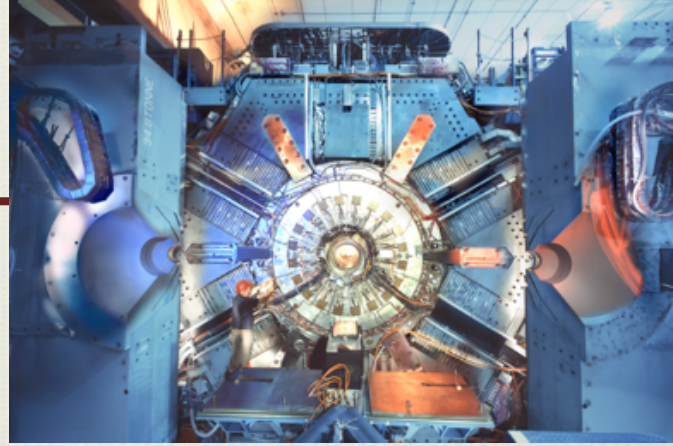
general introduction

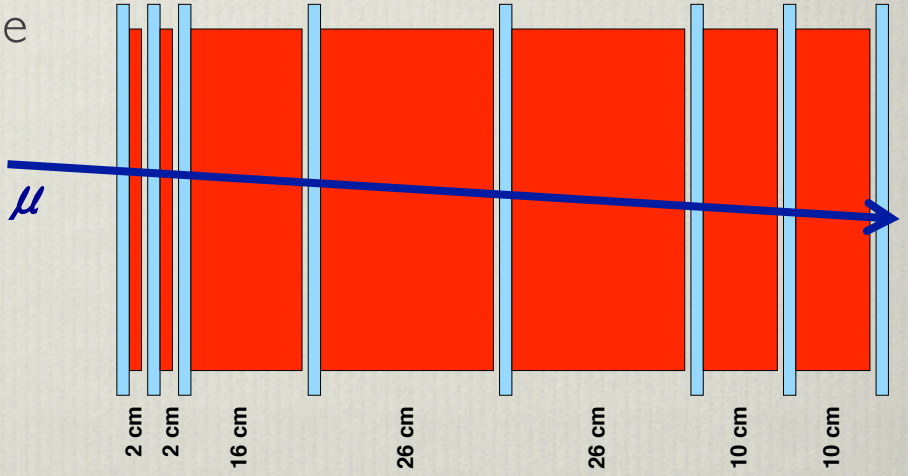
g. cibinetto

first SuperB collaboration meeting
London, Sep. 13-15 2011

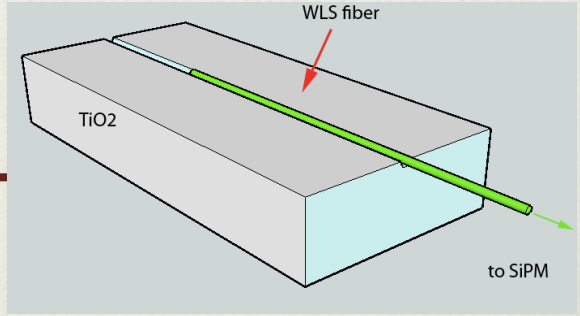
Introduction



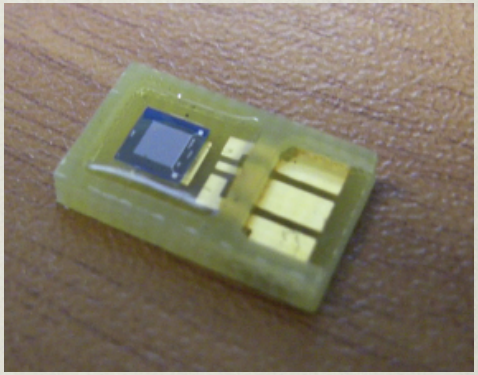
- Built in the magnet flux return, it will be composed by one hexagonal barrel and two endcaps
- Large active area
- Very high rates: hottest region up to few 100 Hz/cm^2
- Fine longitudinal segmentation in front of the stack for K_L ID capability (together with the electromagnetic calorimeter)
- Plan to reuse BaBar iron structure: some mechanical constraint (gap dimensions, amount of iron, accessibility, …)
- Use of 8-9 active layers



Detection technique



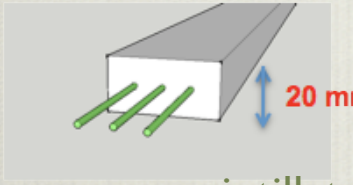
- **Scintillator:**
  - 2x4x400 cm^3 and 1x4x400 cm^3 scintillator bars
  - coated with TiO2
  - Light collection through WLS fibersFibers housed in embedded holes or grooves.
  - Made by FNAL NICADD facility.
- **WLS fibers:**
  - ϕ = 1.0 mm type Y11(300) (Kuraray)
  - ϕ =1.2mm type BCF92 (Saint Gobain)
  - Attenuation length λ ≈ 3.5m
  - trapping efficiency ε ≈ 5.5%



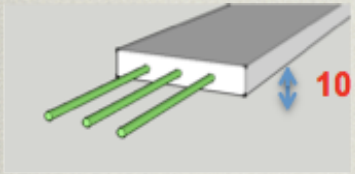
- **Photodetectors:**
  - Silicon Photo Multiplier (FBK-IRST)
  - Gain $>10^5$
  - < 1ns risetime
  - Low bias voltage (≈35V)
  - Dark current rate @ room temperature, ≈MHz @ 1.5 phe, few 100kHz @ 2.5 phe, few 10KHz @ 3.5 p.e.

Timing and Binary readout

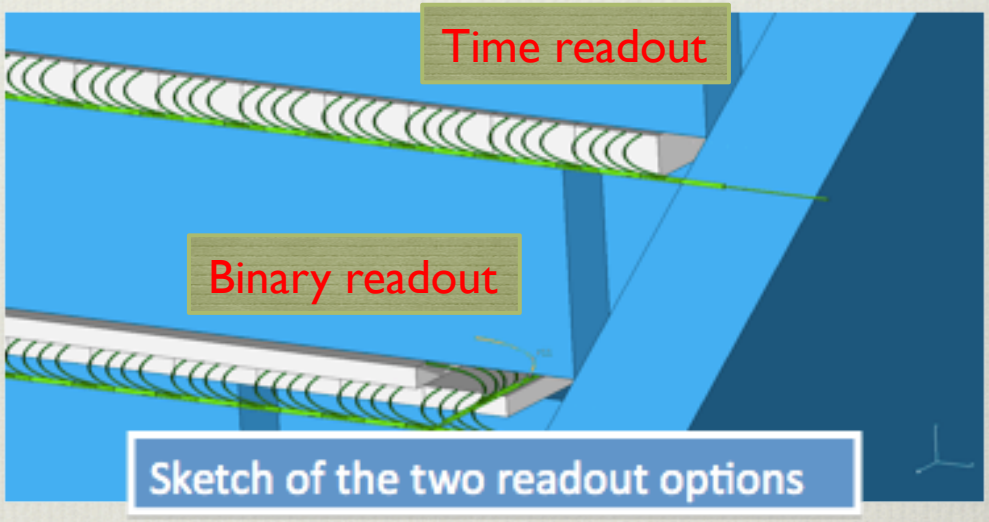
- Timing readout (Barrel): azimuthal coord ϕ measured from the hit bar, polar coord θ from the arrival time of the signal (read on both ends)



scintillator for Time Readout

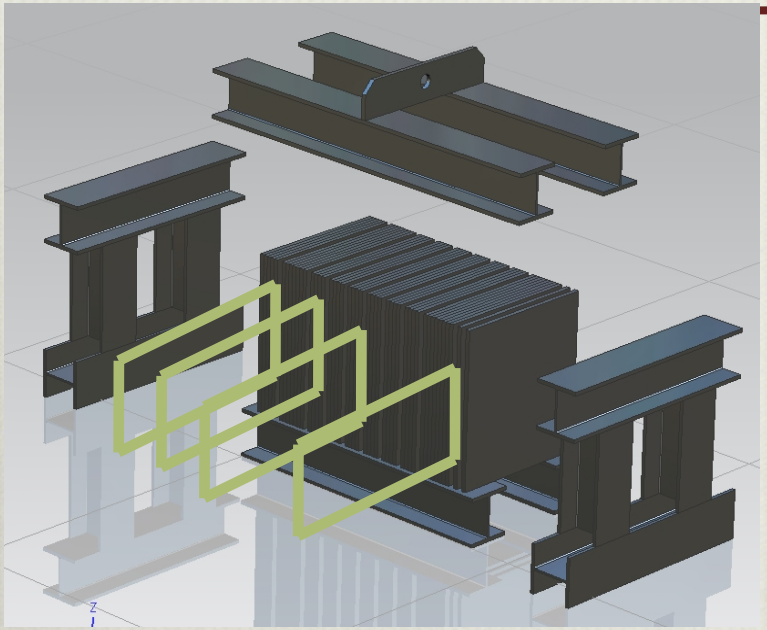


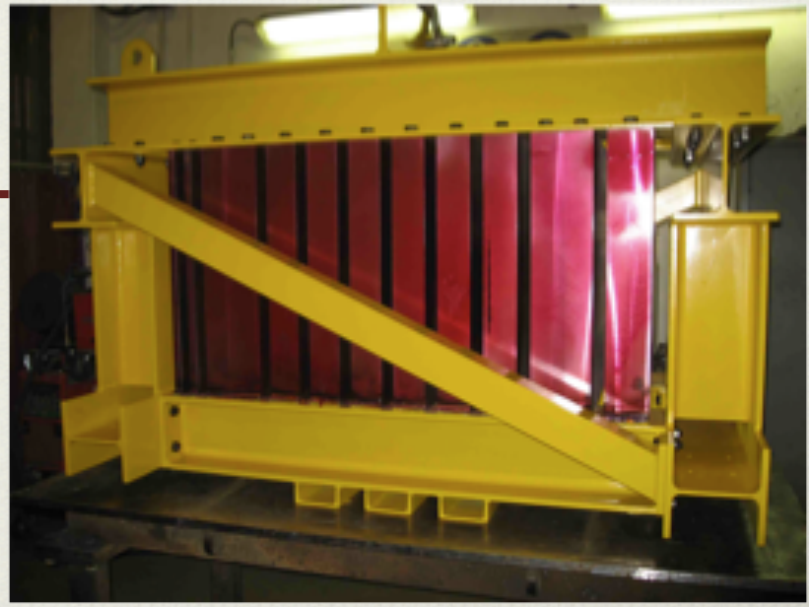
scintillator for Binary Readout



- Double coord binary readout (Endcaps): two layers of orthogonal scintillating bars provide directly the ϕ and θ coordinates (read each bar on one side only).

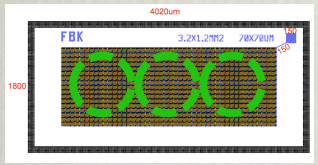
Prototype in a nutshell

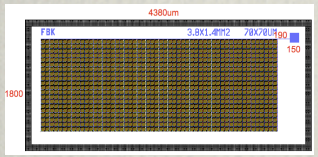


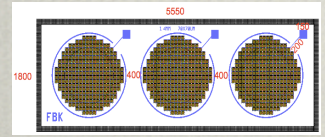


- Iron: 60x60x92 cm^3 , 3cm gaps for the active layers

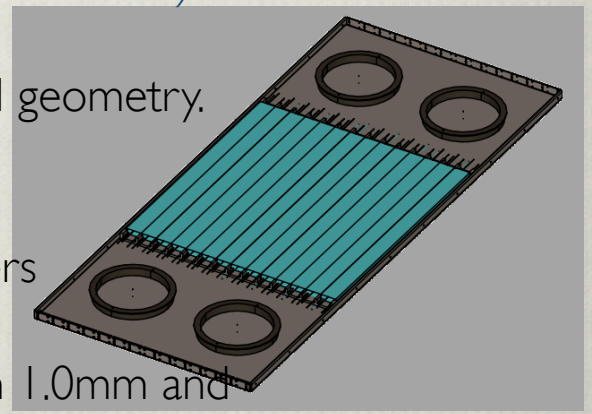
- Readout 9 active layers
  - 4 Layers Time readout (TDC-RO): 112 channels
  - 5 Layers Binary Readout (BiRo) 125 channels







Active layers housed in light tightened boxes (aka Pizza Box)

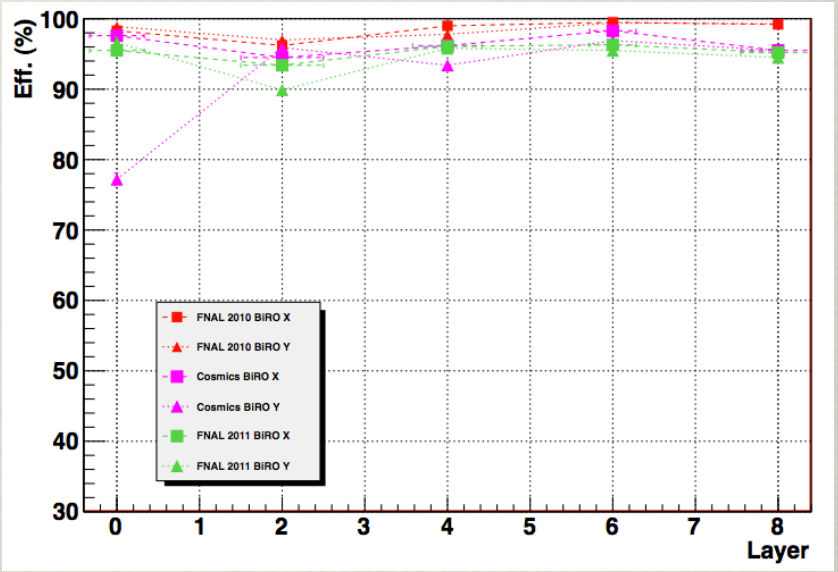


4 special modules to study different fibers or SiPM geometry.
Three types of SiPM with different geometry to be tested:

- 1.2x3.2 mm^2 to be coupled to 1.0mm fibers
- 1.4x3.8 mm^2 for 1.2mm fibers
- array of 3 round sensors: f=1.4mm for both 1.0mm and 1.2 mm fibers

Activities since last meeting

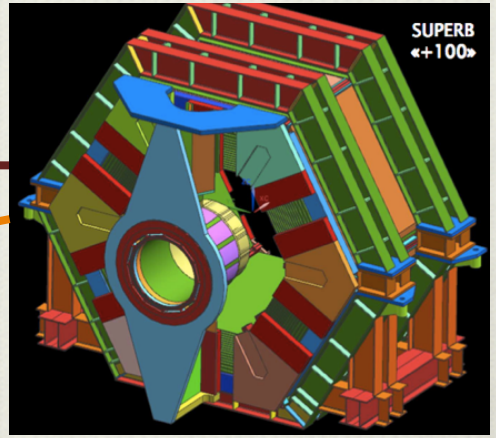
- A second beam test has been done in July with an improved setup.
  - More compact apparatus
  - Time of Flight information added
  - Temperature controlled environment
  - …



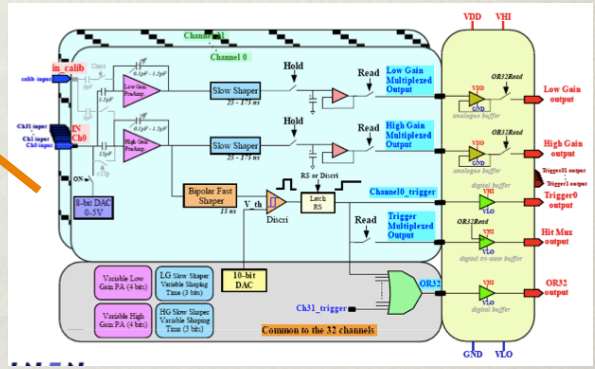
- Data analysis is moving forward
- Prototype performances of the July test confirms the results found during the December beam test and cosmic runs.

Other IFR activities

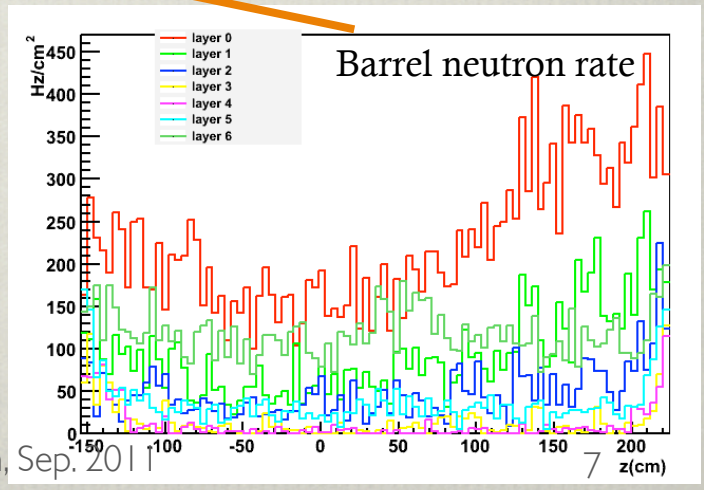
- Mechanics: Finite Element Analysis of the iron structure ongoing, news from BaBar D&D



- Electronics: continue exploiting the SiPM readout ASICS from Orsay OMEGA group.



- Background Simulation: evaluation of SiPM and Front End electronics radiation doses and impact of the background on the reconstruction.

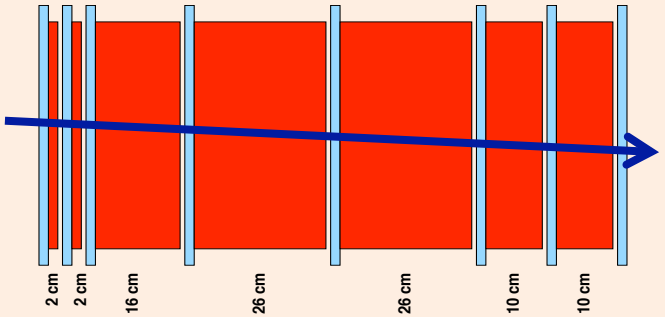


- TDR preparation: IFR outline structure and page count done.

Path toward the TDR

- Few core technical decisions need to be made for the TDR
  - Amount of iron (and its segmentation)
  - Number of active layers (8 vs 9)
  - Position of the SiPM in the barrel

Driven by cost and performance.

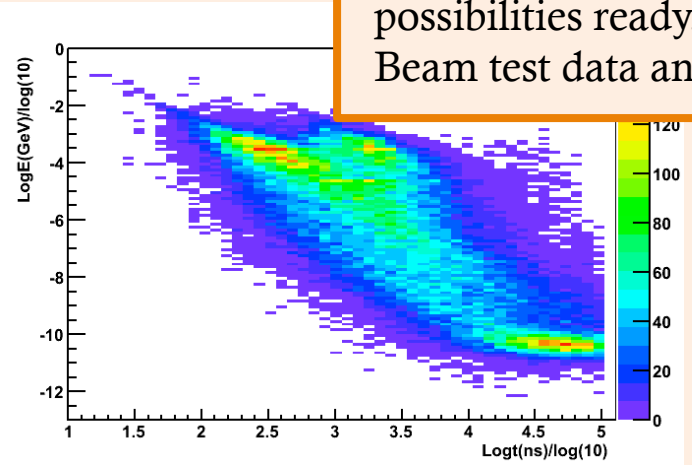


Rough cost and mechanical evaluation of different possibilities ready.
Beam test data analysis ongoing.

Mainly driven by machine background.

Simulation studies are in progress to find the best place and for shielding development.

New SiPM irradiation tests with and without shielding need to be planned.



- In addition we have to formally drop the time readout option

Goal for this meeting (I)

- Review beam test experience and data analysis results
  - experimental setup
  - detection performances
  - muon ID capability
  - other issues
- Review advancements and status of all other areas
  - mechanics (D&D, flux return and detector)
  - electronics
  - background simulation
  - overall detector design

Goal for this meeting (II):TDR planning

- We have to provide a recommendation for the iron structure (based on prototype and simulation analysis, but with impact on mechanics and cost).
- We have to take some decision about the detector
  - scintillator bars, fibers, SiPM design
  - readout options
  - SiPM position
- We have to provide a complete description of the system in terms of
  - mechanics
  - electronics
  - performances
  - schedule, costs and manpower

From my introduction at the last meeting

TDR timing

- The TDR due date is continuously moving forward (now is ~1 year from now), but we cannot rely on that: we need to take action as soon as possible. Not in terms of writing but in terms of planning.

- TDR table of contents should be prepared.

- We need to evaluate the status of each section (in terms of missing information, work to be done, schedule and people involved) and set a list of action items to complete it.

TDR timing

- The TDR due date is continuously moving forward (now is ~1 year from now), but we cannot rely on that: we need to take action as soon as possible. Not in terms of writing but in terms of planning.

now a fist draft should be ready by the end of the year, and the final version by early next spring.

- TDR table of contents ~~should be~~ has been prepared.

- We need to evaluate the status of each section (in terms of missing information, work to be done, schedule and people involved) and set a list of action items to complete it.

One hour of discussion has been scheduled in the last session

IFR TDR (I)

Section	number of pages
x.1 Physics Requirements and Performance Goals	(3 or 4)
x.2 Detector Overview	
x.2.1 The Absorber Structure	(2)
x.2.2 The Active Detector Choice	(1)
x.3 Backgrounds	(3 or 4)
x.4 Identification Performances	
x.4.1 Muon Detection	(4)
x.4.2 KL Detection	(3)
x.5 Detector R&D	
x.5.1 Module Tests and Results	(3)
x.5.2 Prototype Test and Results	(4 or 5)

IFR TDR (II)

Section	number of pages
x.6 Baseline Detector Design	
x.6.1 System Layout	(4 o 5)
x.6.2 Chamber Construction and Assembly	(3)
x.7 Front-End Electronics	
x.7.1 General Overview	(1)
x.7.2 Photodetectors and PCBs	(3)
x.8 Final Assembly and Installation	(1 or 2)
Total	34/39 pages

IFR sessions

11:00	General Overview (10')	Gianluigi Cibinetto (*FE*)
11:15	Flux Return D&D and design (20')	Massimo Benettoni (*PD*)
11:40	Status of electronics and SiPM readout ASICS test (20')	Angelo Cotta Ramusino (*FE*)
12:05	SiPM test in Krakow (20')	Wojtek Kucewicz (*Krakow*)

14:00	The Beam Test at Fermilab: data taking and future plans (20')	Wander Baldini (*FE*)
14:20	Beam test experience and results (20')	Gianluigi Cibinetto (*FE*)
14:40	Prototype performance analysis (15')	Jarek Wiechczynski (*Krakow*)
14:55	Beam test data analysis (20')	Marcello Rotondo (*PD*)
15:15	Discussion and plans for next beam tests (15')	

16:00	Background simulation studies (20')	Valentina Santoro (*FE*)
16:20	TDR preparation (1h00')	