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WP 28 / T2
SiPM coupled advanced fibre detectors

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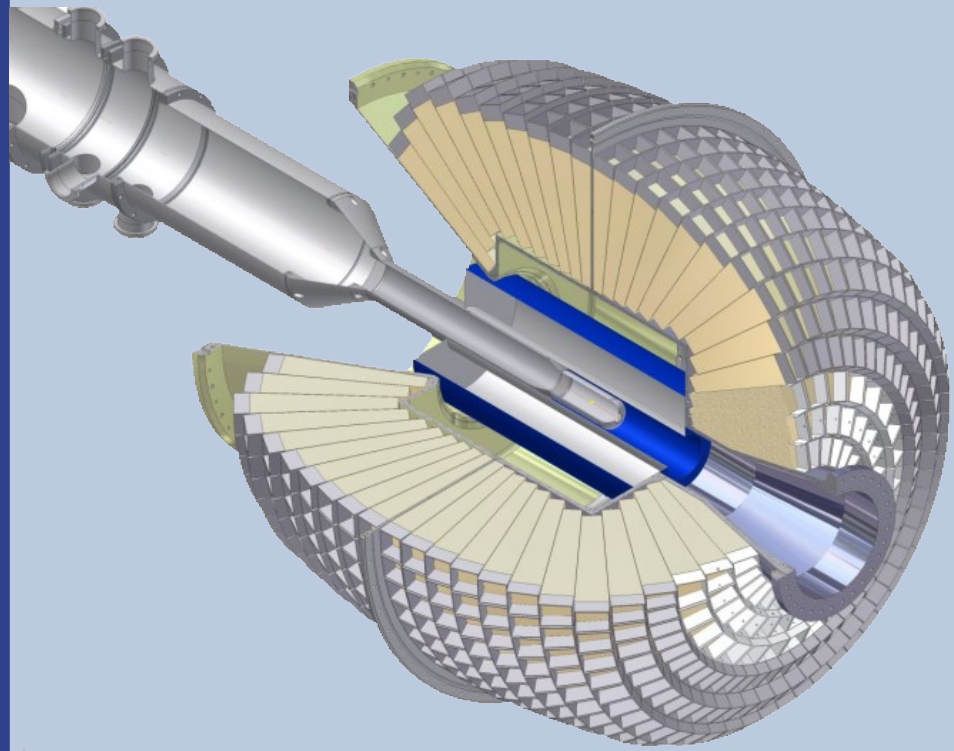
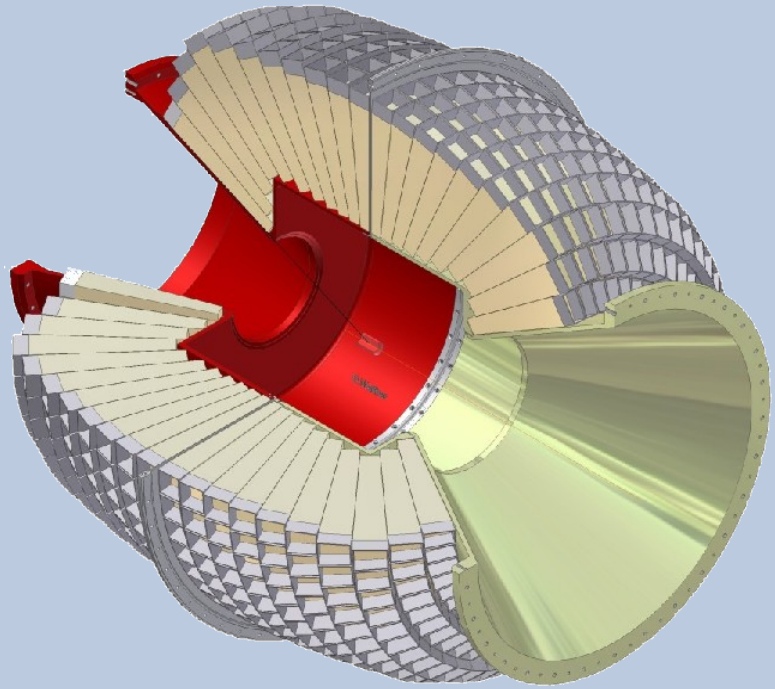
Places for SiPM Application at UBO

2009

- Calorimeter Trigger
- TPC Start Detector T2: SiPM coupled advanced fibre detectors

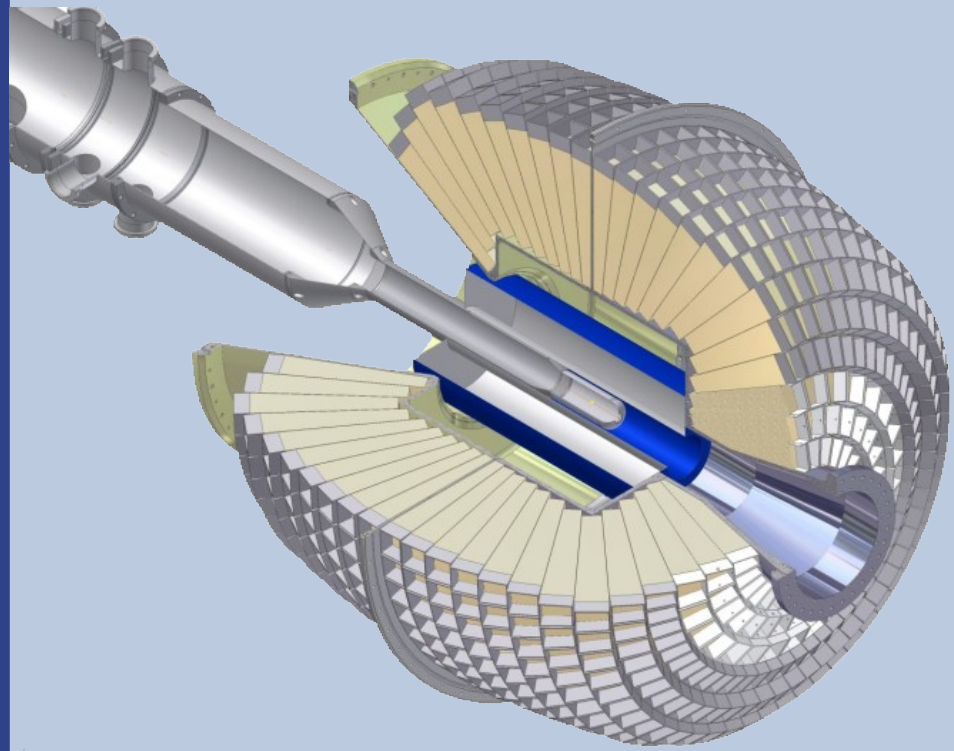


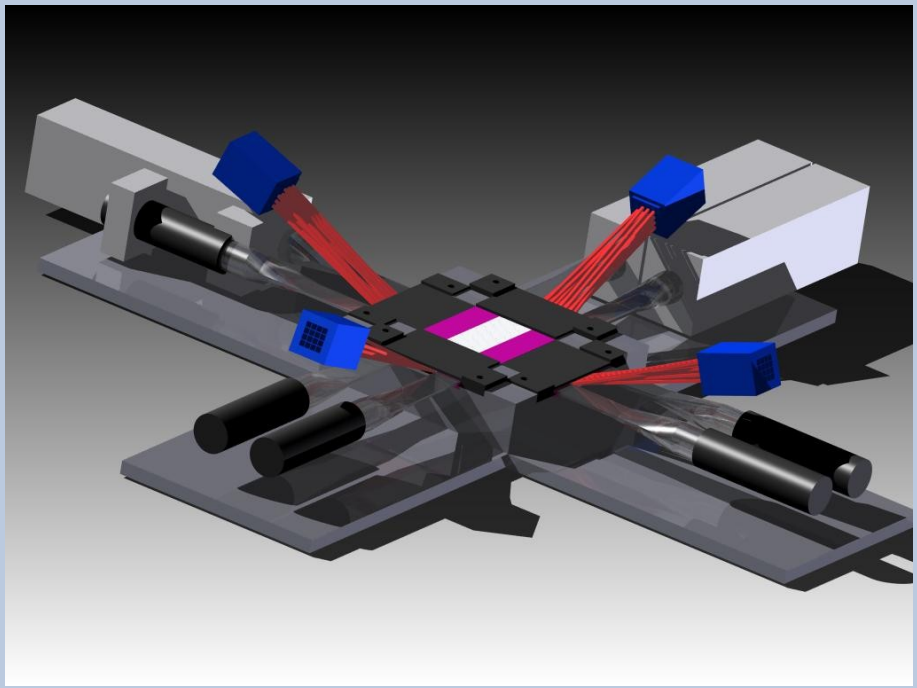


Places for SiPM Application at UBO

2010

- Calorimeter Trigger (APD readout)
- TPC Start Detector (now organic instead of inorganic fibres)
- for WP28 / WP21 : e^- / γ Beam - Monitor using inorganic fibres and SiPMs

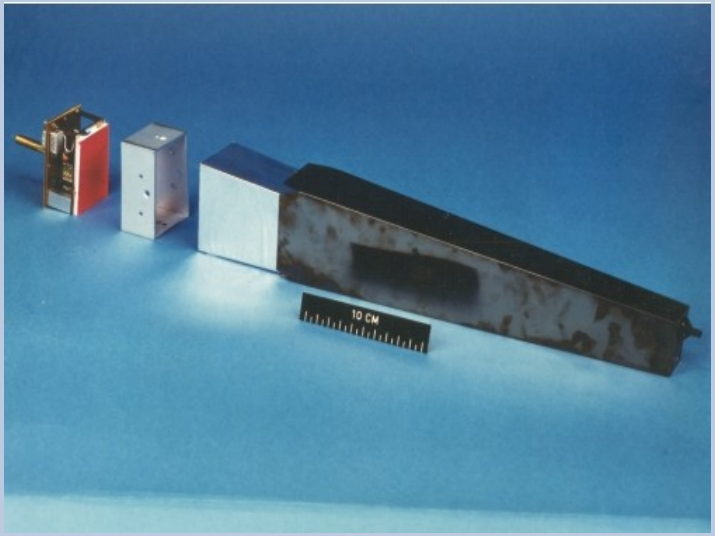




Trigger for the CB Calorimeter

1320 crystals - photodiode readout via WLS

no trigger capability



SiPMs added to the existing readout

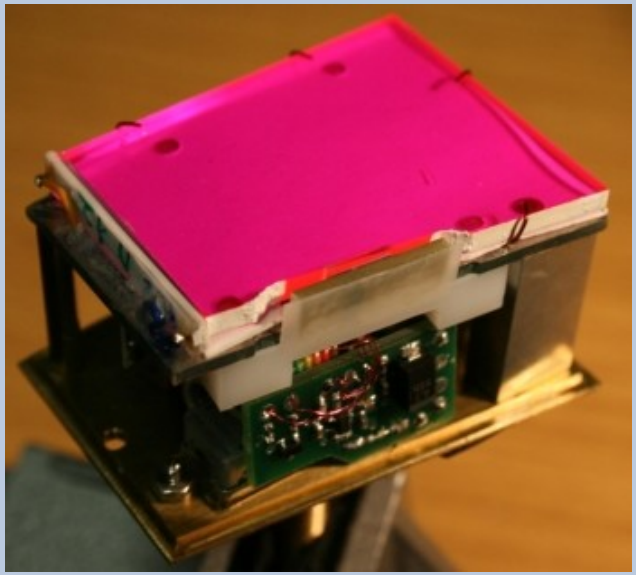
- lower temperature dependance
- low voltage
- min. thr.:

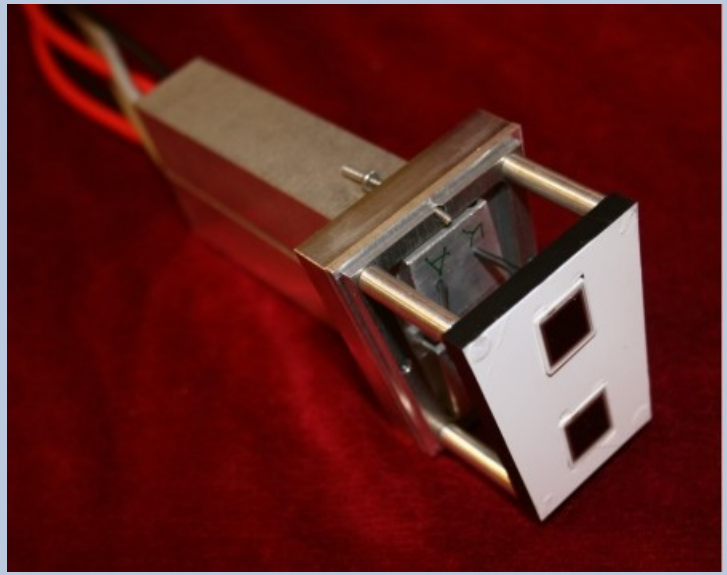
  trigger 16 MeV

new designed readout based on APDs

- strong temperature dependance
- „high“ voltage
- min. thr.:

  timing <1 MeV
  trigger 6 MeV





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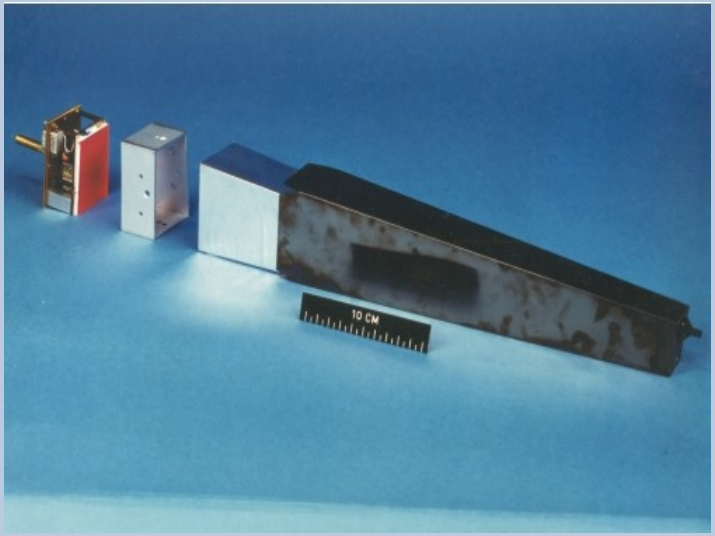

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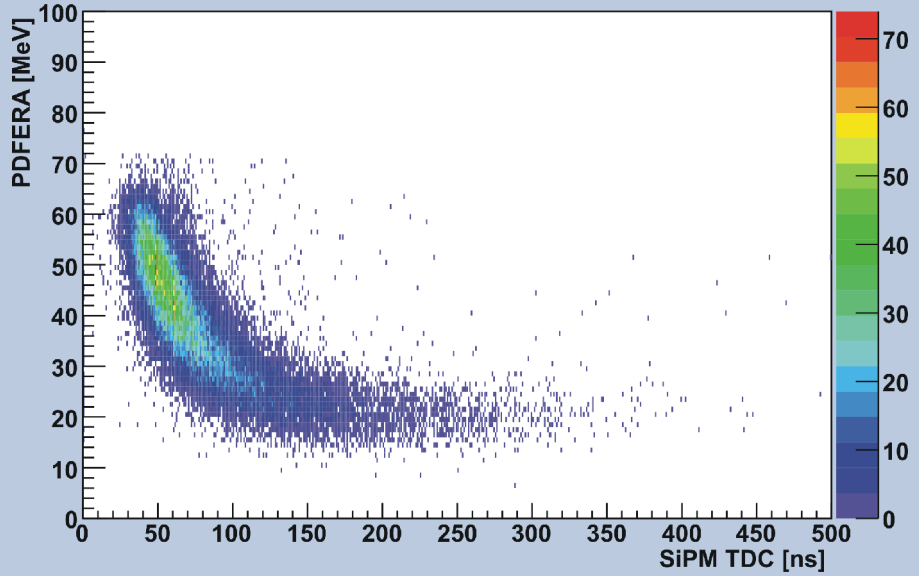
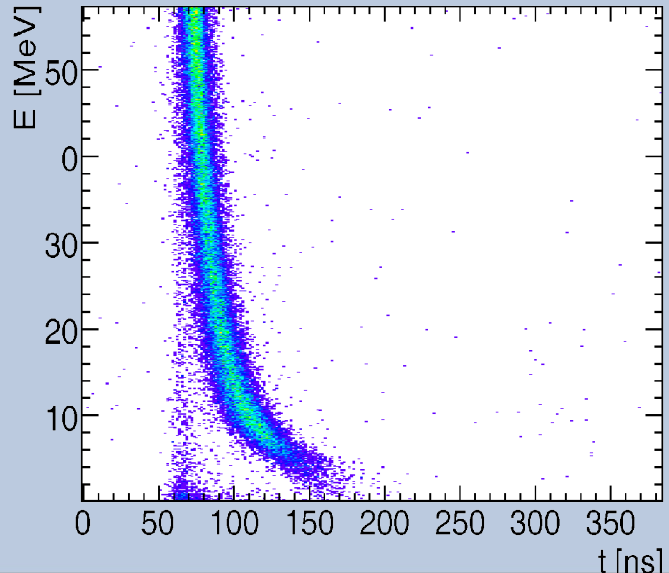




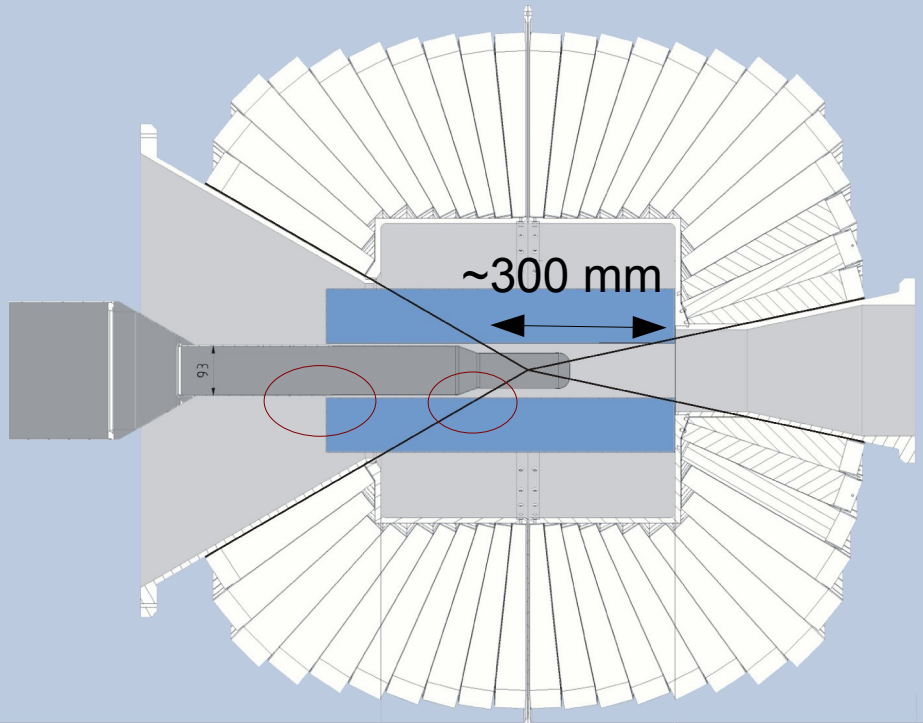
TPC Start Detector

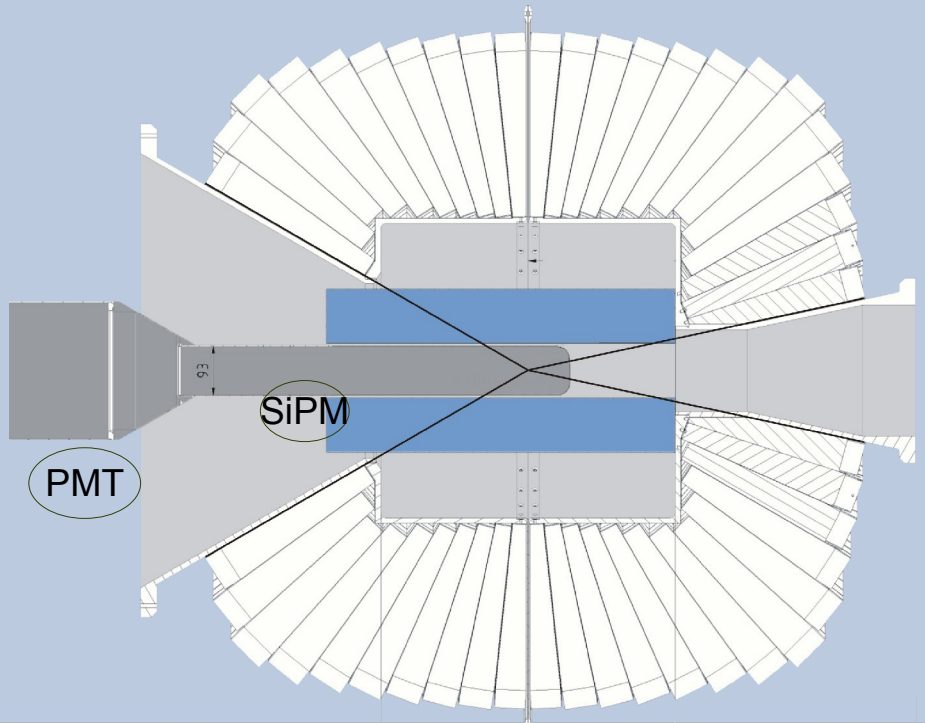
inorganic scintillating fibres (abandoned spring 2009)

- bright, but... high Z →
  - high photon conversion propability
  - large proton scattering angle

two layers of ~300 square (2 mm) plastic scintillator fibres

- small scattering angle
- ~ 20 photoelectrons at 30 cm
- fibre tests (almost) finished





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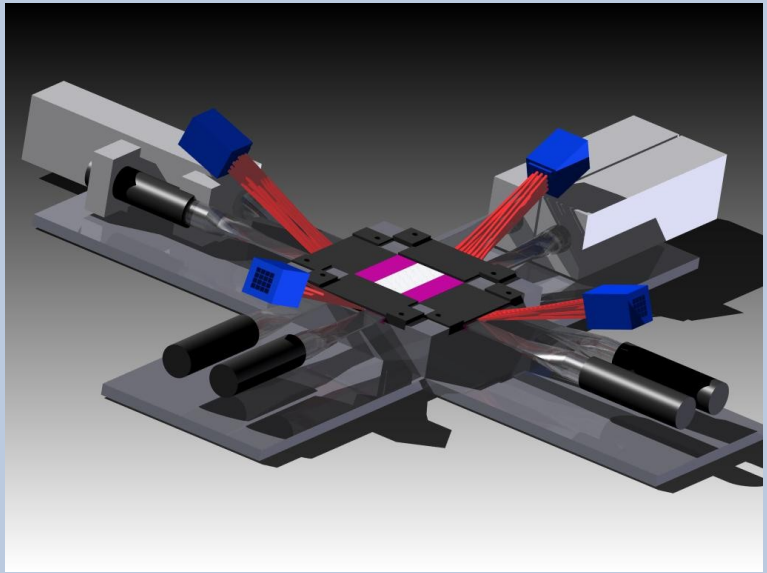
Beam Monitor

WP 28 / 21 : inorganic fibres with SiPM readout



„Proof of Concept“ detector

two times two crossed layers

first layer pair : square organic fibres
(electron beam dimensions and electron veto)

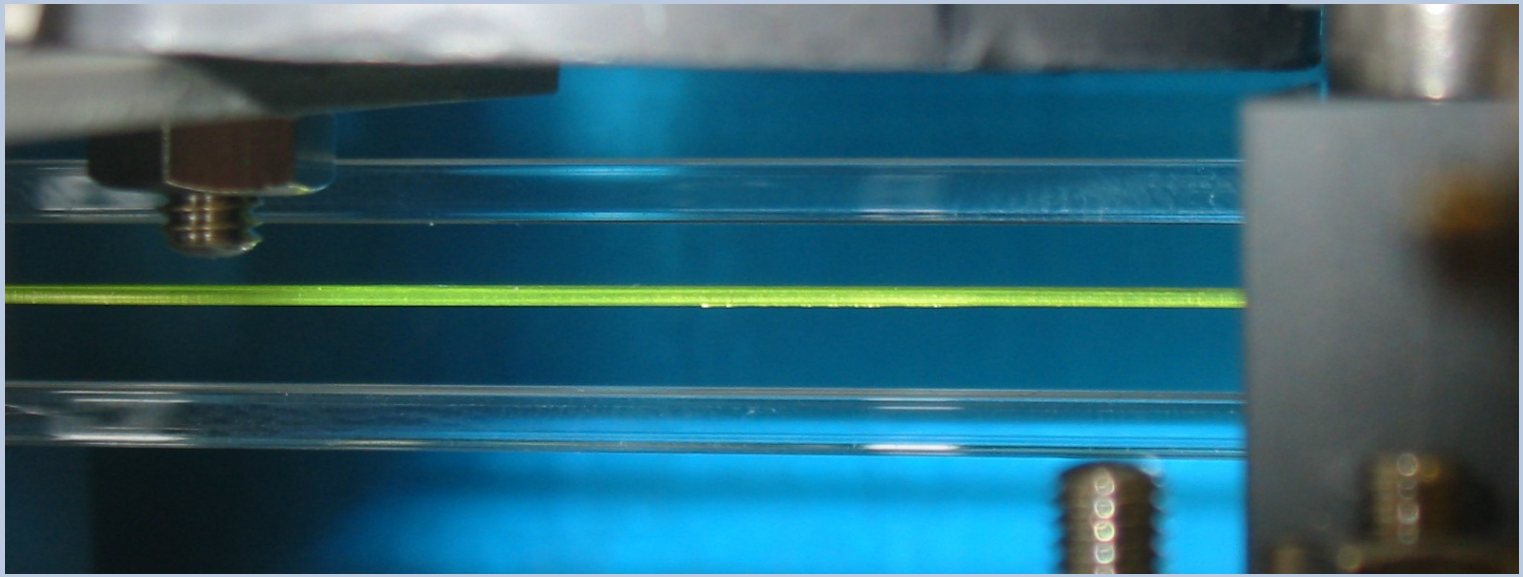
second layer pair : round inorganic fibres
(photon beam dimensions)

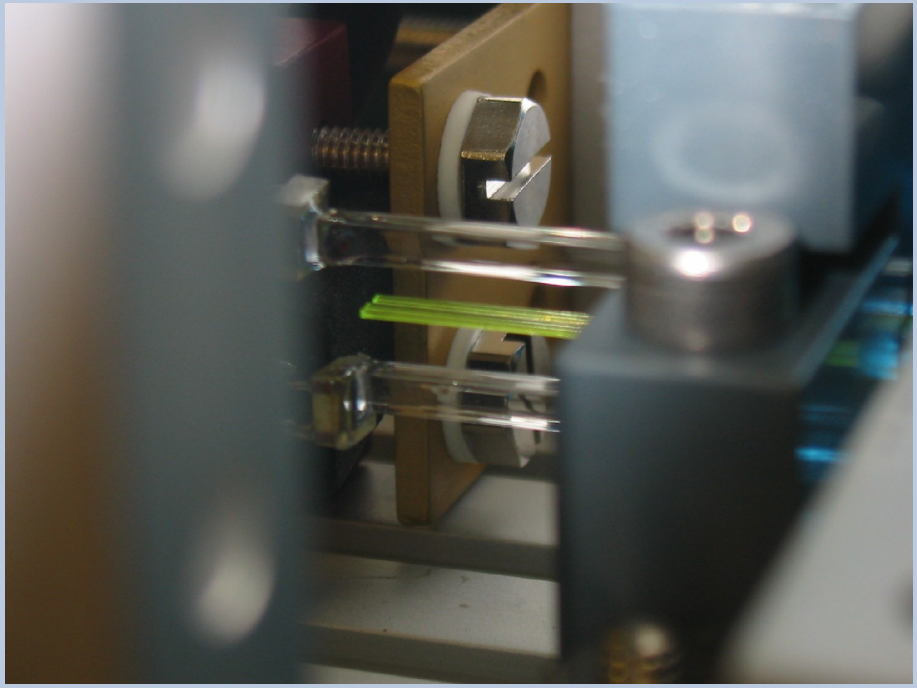
Testsetup

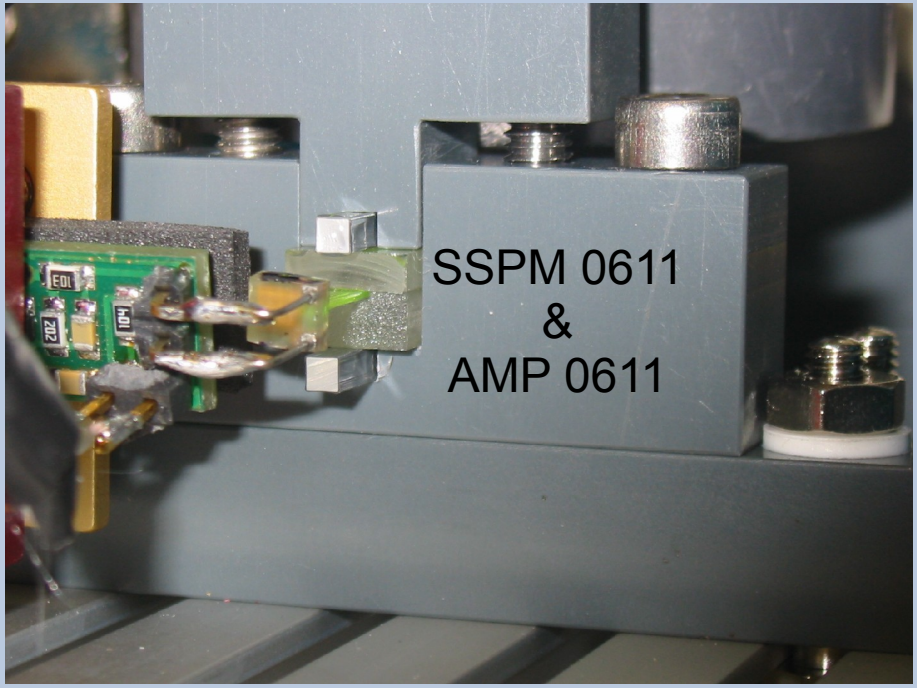
BCF12

YAG : Ce

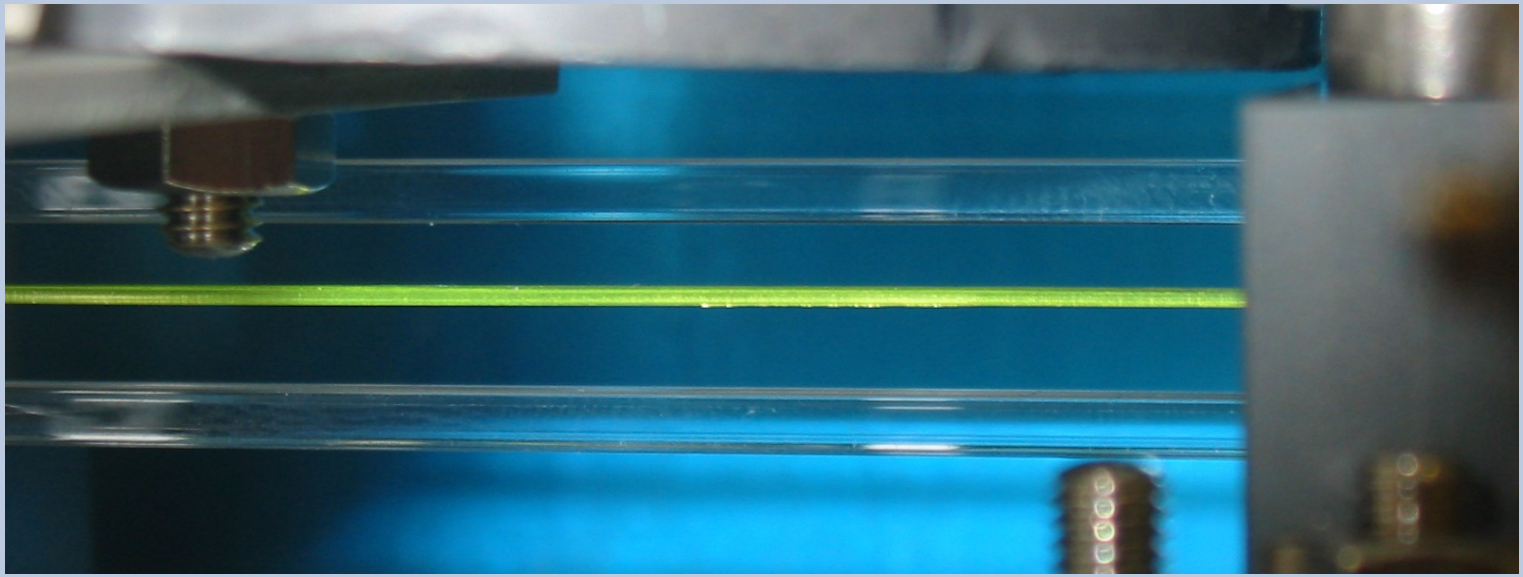
BCF12





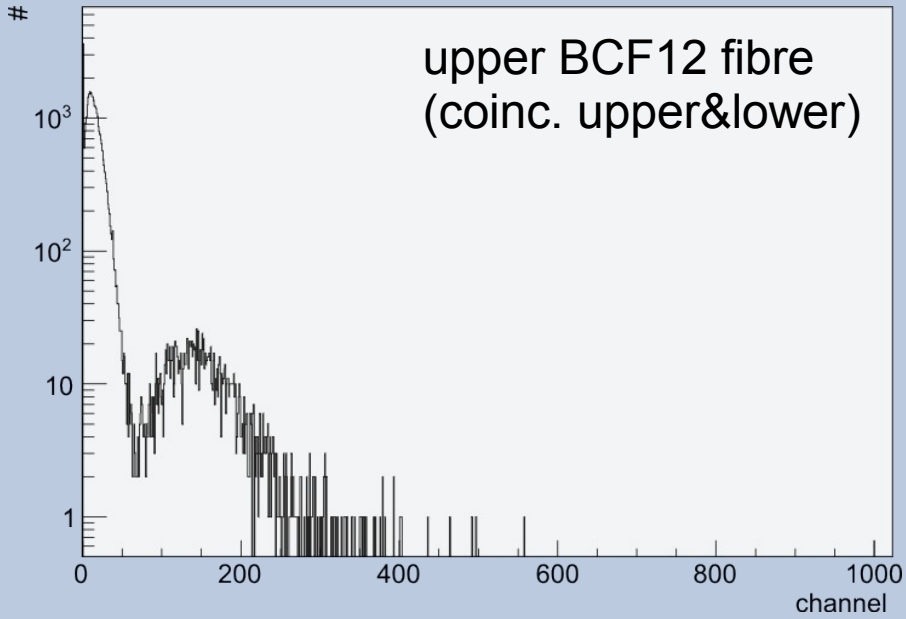


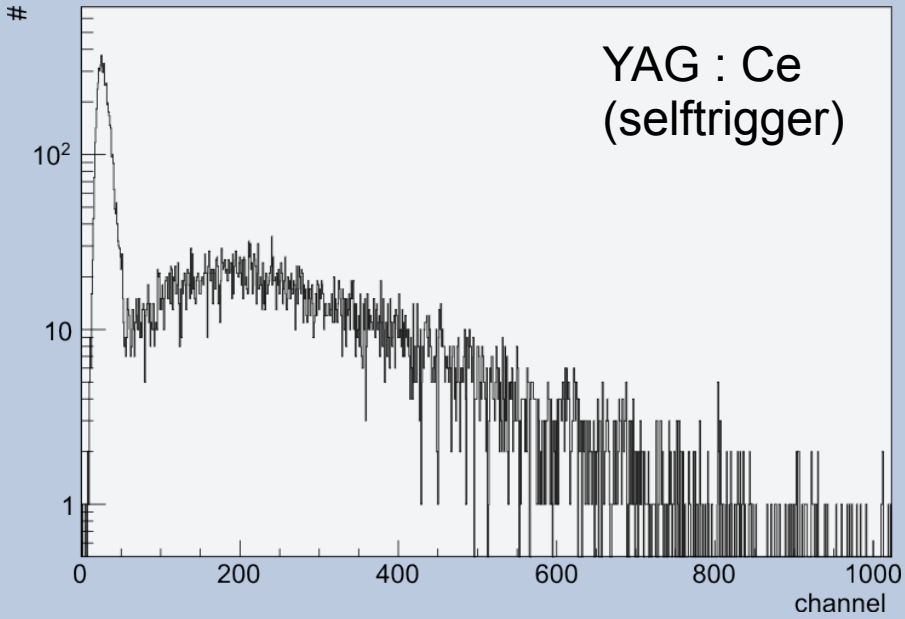
Expected Response



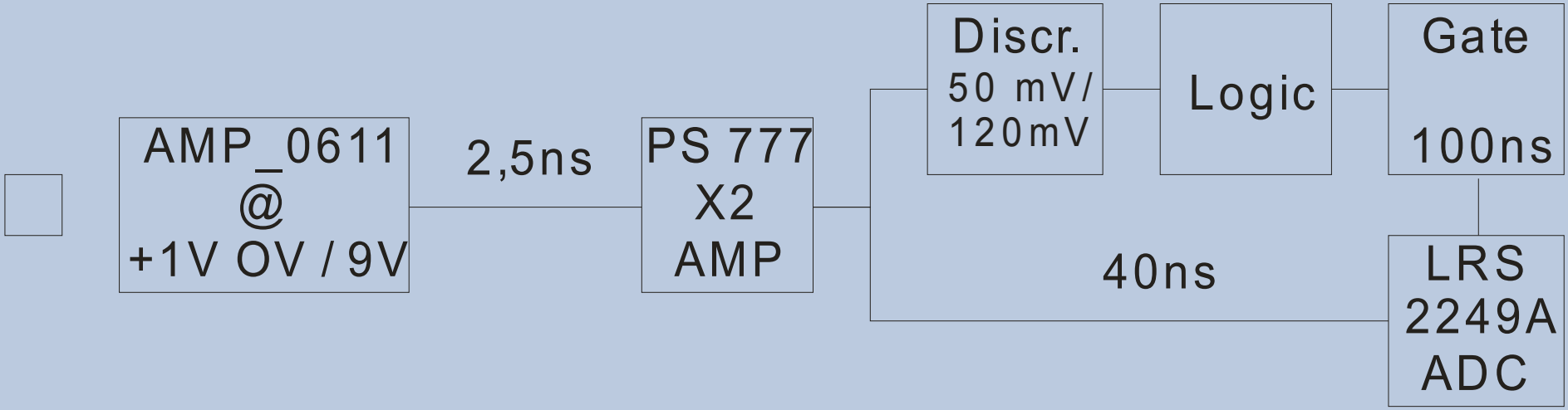
2 mm square organic (i.e. BCF 12 MC)		0,5 mm round inorganic YAG : Ce
1,8 - 2,6 MeV * cm / g	Material	1,4 - 2,4 MeV * cm / g (*)
1,9 - 2,7 MeV / cm	1,05 g/cm³ Density 4,57 g/cm³	6,4 - 11,0 MeV / cm
0,38 - 0,55 MeV	2 mm Thickness ~ 0,35 mm	0,22 - 0,38 MeV
3024 - 4368 Ph	8k Ph/MeV Lightyield 12k-25k Ph/MeV	2911 - 9597 Ph (**)
221 - 319 Ph	>7,3% Trapping Eff. ~ 5%	146 - 480 Ph
55 - 80 Ph	25% PDE @ λ 18%	26 - 86 Ph
	Coupling	

Measured Response

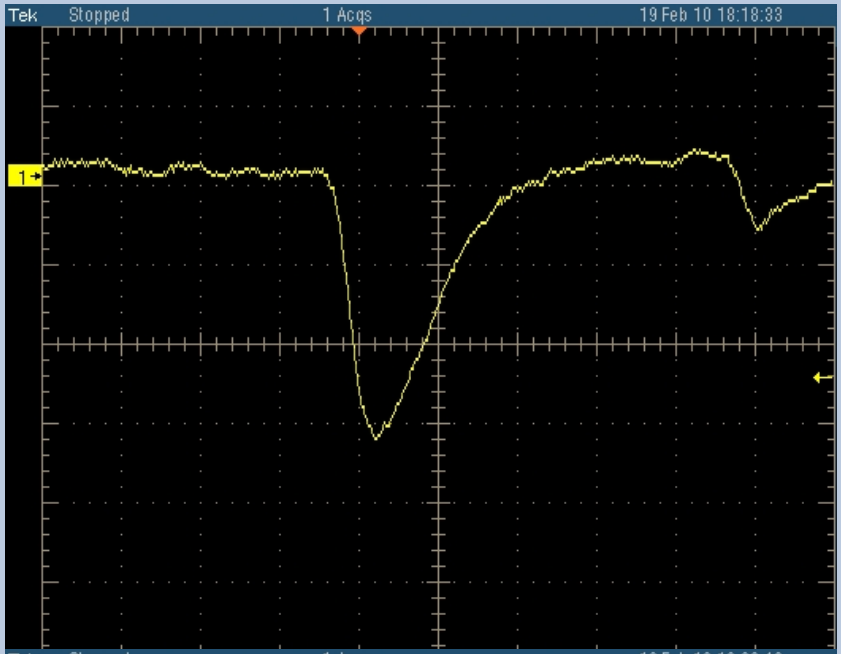




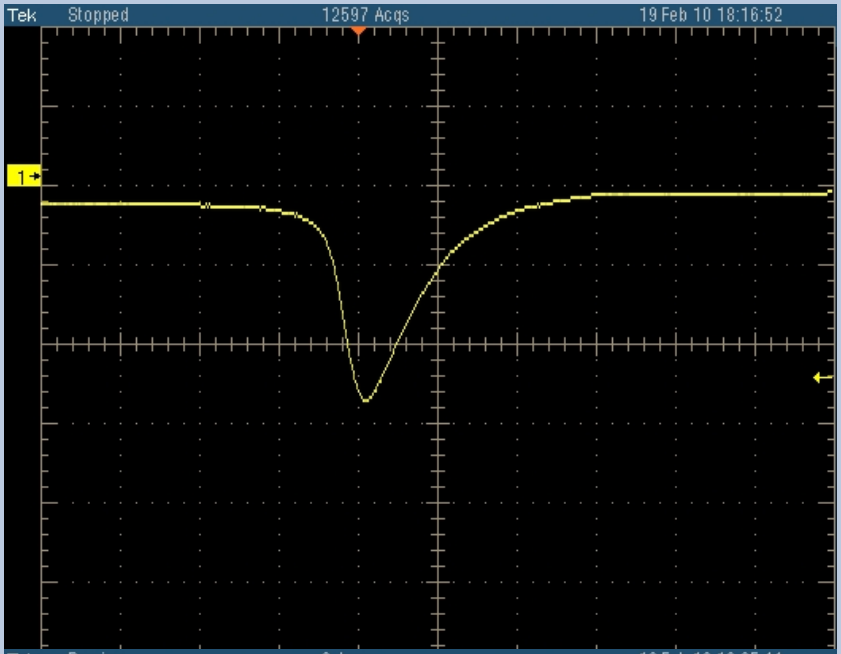
~20 Ph / 100 Ch



Pulse Form



2 AMPs
&
8m Cable



Noise

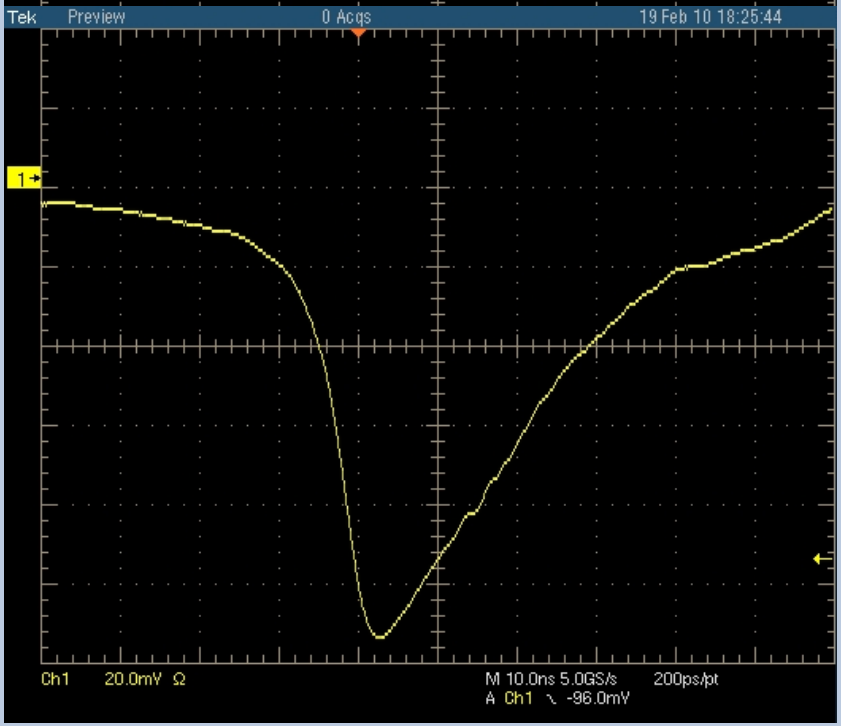
4 ns
Rise

13 ns
Decay

YAG : Ce

13 ns
Rise

42 ns
Decay



short Overview WP 21 Meeting Nov 2009

- many different scintillators possible as fibres
  (LYSO, YAG, BGO,...)
- crossection defined by nozzle
  (round, square, hexagonal,... 0.3 mm - 1 mm)
- length of up to 1 m possible (currently), 2 m per day

excerpt of the test schedule:

- production of different shapes, diameters and materials
- measurement of
  - homogeneity of doping
  - attenuation length, lightyield
  - risetimes, decaytimes
  - trapping efficiencies, cladding
  - coupling to lightguides and detectors
- construction of prototype detectors with SiPM / PMT readout

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Outlook

- acquisition and test of different fibre materials
- test of different SiPMs
- purchase of ~ 60 cm^2 fibres, SiPMs and construction of the detector
- measurements on ELSA's e^- and γ Beam
- use of the detector for PANDA EMC prototype tests at ELSA