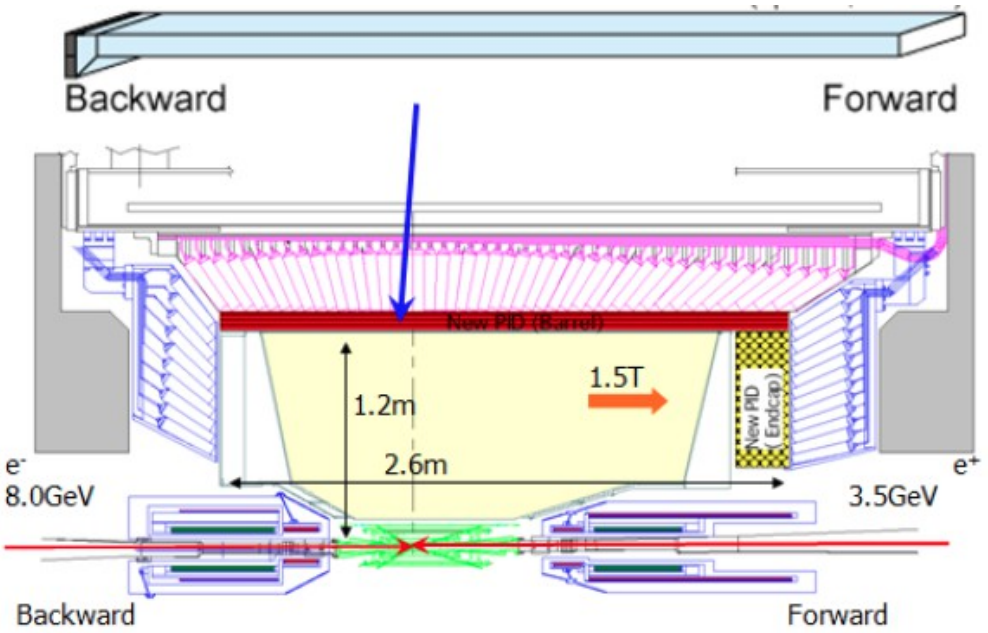
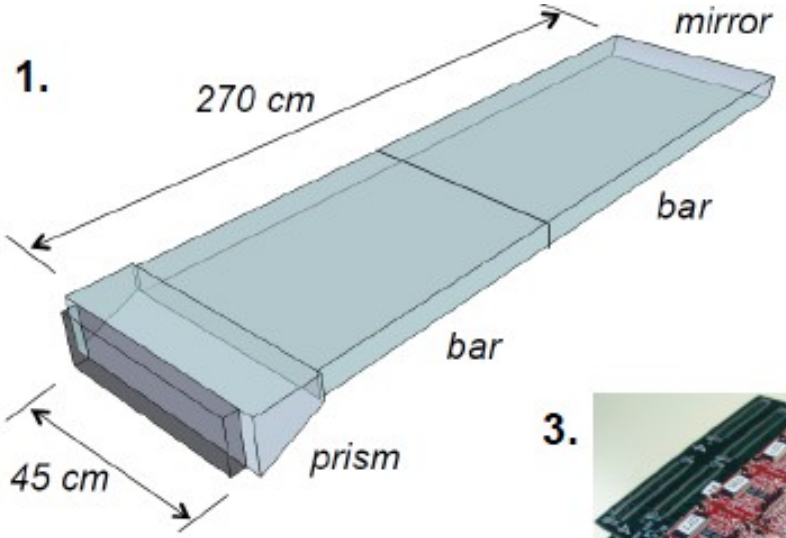
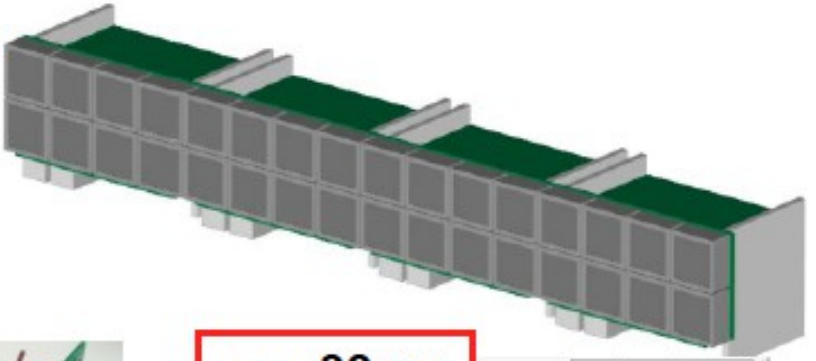
TOP status report



1.

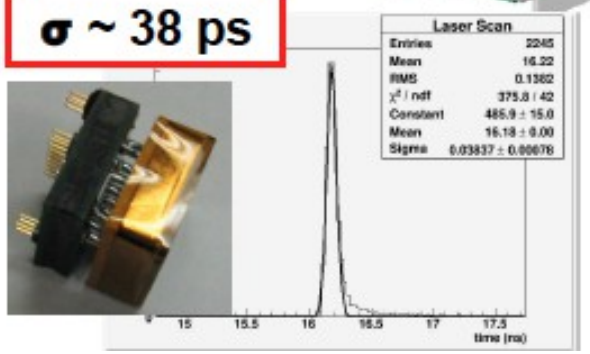


2.

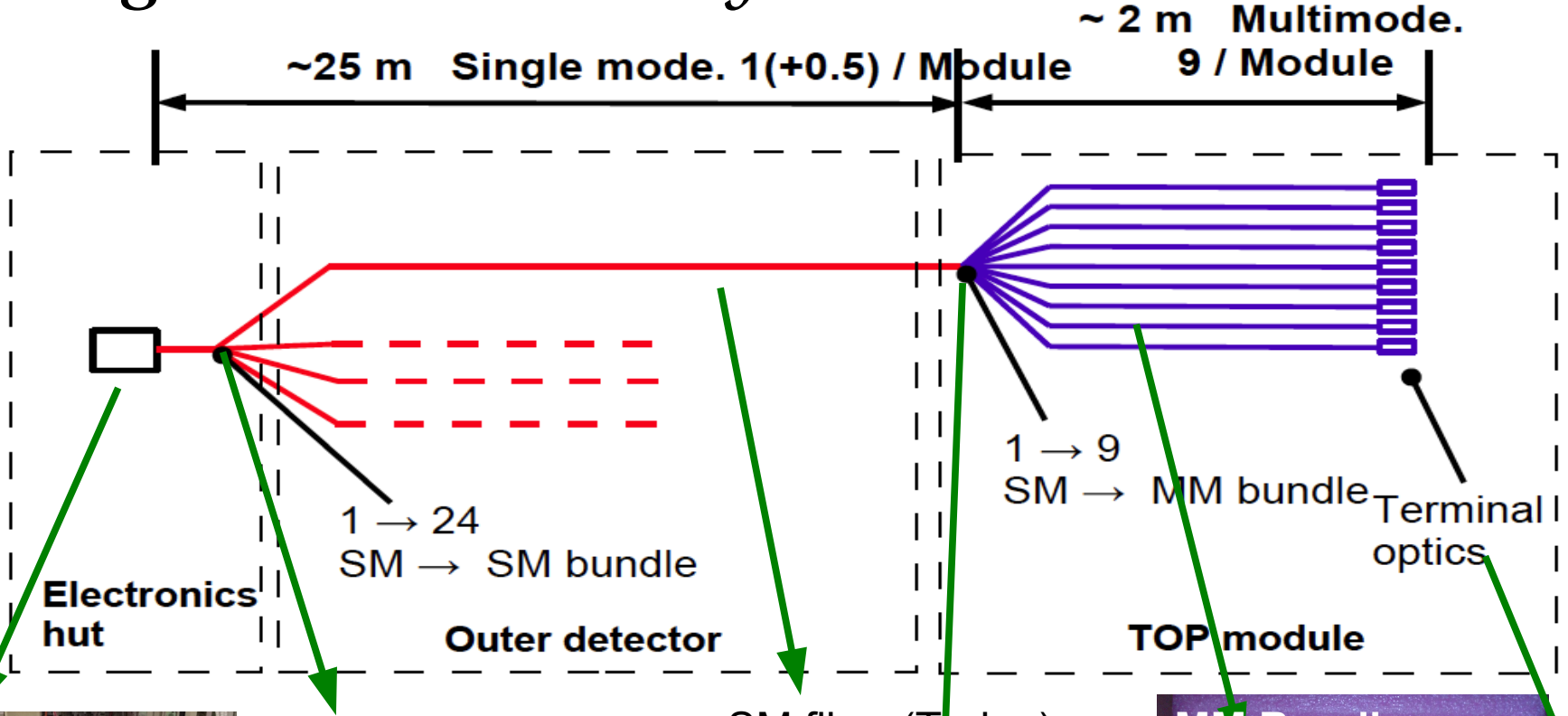


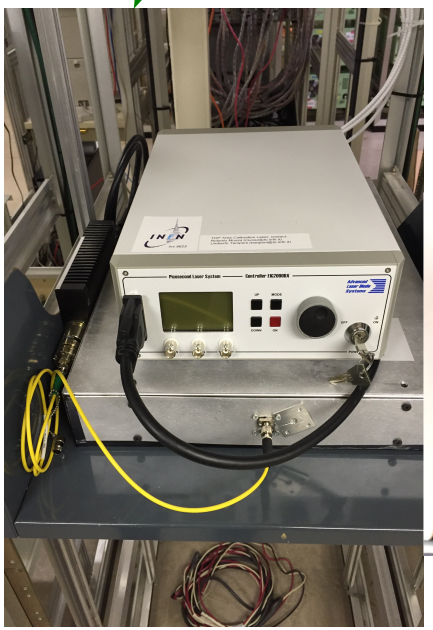
3.

σ ~ 38 ps



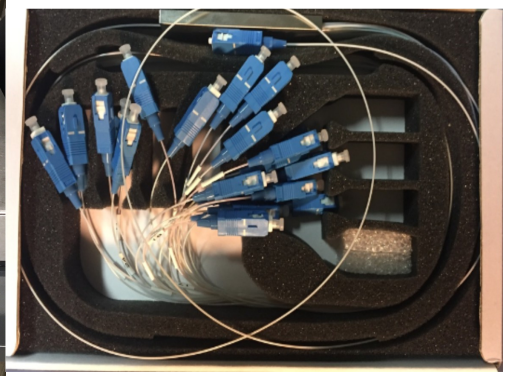
TOP light distribution system



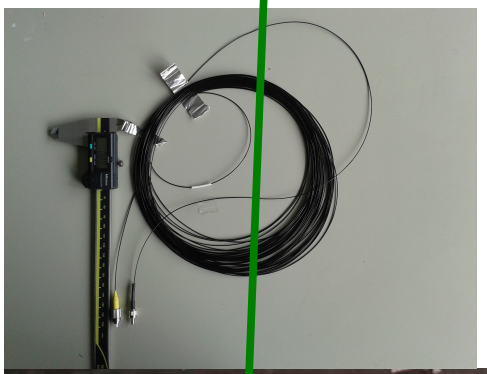


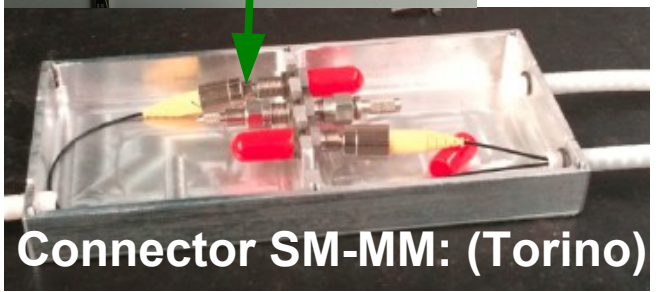
PiLas laser (Torino)

NEW: Splitter 1-24 via Planar Light Circuit (Padova)



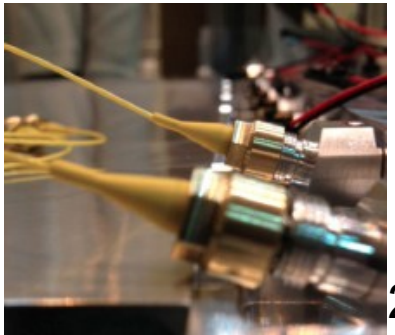
SM fiber (Torino)



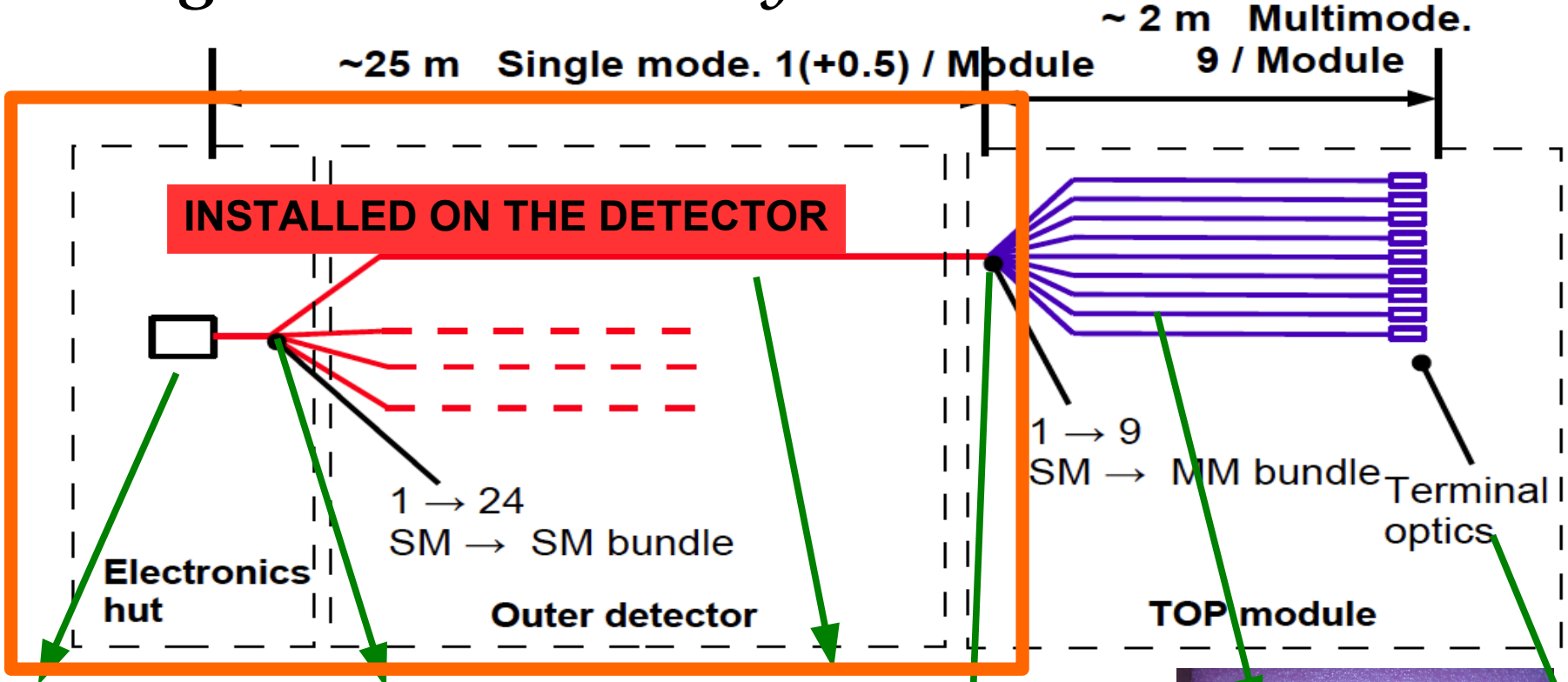


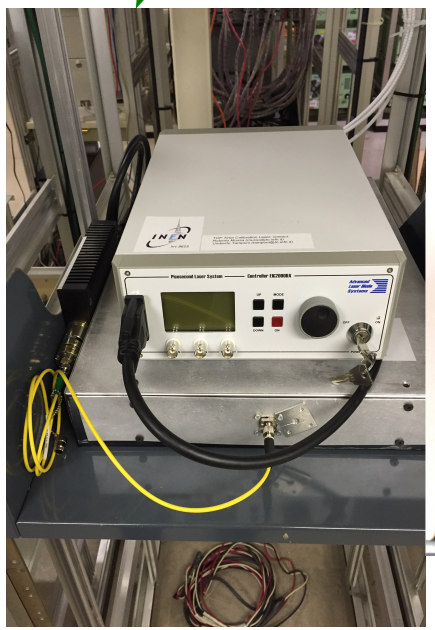
Connector SM-MM: (Torino)

GRIN Lenses (Padova)



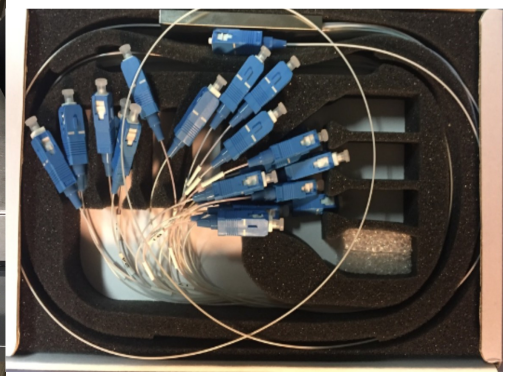
TOP light distribution system



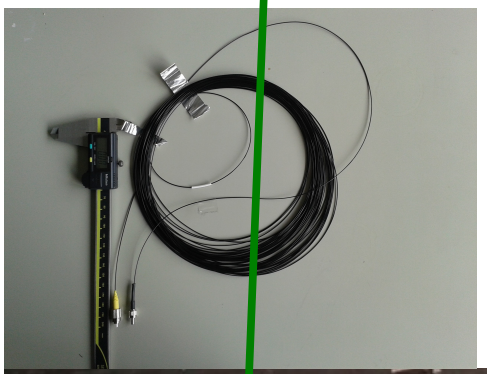


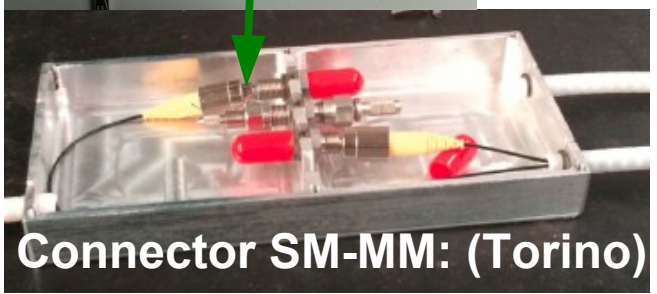
PiLas laser (Torino)

NEW: Splitter 1-24 via Planar Light Circuit (Padova)



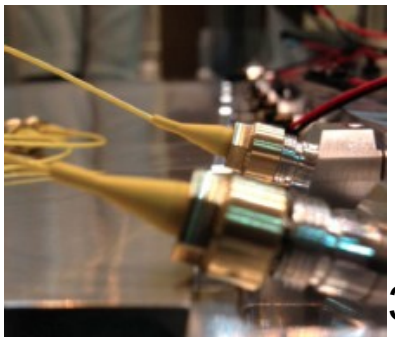
SM fiber (Torino)



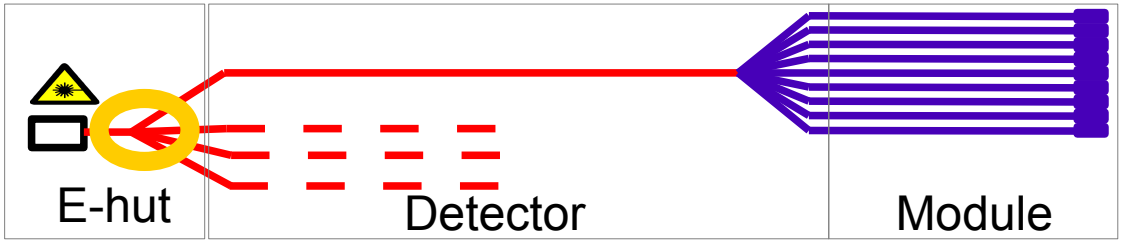


Connector SM-MM: (Torino)

GRIN Lenses (Padova)

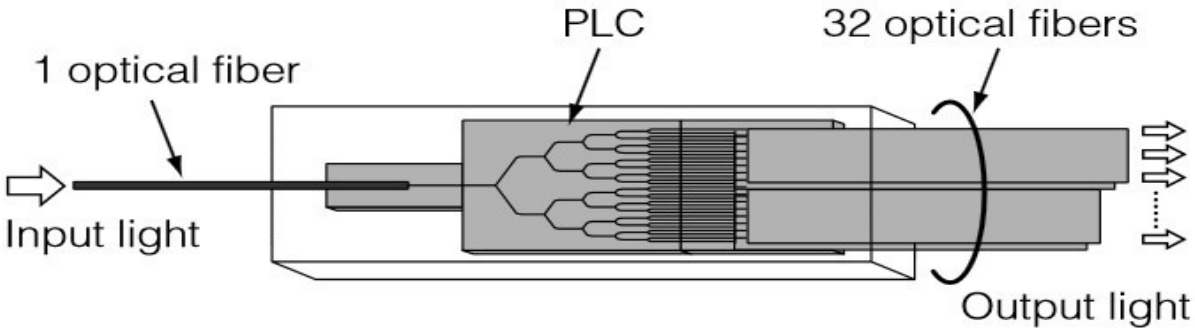


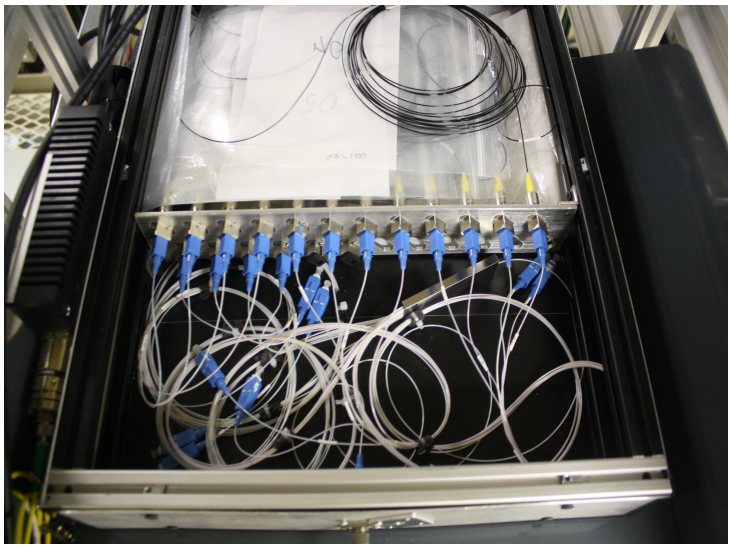
PLC splitter

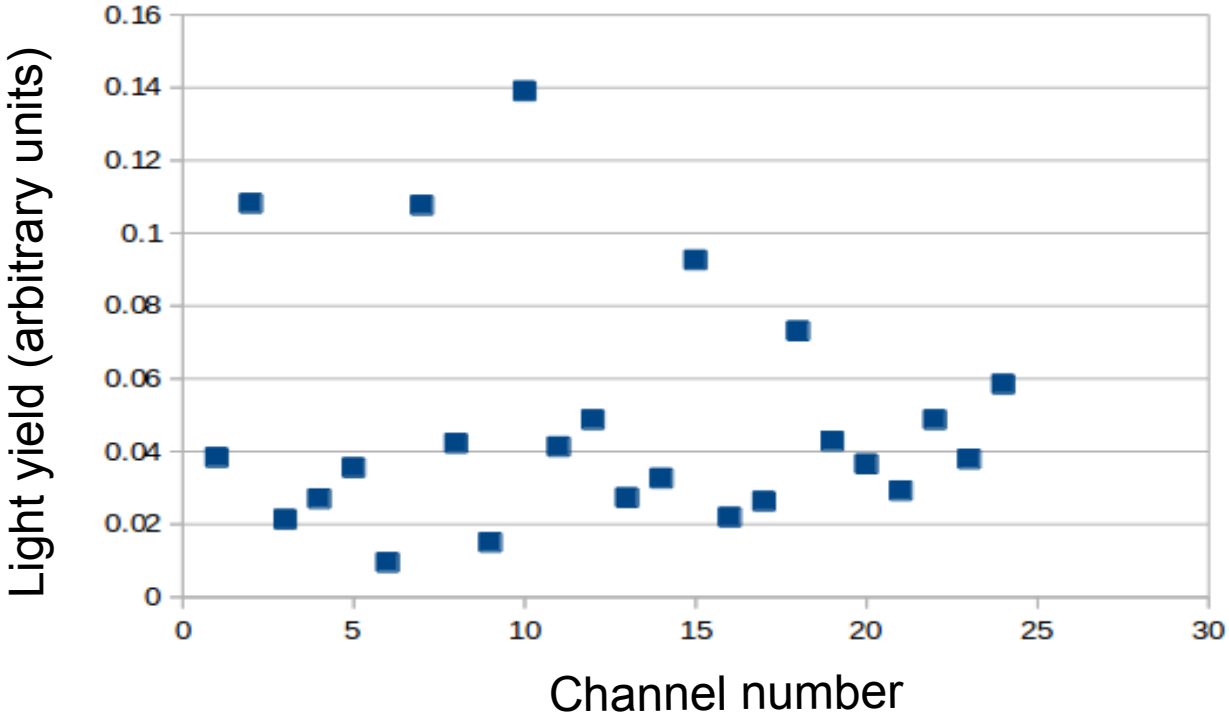


Planar lightwave circuit

- tree of Y shaped, micrometric light guides
- Construction technology similar to electronic semiconductors
- Splitting efficiency ~ 1-2% per channel **(only ~50% light loss due to splitter!)**



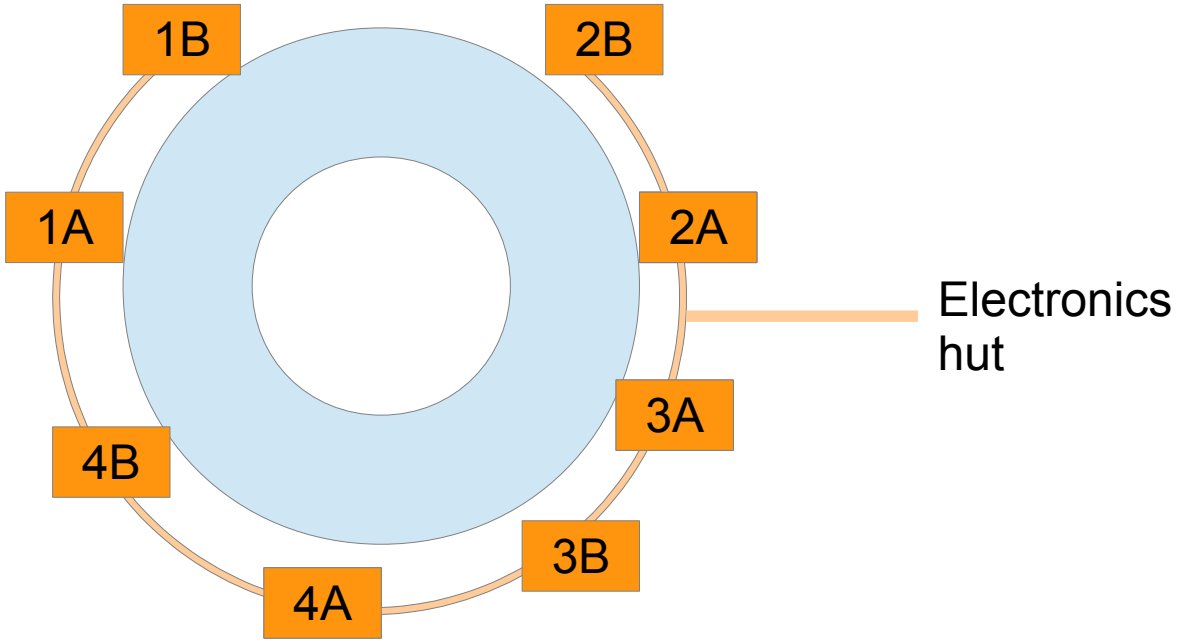


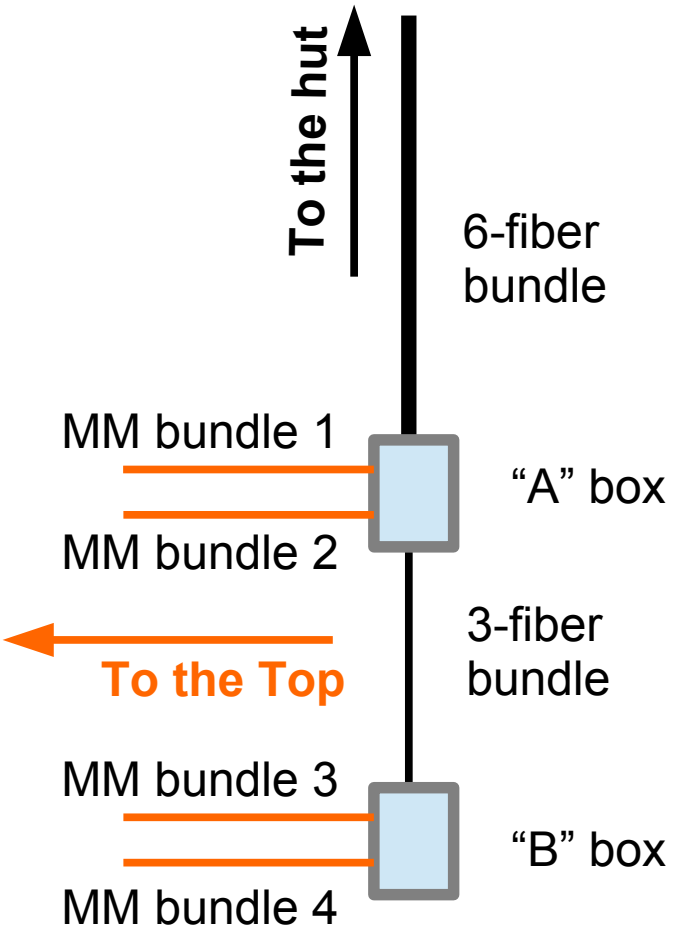


Good uniformity of the light output from each channel from tests both in Padova (with CCD) and in Torino (single photon counting on PMT)

SM Fiber routing and preparation

24 fibers are divided into 4 bundles, each one serving 4 modules (+2 spare fibers)
Each bundle reaches 2 connector boxes, each one serving 2 modules

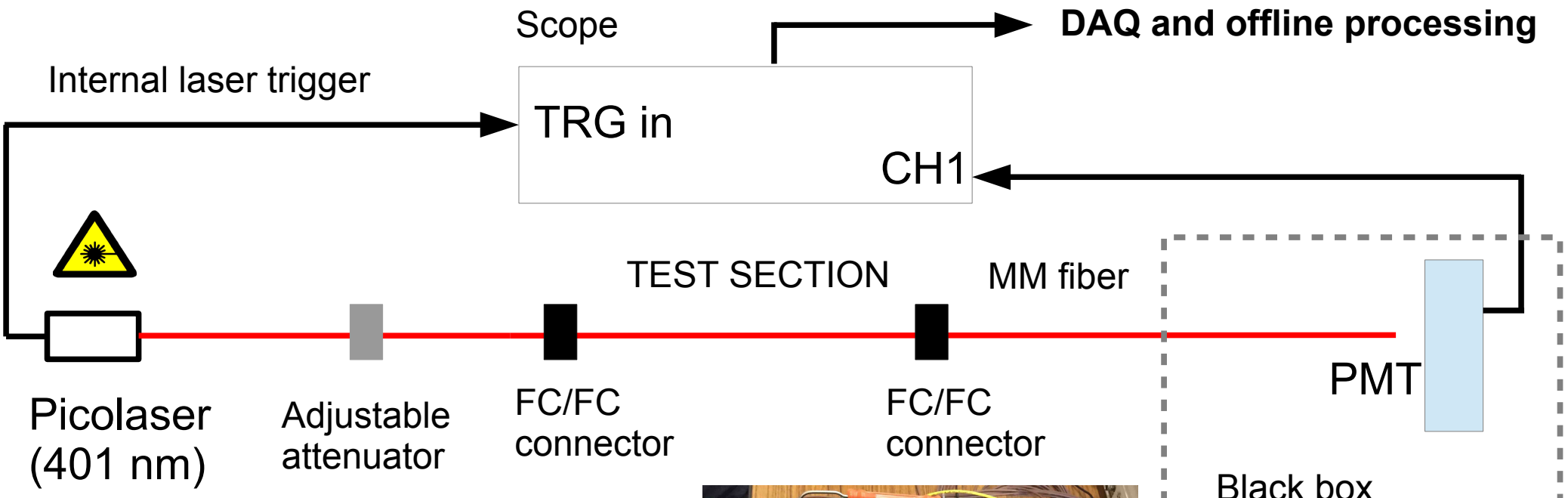




Fiber Production/testing procedure:

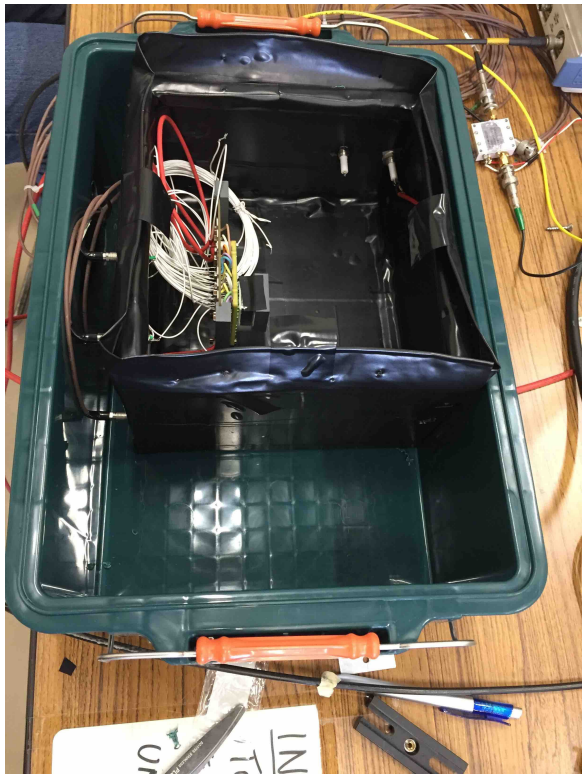
- Cutting and connectorization (Torino)
- Visual inspection an shipping to KEK (Torino)
  - Polishing test w/ diffractive method (Fuji F1)
  - Coating integrity test (Fuji F1)
  - Timing measurements with PLC connected (Fuji F1)
- Preparation of the 4 bundles (Fuji B1)
- Installation on the detector (Tsukuba B4)
- After-installation light transmission check (Tsukuba B4)

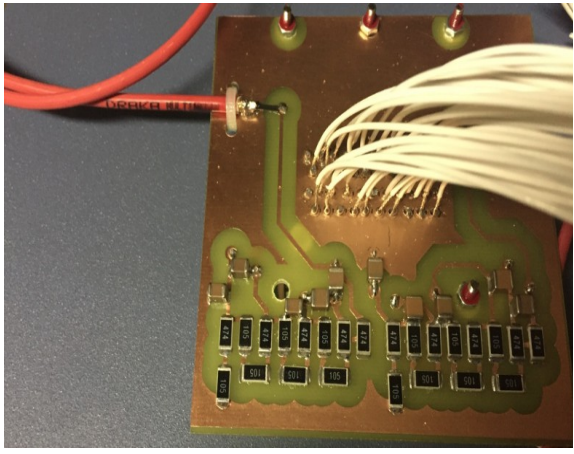
Fiber testing setup (Torino/KEK)



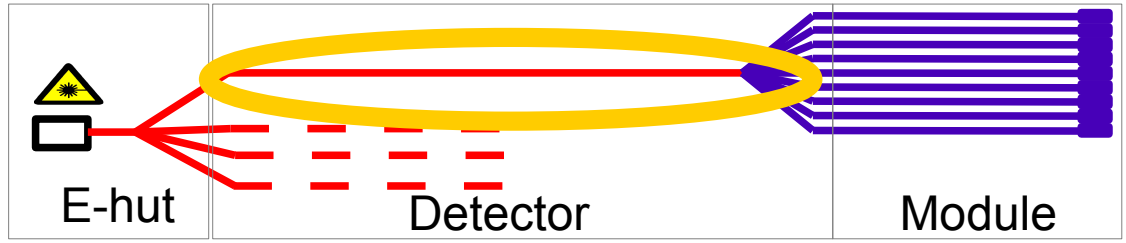
Torino
Fixed black box
PMT KT447 (HV = 2800 V)
LeCroy BW = 2.5 GHz
Sampling rate = 20 GSa/s

KEK
Portable black box (10 Hz dark rate)
PMT KT447 (HV = 2500 V)
LeCroy BW = 2 GHz
Sampling rate = 10 GSa/s

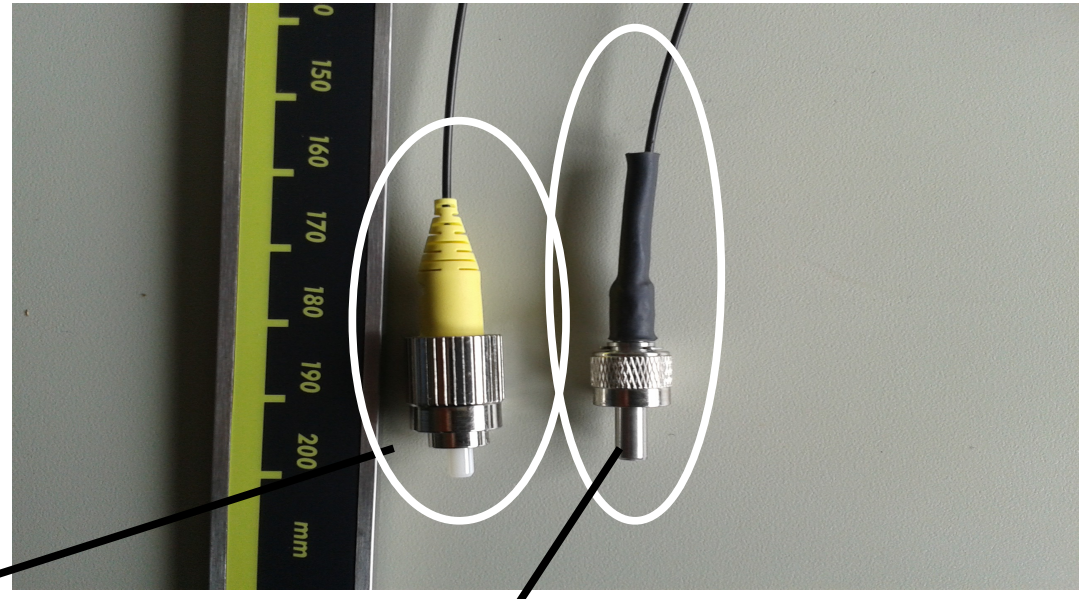




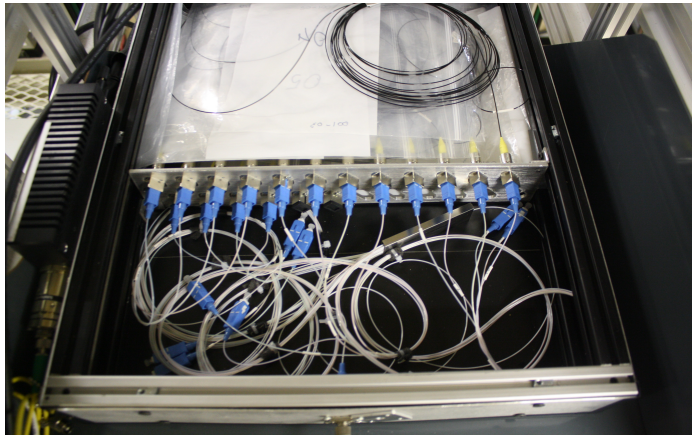
SM fibers testing



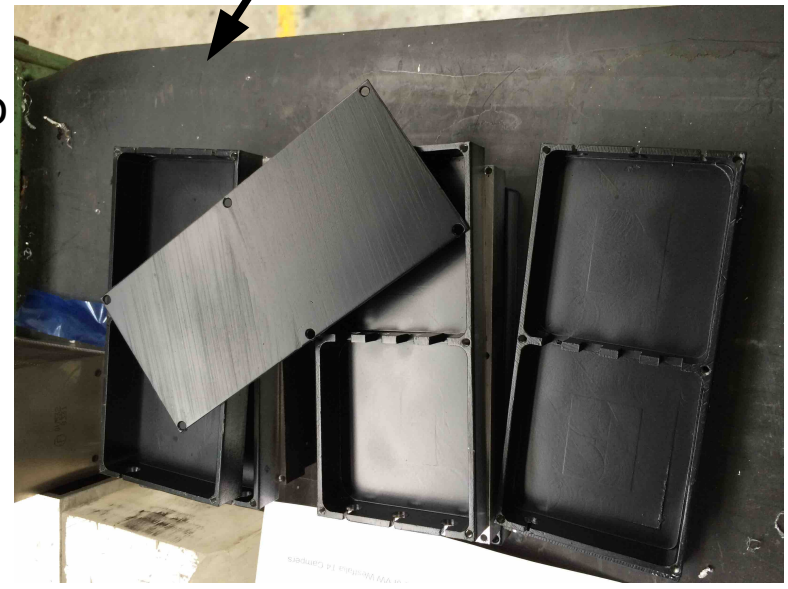
24 (16 + 8 spares), 27-m long single mode fibers prepared By O. Brunasso in Torino



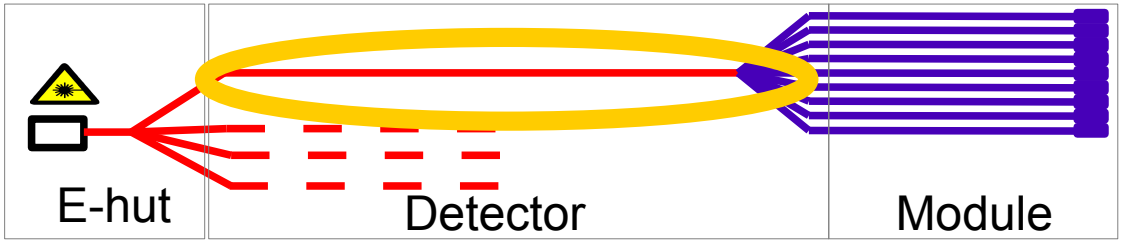
FC connector to the PLC via an SC-FC adapter



SMA connector to the Multi-mode bundle in the calibration connector boxes fixed on the detector

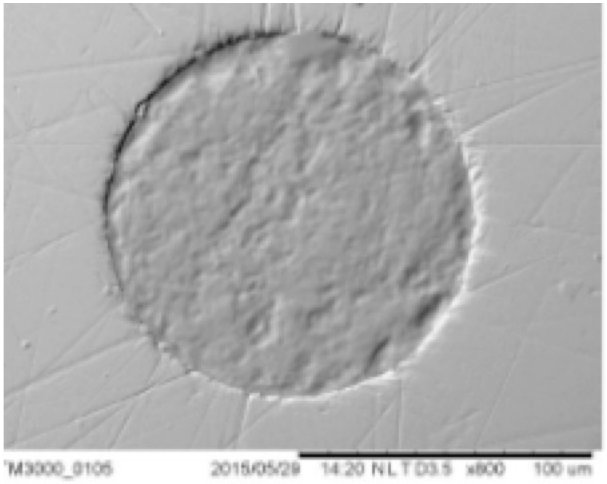


SM fibers testing

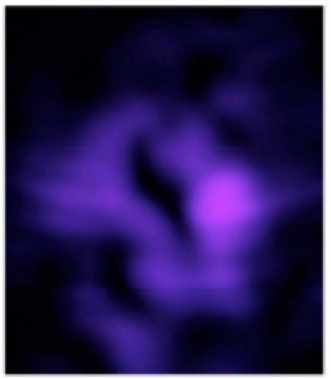


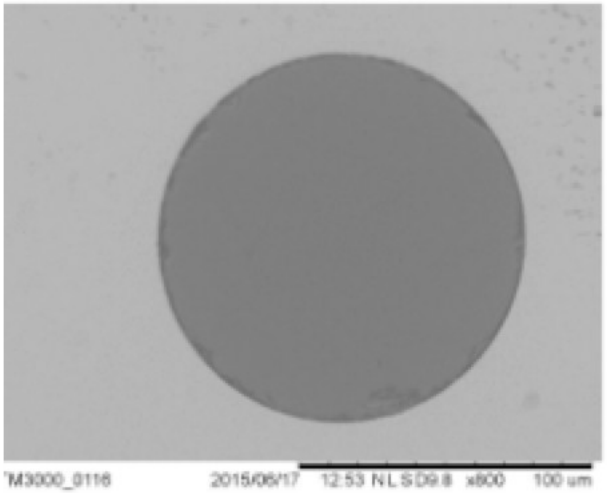
Connector polishing

A bad polishing of the fiber connector was observed in Torino using the SEM
→ A diffraction pattern is produced in the beam spot profile seen on a commercial CCD



BAD



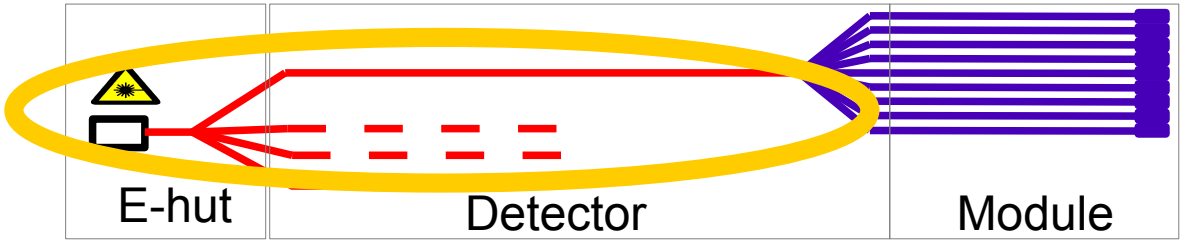


GOOD

All the 24 fibers are tested on each size using 401nm light in Fuji F1

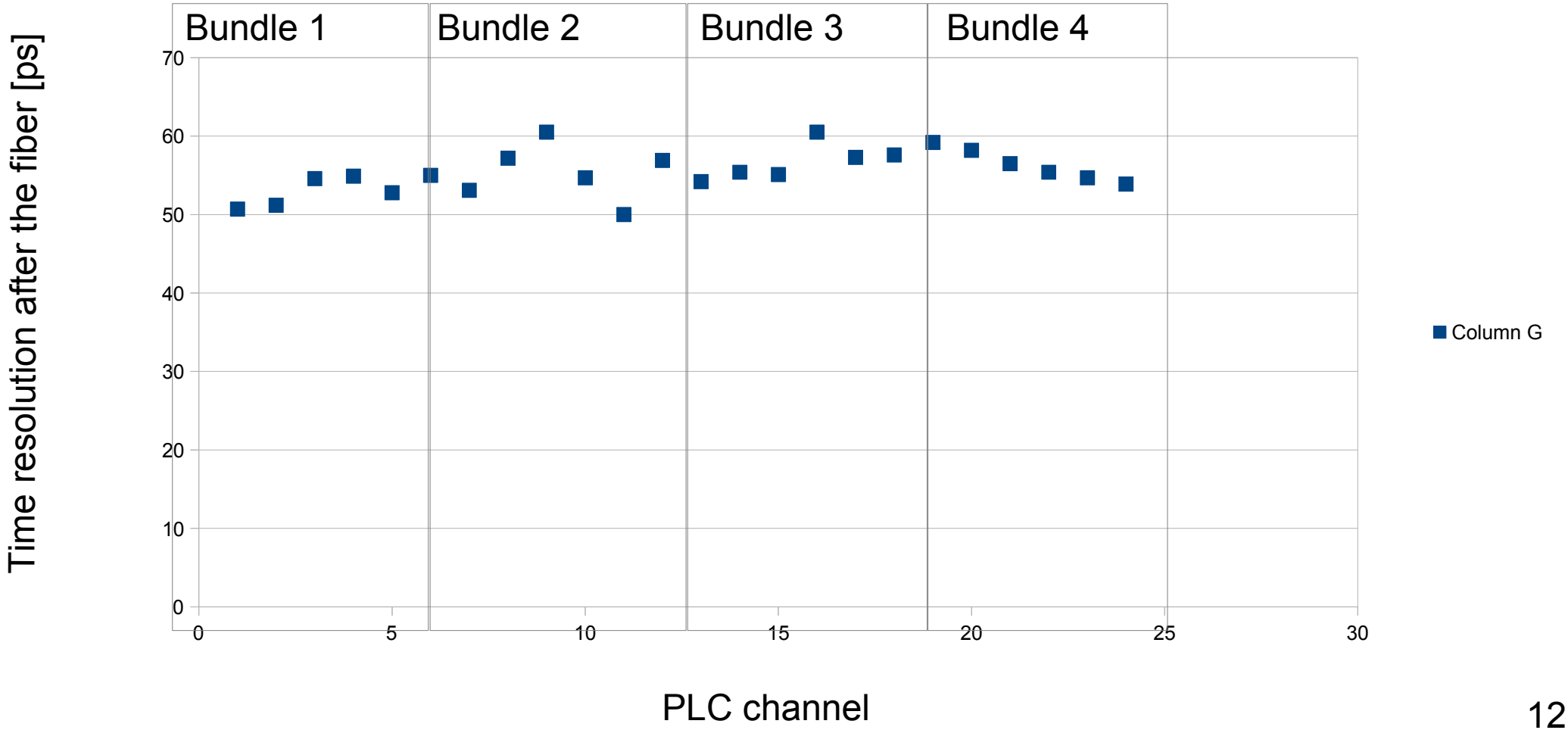
No bad polishing on any connector was found

SM fibers testing

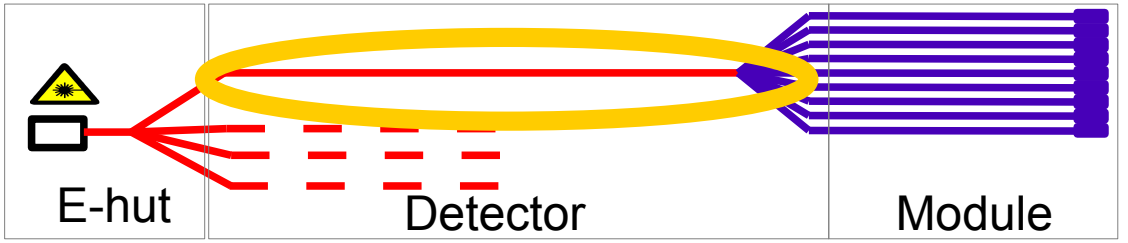


Single Photon time resolution

Time resolution is slightly worse than the one obtained in Torino
→ Different DAQ
→ Lower PMT gain

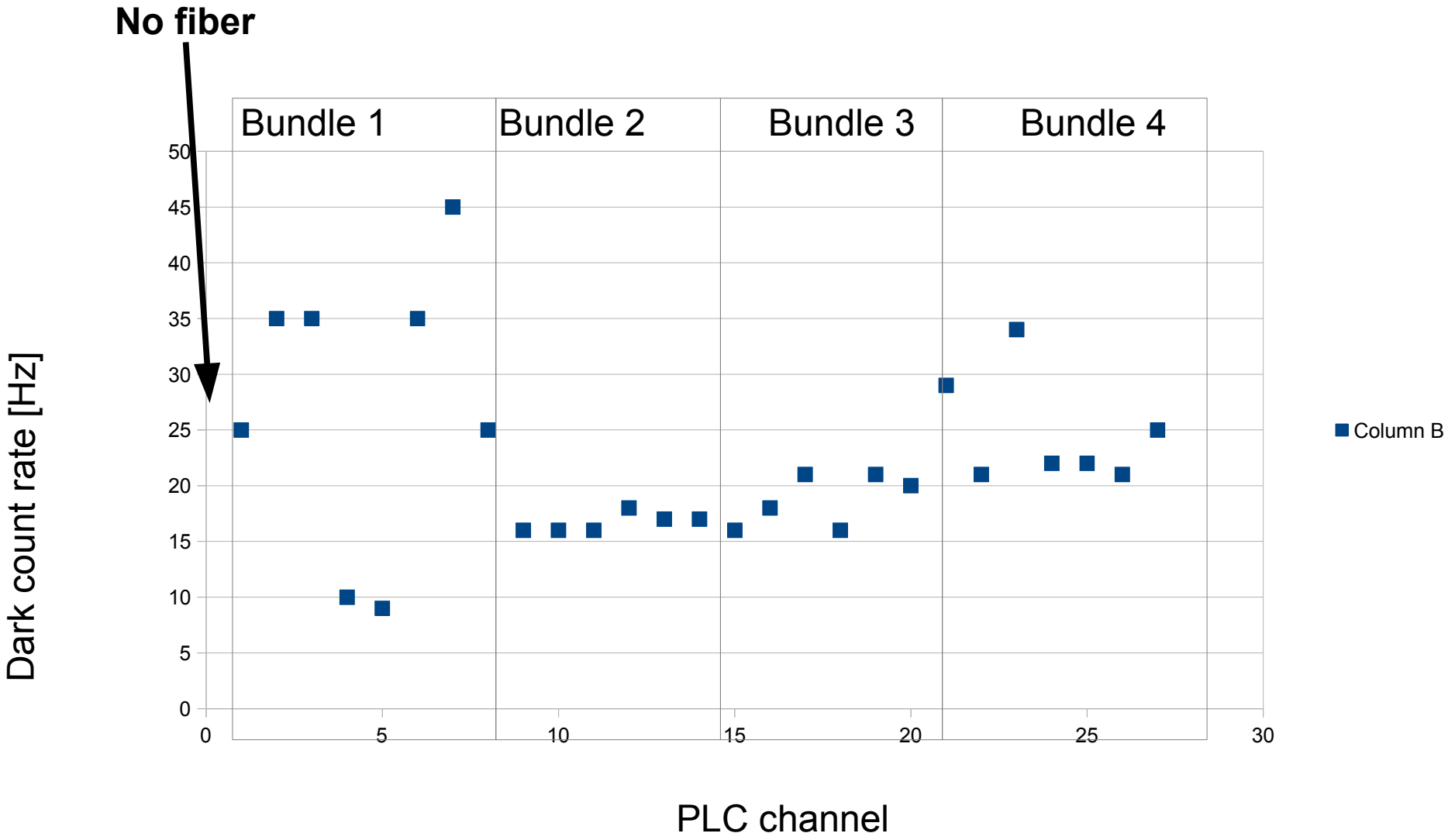


SM fibers testing

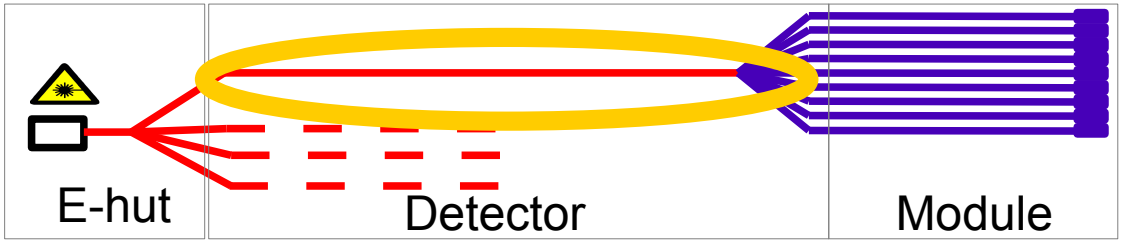


Coating integrity

Dark count rates are taken connecting to the PMT eah SM fiber, leaving it exposed to white light



SM fibers testing

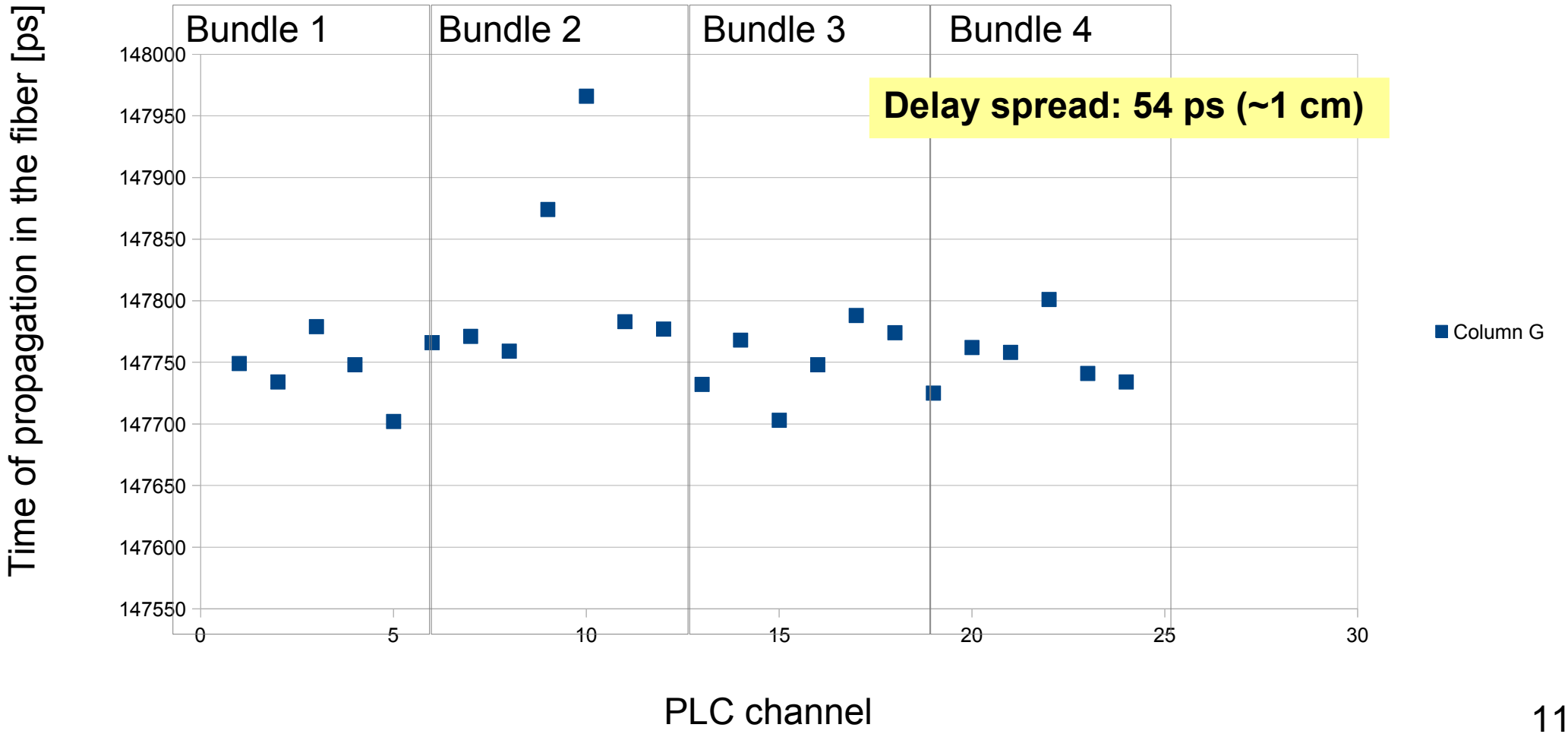


Delay

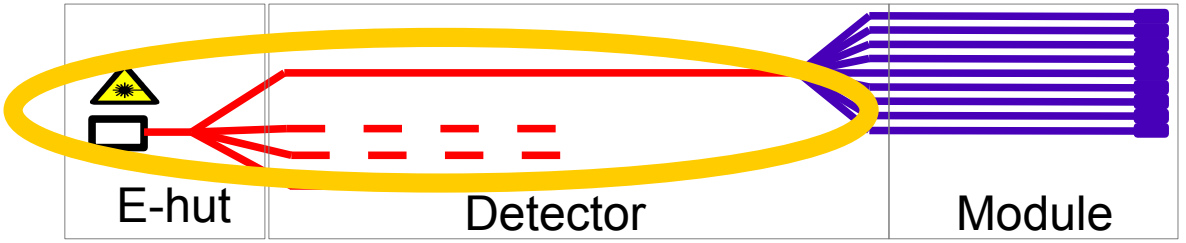
24 fibers connected to the PLC to have 4 similar fibers in each bundle

→ **test of the system AS IT IS ON THE DETECTOR**

→ outlier are left as spare fibers

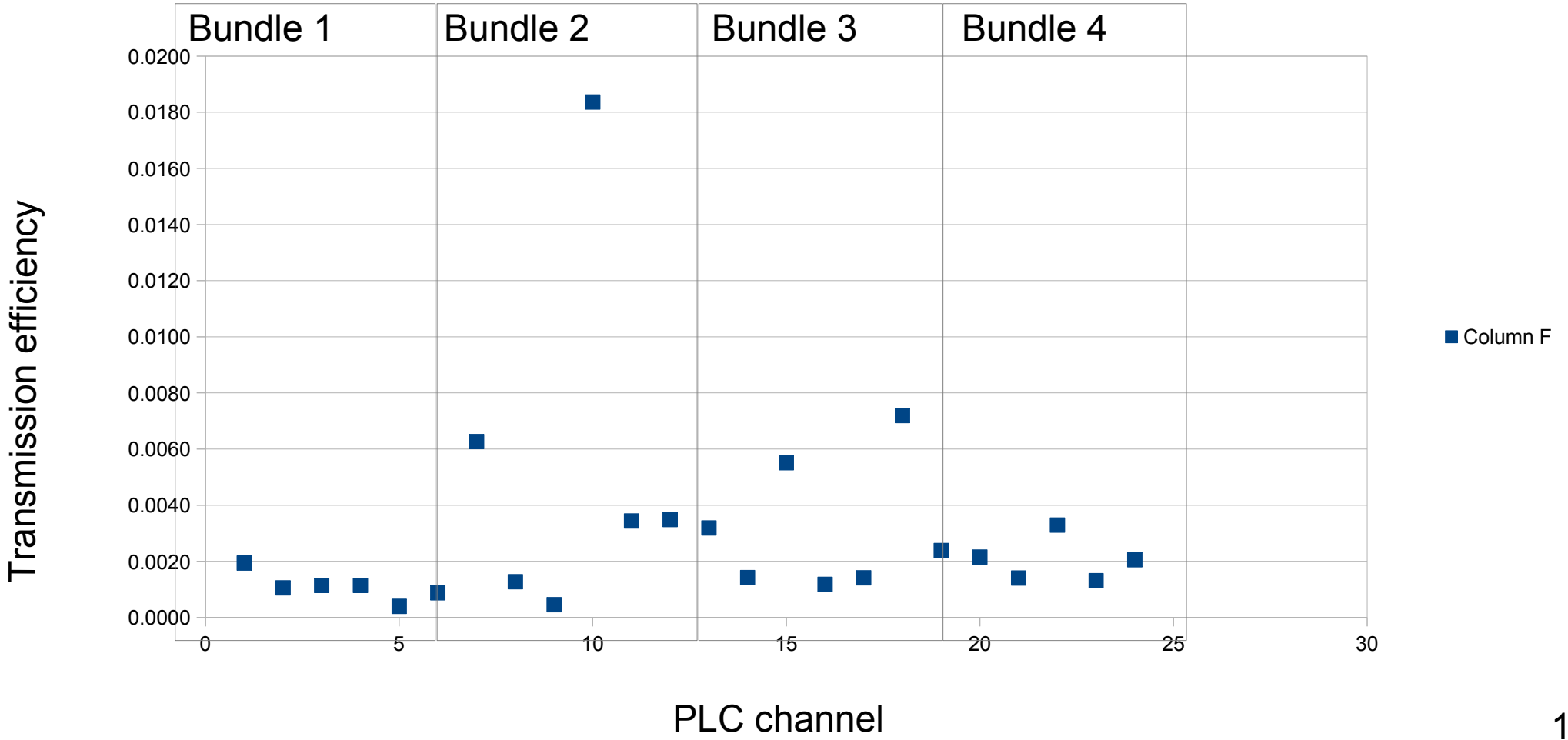


SM fibers testing

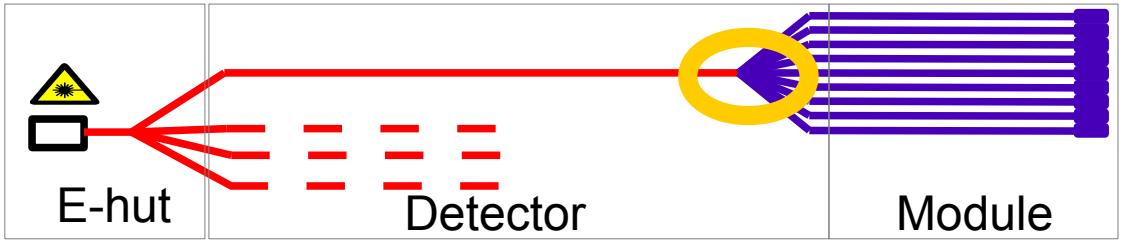


Transmission efficiency

Comparison between single photon counting on each fiber, normalized to the countings from the laser only



SM-MM connector Box installation

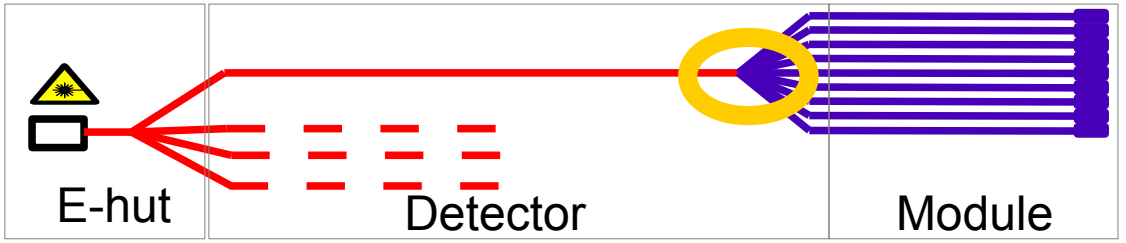


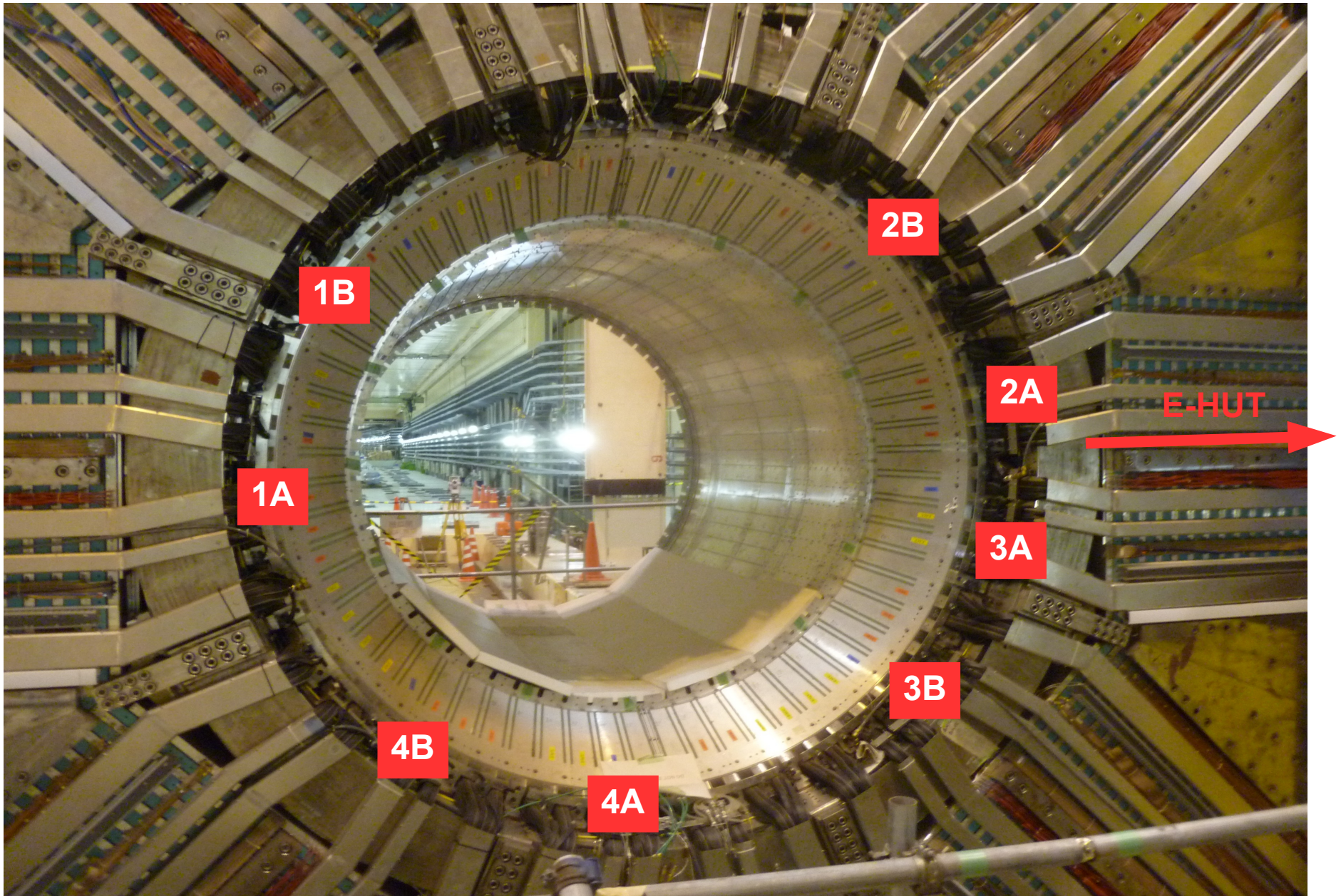
Each connector serves 2 modules
Connectors contain 3 SM fiber ends (2 used + 1 spare)
MM fibers will be routed to enter the QBB modules aside the TOP N_2 pipes
After installing the TOP modules , connectors can be shifted towards the beam pipe for better protection.

The MM fiber bundle is to be connected during module installation, therefore connector boxes need to stay clear until then.

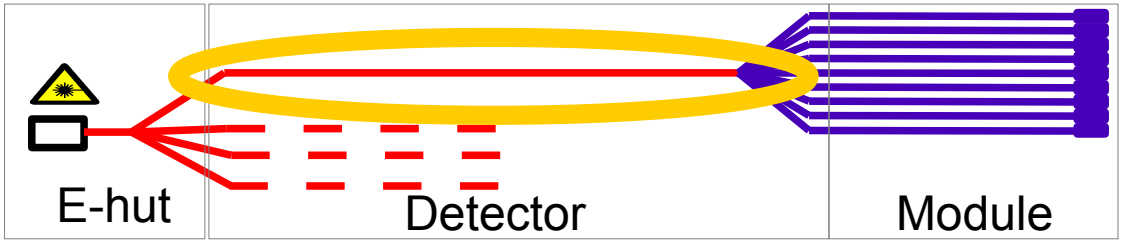
It's OK if CDC cables will stay above these connectors. We'll monitor SM fiber status during CDC cable installation

SM-MM connector Box location



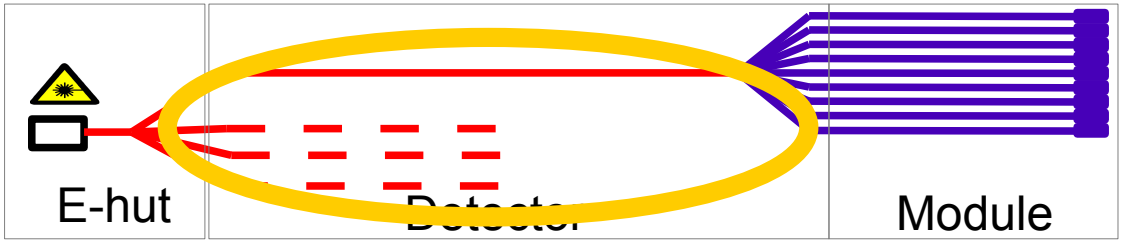


Fiber bundle preparation



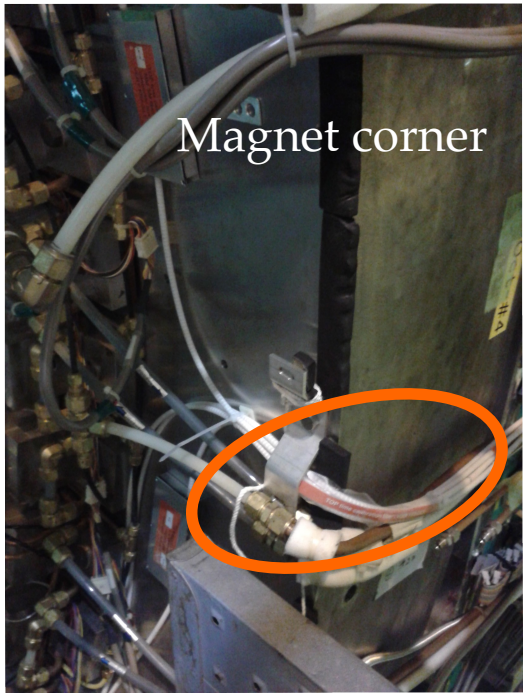
Bundles are protected by 6.2mm diameter miniflex tubing. Bundles were assembled in Fuji Hall, exploiting the large space to avoid entanglement of fibers.

Fiber bundle routing

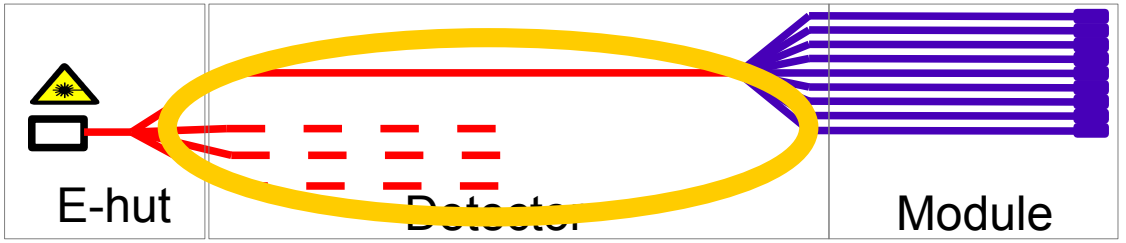


Exit from the E-HUT

Routing towards the detector



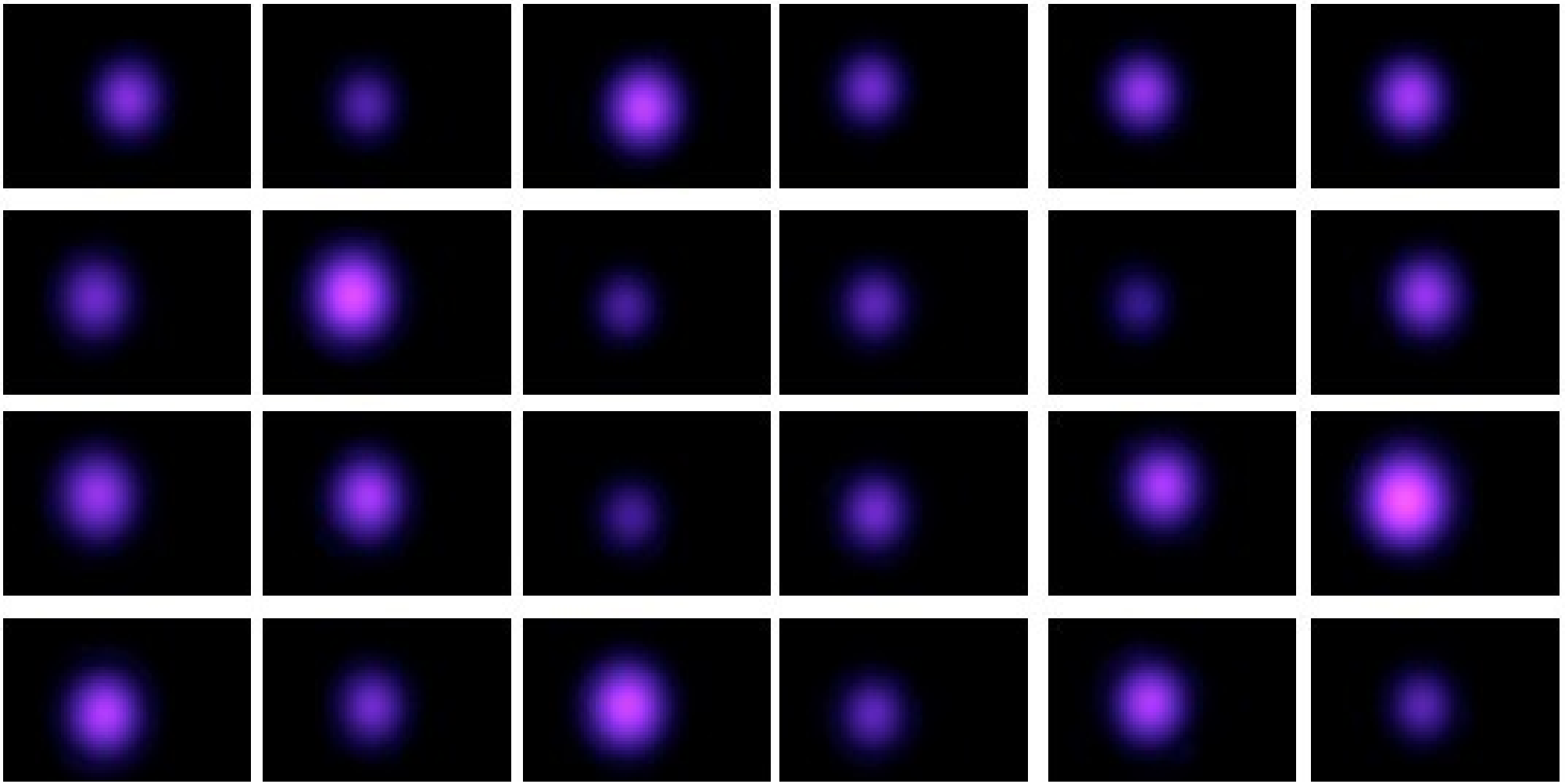
Fiber test on detector



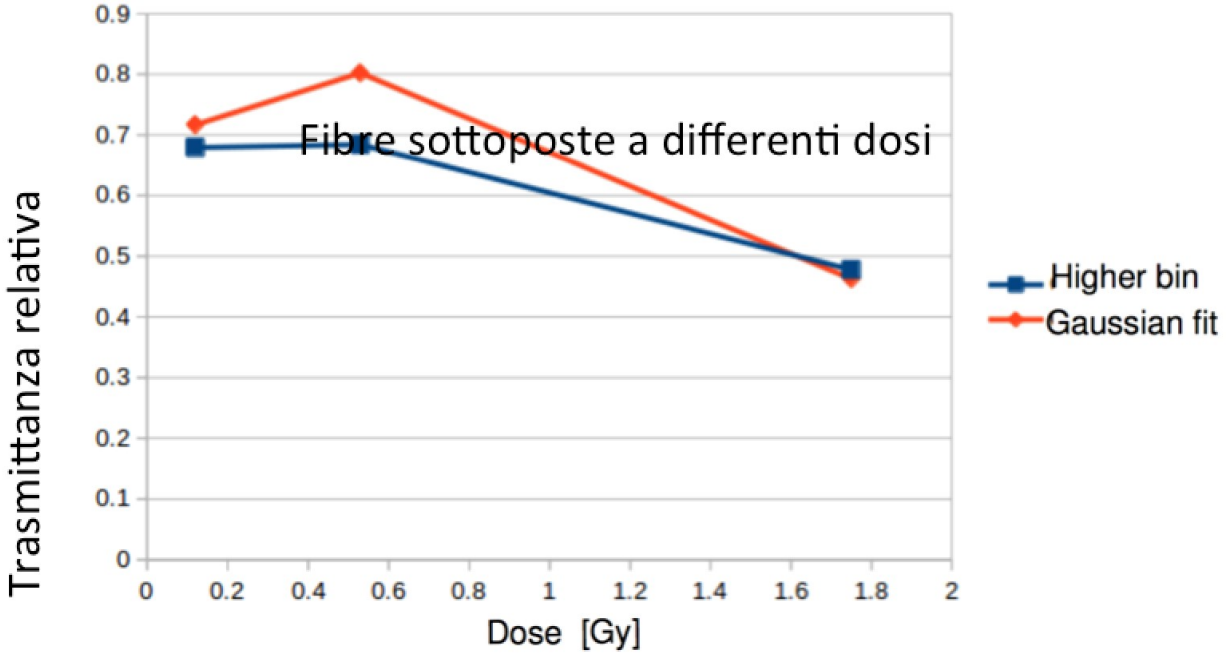
The laser is directly connected to each fiber (no PLC) to check the integrity after the installation

→ **No damaged fibers**

→ **fluctuations in light yield are due to the SM-SM connection**



Tests Irraggiamento Fibre (PD)

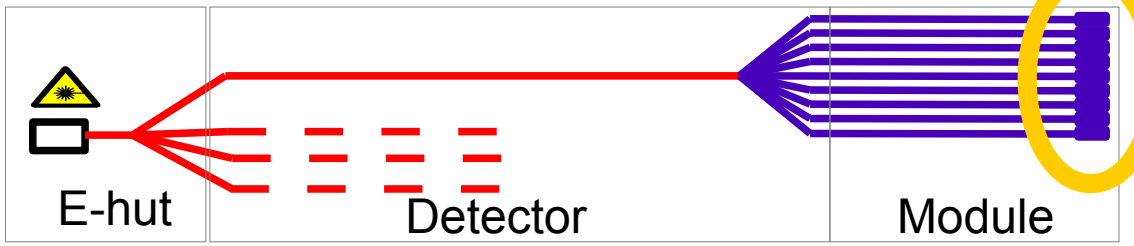


Il test effettuato alla GIF++ ad Agosto ha permesso di accumulare solo 1.8 Gray
Alla massima luminosità sono attesi 5 Gray per anno

Le attenuazioni misurate per le fibre dei bundle MM e per le lenti non sono trascurabili. Ciò non rappresenta un problema per il funzionamento del sistema di calibrazione ma rende difficile poter monitorare la QE dei fotomoltiplicatori.

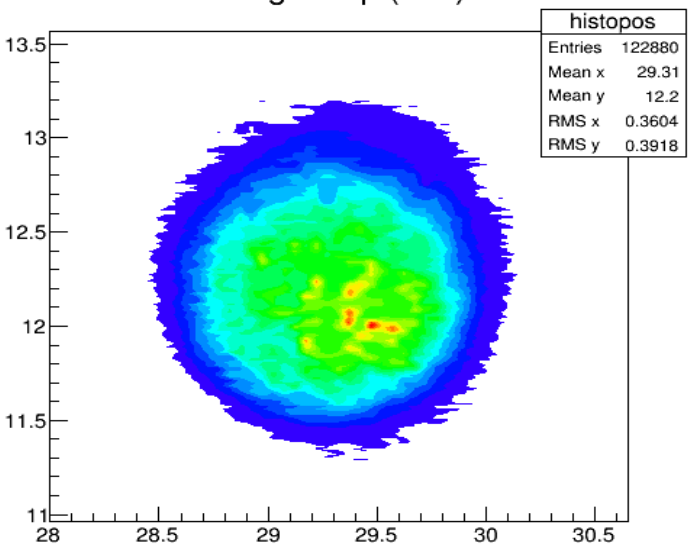
Saranno effettuati altri test (Casaccia, GIF++) con maggiore radiazione massima.

Updates on GRIN lenses

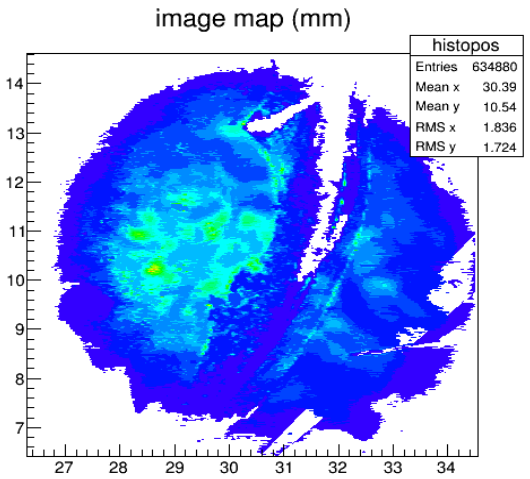


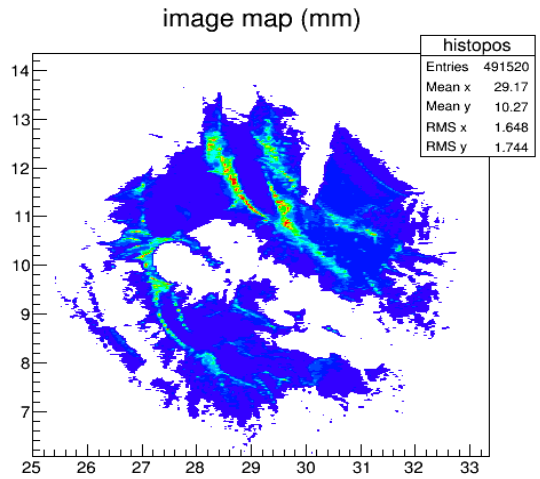
Re-analysis campaign of the light profiles obtained in Padova showed a number of problematic lenses

Good lens



Bad lenses





The problem seems to be due to the gluing procedure, which left grains of aluminum and glue between MM fiber and lens

→ In same cases (50%) can be recovered by removing and the lens and clean

→ Other cases (25%) require the installation of a new lens (a new batch has been ordered)

→ Problematic lenses (25%) already installed have been successfully replaced

You can find all the lenses QC summary in the Padova webpage:
http://lxkopio.pd.infn.it:5210/site/lenses.php

GRIN lenses QC page

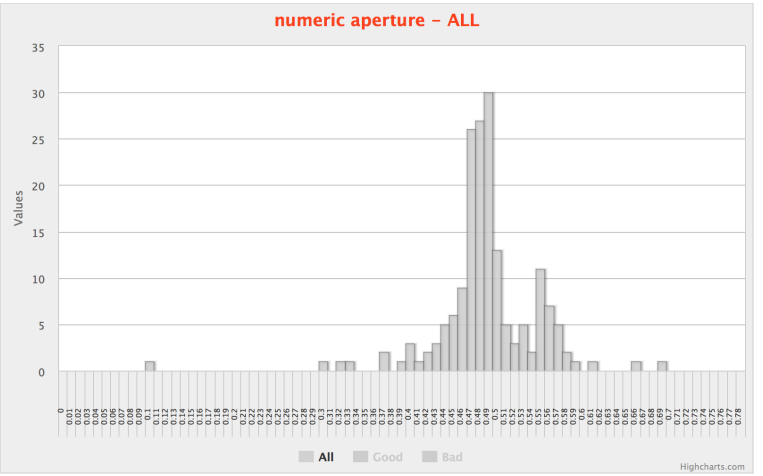
http://lxkopio.pd.infn.it:5210/site/lenses.php

Belle II Padova

- Chi siamo
- TOP meetings KEK
- TOP meetings Italia
- TOP conference takls
- Belle II secreteray
- CRT links
- Laser calibration QC
- Belle-II notes
- Accesso Cloud

Modules

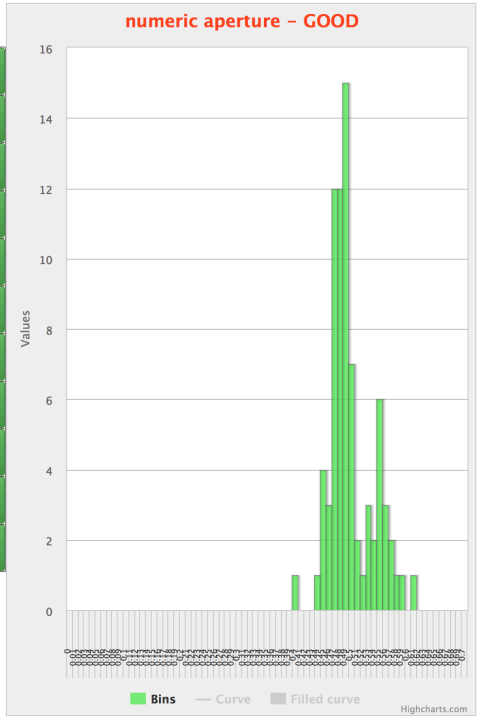
module	pos. 1	pos. 2	pos. 3	pos. 4	pos. 5	pos. 6	pos. 7	pos. 8	pos. 9
2	7 -0.4618 -	28 -0.4713 -	12 -0.4929 -	23 -0.4529 -	16 -0.5066 -	2 -0.4955 -	3 -0.4913 -	107 -0.4958 -	31 -0.4961 -
3	9 -0.4939 -	32 -0.4747 -	14 -0.4705 -	45 -0.5658 -	22 -0.4794 -	68 -0.5321 -	25 -0.4828 -	21 -0.4724 -	40 -0.4883 -
4	18 -0.4857 -	39 -0.4871 -	10 -0.4762 -	36 -0.5192 -	6 -0.4817 -	29 -0.4511 -	33 -0.5010 -	8 -0.4819 -	15 -0.5060 -
5	85 -0.5842 -	58 -0.5475 -	136 -0.4959 -	52 -0.5209 -	-1 - -	92 -0.4899 -	4 -0.4983 -	100 -0.5024 -	94 -0.4826 -
6	74 -0.6165 -	47 -0.5533 -	46 -0.5723 -	106 -0.4787 -	91 -0.5234 -	93 -0.4904 -	26 -0.4958 -	38 -0.5055 -	115 -0.5149 -
7	37 -0.4998 -	103 -0.4766 -	81 -0.5595 -	1 -0.4939 -	5 -0.5116 -	56 -0.5985 -	53 -0.5312 -	49 -0.5438 -	34 -0.4695 -
8	62 -0.5555 -	17 -0.4962 -	48 -0.5649 -	139 -0.4899 -	54 -0.5337 -	11 -0.4825 -	108 -0.4901 -	120 -0.5081 -	55 -0.5551 -
9	44 -0.5504 -	96 -0.4830 -	113 -0.4819 -	129 -0.4789 -	63 -0.4786 -	119 -0.5025 -	59 -0.5612 -	98 -0.4643 -	89 -0.5581 -



Belle2 iTOP Monitoring System QC database | Home

GOOD blocks: 77

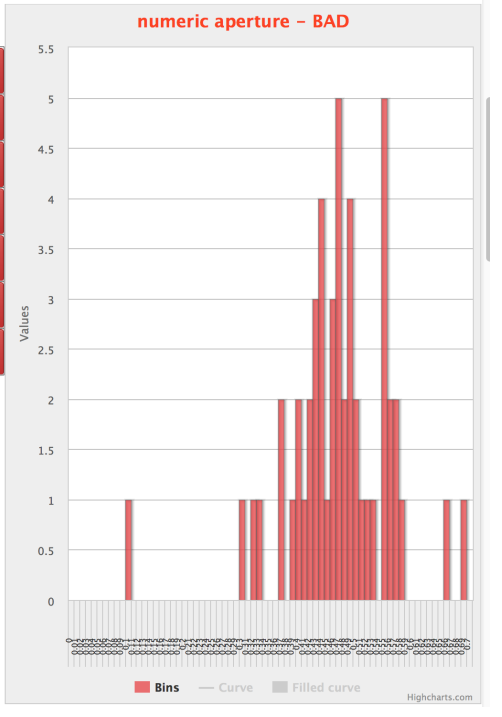
1 0.4939	2 0.4955	3 0.4913	4 0.4983	5 0.5116	6 0.4817	7 0.4618
8 0.4819	9 0.4939	10 0.4762	11 0.4825	12 0.4929	14 0.4705	15 0.5060
16 0.5066	17 0.4962	18 0.4857	21 0.4724	22 0.4794	23 0.4529	25 0.4828
26 0.4958	28 0.4713	29 0.4511	31 0.4961	32 0.4747	33 0.5010	34 0.4695
36 0.5192	37 0.4998	38 0.5055	39 0.4871	40 0.4883	41 0.4567	42 0.4058
43 0.5749	44 0.5504	45 0.5658	46 0.5723	47 0.5533	48 0.5649	49 0.5438
52 0.5209	53 0.5312	54 0.5337	55 0.5551	56 0.5985	58 0.5475	59 0.5612
62 0.5555	63 0.4786	68 0.5321	74 0.6165	81 0.5595	85 0.5842	89 0.5581
90 0.4866	92 0.4899	93 0.4904	94 0.4826	97 0.4927	98 0.4643	100 0.5024
103 0.4766	106 0.4787	107 0.4958	108 0.4901	113 0.4819	118 0.4779	119 0.5025
120 0.5081	129 0.4789	136 0.4959	138 0.4565	139 0.4899	148 0.4478	154 0.4760



Belle2 iTOP Monitoring System QC database | Home

BAD blocks: 51

13 0.4929	19 0.4771	24 0.4502	27 0.4789	35 0.5080	50 0.5576	60 0.5200
66 0.1068	70 0.4805	72 0.5773	75 0.5713	76 0.5881	77 0.5696	84 0.6992
88 0.5543	99 0.4405	101 0.4990	109 0.3222	110 0.5500	114 0.3393	116 0.3757
117 0.4778	123 0.6650	128 0.5047	132 0.4700	133 0.4458	140 0.4689	146 0.5382
150 0.4499	152 0.3769	153 0.4923	156 0.5646	158 0.4392	159 0.4280	160 0.3983
161 0.4140	162 0.5508	163 0.4986	164 0.5157	165 0.4413	166 0.4234	167 0.4858
169 0.4060	172 0.4341	174 0.4766	175 0.5502	176 0.4666	180 0.3057	181 0.4302
183 0.4070	184 0.4655					

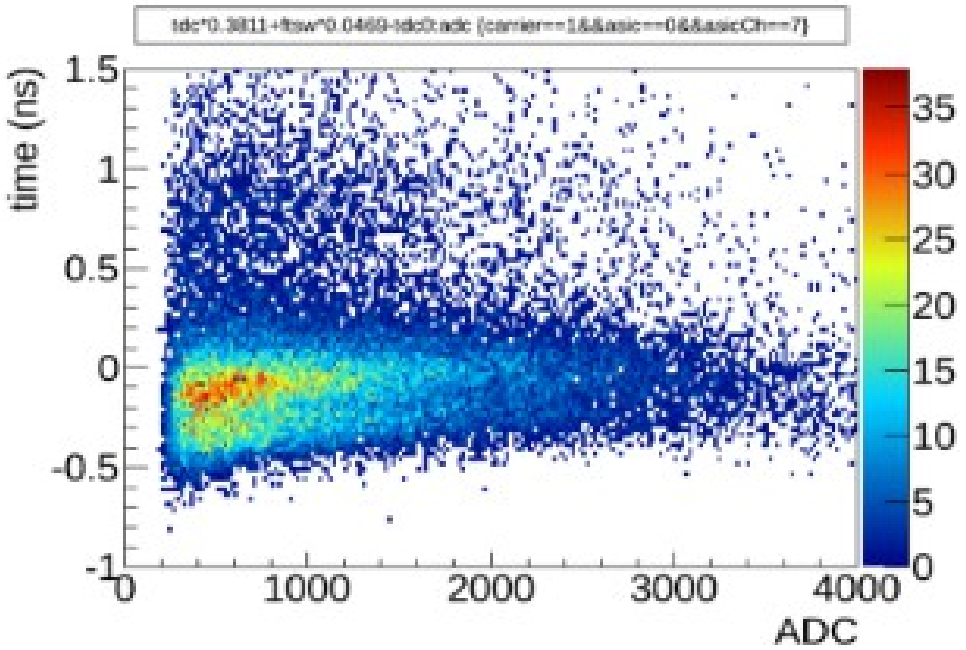


Laser calibration data

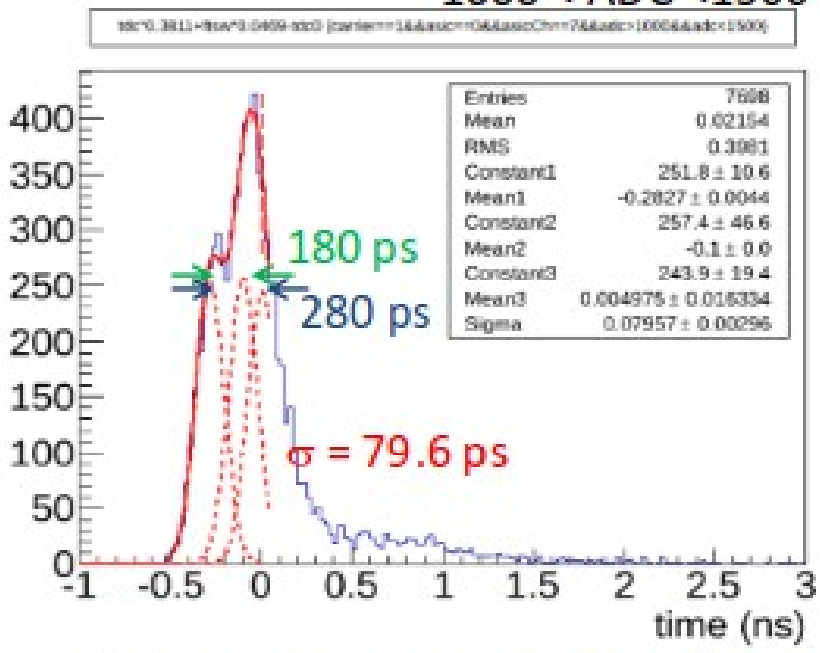
run00298-00318

From M03 at Fuji Hall

TDC distribution



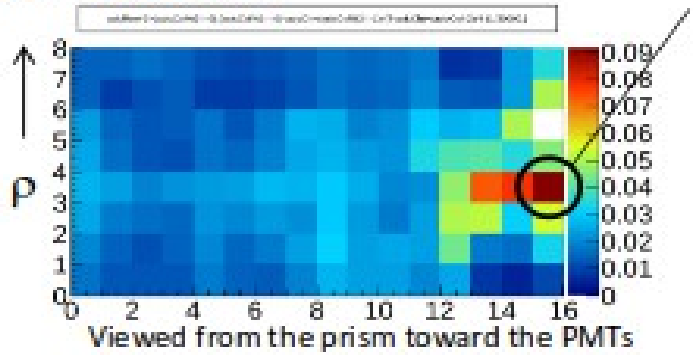
1000 < ADC <1500

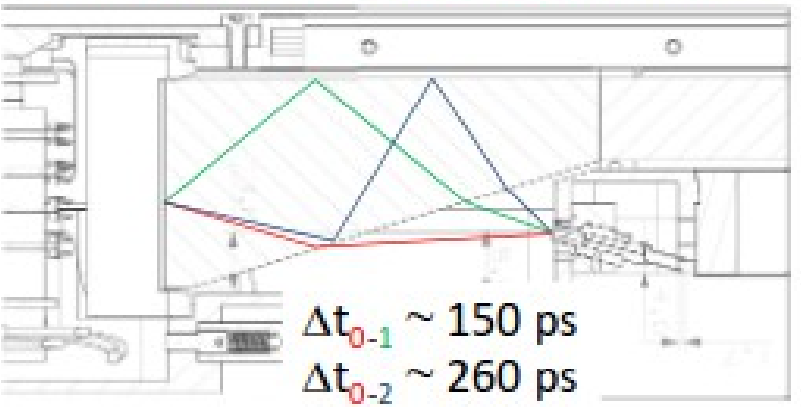


Probably three peaks by direct photons and those reflected once and twice

Board stack #1

This channel





MC simulation of laser calibration

512 pixels per module, 9 light sources

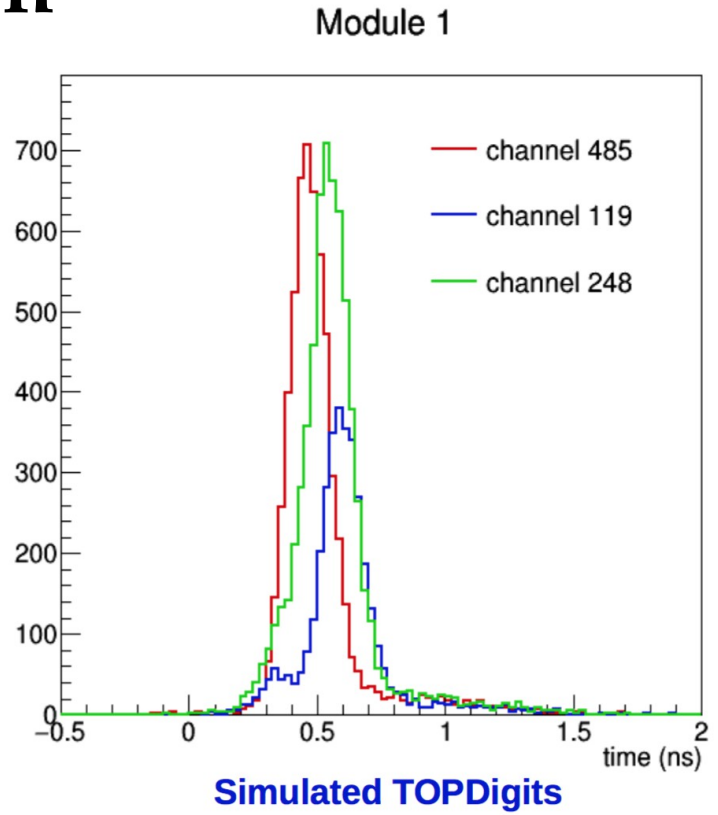
Each pixel sees a different laser peak

Laser peak is a combination of 2 or 3 gaussians with the same width: 0,1,2 reflexions.

A fraction of pixels see light from two sources

Light intensity per pixel depend on MM fiber angular distribution.

SM-MM fiber piping efficiency is not constant



Simulated TOPDigits

Each pixel will have its own PDF for fiber calibration.

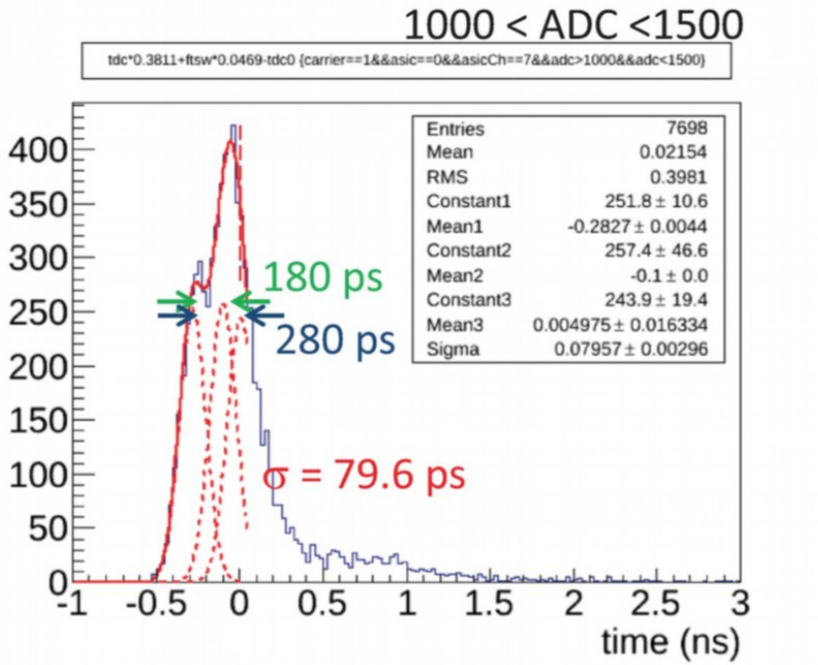
The TOPLaserCalibrator will have to deal with 8192 different PDFs to properly fit all the channels.

Mismodeling yet to be understood , due to different factors:
-the aluminum box is assumed to be 100% opaque;
- the reflection coefficient of the surface of the PMT's is set to 0;
- simplified assumptions have been made on the modeling of the GRIN lenses;

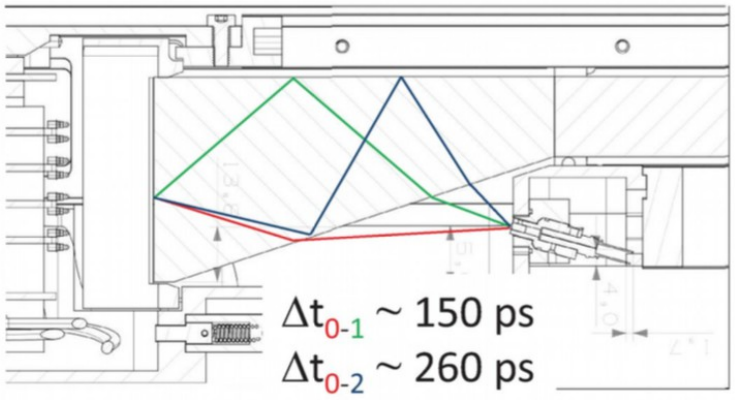
Photons reflected from PMT plane+mirror are much less in MC than in data

Analog signal shape not yet modeled, only arrival times.

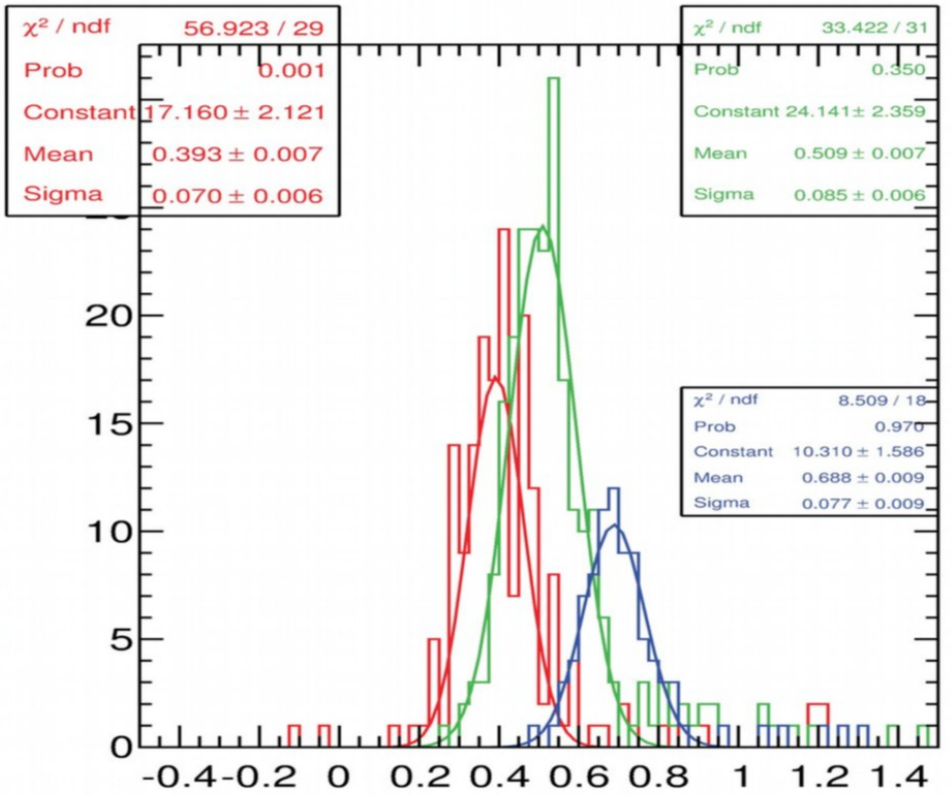
MC – data comparison

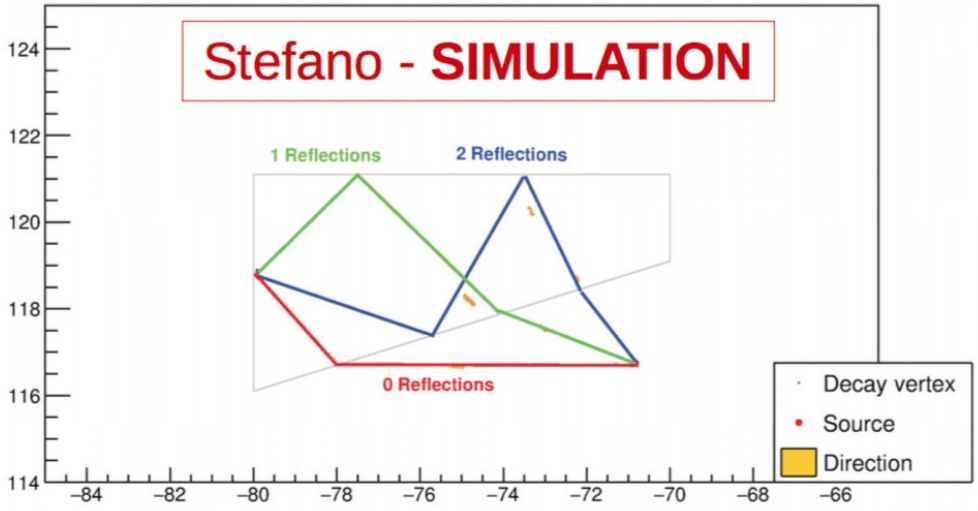


Probably three peaks by direct photons
and those reflected once and twice



Matsuoka-san - **DATA**





Electronics production:

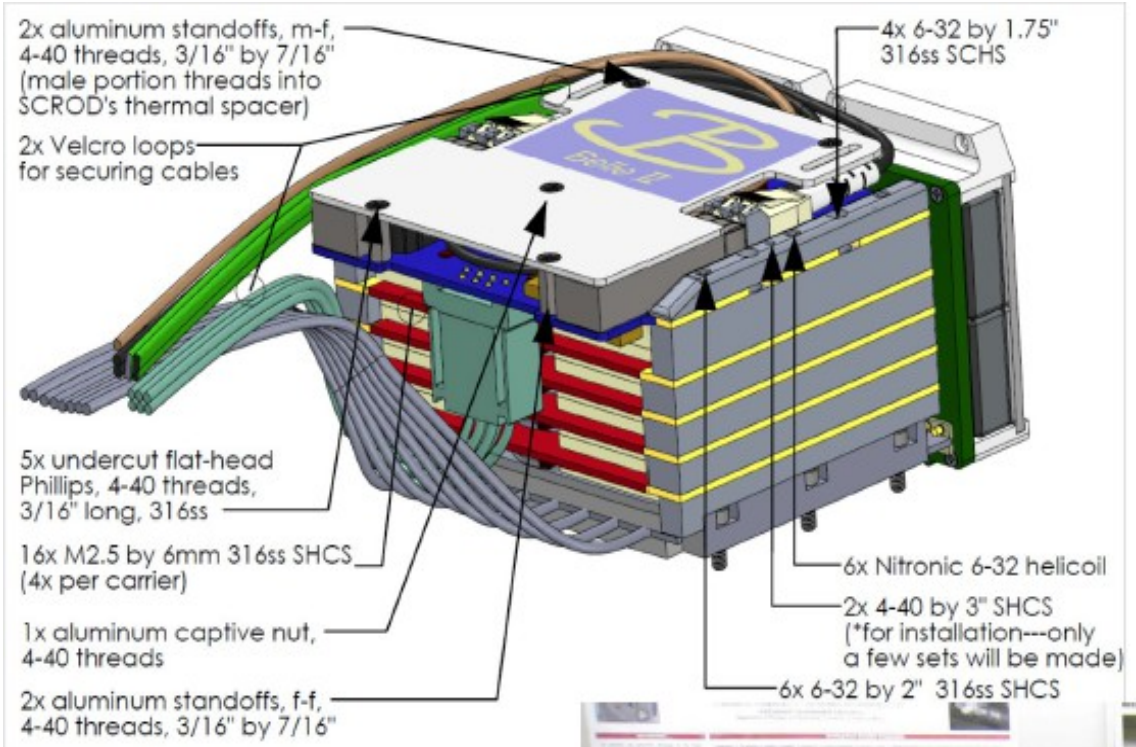
Production of boards (carriers, SCRODs, HV and front boards, TJ Hooker cables and heat sinks) is NEARLY completed. Last shipment (Pittsburgh to UH) due Dec.21
267/272 Grade A carriers and 70/68 Grade A SCRODs are now available.

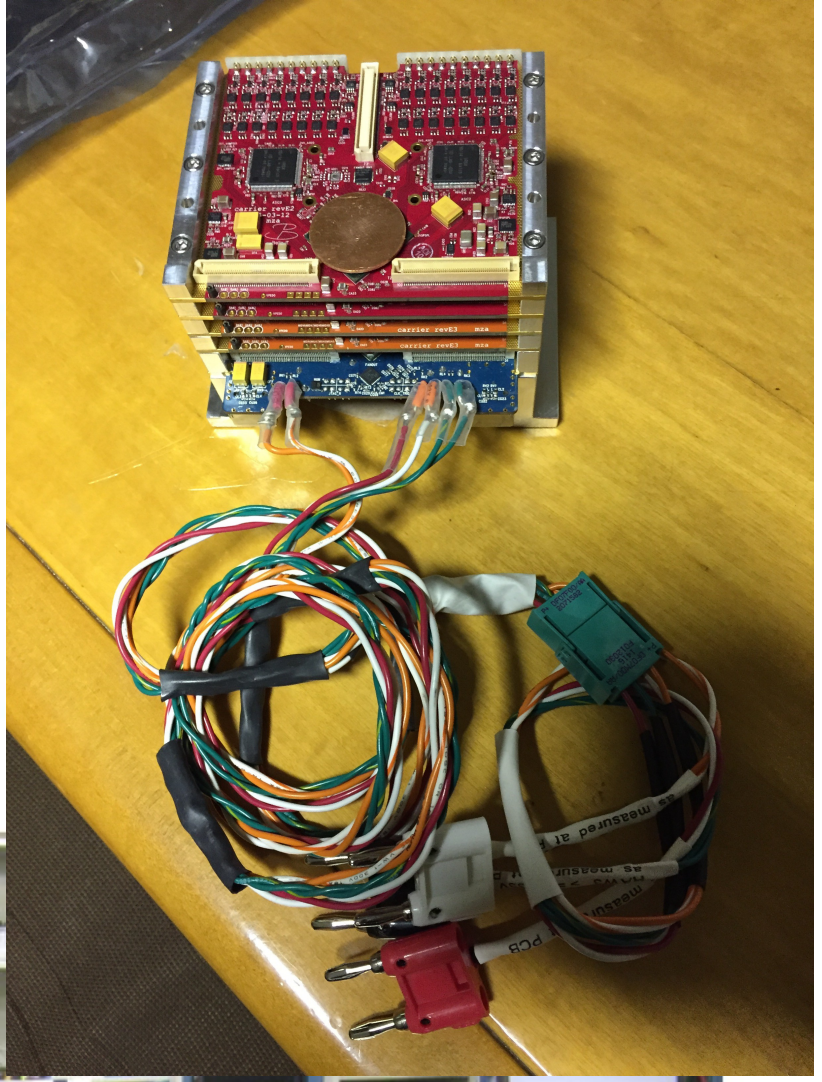
Machining of the remaining heat sinks, which are needed for final boardstack assembly and laser testing arrived on Dec 16th. They need to be sent out for plating and will not be received until after the holidays.

BS for M10,11 laser tested and ready to ship to KEK
BS for M12-14 being laser tested thru holidays, shipped by end 2015.
BS for M15-17 will be assembled in January.

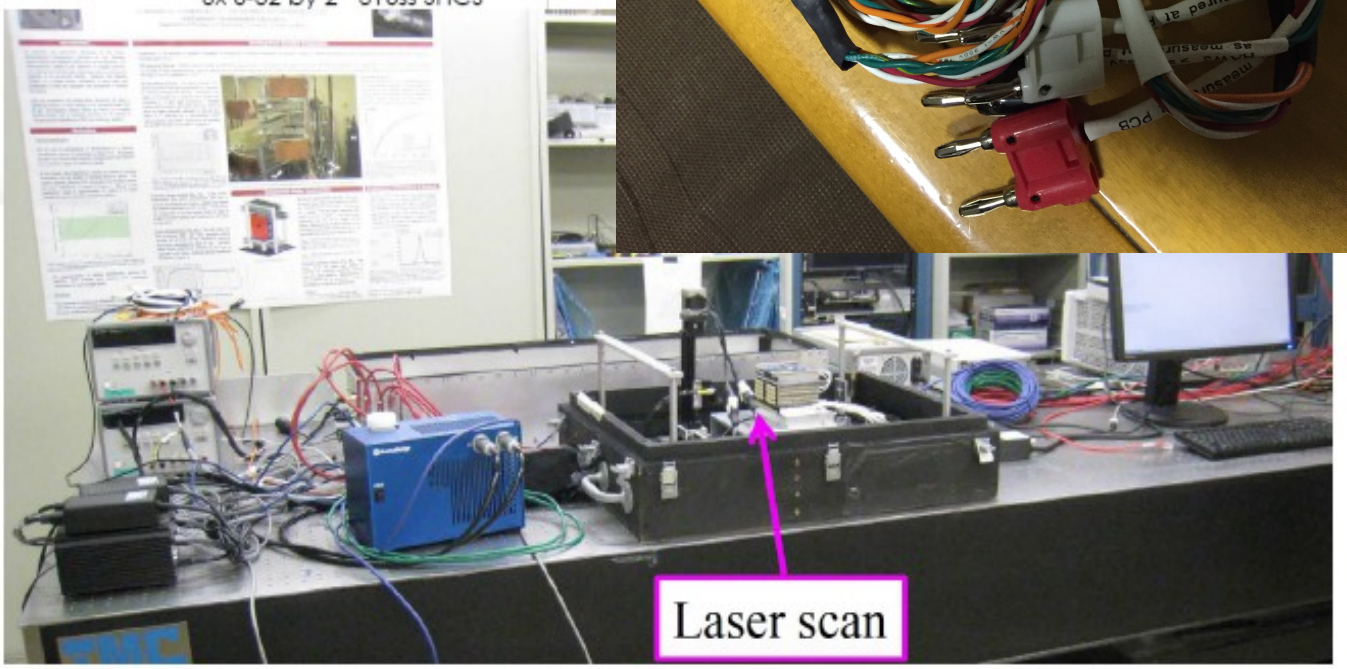
Module	Spcacer 3 (4 ea)	Shop	Spacer 012 (12 ea)	Shop	SCROD Spacer (4 ea)	Shop	Ready for laser testing:
1	Installed	UH	Installed	UH	Installed	UH	
2	Installed	UH	Installed	UH	Installed	UH	
3	Installed	UH	Installed	UH	Installed	UH	
4	At KEK	UH	At KEK	UH	At KEK	UH	
5	At KEK	UH	At KEK	UH	At KEK	UH	
6	At KEK	UH	At KEK	Bear	At KEK	Sherpa-Design	
7	At KEK	UH	At KEK	Bear	At KEK	Sherpa-Design	
8	At KEK	Ole Miss	At KEK	Bear	At KEK	Sherpa-Design	
9	At UH / Assembled	Ole Miss	At UH / Assembled	Bear	At UH / Assembled	Sherpa-Design	
10	At UH / Ready	Ole Miss	At UH / Ready	Bear	At UH / Ready	Sherpa-Design	12/09/15
11	Rework Finished / Being re-plated	Sherpa-Design	At UH / Ready	Bear	At UH / Ready	Sherpa-Design	12/18 – 12/21
12	Rework Finished / Being re-plated	Sherpa-Design	Being Plated	Bear	At UH / Ready	Sherpa-Design	12/22 – 12/24
13	Rework Finished / Being re-plated	Sherpa-Design	Being Plated	Bear	At UH / Ready	Sherpa-Design	12/25 – 12/28
14	Rework Finished / Being re-plated	Sherpa-Design	Being Plated	Bear	At UH / Ready	Sherpa-Design	12/29 – 12/31
15	Sanding flat at UH (12/28)	Ole Miss	In Production	Bear (12/18)	At UH / Ready	Sherpa-Design	
16	Sanding flat at UH (12/28)	Ole Miss	In Production	Bear (12/18)	At UH / Ready	Sherpa-Design	
17	Sanding flat at UH (12/28)	Ole Miss	In Production	Bear (12/18)	At UH / Ready	Sherpa-Design	
1 (remake)	Sanding flat at UH (12/28)	Ole Miss	In Production	Bear (12/18)	At UH / Ready	Sherpa-Design	

TOP Front End: Board stacks





F.Rotondo ha trascorso un mese a UH Manoa per:
- contribuire ai turni di QC delle BS;
- imparare a usare il firmware delle BS
- aiutare a debuggare le FPGA difettose
- costruire un BS per poter leggere 4 (su 8) MCP-PMT, da portare in Italia



Belle2Link saga

Dec.16: L. Wood et al (PNNL) were able to observe calibration pulses from the IRSX through B2L with the setup at PNNL. The calibration pulses are clearly visible in the waveform plots. Major bugs identified at PNNL and Fuji Hall have been resolved this week, including identifying the proper IRSX configuration, which has been a major issue for the past few weeks. There is a remaining problem with the pedestal level ("vPED issue ") that is being investigated now.

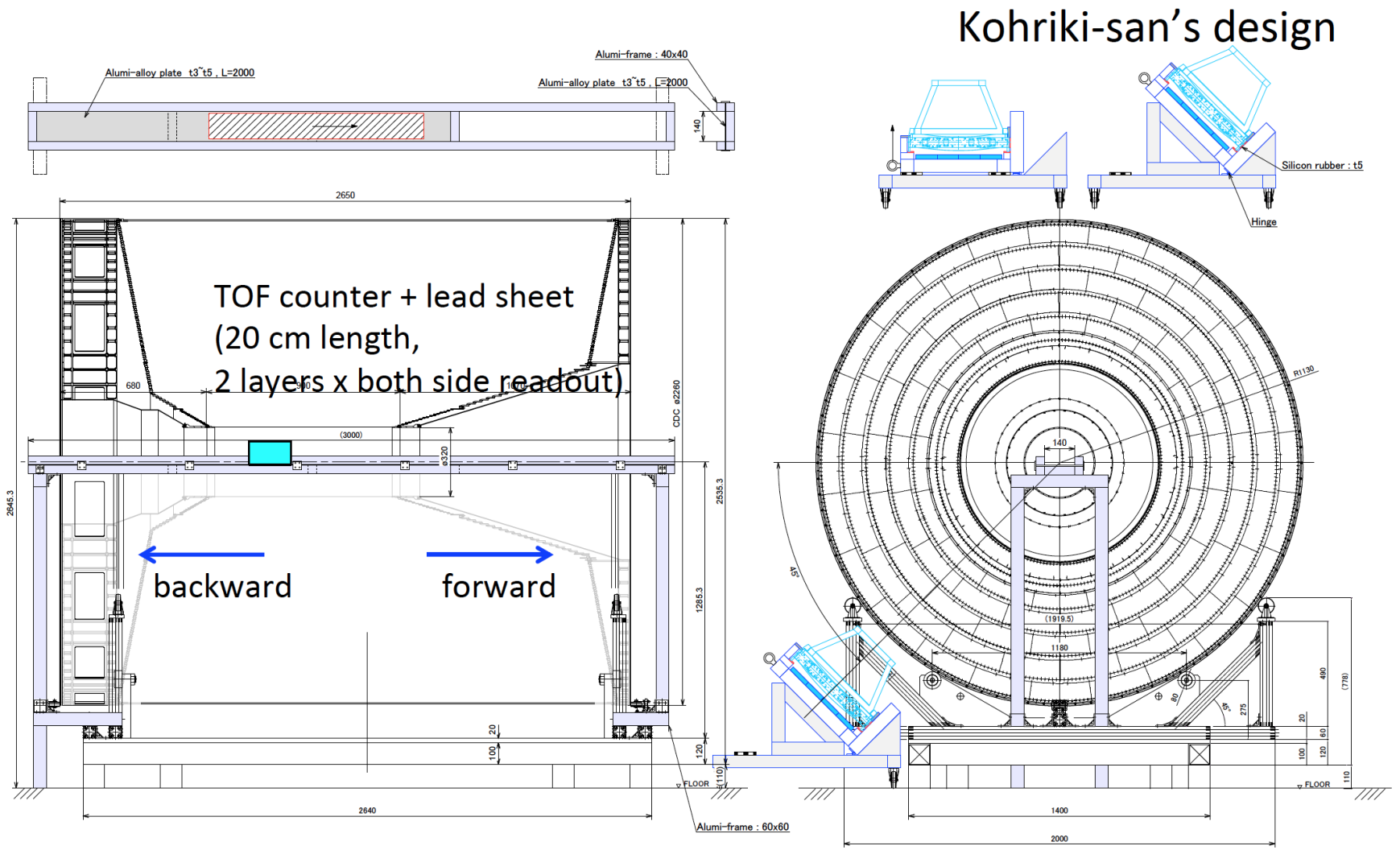
L. Tao (Pittsburgh) and Kichimi-san will now try to observe calibration pulses correlated with triggers and then laser signals at Fuji Hall with B2L.

Varner will go to KEK on Dec 22 to help with integration work.

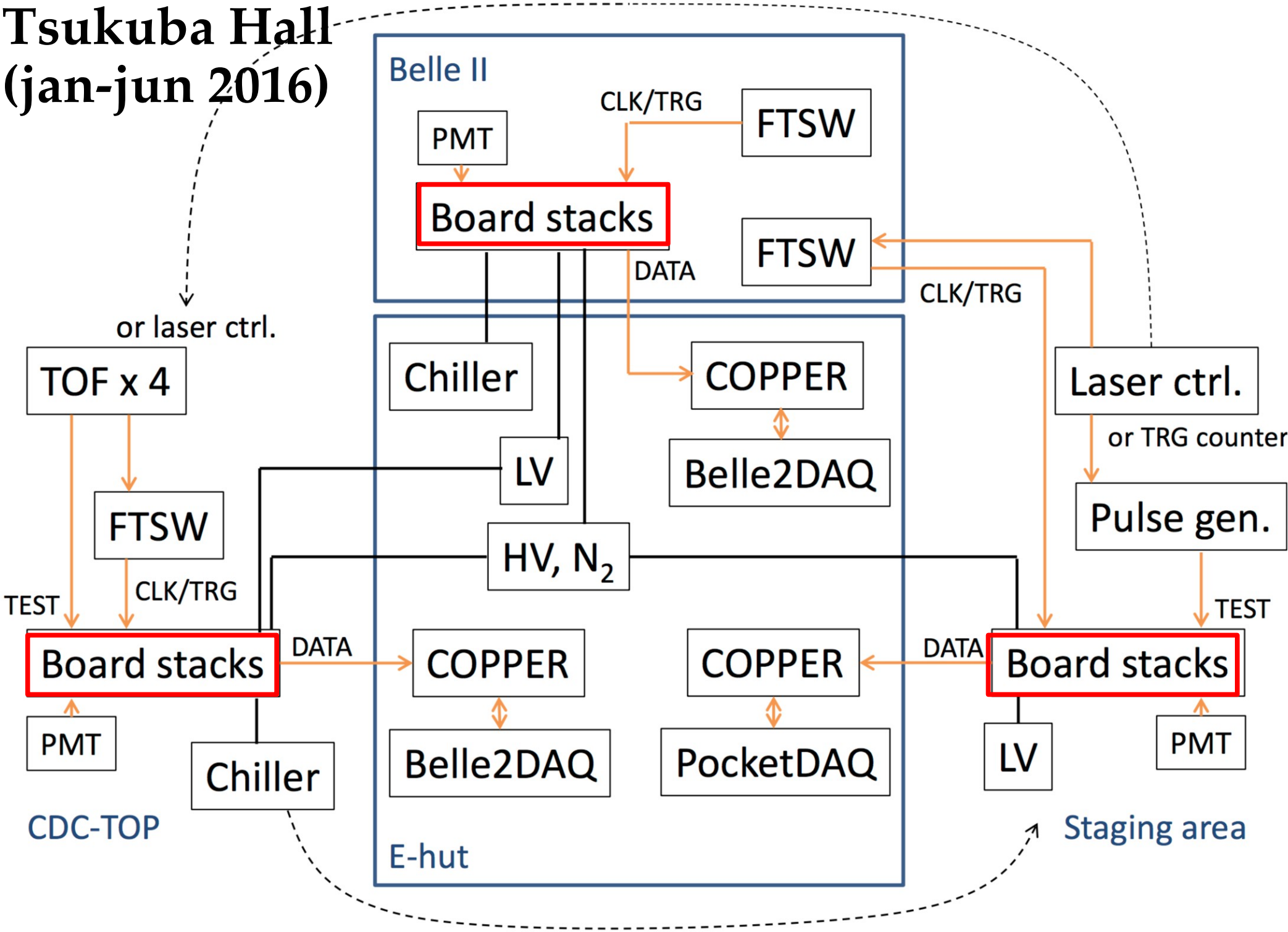
Results of tests of online feature extraction, which are proceeding in parallel to B2L integration appear promising. Checks of the timing are in progress.

CDC-TOP cosmic ray test:

The combined test of CDC-TOP is now planned for February 2016. The test will use TOP module M02 located below the CDC, there will be TOF trigger counters and a lead absorber located at the center of the CDC, which allow selection of high momentum cosmic ray muons.



Tsukuba Hall (jan-jun 2016)



Schedule?

- Move and test first modules week of January 18
- Install and test first modules week of January 25
- **Requires working FW no later than December 21 to be realistic**
- If first modules OK, move more week of 2/1 and test (B2GM week)
- Install more week of 2/8 (BPAC week)

Goals :

- have half TOP installed by End February .
- take data with KLM during Spring
- complete installation in June

Assegni di Ricerca

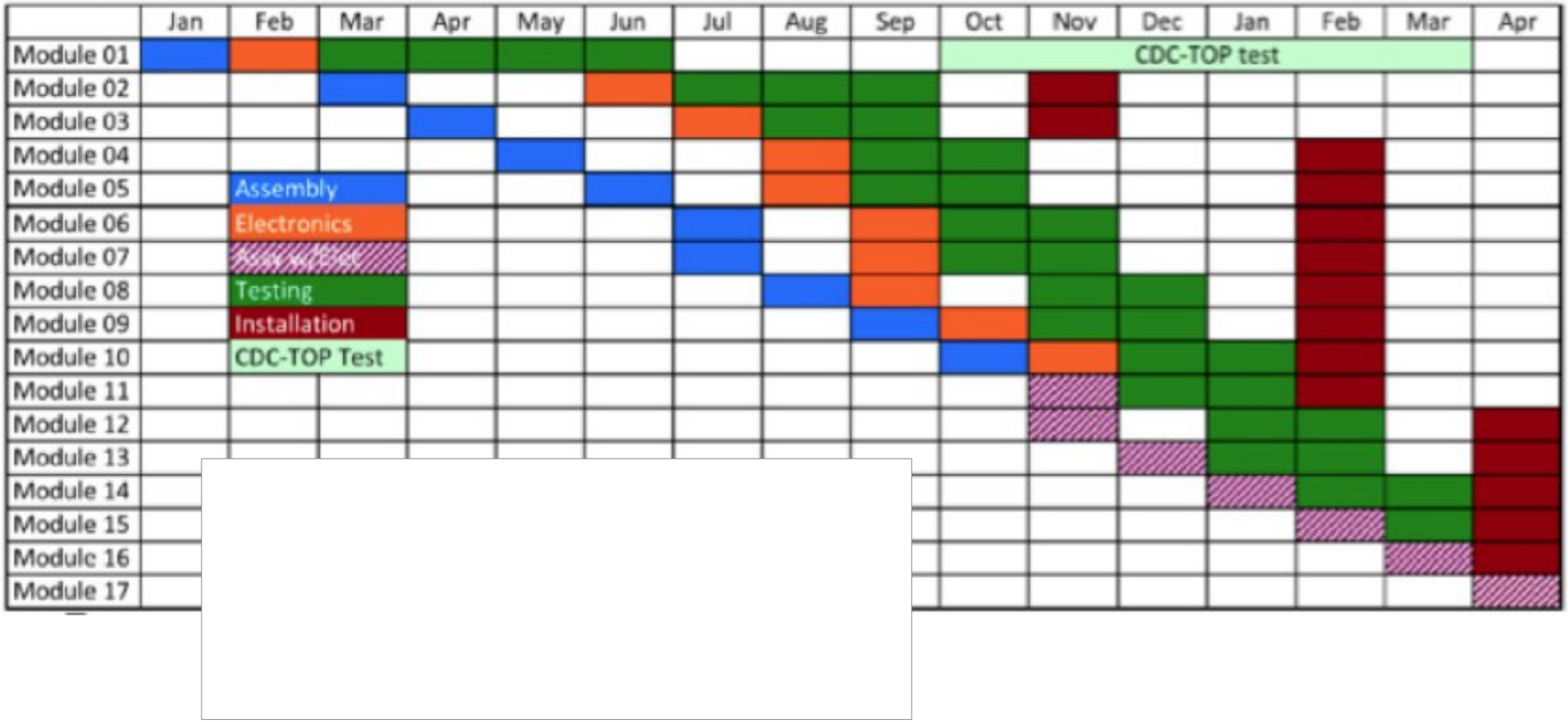
TORINO:
- Elisa Guido (ex BABAR+ATLAS) ha vinto AdR INFN-RISE biennale, prende servizio inizio Gennaio
- AdR annuale Univ-INFN(25%) : concorso in febbraio, operativo da Marzo

PADOVA
- AdR INFN-RISE : bando in scadenza 31/12/15
A pochi giorni dalla scadenza sono state ricevute 4 candidature:

- Dino Tahirovic (Lubljana, Belle II, Arich)
- Wenlong Yuan (Nanjing, Bes III, DQM-tracking)
- Alessio Porcelli (Ginevra, Telescopio SST)
- Deepanwita Dutta (TIFR India, Belle e Belle2 SVD)



TOP: assemblaggio + installazione, schedule generale



QBB: modulo 14 fatto; barre per M15,16 in arrivo da Zygo, per M17 a fine Jan2016.
Ahead of schedule, potremmo avere tutti i moduli pronti a fine Febbraio.

Assemblaggio/QC MCPPMT : osservata QE drop in alcuni MCPPMT (vacuum leak?) , rimandati alla Hamamatsu, che li sostituisce con ALD.

Assemblaggio/QC BS: Fino a M14 entro fine Dicembre. 12 BS ancora da fare per Gennaio 2016 (no spares?)
Problema: mancano 6 FPGA per gli SCRODs

CDC/TOP Test con M02 non ancora partito

Manpower assemblaggio delle Quartz Bar Boxes (QBB)

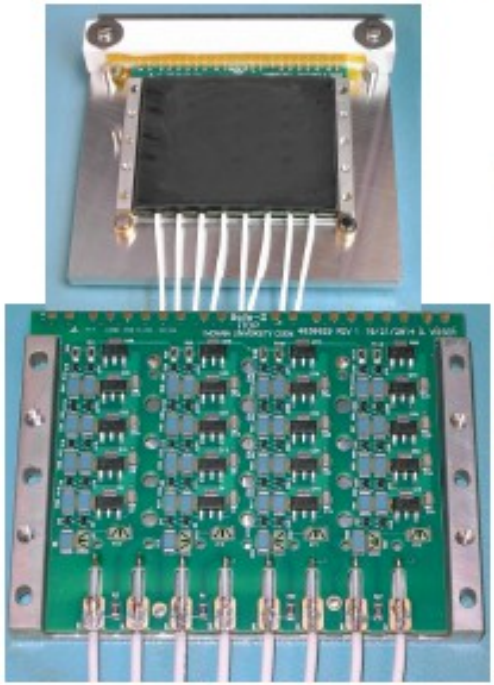
31/08/15	11/09/15	12	08/09	Inami	Suzuki	8/31-9/14	Nagoya
14/09/15	28/09/15	15	09/10	Schwartz	Suzuki		Glasgow
28/09/15	07/10/15	10	10	Schwartz		9/28-10/7	Erzen
08/10/15	16/10/15	9	10/11	Inami	Fast?	10/8-10/16	Erzen
B2GM 10/19/15	23/10/15			Schwartz			
26/10/15	09/11/15	15	11/12	Inami	Suzuki	10/22-11/7	Ramina, Rebeschini
10/11/15	24/11/15	15	12	Fast	Inami	11/7-11/19	Oscar?
24/11/15	08/12/15	15	12/13	Inami	Suzuki	11/23-12/4	Benettoni
09/12/15	22/12/15	14	13/14	Fast	Suzuki/Inami	12/7-12/26	Nagoya
22/12/15	24/12/15	3	14	Inami	Suzuki	12/7-12/26	Nagoya
Christmas/New Years 12/21/15	05/01/15						

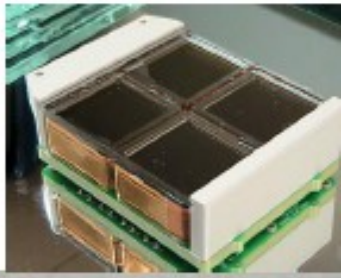
06/01/16	24/01/16	19	14/15	Schwartz
27/01/16	31/01/16	5	14	Inami
B2GM 2/1/2016	05/02/16			
BPAC 2/8/2016	10/02/16			
11/02/16	18/02/16	8	14/15	Schwartz
19/02/16	02/03/16	13	15/16	Inami
03/03/16	23/03/16	21	16	Fast
26/03/16	15/04/16	21	17	Schwartz

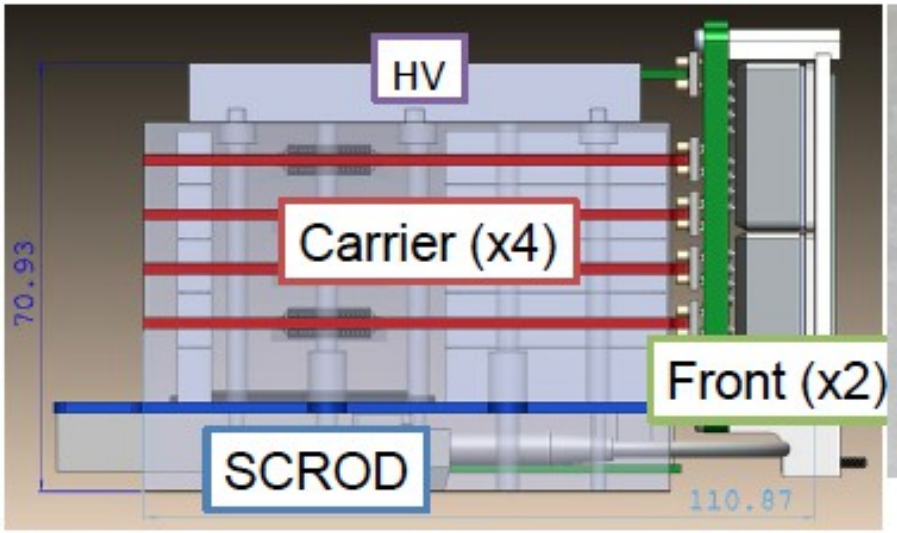
Questo turno potrebbe non essere necessario

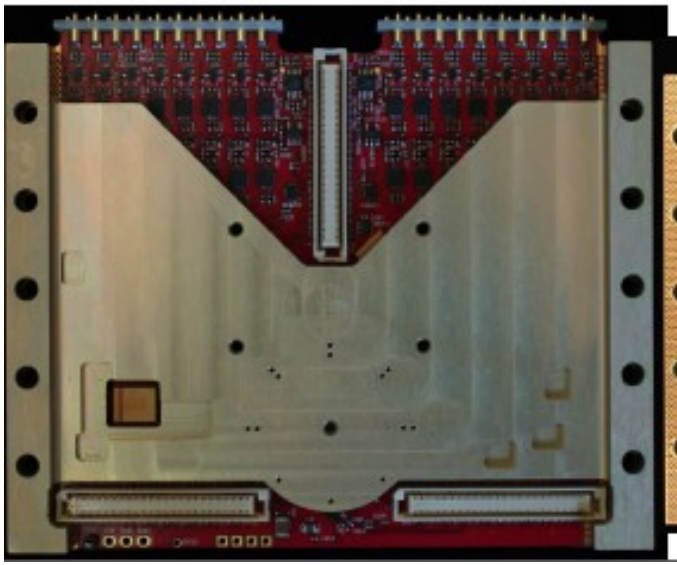
iTOP Readout "boardstack"

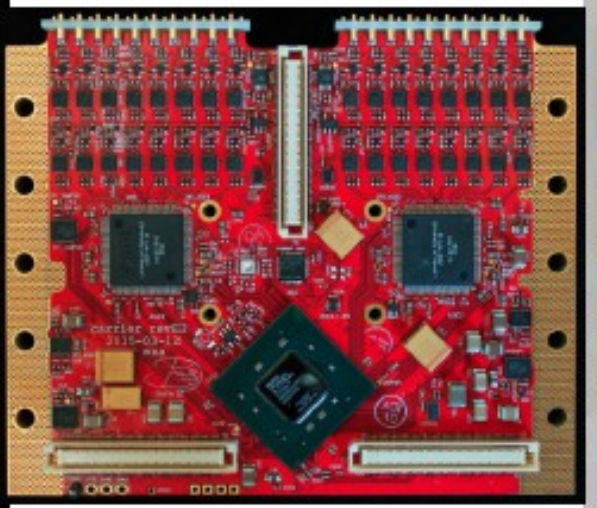
(1 of 4 per TOP Module)









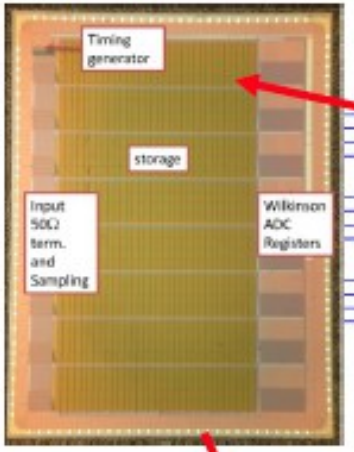


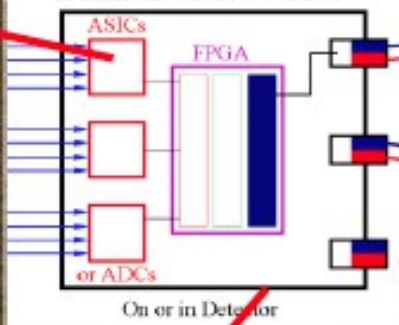
TOP Readout

64 HSLB fiber link receiver cards

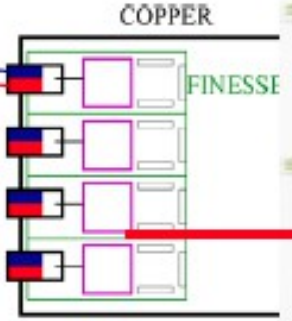
Waveform sampling ASIC

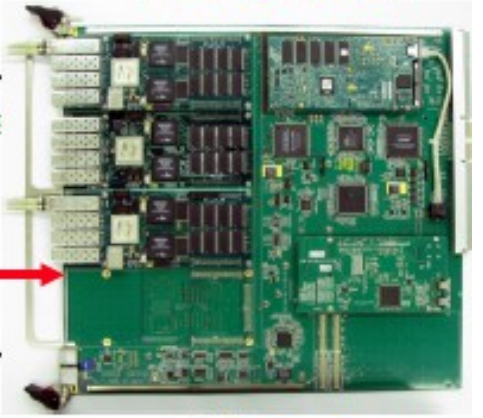
64 DAQ fiber transceivers



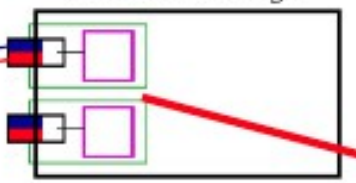


Giga-bit Fiber Transceiver Links





16 COPPER Data Cards



2x Univ. Trigger modules (UT3)

FPGA firmware consists of 3 parts:
1) ASIC/ADC driver (common)
2) Trigger feature extract (subdet. specific)
3) Unified DAQ transport protocol

8k channels

1k 8-ch. ASICs

64 "board stacks"

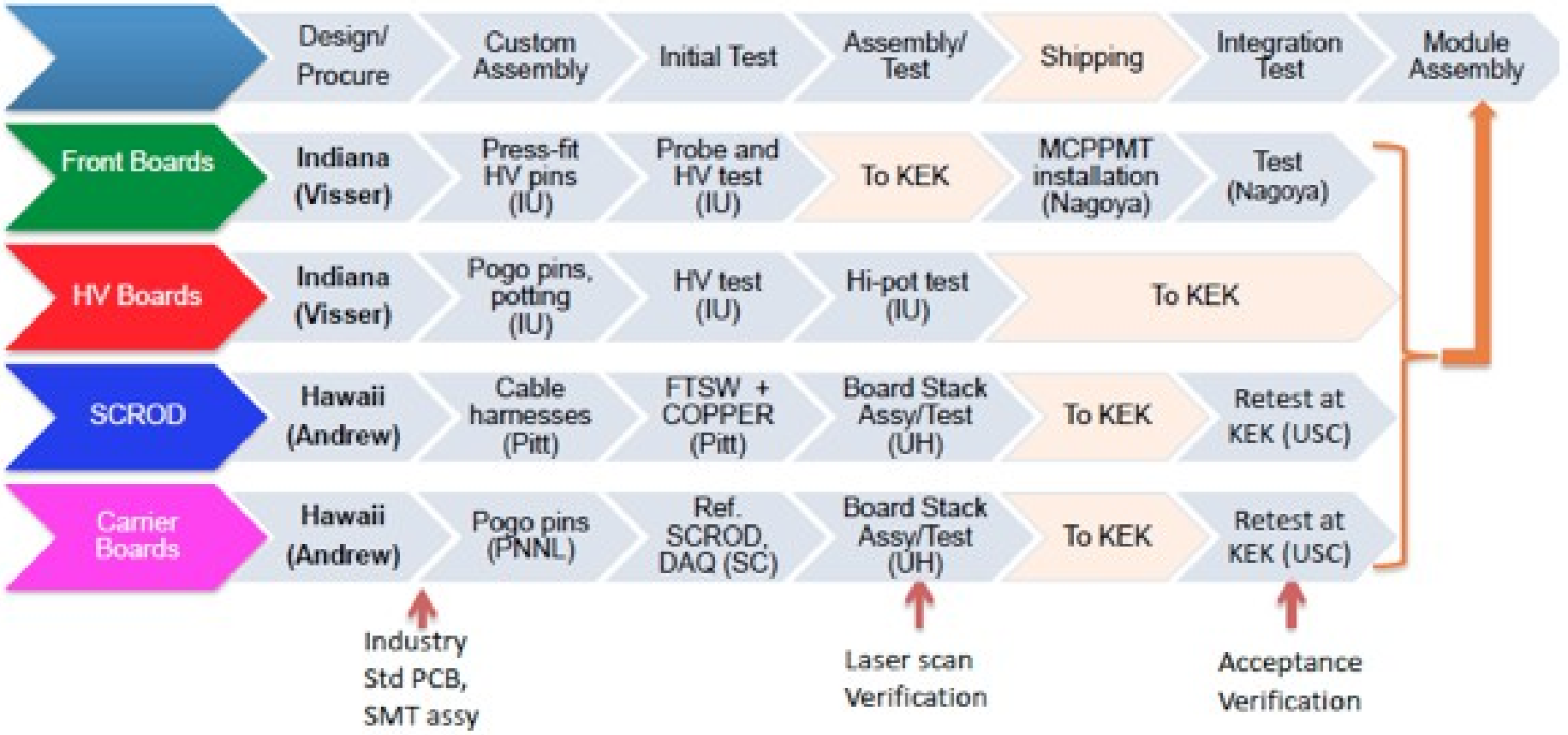
Low-jitter clock

64 SRM

Clock, trigger, programming module (FTSW)

8 FTSW

Production workflow



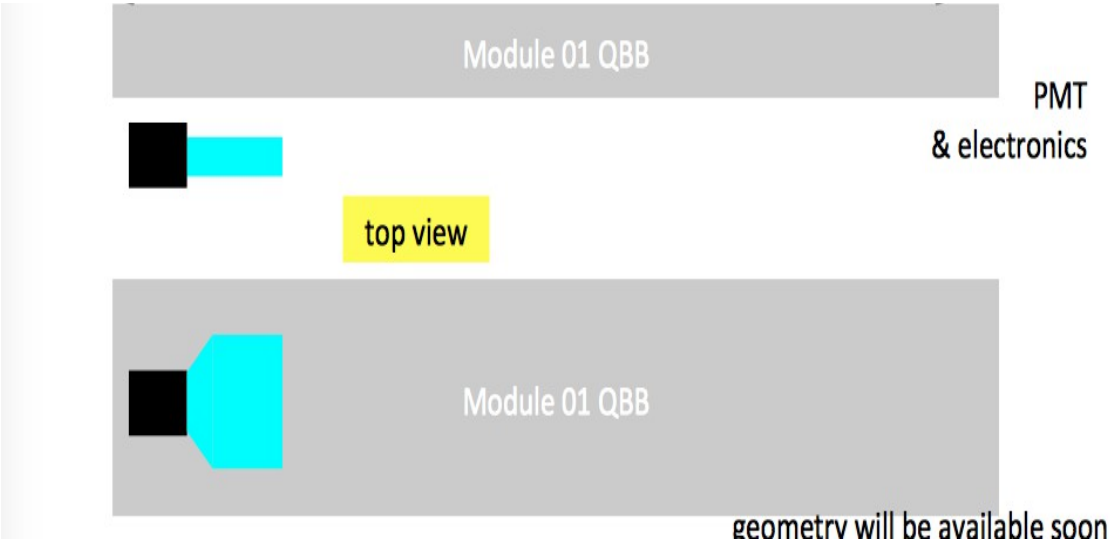
Electronics production (30-SEP-2015)

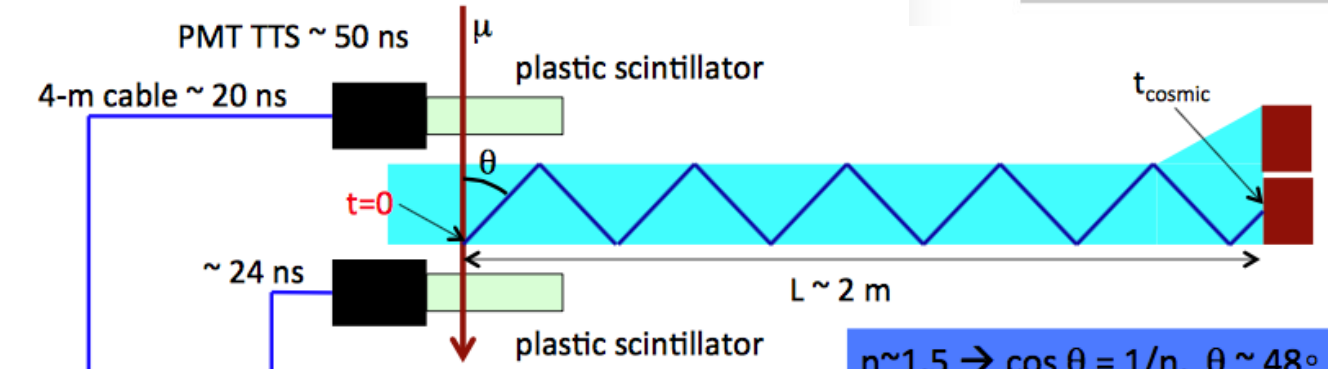
Production Boardstack: Schedule to Completion	9/28	10/5	10/12	10/19	10/26	11/2	11/9	11/16	11/23	11/30	12/7	12/14	12/21	12/28	1/4
travel & other schedules				B2GM											
HVB to cable assembly (Indiana)	20	16	8												
HVB assy / pot / pogo (Indiana)	5	5	5	5	5	5	5	5	5	5	5	5			
HVB final test (Indiana)	4	5	5	5	5	5	5	5	5	5	5	5			
Front test (Indiana)	10	10	12												
carrier verification (South Carolina)	16	16	16	16	16	16	16	1							
carrier heatsink attachment (UH)		32	32		32	32	32	32	32	22					
T/J cable fab/test (Pittsburgh)	8	8	8		8	8	8	8	1	8 [1]					
SCROD power cable fab/test (Pittsburgh)			8	8	8	8	8	8	8	8	8				
SCROD heatsink attachment (UH)			28	28											
boardstack laser verification (UH)			8	8	6	6	6	6	6	5	5				
boardstacks at KEK		4	4		16		12		12			8			
module (quartz + QBB) ready	m09			m10			m11				m12		m13		
integration with module		m04	m05			m06	m07	m08	m09	m10	m11	m12		m13	
LV power supply procurement (Wiener)											ALL				
LV power cables (estimated) (Nagoya procurement)								ALL							
LV patch boxes (Indiana & UH)						ALL									

Testing (76 KEK [m09] + 22 transit + 10 tested)

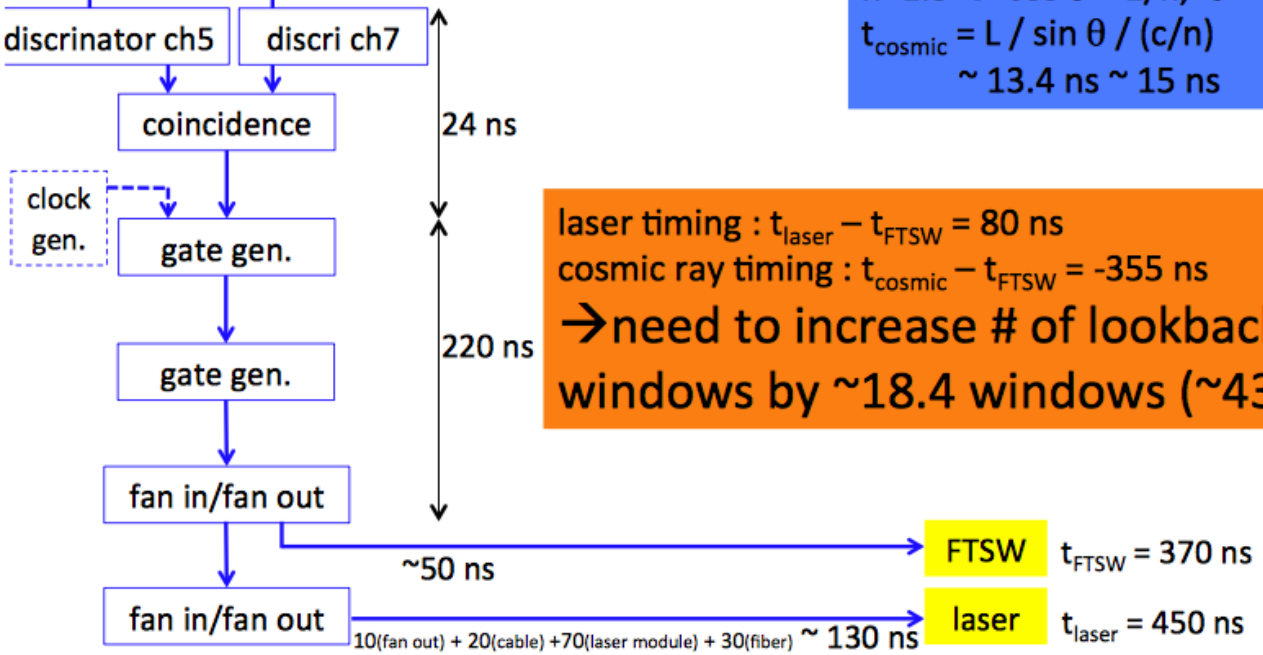
- **HVB custom Assy**
  - **M05 next**
  - **Technician prep work**
- **Carrier revE3**
  - **Summary at back**
  - **Power, TJ hooker cables**
  - **M06+ to UH**
- **Laser testing**
  - **Trigger timestamping**
  - **Next batch heatsinks**
  - **Continuing to improve automation**

Cosmic Ray Setup a Fuji Hall



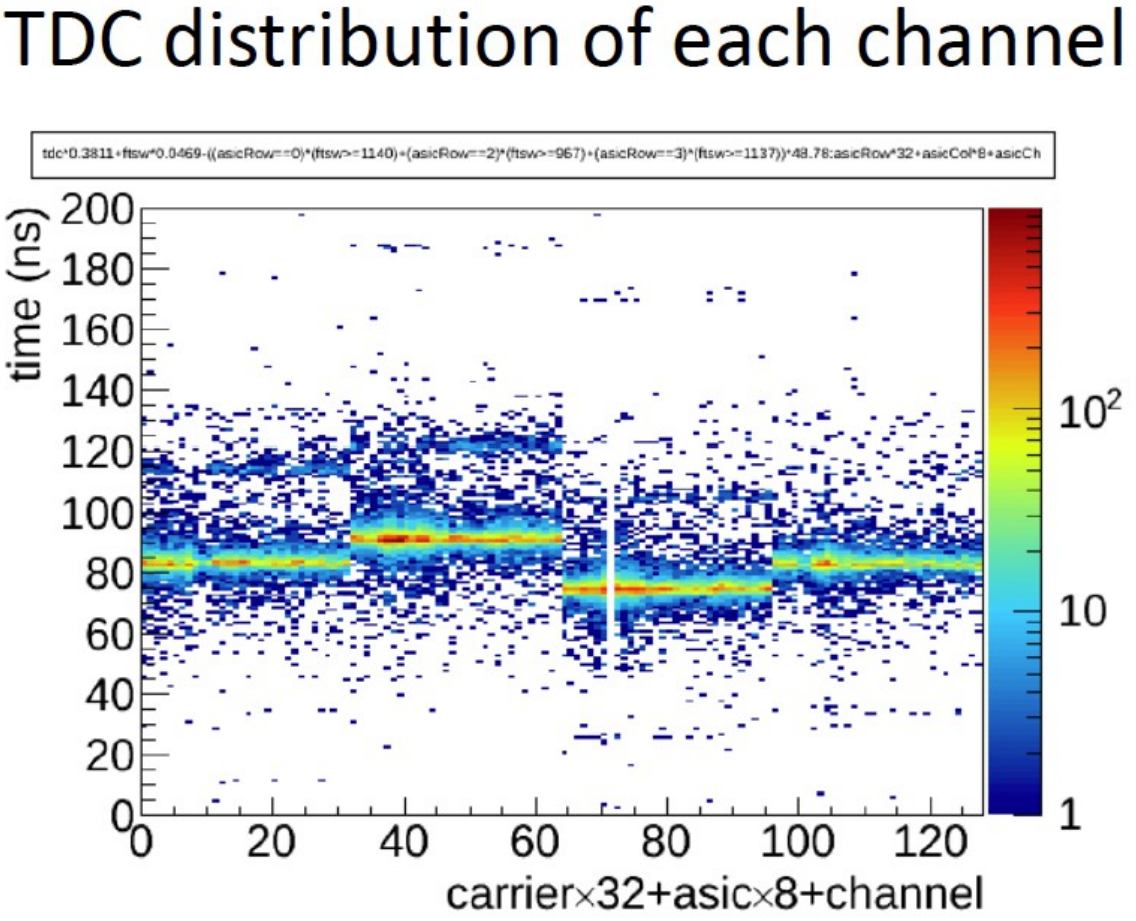


n~1.5 → cos θ = 1/n, θ ~ 48°
t_{cosmic} = L / sin θ / (c/n)
~ 13.4 ns ~ 15 ns

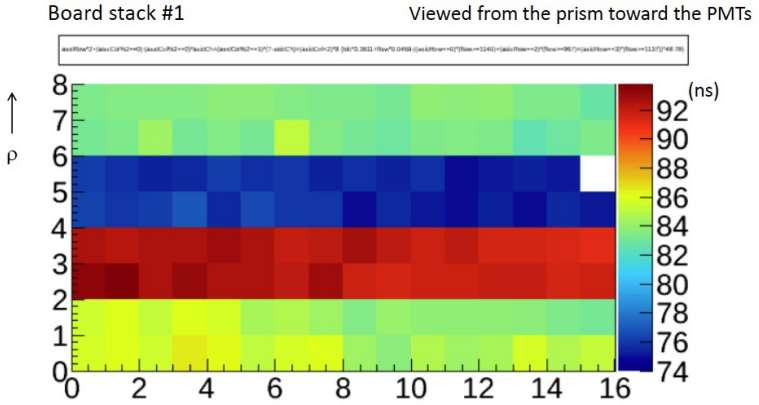


laser timing : $t_{laser} - t_{FTSW}$ = 80 ns
cosmic ray timing : $t_{cosmic} - t_{FTSW}$ = -355 ns
→need to increase # of lookback windows by ~18.4 windows (~435 ns)

Primi segnali calibrazione laser da M01



Mean TDC distribution



Carrier by carrier t0 offset

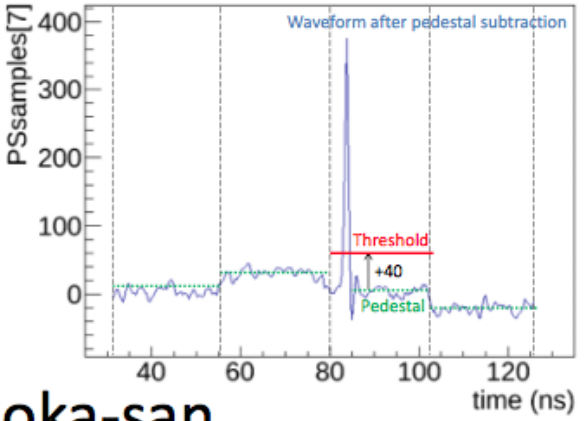
Discussione nel talk di Stefano
Richiesta di G.Varner: provvedere un PLC e una splitter a 4 canali per Fuji Hall

Maeda20151001.pdf (https://www.phys.hawaii.edu/elog/iTOP+Cosmic+Ray+Telescope/1202/1)

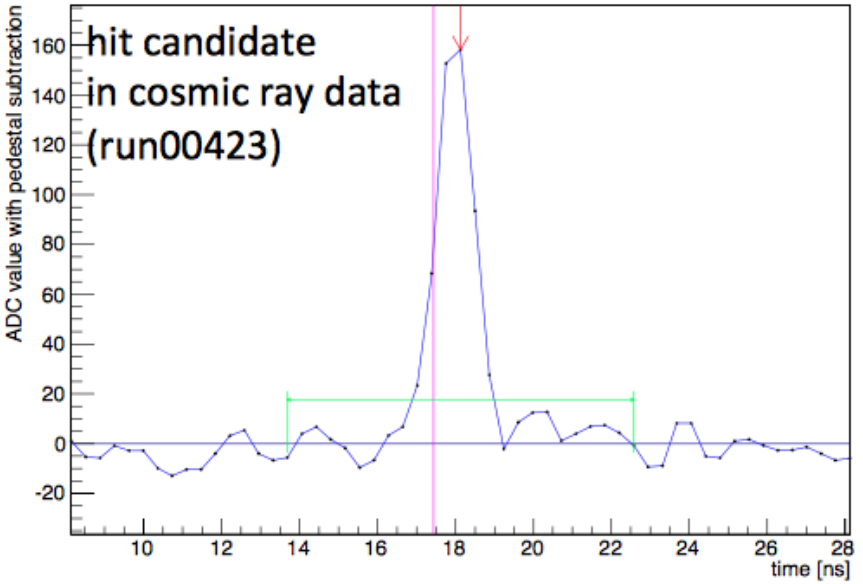
Raggi cosmici in M01 a Fuji Hall

quick look of the data

from Matsuoka-san's slide



- analysis procedure
  - pedestal subtraction
  - window by window baseline correction as was done by Matsuoka-san
- hit identification
  - local maximum with >50 ADC counts

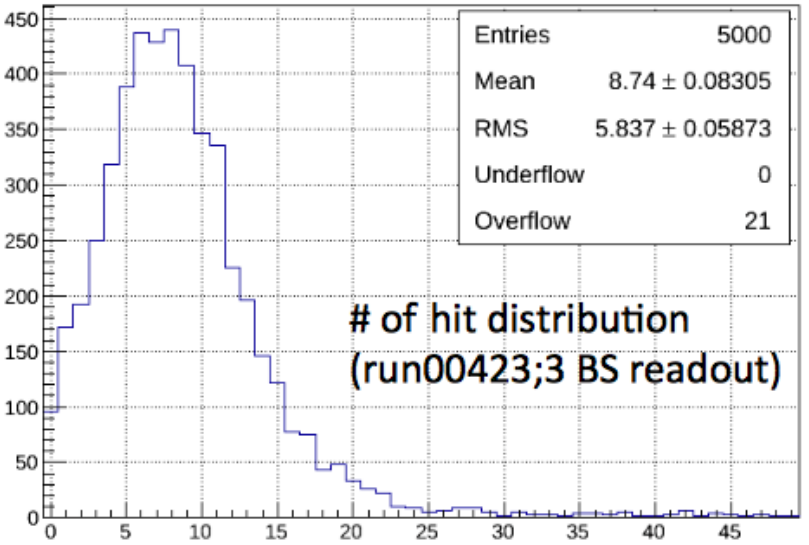


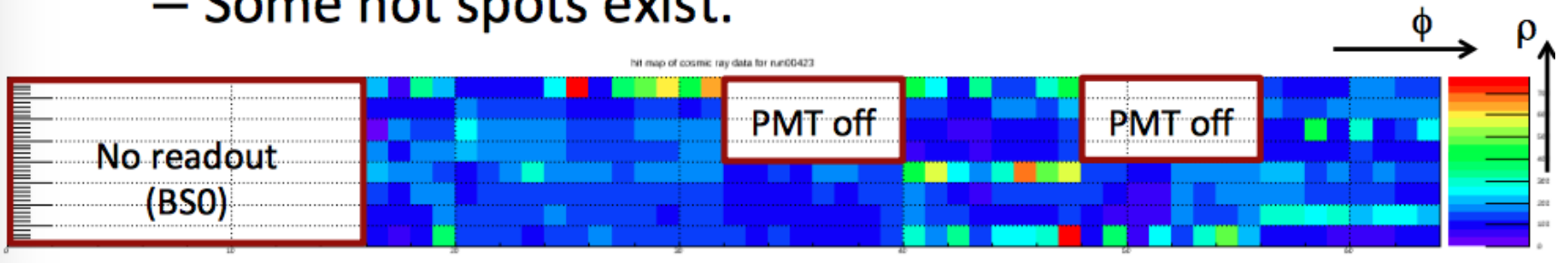
Maeda20151001.pdf (https://www.phys.hawaii.edu/elog/iTOP+Cosmic+Ray+Telescope/1202/1)

Raggi cosmici in M01 a Fuji Hall

hit distribution – run00423

- # of hits
  - – no timing selection
  - – 8.7 p.e. in average
    - smaller than expectation, ~20 p.e.× coverage(62.3%) ~ 12.5 p.e.?
    - to be compared with MC simulation
- hit map
  - – Some hot spots exist.





Maeda20151001.pdf (https://www.phys.hawaii.edu/elog/iTOP+Cosmic+Ray+Telescope/1202/1)

Test su Modulo 01: Sommario delle conclusioni (Luo, Maeda e Kichimi-san)

- Ancora firmware problems : a tutt'oggi non riusciamo a leggere tutti i 4 BS insieme ad alto rate
- Spiacevole che 1 ASIC rotto faccia spegnere 2 PMT

Mdule01 test at Fuji-CRT (gigE-DAQ): Sept.14-29

1. DAQ with various windows
(1) One carrier readout with 16windows (Spet.14) (after misalingment fixed)
4 carrierx 4 win/BS is OK.
Centering signal in the windows is well controlled by lookback.
(2) One BS readout with 4 windows (sept.15-24) for BS1,2,3,0
Pedestal/ Calibration/ Laser/ Cosmic .
Almost stable in a long run for a few hours. Only this mode is usable.
2. Status of BS1,BS2,BS3,BS0, tested by calibration signal.
(1) BS1 : all 16 asics are OK.
(2) BS2 : carrier2-asic1 is bad. (pmt25&26 off)
(3) BS3 : carrier3-asic0 is bad. (pmt29&30 off)
(4) BS0: car0-asic2,3, car1-asic2,3, car4.(all pmts off)
bad: no signal is seen for calibration signal input (ch7).
We did not investigate the individual 8 channels.
3. Several trials of multi-BS readout, but not stable (Sept.25-30) due to "Daq.error Timeout sending xml string". We could continue DAQ.
(1) 2BS readout with 4 windows
(2) 3BS readout with 4 windows
(3) 4BS readout with 4 windows (BS0 HV-off)

Data analysis is in progress by Matsuoka-san and Maeda-san et.al.

Issues on module test in Oct.

1. One BoardStack readout : 4windows x 4carriers
Stable data taking for a few hours
(1) Ring buffer of 64 windows
(2) Centering signal by lookback
2. Setup of BS 2 hours for setup
(1) FW download (~5min)
(2) Configuration (~40min)
(3) Centering signal in the windows
16 win → 4 win for 4 carriers (~40min)
3. Data collection at 10Hz
(1) Pedestal run (10Hz)
(2) Calibration run (10Hz)
(3) Laser run (10Hz) 100Kevents 3 hours.
(4) cosmic run (~1Hz) over night run

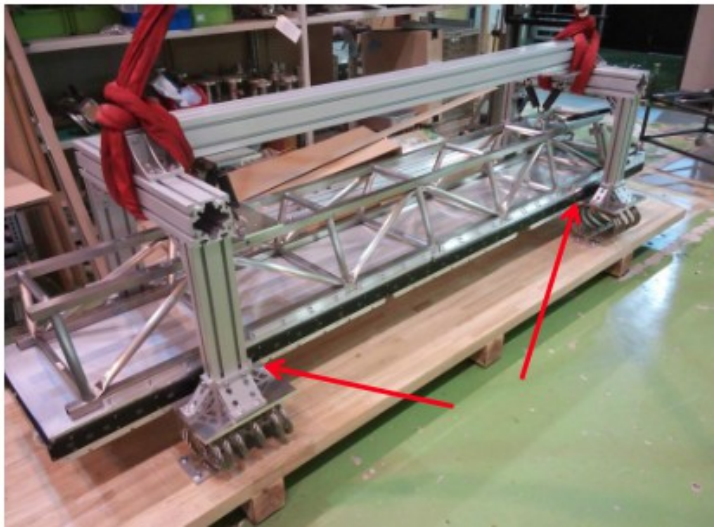
24hours /BS

4. Run script / waveform analysis : to be user-friendly.
5. Difference between rev.A and rev.B
6. How to fix bad asics and how much time.

unknown

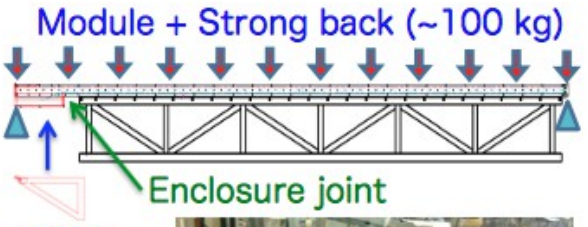
For Installation practice

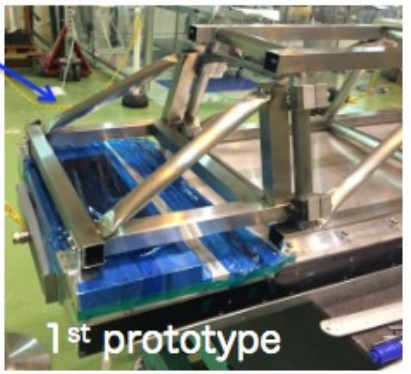
- Platform at Belle detector is in progress.
  - Will be done this week
- Pallet was tested with Prototype4
  - Changed the vertical frame to be longer
  - It looks OK for other things. Will be tested with G meters
- Prototypes and jigs is moving to Tsukuba now

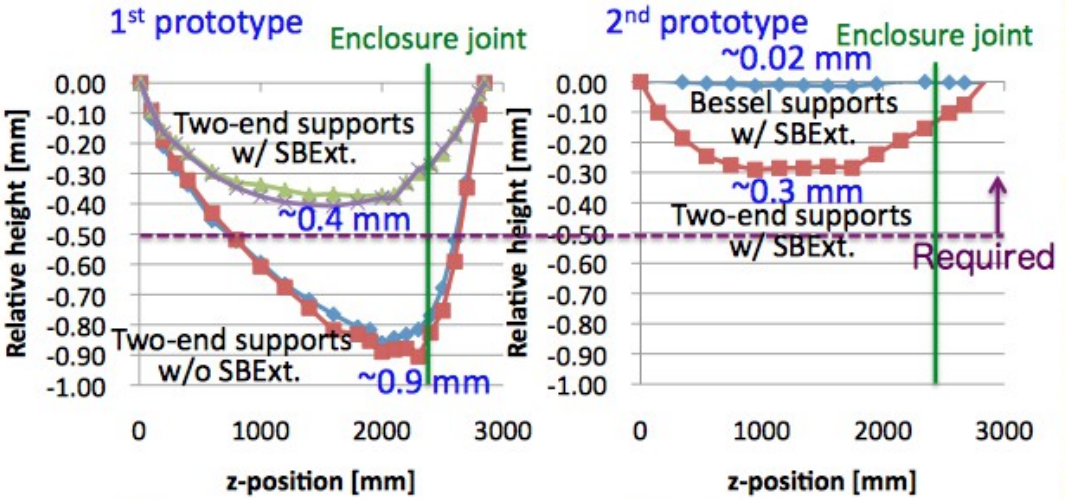


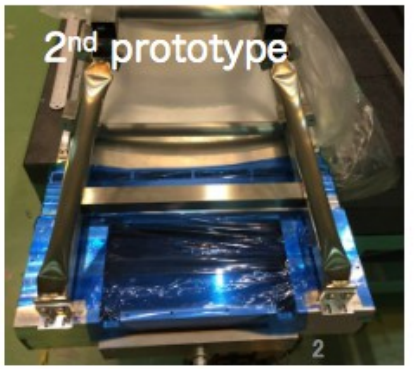
Preparation status (1)

- Strong Back Extension
  - 2nd prototype shows similar performance with the 1st one。
    - ➢The 2nd prototype will be the design for mass production.
    - ➢To be ordered soon for the first 2 modules to be installed in Nov.









TOP: nel 2020/1 dovremo cambiare meta' degli MCPPMT!

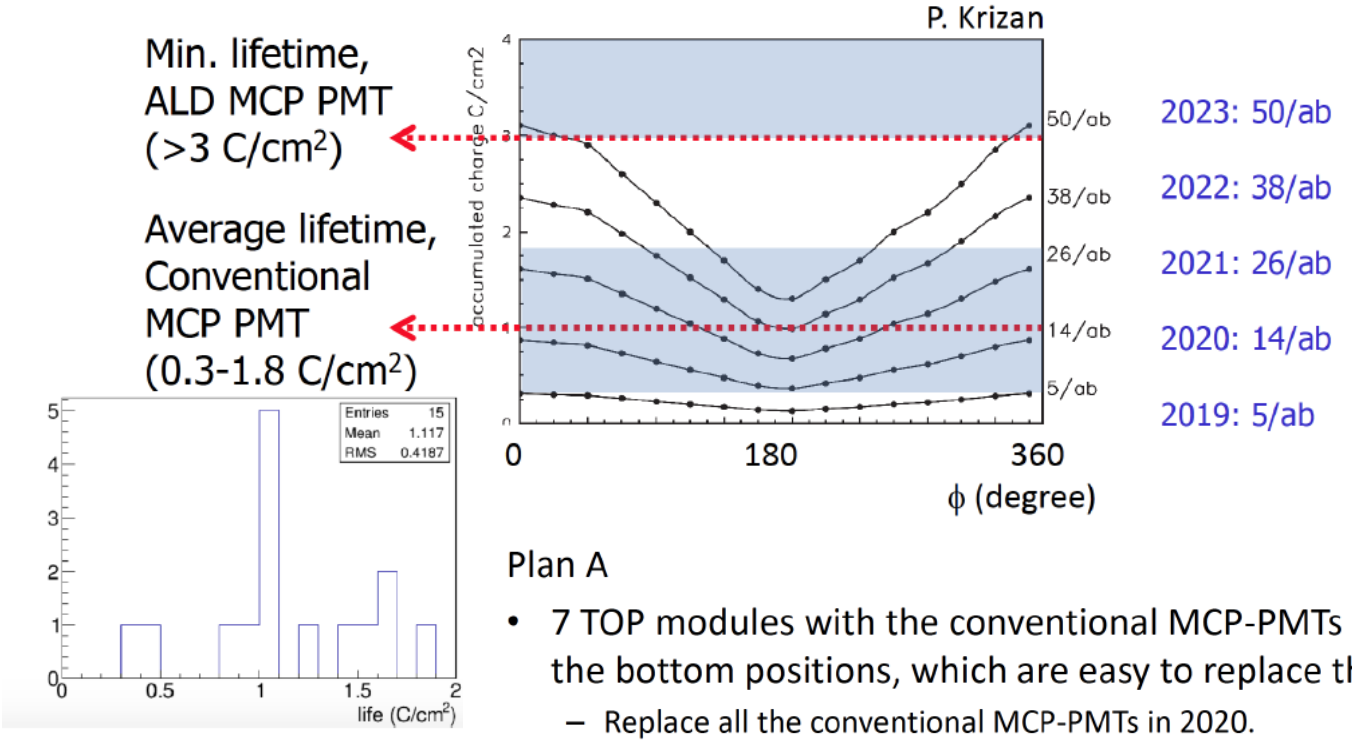
1 MHz/PMT at 5 x 10^5 gain at design luminosity

→ about 1 C/cm^2/50ab^{-1}

Plot the accumulated charge for expected summer shutdown luminosities

Min. lifetime, ALD MCP PMT (>3 C/cm^2)

Average lifetime, Conventional MCP PMT (0.3-1.8 C/cm^2)



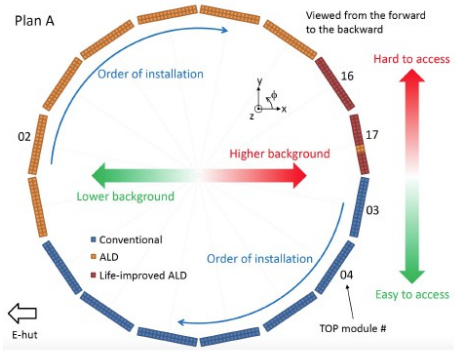
2023: 50/ab

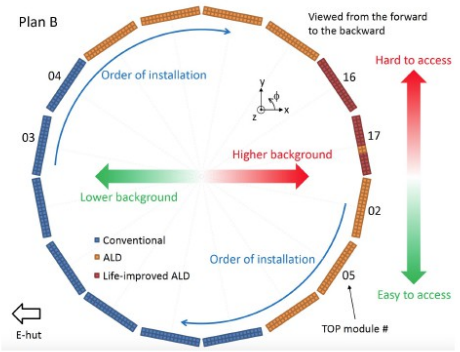
2022: 38/ab

2021: 26/ab

2020: 14/ab

2019: 5/ab





Plan A

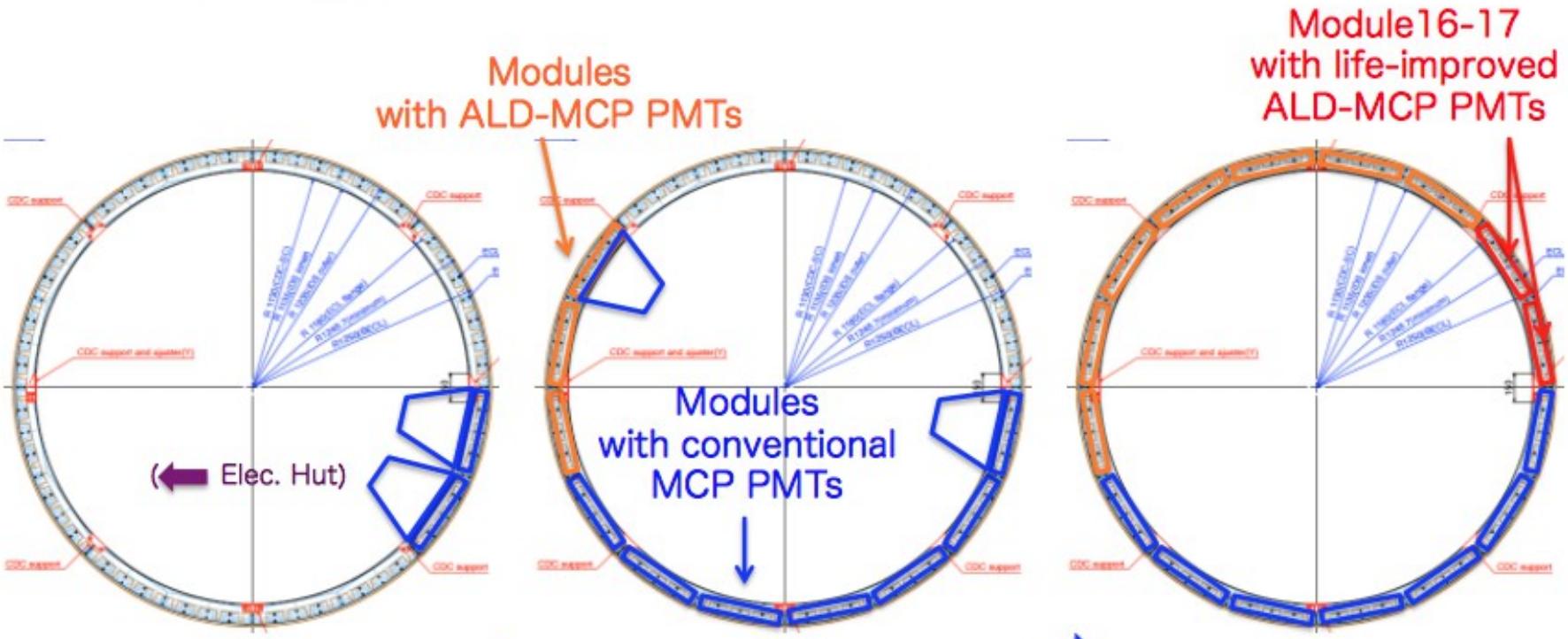
- 7 TOP modules with the conventional MCP-PMTs are placed at the bottom positions, which are easy to replace the PMTs.
  - Replace all the conventional MCP-PMTs in 2020.
  - We can avoid placing the ALD MCP-PMTs at the highest background positions to use them as long as possible above 50 ab^{-1}.

Plan B

- 7 TOP modules with the conventional MCP-PMTs are placed at the lower background positions.
  - Replace 2 modules in 2020 and 5 modules in 2021.
  - 2 of them are placed at the upper side, which will be hard to access.
  - We cannot avoid placing the ALD MCP-PMTs at the highest background positions.

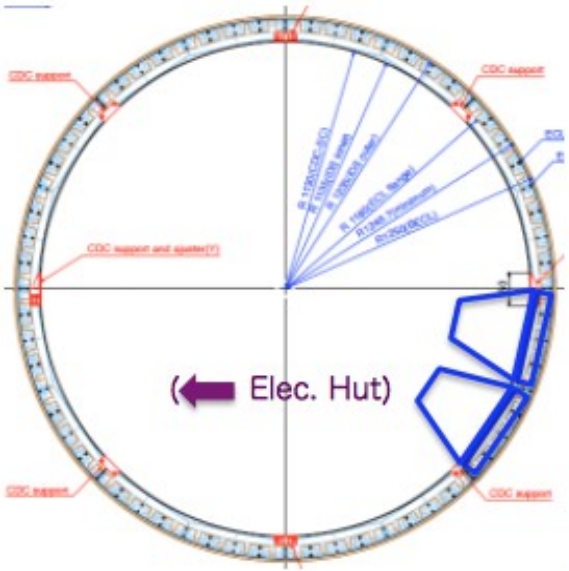
Plan for the 2nd installation (1)

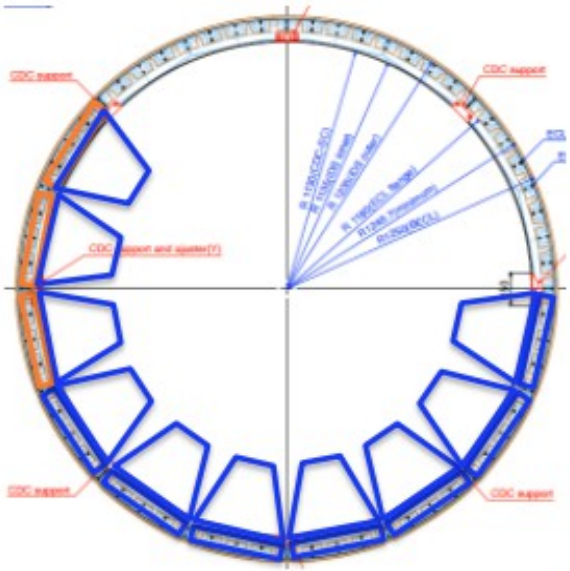
- 10 modules in continuous slots?
  - –If so, need to prepare the PMT integration that way.
  - –Any suggestions?

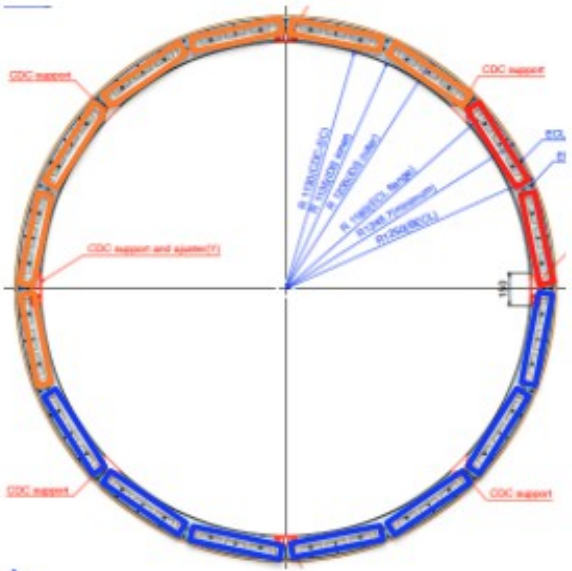


Plan for the 2nd installation (2)

- Shall we leave the SB+SBExt until most of the modules are joined cylindrically?
  - –To prepare for unexpected removal of a module.
  - –We could remove SB+SBExts before starting the 3rd installation.







2 modules in Nov. → +8 modules in Jan.-Feb. → +6 modules in Apr.