FTOF-Counter for *SuperB*

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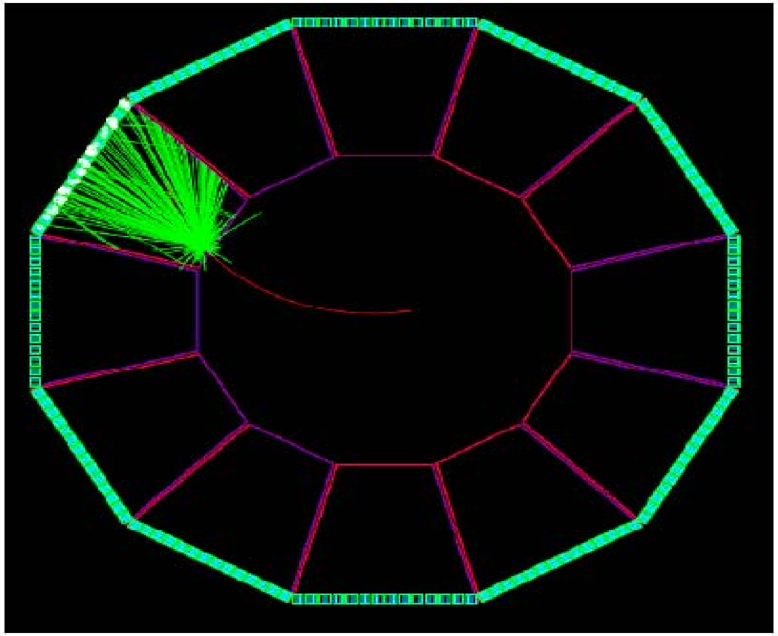
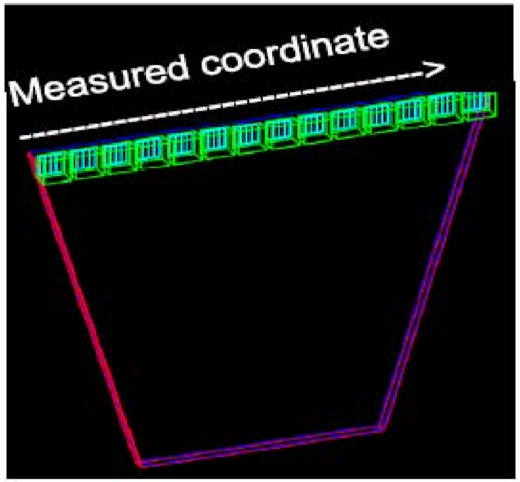
Not many news since last presentation. Main effort put on the CRT tests. See next presentations

The detector is actually located close to the DCH – see next slides





• The detector is made 1.2cm thick (**10% X_0**) quartz sectors,
• There are 12 sectors (30 degree in ϕ) covering **15 < θ < 25** degrees
• The PMT's are attached to the sector outer radius (there are 14 per sector)

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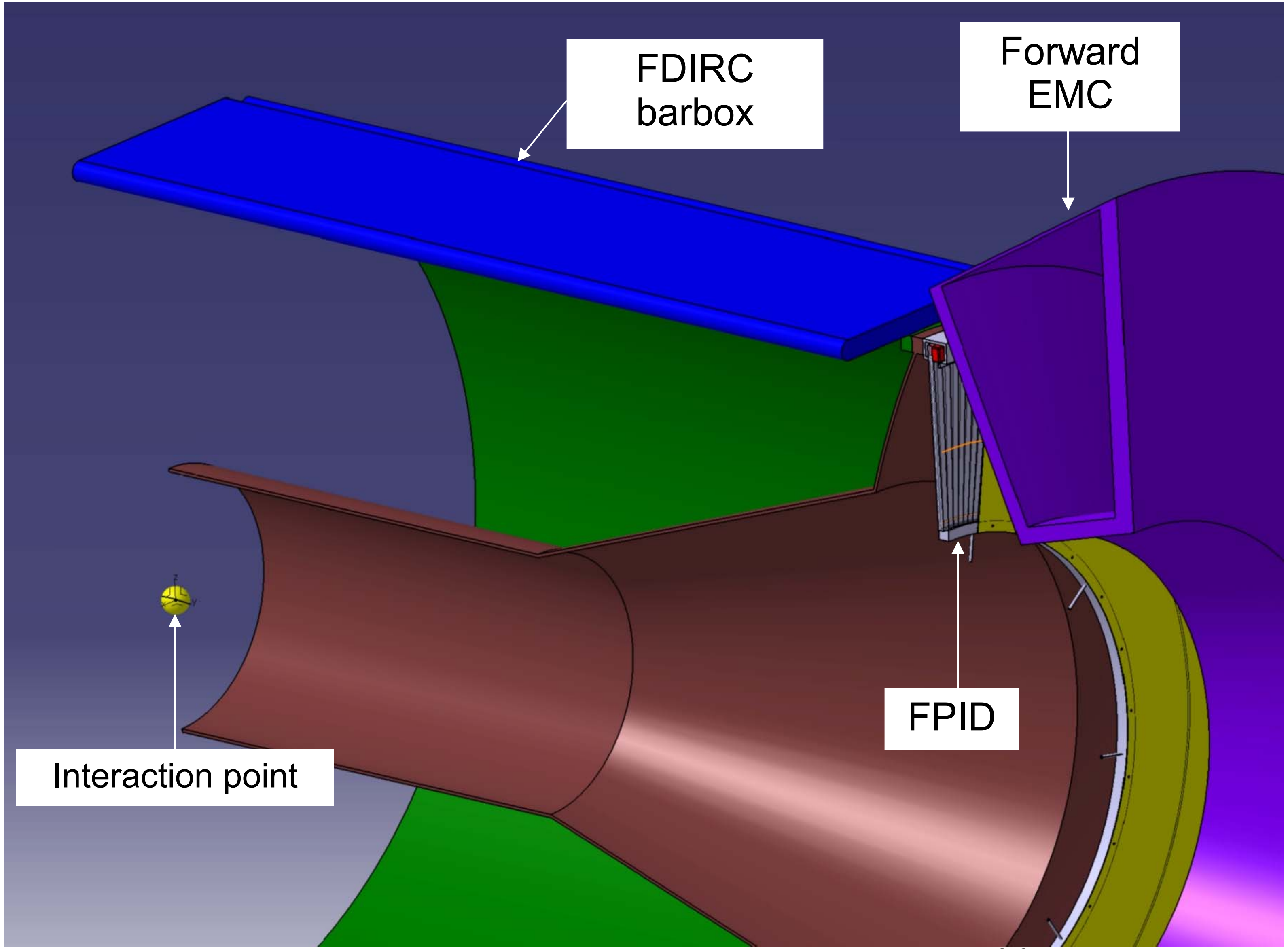
F. Bogard & S. Wallon, LAL, September 2010 design



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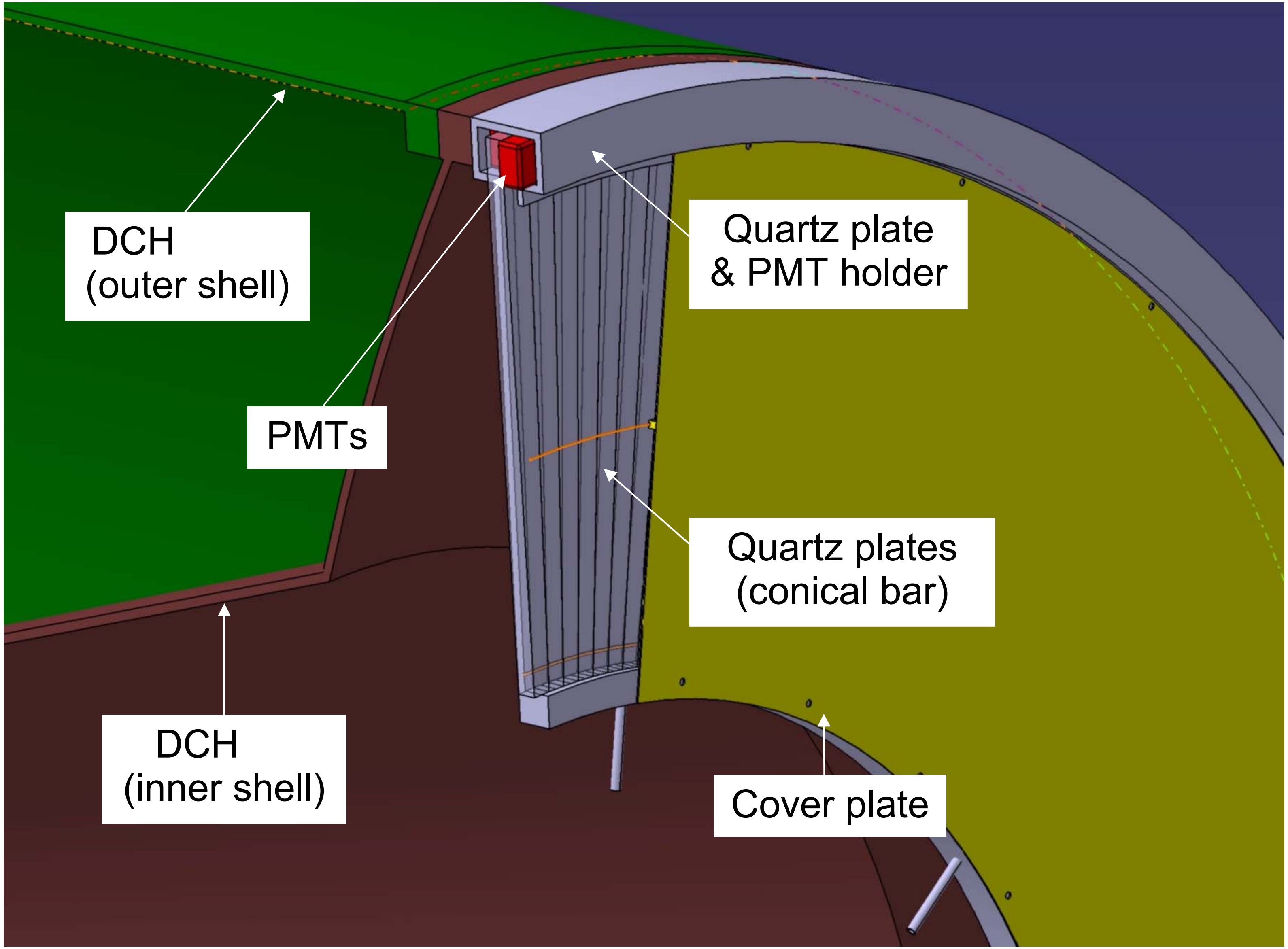

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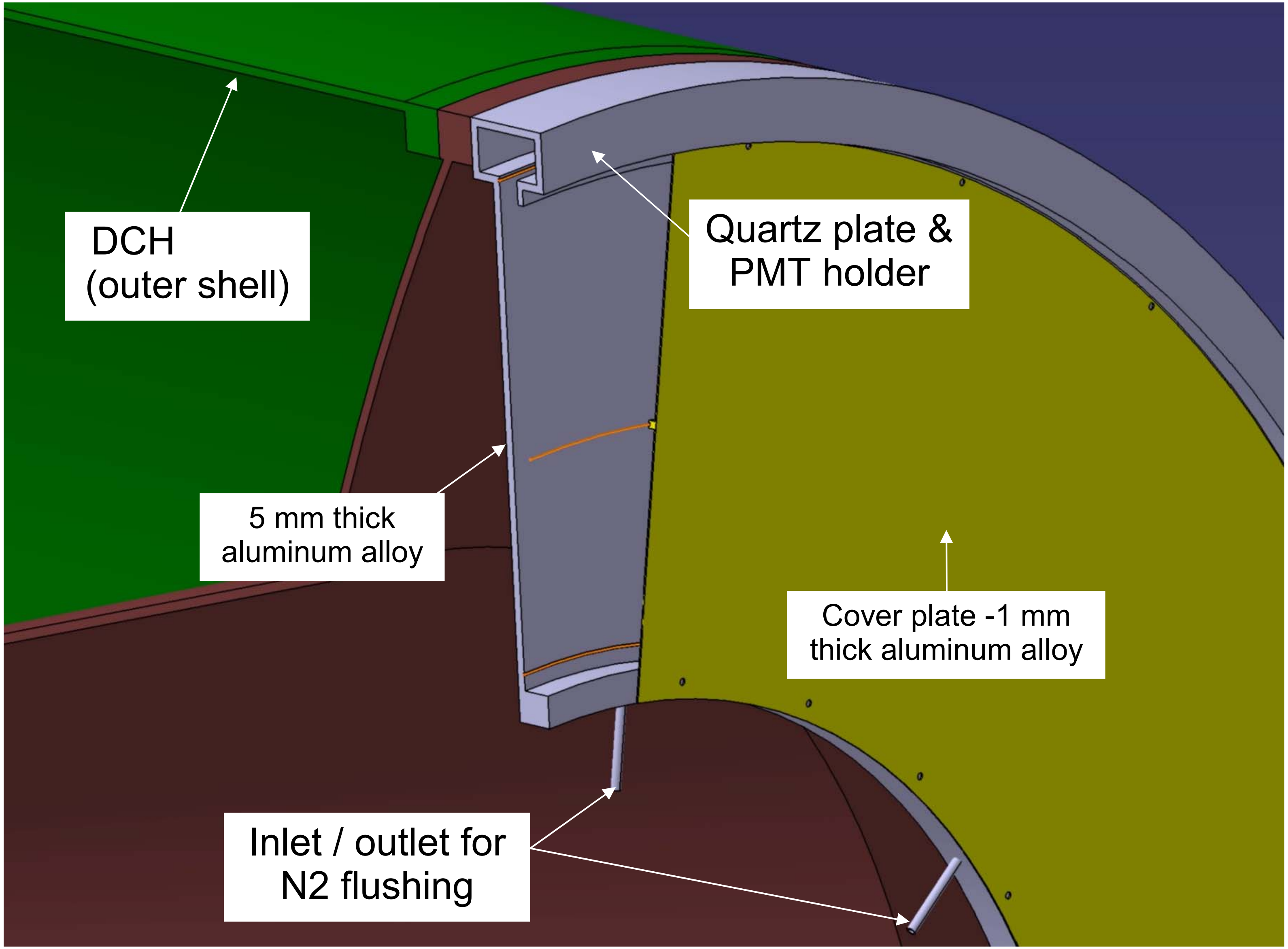
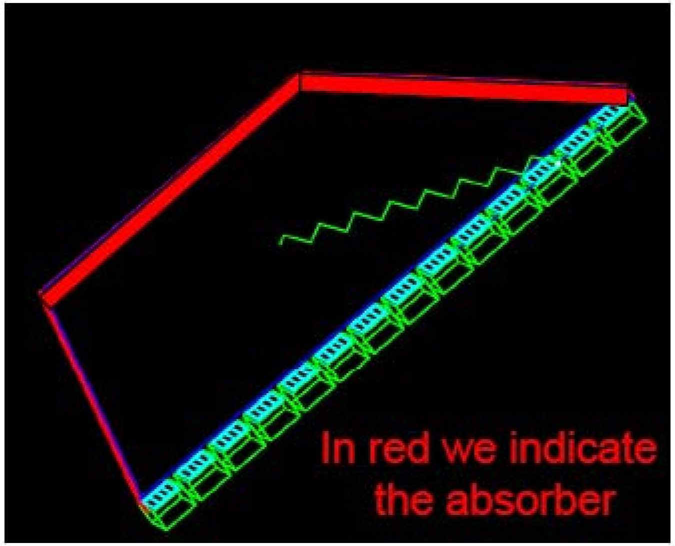


Two possibilities have been considered for the photon collections

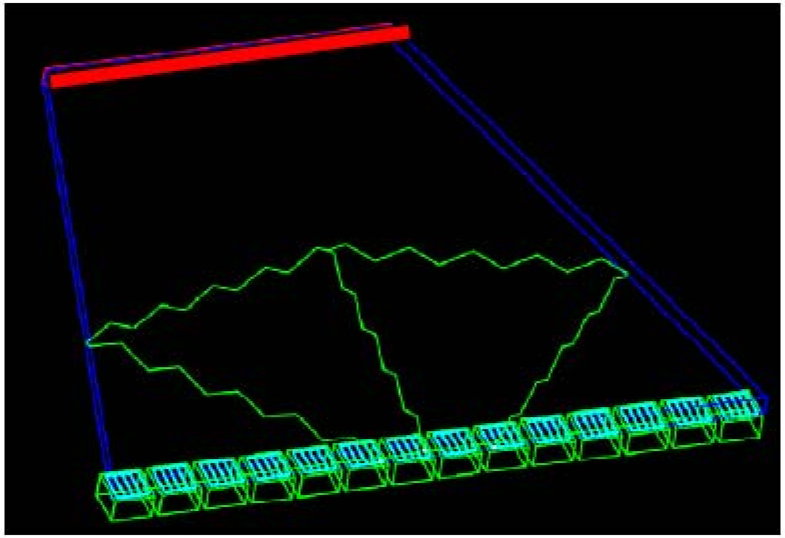
"simple geometry – with absorber"

(only direct photons are collected)



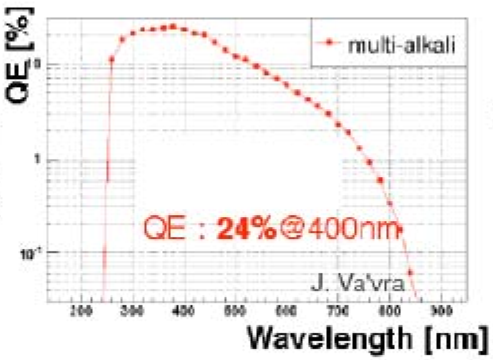
"without absorber"

(photons with different paths are collected)



For these studies we have used SL10 PMTs:

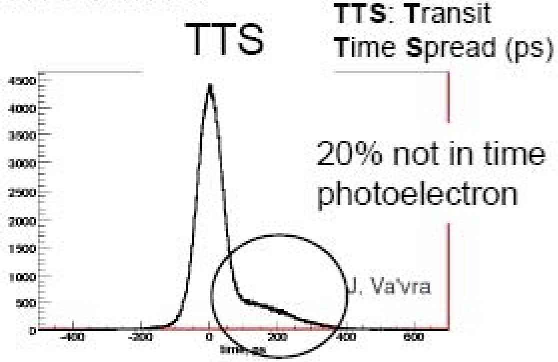
QE: PMT **Q**uantum **E**fficiency



PDE: **P**hoton **D**etection **E**fficiency

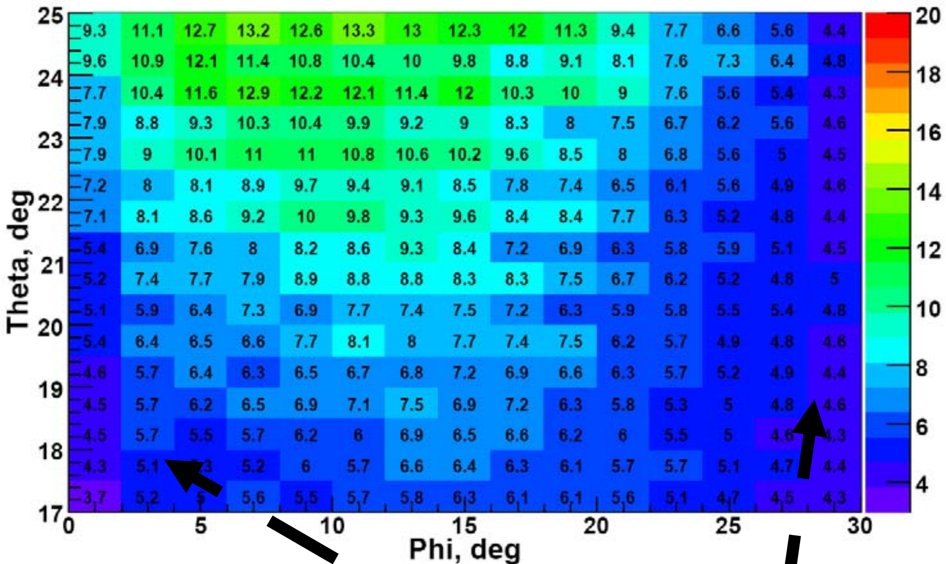
PDE = 0.24 (max.QE)
*0.65 (phot. eff)
*0.82 (pack. eff)
= ~0.13

TTS: **T**ransit **T**ime **S**pread (ps)

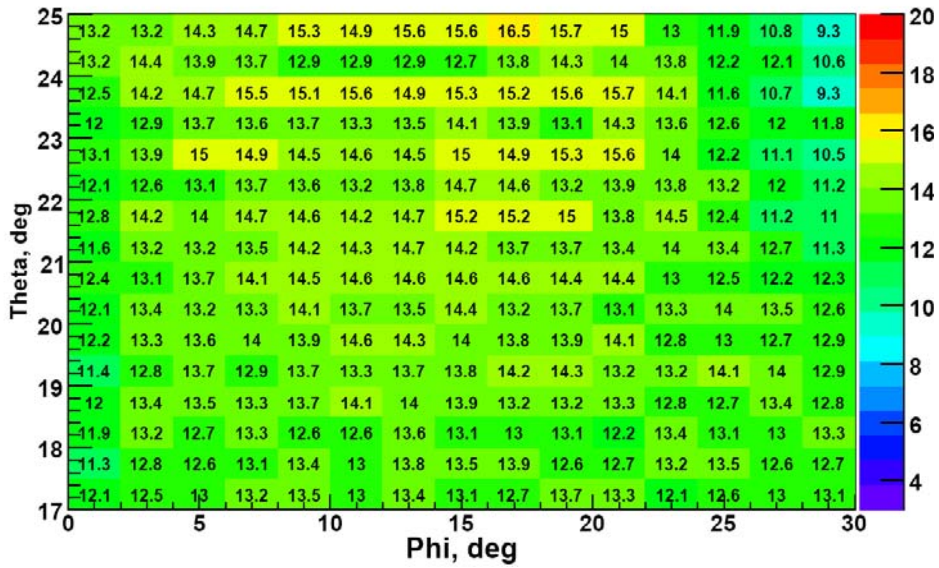


Taking tracks with p = 900 MeV/c (less favourable case)
and looking at the (phi, theta) dependence of Nphe

With absorber



Without absorber



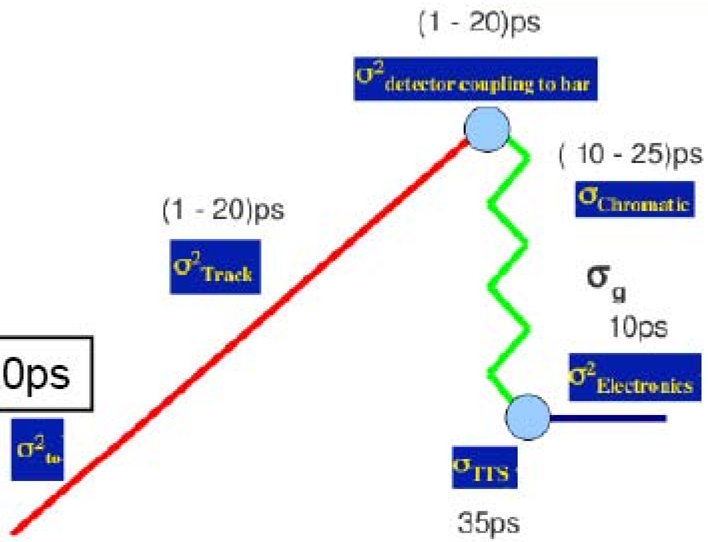
It can be noted the there is a lack
of phe.in the phi-border of the detector

The FTOF device for PID in the forward region located near to the DCH seems to meet the requirements of the minimum number of collected photoelectrons, if we work without absorber (all faces reflecting photons).
In this configuration we collect at least 10 photoelectrons in all theta range and for p>0.9 GeV/c

Time resolution

$$\sigma_{Total} \sim \sqrt{[\sigma^2_{Electronics} + (\sigma_{Chromatic}/\sqrt{(\varepsilon_{Geometrical\_loss} * N_{pe})})^2 + (\sigma_{TTS}/\sqrt{N_{pe}})^2 + \sigma^2_{Track} + \sigma^2_{detector\ coupling\ to\ bar} + \sigma^2_{t0}]}$$

J. Va'vra, Forward TOF update



$\sigma(z)/c = 600\mu m/c \sim 20ps$

σ^2_{t0} By hand

σ^2_{Track} **FastSim**

$\sigma^2_{detector\ coupling\ to\ bar}$ **FastSim**

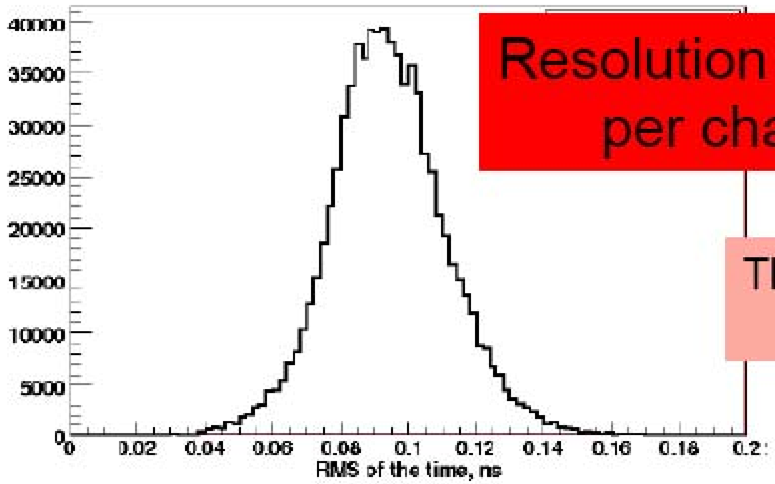
$\sigma_{Chromatic}$ Geant4

σ_g time spread due to geometry of the detector Geant4

σ_{TTS} By hand

$\sigma^2_{Electronics}$ By hand

All these terms are "approximately" divided by **Sqrt (N-phe)**

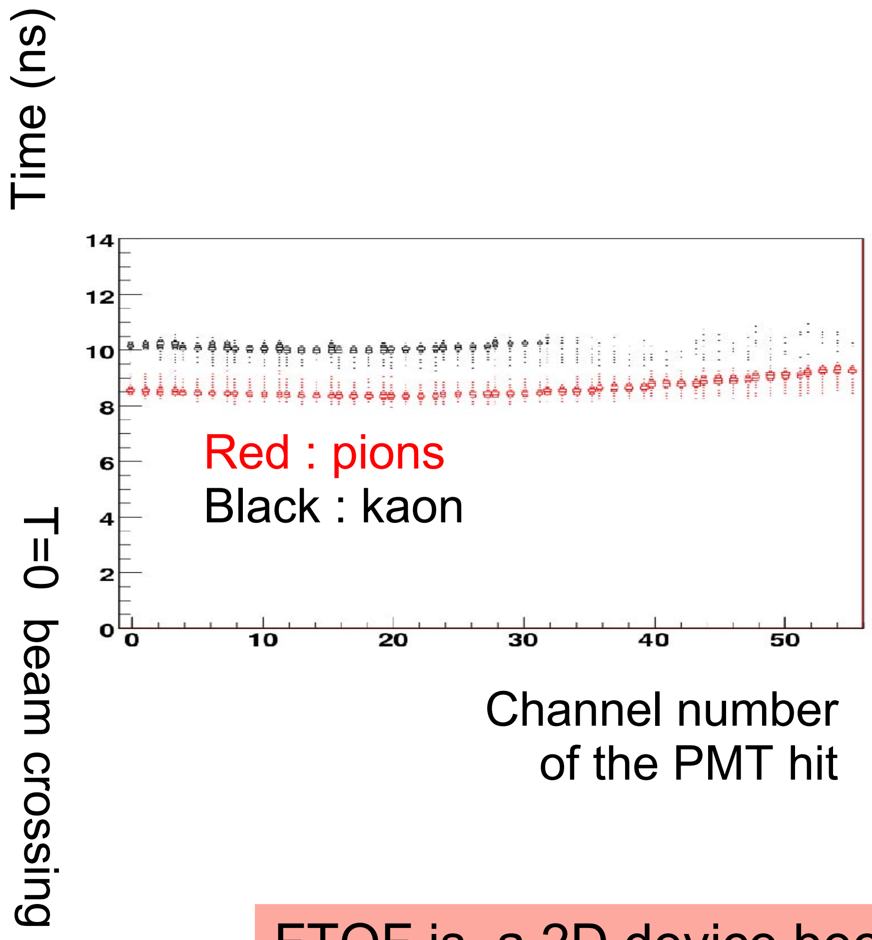


Resolution of ~90ps per channel

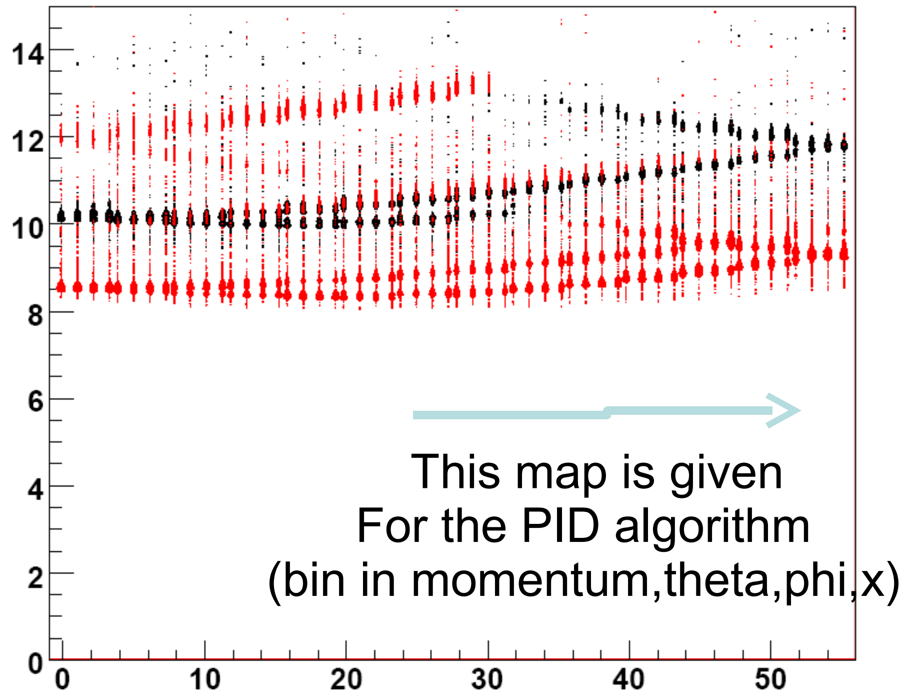
The total time resolution will be between 30-40 ps (minimum 5 phe.)

Photoelectron timing using tracks with P=900Mev , theta=17, phi=0

"simple geometry – with absorber"



"without absorber"



More photons collected but time algorithm more difficult. Under study

FTOF is a 2D device because it measures time vs position

First look at reconstruction
(PID with FTOF)

- Main idea: use 2D information (channel and time) for all recorded hits

- Apply a maximum likelihood method to
  - separate signal hits from background hits
  - decide whether the signal hits come from a kaon or a pion

$$L^{hyp}(f) = \prod_{ph.e.k} \left[(1-f)\, prob^{signal}(k,hyp) + f prob^{background} \right]$$

- All tests so far based on a FTOF fast standalone simulation written by Leonid
  - Half of the simulated tracks used to compute 2D maps; the other half to simulate the reco performances
  - Need to understand how accurate this simulation is
    - Integration in official simulation framework ?
    - But it should be fast enough to produce enough simulated data
  - No real progress since Summer – manpower focused on CRT experiment

- Proper background distribution is a key input (currently missing) to the simulation
  - How many hits per event? How are they distributed in the 2D plane?

- Another issue which remains to be solved: how to deal with the large track parameter space?
  - The track 2D map depends on its mass, on its momentum vector and on the point where it hits the FTOF

FTOF updated cost estimation

- Electronics [Dominique, 2010/12]
  - **250 kEuros** for 672 channels [12 sectors * 14 PMTs / sector * 4 channels / PMT]
  - Includes everything: HV, LV, boards, cables, installation, etc.

- Quartz Plates [Jerry, 2009]
  - Material: 210 k$ [12 + 2 plates, unit cost 15 k$]
  - Manpower: 200 k$
  - QC: 160 k$

Total: 570 k$
~ **450 kEuros**
(1.3 $ / euro)

- Mechanical integration [LAL engineers, 2010/03]
  - Support structure: 80 kEuros
  - Utilities: 20 kEuros
  - Integration: 30 kEuros

Total: **130 kEuros**

- PMTs [Veronique, 2010/12] : **1.2 MEuros**
  - 200 PMTs (168 for the 12 sectors + ~2.5 sectors of spares]
    Quote for SL10 Hamamatsu is ~6 kEuros/PMT
    (Burle PMTs may be cheaper; no quote yet)

The total cost is ~**2 MEuros**. Largely dominated by the PMTs.