BeamCal
Hardware tests

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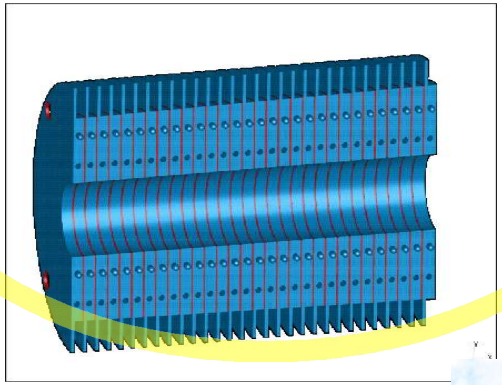
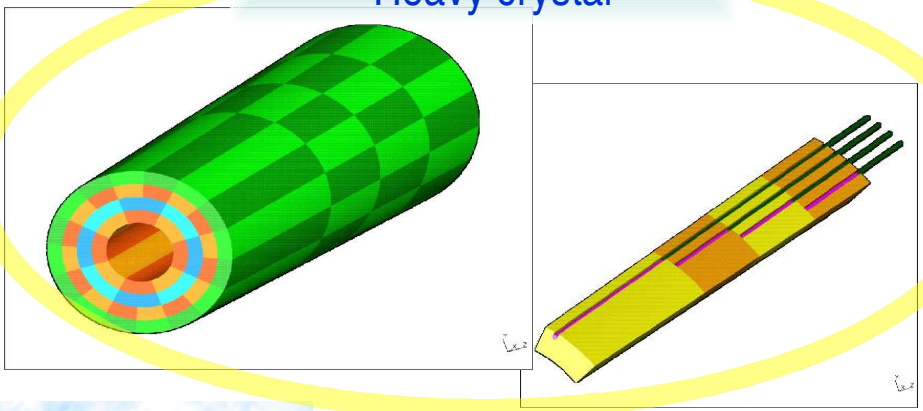
BeamCal options

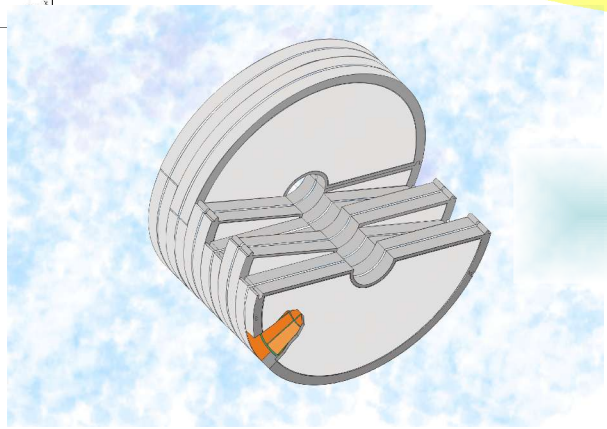
Radiation hard detector + small Moliere radius for an e^- detection on the top of the BG…

Diamond/Tungsten sandwich



Heavy crystal





Tungsten + heavy gas ionization chamber

Testbeam measurements with diamond sensors. Preliminary results

SetUp

Hadronic beam, 3 & 5 GeV

Modes:

Slow extraction ~10^{5}-10^{6} / s

fast extraction ~10^{5}-10^{7} / ~10ns

PA's :

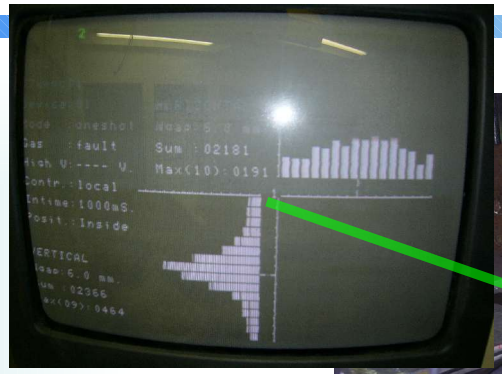
- Amptek A250

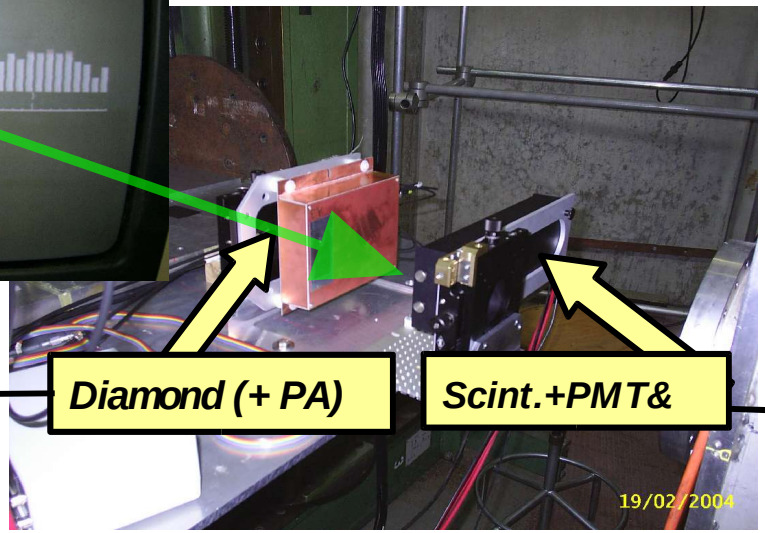
shaping time ~50 ns

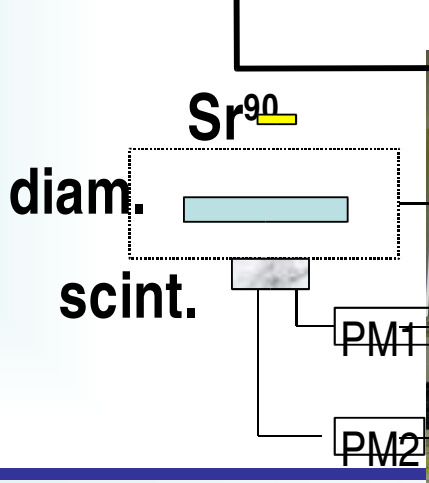
noise ~1000 e^{-} (diamond, area)

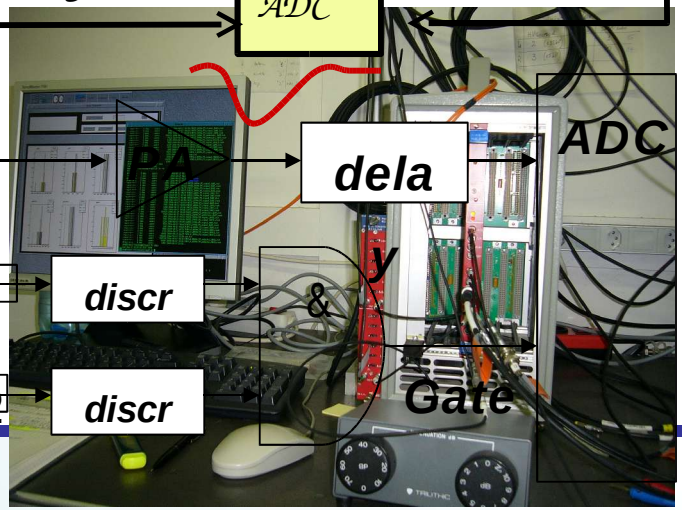
Diamonds :

- Freiburg, group#2 (cut substrate)
- Freiburg, 4 pads
- Element6 4 pads (CCD ~200 μm)
- GPI (Moscow)

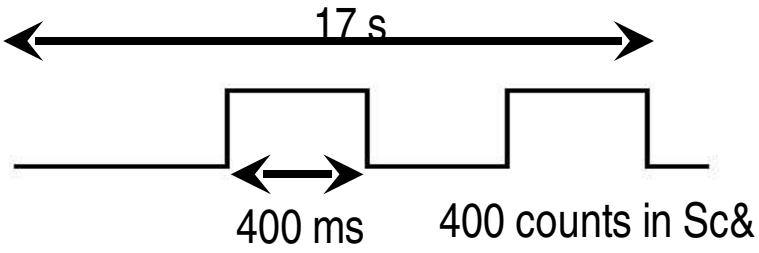


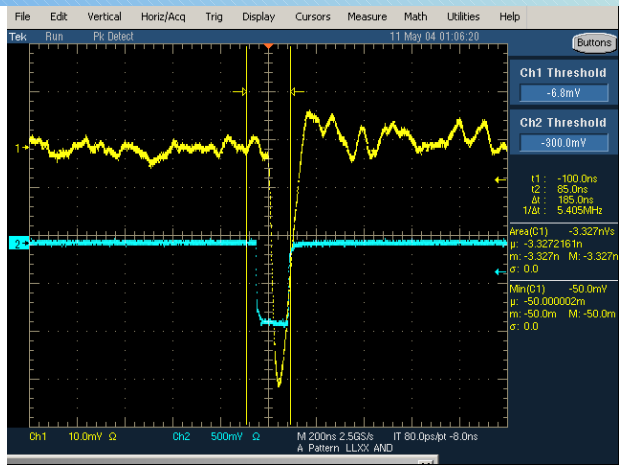


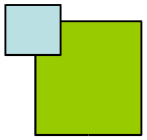




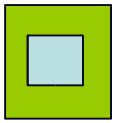
Slow extraction

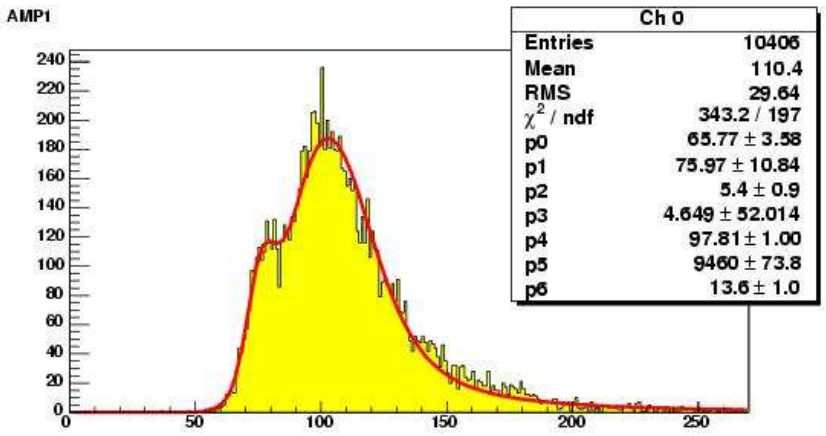


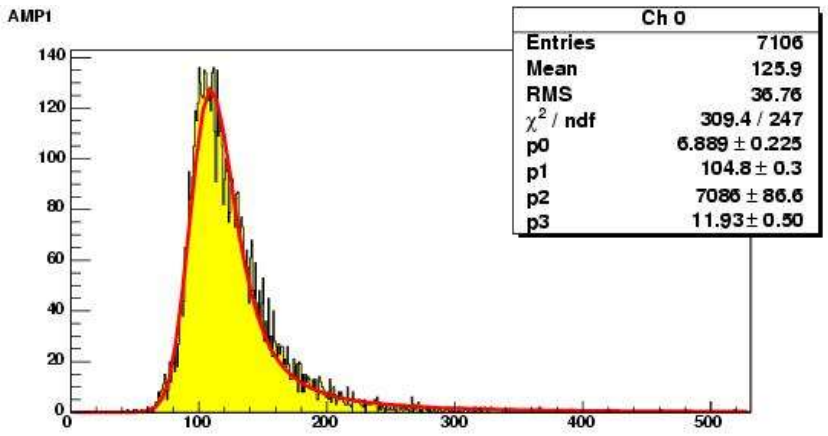




diamond 10x10 mm
scint. 5x 5 mm

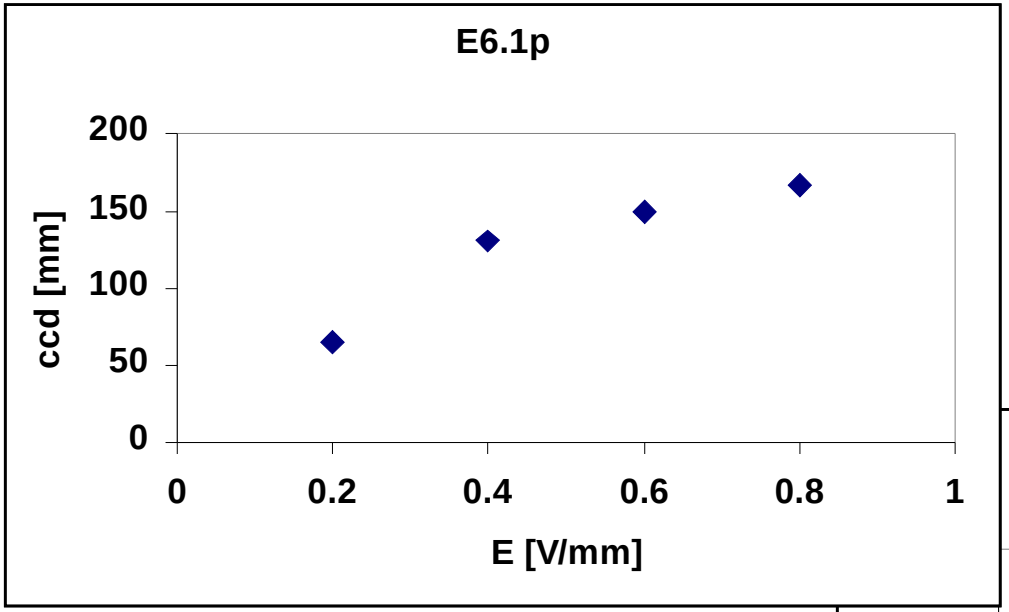


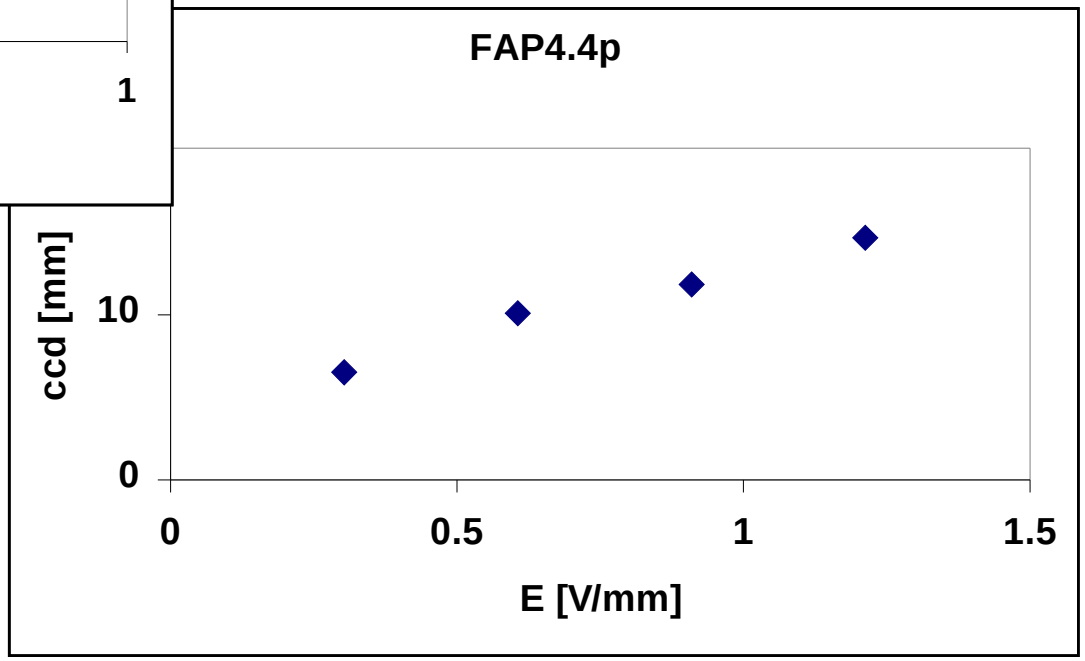




Slow extraction

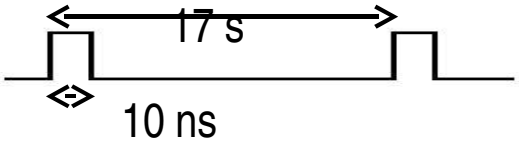
Preliminary results





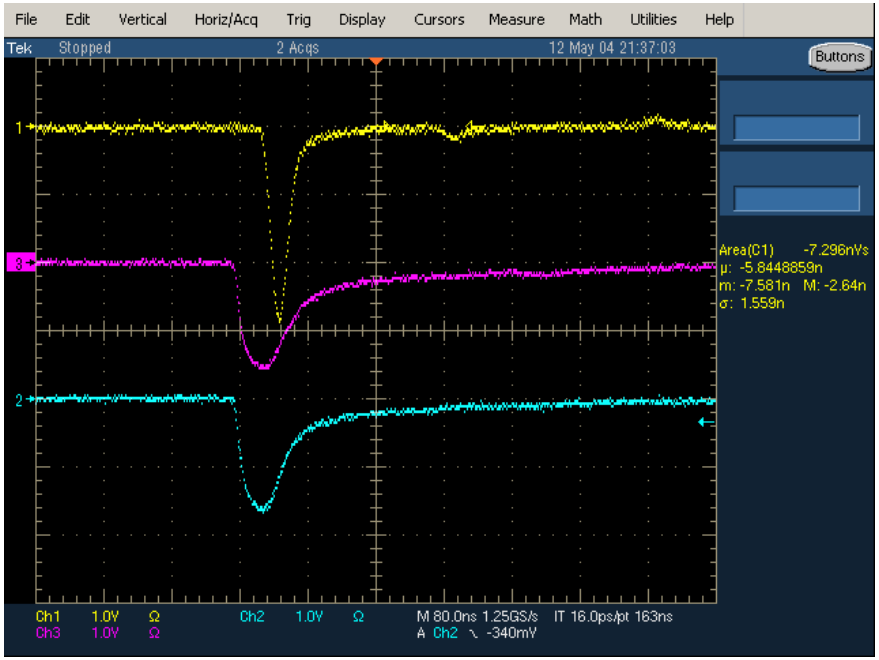
Fast extraction

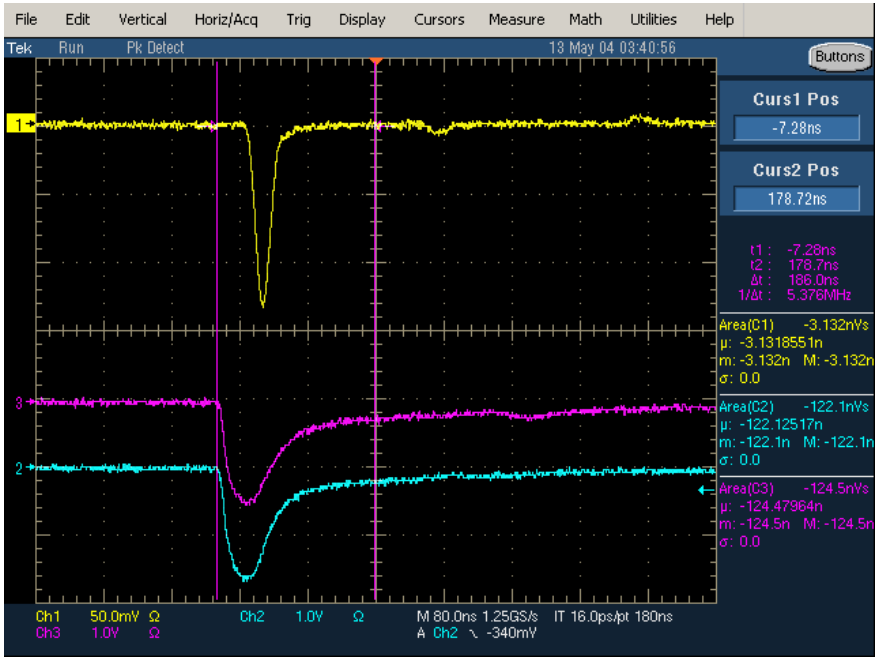
10^5-10^7 particles/ 10 ns - No PA was needed!



E6

FAP21





Fast extraction

Wide range of intensities :

"Very Low Intensity"

"Low Intensity"

"High Intensity"

"Very High Intensity"

PM 's estimation:

LI : VLI ~ 15

HI : LI ~ 13

VHI : HI ~ 3

~ 600

Intensity measurements :

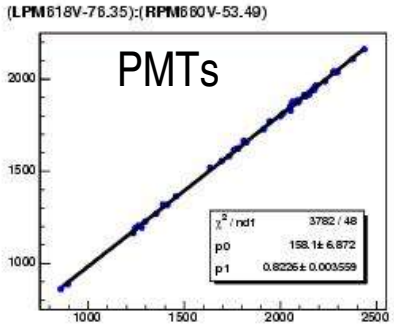
RPhL

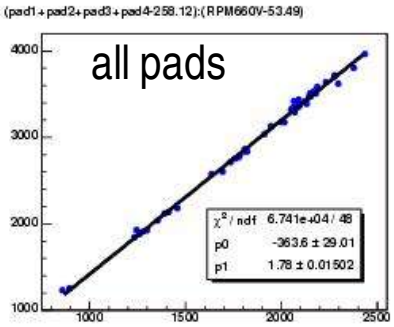
TL

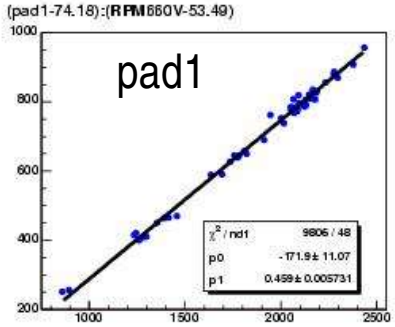
Fast extraction

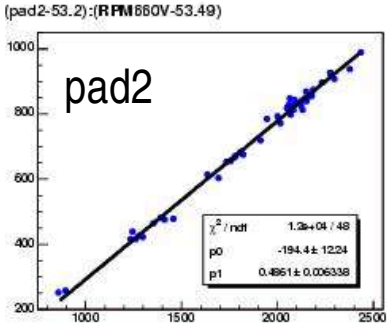
VERY Preliminary results

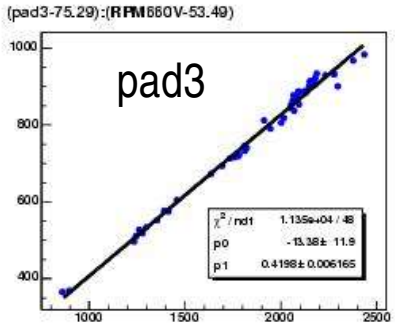
fast_E64p_p5_300Vn_ITURN_NT.root - E6_4pad_300Vn_P5_signal_

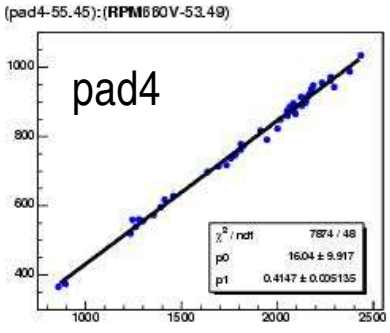




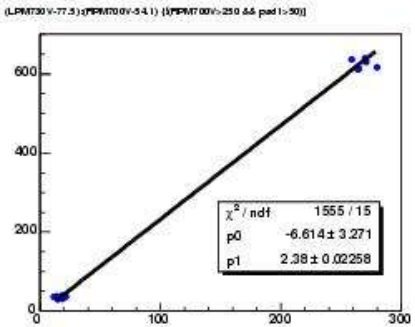


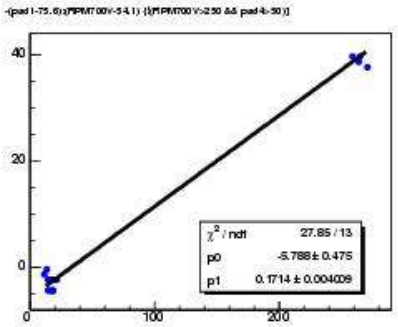


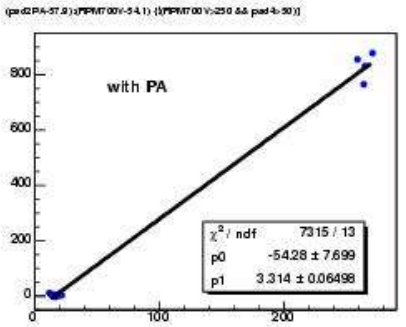


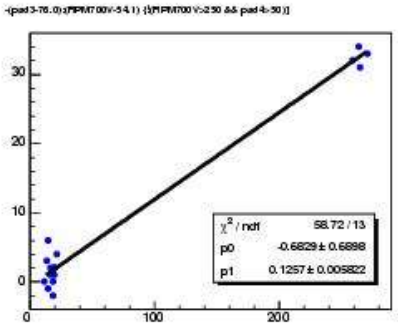


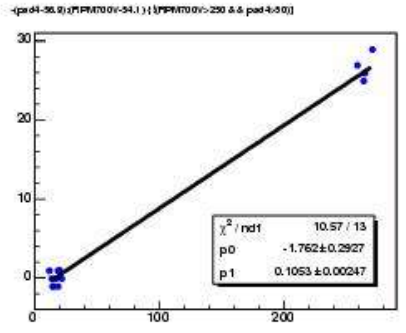
fast_E64p_p5_400Vn_LITURN_NT.root - fastVLI_E64p_400Vn_p5_s





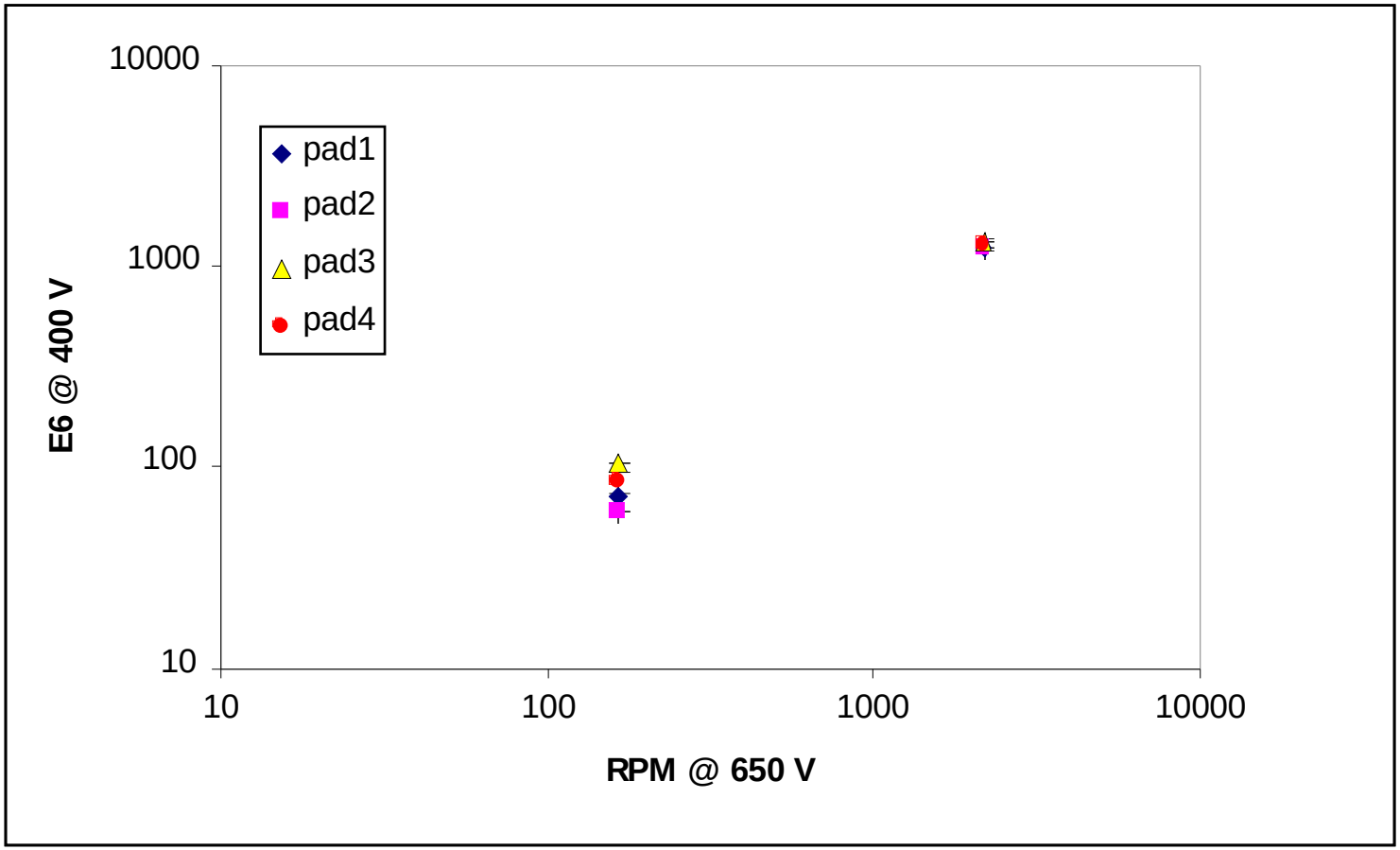






Fast extraction

VERY Preliminary results



To be done

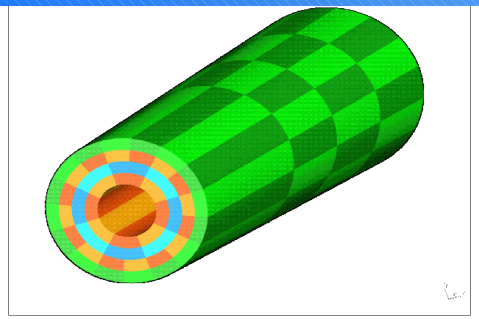
PMT's calibration

Intensity estimation using PMT's and dosimetry methods

Data analysis…

Studies
for a Heavy Crystal Option

Longitudinal Segmentation



Crystal cut into segments in depth

Optical isolated fibers

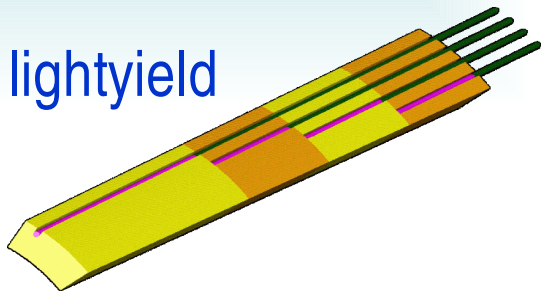
Readout with photodetectors

Material:

Radiation hard

Dense

High lightyield



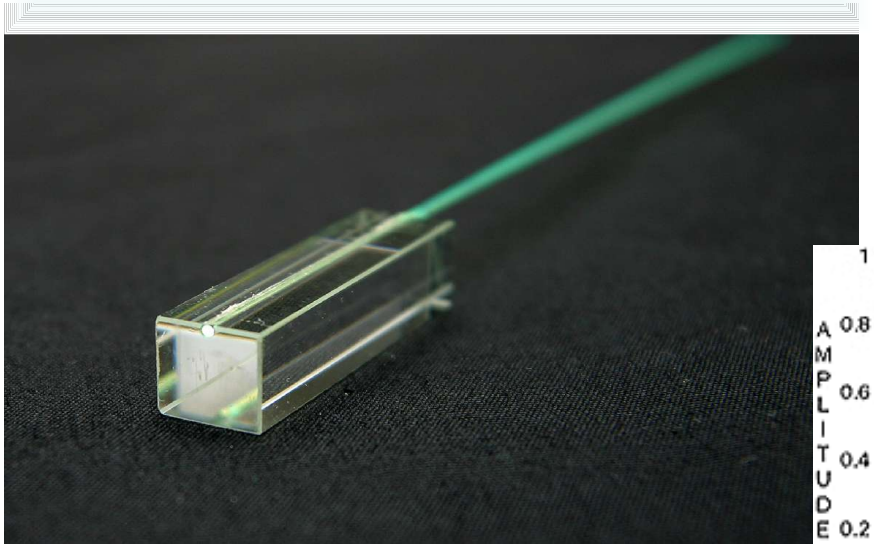
Main questions :

Lightyield reduction due to fiber readout?

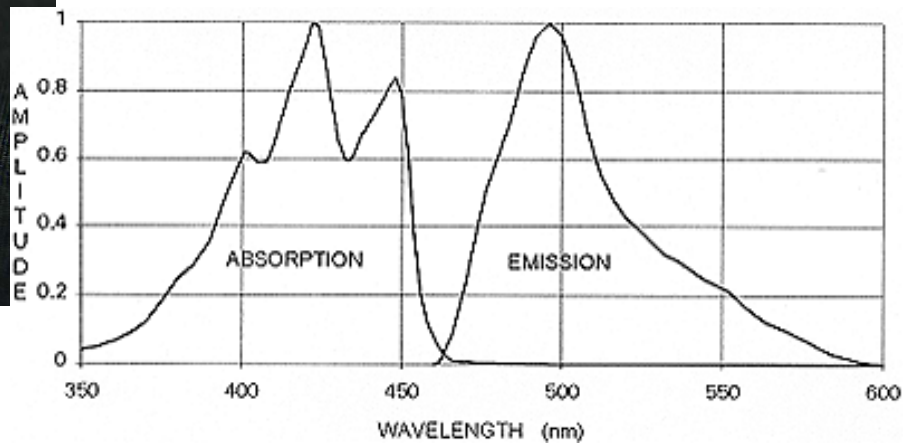
Crosstalk?

WLS fibers

BCF-91A WLS Fibers attched to different samples

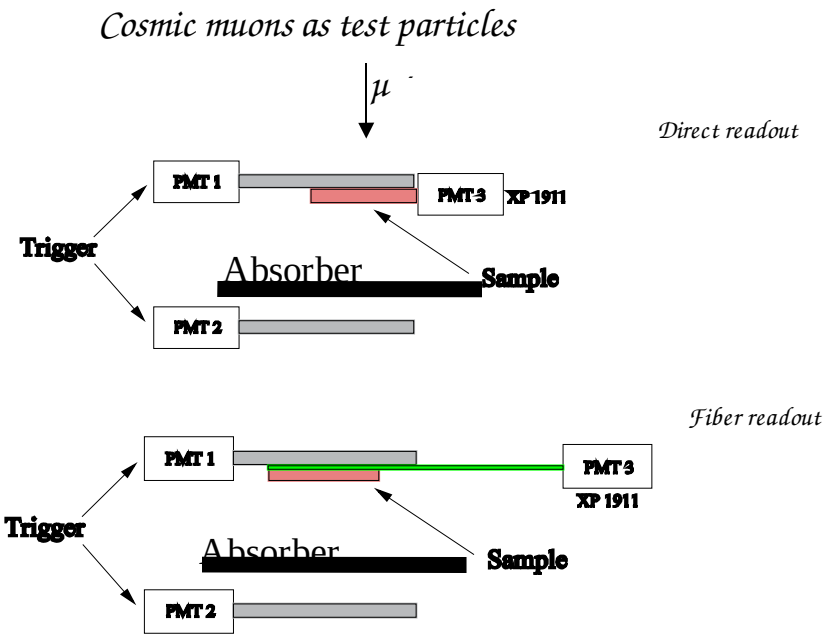


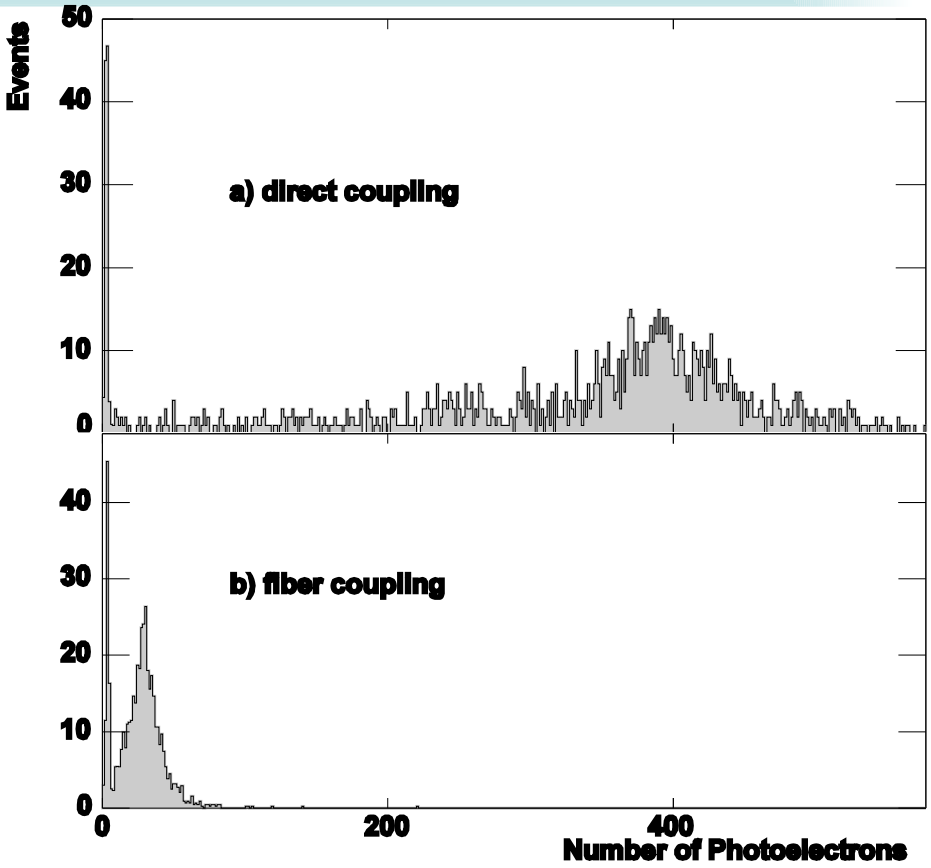
Emission-Absorption spectrum of the Fibers



Direct readout vs Fiber readout

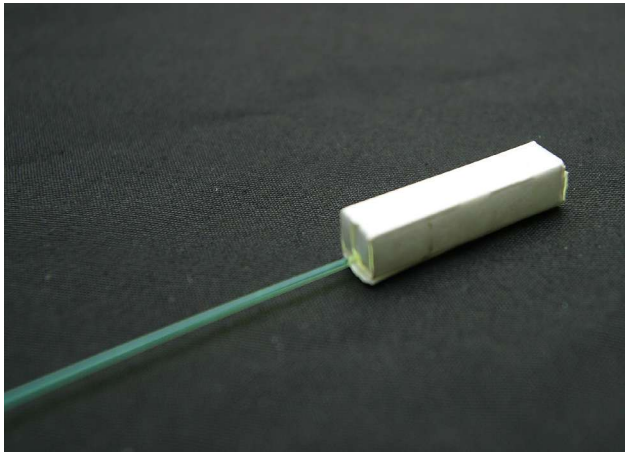
Comparision of the lightyield of the Fiber readout with the direct readout





Lightyeld - Results

Plastic Scintillator



Direct readout : (QE_{PMT} 25 ± 1 %)

Photoelectrons : 390 ± 50 p.e. / μ

Lightyield : 1560 ± 260 photons / μ

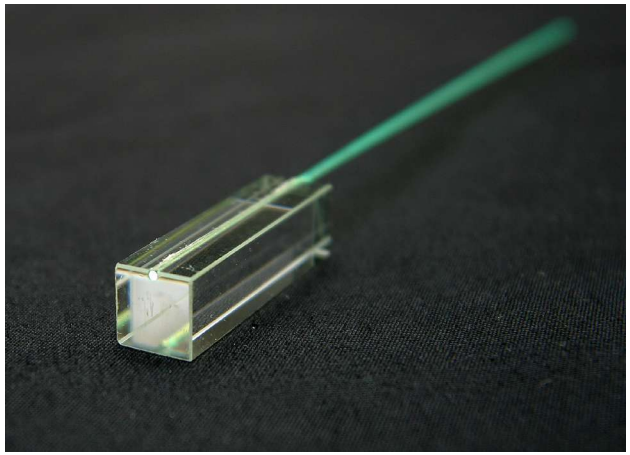
Fiber readout : (QE_{PMT} 13 ± 2 %)

Photoelectrons : 27 ± 4 p.e. / μ

Lightyield : 210 ± 60 photons / μ

Lightyield reduced to 14 ± 4 %

Leadglass



Direct readout : (QE_{PMT} 15 ± 2 %)

Photoelectrons : 18.2 ± 2.2 p.e. / μ

Lightyield : 120 ± 30 photons / μ

Fiber readout : (QE_{PMT} 13 ± 2 %)

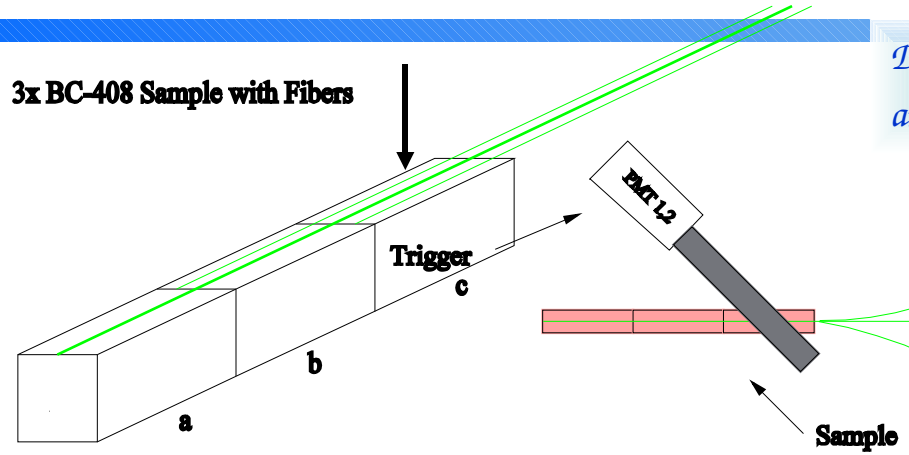
Photoelectrons : 2.4 ± 0.5 p.e. / μ

Lightyield : 19 ± 7 photons / μ

Lightyield reduced to 16 ± 7 %

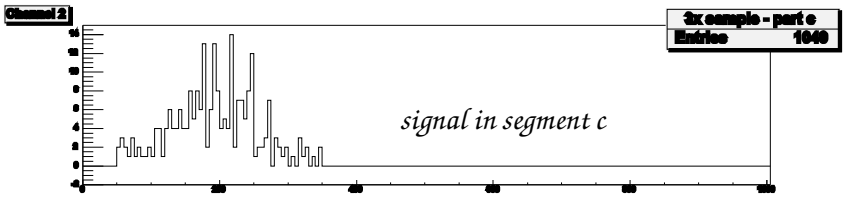
Crosstalk

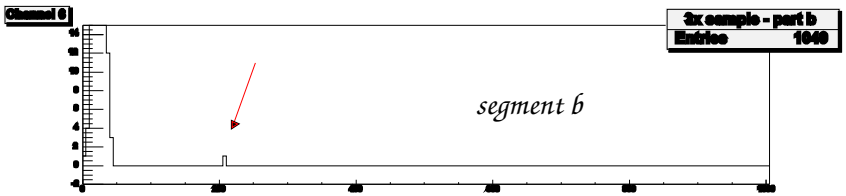
Do we see Crosstalk between the fibers and the segments they cross?

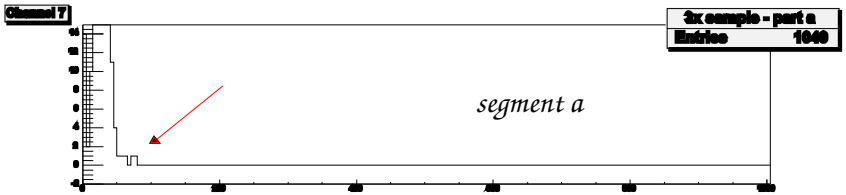


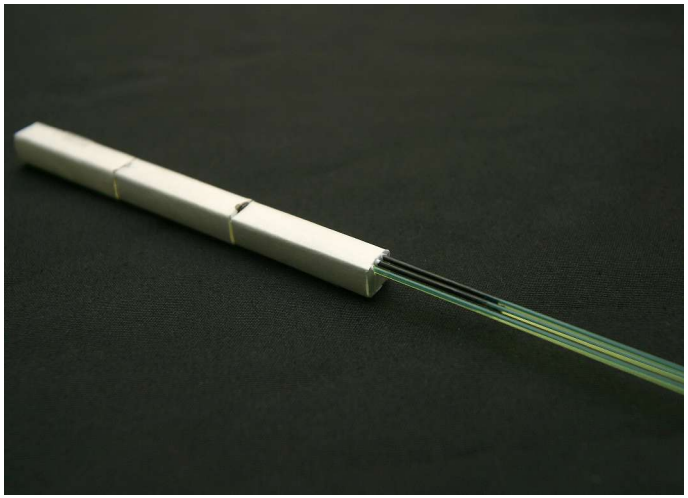
Signal in segment c

Signals in segments a,b ???



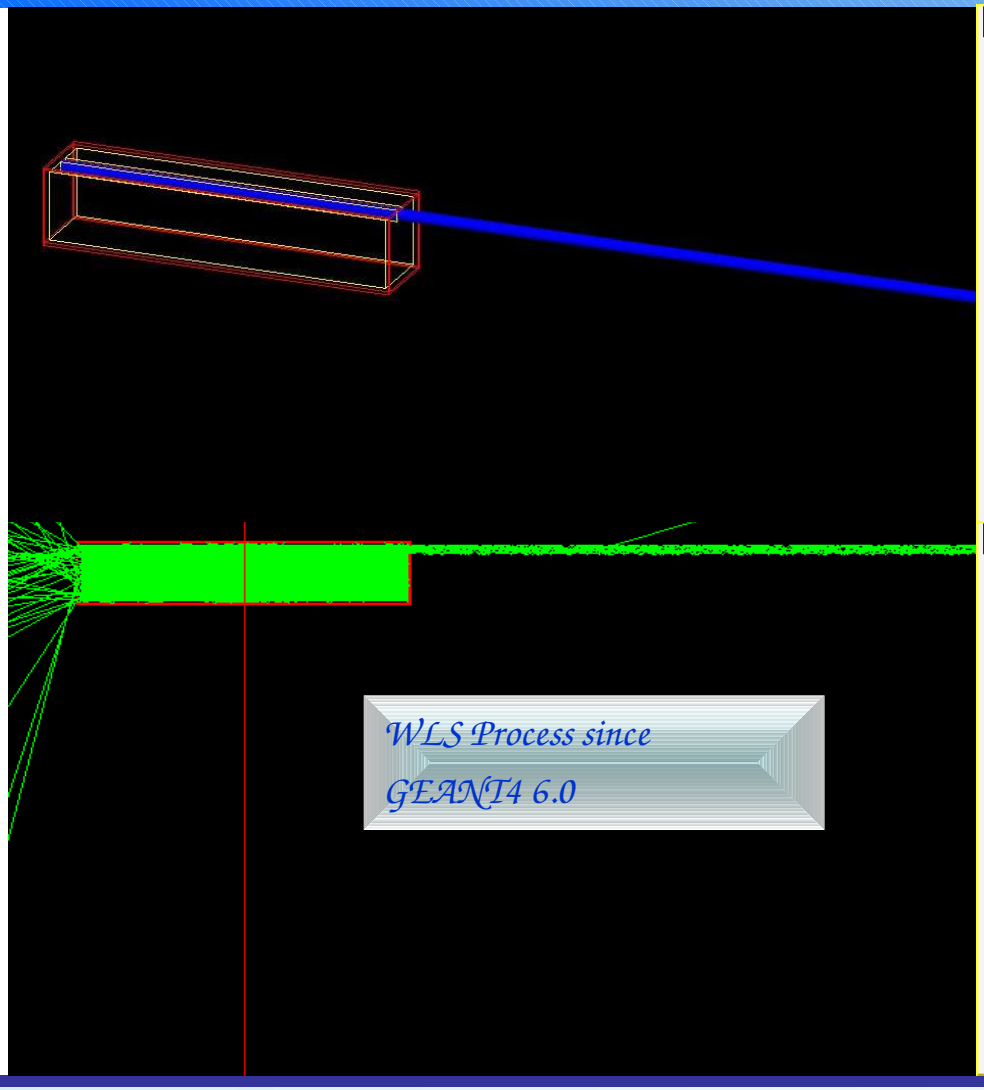




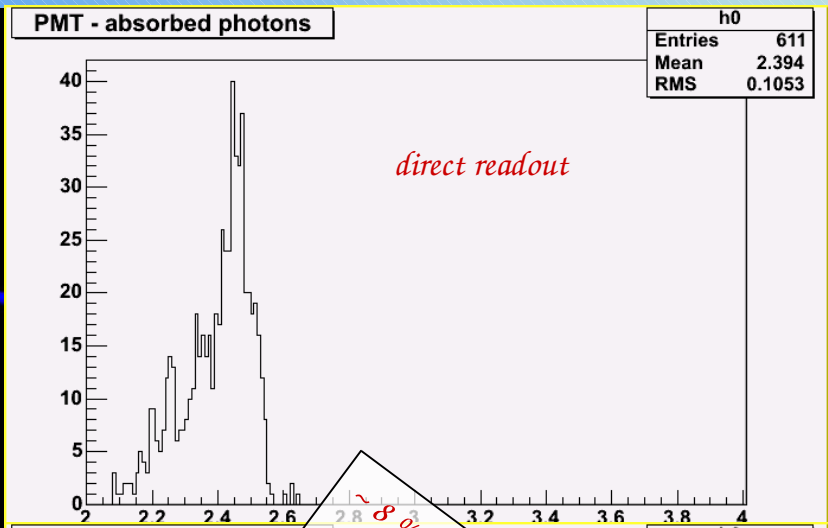


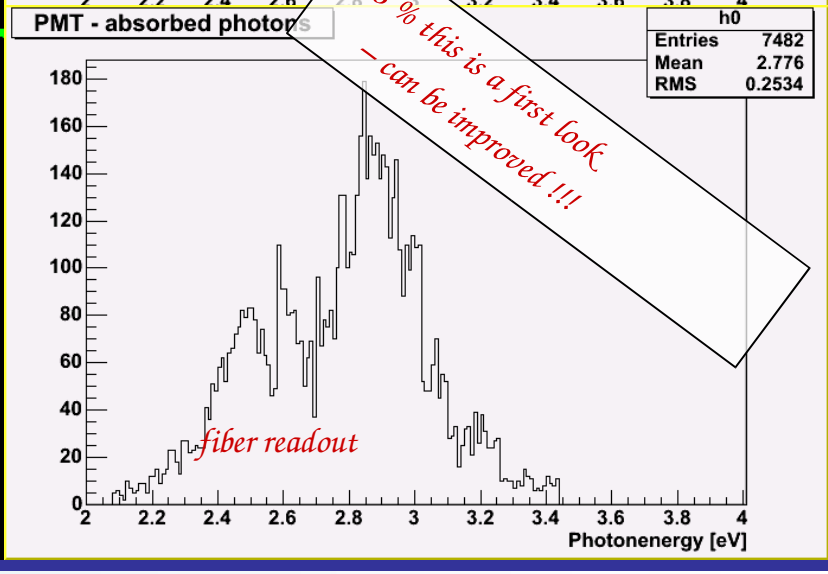
-> Crosstalk < 1%

GEANT4 simulation of lightyield



WLS Process since
GEANT4 6.0





~ 8 % this is a first look
– can be improved !!!

Summary

Fiber readout method was tested with different samples

The lightyield is reduced due to fiber readout to ~15 %

There seems to be no relevant crosstalk between the segments (< 1%)

First simulation results are comparable and can be improved

the technology is promising