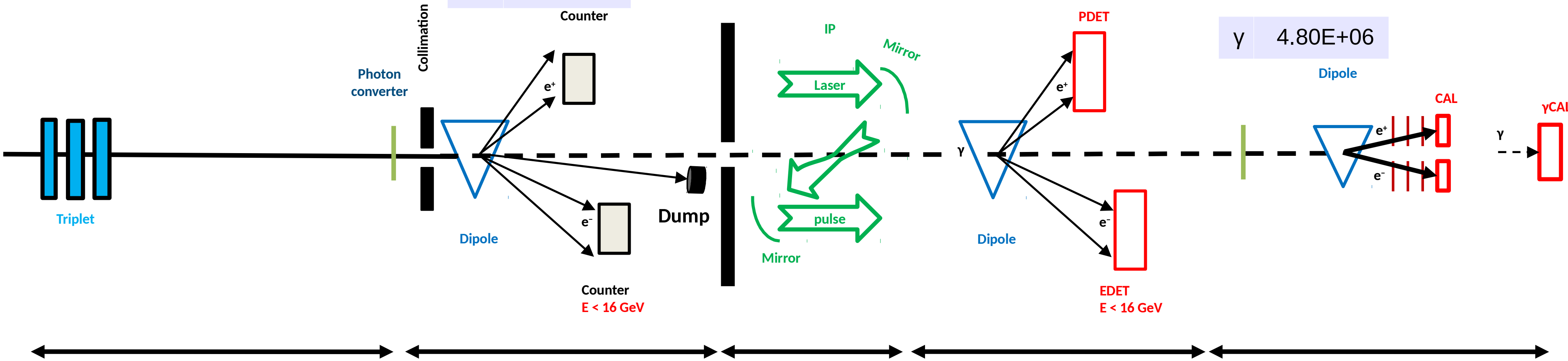
Photon-Photon collisions at LUXE

e-	6.25E+09

e-	6.26E+09
e+	1.62E+06
γ	5.60E+08

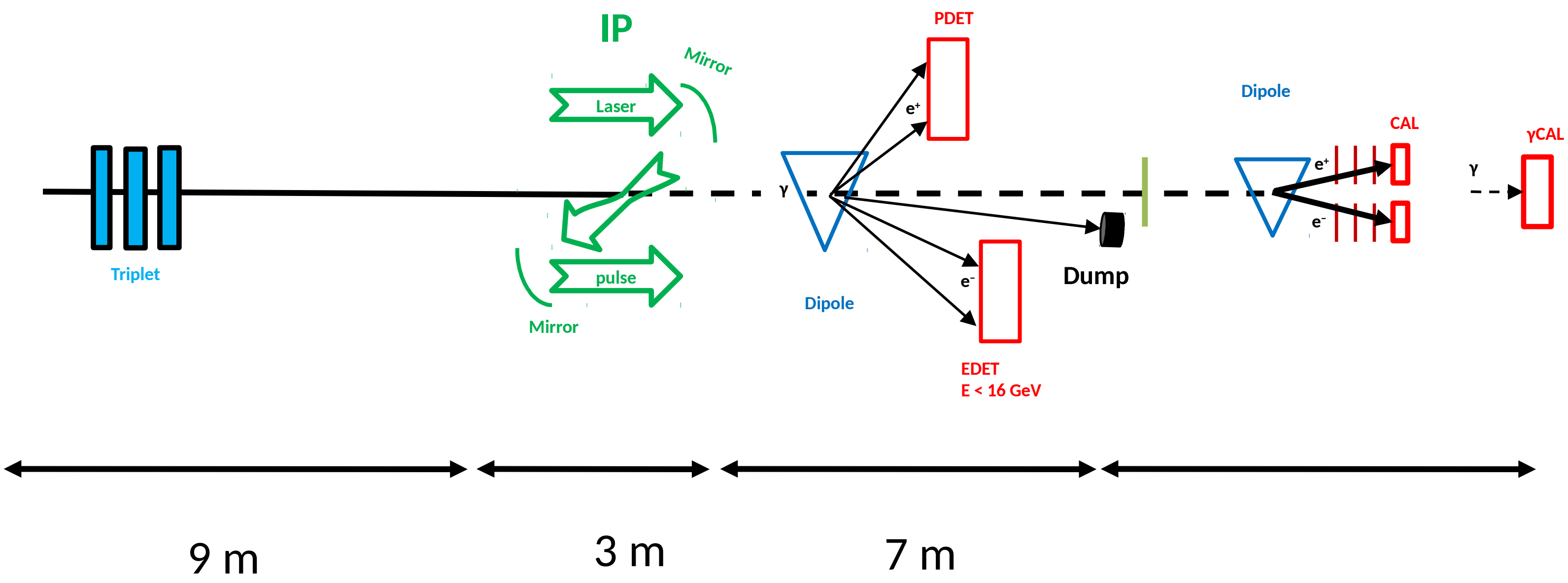
γ	4.91E+06
γ, E >7GeV	4.66E+05

	Stage 0	Stage 0.5
e-	1.32	24.5
e+	1.32	24.5



Area	Desctiption	e-	e+	Gamma	Notes
A	Incident beam	6.25E+09			XFEL beam sigma_xy = 5µm, emittance: 1.4e-3
B	Target	6.26E+09	1.62E+06	5.60E+08	Tungsten 35 um, (1%X0), 5 m upstream of IP
C	Collimator	6.26E+09	1.62E+06	5.60E+08	After target: 35 um tungsten (1%X0); +/-10 cm
D	Dipole	6.26E+09	1.62E+06	5.60E+08	
E	IP			4.91E+06	Geometrical cut |x|<25um && |y|<25um is applied to match laser transverse size
	E > 7 GeV			4.66E+05	
	E > 12 GeV			1.92E+05	
F	Dipole				
	Stage 0	1.32	1.32	4.80E+06	Laser: 1.0e19 W/cm2, (0.35J, 100um2, 35 fs)
	Stage 0.5	24.5	24.5		Laser: 2.6e19 W/cm2, (1.0J, 100um2, 35 fs)
	Stage 1				Laser: 2.0E+20 xi=6.88
G	γ detector			4.80E+06	

Electron-Photon collisions at LUXE



Area	Desctiption	e-	e+	Gamma	Notes
A	Incident beam	6.00E+09			
B	HICS	6.00E+09		5.74E+09	6.0e-9 electrons were used as input in simulation

Number of particles

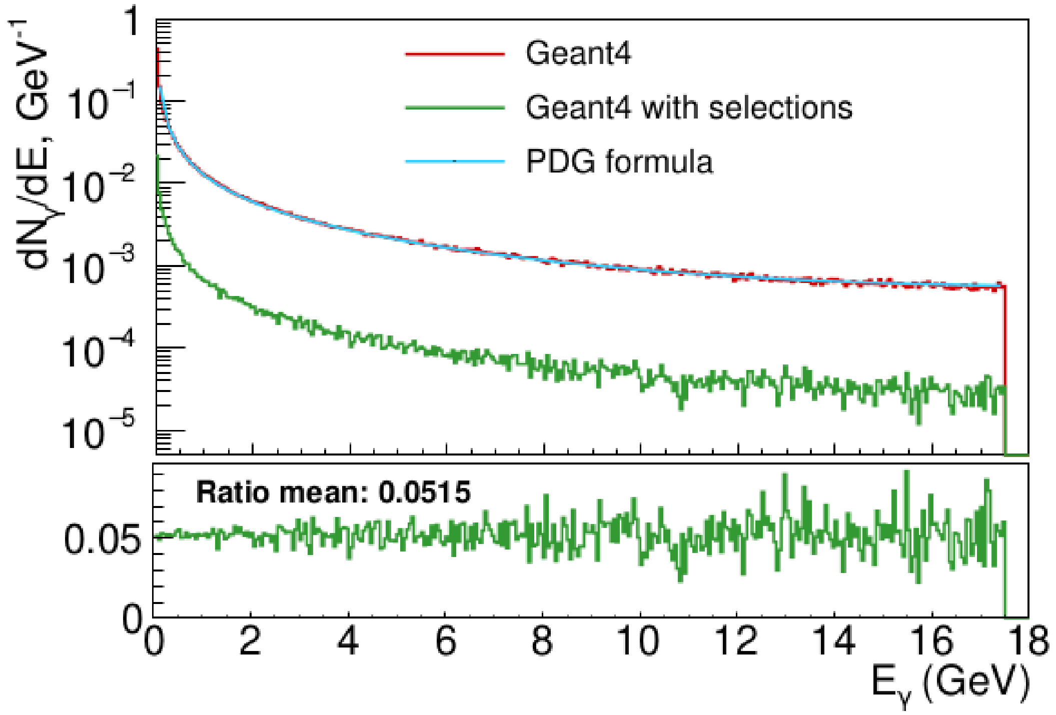
2 m from the target to IP

	e-	e+	Gamma	
Before target	6.25E+09			XFEL beam sigma_xy = 5µm, emittance: 1.4e-3
After target				35 um tungsten (1%X0)
Before IP			2.89E+07	
After IP				
Stage-0	7.89	7.89		Laser: 1.0e19 W/cm2, (0.35J, 100um2, 35 fs)
Stage-0.5	128.3	128.3		Laser: 2.6e19 W/cm2, (1.0J, 100um2, 35 fs)

Bremsstrahlung production Gent4 vs PDG formula

PDG formula for bremsstrahlung production:

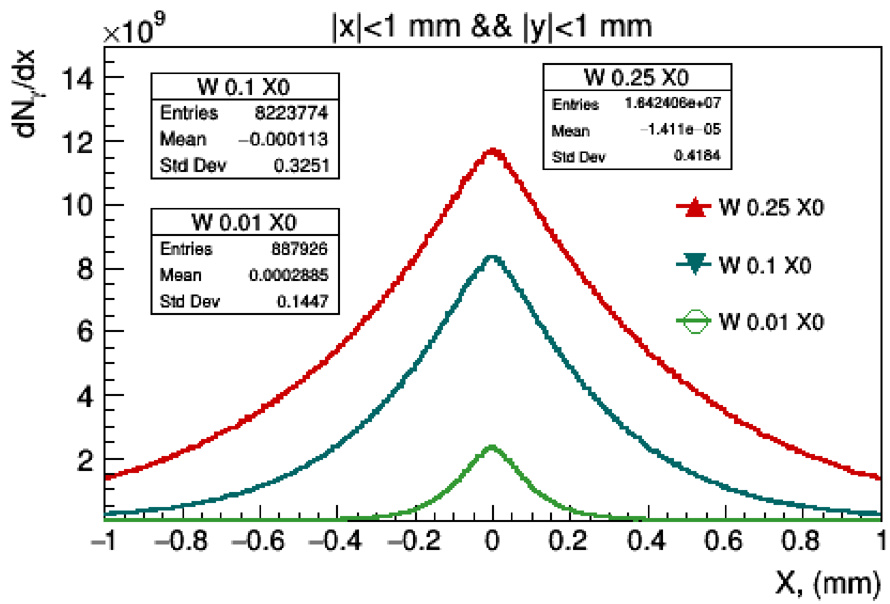
$$\omega_i \frac{dN_\gamma}{d\omega_i} \approx \left[\frac{4}{3} - \frac{4}{3}\left(\frac{\omega_i}{E_e}\right) + \left(\frac{\omega_i}{E_e}\right)^2\right] \frac{X}{X_0}$$



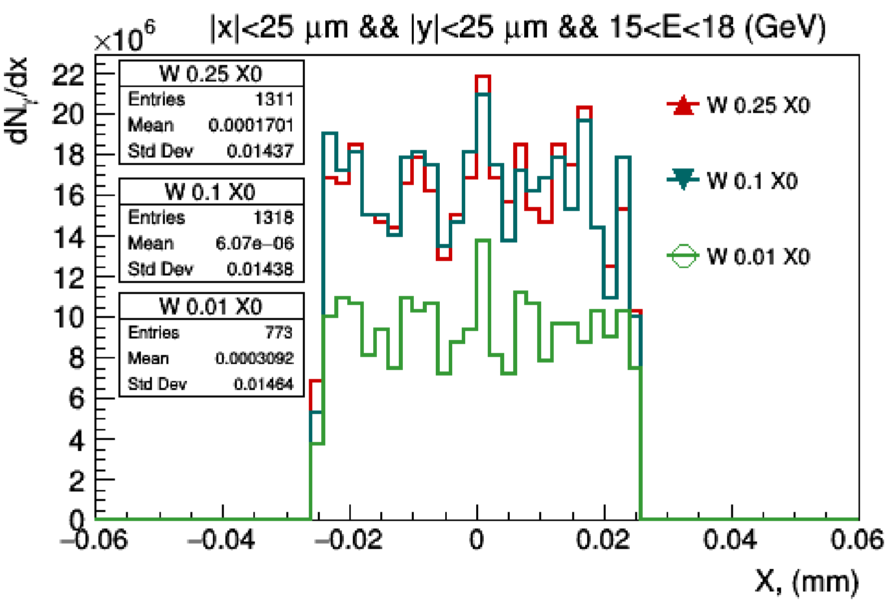
- Gaussian beam;
- Tungsten target 1%X0 (35um), 2m from IP;
- 10M electrons
- Two histograms are compered:
  - |x| < 1mm and |y| < 1mm;
  - |x| < 25um and |y| < 25um.

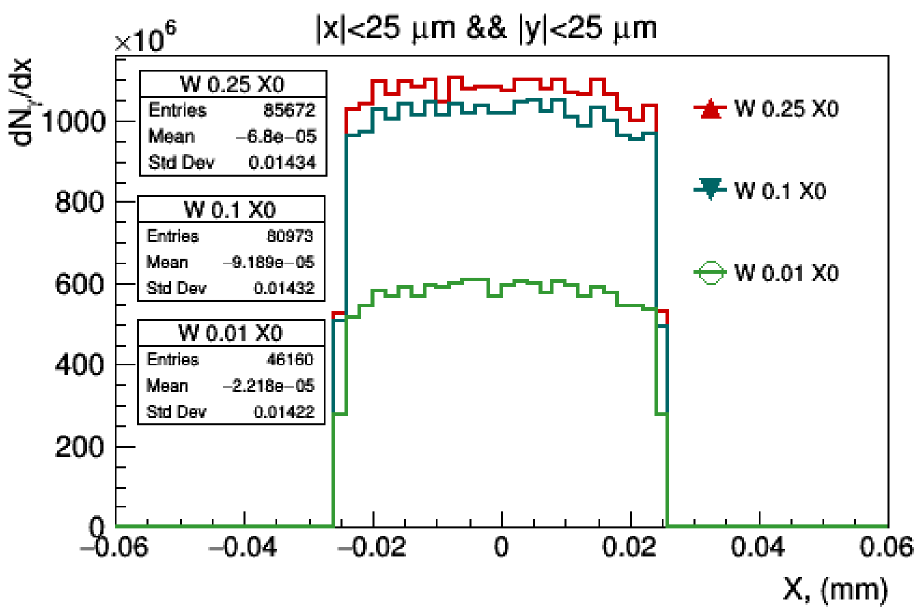
Bremsstrahlung Production

- Gaussian beam;
- Different tungsten thickness, 2m from IP;
- 10M electrons;
- Bin content multiplied by 625/bin_width.

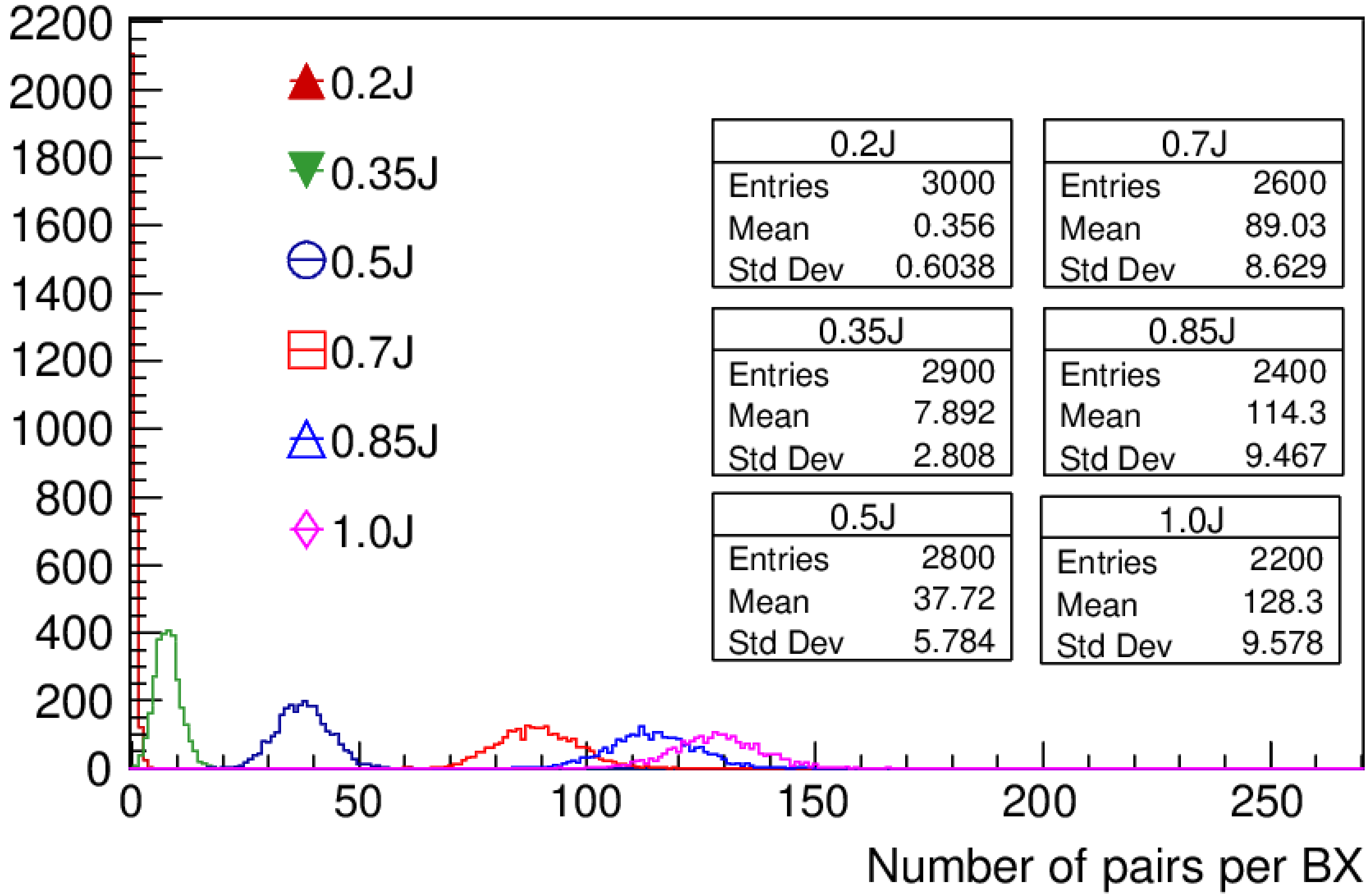


The fraction of photons inside
|x|<25um and
|y|<25um
can be estimated as 46160/887926 = 0.052.
More accurate estimation is on the next page.

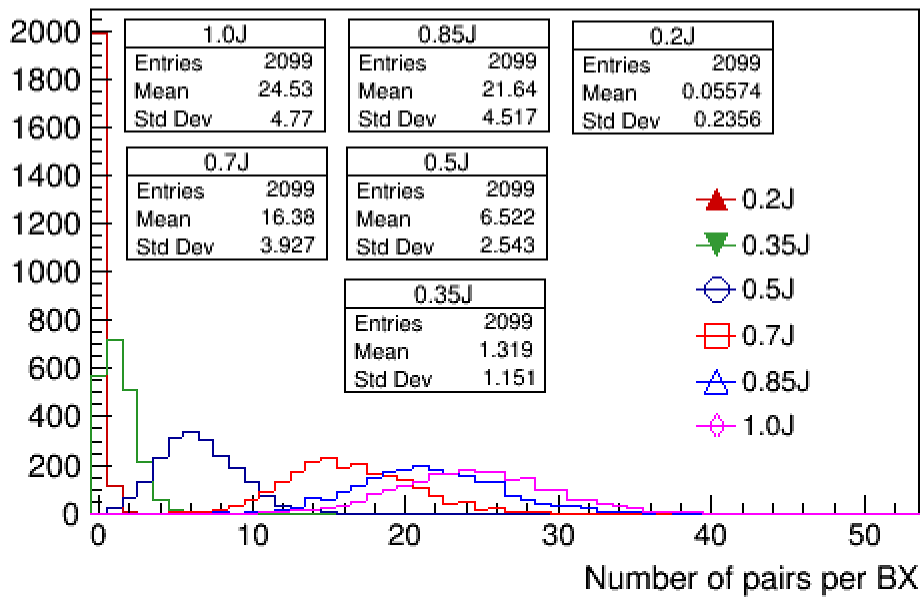


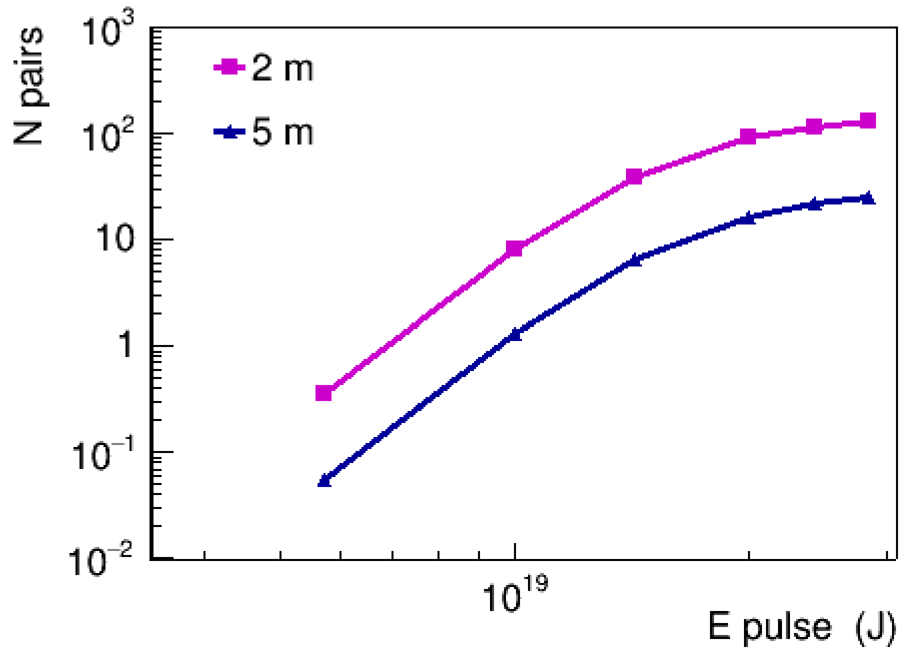


Number of pairs for different laser intensity, target 2 m upstream of IP



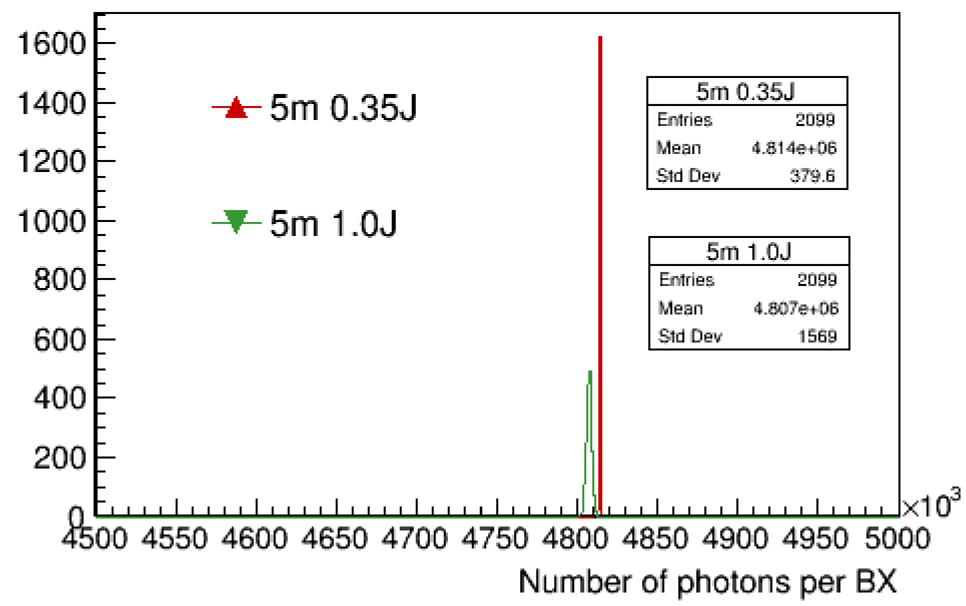
Tungsten target 5 m upstream of IP

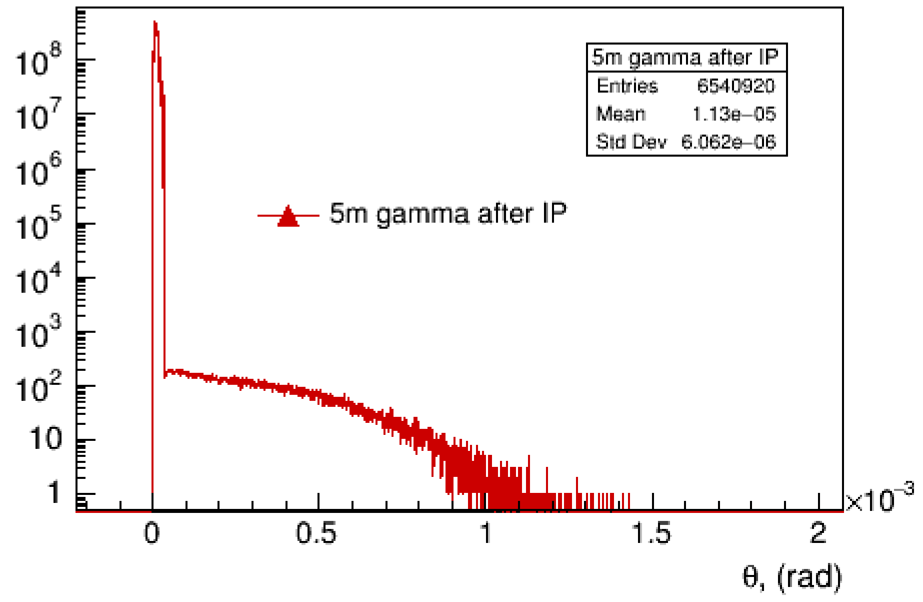




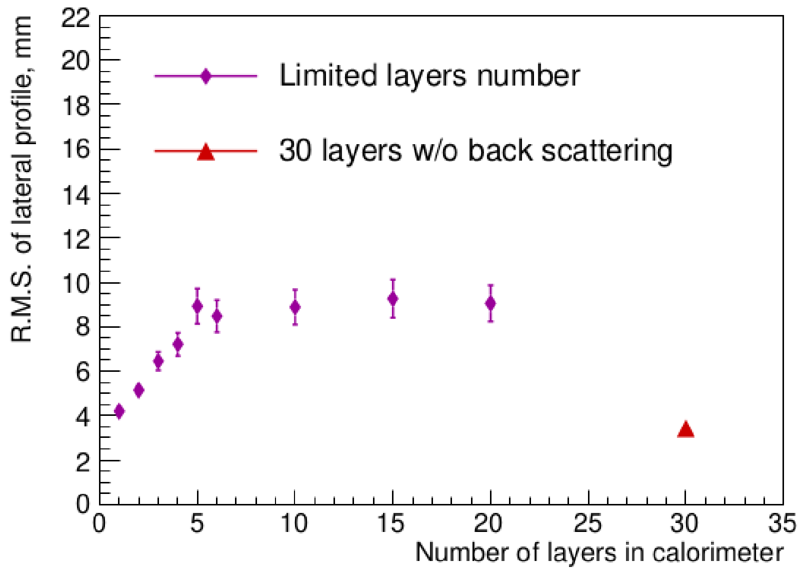
xi	I (W/cm2)	N pairs 2m	N pairs 5m	N2/N5
1.16	5.71E+018	0.356	0.0557408	6.39
1.54	1E+019	7.89241	1.31872	5.98
1.84	1.429E+019	37.7175	6.52168	5.78
2.18	2E+019	89.0315	16.3754	5.44
2.4	2.429E+019	114.31	21.6355	5.28
2.6	2.857E+019	128.306	24.5345	5.23

Gamma after IP

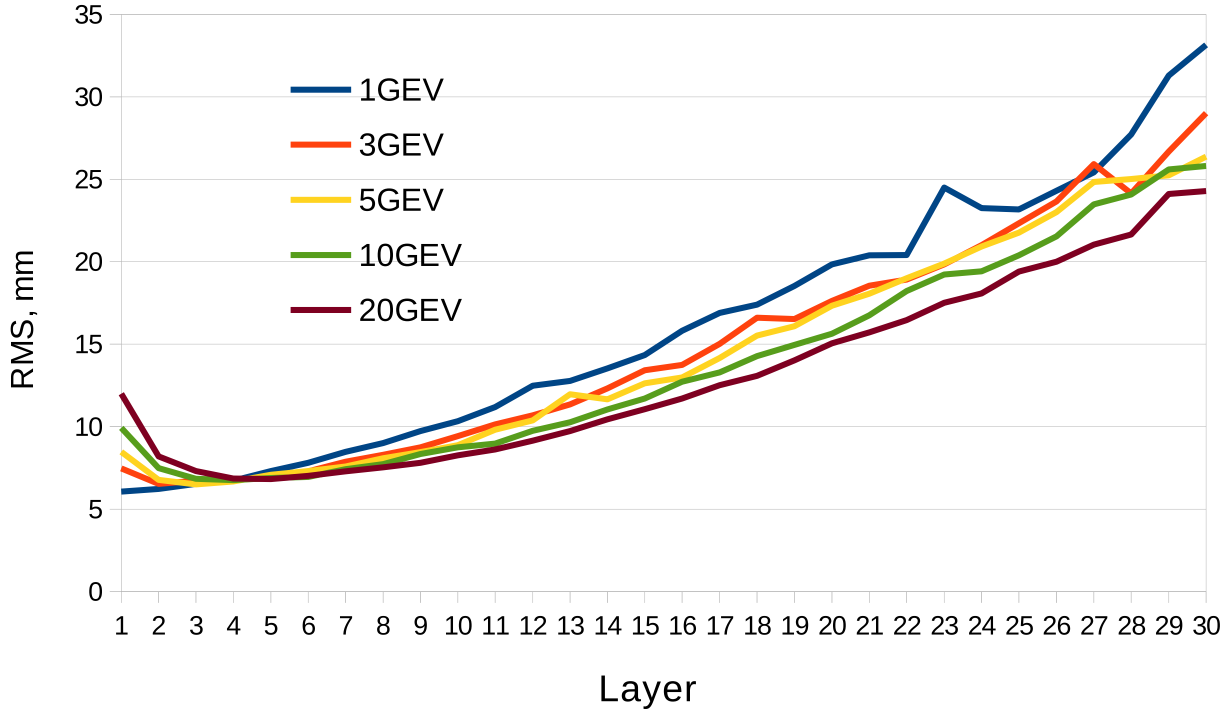




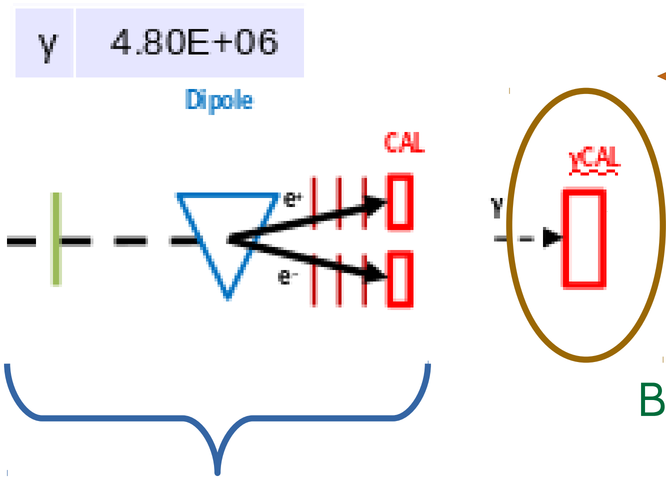
Back scattering in calorimeter

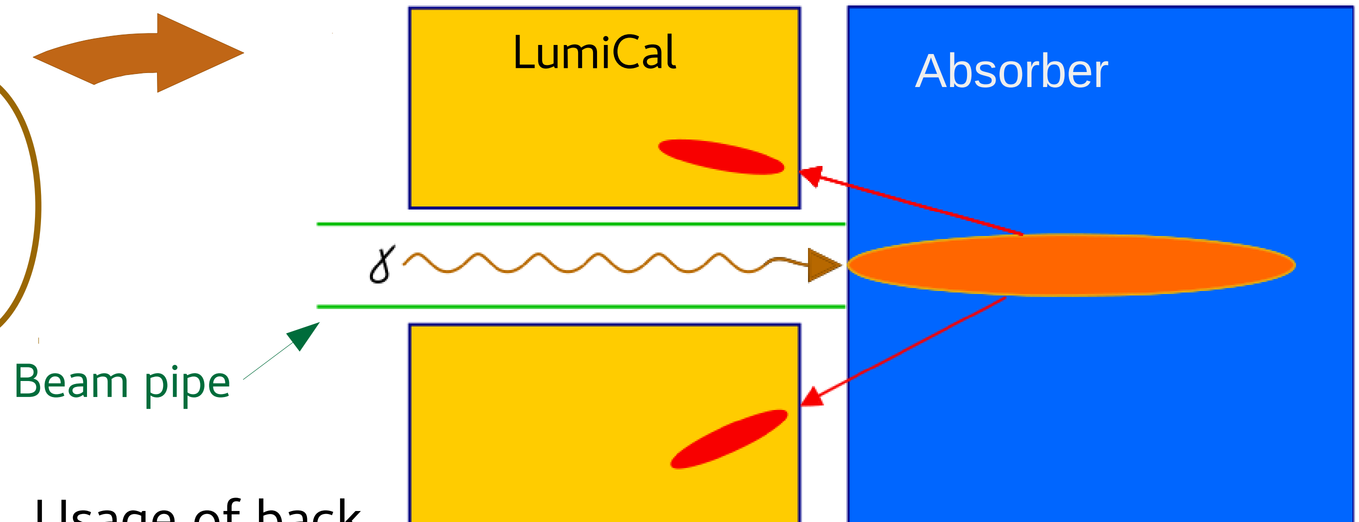


RMS of the lateral shower profile in different layers for different electron beam energy



Possible techniques for gamma detector

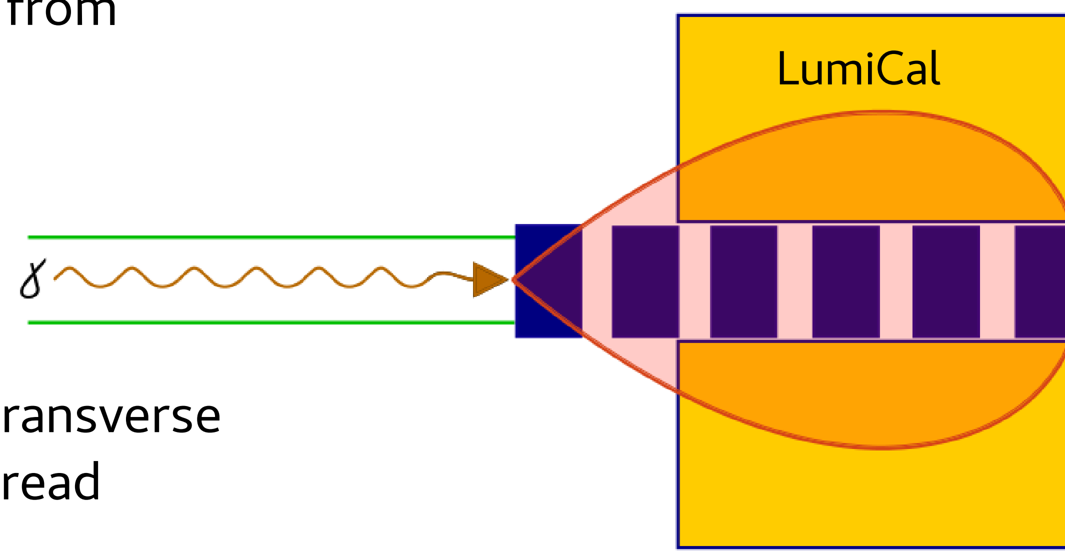




10 μm tungsten wire converter produce:

- ~5e5 e+e- for HICS;
- ~100 e+e- for bremsstrahlung (OPPP);
- By scanning x, φ probe E(θ)

Usage of back scattering from absorber



Usage of transverse shower spread

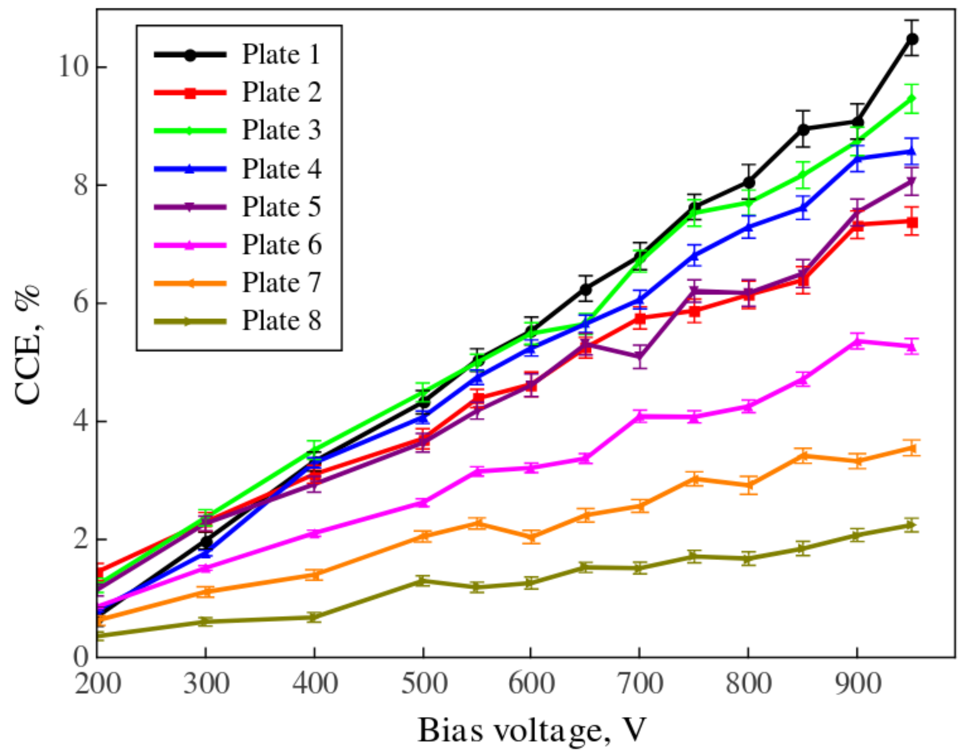
Sapphire sensor

arXiv:1504.04023

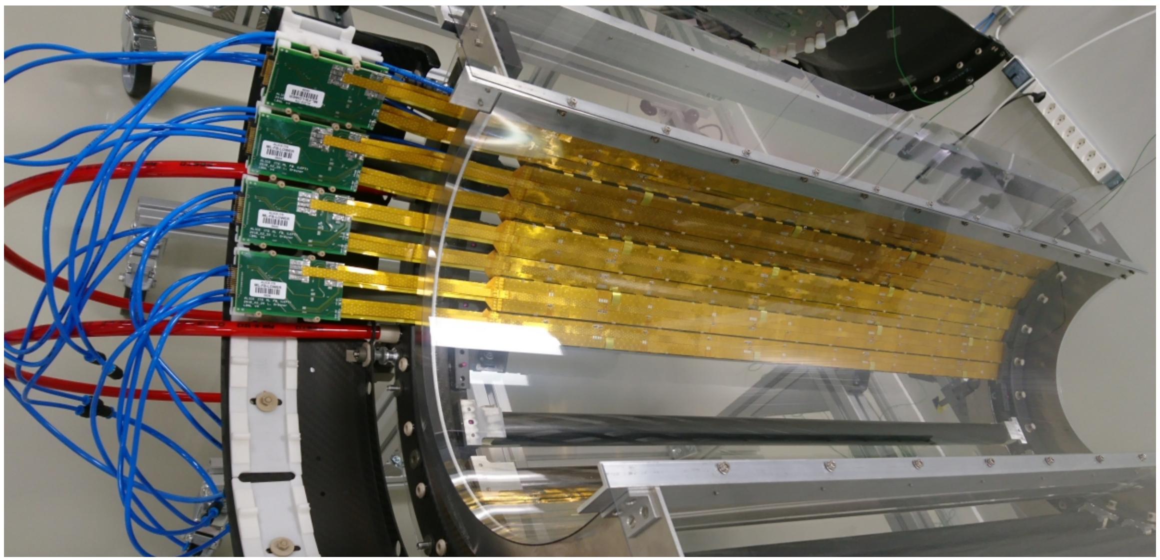
- For a CCE of about 10% of industrially produced sapphire,the signal expected for particles crossing a plate of 500µm thickness perpendicular to its surface is only about 1100 e;
- CCE depends on applied voltage and can be below 10%;
- Good radiation hardness.

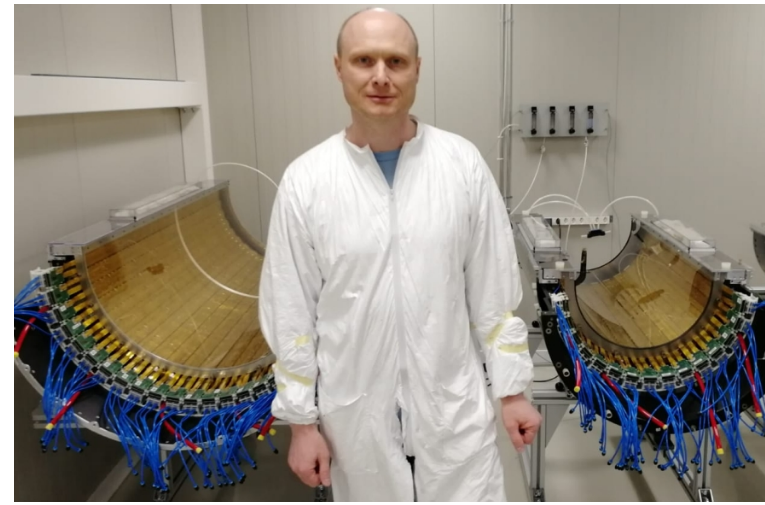
For comparison: 300µm Si: ~25000 eh
with CCE ~100%

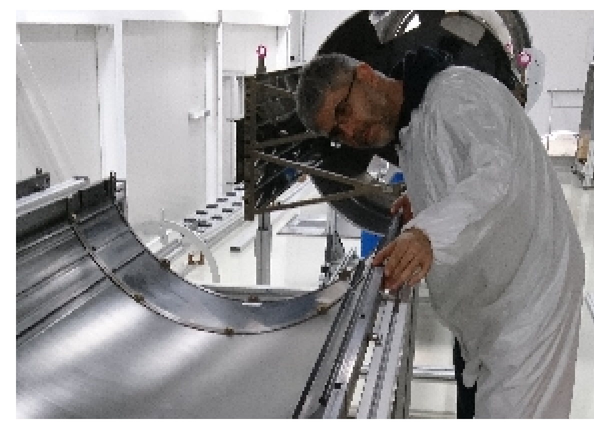
Thin sapphire sensors can be considered for usage in present design of LumiCal instead of silicon.

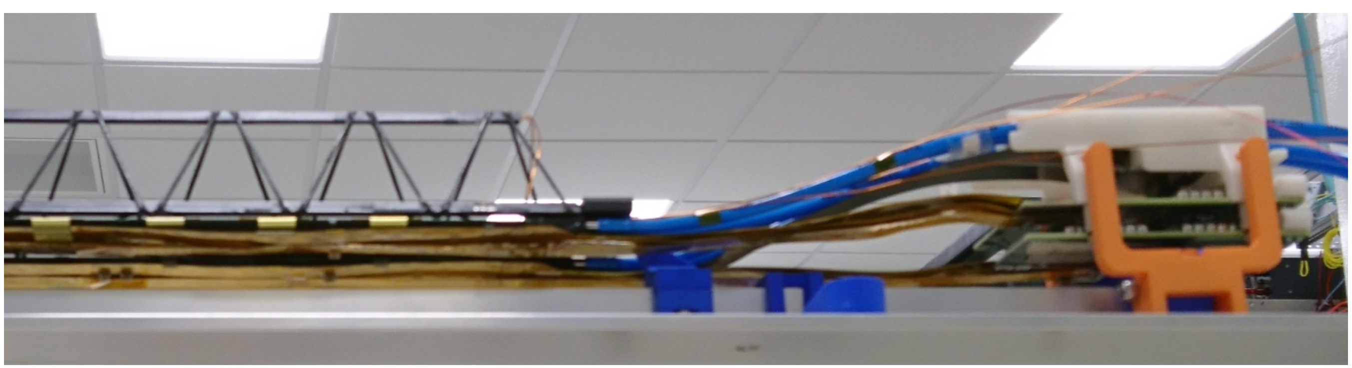


CERN ALICE ITS assembly clean room









10th Terascale Detector Workshop 2017

10-13 April 2017
DESY Hamburg
Europe/Berlin timezone

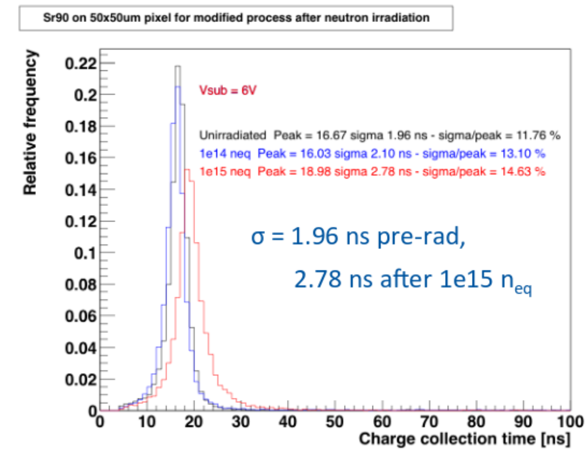
The ALPIDE CMOS Pixel Sensor development for the ALICE ITS upgrade

W. Snoeys, CERN, for the ALICE collaboration

Summary

ALPIDE CMOS Pixel Sensor Chip for the ALICE ITS upgrade now in production

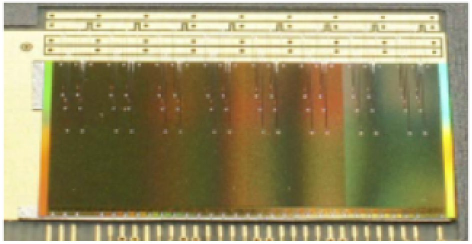
Used also for the new Muon Forward Tracker (MFT) detector



Key features

- 15 mm × 30 mm, 512 × 1024 pixels, 29 μm x 27 μm pitch
- High resistivity epitaxial layer, deep pwell, reverse bias
- 40nW analog front-end, in-pixel discrimination and multi-event buffer
- Global Shutter (<10 us). Triggered or Continuous readout modes
- Versatile interfaces and features for the integration of multi-chip modules
- Power density < 35 mW/cm^2 (<20 mW/cm^2 with readout from parallel port)

Performance of full-scale prototypes in test beams



- Detection Efficiency > 99%
- Fake hit rate << 10^{-5} /event/pixel
- Position resolution < 5 μm

Starting point for ATLAS development after first results of the process modification

See H. Pernegger's presentation

Readout rate, Pb-Pb interactions (kHz)	100	
Hit Density, Pb-Pb interactions (cm^{-2})	18.6	2.8