iTOP Commissioning

Tao Luo
University of Pittsburgh

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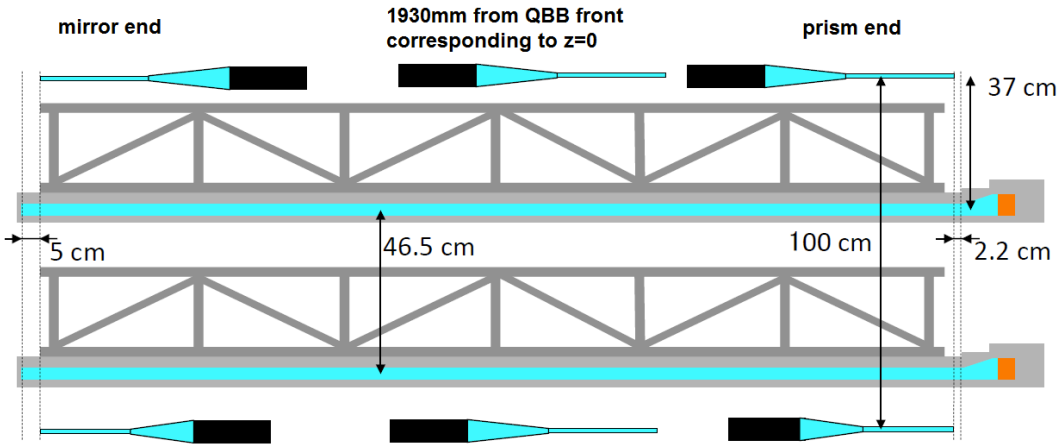
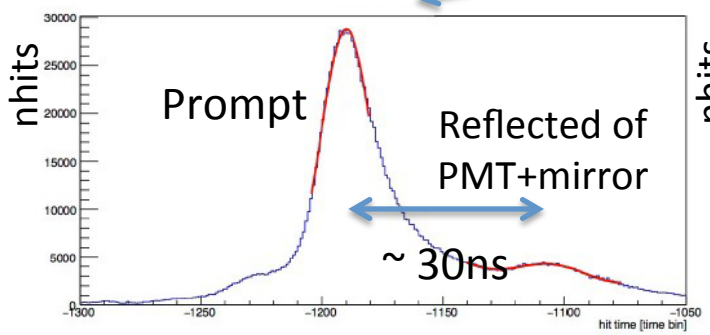
Module Production and Testing

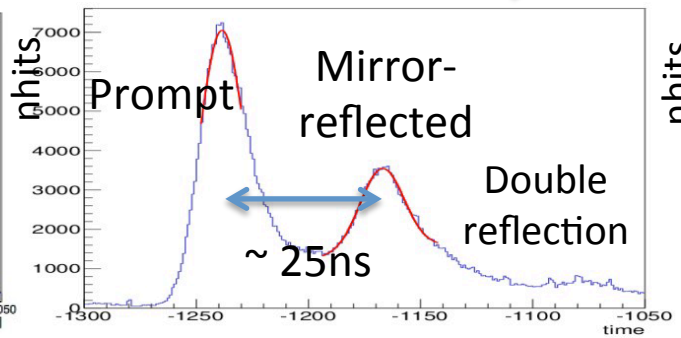
- Fuji Hall Testing (~9 days per module)
  - Initial tests and preparations (~2-3 days)
    - Cabling LV/HV/readout/cooling, etc.
    - Dark rate/light sealing
    - Communication/memory tests
    - Threshold scan
    - Cable performance/temperatures
    - Etc.
  - Two readouts with shared cosmic trigger (~6 days)
- Tsukuba Hall Testing (<4 days per module)
  - Setup (~1 day) then cosmics (~2 days) and laser (several hours, late-March+)
    - Comparison of PMT/ASIC hitmaps, prompt nHit with that from Fuji hall test
    - Pre/post move to Tsukuba and amongst modules
- 2+ shifters at KEK many hours/day, 7 days/week, +1 for daily data review

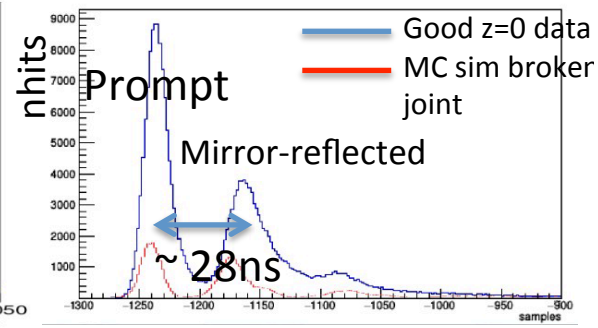
Sample Results

- Cosmic trigger at 3 locations
- No broken joint observed









Time bins (referencing to calibration pulse)

Issues Identified / Actions Taken

- "Fast feedback" plots and scripts
  - Immediately identify setup problems (pulser/HV off, ASIC reconfiguration needed, etc.)
  - Automated data transfer/processing/daily plots to monitor progress
- Boardstack/readout electronics:
  - 70 produced: 2 with communication issues (64 required for installation)
  - Many transient configuration/readout complications (debugging/ resolved over time)
- Cable tolerances
  - High temperature/resistance
  - Retest/replace AWG16 → 14 wire
- Optics performance
  - No catastrophic "broken bar" issues identified during testing and transport

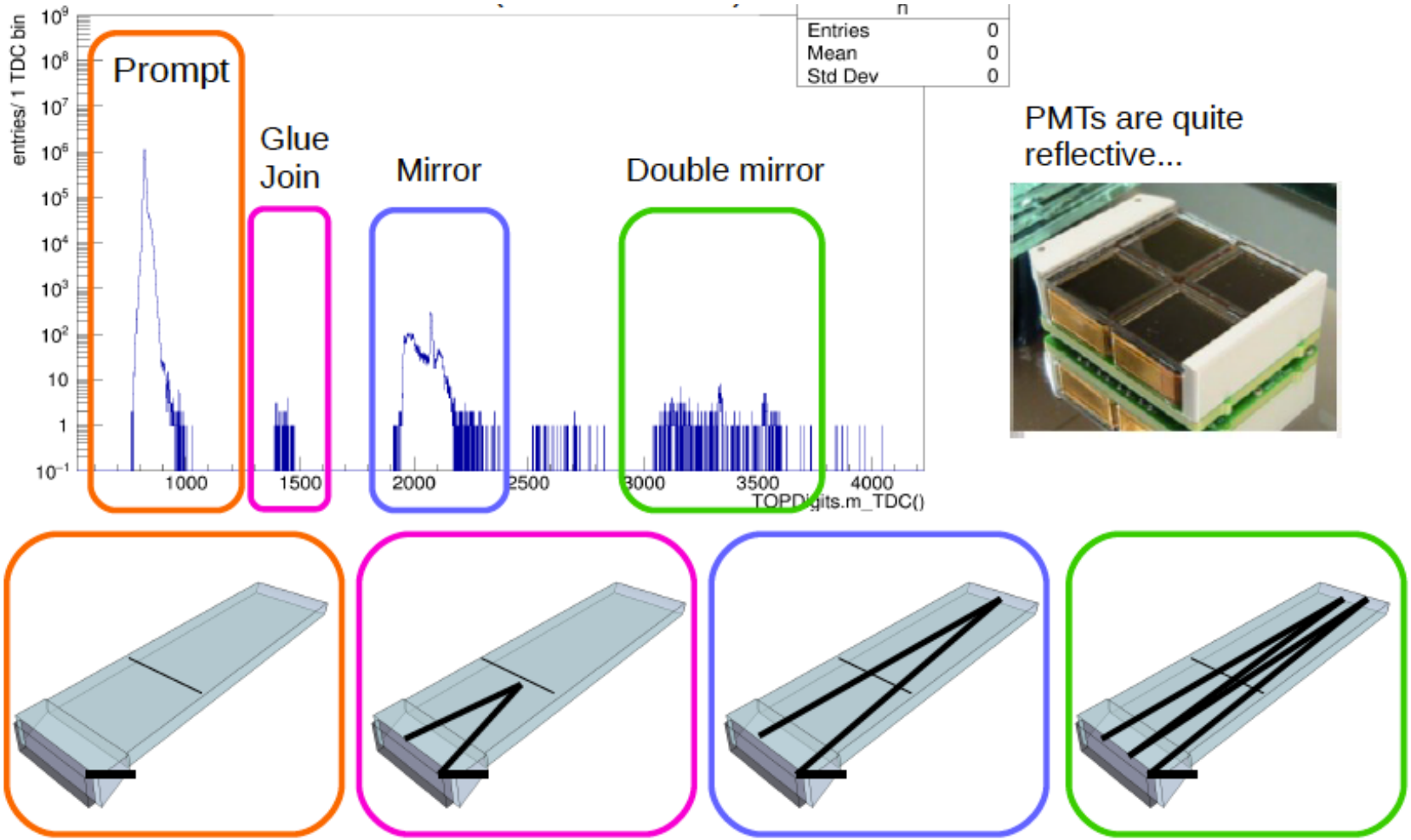
In-situ testing

Month	April																																
Date	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13
Day of the week	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri
Slot 01																														Install			
Slot 02																														Install			
Slot 03																													Install				
Slot 04																													Install				
Slot 05											Install	Cooling											First	Simultanoeus readout development									
Slot 06											Install											First	test										
Slot 07										Install									First	test				Feasible only if interlock is ready.									
Slot 08									Install									First	test														
Slot 09					Install												First	test															
Slot 10				Install												First	test																
Slot 11				Install											First	test																	
Slot 12				Install							First	test																					
Slot 13	Install									First	test																						
Slot 14	Install									First	test																						
Slot 15																																	
Slot 16																																	Install
HV / LV slow control and interlock								Interlock development																									
KLM / ECL trigger integration																																	
MAGNET tests																																	
DAQ support	DAQ experts in europe																																
TOP/CDC									CDC-TOP DAQ Shakedown Period																								
Other (conferences /meetings)																																	
Development																																	

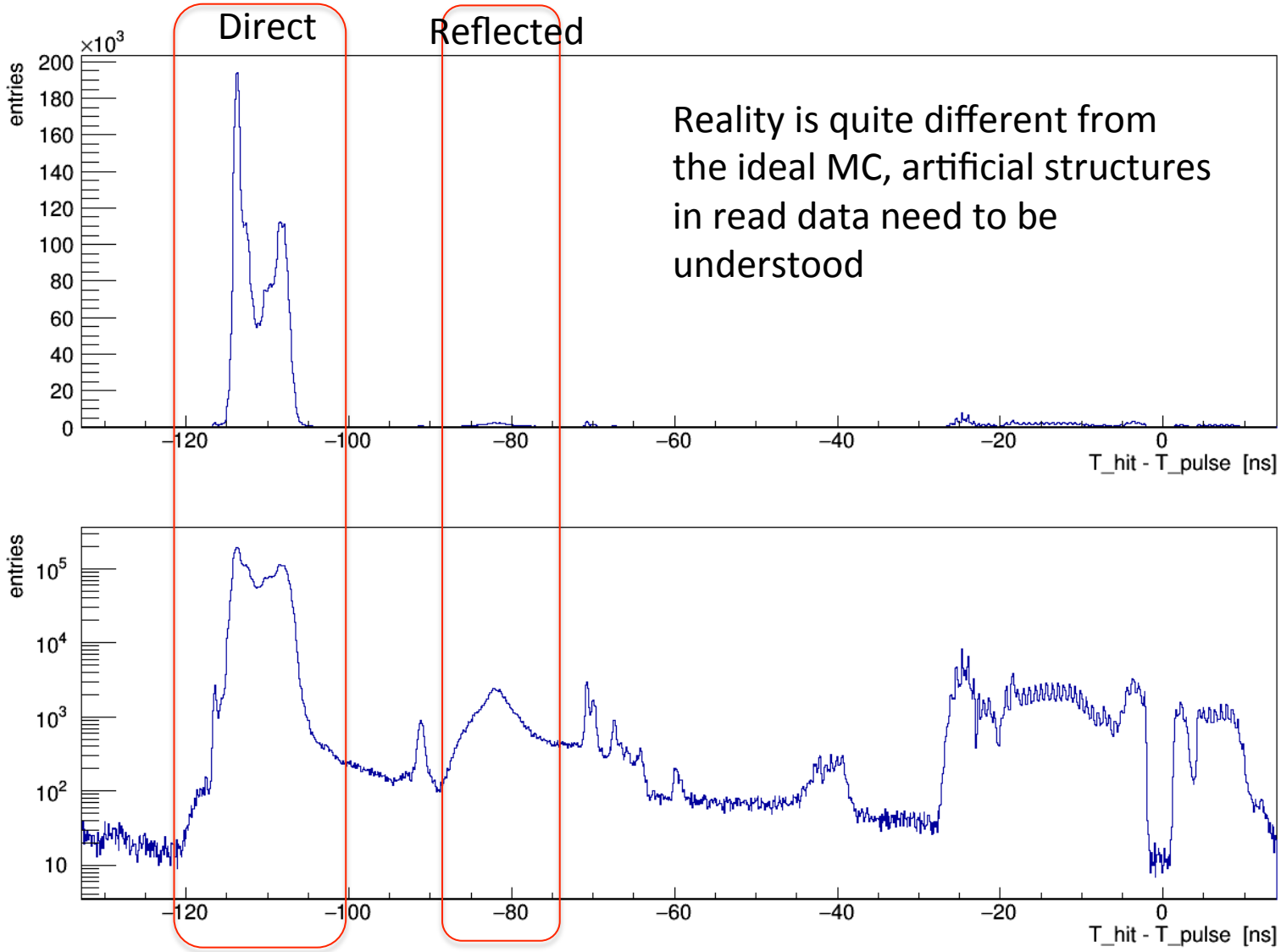
- In-situ tests, slot-by slot just after installation
  - Cabling test
  - Cooling and temperatures
  - HV test (dark counts & currents)
  - DAQ
  - Interlocks
  - Optics integrity with laser
  - Commissioning laser system itself

TOP tomography with time from MC simulation

Photon time (MC simulation)

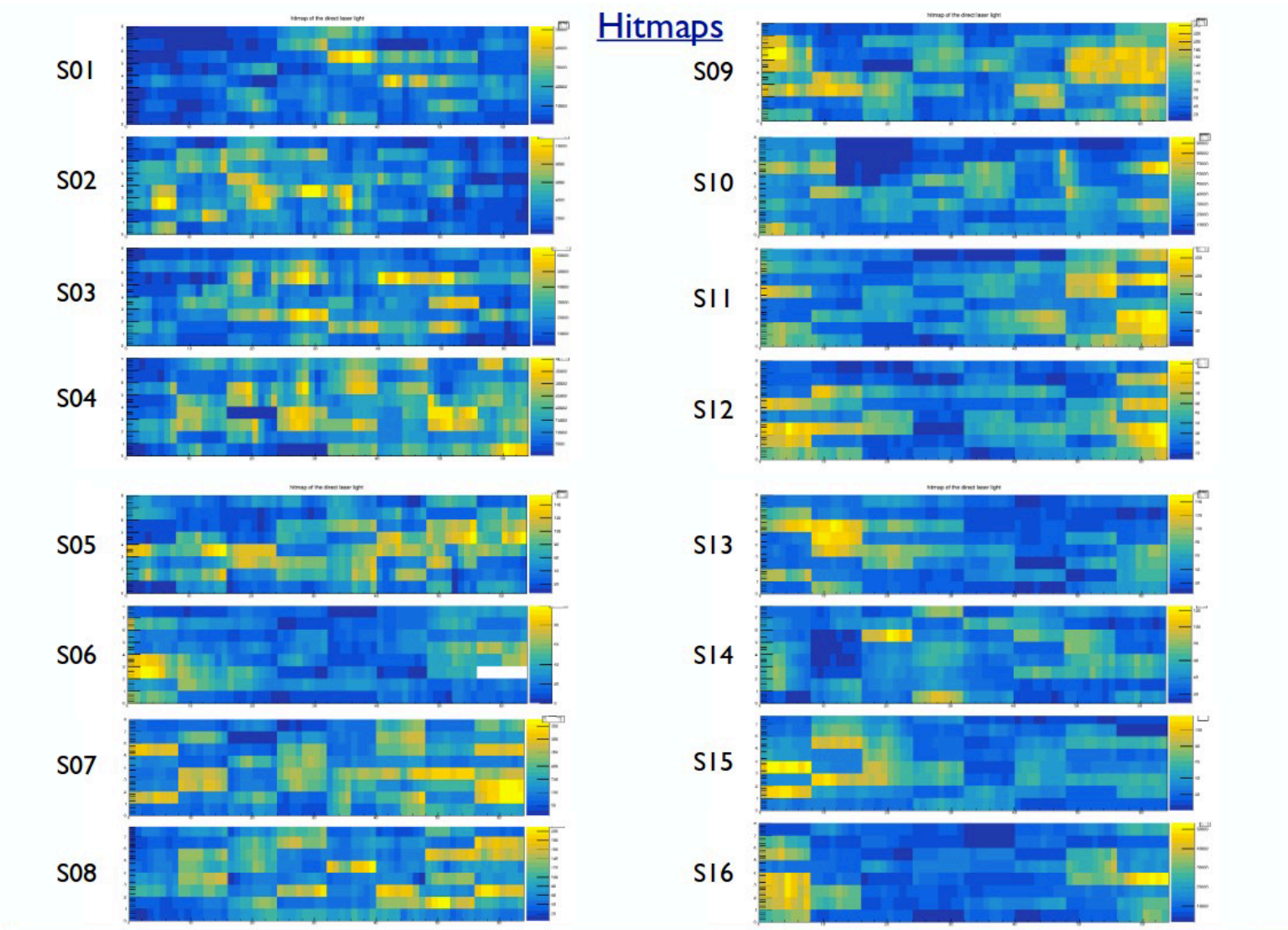


TOP tomography: real data



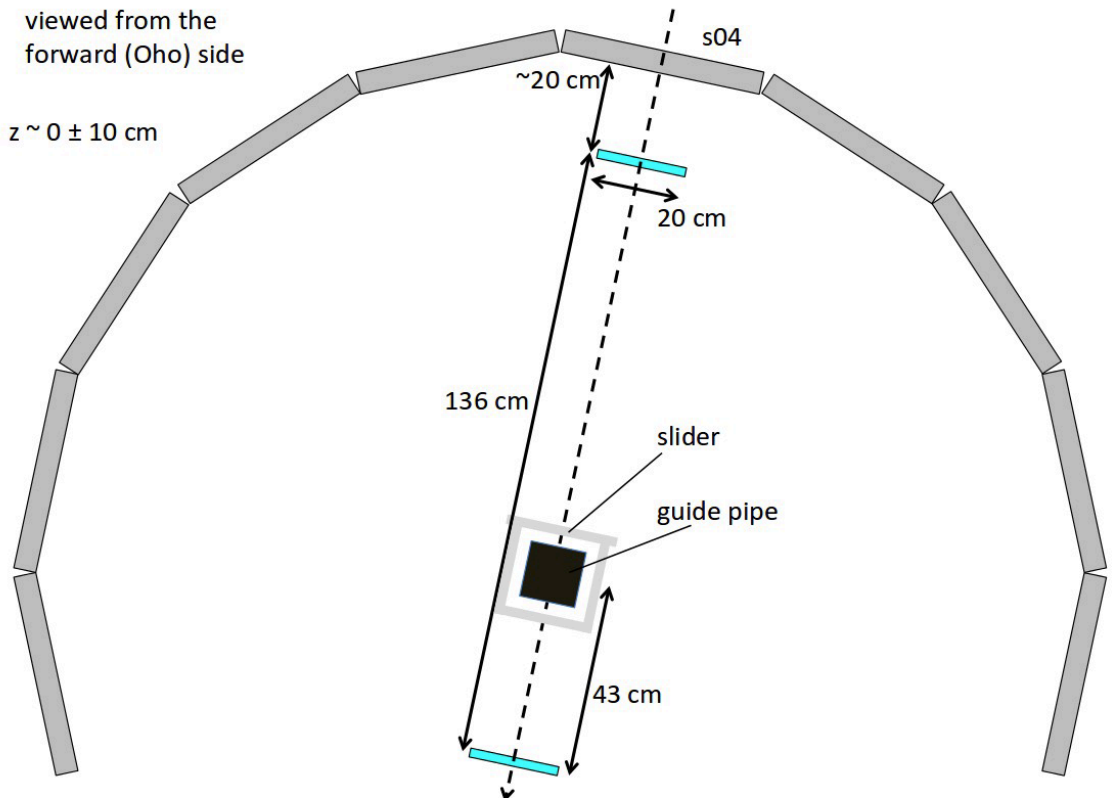
Reality is quite different from the ideal MC, artificial structures in read data need to be understood

Family picture

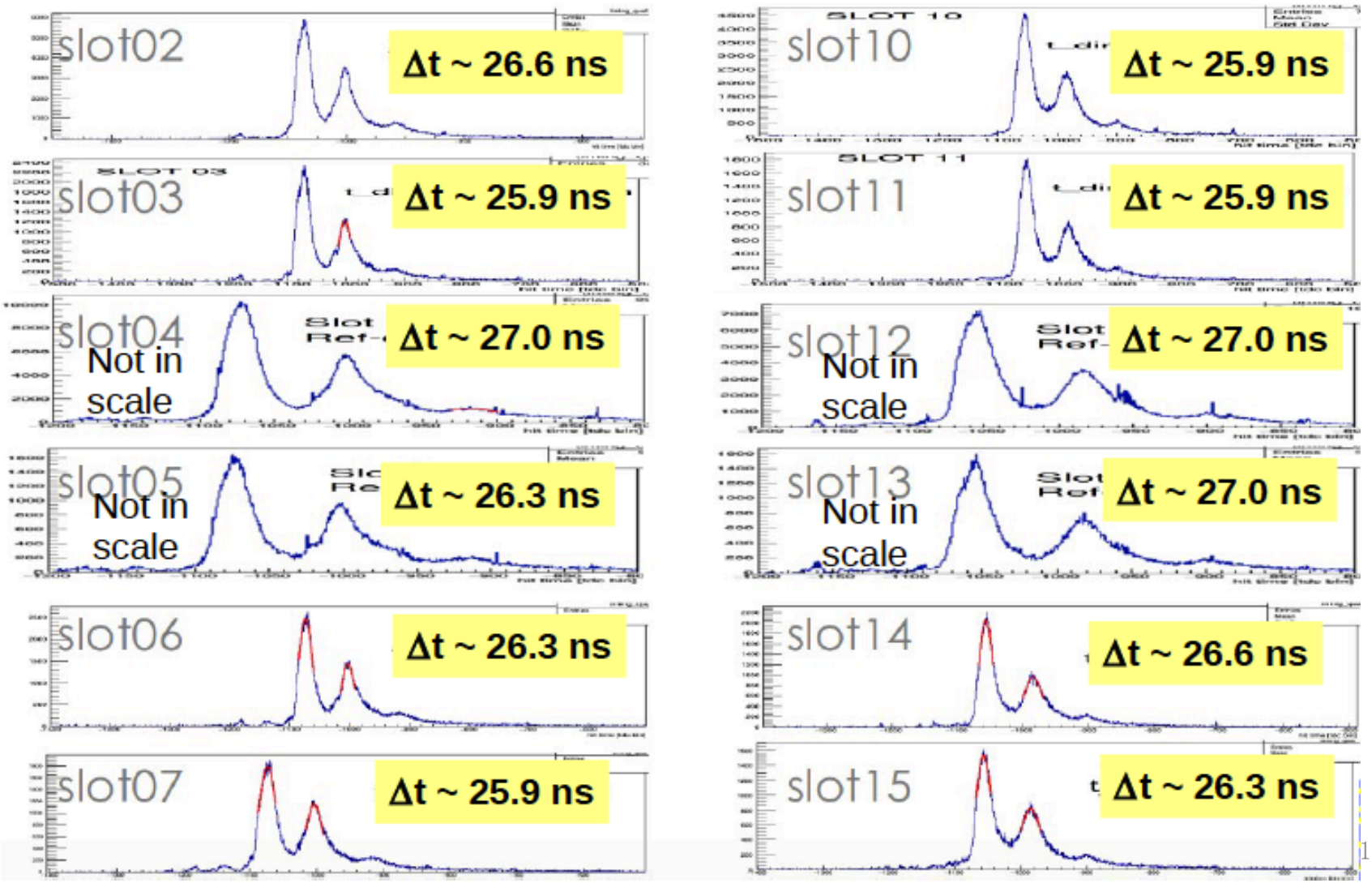


CRT commissioning

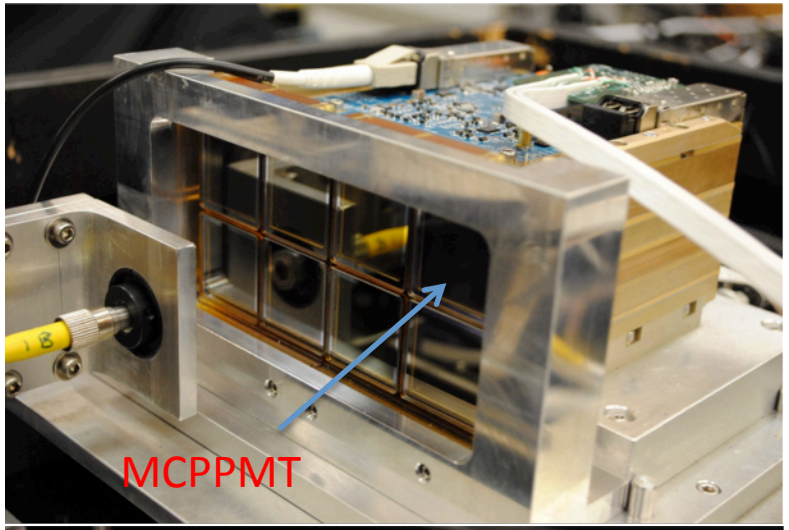
Without a KLM trigger, Nagya group set up a scintillator coincidence recycling the slider used for the slot installation
Two modules (back-to-back) at once
→ 0.15 – 0.05 Hz

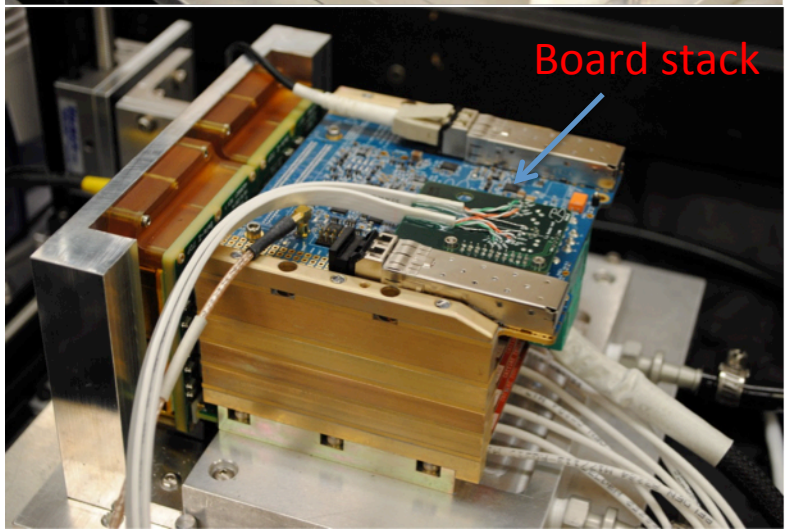


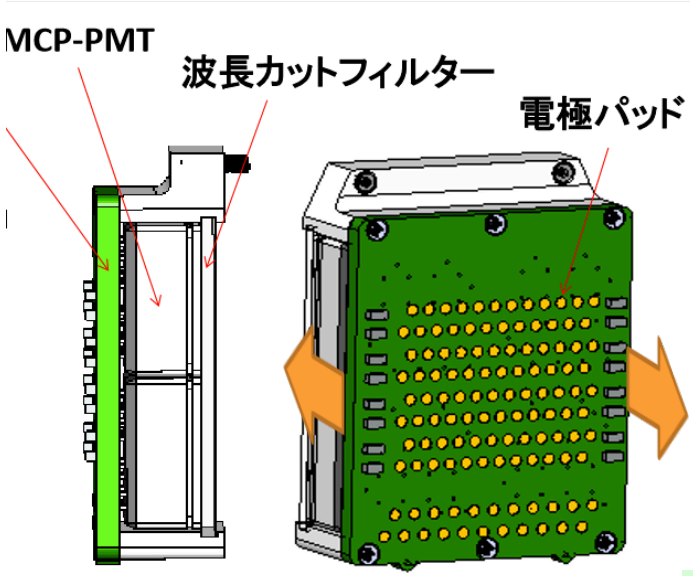
CRT commissioning



Rotation of MCPPMT in 1.5 T magnetic field

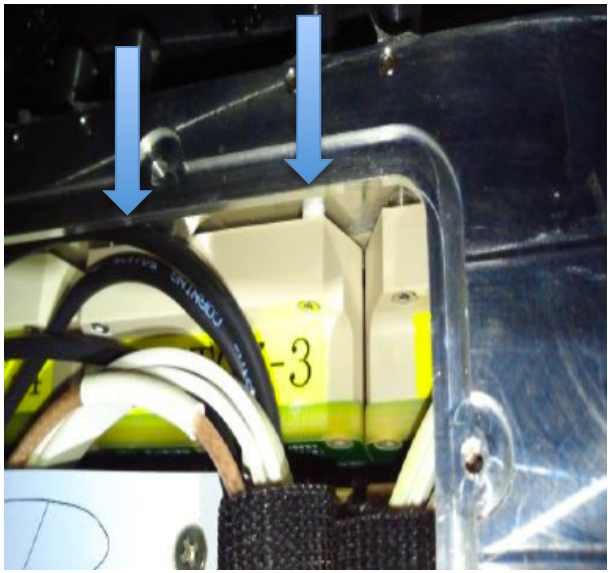






The optical contact becomes bad

Rotate



Two 1.5 mm thick plastic rectangle shim were inserted between the enclosure and the upper PEEK parts of the PMT modules to prevent the rotation

Conclusions

- No dead channels
- No major HV and LV issues
- Consistent behaviour among all the slots
- No catastrophic optical damages during transportation and installation
- The FEE boards and the PMTs work as expected

Referring to Bryan, Umberto, Matsuoka-san's talks