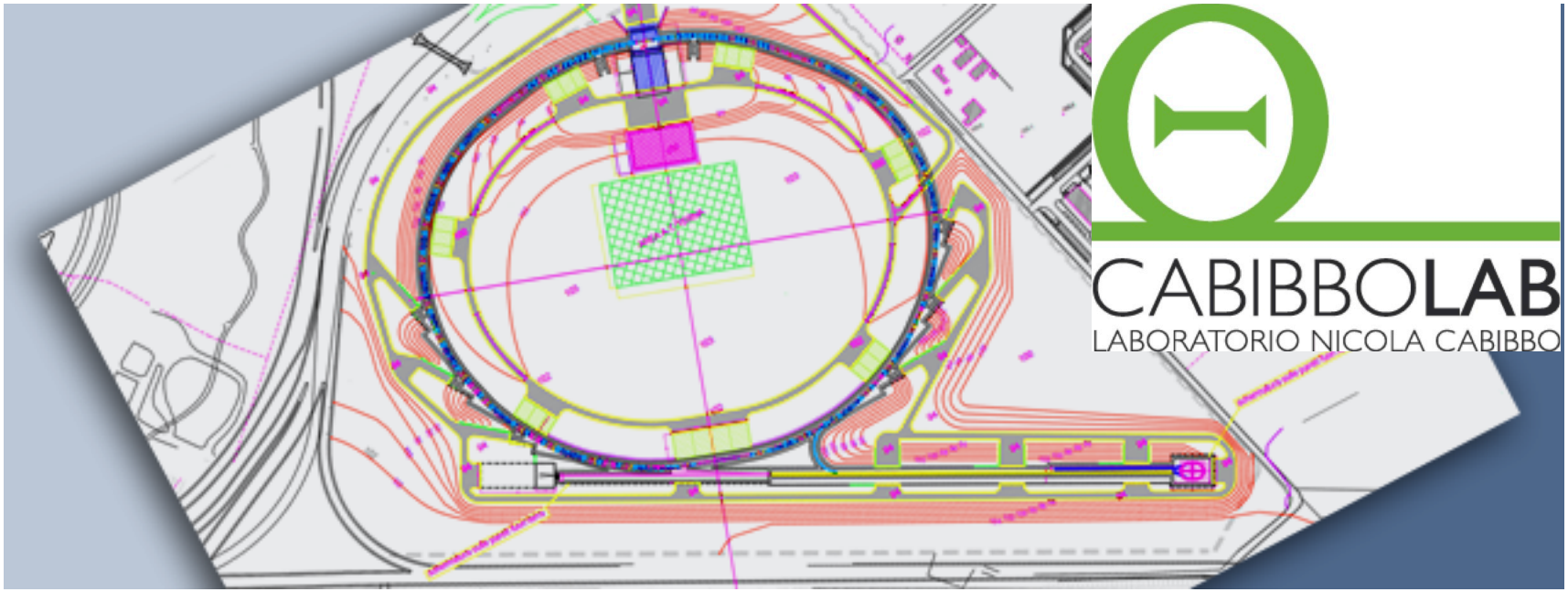


CABIBBOLAB
LABORATORIO NICOLA CABIBBO

SuperB

Detector Status

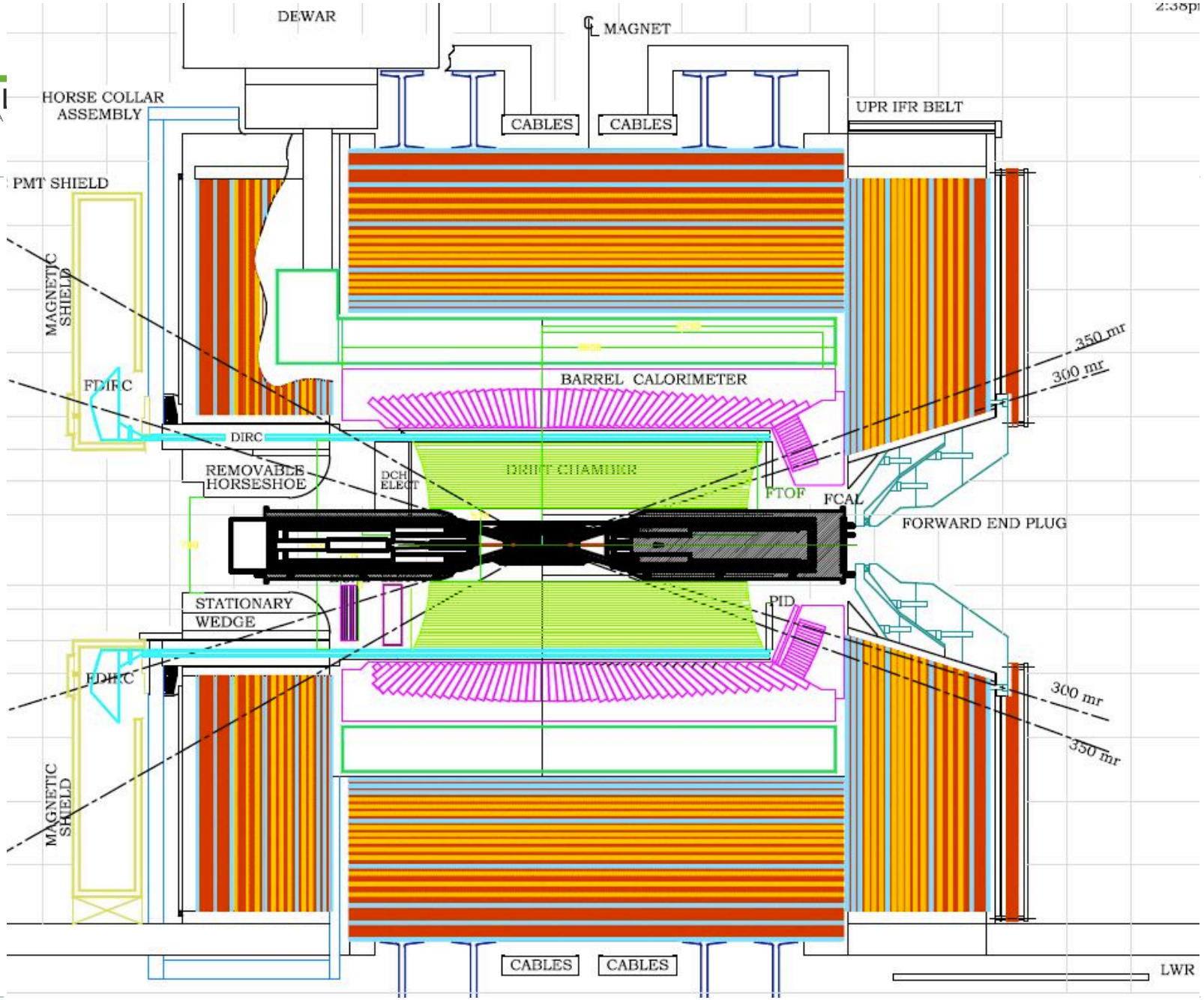
F.Forti, INFN and University, Pisa

Overview

- The design of the detector is almost completely defined
- Updates to budget and schedule will be discussed at this meeting.
- The TDR is 80-90% complete and should be published in the next month or so.

…but…

- Need a clear and realistic schedule for the machine construction and the corresponding funding
- Eagerly waiting for ministerial review to happen in october.


DEWAR
MAGNET
HORSE COLLAR ASSEMBLY
CABLES
CABLES
UPR IFR BELT
PMT SHIELD
MAGNETIC SHIELD
FDIRC
BARREL CALORIMETER
350 mr
300 mr
DIRC
REMOVABLE HORSESHOE
DCH ELECT
DRIFT CHAMBER
FTOF
FCAL
FORWARD END PLUG
STATIONARY WEDGE
PID
FDIRC
300 mr
350 mr
MAGNETIC SHIELD
CABLES
CABLES
LWR

Detector Design Issues – all defined

System	Baseline	Issues (technical OR manpower; R&D)
MDI	Initial IR designed	Magnetic elements and radiation masks. Design of tungsten shields. Cryostats radius Background simulations: global map, detector occupancy
SVT	6-layer silicon	Technology for Layer 0: striplets, with pixels as upgrade path. Thin pixels R&D. Readout chip for strips. Mechanical design.
DCH	Stereo-axial He-based	Dimensions (inner radius, length) defined. Mechanical structure. Cluster counting option as upgrade
EMC	Barrel: CsI(Tl) Forw: LYSO	Electronics and trigger. Mechanical structure Forward EMC technology: hybrid LYSO+CsI(Tl) with Pure CsI as R&D. Backward EMC: cost/benefit analysis
PID	DIRC w/ FBLOCK	FBLOCK design completed. Photon detection defined. Mechanical structure designed Forward PID: cost/benefit analysis. Prove TOF technology.
IFR	Scintillator+ fibers	9 layers. SiPM location defined. Extra 10cm iron. Mechanical design of extra shield.
ETD	Synchronous const. latency	Fast link rad hardness. L1Trigger (jitter and rate). ROM designed. Link to computing for HLT.

TDR process and timeline

- The Technical Design Report is an essential step to get funding and get the detector built.
- Funding and schedule
  - The TDR will contain an updated budget and a schedule for construction.
  - It will not be incorporate funding agencies intentions and committments into the TDR:
    - → A separate financial document to detail the agencies contributions will be published later

TDR Timeline

- June-July 2011:
  - setup SVN repository + initial outline
- September 2011
  - Detailed outline with page count + editorial responsibilities
  - Tentative institutional matrix of responsibilities and money allocation
- ~~December 2011~~ → March 2012
  - First (in)complete draft,
  - Decision about what is in and what is out
  - ~~Updated budget and schedule for construction~~
- ~~February 2012~~ → ~~June 2012~~ → September 2012
  - Complete draft into final editing
  - Final readers identified
- ~~July 2012~~ → September 2012
  - Updated budget and schedule for construction
- ~~September~~ → **October 2012: Publish**

Contents

MDI

Eugenio Paoloni (+Alejandro Perez)

A new default detector configuration for SuperB

- **Several improvements to the detector model where implemented for Summer-2012 production (Geometry_CABIBBO-V03)**
  - **Final focus:** more realistic W-shield compatible with space available and integration constrains. Conical shape of 3cm thick and cylindrical shape 4.5cm thick with increased external radius.
  - **SVT:** newest L0 model (F. Bosi). L1-5 model adapted to the SuperB angular coverage (±300 mrad)
  - **DCH:** Internal radius increased to make room for W-shield (265 → 265 mm); new foils of copper and Aluminium according to latest machanical drawings
  - **EMC:** Hybrid CsI-LYSO fwd-end-cap model and RadFET monitors
  - **IFR:** new iron/Boron-loaded-polyethylene shields
  - **Detector Hall:** more realistic model using Fabrizio Raffaeilli drawings
  - **Solenoidal detector field:** field was extending beyond the Super-conducting magnet volume and was not zero inside the FDIRC FBLOCK.
- **NOTE:** found a problem with FDIRC geometry related with the MaPMT photocathode using BK7. The problem was fixed (changing material to Aluminium) and committed but not in time for Summer-2012 production. Summer-2012 samples are still usable applying a post-production patch. New production will be run if needed.

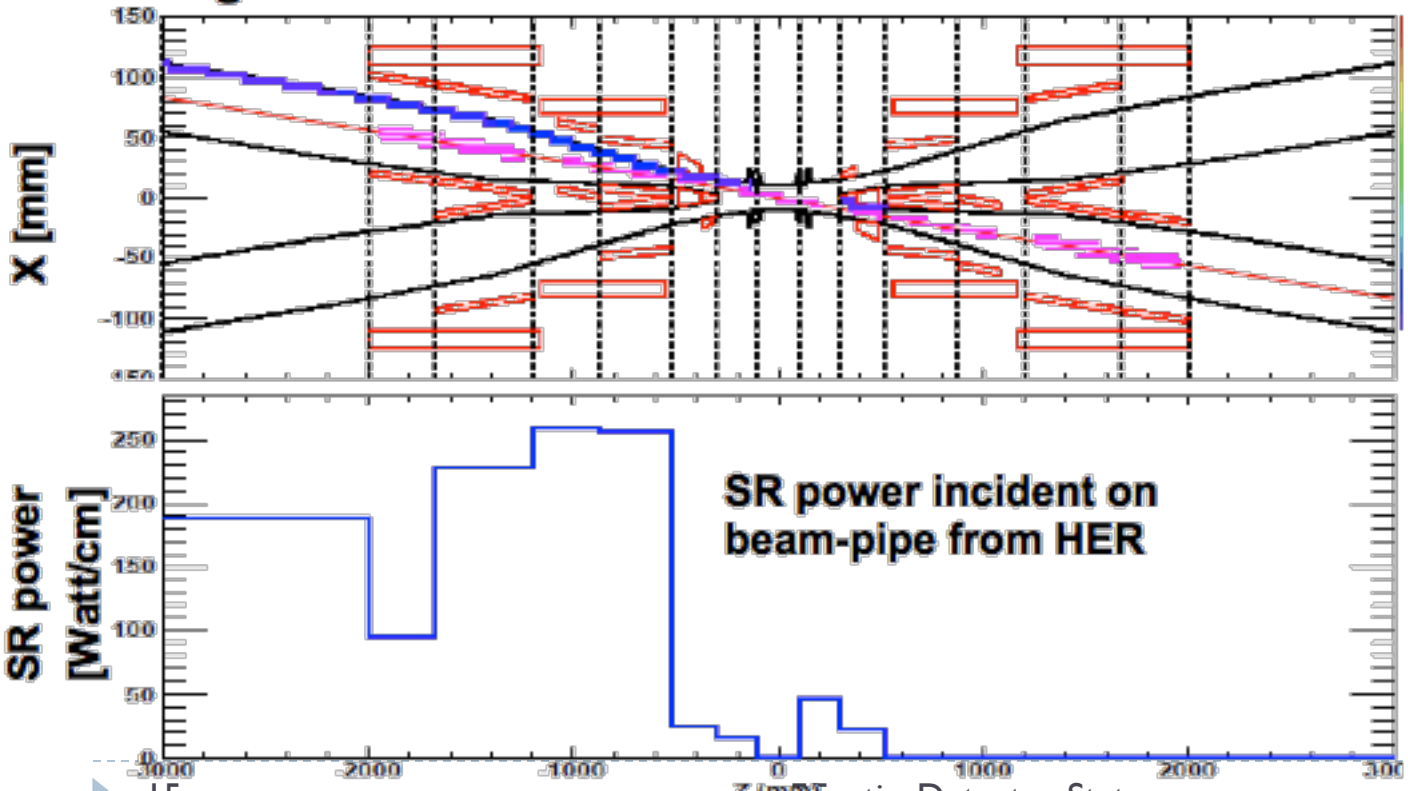
The machine background model

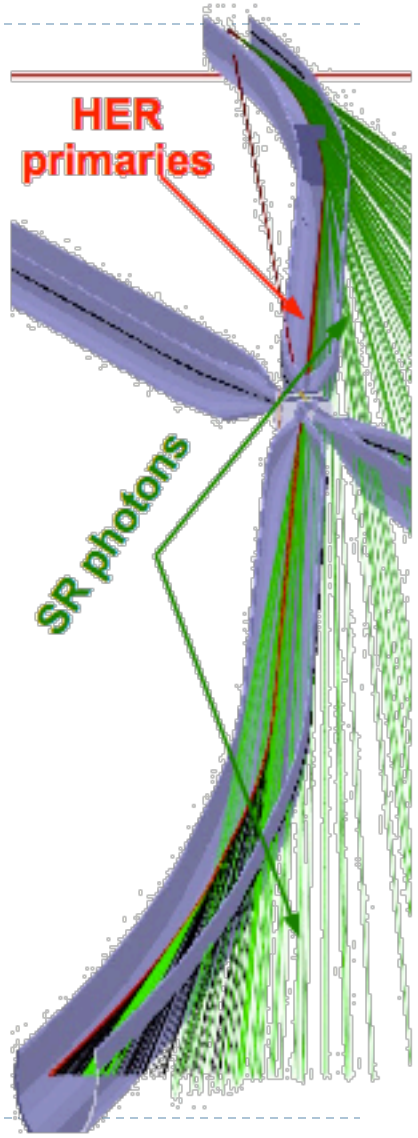
- **We are continuously our background model. The usual samples have been studied**
  - Rad-Bhabha with $\Delta E/E = \kappa > 30\%$. This is the main Rad-bhabha component giving backgrounds on the detector.
  - Pairs, Touschek HER/LER and Beam-Gas

- **In this cycle we also produced for the first time two other background sources**
  - Rad-Bhabha with $0.5 < \kappa < 30\%$
    - This range models the a significant fraction of the total Rad-bhabha losses at the for $|Z| > 10$m (first downstream dipoles)
    - These losses can contribute significantly to the neutron cloud build up process
  - Synchrotron Radiation (SR). See next slide.

The machine background model: Synchrotron Radiation

- SR energy spectrum is the soft X-ray, but the rates are huge (hundreds of watts)
- The final focus W-shield should be more than adequate to absorb SR-photons passing through the thin beam-pipe
- The small fraction of the SR radiation that will be reflected and diffused by the inner surface of the pipe eventually hitting the SVT will be evaluated with Bruno

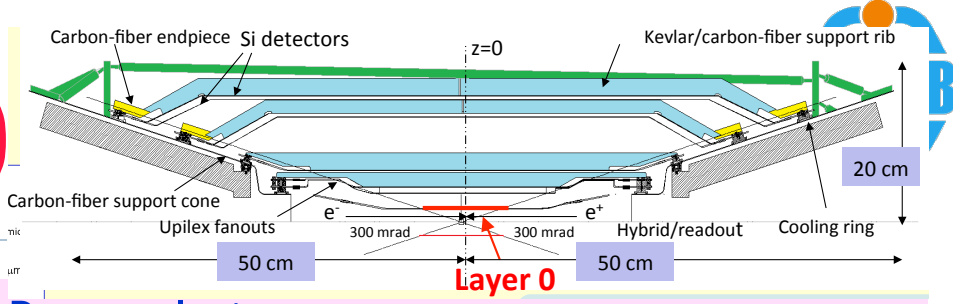




SVT

Giuliana Rizzo

SVT – Update (I)



- Most of the activity focused on the TDR completion:
  - Internal revision of the text started on completed sections (~ 75%)
  - Some of the parallel sessions devoted to TDR reading.

Other significant progress:

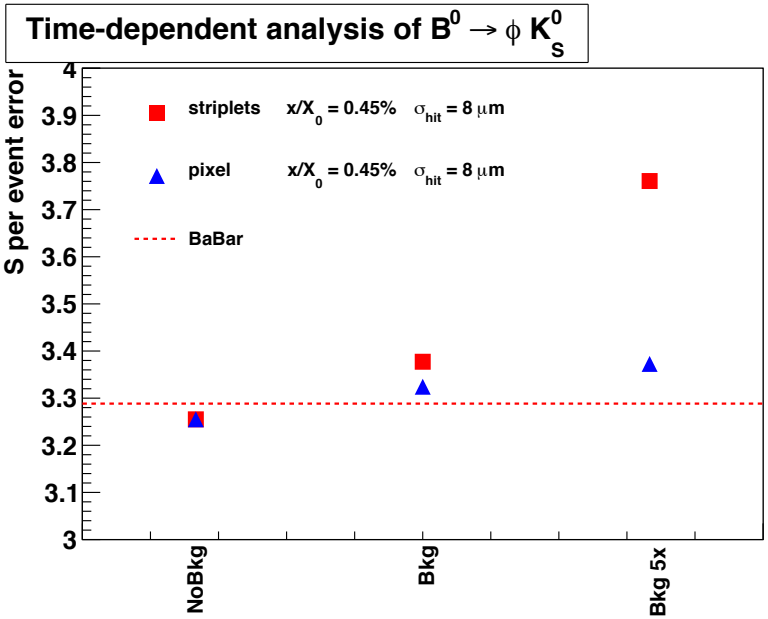
1. New/more reliable simulation of the hit time resolution to define time window cut for reconstruction/offline occupancy
   - Now include noise effects and sim. results are able to reproduce time resolutions achieved in BaBar data.
2. With present background simulation and new time window cut SuperB average offline cluster occupancy ~ 2% (x5 safety included) only 2-3 times higher than average BaBar occu.
   - Studies on BaBar data in high background conditions (L1 cluster occup. up to 5%) used to evaluate hit-to-track efficiency in SuperB : 95% with 3% cluster occu!

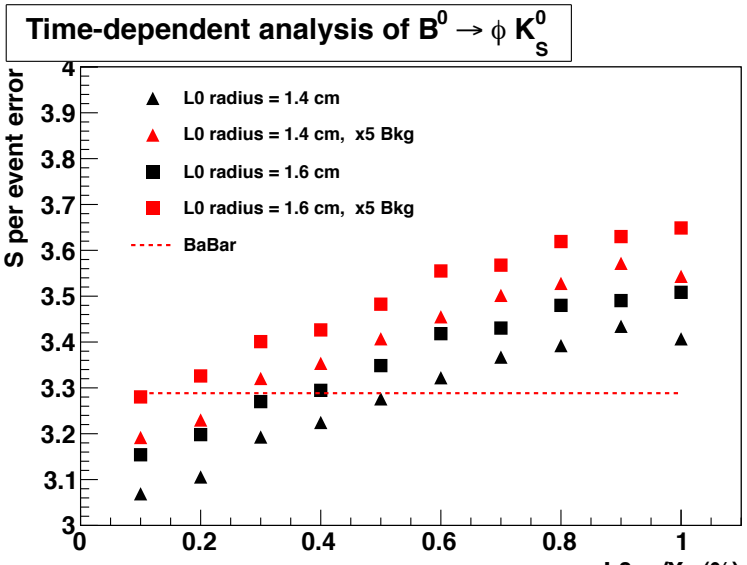
Layer	View	Shaping time	Offline time window (+/- 5x NEW time resolution) ns	offline cluster occupancy (x5 included)
0	1	25	100	0.023
0	2	25	100	0.015
1	phi	75	110	0.016
1	z	75	110	0.016
2	phi	100	120	0.015
2	z	100	120	0.017
3	phi	150	150	0.030
3	z	150	150	0.015
4	phi	500	500	0.027
4	z	500	500	0.022
5	phi	750	550	0.023
5	z	750	550	0.017

SVT – Update (II)

3. Fastim performance comparison for striplets and pixel in Layer0 completed

- As expected pixel performance more robust in high background (pixel occup. 200 times smaller than striplets)→ main motivation for pixel upgrade for full luminosity.
  - With x5 background, sensitivity to S reduced by 15% with striplets, while only 3% degradation seen with pixel with same material budget assumed.
- Thinner pixel options can further improve S sensitivity even with nominal background





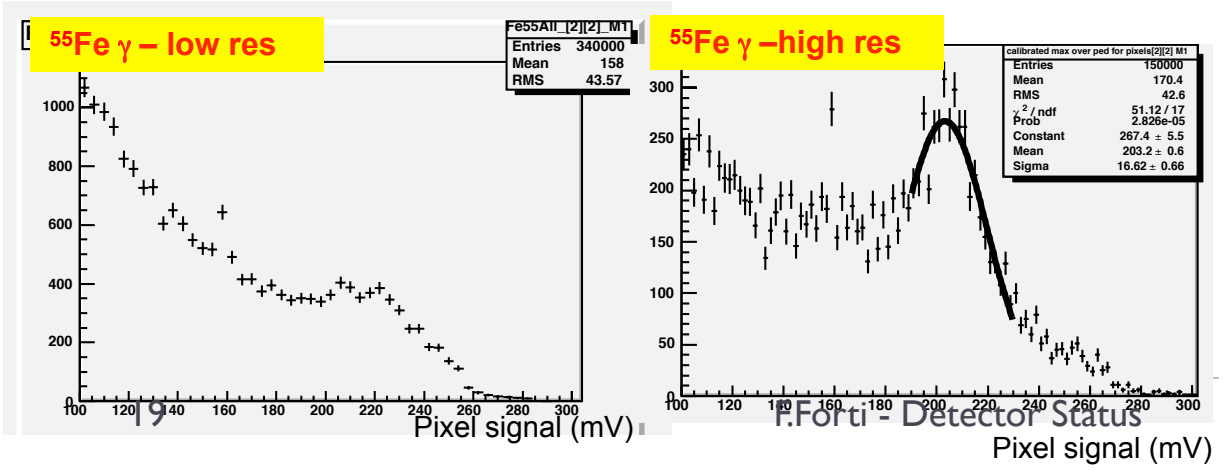
SVT – Update (III)

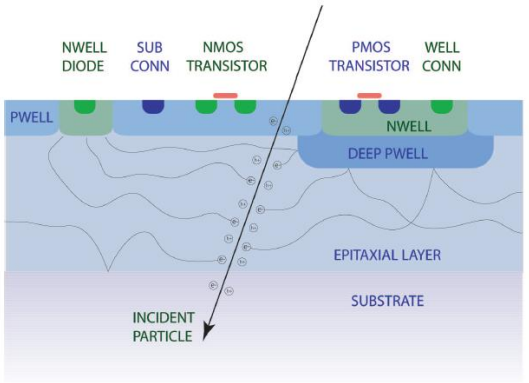
4. Higher neutron fluence found in SVT (bug fix) and effect on FE noise reavaluated
   - S/N marginal in L4-5 with 7.5 yrs x5 safety
   - A few knobs to improve the situation. Reduce:
     - Reduce ambient temperature (T=12^0 C, in this table) & shaping time. Neutron shield in the hall?

Layer	View	Shaping time	S/N at the start of data taking	S/N in 75 ab-1	S/N in 75 ab-1 x5 bkg
0	1	25	17	17	16
0	2	25	17	17	16
1	phi	75	21	20	16
1	z	75	32	27	18
2	phi	100	22	20	16
2	z	100	34	27	18
3	phi	150	27	21	14
3	z	150	34	27	16
4	phi	500	22	17	10
4	z	500	29	19	11
5	phi	750	22	14	8
5	z	750	30	18	10

R&D on pixel:

- INMAPS MAPS with high resistivity epi layer under test:
  - Better charge collection evident with Fe55 spectrum
  - Irradiation with neutrons performed (4 steps up to 1x10^14 n/cm2) and chips are being tested now.
- Getting ready for Nov. testbeam at CERN





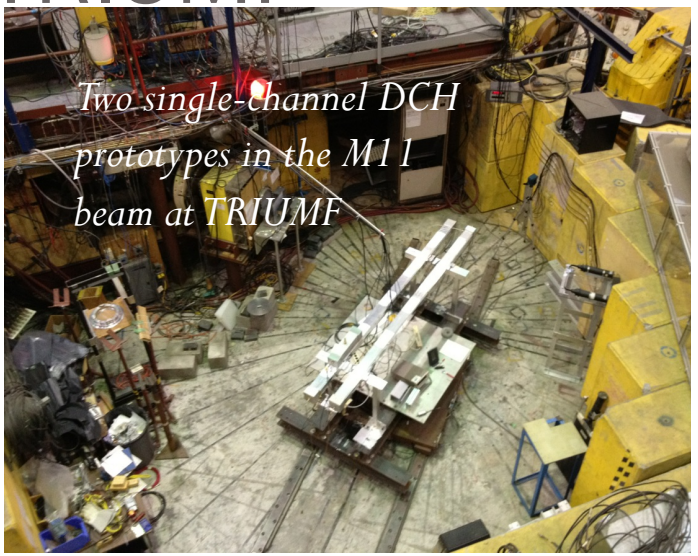
INMAPS CMOS process with 4 wells & high resistivity to improve charge collection efficiency and radiation resistance

DCH

Giuseppe Finocchiaro and Mike Roney

DCH prototype beam tests at TRIUMF

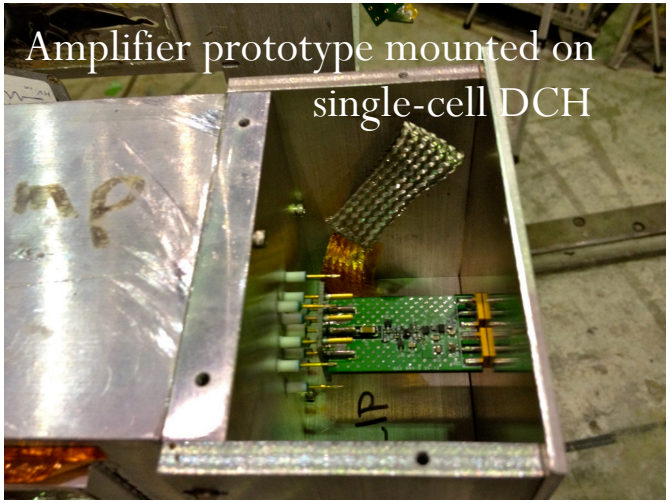
- **Goals:**
  - establish benefits of cluster counting on PID
  - test amplifier prototypes
  - study impact on PID of design choices (sense wire, cables, connectors, gas gain)

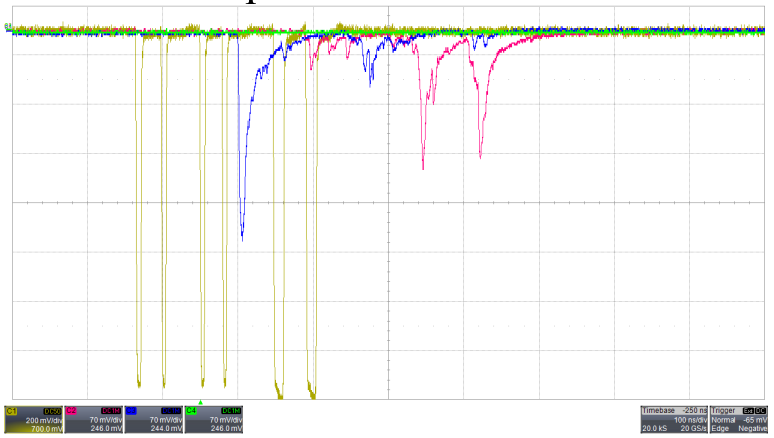


- Five prototype amplifiers provided by JP Martin (Montreal).
- Input impedance 50, 170 or 380 Ω; chamber impedance = 380 Ω, terminated at non-readout end.
- High impedance gives better charge collection efficiency, but stray capacitance may give low bandwidth.
- Experimentally determine best performance.

e^+, μ^+, π^+ at 140–350 MeV/c.
μ/π separation here $\approx \pi/K$ separation at 2–3 GeV/c

- **NEXT BEAM TEST: November 2012 with LNF team bringing PROTO-2 28 sense wire chamber to TRIUMF**



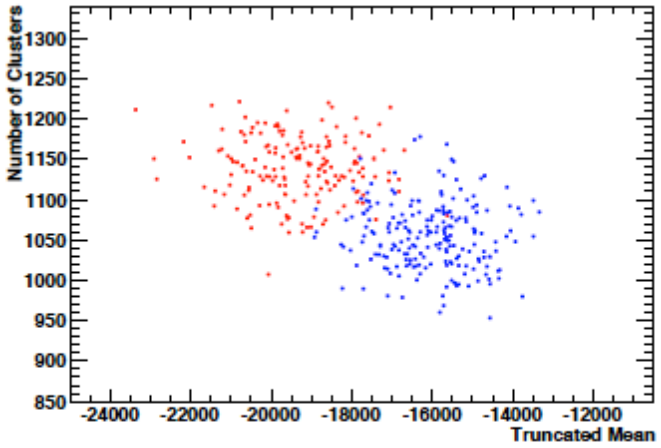


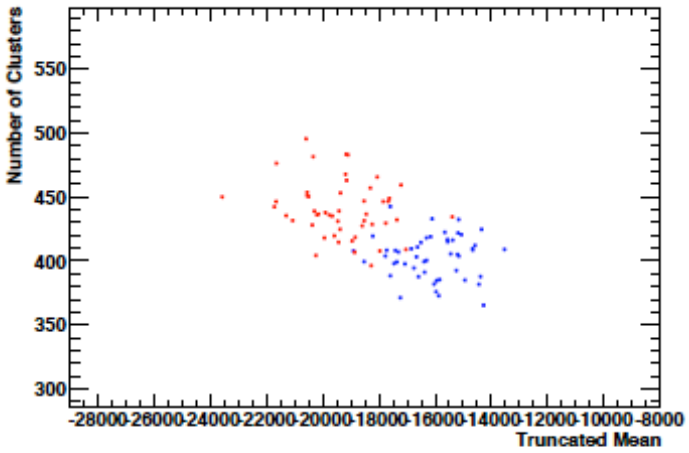
Waveforms from prototypes with 20 μm (red) and 30 μm (blue) sense wire. Yellow curve is TOF signal

Initial Cluster Counting Analysis with TRIUMF test beam data

- 140MeV/c μ/π
- Use a likelihood ratio: $R = L_\mu/(L_\mu+L_\pi)$ to select muons (L_μ and L_π are 2D Gaussians)

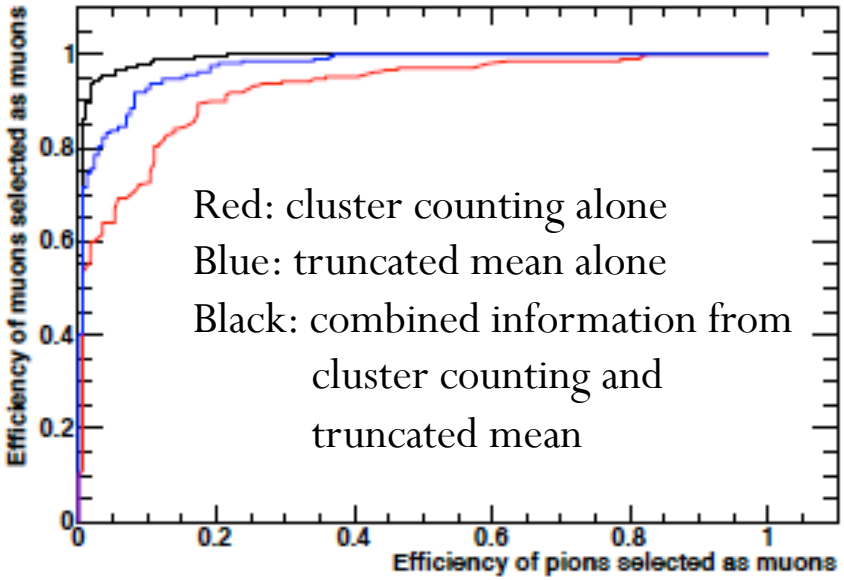
No. clusters vs Truncated Mean
Blue = muons,
Red = Pions





(a) Real data.

- Combining cluster counting with truncated mean substantially improves PID
- For 1% efficiency for pion selection, muon efficiency increases from 72% for truncated mean alone to 86% by adding cluster counting information



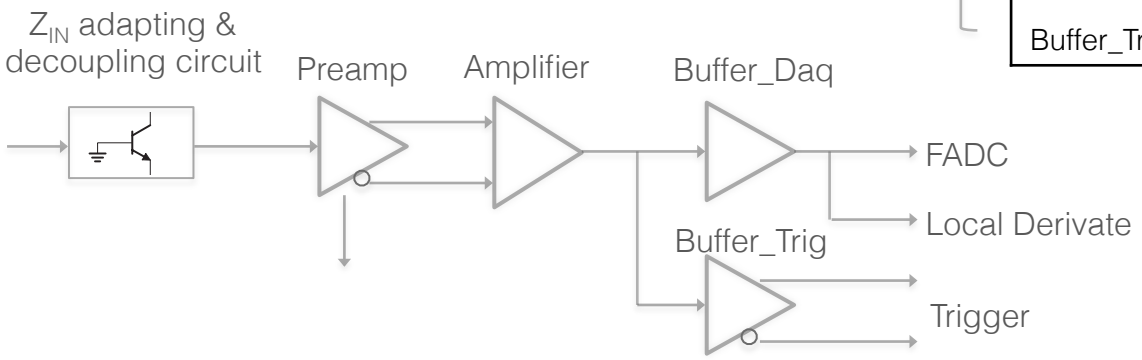
New design (50% higher BW) of Proto II Preamp

Requirements

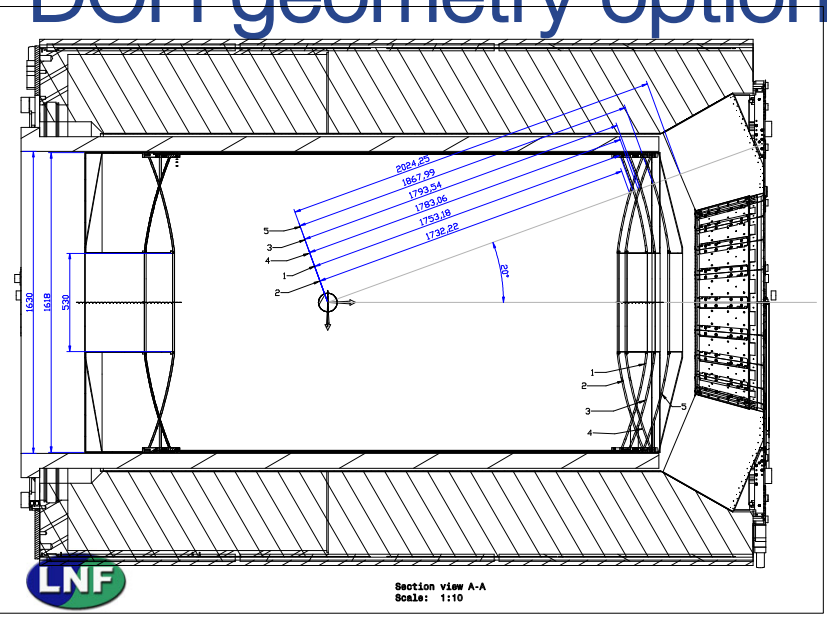
- *BW ≈ 350 MHz*
- *Gain ≥ 5 mV/fC*
- *Noise ≤ 2000 erms*

BW ≈ 350 MHz

Z_{IN} decoupling	BFP740 SiGe Transistor (BW > 10 GHz)
Preamp	MAX3658 (BW ≥ 350 MHz)
Amplifier	CLC1606 (BW ≥ 1 GHz @ G = 2)
Buffer_Daq	CLC1606 (BW ≥ 1 GHz @ G = 2)
Buffer_Trig	THS4503 (BW ≥ 370 MHz @ G = 1)



DCH geometry option comparison



New FastSim configurations including:

- Updated inner radius (265mm)
- Updated inner cylinder thickness (0.5mm)
- Updated wire layout (previous studies used BaBar layout)
- 5 different endcap geometries/ DCH lengths

PID

Nicolas Arnaud and Jerry Va’vra

FDIRC

- Added 8 inches of lead absorber to CRT to increase the cut off muon energy to ~2 GeV.
- The scanning setup with IRS-2 electronics is working.
- FDIRC is in CRT and ready to start taking data.
- 512 pixels instrumented with the IRS-2 electronics.
- ~97% of channels working.
- First short dst file produced.
- Will start tuning the analysis soon.
- MC program is close to producing pixel constants.
- Measured the refraction index of SES-403 RTV.
- PID TDR chapter finished.
- Budget estimate for barrel PID is completed.
- Analysis of the Summer 2012 background production is ongoing
- Rad Bhabha rates lower (15-20%) than in Elba as fake hits were due to the use of a wrong material to simulate the MaPMT photocathode
- TDC chip (SCATS) tests ongoing at LAL – chip sent to Bari as well

FTOF

- **Analysis of the Summer 2012 bkg samples in progress**
- **TDR section about the forward PID almost complete – FARICH report to be added (requested late)**
- **Still missing report from the integration group about the exact space available in the forward region of SuperB for the FTOF**

EMC

Claudia Cecchi and Frank Porter

EMC at this meeting

- Wednesday 16:30-18:30
  - Chih-hsiang Cheng – Fastsim updates
  - Shawn Osier – Discussion of barrel transport
  - Criso Sciacca – Barrel transport options
  - Valerio Pettinacci – Forward mechanics
- Thursday 08:30-10:30
  - Elisa Manoni – Validation of the new implementation of fastsim
  - Stefano Germani – Updates on fullsim
  - Claudia&Frank – Discussion of TDR, budget,& schedule
- Thursday 11:00-13:00
  - Paolo Gauzzi – Updates on measurements for the noise study in the barrel
  - Alessandro Rossi - CsI measurements
  - Gerald Eigen – Backward EMC

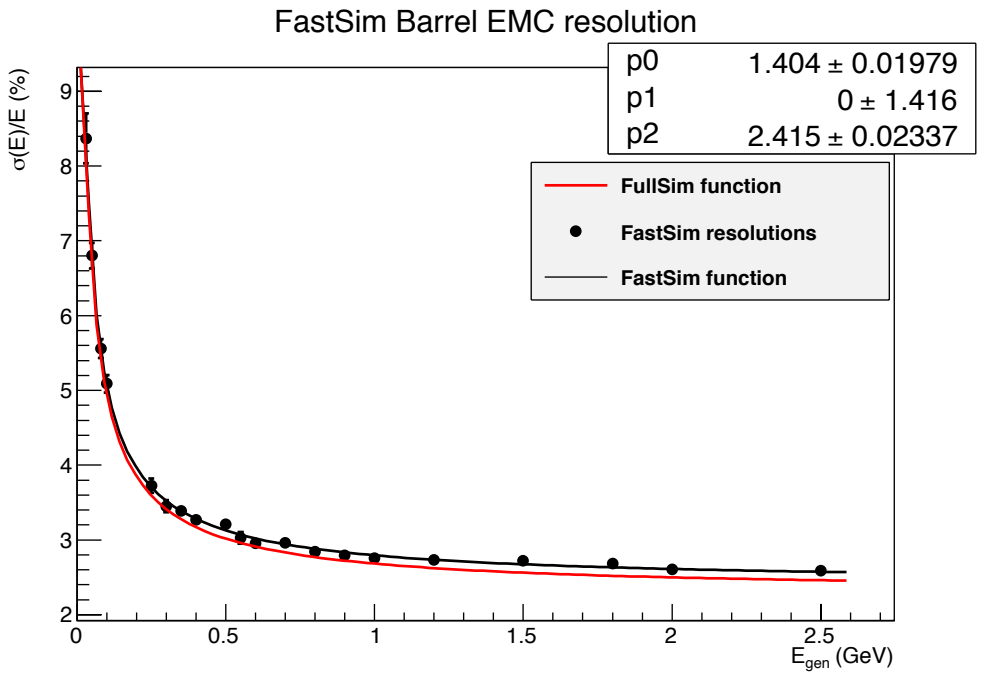
EMC status

- TDR
  - Mostly written, but significant pieces to finish
  - Editing is underway
- Budget&Schedule
  - Have begun to re-do white paper WBS
  - Work on schedule also begun; Detailed cost and schedule draft for barrel disassembly from Shawn Osier
- Simulations – Both fastsim and fullsim have been updated
- Two spare endcap modules shipped to Roma1 for mechanical studies

Fullsim – Fastsim comparison

Fastsim and fullsin resolution energy resolution in good agreement.

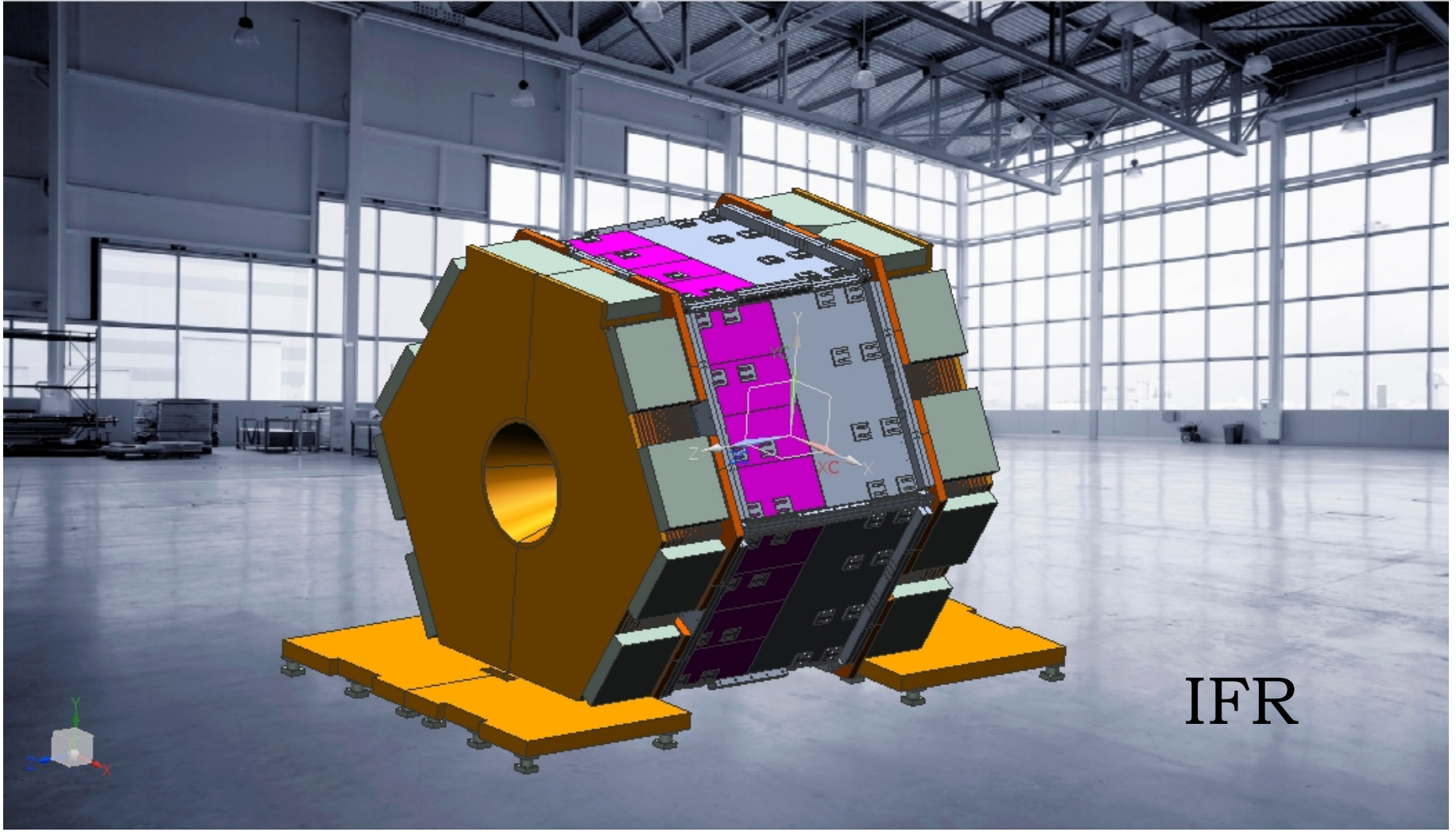
full-fast.pdf



Spare endcap module shipping

View from IP

(Note the red. . .)

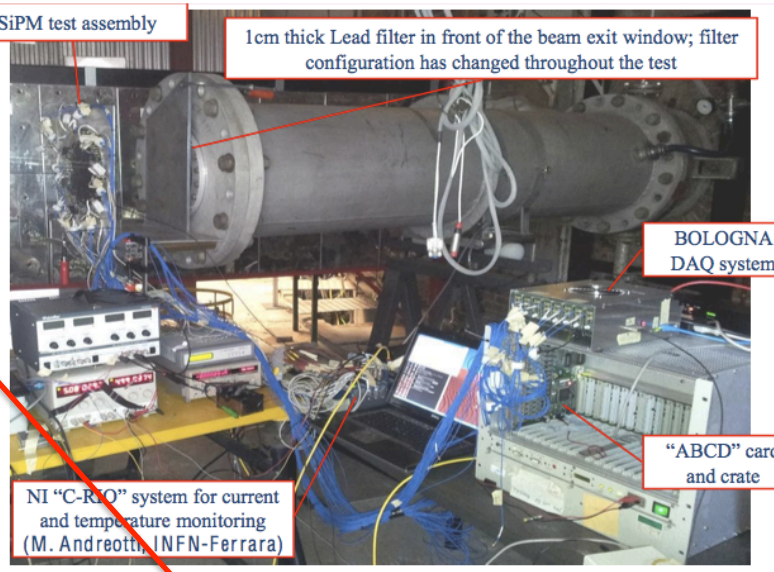


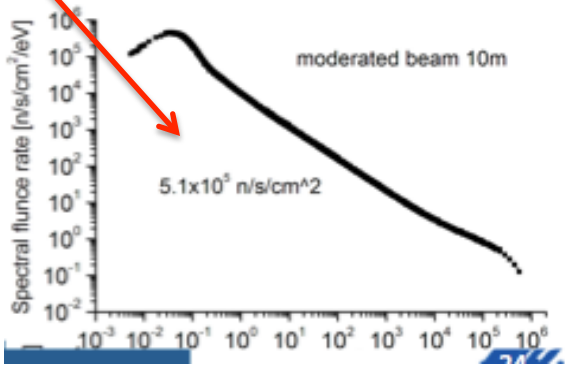
Wander Baldini

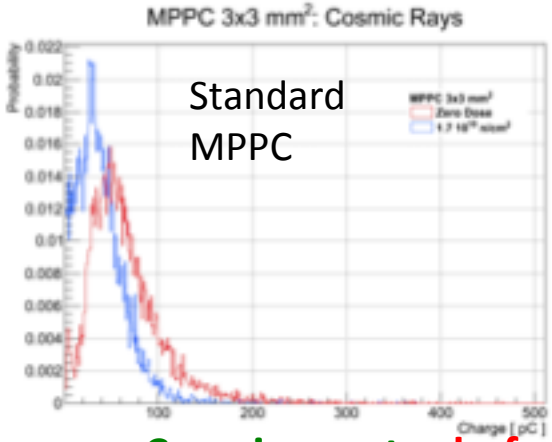
The GELINA irradiation test

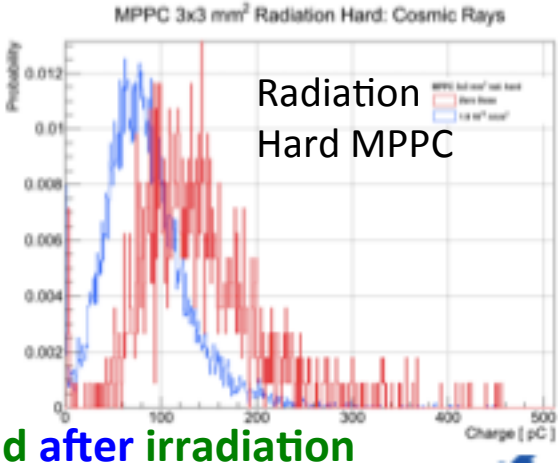
- 9-20 July at the GELINA facility (Geel, Belgium)
- The facility: 100 MeV linac, electrons on Uranium target + moderator to obtain a neutron beam similar to superB in the low energy range (≤ keV)
- Several Hamamatsu, FBK and SenSL devices:
  - 25,50,100 µm pixels
  - 1x1, 3x3 mm^2 active area
  - Radiation Hard devices from Hamamatsu (3x3 mm^2)
- Measured:
  - Dark Current/Noise vs dose
  - I-V curves
  - Threshold scan
  - Dark spectra for a subset of SiPMs

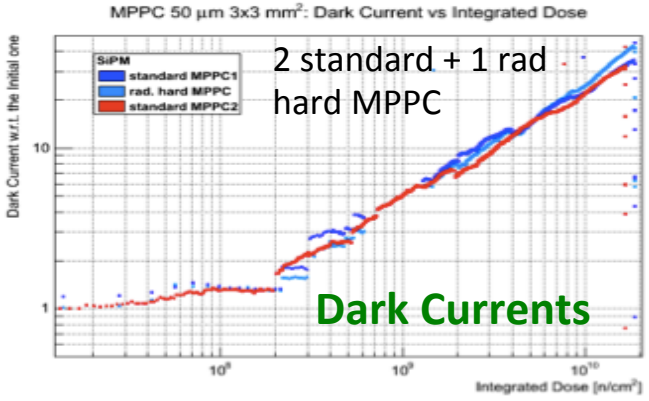
- Total integrated dose: **1.86 x 10^{10} n/cm^2** (about 2 running years x safety factor 5)







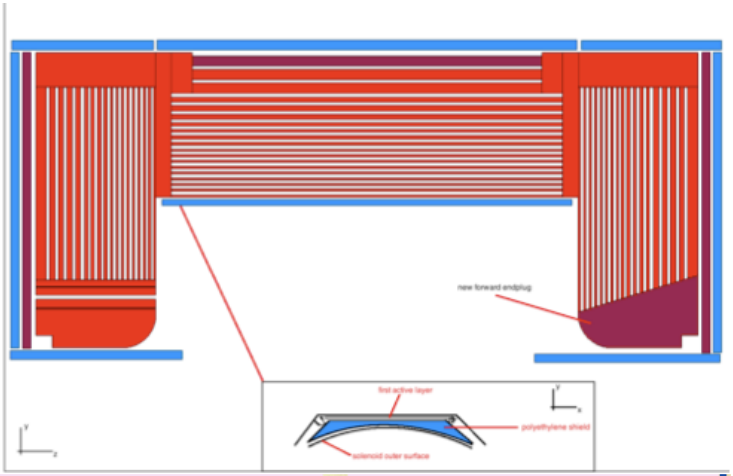


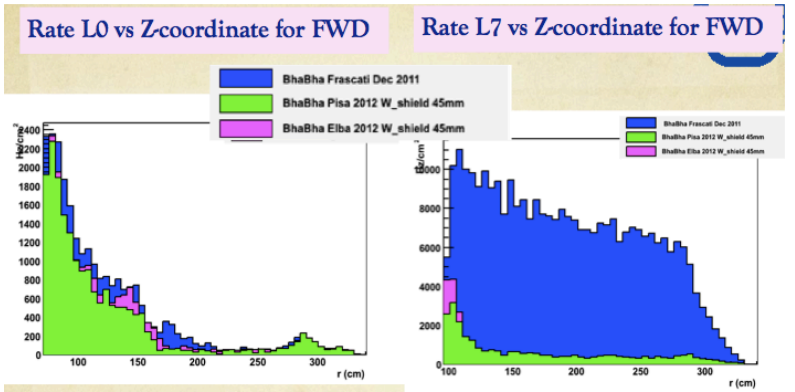


Cosmic spectra before and after irradiation

Update on background simulation and shielding

- New MC production with more shielding all around the detector:
  - 10 cm Fe + 10 cm Polyethylene-Boron in front of each encap
  - 10cm Polyethylene-Boron external to the Barrel
  - 5cm Polyethylene-Boron between solenoid and L0
- Useful exercise to understand effect of shielding even if rather difficult to implement
- Clear effects on barrel and endcaps Layer 7, Endcaps L0 still exposed to high neutron flux



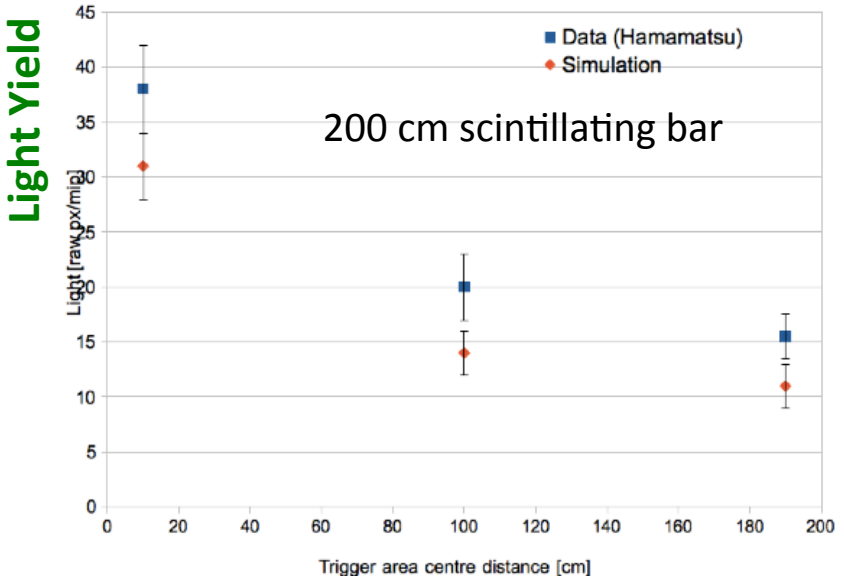


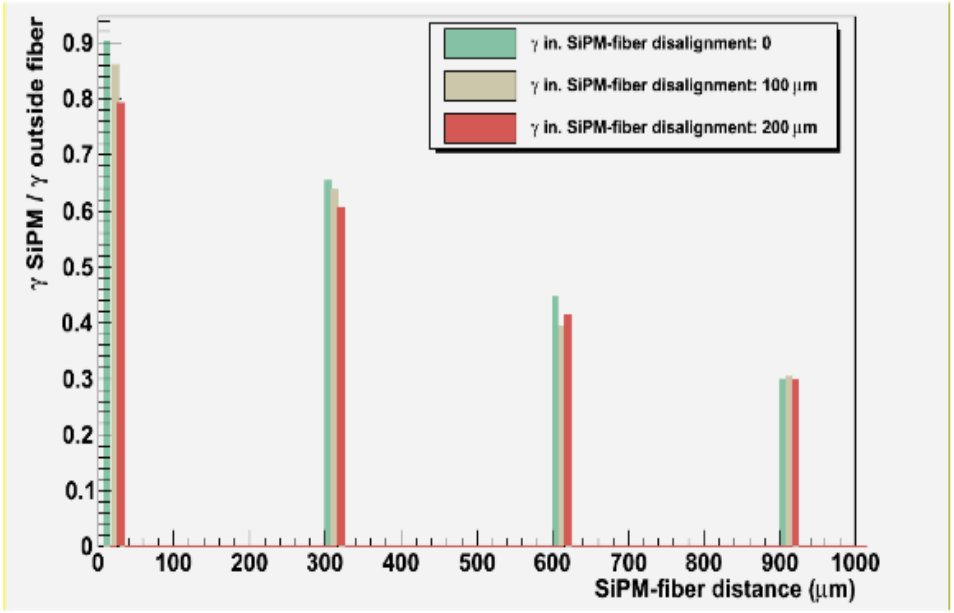
Update on R&D

- Development in Bologna of a detailed FLUKA simulation and comparison with measured data for 25 and 200 cm scintillator bars

- Some adjustments needed but the overall behaviour is well reproduced (at a 10-20% level)

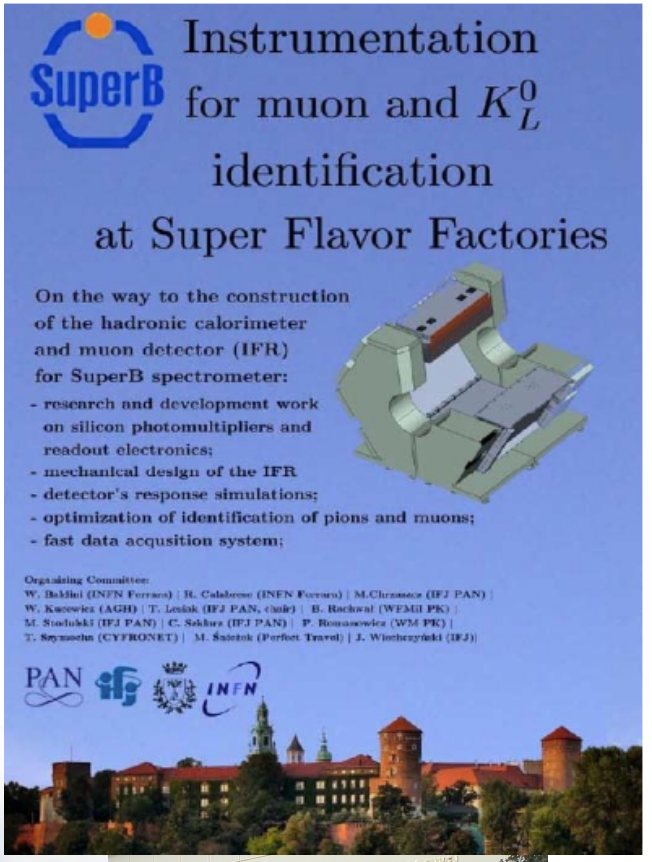
- Very useful (and time-saving) to understand effects of:
  - Fibers-SiPM misalignments (both axial and transversal)
  - Position/number of fibers in the scintillator





The IFR workshop

- Held in Krakow 7-9 Sept.
- Many interesting discussions about all the main topics related to the IFR design and construction
- Many thanks to Our IFJ-PAN, AGH, CUT colleagues for the perfect organization



TDR Status and next activities

- The writing of the TDR is ~80% complete
- All our efforts, in the next weeks, will be dedicated to the TDR finalization

Other short term future activities:

- Continue the irradiation test data analysis
- Finalization of the Testbeams data analysis
- Background studies and remediation
- …..

ETD/Online

Dominique Breton, Umberto Marconi, Steffen Luitz

ETD Progress

- Things have been very quiet since Elba
- Main focus has been on completing the TDR
  - ETD/Online chapter almost complete
    - We have solutions for remaining design "issues", to be discussed and agreed upon during this meeting
    - Major progress in "writing", after this meeting ready for editorial review
  - Electronics chapter
    - Missing some subdetector contributions (in the new short format)
    - Some editorial work on "infrastructure" still required
  - WBS and cost estimates
    - Have been updated, however in-depth review of the subdetector electronics still required
      - Will do during this meeting
- We have 3 sessions – will use all time to go through TDR and WBS
  - 1st session: common ETD/Online
  - 2nd and 3rd sessions: Sub-Detectors
- Note: We should seriously consider changing the global clock from 59.5 to 39.66MHz (RF/8 -> RF/12)
- – This would allow the use of a lot of technology developed for LHC (components, links, even systems)
- – Would allow for savings in cost and effort – Will discuss during this meeting – sorry proposing this
- so late! – The few people I talked to seemed quite positive .

Integration

F.Raffaelli, W.Wisniewski

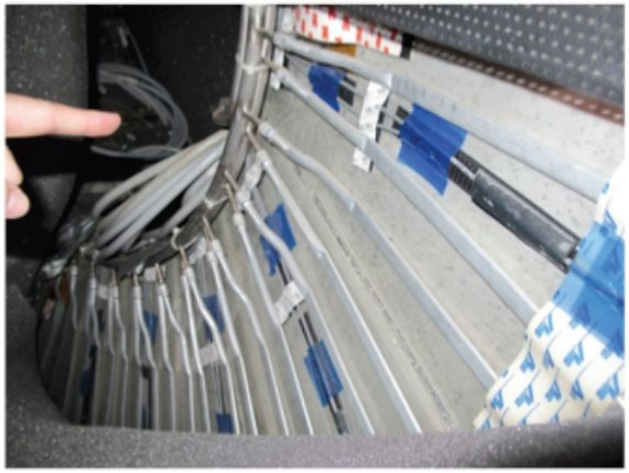
Topics of Meeting of Detector Integration at SLAC and problems solved

- During the meeting we review all detector interface going through the reference Babar drawing comparing it to the SuperB reference drawing.
- We compare the available space for the SuperB services.
- We check the envelope of the sub-detector measuring the reusable Babar parts.
- We discuss the EMC transportation.
- We discuss the new backward shielding modularity and the BMC integration.
- We were able to update the detector envelope

Survey was made and inspection was made after the meeting

- Forward calorimeter service envelope
- Wire chamber supports.
- Dirch inner tube measurements.

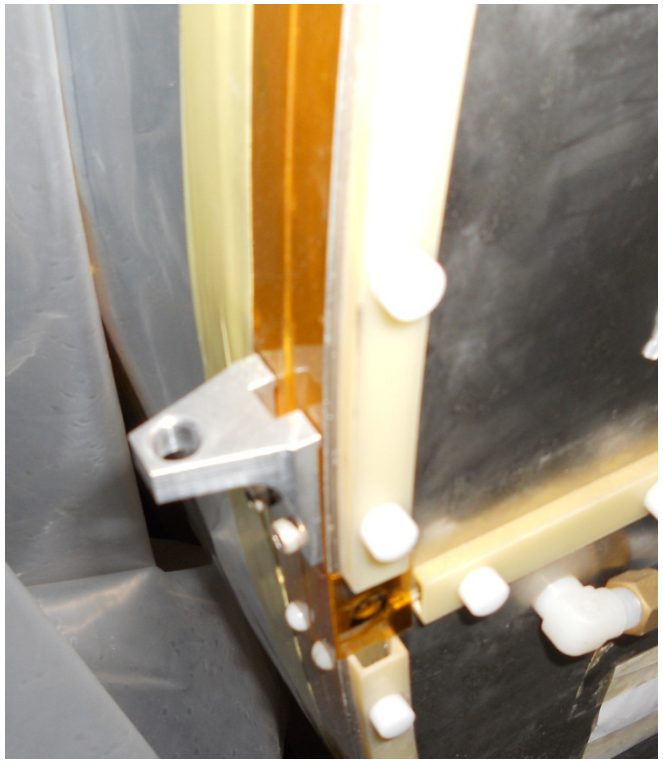
Its envelope (added thickness) can be evaluated, approximately and conservatively, 60 mm for the inner ring and 20 mm for the external area.

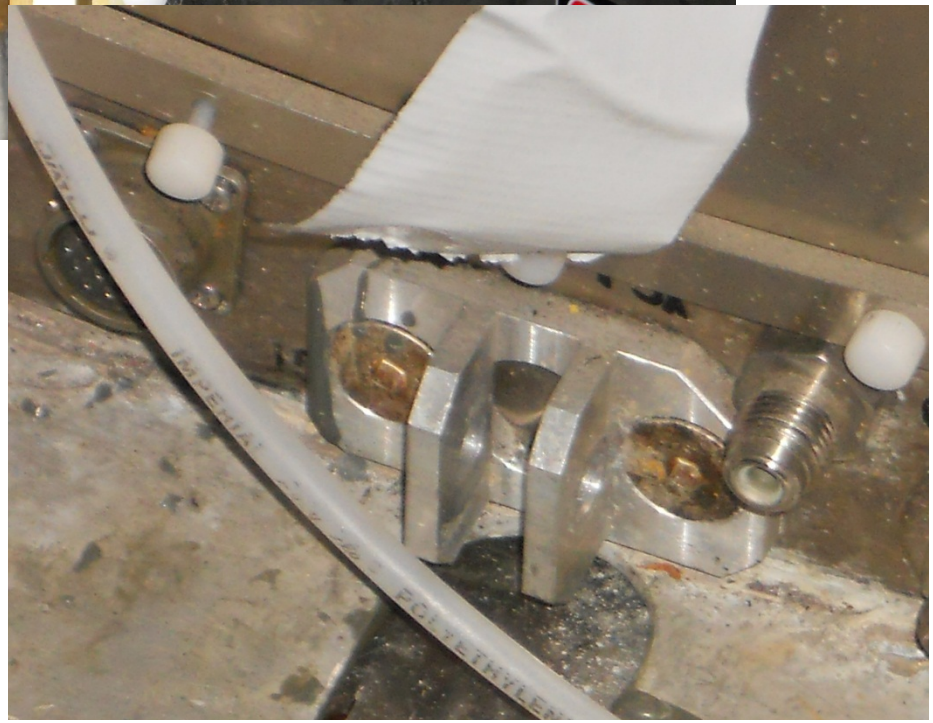


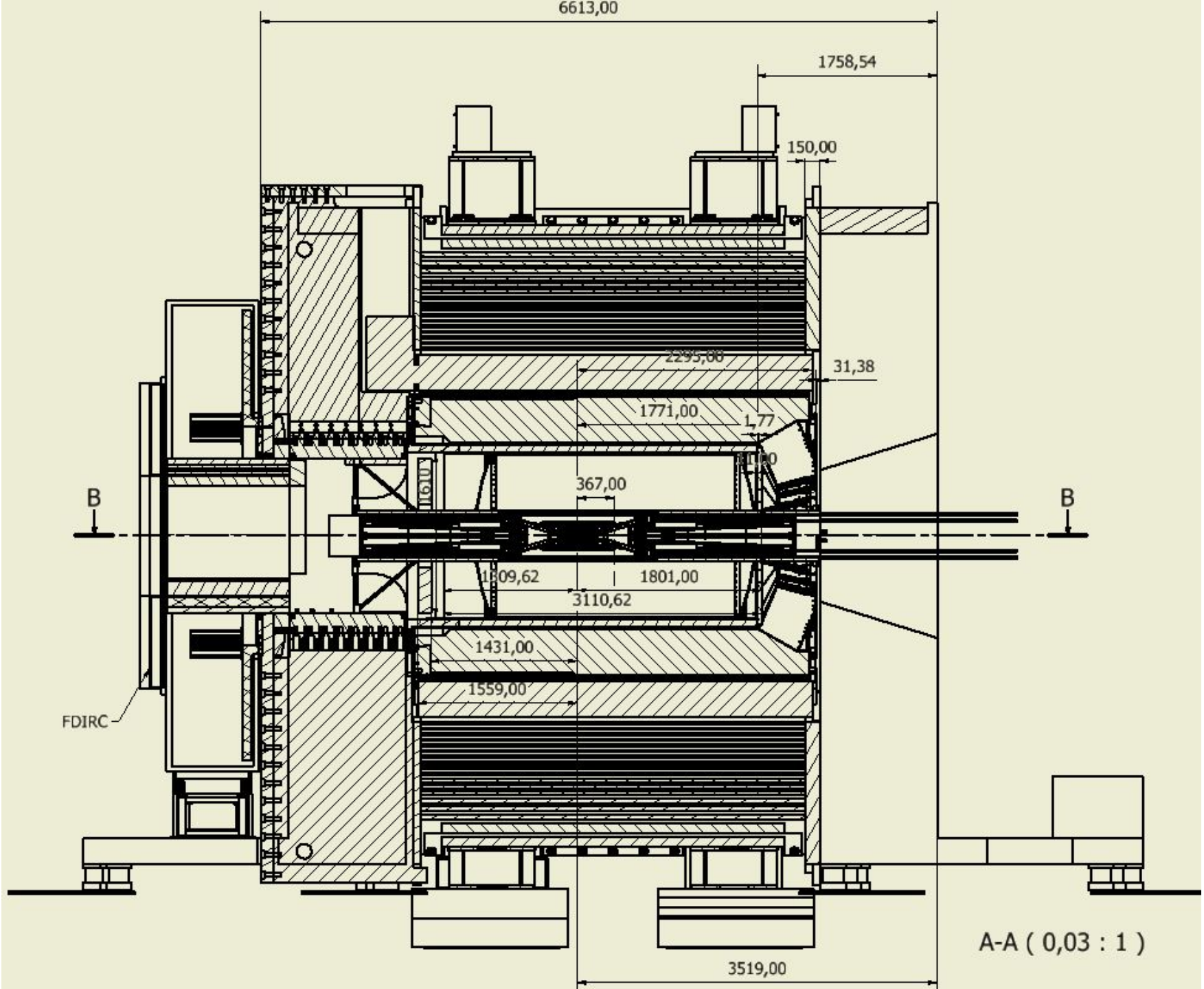
FWD Cal calibration system

Survey was made and inspection was made after the meeting

- Wire chamber supports






6613,00
1758,54
150,00
2295,00
31,38
1771,00
1,77
367,00
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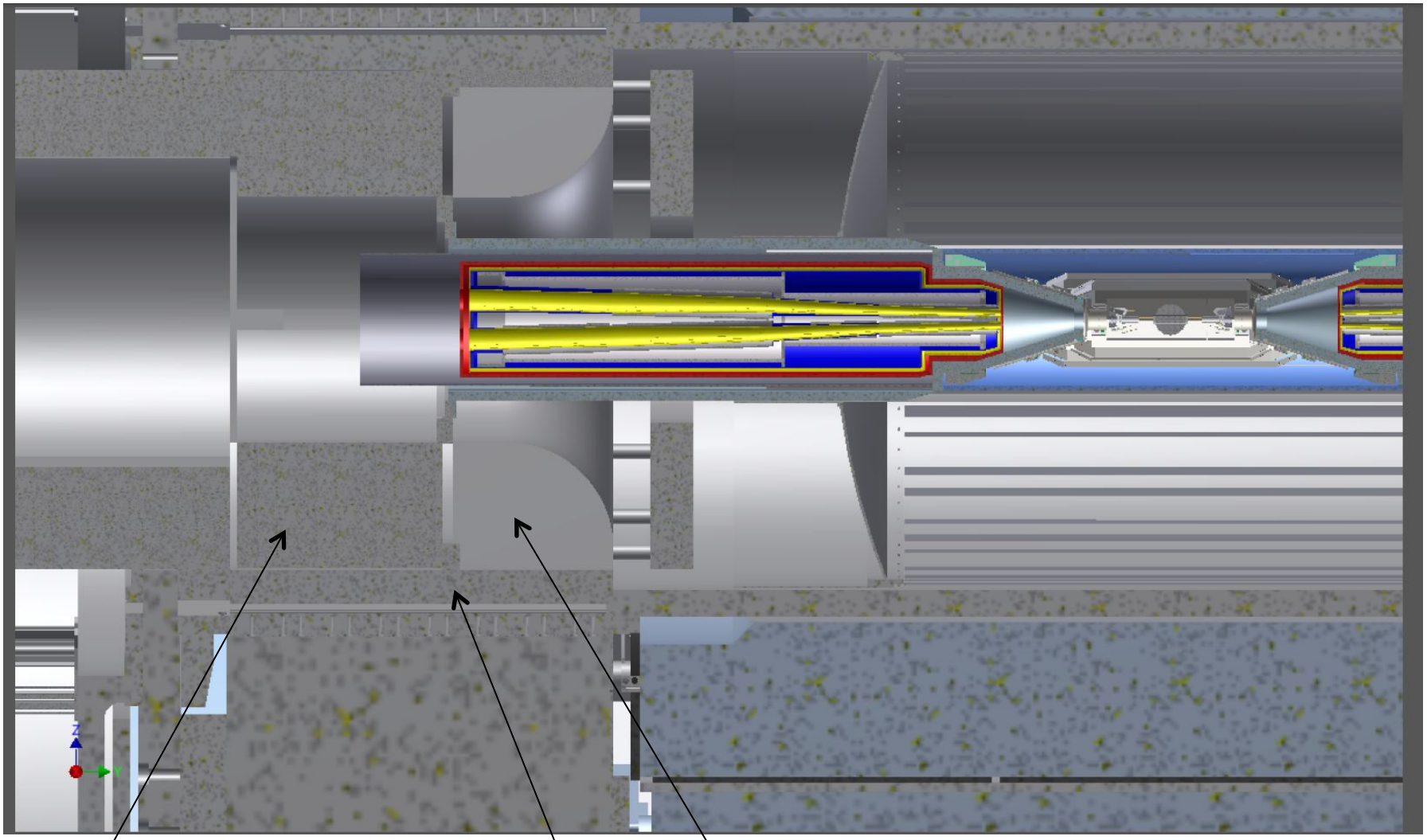
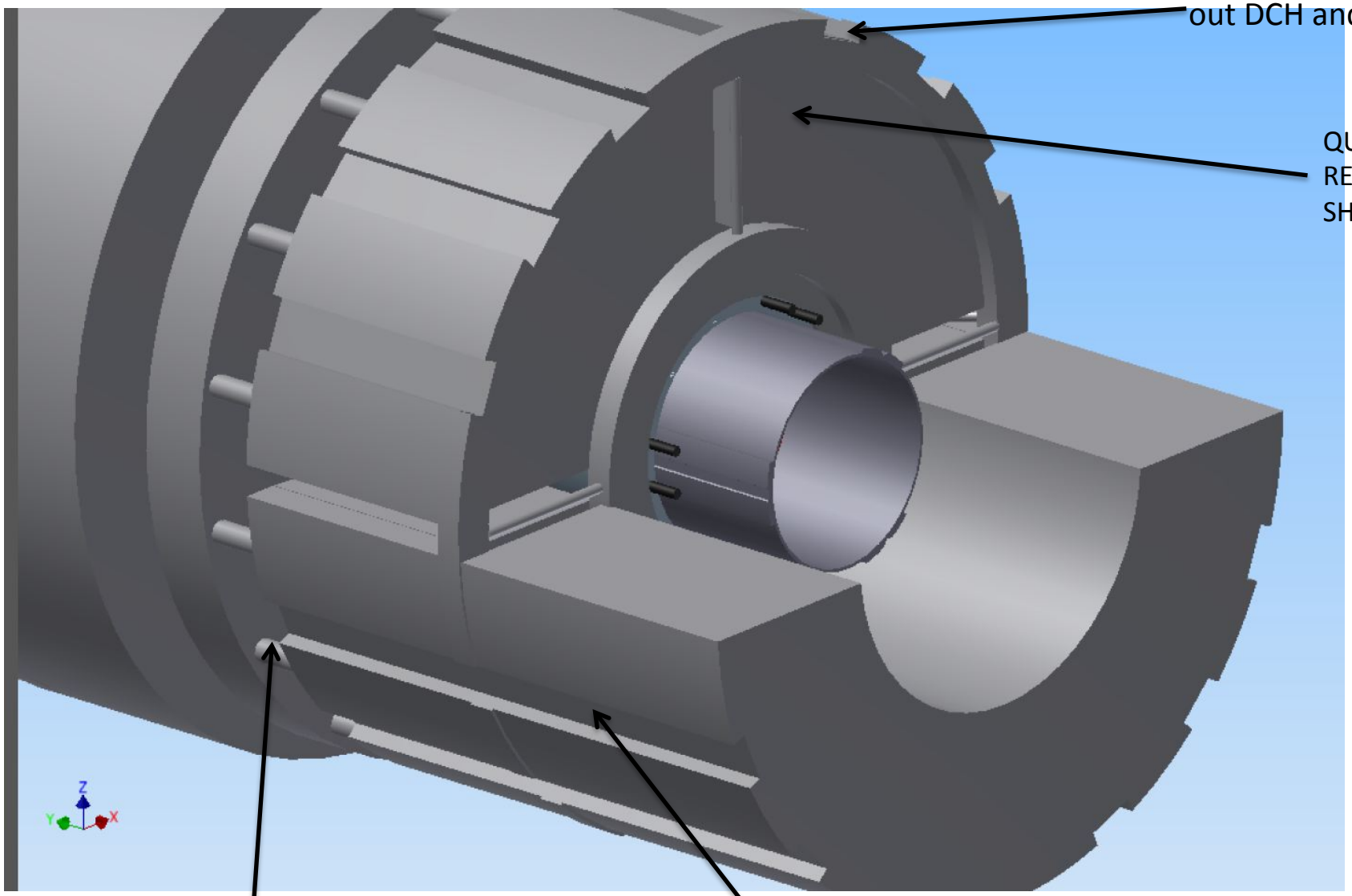
B
1809,62
1801,00
3110,62
1431,00
1559,00
FDIRC
3519,00
A-A (0,03 : 1)

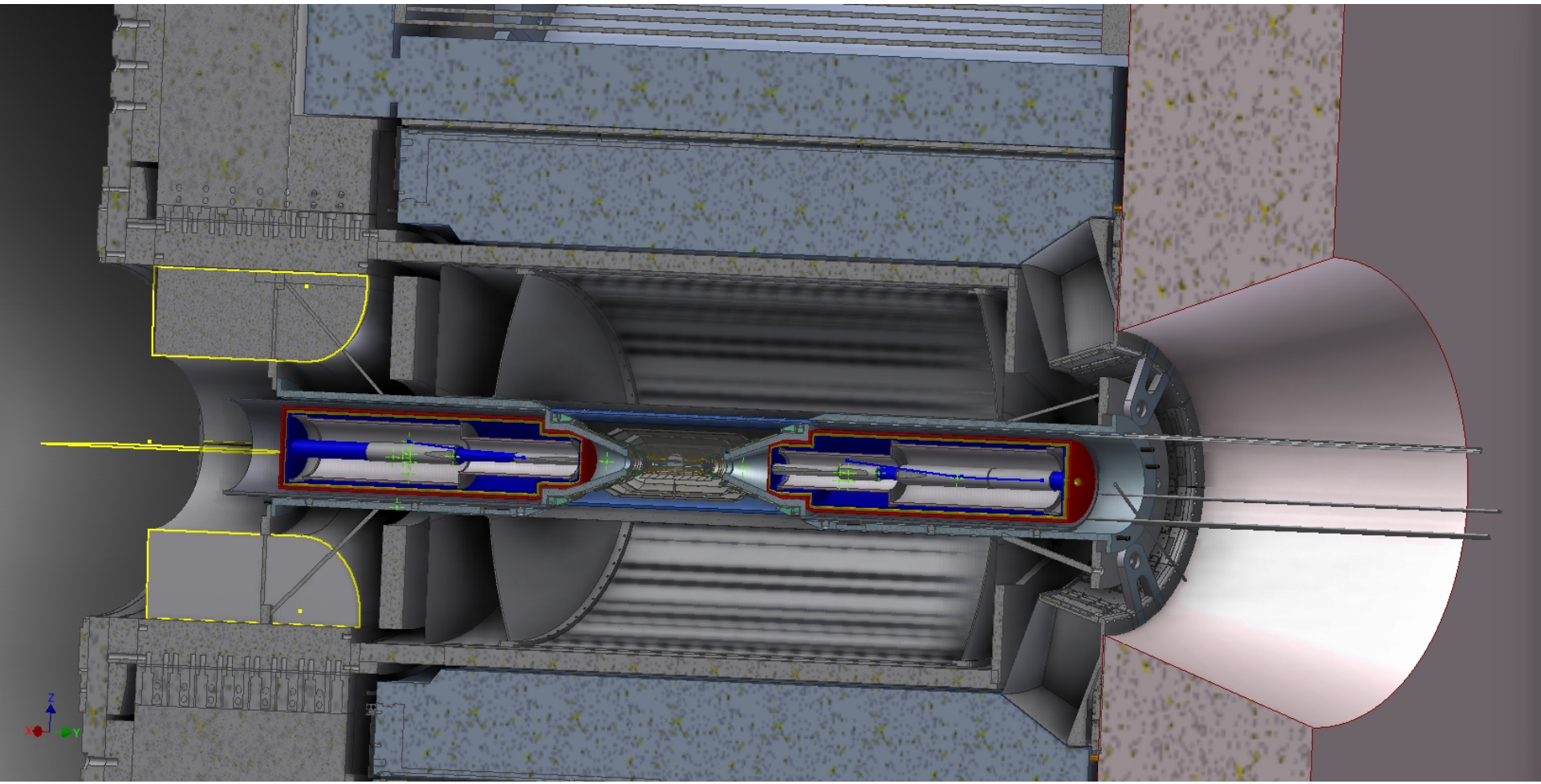
Supporting the SuperB detectors backward end

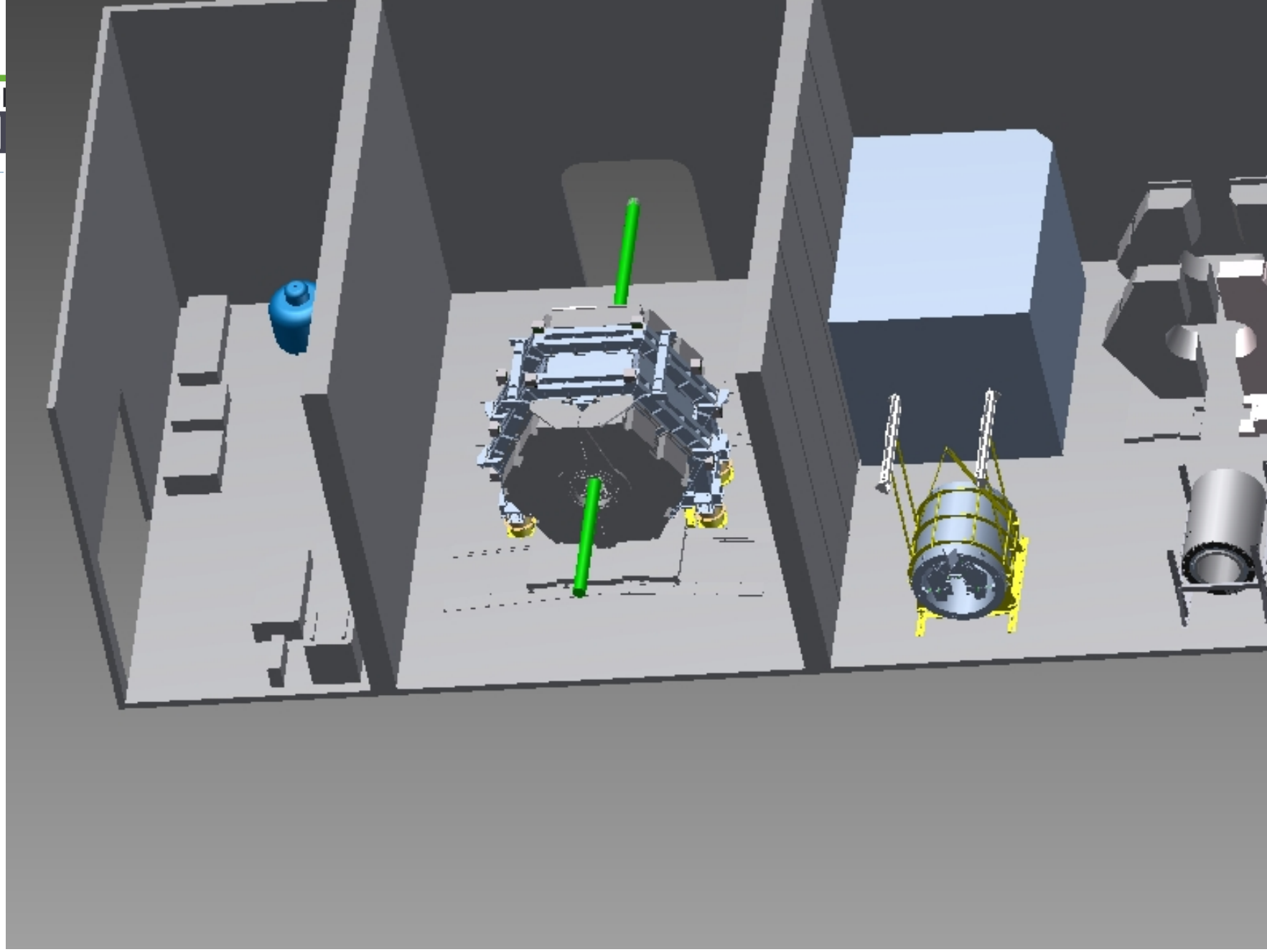


Supporting the SuperB detectors

Backward end







Interaction with accelerator team

- Need to be boosted, with more regular technical contact
- Large questions need to be addressed soon
  - IR Hall: dimensions, layout, services, power, cooling, cryo, etc.
  - Envelopes in Machine-Detector Interface. Strategies for mechanical integration between detector and machine
  - Commissioning strategy: the full 1.5T field **is** needed for machine commissioning. Big impact on detector assembly and commissioning strategy → being investigated
  - Overall schedule: need to start laying down the overall integrated schedule for accelerator and detector construction

Agenda

SuperB

All Plenary Sessions will be held in Aula G (Bldg B)

CABIBBOLAB
LABORATORIO NICOLA CABIBBO

SuperB Collaboration Meeting
Pisa University and INFN
September 19 - 22, 2012
AGENDA

Wednesday, September 19

8:30	**CLOSED MEETINGS**
250	Technical Board *(restricted)*
10:30	***Coffee Beak and Registration***
11:00	**CLOSED MEETINGS**
250	Technical Board *(restricted)*
13:00	***Lunch and Registration***
14:00	**PLENARY 1**
	Introduction and Status
10'	Welcome
20'	Meeting Goals *(M. Giorgi)*
20'	Physics *(A. Bevan)*
20'	Computing *(F. Bianchi)*
20'	Detector *(F. Forti)*
16:00	***Coffee Break and Registration***
16:30	**PARALLEL 1**
131	SVT
248	DCH
250	PID
230	EMC
133	IFR
241	17:30-19:30 - Ex Bd (restricted)
18:30	

Thursday, September 20

8:30	**PARALLEL 2**
131	SVT
248	DCH
250	PID
230	EMC
133	IFR
10:30	***Coffee Beak***
11:00	**PARALLEL 3**
131	SVT
248	DCH
250	PID
230	EMC
133	IFR
13:00	***Lunch***
14:00	**PARALLEL 4**
131	ETD 1
250	MDI/Backgrounds
230	COMP: R&D
16:00	***Lunch***
16:30	**PARALLEL 5**
250	MDI/Backgrounds
230	COMP: Distributed Comp
131	17:30-19:30 - COUNCIL
18:30	
	20:00 **Social Dinner**

Friday, September 21

8:30	**PARALLEL 6**
131	ETD 2
230	COMP + BKGND (Fullsim)
10:30	***Coffee Beak***
11:00	**PARALLEL 7**
131	ETD 3
250	Integration
13:00	***Lunch***
14:00	**PLENARY 2**
	Accel and Cabibbo Lab Status
30'	Accel Status *(A. Variola - phone)*
30'	Cabibbo Lab Status *(M. Giorgi)*
20'	Integr, Inst, IR Hall Summary
20'	MDI Summary
15'	Comp Summary
16:00	***Lunch***
16:30	**PLENARY 3**
	Summaries
15'	SVT
15'	DCH
15'	PID
15'	EMC
15'	IFR
15'	ETD
20'	Council and Exec Board Report
18:30	

Saturday, September 22

8:30	**CLOSED MEETINGS**
250	Technical Board TDR Editorial Board *(restricted)*
10:30	***Coffee Beak***
11:00	**CLOSED MEETINGS**
250	Technical Board TDR Editorial Board *(restricted)*
13:00	***Adjourn***
14:00	
16:00	***Adjourn***
16:30	
18:30	

DETECTOR TIMELINE CARTOON

Data Taking

Circulating Beams

Bkgnd/ Commissioning Detector

2017

Detector Commissioning

2016

IR Hall Available

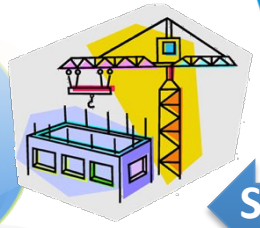
Detector Assembly

Start

2015

2014

Transp. of Babar pieces



Detector Procurement

Start

Start

Civil Construction

2013

MDI IR Hall Services

Design

Detector TDR

2012

CabibboLab