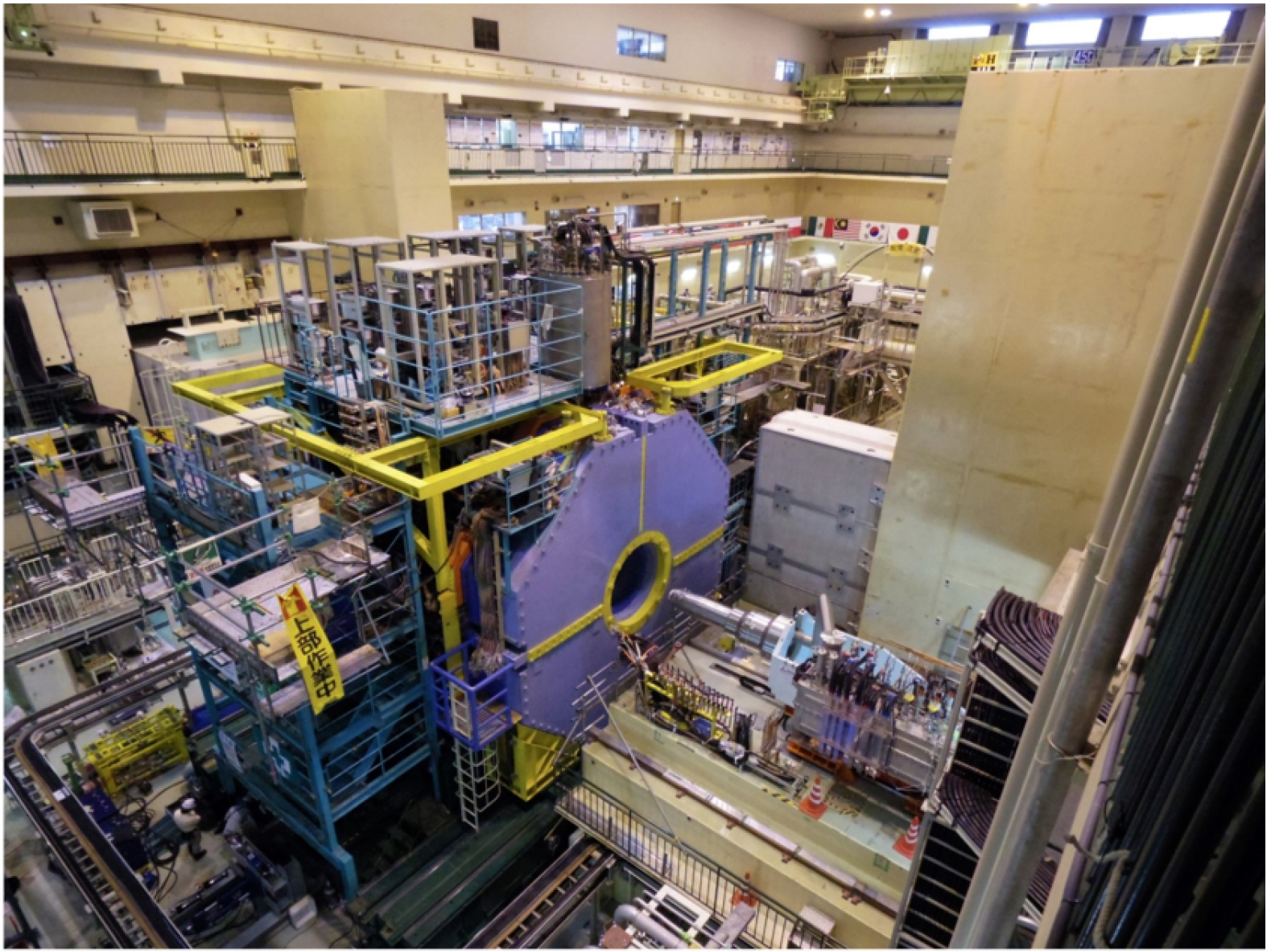
Richieste servizi di base per Belle-II

Bianchi (50%)
Bussa (50%)
Destefanis (50%)
Greco (50%)
Guido (100%)
Maggiora (40%)
Marcello (50%)
Mussa (50%)
Spataro (50%)
Tamponi (100%)

Roberto Mussa

Consiglio di Sezione 30/6/17

Belle II Roll-in



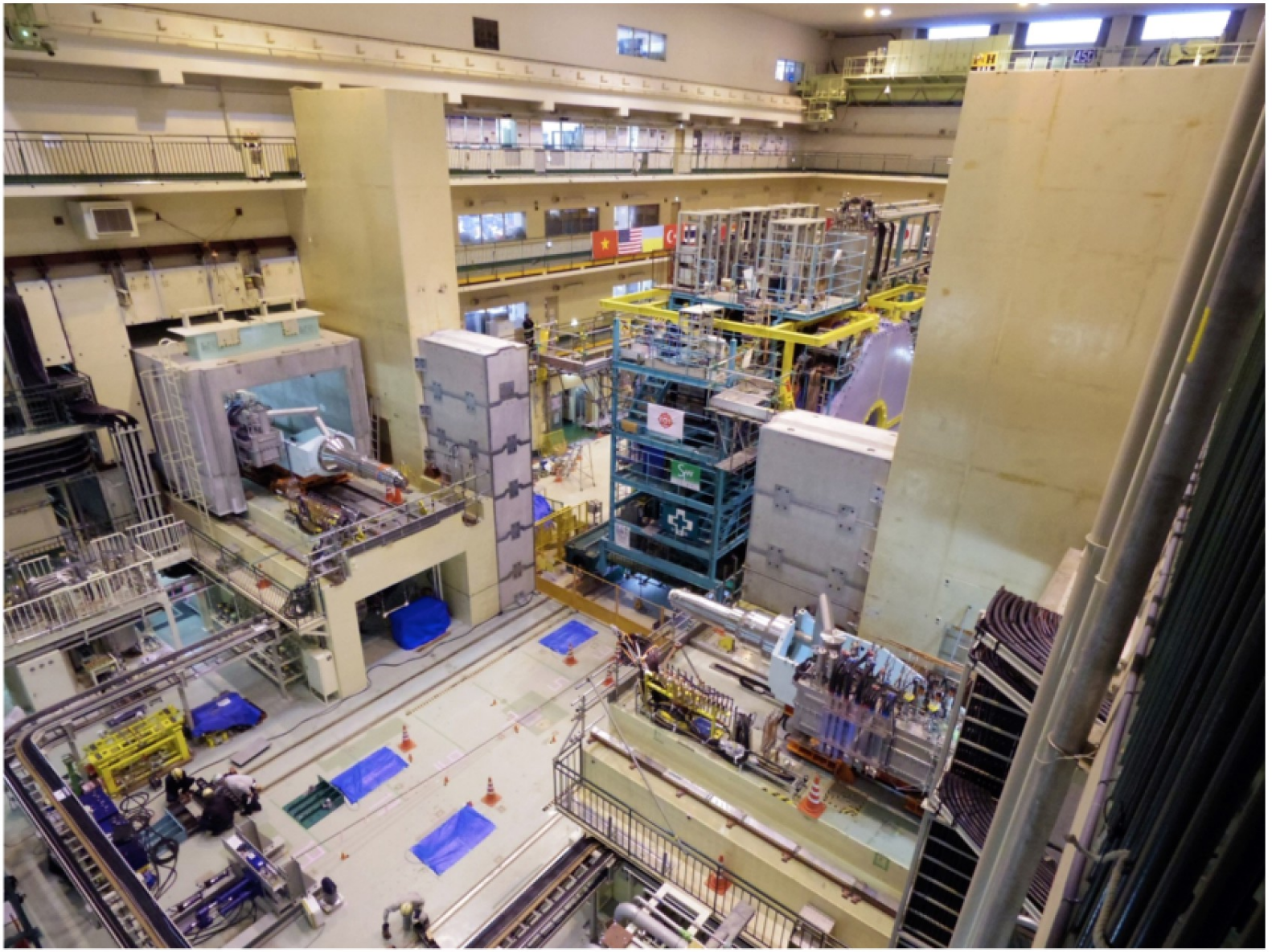
Belle II rolled-in to the beam line on April 11th, 2017

One of the most significant milestones in the construction phase

Live broadcasted by a video sharing website

KEK × niconico

Belle II Roll-in

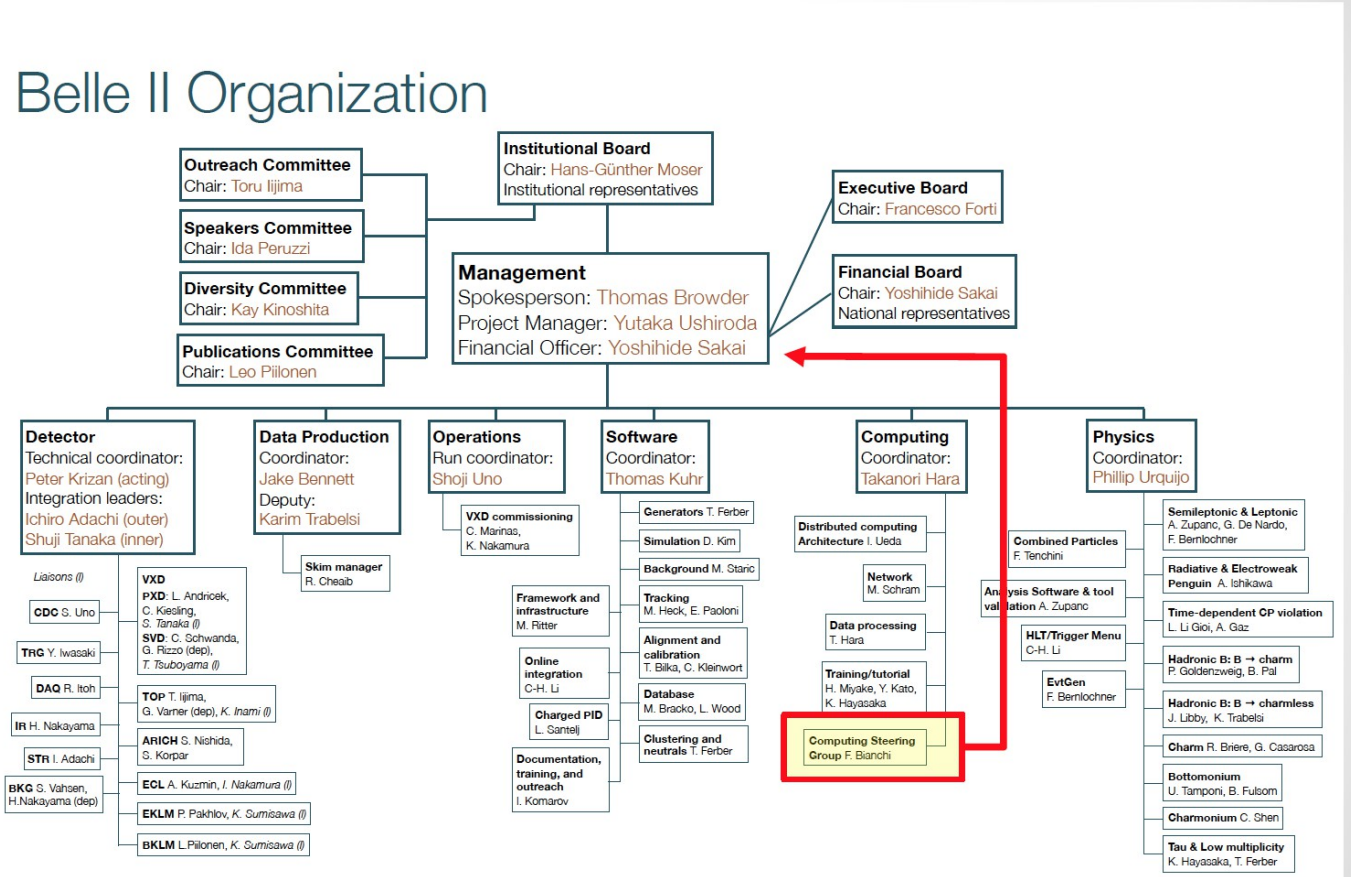


Belle II rolled-in to the beam line on April 11th, 2017
One of the most significant milestones in the construction phase
Live broadcasted by a video sharing website

KEK × niconico

Computing: good news da Fabrizio

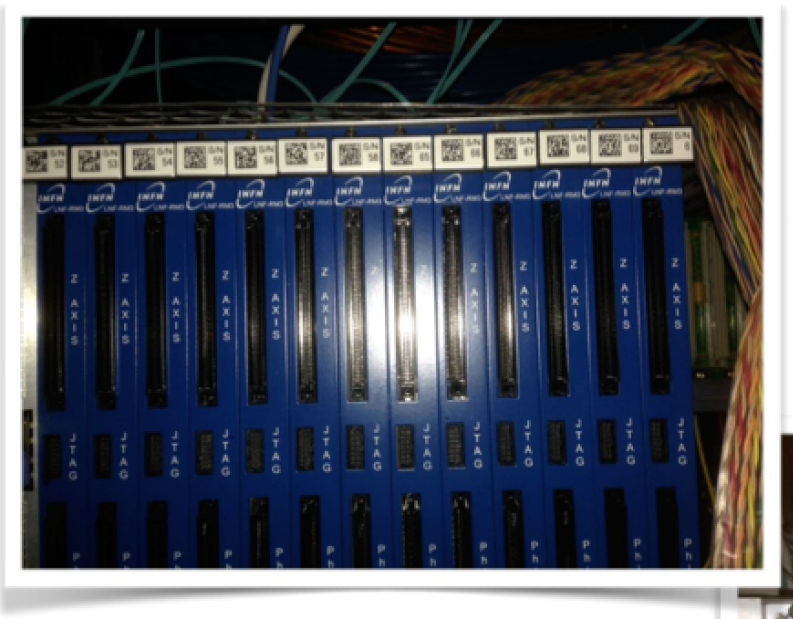
- The Computing Steering Group is central for the deployment of distributed computing resources.
- Considered more appropriate to report directly to the management
- Close interaction with computing management



Finalmente stiamo convergendo sul MoU KEK/INFN

Tracciatore esterno : nuove responsabilita' italiane

BKLM: RPC Readout (INFN Roma3 and LNF (Frascati))



Sector BF3

6 days to install, cable & commission 4 crates

... e lavoro per Oscar .... (Luglio 2017)

- ✓ 13 Indiana pre-production boards in BF2 operating since October 2016
- ✓ 13 INFN pre-production boards in BF6 operating since February 2017
- ✓ **52 INFN production boards in BF1, BF3, BF4, BF7 since June 2017**
- ✓ **70 boards delivered to INFN on June 21, plus 98 boards on June 28 ➡ completion**

Calorimetro: so far , so good

ECL Status and Highlights

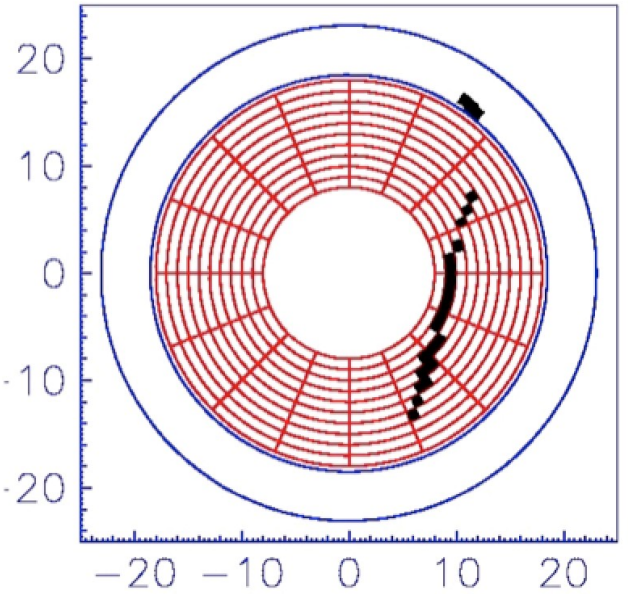
- Barrel and backward ECL endcap are connected and provide data.
- ECL works in the Global Cosmic Run

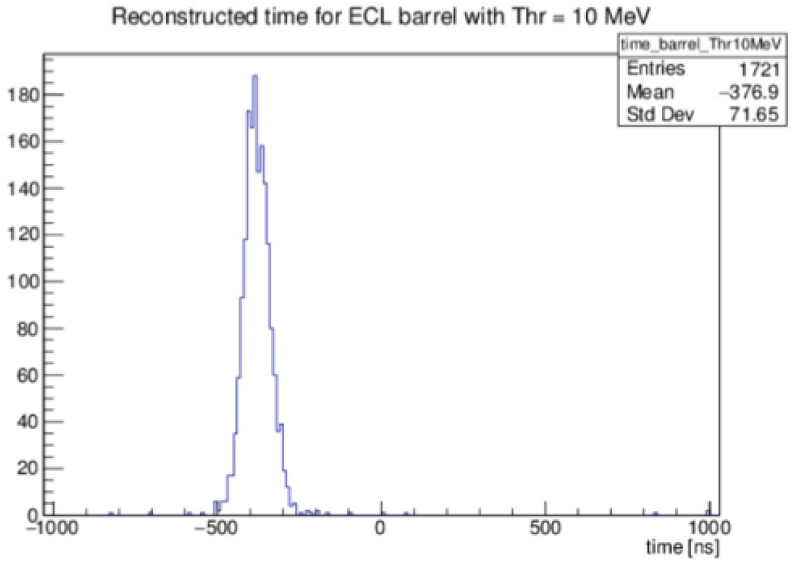
Current tasks/issues:

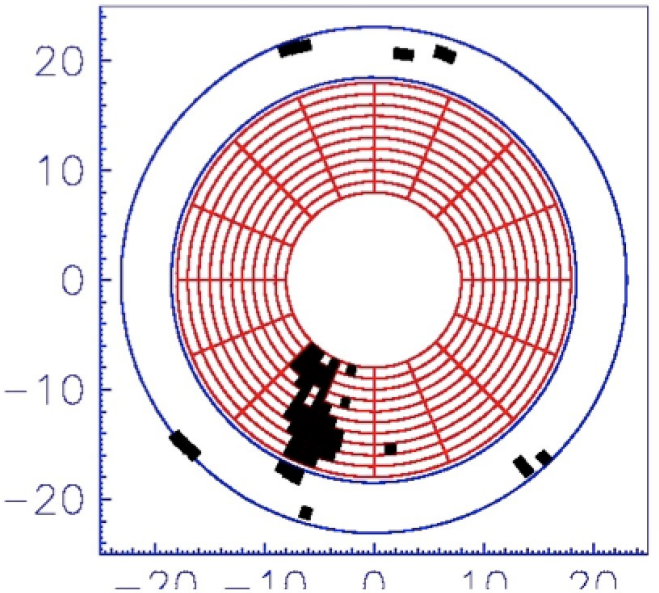
- **Modify firmware to increase time adjustment window.**

(Currently in the global run we have shifted time)

- **Implement test pulse calibrations in global mode**



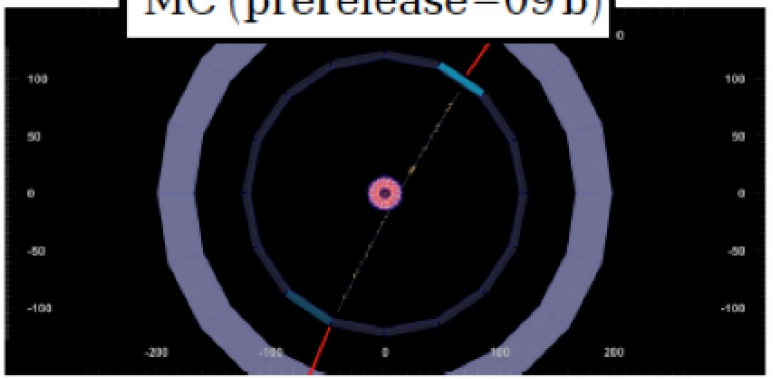


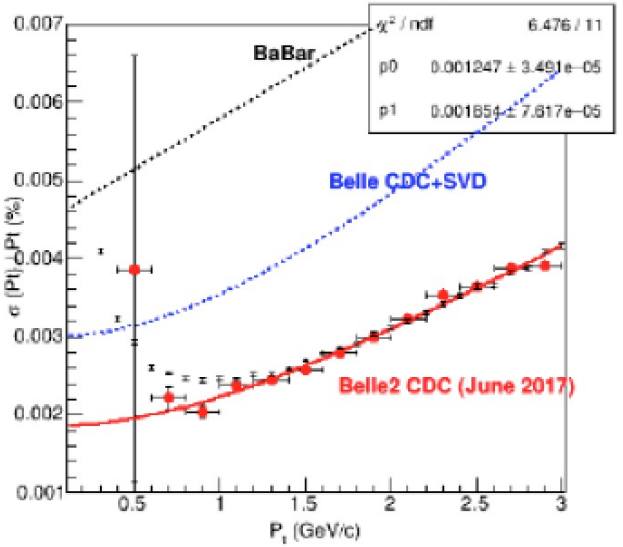


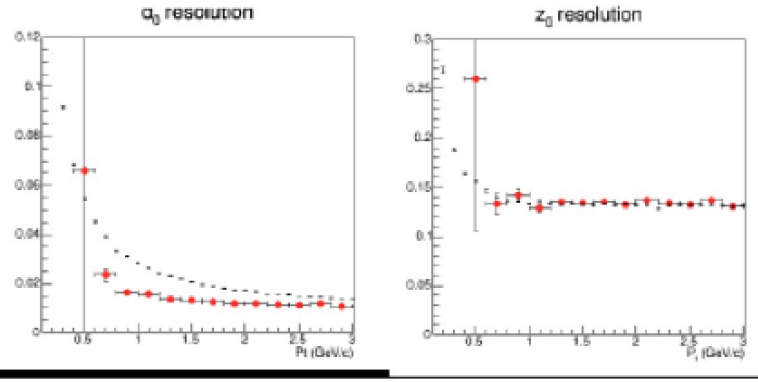
Central Drift Chamber: allineamenti in corso ...

CDC performances with magnetic field

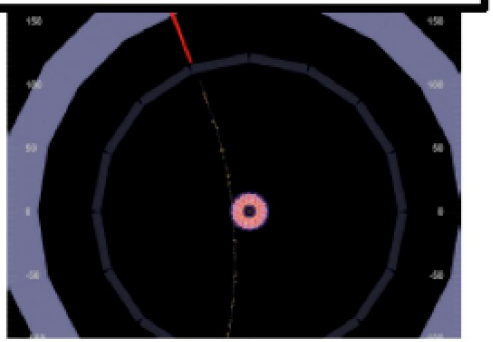
MC (prerelease−09b)



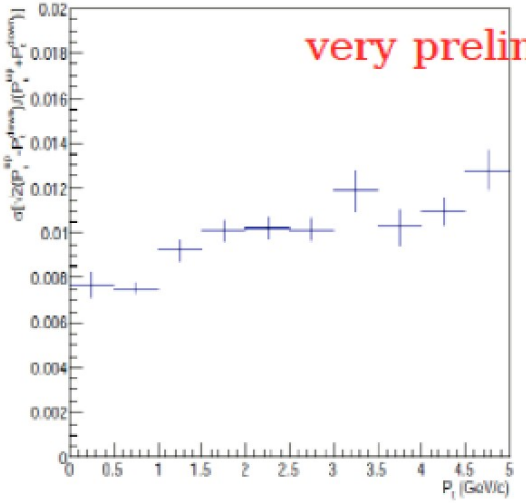


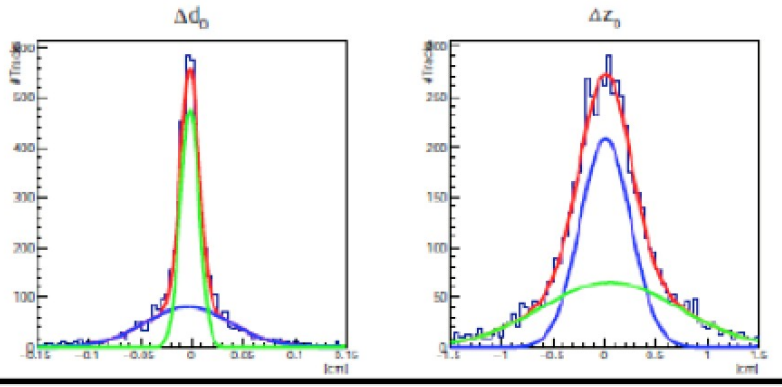


GCR data, June 2017



Pt Resolution





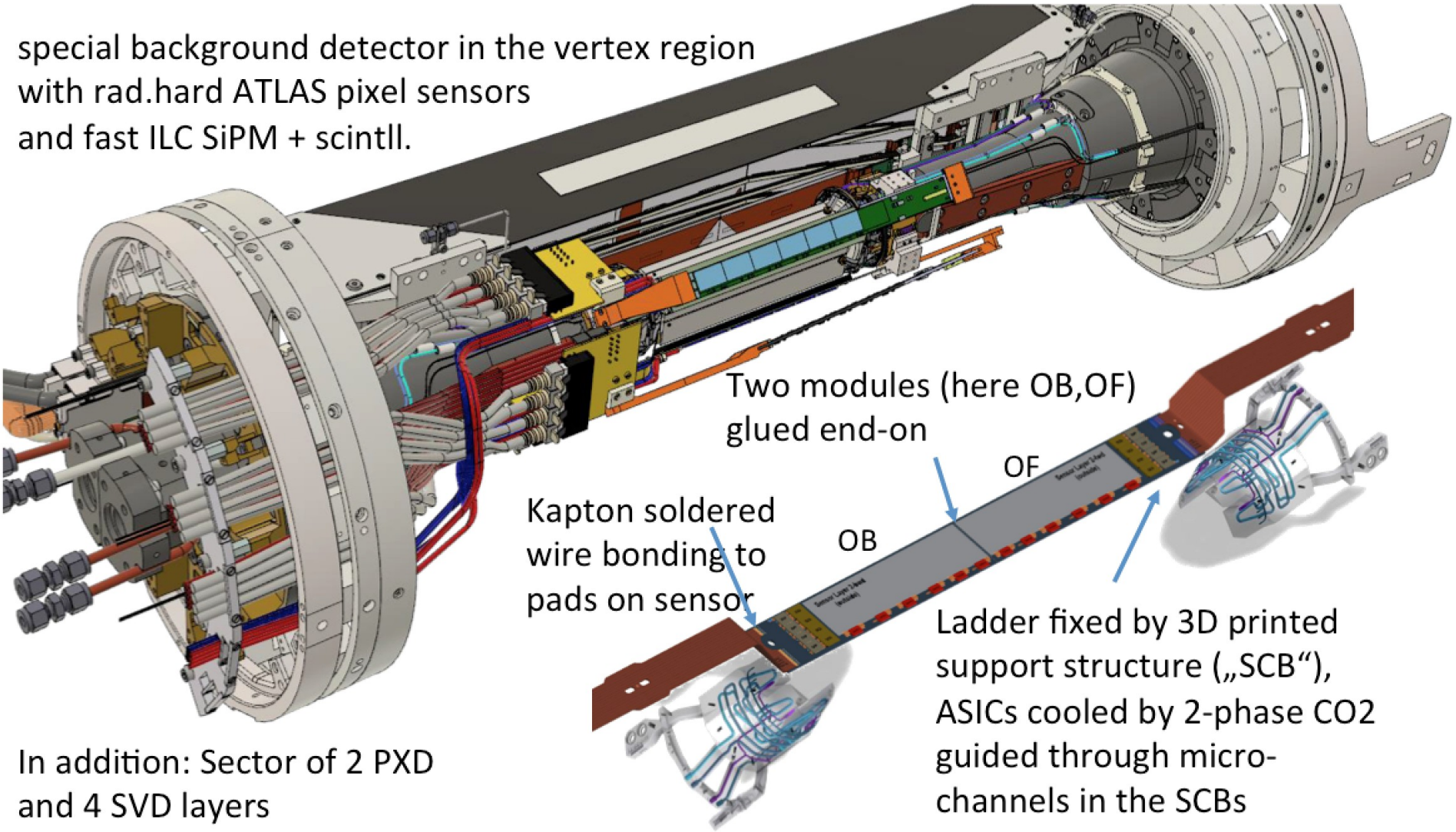
Per non bruciare tutto subito, durante Phase II ...

Phase 2 Detector: Inner BEAST

First nano-beam collisions during Phase 2

special background detector in the vertex region
with rad.hard ATLAS pixel sensors
and fast ILC SiPM + scintll.

Vertex detector mounted
on the beam pipe



In addition: Sector of 2 PXD
and 4 SVD layers

SVD: sara' installato dopo Phase 2

SVD ladder mount – milestones

Item	Date
Ladder mount 1st half shell start	Jul 31, 2017
L3 mount	Jul/Aug 2017
L4 mount	Aug/Sep 2017
L5 mount	Sep/Oct 2017
L6 mount	Oct/Nov 2017
Completion 1st half shell (including pick up)	Dec 4, 2017
Ladder mount 2nd half shell start	Dec 14, 2017
Completion 2nd half shell (including pick up)	Apr 20, 2018

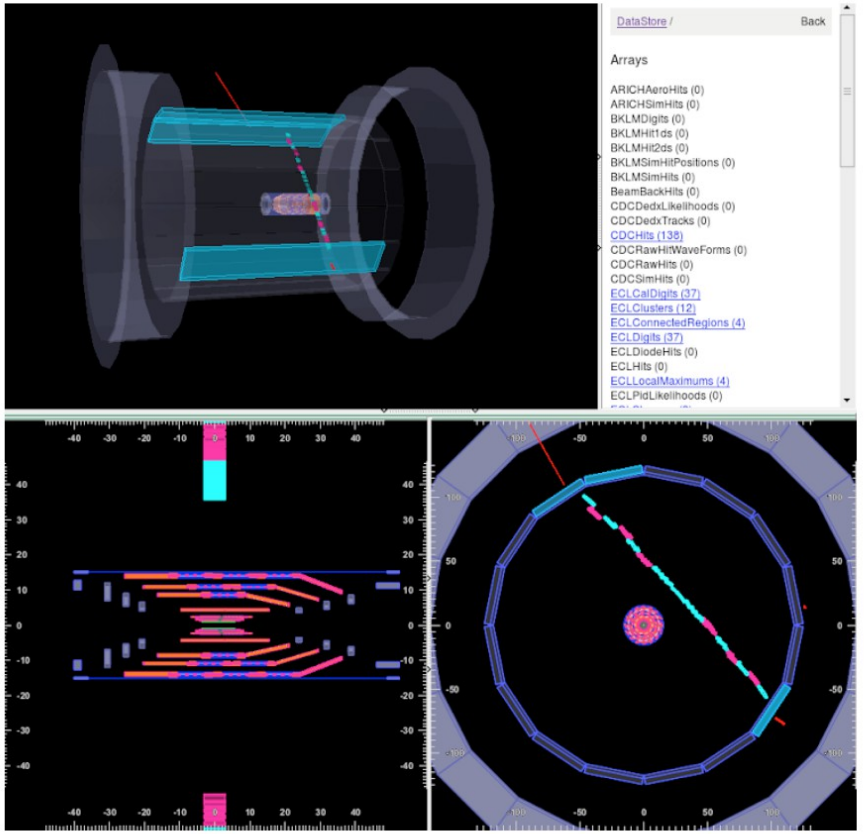
TOP : near term plans

- The near term goal is to obtain some plots/ distributions w/ calibrated data in the Gloal CRT data-taking (July – August)
  - **(x, t) distribution (hit display)**
  - **N_hit vs incident position and angles**
- Near term milestones to achieve this goal
  - **Stable DAQ w/ current FW**
    - Need pinning down the b2llost issue
  - **Calibration**
    - Time Base Calibration
    - Local T0
    - Alignment
    - PMT gain
    - Bad channel masking
  - **Trigger**
    - Produce individual t0
    - Produce combined t0

Also, (event-by-event) probability distribution w/ CRT data

Sam Cunliffe, Jan Strube

Eager to see more quantitative information !

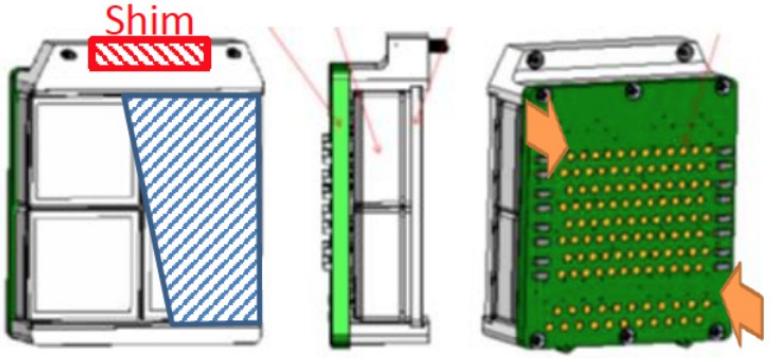


TOP : il problema dei PMT magnetici

- The PMT tube is made of Kovar and suffers ~1 kgf/PMT in 1.5 T (maximum ~1.4 kgf/PMT in ~1.1 T).

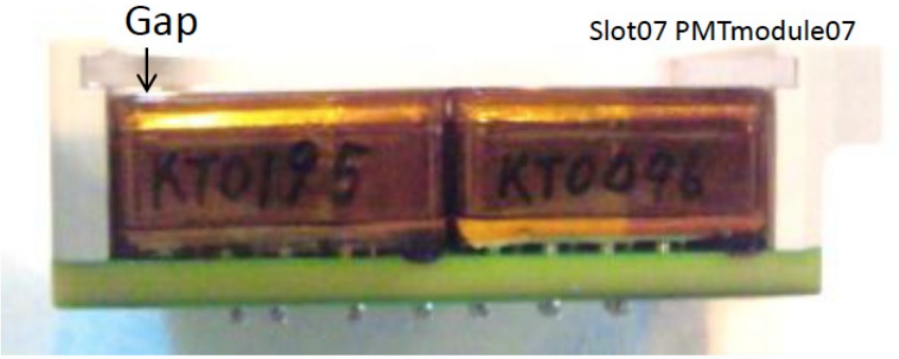
Rotation of PMT module

- Large effect on photon transmittance due to bubbles of the optical oil on the Si cookie
- Has been fixed in situ by shimming



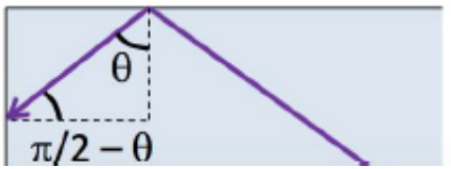
Rotation of PMT

- Effect only for photons of larger incident angles than ~43° if the peel-off surface is clear.
- Wil be fixed if necessary after phase 2



- Two potential problems
  - Optical loss of photons
  - Mechanical safety on PMT structure

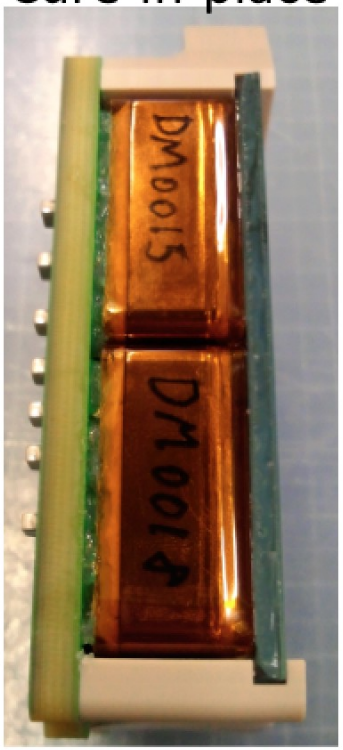
Probably not an issue.
Need check with phase 2 data



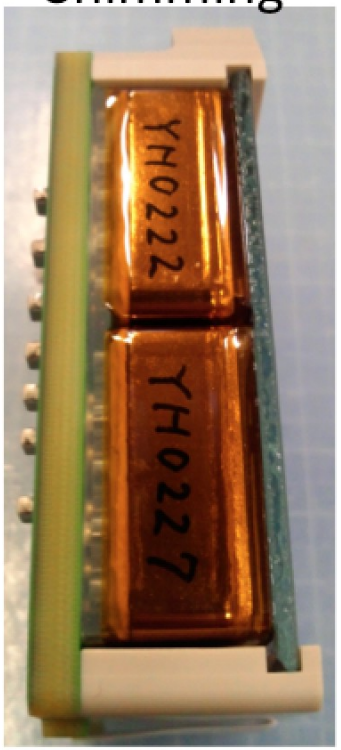
TOP : il problema dei PMT magnetici /2

Item to be checked	Status
Effect on PID performance	✓ Checked with MC that it is modest. ☐ To be checked with the Phase2 data.
Mechanical safety of PMT	✓ Tested. There should be no problem.
Repair method	✓ Tested two methods. ☐ Baseline method will be decided in this B2GM.

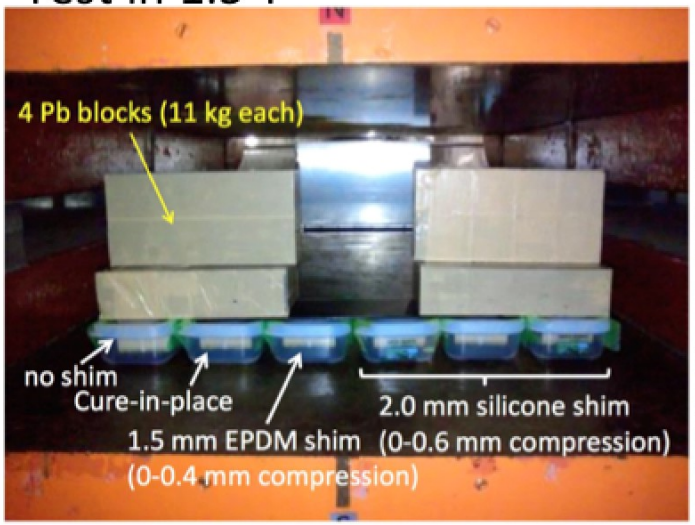
Cure-in-place



Shimming



Test in 1.5 T



Test with weight

- Tested in 1.5 T for 3 months
  - Actual integrated exposure time > 8 days
- Tested with 2kgf weight for 74 days

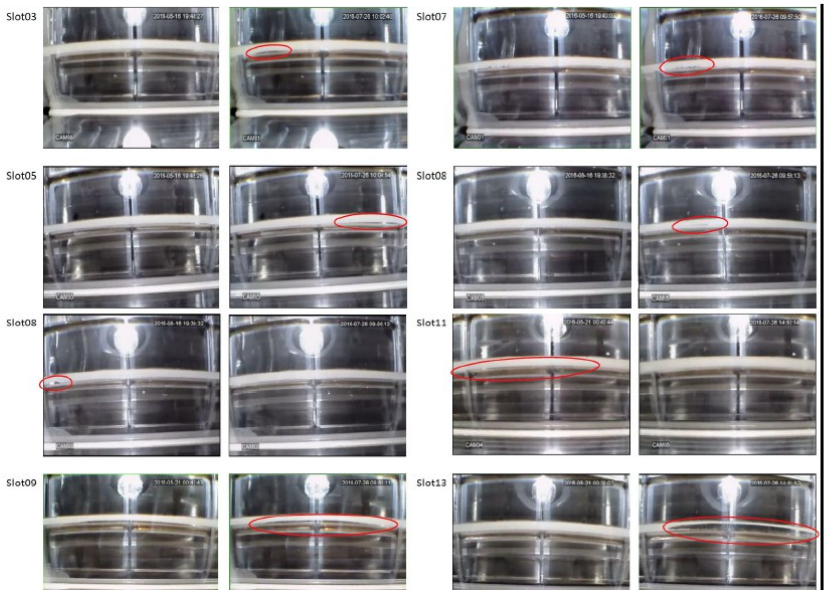
TOP : nuovi problemi meccanici

- After roll-in (April 20), glue joint between the prism and PEEK frame found to be partially broken for some slots.
  - Similar delamination was observed in slot 11 in October 2016, but it was due to the PMT module assembled too high that pushed the PEEK frame away from the prism.
- Matsuoka-san carefully investigated all the pictures taken after installation.
- Two concerns:
  - Mechanical health for quartz optics
  - Contamination of optical oil leaking to the prism surface.
    - Affect photons at the last bounce.

Delamination visible in CCD photos

	Shooting date	B-field (T)	Slot 01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
2016	5/16 (after installation)	0																
	7/26 (after B-field meas.)	0																
	7/26 (after 1st repair)	1.5																
	9/13 (after 2nd repair)	0																
	9/16	0/1/1.5																
	9/19 (start of 1 week B test)	0/1/1.5																
	9/26,27 (after 1 week B test)	1.5/0																
	9/27,28,29,30,10/1,2,3	1.5																
	10/3 (slot11 glue broken)	0																
	10/4,10	0																
2017	4/20 (after roll-in)	0																
	5/24,26	0/1.5																

Black: Large delamination can be seen (compared to the photo taken on 5/16)
Red: Small delamination can be seen (compared to the photo taken on 5/16)
Orange: Small delamination can be seen (compared to the photo taken on 7/26)



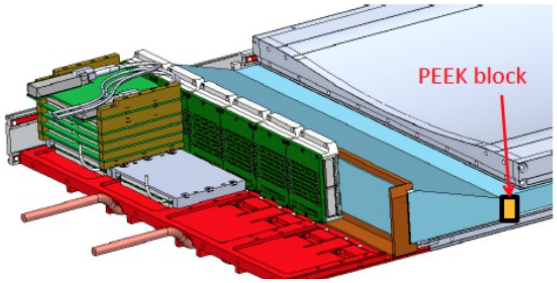
TOP : nuovi problemi meccanici/2

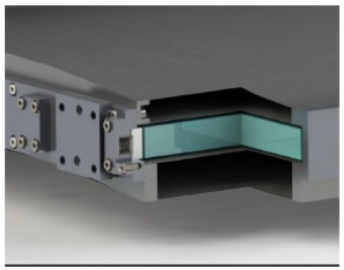
- Mechanical concern is not serious one.
  - Even if the PEEK – prism glue joint is completely broken, the mechanical force from the PMT module is received by PEEK block at the prism corner and the springs on the mirror end.
- Optical concern need more carefully checked.
  - Start to check the flow of optical oil on the glass
  - If surface is not clean, oil flow happens a bit.
  - Continue checking for long term
  - Check N2 gas leak when PMT modules are removed, and seal by silicon glue if leak is found.

On mechanical concern

8

- Force by PMT modules; 2kgf x 32 = 64kgf in design
  - Should be smaller now because of shimming
- The force received by PEEK frame, PEEK block at the corner of prism and springs on the mirror end.
  - Long-term allowable pressure at the corner on PEEK block; 6.9MPa x 20x(4~5)mm^2 = 56~70kgf.
  - Force by forward spring; 12.5~14.2kgf
- Tolerable even completely removed PEEK frame

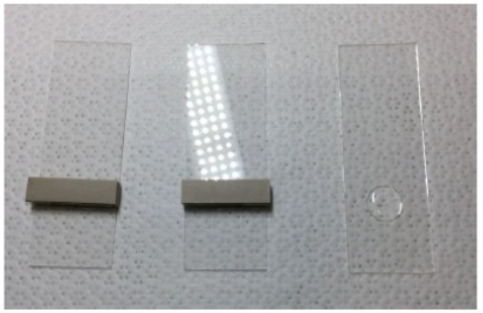




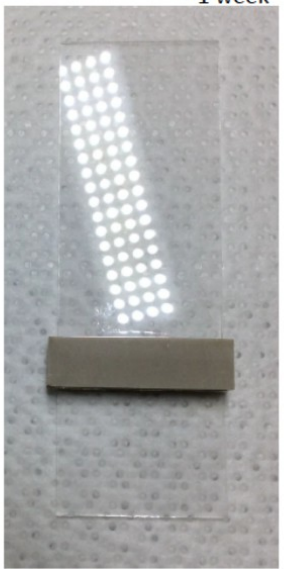
On optics

- Contamination by optical oil due to surface pressure
- Started to check the flow of optical oil on the glass
- If surface is not clean, oil flow happens a bit.
- Continue to check for long term

- Check N2 gas leak when PMTs are removed.
  - Seal by silicone glue if leak is found.



~1 week



TOP : sostituzione di 7/16 dei MCPPMT

Test plan (draft)

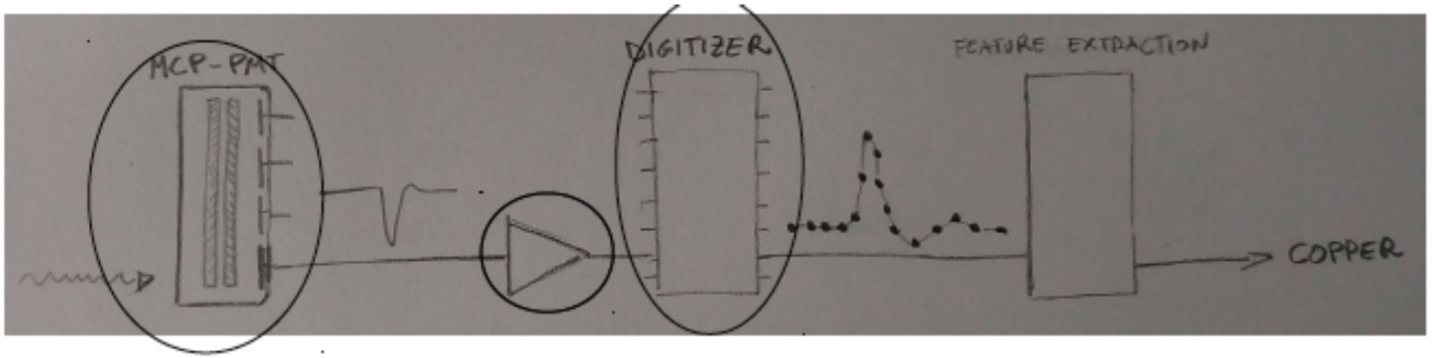
Year	2017				2018				2019				2020		
Month	1	4	7	10	1	4	7	10	1	4	7	10	1	4	7
Global schedule					Phase 2				Physics run			Physics run			
PMT production	Current production														
			Another small production												
							Mass production if necessary								
New PMTs (prospect)	28	26		5 /month			10 PMTs/month								
PMT test at Nagoya		10 /month		5 /month			10 PMTs/month								
PMT test at KEK							~100 PMTs				~100 PMTs				
PMT installation													Assy		Install
Available PMTs	37	63	Unclear (depends on budget situation)												

Maximum rate:

- QE measurement: 2 PMTs/day = 40 PMTs/month
- HV test: 8 PMTs/day = 160 PMTs/month
- Laser test in 0 T: 5 PMTs/day = 100 PMTs/month

TOP : calibrazione temporale (resp: U.Tamponi)

What we have to calibrate



Photon detection
→ PMT Transient time

Fast amplifier
→ Transient time

Digitization of the waveform
→ sampling bin size

$$T_{photon} = t_{digit} + T^0_{channel} + T^0_{module}$$

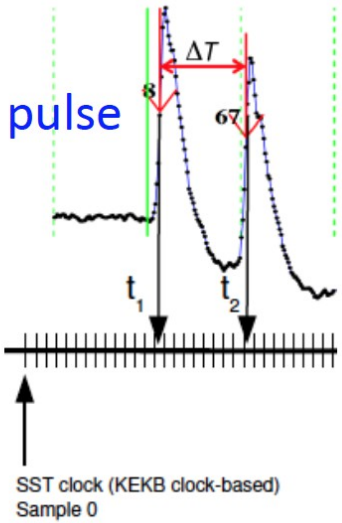
+ PMT channel gain

Time base calibration (TBC)
Calibration of the bin size of the digitizer

Local T0
Synchronization of the channels within a single quartz bar

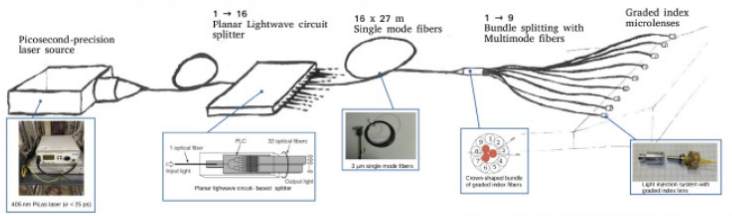
Module T0
Synchronization of the modules one with the others

Double cal pulse



Laser pulse calibration

To synchronize the channels within a single module we flash them with a laser pulse



Alignment

$$\chi^2 \equiv -2\sum^{n} \log \mathcal{L}_{\mu}^{(i)}(\hat{p}) = \min,$$

$$\hat{p} \equiv (\Delta x, \Delta y, \Delta z, \alpha, \beta, \gamma, t_0)$$

TOP : calibrazione temporale (resp: U.Tamponi)

Calibration steps

Time base calibration (TBC)
What is it? Calibration of the sampling rate of each asic.
How many? 256 constants / channel (131072 / module)
Run type? Local pulser runs , O(500k evts / channel)
How frequently? Phase II: ~ 1 per day. PhaseIII: TBD

Local T0
What is it? Inter-calibration of the delays of the channels within a single module
How many? 1 constant / channel (512/module)
Run type? Local lasers run, O(1 hr)
How frequently? Phase II: ~ 1 per day. PhaseIII: TBD

Alignment
What is it? Geometrical and time alignment of the 16 modules
How many? 7 constants / module (3 shifts + 3 angles + 1 time offset)
Run type? Muons, O(10 k evt/module)
How frequently? PhaseII: 1 per run . PhaseIII: 1 per run

Two methods
- Matrix inversion
- Iterative

Xialong Wang

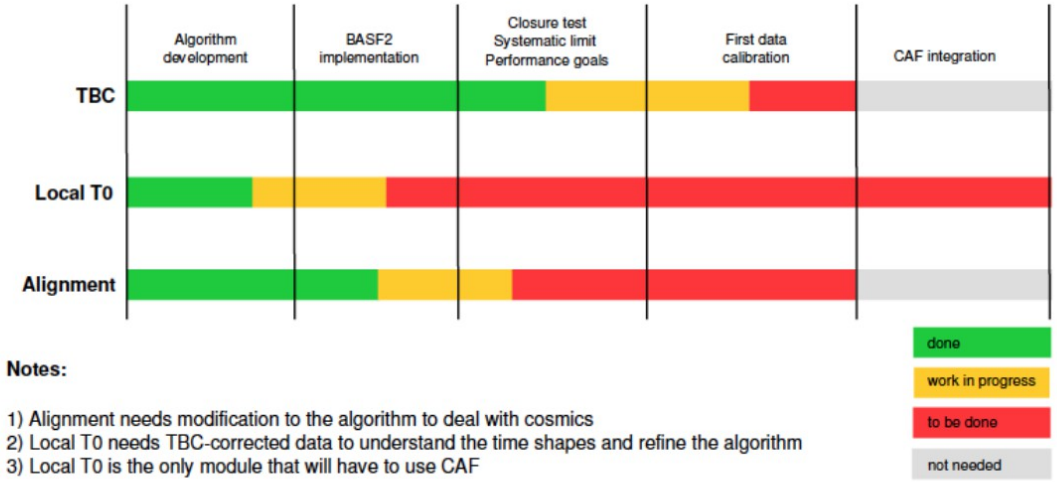
Wenlong Yuan

Studies at Padova to understand distribution of the laser signals

Alessandro Gaz

On top of this we have the **PMT gain**, **threshold efficiency** and **channel masking** monitoring, that go in the condition DB

Readiness and roadmap



Notes:

1) Alignment needs modification to the algorithm to deal with cosmics
2) Local T0 needs TBC-corrected data to understand the time shapes and refine the algorithm
3) Local T0 is the only module that will have to use CAF

The calibration software is evolving steadily.

Issues in Epic

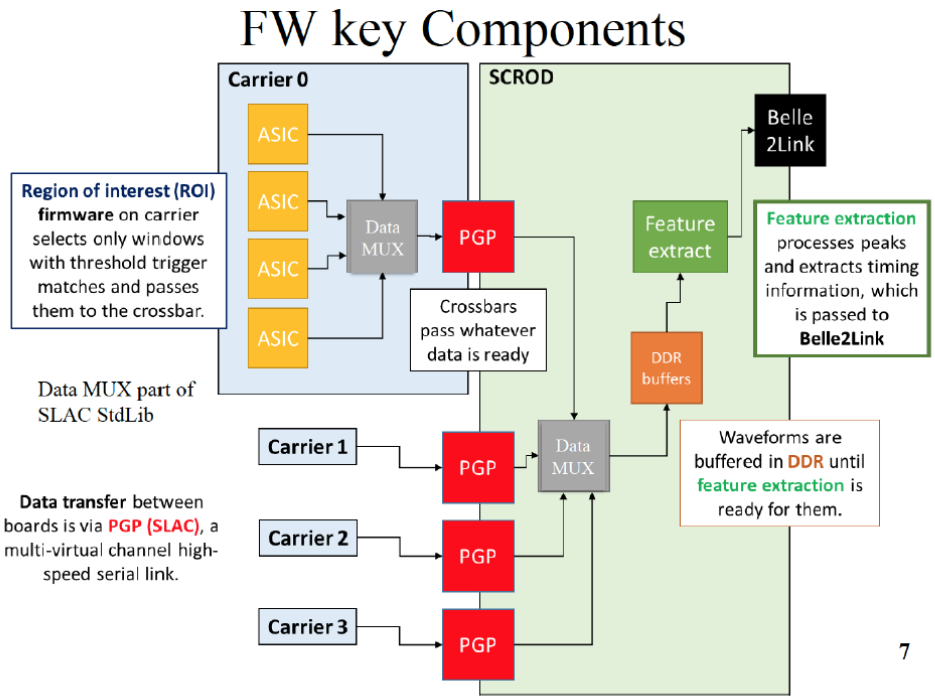
BII-2018	Matrix inversion-based time base correction	DONE	Marko Staric
BII-2019	Iterative based time base correction	DONE	Xiaolong Wang
BII-2020	TOP T0 correction	IN PROGRESS	Stefano Lacaprara
BII-2021	PMT gain monitoring tool	IN PROGRESS	Yosuke Maeda
BII-2022	TOP Calibration monitoring tools	IN PROGRESS	Elisa Guido
BII-2023	TOP Channel masking	DONE	Samuel Thomas Cunliffe
BII-2024	TOP Alignment module	IN PROGRESS	Alessandro Gaz
BII-2026	TOP inter-module time alignment without B field	WON'T FIX	Umberto Tamponi
BII-2045	Realistic digitizer module	IN PROGRESS	Marko Staric
BII-2046	Simulation of the laser events with double calpulse	OPEN	Marko Staric
BII-2061	Missing DB classes for TOP calibration constants	DONE	Umberto Tamponi
BII-2351	TOP Calibration benchmark tools	OPEN	Umberto Tamponi

Also, slow control, DQM

Saurabh Sandyila, Boqun Wang

But ..... la saga del firmware non e' conclusa

- Significant progress in firmware development resulted in producing a “stable” version that allows TOP joining the Global DAQ.
- The current stable version: 30-31/3D-06 is based on pre-roll-in version “2E-30-kurtis/30-05-kurtis” with selected updates;
  - Super-short headers for empty channels
  - Bugfixes, etc



1.2MB/event

2	Type (=0x00-0x03)	Version (=0x01)		0xAAAA
3	numWin_trigPat		SCROD ID	ConvertedAddr
4	Carrier	IRSX	0000?	LastWriteAddress	slow data
5	samp_fine				samp_i
6	SamplePeak				vPeak
7	SampleRise				vRise0
8	vRise1				SampleFall
9	vFall0				vFall1
10	Integral				QualityFlags
11	n_samp_fine				n_samp_i
12	SamplePeakNeg				vPeakNeg
13	SampleRiseNeg				vRise0Neg
14	vRise1Neg				SampleFallNeg
15	vFall0Neg				vFall1Neg
16	IntegralNeg				QualityFlagsNeg

50kB/event

2	Type (=0xBE)	8 LSB of carrier event #	0	SCROD ID	0	carr	asic	chan

Some limitations:

- Trigger rate < 750Hz max.
- Only the 1st peak found per channel
- All waveforms are still passed from carrier to SCROD
- All channels report data to Belle2Link

- TOP firmware boot camp (June 26-30)

➔ Goal is to expand group of people functional at different levels
- Read/basic understanding of code and how it works
- Simulate/verify existing/new functionality
- Debug problems encountered in the future
- Develop new code for improved performance, new functionality

- Current firmware
  - *Goal: support global CDT data-taking.*
  - Tracking down b2llost issue – trying to determine correlation between error occurring and things happening elsewhere in the DAQ system.
- Production firmware:
  - *Goal: allow variable number of windows to support multiple hits per channel and higher data rates.*
  - Integration of carrier and SCROD components
    - Implement new carrier/SCROD data format
    - Add pedestal calculation, subtraction, and feature extraction into new SCROD processor code.
    - Define and implement new B2L data format
    - Update parser for new format
  - Evaluation

FE by template fitting
by Tobias Weber

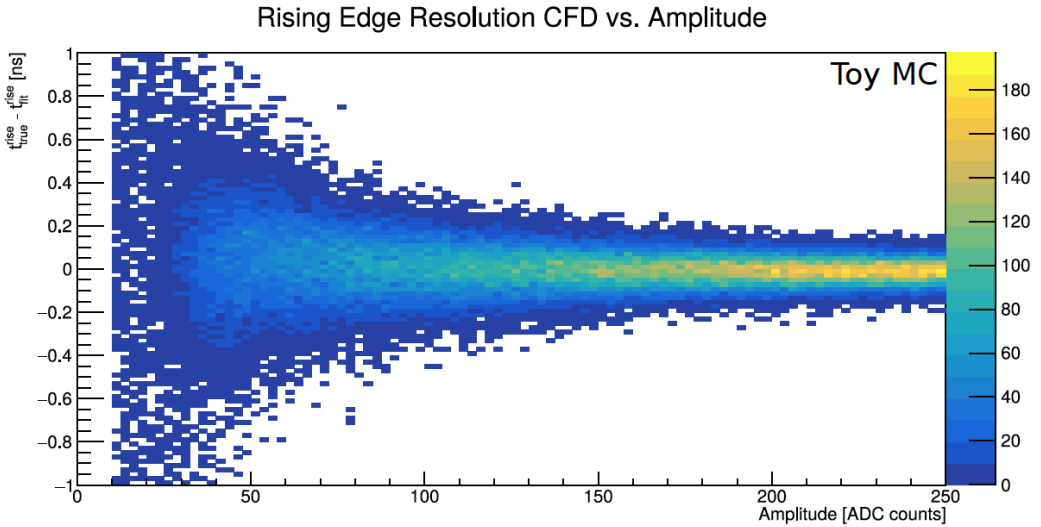
Tamponi e Pacher da Torino

TOP : template fitter

Tipicamente il tempo di arrivo viene misurato con il metodo del Constant Fraction Discriminator (CFD) la cui risoluzione peggiora a basse ampiezze.

Possiamo migliorarla usando non solo i bin adiacenti al 50% del picco, con pesi calibrati alla vera forma del segnale di singolo fotone.

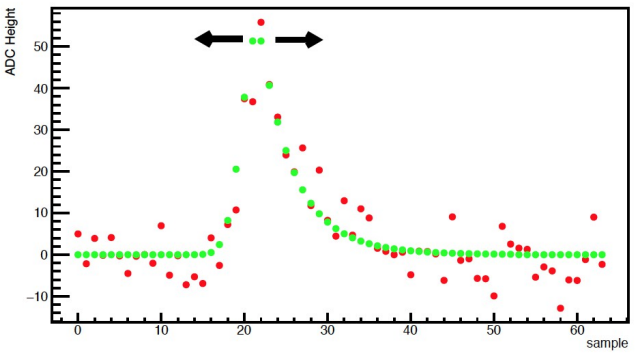
Era responsabilita' di T.Webber (Hawaii) che pero' finisce il suo postdoc. Durante il bootcamp, UT ha preso l'impegno di sviluppare il TF da caricare sul FPGA.

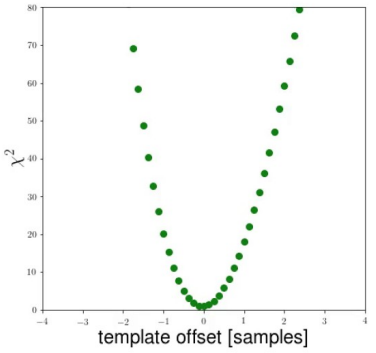


- waveform of typical signal event known
  $\Rightarrow$ create signal template t(n)
- slide template over measured event and minimize

$$\chi^2 = \sum_{n=0}^{N} [s(n) - a \cdot t(n+j) + b]^2$$

to extract timing offset *j*, amplitude scaling *a* and offset b.





Richieste ai Servizi

Goal : bench test del Front End con la DAQ dell'esperimento su un Boardstack assemblato da F.Rotondo a Manoa

Umberto+Luca porteranno a Torino tutto quanto serve per cominciare tests full steam del firmware dell'esperimento .

DOMANDA DI UTILIZZO DEI SERVIZI DI BASE

Data della richiesta: 26/6/2017

Lab. Tecnologico	Lab. Elettronica	Centro di Calcolo
	✓	

nuova richiesta	
richiesta di continuazione	✓

Esperimento: Belle

Responsabile locale: Mussa

Responsabile dell'attivita': Mussa

Descrizione dettagliata dell'attivita' richiesta

Sviluppo Front-End Rivelatore TOP

PLANNING													MILESTONES	
Subattivita'	G	F	M	A	M	G	L	A	S	O	N	D	Data-mese	Descrizione
F/E TOP	✓	✓												

Tecnici e tecnologi attualmente assegnati all'attivita'					Richieste di supporto tecnico per		
INFN		ALTRI ENTI				l'anno:	
Nome	mesi/U	Ente	Nome	mesi/U	Tipologia	N.	mesi/U
Rotondo	2				Tecnici mecc. /elettr/CdC	1	2
					Disegnatori meccanici		
					Microsaldatori		
					Tecnologi progett. mecc.		
					Tecnologi elettronici/CdC		
					Tecnologi microelettronica		