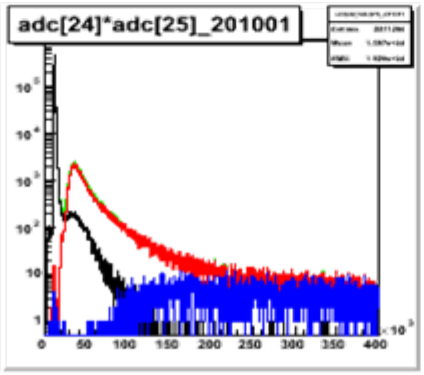


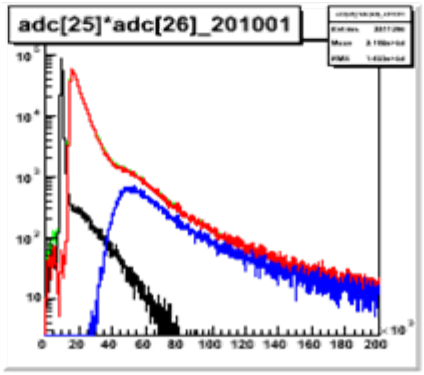


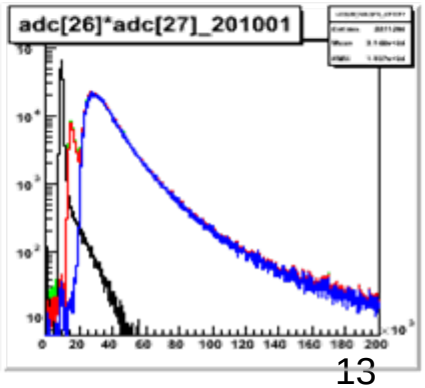




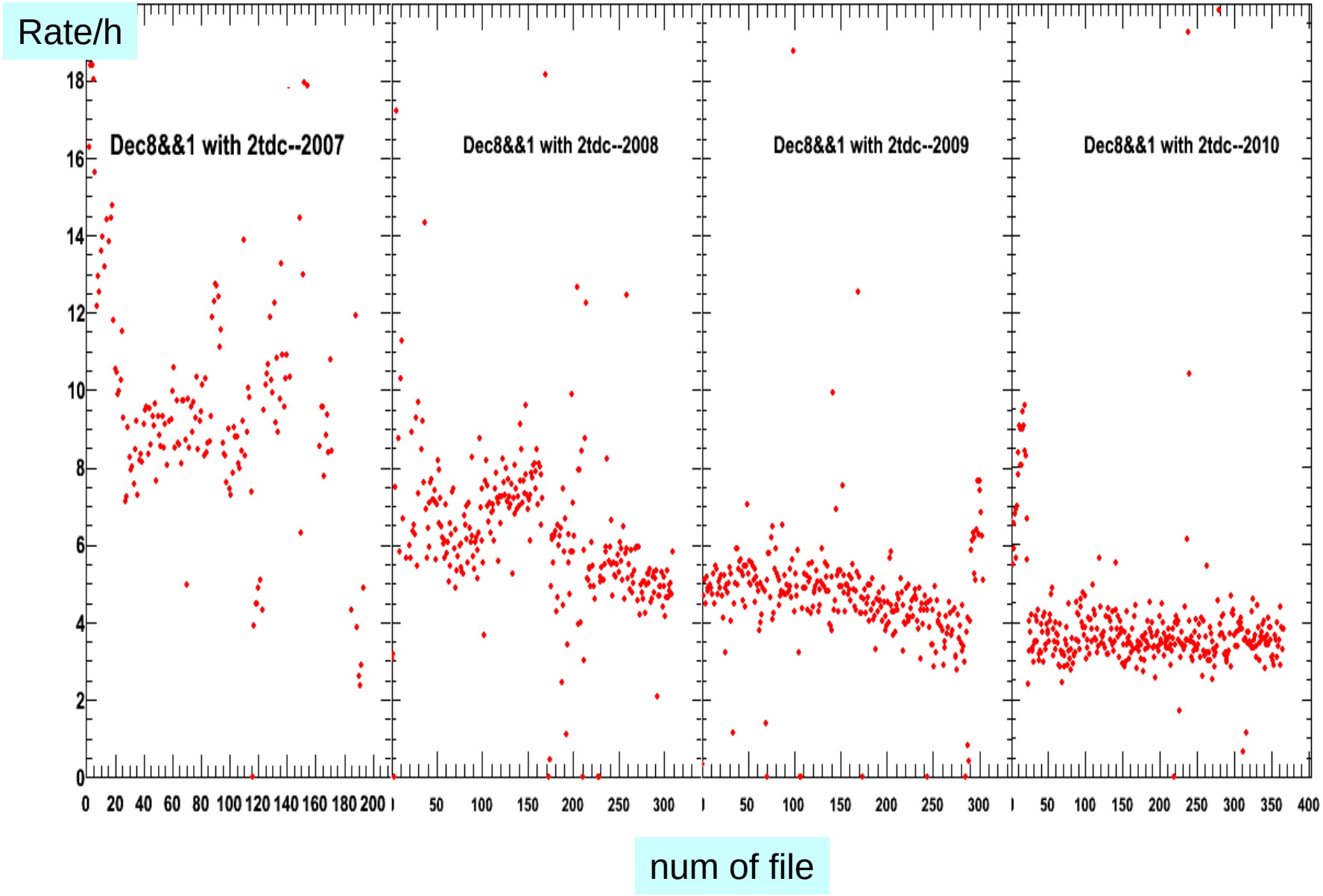




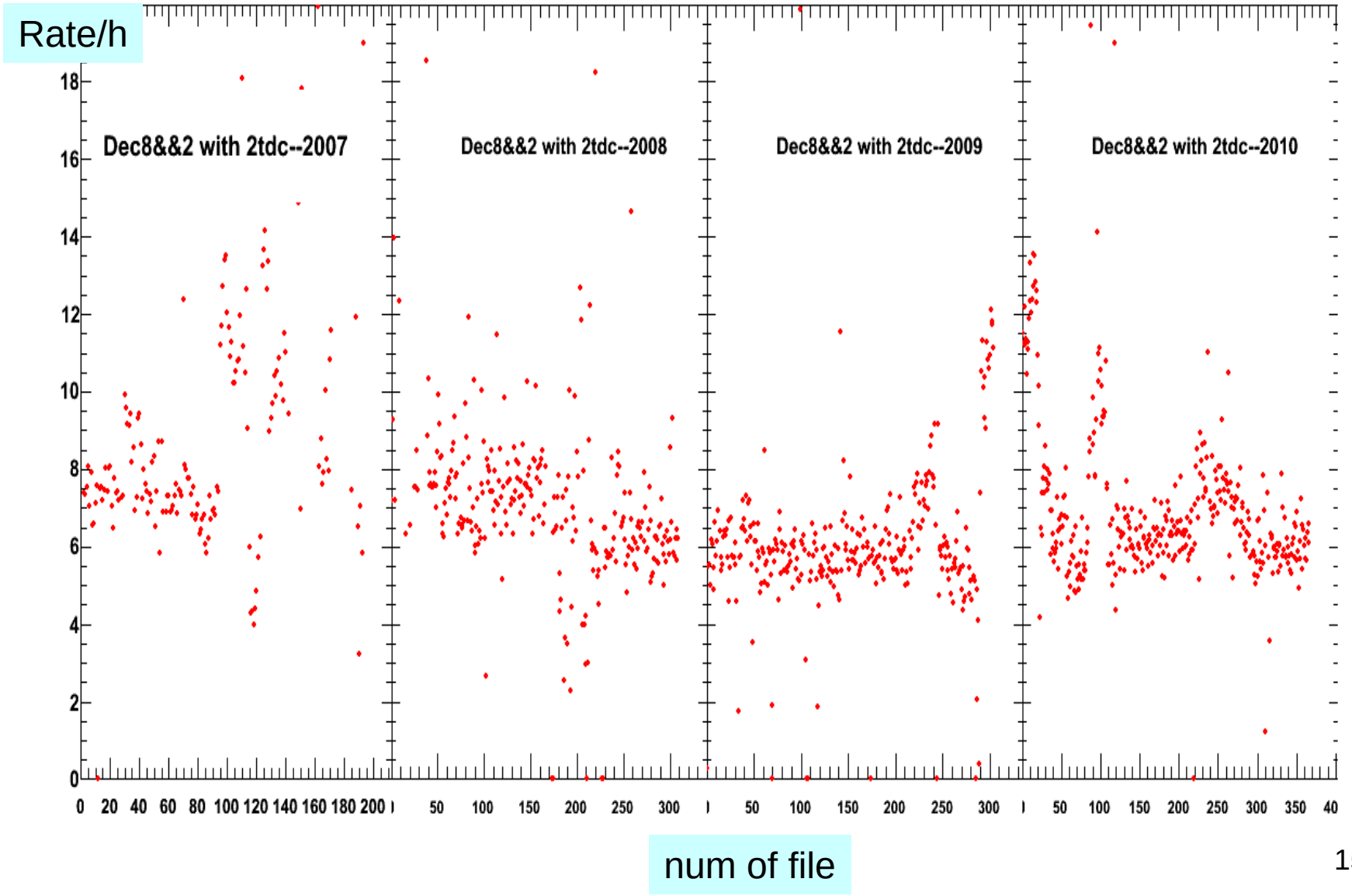




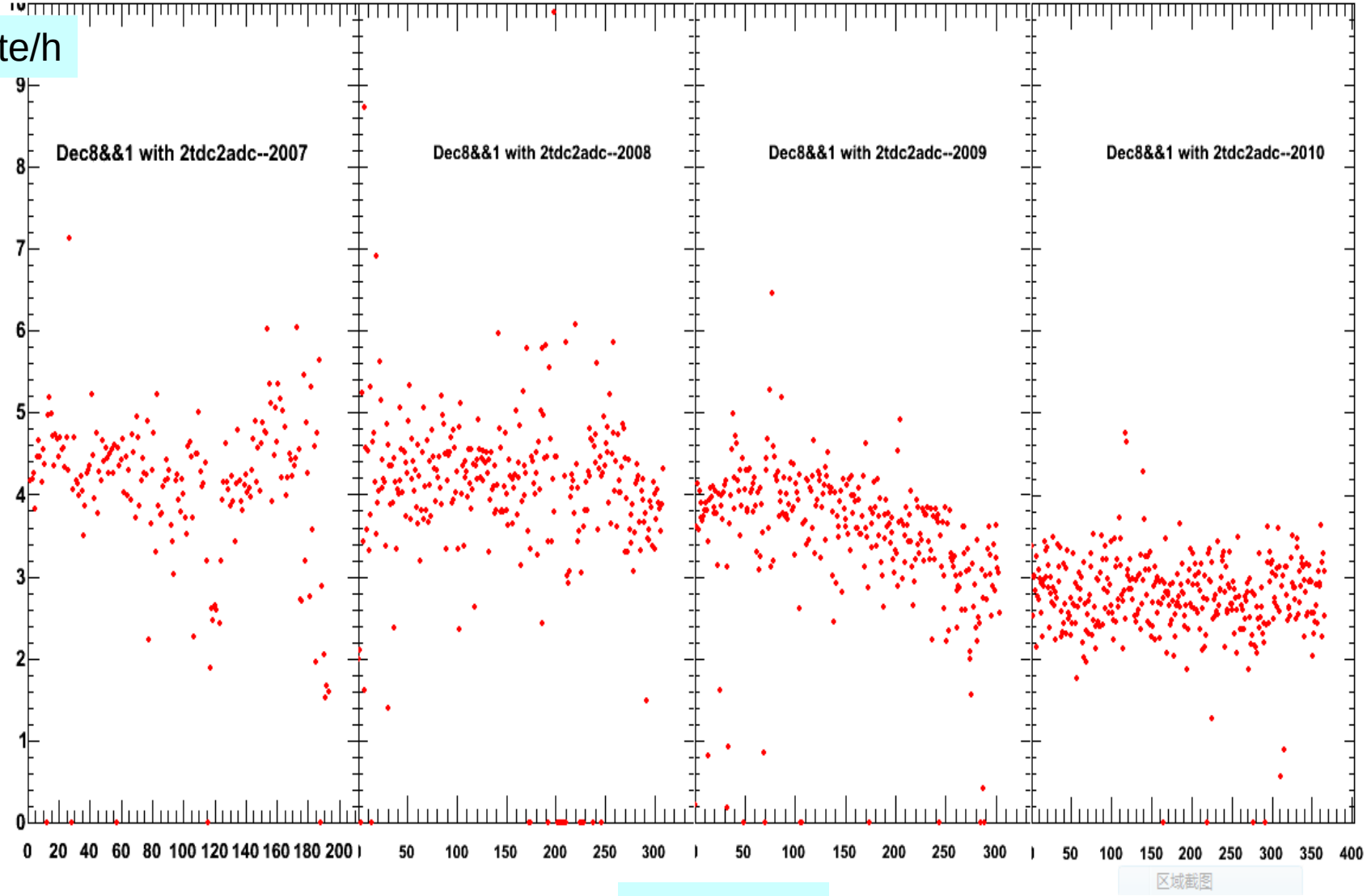
The rate of detector 1&&8 with 2tdc cut



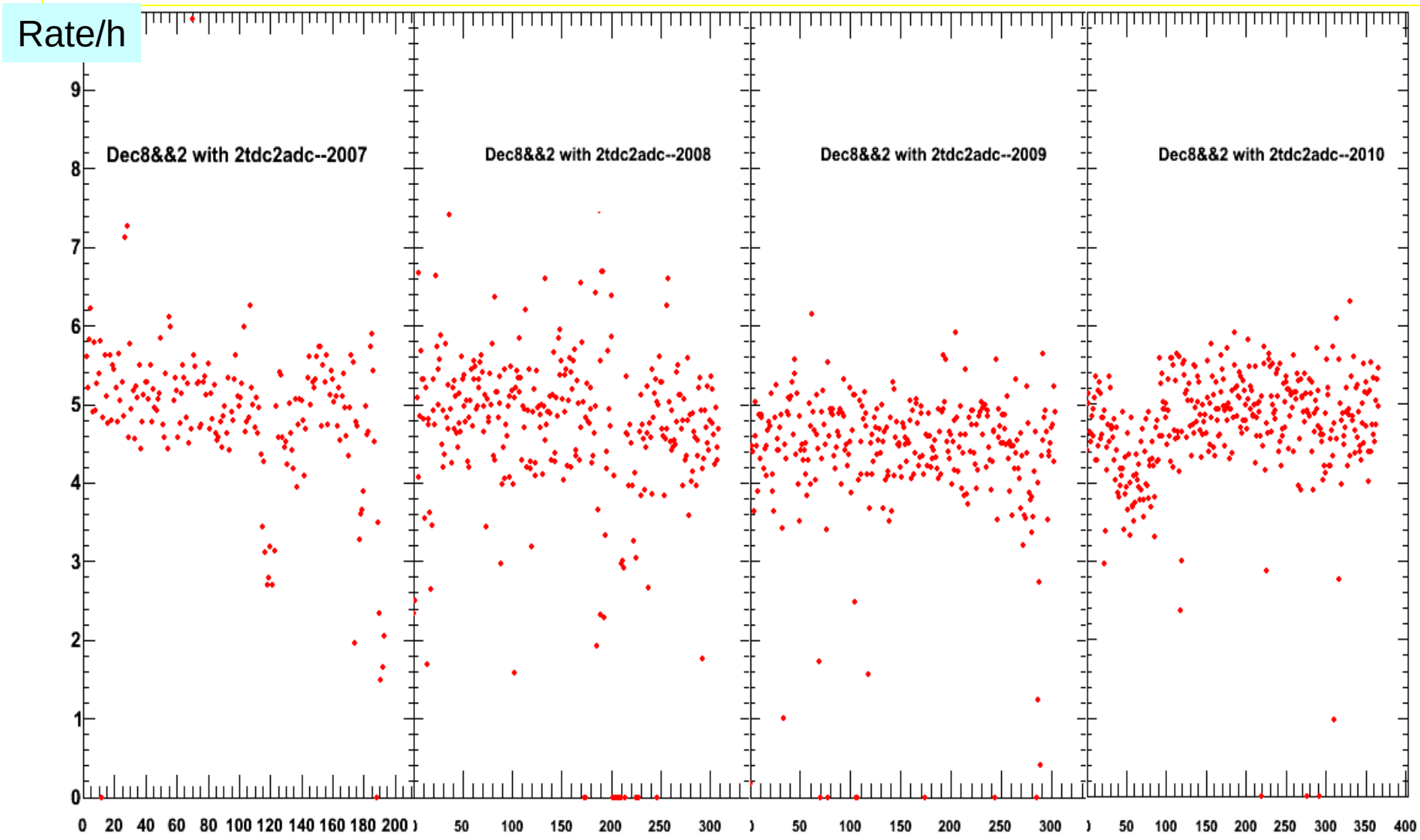
The rate of detector 2&&8 with 2tdc cut



The rate of detector 1&&8 with tdc and adc cut

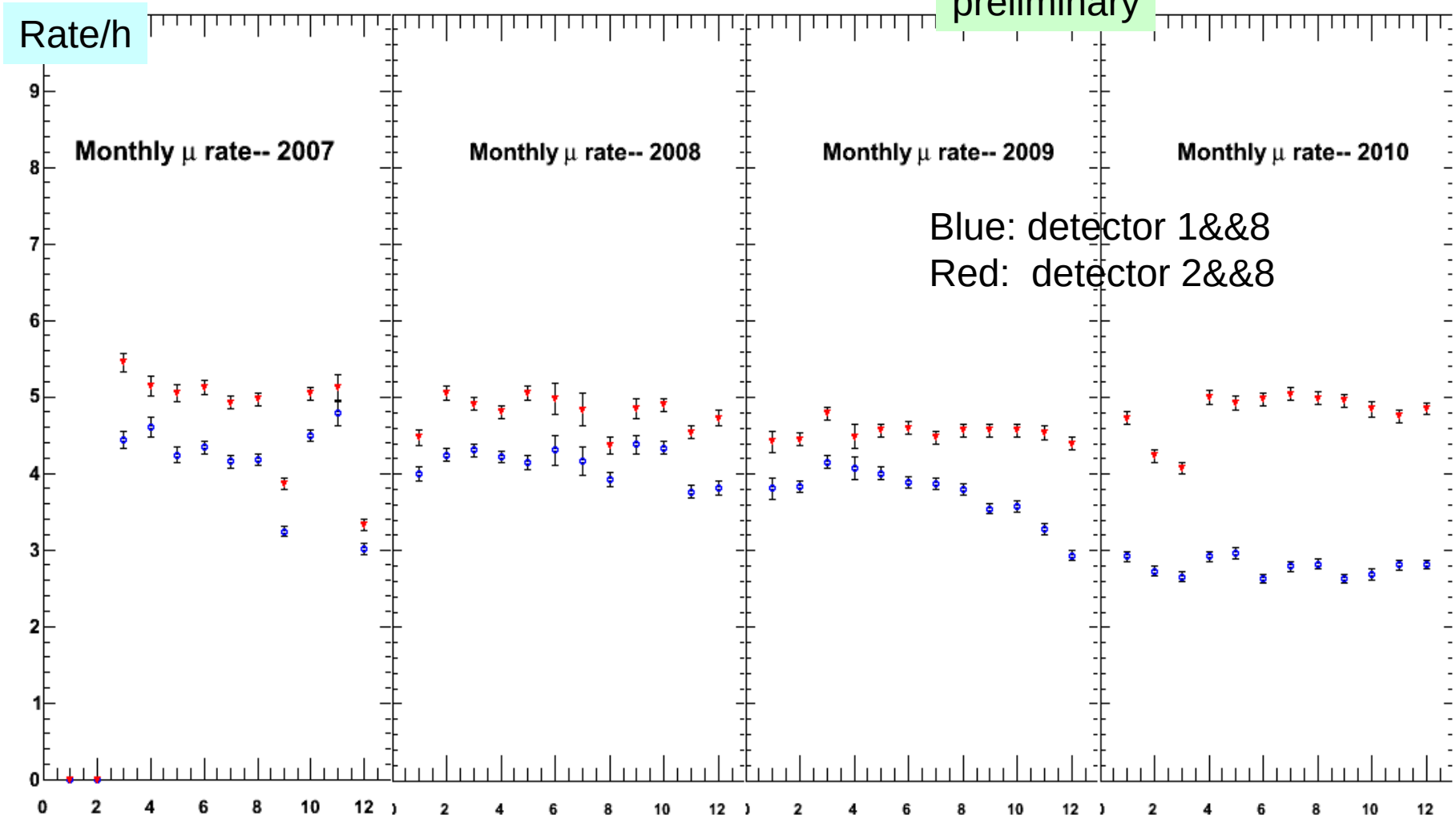


The rate of detector 2&&8 with tdc and adc cut



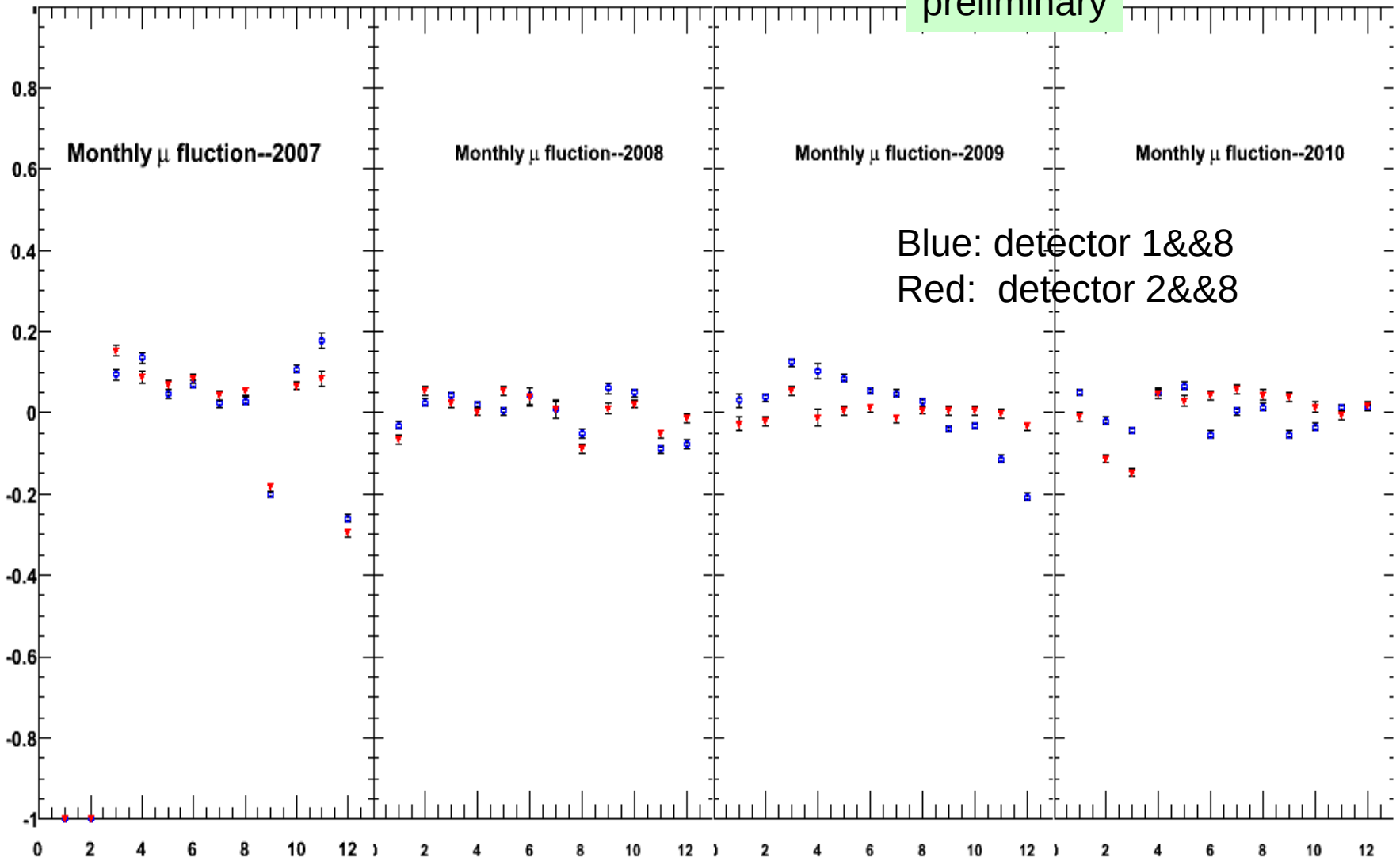
Monthly muon rate of detector top and bottom

preliminary

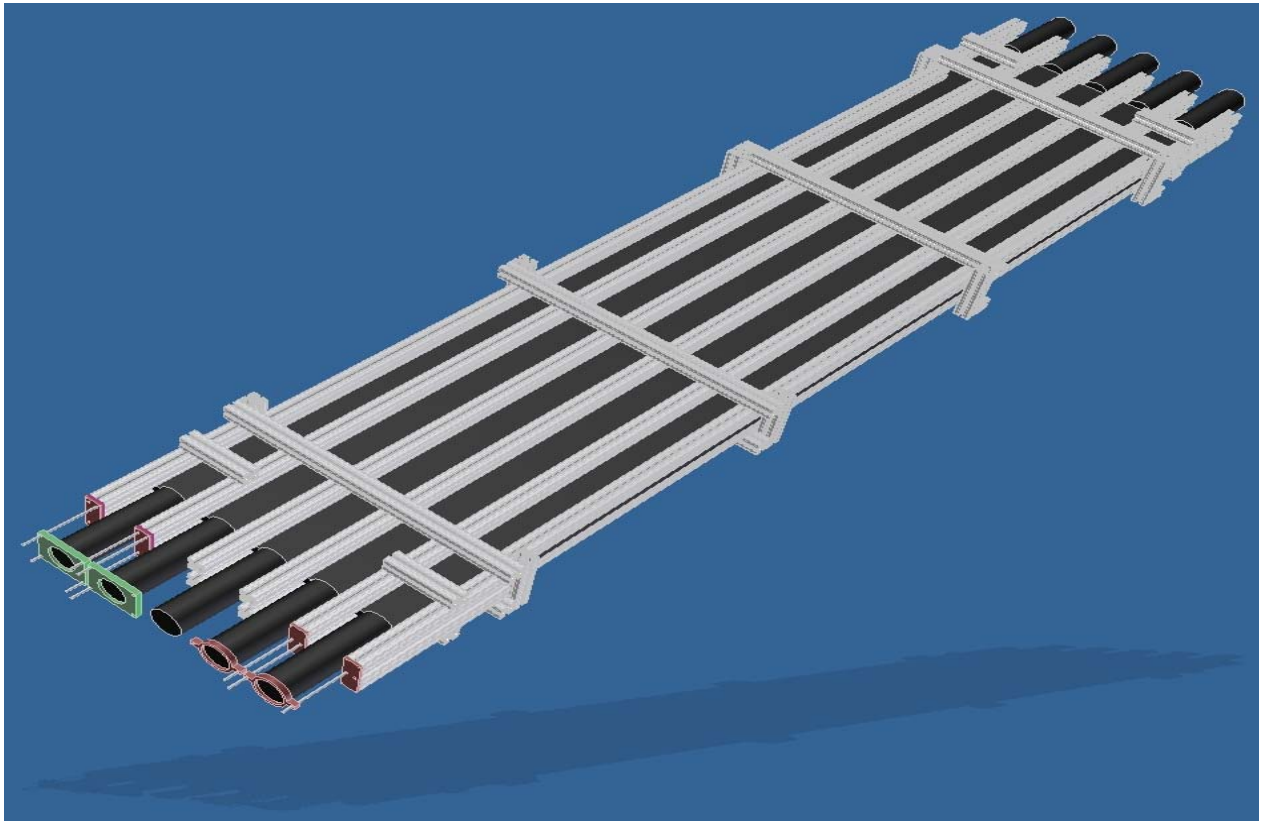


Monthly muon rate fluctioin of top and bottom

preliminary



Install new scintillator on top of MUD to test the efficiency



The plastic scintillator: 220 cm length, 10 cm width, 2cm height.
The holder: aluminium framework, 3cmX3cm
Two PMT for each scintillator: PMT 6410, 20 cm length, 6cm diameter

Summary

- We have done carefully data quality check of MUD data, more than 90% files are at good condition.
- PMT3, PMT4 and PMT21 are not at good now
- Selection criteria for muon events is optimized
- The rate of every file is analyzed with different cut
- Preliminary result of monthly rate and fluction is got from the year of 2007—2010
- New scintillator layers and PMT are assembled and studied for the efficiency check at SNU

Next

- New scintillator layers will be installed on the top of MUD to check the efficiency
- The reason of the unnormal files will be totally studied
- More confident result of muon rate will be get
- The data of MUD, CSI and Neutron detector will be studied together
- New PMT may be changed

Thank you!