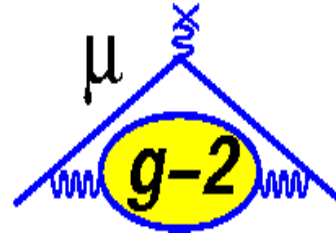


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WP3: Muon $g-2$ Calibration System Update

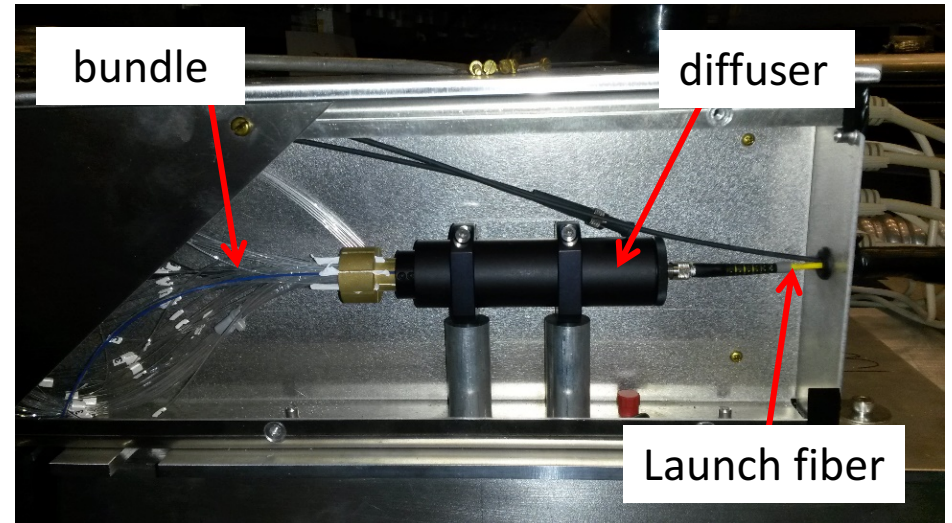
C. Ferrari, D. Cauz
MUSE Scientific Board Meeting
June 28th 2017

Outline

- Distribution boxes
- Source monitors
- Local monitors
- Front-end electronics
- Laser interlock system
- System debugging
- Calorimeter calibration
- Provisional data acquisition

Distribution boxes

- All of the 24 secondary distribution boxes (diffusers and bundles of 54 fibers) have been integrated into the calorimeters
- The calorimeters were installed in the ring and connected to
 - the launch optical fibers (24 quartz fibers that carry laser pulses from the laser hut to the calorimeters through the distribution boxes) and
 - local monitor fibers (24 fibers that transmit back the laser pulses to PMTs in the Laser hut)

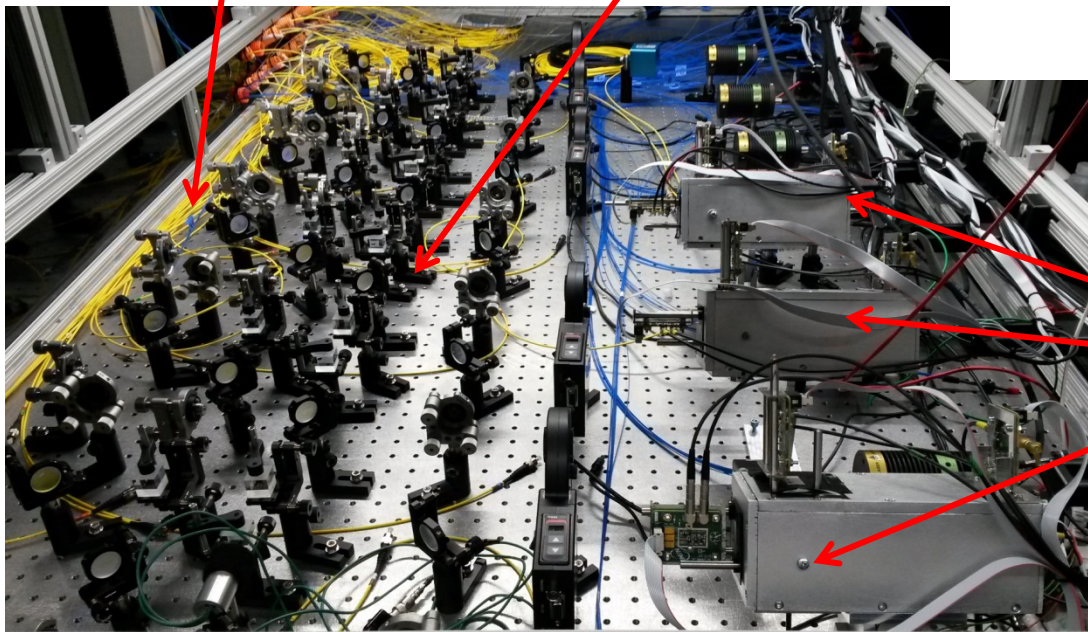


Source monitors

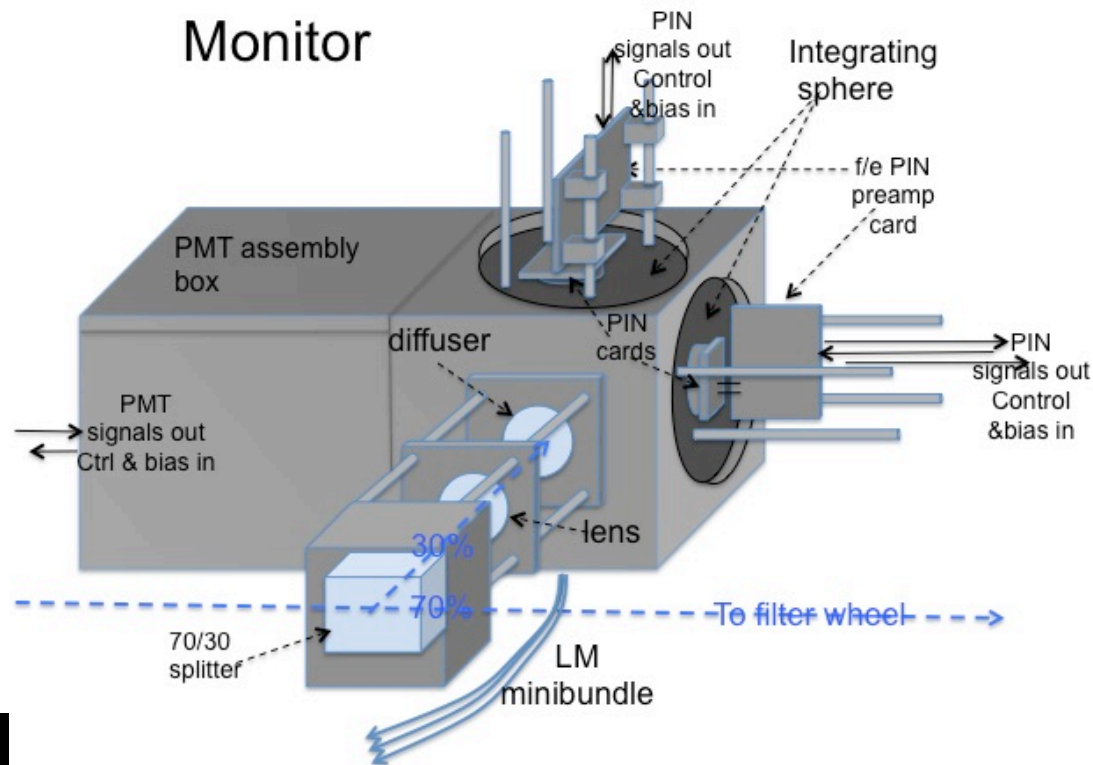
- The six source monitors (SM) were installed, adding to the focusing optics and launch fibers

Launch fibers

Focusing optics



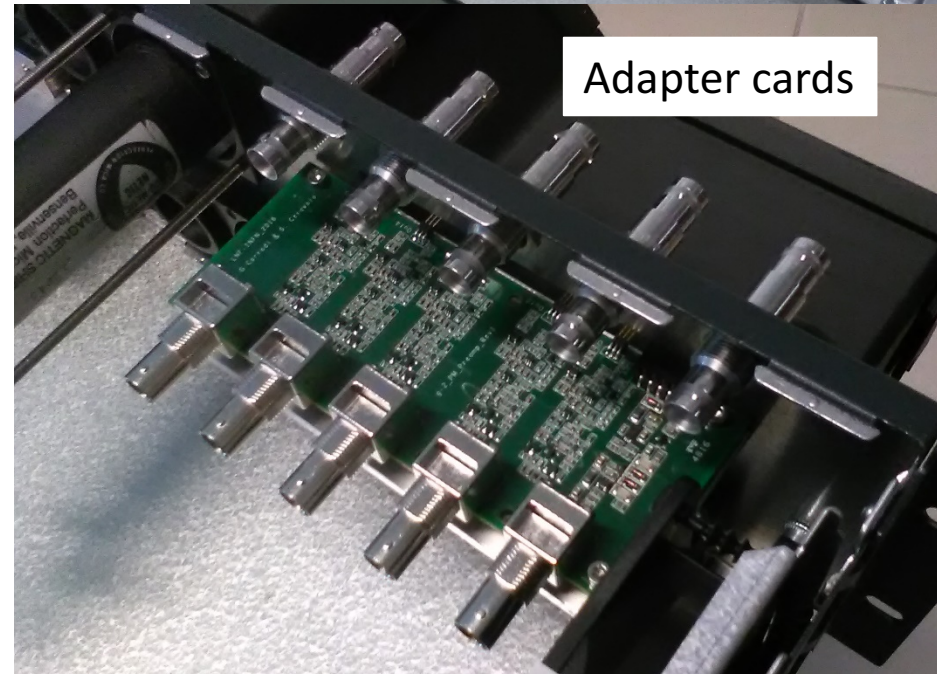
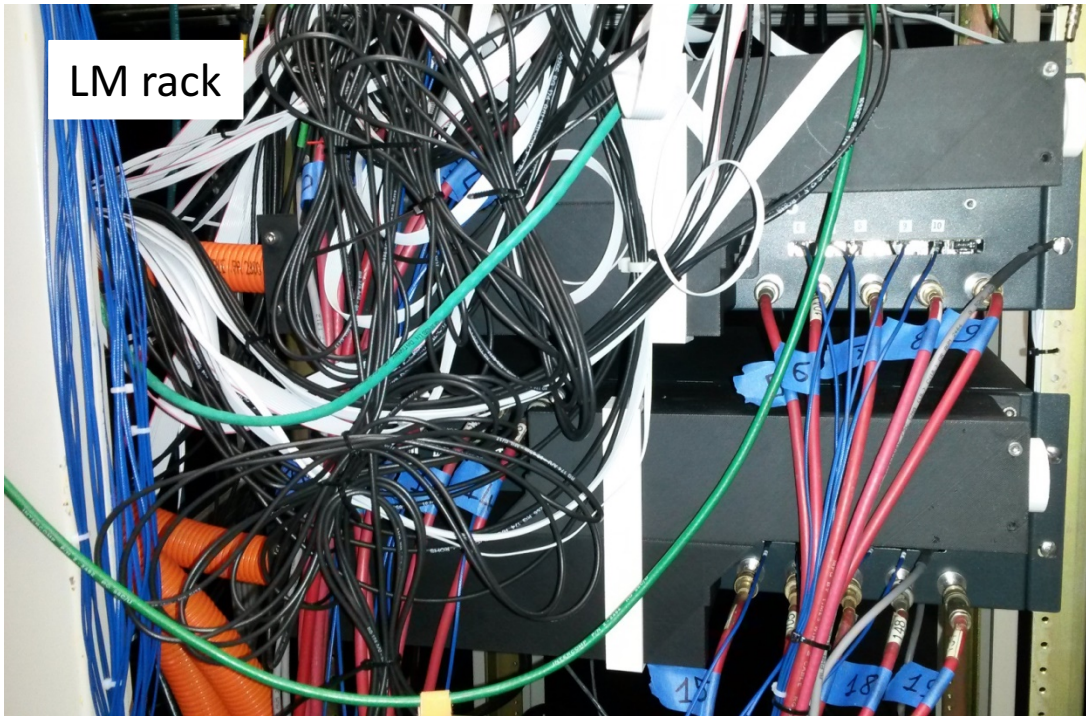
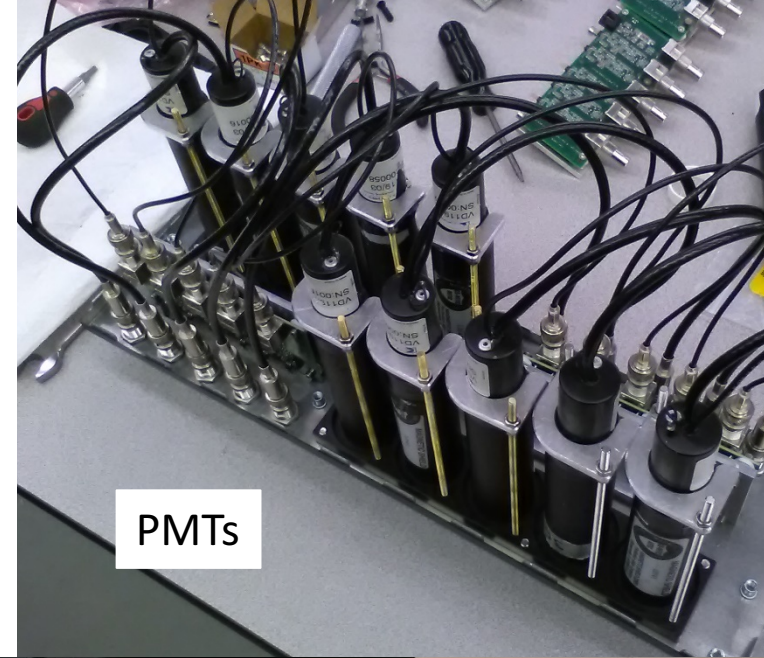
Source Monitor



Source monitors

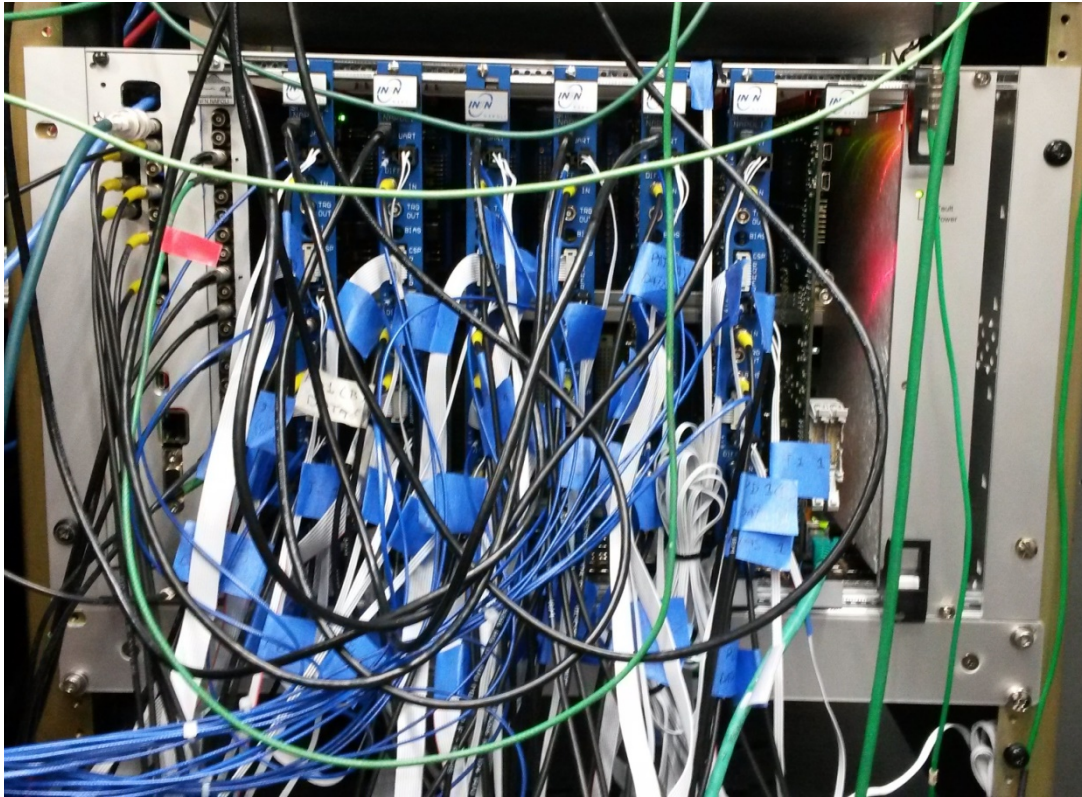
Local monitors

- The 24 local monitors (LM) were installed, comprising PMTs and adapter cards to the RIDERS



FE electronics

- The front end electronics for the SM signals was installed, in the laser hut near the optical table

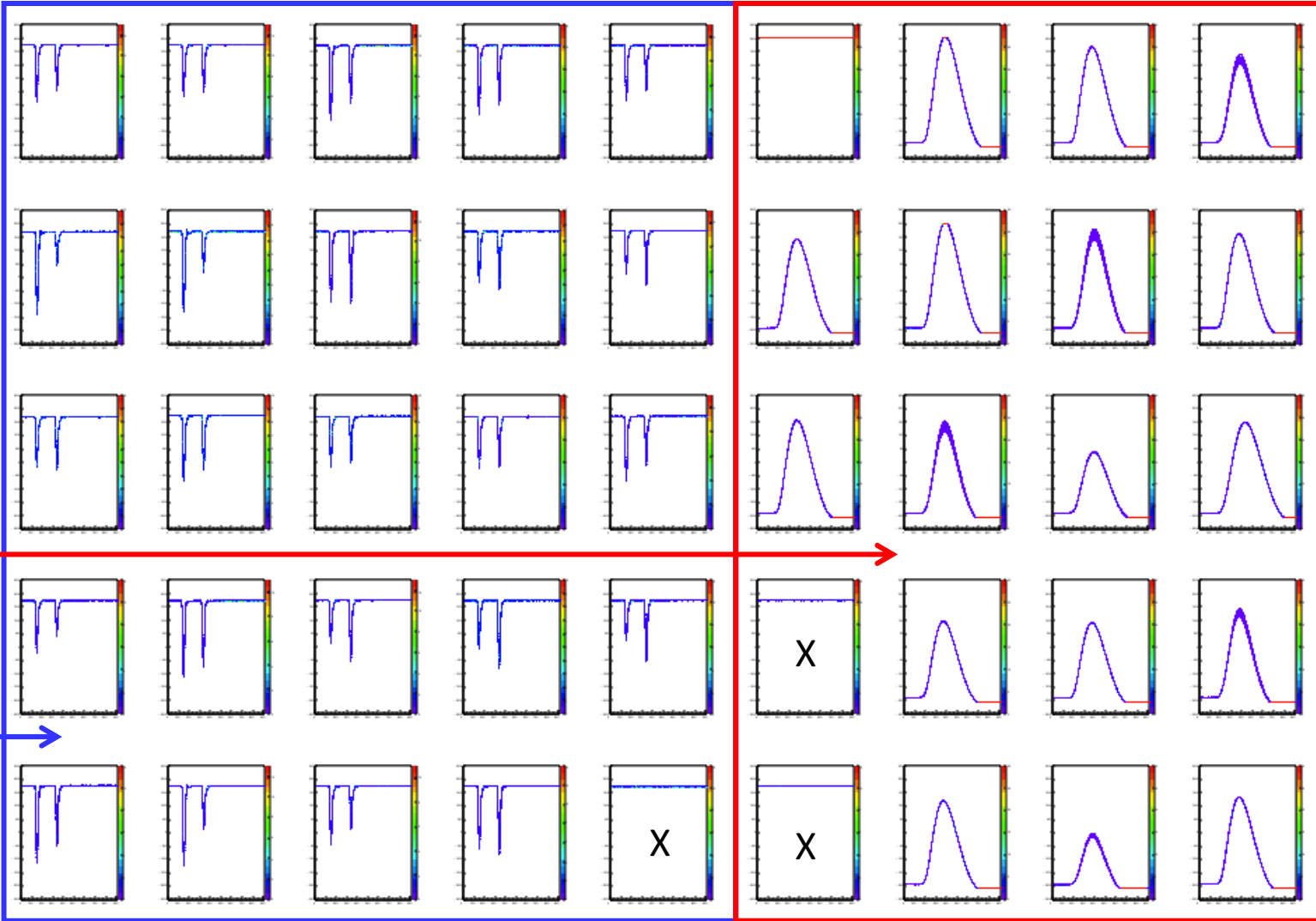


Laser interlock system

- The interlock system in the laser hut was completed and we obtained the ORC for the Class 3B laser
- We may now operate all the six lasers at the same time

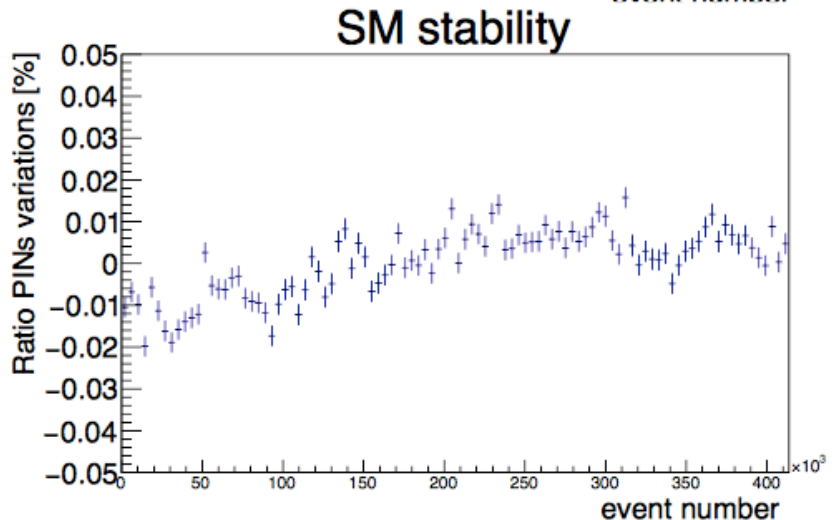
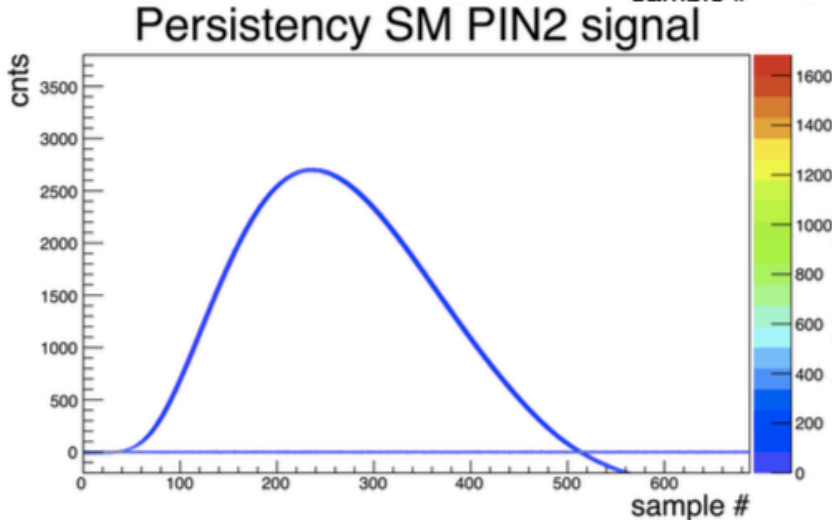
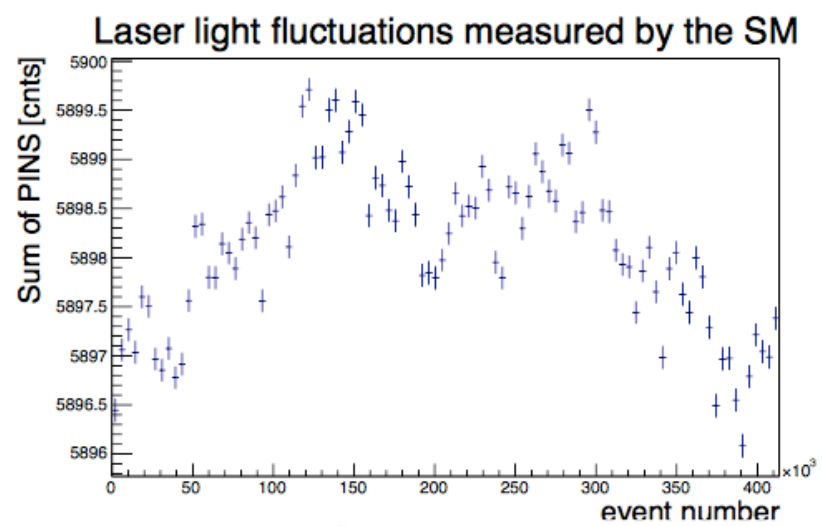
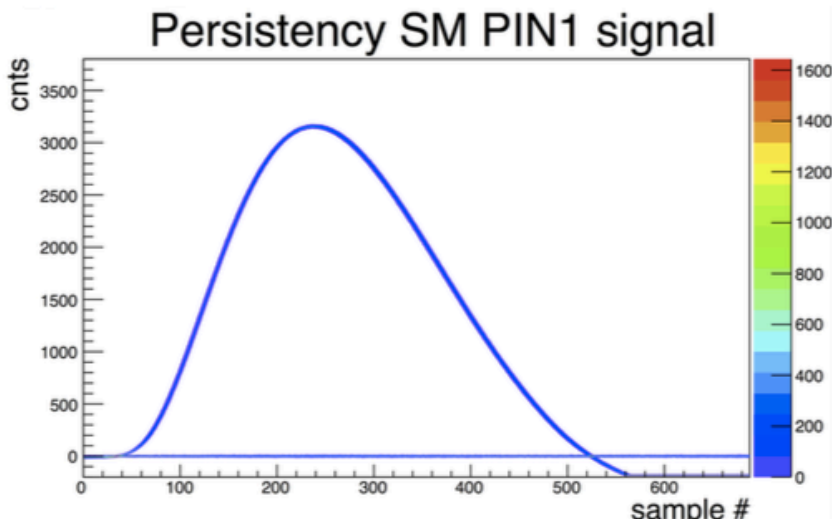
System debugging

- The monitors, even if not optimized, are working well
- The figure shows the DQM, with
- 17 sensors of the **source monitor** (one PMT is still missing)
- The 24 PMTs of the **local monitor**



Preliminary SM stability analysis

Courtesy of Anna Driutti

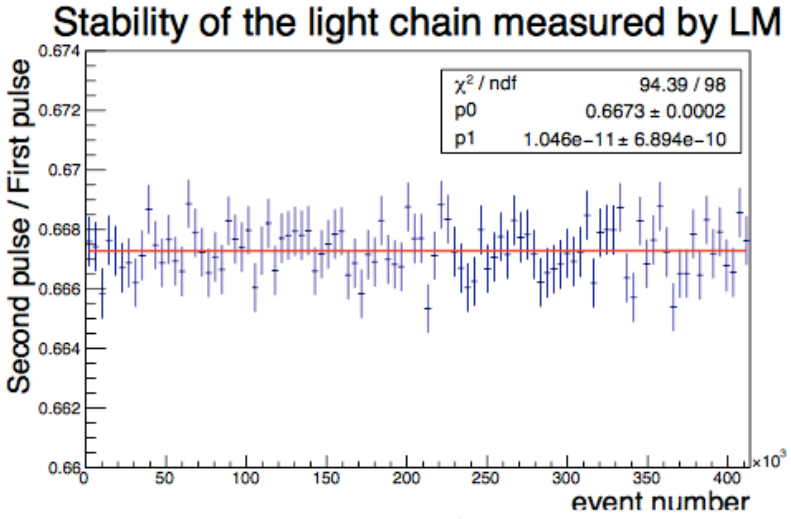
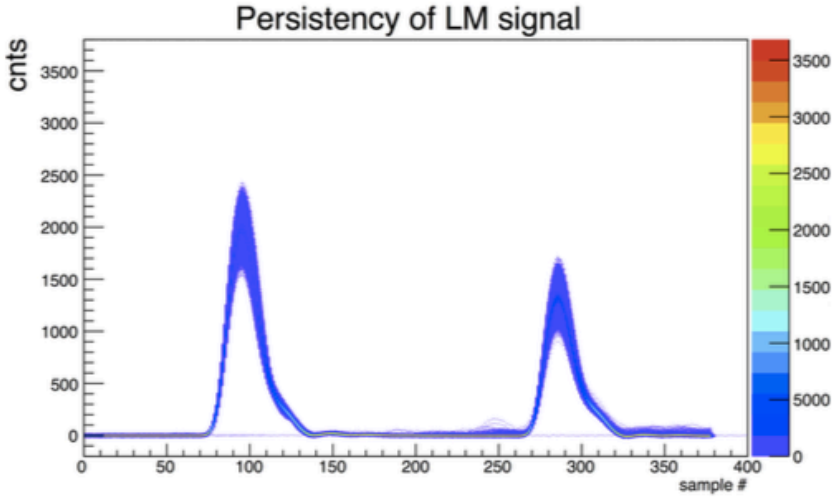


► There are 6 SMs \Rightarrow 6 SM corrections vs. time saved in the DB.

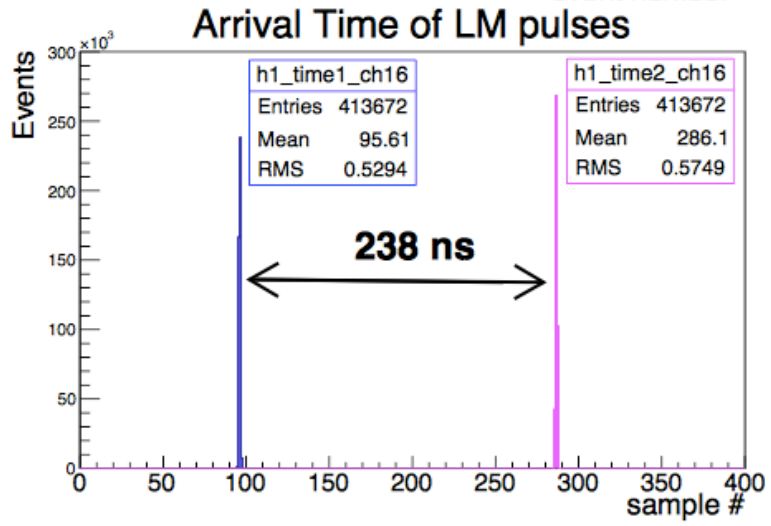
Data collection time 1.5 hours

Preliminary LM stability analysis

Courtesy of Anna Driutti



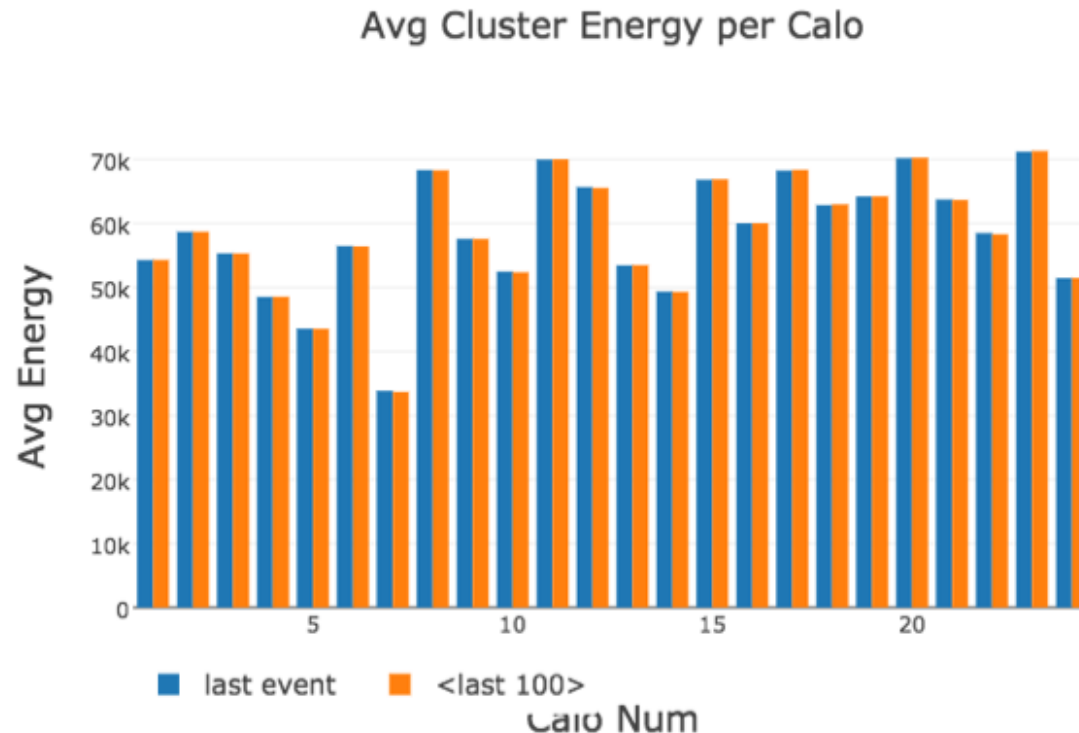
- ▶ LM receives two pulses:
first pulse: from SM
second pulse from diffuser upstream of calorimeter.
- ▶ **ratio of pulses** = measurement of distribution chain stability.
- ▶ There are 24 LMs (Photonics PMT) one for each calorimeter.



Data collection time 1.5 hours

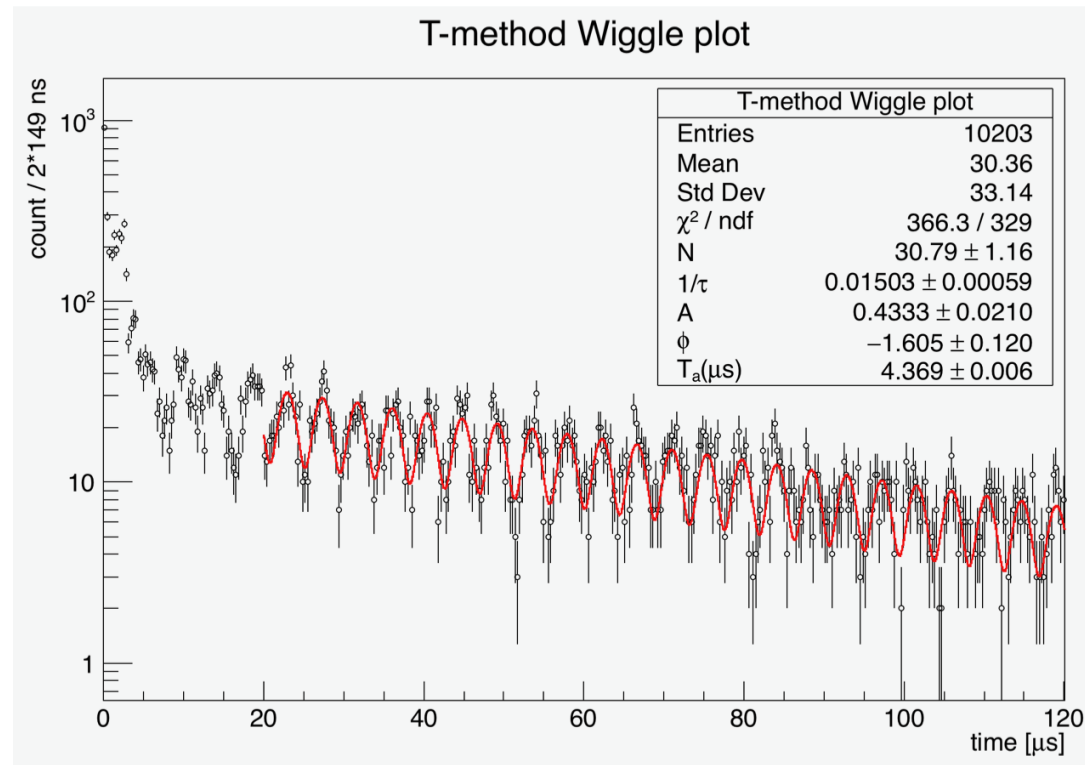
Calorimeter calibration

- We successfully fed with laser pulses all 24 calorimeters and calibrated the gain of all 1296 SiPMs using laser pulses of different intensity by varying the filters in the filter wheels placed in front of the six lasers
- The figure shows the result of the calibration procedure (the calorimeter 7 has not been optimized and shows a lower signal)



Provisional data acquisition

- In June Fermilab delivered a provisional beam (not the final beam, though, because the delivery ring is not yet working). The beam is contaminated with protons and pions, but the kickers are able to select the part of the beam with muons, it was thus possible to produce the first wiggle plot (see figure).
- This plot is proof that the calibration system is ready for data taking. After the summer break the final beam of muons will be delivered and the experiment proper will start



Conclusions

- Laser system completed
- Class 3B laser ORC obtained
- The laser system has been used 24/7 during the 5-week engineering run with proton beam
- Some upgrade is scheduled during the summer shut down
 - Setup of double pulse configuration (for pile-up and SiPM gain sagging studies)
 - Setup of 3-laser configuration (to simplify the switching between the normal and the double pulse configurations)
 - Installation of the new LM PMTs
 - Installation of the HV power supply for all LM PMTs