The ^{32}S (p, γ) Resonance: A Measurement of Level Widths and Excitation Energies

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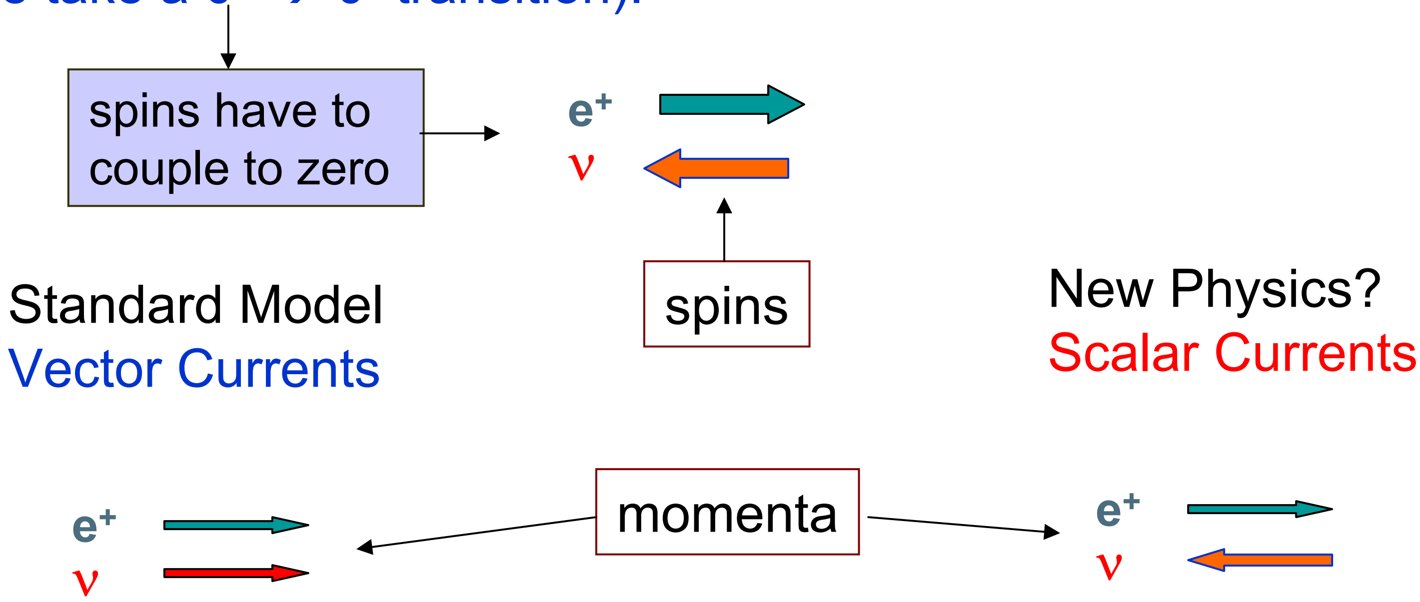
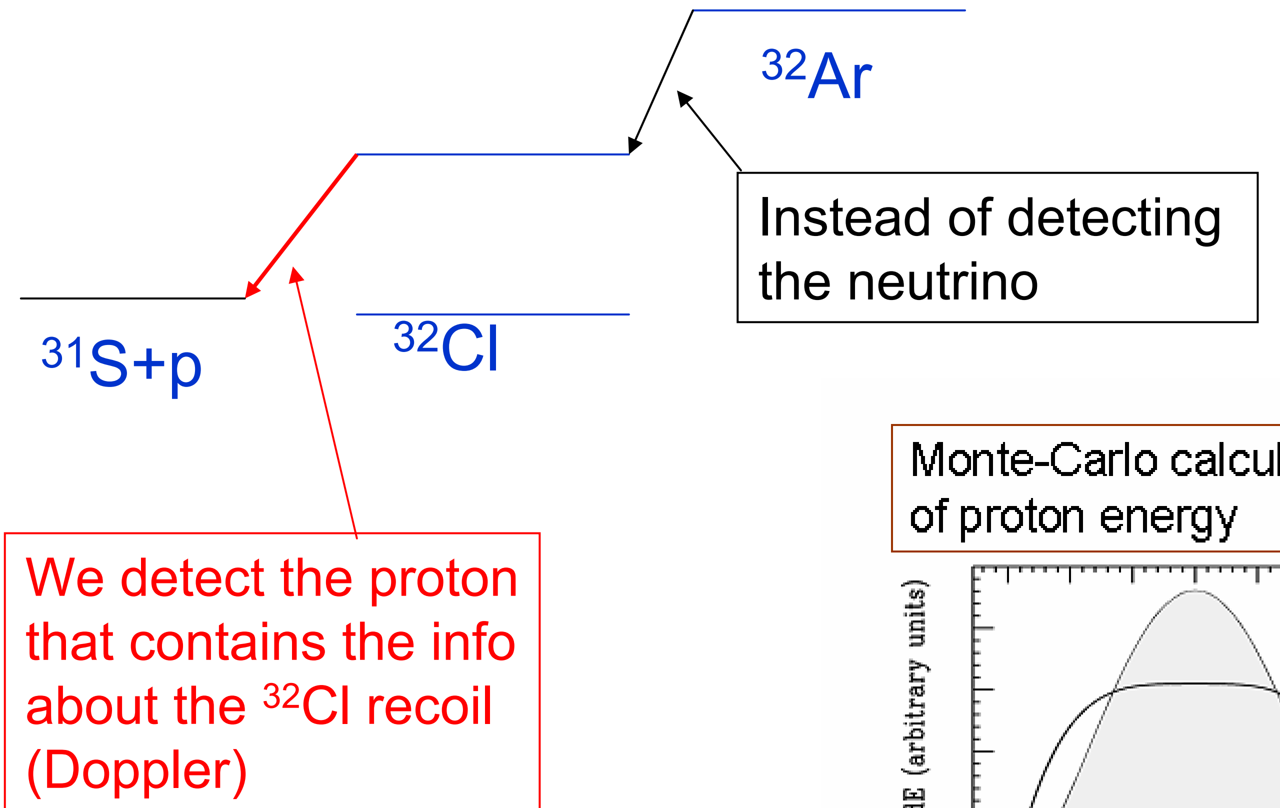
Finding New Physics in ^{32}Ar Decay

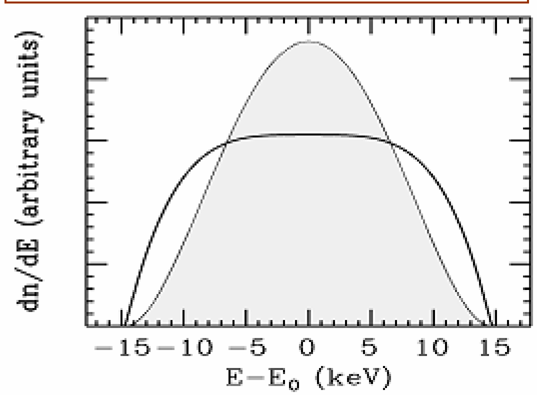
The e-ν correlation depends strongly on the nature of the carrier (we take a $0^+ \rightarrow 0^+$ transition).

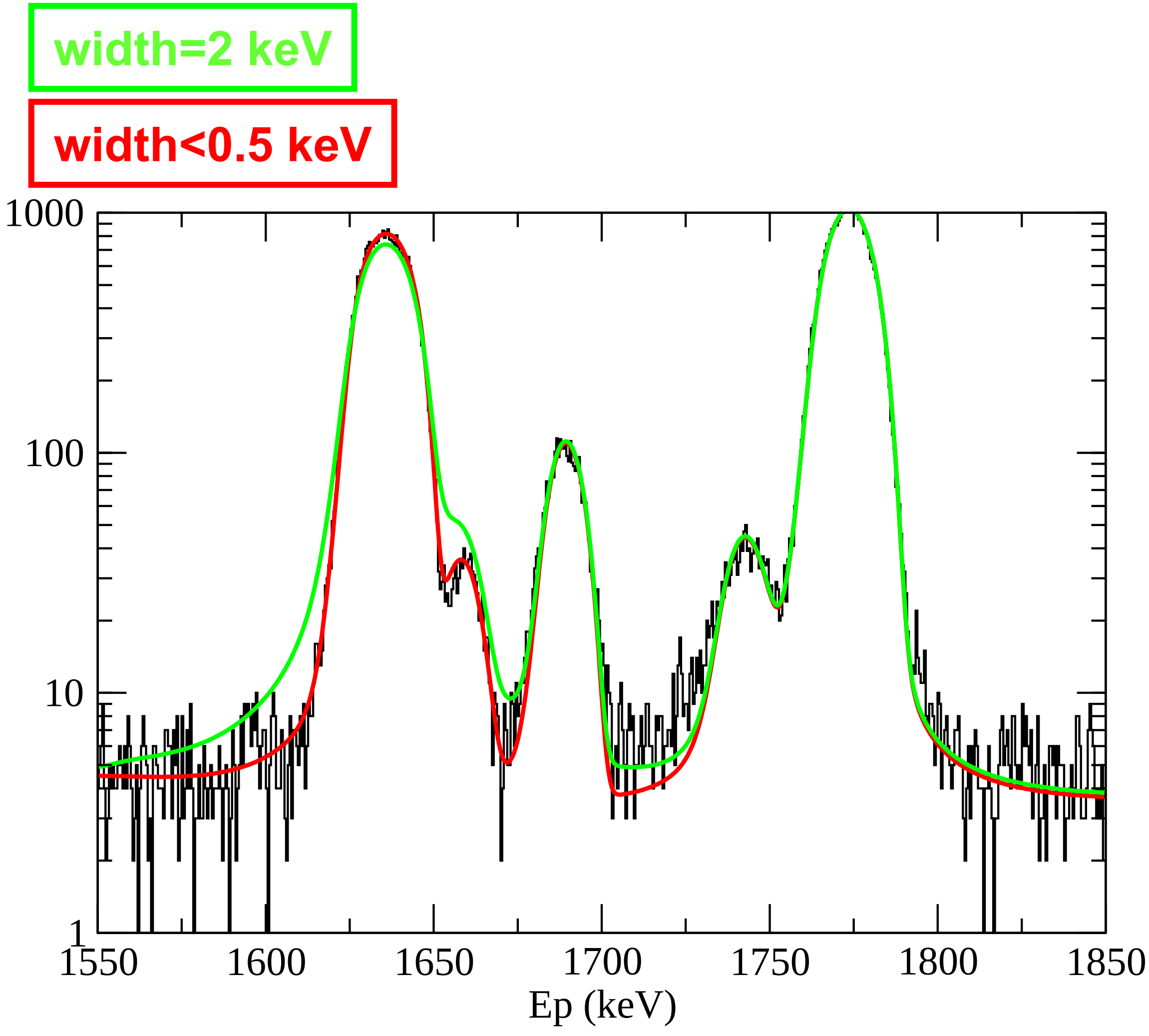


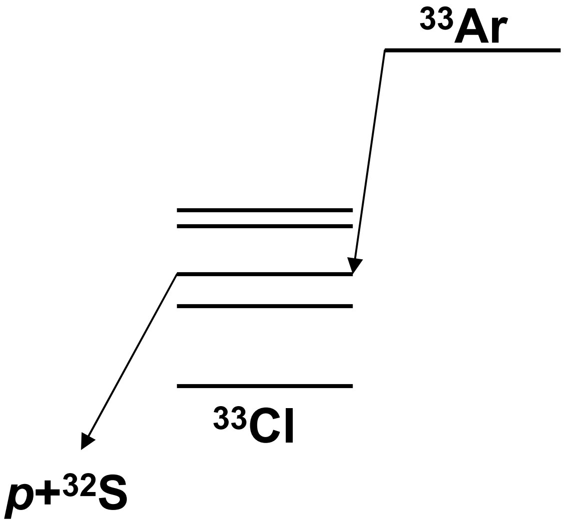
A trick to avoid detecting the neutrino



Monte-Carlo calculation of proton energy

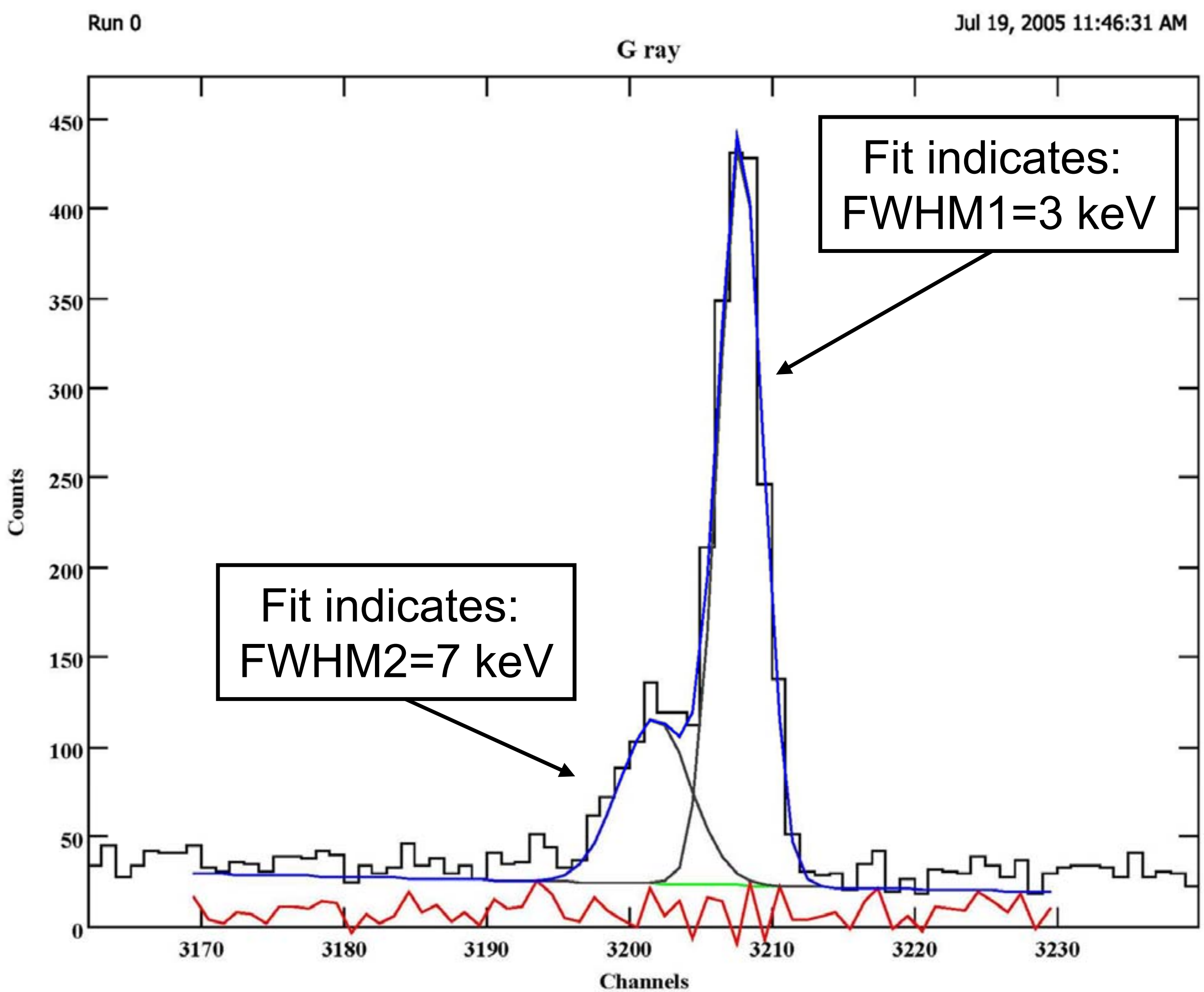






Energy peak width gives width of natural resonance in ^{33}Cl

But width from p+^{32}S seems much larger!



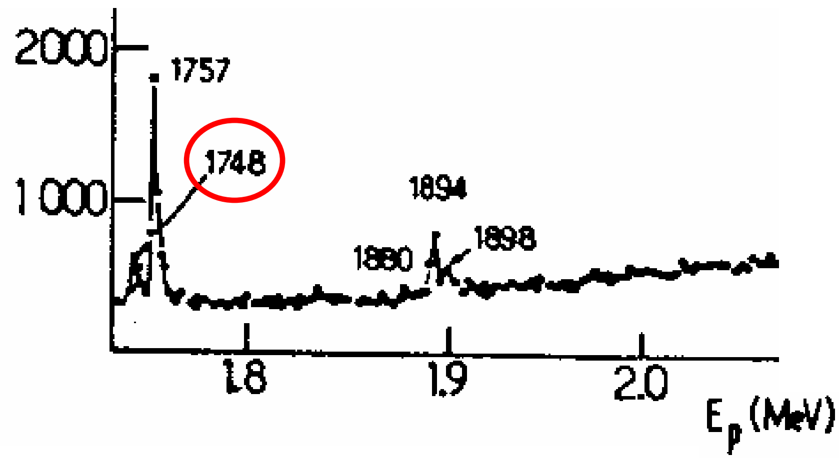
Gamma ray energy curve in thick target shows level of interest to be wide.

Width of Resonance Measured by M. M. Aleonard et. al, Nucl. Phys. **A257**, 490 (1976)

TABLEAU 1

Comparaison des énergies et des forces des résonances observées dans la réaction $^{32}S(p, \gamma)^{33}Cl$

E_p (keV) notre travail	E_p (keV) réf. [1]	E_x [a] (keV)	Γ [c] (keV) notre travail	notre travail
421.8±0.6 [b]		2865.5±0.4 [b]		(9 ±4)×10^{-5} [i]
579.8±0.6	579.9±0.5	2838.7±0.8		0.08 ±0.01 [i]
587.9±0.5	587.4±0.5	2846.6±0.7		0.21 ±0.03 [i]
720.7±0.6 [b]		2975.4±0.3 [b]		(1.4 ±0.6)×10^{-4} [i]
1587.8±1.1		3816.2±1.2		0.053±0.007
1748.4±1.0		3971.5±1.1	5±3	0.09 ±0.02
1757.2±0.9 [j]	1754.6±0.7	3980.4±1.0		0.38 ±0.04 [j]
1879.7±1.1		4099.2±1.2		0.019±0.008
1893.8±1.1		4112.9±1.2		0.07 ±0.02
1898 ±2	1900 ±2	4117 ±2	14±4	0.19 ±0.07
2229.4±1.3	2227 ±2	4438.3±1.4	2±1	0.30 ±0.04
2255.4±1.3	2257 ±2	4463.6±1.8		0.14 ±0.02
2547.2±1.5	2547 ±2	4746.5±1.5		1.4 ±0.2
2577 ±3		4775 ±3		(9.3 ±1.9)×10^{-2} [i]



Determining the Width of the Energy Peak

Purpose:

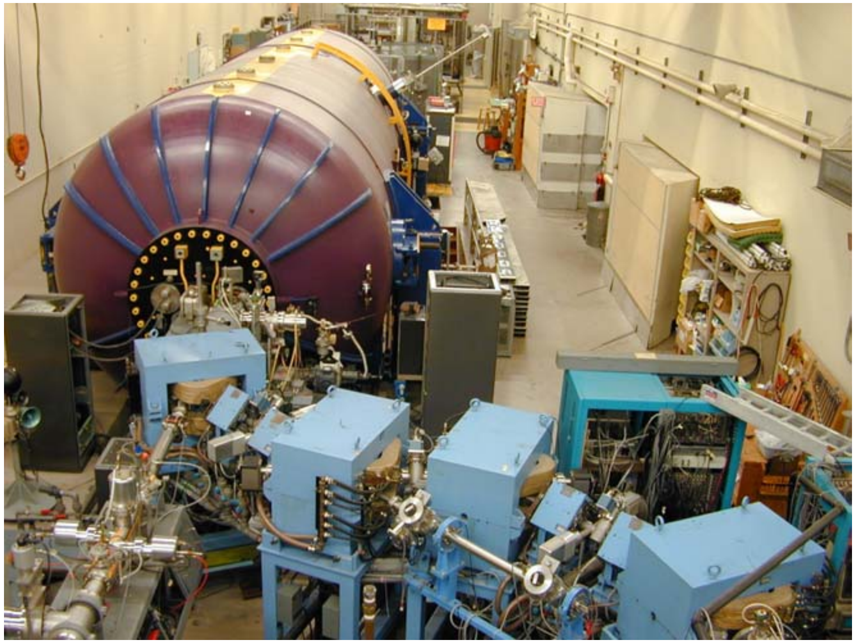
Confirm that the energy level in ^{33}Cl used for calibration from ^{33}Ar decay and the state populated via ^{32}S+ *p* are the same.

Method:

^{32}S + *p* excitation function

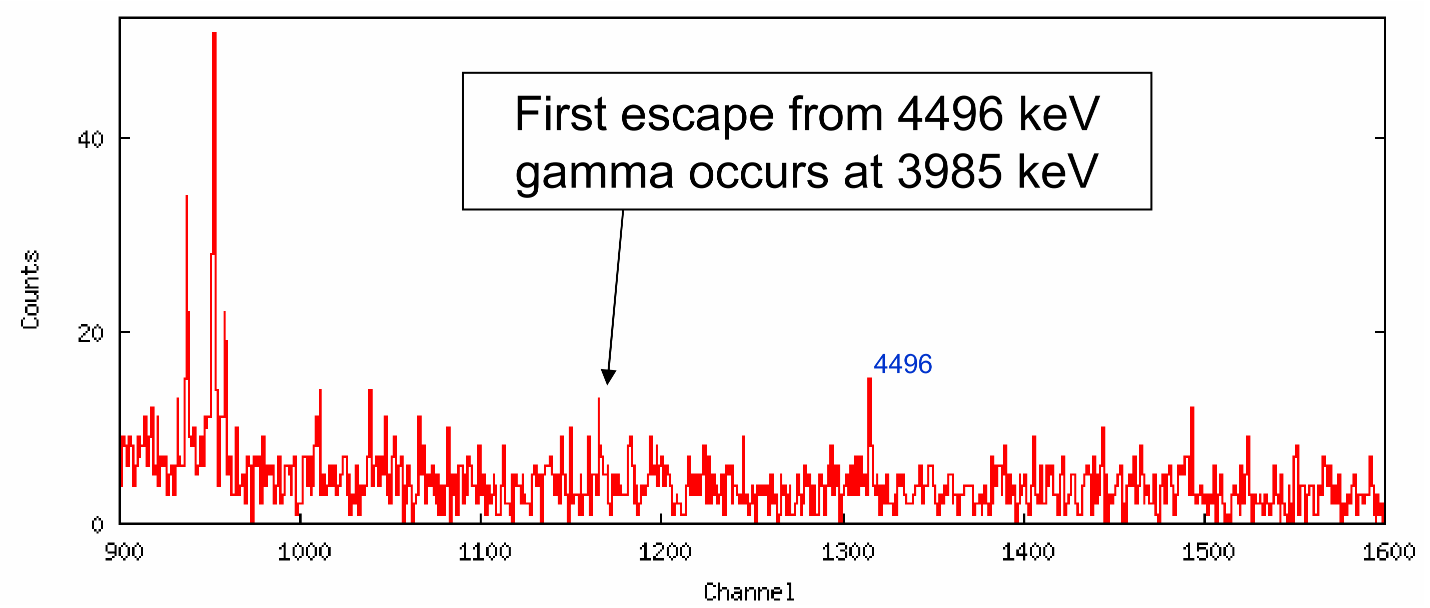
Summary of my projects

- Target preparation
- Accelerator training
- Checking energy resolution of Ge detectors
- Making some hardware
- Running the experiment
- Monte Carlo calculations



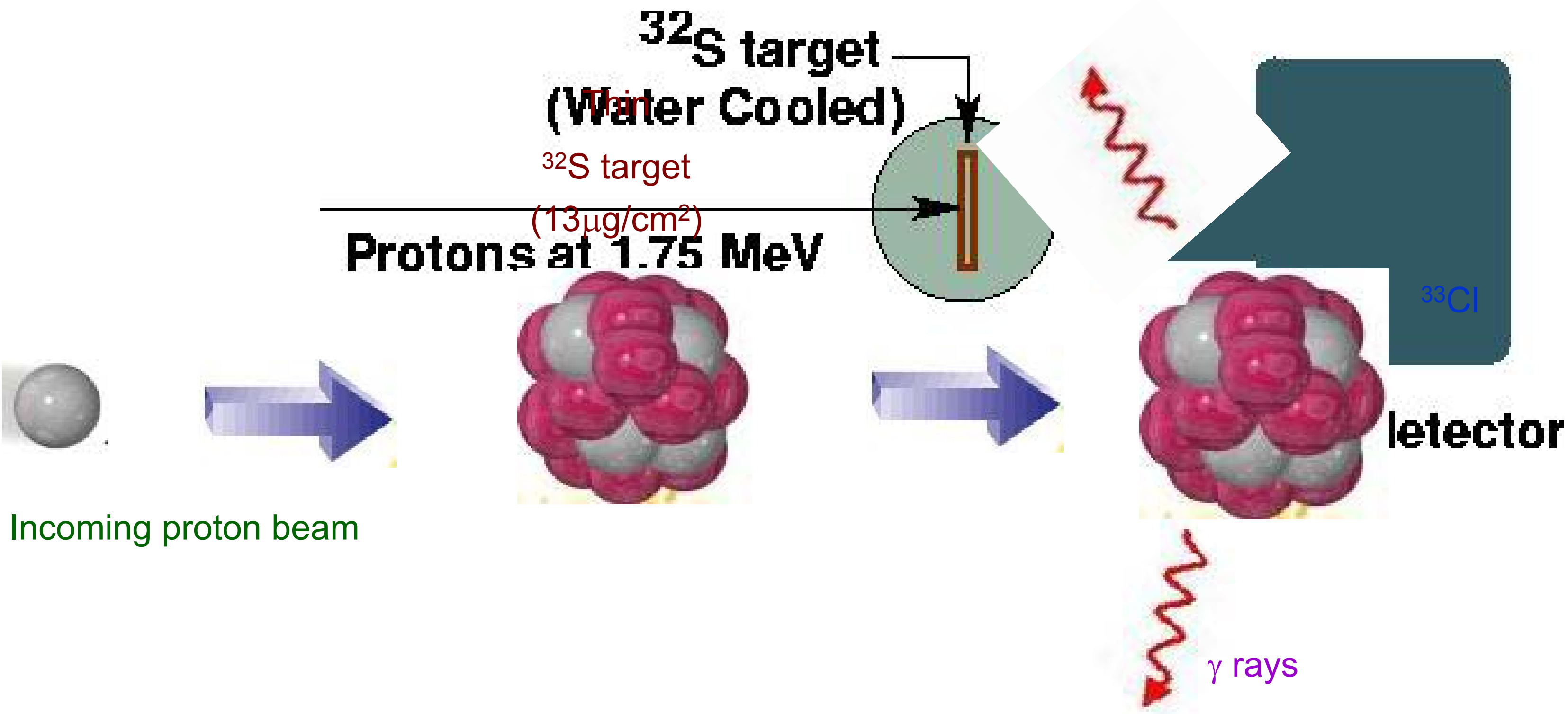
Making the Sulfur Targets

- Under vacuum, evaporate Ag_2S on thin Carbon foils
  - Test target with beam
  - Carbon caused background



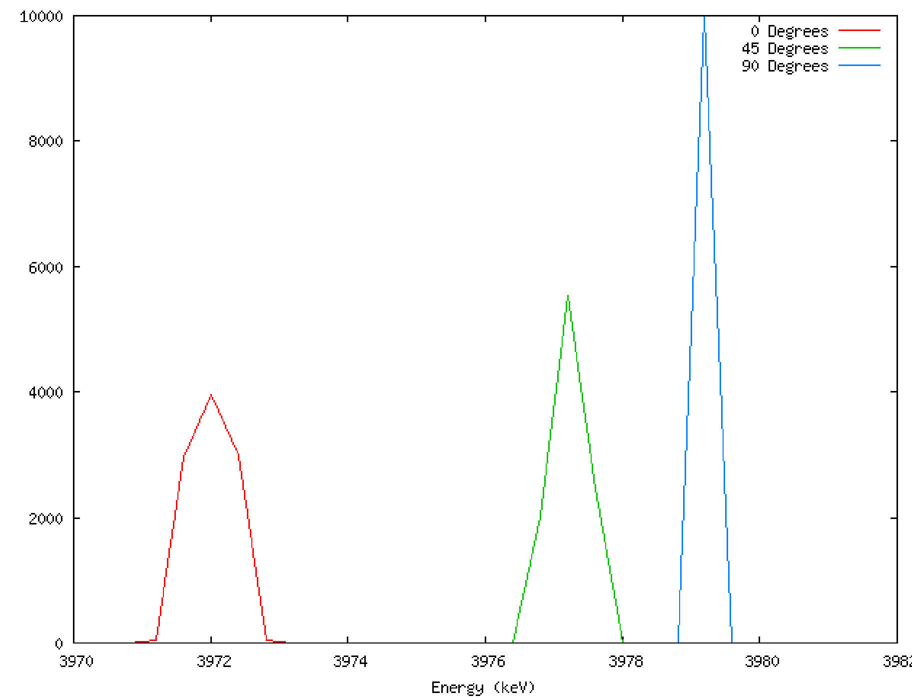
- Use new method to make Ag_2S target without evaporator.
  - Test target thickness by impinging protons

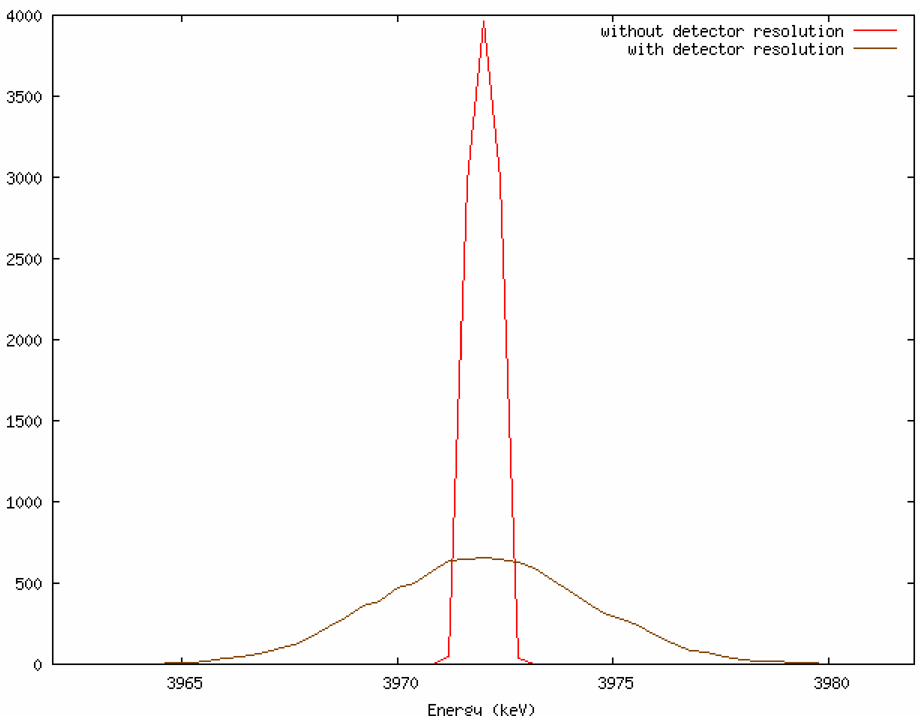
The Experiment



Monte Carlo Calculations to Show Gammas Incident on a Ge Detector

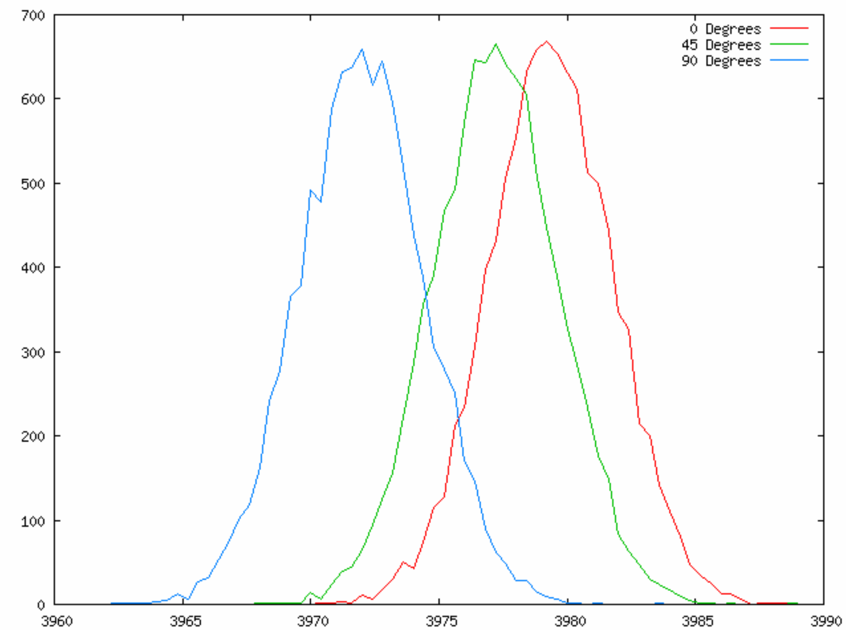
- Simulation of Doppler broadening across face of detector





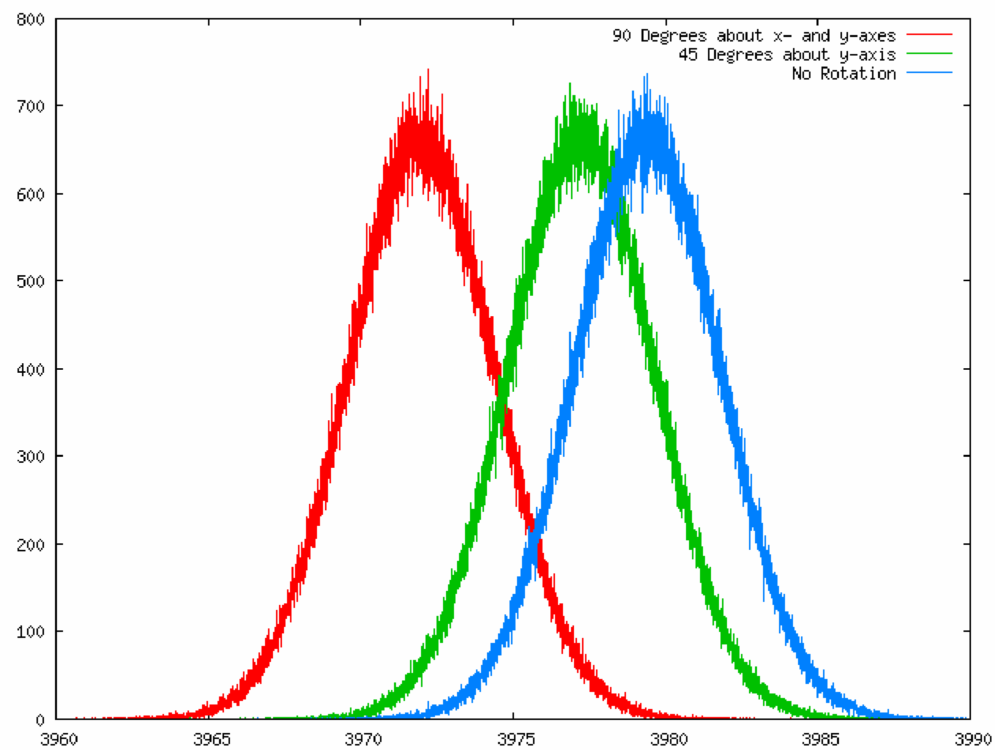
- Simulation to take detector resolution into account.

More Precise Calculations

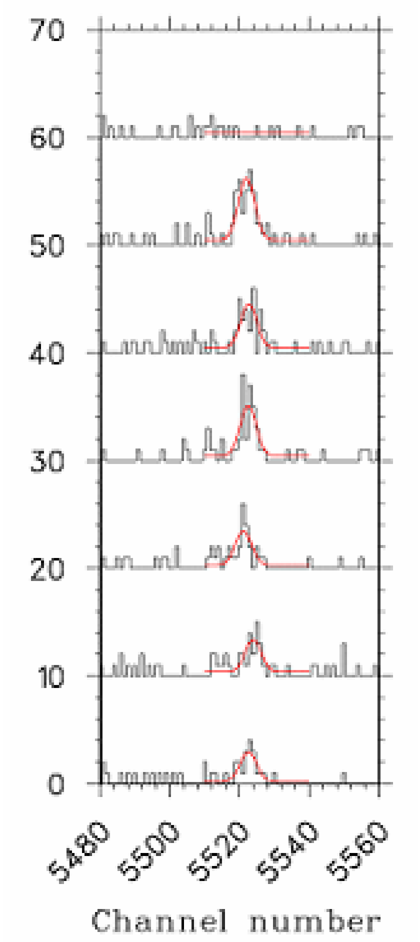


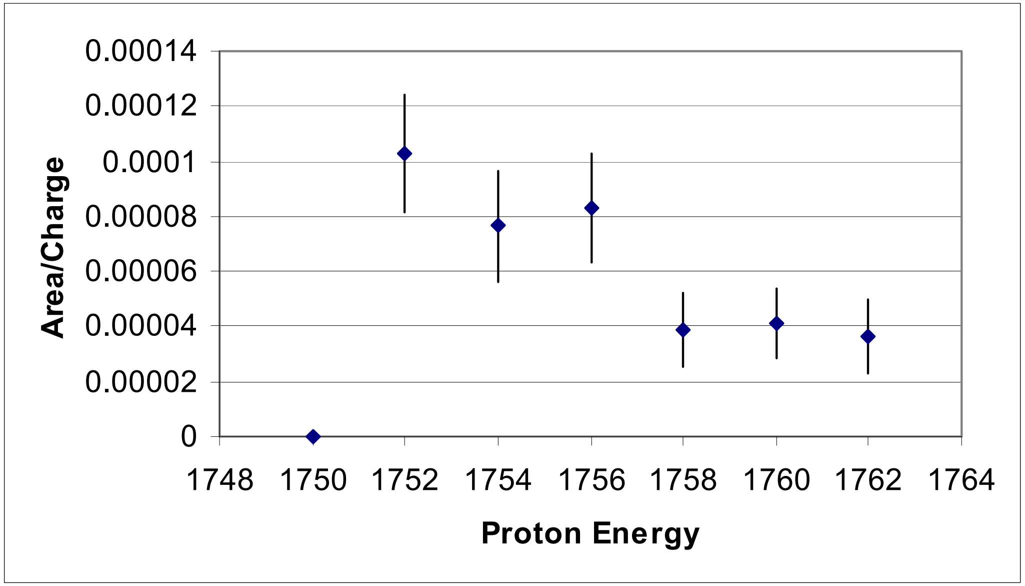
- Monte Carlo with energy loss through the target

- High statistics calculation with rotations about x- and y-axes

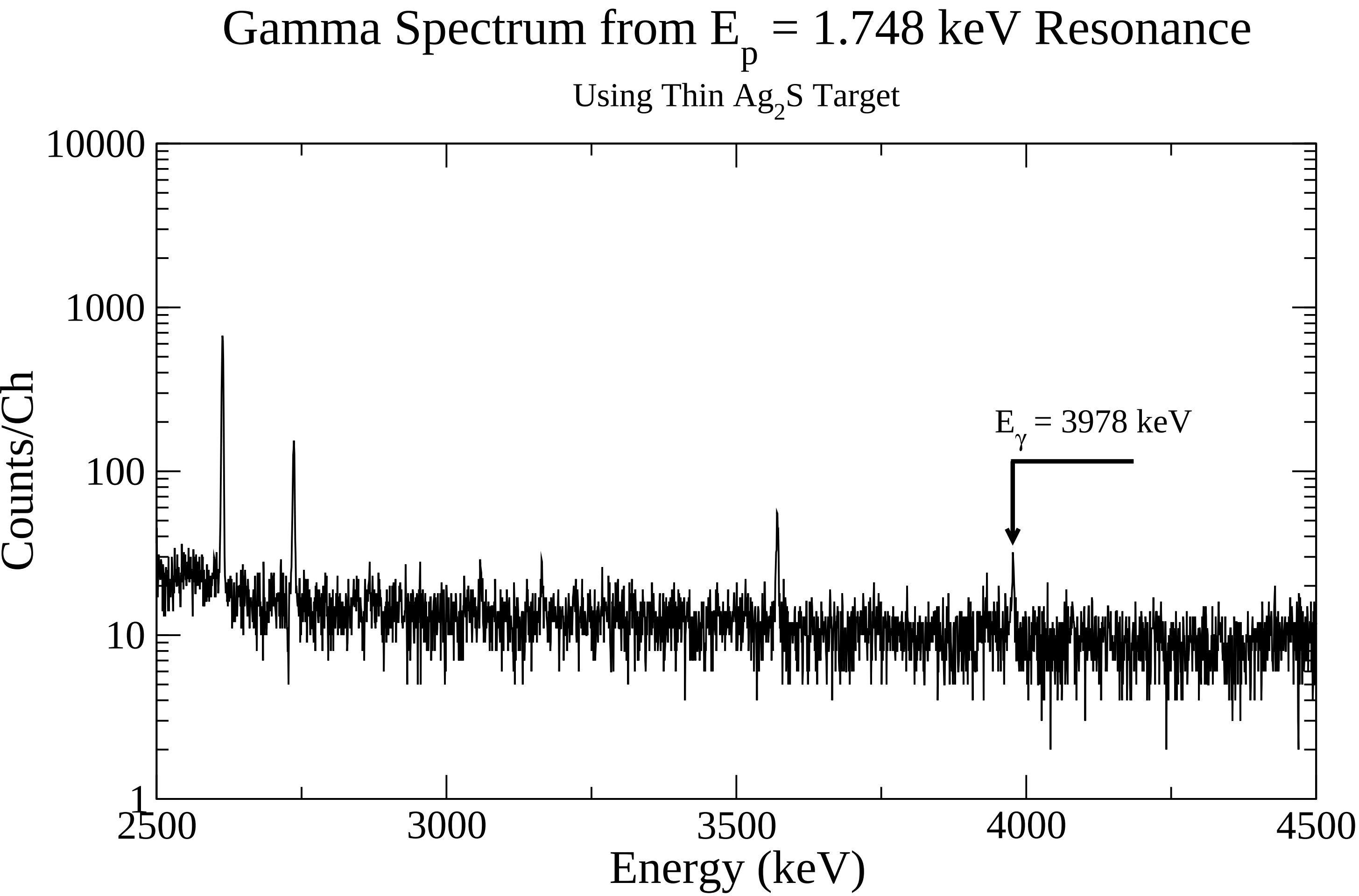


Preliminary Data & Excitation Function





Resonance of Interest : New Target works!



Width < 3 keV

Acknowledgements

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