General Overview

G. Cibinetto
University of Ferrara - INFN

Super B workshp - Orsay 15-18 Feb 2009

Outline

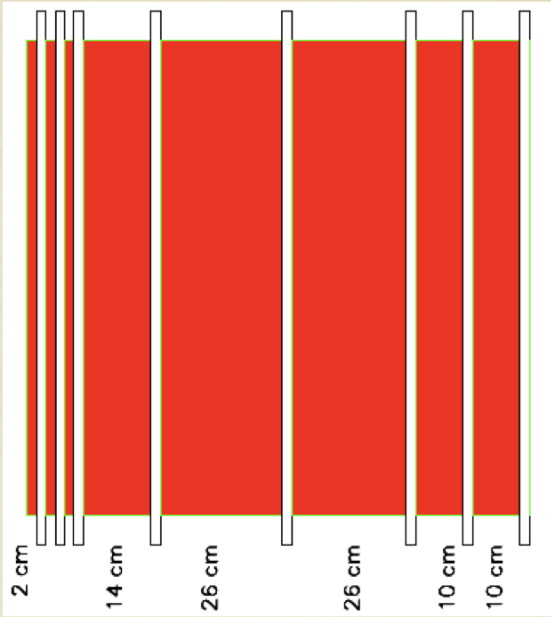
- Introduction to the IFR
- Ongoing activities
- What's new
- Goal for the meeting and plans for the TDR
- Other IFR contributions

The IFR baseline design

- The muon and K_L detector is build in the magnet flux return.
- It will be composed by one hexagonal barrel and 2 endcaps like in Babar.
- Plan to reuse BaBar iron structure
- Add iron to BaBar stack to improve μ ID:

  ➔ 7-8 detection layers should be enough

- Keep longitudinal segmentation in front of stack to retain K_L ID capability.



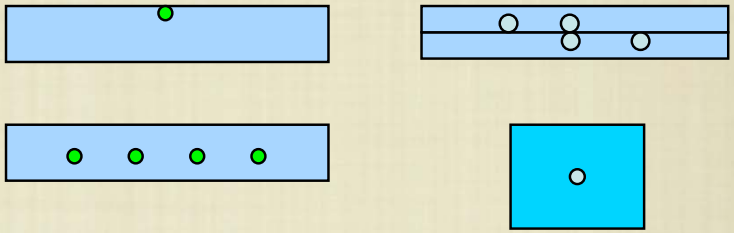
A possible (not optimized) configuration

Need to optimize:

- Scintillation bars geometry
- Number of active layers
- Where and how much iron we need to add

The scintillator bars

- In contact with FNAL-NICADD facility
- Various candidates:



- We have some spares from Minos and Itasca company that we are using for R&D
- In a second stage of the R&D we'll have to make our own prototype.

The WLS fiber

- Baseline: Kuraray Y11-175 Φ=1.0 mm, round, double cladding
  - Trapping efficiency = 5.4%
  - Attenuation Length ~ 3.5m
  - Emission peak: 476 nm
- Possible alternatives:
  - Different diameter/dopant concentration: increase the light yield
  - Square shape: higher trapping efficiency (~+30%)
  - Bicron BCF-92 fibers (round multiclad):
    - Trapping efficiency = 5.6%
    - Attenuation Length ~ 3.5m
    - Emission peak: 492 nm
    - Decay time: 2.7 ns (Y11-200 is ≈10ns), faster → better time resolution

Fiber readout

- Geiger mode APDs: MPPC (Hamamatsu), SiPM (FBK- IRST)
  - G >10^5
  - DE ≈ 40% (530nm) (DE = Q.E x Fill factor x Aval. prob.)
  - ~ 1ns risetime
  - ≈ 10 times less sensitive to V and T variations
  - Low bias voltage (50-70V)
  - Dark current rate @ room temperature : 100s of kHz thr = 0.5 phe; few kHz if thr = 1.5 phe

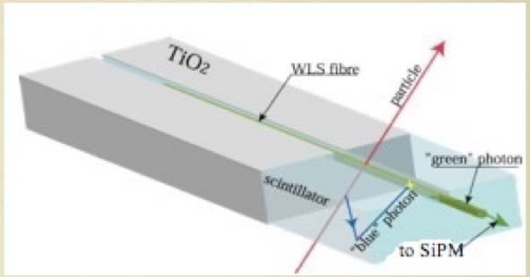
$$\begin{cases} \frac{\Delta G}{G} = 7 \cdot \frac{\Delta V}{V} \\ \frac{\Delta G}{G} = 1.3 \cdot \frac{\Delta T}{T} \end{cases}$$

- APD:
  - For BaBar R&D was considered the model RMD #S0223:
    - G>1000
    - QE=65% (>530 nm)
    - 5ns risetime
    - High bias voltage (1850V) → difficult to stabilize
    - G very sensitive to V and T variations
  - Hamamatsu APDs have lower gain (few 100), bias voltage 400- 500 V

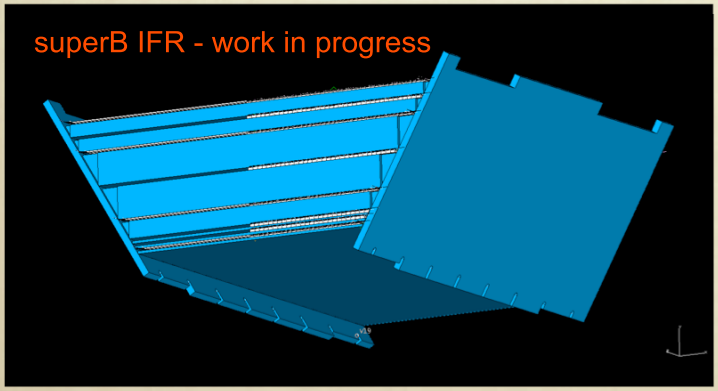
$$\begin{cases} \frac{\Delta G}{G} = 75 \cdot \frac{\Delta V}{V} \\ \frac{\Delta G}{G} = 17 \cdot \frac{\Delta T}{T} \end{cases}$$

Ongoing activities

- Detector R&D:
  - efficiency and time resolution studies with more (Φ=1mm for the moment) fibers per scintillator, with 2x2 mm^2 SiPM
  - Optimization of mechanical coupling: WLS/clear fibers and fiber/photodetectors
  - 1.2mm and clear fibers ordered, expected end February
  - Hamamatsu MPPC Array 1x4 1x1 mm^2 and 3x3 mm^2 ordered



- FE electronics:
  - Optimization of FE amplifiers: gain x BandWidth and noise studies



- Detector and background simulation
  - absorber optimization
  - reuse of BaBar flux return
- Detector Design/Mechanics
  - Study of the detector layout
  - Study of the Prototype layout

What's new

- SiPM/MPPC aging tests appeared in literature indicate that neutron irradiation can be and issue.
- Waiting for simulations, in the worst case scenario we have to bring all the photodetectors out of the detector:

4m of WLS + 10m of clear fibers

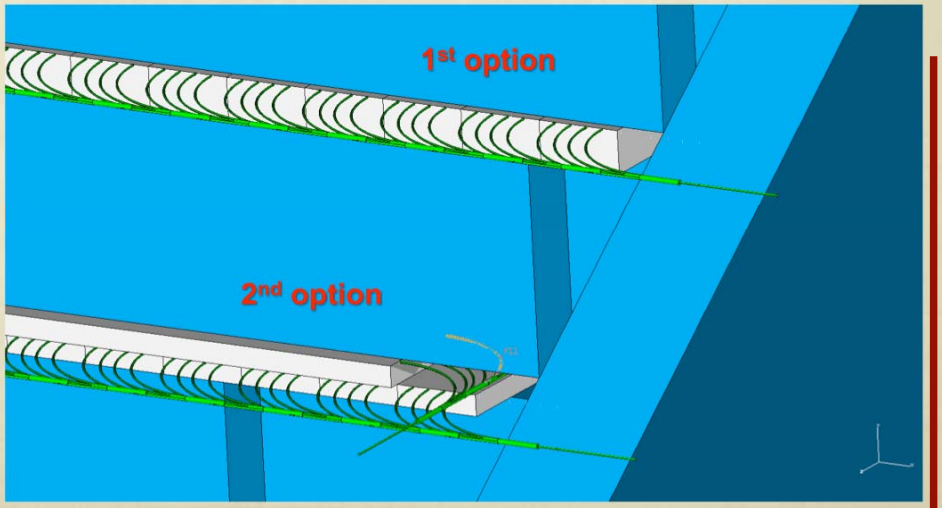
Reduction of factor ~3 in number of p.e. to be recovered, keeping the same time resolution

4 fibers/scintill-bar on 2x2 mm^2 SiPM (or array of 4 1x1 mm^2 MPPC)

1.2mm fibers (ordered from Kuraray , expected end Feb.)

1.5mm clear fibers (ordered from Kuraray , expected end Feb.)

Coupling WLS/clear fiber



- As 2-nd option we are considering also the "double coord layout": orthogonal scintillator bars, 1cm thick (mechanically rather complicated)

Priorities

- Many steps ahead have been done since the Elba meeting in R&D, simulation and detector design.
- Some critical questions are still pending:
  - How to optimize the detector
  - Neutron rate and SiPM aging
  - Re-use of BaBar iron
  - other?
- Don’t need an answer right now, but we need to know when and how an answer will be given.

Goal for this meeting

- Review he status of the different activities and manpower needs.
- Identify the top priorities:
  - what / who / when
- Detailed planning of the prototype design and construction activities.
- All in all: TDR phase preparation.

Road to the TDR (I)

- Construction and test of a prototype to measure/confirm performances
- Final layout of the single detector module: scintill + WLS FIBER + photodetector based on R&D and prototype test results
  - Number of fibers per scint. bar
  - Kuraray / Saint-Gobain and diameter
  - Type of photodetectors : SiPM or MPPC, active surface dimensions
- Mechanics
  - understand if we will reuse the Babar flux return or we need to build a new one
  - module layout and assembling
- Development and test of the Front End Electronics:
  - amplifier
  - discriminators
  - TDC

Road to the TDR (II)

- Simulation
  - improve IFR description
  - optimize iron, and scintillator
  - provide PID and (maybe) other tools
  - study the background sources and their impact on the detector

The IFR group

- At the present:
  - Ferrara INFN-University
  - Padova INFN-University
  - Roma1 INFN-University

Other institutions showed interest in joining the enterprise: wait for the Italian government approval.

Additional forces would be very helpful, in particular in the area of simulation

After this talk

09:00->*10:30* Parallel II - IFR (Convener: Roberto Calabrese (*FE*))
Description:
Location: SALLE 166

09:00	General Overview (15')	Gianluigi Cibinetto (*Ferrara University*)
09:20	Mechanical Design (15')	Vito Carassiti (*INFN Ferrara*)
09:40	Electronics Design (15')	Roberto Malaguti (*INFN Ferrara*)
10:00	Fast simulation status (15')	Marcello Rotondo (*INFN Padova*)
10:15	Full simulation status (10')	Mauro Munerato (*Ferrara University*)

11:00->*12:30* Parallel III - IFR (Convener: Roberto Calabrese (*FE*))
Description:
Location: Salle 166 - Bdlg 200

11:00	IFR R&D Status in Ferrara (25')	Wander Baldini (*INFN Ferrara*)
11:30	IFR R&D Status in Padova (15')	Flavio Dal Corso (*INFN Padova*)

What to do this afternoon...

14:00->*15:30* Parallel IV -Computing: fast simulation (Convener: Matteo Rama (*LNF*) , David Brown (*Lawrence Berkeley National Lab*))
Description:
Location: Salle 129 - Bldg 200

14:00	PacTrk overview (15')	David Brown (*Lawrence Berkeley National Lab*)
14:15	Hit confusion (15') (Slides)	Doug Roberts (*U. Maryland*)
14:30	EMC (15')	Chih-hsiang Cheng (*Caltech*)
14:45	IFR (05')	marcello rotondo (*INFN Padova*)
14:50	Update of DIRC simulation (10')	Brian Meadows (*University of Cincinnati*)
15:00	Aerogel PID (10')	Evgeniy Kravchenko (*Budker INP*)
15:10	TOF PID (05')	NICOLAS ARNAUD (*LAL ORSAY CNRS-IN2P3*)

AND LATER

16:00->*19:00* Parallel V - detector electronics (Convener: Dominique Breton (*LAL Orsay*) , Umberto Marconi (*INFN*))
Description:
Location: AUDITORIUM - Bldg 200

16:00	Modelisation of SuperB Front-End Electronics (15')	Dominique Breton, Jihane Maalmi (LAL)
16:15	A simple and convenient tool for behavioral simulation (15')	Sergio Cavaliere (INFN-NA)
16:30	Defining high speed serial links for SuperB (15')	A. Aloisio, R. Giordano (Napoli)
16:45	SVT front-end electronics (15')	Mauro Villa (INFN-BO)
17:00	Calorimeter front-end electronics (15')	Martin Kocian
17:15	IFR front-end electronics (15')	Roberto Malaguti (INFN Ferrara)
17:30	Ongoing R&D in Orsay	
17:45	R&D for PID front-end	

16:00->*17:30* Parallel V - Computing: Full Simulation (Convener: Fabrizio Bianchi (*TO*) , Eugenio Paoloni (*PI*))
Description:
Location: Salle 129 - Bldg 200

16:00	Core development of Full Simulation (20')	A. Di Simone (*Roma II*)
16:20	Status of Backround simulation (20')	E. Paoloni (*Pisa*)
16:40	Status and requirements from Subdetectors (20')	Subdetector representatives
17:00	Plans of future works (30')	

16:00->*18:30* Parallel V - detector geometry group (Convener: Achille Stocchi (*LAL*) , Matteo Rama (*LNF*))
Description:
Location: Salle 166 - Bldg 200

16:00	SVT studies (10')	Nicola Neri (*Universita' di Pisa & INFN*)
16:10	study of deltaT in B->Kspi0 (10')	Gabriele Simi (*UMD College Park, MD*)
16:20	study of B and D vertexing (10')	Aritoki Suzuki (*Lawrence Berkeley National Laboratory*)
16:30	mu/pi separation using TOF in DIRC (10')	Brian Meadows (*University of Cincinnati*)
16:40	physics case of forw. PID (20')	Achille Stocchi, Leonid Burmistrov (*LAL*)
17:00	Breco in FastSim. Impact of PID (15')	Elisa Manoni (*PG*)
17:15	endcap EMC - plans (20')	Chih-hsiang Cheng (*Caltech*) , Elisa Manoni (*PG*)
17:35	IFR optimization strategy (10')	Gianluigi Cibinetto (*FE*) , marcello rotondo (*INFN Padova*)
17:45	AFit (15') (Minutes; Slides)	Adrian Bevan (*Queen Mary, U. London*)

Open issues

- How to perform the geometry optimization
- reuse babar flux
- neutron rate
- double view -vs- single view readout
- manpower for simulation
- something like cylindrical RPC