

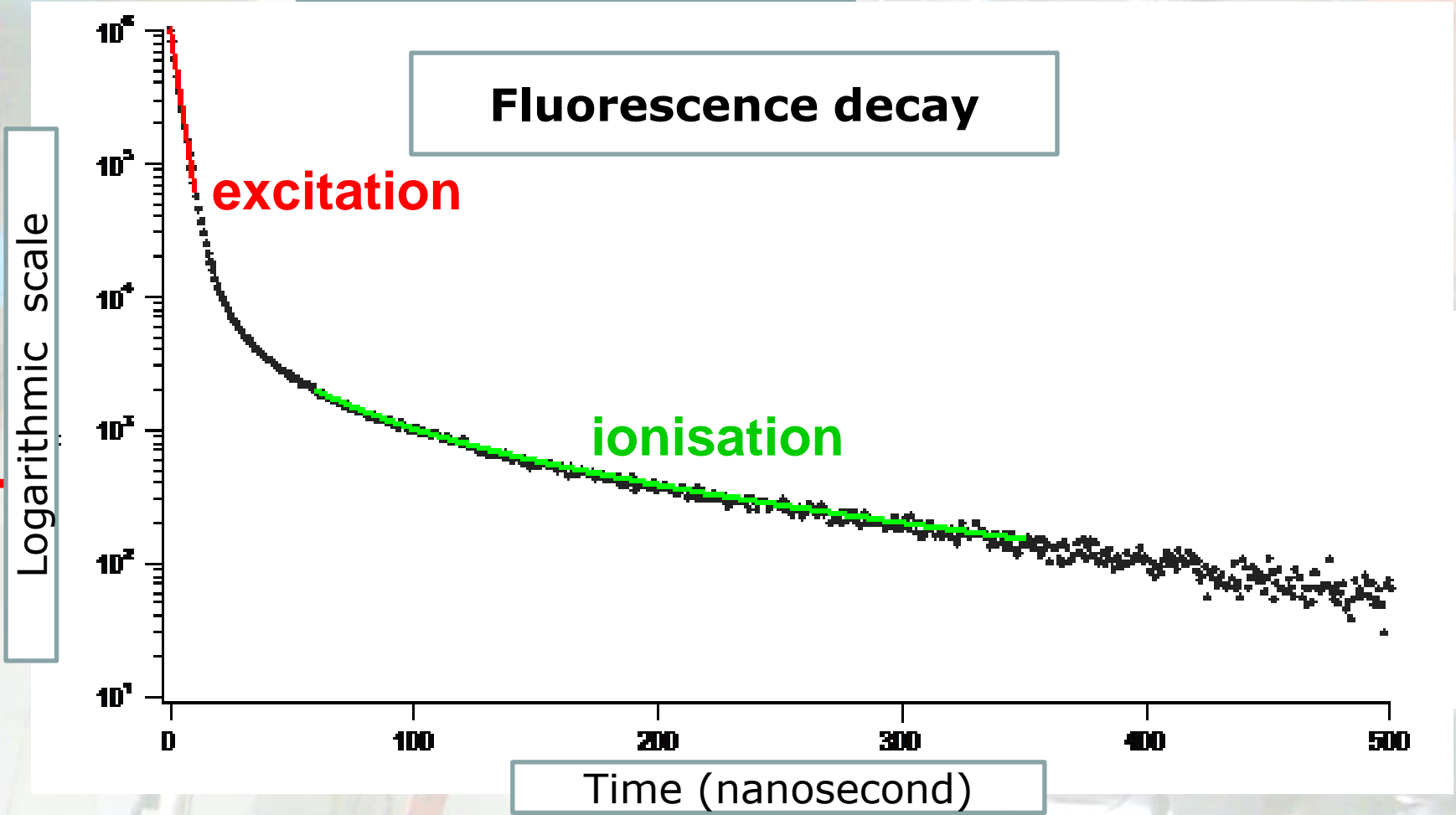
Développement de nouvelles méthodes de mesure de fluorescence pour des applications en physique nucléaire et en dosimétrie

Till SOHIER, Mélodie MUNIER, Jean-Marc JUNG, Rémi BARILLON, Hubert GRESS, Mauricio TORRES, Quentin RAFFY

Université de Strasbourg et Institut Pluridisciplinaire Hubert Curien
Département de Recherches en Subatomiques
Laboratoire de Chimie Nucléaire

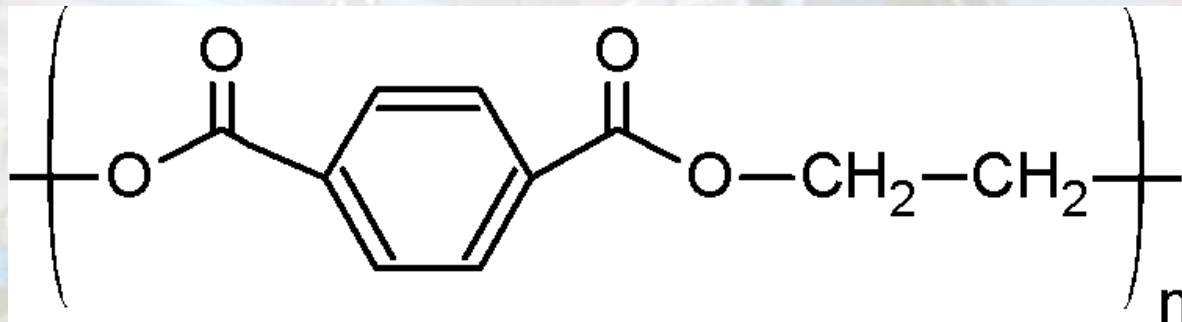
- **GOAL:**
 - *Improvement of the **Linear Energy Transfert (LET)** measurement in the hadrontherapy field*
- **Comparison:**
 - *Between **ionisation chamber (reference method)** and **fluorescence intensity emission measurement***
- **Problem:**
 - *Direct measurement methods are not reliable because of the **high noise and saturation** of the photodetectors*
- **Solution:**
 - Time correlated single photon counting (TCSPC) method

Experimental methods: Time correlated single photon counting (TCSPC) method

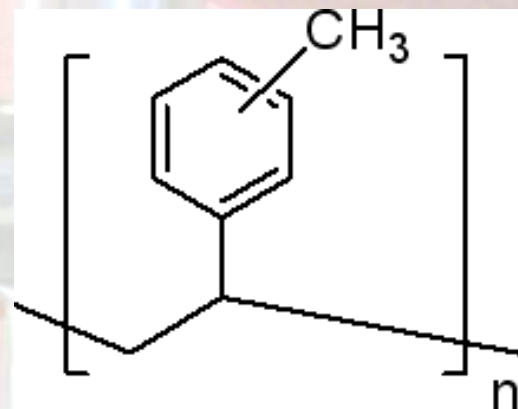


Fluorescent Samples

Polyéthylène téréphtalate (PET) [Goodfellow©]

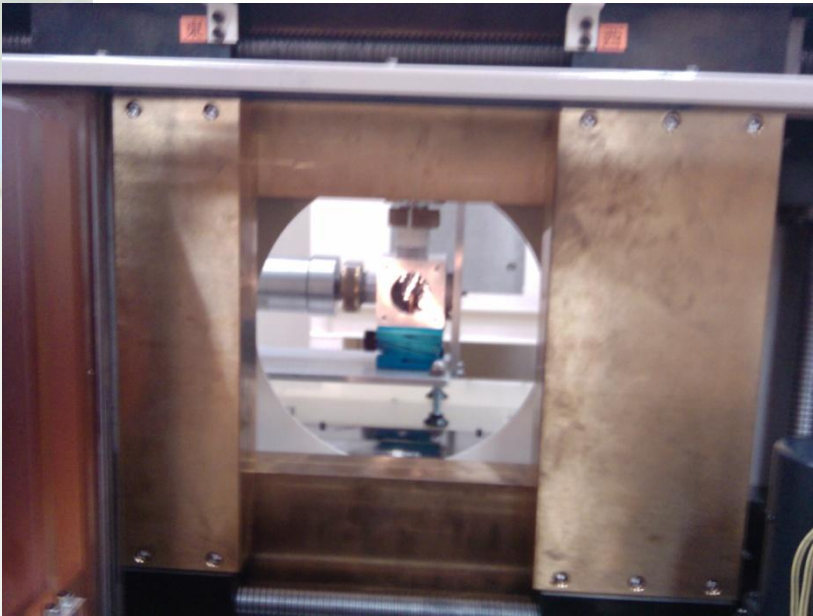


Polyvinyltoluene (PVT) [Bicron©]

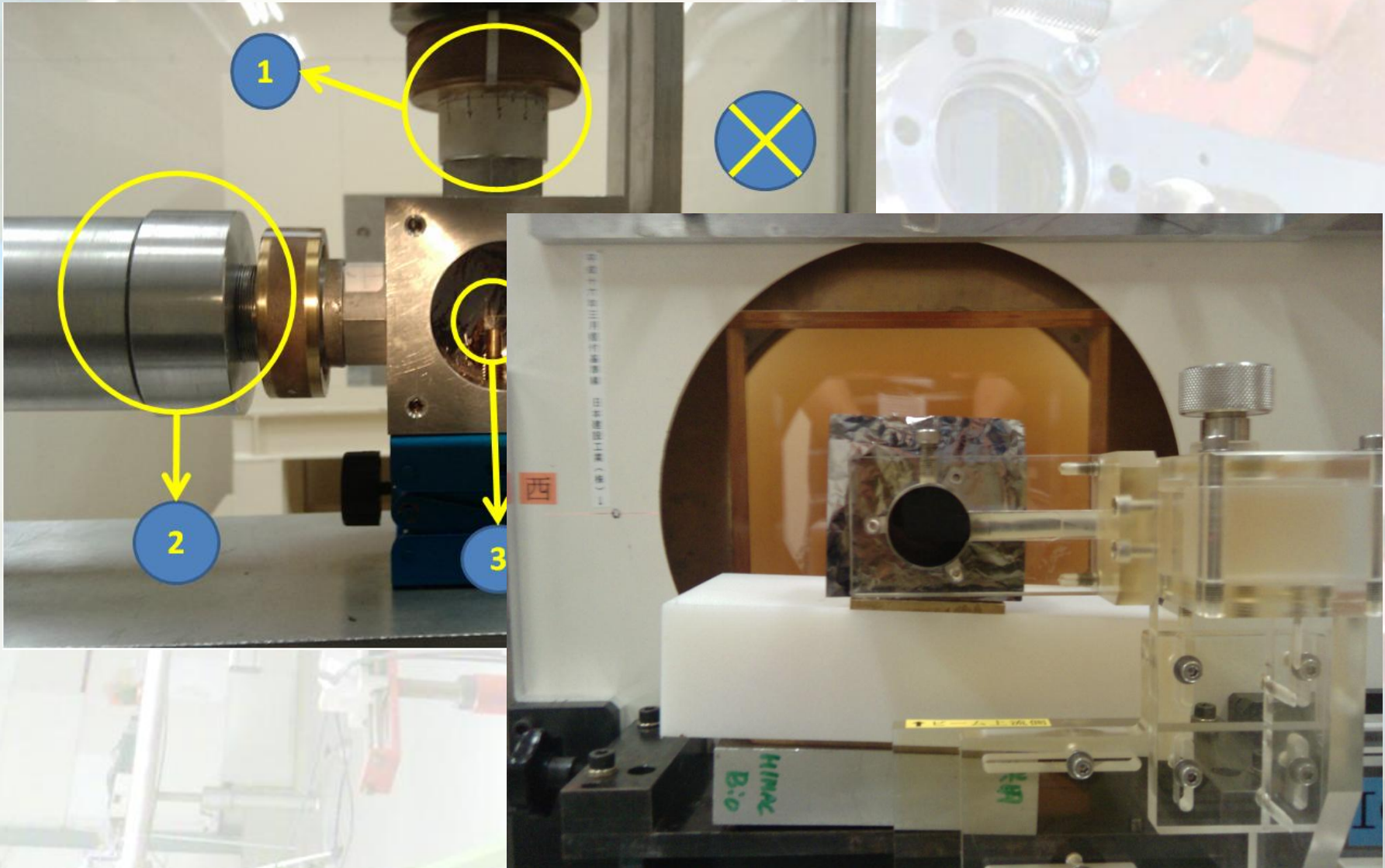


Fluorescence measurement for several LET : Protocols

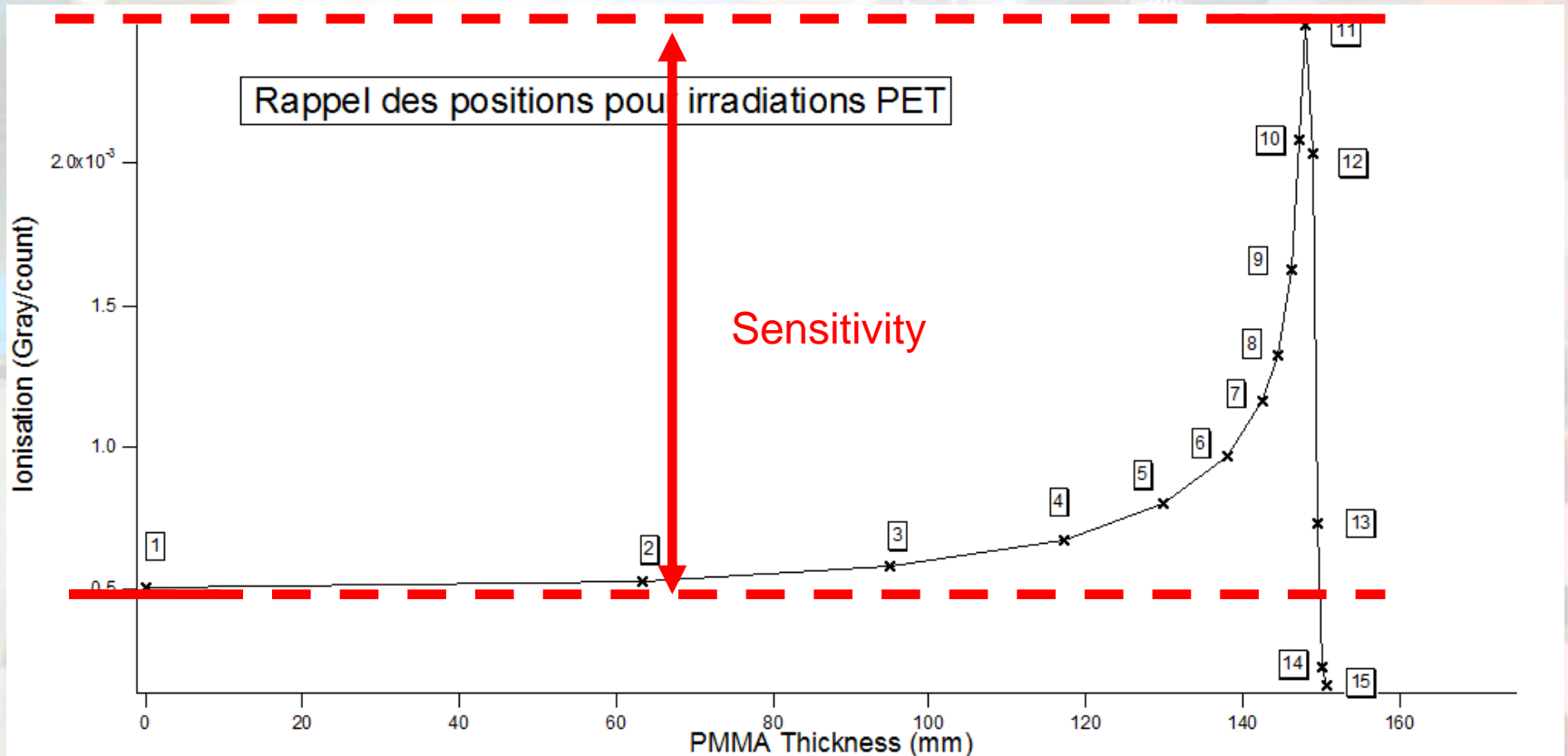
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Fluorescence measurement for several LET : Protocols



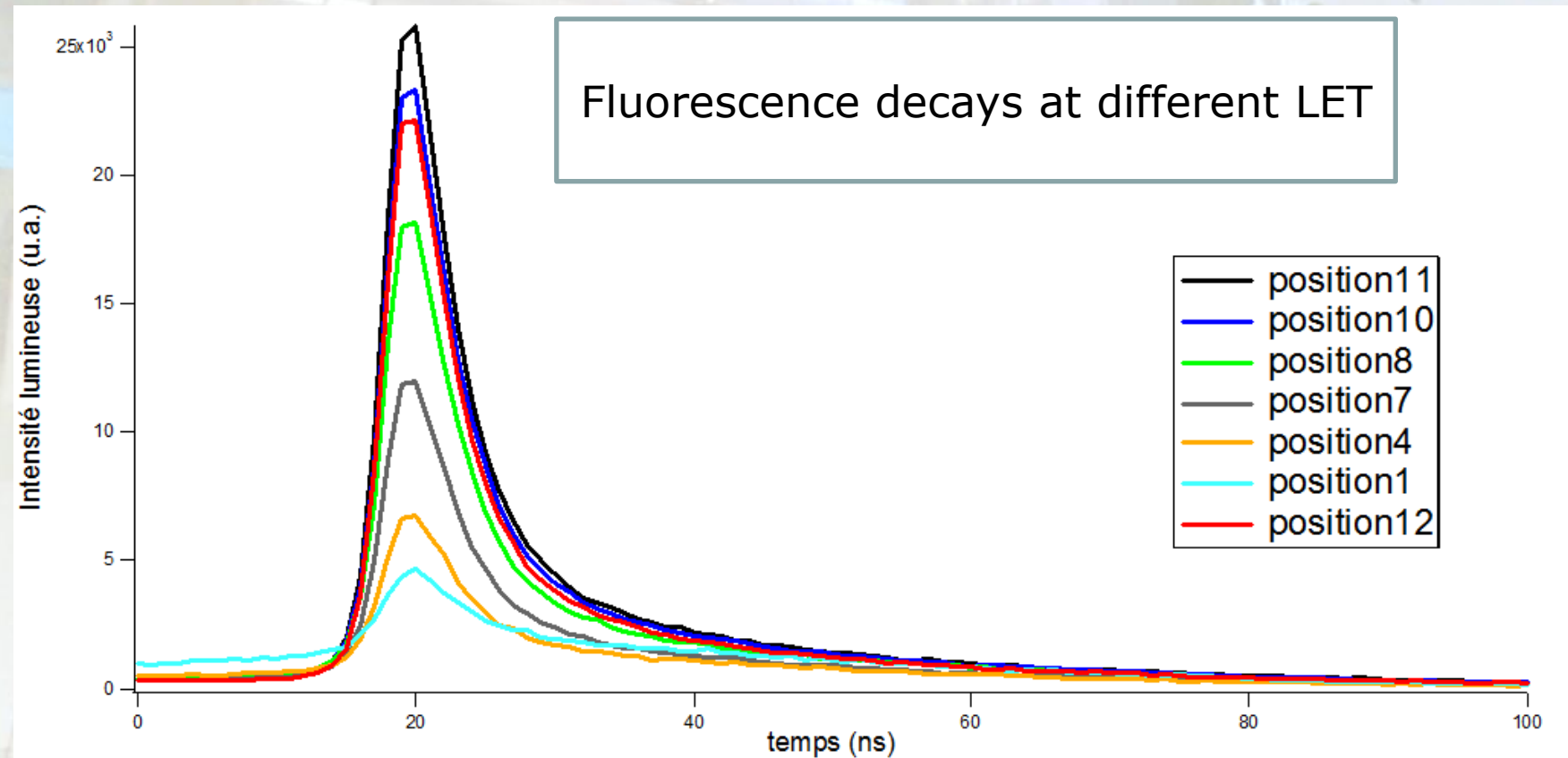
Fluorescence measurement for several LET : Protocols



- Reference method: gives the result directly in *Grays*
- Can be considered as an absolute measurement method

Fluorescence intensity measurement for several LET : Results

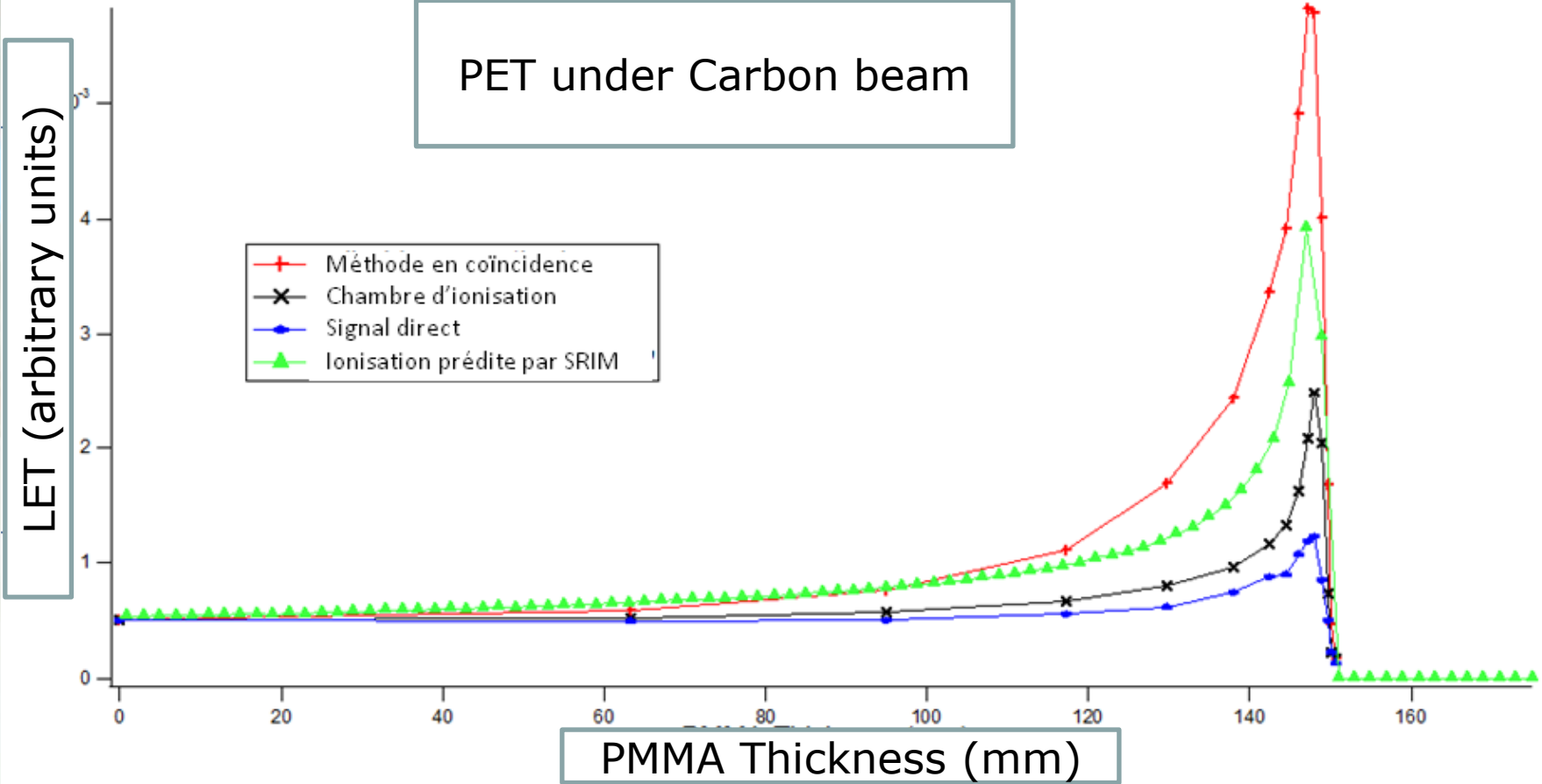
- Normalized to irradiation time



Fluorescence measurement for several LET : Results

Irradiation under carbon beam of 290 MeV/u

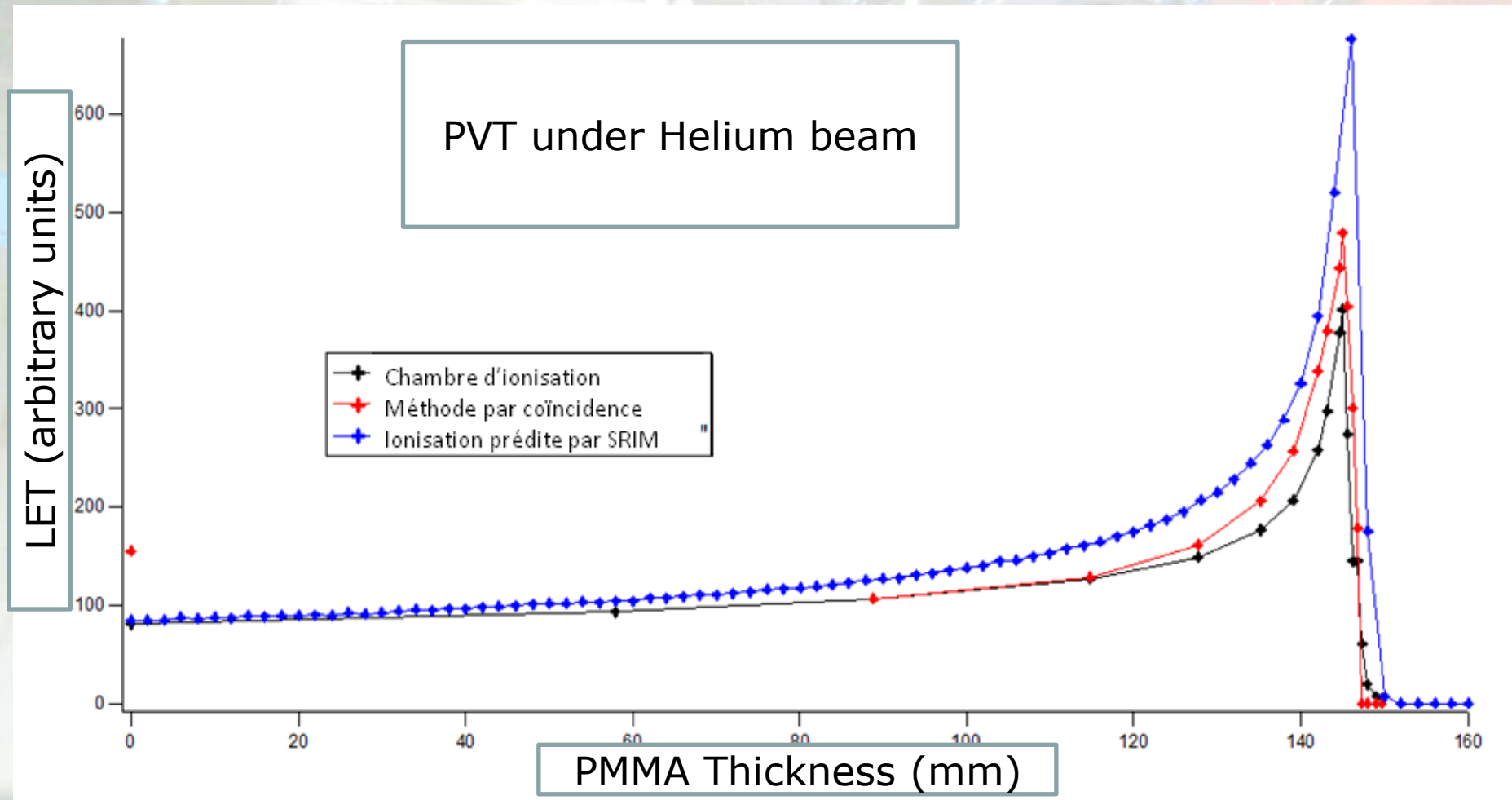
PET under Carbon beam



Fluorescence measurement for several LET : Results

Irradiation under hélium beam of 150 MeV/u

PVT under Helium beam

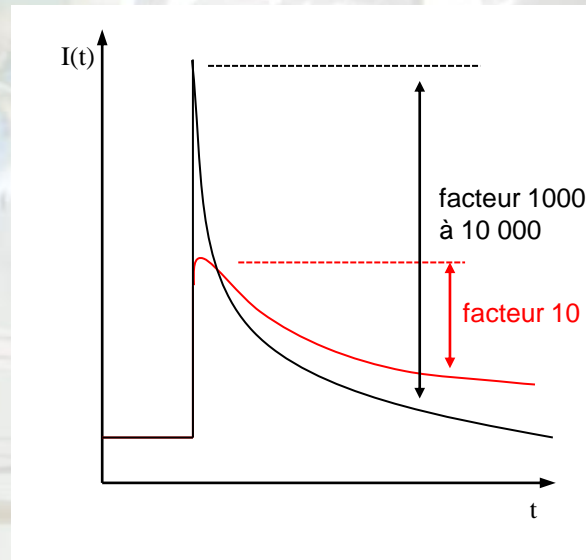


Results summary

Measurement method	Direct measure	Ionisation Chamber	SRIM	TCSPC
Sensitivity carbon	2,44	4,91	7,27	11,4
Sensitivity helium		3,79	6,38	4,52

- TCSPC measurement method is more sensitive than the ionisation chamber for carbon and helium
- TCSPC method seems to show higher LET sensitivity than predicted by the Bethe-Block formula with carbons

- ***TCSPC avoids saturation through statistical reconstruction of the fluorescence decay***



- TCSPC measurement methods avoids the intrinsic Photomultiplier noise
 - *Noise is not correlated in coincidence method*
- better sensitivity in comparison to the traditional method (ionisation chamber)
 - *Because **Fluorescence** takes also in account the excitation in the medium*
- This method can also be used to measure, at high resolution, the dose rate of X and gamma rays.