

GENERAL OVERVIEW

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SUPER B WORKSHOP - FRASCATI 1-4 DEC 2009

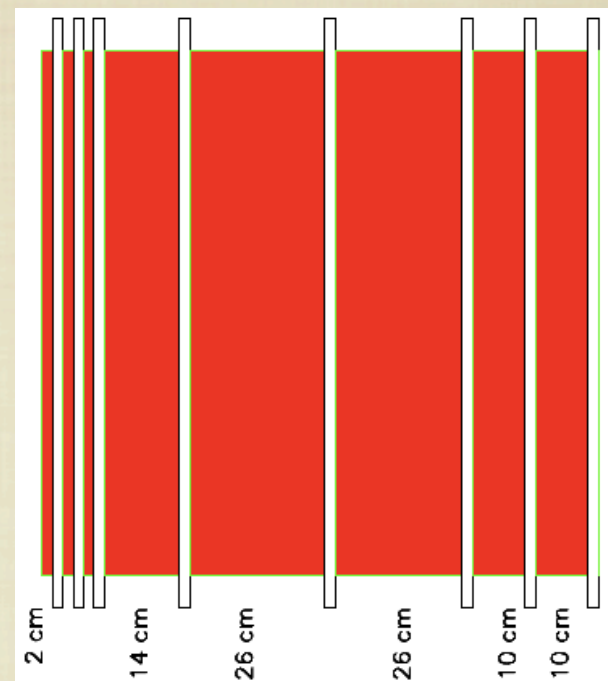
OUTLINE

- Introduction to the IFR
- News since Perugia workshop
- Ongoing activities
- Goal for the meeting and plans for the TDR
- Other IFR contributions

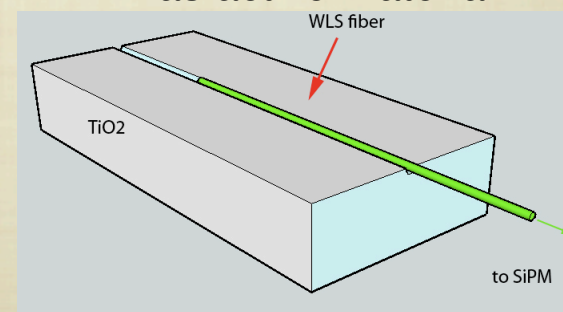
THE IFR BASELINE DESIGN

- 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



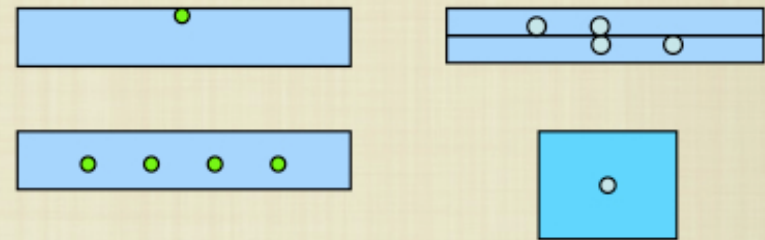
MINOS like scintillators as active material



THE SCINTILLATOR BARS

We tested some different layouts
made by the FNAL-NICADD facility

more R&D results will be shown in
Wander's talk



We will order soon our own layout for the prototype!!!

THE WLS FIBERS

- Kuraray Y11-175 $f=1.2\text{mm}$, round, double cladding
 - Trapping efficiency = 5.4%
Better light yield
 - Attenuation length $\sim 3.5\text{m}$
Worst time resolution
 - Emission peak: 476nm
Good for binary readout
- Bicron BCF-92 $f=1\text{mm}$, round, multiclad
 - Trapping efficiency = 5.6%
Better time resolution
 - Attenuation length $\sim 3.5\text{m}$
Worst light yield
 - Emission peak 492 nm
Good for TDC readout
 - Decay time 2.7 ns (Y11-200 $\sim 10\text{ns}$)

THE PHOTODETECTORS

- Geiger mode APDs: MPPC (Hamamatsu), SiPM (FBK-IRST)

- $G > 10^5$

- DE \approx 40% (530nm) (DE = Q.E x Fill factor x Aval. prob.)

- \sim 1ns risetime

- \approx 10 times less sensitive to V and T variations w.r.t. APDs

- Low bias voltage (50-70V)

- Dark current rate @ room temperature : $\left\{ \begin{array}{l} 100\text{s of kHz thr} = 0.5 \text{ phe} \\ \text{few kHz if thr} = 1.5 \text{ phe} \end{array} \right.$

$$\left\{ \begin{array}{l} \frac{\Delta G}{G} = 7 \cdot \frac{\Delta V}{V} \\ \frac{\Delta G}{G} = 1.3 \cdot \frac{\Delta T}{T} \end{array} \right.$$

MPPC higher gain and Q.E. - SiPM better time resolution

SiPMs have notable differences from device to device: need careful characterization for the prototype and detector



is

THE NEUTRON ISSUE

- SiPM/MPPC aging tests appeared in literature indicate that neutron irradiation can be an issue.

See IFR session at Perugia meeting



- 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 12 in number of p.e. to be recovered, keeping the same time resolution

4 fibers/scintill-bar on $2 \times 2 \text{ mm}^2$ SiPM (or array of $4 \times 1 \text{ mm}^2$ MPPC)

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

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

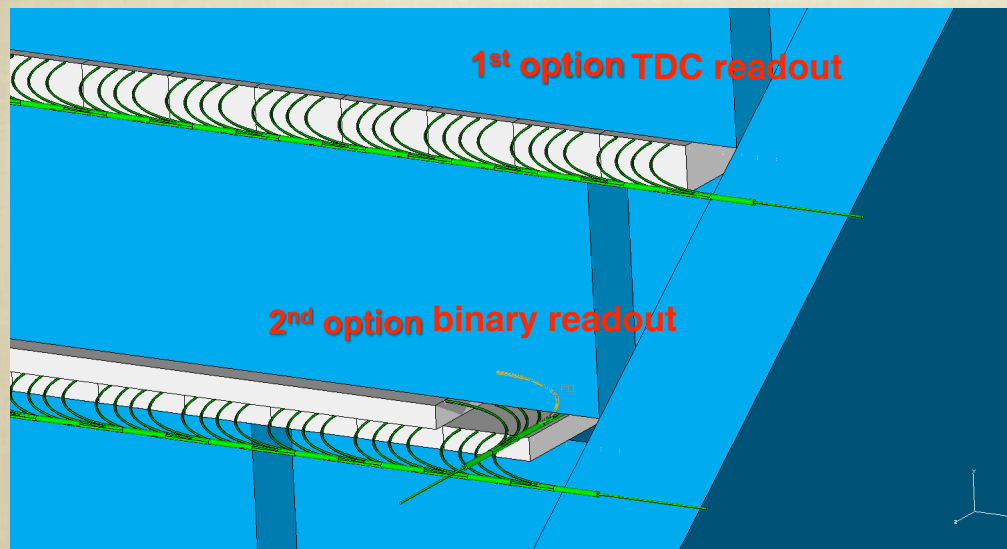
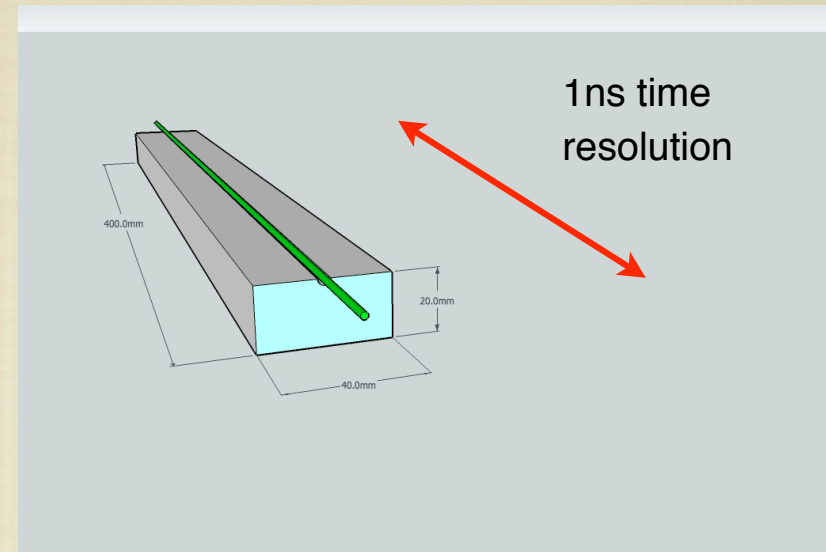
Coupling WLS/clear fiber

NOT feasible
see Wander's talk at Perugia meeting

we are addressing this with simulation these days and we'll have a meeting on Wednesday to plan for future irradiation tests

READOUT OPTIONS

- Baseline for the Barrel readout: read one coordinate with the bar position and the other with the arrival time of the signal
 - Need a time resolution ~ 1 ns to have ~ 20 cm
 - Read 2 coordinates with the same bar
 - Time distribution helps reducing the SiPM noise



- As baseline for the endcaps we consider the “double coord layout”: orthogonal scintillator bars, 1 cm thick.
 - binary readout (but better spatial resolution)
 - would be mechanically rather complicated for the barrel
 - Single counts probably ok with 40MHz sampling

Both will be tested on a full scale prototype



CRITICAL ISSUES AT THE END OF SLAC MEETING

- **Place the order** for the prototype material (scintillator, fiber, SiPM, electronics, mechanics, ...).
- Finalize the **prototype design** based on simulation, mechanical constraints and R&D results.
- Design of all the **small parts for the prototype**.
- **Improve the optimization** code and continue the test mu/pi separation for **different configurations**.
- Need to have a better understanding of the **machine backgrounds** particularly neutron background that can damage the SiPM performances.

FROM SLAC TO HERE

- Place the order for the prototype material (scintillator, fiber, SiPM, electronics, mechanics, ...).

everything should be placed
- beam test still pending

- Finalize the prototype design based on simulation, mechanical constraints and R&D results.

Proposal has been made by
simulation and first design is ready

- Design of all the small parts for the prototype.

Done some sketches: design will
be ready before Xmas.

- Improve the optimization code and continue the test mu/pi separation for different configurations.

Work has been done to improve the reliability of
the code and to test prototype configurations

- Need to have a better understanding of the machine backgrounds particularly neutron background that can damage the SiPM performances.

just started working on background rates, but we
need full sim and computing to make their part

ONGOING ACTIVITIES

R&D

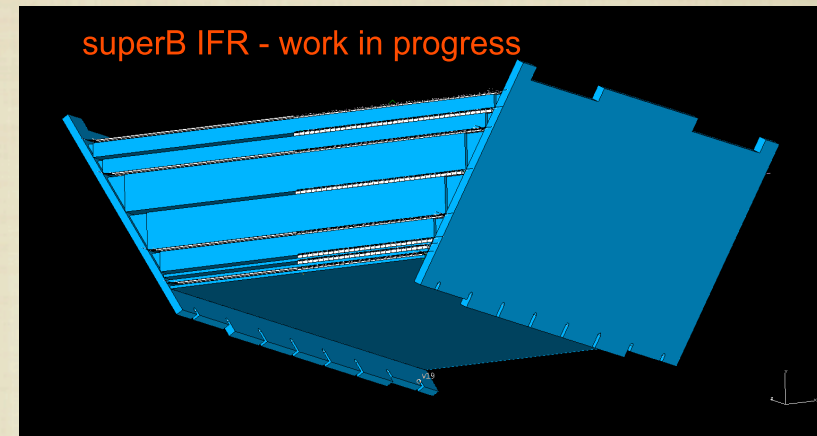
Now that the baseline has been established we work on:

- improvements
- optimize mechanical coupling
- complete/refine measurements

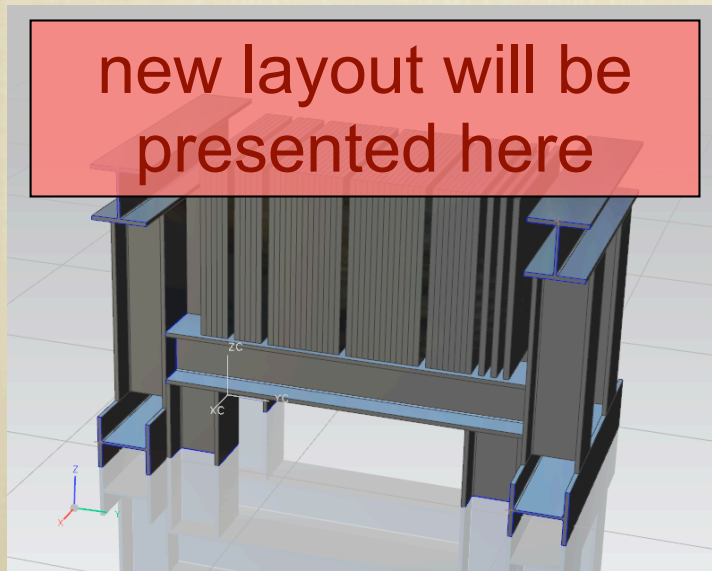
Simulation and detector optimization

Improve the code

Study different detector and prototype configurations



new layout will be presented here



Prototype design and preparation

- Optimize design for electronics
- Finalize prototype design
- Small part design (pizza box, optical couplings)
- Fiber polishing
- Data acquisition system

GOAL FOR THIS MEETING

Review **advancements and achievements** in all the development areas

☑ Particular focus on:

➔ prototype design and construction (where, what, who, when)

➔ detector optimization: preliminary results are expected

☑ Plan for further studies and possible remediation of the effect of the **neutron background** on the photon detectors.

☑ **Review the TDR preparation** process and prioritize the short and medium term activities.

☑ White paper organization

TOWARD THE TDR

A 3D, yellow, blocky text graphic that says "done".

finalize prototype design (mechanics and electronics) .

A 3D, yellow, blocky text graphic that says "done".

place orders for prototype construction (needed simulation results first)

January 2010

begin prototype assembly

Spring 2010

prototype test with cosmics

Summer 2010

test beam

A very hot season is waiting for us!

IFR SESSIONS

16:30->18:00 **Parallel - IFR I** (Convener: Roberto Calabrese (FE))

Description:

Location: Aula Seminari

Phone number: +39 06 6228 8548

or http://server10.infn.it/video/index.php?page=telephone_numbers

Meeting ID: 1551

16:30 General Overview (10')	Gianluigi Cibinetto (FE)
16:45 Fast simulation status (10')	Marcello Rotondo (PD)
17:00 Full simulation and detector optimization (15')	Mauro Munerato (FE)
17:20 Status of the IFR electronics (20')	Angelo Cotta Ramusino (FE)
17:45 IFR R&D status (15')	Wander Baldini (FE)

14:30->16:00 **Parallel - IFR II** (Convener: Roberto Calabrese (FE))

Description:

Location: Aula Seminari

Phone number: +39 06 6228 8548

or http://server10.infn.it/video/index.php?page=telephone_numbers

Meeting ID: 1551

14:30 Status of prototype preparation (I) (10')	Wander Baldini (FE)
14:45 Status of prototype preparation (II) (10')	Mario Posocco (PD)
15:00 Status of mechanics for the prototype (15')	Massimo Benettoni (PD)
15:20 Discussion about prototype construction and test (20')	

OTHER IFR CONTRIBUTIONS



- Background session (future planning)

- Detector Geometry Working Group (update on optimization)

- ETD (Frontend electronics)