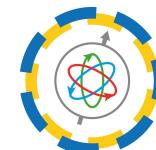
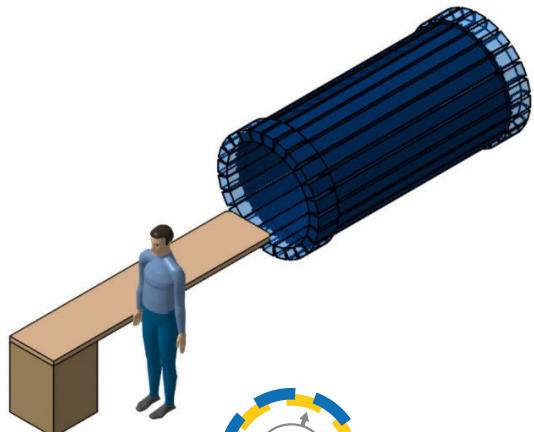
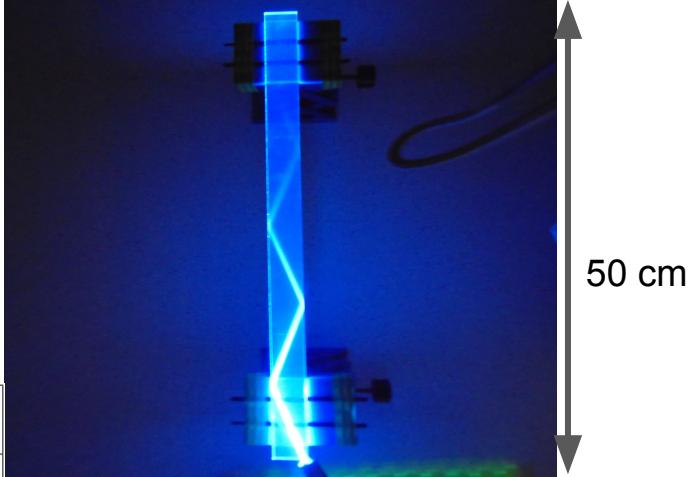


Status of assembly of modular PET from plastic scintillators

Szymon Niedźwiecki
on behalf of the J-PET group

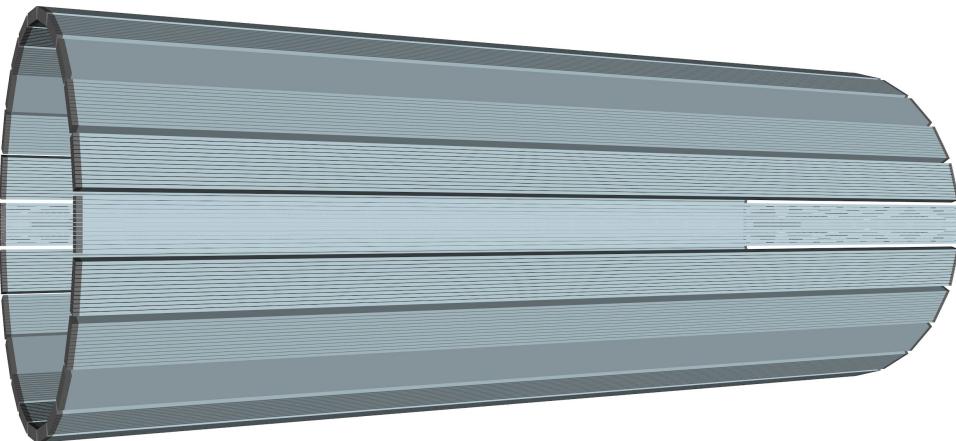
Aim of the J-PET group

Name	Density [g/cm ³]	Scintillation rise / decay time [ns]	Light output [per keV]	Light attenuation length [cm]	Probability of detection for 2 cm thick material [%]
Used in PET scanners					
BGO	7.13	- / 300	6	22.8	84
LYSO	7.2	- / 50	25	20.9	82
GSO	6.71	- / 50	10	22.2	71
Fast crystal					
LaBr ₃	5.3	9 / 16	63	16.0	61
Plastic scintillators					
BC-420	1.023	0.5 / 1.5	11	110	18
BC-404	1.023	0.7 / 1.8	12	160	18
BC-408	1.023	0.9 / 2.1	11	380	18

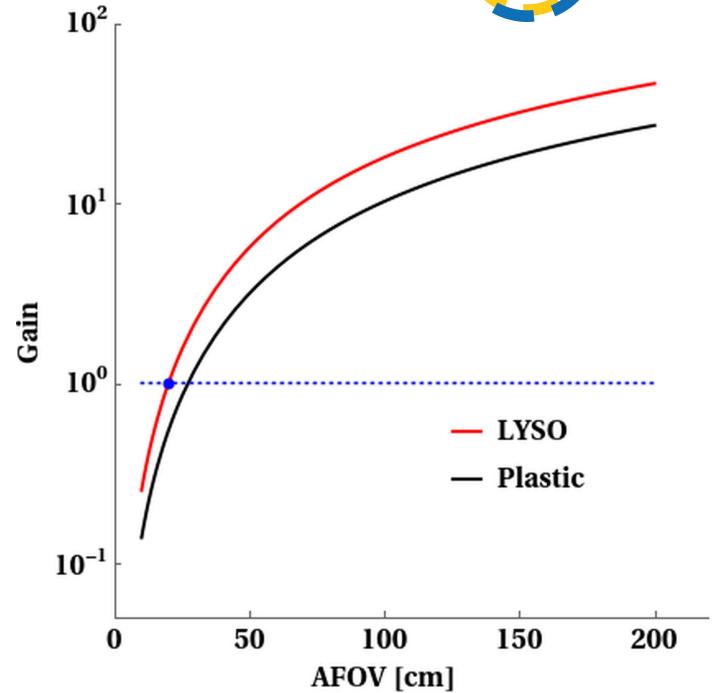


J-PET

Expected performance

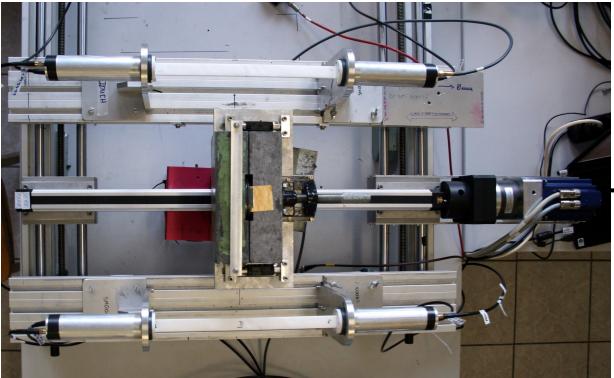


24 modules
single scintillator: $6 \times 30 \times 2000 \text{ mm}^3$



Gain is relative to LYSO PET with
AFOV = 20 cm

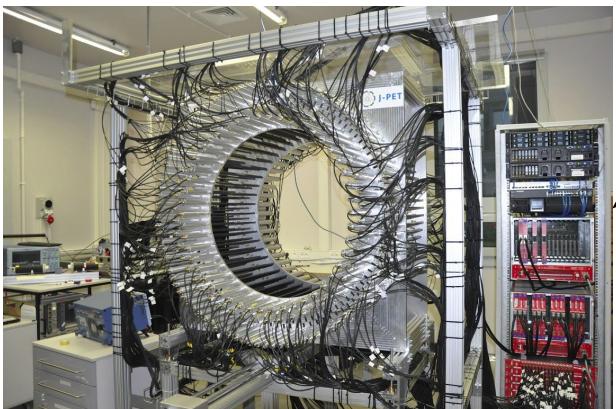
2012: 2 scintillators



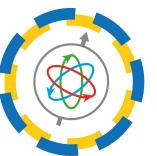
2014: 24 scintillators



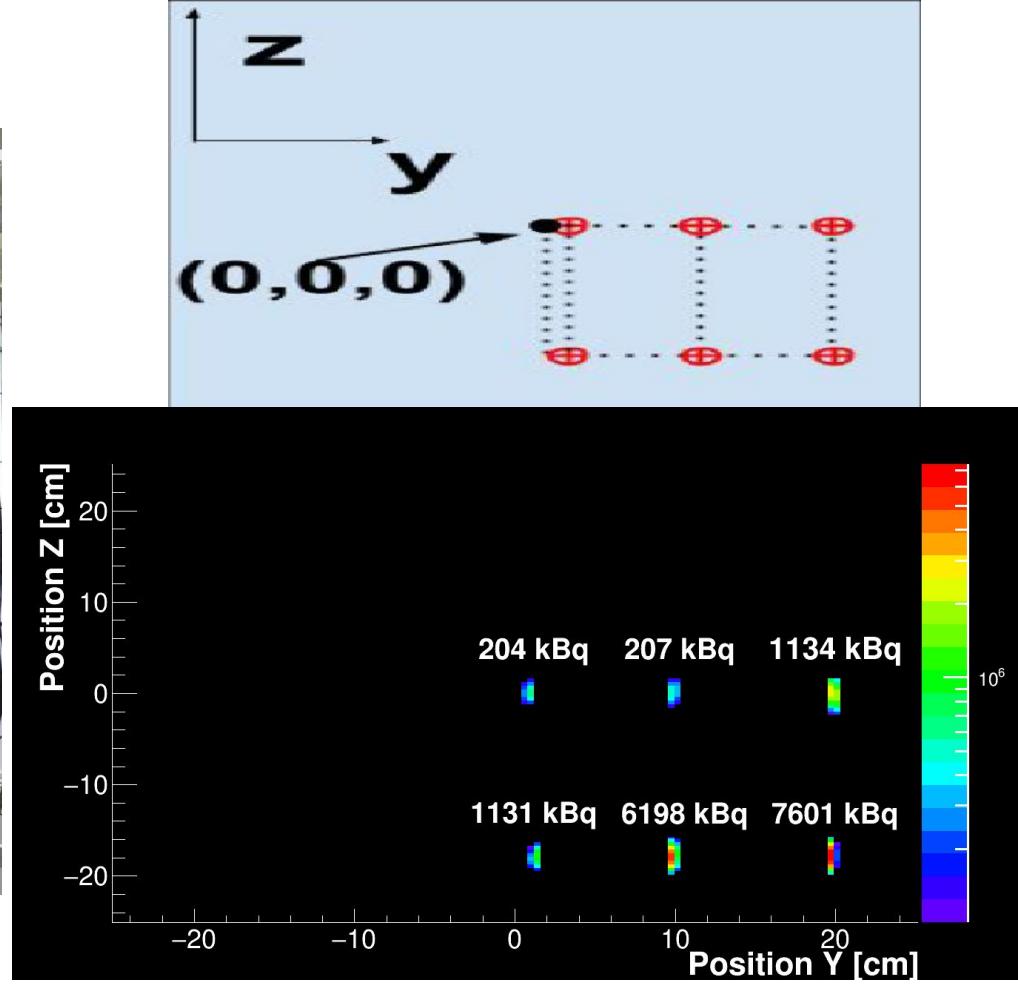
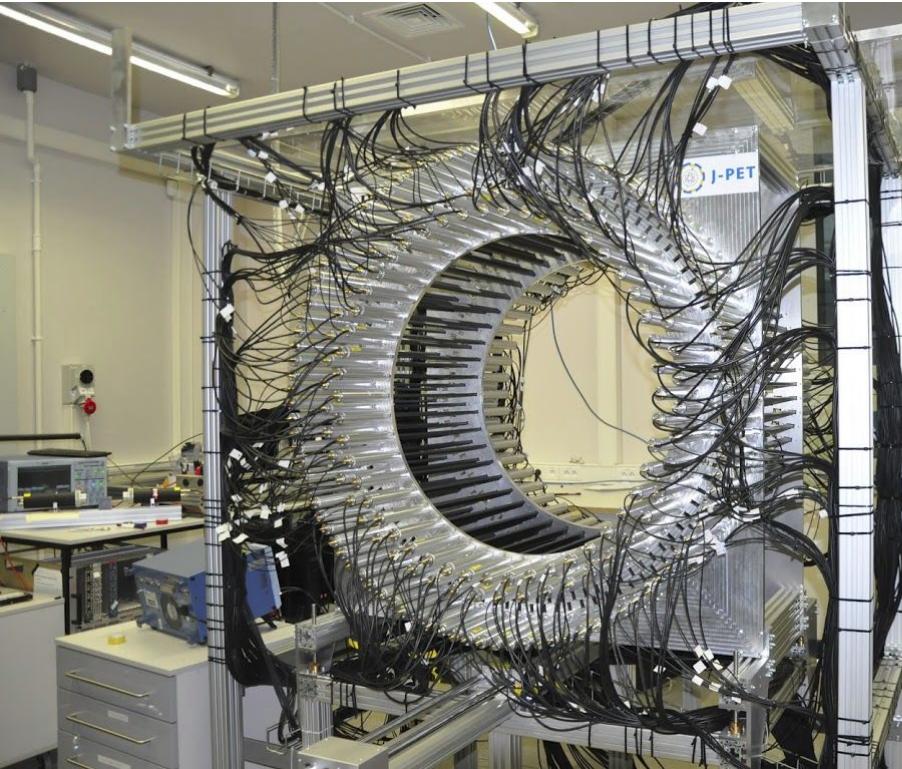
2016: 192 scintillators

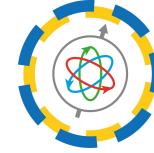
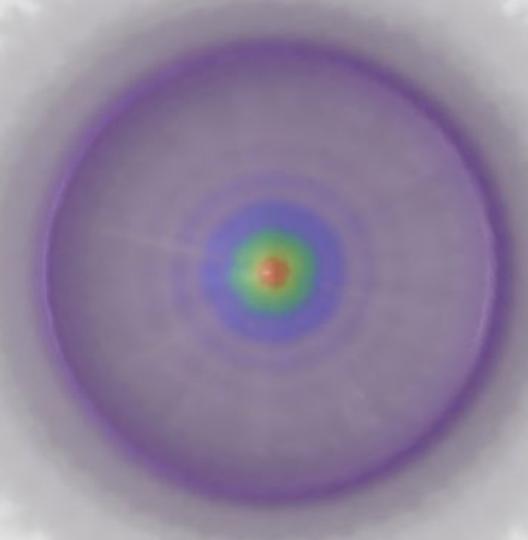
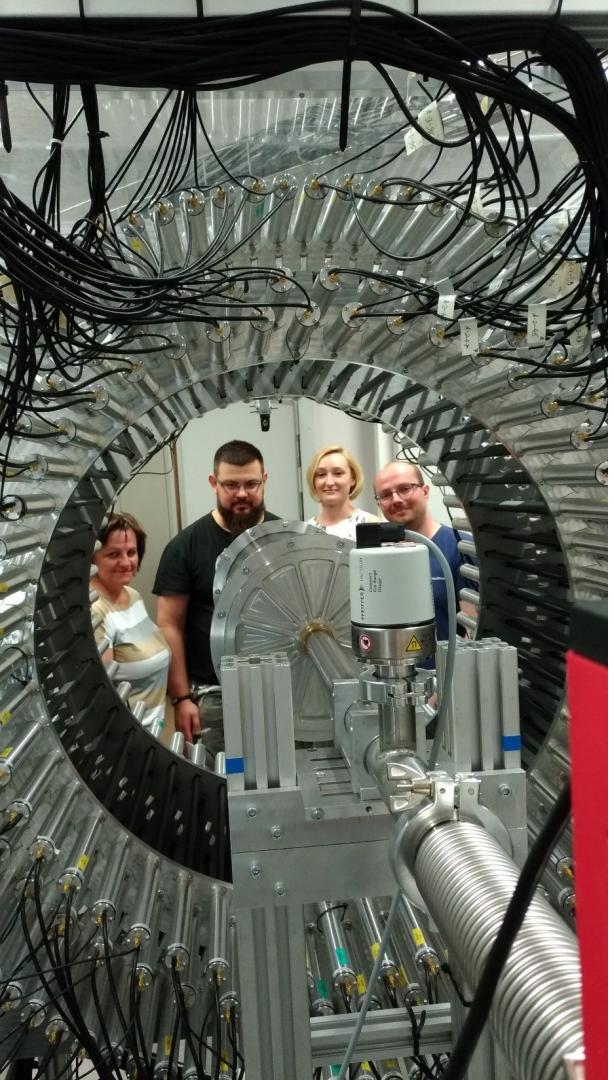


CRT \sim 600 ps
PSF(radial) \sim 5 mm
PSF(axial) \sim 1.2 cm
FWHM(E_{res} @ 340 keV) \sim 21 %



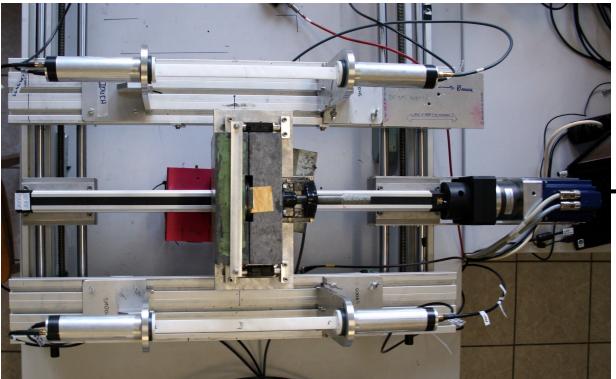
J-PET





J-PET

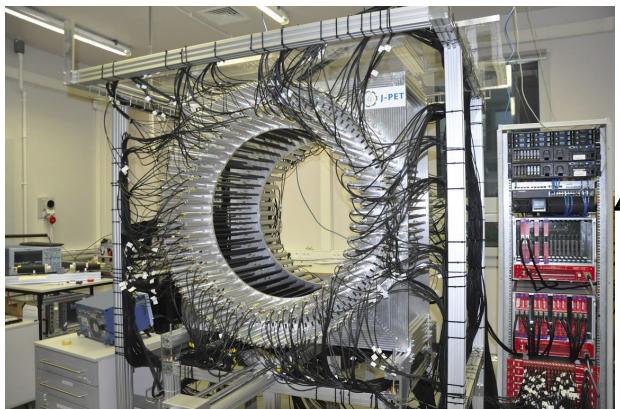
2012: 2 scintillators



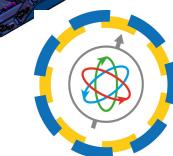
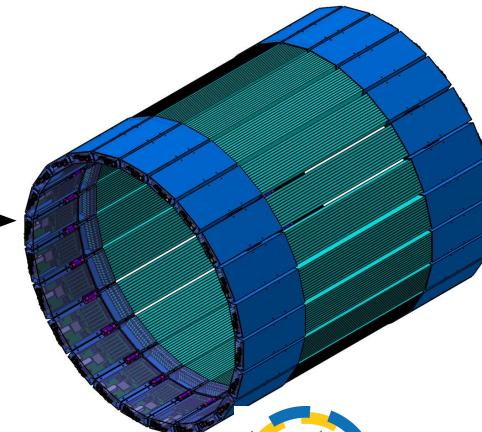
2014: 24 scintillators



2016: 192 scintillators

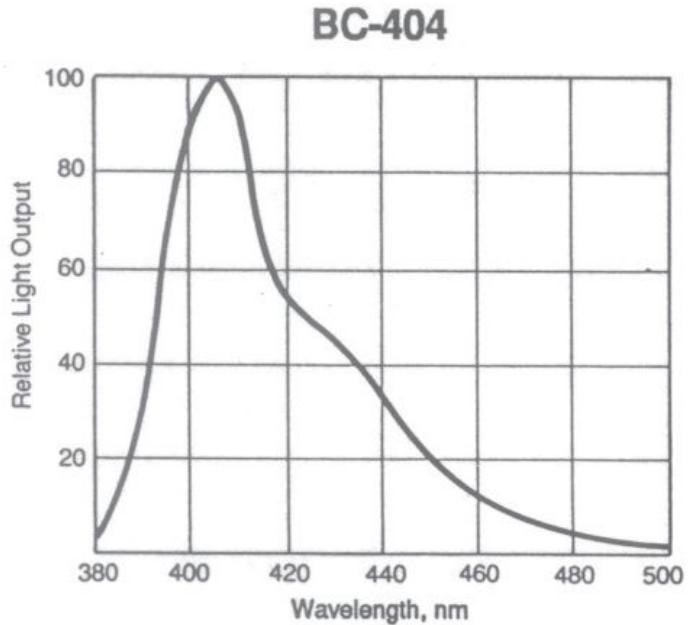


2019: 312 scintillators



J-PET 7

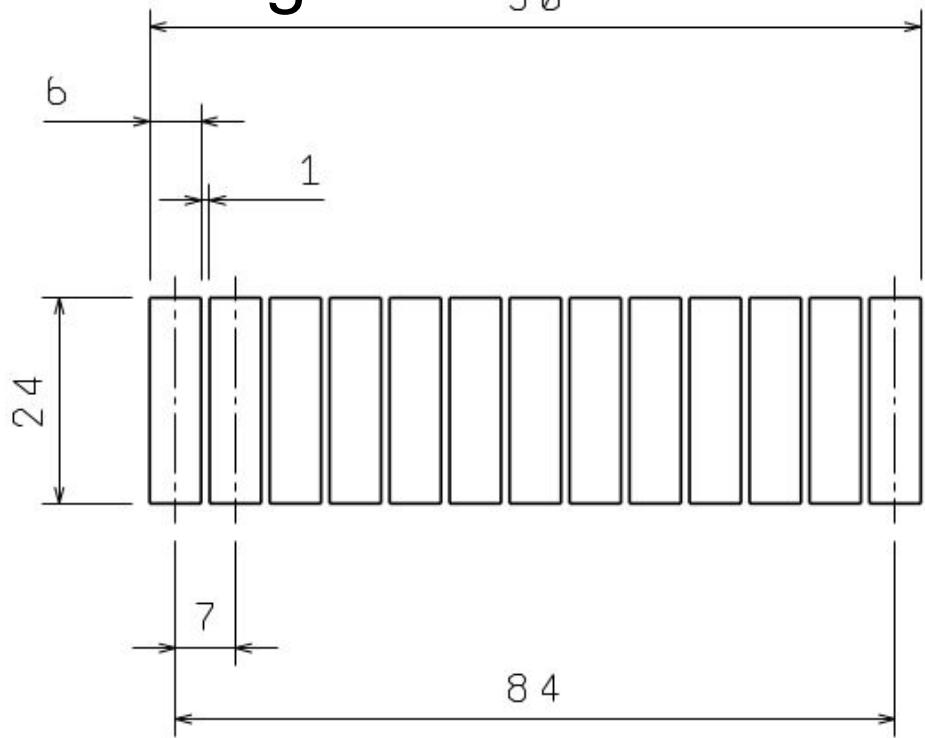
Single module design - scintillators



Scintillation Properties

BC-404	
Light Output, %Anthracene	68
Rise Time, ns	0.7
Decay Time (ns)	1.8
Pulse Width, FWHM, ns	2.2
Wavelength of Max. Emission, nm	408
Light Attenuation Length, cm*	140
Bulk Light Attenuation Length, cm	160

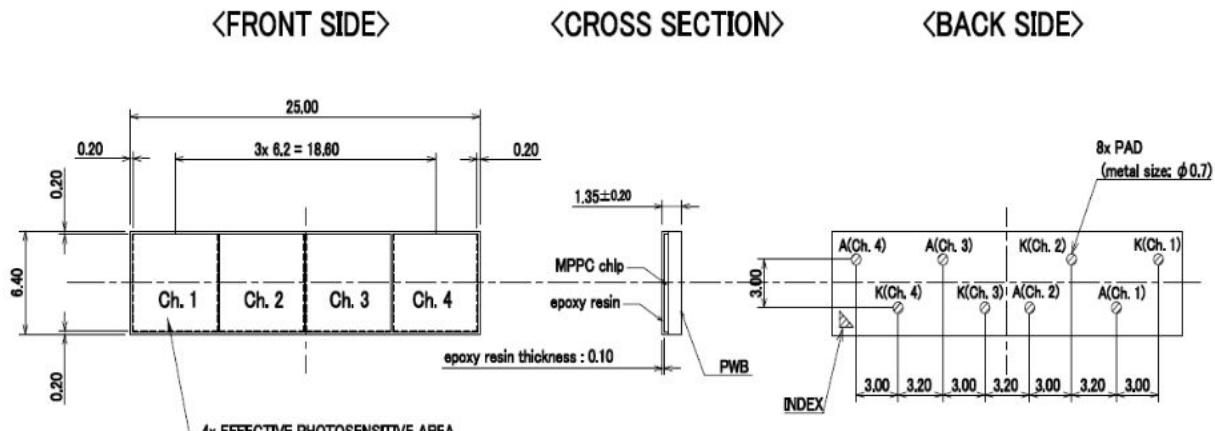
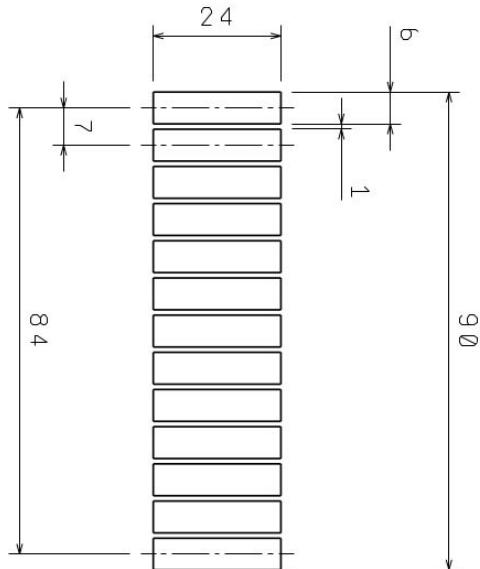
Single module design - scint. arragment



Single module design - SiPMs

S13361-6674 data sheet

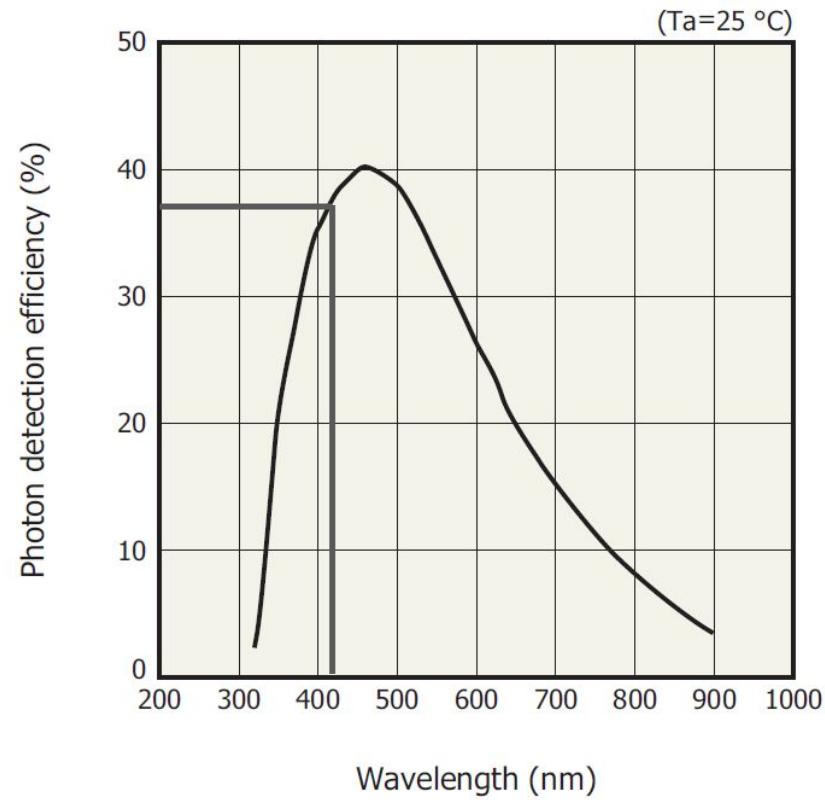
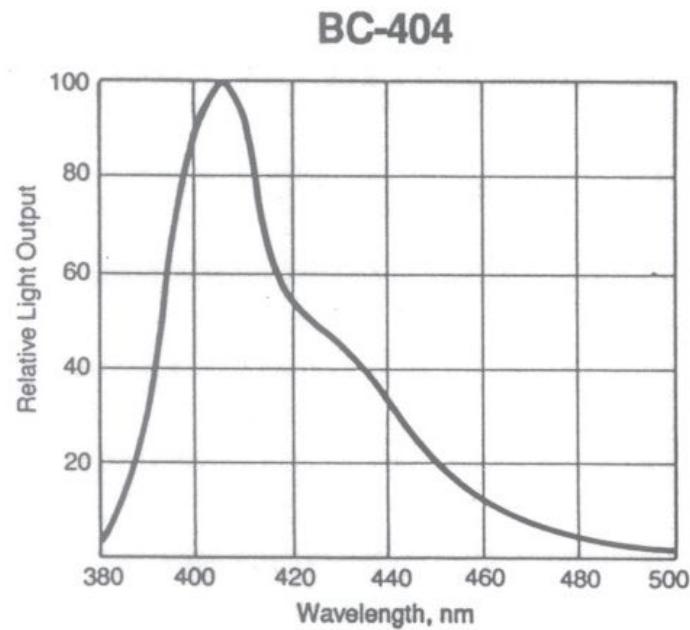
■ Dimensional outline (unit: mm)



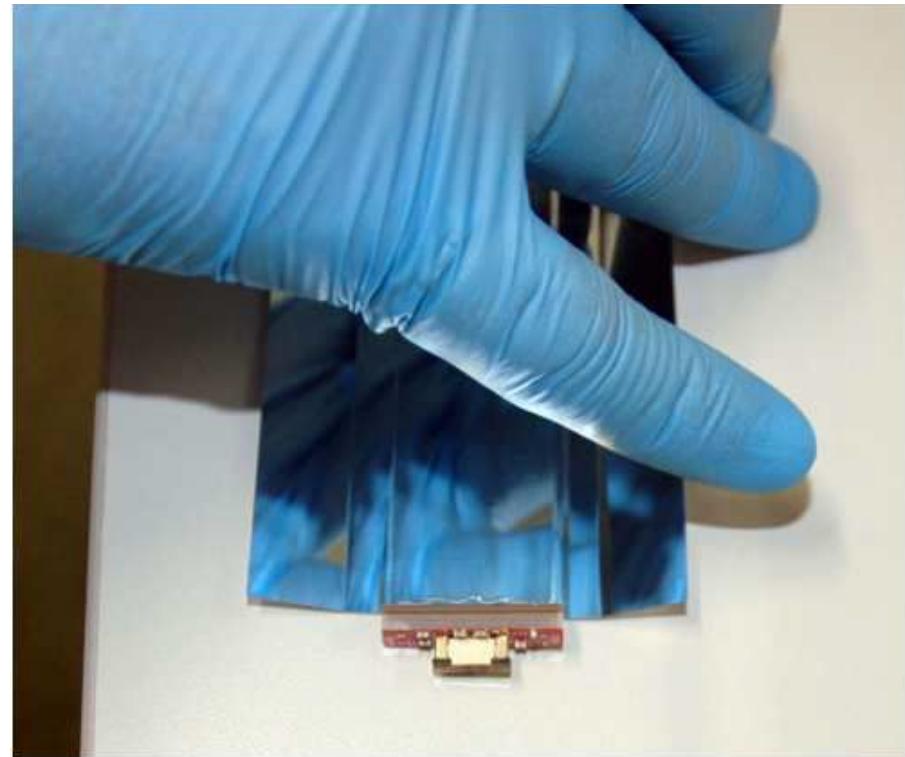
EFFECTIVE PHOTOSENSITIVE AREA : 6.0mm x 6.0mm
 MPPC CHIP SIZE : 6.1mm x 6.1mm
 CHANNEL PITCH : 6.2mm
 GENERAL TOLERANCE : ±0.1

* A : Anode
 K : Cathode

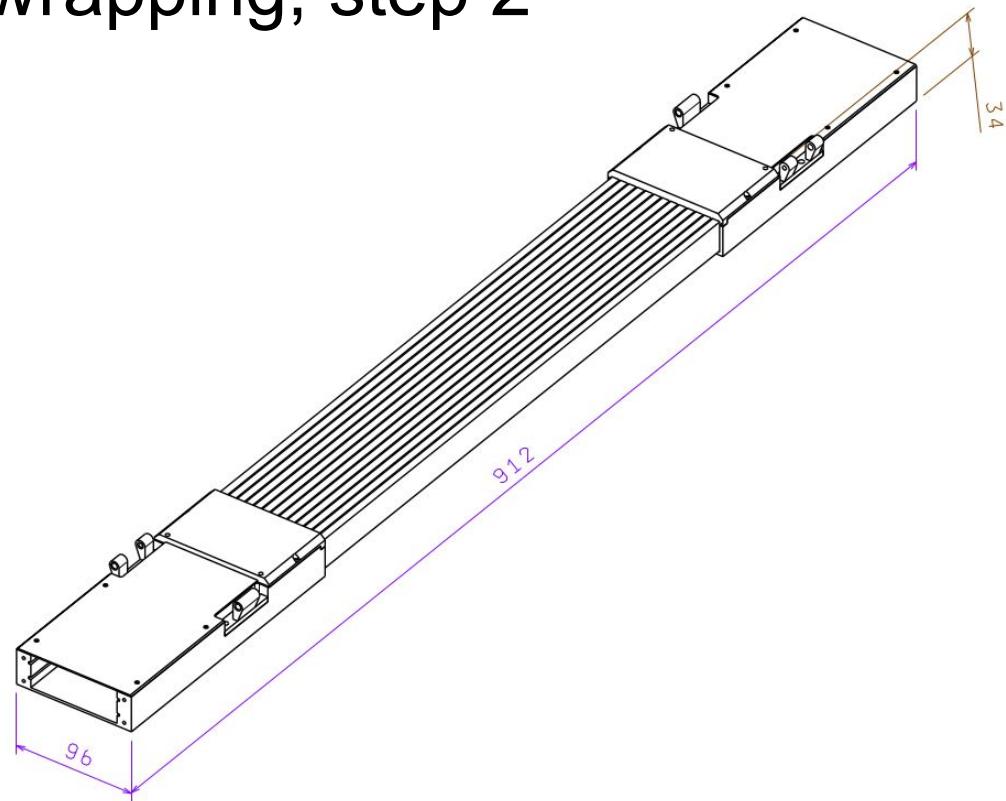
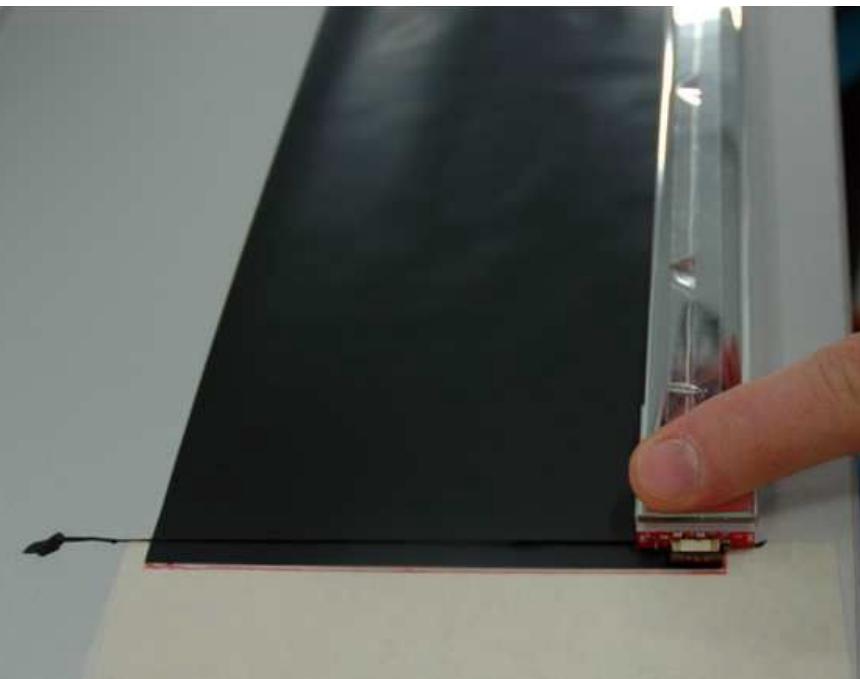
Single module design - spectra comparison



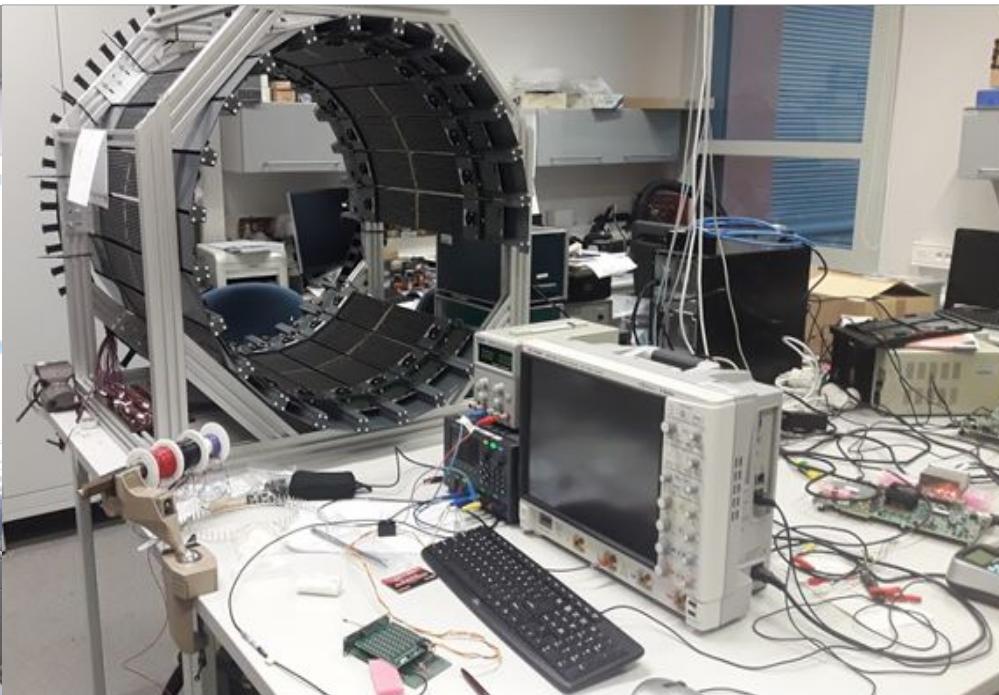
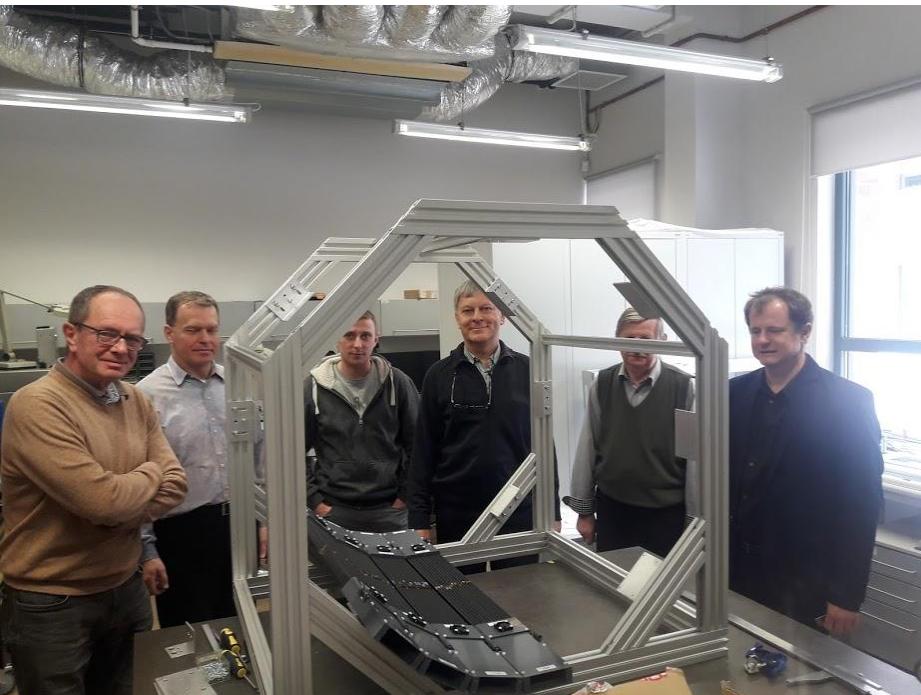
Single module design - wrapping, step 1



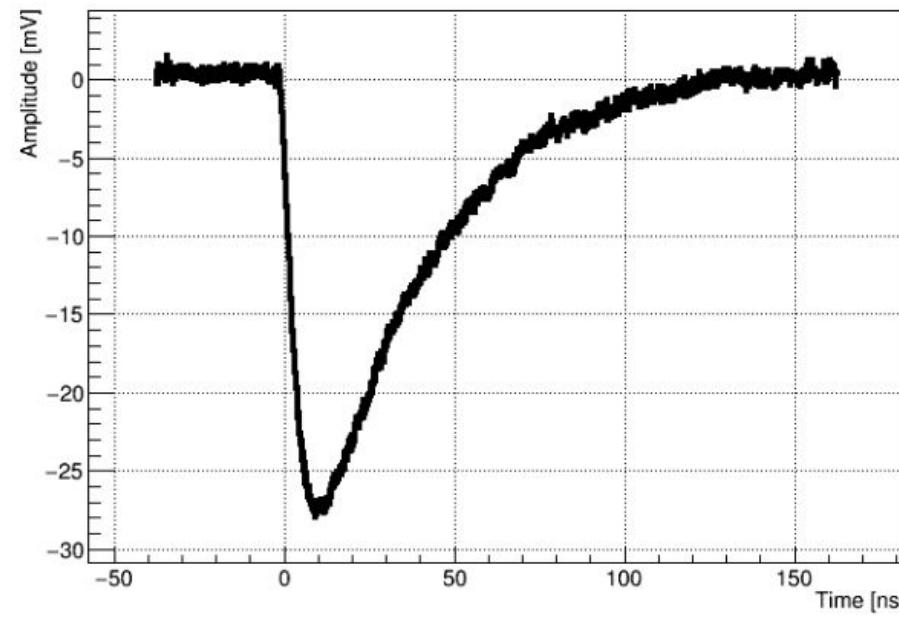
Single module design - wrapping, step 2



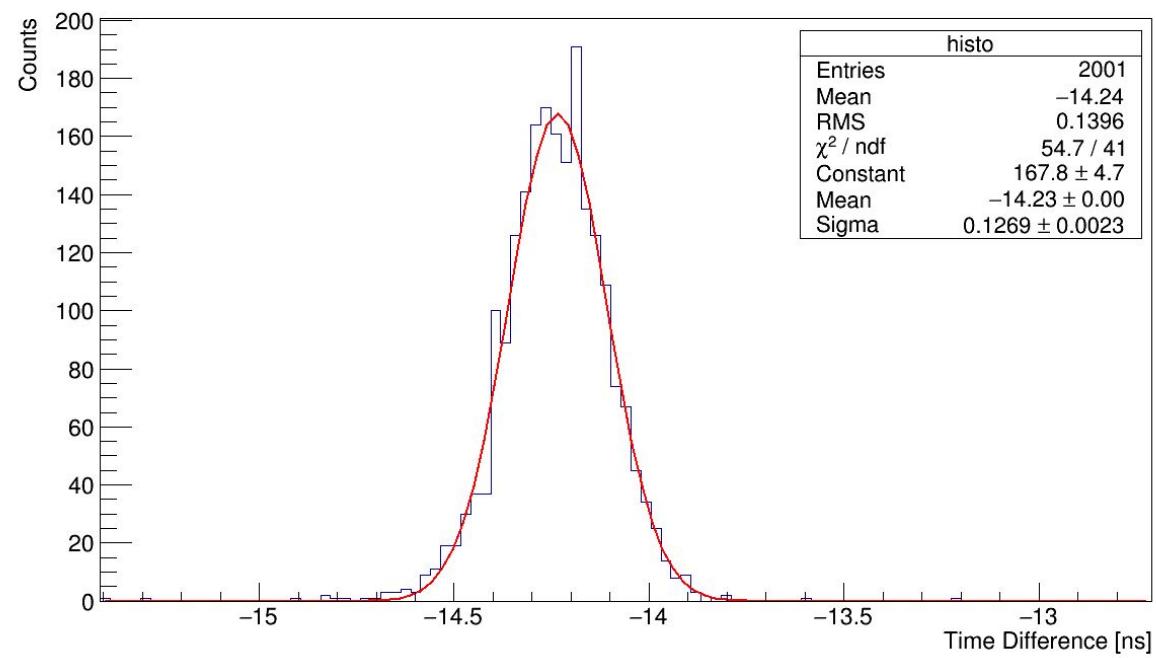
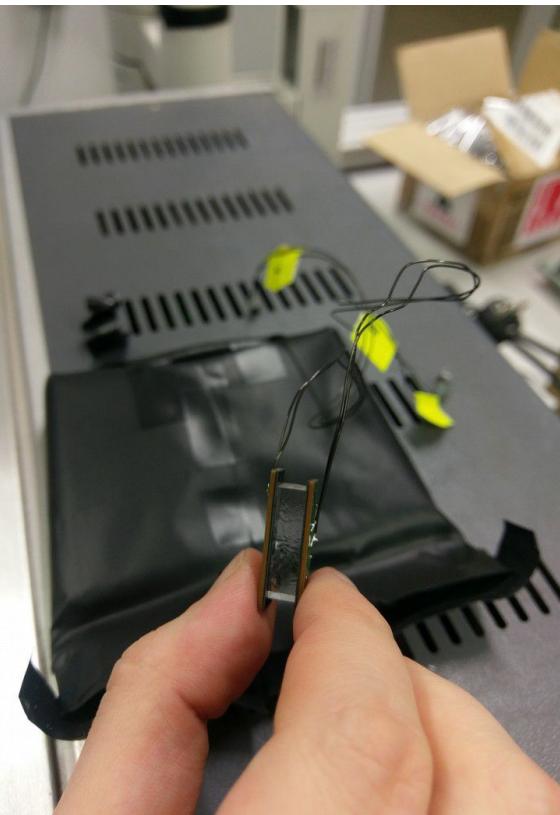
Mechanical assembly



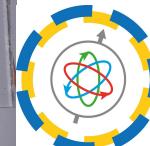
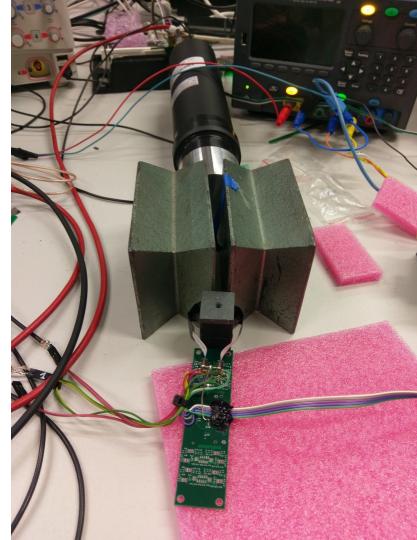
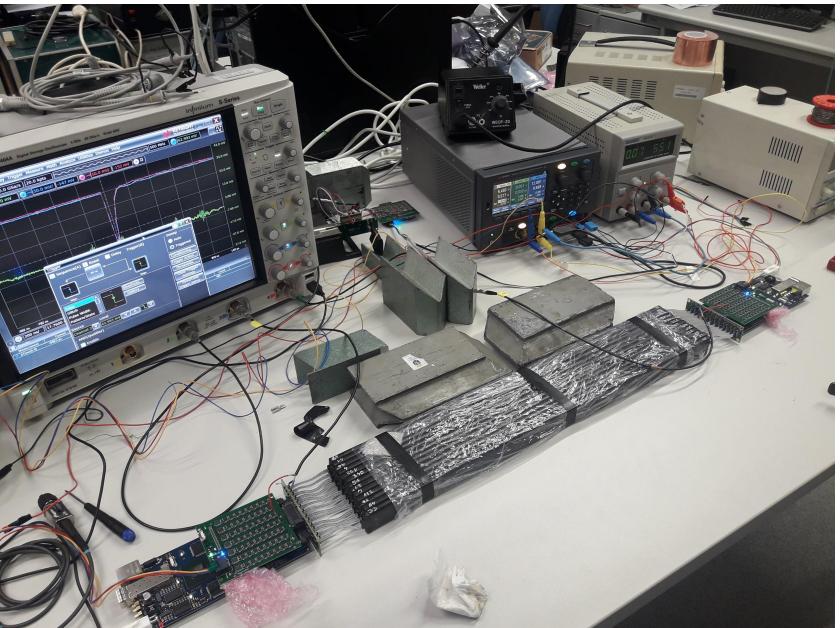
Tests of electronic boards



Tests of electronic boards

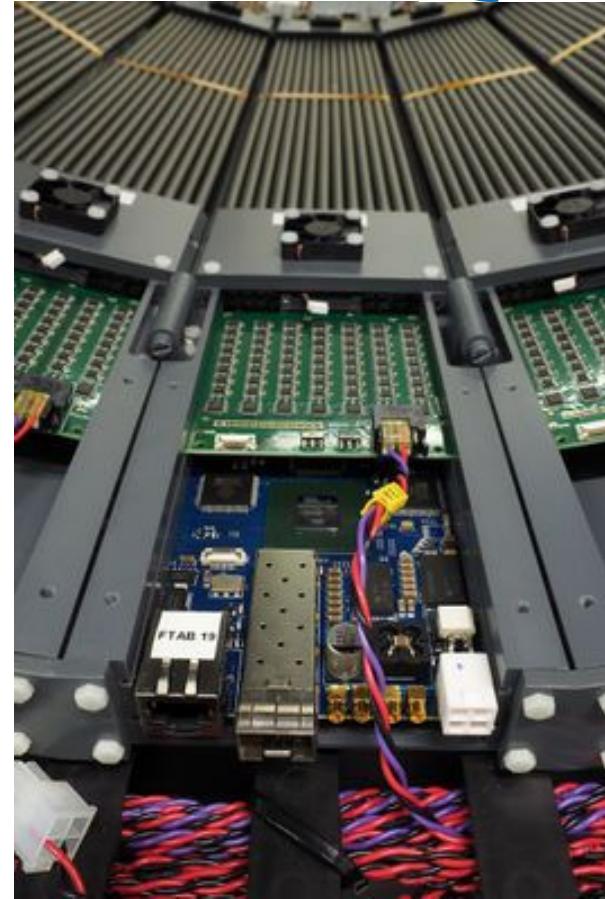
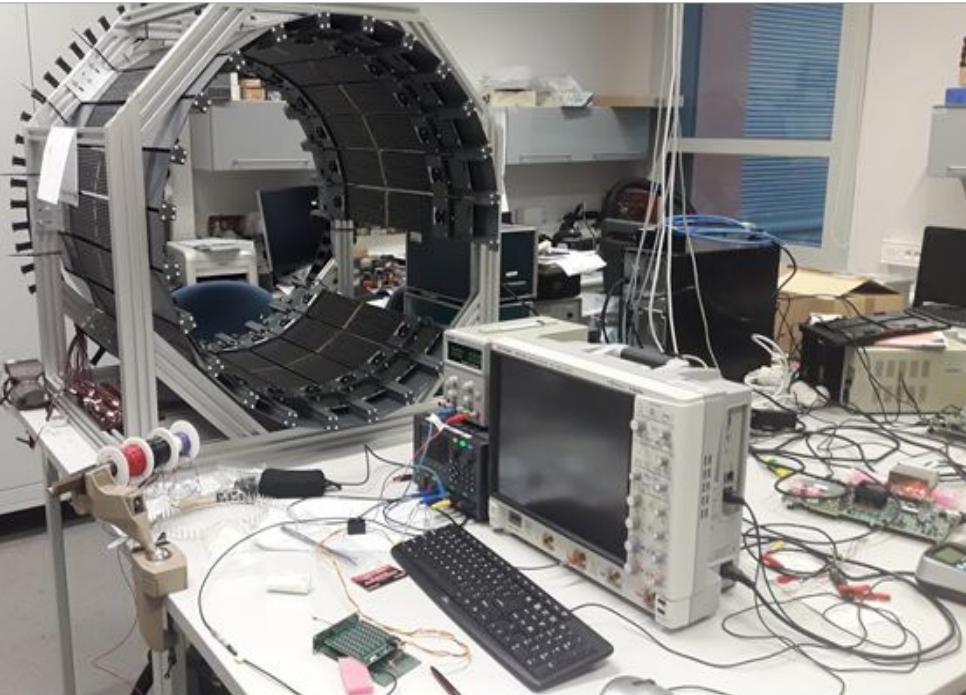


Tests of FEBs



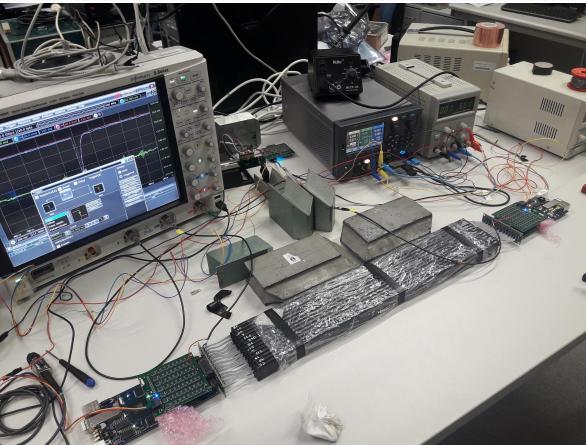
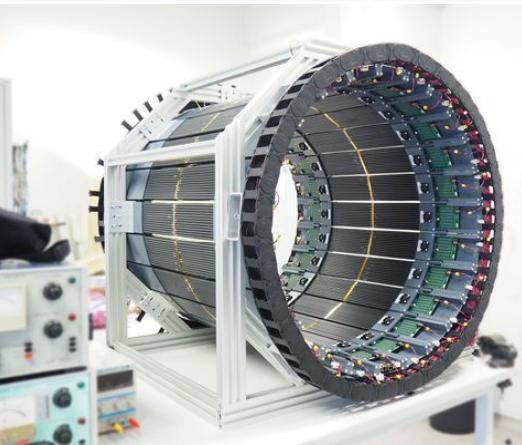
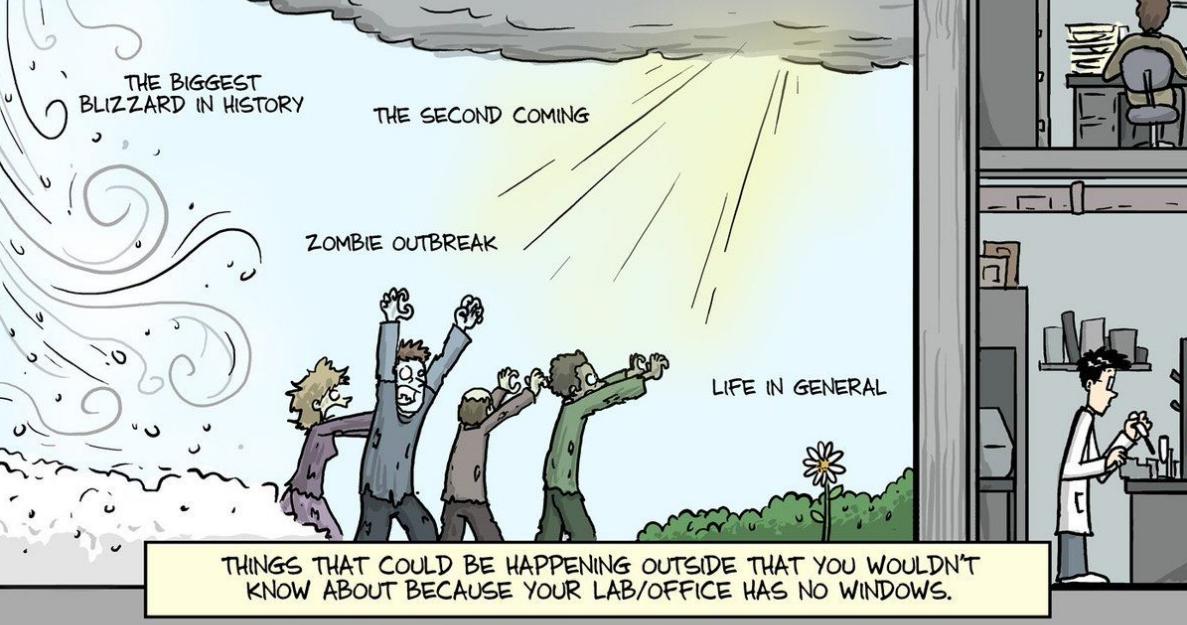
J-PET

FEBs mounting



Near future plans

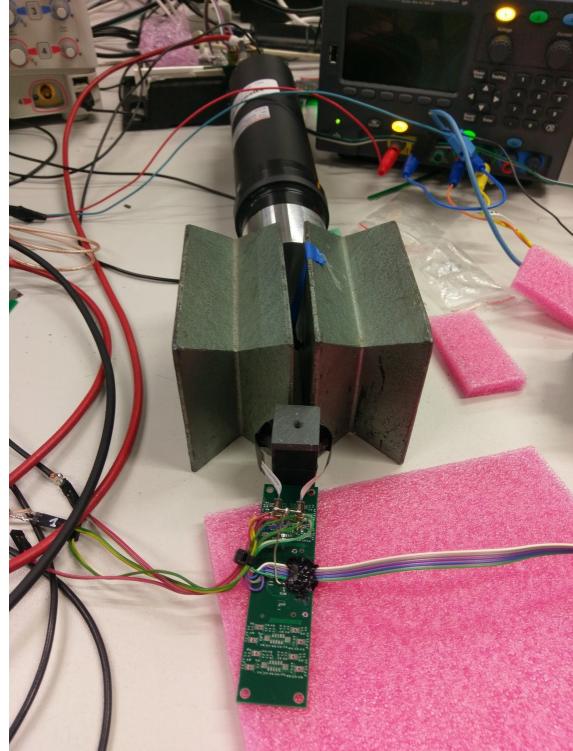
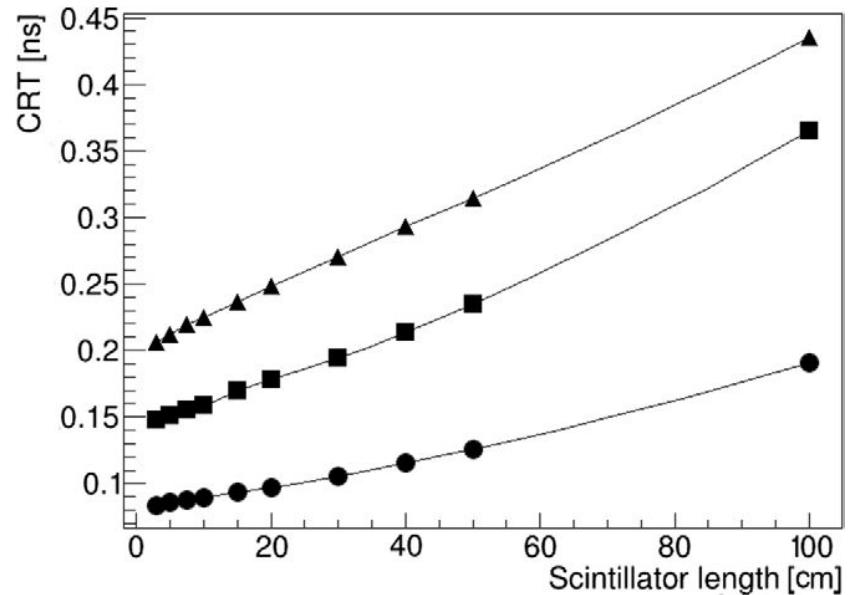
- readout tests of whole DAQ chain;
- threshold and voltage slow control;
- first tests with point sources;
- establishing calibration methods;
- estimation of prototype resolutions;



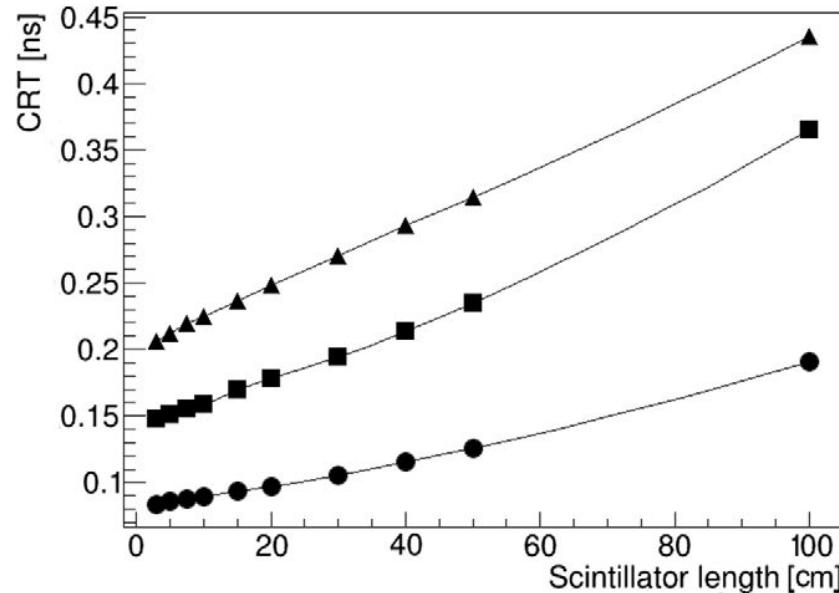
Thank you for Your attention!



Initial tests of timing resolution



Initial tests of timing resolution



Ładniejsza tabela

Supply	Rise [ns]	Amp at	Best	Time	Best	Hit
Voltage [V]		CE [mV]	threshold [mV]	difference[ps]	threshold[mV]	time[ps]
40.5	5	20	2.5	322	2.5	172
40.8	5	25	2.5	295	2.5	222
41.1	5	30	2.5	257	2.5	187
56.0	6	15	2.5	374	5.0	239

RED:
currently used
SiPMs

GREEN:
new version of
SiPMs