

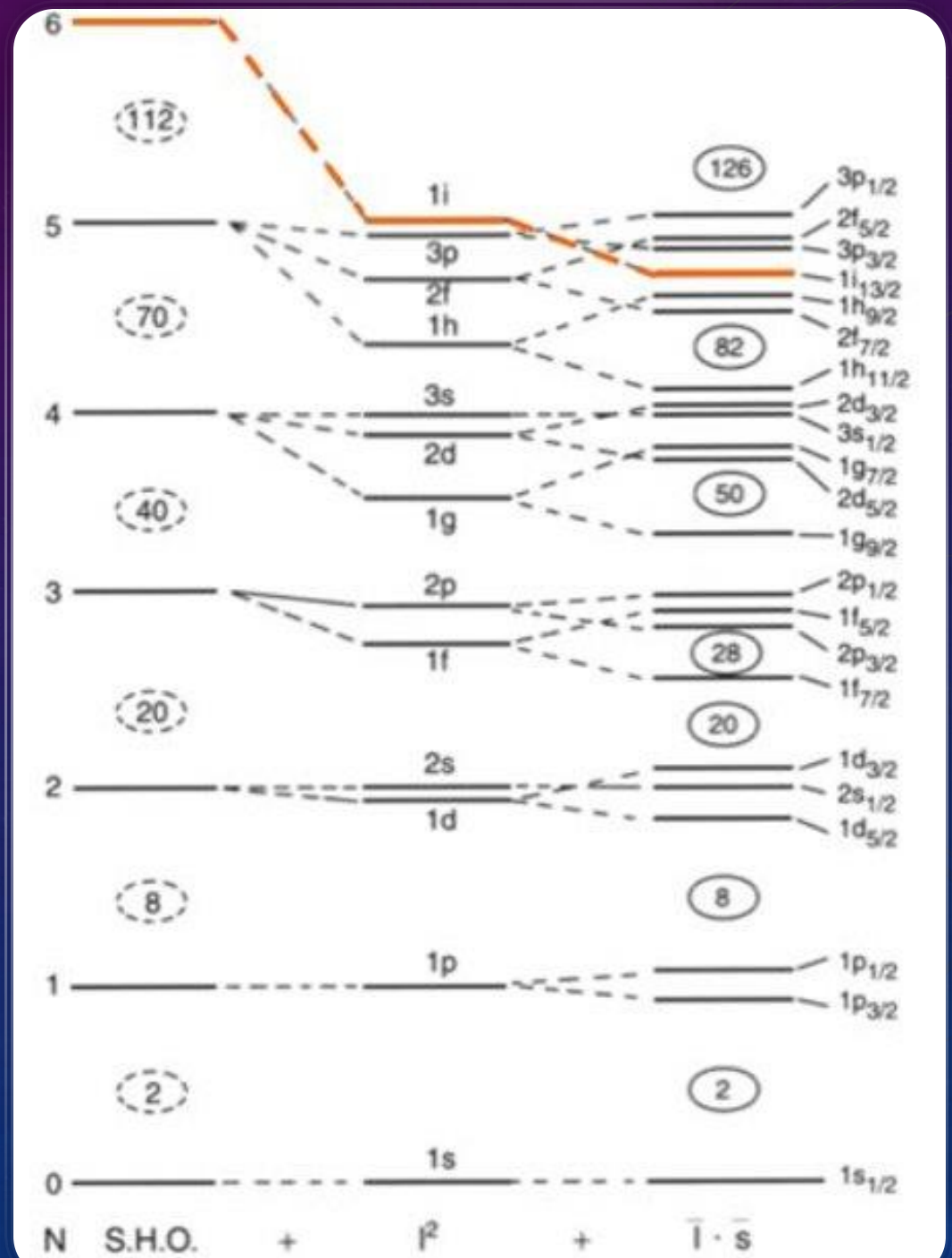
Investigating the Nuclear Shell Closure at $N=32$ in Neutron Rich ^{52}Ca

ROBIN COLEMAN – UNIVERSITY OF GUELPH

WNPPC 2019

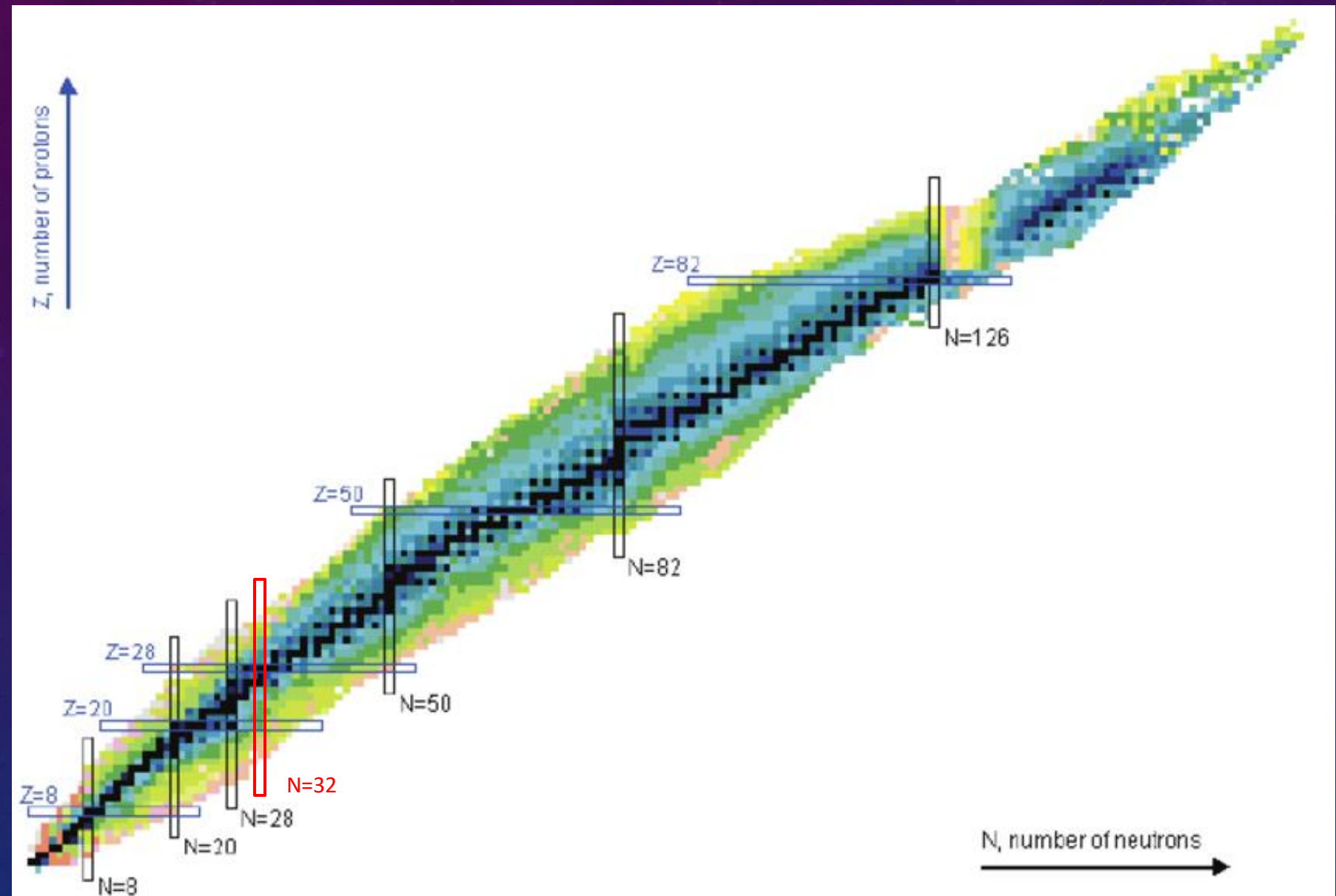
MOTIVATION

- Shell model Calculations
- Magic Numbers
 - Elevated first 2+ level
 - Small Charge Radius
 - High Separation Energy



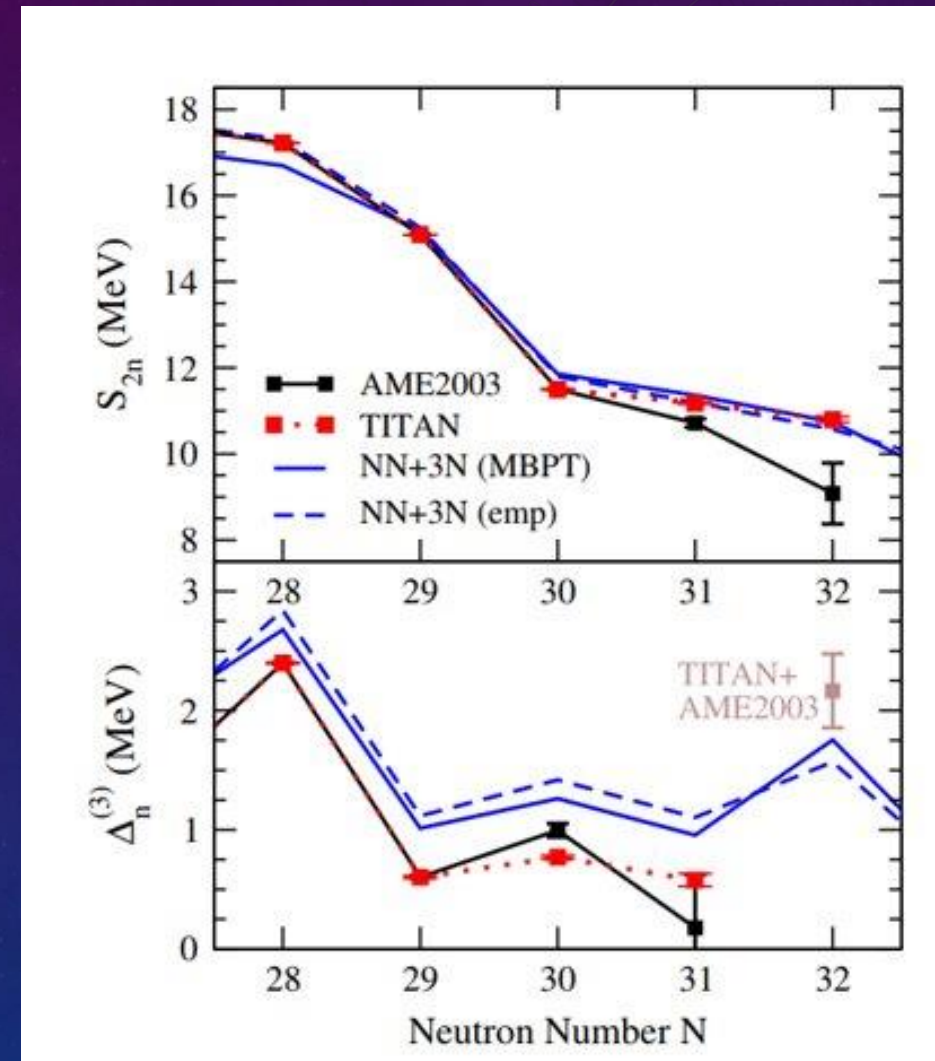
MOTIVATION

- R-Process
 - Rapid capture of Neutrons
 - Synthesis depends on Stability
 - Magic Nuclei



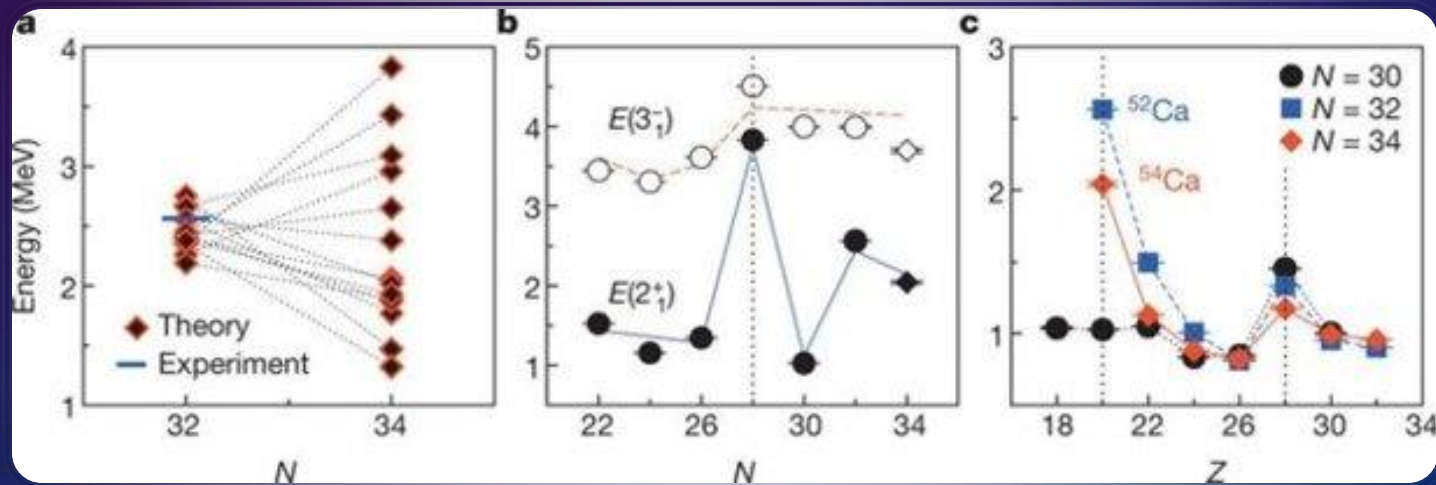
MOTIVATION

- Separation Energy
 - Measured at TITAN 2012

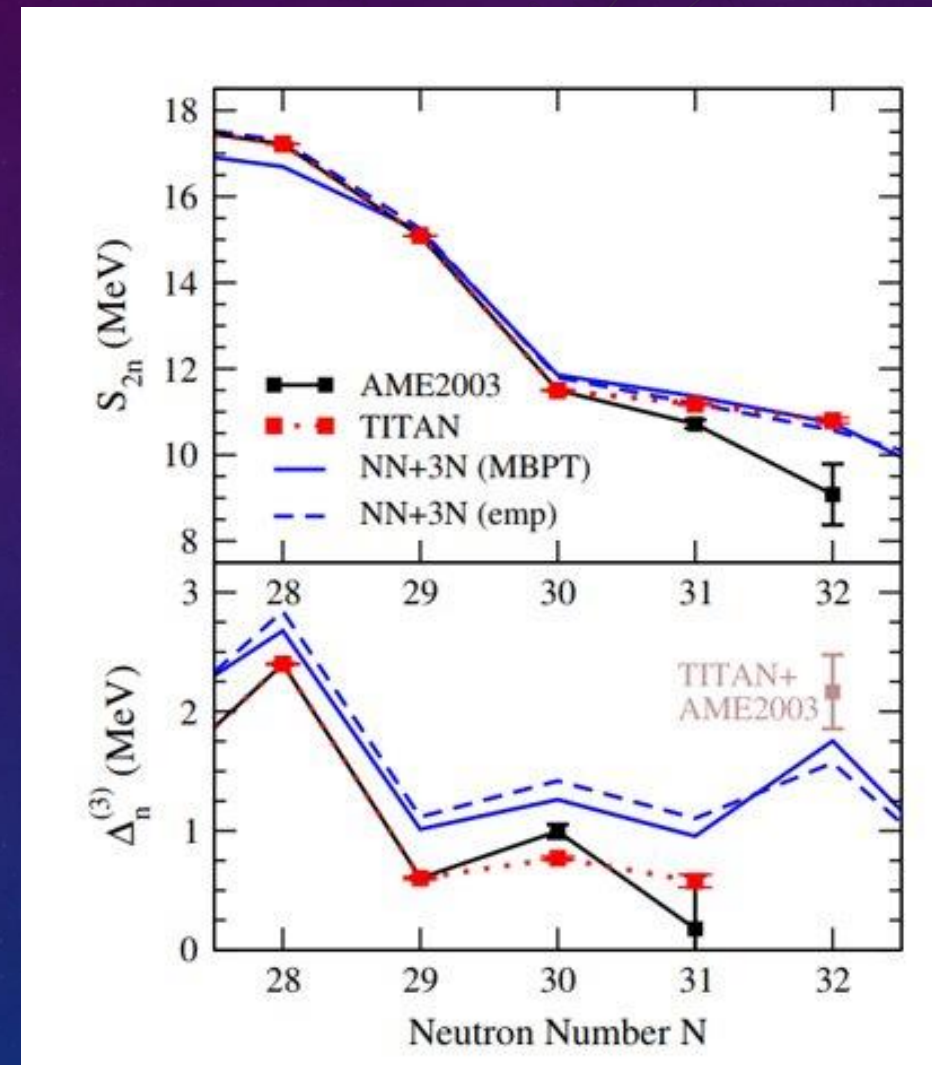


MOTIVATION

- Separation Energy
 - Measured at TITAN 2012
- Excitation Energy
 - Measured at RIKEN 2013



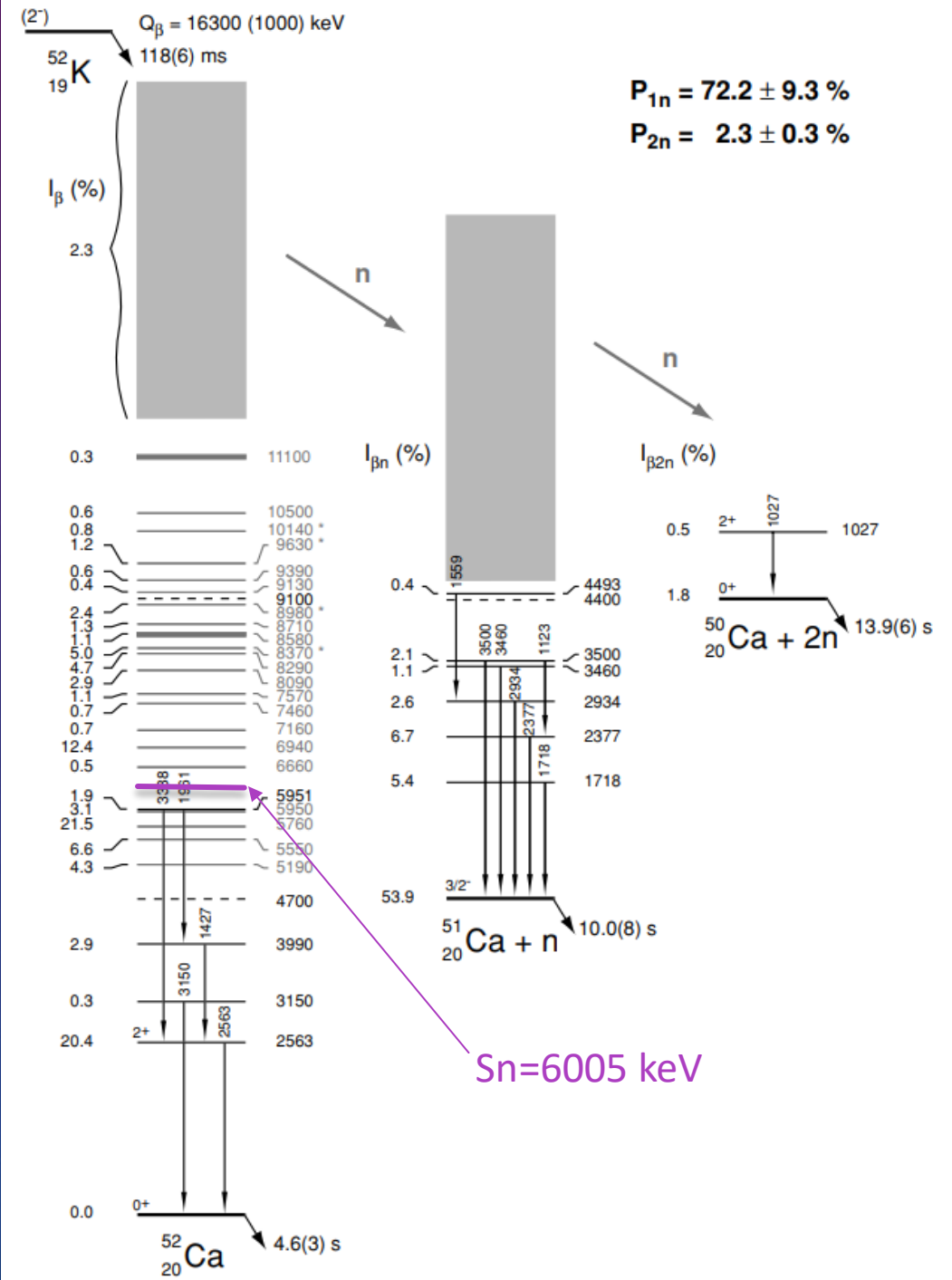
Nature 502, 207 (2013)



arXiv:1204.1987v1 [nucl-ex] 9 Apr 2012

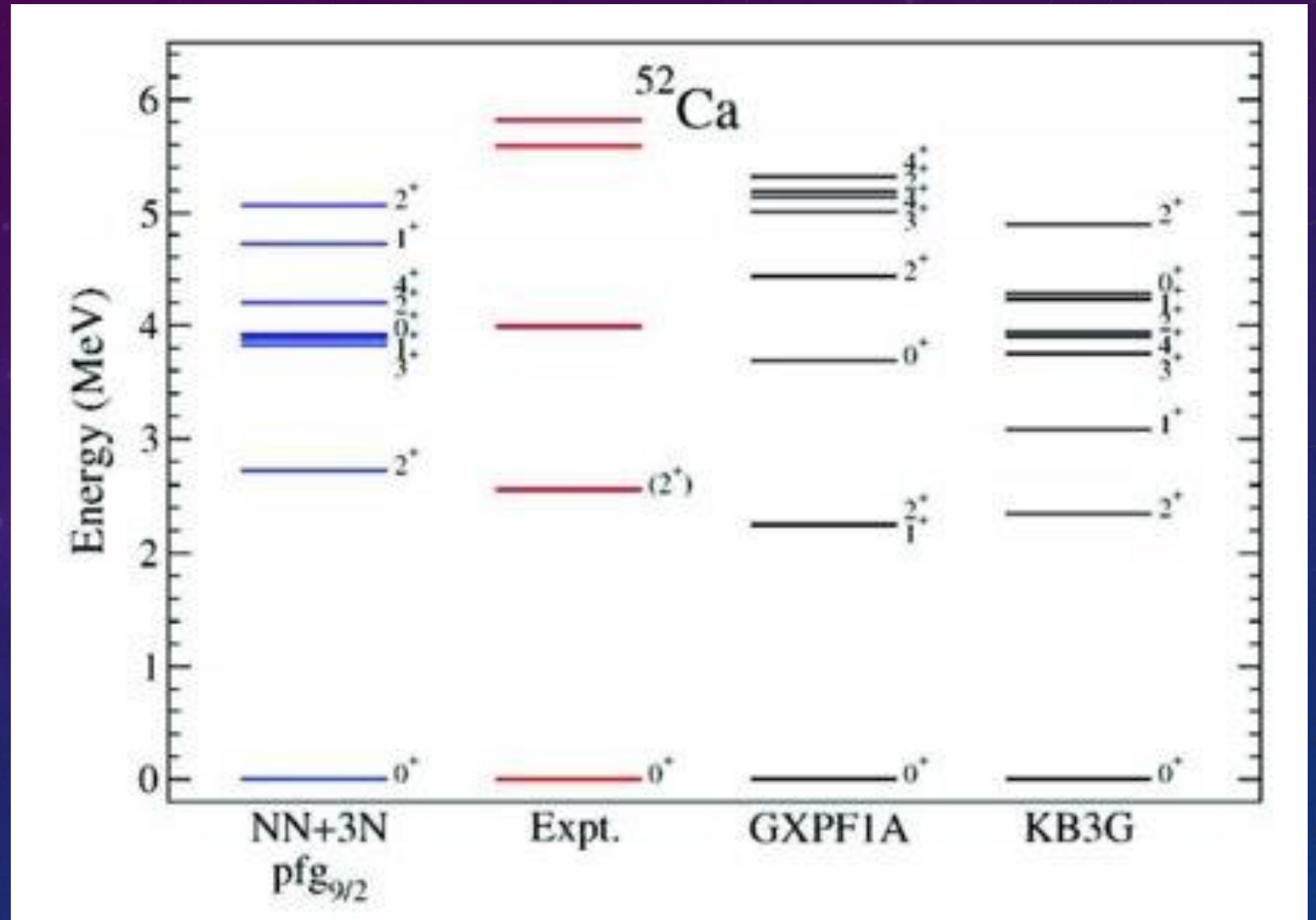
MOTIVATION

- Previous Level Scheme
 - 5 Gamma-ray Transitions
 - 4 Observed Excited Levels
 - Other levels are deduced from the beta-delayed neutron energy spectra



MOTIVATION

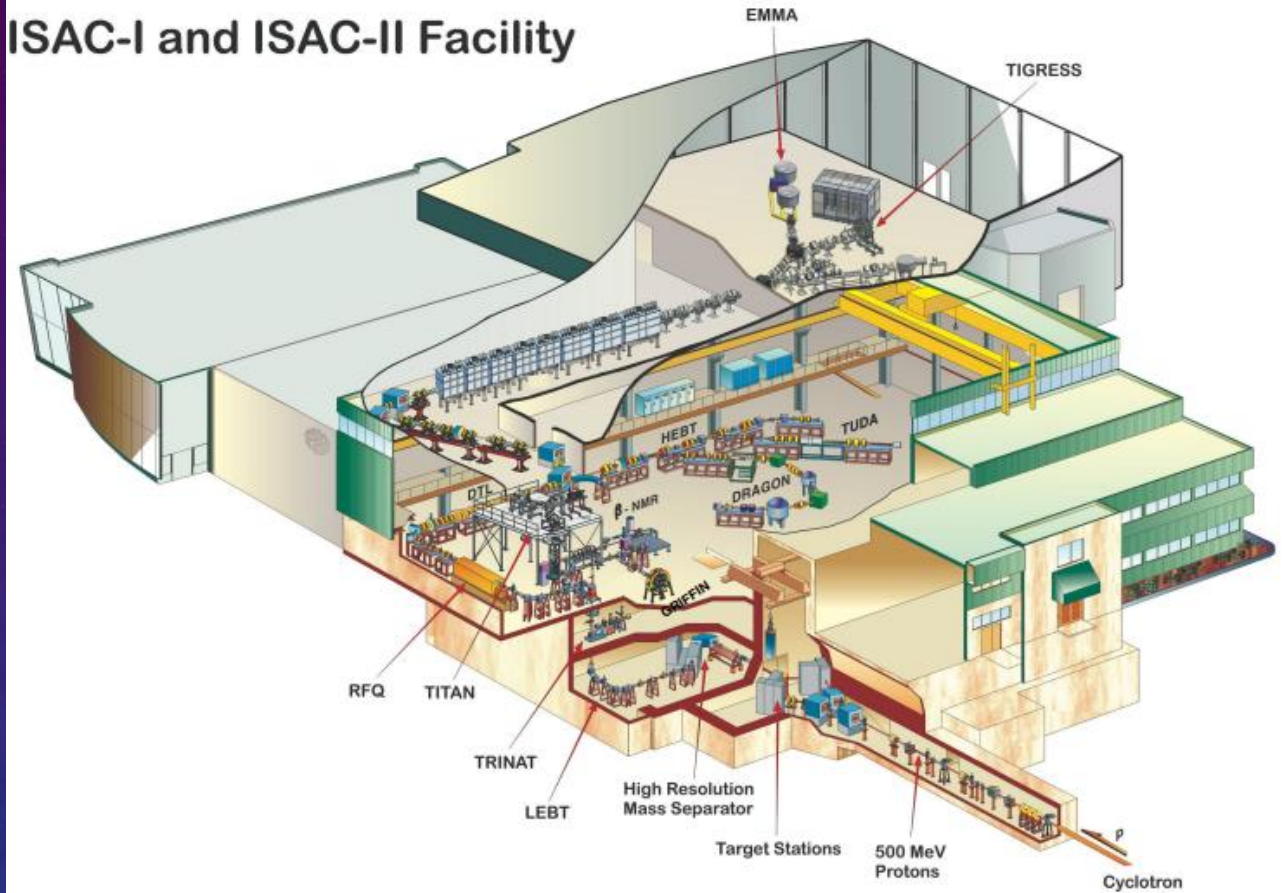
- Different Interactions
 - NN+3N
 - GXPF1A- G Matrix pf interaction
 - KB3G- Kuo-Brown Interaction



EXPERIMENT

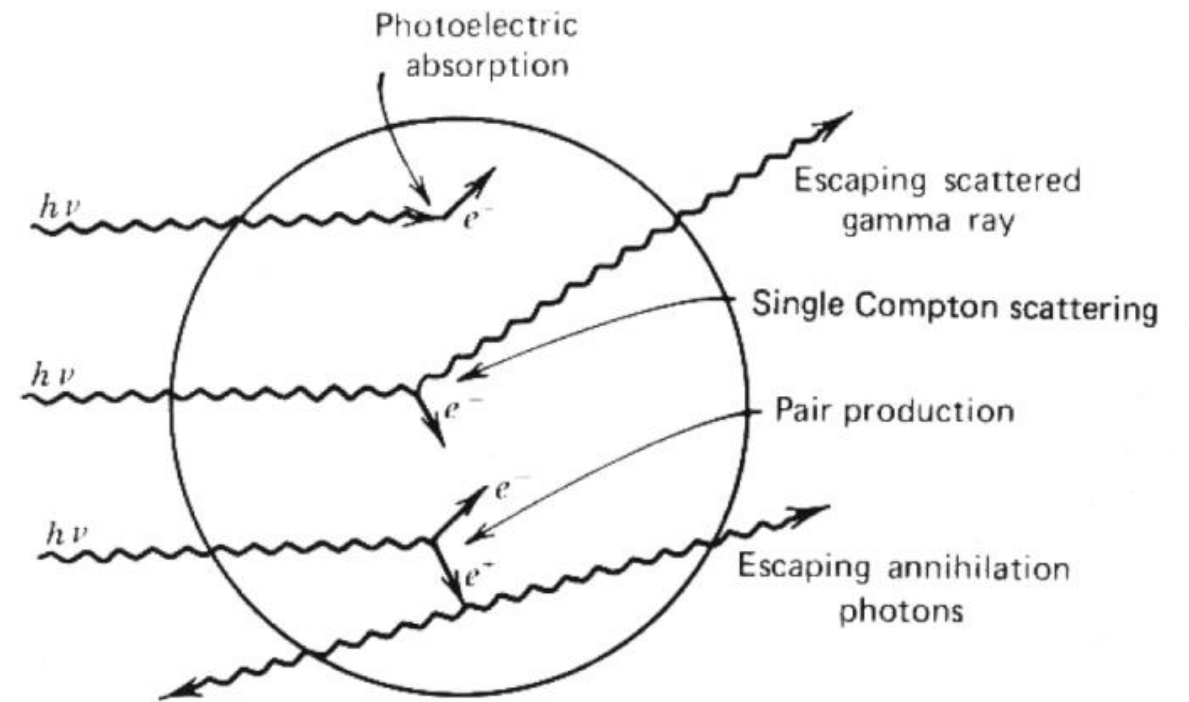
- TRIUMF – Vancouver, BC
 - ISAC 1
- GRIFFIN – High precision gamma energy
 - ZDS & SCEPTAR – Beta tagging Scintillators
 - DESCANT – Neutron Tagger

ISAC-I and ISAC-II Facility



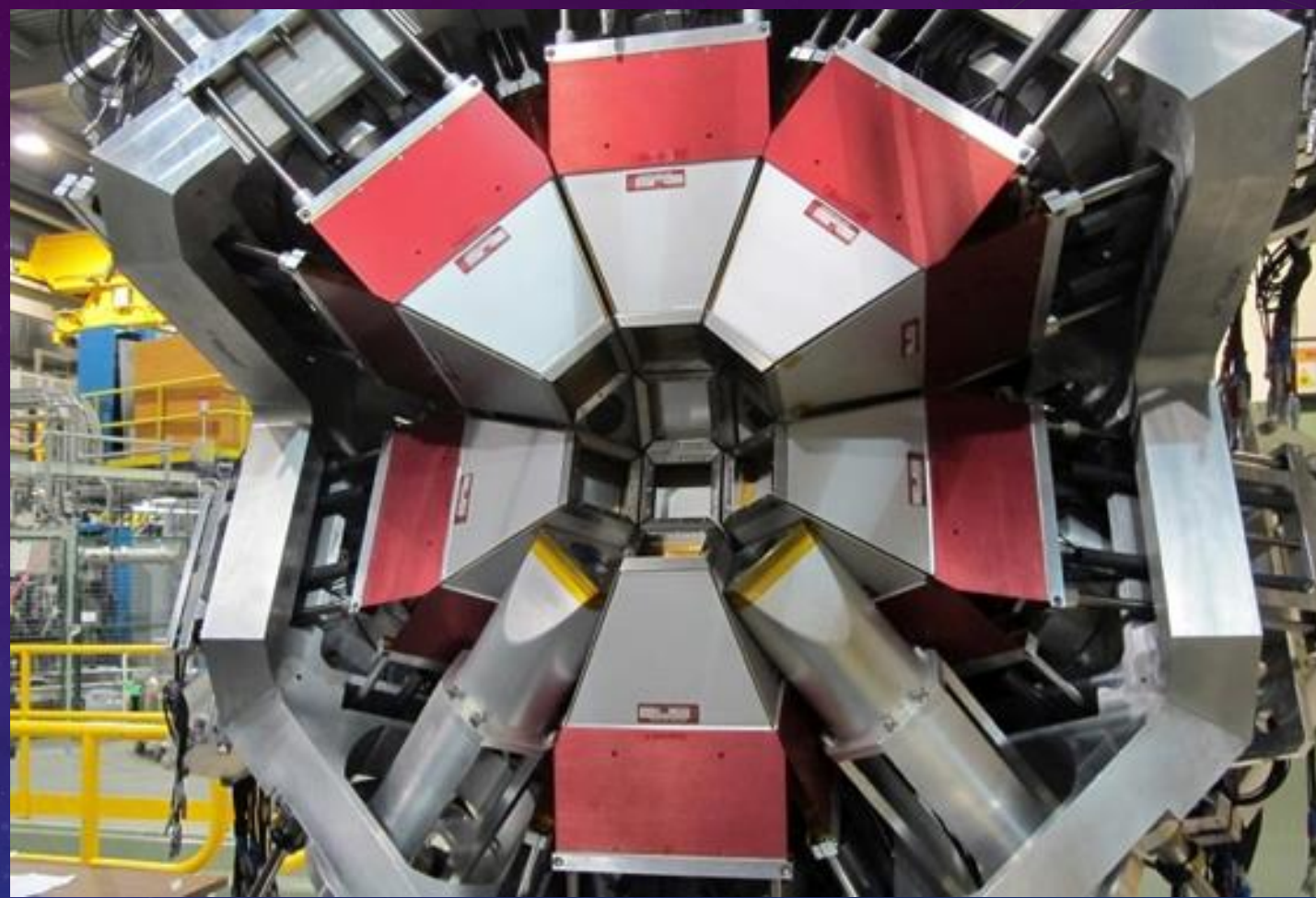
EXPERIMENT

- Compton Scattering
 - Energy escapes detector
- Suppression Shields
 - Any gamma ray interacting with the BGO tags the event
 - False vetoes suppress real data.

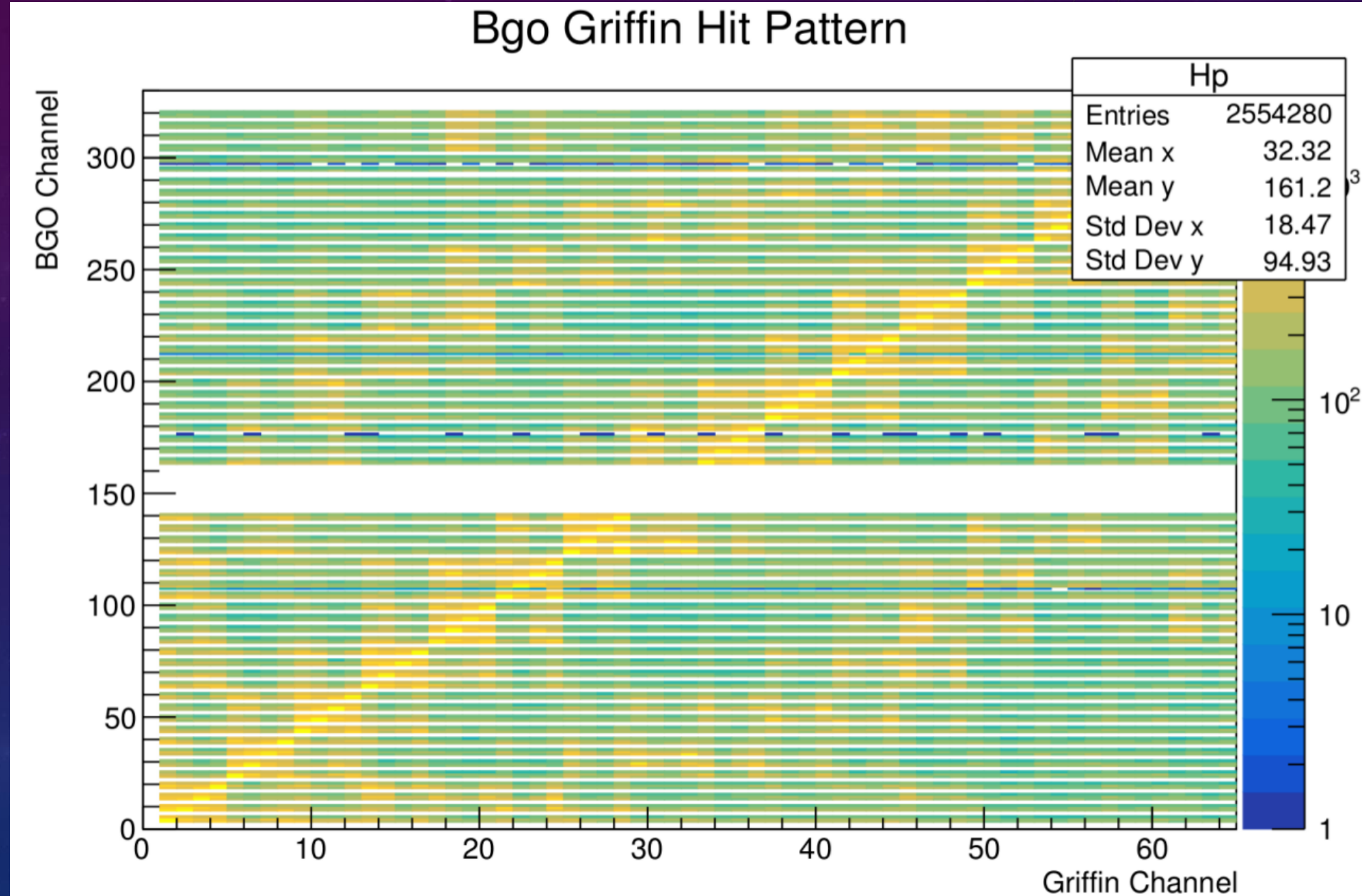


EXPERIMENT

- BGO Suppression Shields
 - Installed on 15 of 16 GRIFFIN clovers
- Suppression Scheme
 - GRIFFIN/BGO coincidence selective
 - Reduces false vetoes

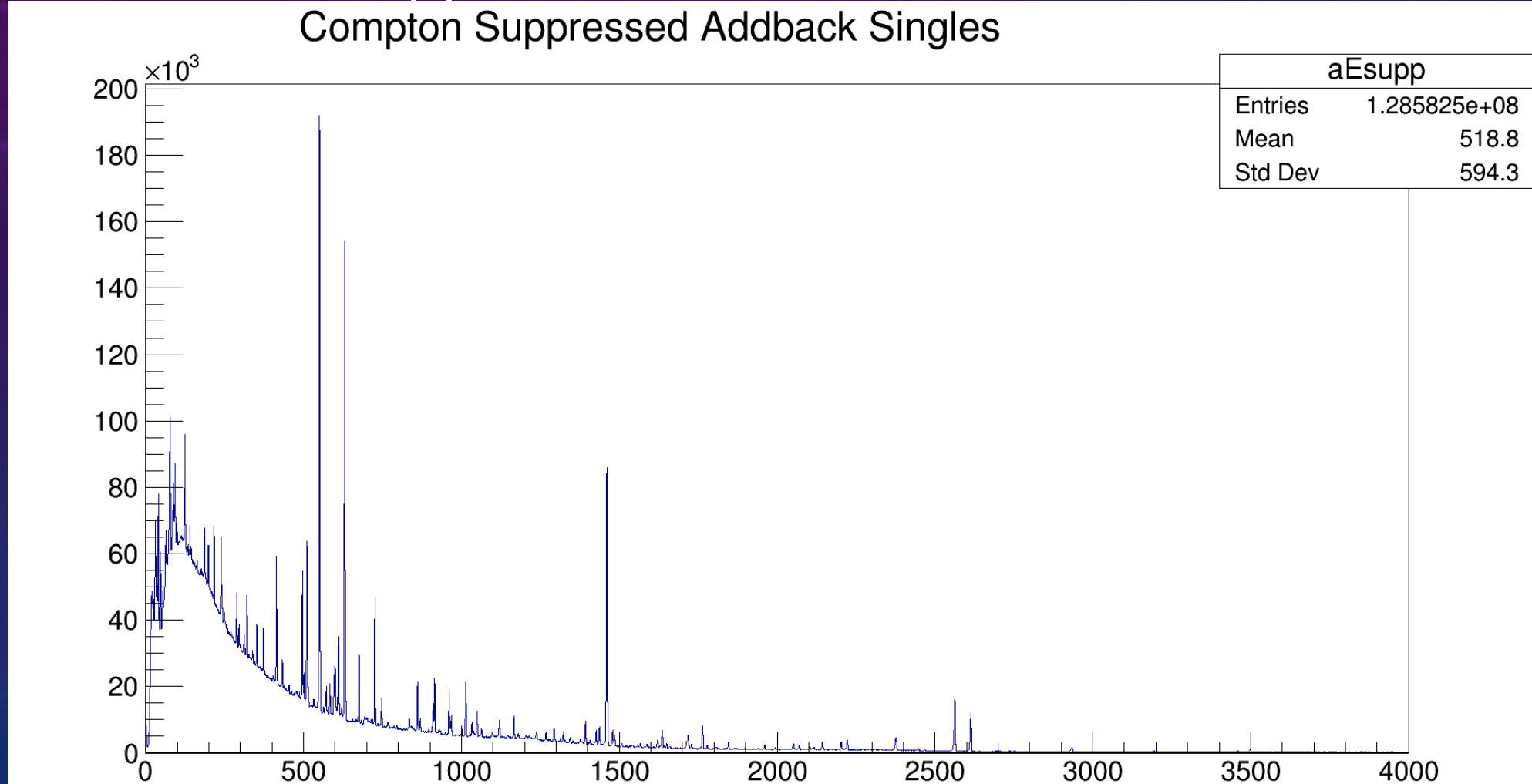


BGO SUPPRESSION



EXPERIMENT

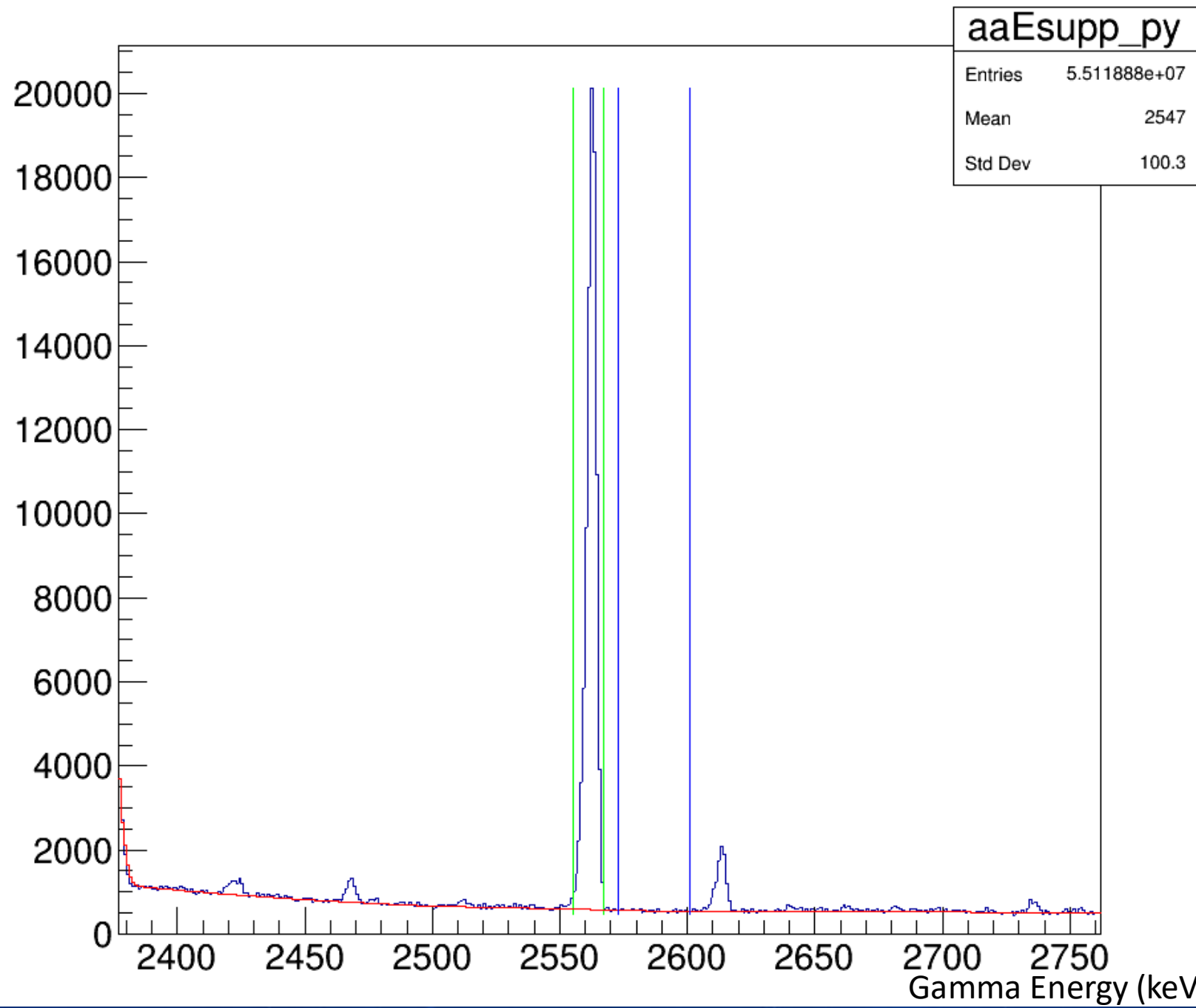
- ^{52}Ca Compton-suppressed Gamma spectrum
- Following 48 hrs of ~ 300 pps



PRELIMINARY RESULTS

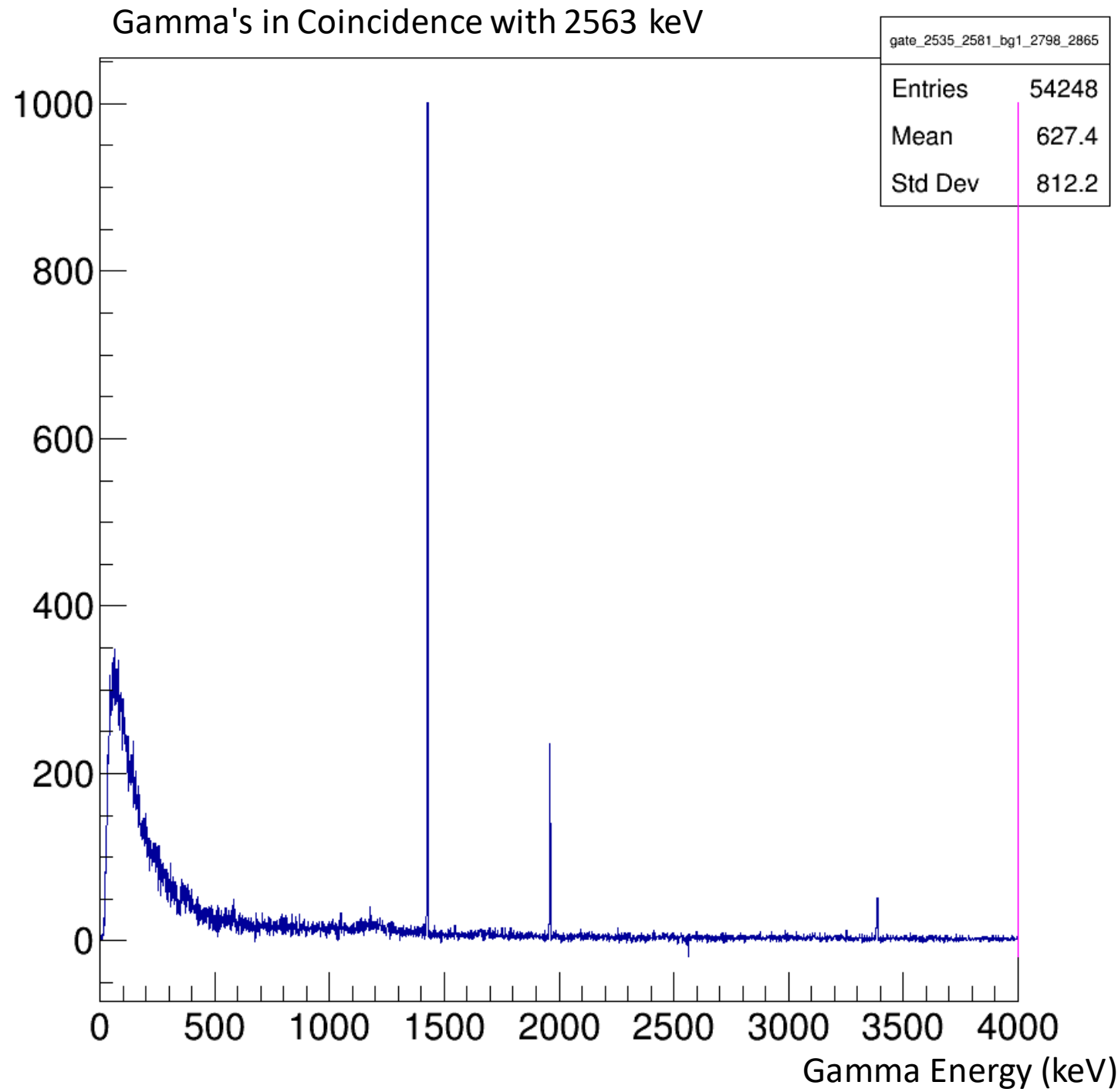
- Gated on Strongest transition (2563 keV)

Compton Suppressed Addback Addback Coincidence



PRELIMINARY RESULTS

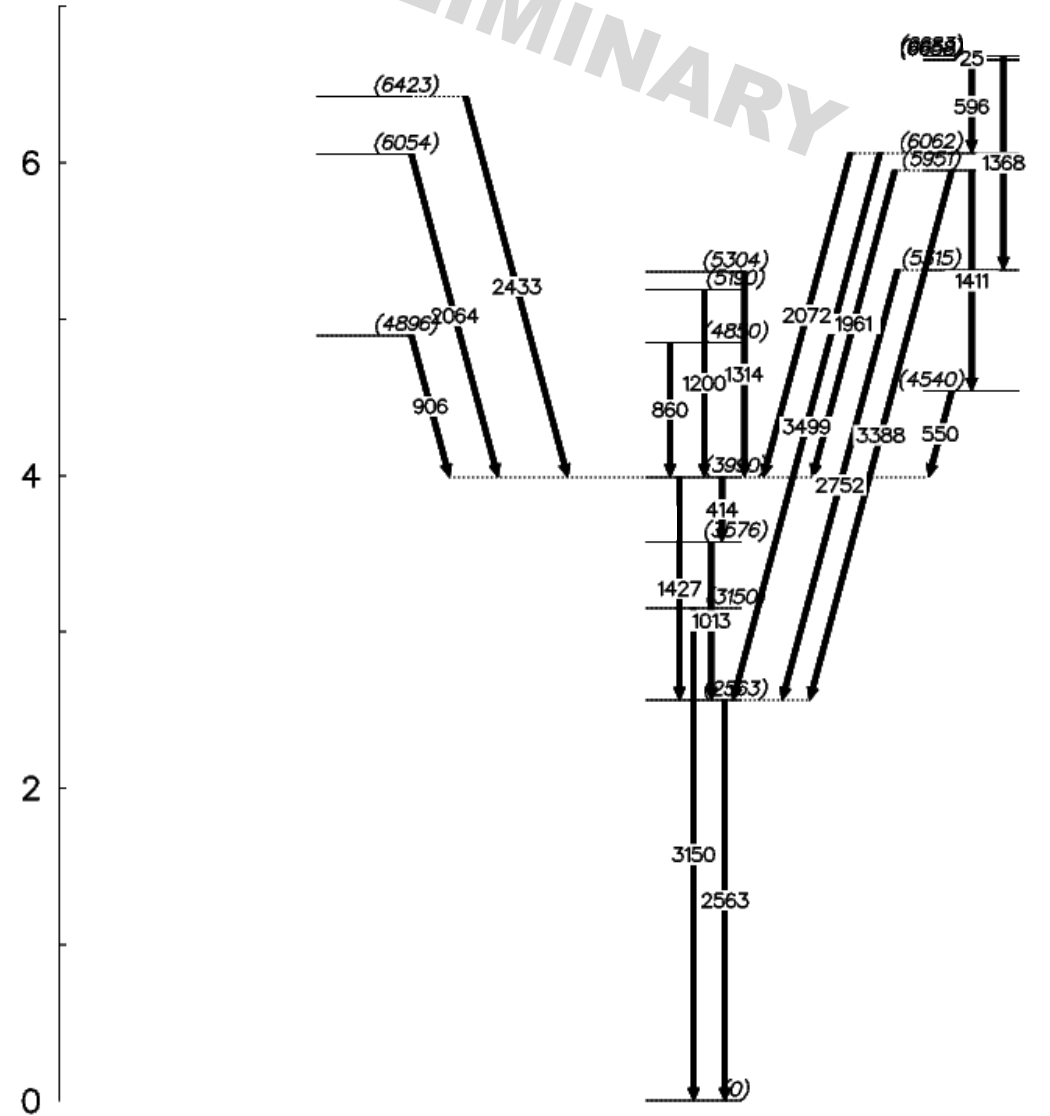
- Gated on Strongest transition (2563)
- 3170 counts in Strongest Peak



PRELIMINARY RESULTS

- Preliminary Level Scheme
 - 16 Levels
 - 12 New
 - 22 Transitions
 - 17 New

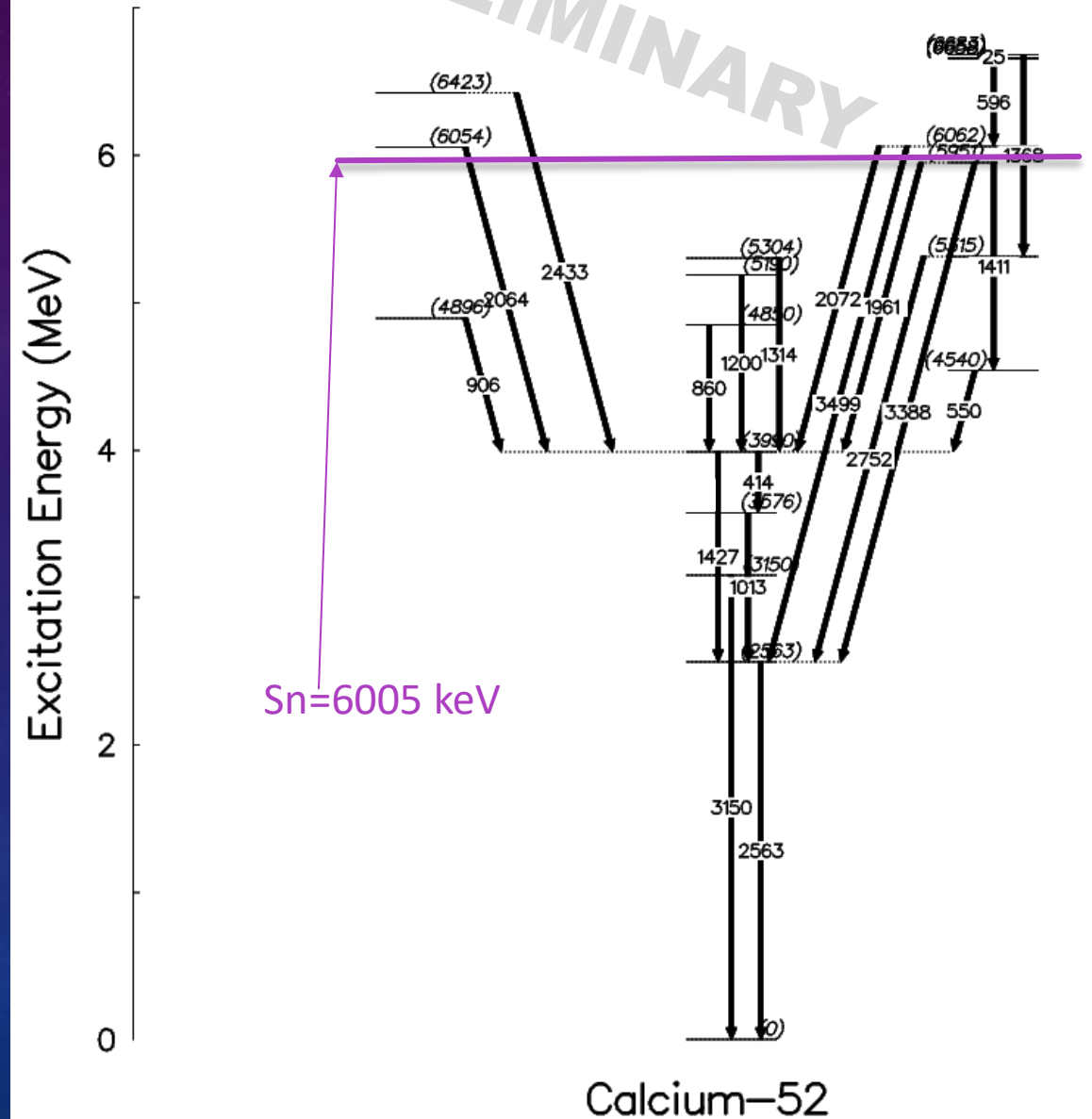
Excitation Energy (MeV)



Calcium-52

FUTURE WORK

- Finish Level Scheme
- Assign Spins Where Possible
 - Via gamma-gamma angular correlations
- Long Term
 - Continue campaign of heavy Ca isotopes
 - Provide Data to test Shell-Model Calculations



COLLABORATORS



C.E. Svensson
F.A. Ali
V. Bildstein
C. Burbadge
R. Dunlop
P.E. Garret
F. Ghazi Moradi
A.T. Laffoley
A.D. MacLean
A. Radich
T. Zidar



G.C. Ball
S.S. Bhattacharjee
M. Bowry
R. Caballero-Folch
A.B. Garnsworthy
G. Hackman
R. Lafleur
B. Olaizola
C.J. Pearson
E. Timakova



C.R. Natzke



N. Bernier
Y. Saito
D. Yates



C. Andreoiu
F.H. Garcia
K. Whitmore



G.F. Grinyer
M.P. Hladun
J.L. Mitchell



I. Dillmann



L. Sexton

THANK YOU!