



Status of PRT-INFN

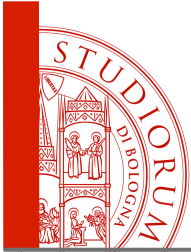
the PRT-INFN group

Braunschweig, 16 January 2017 - PRT meeting

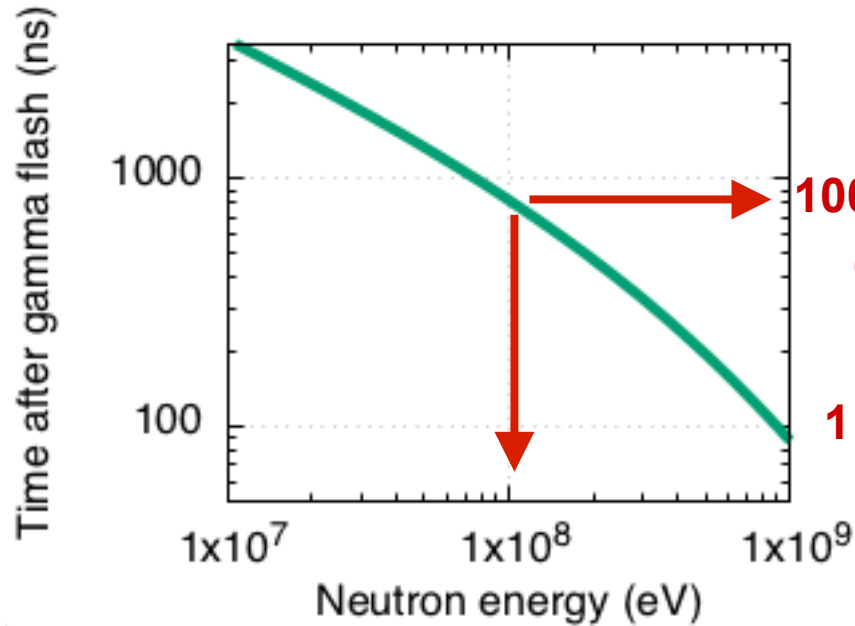


- **Results of the 1st test at n_TOF**
 - Response to γ flash (maximum energy)
 - Finding coincidences (discriminate particles)
- **Calibration with γ -ray sources**
- **Test with 62-MeV protons**
- **Towards the second test**
 - Need for Silicon layers !
 - Influence of the converter thickness
 - Efficiency of the PRT



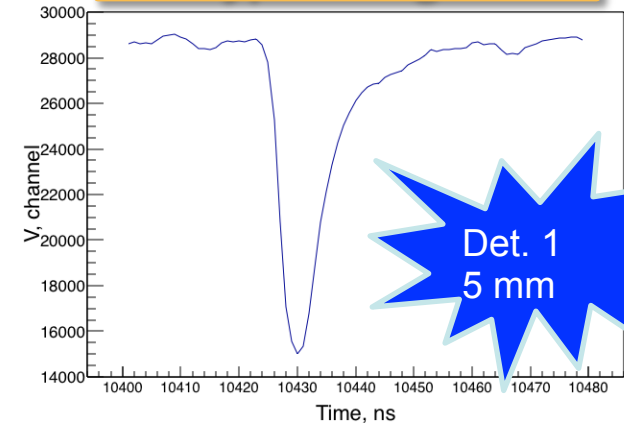


Response to γ flash

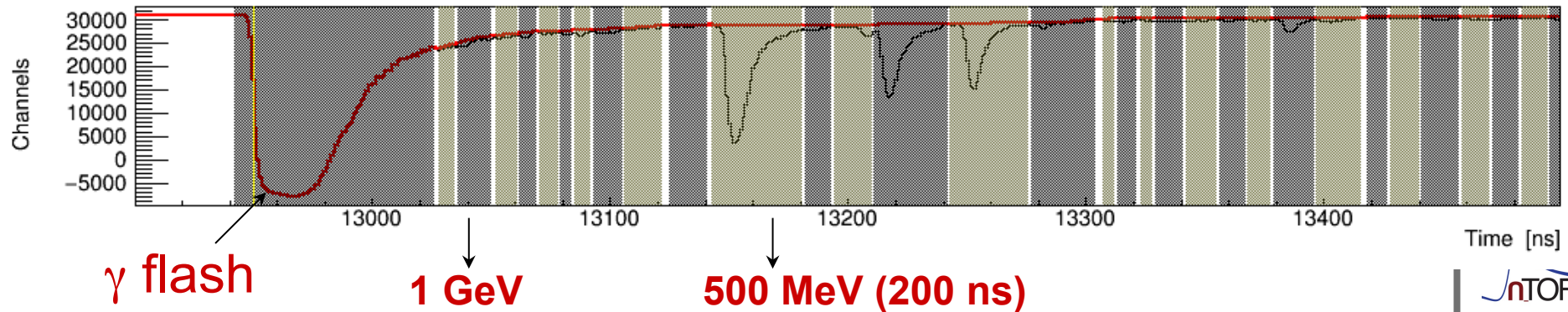


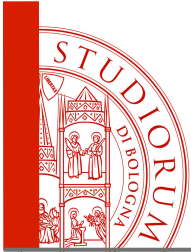
Signal - Event 2 Movie 0 (PRTI-2)

Typical signal



Rise time ~ 2-3 ns
FWHM ~ 8 ns

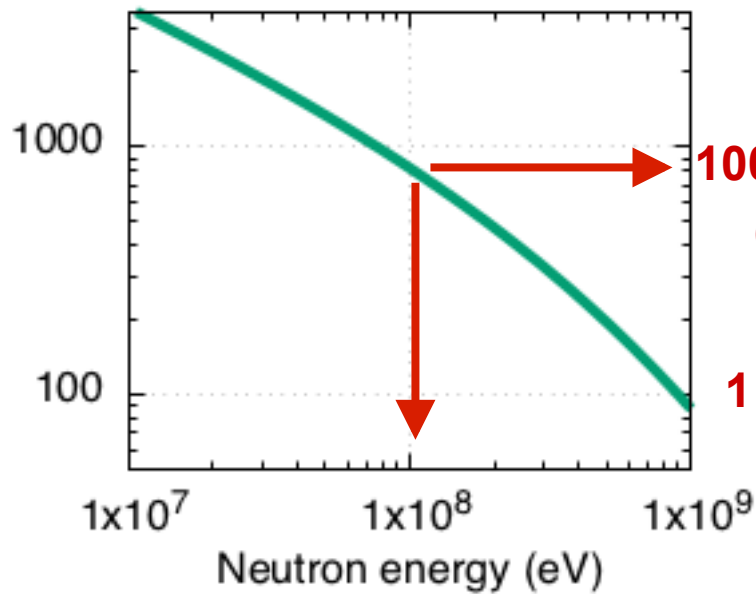




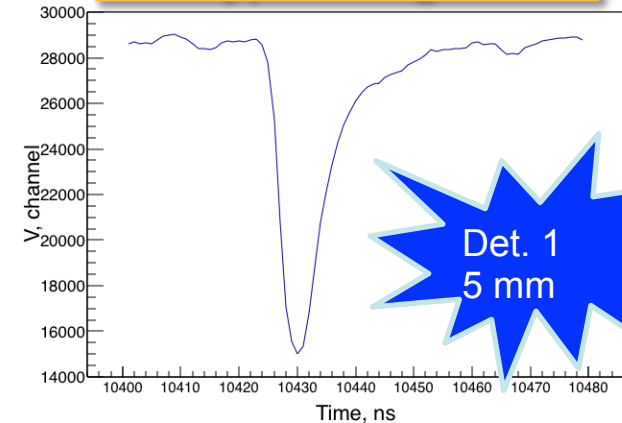
Response to γ flash



Time after gamma flash (ns)

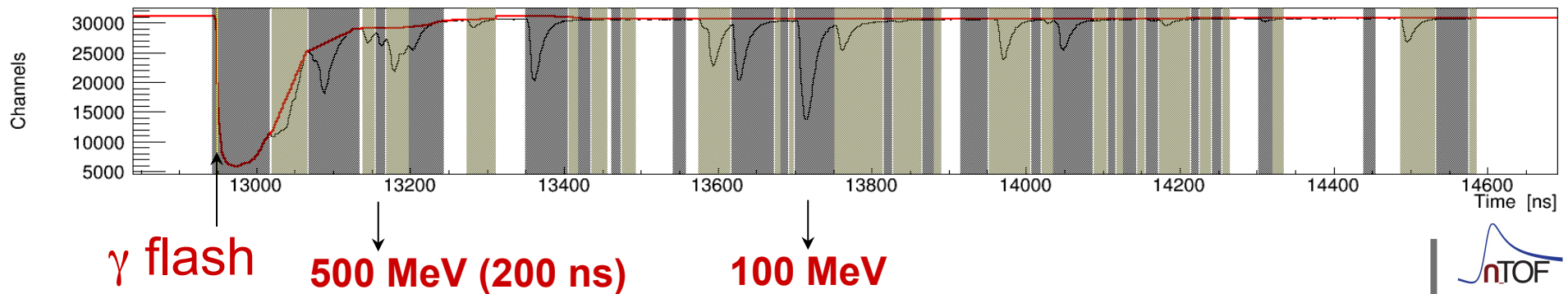


Typical signal

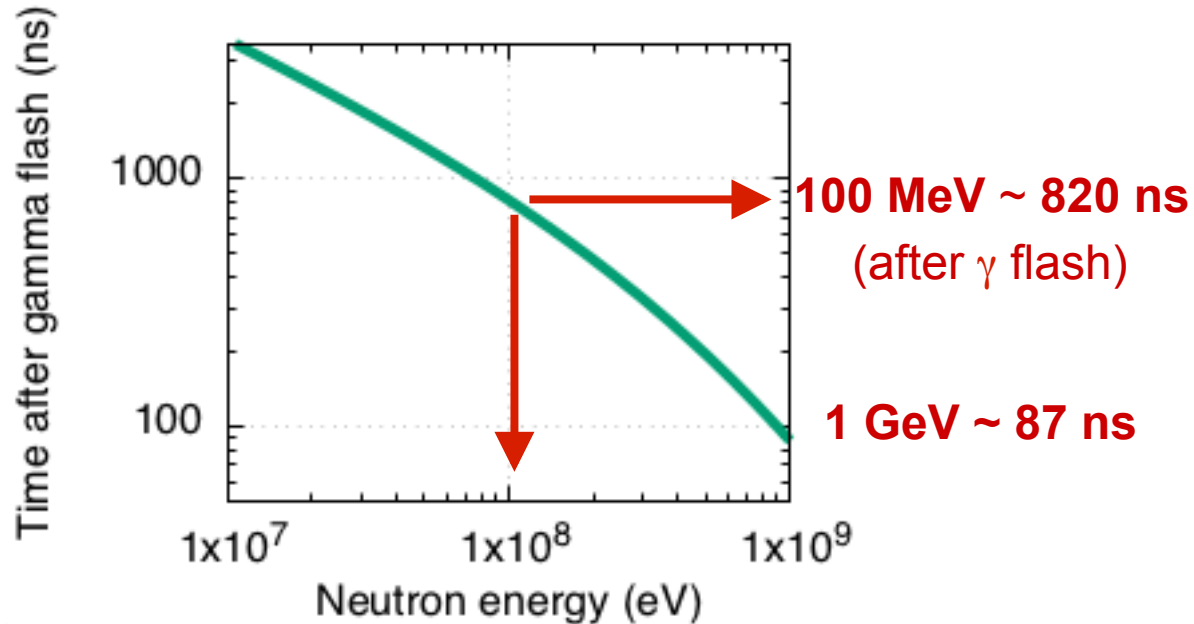


Rise time ~ 2-3 ns
FWHM ~ 8 ns

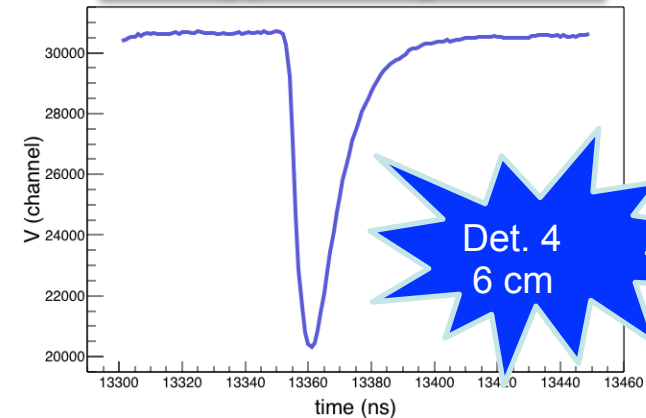
Signal - Event 6 Movie 0 (PRTI-5)



Response to γ flash

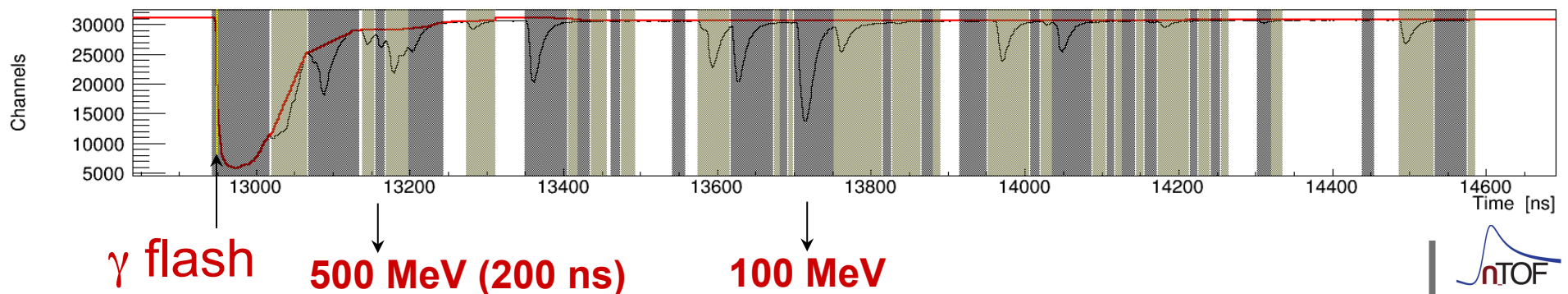


Typical signal

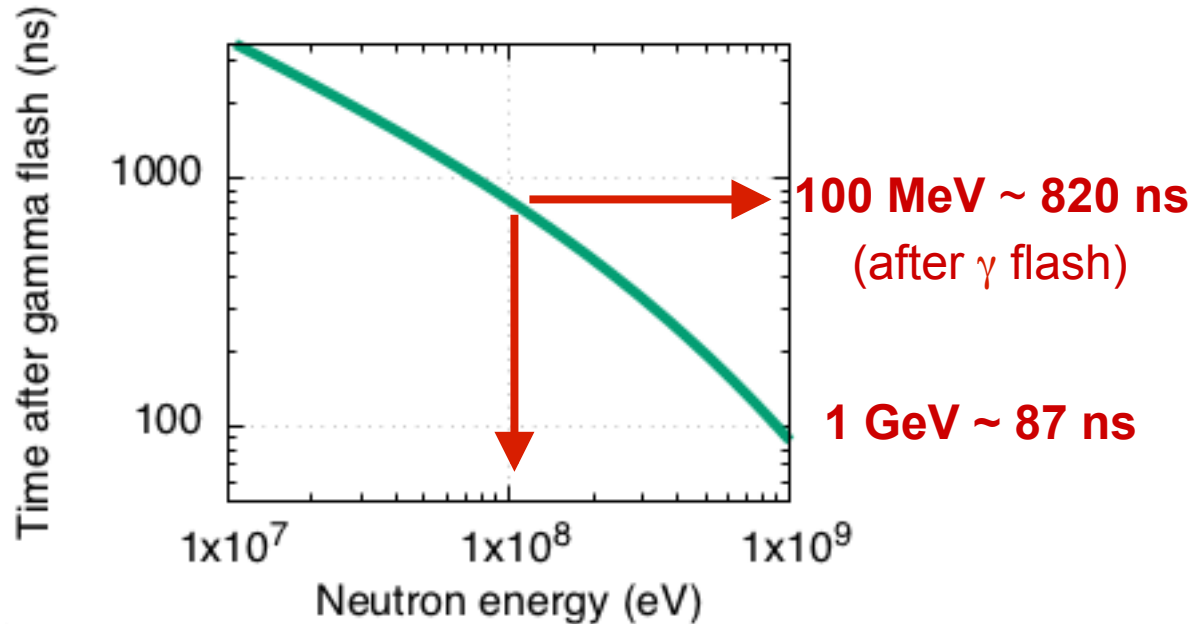


Rise time ~ 3 ns
FWHM ~ 9 ns

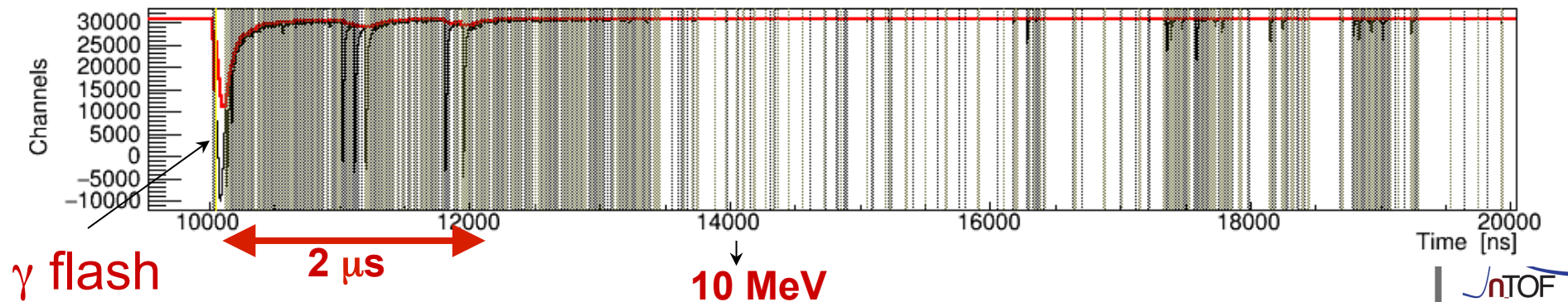
Signal - Event 6 Movie 0 (PRTI-5)

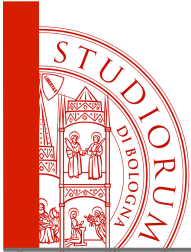


Response to γ flash

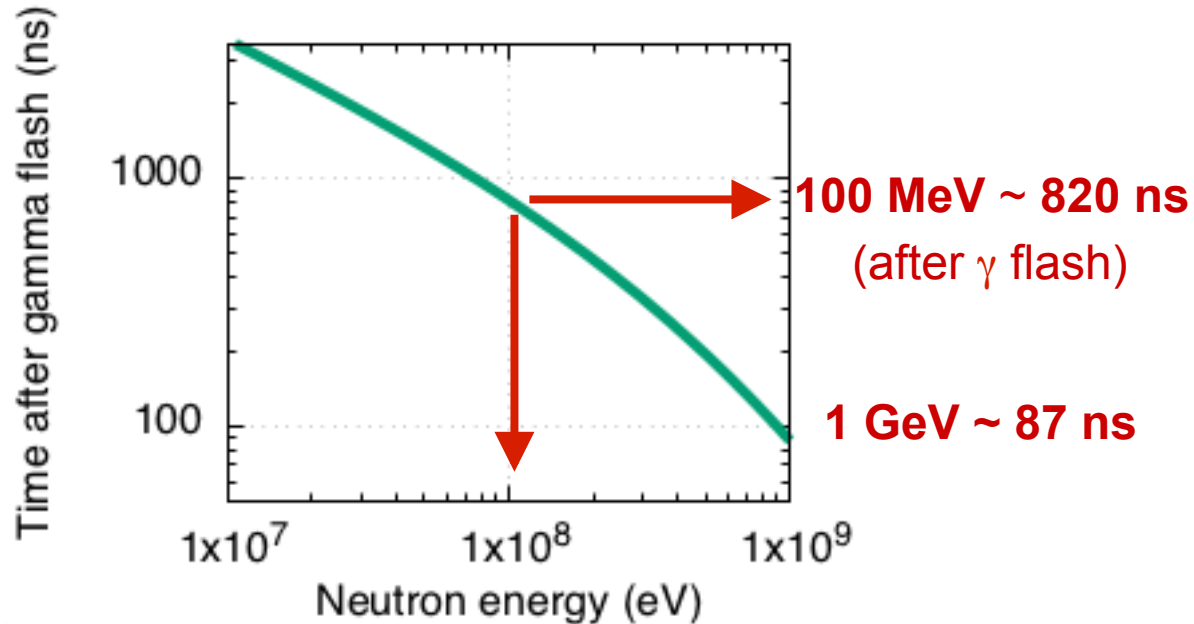


Signal - Event 1 Movie 0 (PRTI-2)

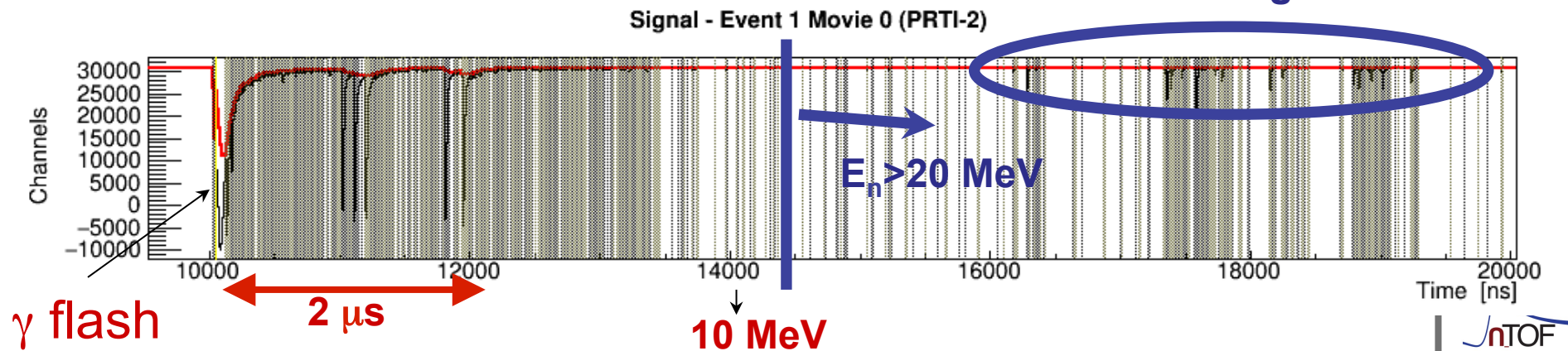




Response to γ flash



Study of γ -ray background

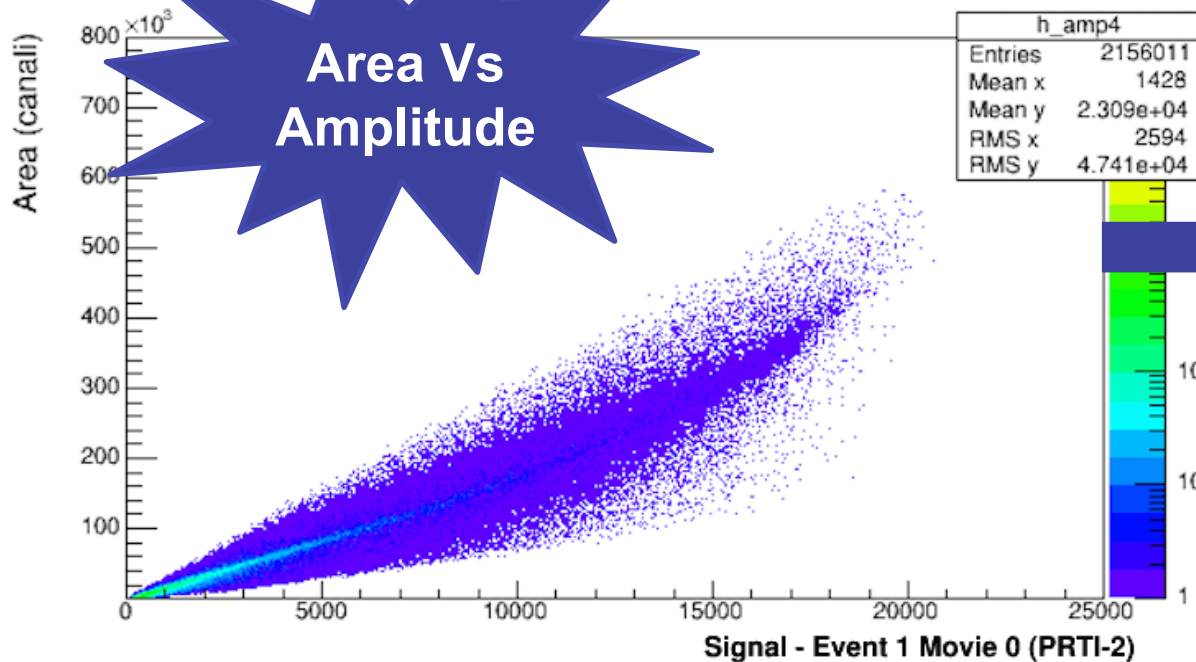




Response to γ flash

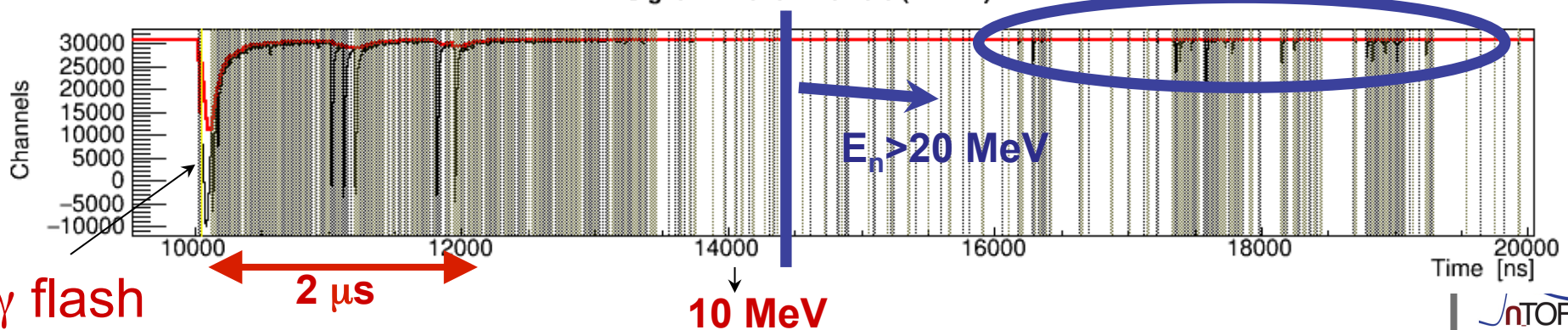


Istituto Nazionale
di Fisica Nucleare



Analysis
conditions

Study of γ -ray
background





PRT coincidences



$E_p \sim 30 \div 60 \text{ MeV}$

$E_n \sim 35 \div 68 \text{ MeV}$

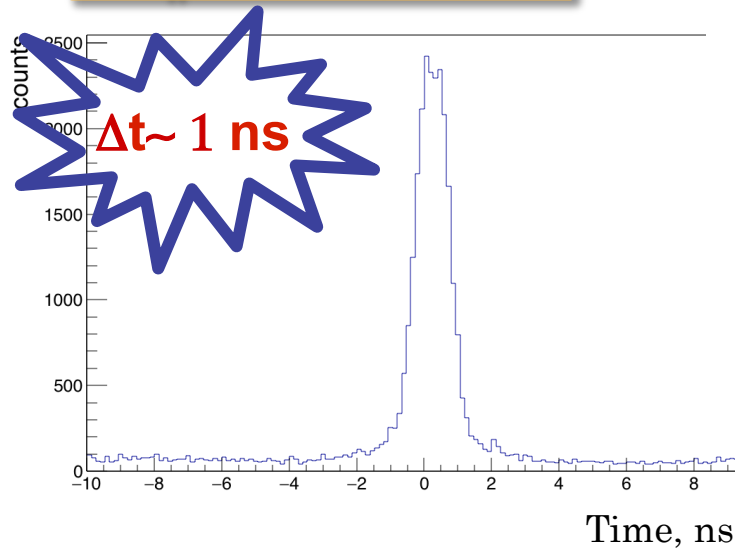
ΔE_1 ΔE_2



3 cm

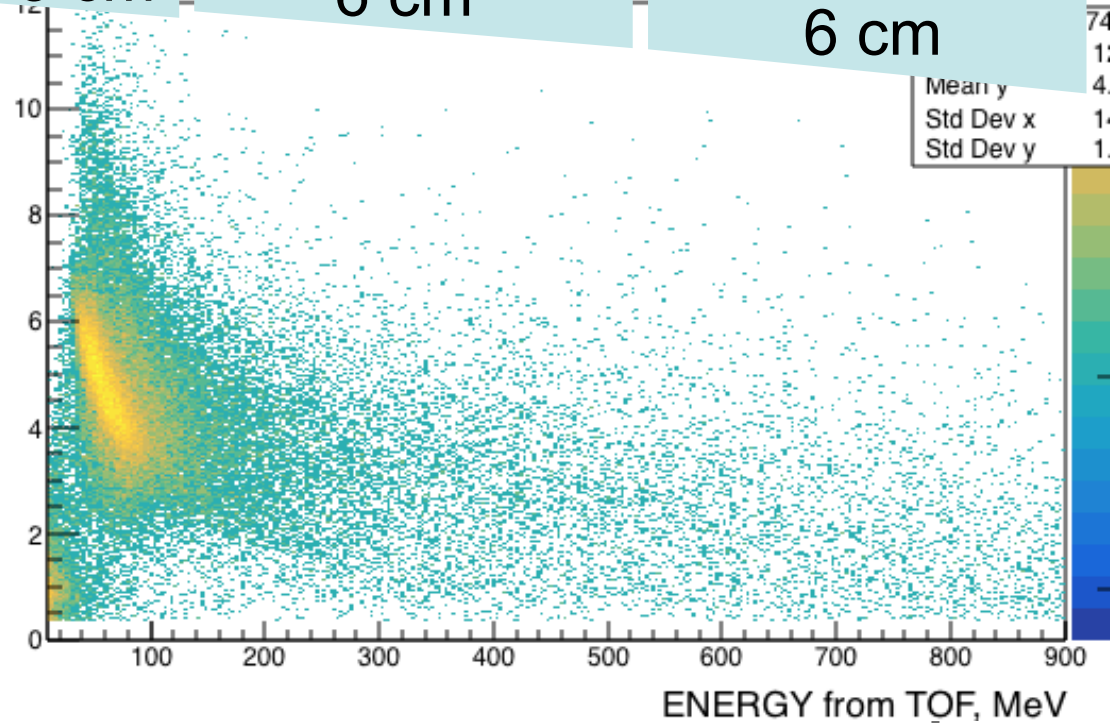
6 cm

6 cm



Time distribution of coincidences

$y = \Delta E_1$



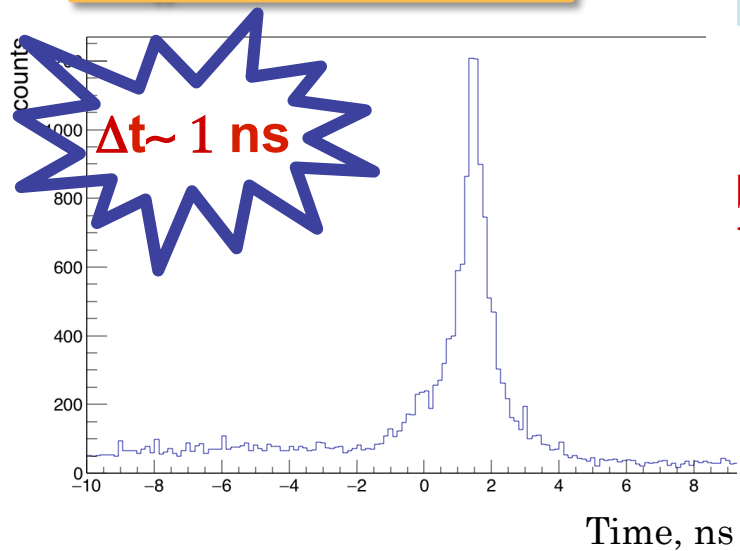
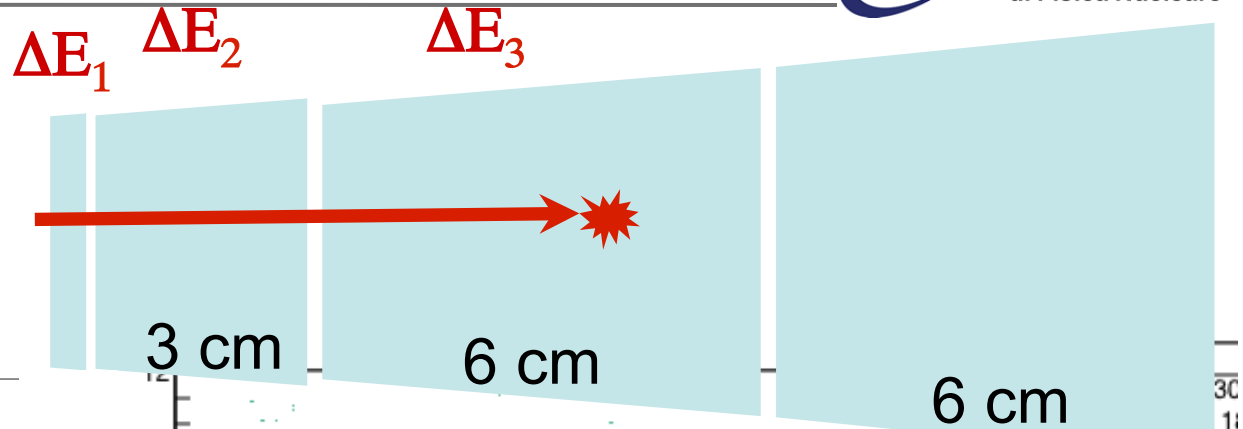


PRT coincidences



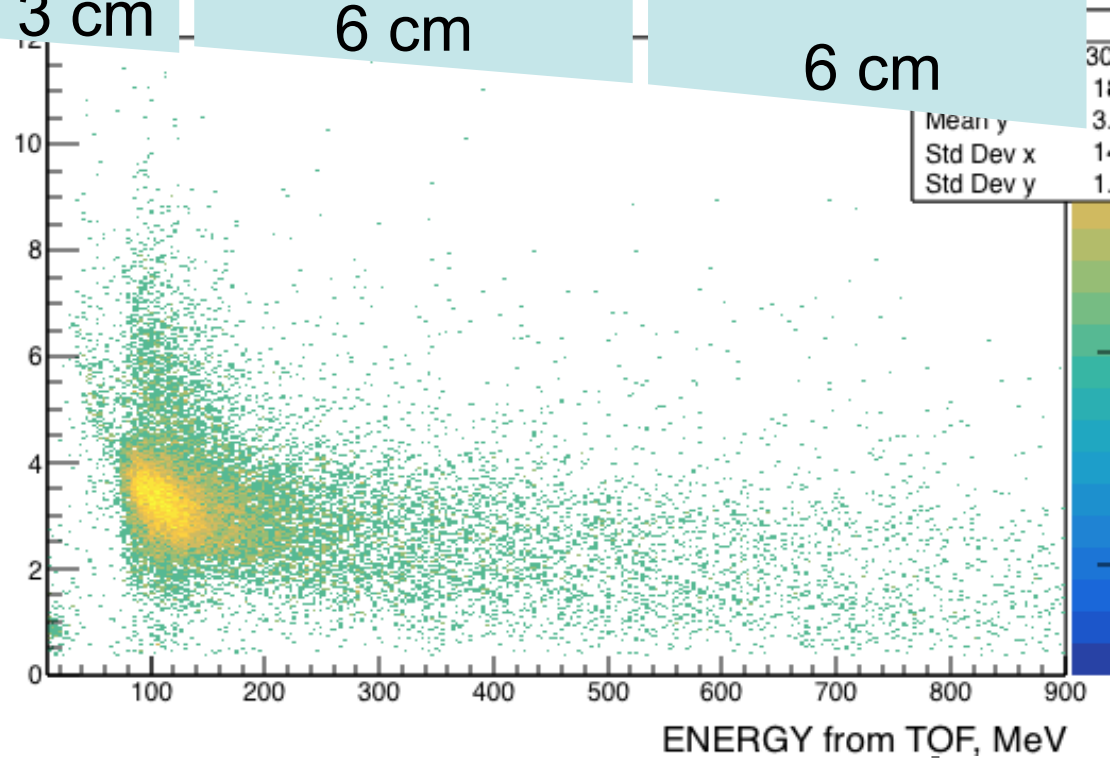
$E_p \sim 80 \div 110 \text{ MeV}$

$E_n \sim 91 \div 125 \text{ MeV}$



Time distribution of coincidences

$y = \Delta E_1$



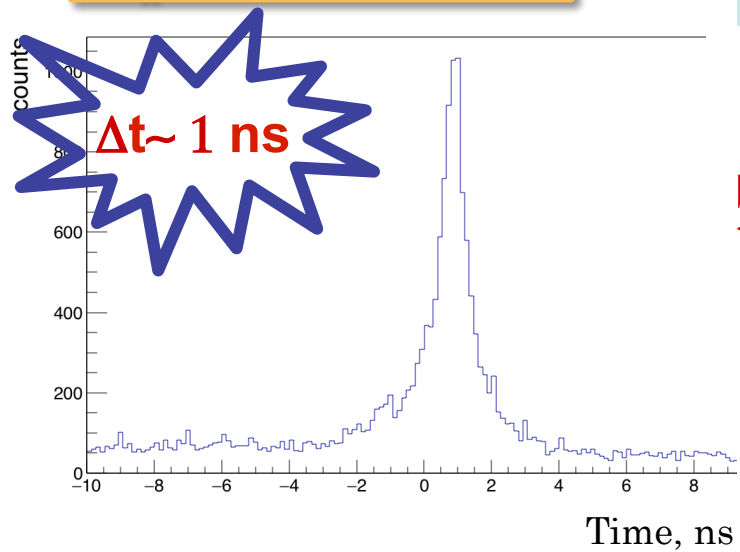
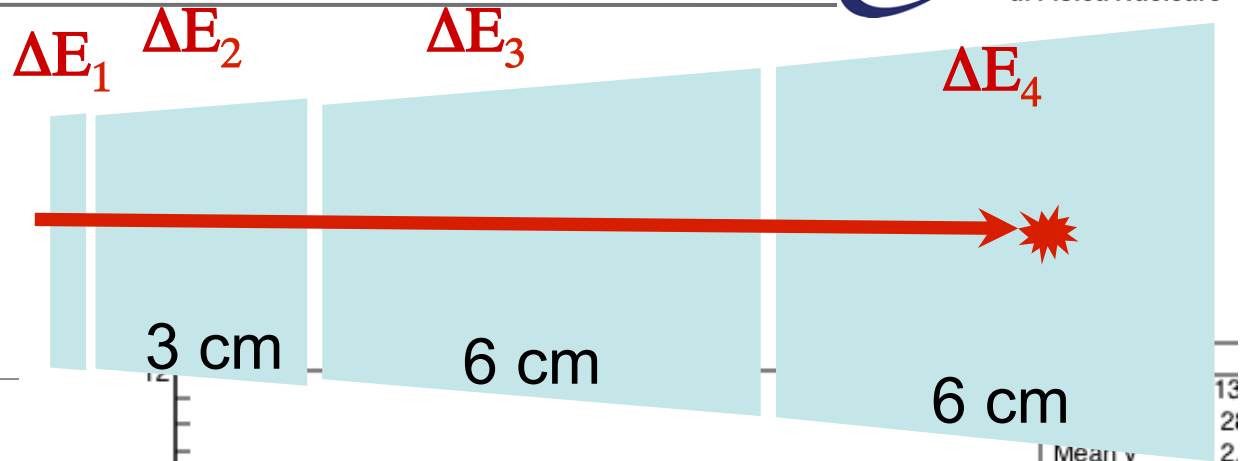


PRT coincidences



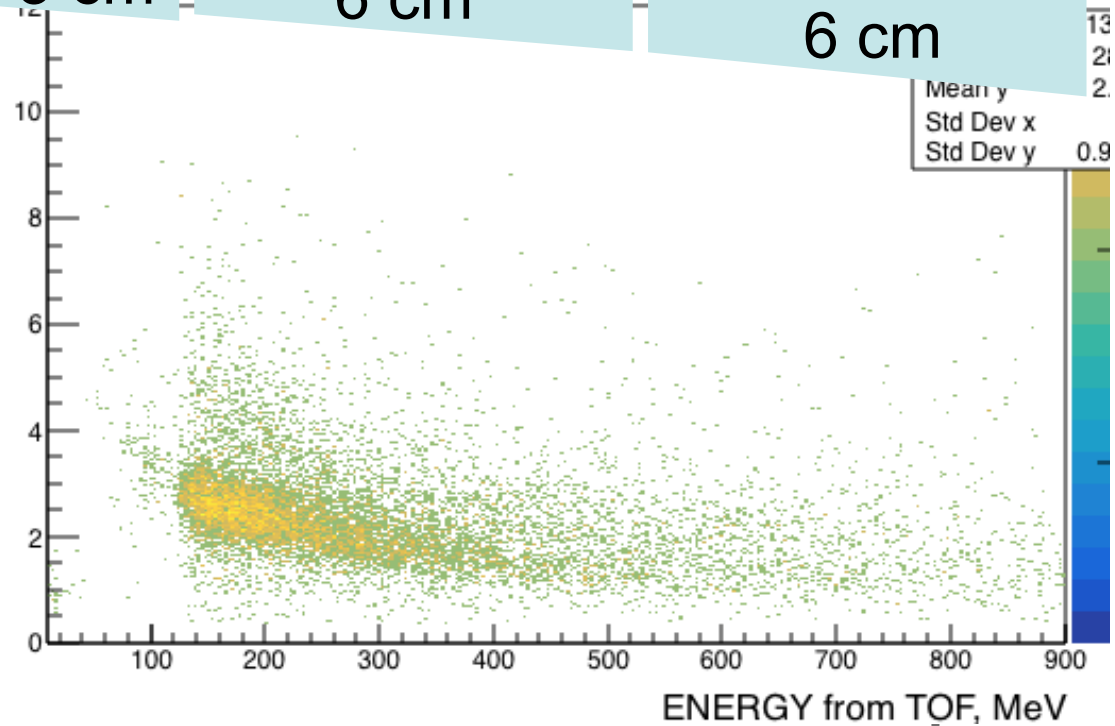
$E_p \sim 120 \div 150 \text{ MeV}$

$E_n \sim 136 \div 170 \text{ MeV}$



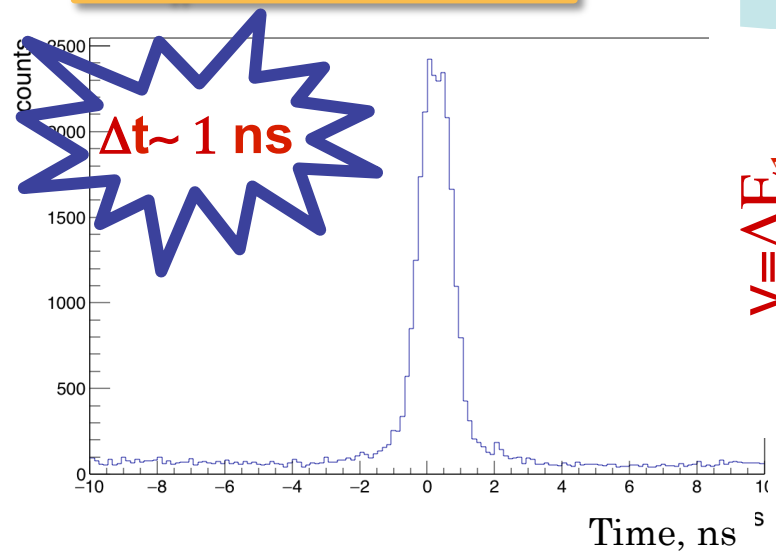
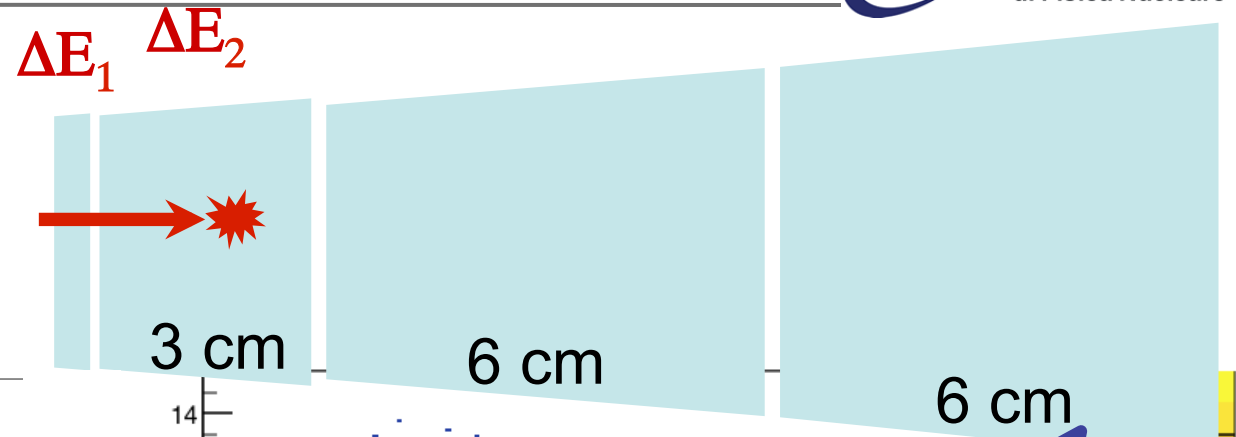
Time distribution of coincidences

$y = \Delta E_1$



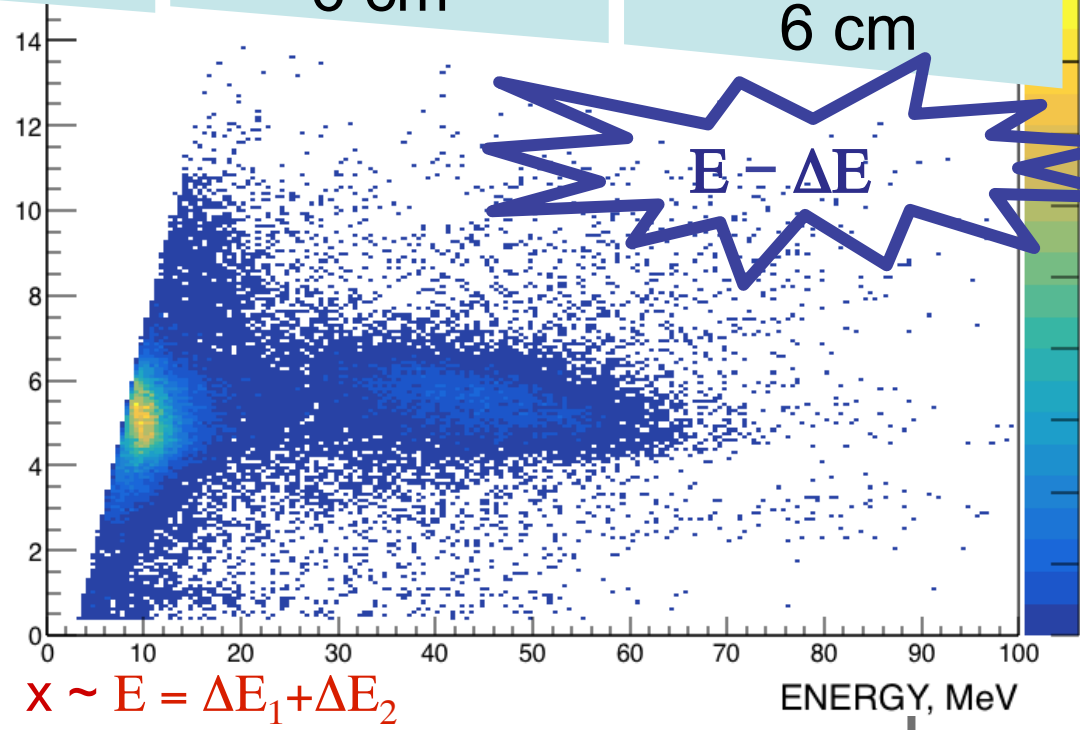
$E_p \sim 30 \div 60 \text{ MeV}$

$E_n \sim 34 \div 68 \text{ MeV}$



Time distribution of coincidences

$y = \Delta E_1$



$x \sim E = \Delta E_1 + \Delta E_2$

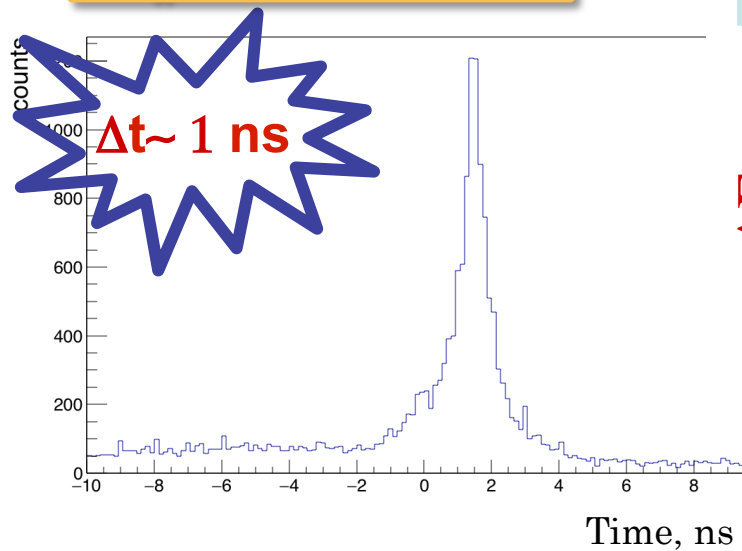
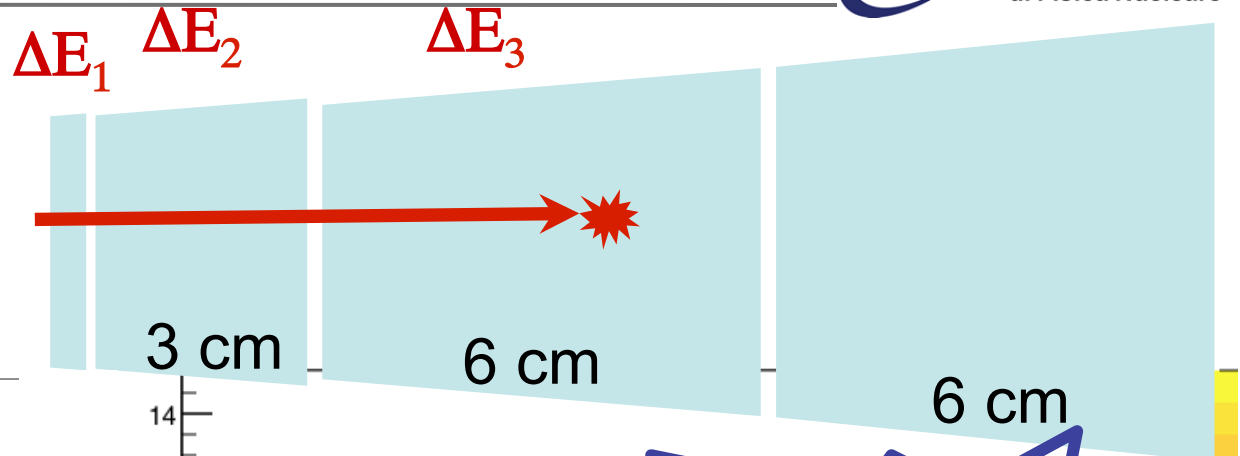


PRT coincidences



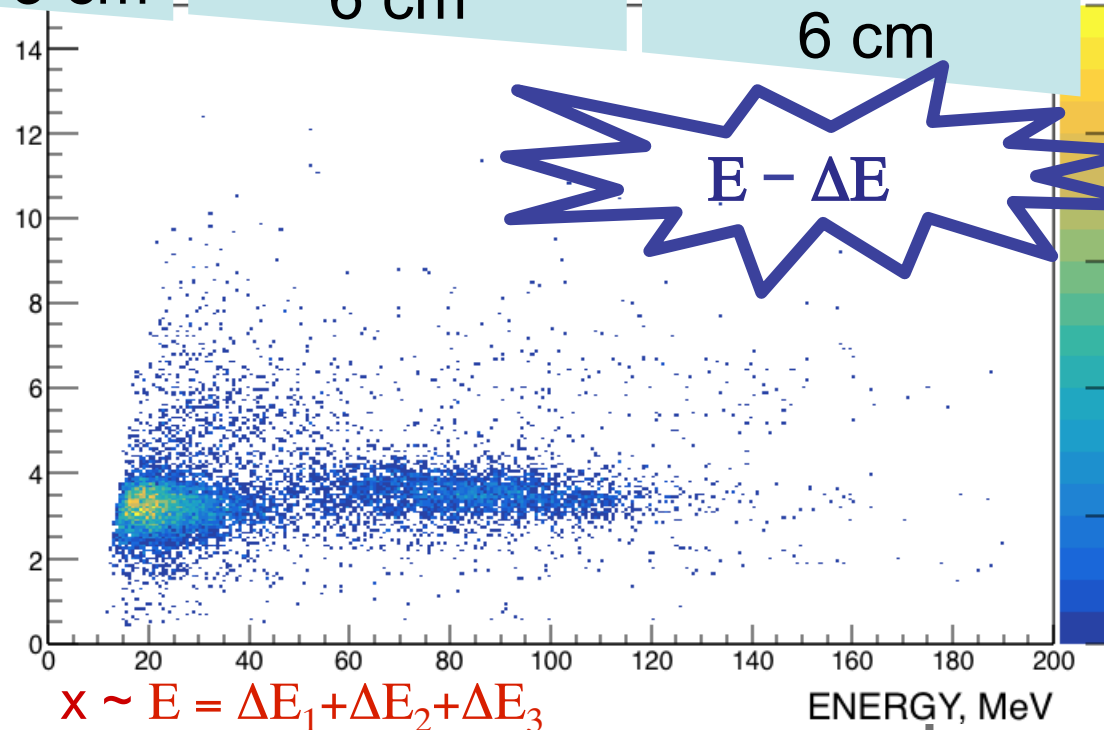
$$E_p \sim 80 \div 110 \text{ MeV}$$

$$E_n \sim 91 \div 125 \text{ MeV}$$



Time distribution of coincidences

$$y = \Delta E_1$$



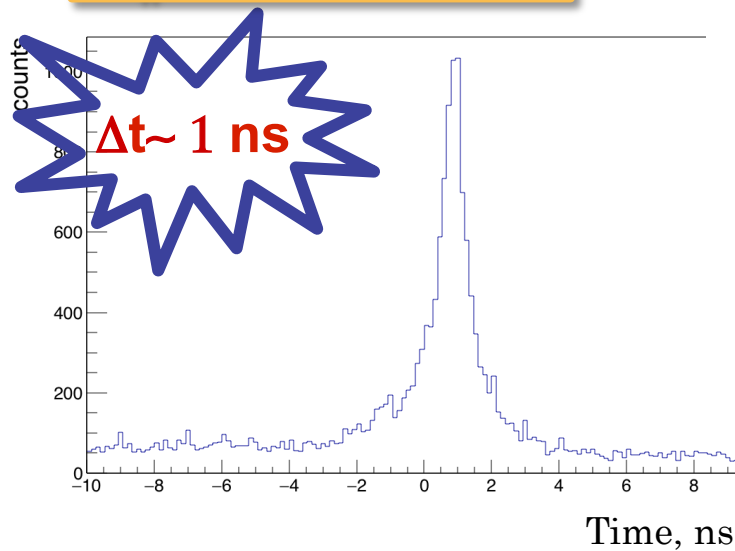
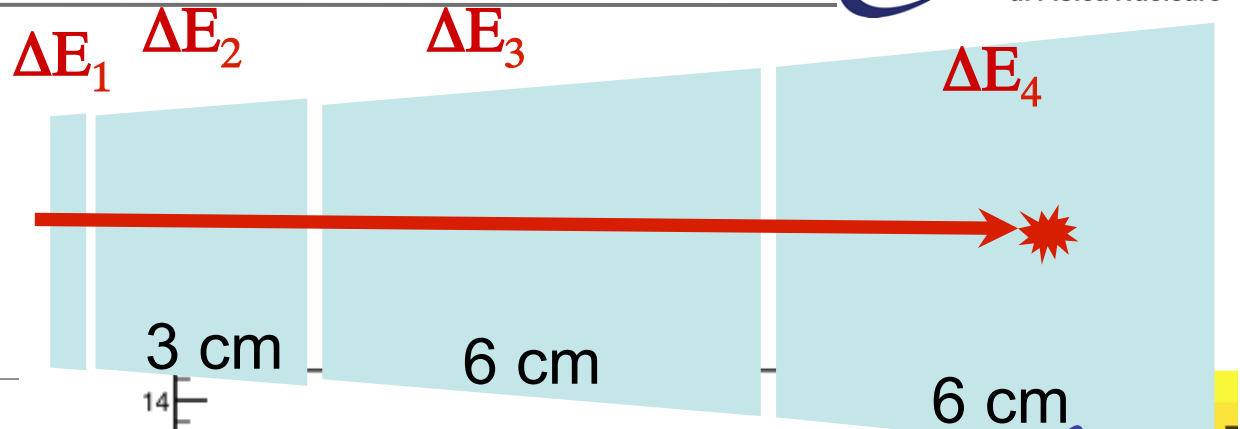


PRT coincidences

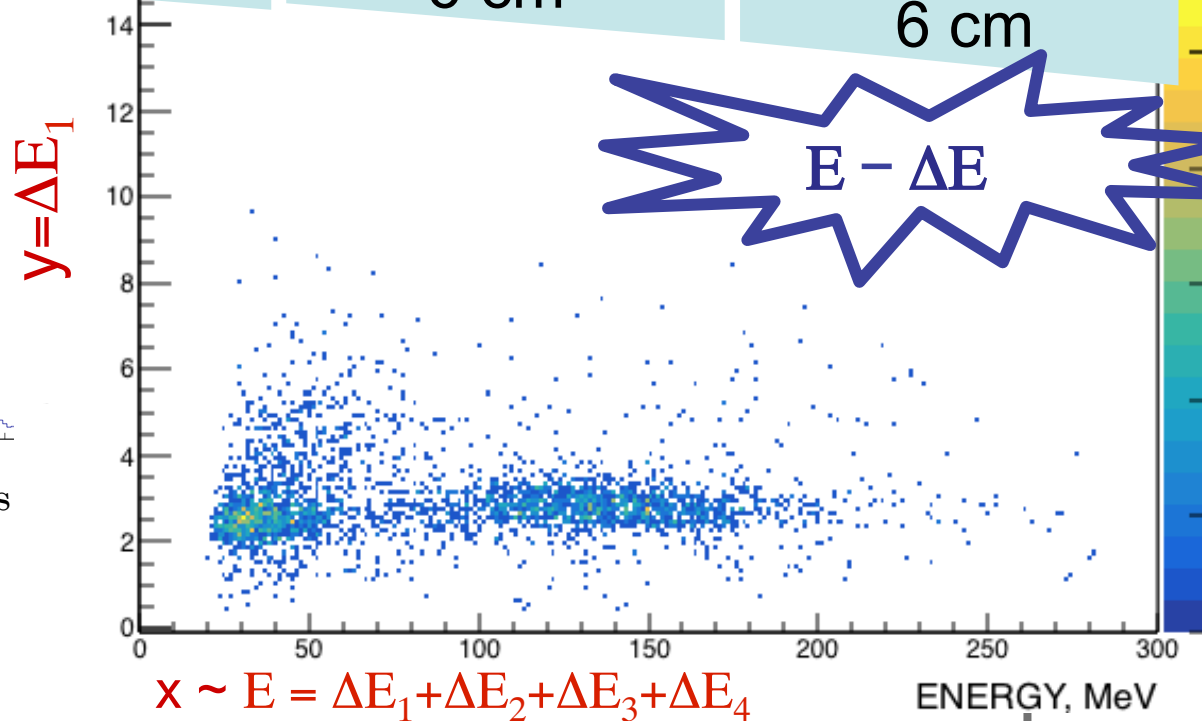


$E_p \sim 120 \div 150 \text{ MeV}$

$E_n \sim 136 \div 170 \text{ MeV}$



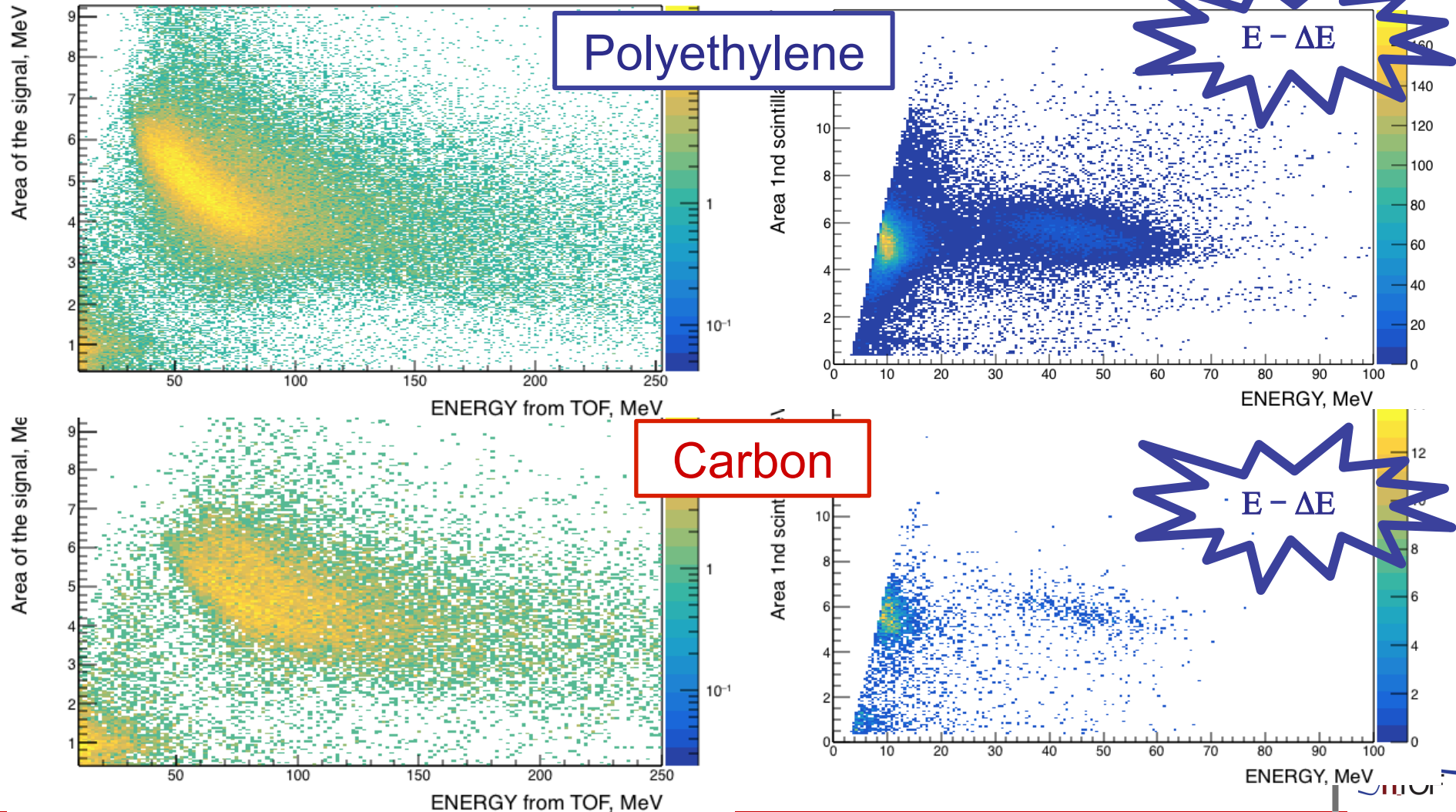
Time distribution of coincidences

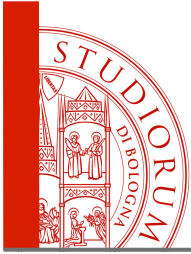


$$x \sim E = \Delta E_1 + \Delta E_2 + \Delta E_3 + \Delta E_4$$

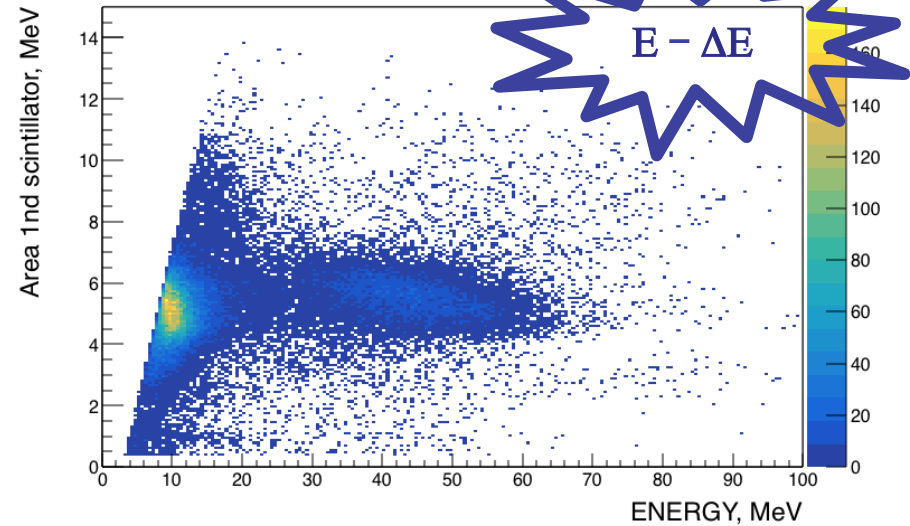
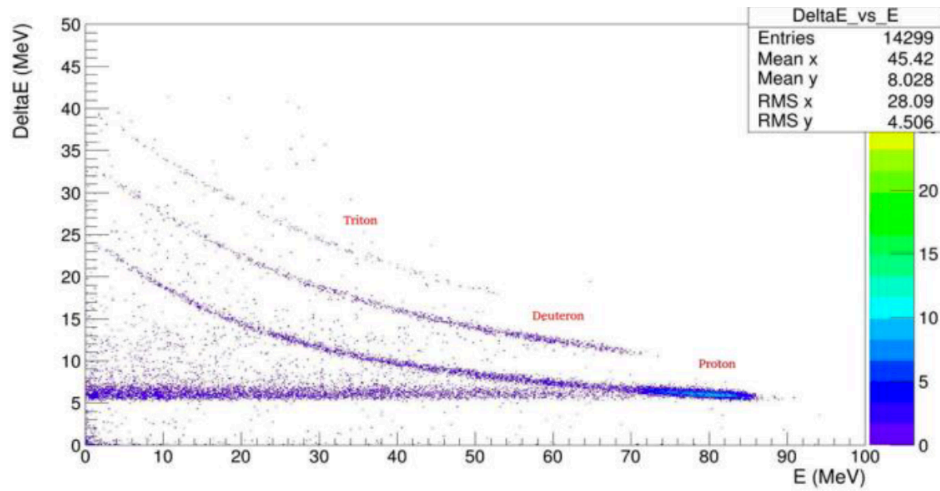
ENERGY, MeV

TOF- ΔE Vs E- ΔE

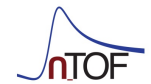


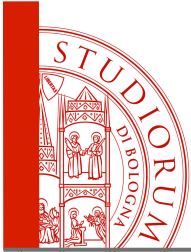


TOF- ΔE Vs E- ΔE

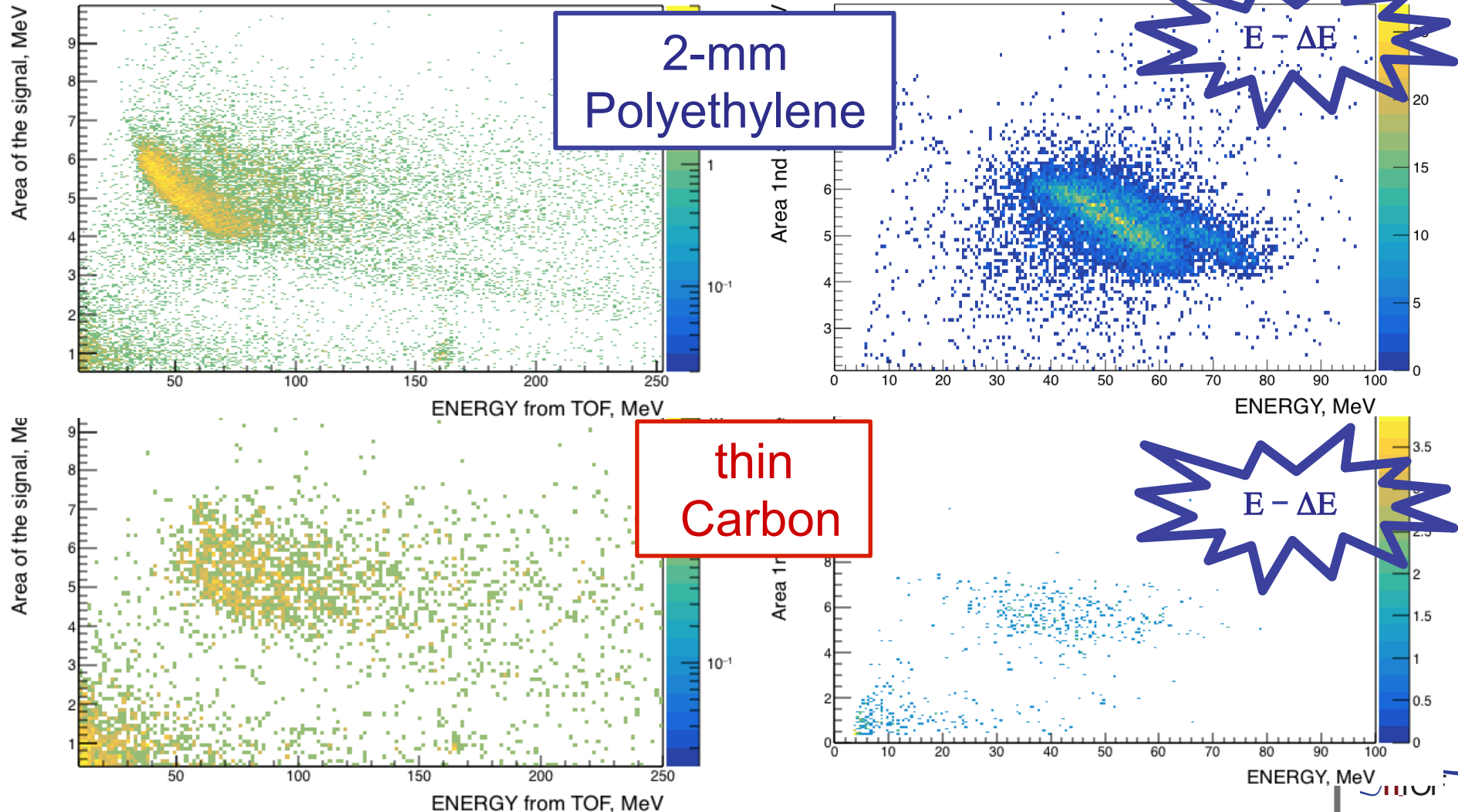


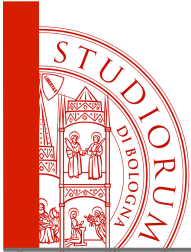
GEANT4
 $n+^{12}\text{C}$



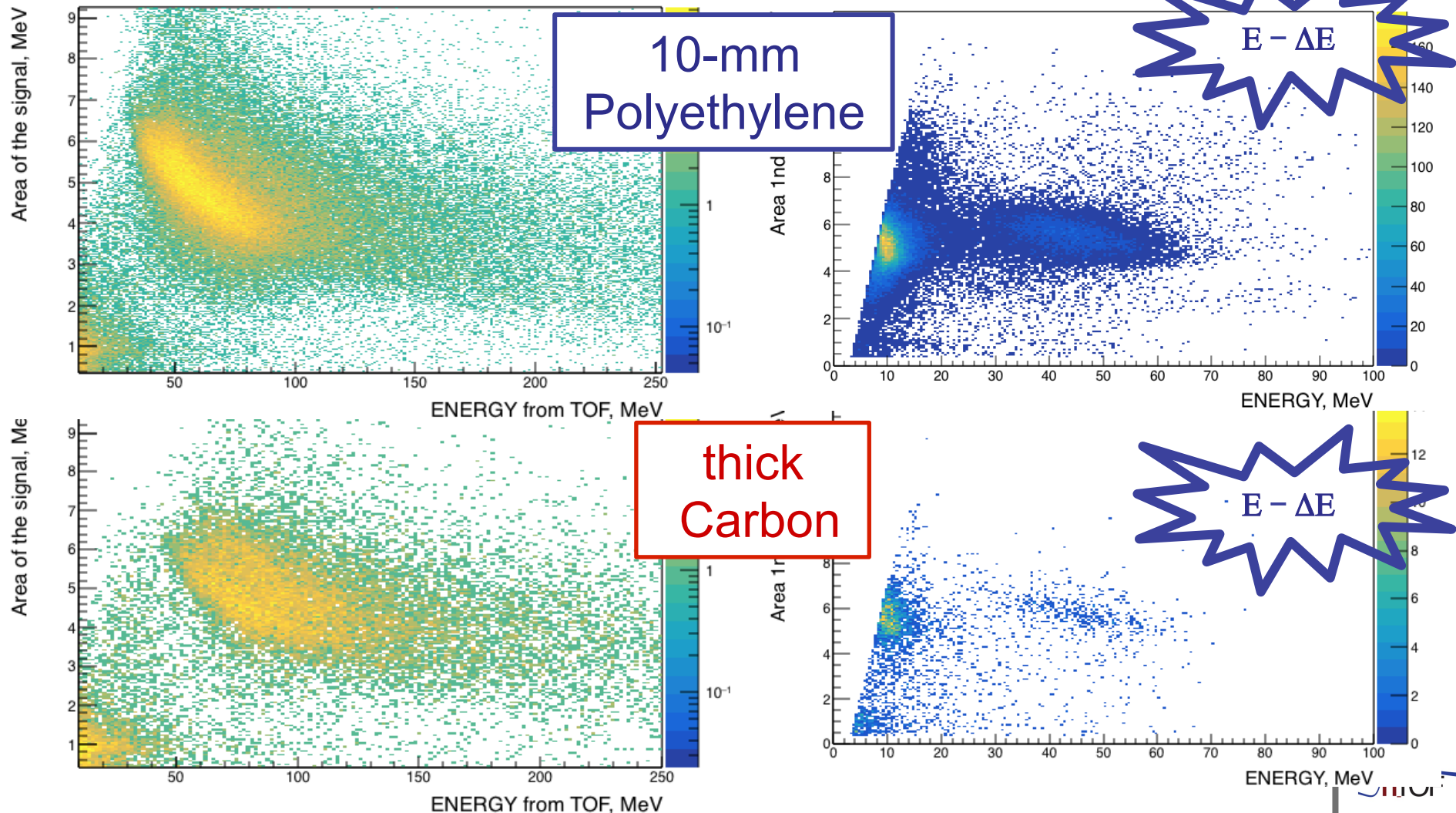


Impact of the converter





Impact of the converter





What's new

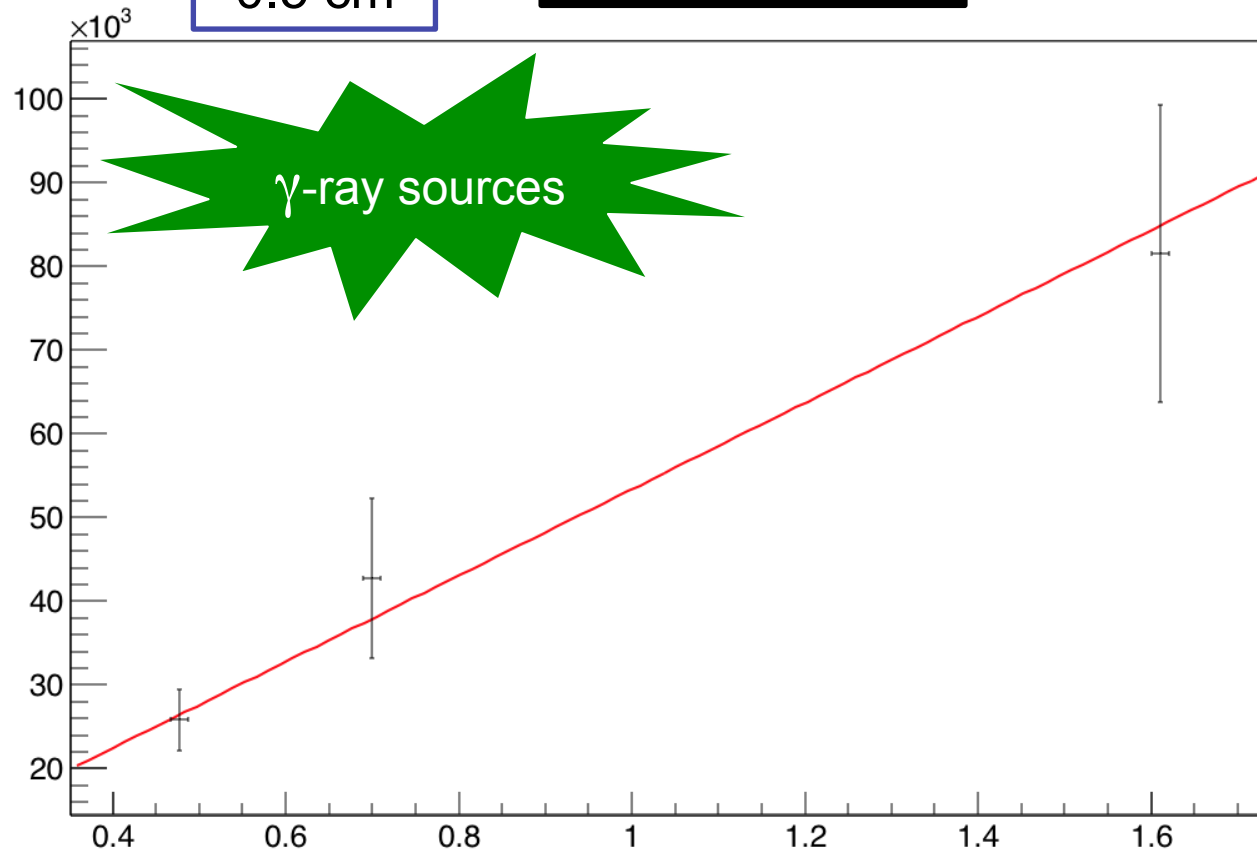


What's new

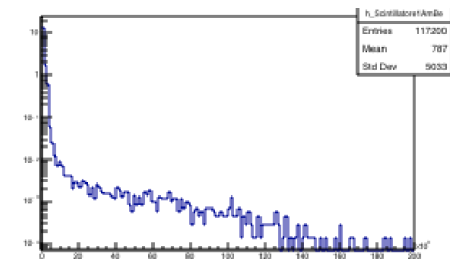
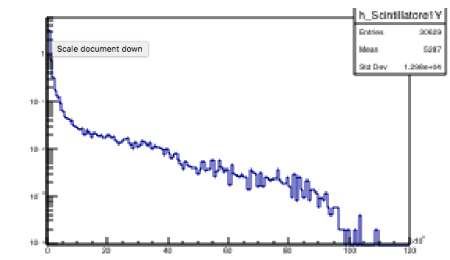
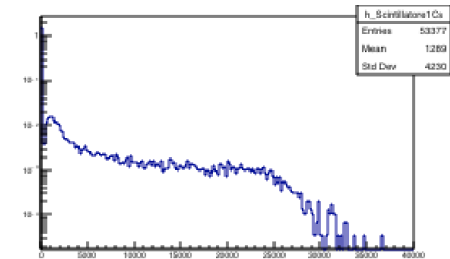
0.5 cm

Scintillator 1

channels



Cs, Y, AmBe

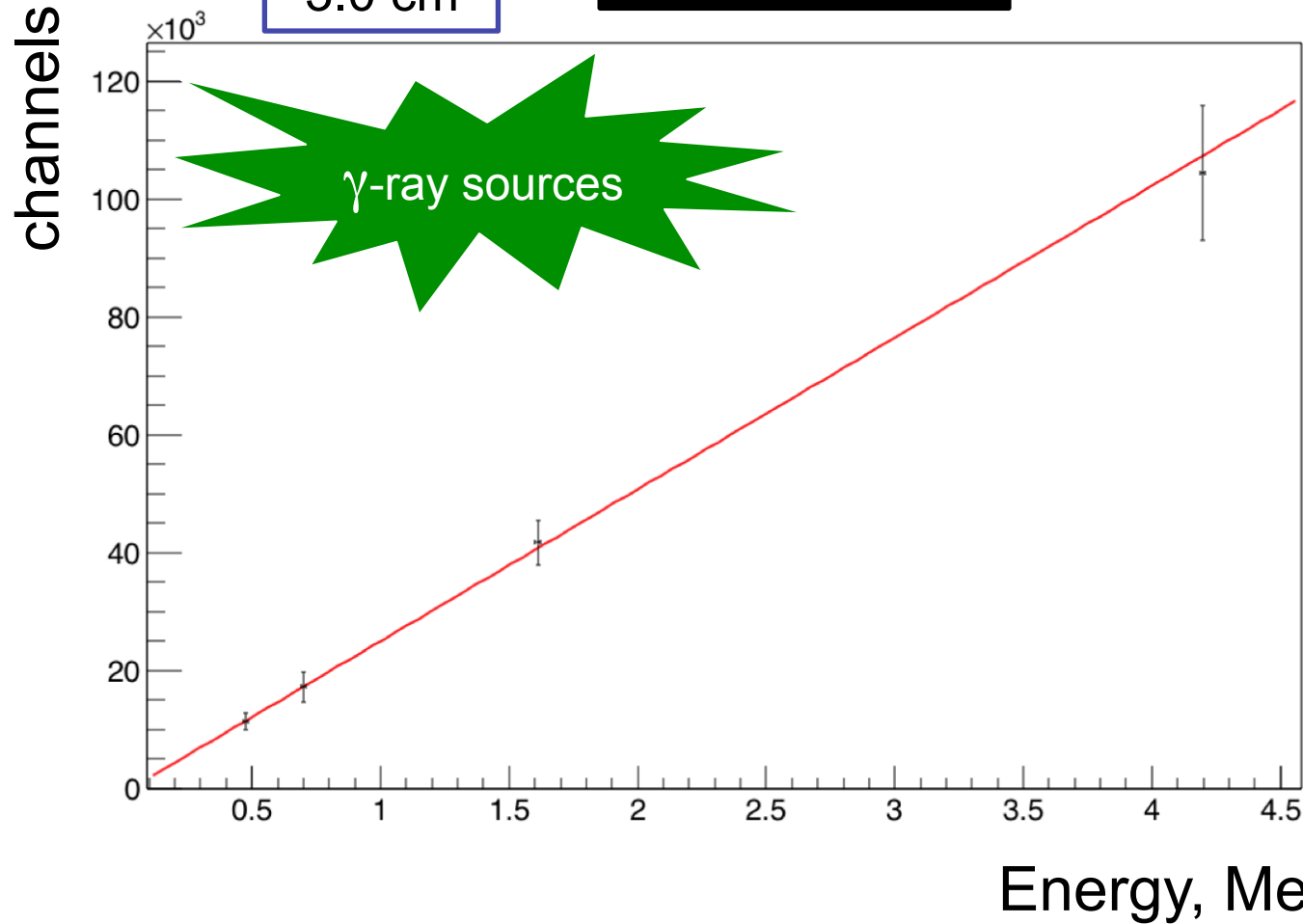


Energy, MeV

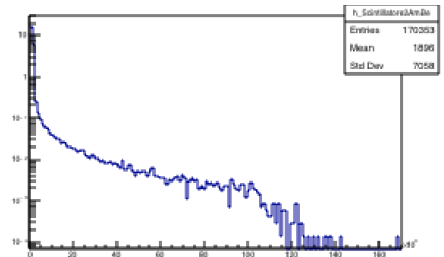
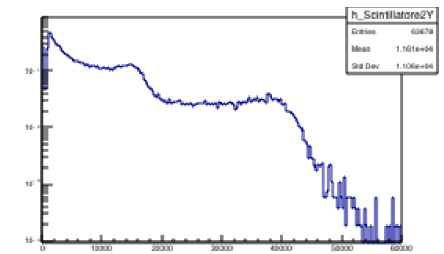
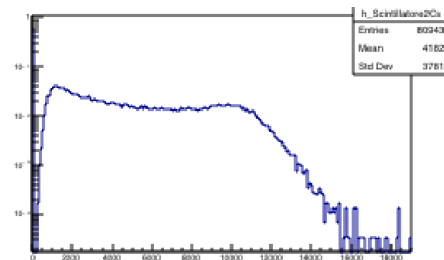
What's new

3.0 cm

Scintillator 2



Cs, Y, AmBe

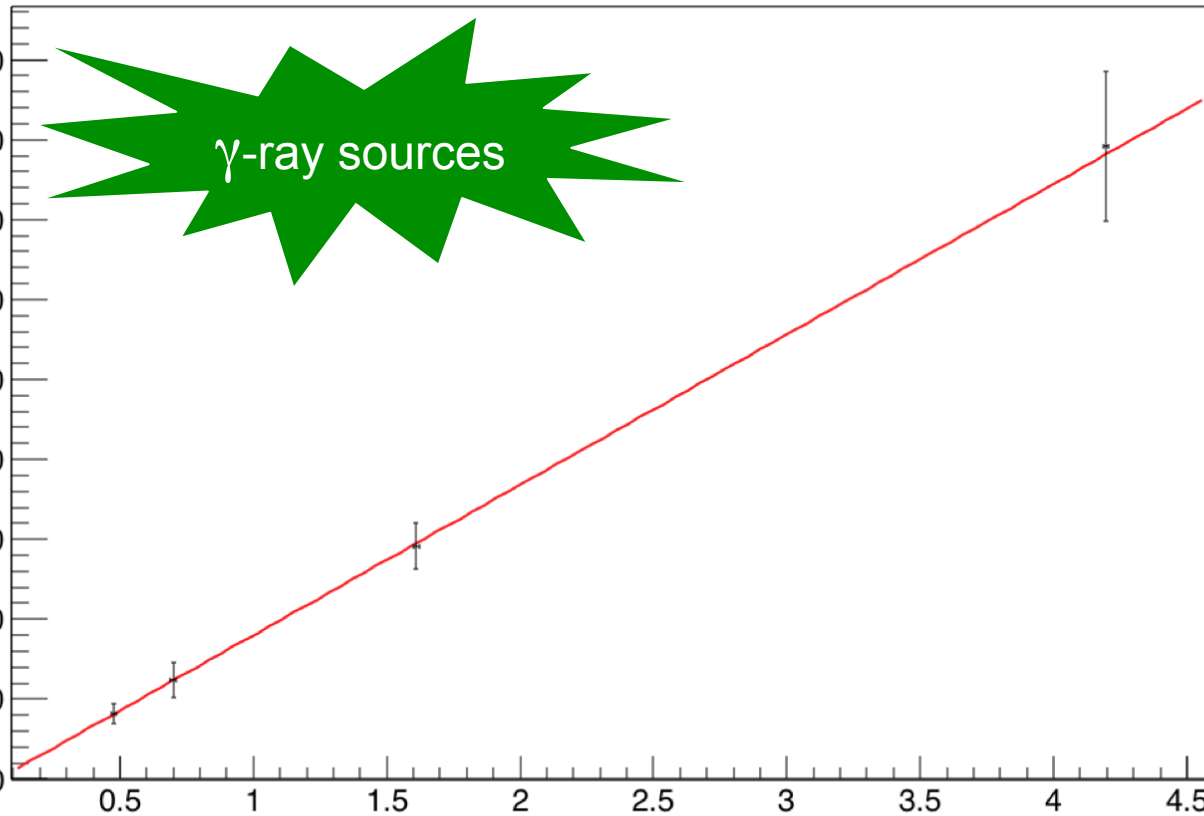


What's new

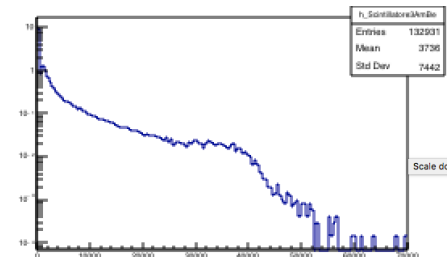
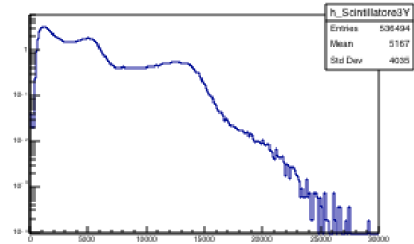
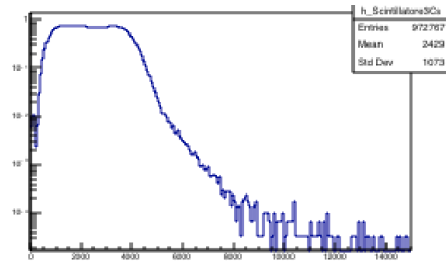
6.0 cm

Scintillator 3

channels



Cs, Y, AmBe

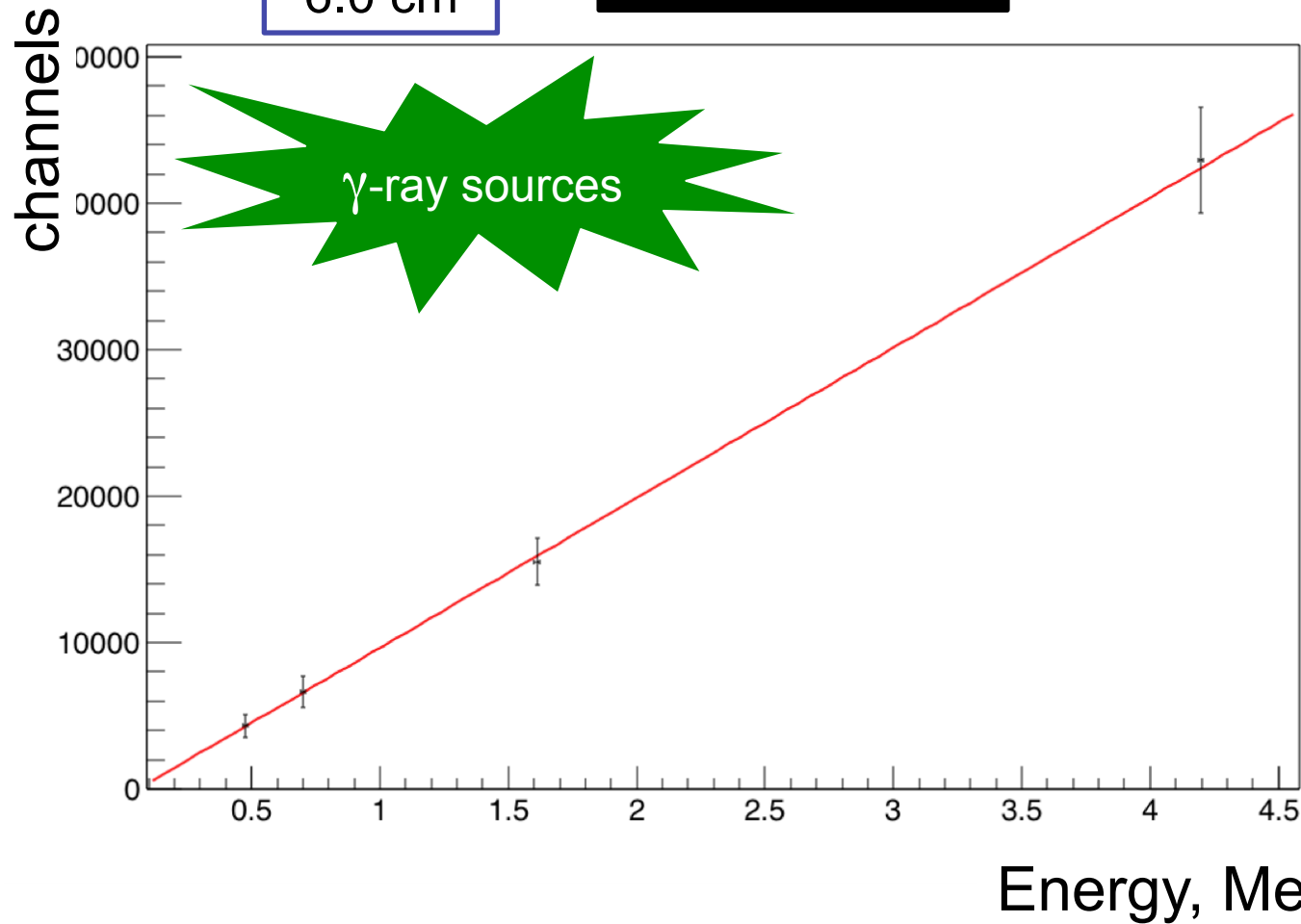


Energy, MeV

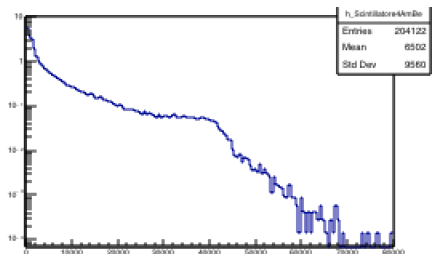
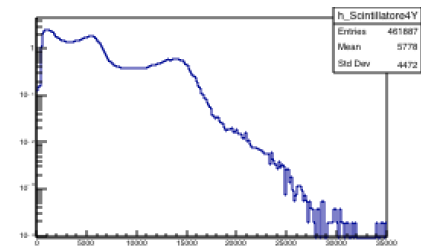
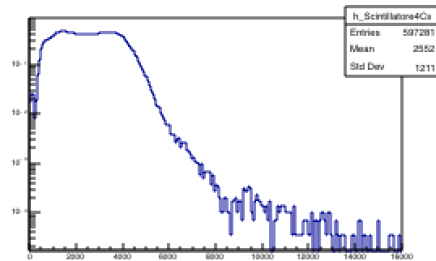
What's new

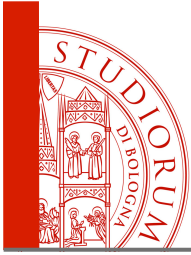
6.0 cm

Scintillator 4



Cs, Y, AmBe



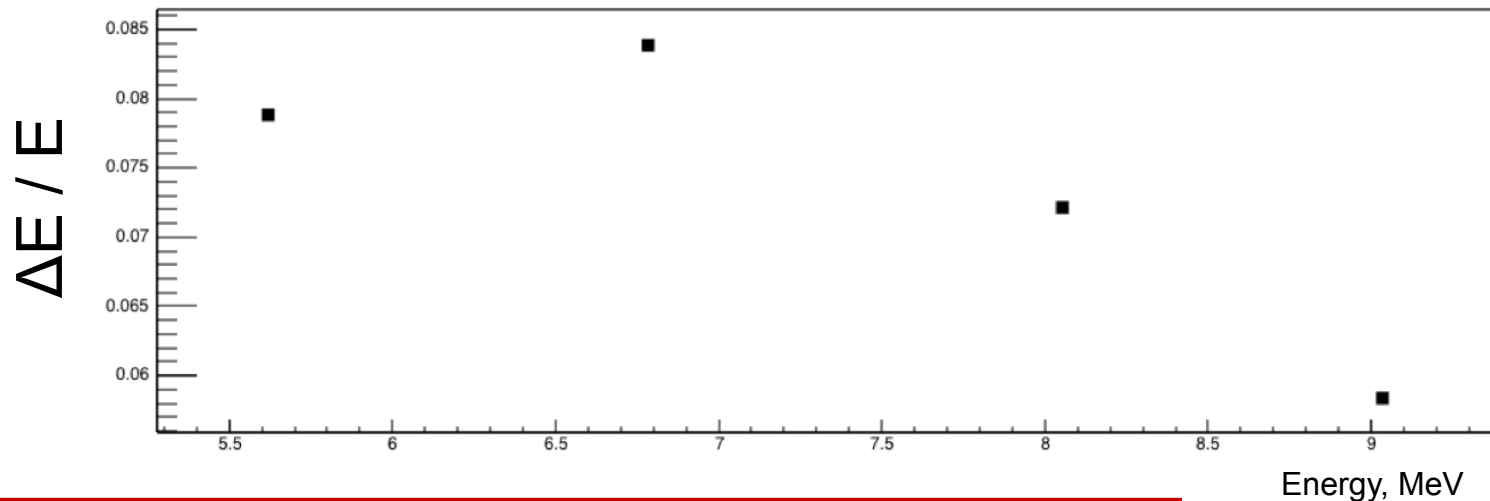
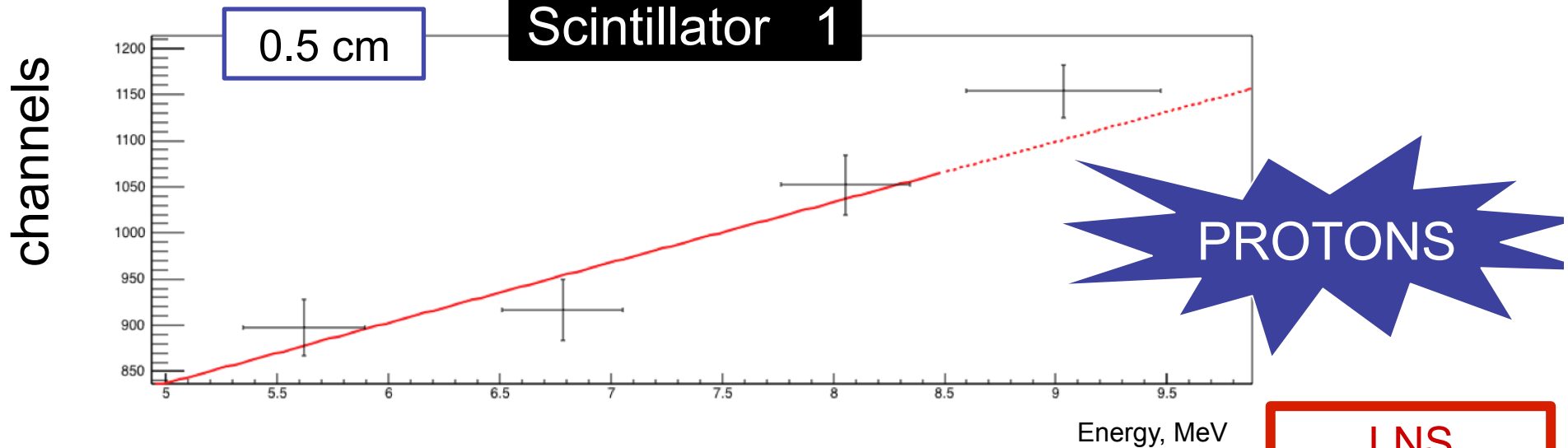


What's new





What's new

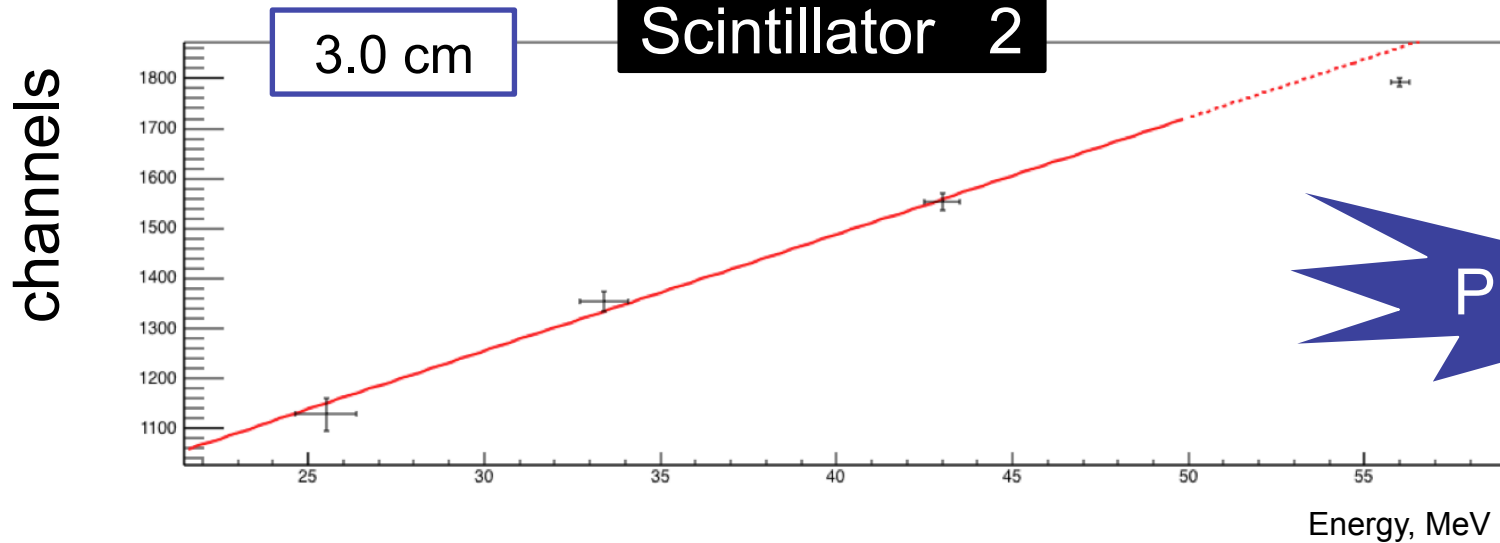


LNS
cyclotron
 $E_p = 62$ MeV

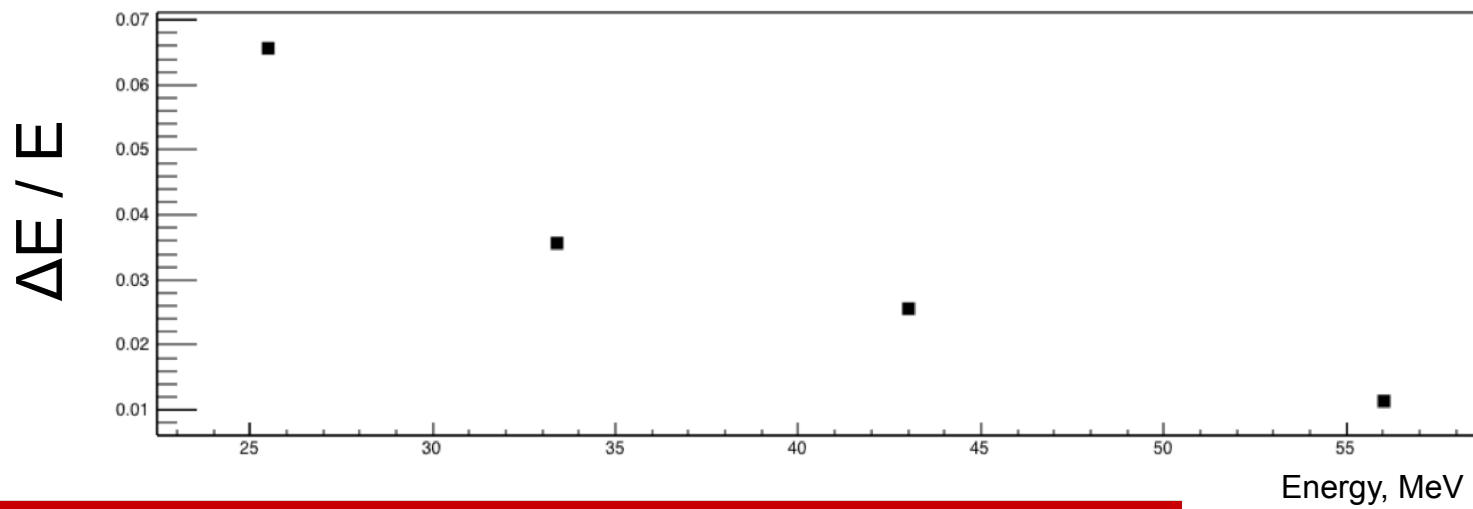
With aluminum
degrader 5, 8, 10
mm
→
 $E_p = 50, 42, 36,$
MeV



What's new



PROTONS

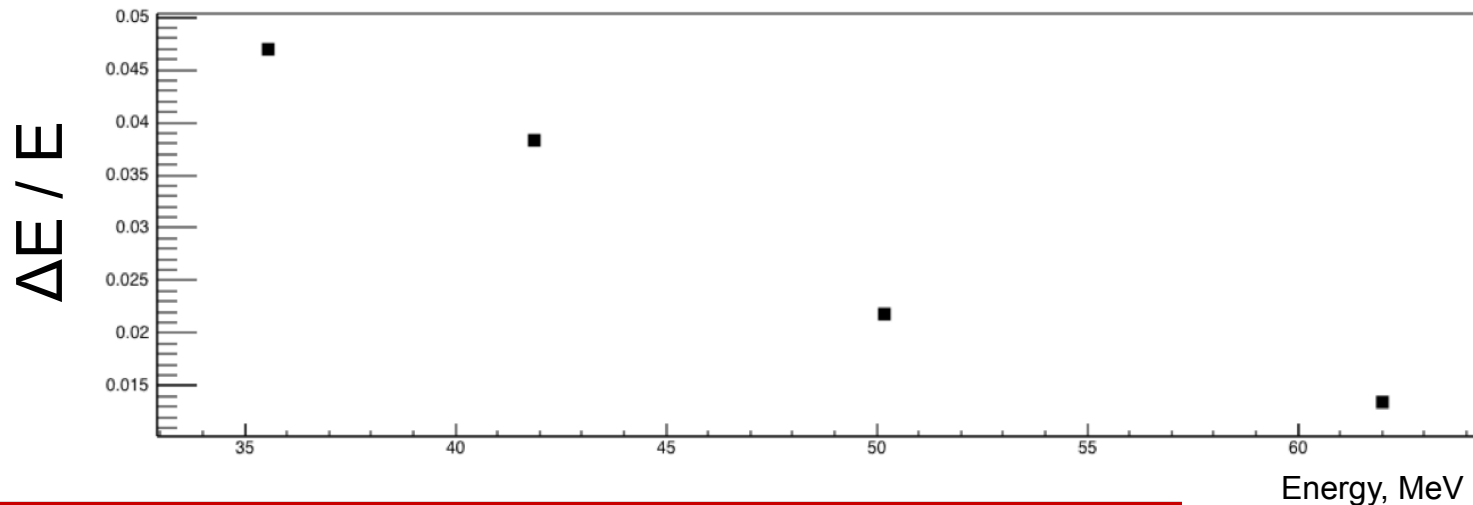
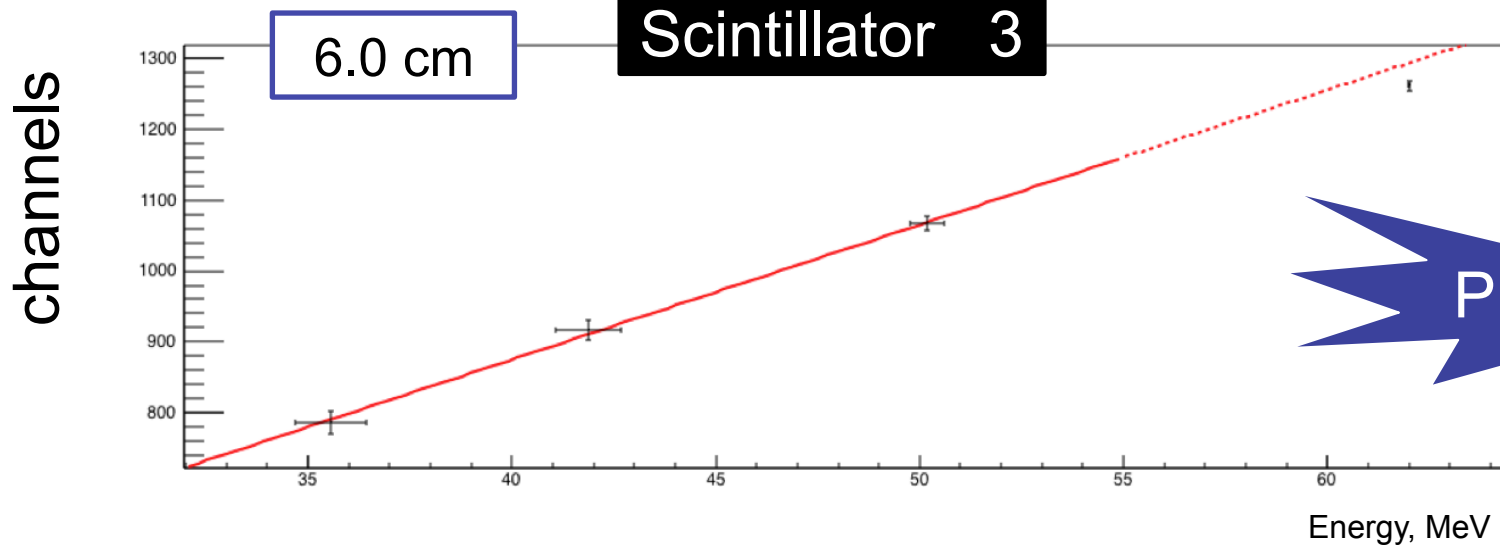


LNS
cyclotron
 $E_p = 62$ MeV

With aluminum
degrader 5, 8, 10
mm
→
 $E_p = 50, 42, 36,$
MeV



What's new

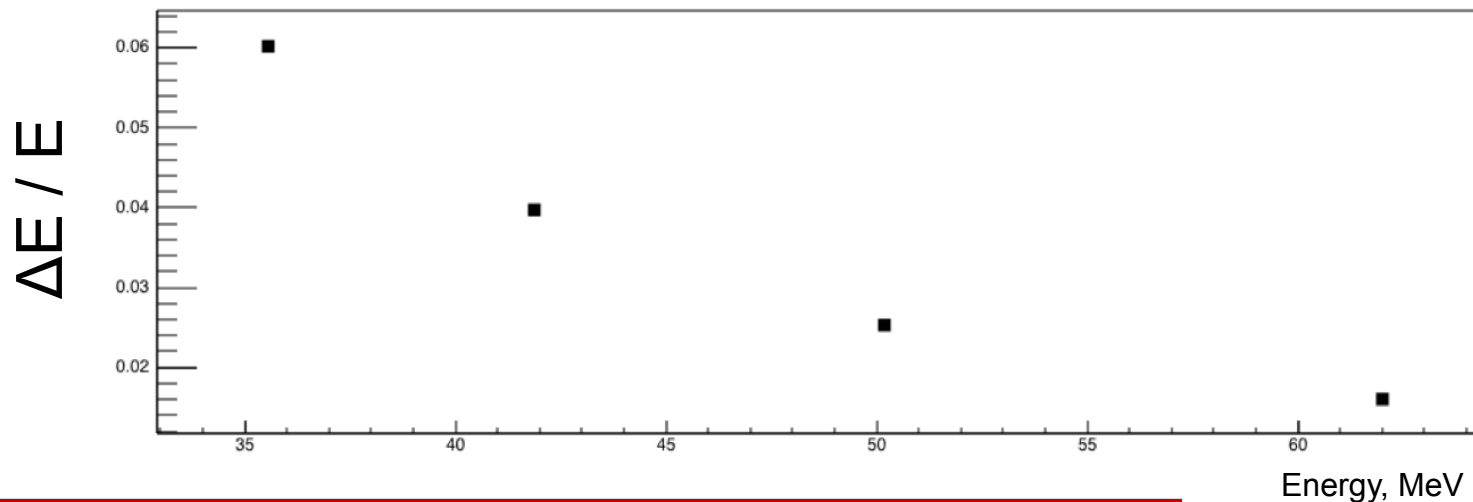
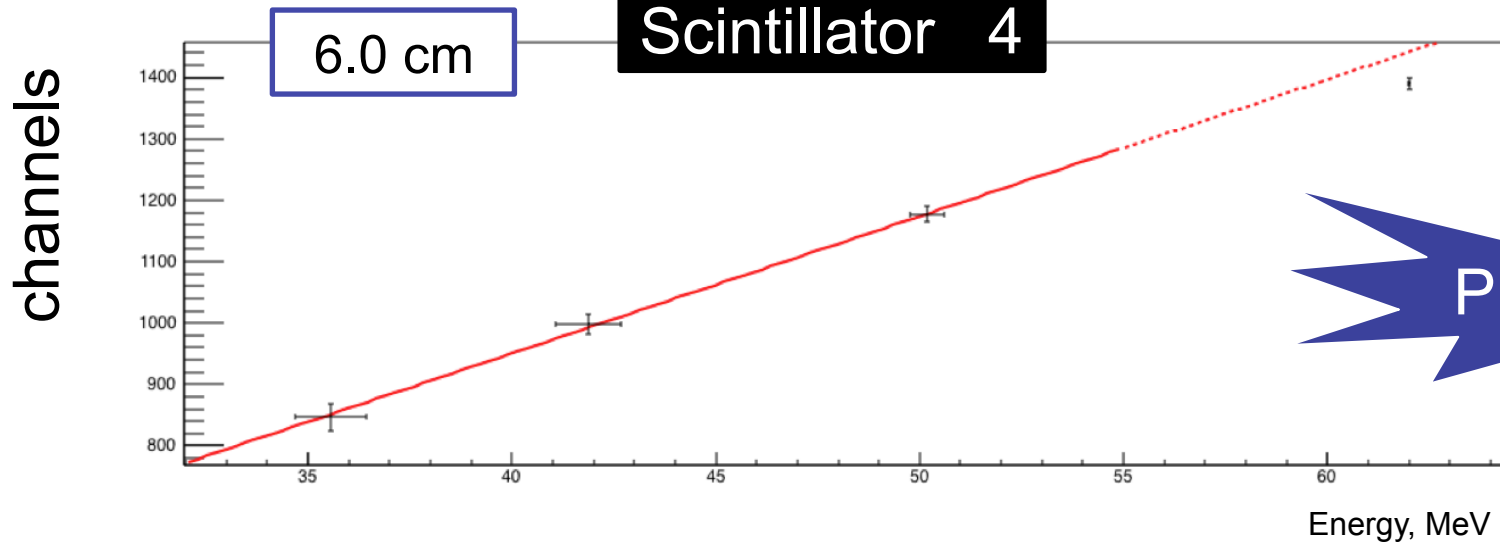


LNS
cyclotron
 $E_p = 62$ MeV

With aluminum
degrader 5, 8, 10
mm
→
 $E_p = 50, 42, 36,$
MeV

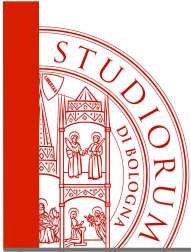


What's new

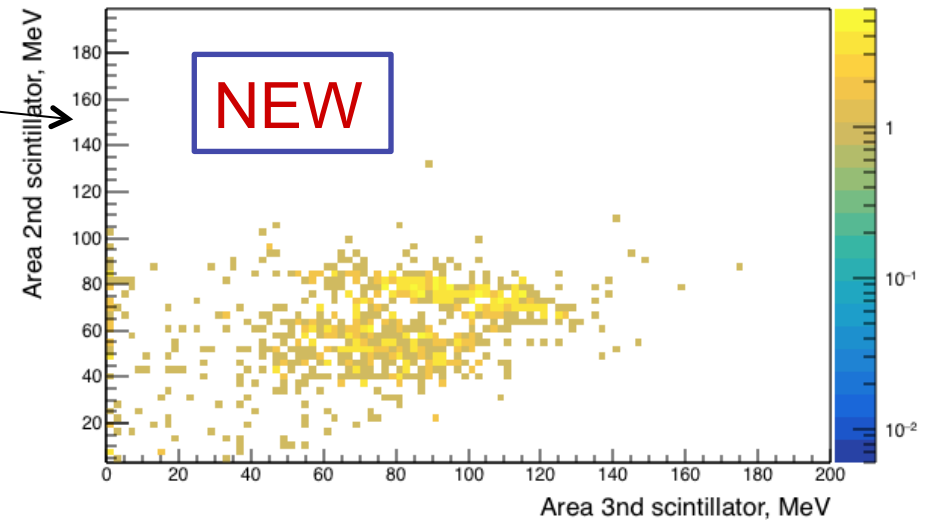
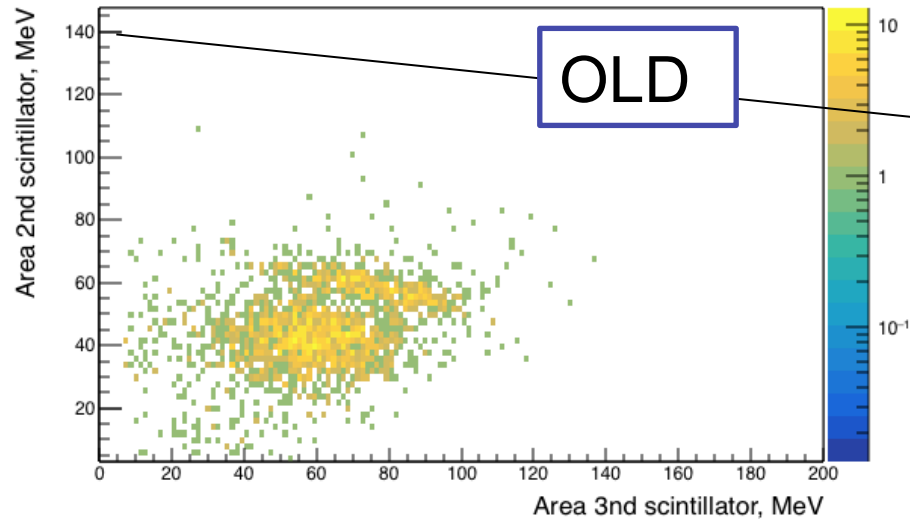
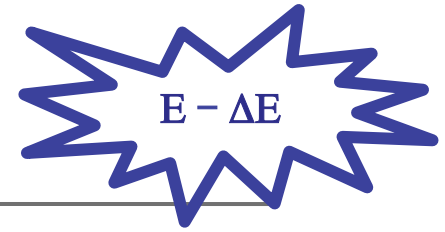


LNS
cyclotron
 $E_p = 62$ MeV

With aluminum
degrader 5, 8, 10
mm
→
 $E_p = 50, 42, 36,$
MeV

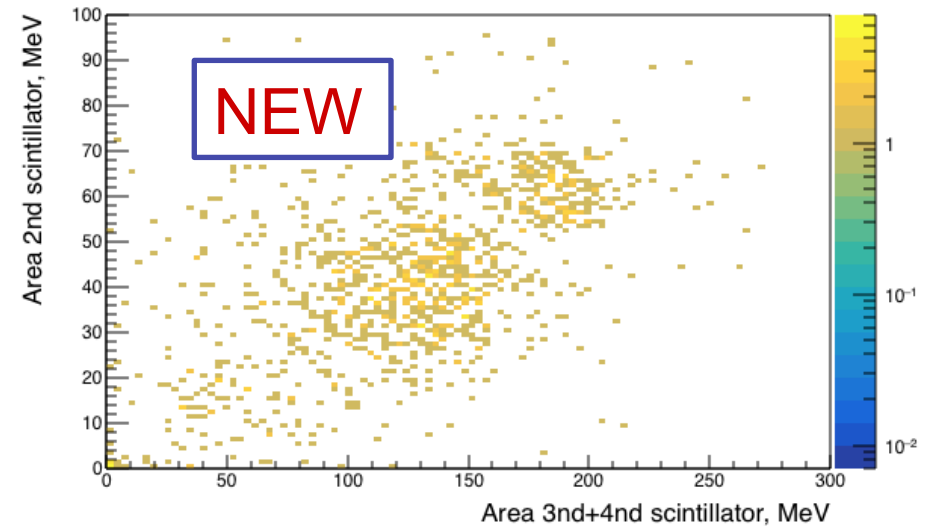
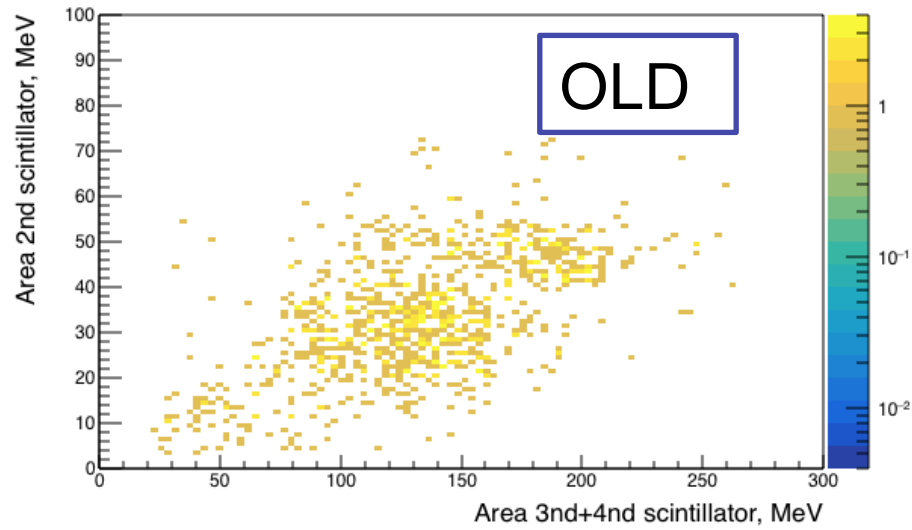
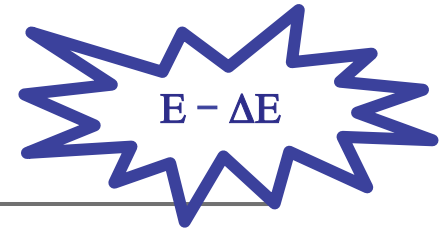


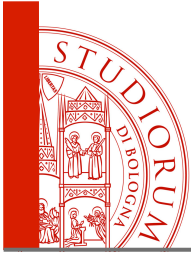
What's new



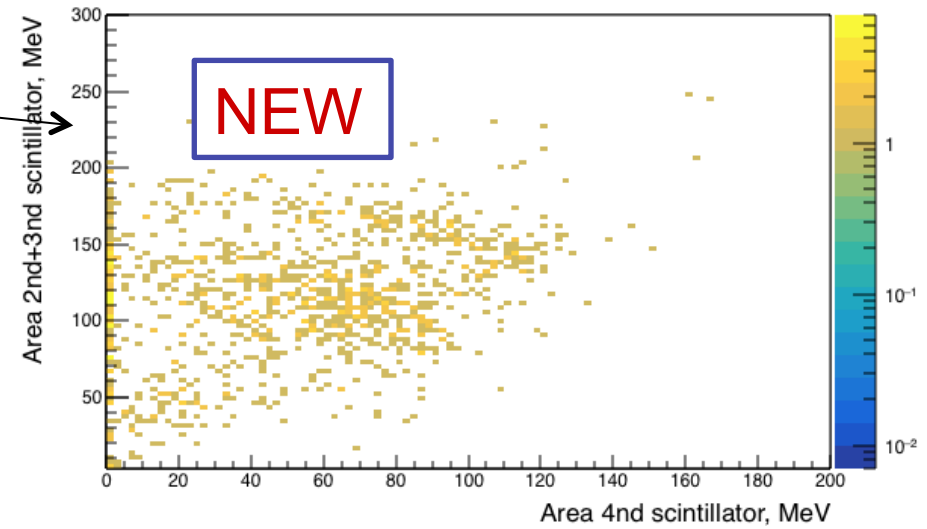
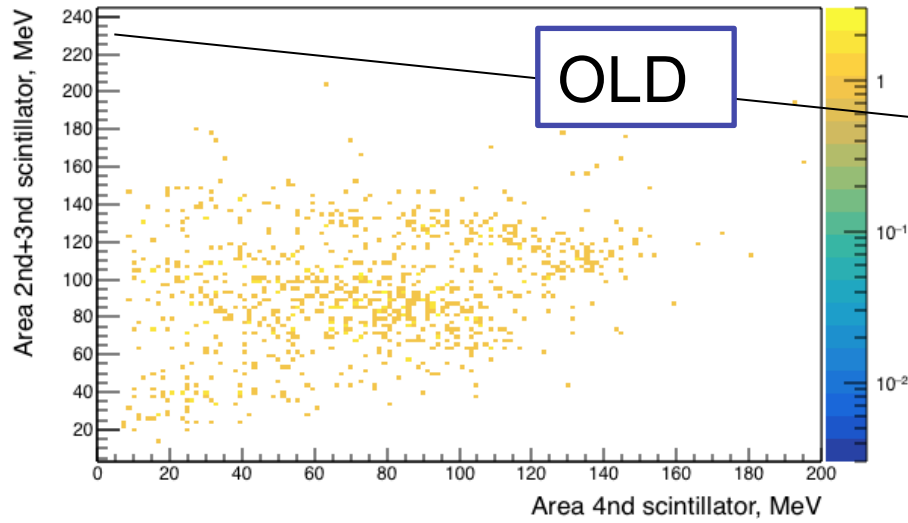
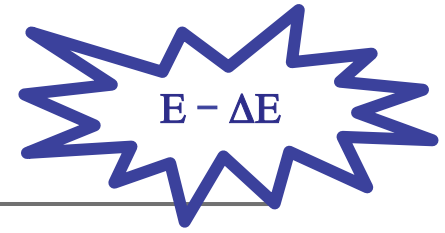


What's new





What's new

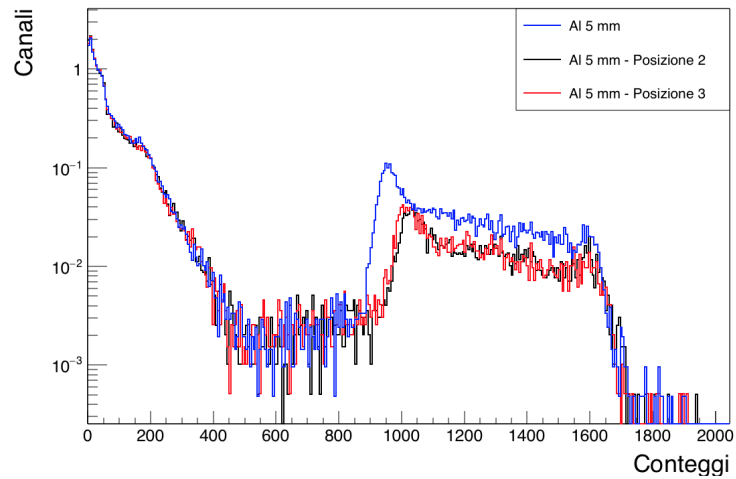




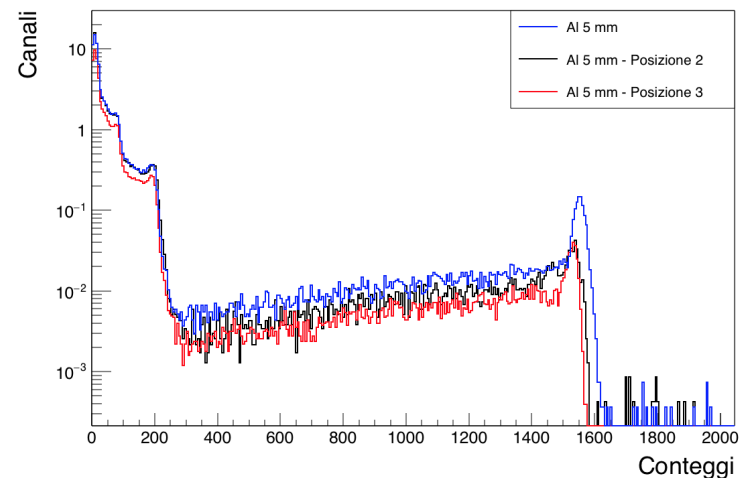
What's new

What's new

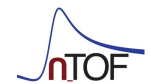
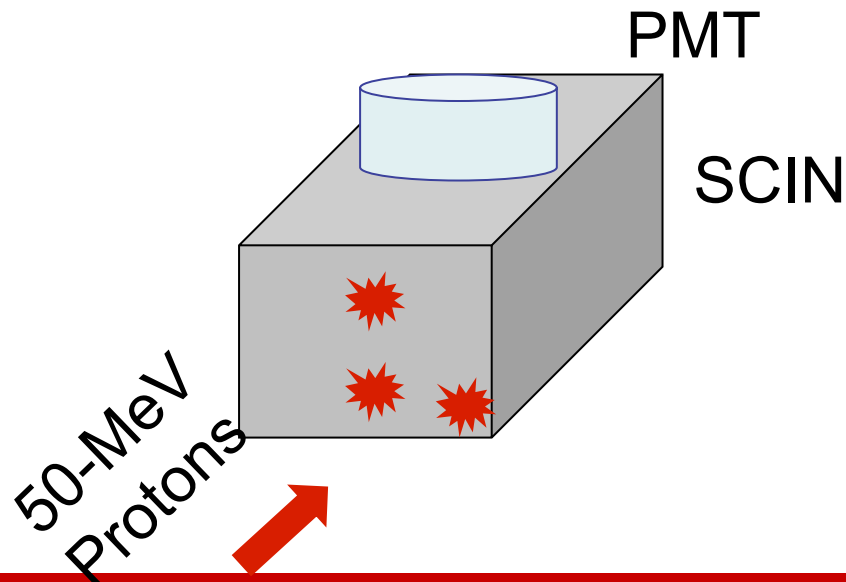
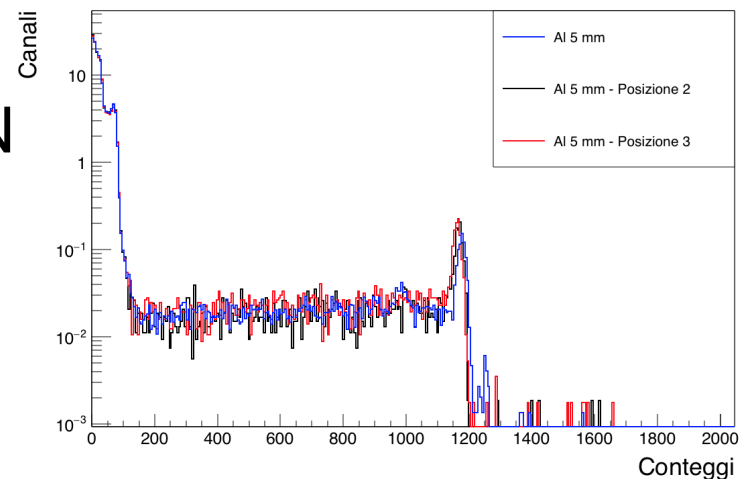
Scintillatore 1



Scintillatore 2



Scintillatore 4



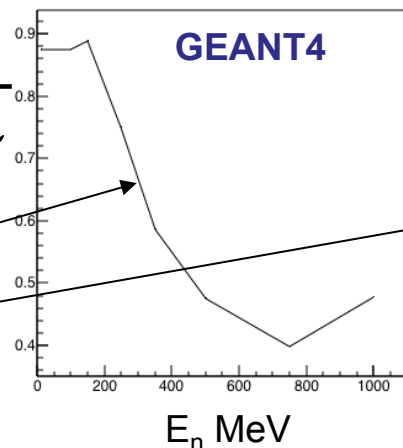
10-mm Polyethylene

$$\varphi_n = \frac{C}{n\Omega\varepsilon\sigma}$$

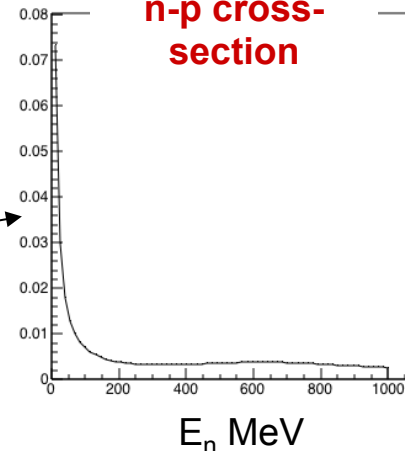
Solid angle

Sample Areal density

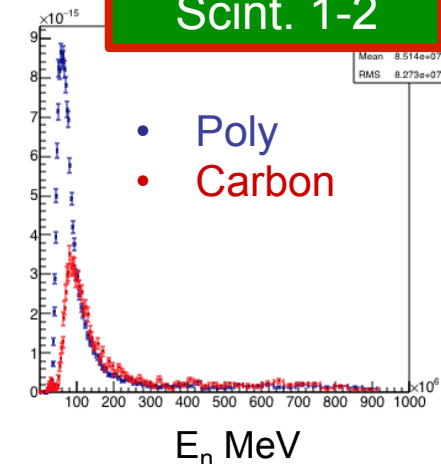
Efficiency



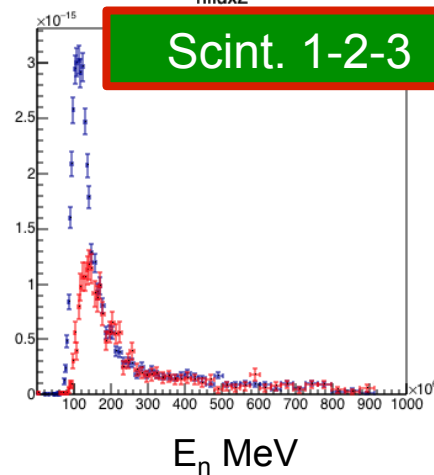
n-p cross-section



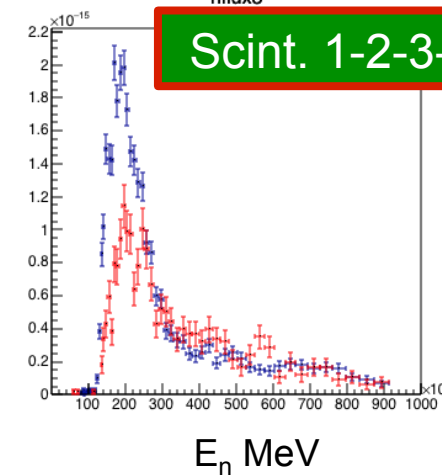
Scint. 1-2



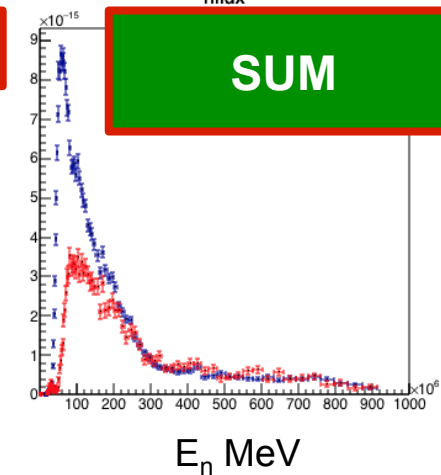
Scint. 1-2-3



Scint. 1-2-3-4



SUM



TEST - FLUX

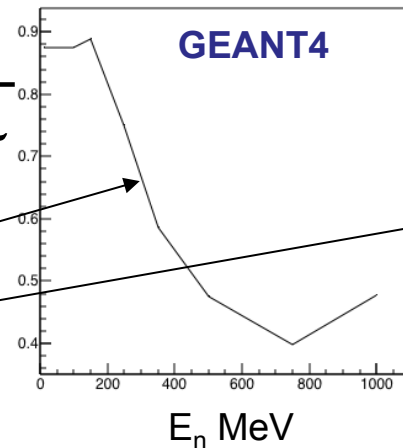
10-mm Polyethylene

$$\varphi_n = \frac{C}{n\Omega\varepsilon\sigma}$$

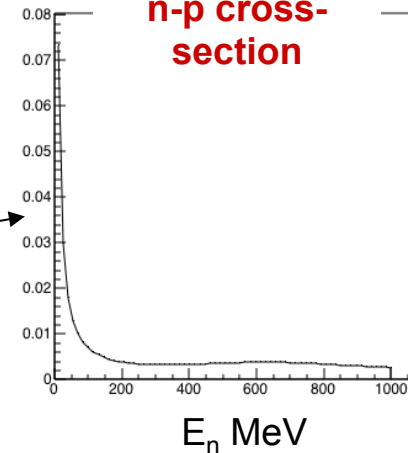
Solid angle

Sample Areal density

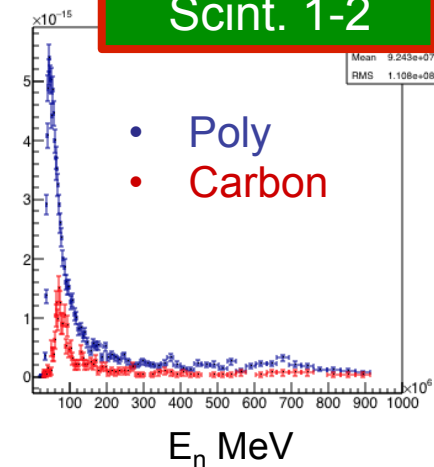
Efficiency



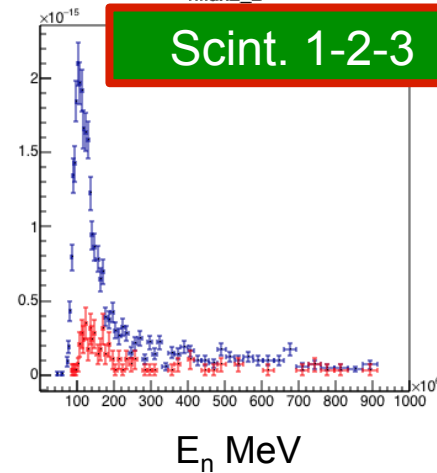
n-p cross-section



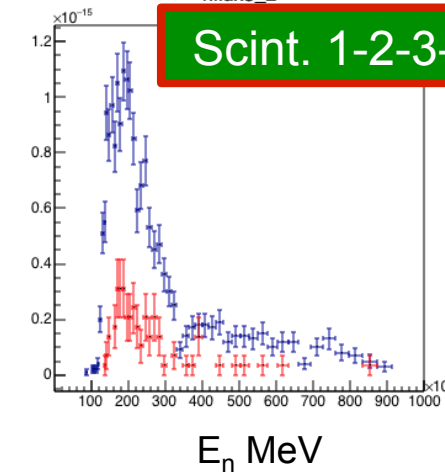
Scint. 1-2



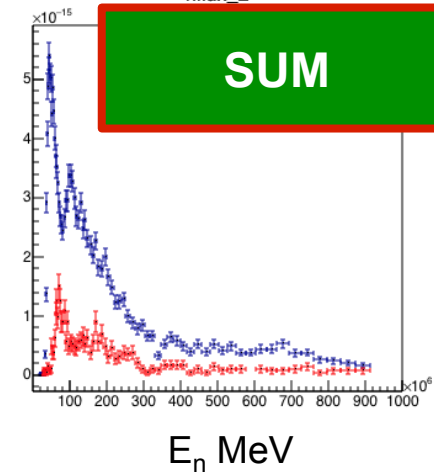
Scint. 1-2-3



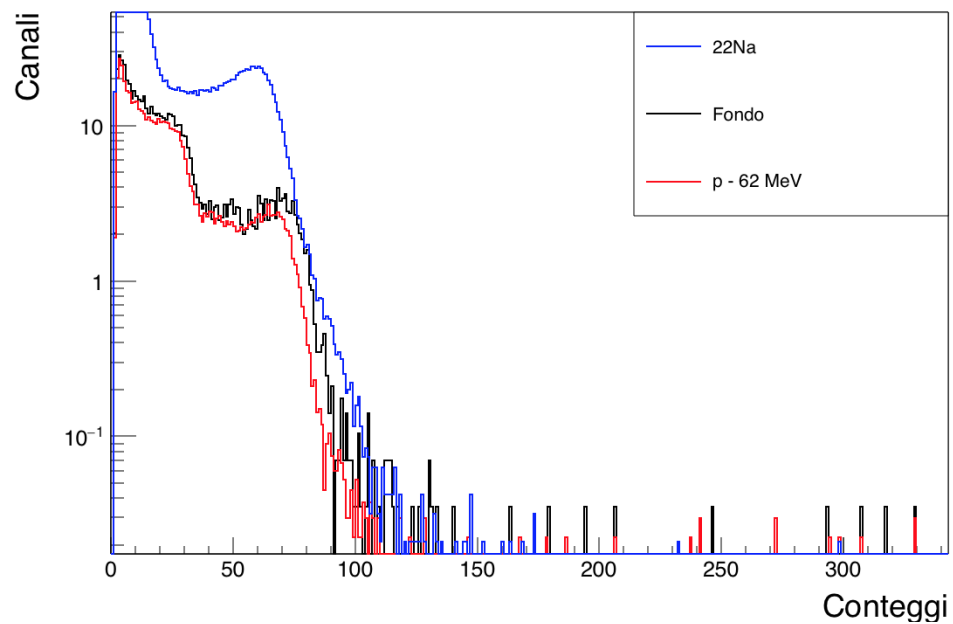
Scint. 1-2-3-4

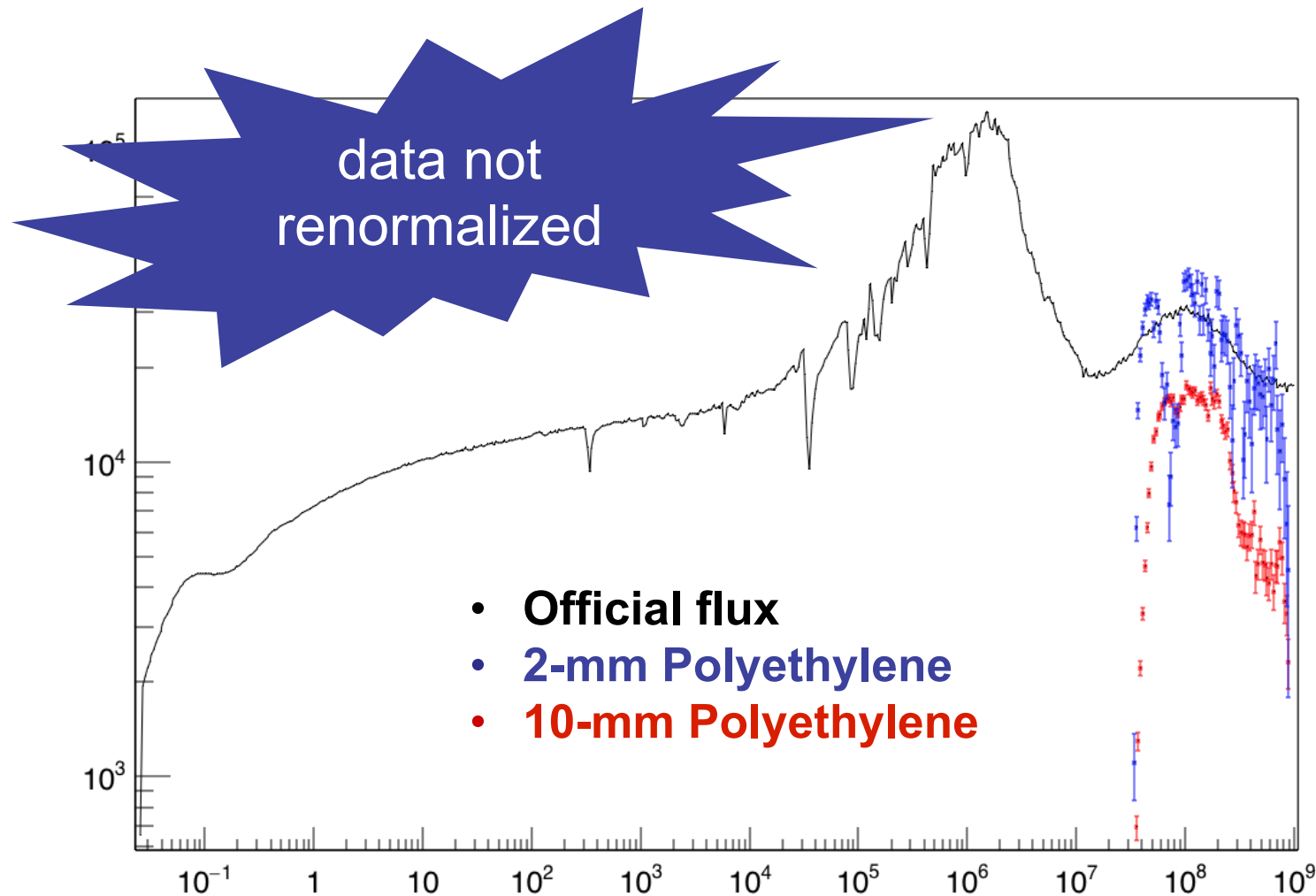


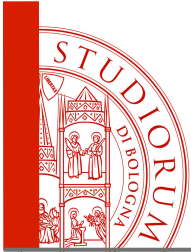
SUM



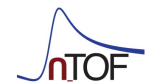
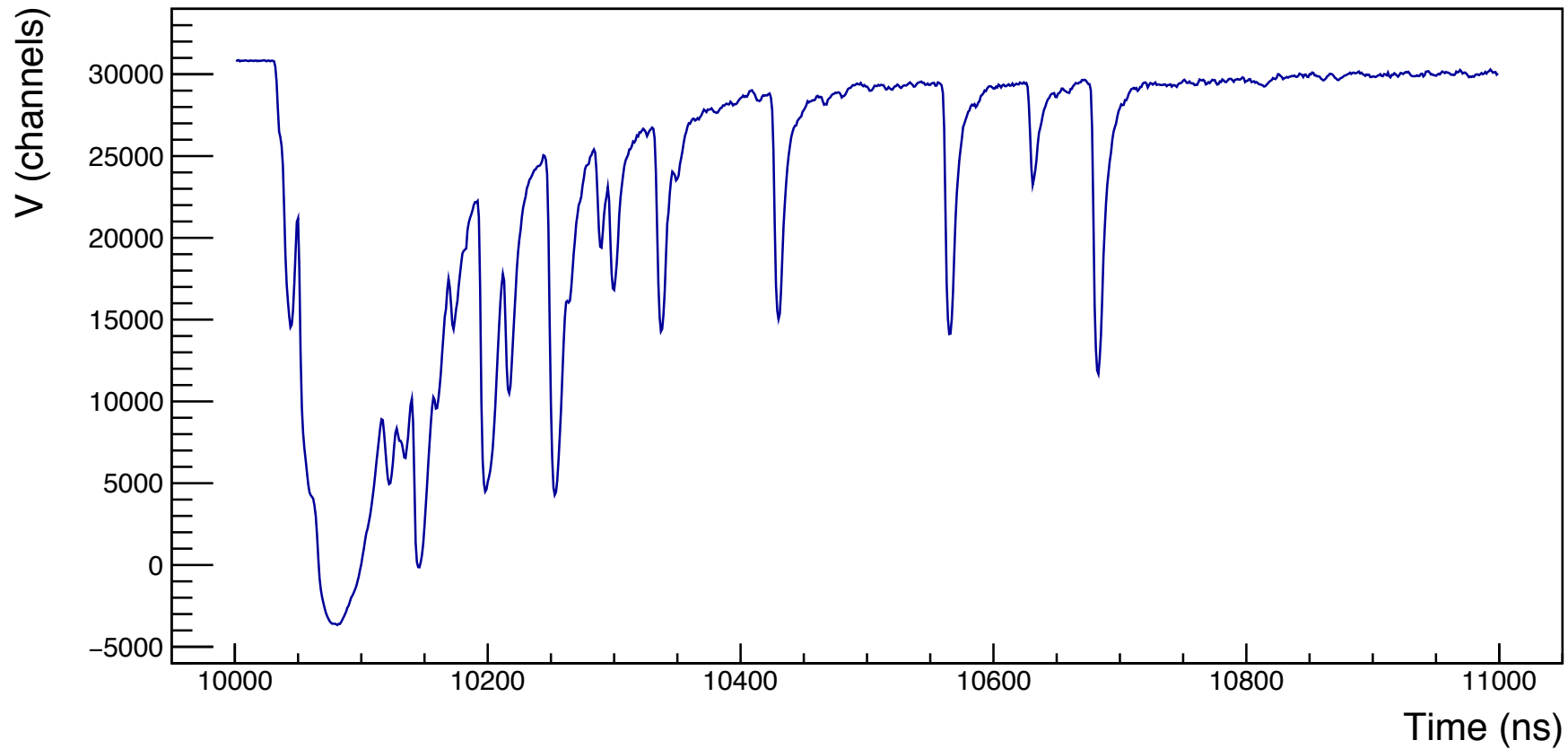
Scintillatore 3

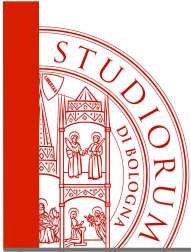




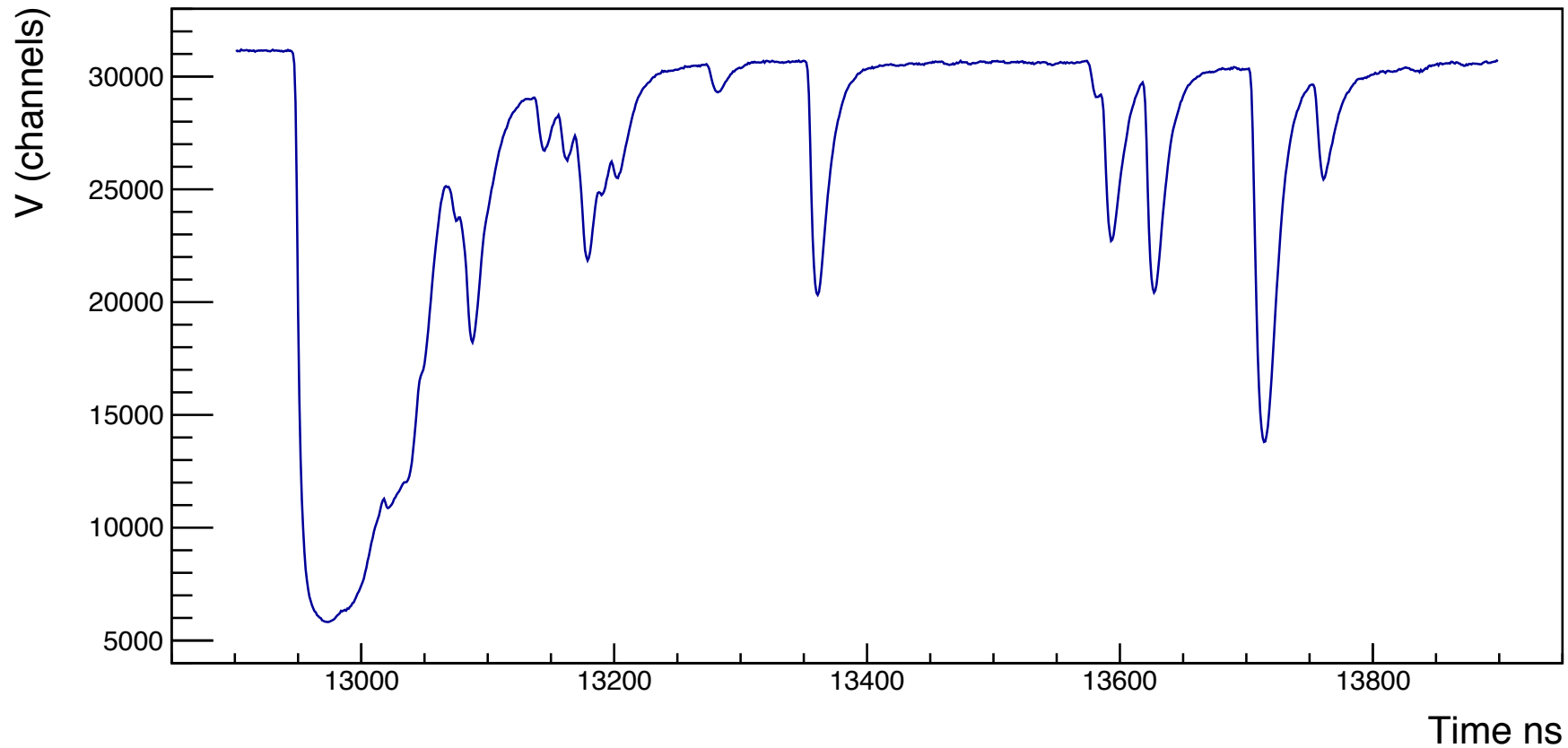


Backup SCI1





Backup SCI4





Backup $n+^{12}\text{C}$



α →

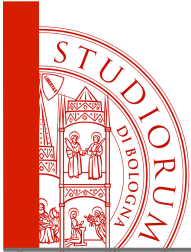
Reaction Products	Q-value MeV	Threshold MeV
$^9\text{Be} + \alpha$	-5.7	6.2
$n + 3\alpha$	-7.3	7.9
...
$^{12}\text{B} + p$	-12.6	13.6
$^{11}\text{B} + n + p$	-16.0	17.3
...
$^{11}\text{B} + d$	-13.7	14.9
...
$^{10}\text{B} + t$	-19.0	20.5

p →

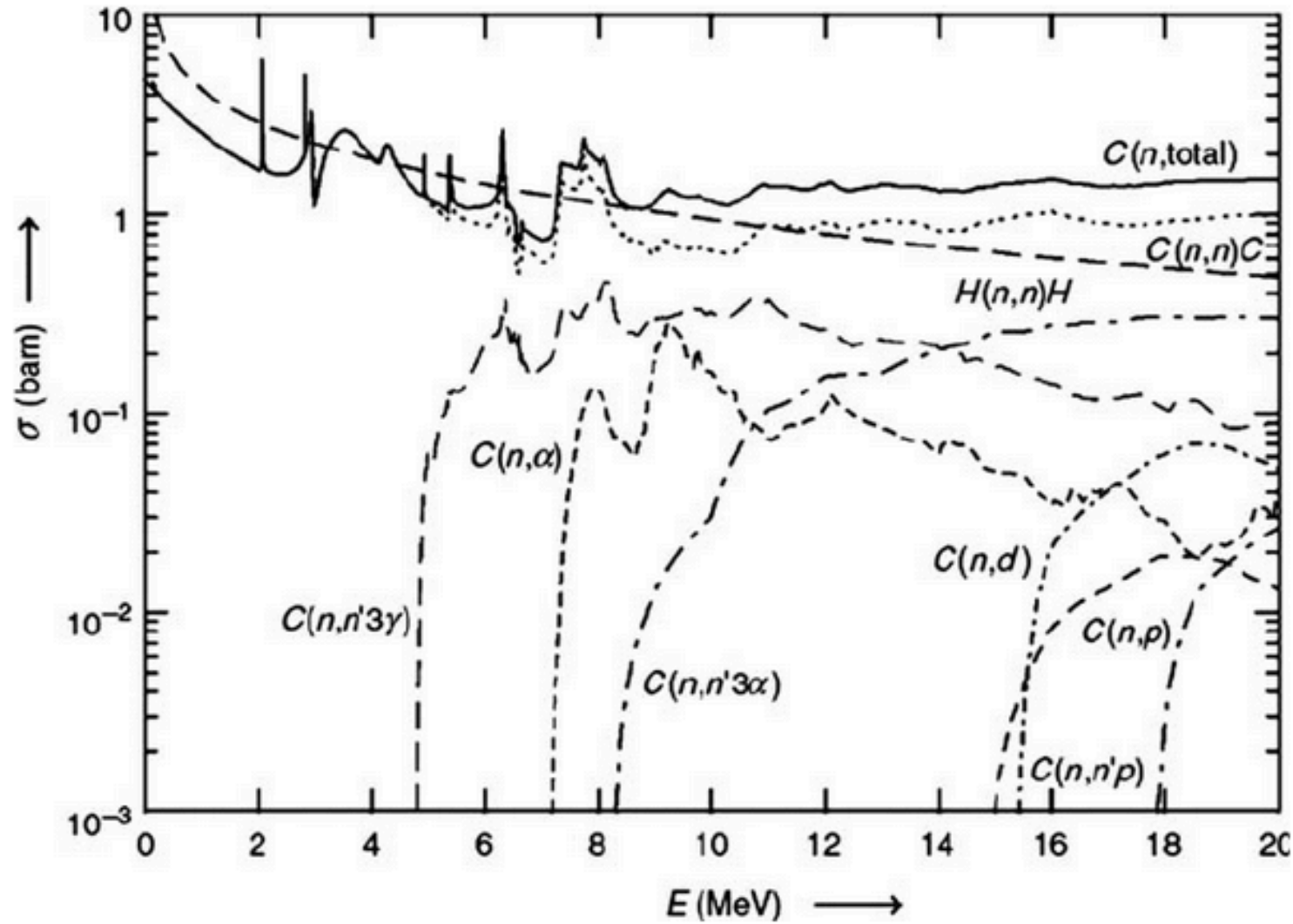
d →

t →





Backup ^{12}C



DOI: 10.1093/rpd/ncq166

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