Lifetime and Coulex Measurements in A=46 Isobars

Scott Alexander Milne, sam519@york.ac.uk

(and Alberto Boso, alberto.boso@pd.infn.it)

AGATA Collaboration Meeting 2014

AGATA
ADVANCED GAMMA TRACKING ARRAY

Overview

- Nuclei of Interest
- Motivation/Previous Studies
- The Experiment at GSI
- Triple Gold Plunger Target
- Preliminary Analysis
- Conclusion/Future Work

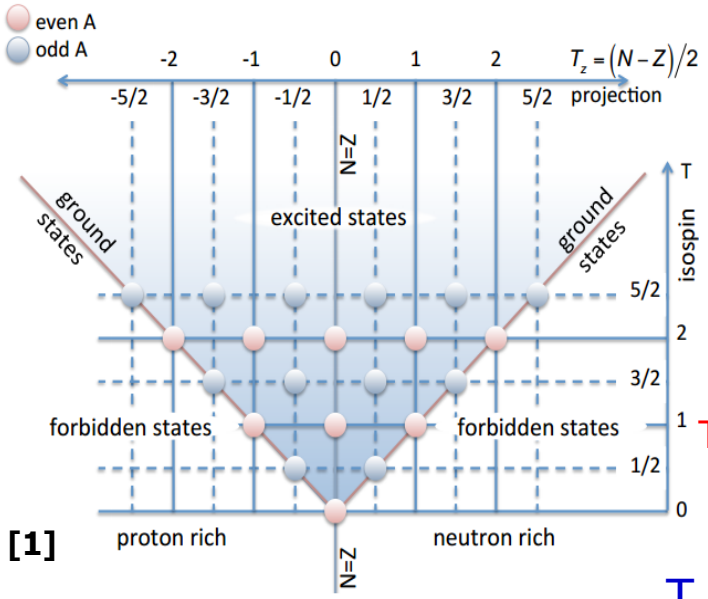
Nuclei of Interest

Isospin:

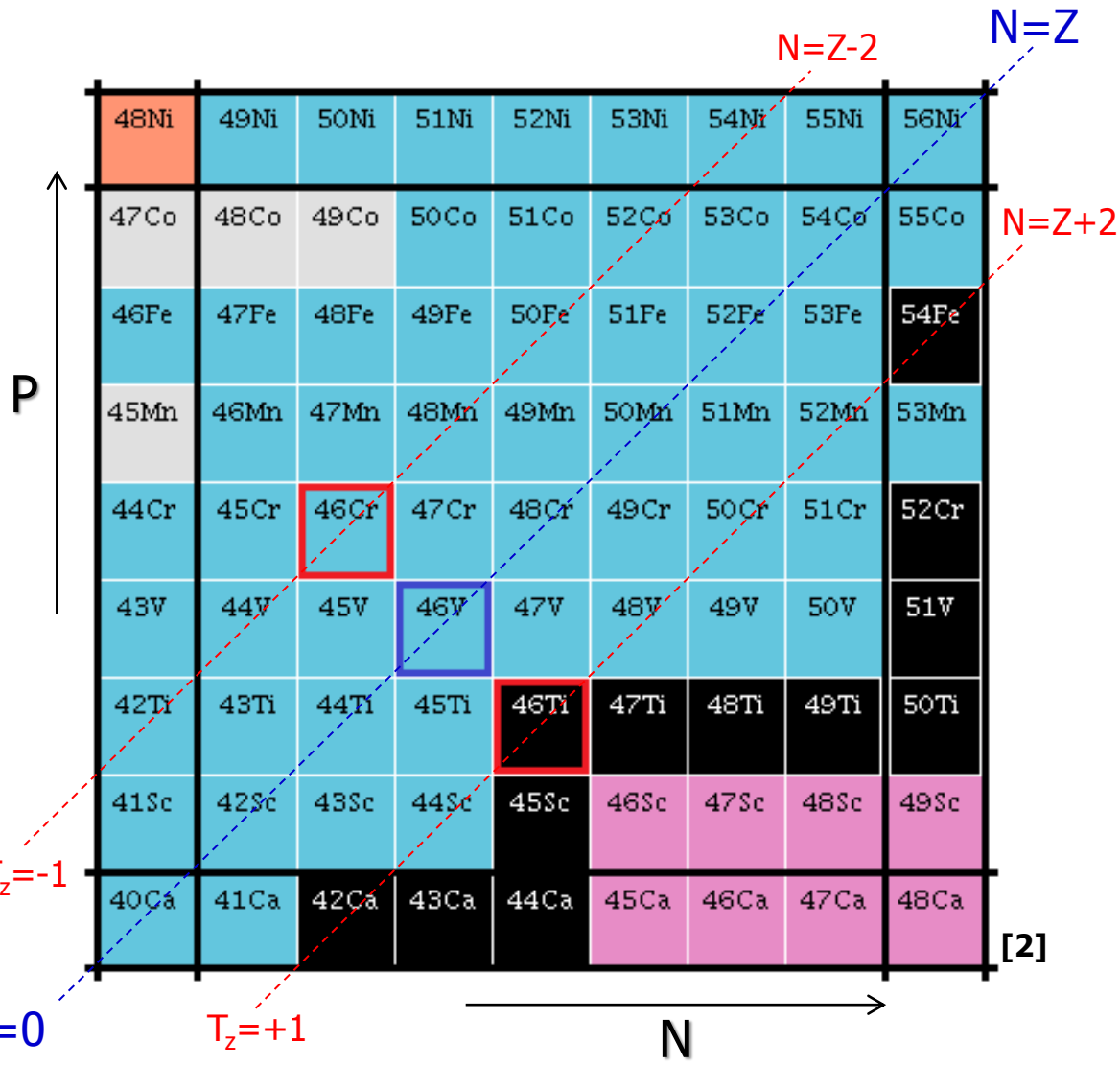
$$T_z = \sum_i^A t_{z_i} = \frac{N-Z}{2}$$

Proton: $t_z = -\frac{1}{2}$ ***Neutron:*** $t_z = +\frac{1}{2}$

Stable
EC+β+
β-
α
P
N
SF
Unknown



[1]



[2]

[1] – Professor Mike Bentley – Private Communications
[2] – Adapted from National Nuclear Data Center (NNDC) - Brookhaven National Laboratory - http://www.nndc.bnl.gov/

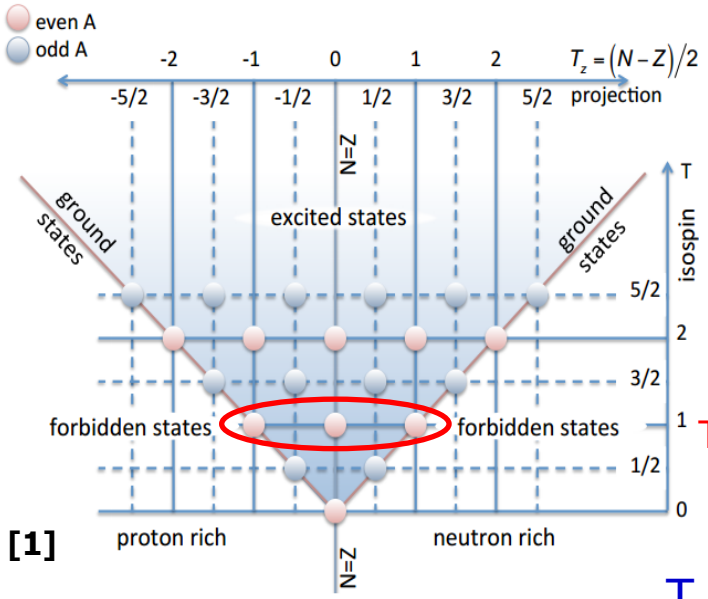
Nuclei of Interest

Isospin:

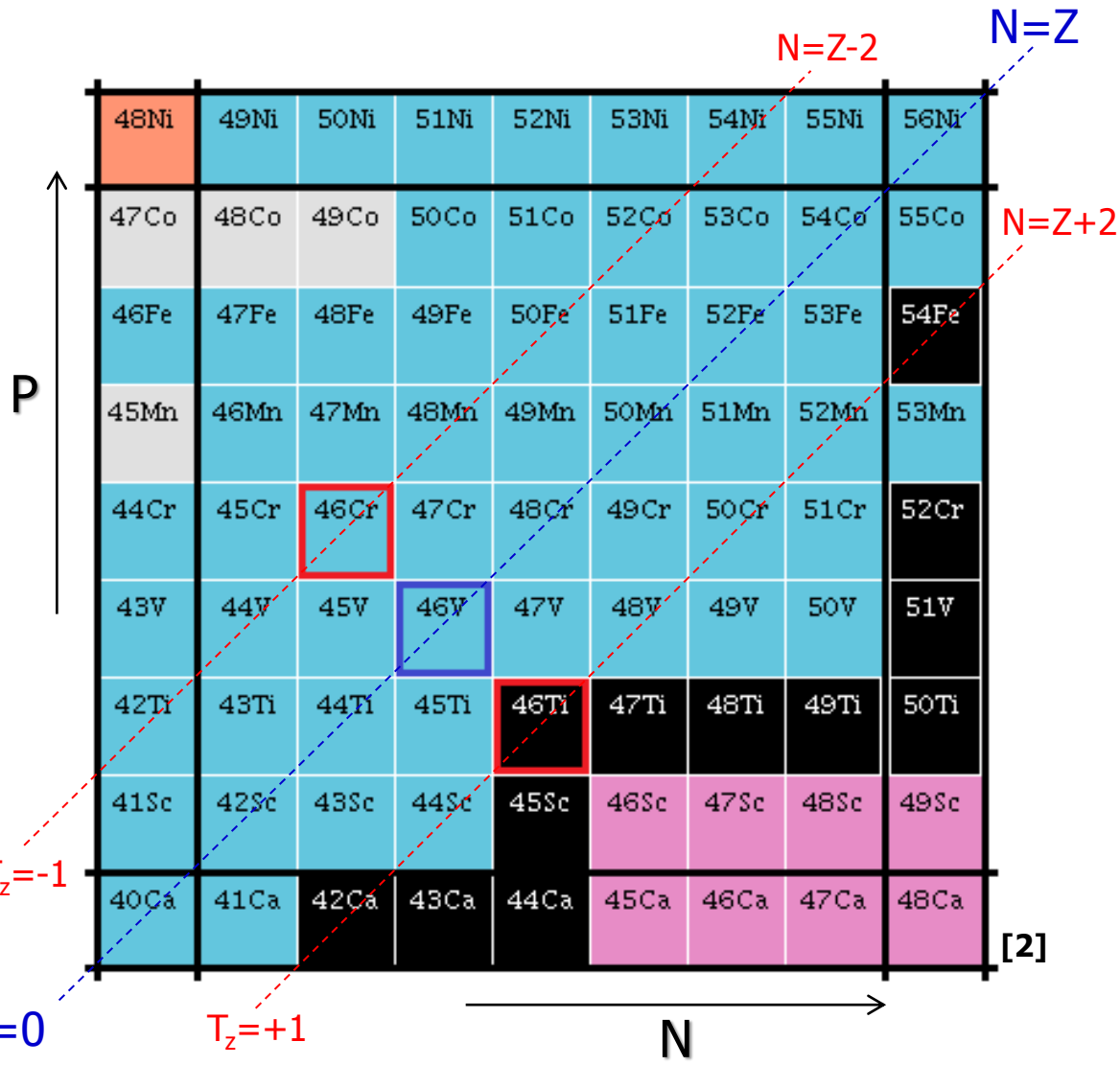
$$T_z = \sum_i^A t_{z_i} = \frac{N-Z}{2}$$

Proton: $t_z = -\frac{1}{2}$ ***Neutron:*** $t_z = +\frac{1}{2}$

Stable
EC+β+
β-
α
P
N
SF
Unknown



[1]



[2]

[1] – Professor Mike Bentley – Private Communications
[2] – Adapted from National Nuclear Data Center (NNDC) - Brookhaven National Laboratory - http://www.nndc.bnl.gov/

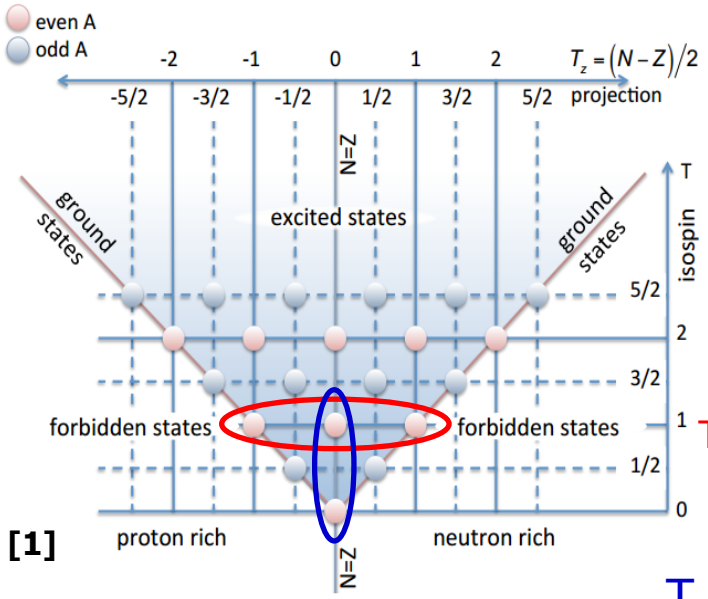
Nuclei of Interest

Isospin:

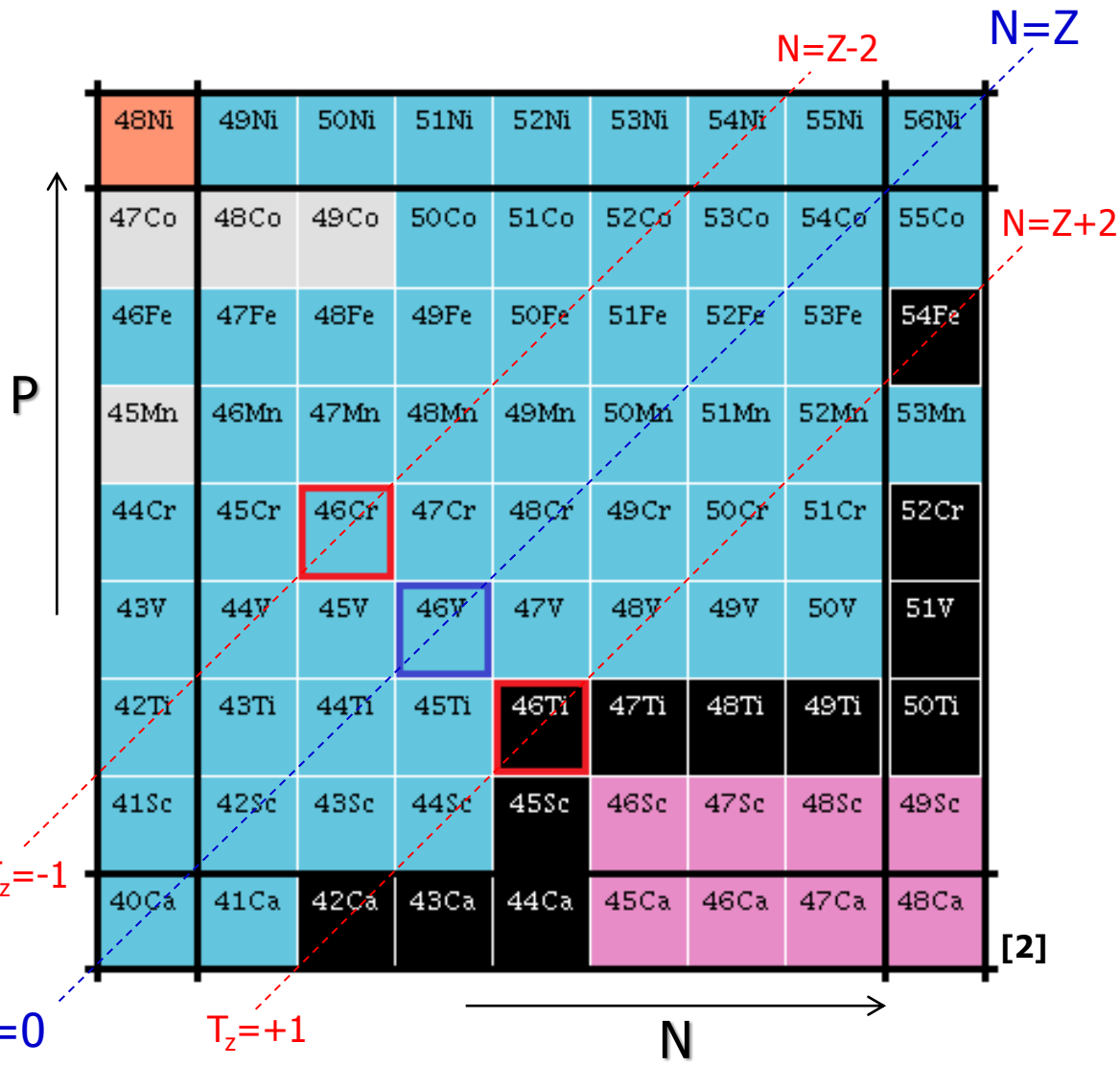
$$T_z = \sum_i^A t_{z_i} = \frac{N-Z}{2}$$

Proton: $t_z = -\frac{1}{2}$ ***Neutron:*** $t_z = +\frac{1}{2}$

Stable
EC+β+
β-
α
P
N
SF
Unknown



[1]

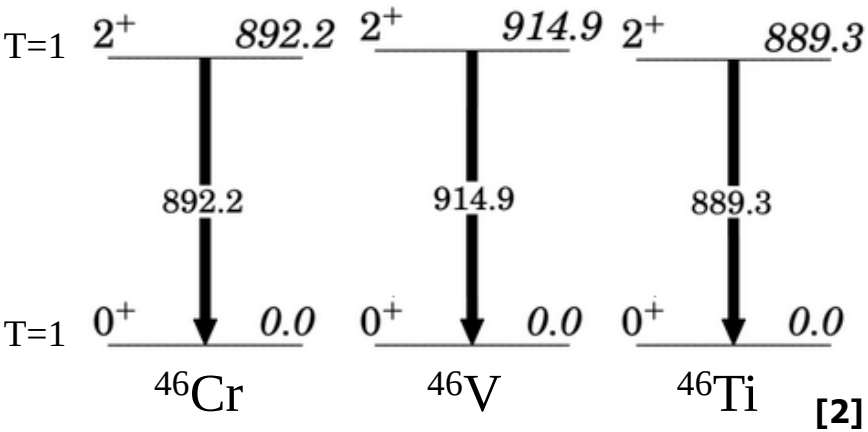


[2]

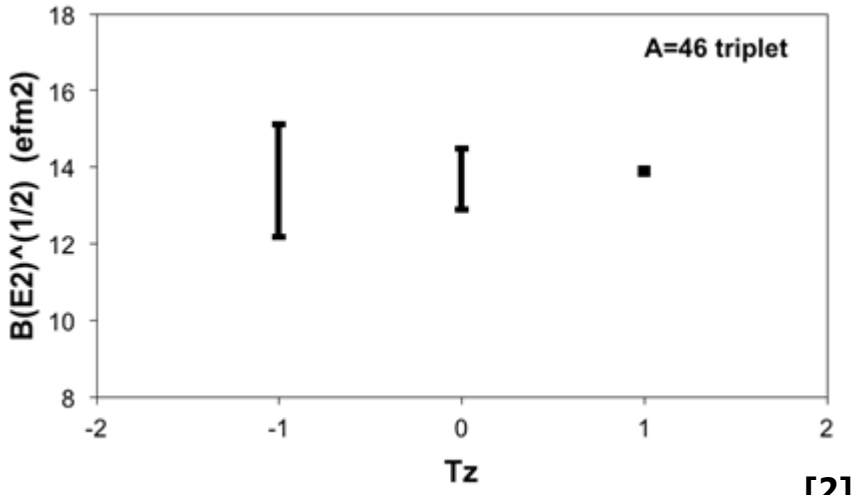
[1] – Professor Mike Bentley – Private Communications
[2] – Adapted from National Nuclear Data Center (NNDC) - Brookhaven National Laboratory - http://www.nndc.bnl.gov/

Motivation

- Investigate the purity of the isospin q.n.
- Coulomb interaction between protons dilates proton W.Fn relative to that of a neutron in the same orbit → mixes isospin
- Any significant charge asymmetry/charge dependence of nucleon-nucleon interaction
- Electromagnetic transition matrix elements, directly sensitive to isospin admixtures
- Test the Linearity of $\sqrt{B(E2)}$ vs T_z
- Investigate isospin mixing in ^{46}V (with T=0, 2+ states)



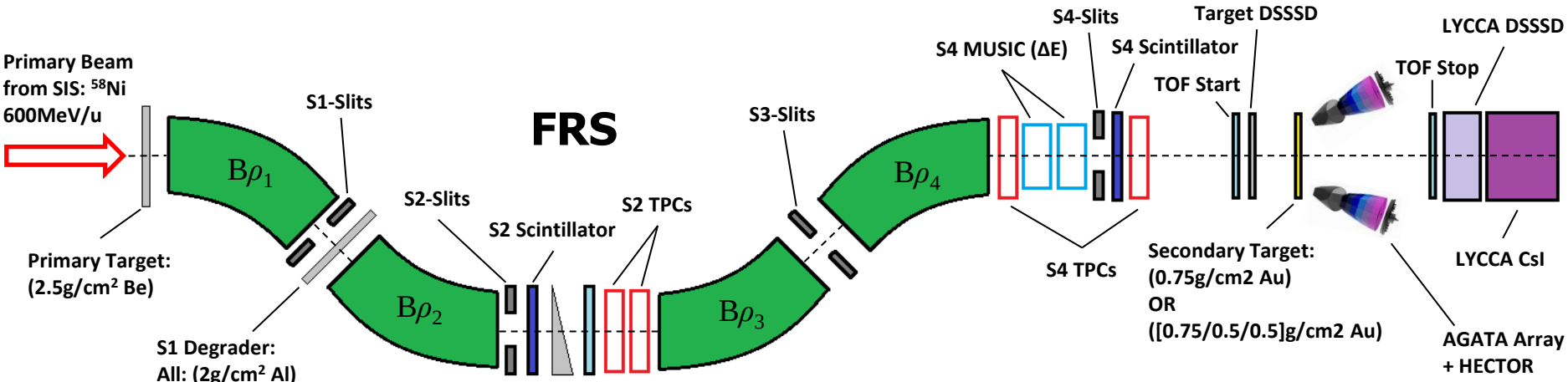
[2]



[2]

[2] – Data from NNDC - http://www.nndc.bnl.gov/

The Experiment @GSI

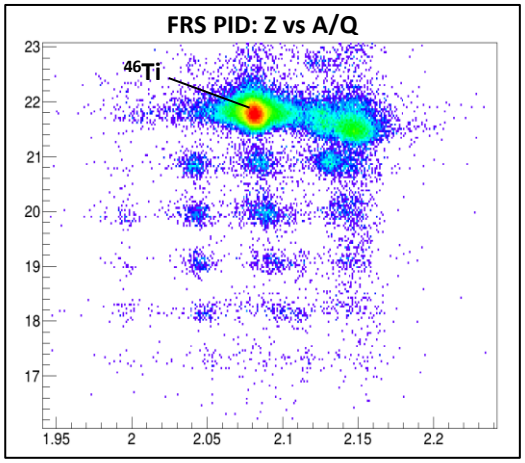


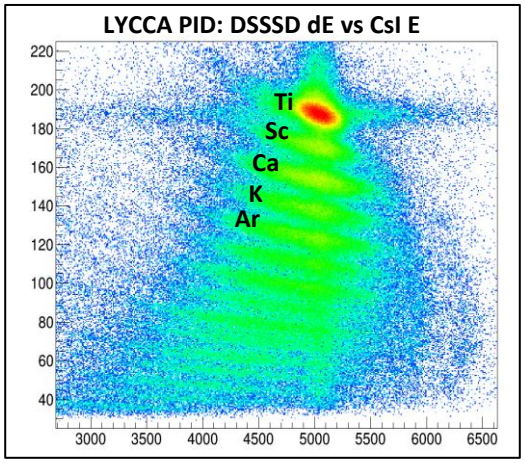
FRS ToF: S2 Sci → S4 Sci ($\beta\gamma$)

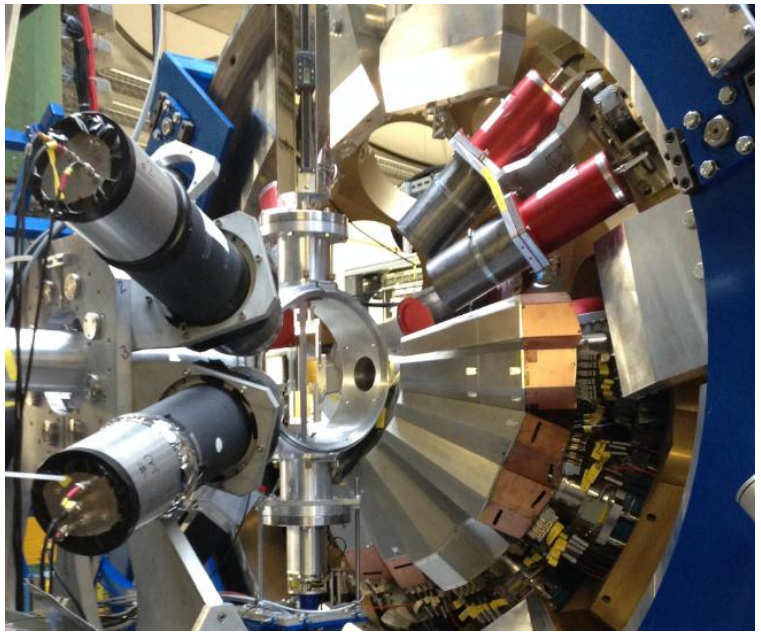
$$\frac{A}{Q} = \frac{B\rho e}{cu\beta\gamma}$$

S2 Degrader (Achromatic):
^{46}Ti: (8.0g/cm² Al)
^{46}V: (6.8g/cm² Al)
^{46}Cr: (5.7g/cm² Al)

S2 Finger

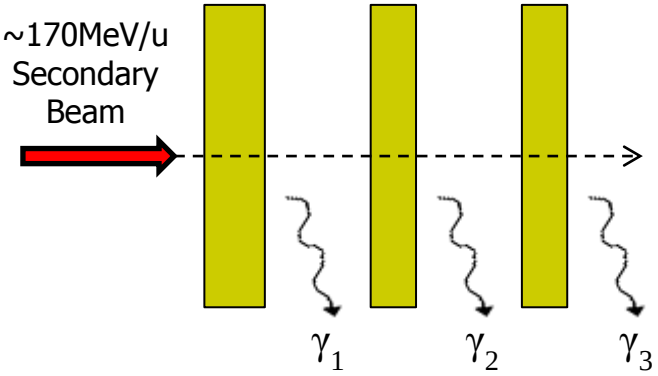


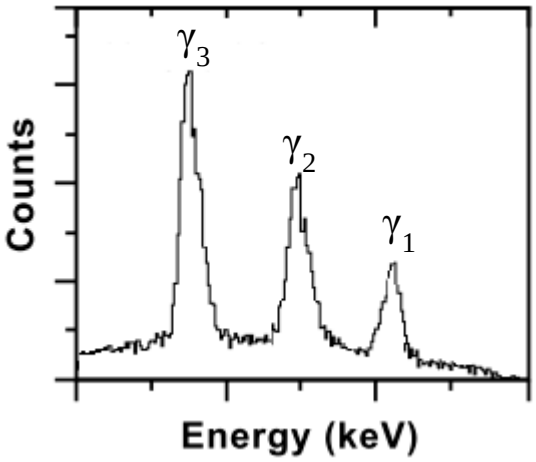




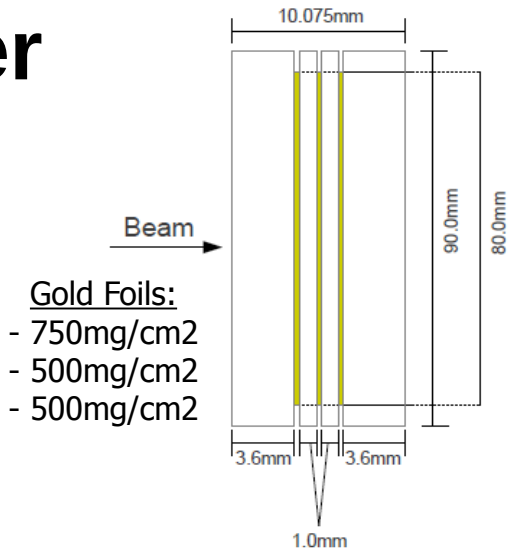
Secondary Targets

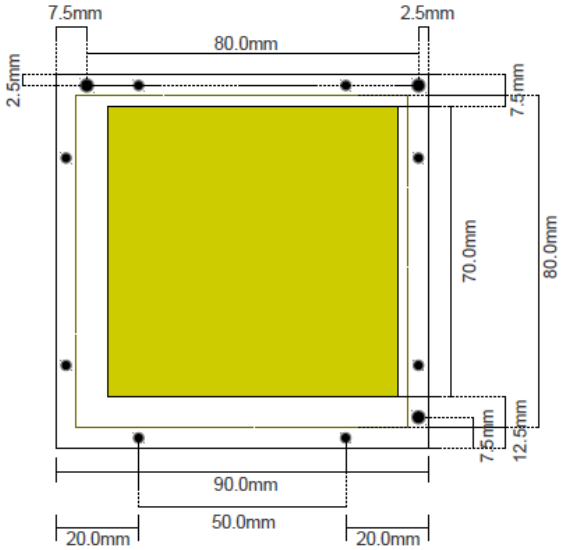
Triple Gold Plunger

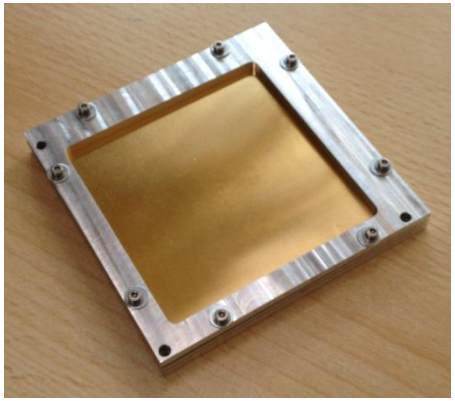




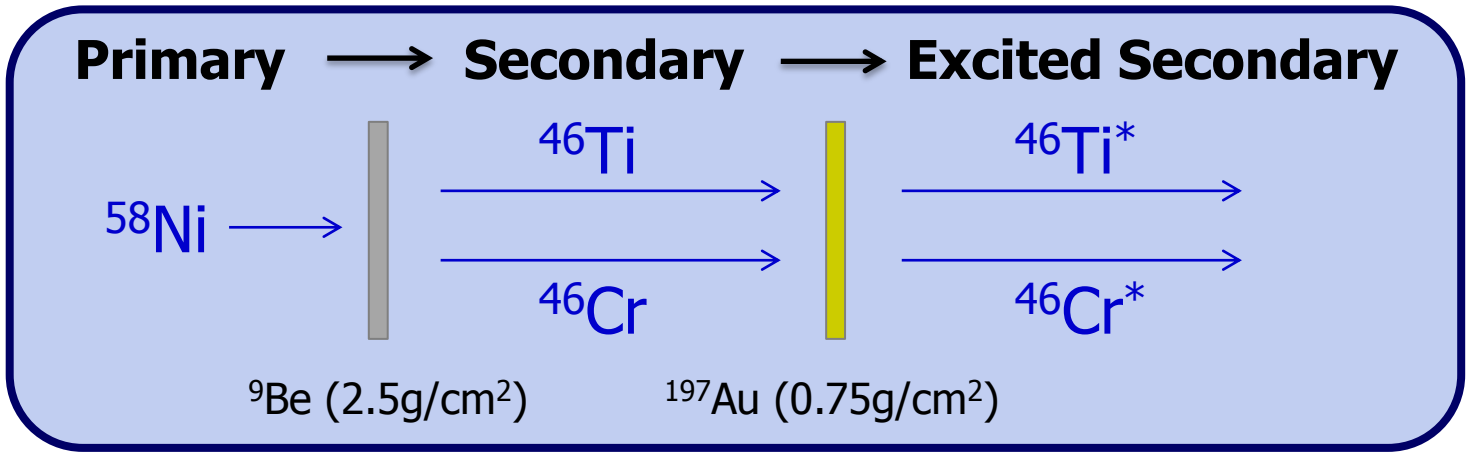
Doppler Shift: $E_{exp} = E_{cor} \frac{\sqrt{(1-\beta^2)}}{[1-\beta Cos(\theta_{dop})]}$



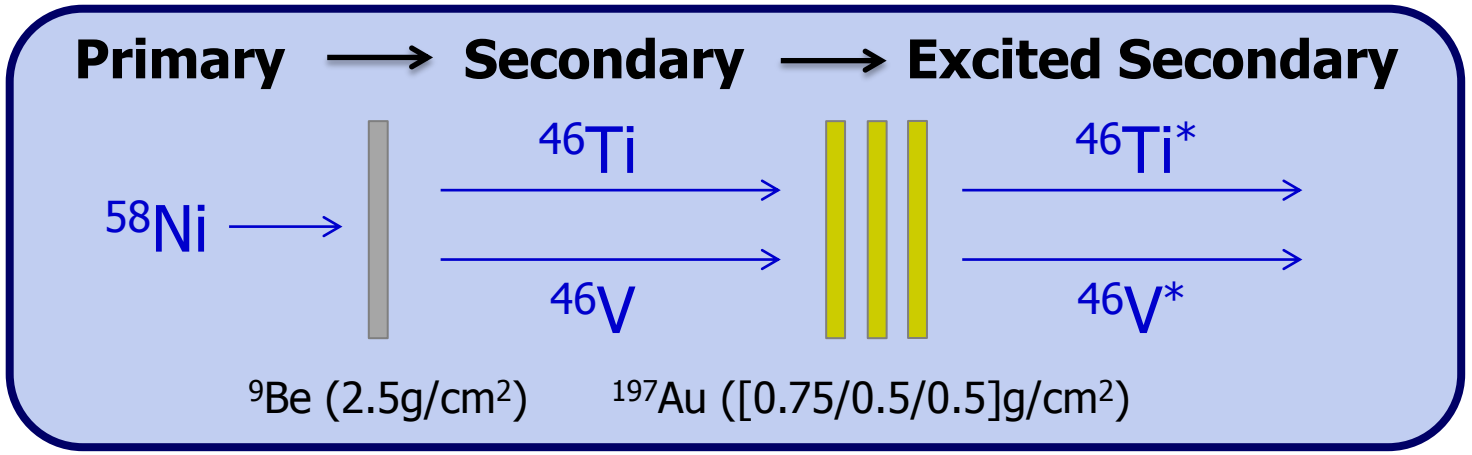




The Experiment

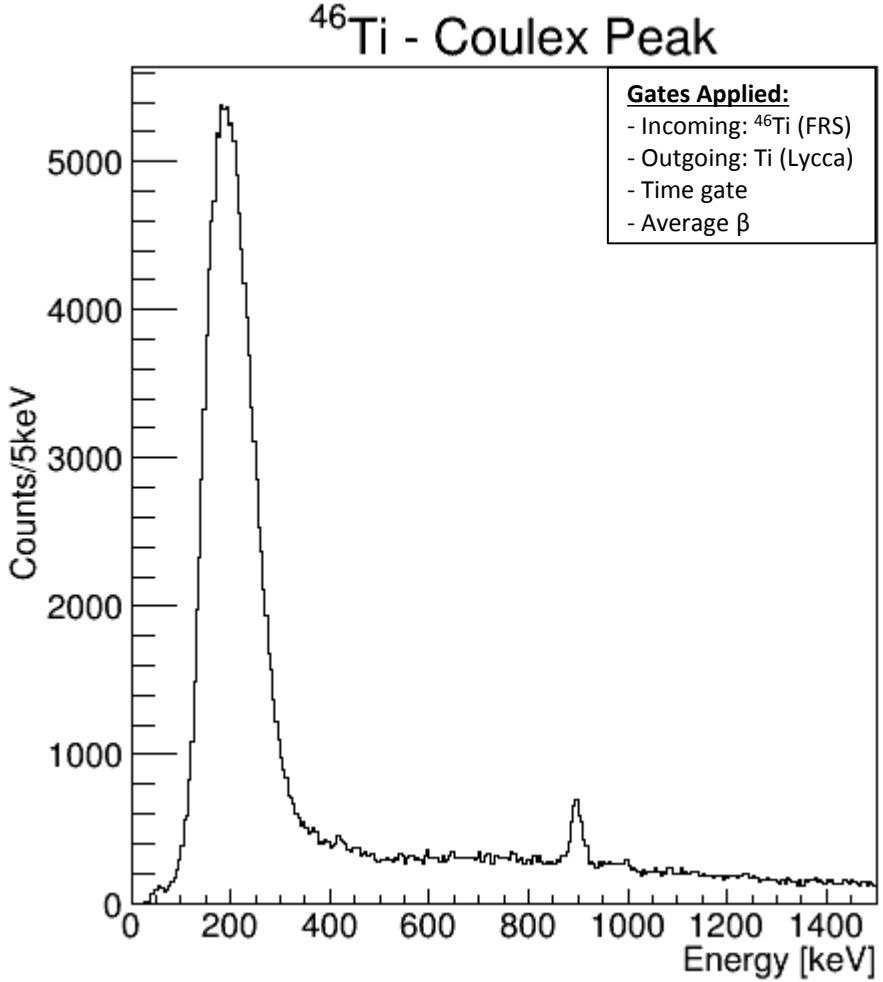


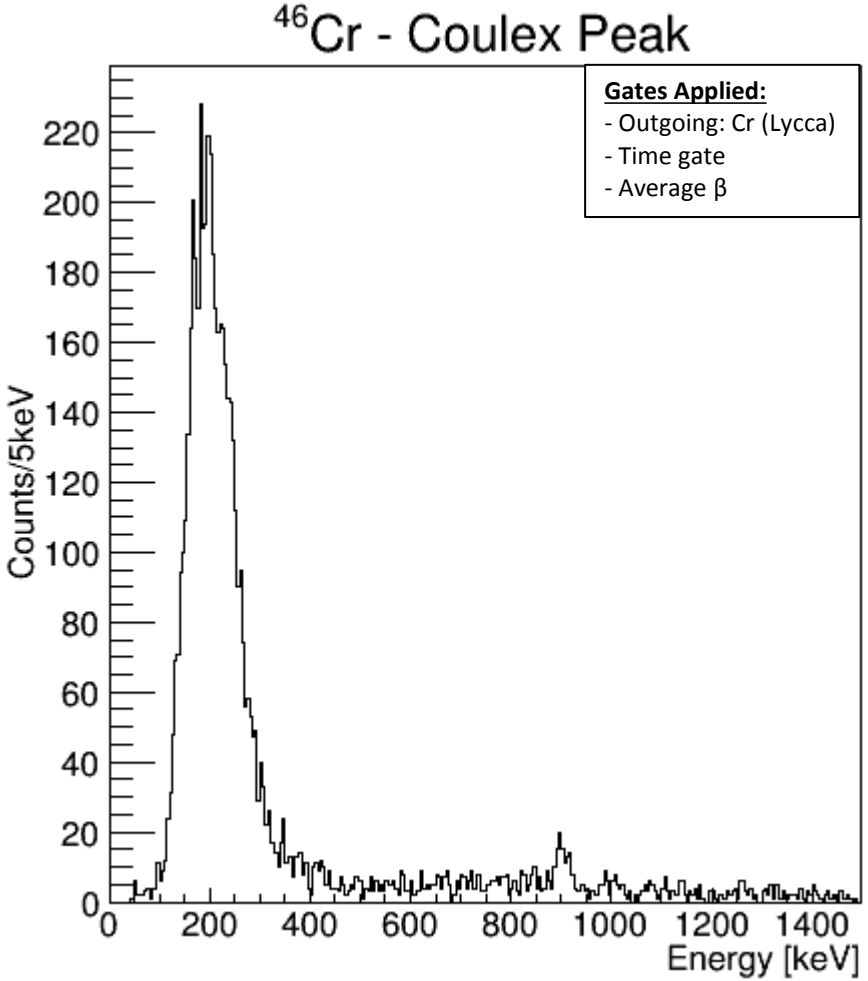
Coulex: Cross section



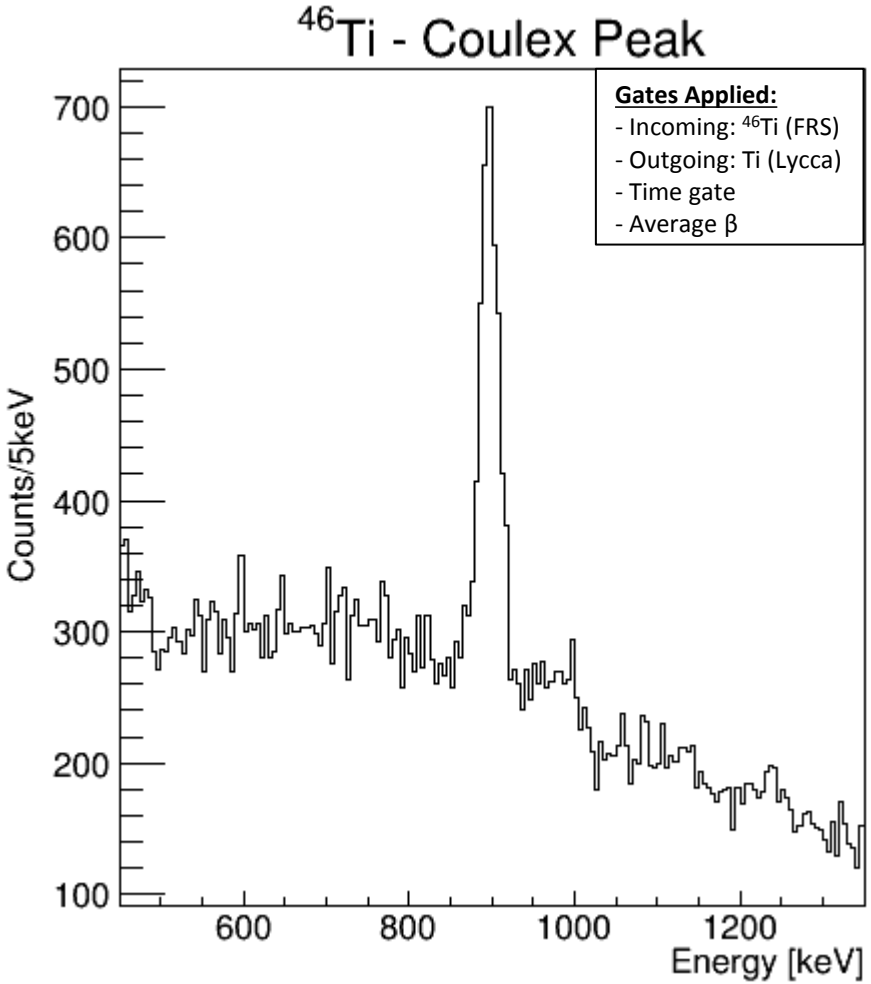
Plunger: Lifetime

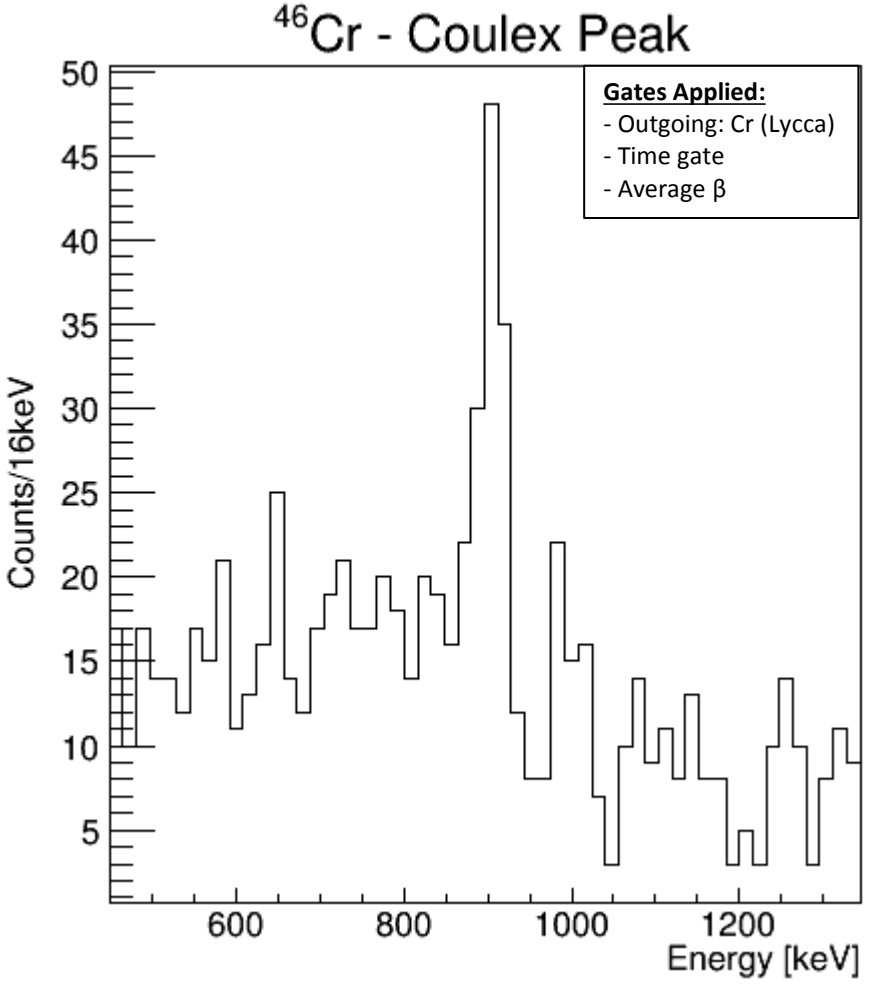
Analysis - Coulex



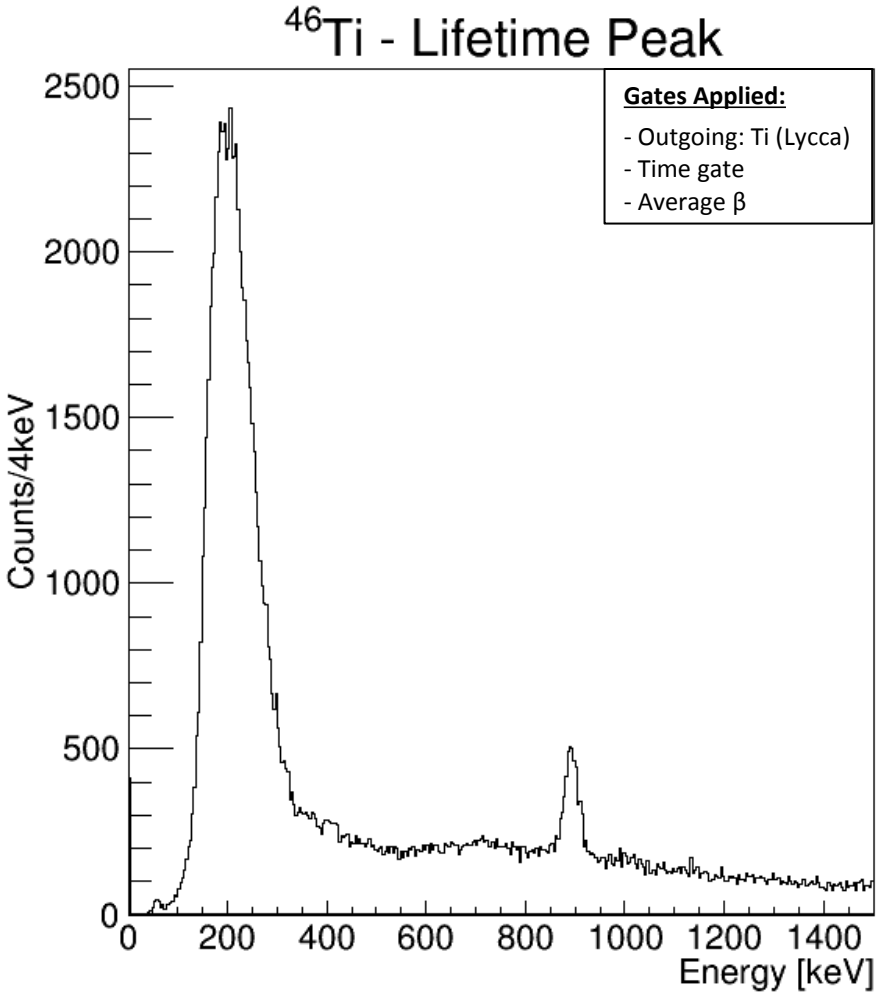


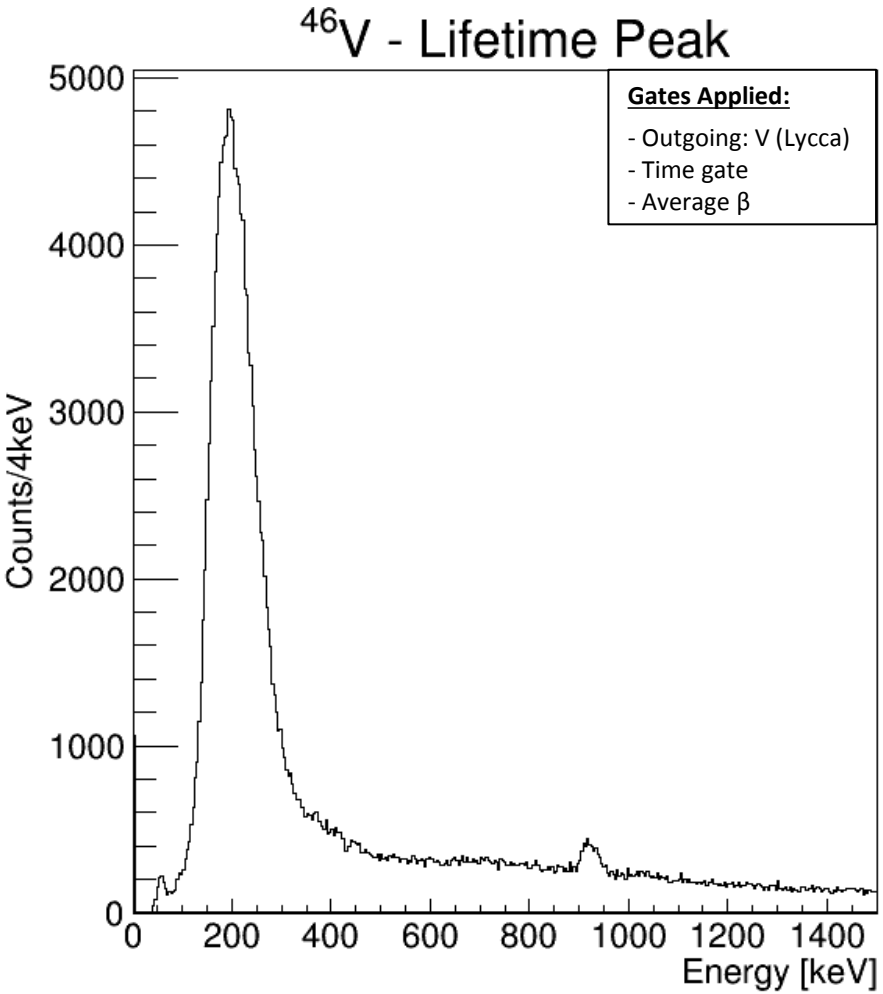
Analysis - Coulex



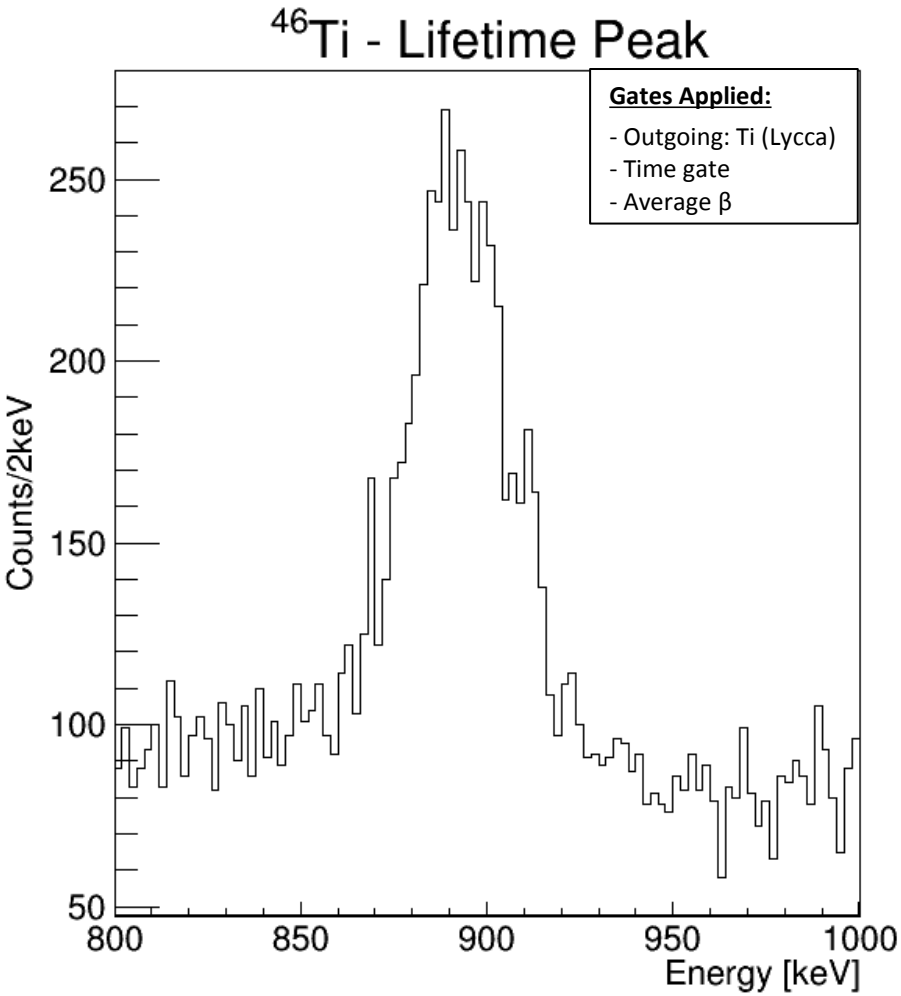


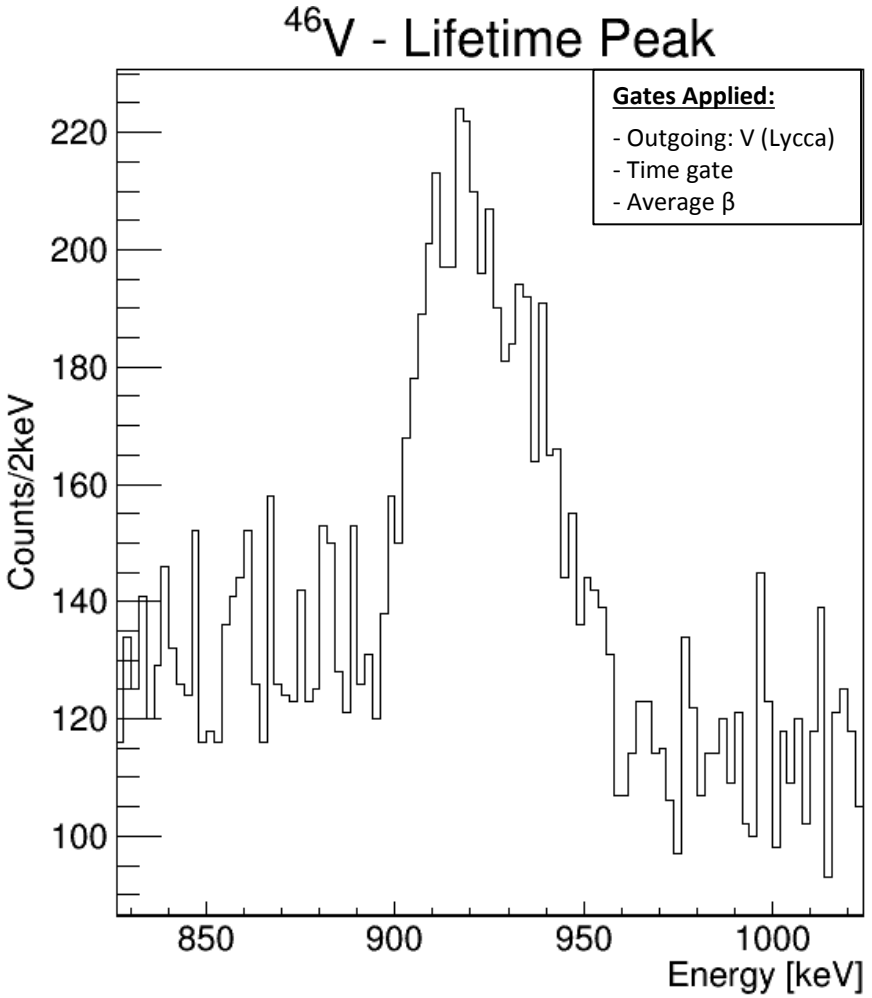
Analysis - Lifetime





Analysis - Lifetime





Conclusion

Current Status:

- Peaks obtained for all the sub experiments

Future Work:

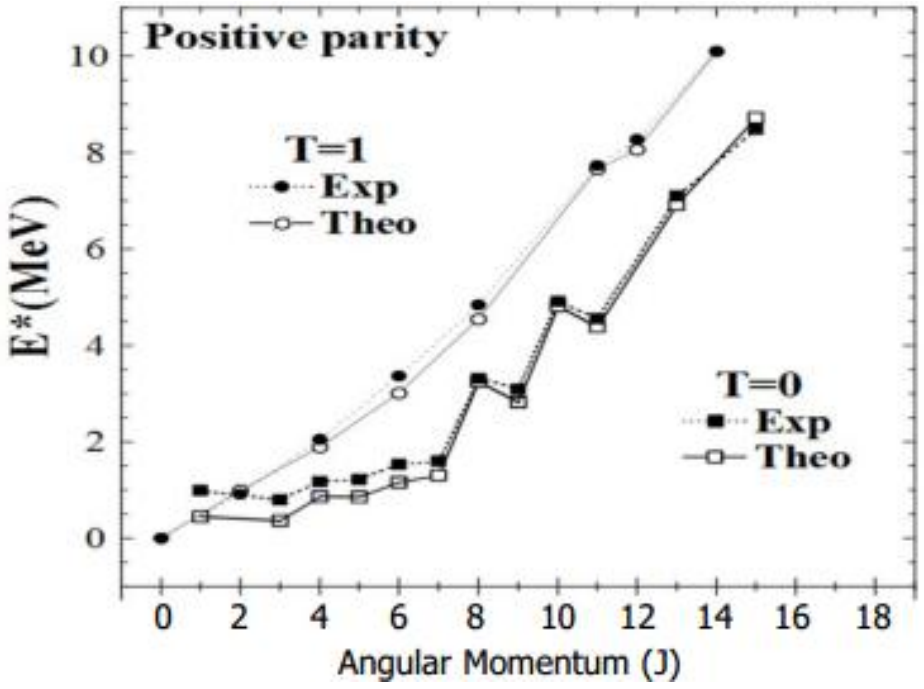
- Complete FRS/LYCCA calibrations
- AGATA corrections and optimisations
- Event-by-event Doppler corrections
- Peak simulation fits for the lifetime experiments
- Coulex cross section measurements

Thank you for your attention!

S.A.Milne, A.Boso, M.A.Bentley, S.M.Lenzi, F.Recchia, L.Scruton, D. Rudolph, T.Henry, A.Bruce, J.Gerl, P.Boutachkov, D.Napoli, M.Gorska, D.Ralet, M.L.Cortes, M.Reese, C.Stahl, N.Lalovic, C.Louchart-Henning, M.Lettmann, C.Fahlander, R.M.Perezvidal, I.Kojouharov, H.Schaffner, T.Habermann, N.Singh, L.Grassi, T.Arici, A.Gottardo, V.Modamio, A.Gottardo, J.Valiente, G.Tuomas, P.Golubev, F.Ameil, C.Lizarazo, C.Millan, P.P.Singh, T.Moeller, S.Aydin, S.Afara

AGATA
ADVANCED GAMMA TRACKING ARRAY

J=2+,T=0 ^{46}V



- Shell model calculations predict a T=0 J=2$^+$ state within 200keV of the T=1, J=2$^+$ state in ^{46}V