Tandem Research Activities

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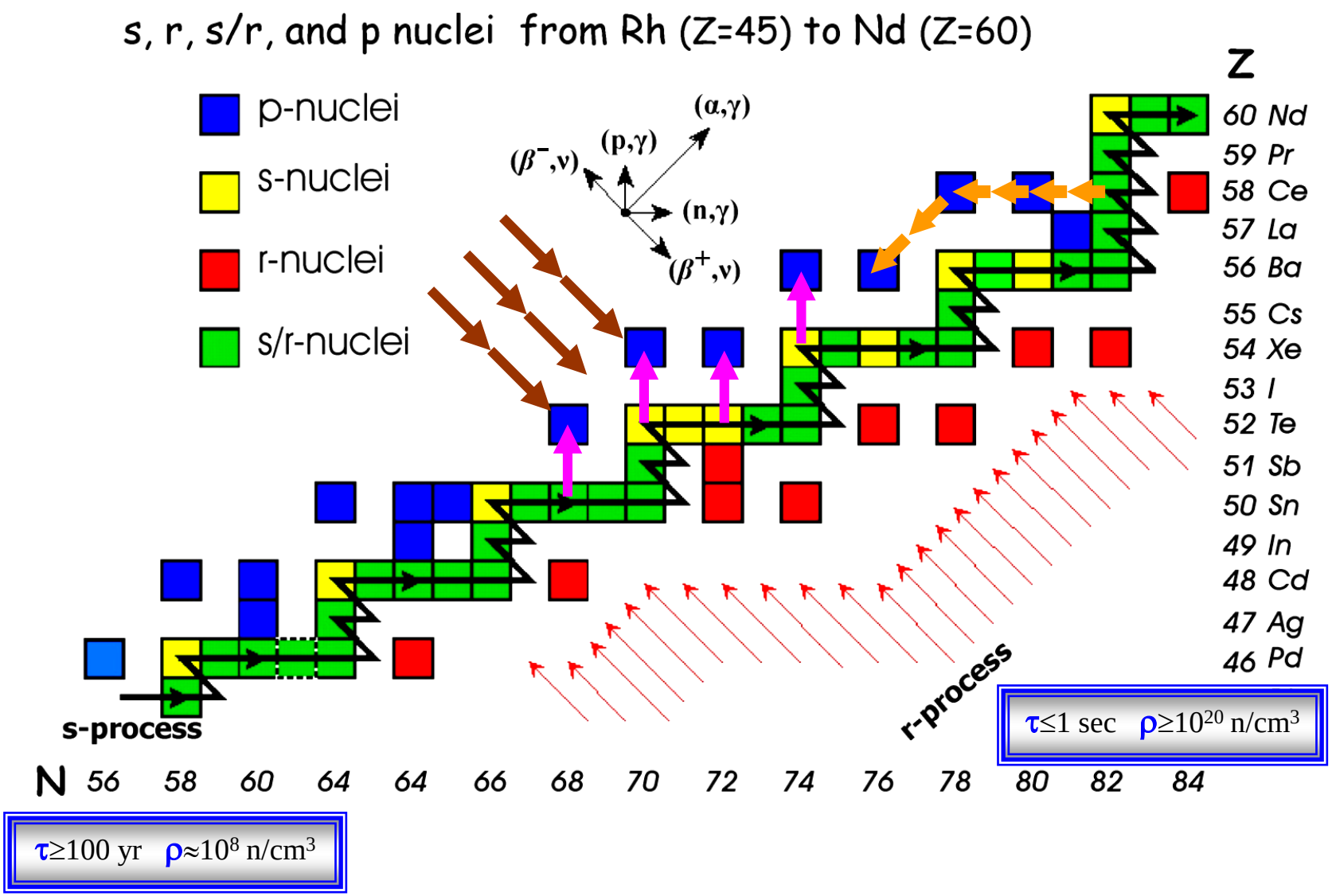
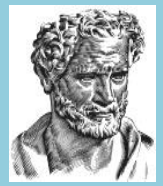
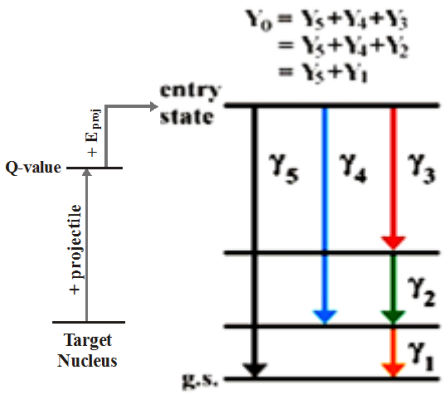
Pathways for heavy-element nucleosynthesis

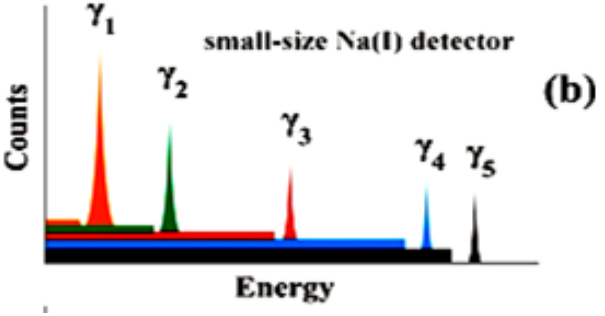


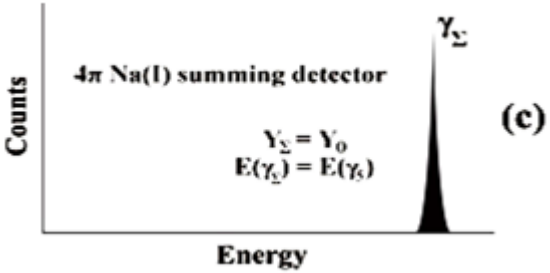


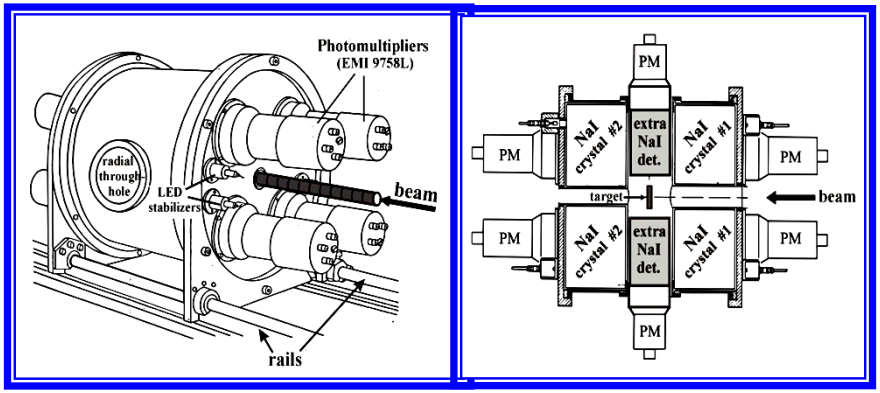
Experimental Methods

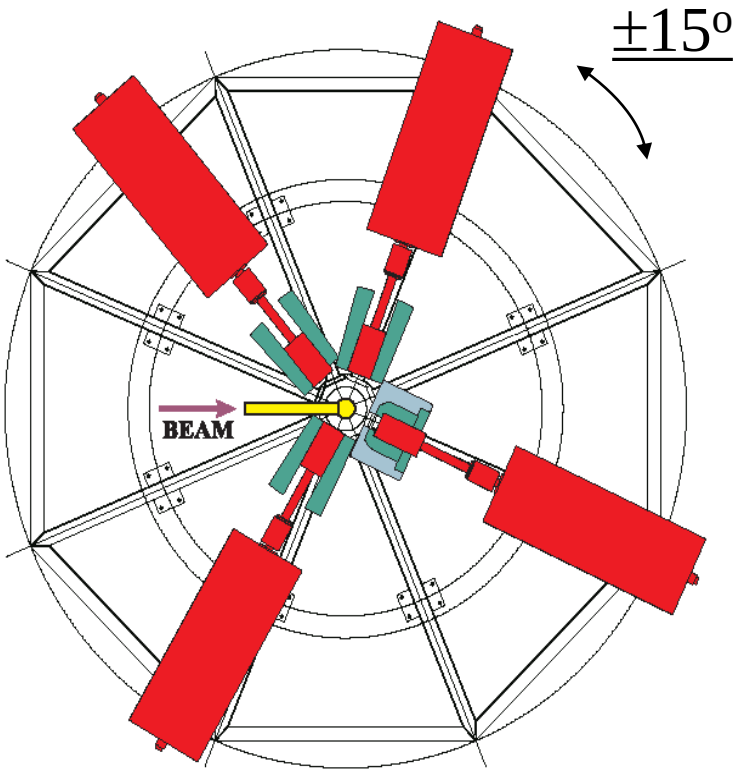


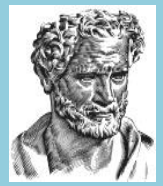
(a)



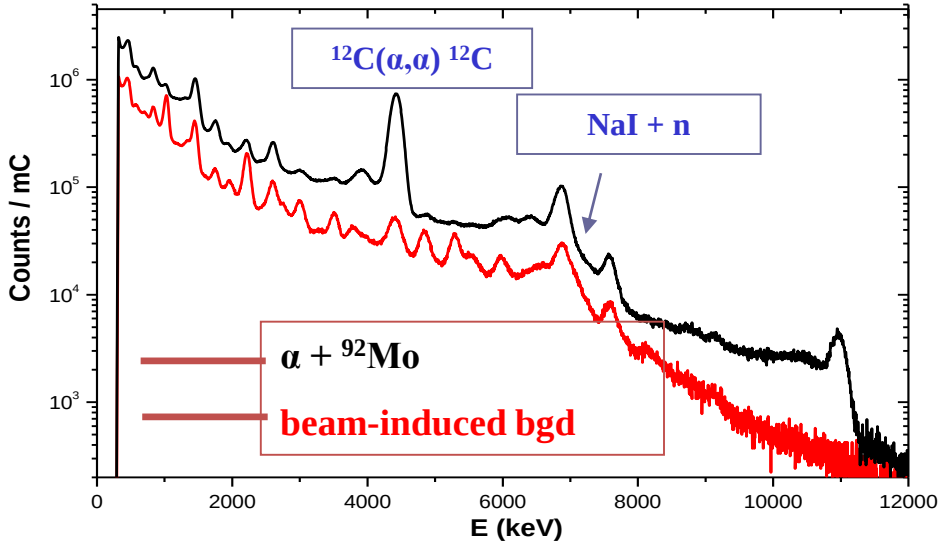








The 4π γ-summing method



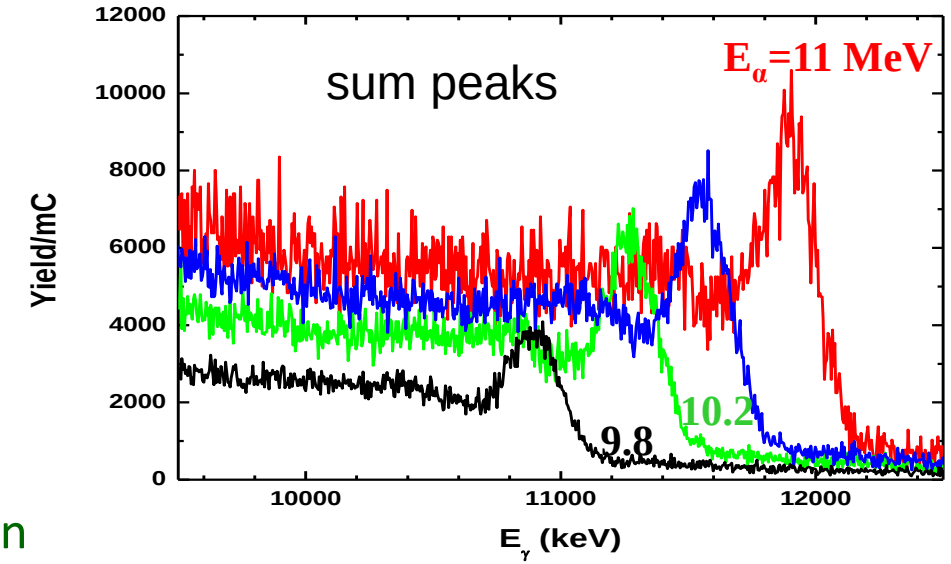
$$\sigma=(Y/\varepsilon)*(1/\xi)*(A/N_A)$$

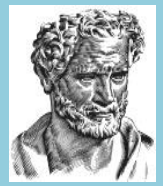
BUT $\varepsilon=f(E,M)$

Solutions (up to now):

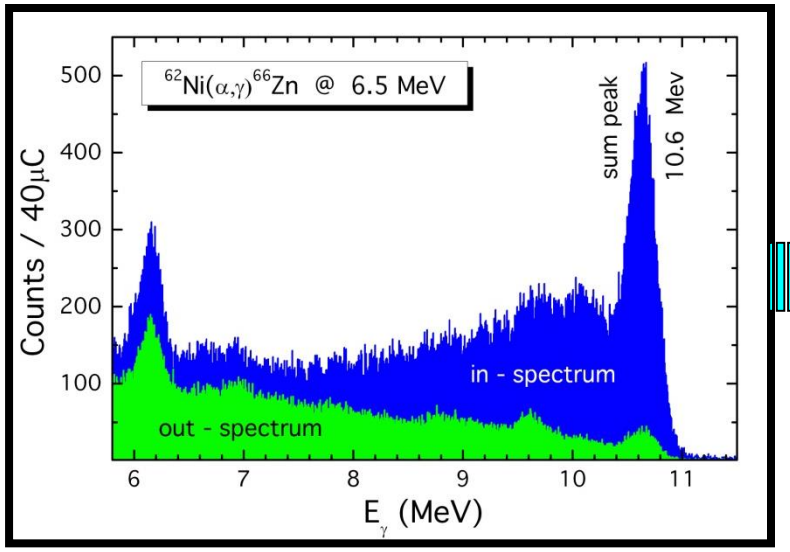
- Theoretical calculations
- Simulation

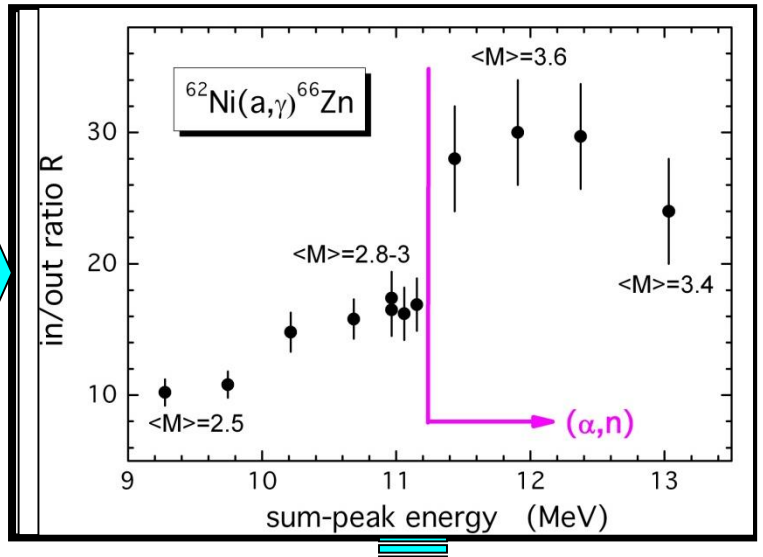
No “real” experimental solution

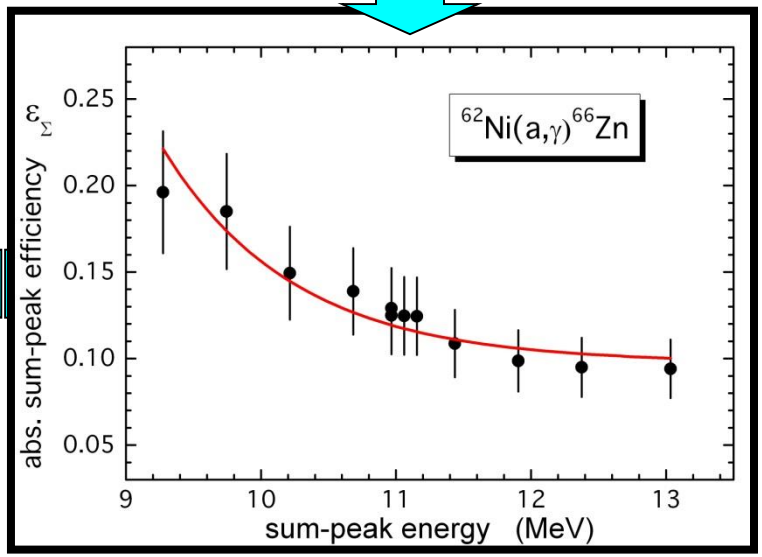


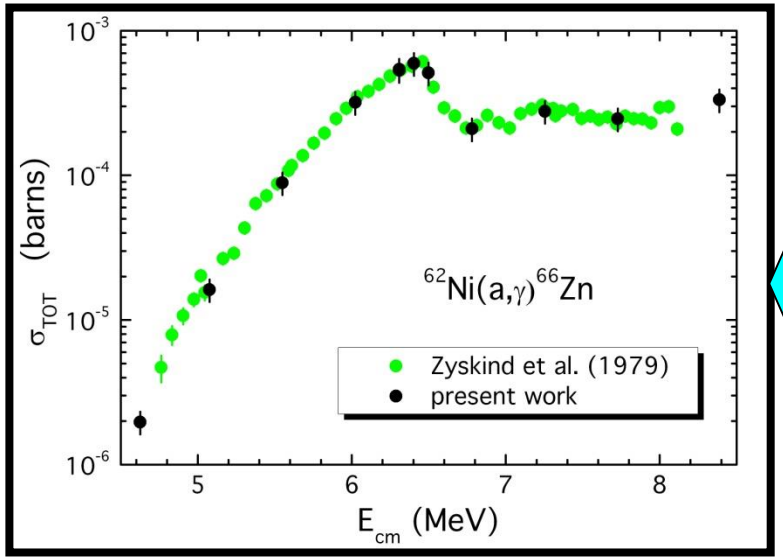


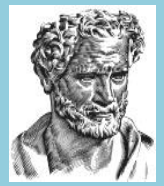
Efficiency Check



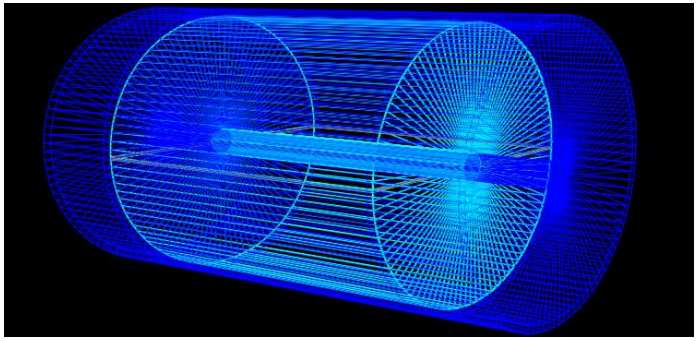


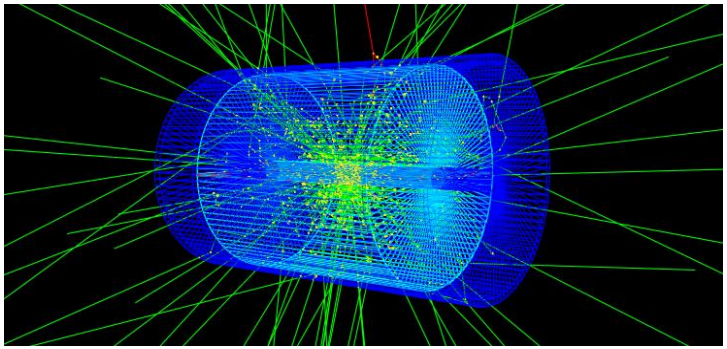


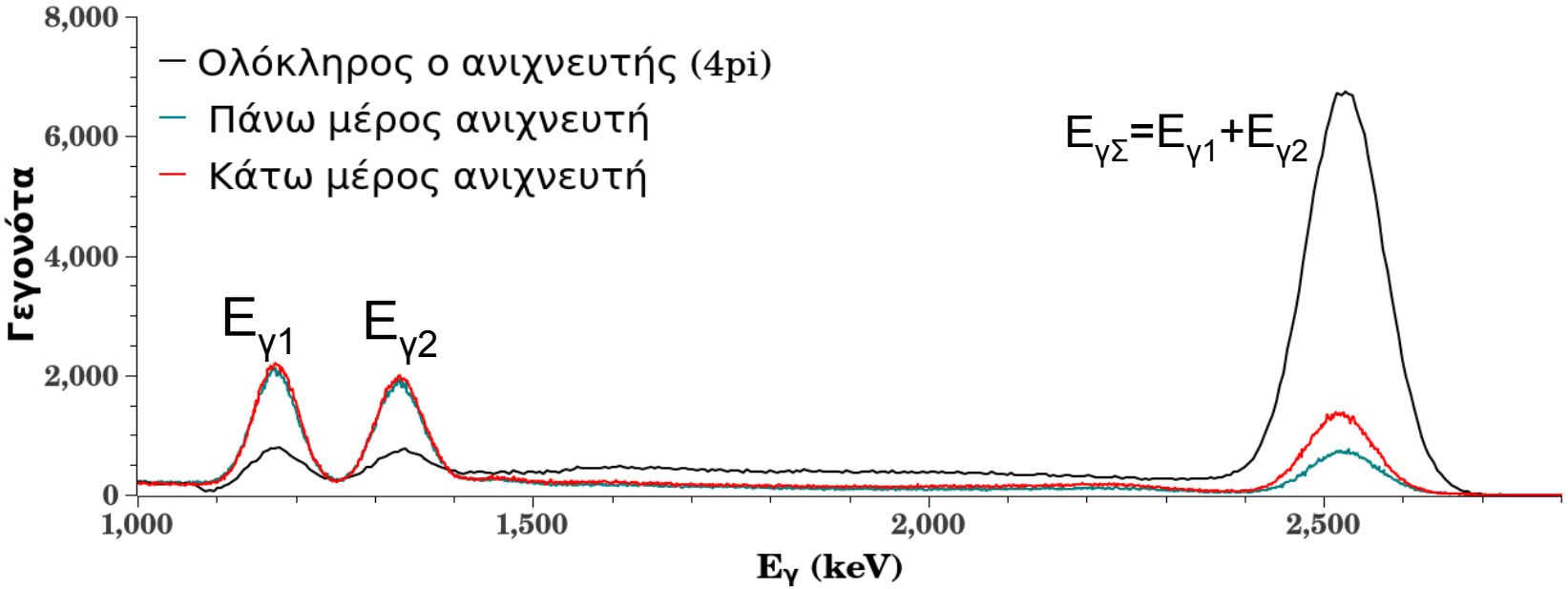




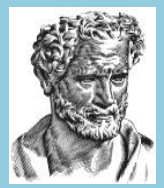
Neoptolemos Efficiency







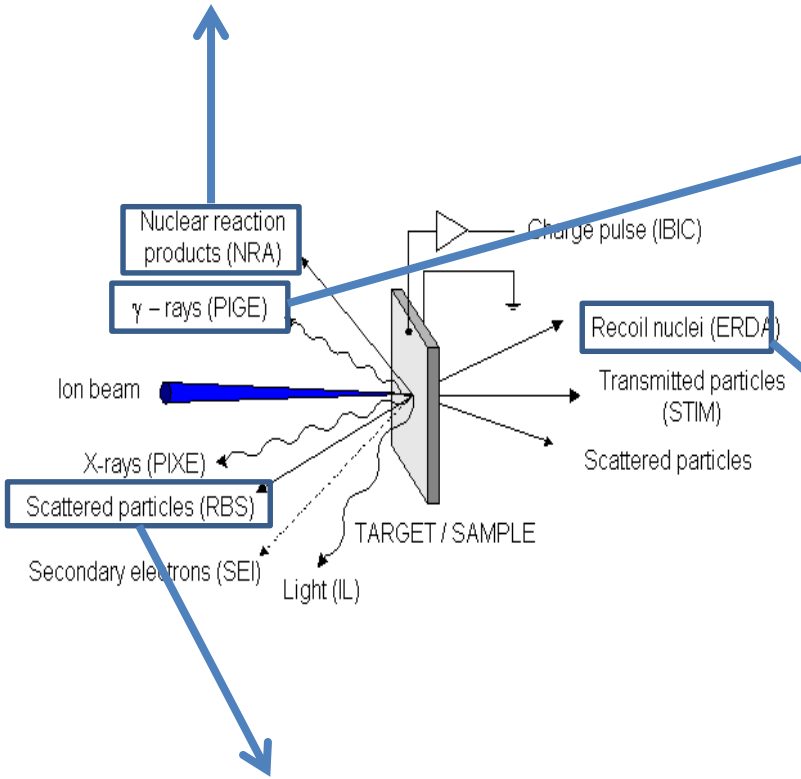
^{60}Co	experimental	simulated
$\frac{I_{\gamma_1}}{I_{\gamma\Sigma}}$	6.29 %	6.64 %
$\frac{I_{\gamma_2}}{I_{\gamma\Sigma}}$	4.72 %	4.70 %
$\frac{I_{\gamma_1}+I_{\gamma_2}}{I_{\gamma\Sigma}}$	11 %	11.1 %



Ion Beam Analysis

Nuclear Reaction Analysis

Detection of reaction products(p, d, α)
Suitable for light elements in heavy matrices
Depth profiling



Particle Induced Gamma – ray Emission

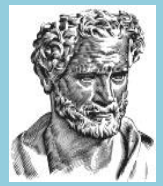
Detection of γ-rays
Suitable for < Si
(Depth profiling)

Elastic Recoil Detection Analysis

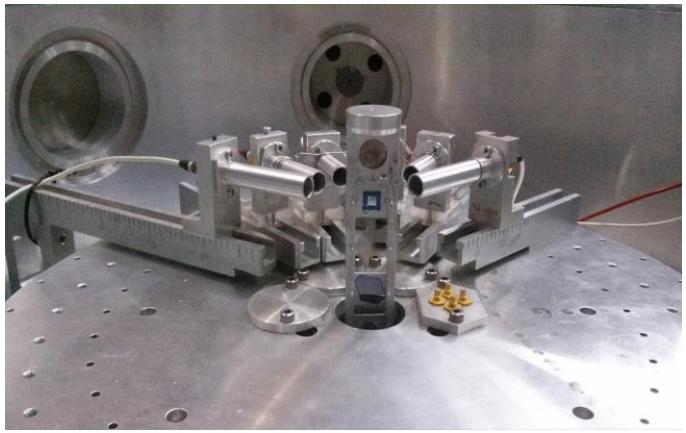
Detection of recoil particles
Suitable for < Si
Depth profiling

Rutherford Back Scattering

Detection of elastically scattered particles
Suitable for heavy elements in light matrices
Depth profiling



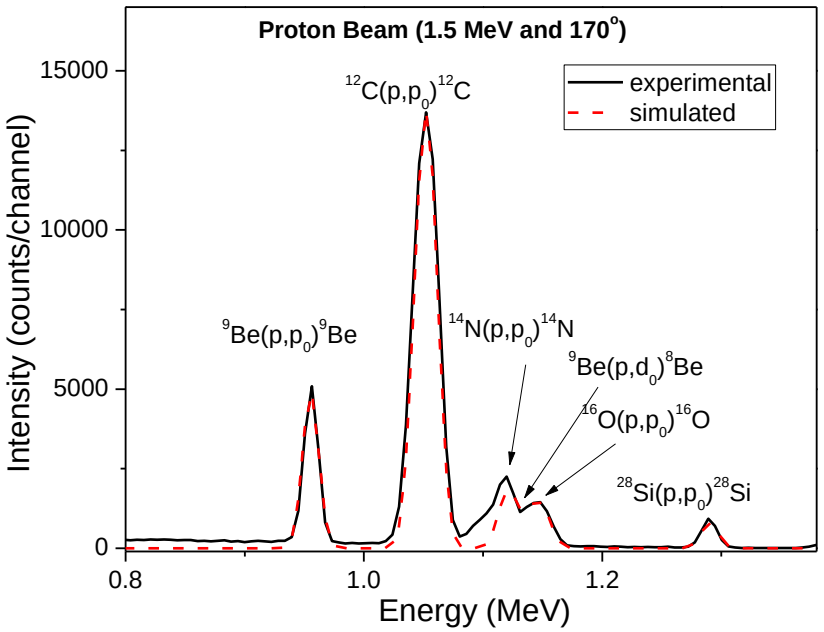
^{9}Be(d,x) Reactions

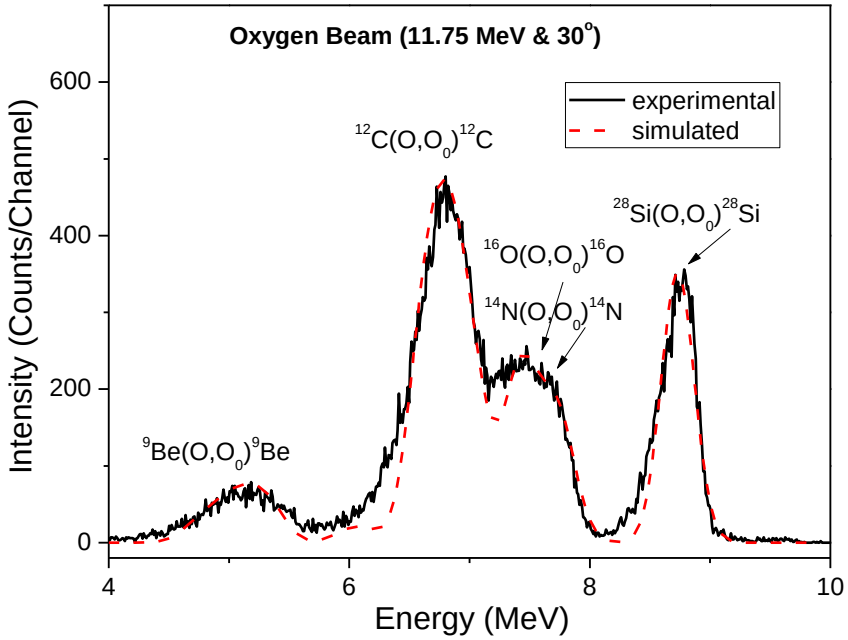


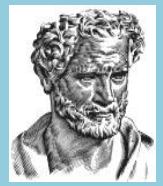
Motor driven goniometer

Great angular accuracy (0.01 deg.)
Up to 4 targets
Water cooling available

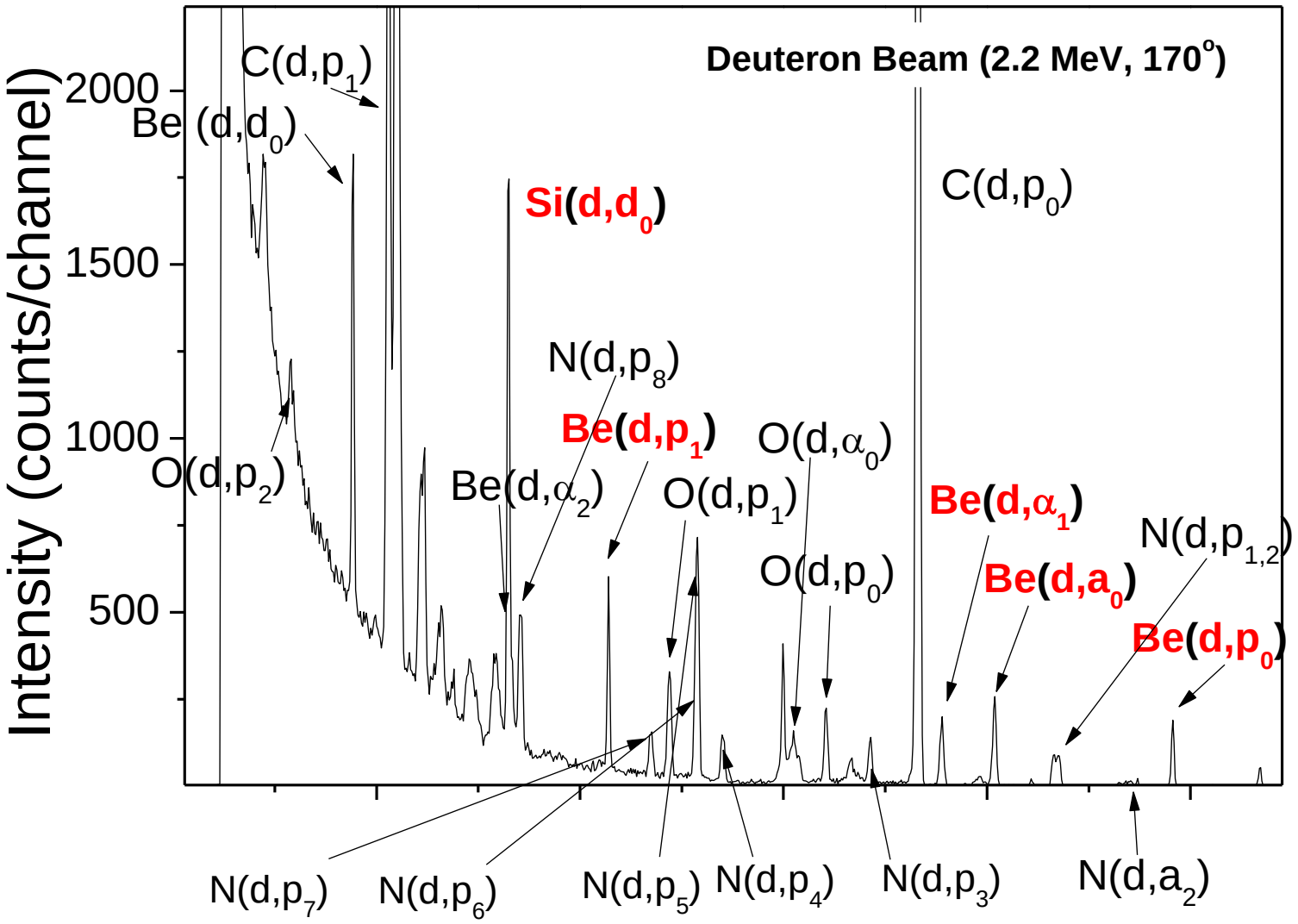
Target Characterization

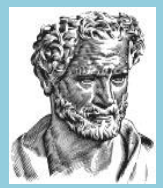






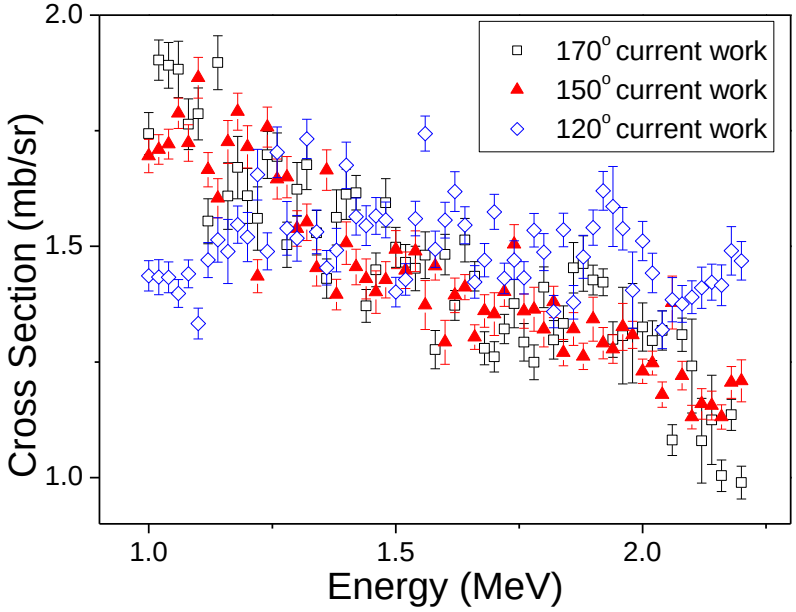
Typical Spectrum

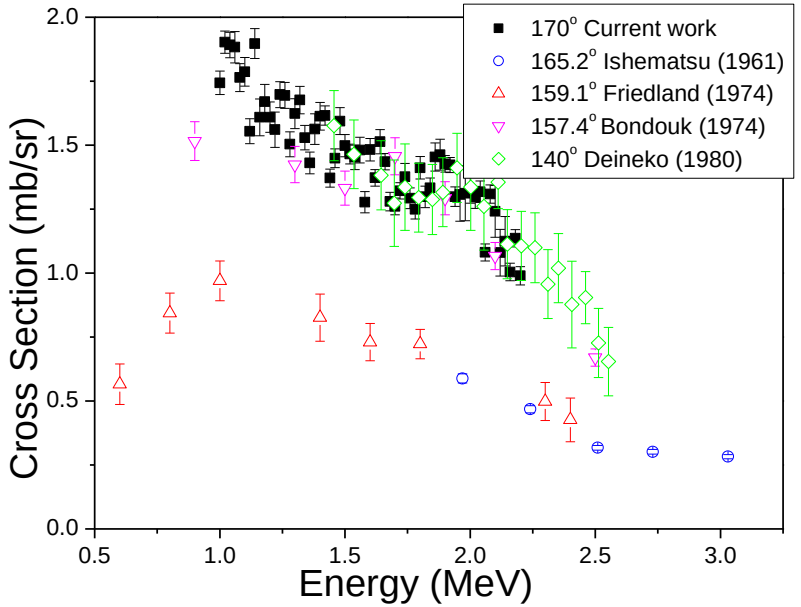




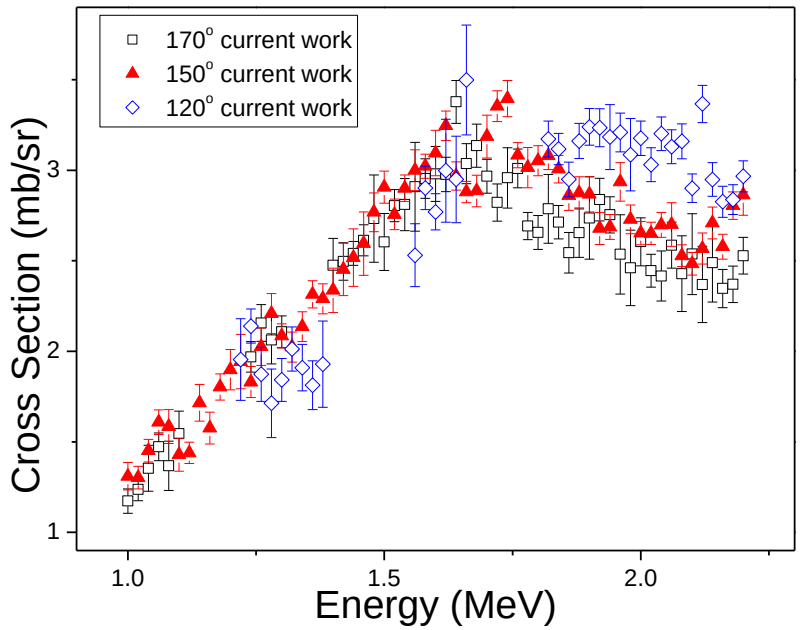
Results

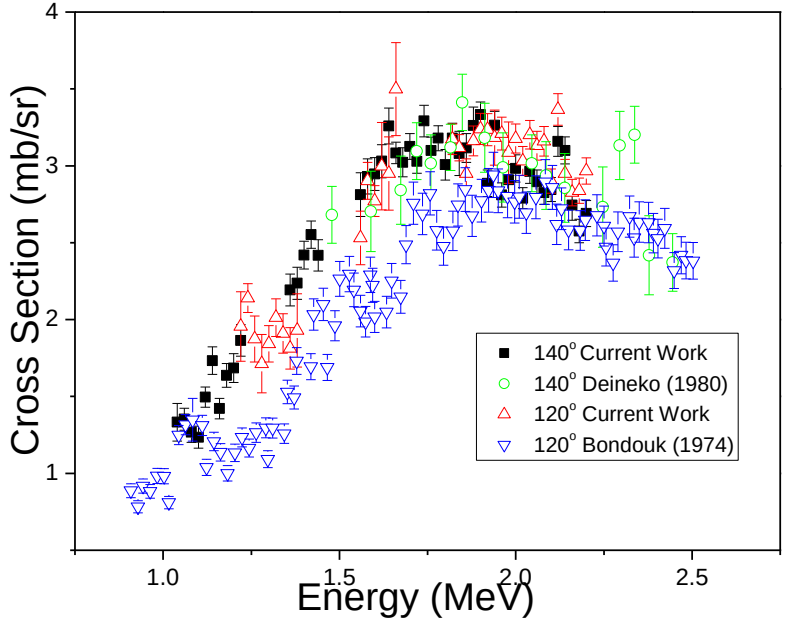
$^{9}Be(d,p_0)$ Reaction

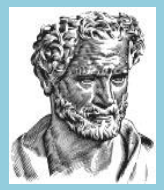




$^{9}Be(d,p_1)$ Reaction



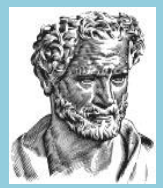




Differential Cross Section Measurements

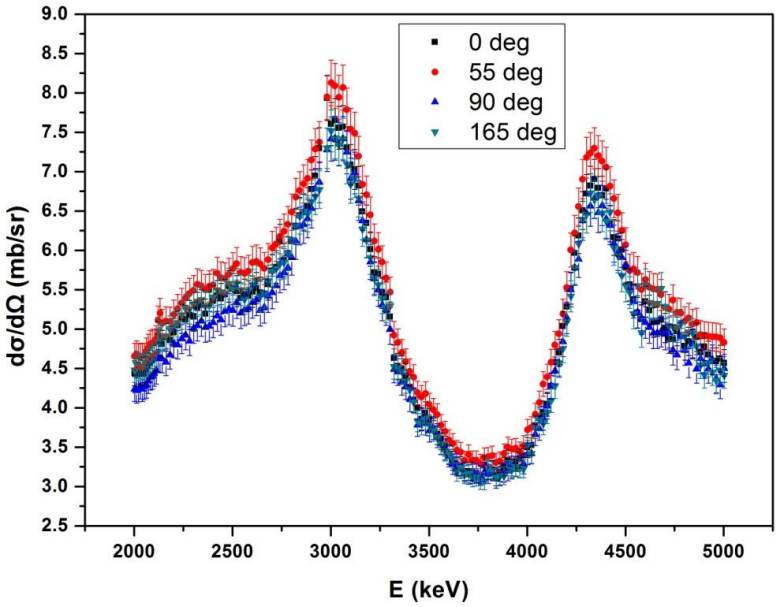
$$\left(\frac{d\sigma}{d\Omega}\right)(E,\vartheta) = \frac{N_\gamma(E,\vartheta)}{\xi \cdot N_{\mathrm{p}} \cdot \varepsilon_{abs}(E_\gamma)}$$

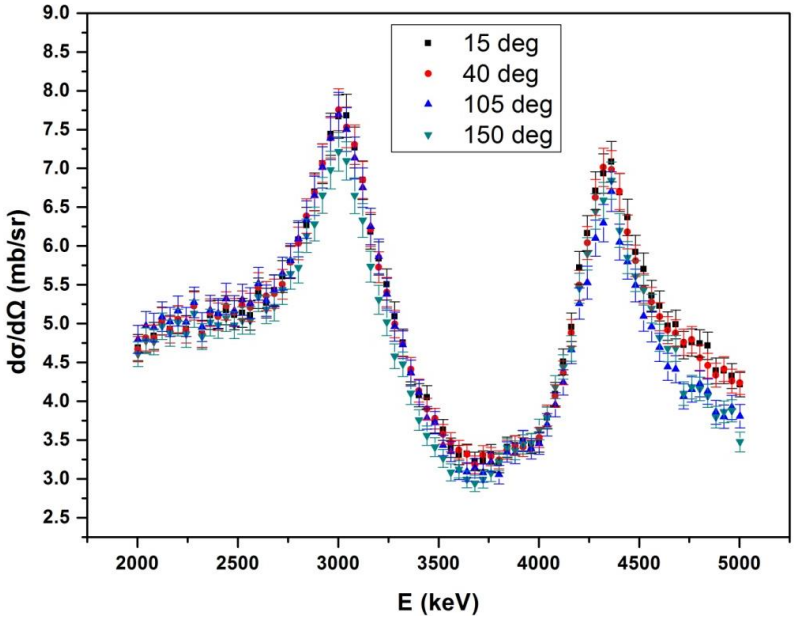
- Electronically controlled turntable
- Initial angles: 0^o – 55^o – 90^o - 165^o
- 4 HPGe detectors (1 – 80%, 3 – 100%) placed between 25 and 30 cm from target
- Faraday cup for target/charge measurement
- + 300 V suppression voltage on collimator
- Air cooled target
- NIM electronics
- Singles Fast ADC DAQ



Differential Cross Sections

$^{10}B(p,\alpha\gamma)^{7}Be$





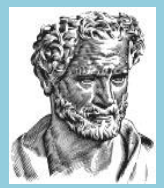
NO Significant angular distribution throughout the whole energy range

TWO broad resonances present:

They correspond to ^{11}C:

E: 11440 keV Γ: 360 keV

E: 12650 keV Γ: 360 keV



Thank You for Your Attention !