MEG実験2008 液体キセノン検出器 I

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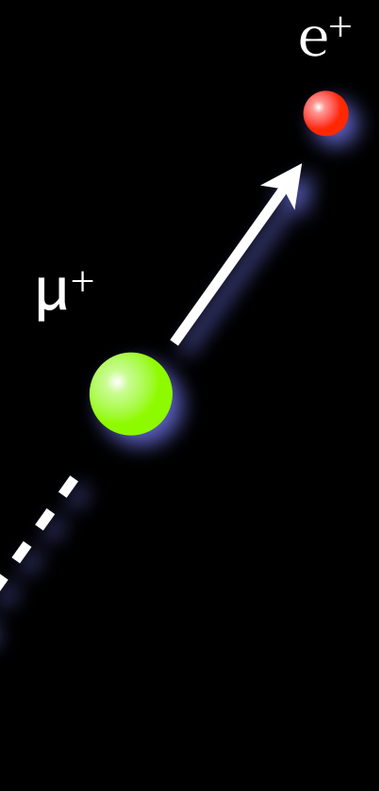
- 2008 runs
- Xe detector conditions and stability

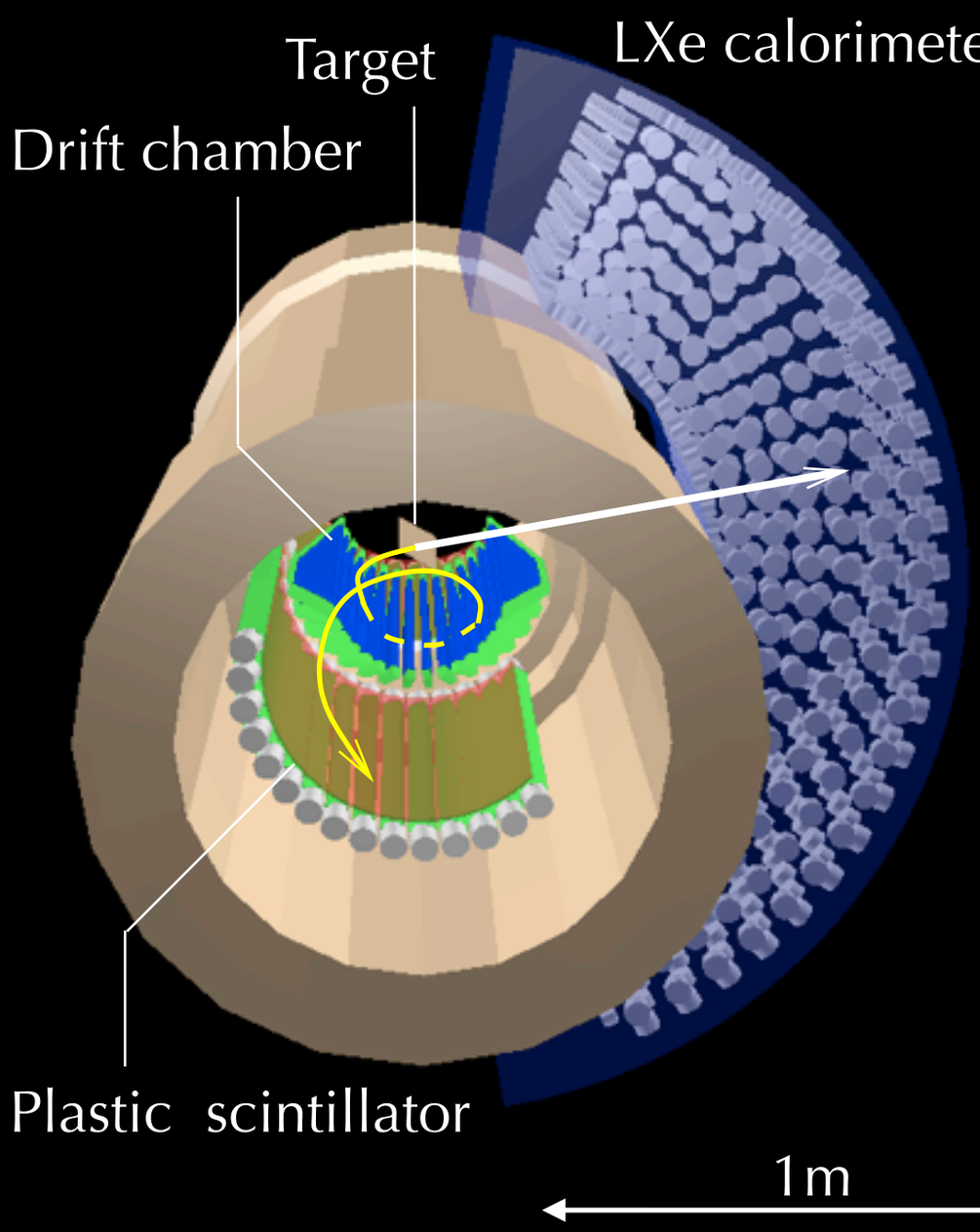
Introduction

μ→e+γ decay

- Lepton Flavor Violation
- Prohibited in the Standard Model
  - Sensitive to New Physics, e.g. SUSY, GUT, Seesaw, et.
- Two body decay
  - 180° opening angle
  - Ee = Eγ = 52.8 MeV
  - Simultaneous
- BG
  - radiative decay
  - accidental overlap

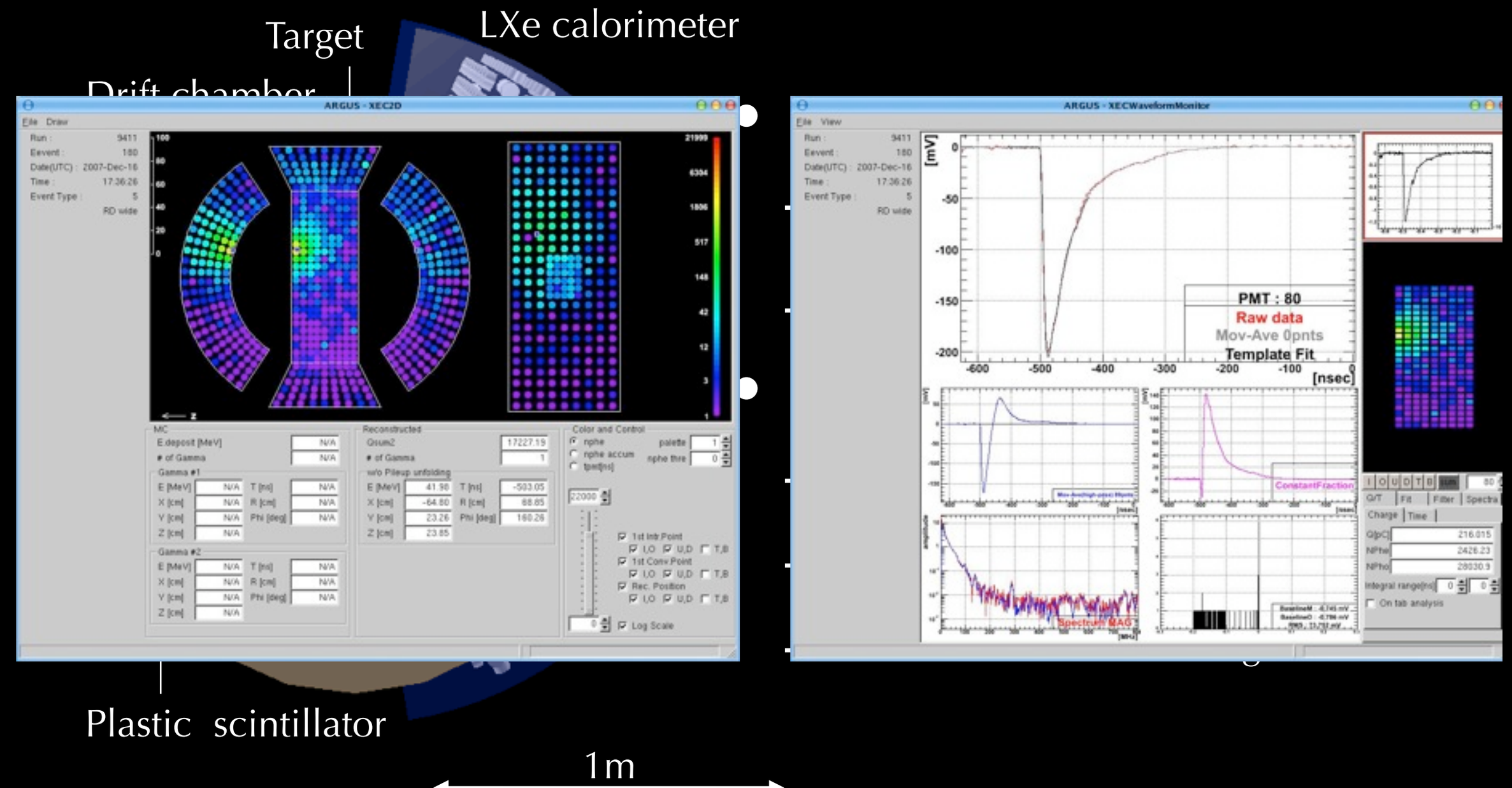


MEG experiment



- Gamma Detector
  - 850 ℓ Liq. Xe as scintillator
  - 846 PMTs
- Positron Calorimeter
  - Gradient B-field SC magnet
  - 16 low mass drift chamber
  - Plastic scintillator timing counter

MEG experiment



2008 runs

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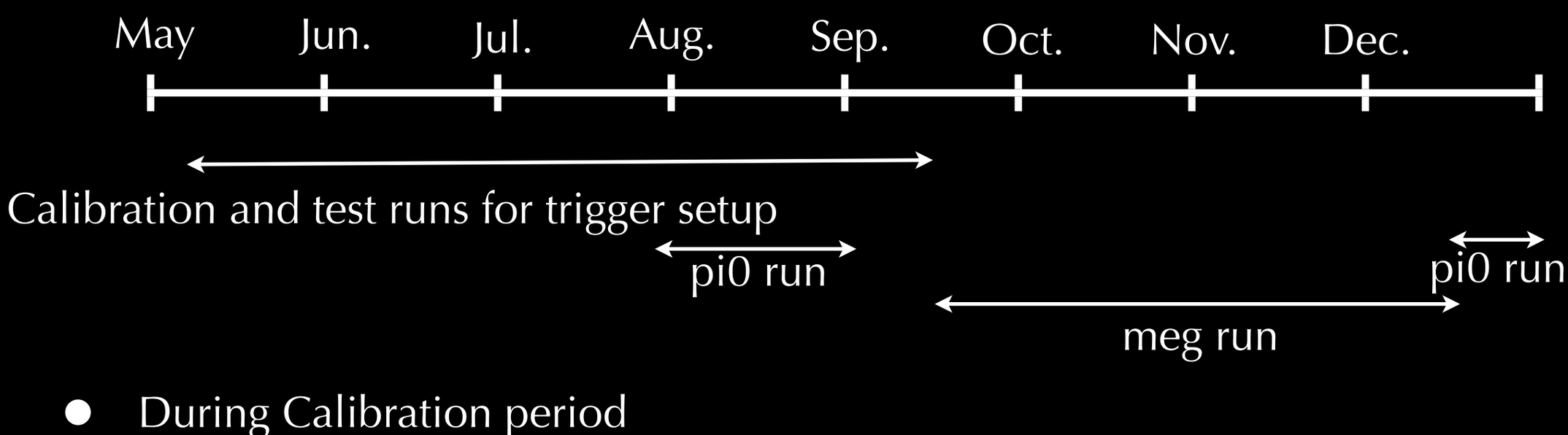
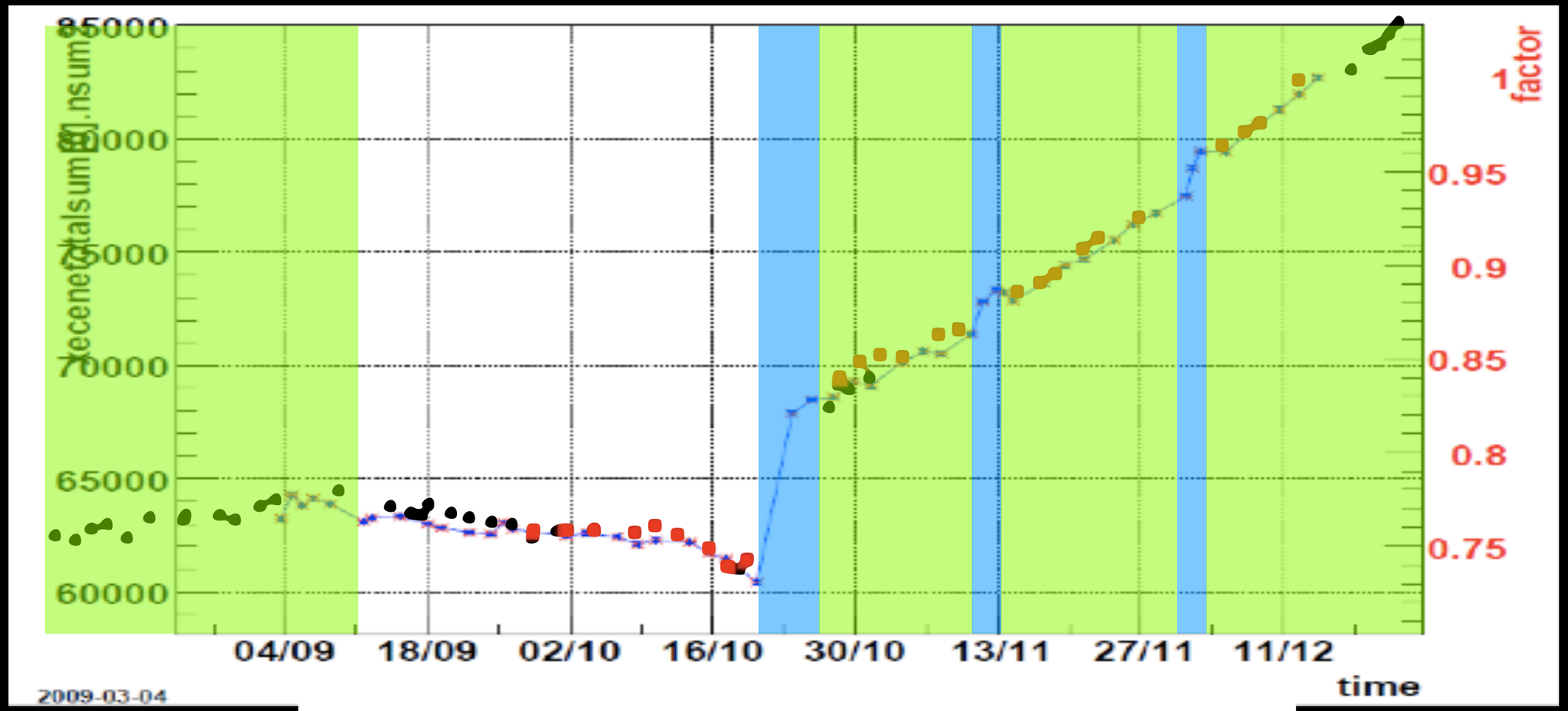


- During Calibration period
  - alpha, LED runs : everyday
  - CW, CR runs : once per 2days
  - pi0 run in Aug. , end of Dec.
- meg run
  - Total time 49 days
  - live time　39 days
  - LED, cosmic ray data taken together with meg data
  - alpha, CW run : once per 2 days
  - LED run w/ beam on everyday
  - radiative decay dedicated run

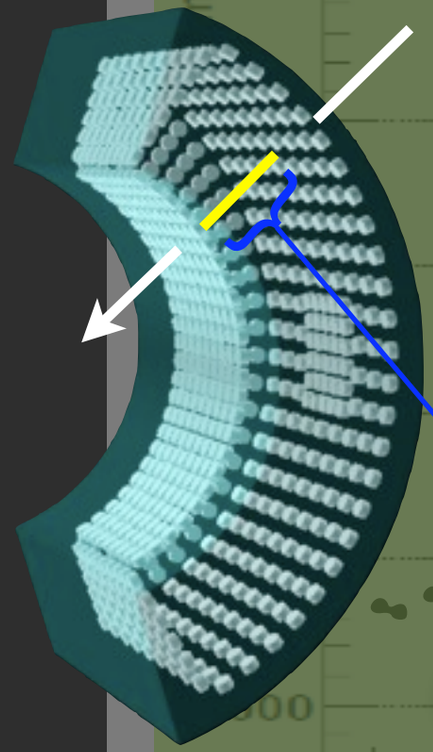
Xe detector conditions

Purification and light yield monitoring



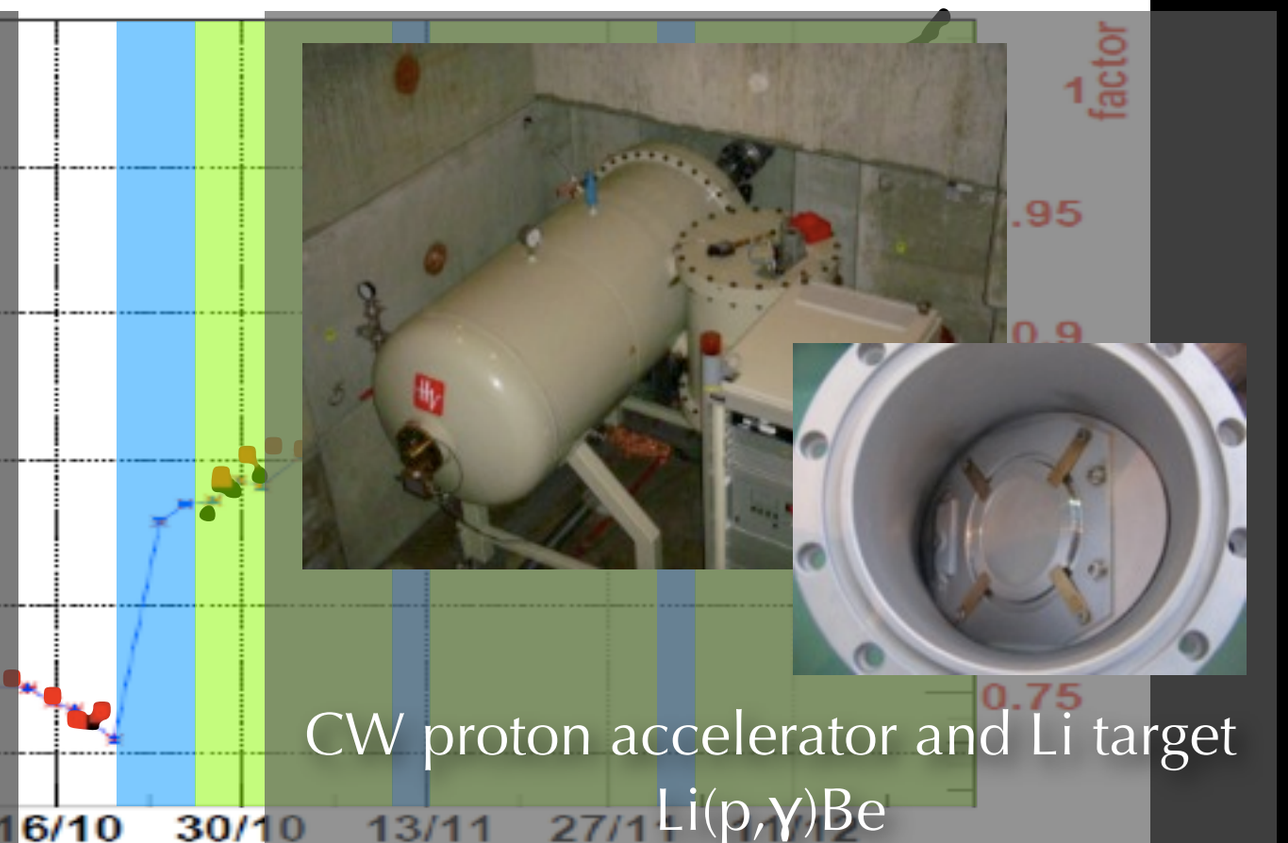
- Gas phase purification
- Liquid phase + gas phase purification
- CR data with muon beam off
- CR data with muon beam on
- CW data

Light yield monitoring



Select cosmic ray events which penetrate both the inner and outer face

histogram of qsum2 / length



CW proton accelerator and Li target

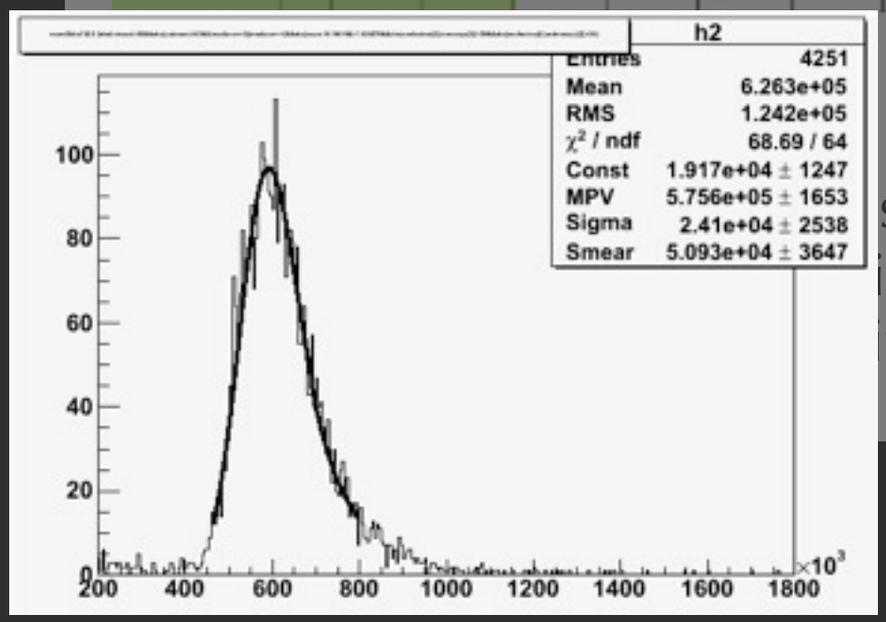
Li(p,γ)Be

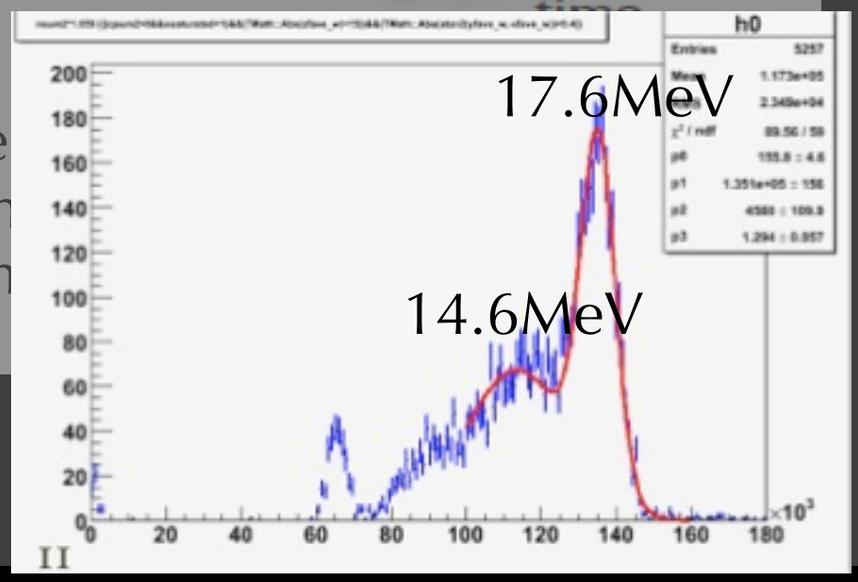
purification

se + gas phase

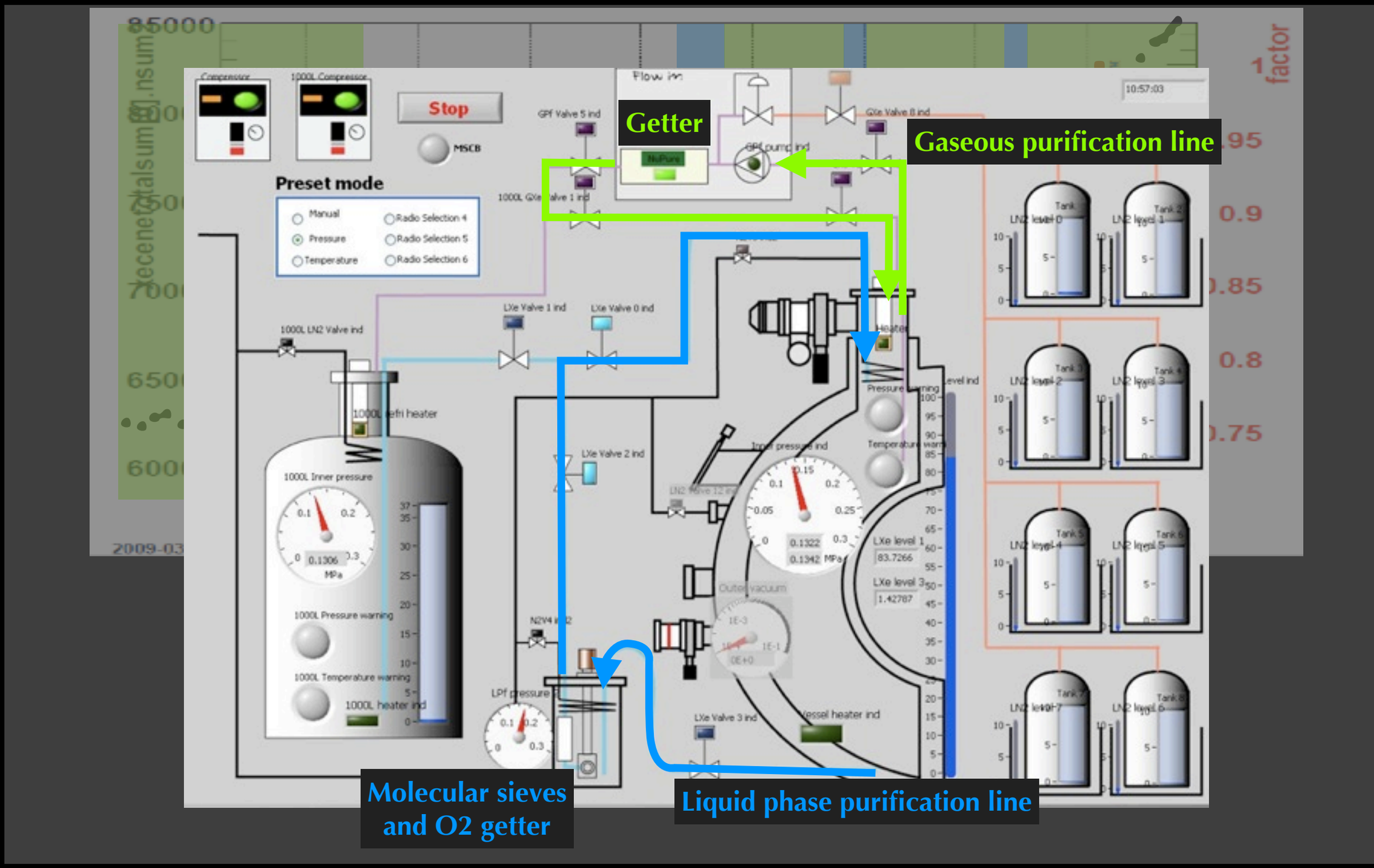
ith muon beam

ith muon beam

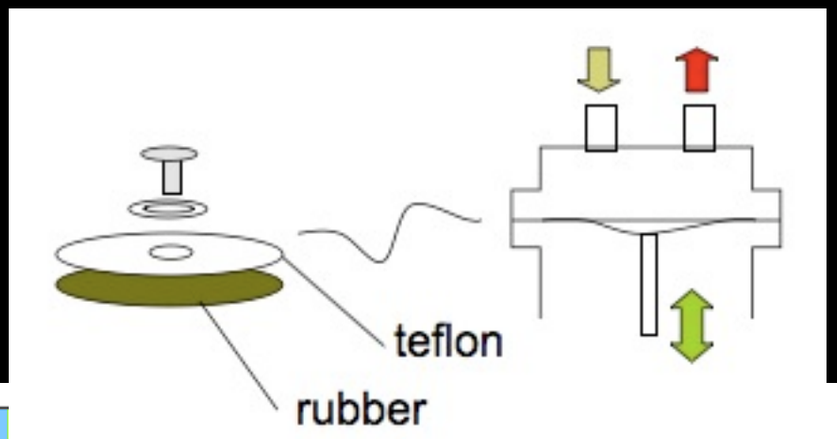


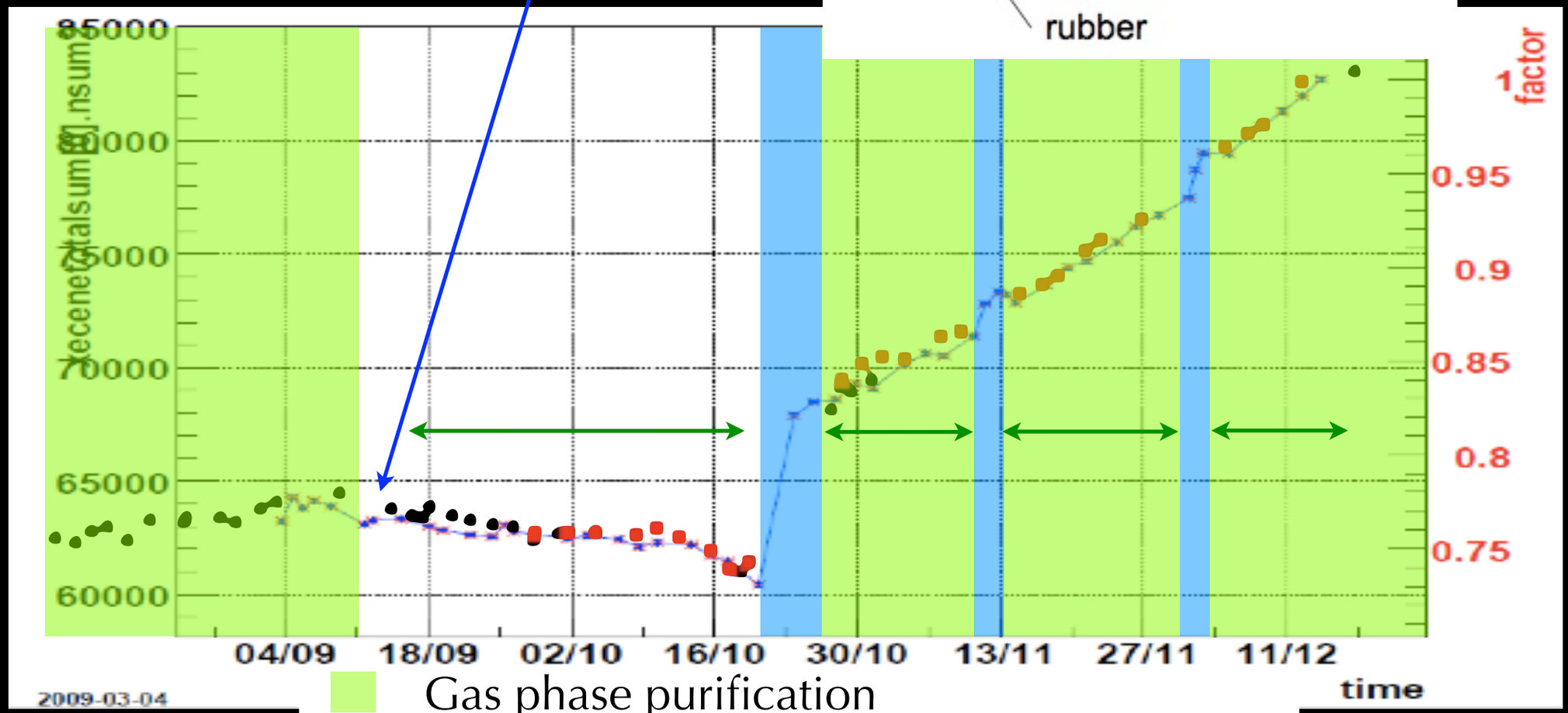


Liquid and gaseous purification



Replaced diaphragm for gaseous purification circulation pump





Gas phase purification
Liquid phase + gas phase purification
meg run
CR data with muon beam off
CR data with muon beam on
CW data

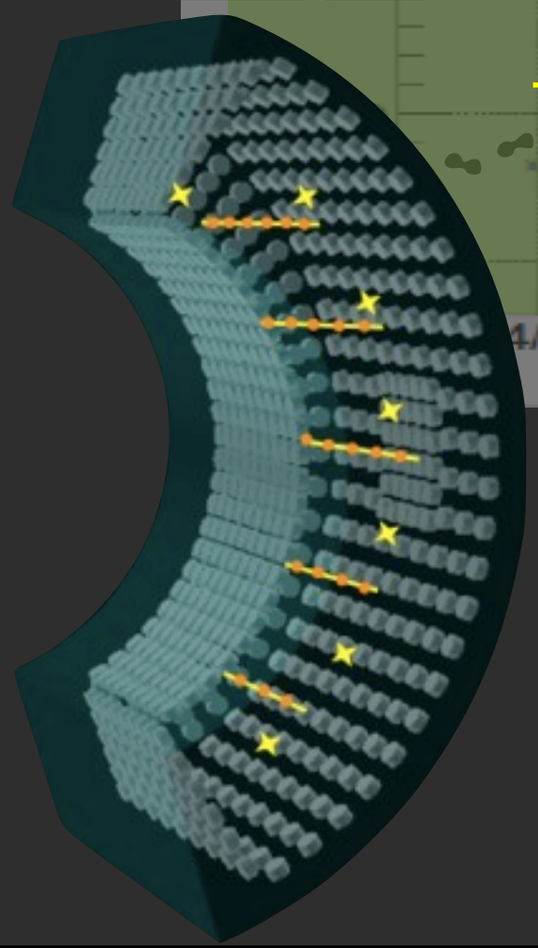
Light yield is monitored with good accuracy < 1%
During meg run, light yield correction by CW run data
CW run is take once per 2 days

Data quality is O.K. in meg run

Difference between α and γ

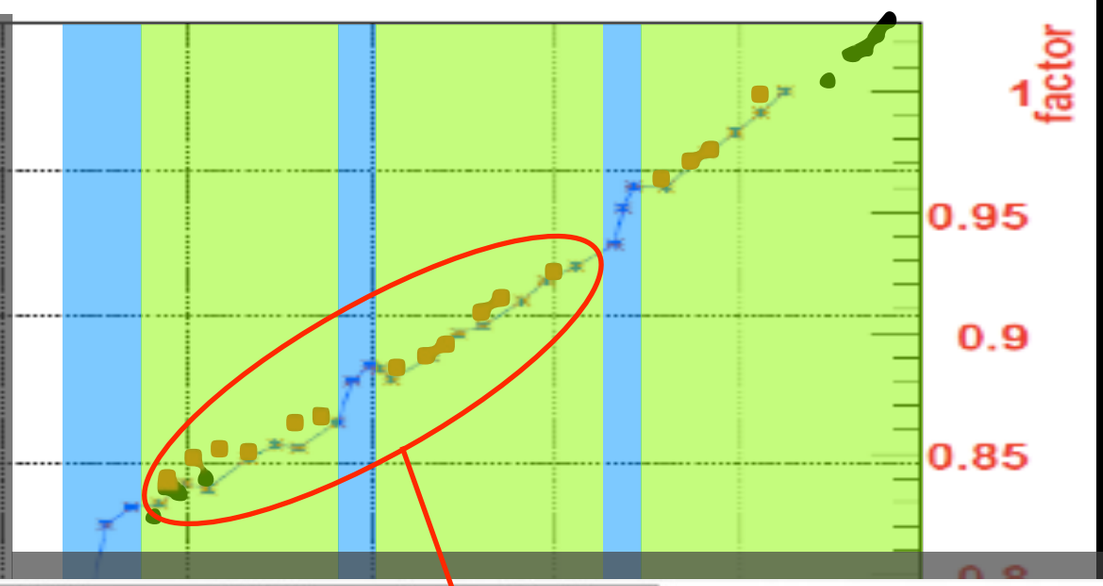
^{241}Am α source on wire
5source × 5wires : total 25

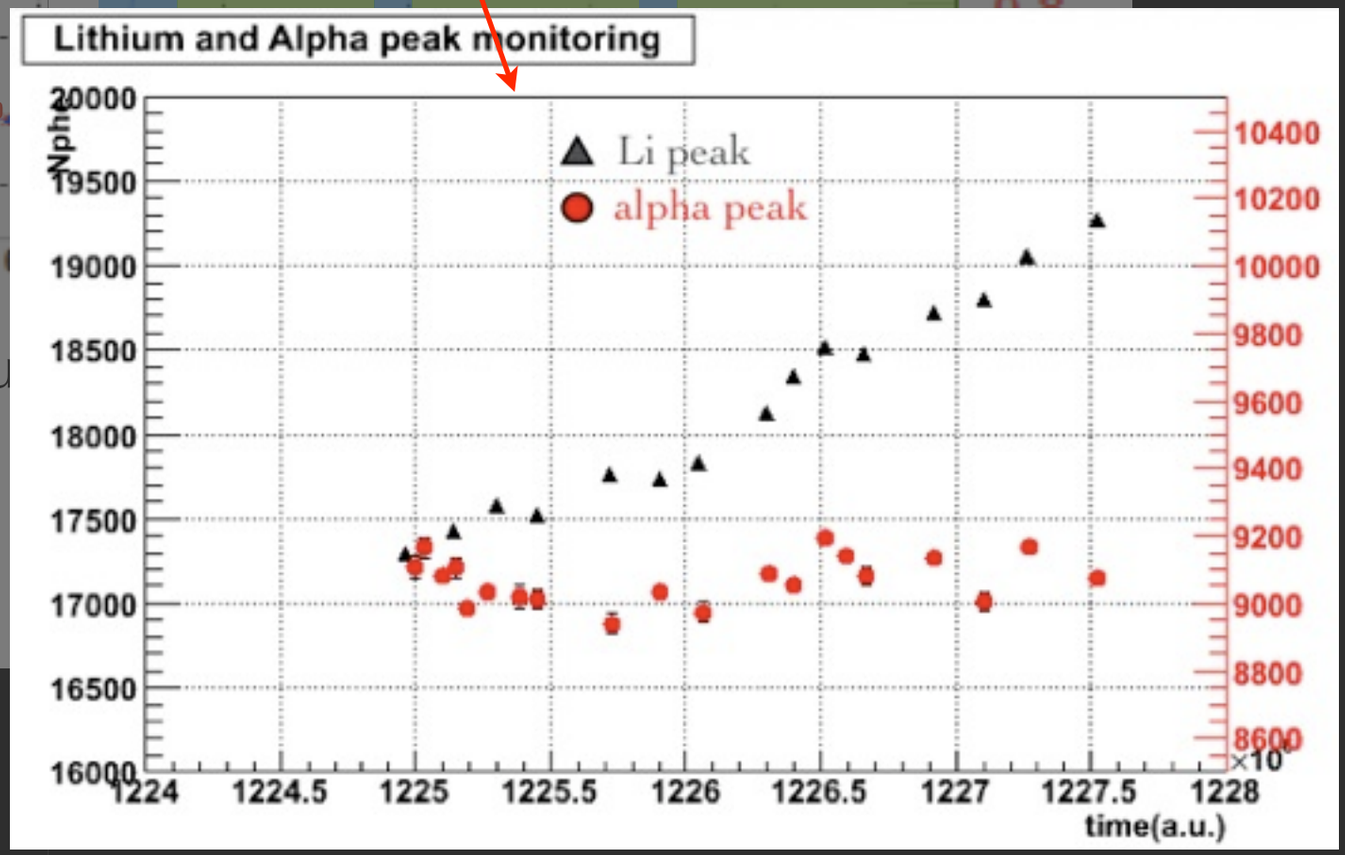
LED : 6 points on
each lateral faces



α wire
α source
LED

Gas phase pu
Liquid phase
CR data with
CR data with
CW data





Difference between α and γ

Xe scintillation photon generating processes

excitation process(fast):

$X\ e + X\ e^* \rightarrow X\ e^*_2 \rightarrow 2X\ e + h\nu$

recombination process(slow):

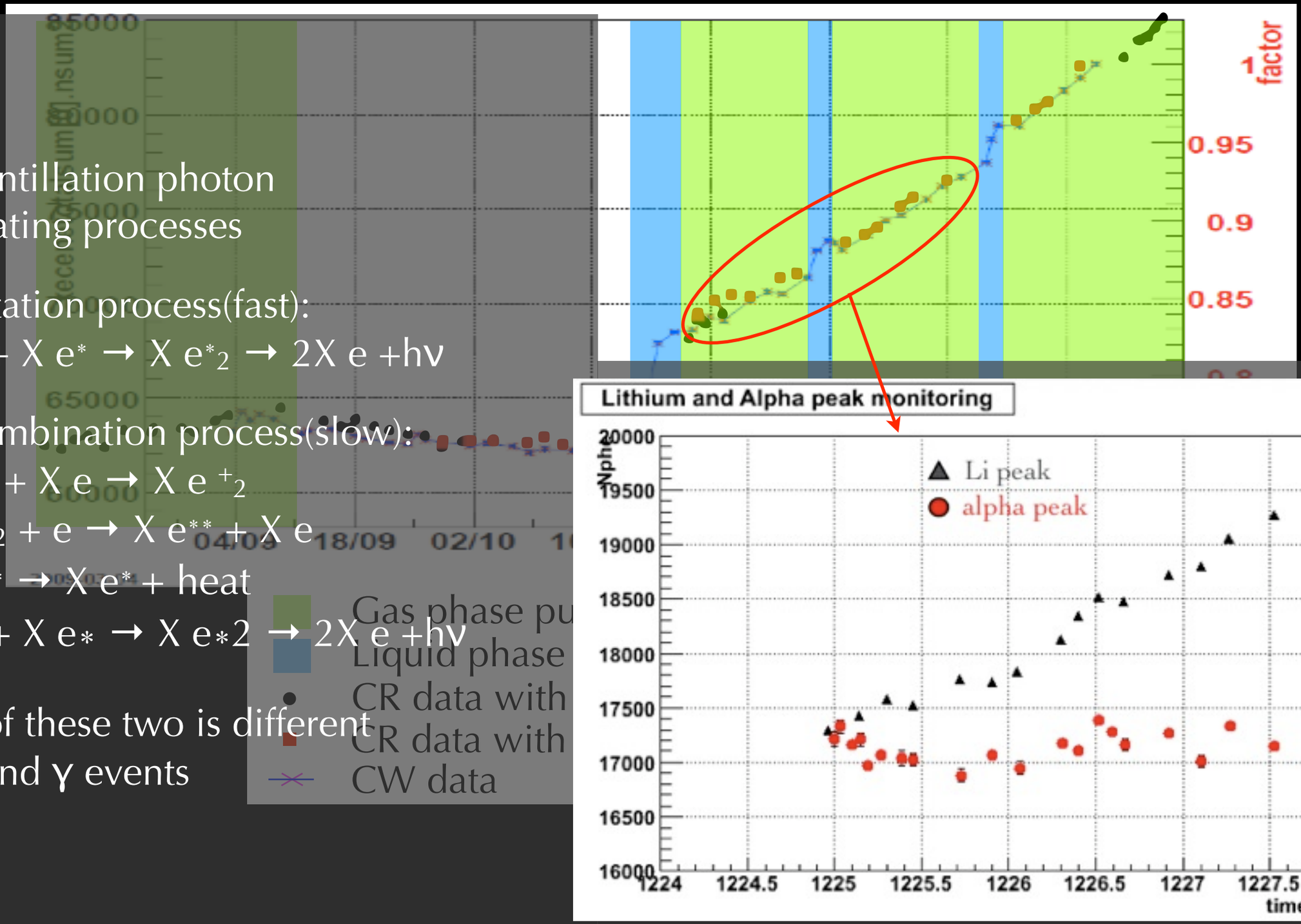
$X\ e^+ + X\ e \rightarrow X\ e^+_2$

$X\ e^+_2 + e \rightarrow X\ e^{**} + X\ e$

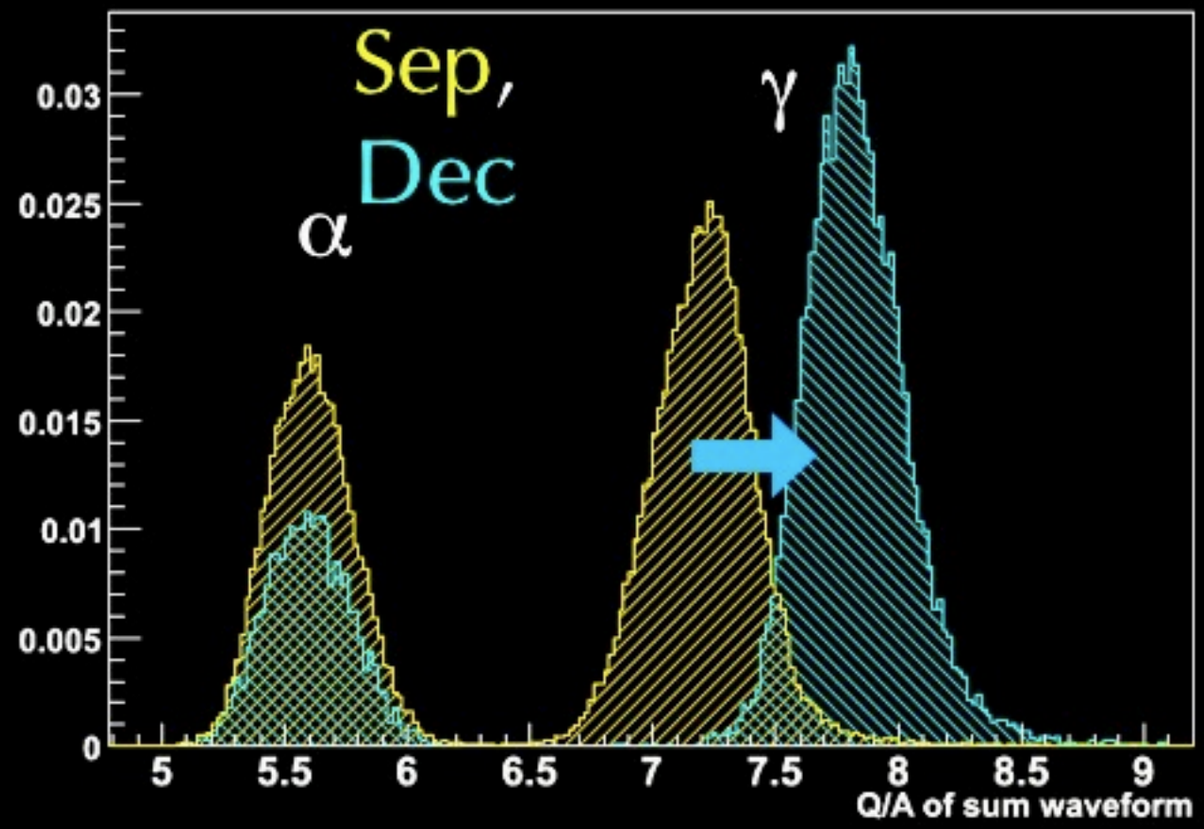
$X\ e^{**} \rightarrow X\ e^* + \text{heat}$

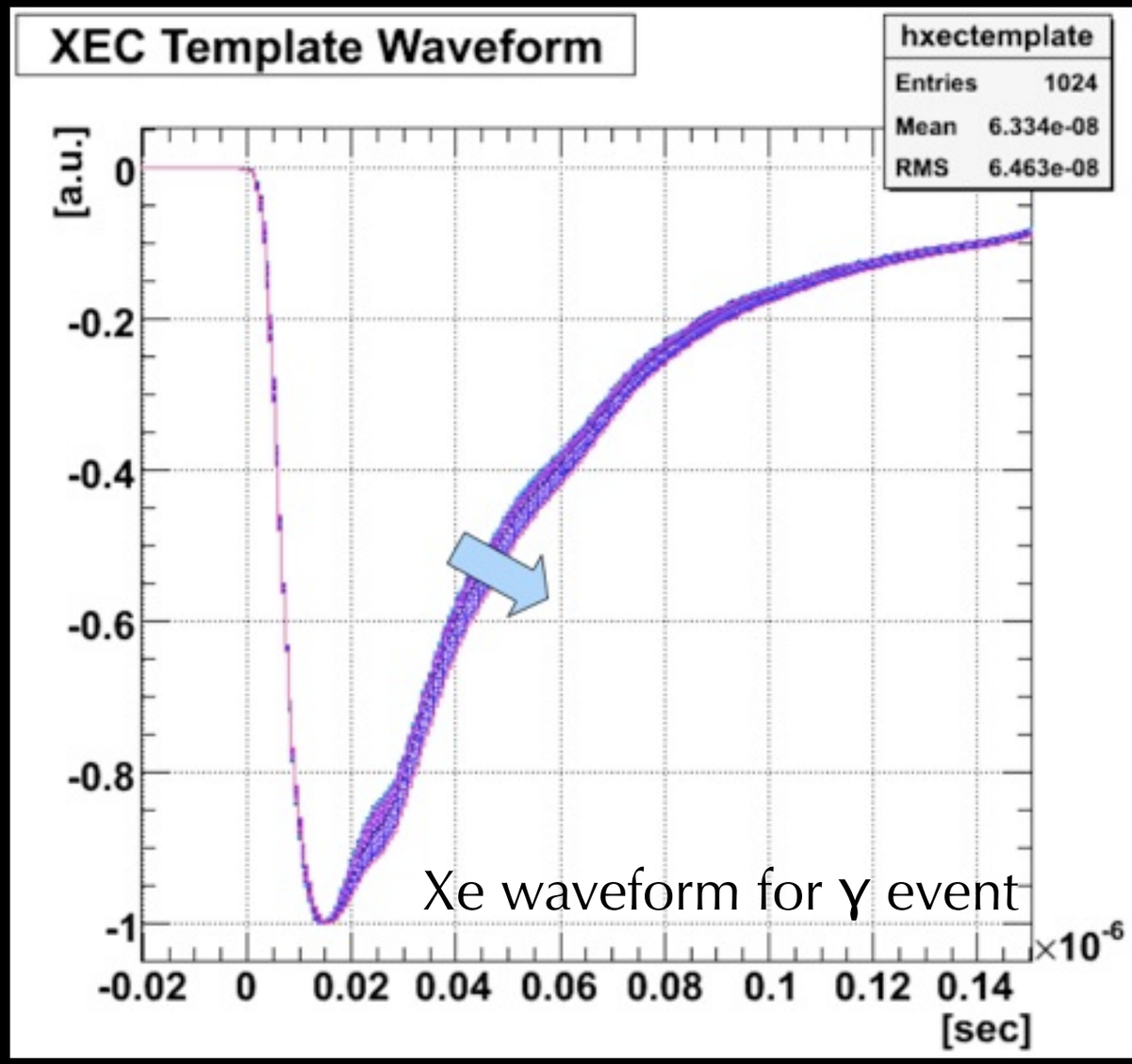
$X\ e + X\ e* \rightarrow X\ e*2 \rightarrow 2X\ e + h\nu$

Ratio of these two is different for α and γ events



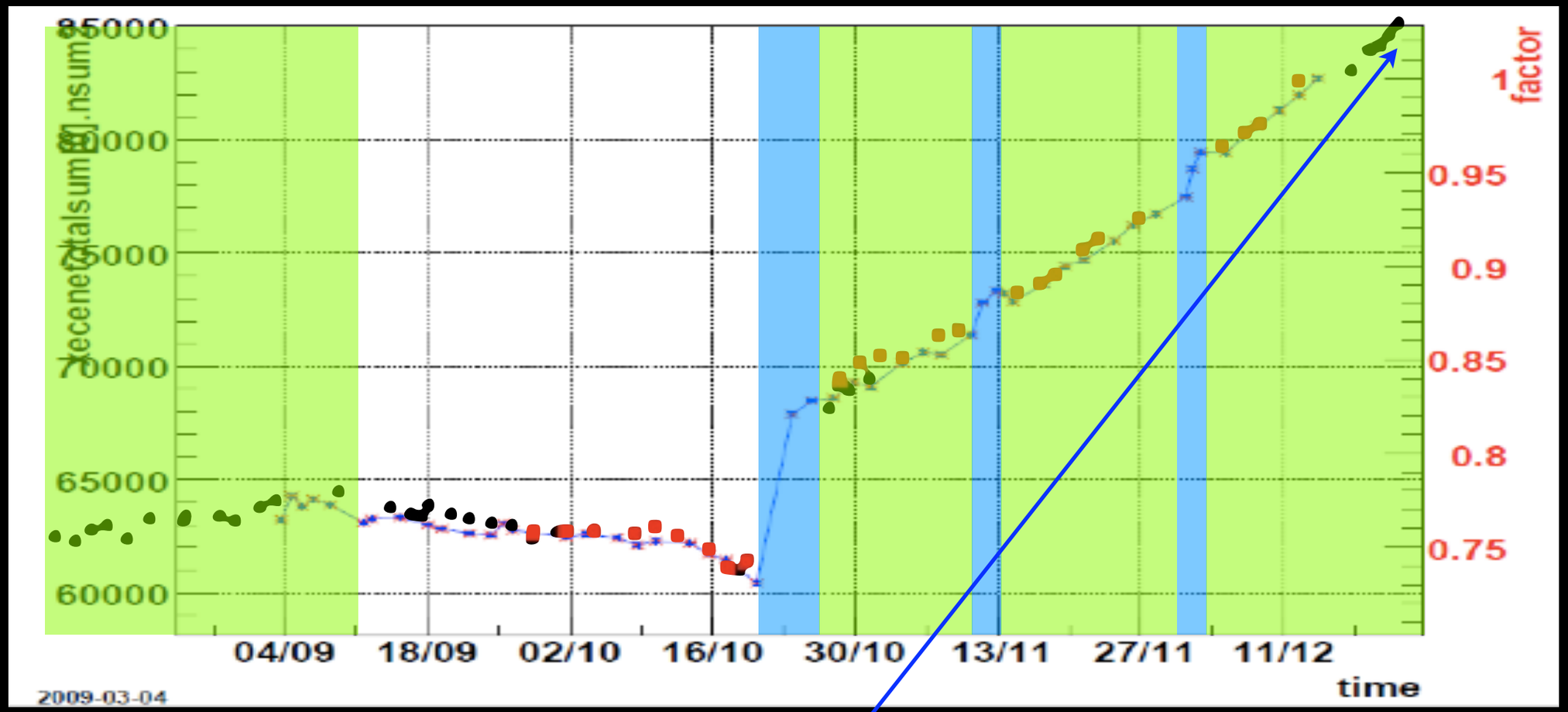
Purification and waveform shape





- Only the waveform for gamma signal changed
- There exists impurity which prevent recombination process?

Purification and light yield



Still going up
Room for improvement

Problem on cooling pipe

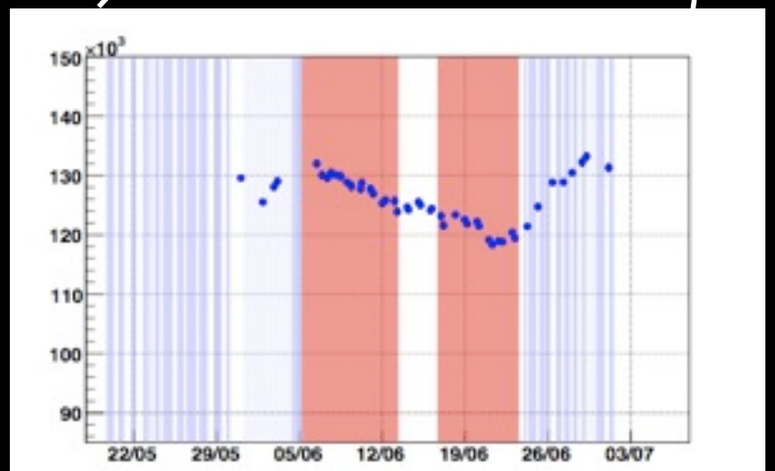
May Jun. Jul. Aug. Sep. Oct. Nov. Dec.

Calibration and test runs for trigger setup

pi0 run

pi0 run

meg run

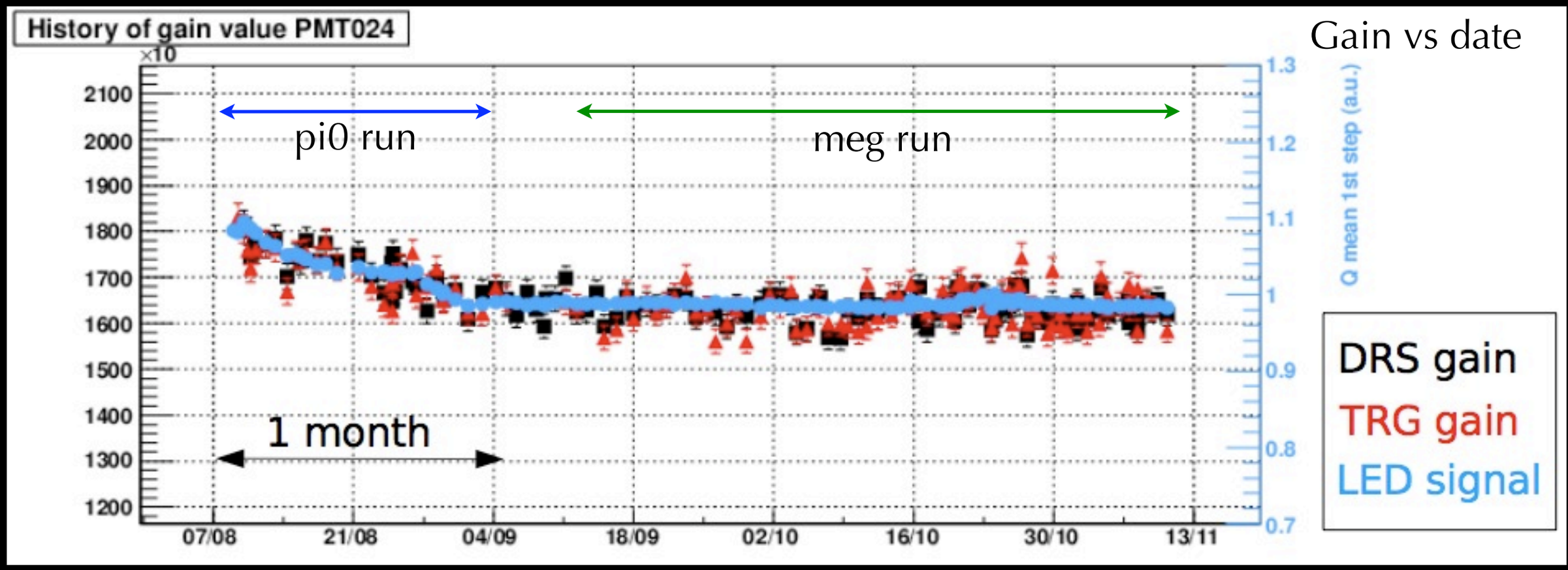


Used LN2 cooling pipe inside detector
Liquid phase + gas phase purification

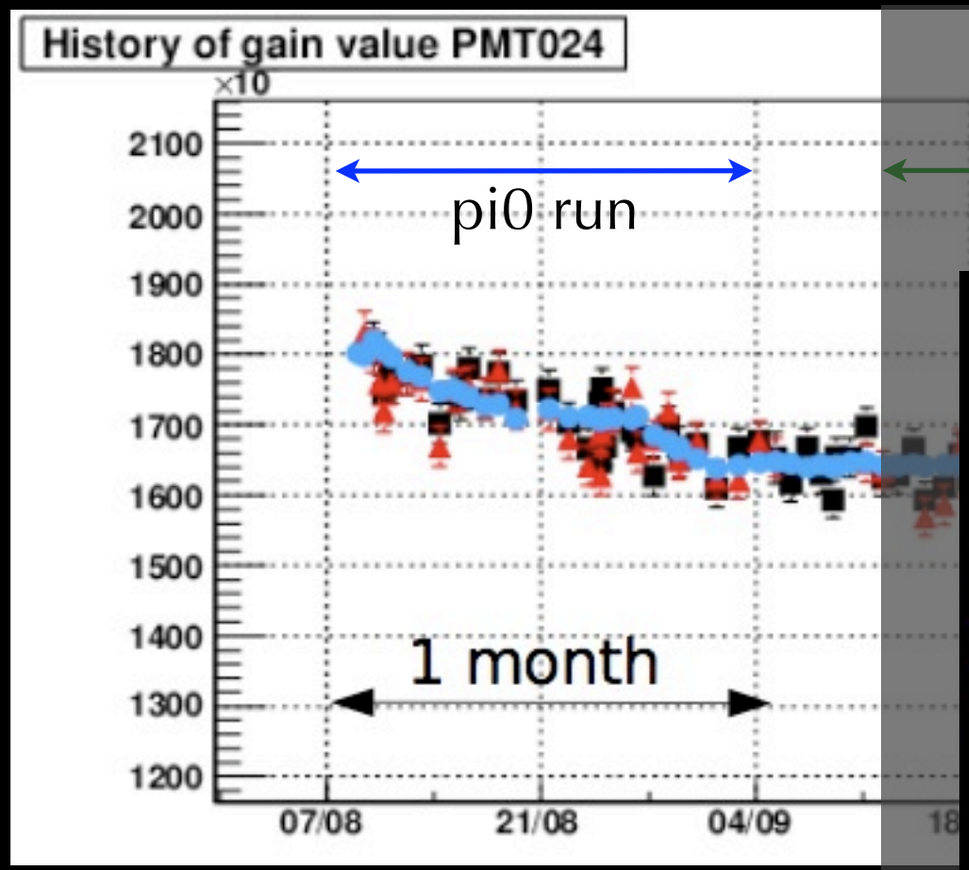
- Light yield decreased with LN2 pipe operation inside
- might be leak when used in low temperature

- We stopped to use this cooling pipe at that time
- New SUS cooling pipe will be used in 2009

Gain decrease



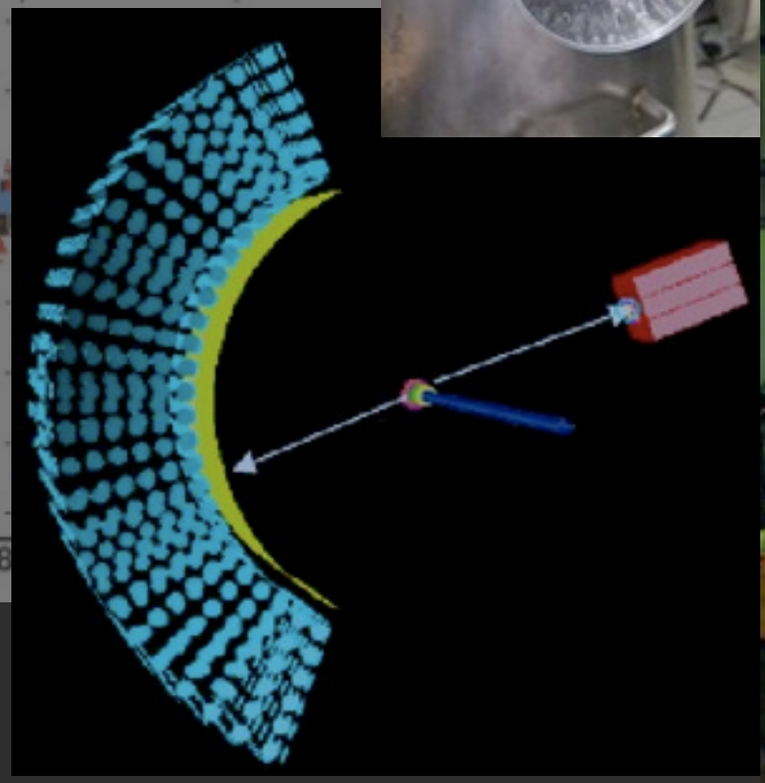
pi0 run



Gain vs date

Liquid H2 target

NaI mover

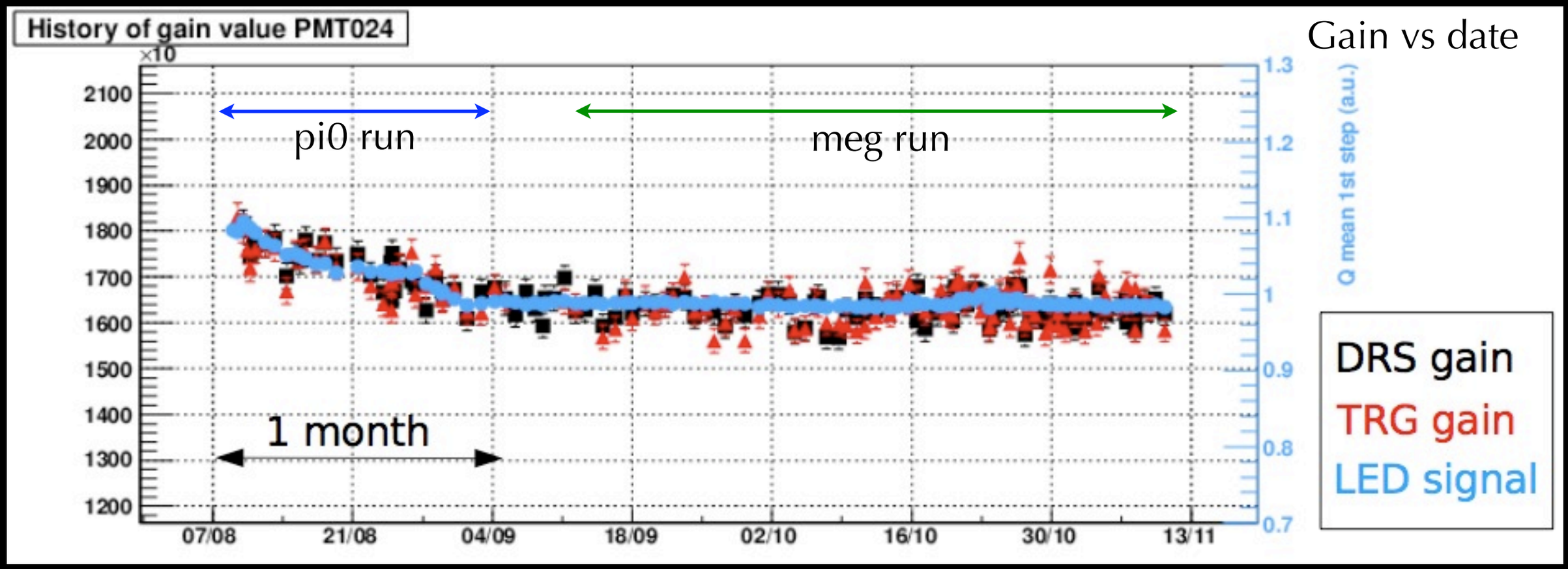


$\pi^- + p \rightarrow \pi^0 + n$

$\pi^0 \rightarrow \gamma\gamma$ (55MeV, 83MeV)

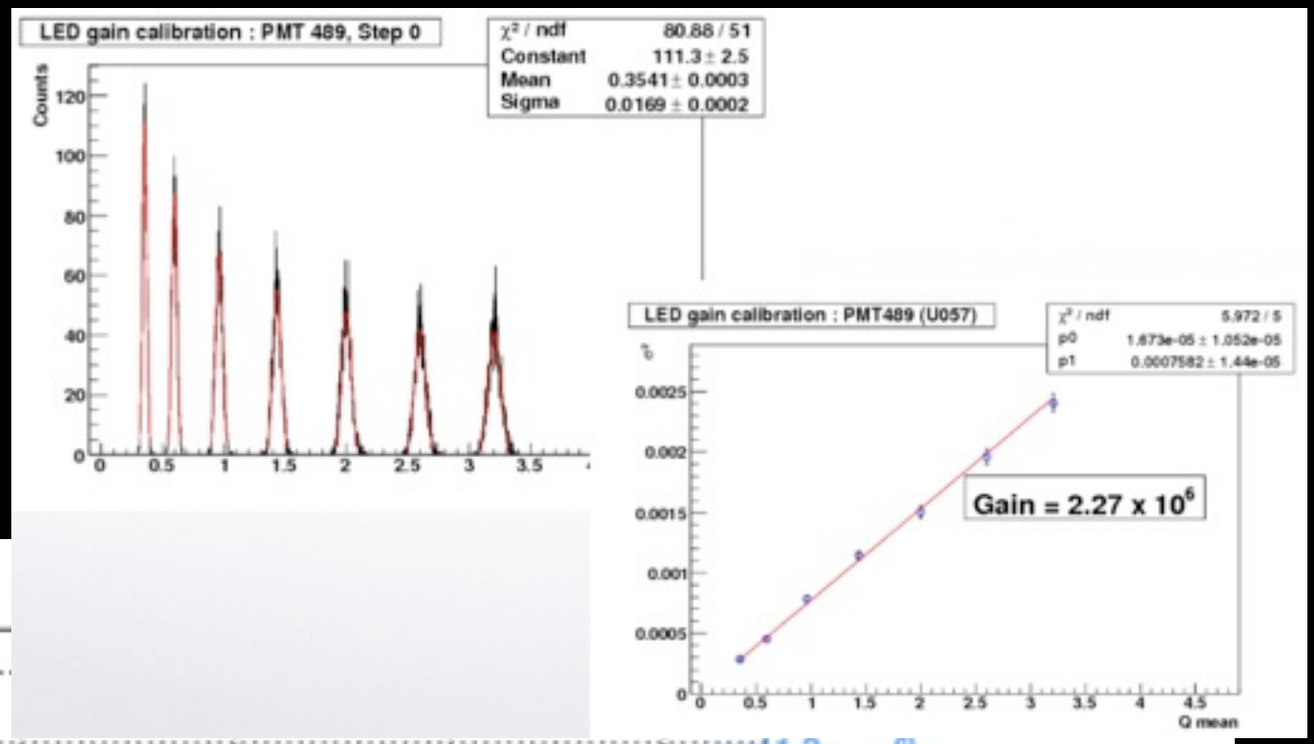
$\pi^- + p \rightarrow \gamma + n$ (129MeV)

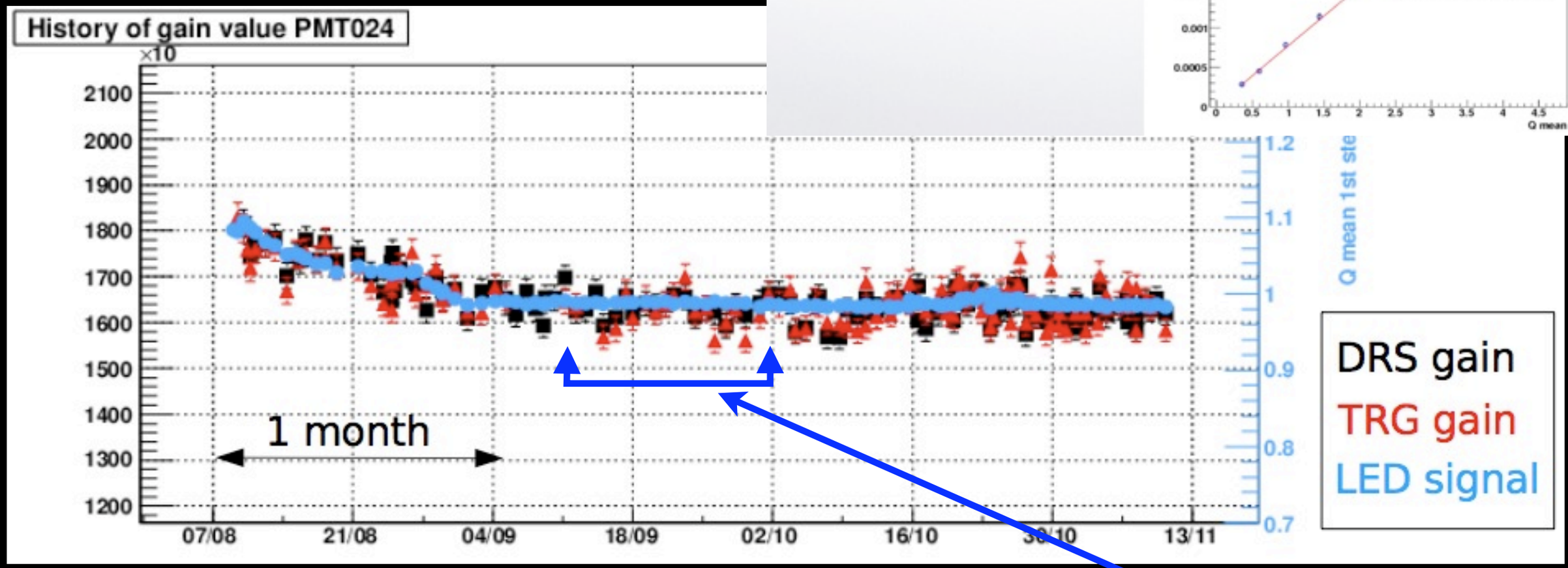
Gain decrease



- With high intensity beam, Gain decreased
- During meg run gain decrease is small

- Photo cathode material is blow up by photons?

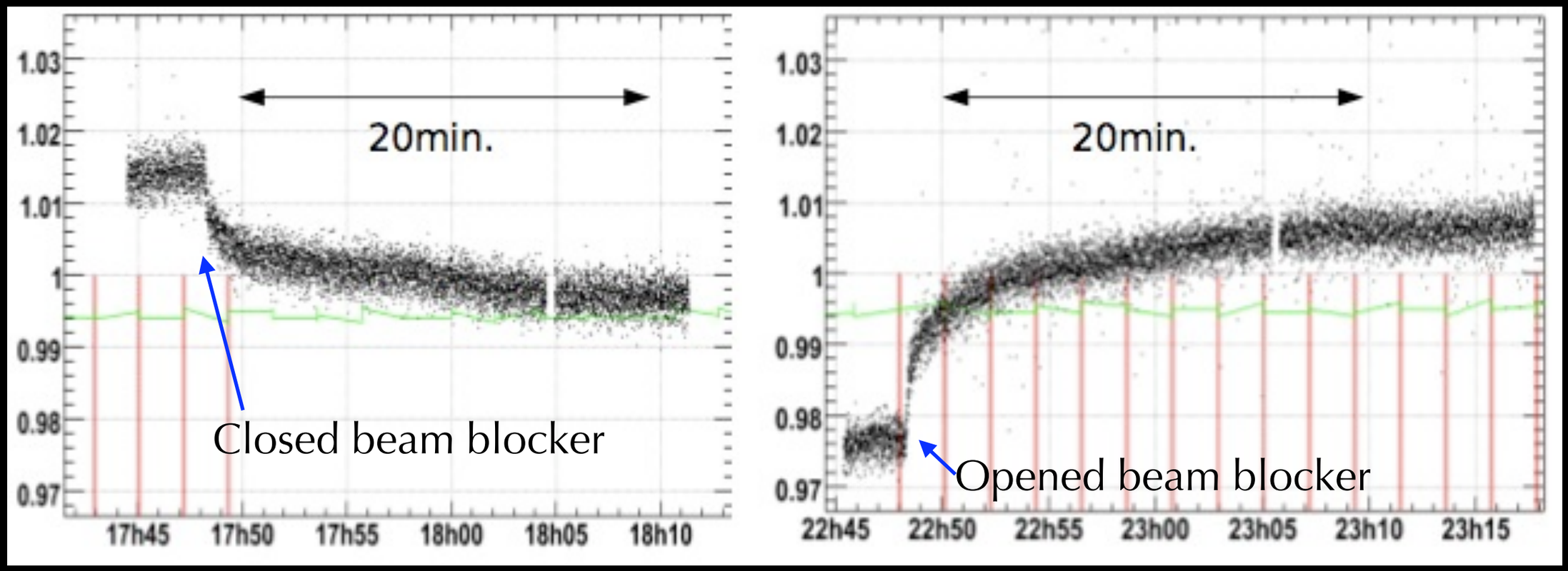




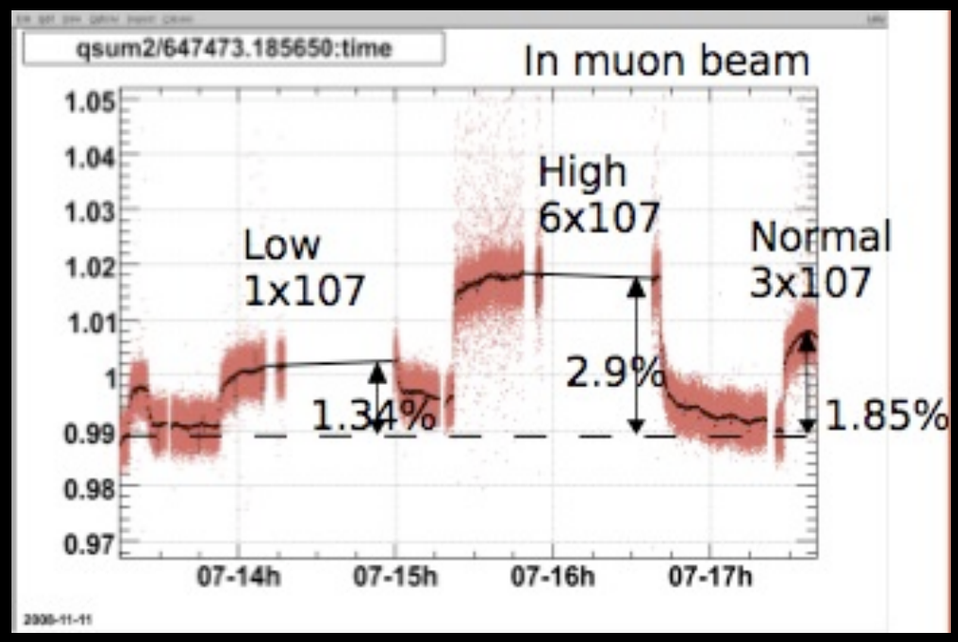
LED signal peak fluctuation < 0.3 %

Absolute gain : average this period
Gain shift : use LED signal peak

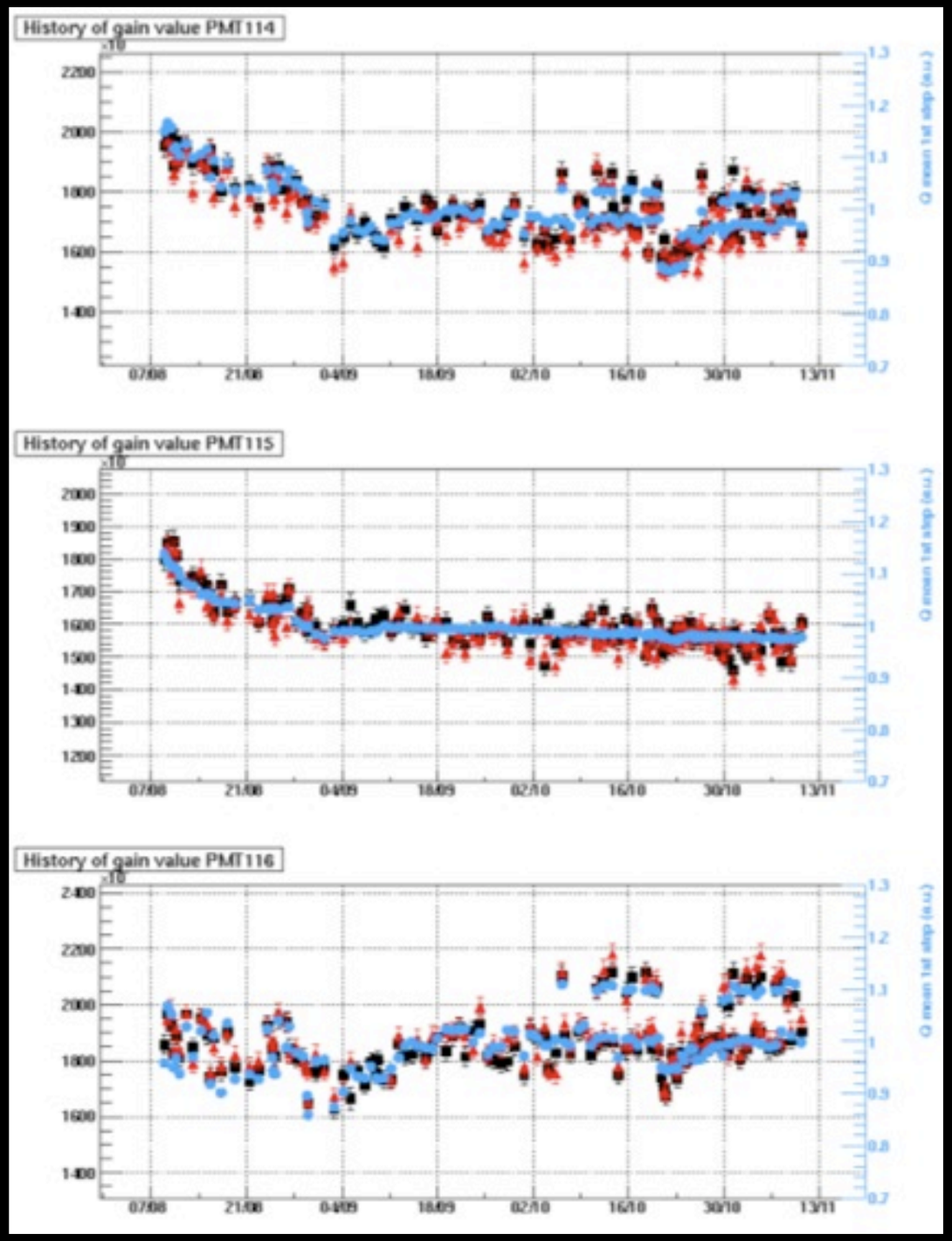
Gain shift



- Gain shift observed with beam on and off
- Gain stabilize after few dozens of minutes
- Depend on beam rate

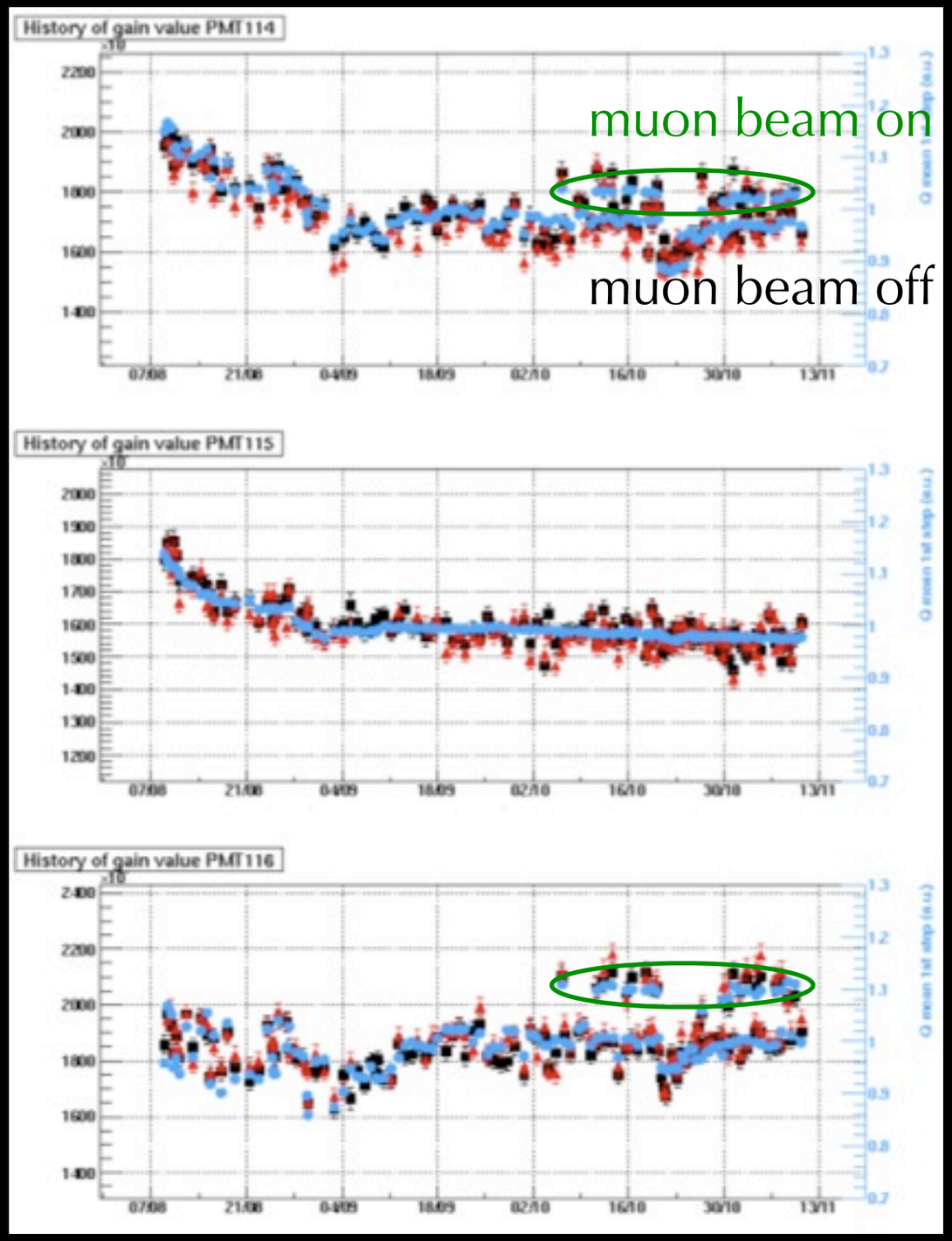


Gain shift : individual PMT



- Amount of shift reproduce
- Some shifts a lot, some do not
- There seemed some correlation with lot number
- Investigation for the cause of the problem on going
- For meg run gain : use LED with muon beam on data
- Correct time development of gain with time after beam blocker open/close

Gain shift : individual PMT



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Conclusion

- We could do meg run
- Accuracy of light yield correction : <1%
- Accuracy of gain shift correction : < 0.3%
- meg data quality : good
- Still remains room for improvement (light yield)