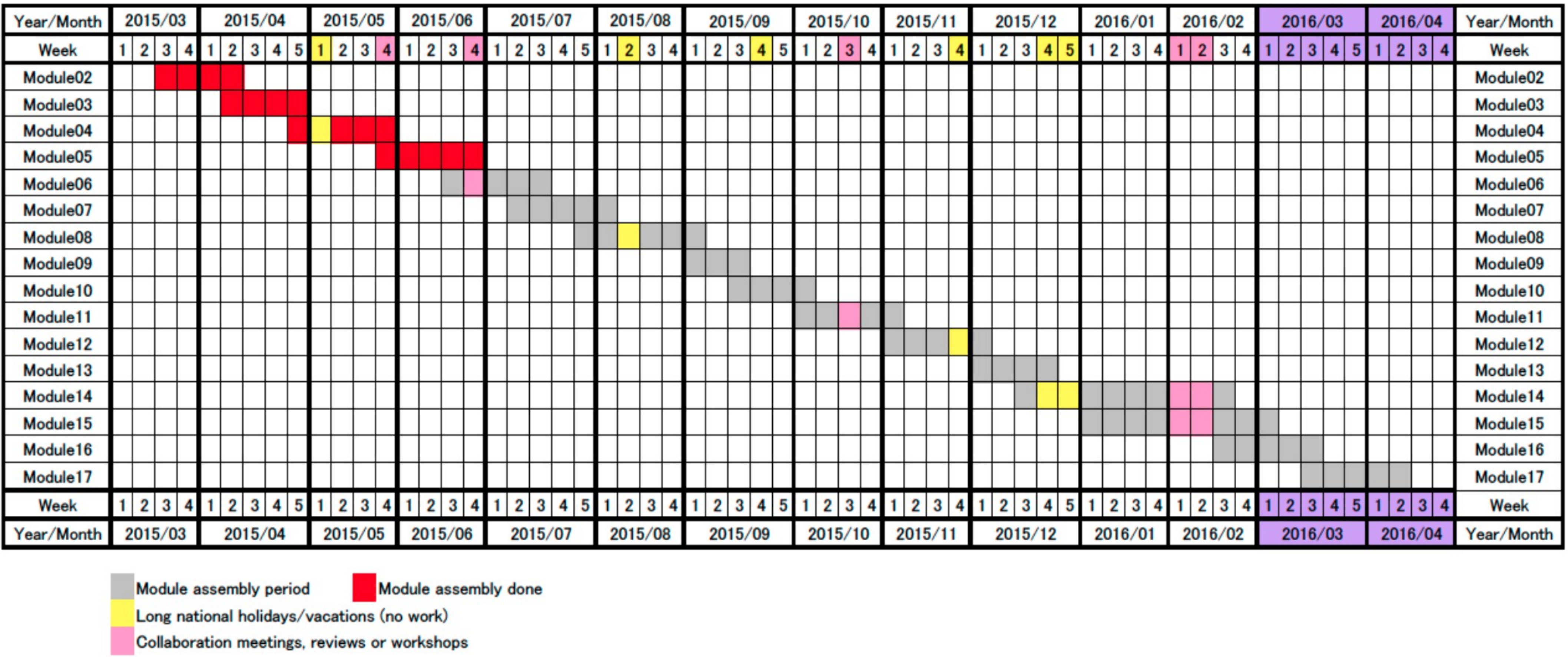
TOP Time Calibration System
Progress Report (DRAFT)

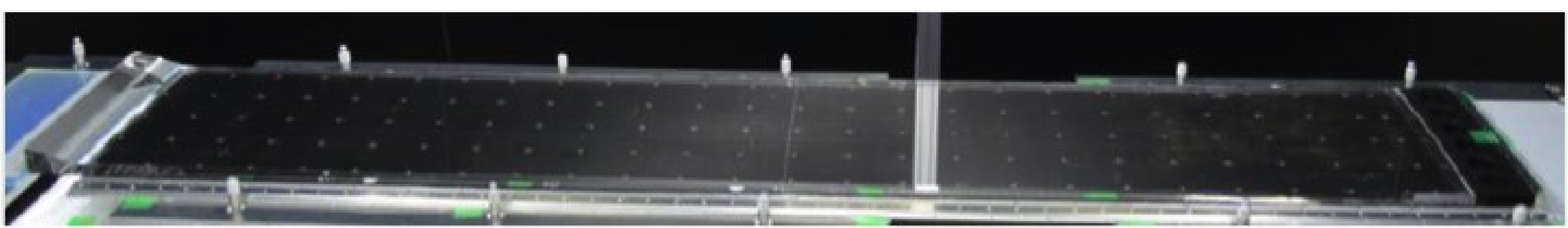
M.Benettoni, A.Gaz, S.Lacaprara, M.Posocco, *L.Ramina, M.Rebeschini,* P.Sartori, R.Stroili, E.Torassa
(Univ. and INFN Padova)

O.Brunasso, M.Mignone, F.Rotondo,
R.Mussa, U.Tamponi,
M.Greco, S.Marcello
(Univ. and INFN Torino)

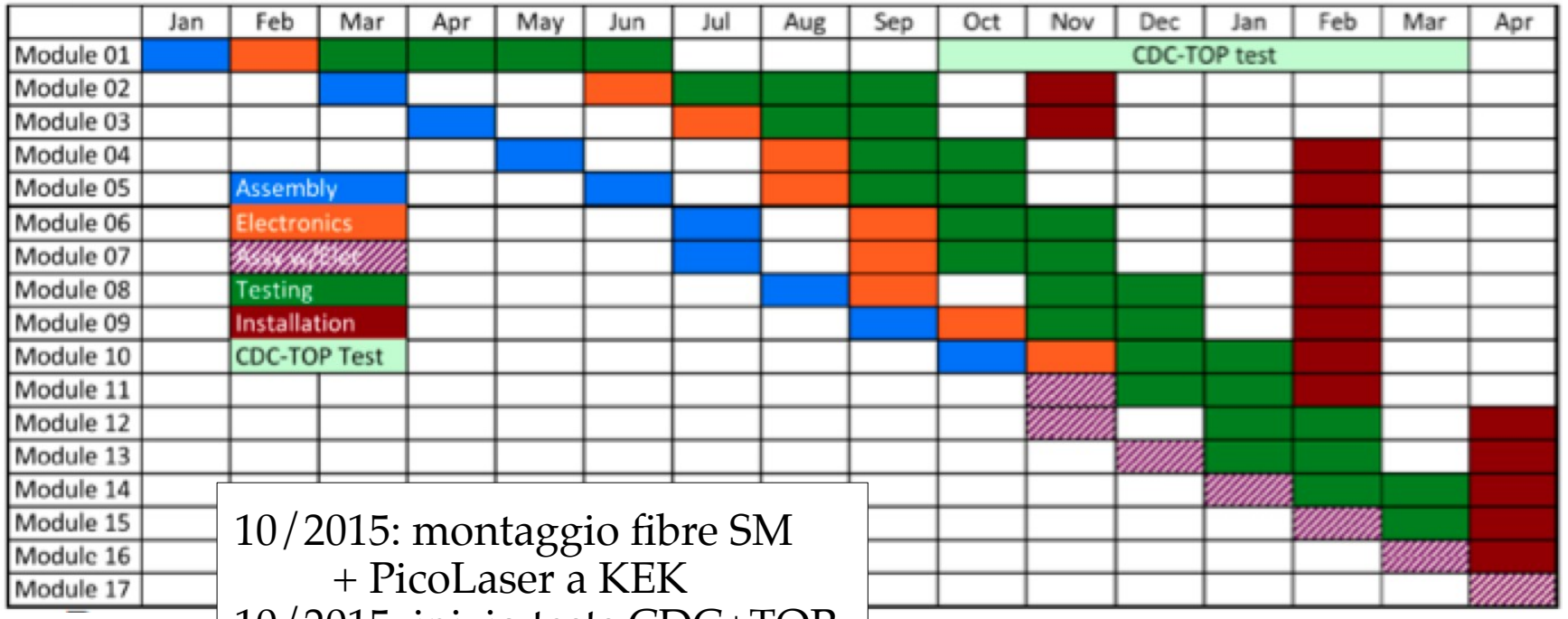
Riunione Referaggio Belle-II Italia 7 Settembre 2015 Roma

Assemblaggio delle barre di quarzo

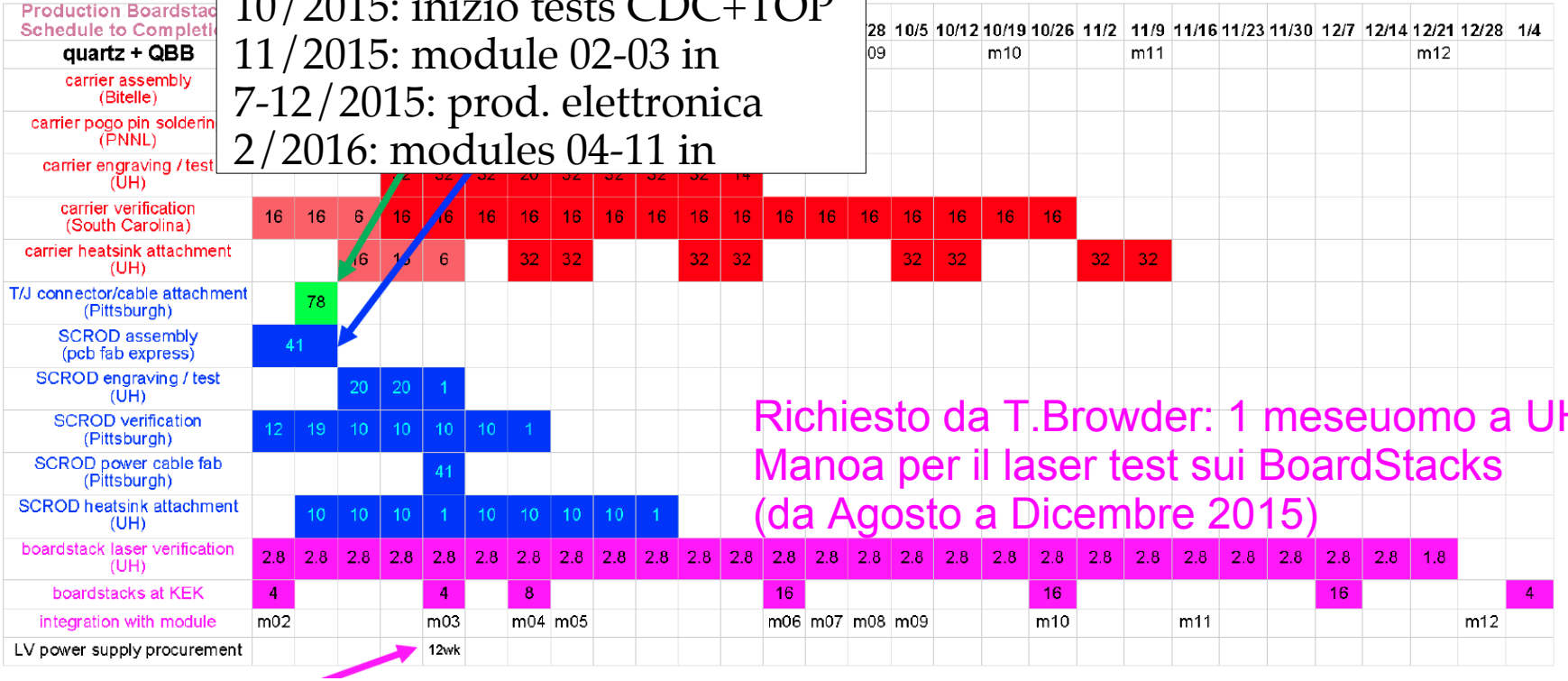




Commissioning TOP : schedule generale



10/2015: montaggio fibre SM
+ PicoLaser a KEK
10/2015: inizio tests CDC+TOP
11/2015: module 02-03 in
7-12/2015: prod. elettronica
2/2016: modules 04-11 in



Richiesto da T.Browder: 1 meseuomo a UH Manoa per il laser test sui BoardStacks (da Agosto a Dicembre 2015)

Assemblaggio Barre di Quarzo (QBB)

- Module07 is completed up to MCPPMT install
  - Moved to BR2 on cart with Module 06
- Module 08 well along
  - Polished prism per Zygo instructions and re-glued – near perfect!
  - Small grey haze near top, wall side of bar-bar joint
    - Maybe acetone used too early? Very high humidity right now (60-75%)?
  - Prism joint "biased" Y angle by 10 arcseconds – moved to <3 now
    - We should bias all joints in Y angle in future (need to document in procedures)
  - Can move optics as soon as Sunday, but will likely do Monday
- Module 09 optics QA started 8/26

We have fallen 1.5 weeks behind schedule which means we can not meet March/April installation!

We must remain vigilant not to loose more time

Assemblaggio Barre di Quarzo (QBB)

Contributo dei tecnici/tecnologi italiani:

Start Date	End Date	Days	Module(s)	Optics lead	QBB lead	echnician Date	Technician
16/03/15	30/03/15	15	02/03	Schwartz	Suzuki		Erzen
30/03/15	01/04/15	3	03	Inami	Suzuki		Brunasso
New JFY 4/1/2015	12/04/15						
02/04/15	14/04/15	13	03/04	Fast	Inami		Brunasso
15/04/15	24/04/15	10	04	Inami	Suzuki		Benettoni
Golden Week 4/29/15	05/05/15						
11/05/15	22/05/15	12	04	Inami	Suzuki		Brunasso, Ketter
FPCP @ Nagoya 5/25/2015	29/05/15						Ketter
28/05/15	06/06/15	10	05	Fast	Suzuki		Ketter
08/06/15	22/06/15	15	05/06	Schwartz	Inami		Erzen
B2GM 6/22/15	26/06/15						
27/06/15	12/07/15	16	06/07	Inami	Suzuki	6/27-7/12	Ramina, Rebeschini
13/07/15	27/07/15	15	07/08	Schwartz	Suzuki	7/13-7/24	Ketter
28/07/15	07/08/15	11	07/08	Inami	Suzuki	7/24-8/7	Glasgow
Obon 8/8/2015	16/08/15						
17/08/15	31/08/15	15	08	Fast	Inami	8/17-8/31	Brunasso

1-8/2015:
TO: 6 mw
PD: 6 mw

Assemblaggio Barre di Quarzo (QBB)

Contributo dei tecnici/tecnologi italiani:

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						

Full 2015:
TO: 8 mw
PD: 12 mw

Invecchiamento dei MCPPMT

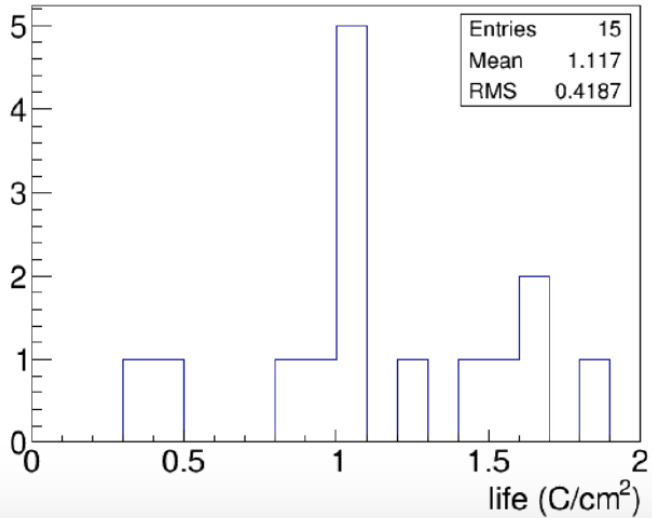
1 MHz/PMT at 5 x 10^5 gain at design luminosity

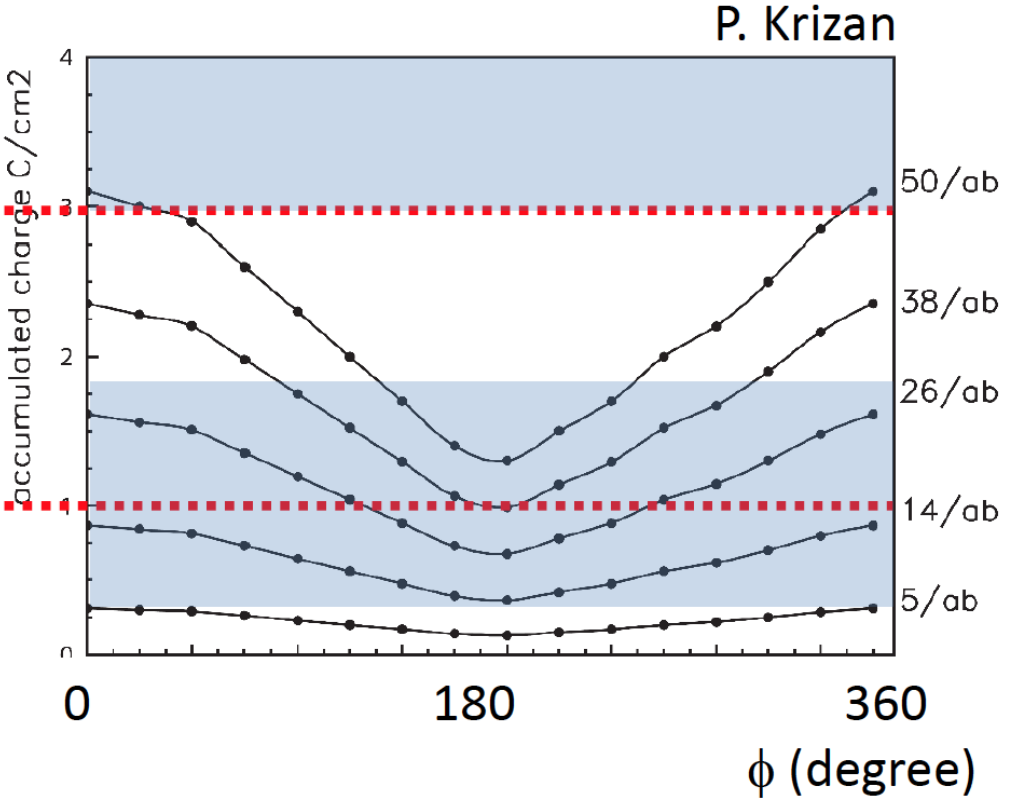
→ about 1 C/cm^2/50ab^{-1}

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

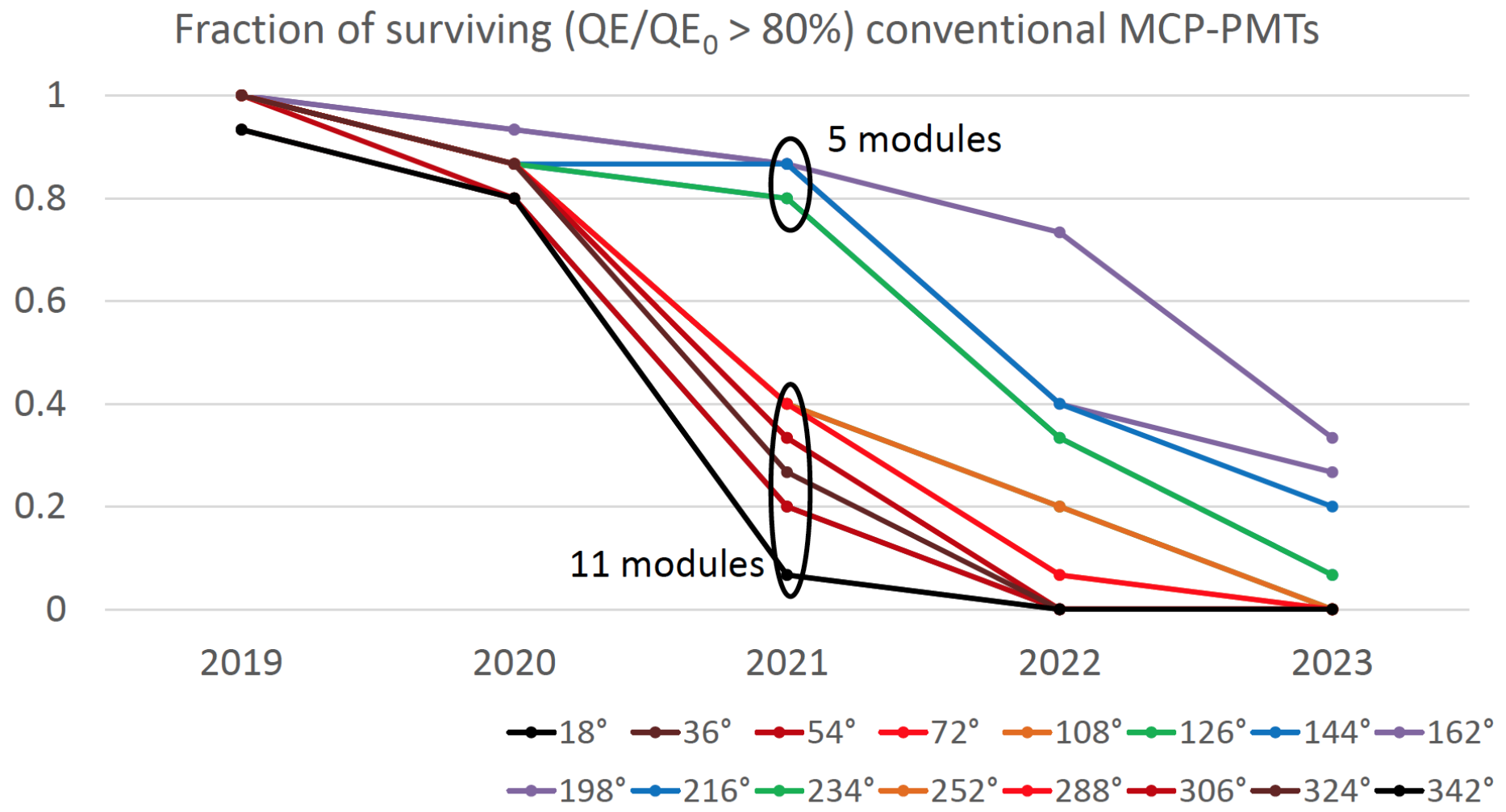
2022: 38/ab

2021: 26/ab

2020: 14/ab

2019: 5/ab

Survival rate dei MCPPMT vs Ldt



- We will have 7 TOP modules with the conventional MCP-PMTs.
- All of them will survive in 2020 at any position.
- 5 modules will survive in 2021 at the lower background positions.

Strategia di disposizione dei MCPPMT

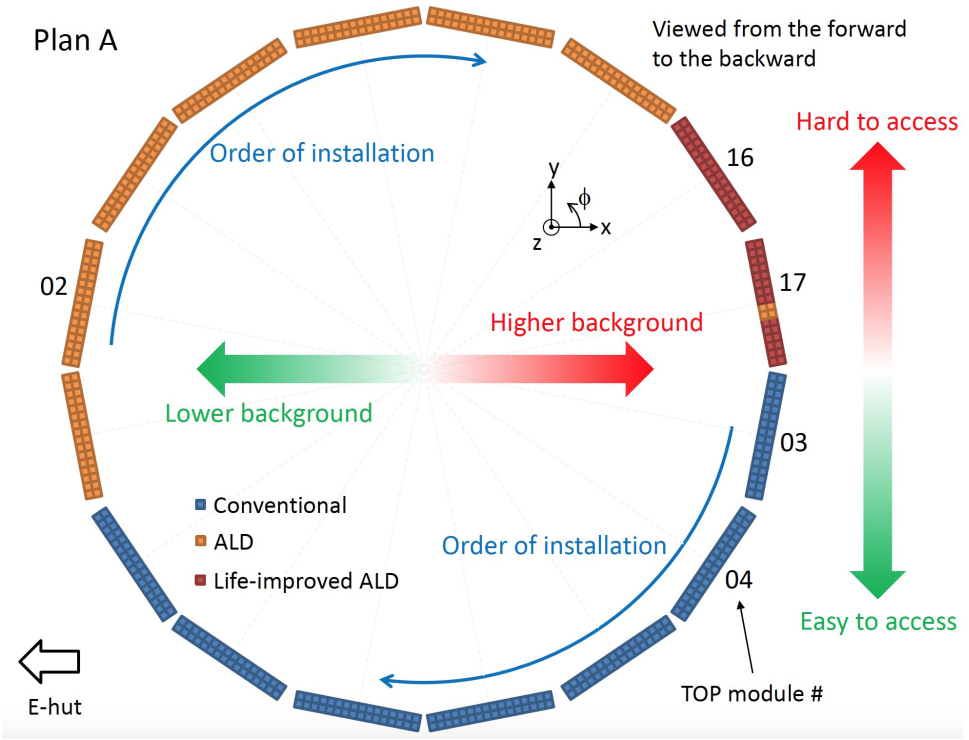
Plan A

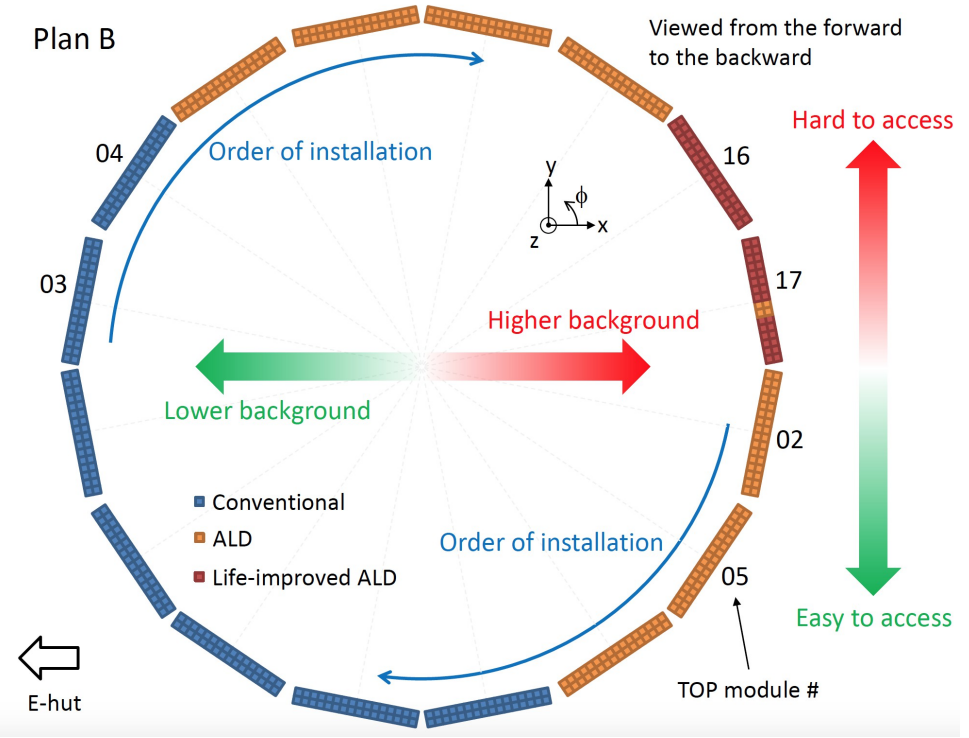
- 7 TOP modules with the conventional MCP-PMTs are placed at the bottom positions, which are easy to replace the PMTs.
  - Replace all the conventional MCP-PMTs in 2020.
  - We can avoid placing the ALD MCP-PMTs at the highest background positions to use them as long as possible above 50 ab^{-1}.

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.

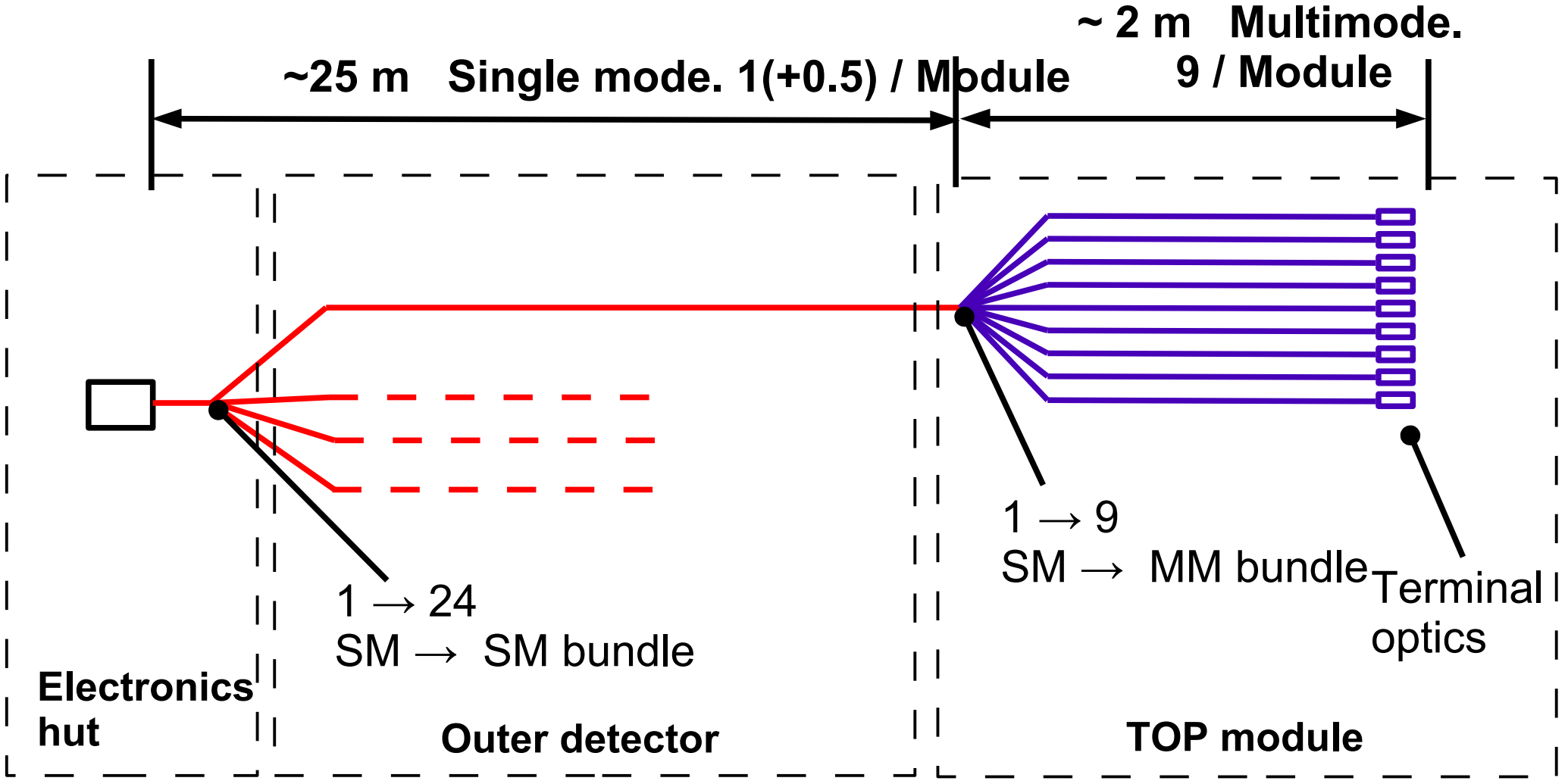
Strategia di disposizione dei MCPPMT /2





Preferibile il piano A
La disposizione ovviamente cambia nei due scenari
Ma dobbiamo decidere molto presto quale piano seguire

TopTimeCal:Light distribution



Tasks in Torino

→ Time resolution of the calibration system
→ SM → SM bundle
→ MC simulation

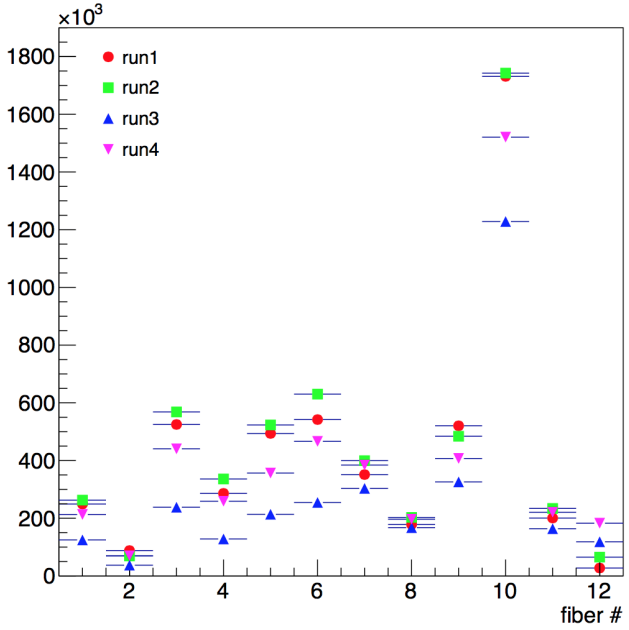
Tasks in Padova

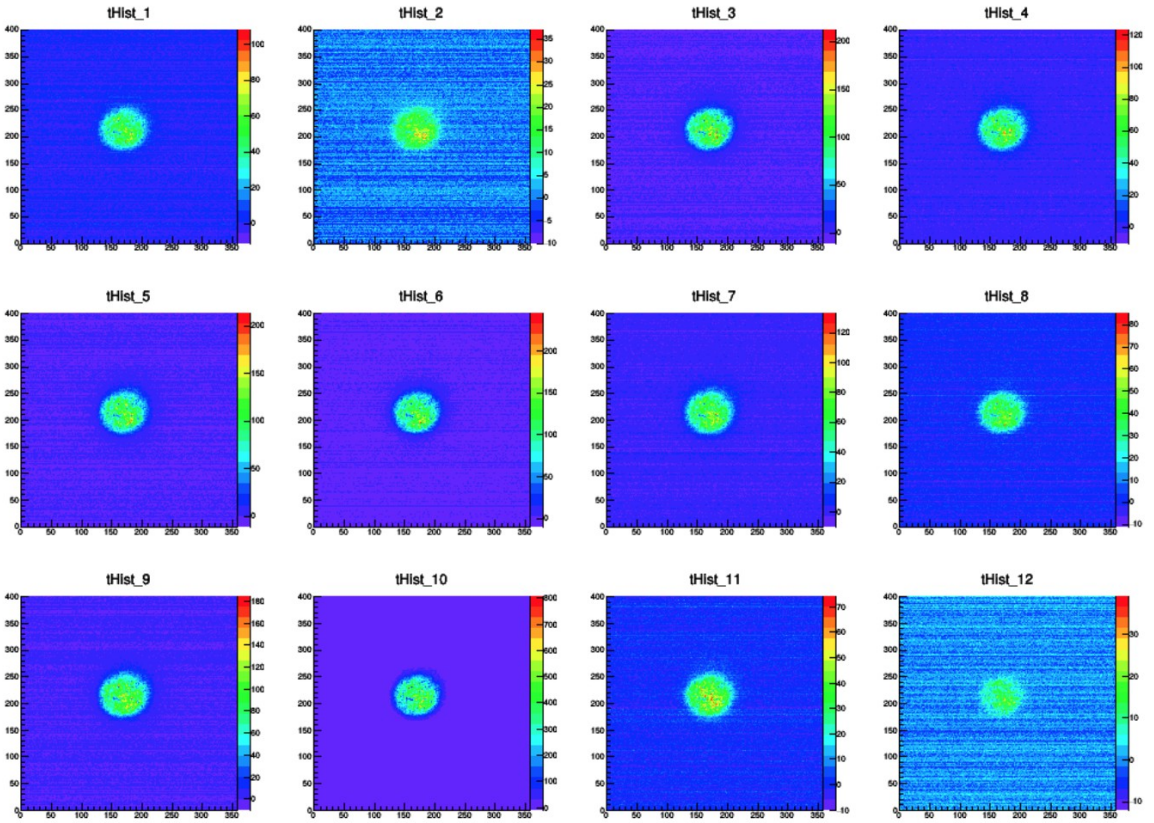
→ SM → MM bundle
→ Terminal optics
→ Light injection mechanics
→ Radiation tests

Tests sui PLC splitters (A.Gaz, PD)

I PLC (Planar Light Circuits) sono mini guide ottiche che consentono di aumentare di parecchio la piping efficiency,limitata dal fattore geometrico ~ $(Rcore/Rclad)^2$, con fibre SM
Stiamo testando questi splitters per cercare di aumentare la nostra piping efficiency, senza pero' introdurre disomogeneita e altri tipi di inefficienza.

light transmission - PLC1

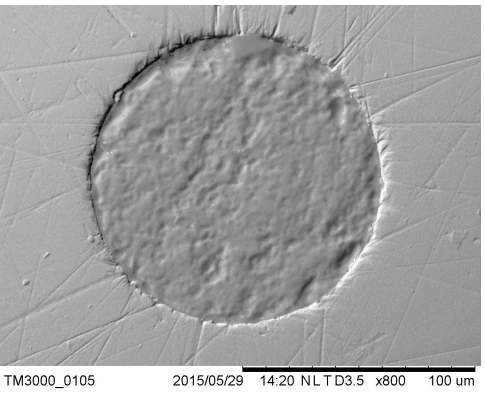




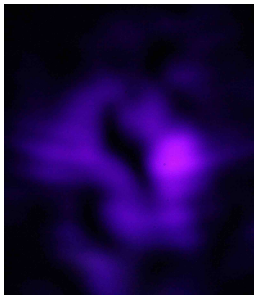
R.Mussa, TOP Progress Report

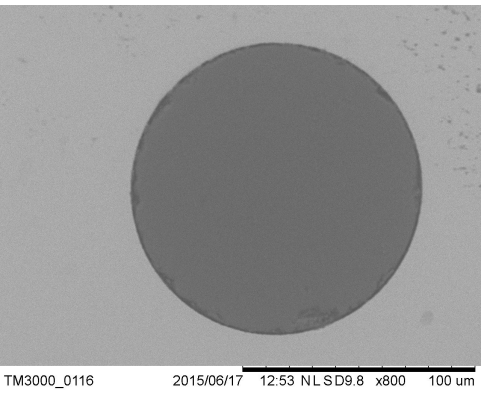
Controllo di qualita' delle fibre

Ottimizzazione polishing fibre SM: SEM(sn) , Laser (dx)

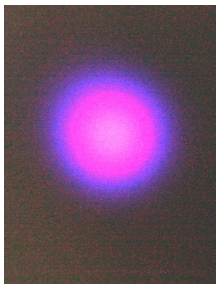


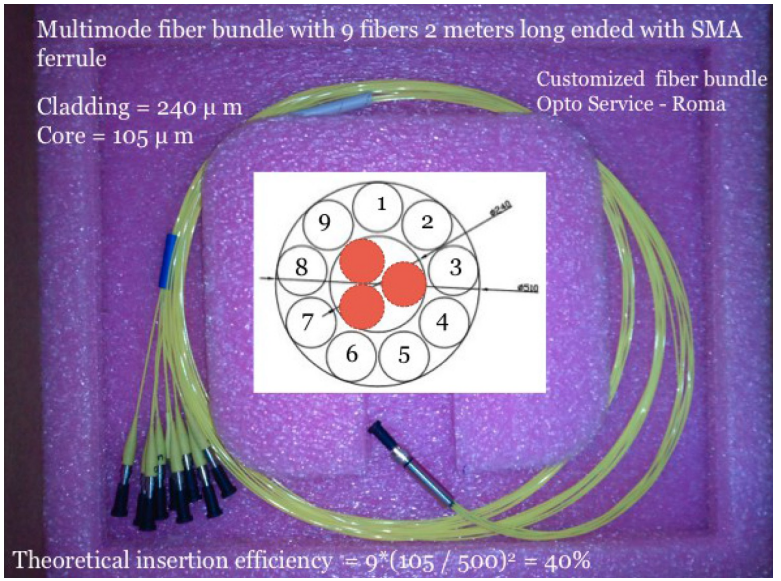
BAD



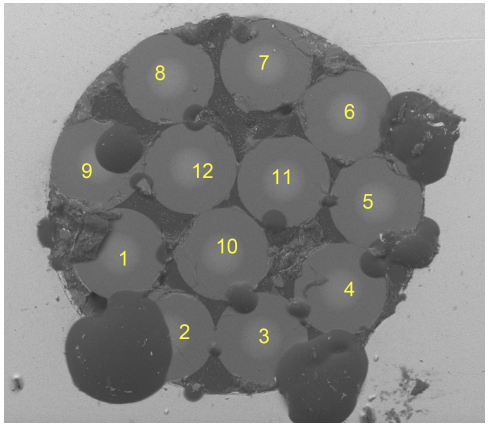


GOOD



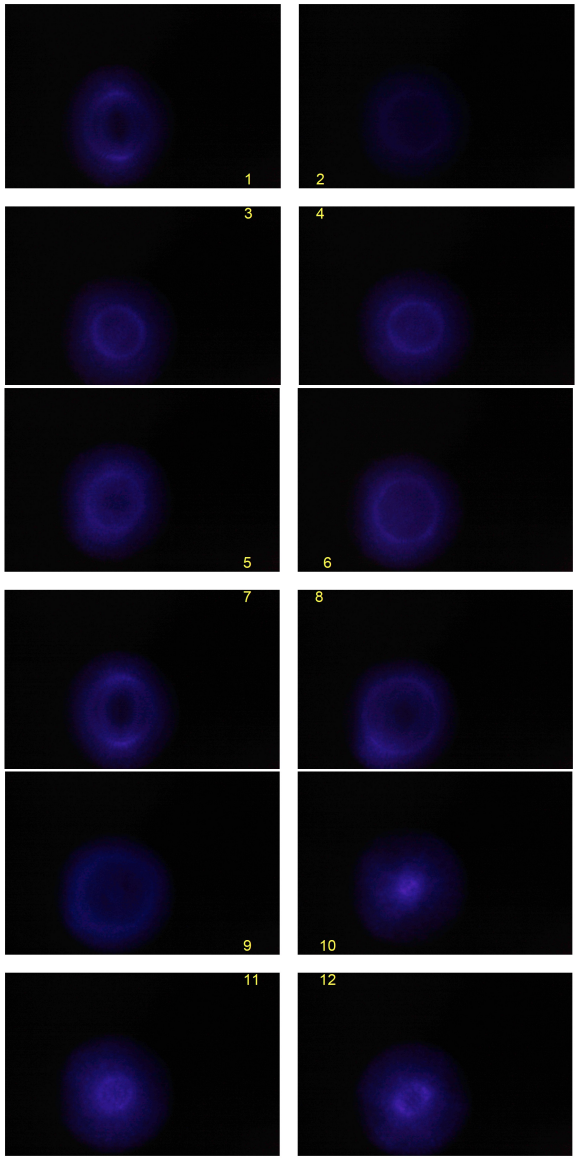


MM bundle al SEM



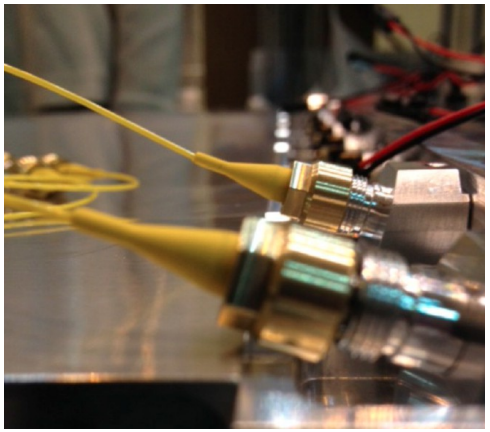
(*) foto SEM fatte all'INRIM (M.Pisani)

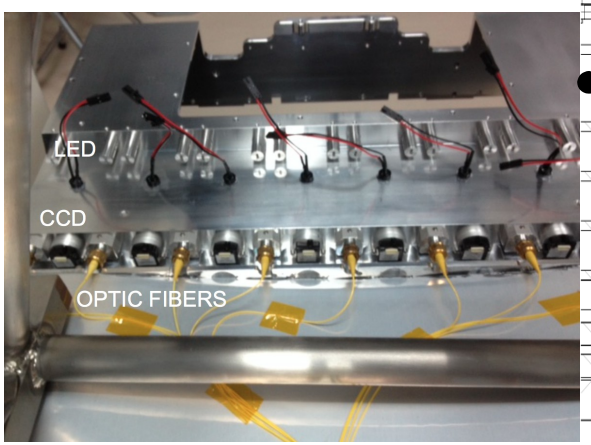
Laser spots da catena SM+MM bundle (senza GRIN lens)

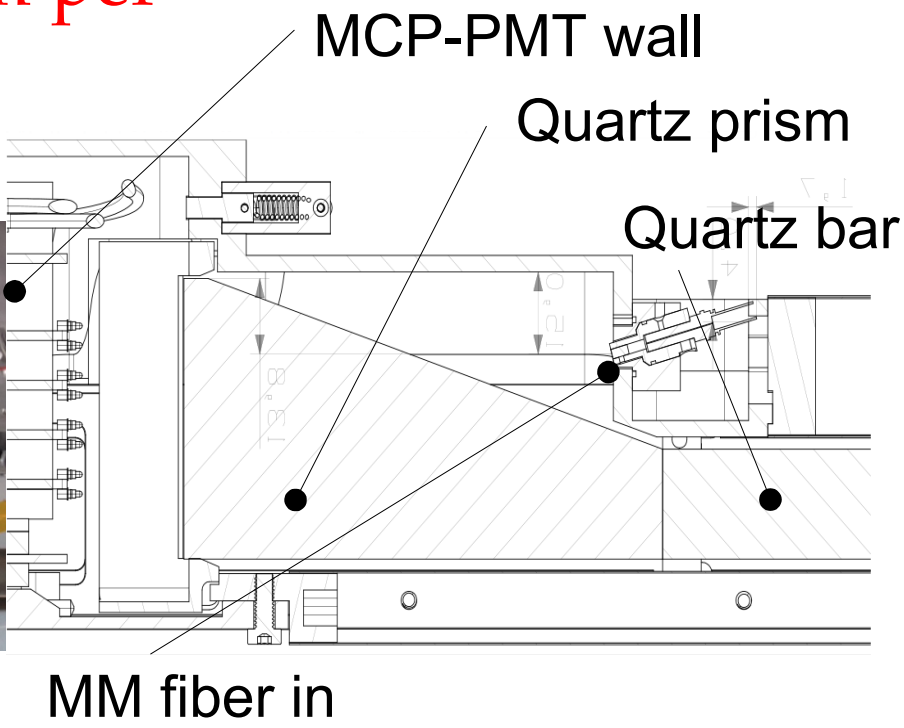


Realizzazione di connettori custom per il TOPTimeCal

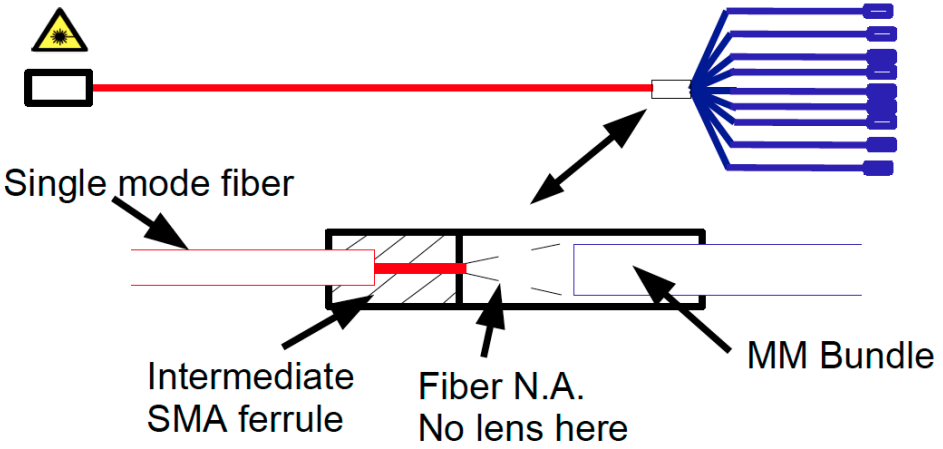
Connessioni fibre MM sulla QBB (PD)

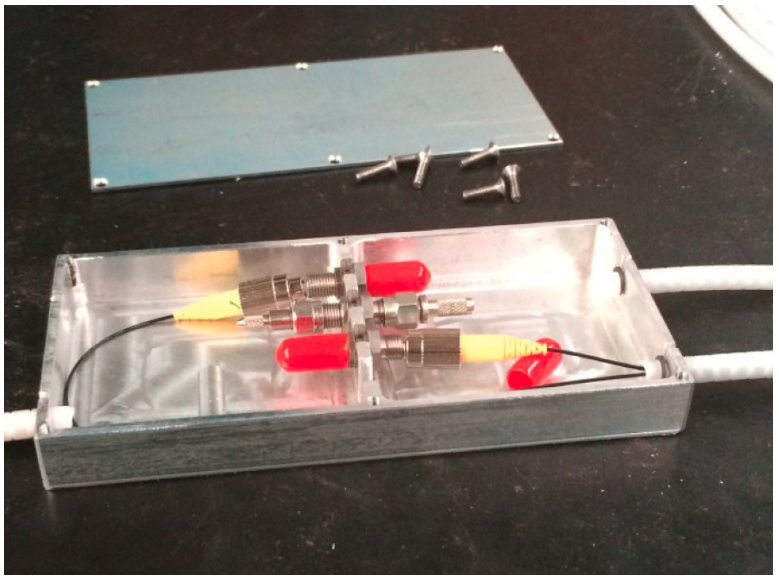






Connessioni fibra SM- bundle MM (TO)



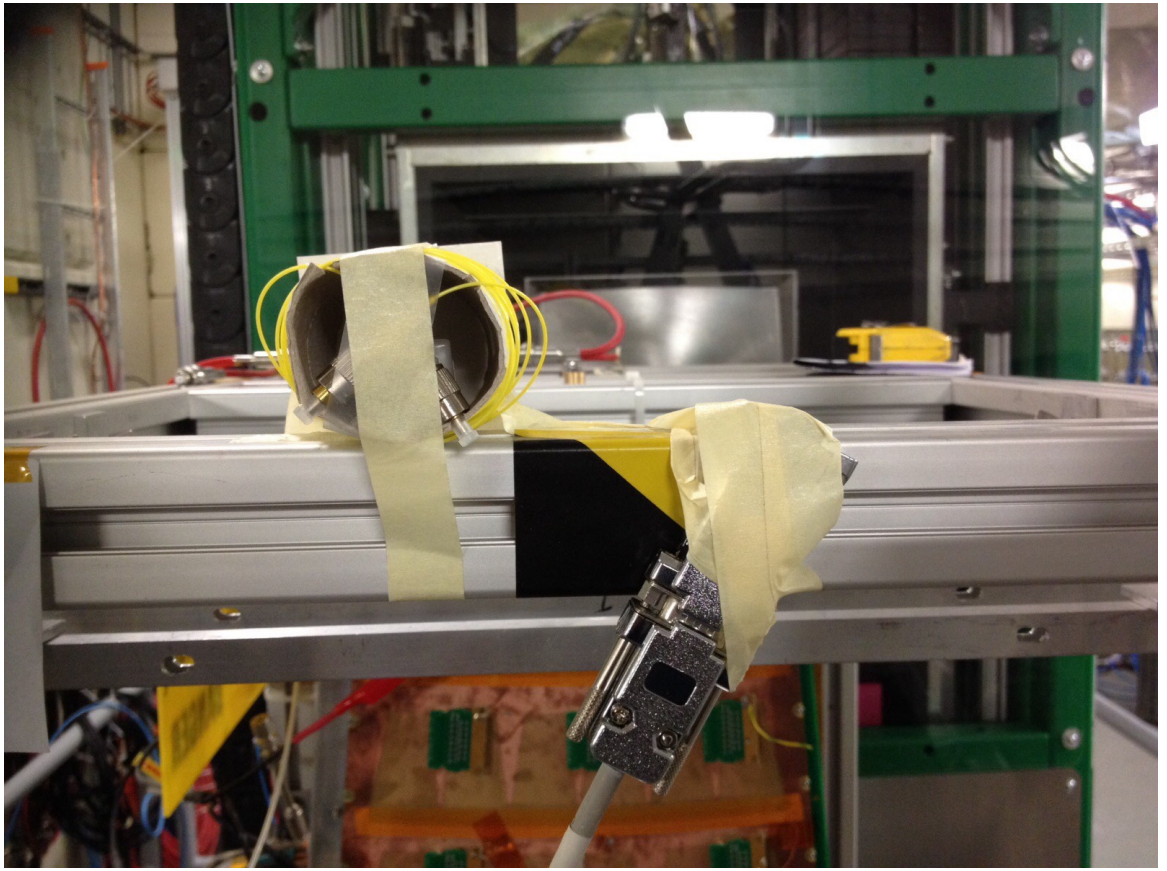


Tests Irraggiamento fibre al CERN (in corso)

Annesso a test su camere di CMS

Goal: studio degli effetti sulle fibre MM per un irraggiamento gamma corrispondente a 5 Gray (full Belle-II)

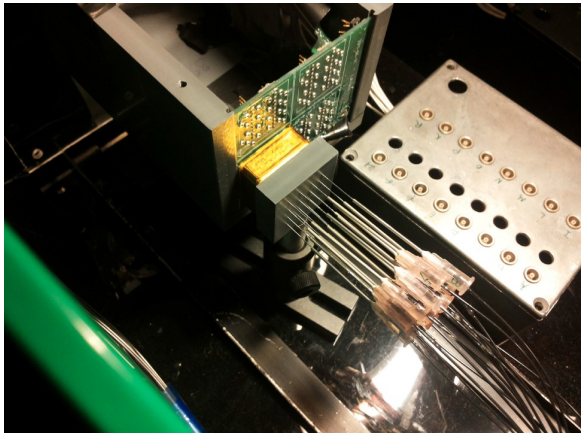
Complementare ai tests di irraggiamento con neutroni effettuati a LNL



Supporto Lab.Elettronica (M.Mignone)

Il sistema di calibrazione temporale verra' testato in-situ tramite un ALD-MCP-PMT letto da digitizer Caen V1742

- risoluzione temporale sulle fibre SM
- ritardo relativo tra le fibre SM
- ottimizzazione della connessione Laser – bundle SM



To Do: scheda di interfaccia per migliorare la HV+connector box (cavi Fileca e connettori LEMO)

Richiesta di supporto urgente per il commissioning dell'elttronica

University of Hawai'i at Manoa
High Energy Physics Group
Department of Physics & Astronomy

Watanabe Hall • 2505 Correa Road • Honolulu, Hawaii 96822
Phone (808) 956-2936 • FAX (808) 956-2930 • Email: teb@phys.hawaii.edu
July 1, 2015

Dear Dr Mussa (Roberto),

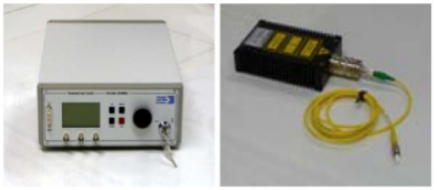
I am writing to request your help in the testing, calibration and final production of the readout system for the iTOP (imaging Time Of Propagation) system, which will be installed in the next year in the Belle II detector at the SuperKEKB accelerator in Tsukuba, Japan. This iTOP particle identification detector is a collaboration of Italy, the US, Japan and Slovenia. Initially, the greatest area of concern was the production of quartz optical modules. Thanks to a full mobilization of the collaboration including important contributions from technicians from Italy, this part of the project is now on-track and on-schedule.

As noted last week by the external BPAC review committee chaired by Prof. Tatsuya Nakada of EPFL Lausanne, the testing and integration of the readout system is now the central concern. Italy has made a major contribution by constructing a laser calibration system and will develop an electronics calibration module in the future. However, the testing of readout electronics is a major bottleneck. A test station with single photo-electron pulses and the full readout chain is available at our laboratory at the University of Hawaii at Manoa. However, the staffing of electronics experts needed to carry out the testing on the production readout electronics is marginal. I would like to request the assistance of your team from Torino to carry out this work. I believe that with your help on readout electronics we can remain on schedule and install the iTOP detector on time.

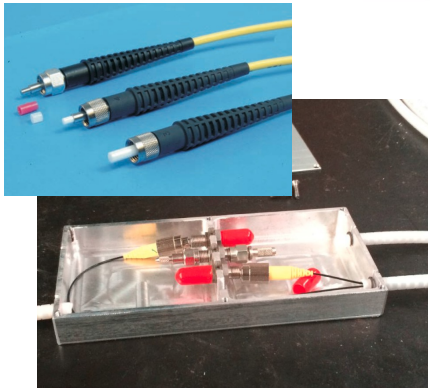
Best regards,

Thomas E. Browder
Professor of Physics
Belle II Spokesperson

TOP TimeCal: parts procurement

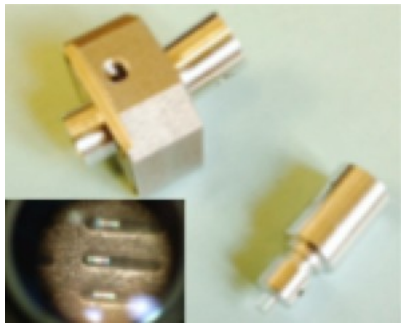


PiLas Laser 100% (1+1 spare)

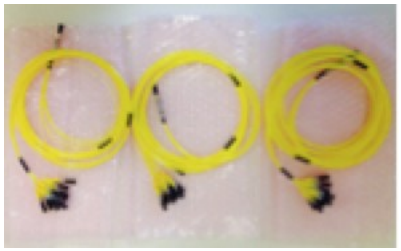


SM Fibers 75%
(100% ordered, delivery residual 25% Sept 2015)

SM+MM connectors 10%

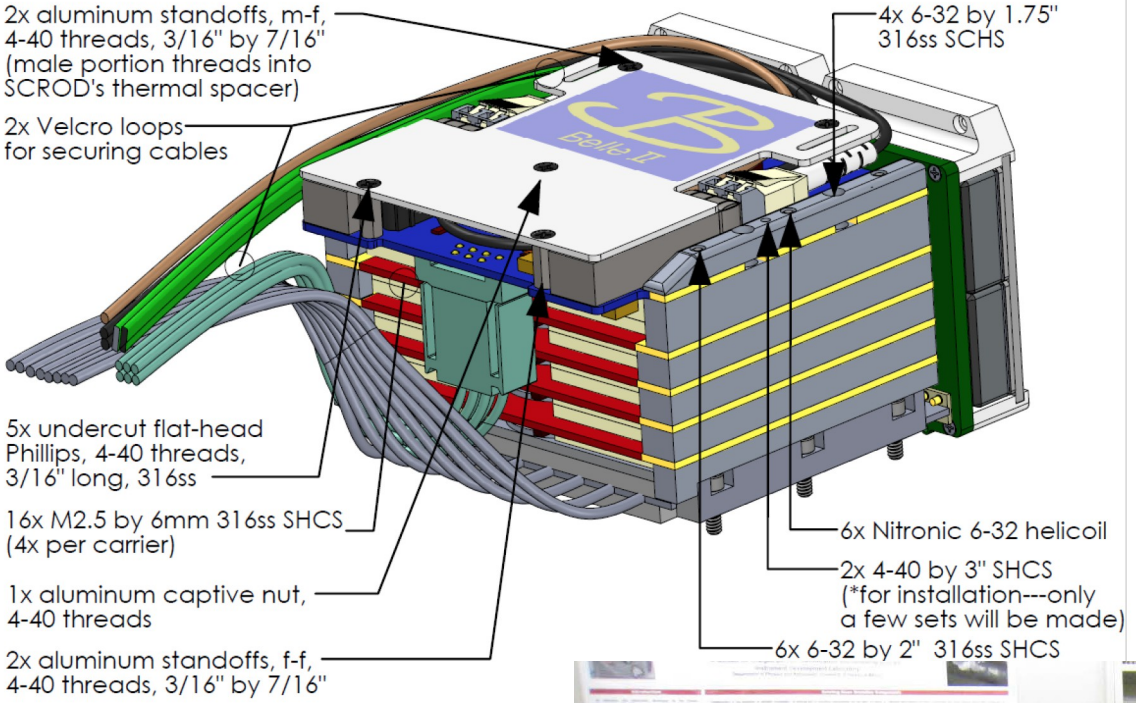


GRIN Lenses 100%
Cylinders + Blocks
(100% ordered, delivery residual 50% Sept 2015)



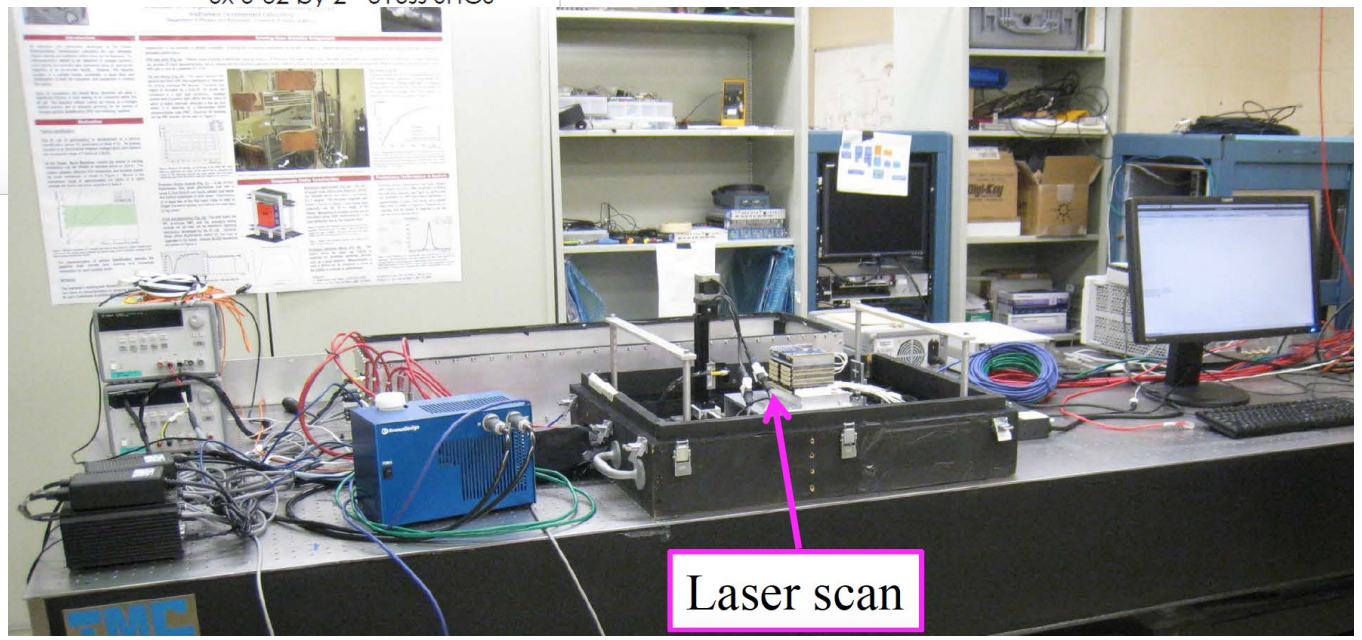
MM fiber bundles 50%
(100% ordered, delivery residual 50% Oct 2015)

Commissioning dei Board Stacks



F.Rotondo (tecnico elettronico) andra a UH Manoa a novembre per contribuire ai test di quality control dei board stacks e imparare a usare le FPGA

Nel 2016 , intendiamo portare in Italia un board stack in modo di poter riprodurre totalmente la catena di read-out della time calibration



Anagrafica PID

Torino

Fisici:
M.Greco 50%
S.Marcello 50%
R.Mussa 60%
U.Tamponi 100%
+1 AdR cofin Jennifer

FTE = 2.6

Tecnici:
O.Brunasso 3 mu
M.Mignone 2 mu
F.Rotondo (ex Panda)

Padova

Fisici:
A.Gaz 100%
S.Lacaprara 30%
M.Posocco 100%
P.Sartori 60%
R.Stroili 100%
E.Torassa 40%

Tecnologi:
M.Benettoni 20%
F.Dal Corso 20%

FTE = 4.7

Tecnici:
L.Ramina
M.Rebeschini

Richieste 2016 Torino (PID+COMP)

Capitolo	*Descrizione*	Parziali		Totale	
		Richiesta	SJ	Richieste	SJ
MISSIONI	1. Metab: 1 m.u/FTE + 1.5kE/FTE *5.1FTE	38.50			
	2. PID:2 TOP workshops x 1 pers x 2 kE	4.00			
	3. PID:Assemblaggio QBB a KEK	8.00			
	4. PID:Coordinamento TOP	5.00			
	5. PID:installazione+commissioning TOP-TC a KEK	10.00			
	6. COMP:Workshop computing (2 persone * 2 workshop)	6.00			
	7. COMP:Coordinamento Computing Italia, chair Computing Steering Group, Regional Coordinator for Europe (Bianchi)	10.00			
	8. PHT:B2TIP meeting	3.00		84.50	0.00
CONSUMO	1. Metab: 1.5kE/FTE *5.1FTE	7.50			
	2. PID:consumi lab.elettronica	2.00			
	3. PID:consumi lab.tecnologico	3.00		12.50	0.00
INVENTARIO	1. COMP:Spazio Disco 200 TB	50.00			
	2. COMP:CPU 6 KHEPSpec	80.00		130.00	0.00
APPARATI	1. PID:elettronica trigger piLas	4.00			
	2. PID:2 ALD-MCPPMT	12.00		16.00	0.00

TO richiede, nello specifico:
4kE per l'elettronica di Trigger per il PiLas da installare nell'E-hut
12 kE per altri due MCPPMT da tenere in Italia per tests sulla catena completa.

Richieste 2016 Padova

Capitolo	*Descrizione*	Parziali		Totale	
		Richiesta	SJ	Richieste	SJ
MISSIONI	1. Metab: 1 m.u/FTE + 1.5kE/FTE *4.8FTE	36.00			
	2. PID:Assemblaggio QBB e Installazione TOP a KEK	12.00			
	3. PID:commissioning TOP e test CDC-TOP a KEK	12.00			
	4. PID:2 TOP workshops x 3 pers x 2 kE	12.00			
	5. COMP:Workshop computing (2 persone * 2 workshop)	6.00			
	6. PHT:B2TIP meeting	6.00		84.00	0.00
CONSUMO	1. Metab: 1.5kE/FTE *4.8FTE	7.00			
	2. PID:consumi lab.elettronica	2.00			
	3. PID:consumi meccanica	1.00		10.00	0.00
TRASPORTI	1. PID:Spedizione sistema di controllo laser	1.00		1.00	0.00
APPARATI	1. PID:1 PMT e 2 ASIC per controllo stabilità laser	4.00		4.00	0.00

PD propone di sviluppare il sistema di monitoraggio della stabilita' del laser da installarsi nella E-hut

ASICs+PMT: 5 kE

A	B	C	D	E	F	G	H	I	J	K
SUBSYSTEM	ITEM	Sede	CAT	TOT COST	2013	2014	2015	2016	2017	2018
PID	Laser(s)		ATTR	78	28	0	25	0	25	
PID	Componenti ottici + fibre		CORE	82	12	28	25	12	5	
PID	Fotosensori di riferimento		ATTR	24	0	12	0	12		
PID	Meccanica/elettronica di supporto		CORE	78.5	2	26.5	30	10	5	5
PID	**subTotale Calibration system**			262.5	42	66.5	80	34	35	5
PID	Power supplies		CORE	50	0	0	0	25	25	0
PID	Missioni testbeam+cosmici		MISS	32	9	13	5	5		
PID	Missioni commissioning e run		MISS	117	8	27	30	20	20	12
PID	Missioni coordinamento		MISS	30	5	5	5	5	5	5
PID	**Totale PID**			**491.5**	**64**	**111.5**	**120**	**89**	**85**	**22**

SUBSYSTEM	ITEM	Sede	CAT	TOT COST	2013	2014	2015	2016	2017	2018
PID	Laser(s)		ATTR	87	28	0	25	9	25	
PID	Componenti ottici + fibre		CORE	70	12	28	25	0	5	
PID	Fotosensori di riferimento		ATTR	24	0	12	0	12		
PID	Meccanica/elettronica di supporto		CORE	72.5	2	20	18	22.5	5	5
PID	**subTotale Calibration system**			253.5	42	60	68	43.5	35	5
PID	Power supplies		CORE	50	0	0	0	0	25	25
PID	Missioni testbeam+cosmici		MISS	32	9	13	5	5		
PID	Missioni commissioning e run		MISS	117	8	27	30	20	20	12
PID	Missioni coordinamento		MISS	30	5	5	5	5	5	5
PID	**Totale PID**			**482.5**	**64**	**105**	**108**	**73.5**	**85**	**47**

Backup