

Physicochemical measurement of the dose deposited by accelerated ions

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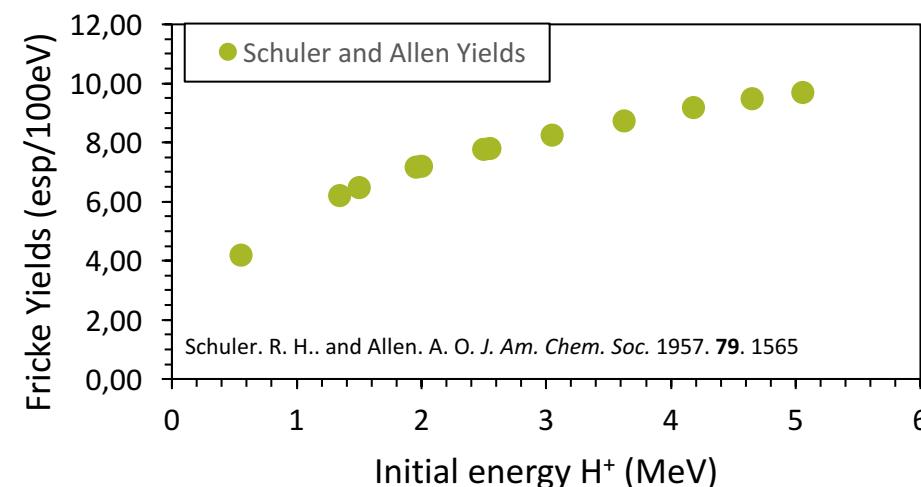
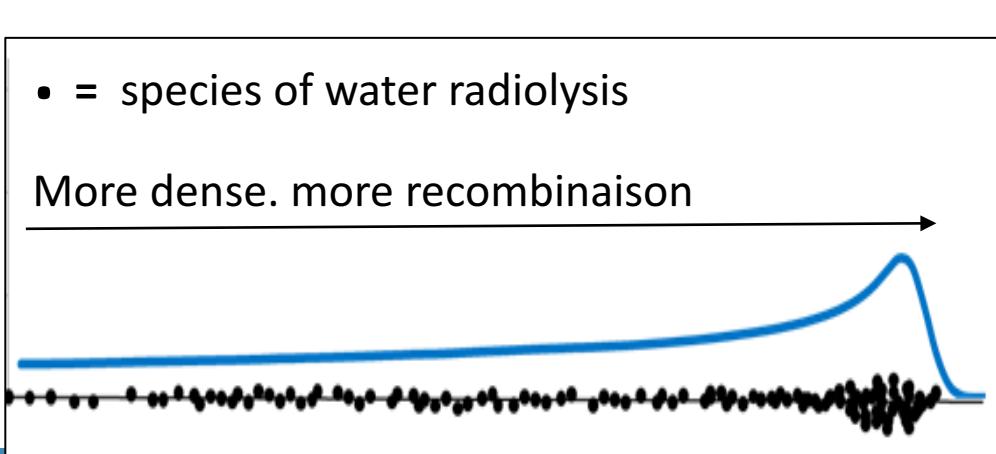
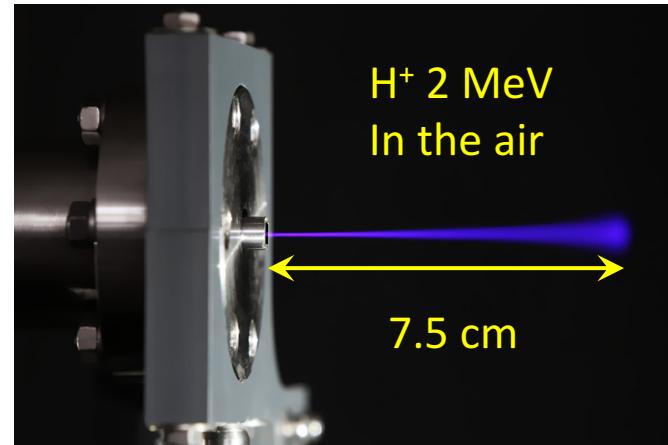
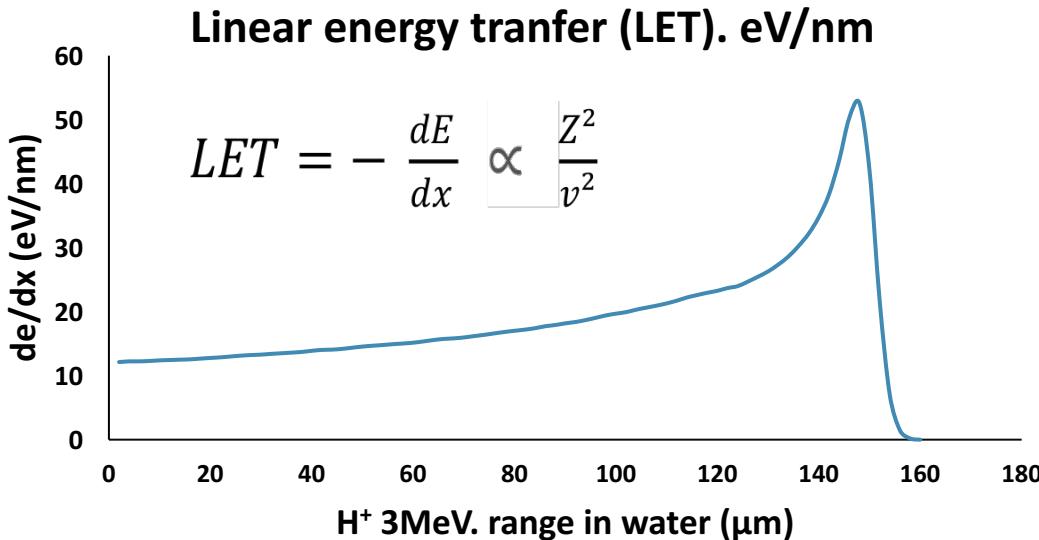
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Radiochemistry and Nuclear Instrumentation**

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Dose deposition of the ions



Fricke yields will vary with LET. hence with initial energy of the particles

Goal of research

Determine the dose of H⁺ irradiation

To Do

- Determine the energy loss
- Determine Fe³⁺ concentration
- $G_{Fe3+} = 100 \cdot \frac{N_{Fe3+}}{E} \rightarrow E = 100 \cdot \frac{N_{Fe3+}}{G_{Fe3+}}$

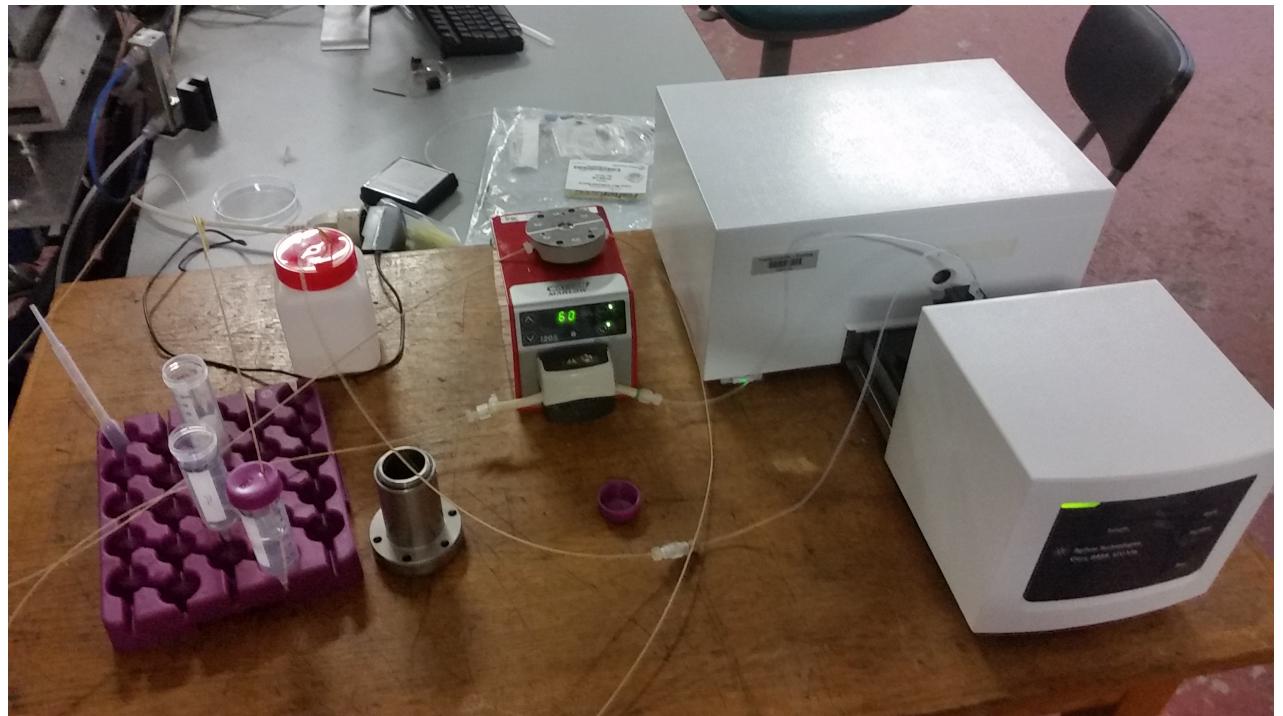
Experimental methodology

Particle accelerator: 4 MV Van de Graaff. ACACIA

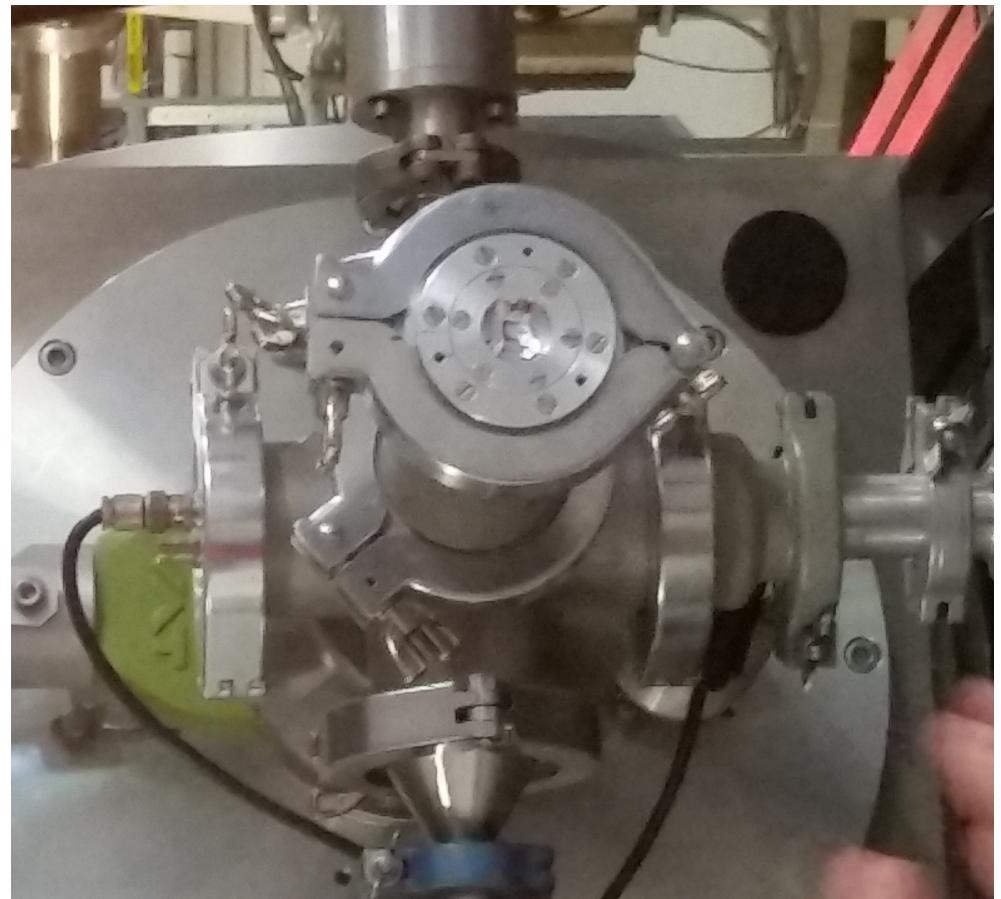


Particles: H⁺ Energies : 1 – 3.5 MeV





**Peristaltic pump
&
UV-Vis-spectrophotometer**

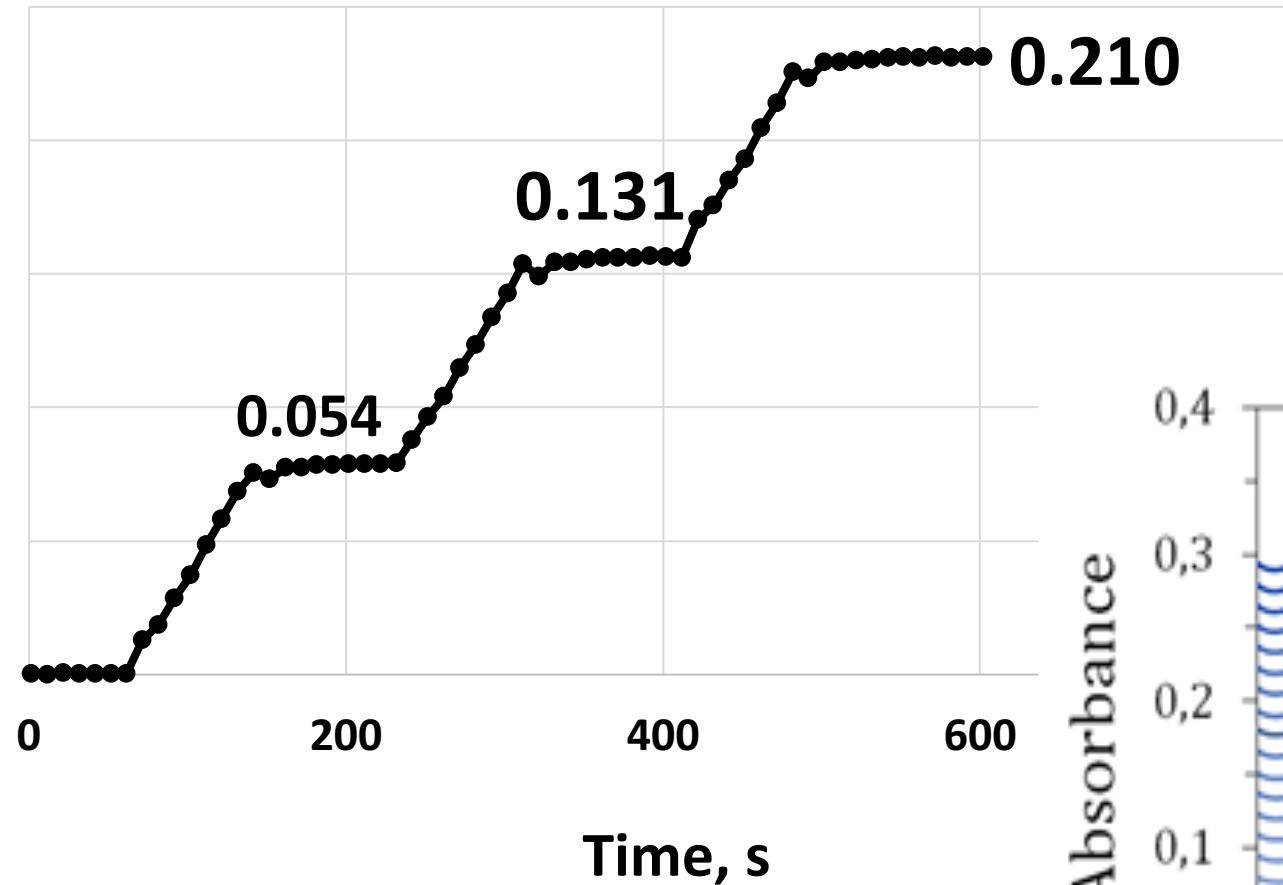


**Irradiation cell with 2x
12 μm aluminized mylar
window**

Time-evolution of absorbance.

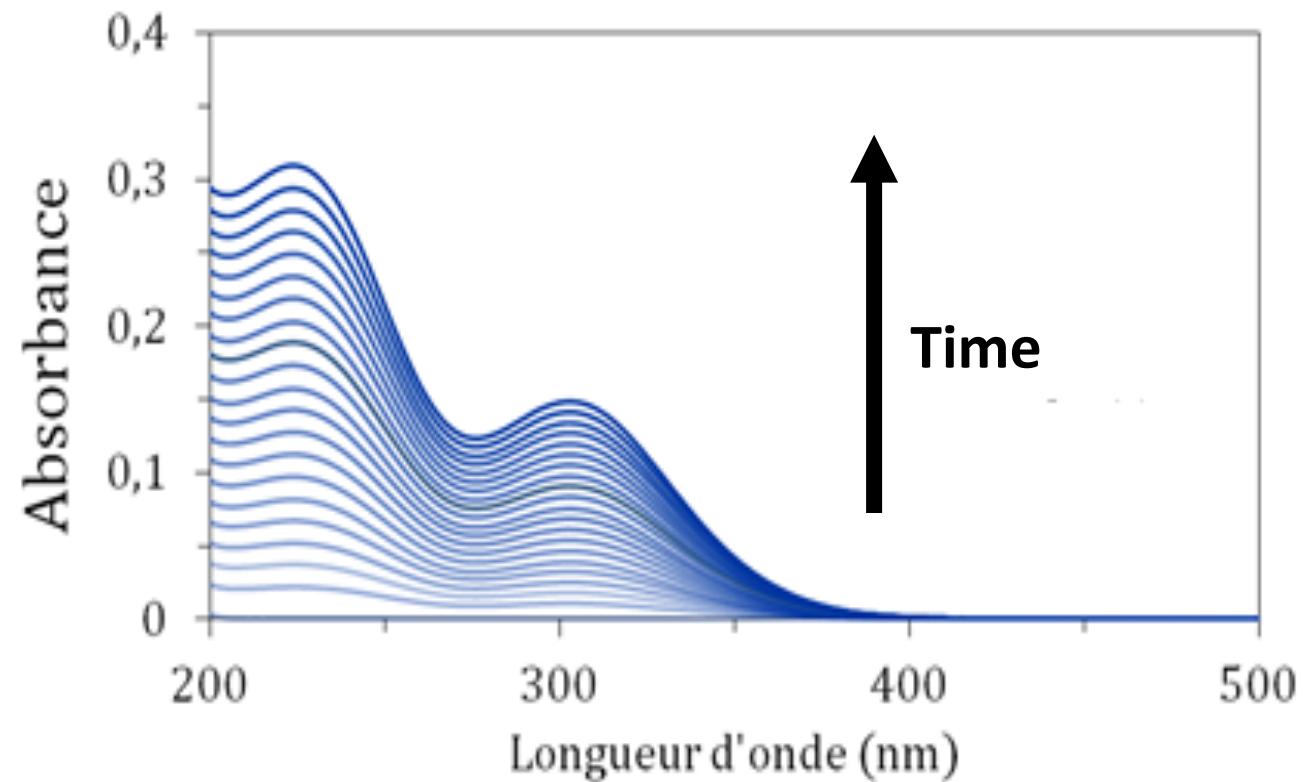
$\lambda = 304 \text{ nm}$

Absorbance



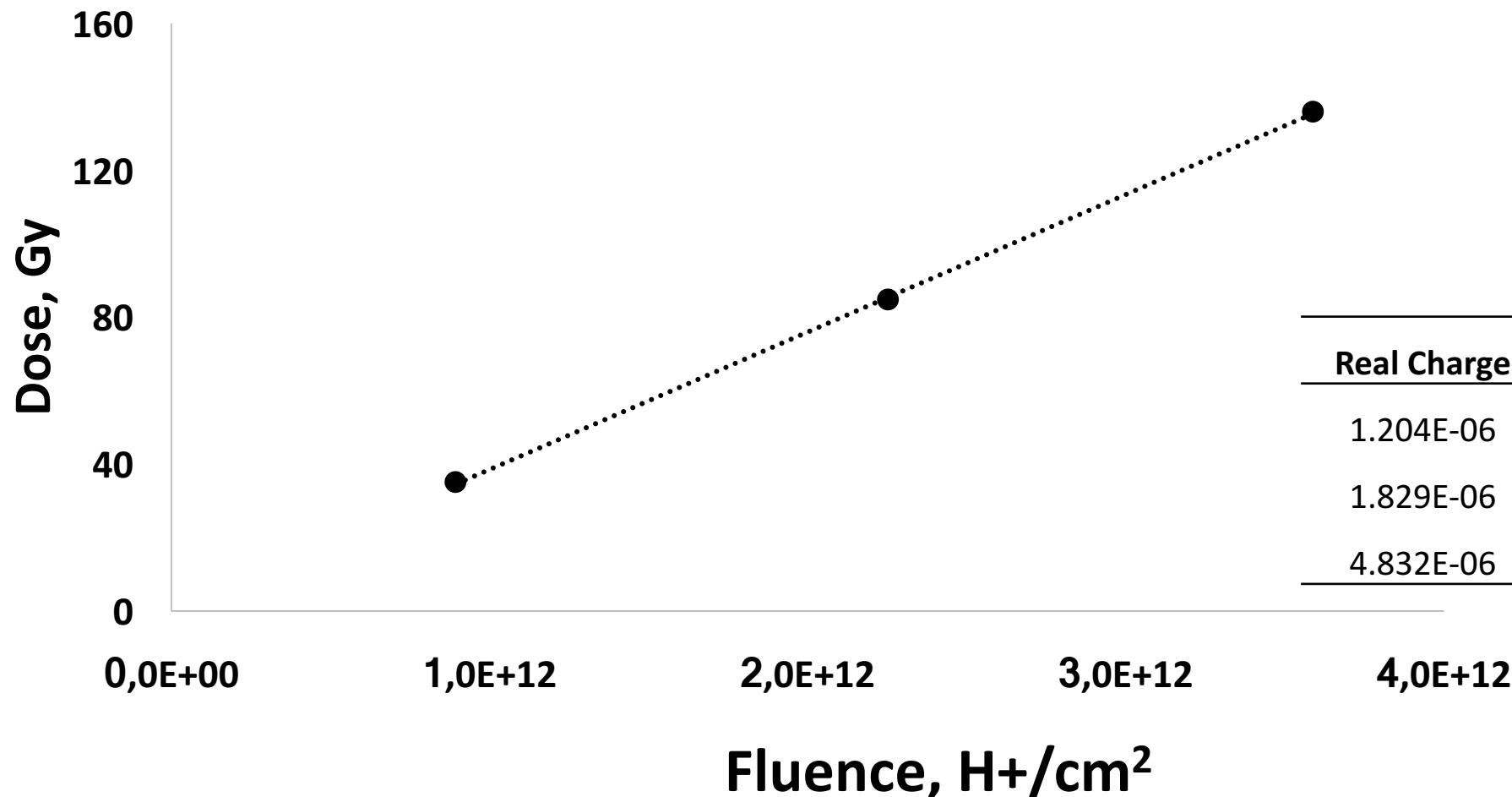
$$A = \log\left(\frac{I_0}{I_t}\right) = \epsilon \cdot l \cdot [Fe^{3+}]$$

Beer-Lambert's Law



$$G_{Fe^{3+}} = 100 \cdot \frac{N_{Fe^{3+}}}{E} \rightarrow E = 100 \cdot \frac{N_{Fe^{3+}}}{G_{Fe^{3+}}}$$

#	Abs.	Fe[3+], mol/L	E, eV	E, J	Dose, Gy
1	0.054	2.46E-05	1.788E+18	0.286	34.924
2	0.131	5.96E-05	4.338E+18	0.694	84.723
3	0.21	9.56E-05	6.954E+18	1.113	135.815



-Big man in a suit of armor. Take that off, what are you?

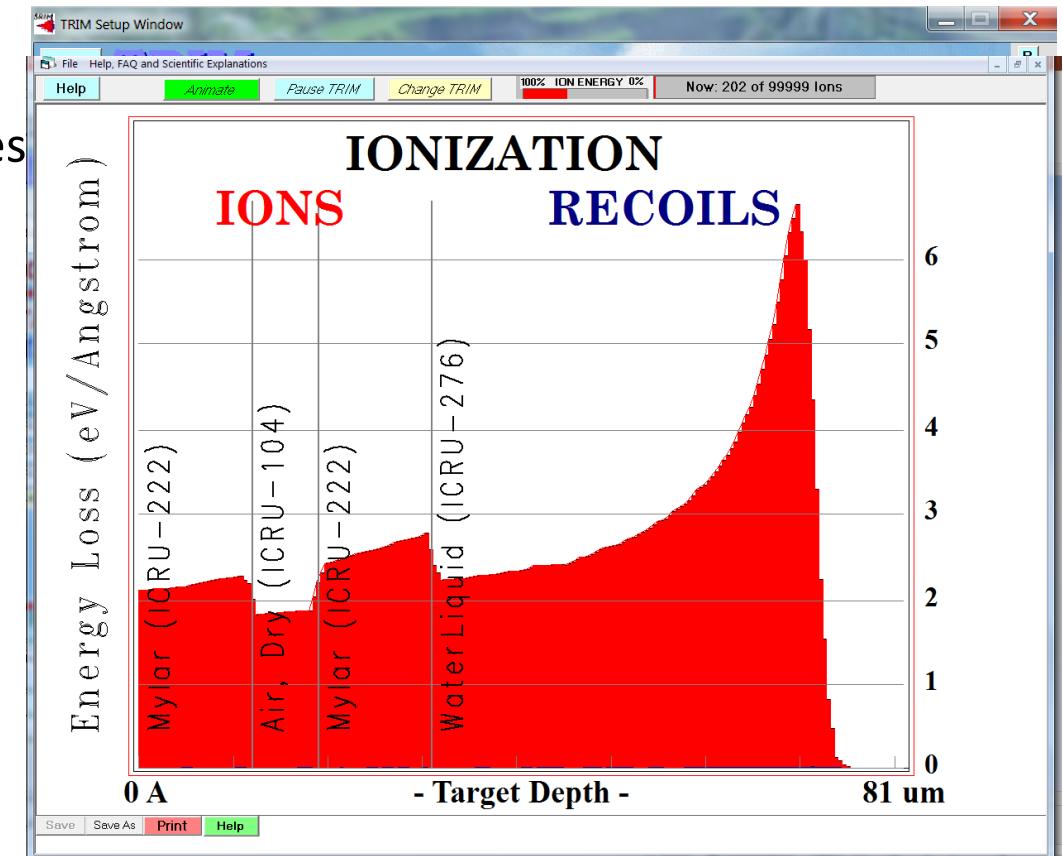


- Geniuses, scientists, polyglots, coffee & tea adepts

Practical work

The solution will be irradiated with 2 MeV protons (energy inside the beam line. under vacuum)

- Preparation of the irradiation setup.
- Irradiation of the Fricke solution with increasing fluences
 - UV-Vis Online measurements
 - Determination of $N_{Fe^{3+}}$
 - Determination of the energy of the protons in solution
 - SRIM software
 - Determination of $G_{Fe^{3+}}$
 - Determination of the dose deposited in solution



$$G_{Fe^{3+}} = 100 \cdot \frac{N_{Fe^{3+}}}{E} \rightarrow E = 100 \cdot \frac{N_{Fe^{3+}}}{G_{Fe^{3+}}}$$