

FDIRC background issues

(comparison of 3 methods to calculate it, where to put the shielding ?)

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SuperB collaboration meeting in Frascati, Dec.2011

3 methods

- Alejandro, Doug, Andrea:

- a) Geant 4 simulation,
- b) Proper geometry,
- c) Proper Snell's law treatment of optical photons, QE, etc.

- Riccardo, Andrea

- a) Geant 4 simulation,
- b) Proper geometry,
- c) Convert short electron tracks to photons as; $N_{pe} = N_0 L (1 - 1/(n^2 \beta^2))$, $N_0 = 26$
- d) Apply a fudge factor of 2 for a loss of optical photons in optical structure.

- Jerry

- a) Work out rates in Belle-I Aerogel window PMT glass,
- b) Scale it to FDIRC by volume ratios,
- c) Assume that the luminosity scales as $1 \times \text{LUMI}$,
- d) Apply a fudge factor of 2 for a loss of optical photons in optical structure.

FDIRC background at full luminosity

Method	Person	Rate per double-pixel from the bar box, i.e., <u>from active volume</u>	Rate per double-pixel from the Photon camera <u>if not shielded</u>
Real MC simulation using a proper treatment of optical photons	Alejandro, Doug, Andrea	~ 85 kHz	~ 550 kHz
MC simulation using a simple treatment of optical photons	Riccardo	~ 67 kHz *	~ 400 kHz *
Empirical scaling from Belle-I by quartz volume and as Lumi-term	Jerry	~ 75 kHz *	~ 120 kHz *

* Apply a factor of 2 reduction for a photon loss on optical surfaces

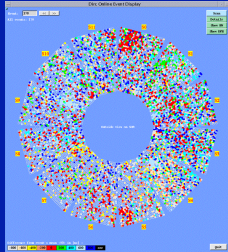
- **Impressive agreement, but may be still completely wrong !**
- **We clearly need to shield the photon camera.**

Lessons from the DIRC shielding battle

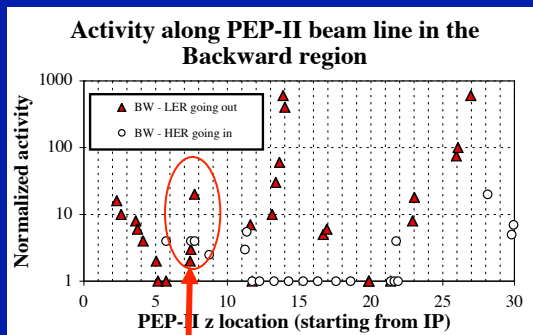
J. Vavra, http://www.slac.stanford.edu/~jjv/activity/Long_manual_bckg_detectors.pdf

1) **Started with no shielding**

DIRC Display (1999):

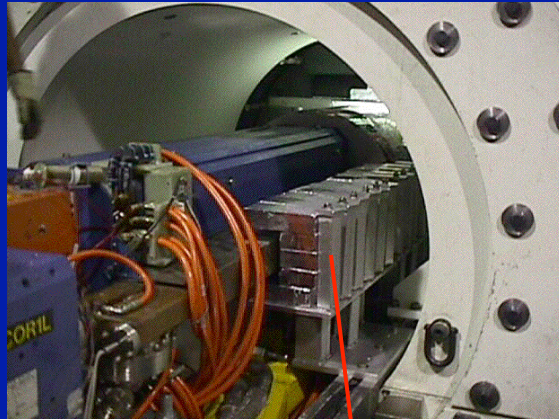


Geiger counter survey (2003):



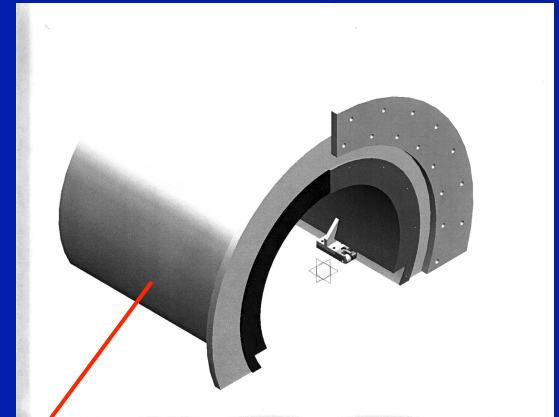
Located just under DIRC

Improved shielding with lead bricks:

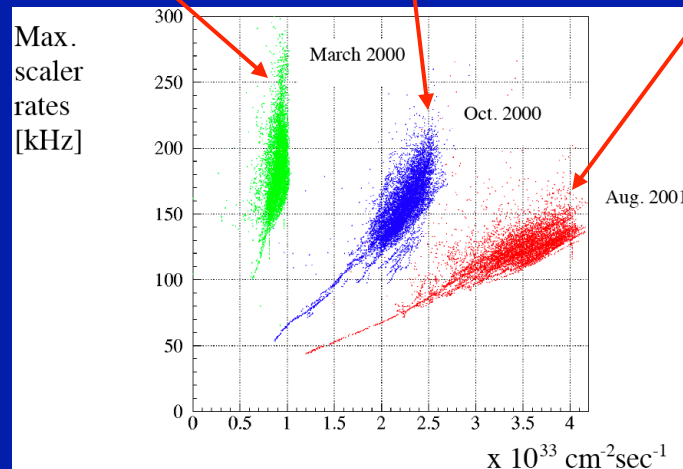


3)

Properly engineered shielding under DIRC SOB (2001):



Improvements in DIRC background = $f(\text{time})$:



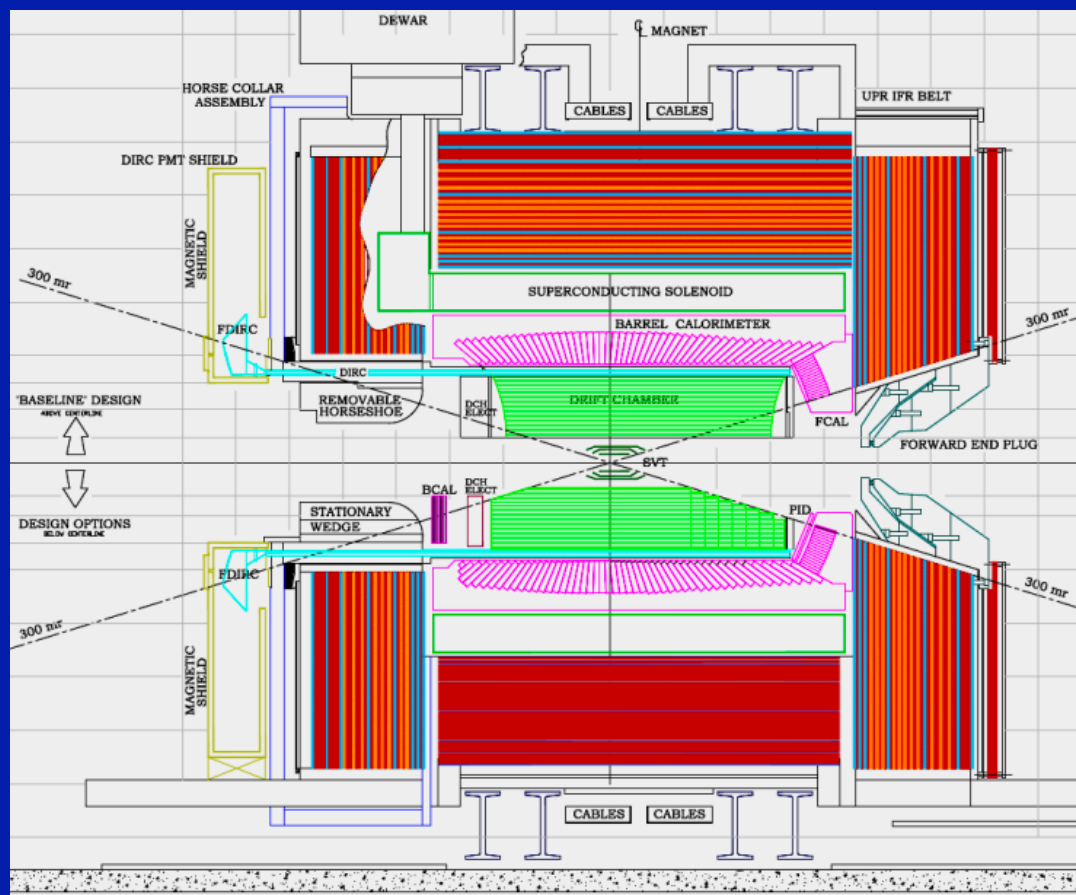
Fight against background:

- 1) Apply timing cut: $\pm 8\text{ns}$
- 2) Add shielding !!! But where ?
- 3) Install background detectors
- 4) Improve machine

Rate was limited by:

Electronics dead time: $\sim 5\%$ at a rate of $\sim 250\text{ kHz/PMT}$

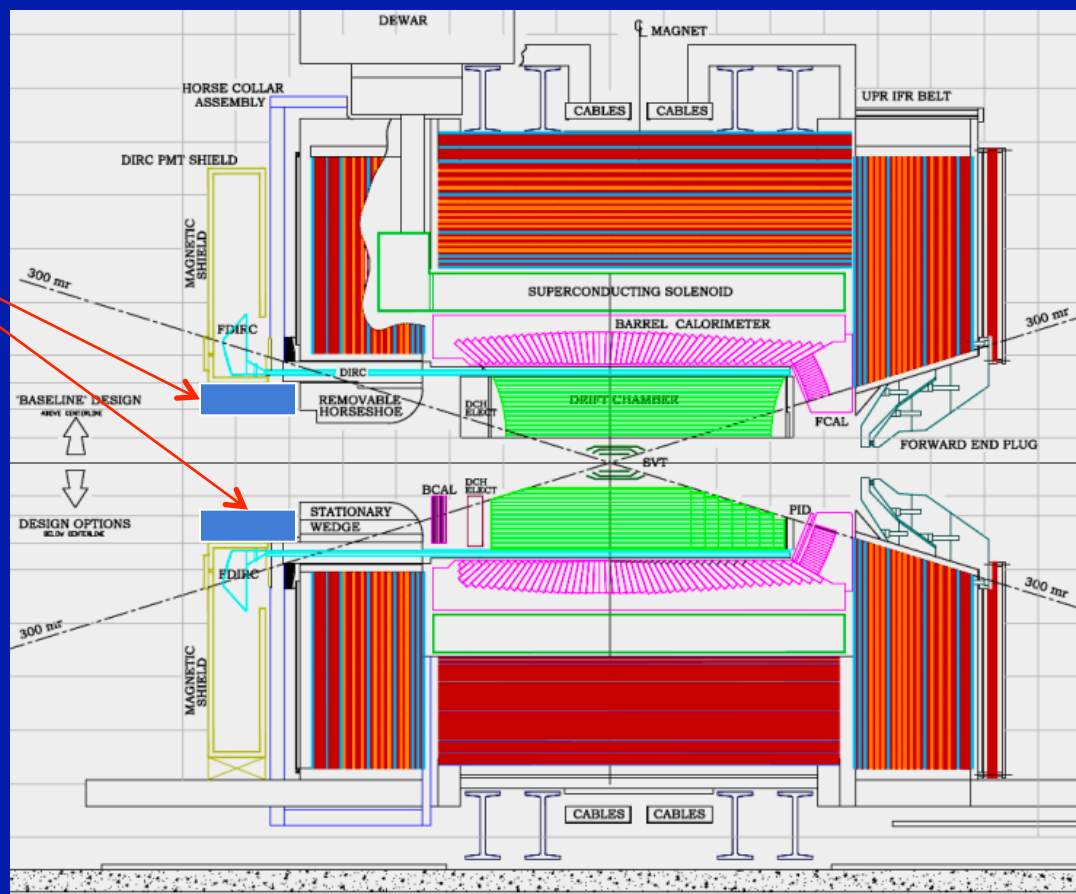
New FDIRC shielding



- Need to come up with something which will work from several point of views: FDIRC camera background, easy access, cables, etc.

New FDIRC shielding

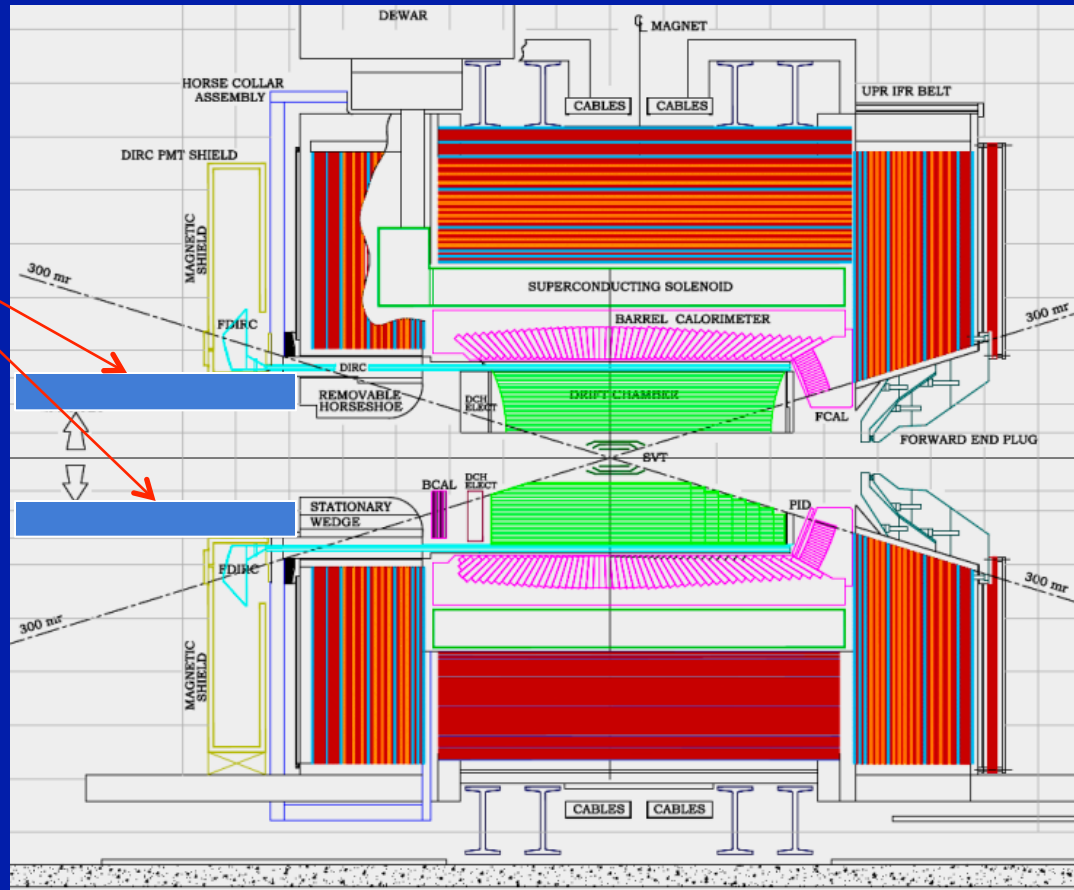
Need shielding:



- Need to come up with something which will work from several point of views: FDIRC camera background, easy access, cables, etc.
- We need to add a shield under the Photon camera.

New FDIRC shielding

Or this ?



- Need to come up with something which will work from several point of views: FDIRC camera background, easy access, cables, etc.
- May be that all beam line components need to be shielded in a tunnel !!