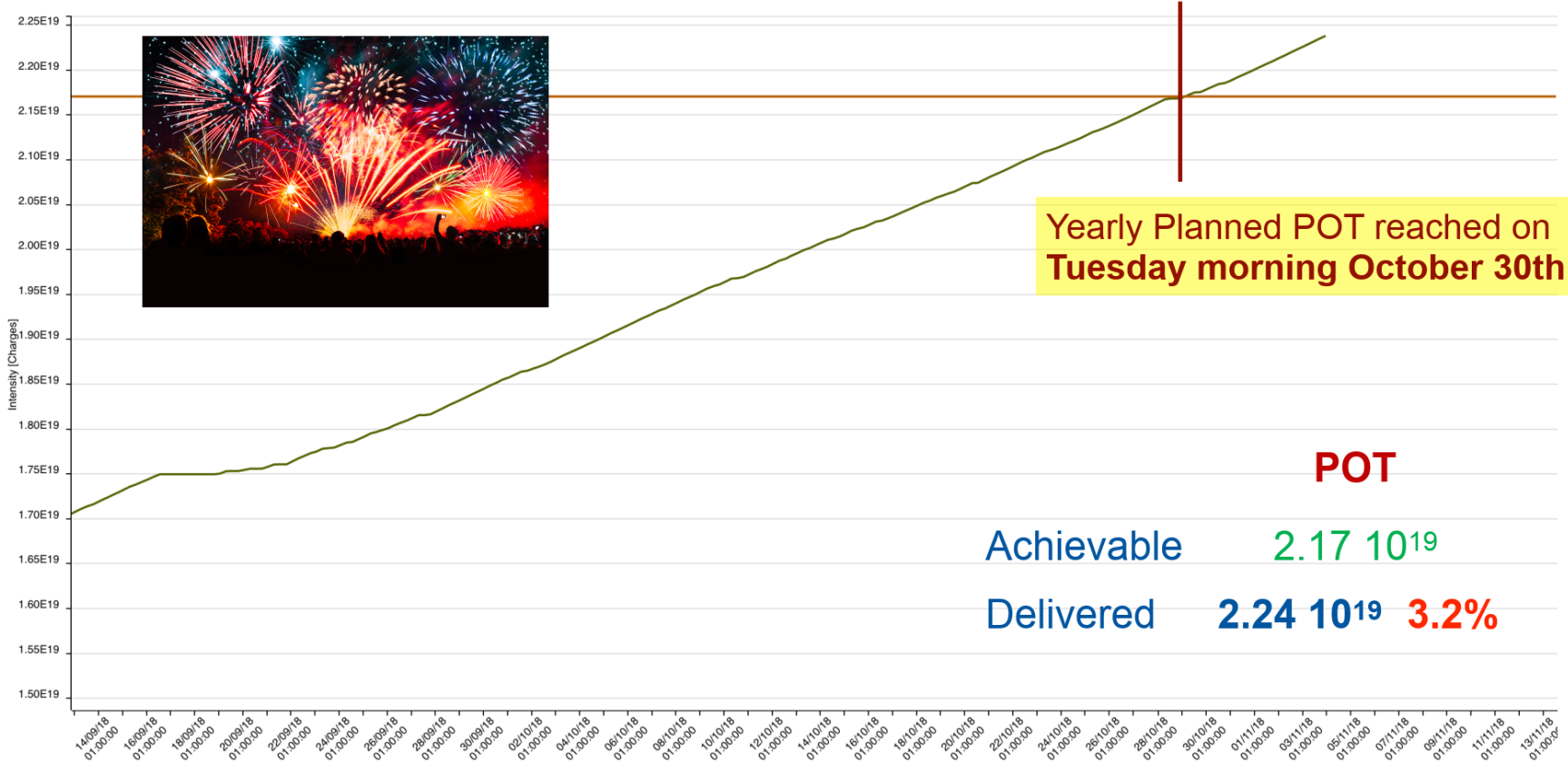


## Status of n\_TOF

M. Barbagallo, on behalf of the n\_TOF Collaboration

60<sup>th</sup> ISOLDE and n\_TOF Committee, CERN, 7-8 November 2018

## nTOF - Cumulative Intensity on Target



Shown at FOM 06/11/18

# Experimental Program

## Apr-May

**n\_TOF Schedule 2018 ver. 2.1**

BaF detector test

	Mar	Apr	Apr	Apr	Apr	Apr	May	May	May	May	June	EAR1
Week	13	14	15	16	17	18	19	20	21	22	23	
Mo	26	2	9	16	23	30	7	14	21	28	4	
Tu												
We				MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18	
Th												
Fr						$^{80}\text{Se}(n,g) 2.85 E^{18}$ (requested $3.0E^{18}$ )			$^{140}\text{Ce}(n,g) 2.5 E^{18}$ (requested $2.9E^{18}$ )			
Sa			$^{68}\text{Zn}(n,g) 2.36 E^{18}$ (requested $2.2E^{18}$ )									
Su												

Commissioning

	Mar	Apr	Apr	Apr	Apr	Apr	May	May	May	May	June	EAR2
Week	13	14	15	16	17	18	19	20	21	22	23	
Mo	26	2	9	16	23	30	7	14	21	28	4	
Tu												
We		Commissioning		MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18	
Th			<i>C6D6 test for background and <math>\gamma</math>-flash</i>									
Fr				<i>PPAC &amp; <math>^{16}\text{O}</math> electronic test</i>			<i>Clyc g-ray detector test</i>	<i>Imaging+Ge det electronic test</i>		$^{241}\text{Am}(n,f) 4.2 E^{18}$ (requested $3.0E^{18}$ )		
Sa												
Su												

Big collimator

# Experimental Program

Jun-Aug

**n\_TOF Schedule 2018 ver. 2.1**

	June 24	June 25	June 26	July 27	July 28	July 29	July 30	July 31	Aug 6	Aug 13	Aug 20	EAR1
Mo	11	18	25	2	9	16	23	30	6	13	20	
Tu		Technical Stop ITS1 30 h										
We			MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18		MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18	
Th		$^{35}\text{Cl}(n,g) 1.7 E^{18}$ <i>(requested <math>2.0E^{18}</math>)</i>			$^{205}\text{Tl}(n,g) 2.6 E^{18}$ <i>(requested <math>3.0E^{18}</math>)</i>				$^{230}\text{Th}(n,f) 2.7 E^{18}$ <i>(requested <math>3.0E^{18}</math>)</i>			
Fr												
Sa												
Su												

Big collimator

	June 24	June 25	June 26	July 27	July 28	July 29	July 30	July 31	Aug 6	Aug 13	Aug 20	EAR2
Mo	11	18	25	2	9	16	23	30	6	13	20	
Tu		Technical Stop ITS1 30 h										
We			MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18		MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18	
Th	$^{241}\text{Am}(n,f) 4.2 E^{18}$ <i>(requested <math>3.0E^{18}</math>)</i>				$^{230}\text{Th}(n,f) 2.9 E^{18}$ <i>(requested <math>3.0E^{18}</math>)</i>				$^{53}\text{Mn}(n,g) 3.0 E^{18}$ <i>(requested <math>3.5E^{18}</math>)</i>			
Fr												
Sa												
Su												

Small collimator

CEA fission chamber test

# Experimental Program

## Sep-Nov

**n\_TOF Schedule 2018 ver. 2.2**

Ge det test | Small collimator | Big collimator

	Aug	Sep	Sep	Sep	Sep	Oct	Oct	Oct	Oct	Oct	Nov
Week	35	36	37	38	39	40	41	42	43	44	45
Mo	27	3	10	17	24	1	8	15	22	29	5
Tu				Technical Stop ITS2 30 h							
We	MD: 10 h 8 to 18	MD: 10 h 8 to 18			MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18		MD: 10 h 8 to 18
Th										MD: 10 h 8 to 18	
Fr		$^{12}\text{C}(n,p) 1.8 \text{ E}^{18}$ (requested $2.0\text{E}^{18}$ )				$^{235}\text{U}(n,f) 3.5 \text{ E}^{18}$ (requested $4.0\text{E}^{18}$ )					
Sa										$^{16}\text{O}(n,\alpha) 1.4 \text{ E}^{18}$ (requested $2.0\text{E}^{18}$ )	
Su											

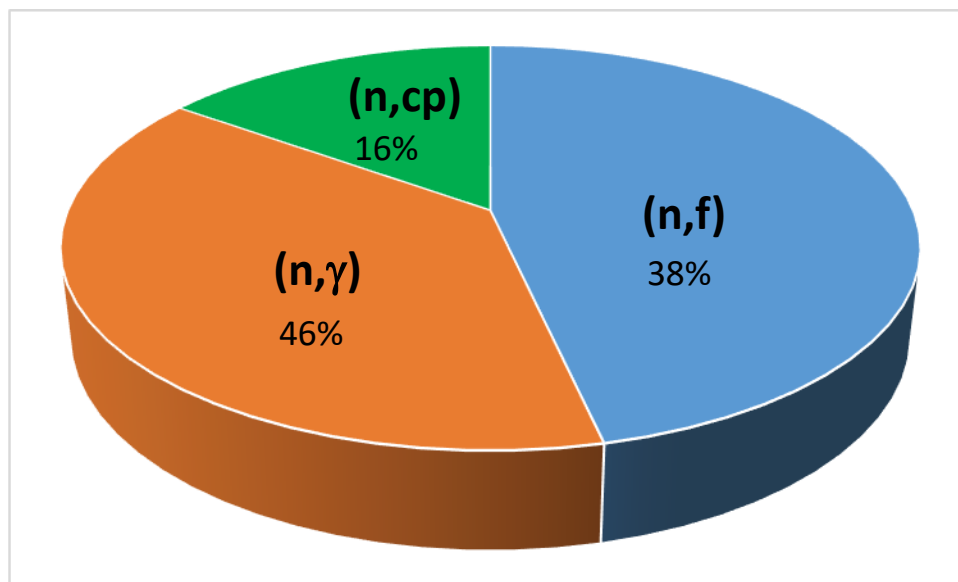
EAR1

	Aug	Sep	Sep	Sep	Sep	Oct	Oct	Oct	Oct	Oct	Nov
Week	35	36	37	38	39	40	41	42	43	44	45
Mo	27	3	10	17	24	1	8	15	22	29	5
Tu				Technical Stop ITS2 30 h							
We	MD: 10 h 8 to 18	MD: 10 h 8 to 18			MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18	MD: 10 h 8 to 18		MD: 10 h 8 to 18
Th										MD: 10 h 8 to 18	
Fr		iTED $1.2 \text{ E}^{18}$ (requested $1.2\text{E}^{18}$ )									
Sa						$^{239}\text{Pu}(n,f) 5.0 \text{ E}^{18}$ (requested $6.0\text{E}^{18}$ )					
Su											

EAR2

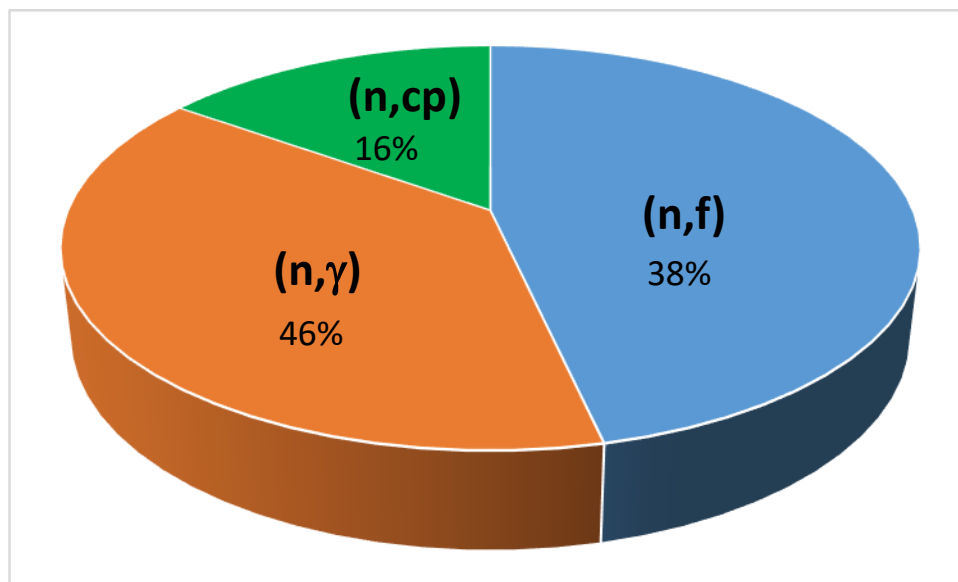
In total 13 experiments have been performed:

- 6 (n, $\gamma$ ) energy differential cross-section measurements
- 2 (n,cp) energy differential cross-section measurements
- 5 (n,f) energy differential cross-section measurements + 1  $\gamma$  multiplicity and Z/A FFs distribution



In total 13 experiments have been performed:

- 6 (n, $\gamma$ ) energy differential cross-section measurements
- 2 (n,cp) energy differential cross-section measurements
- 5 (n,f) energy differential cross-section measurements + 1  $\gamma$  multiplicity and Z/A FFs distribution



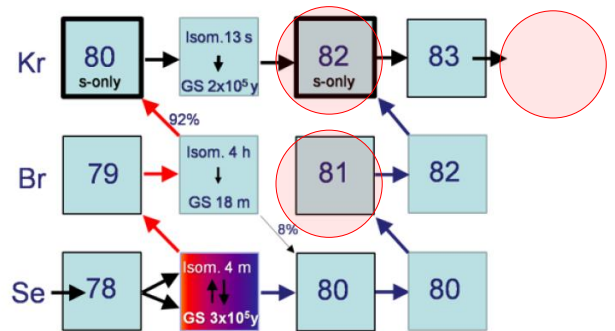
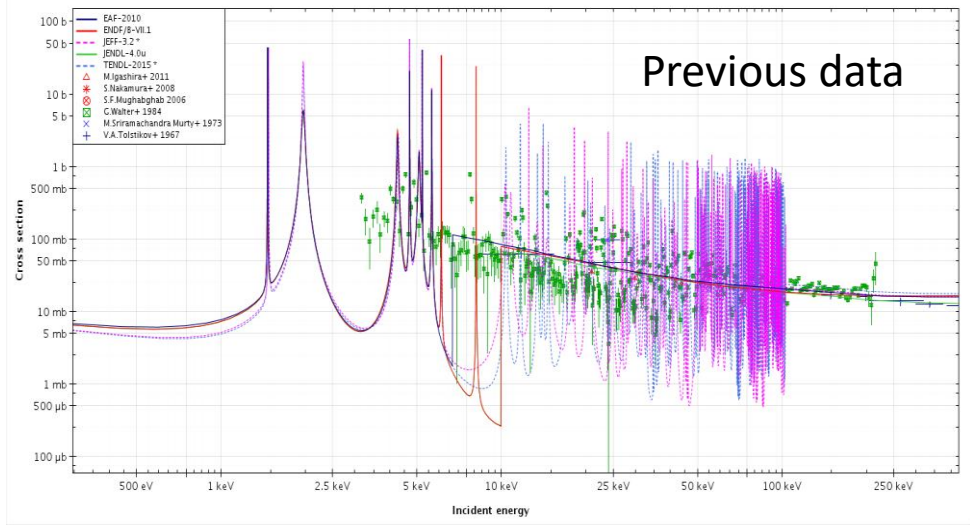
8 detector tests carried out (mostly in parasitic mode)

# A few preliminary results

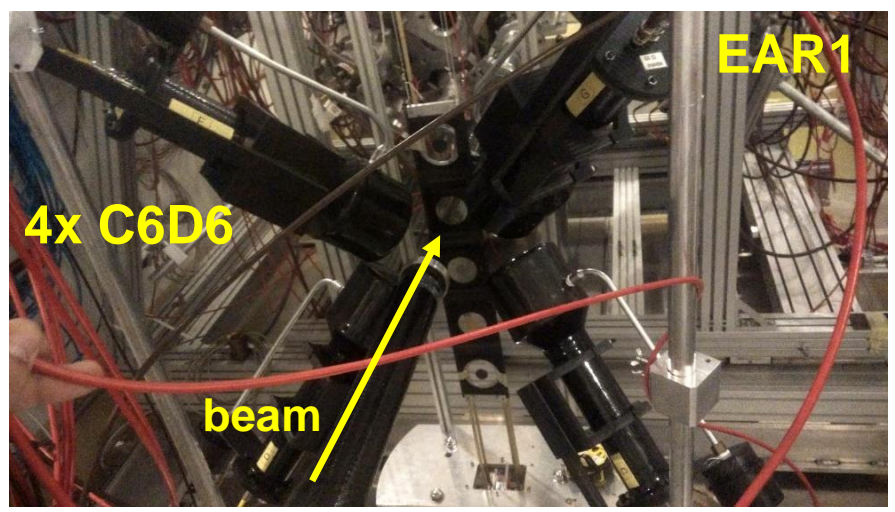
$^{80}\text{Se}(n,\gamma)$  (CERN-INTC-2018-005/INTC-P-536)



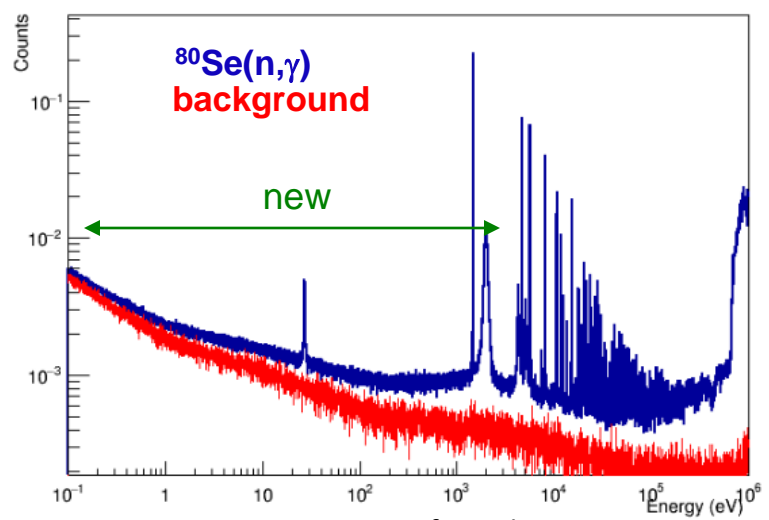
Thermal conditions in Massive Stars



3 keV cut-off strongly affects MACS at 30 keV (He burning)  
Very short flight path (60 cm)



Energy Spectrum All Detectors Added



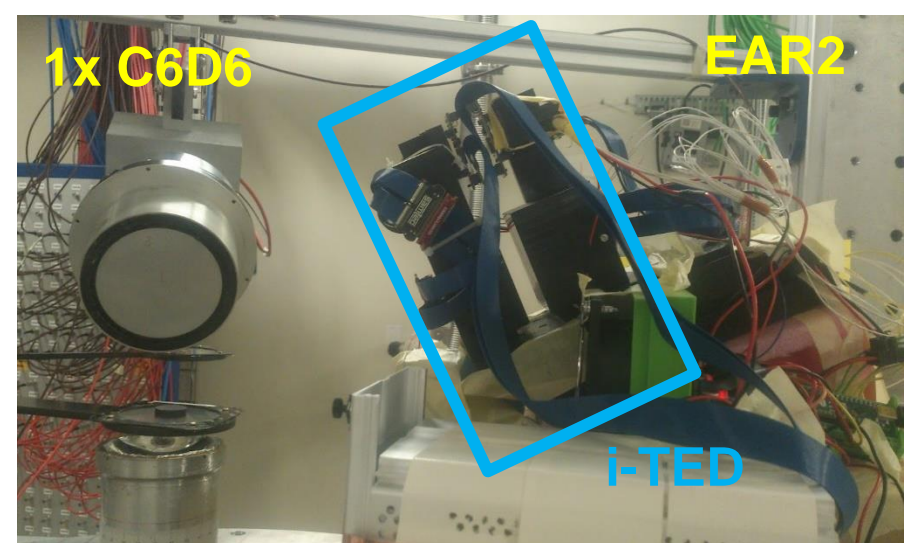
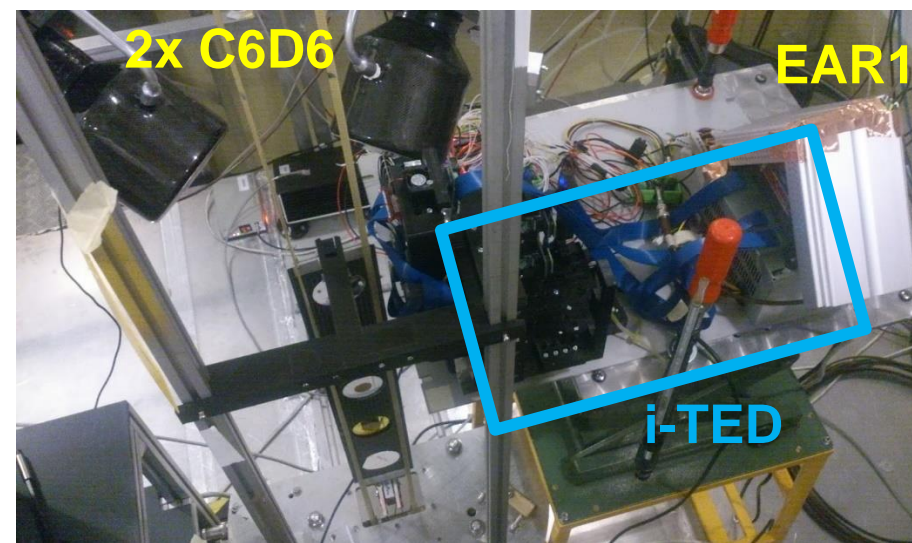
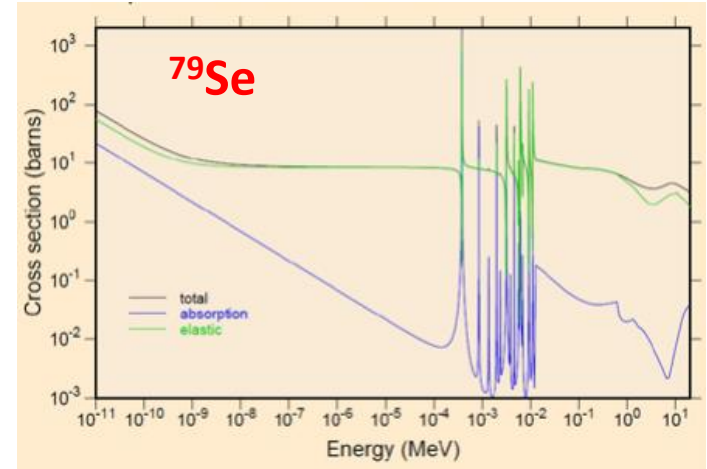
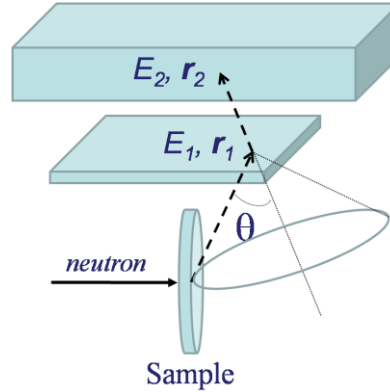
Courtesy of V. Babiano



# A few preliminary results

## i-TED detector test (CERN-INTC-2018-006/INTC-P-537)

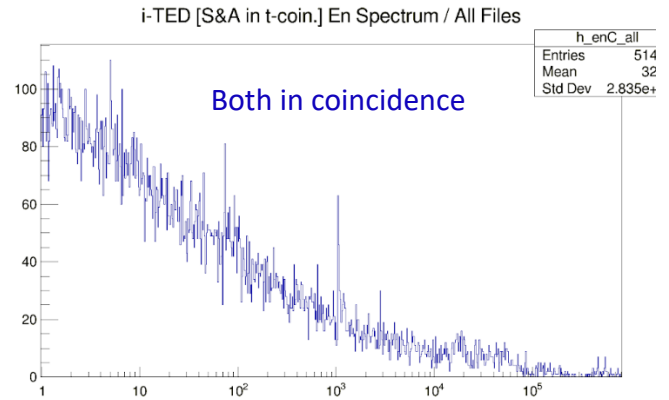
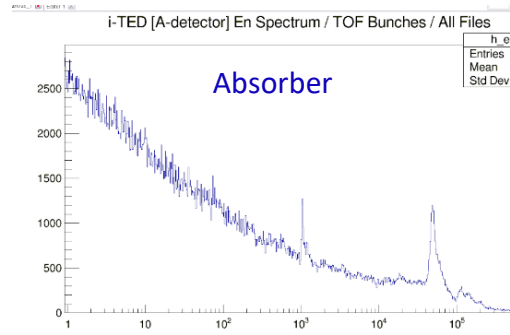
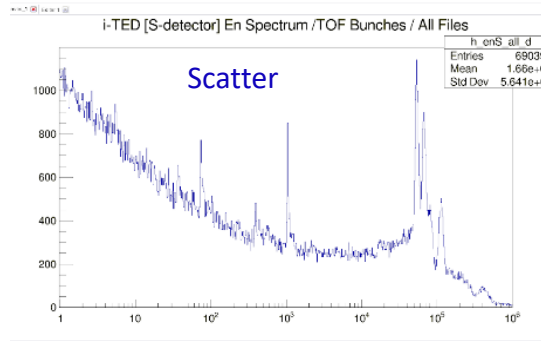
- Lower neutron sensitivity
- Higher selectivity
- Compton imaging with SiPM+LaCl<sub>3</sub>



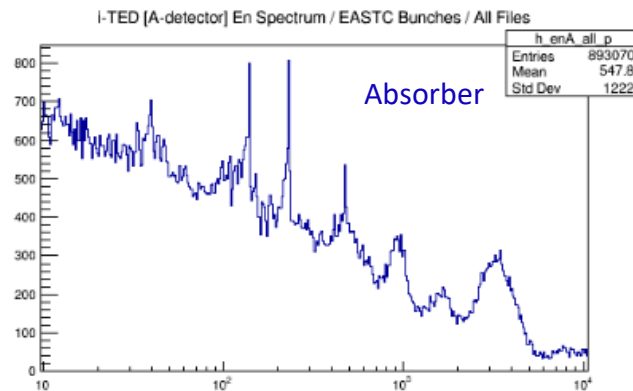
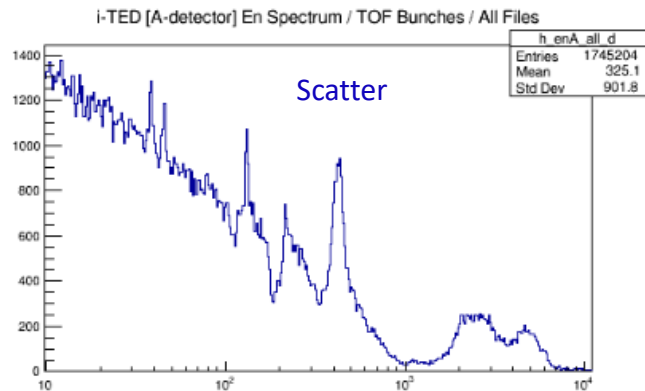
# A few preliminary results

## i-TED detector test (CERN-INTC-2018-006/INTC-P-537)

### $^{56}\text{Fe}(n,\gamma)\text{@EAR1}$



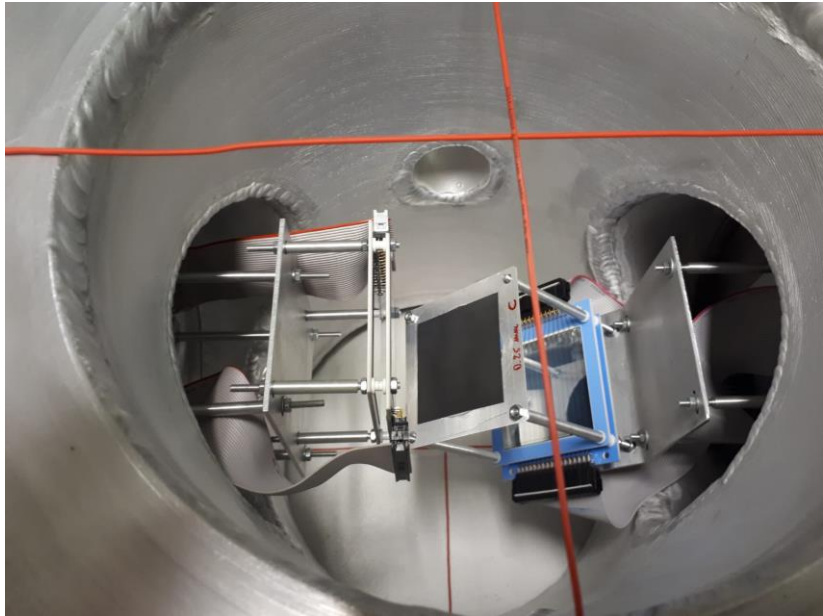
### $^{93}\text{Nb}(n,\gamma)\text{@EAR2}$



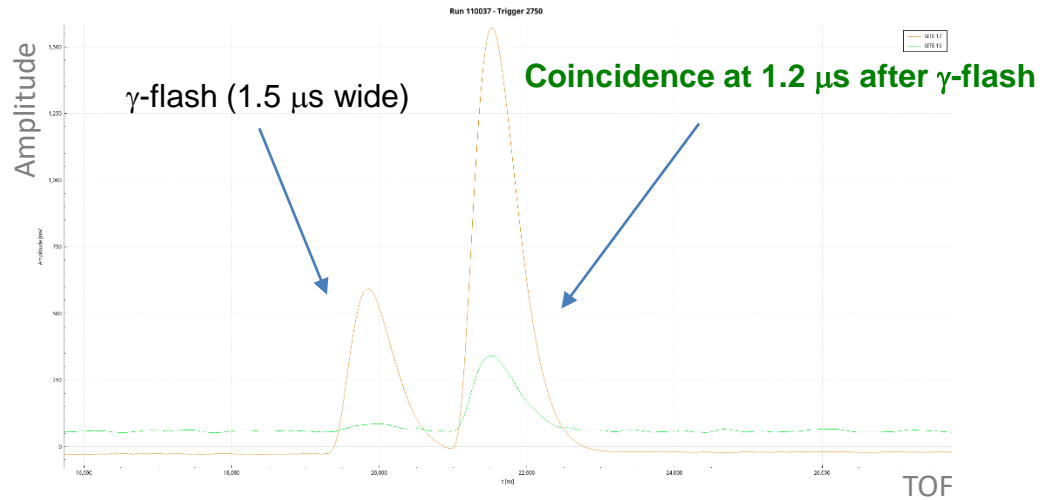
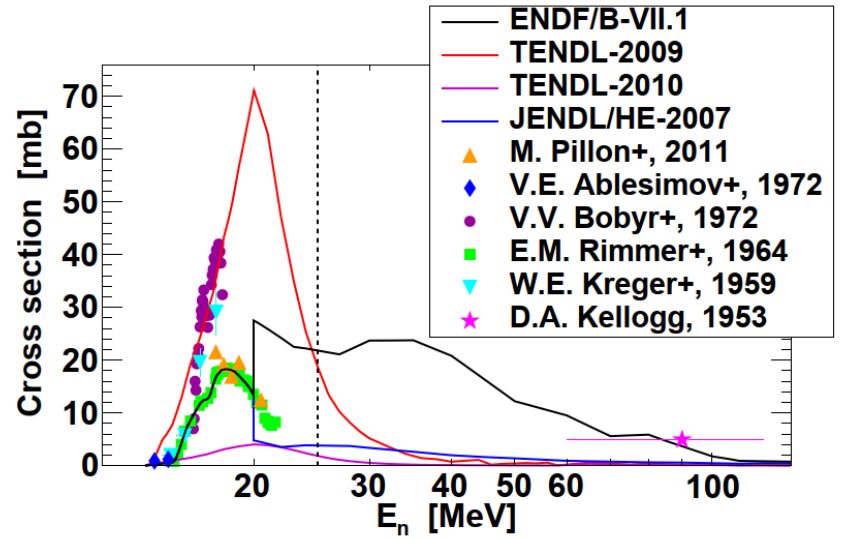
Courtesy of C. Domingo Pardo

# A few preliminary results

$^{12}\text{C}(n,p/d)$  (CERN-INTC-2017-001/INTC-P-488) ➔ Cross-section above threshold up to 30 MeV for medical applications and nuclear technologies

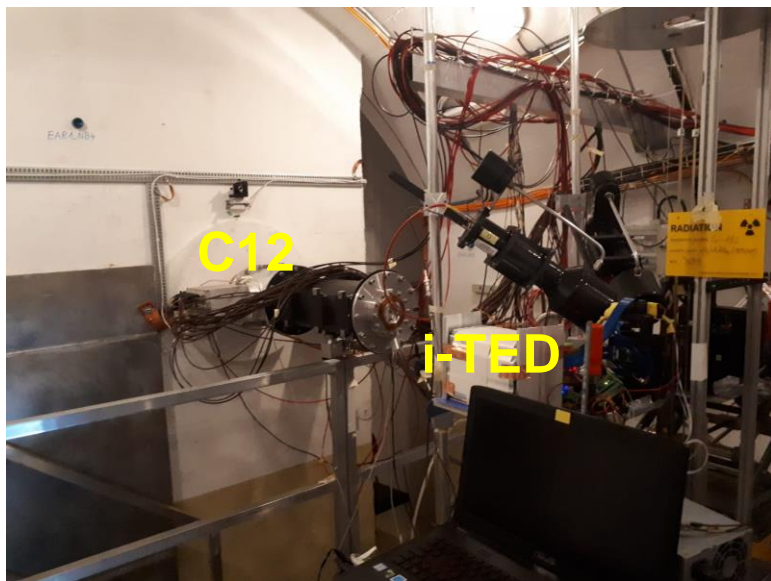


2 Silicon telescopes at different angles

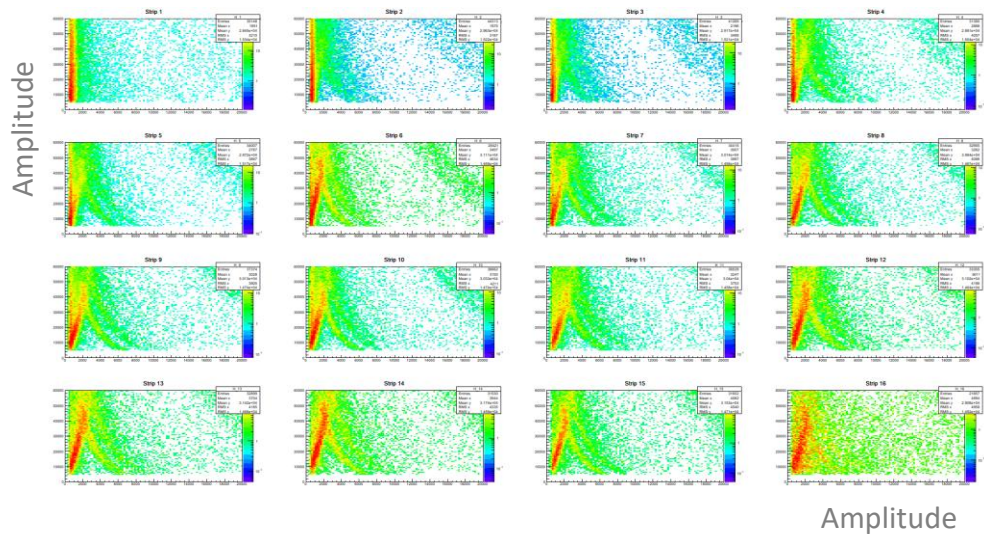
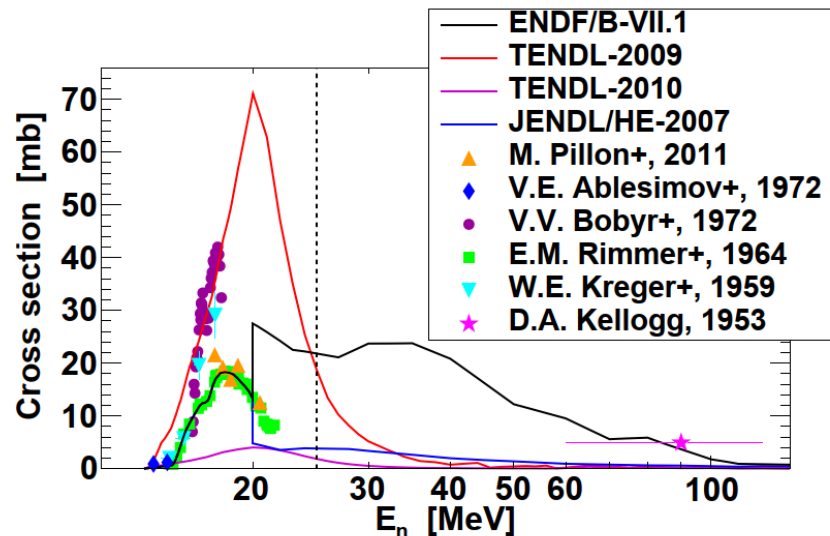


# A few preliminary results

$^{12}\text{C}(n,p/d)$  (CERN-INTC-2017-001/INTC-P-488) ➔ Cross-section above threshold up to 30 MeV for medical applications and nuclear technologies

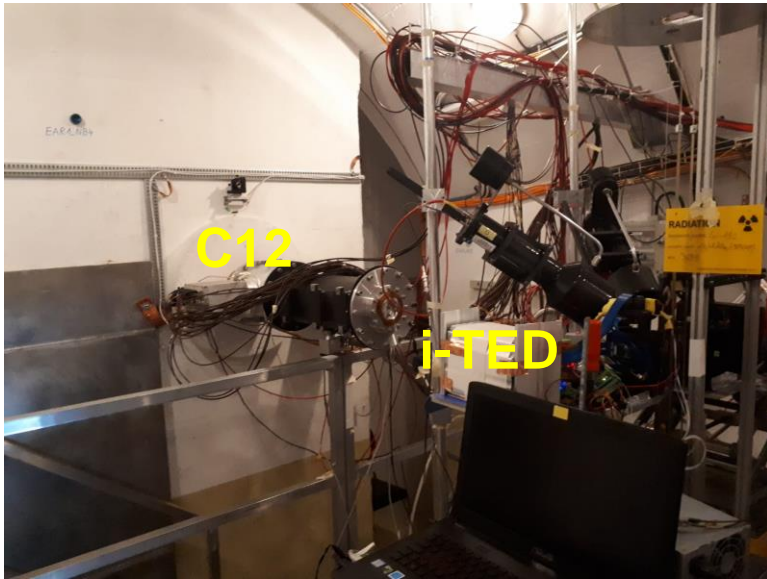


2 Silicon telescopes at different angles

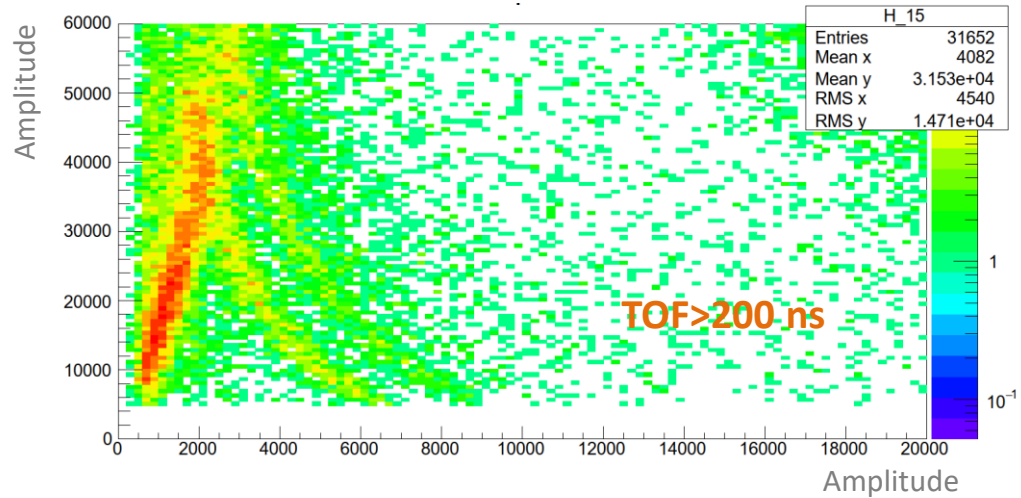
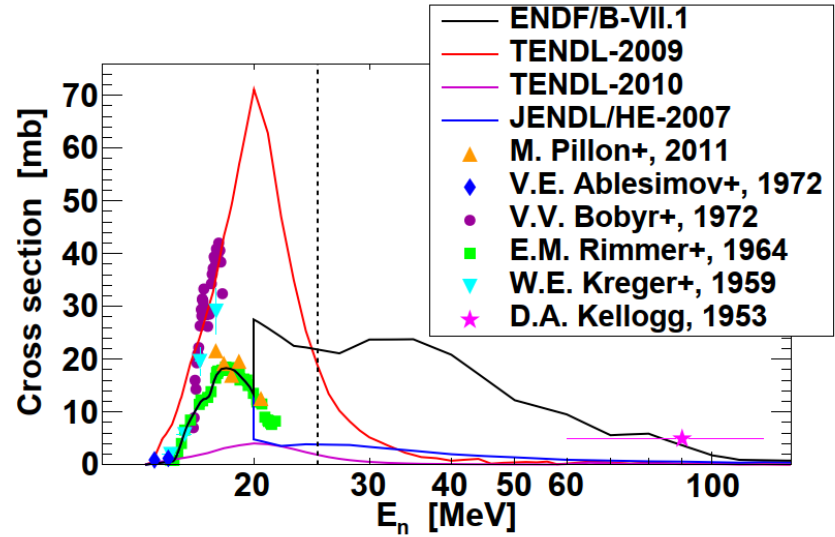


# A few preliminary results

$^{12}\text{C}(n,p/d)$  (CERN-INTC-2017-001/INTC-P-488) ➔ Cross-section above threshold up to 30 MeV for medical applications and nuclear technologies



2 Silicon telescopes at different angles

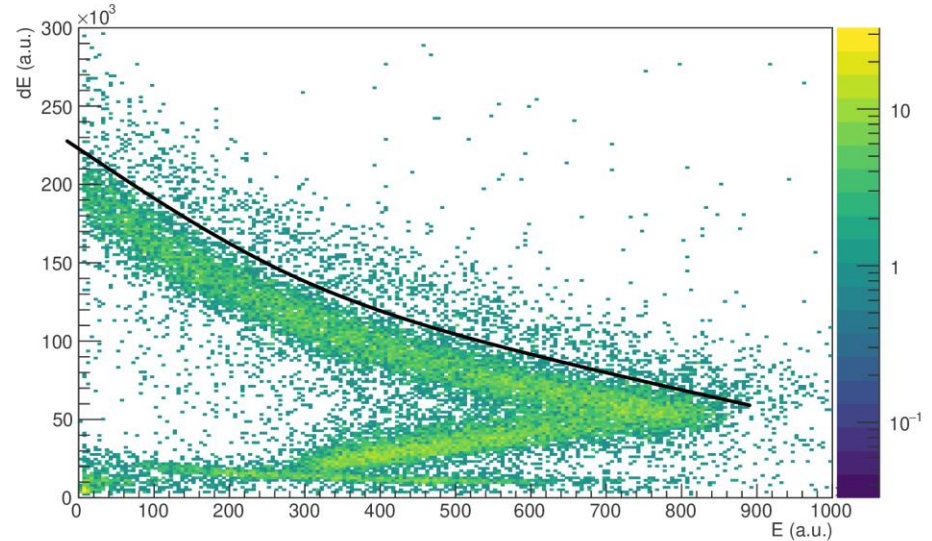
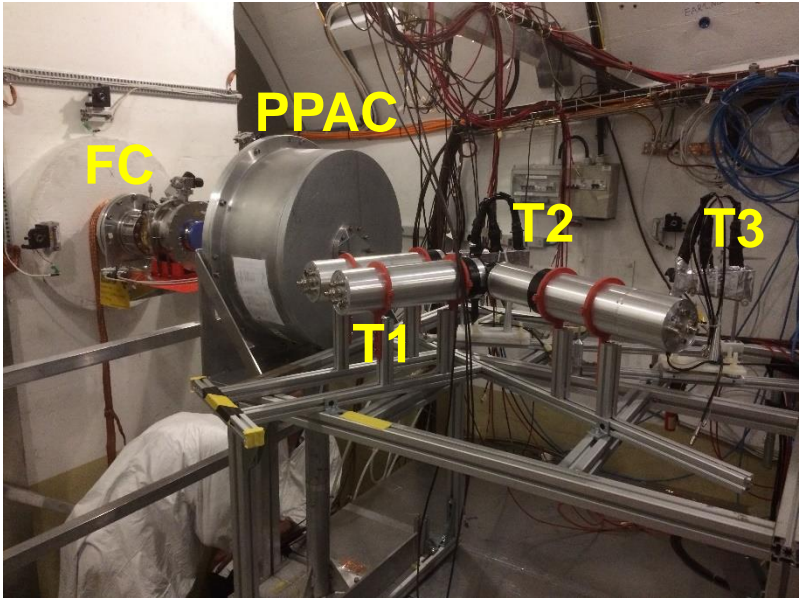
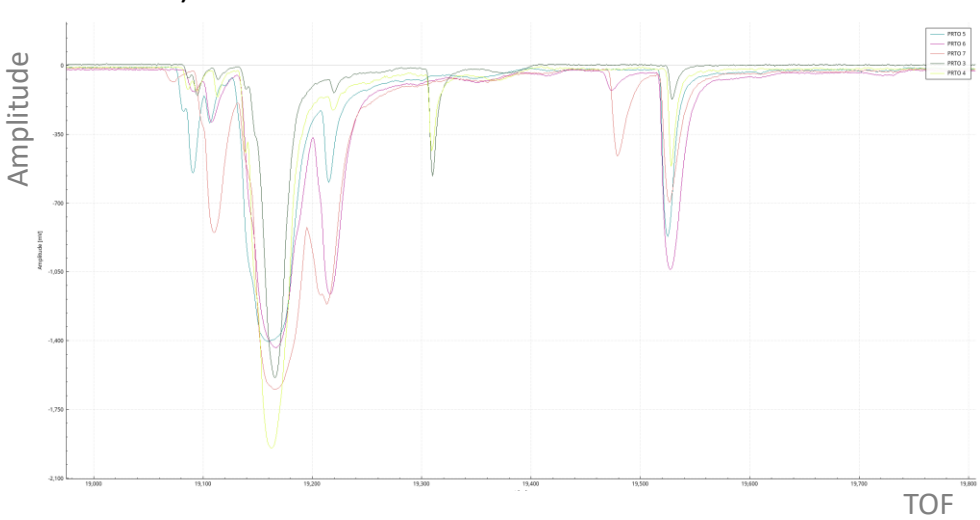


# A few preliminary results

## Proton Recoil Telescope (CERN-INTC-2017-036/INTC-P-507)



$^{235}\text{U}(n,f)$  cross-section relative to n-p scattering above 200 MeV



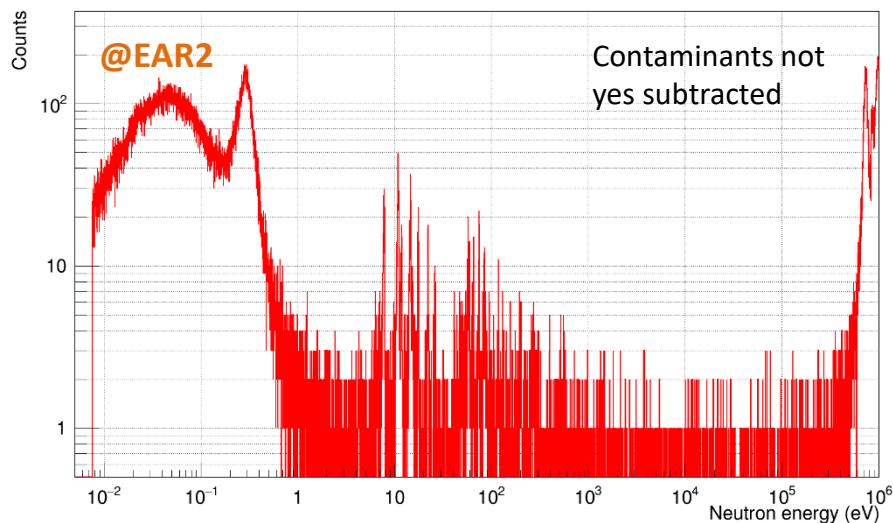
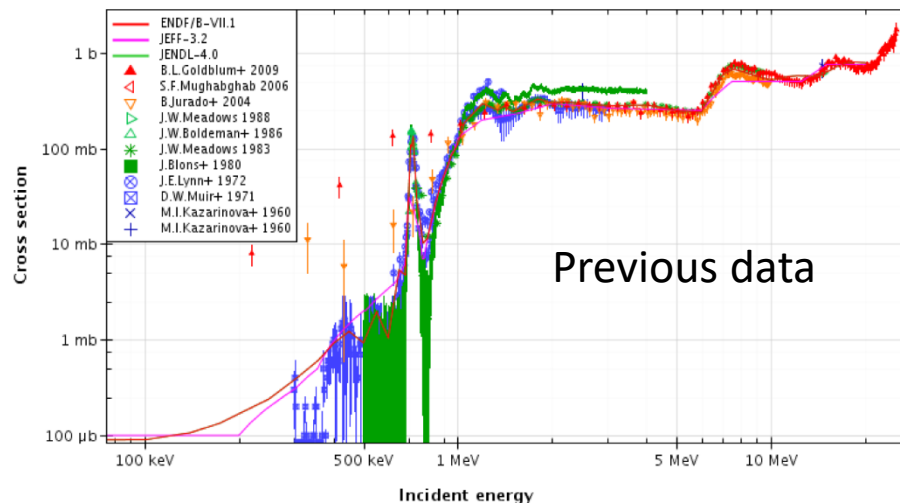
Courtesy of E. Pirovano

# A few preliminary results

$^{230}\text{Th}(n,f)$  (CERN-INTC-2017-009/INTC-P-493) ➔ Lack of data for TH/U fuel cycle

Measurement performed in both Experimental Areas:

- **EAR1**  
Threshold and high energy part (>300 keV)
- **EAR2**  
Subthreshold and low energy part (<300 keV),  
Including resonances (if any)



Courtesy of V. Michalopoulou

# A few preliminary results

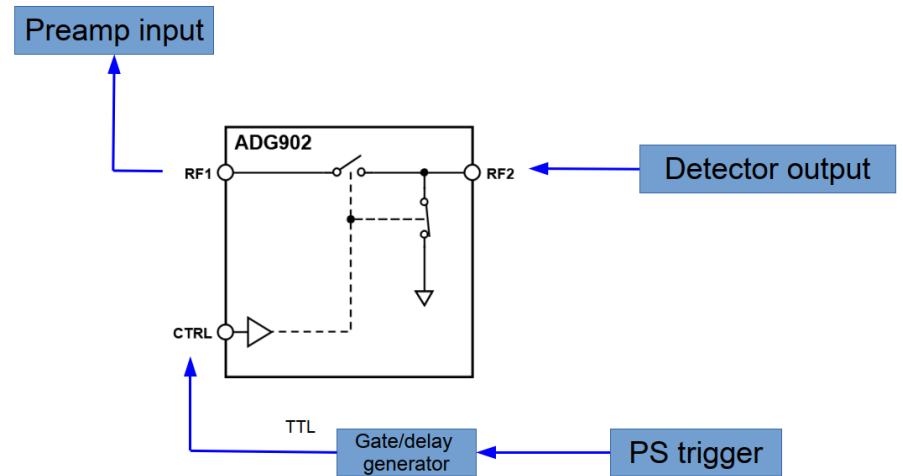
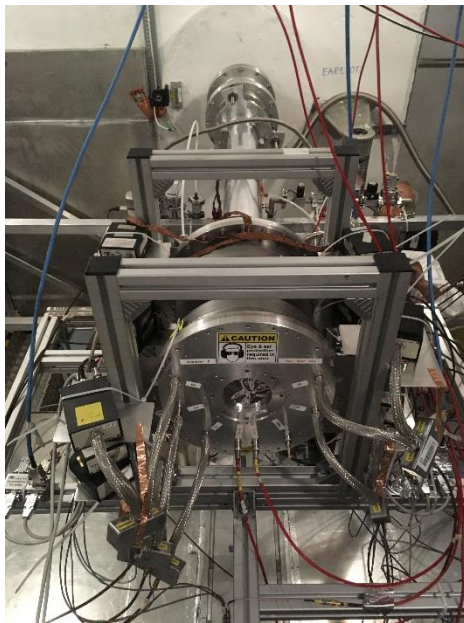
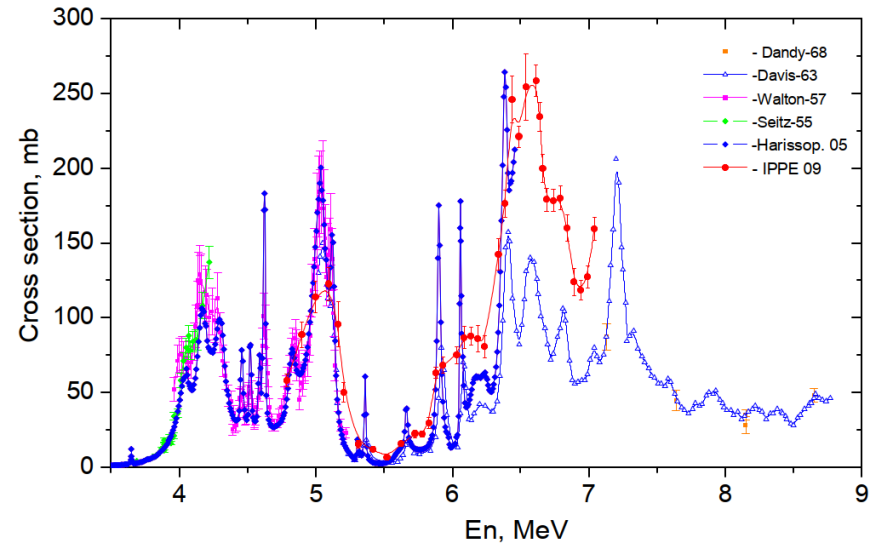
$^{16}\text{O}$  (CERN-INTC-2015-001/INTC-P-430)



First of a set of measurements for nuclear technologies, nuclear Astrophysics and nuclear medicine.

Challenging measurement with gaseous target @n\_TOF

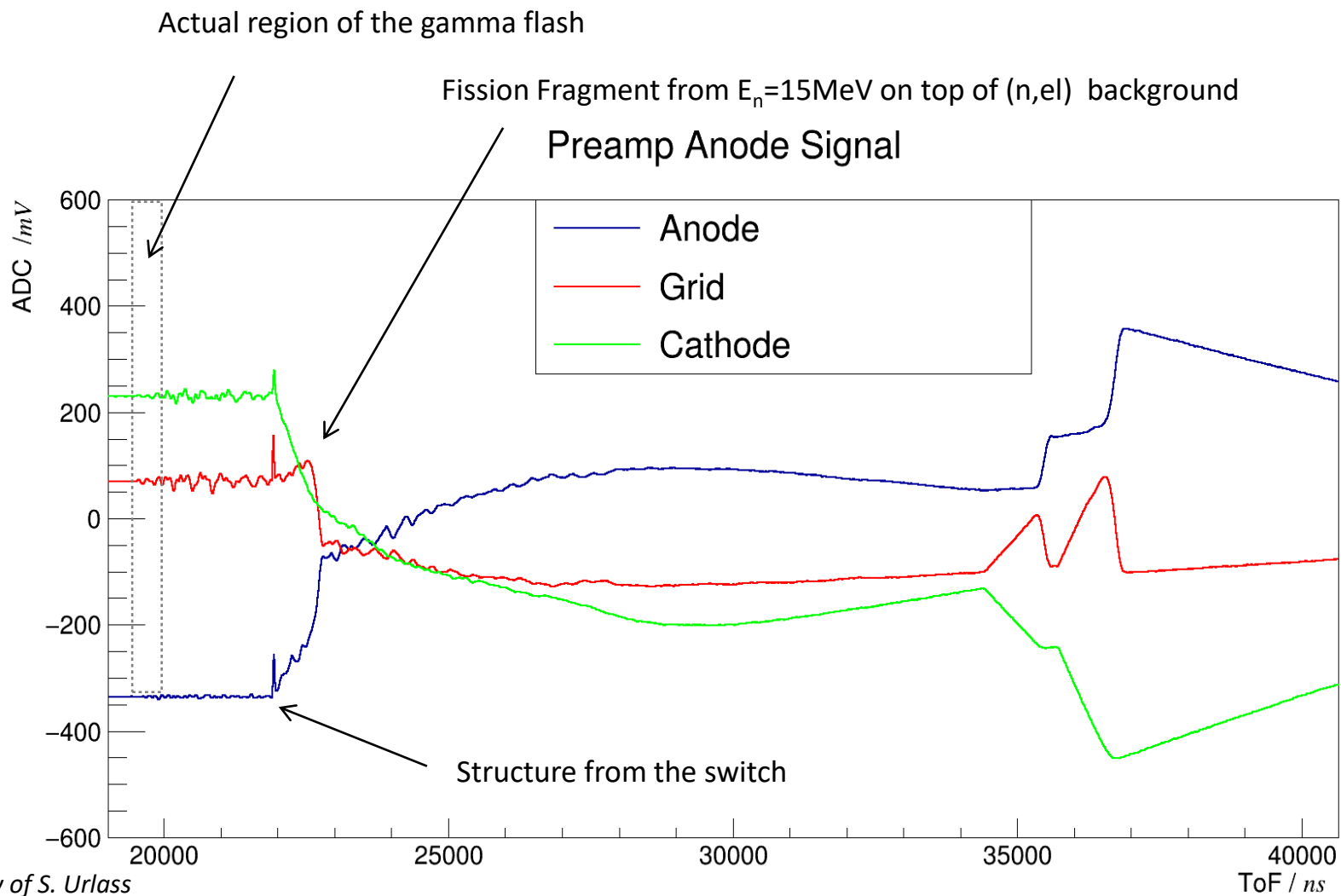
(Response to g-flash, background rejection)





# A few preliminary results

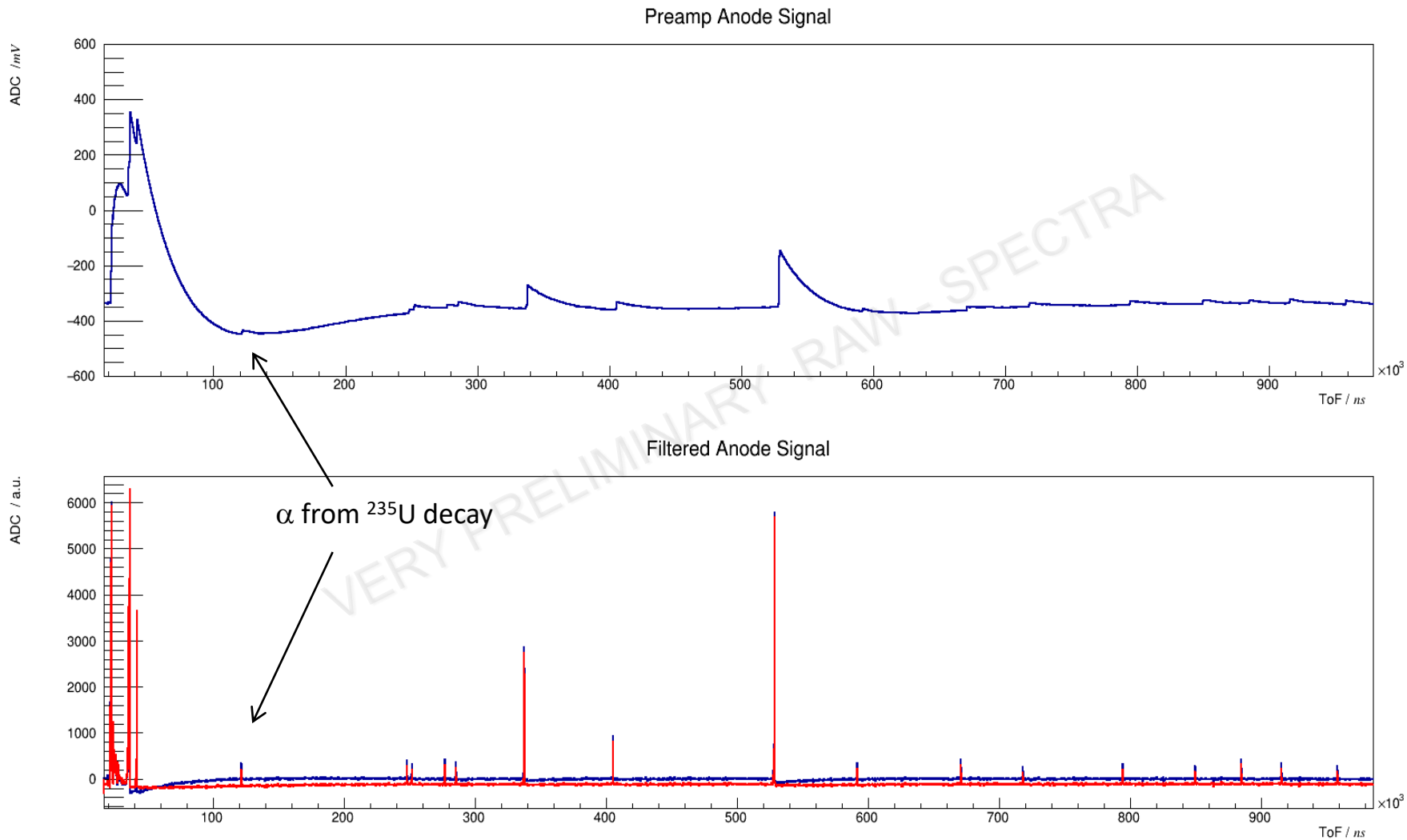
$^{16}\text{O}$  (CERN-INTC-2015-001/INTC-P-430)



Courtesy of S. Urlass

# A few preliminary results

$^{16}\text{O}$  (CERN-INTC-2015-001/INTC-P-430)



Courtesy of S. Urlass

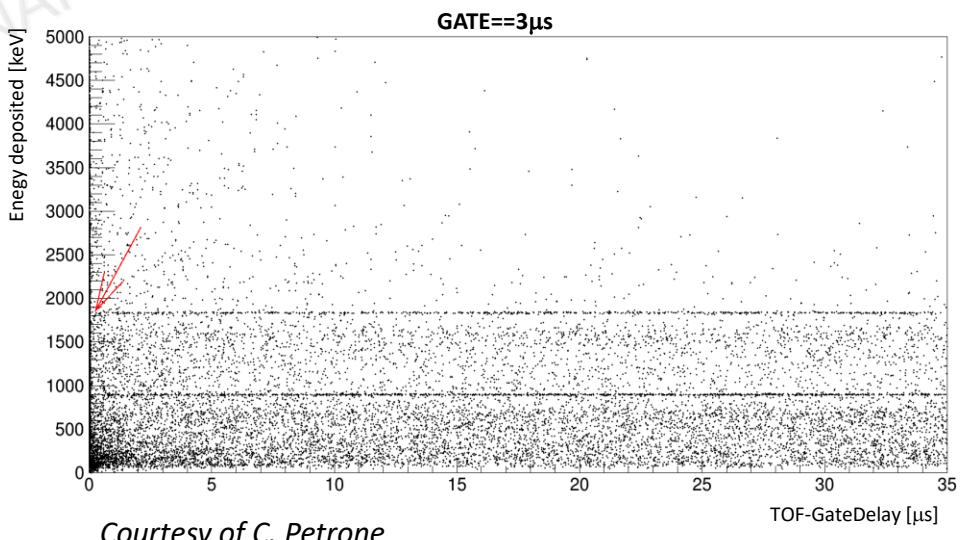
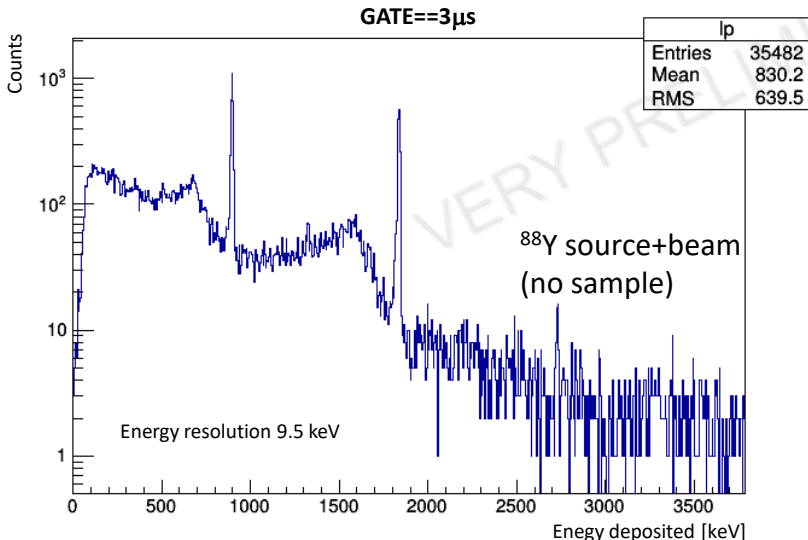
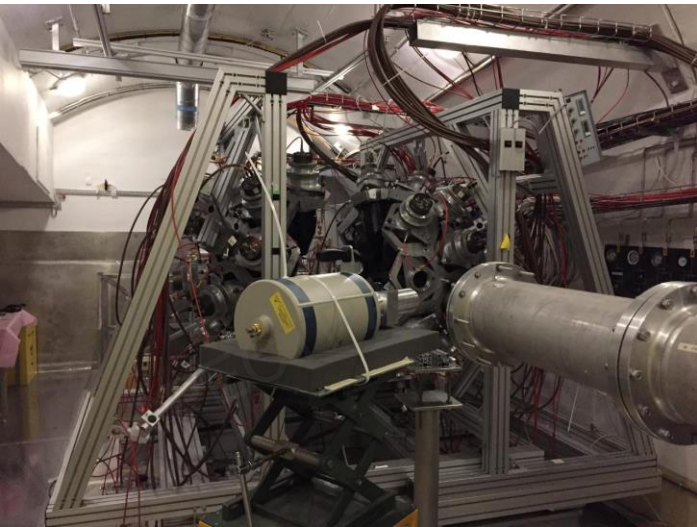
# A few preliminary results

## HPGe detector test@EAR1



Open in the **near future** a wide set of **(n,xn) measurements at n\_TOF**

Main limitation: g-flash     **Solution:** Switch system



- **n\_TOF Phase-3** experimental program has been successfully completed before **LS2**.
- In general preliminary results for the experiments performed look good and data analysis is proceeding smoothly.
- Detectors development for new Physics studies at n\_TOF has been performed and preliminary results look extremely promising.
- The successful completion of the **n\_TOF experimental program** is also the result of a fruitful collaboration with RP team, PS team and ISOLDE.