



DE LA RECHERCHE À L'INDUSTRIE

cea



# Production and decay spectroscopy of neutron-deficient actinides at IGISOL using $^{232}\text{Th}(p,x)Y$ reaction

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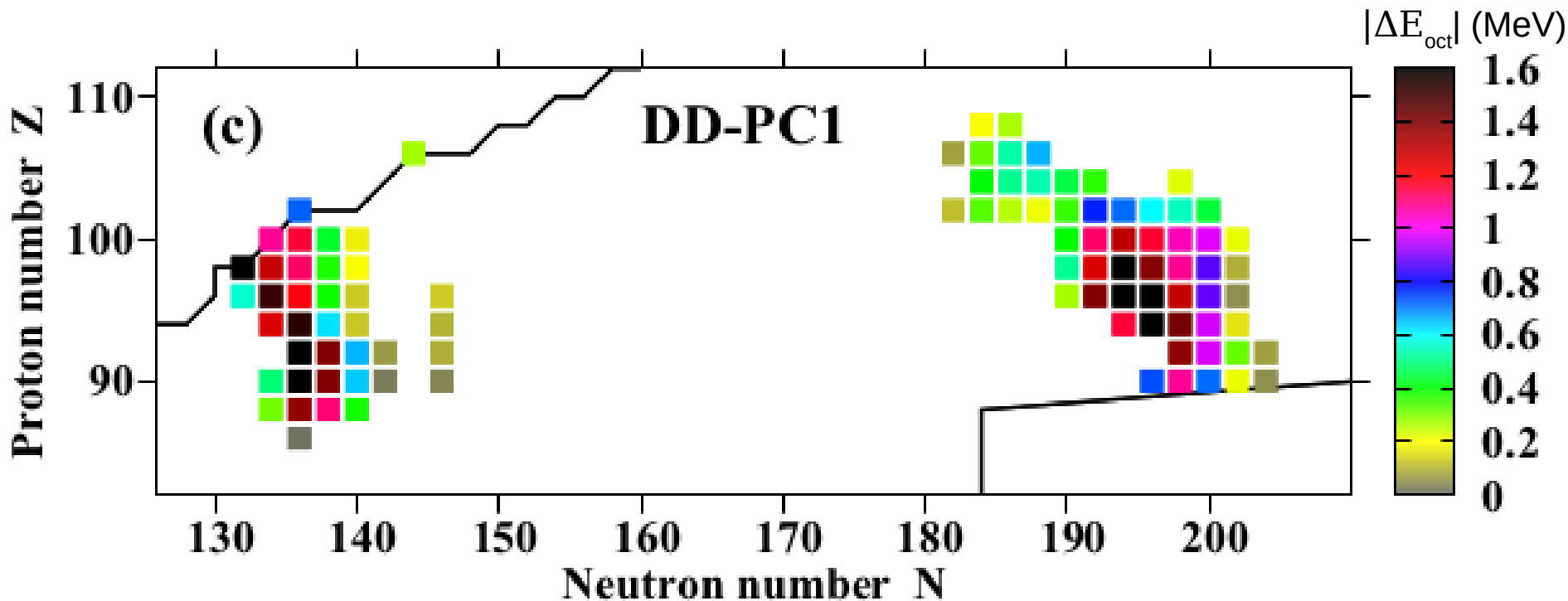
Supervised by M. Vandebrouck (CEA/Irfu/DPhN)

In collaboration with I. Moore, I. Pohjalainen and A. Raggio (University of Jyväskylä)



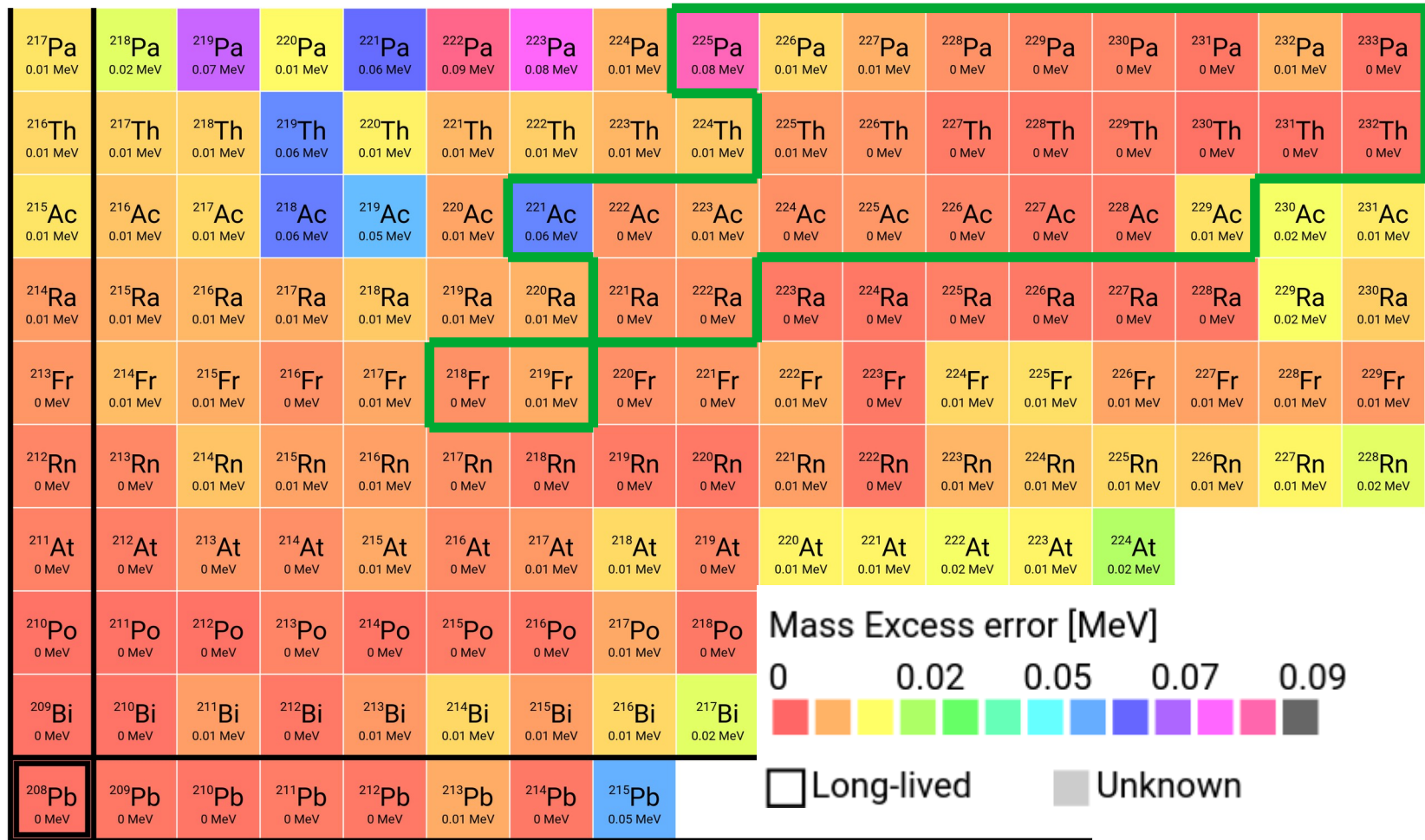
**Colloque GANIL  
September 2021**

Prediction of strong octupolar deformations in the ground state of neutron-deficient actinides :

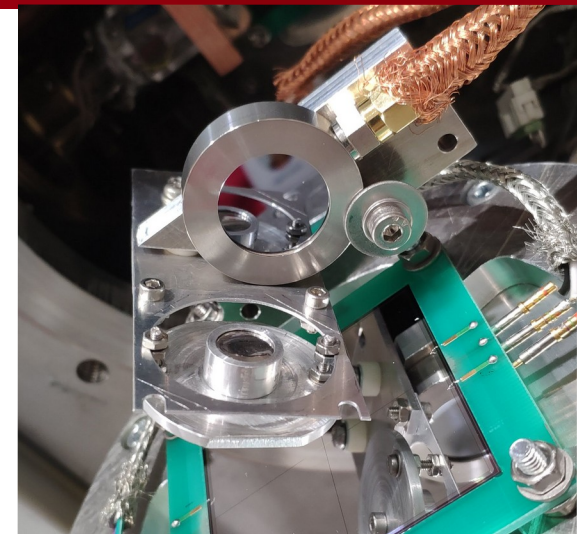
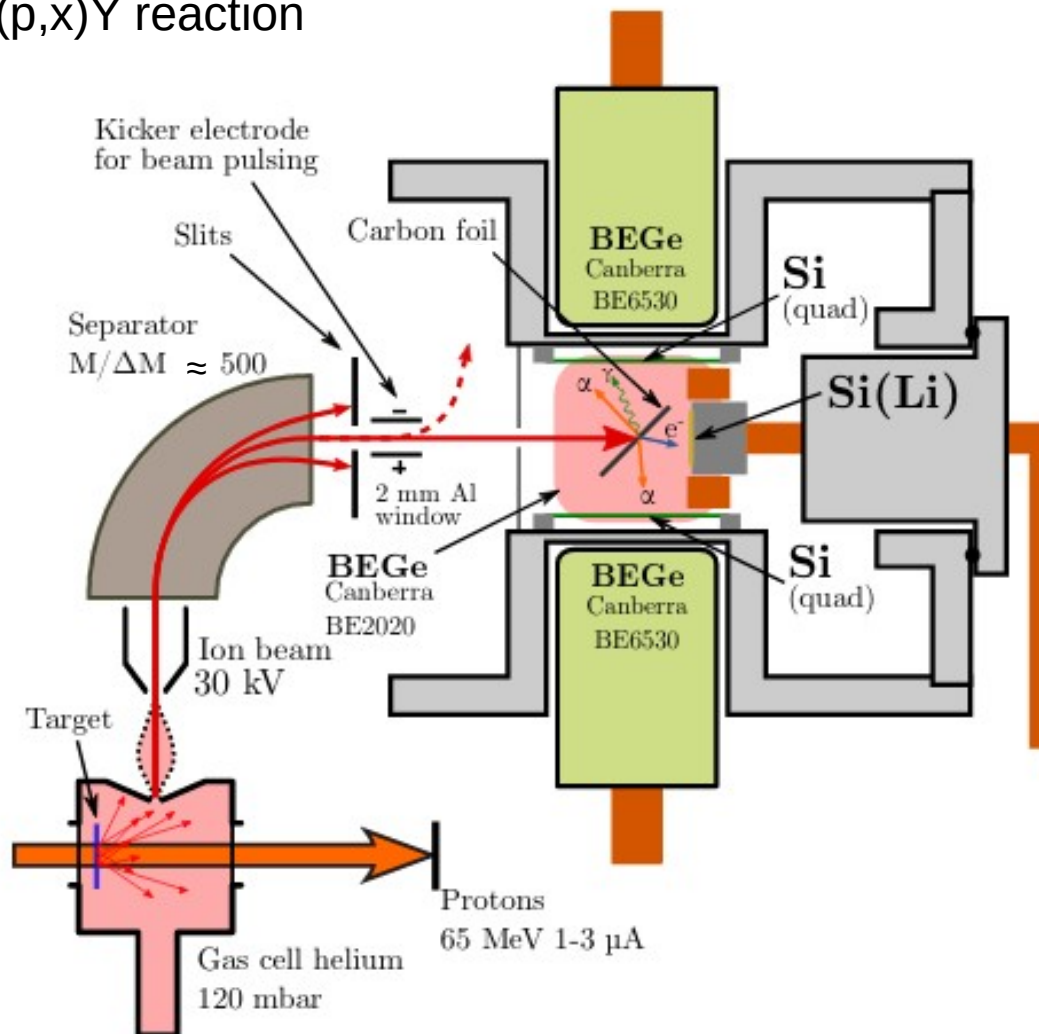


S. E. Agbemava *et al.* PRC 96 (2017)

Mass excess uncertainty in the neutron-deficient actinides. The nuclei produced through  $^{232}\text{Th}(p,x)Y$  reaction at IGISOL are highlighted in the green area.



## $^{232}\text{Th}(p,x)\text{Y}$ reaction



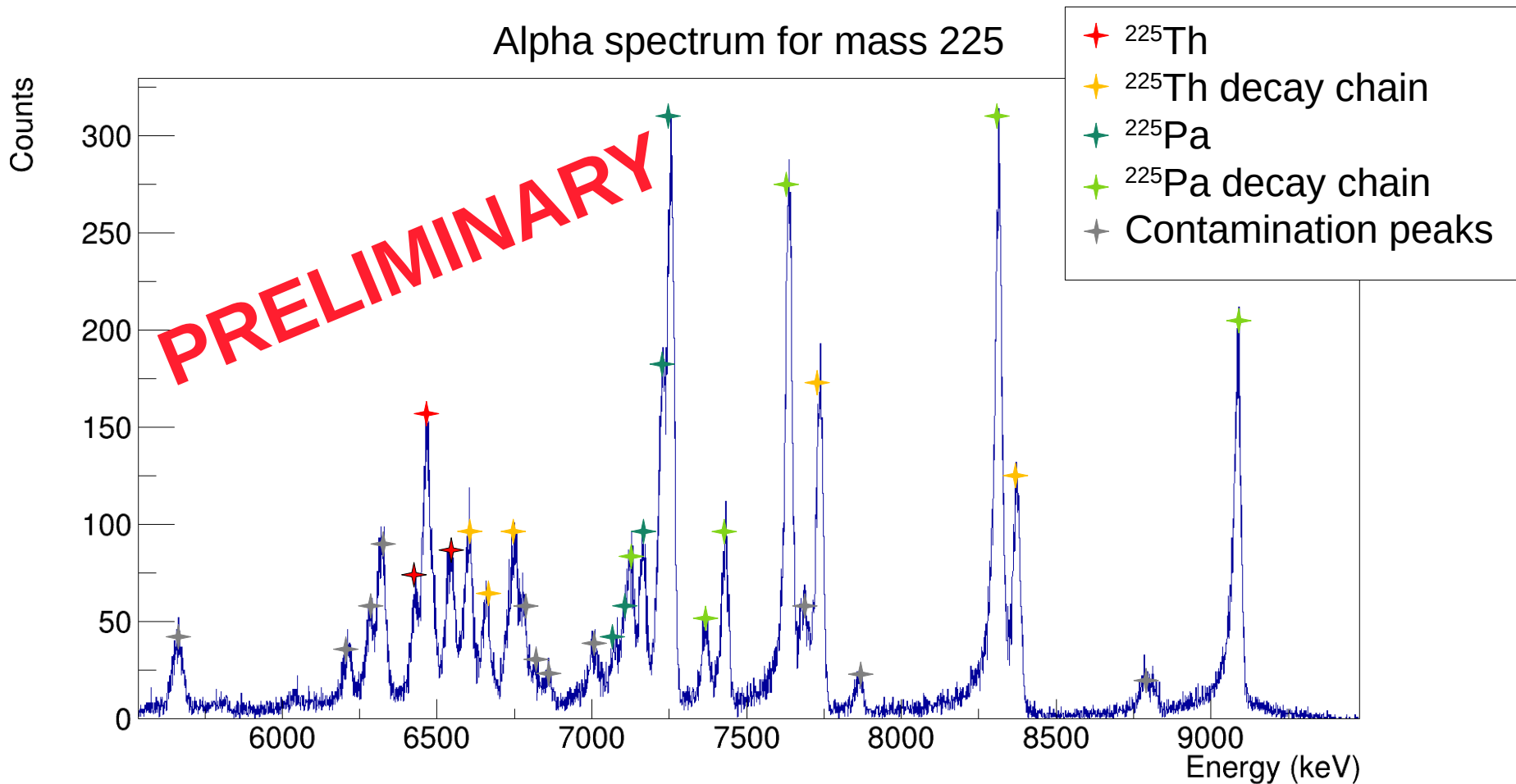
**On going analysis :**  
 $^{225}\text{Pa} \rightarrow ^{221}\text{Ac} \rightarrow ^{217}\text{Fr}$

Existing literature :

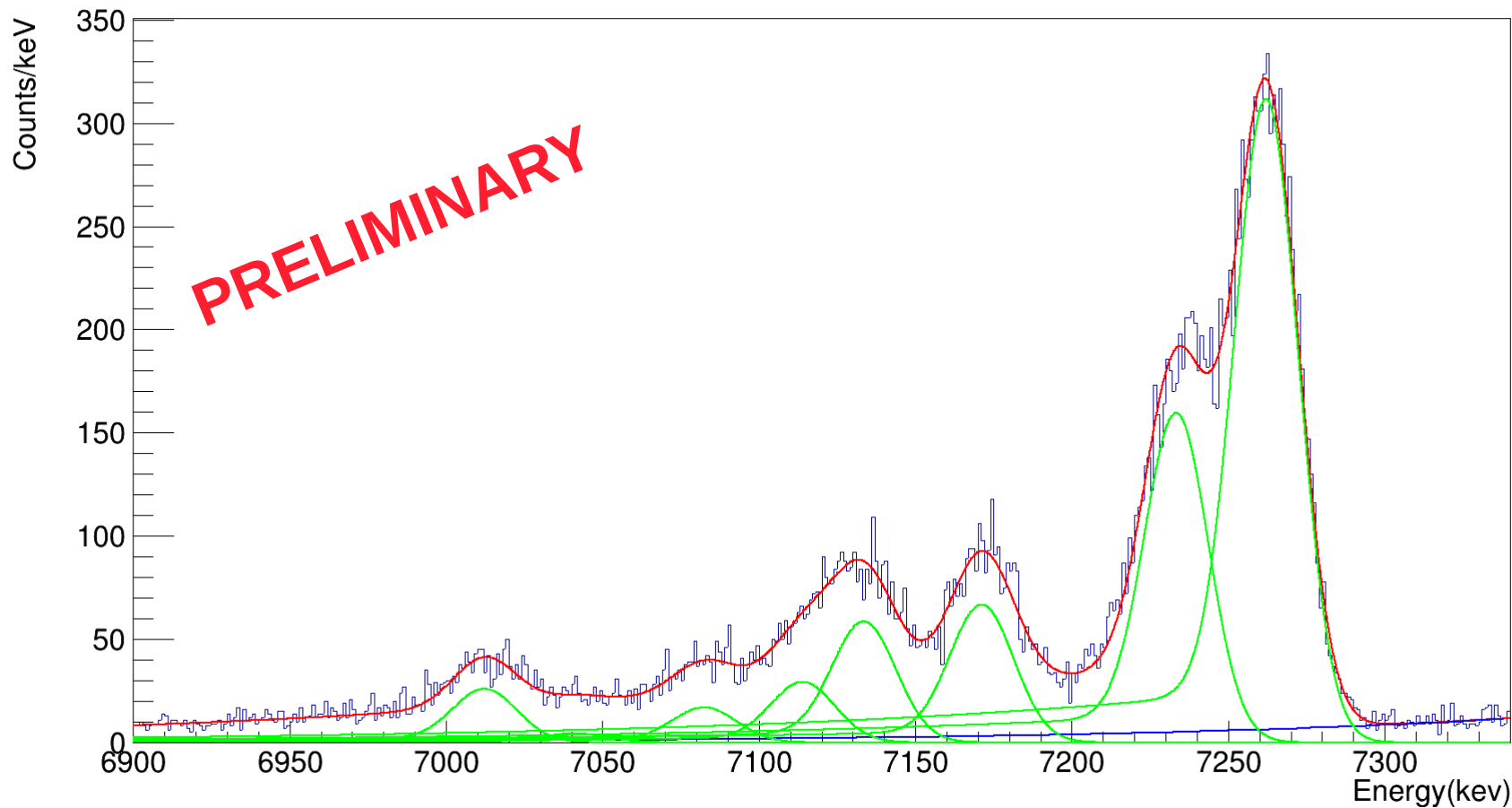
$^{225}\text{Pa}$  decay data

Element	Our work	
	$E_\alpha$ (keV)	$I$ (%)
$^{225}\text{Pa}$	7170(5)	17(1)
	7235(5)	30(2)
	7261(5)	53(2)
$^{221}\text{Ac}$	7373(5)	6(1)
	7437(5)	20(2)
	7641(5)	74(3)
$^{217}\text{Fr}$	8312(5)	
$^{213}\text{At}$	9080(5)	

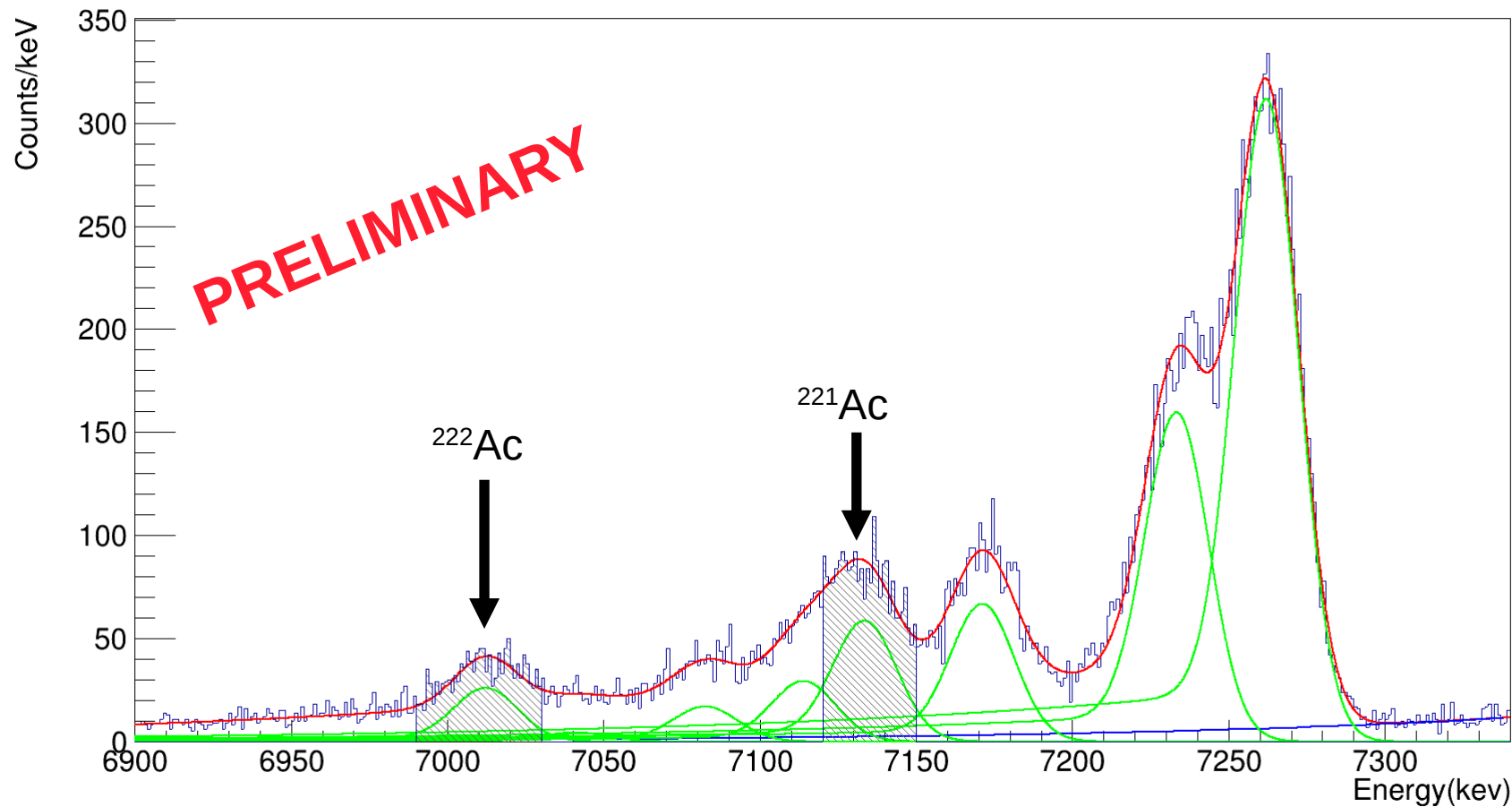
(1988) Nuclear Inst. and Methods in Physics Research, B, 31 (3), pp. 483-486

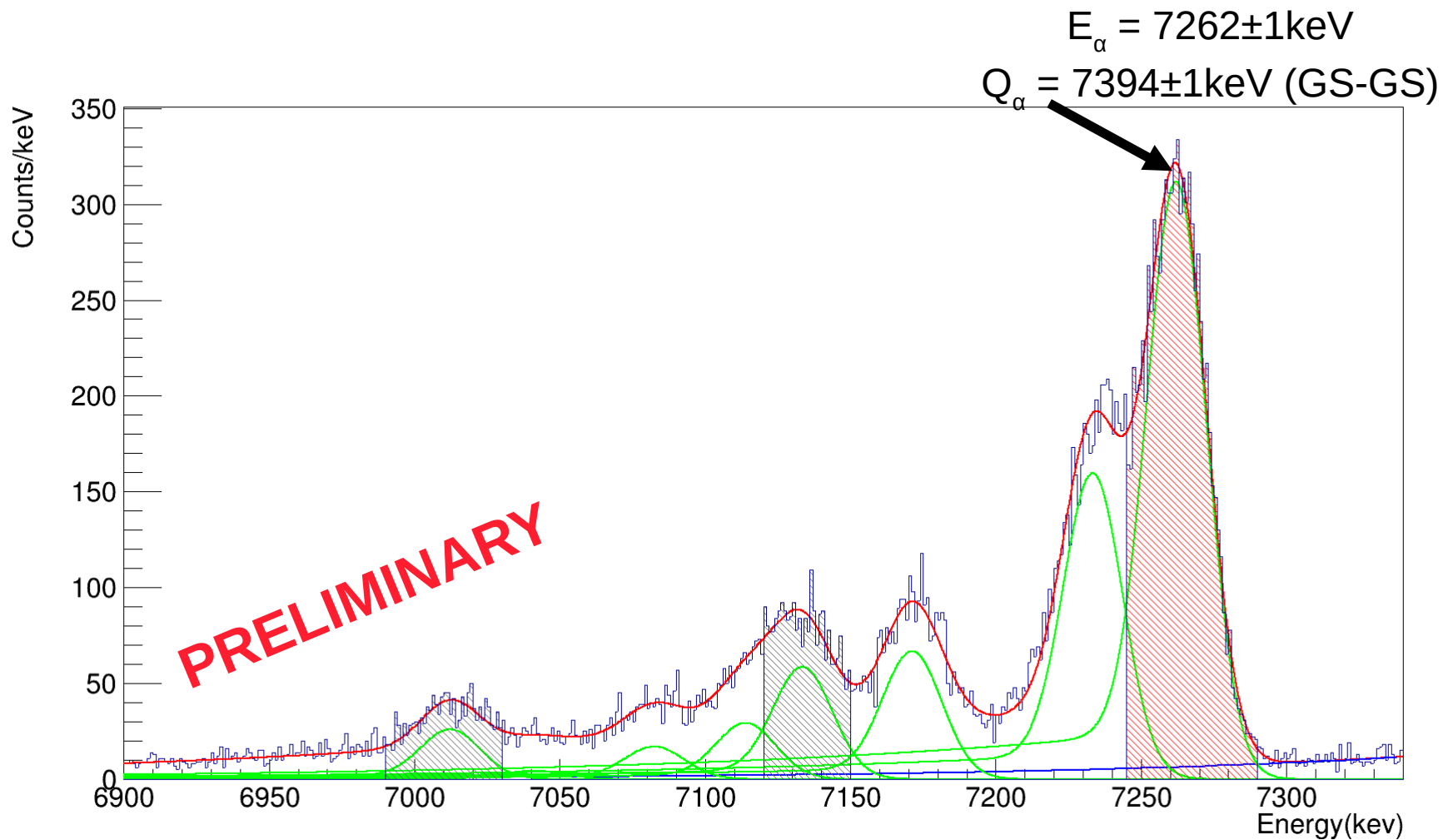


## Fit of alpha spectrum in the $^{225}\text{Pa}$ region



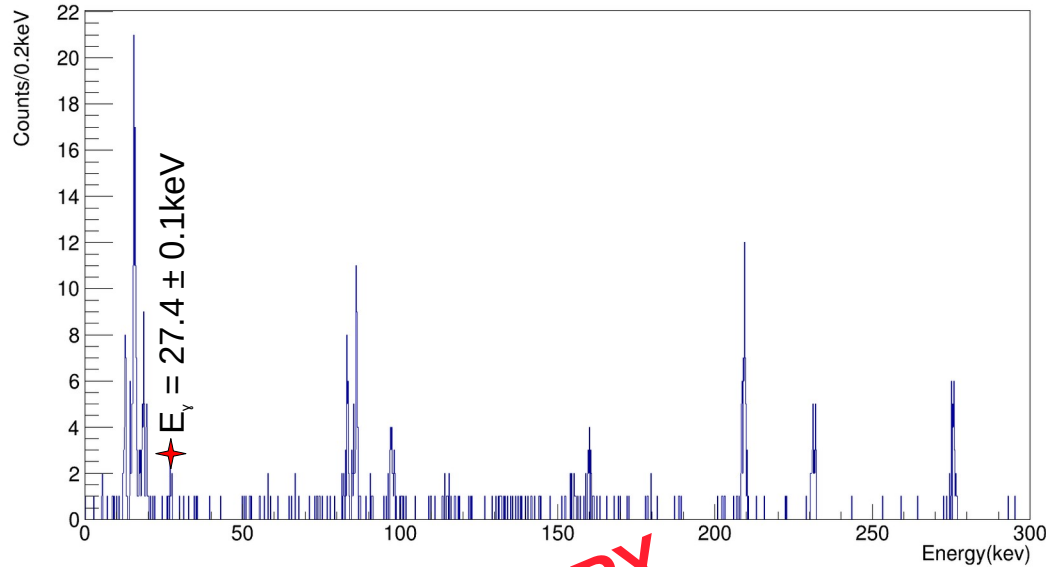
## Contamination Peaks



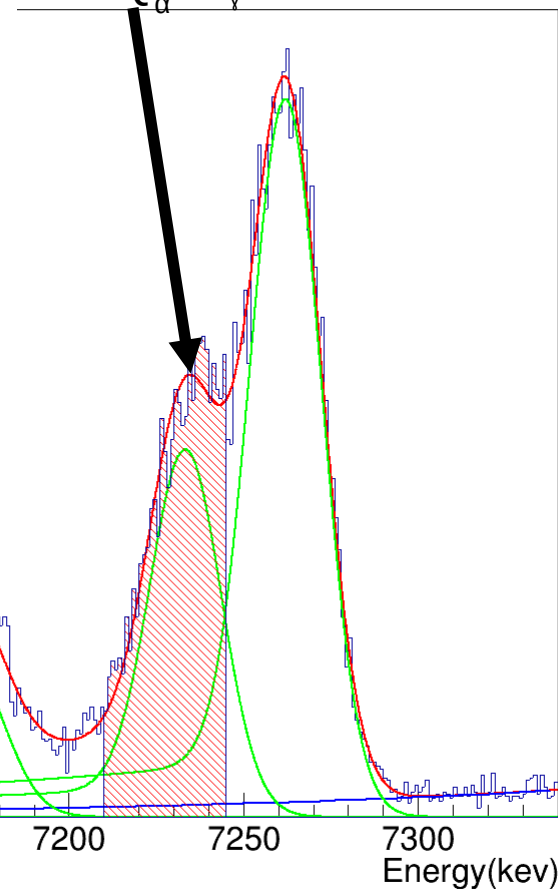




Energy gamma (Gate :  $7210 < E_{\alpha} < 7245$ )

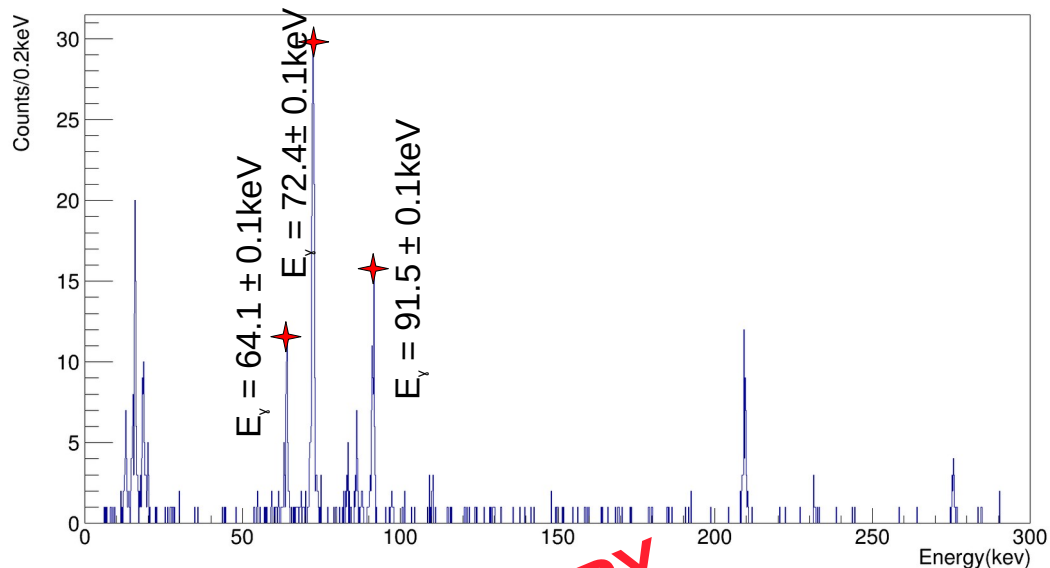


$E_{\alpha} = 7234 \pm 1 \text{ keV}$   
 $Q_{\alpha} + E_{\gamma} = 7392 \pm 1 \text{ keV}$



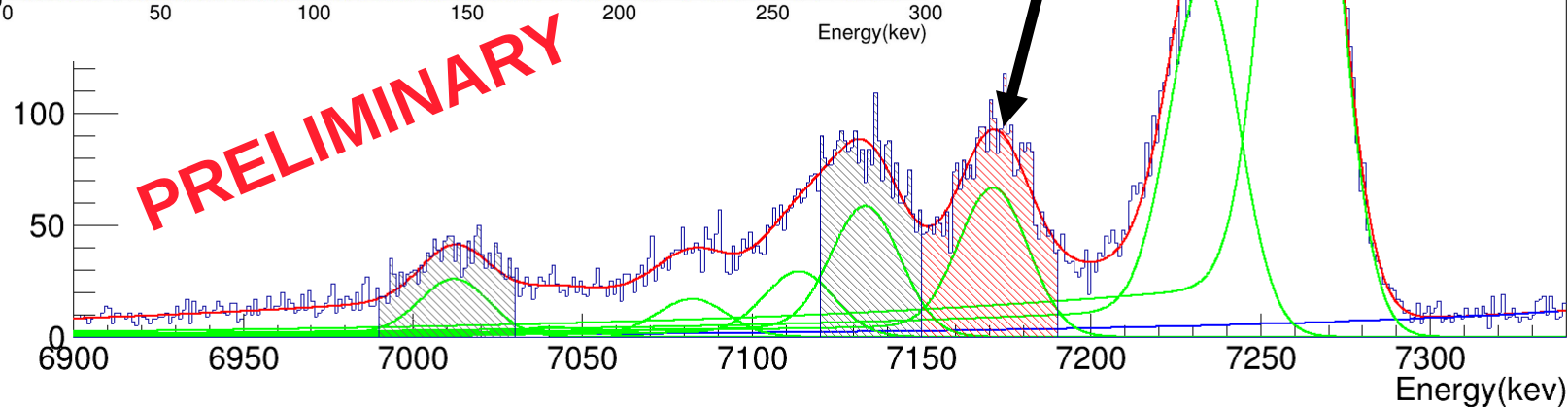
**PRELIMINARY**

Energy gamma (Gate :  $7150 < E_{\alpha} < 7190$ )

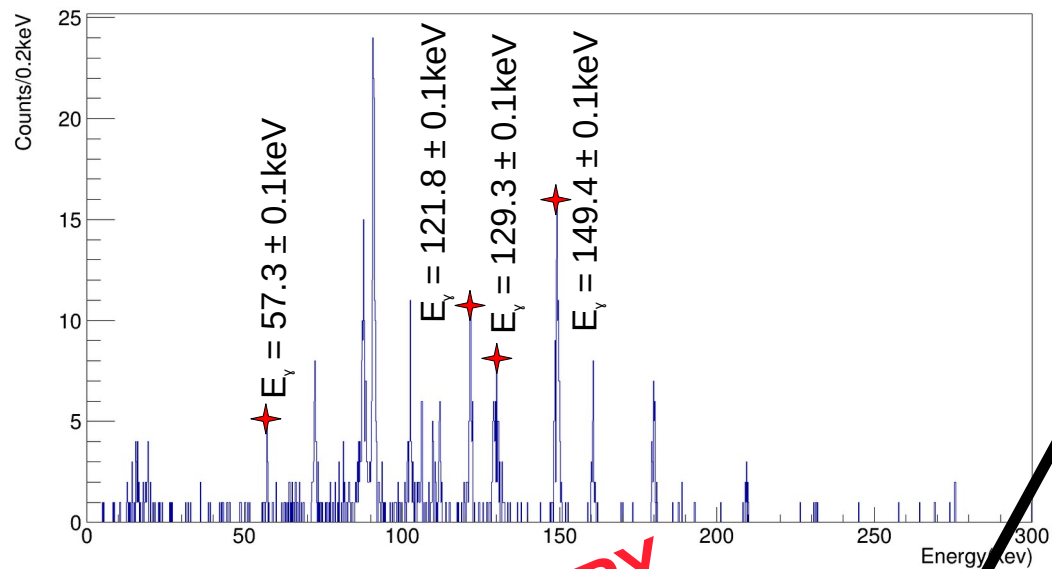


$$E_{\alpha} = 7172 \pm 1 \text{ keV}$$

$$Q_{\alpha} + E_{\gamma} = 7393 \pm 1 \text{ keV}$$

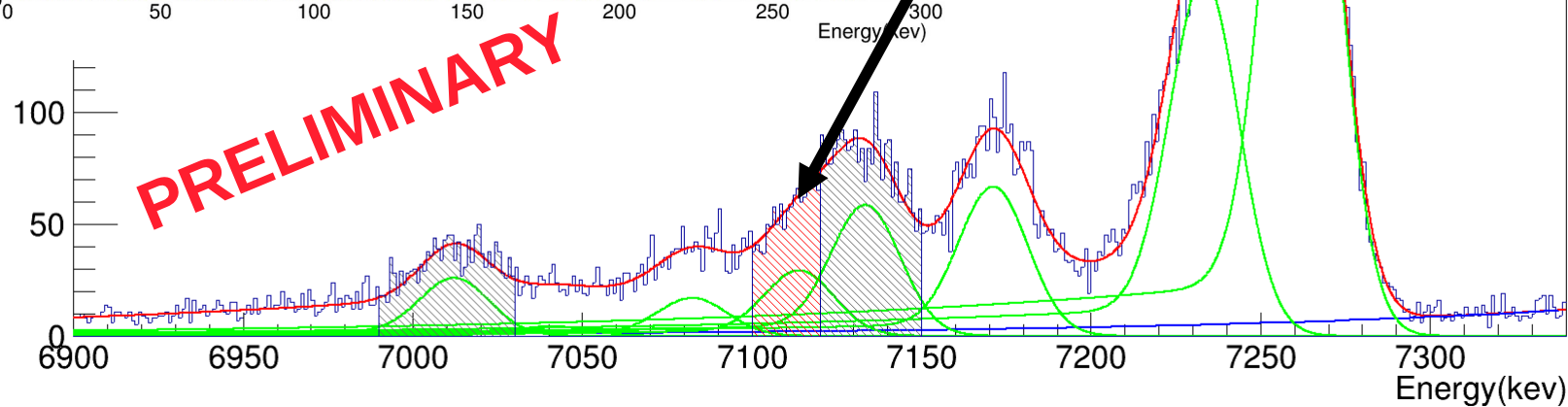


Energy gamma (Gate :  $7100 < E_{\alpha} < 7120$ )

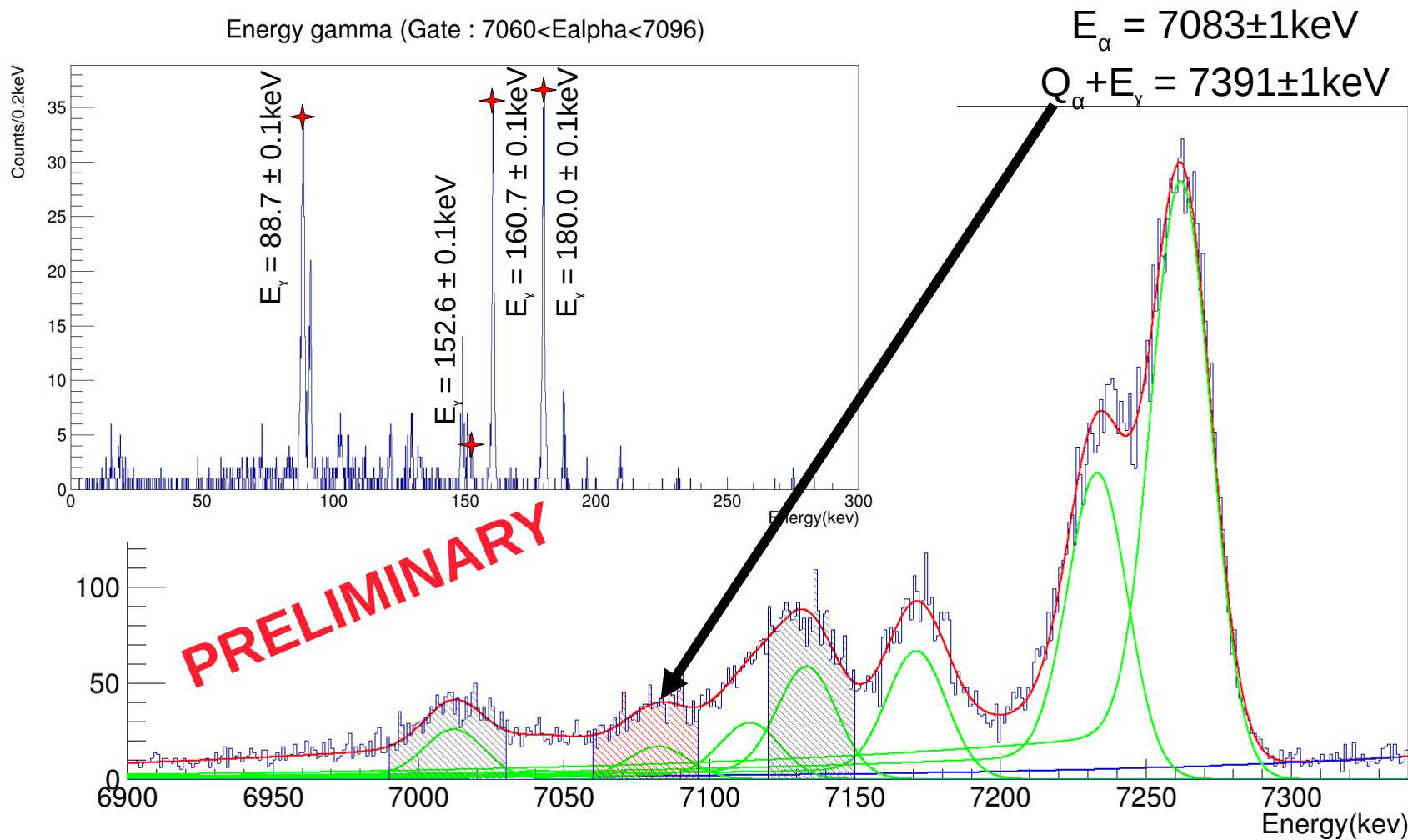


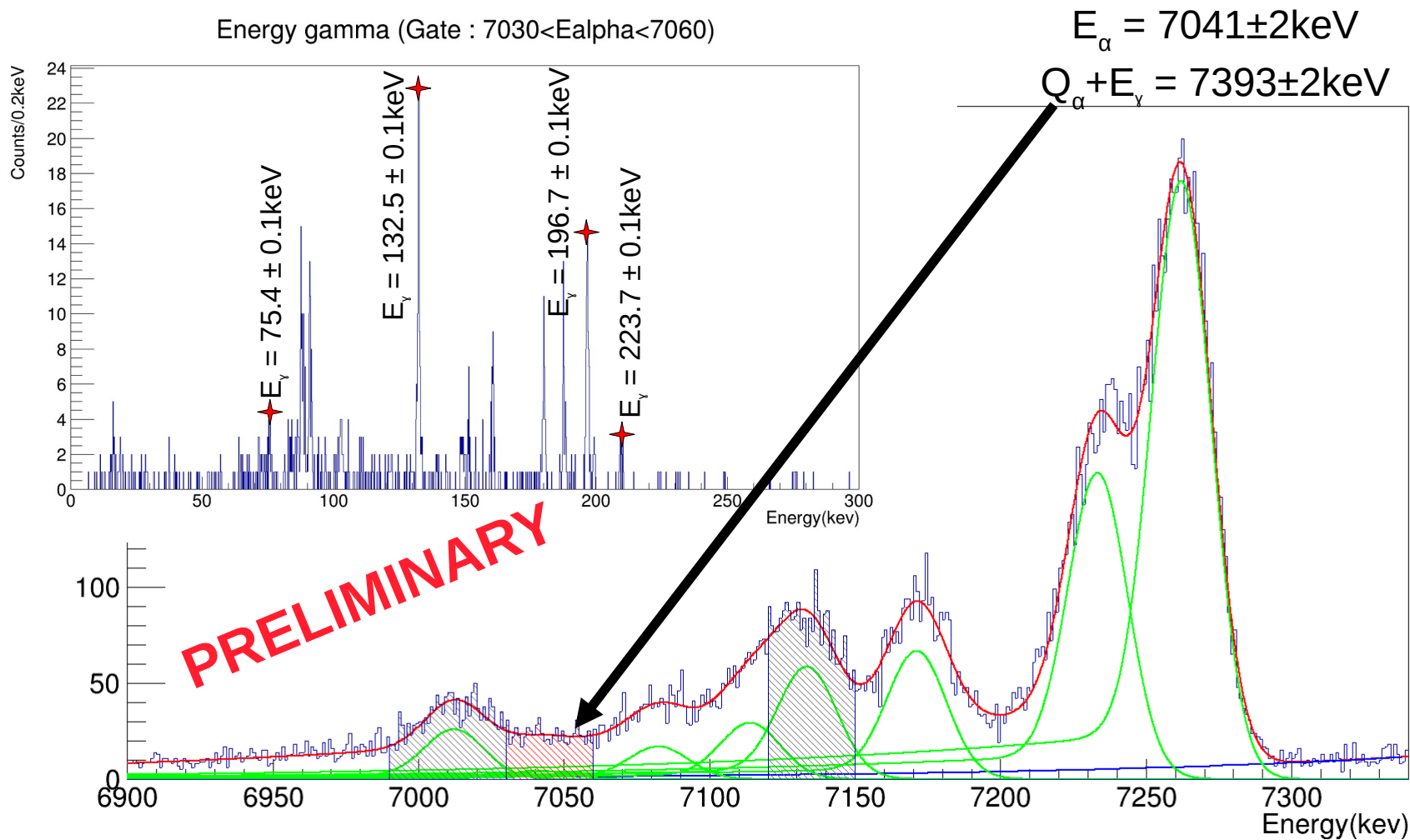
$E_{\alpha} = 7114 \pm 2 \text{ keV}$

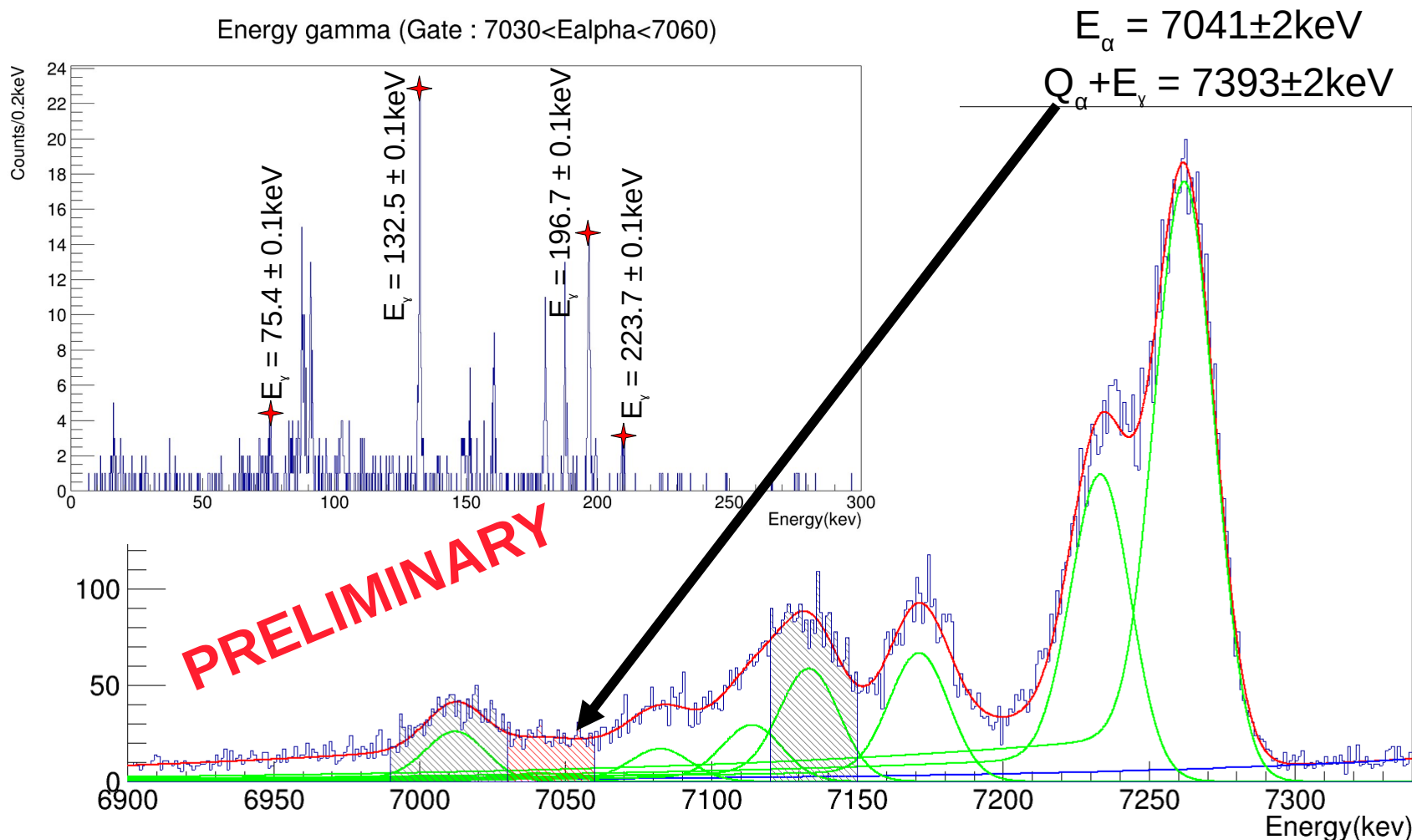
$Q_{\alpha} + E_{\gamma} = 7393 \pm 2 \text{ keV}$



Energy gamma (Gate :  $7060 < E_{\alpha} < 7096$ )

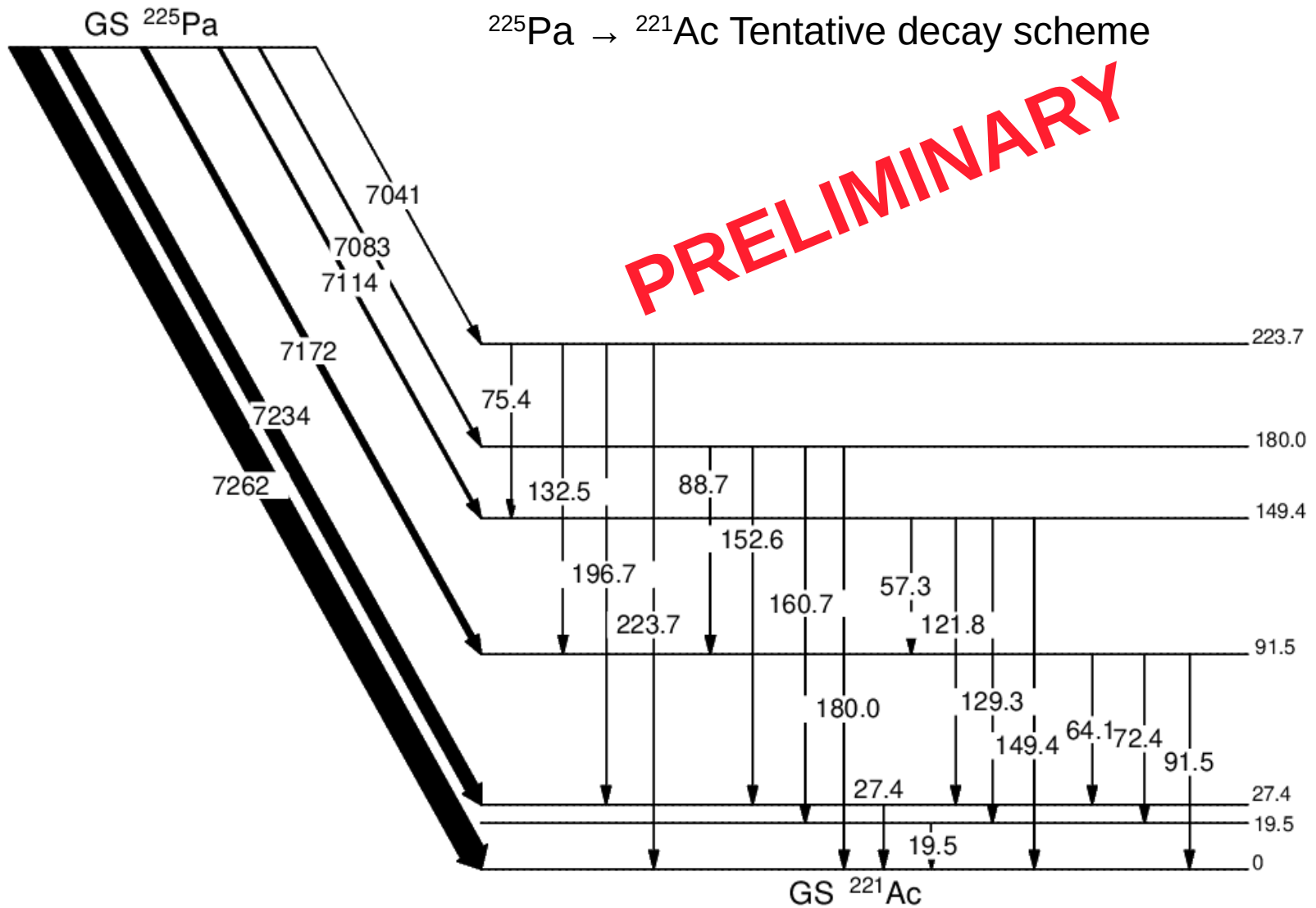






All measured  $Q_{\alpha} + E_{\gamma}$  are compatible within  $\pm 2 \text{ keV}$

Litterature GS-GS  $Q_{\alpha}$  :  $7390 \pm 50 \text{ keV}$     **This work :  $7392.7 \pm 0.5 \text{ keV}$**



To do list :

$^{225}\text{Pa}$  data analysis :

- Extraction the multi-polarities of the transitions
- Interpretation of the results

Continue the analysis with the  $^{221}\text{Ac}$  data

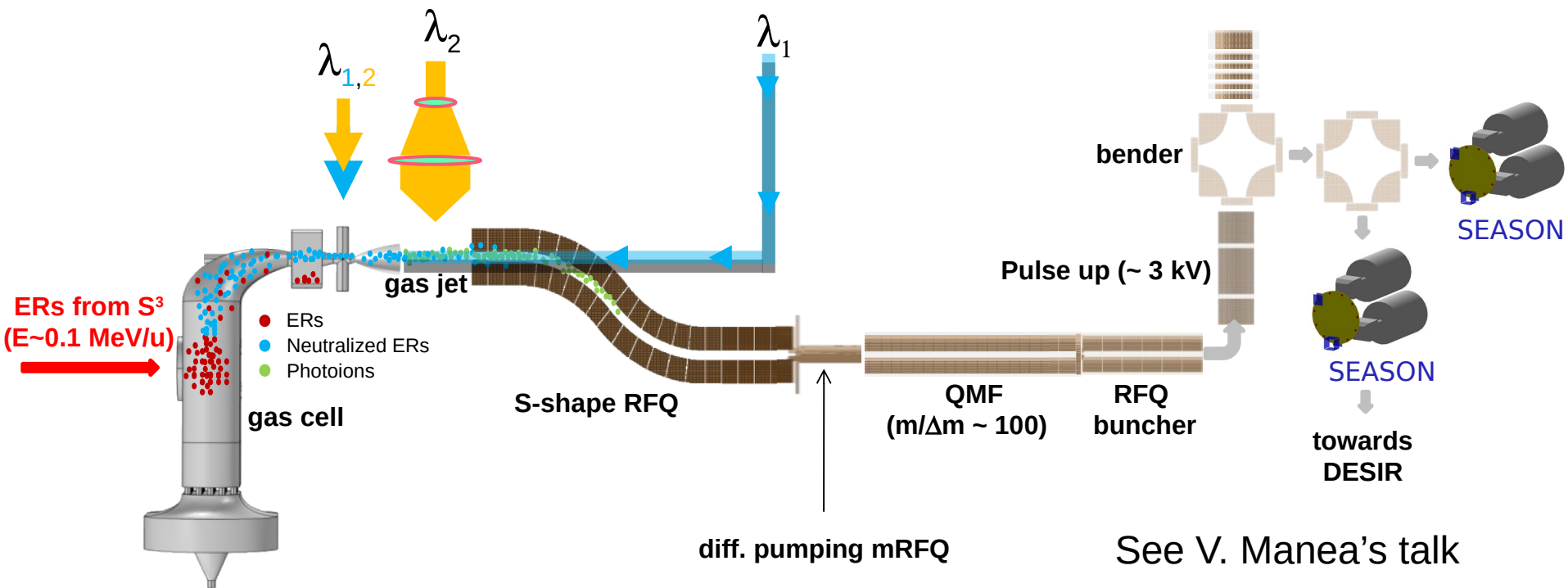
Future experiments planned :

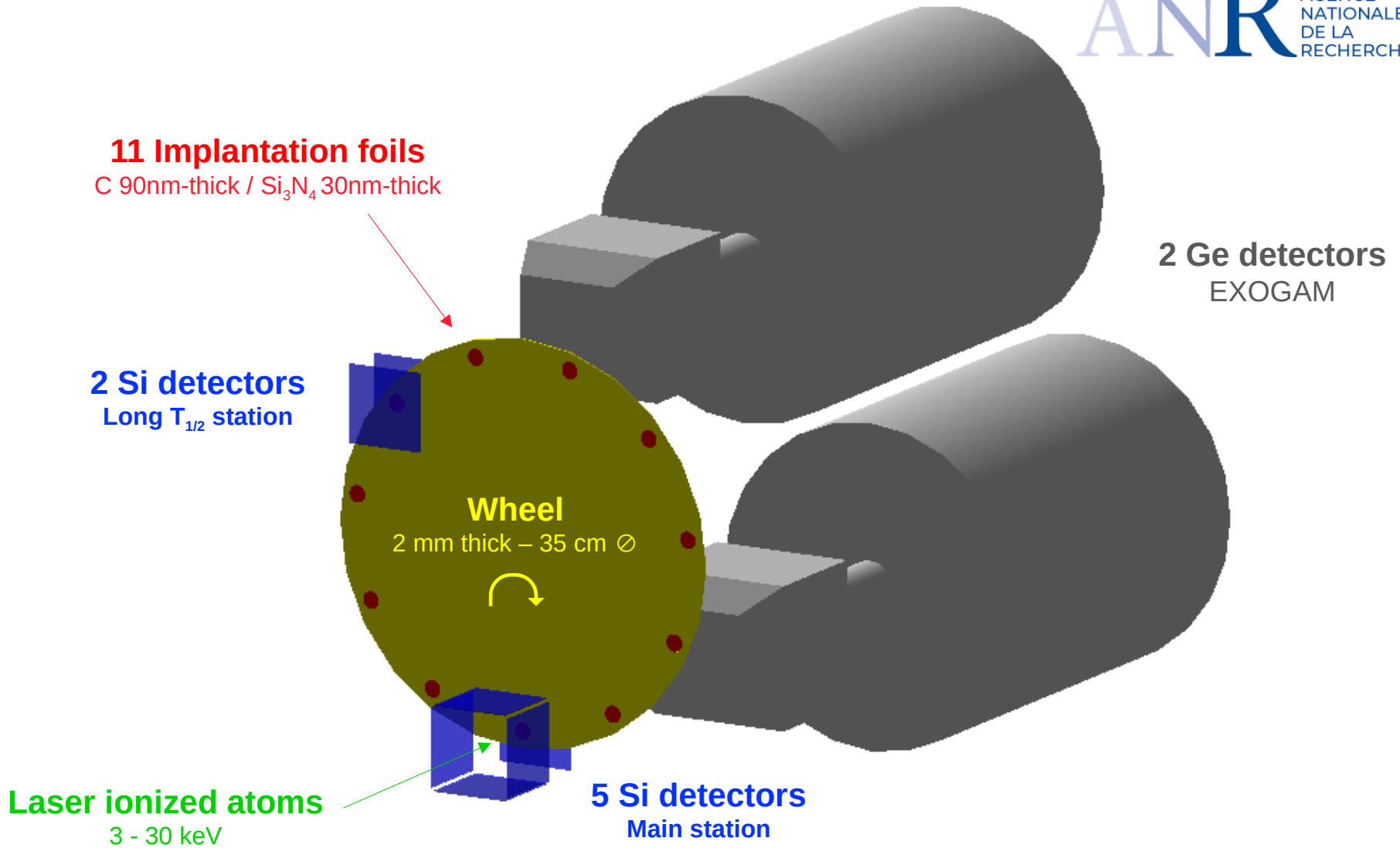
- $^{233}\text{U}(p,x)\text{Y}$  reaction at IGISOL
- Improve the decay spectroscopy setup using the SEASON detector at Jyväskylä
- Move toward laser spectroscopy with SEASON at Jyväskylä and at GANIL-SPIRAL2

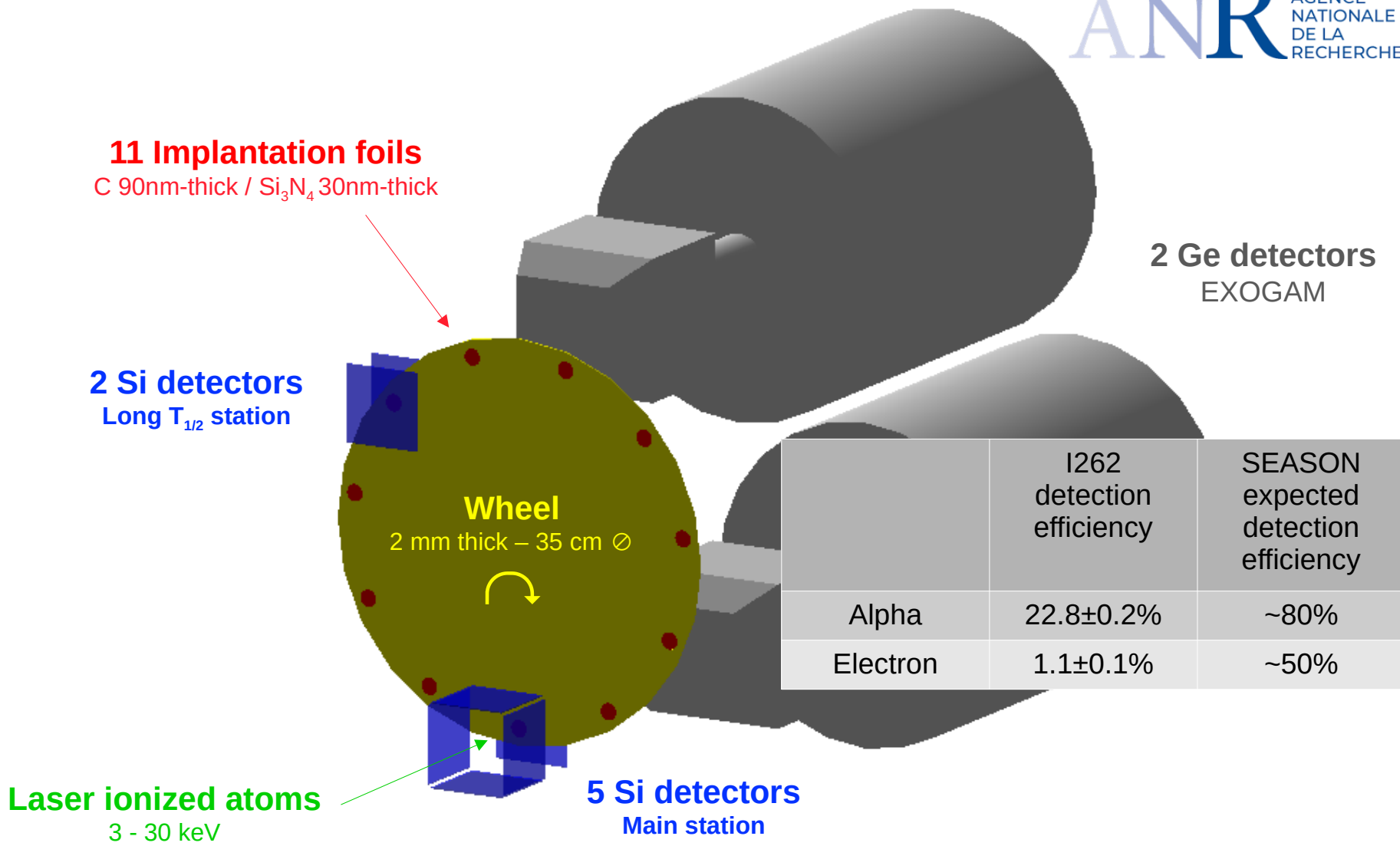


## SEASON (Spectroscopy Electron Alpha in Silicon bOx couNter)

- 1) Counting detector for laser ionization spectroscopy of HN/SHN
- 2)  $\alpha$  – electron –  $\gamma$  decay spectroscopy







Thank you for your attention !