My talk

Not much history left to talk about. ☹

U. Garg
University of Notre Dame

RVFJ Symposium
Chapel Hill
September 19-20, 2025

A proposal for PHASE I of a

BGO SUM-ENERGY/MULTIPLICITY SPECTROMETER

and a

MULTI-COMPTON-SUPPRESION-SPECTROMETER SYSTEM.

U.Garg, E.G. Funk, J.J. Kolata, and J.W. Mihelich

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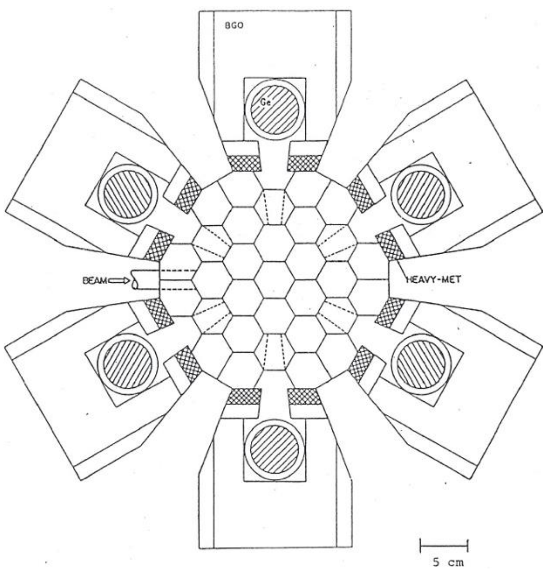
University of Notre Dame

Notre Dame, IN 46556.



Submitted to

Division of Nuclear Physics

U.S. Department of Energy

Washington, D.C. 20545

October, 1983

ARGONNE NATIONAL LABORATORY
9700 South Cass Avenue, Argonne, Illinois 60439

Telephone: 312-972-4004

August 26, 1985

Chancellor George A. Russell
Secretary to the Trustees, AUA Trust Fund
University of Missouri-Kansas City
5100 Rockhill Road
Kansas City, Missouri 64110

Dear Chancellor Russell:

On behalf of the Physics Division at Argonne National Laboratory, I wish to lend our strong support to the proposal recently submitted to the Argonne Universities Trust Fund by Notre Dame University for collaborative research in the development of a state-of-the art gamma-ray facility. This project will result in a forefront research instrument to study high-spin states in nuclei produced using the ATLAS heavy-ion accelerator at Argonne. The project has been under way now for about two years and is a collaborative effort involving personnel from Notre Dame and from Argonne.

I can honestly say that this collaboration is the smoothest and most fruitful of the many University collaborations of which I have been aware in my 23 years at Argonne. Unfortunately, because of a funding stringency in FY1986, the Notre Dame effort is likely to be quite severely hampered. For this reason, I would like to urge you to consider favorably the Notre Dame request submitted by Professor Umesh Garg, so that the project can proceed on a reasonable time-scale.

Perhaps I should emphasize that, although this collaboration is one between Notre Dame and Argonne, the final gamma-ray facility will be available to all ATLAS users. A large number of these are from several mid-western universities.

Yours sincerely,

Don Gemmell

Donald S. Gemmell
Director, Physics Division

DSG:ms

bc: U. Garg ✓

Volume 151B, number 5,6 PHYSICS LETTERS 21 February 1985

BACKBENDING IN THE 1/2$^-$[541] BAND IN ^{181}Ir

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and

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Physics Division, Argonne National Laboratory, Argonne, IL 60439, USA

Received 20 September 1984

A backbending has been observed in the 1/2$^-$[541] band in the odd-proton nucleus ^{181}Ir at $\hbar\omega \sim 0.3$ MeV, with $\Delta i_x \sim 6.5\hbar$, in contrast with only an upbend observed near this frequency in the "core" nucleus ^{180}Os. The nature of this backbend is explored in the framework of the cranked Hartree–Fock–Boguliubov approximation.

VOLUME 55, NUMBER 17 PHYSICAL REVIEW LETTERS 21 OCTOBER 1985

Total γ-Ray Spectrum in ^{153}Ho: From the Yrast Line into the Continuum

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M. L. Drigert and U. Garg
University of Notre Dame, Notre Dame, Indiana 46556

and

H. Helppi
Lappeenranta University of Technology, Finland
(Received 17 May 1985)

The γ radiation from ^{153}Ho has been measured with Compton-suppressed Ge detectors. At least four components can be identified; the energy and spin removed by each of these have been measured, and their Doppler shifts analyzed. New fine structure is observed in the pre-yrast γ spectrum which arises from single-particle transitions forming the link between the yrast and continuum cascades. Near the yrast line the single-particle character of the states is preserved, but at higher energies collective modes begin to dominate.

PACS numbers: 23.20.–g, 21.10.Pc, 21.10.Re, 27.70.+q

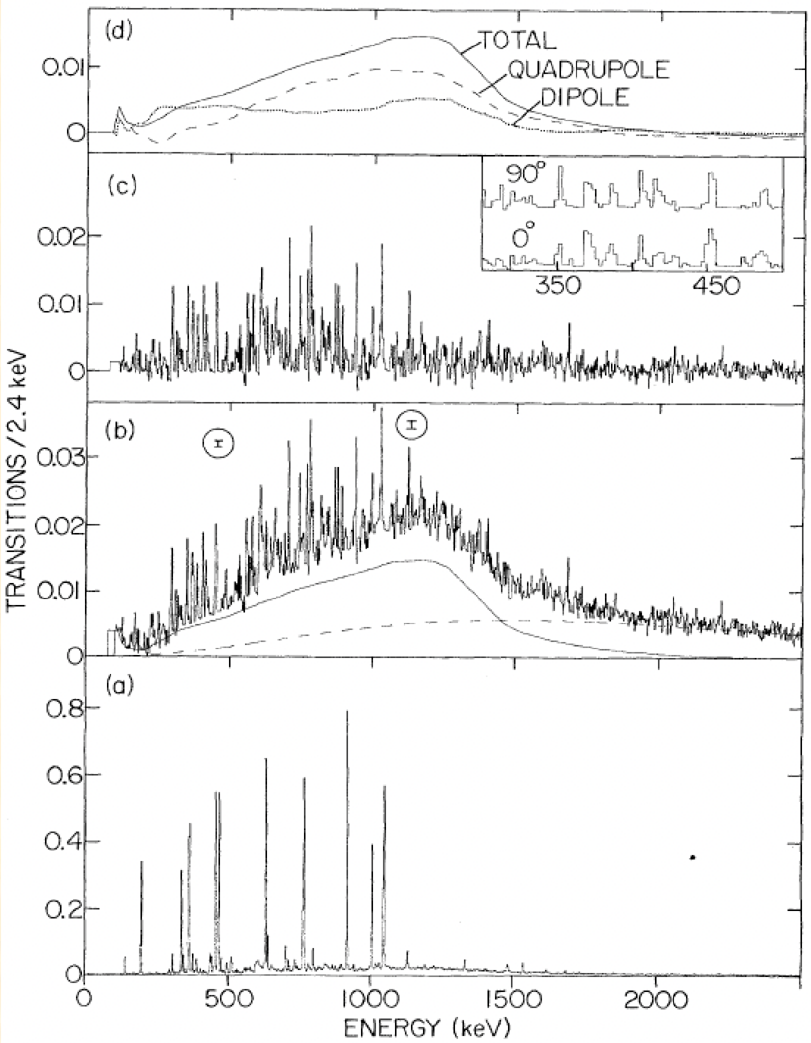

FIG. 1. Unfolded γ spectra from the reaction $^{120}Sn(^{37}Cl,4n)$ at 165 MeV. (a) Total spectrum. (b) Spectrum with the trees removed, showing grass (fine structure), soil (full line), and statistical (dashed line) components. Typical statistical errors are enclosed in circles. (c) Grass spectrum; the inset shows the 0° and 90° grass spectra between 300 and 500 keV on an expanded scale. (d) Multipole decomposition of the soil obtained from the observed anisotropies assuming stretched transitions.

The Isoscalar Giant Monopole Resonance in Exotic Nuclei and the Asymmetry Term of Nuclear Incompressibility

U. Garg
University of Notre Dame

Supported in part by the National Science Foundation

RVFJ Symposium
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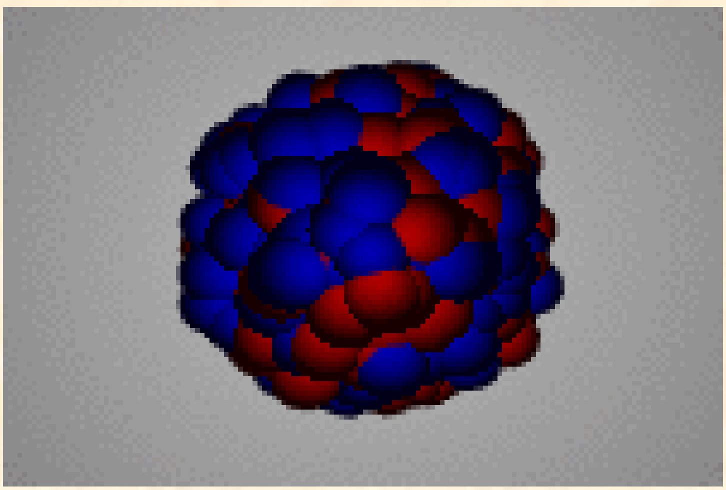
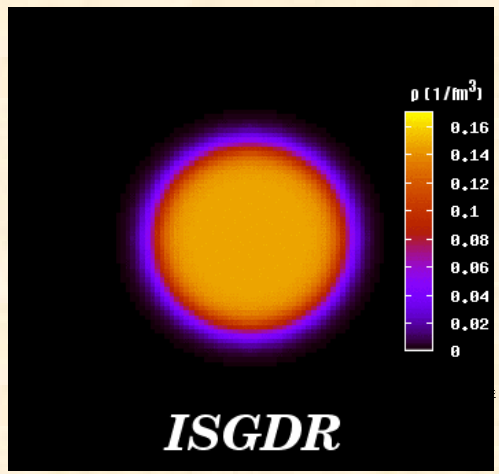
The Compressional Mode Giant Resonances

GMR	ISGDR
l = 0	l = 1



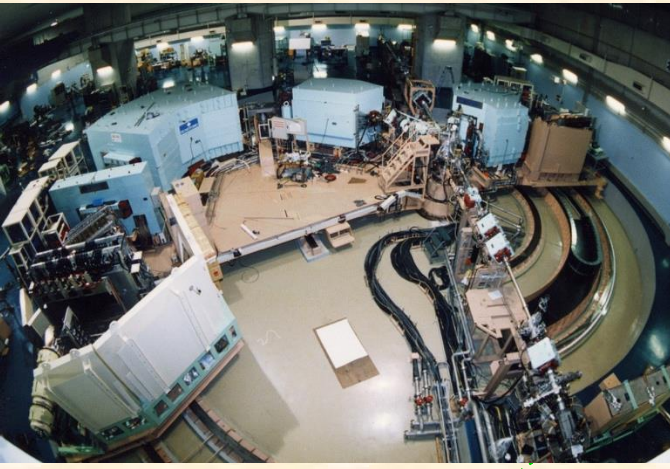


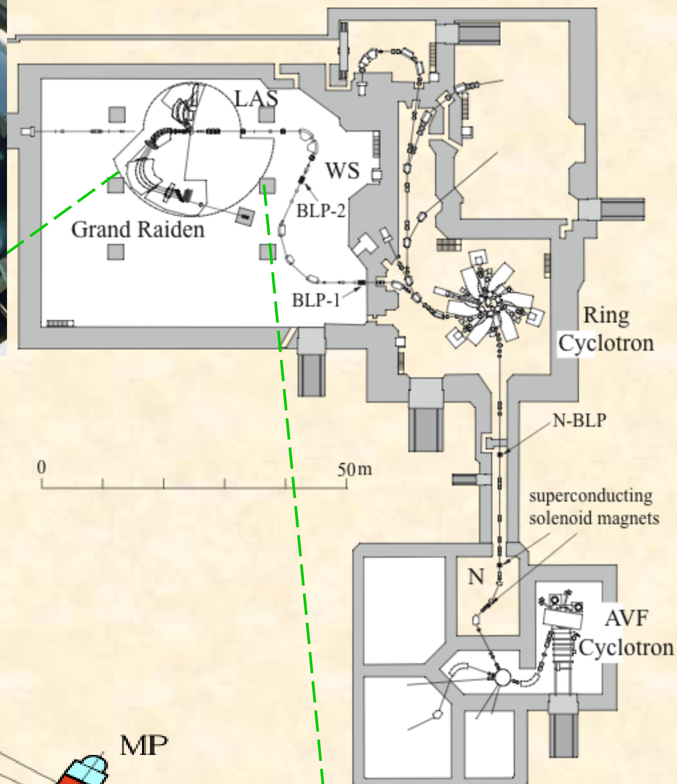
"Breathing Mode"	"Squeezing Mode"
$\square \; r_i^2$	$\square \; r_i^3 Y_1$
$2 \square \omega$	$3 \square \omega$

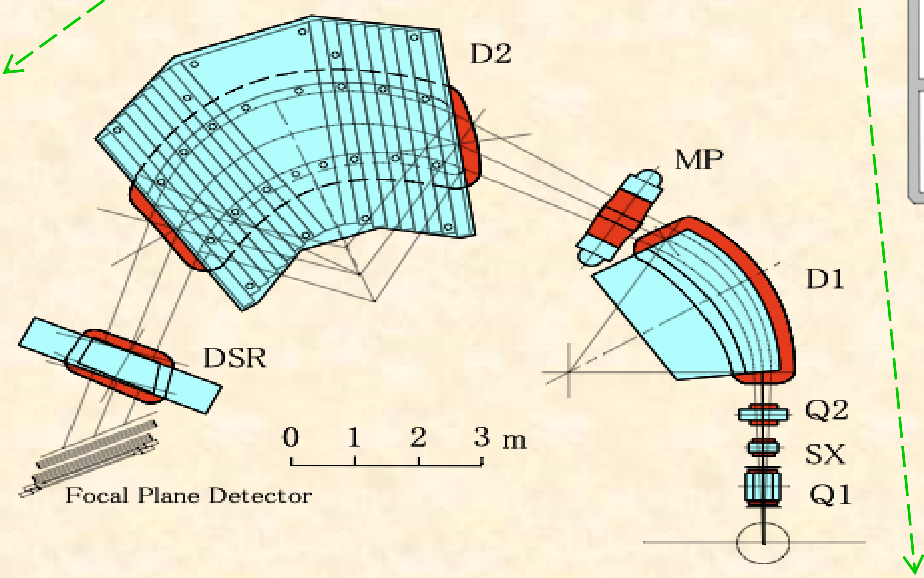
The energies of both these resonances are directly related to Nuclear Incompressibility.

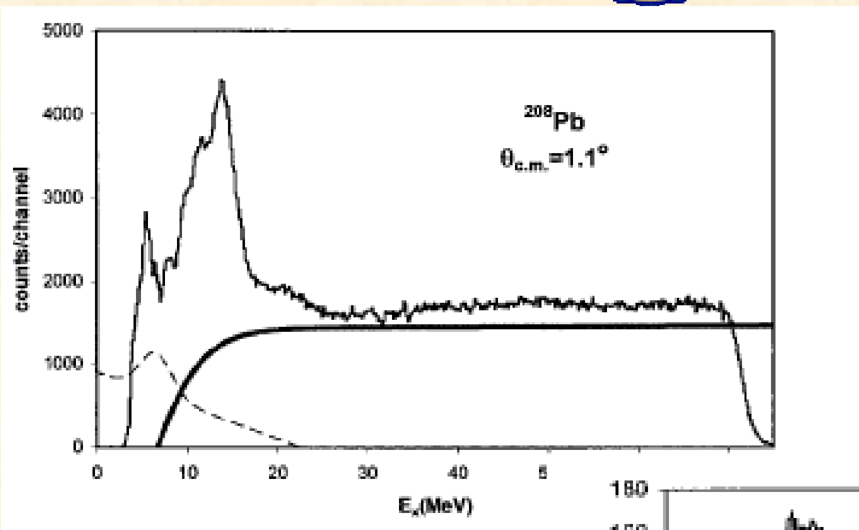
$$E_{GMR} = \square \sqrt{\frac{K_A}{m\langle r^2 \rangle}}$$

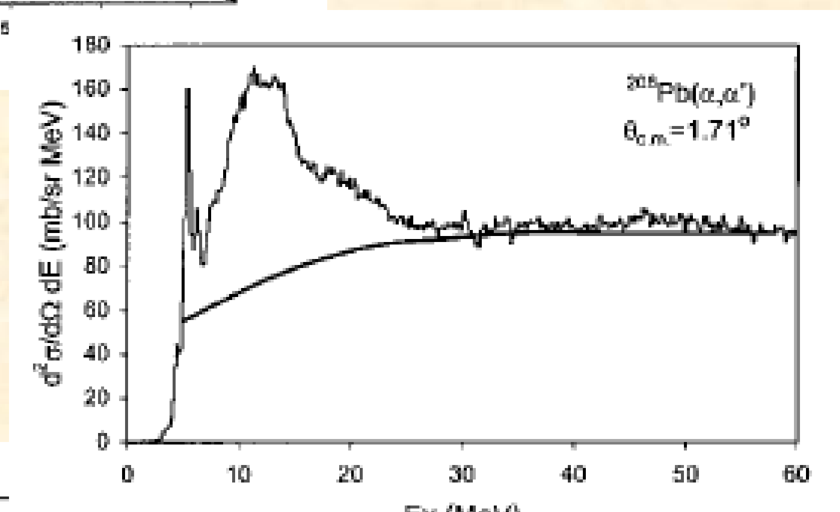
$$E_{ISGDR} = \square \sqrt{\frac{7}{3} \frac{K_A + \frac{27}{25}\varepsilon_F}{m\langle r^2 \rangle}}$$

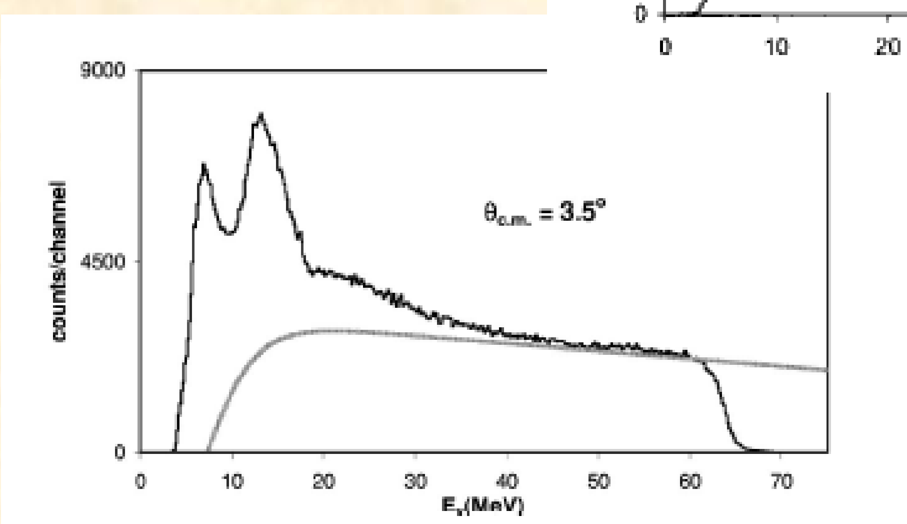



LAS
WS
BLP-2
Grand Raiden
BLP-1
Ring
Cyclotron
N-BLP
0
50m
superconducting
solenoid magnets
N
AVF
Cyclotron

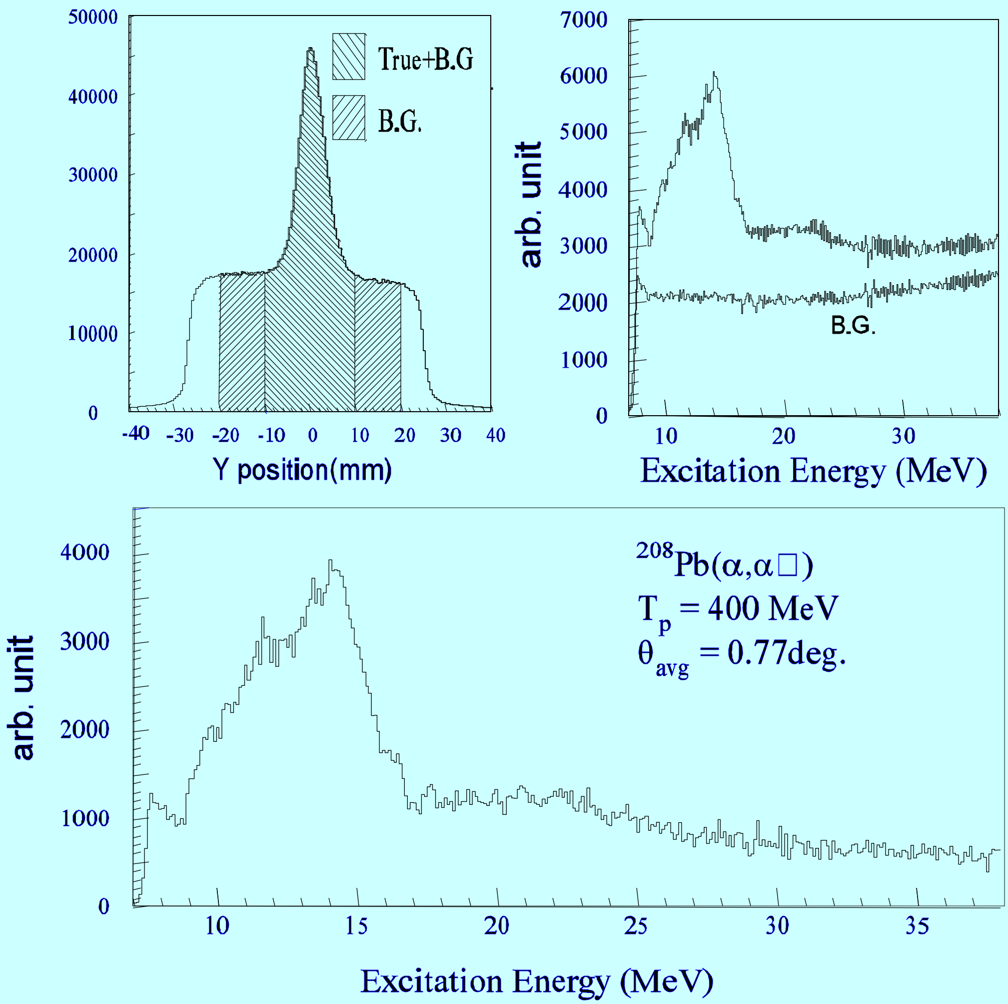

D2
MP
D1
DSR
Q2
SX
Q1
0 1 2 3 m
Focal Plane Detector







240 MeV (α,α') [Texas A & M]



True+B.G
B.G.
Y position(mm)
arb. unit
B.G.
Excitation Energy (MeV)
^{208}Pb(α,α□)
T_p = 400 MeV
θ_{avg} = 0.77deg.
arb. unit
Excitation Energy (MeV)

From GMR data on ^{208}Pb and ^{90}Zr

$K = 240 \pm 20$ MeV

This number is consistent with both GMR and ISGDR data and with non-relativistic and relativistic calculations

We know K_A from E_{GMR}:

$$E_{GMR} = \hbar\sqrt{\frac{K_A}{m\langle r^2\rangle}}$$

In an approximate way, K_A may be expressed as:

$$K_A \sim K_\infty (1 + cA^{-1/3}) + K_\tau ((N-Z)/A)^2 + K_{Coul} Z^2 A^{-4/3}$$

$$c \sim -1$$

K_{Coul} is, basically, model independent

K_τ ??

Measurements over a series of isotopes gives K_τ

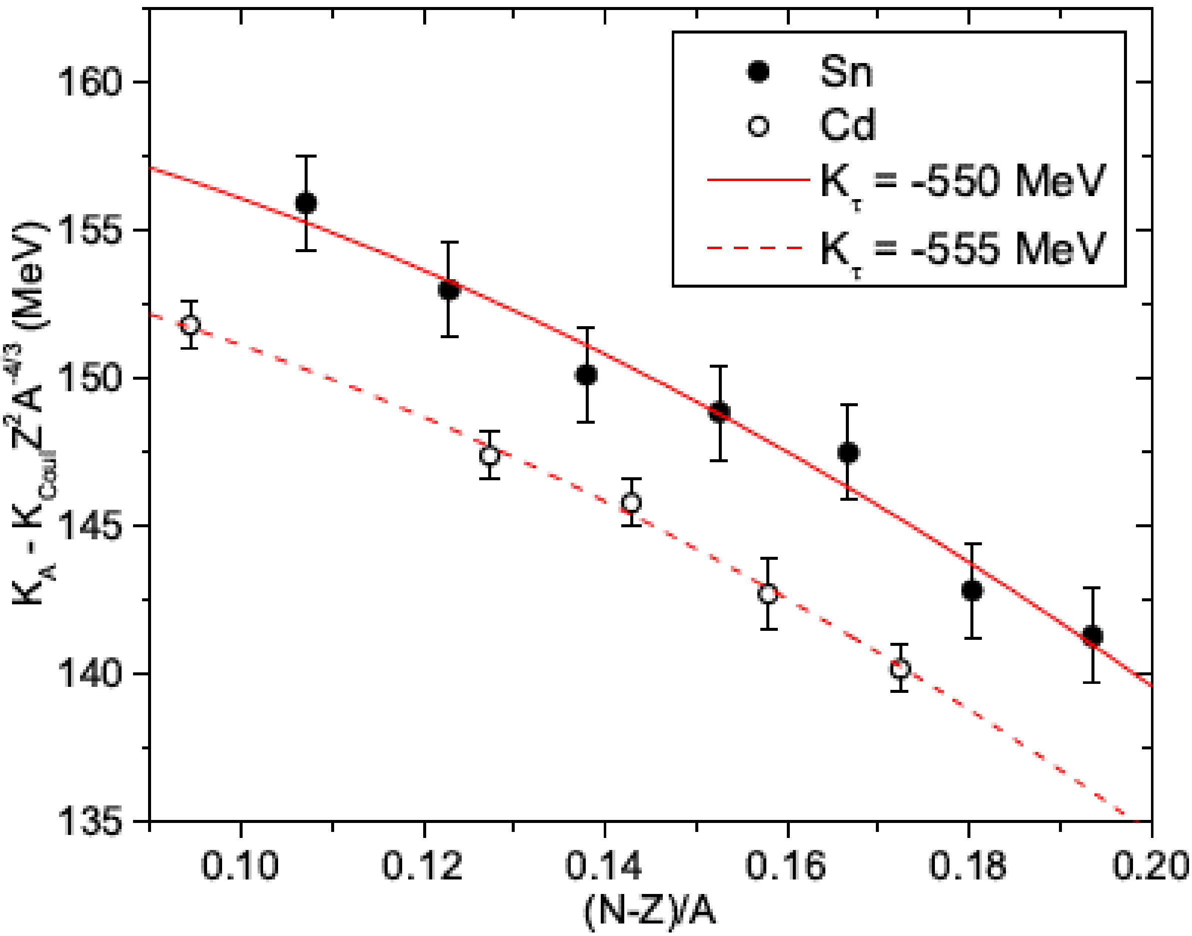
$$K_\tau = K_{sym} - 6L - Q_0 L/K_\infty$$

$$K_A \sim K_{vol}\,(1 + cA^{-1/3}) + K_\tau\,((N - Z)/A)^2 + K_{Coul}\,Z^2A^{-4/3}$$

$$K_A - K_{Coul}\,Z^2A^{-4/3} \sim K_{vol}\,(1 + cA^{-1/3}) + K_\tau\,((N - Z)/A)^2$$

$$\sim \text{Constant} + K_\tau\,((N - Z)/A)^2$$

We use K_{Coul} = - 5.2 MeV (from Sagawa)



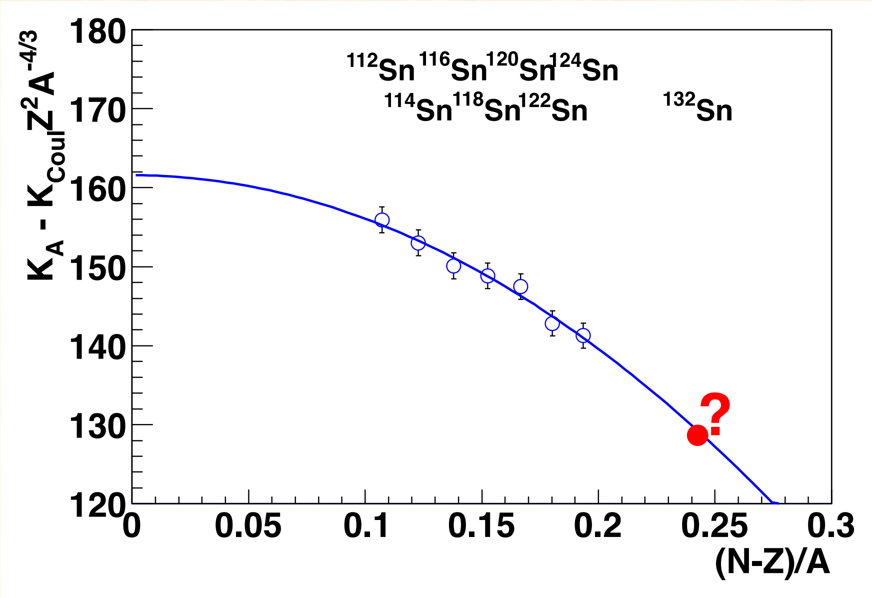
$$K_\tau = -550 \pm 100 \text{ MeV}$$

$$K_\tau = K_{sym} - 6L - Q_0 L / K_\infty$$

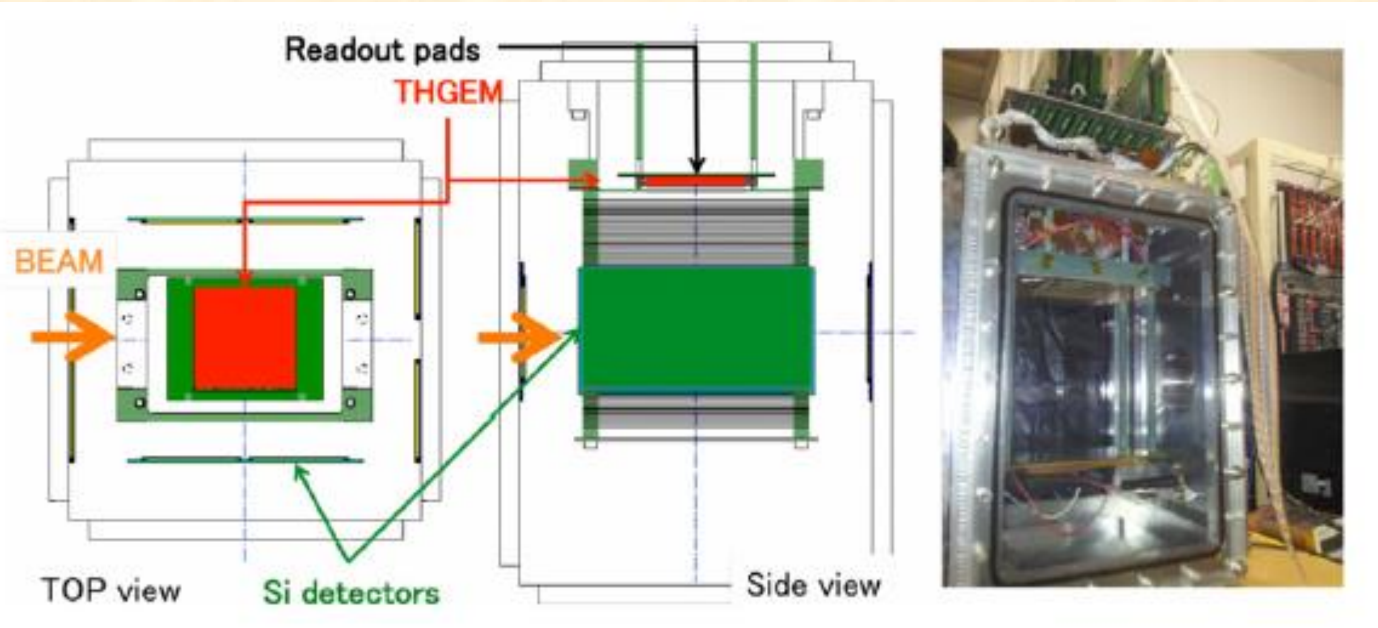
Can we do any better on K_∞ and K_τ ?

-- Not much, I think, on K_∞

-- Can hope for improvement in K_τ



± 50 MeV, perhaps

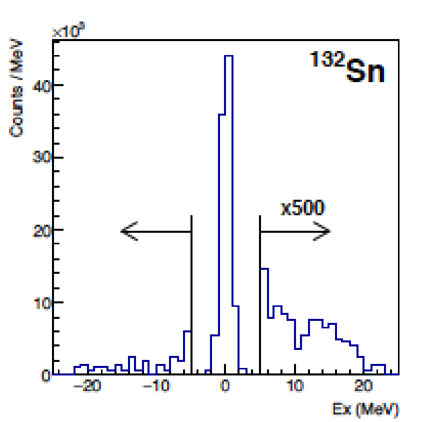


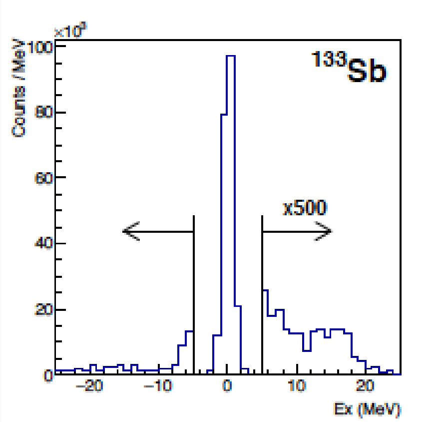
RIBF 113

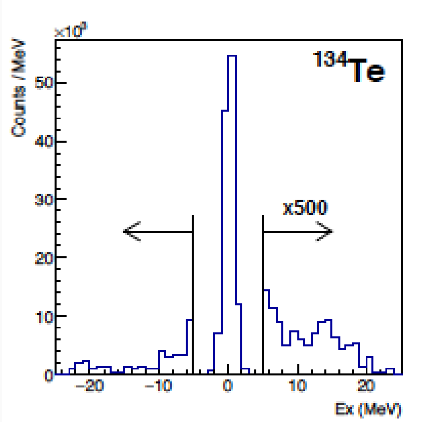
$^{132}Sn + ^{2}H$
100 MeV/A
>50 kHz ^{132}Sn

Preliminary uncorrected energy spectra for ^{132}Sn, ^{133}Sb, and ^{134}Te.

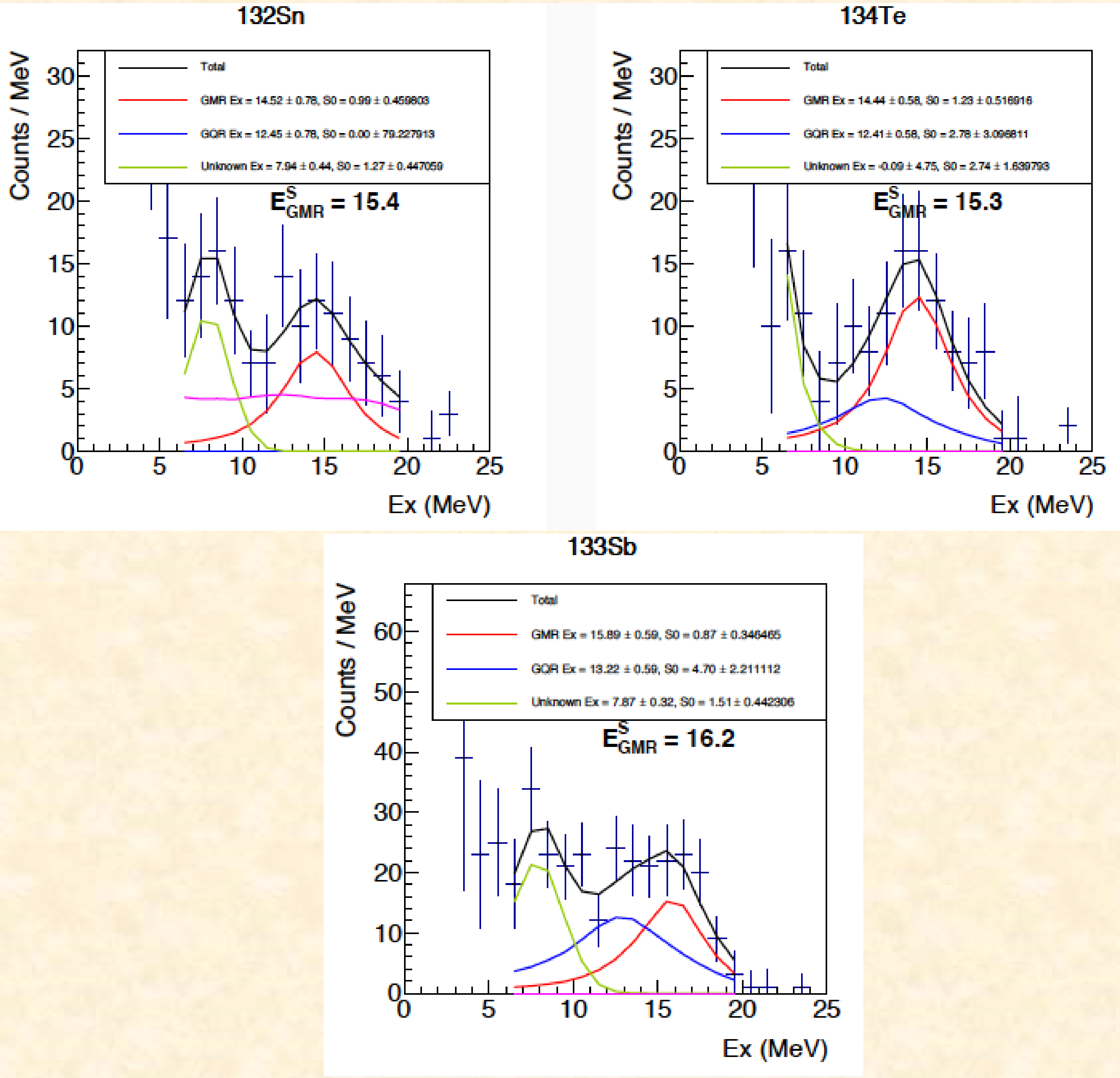
Particle identifications of beam and recoil particles have been done.



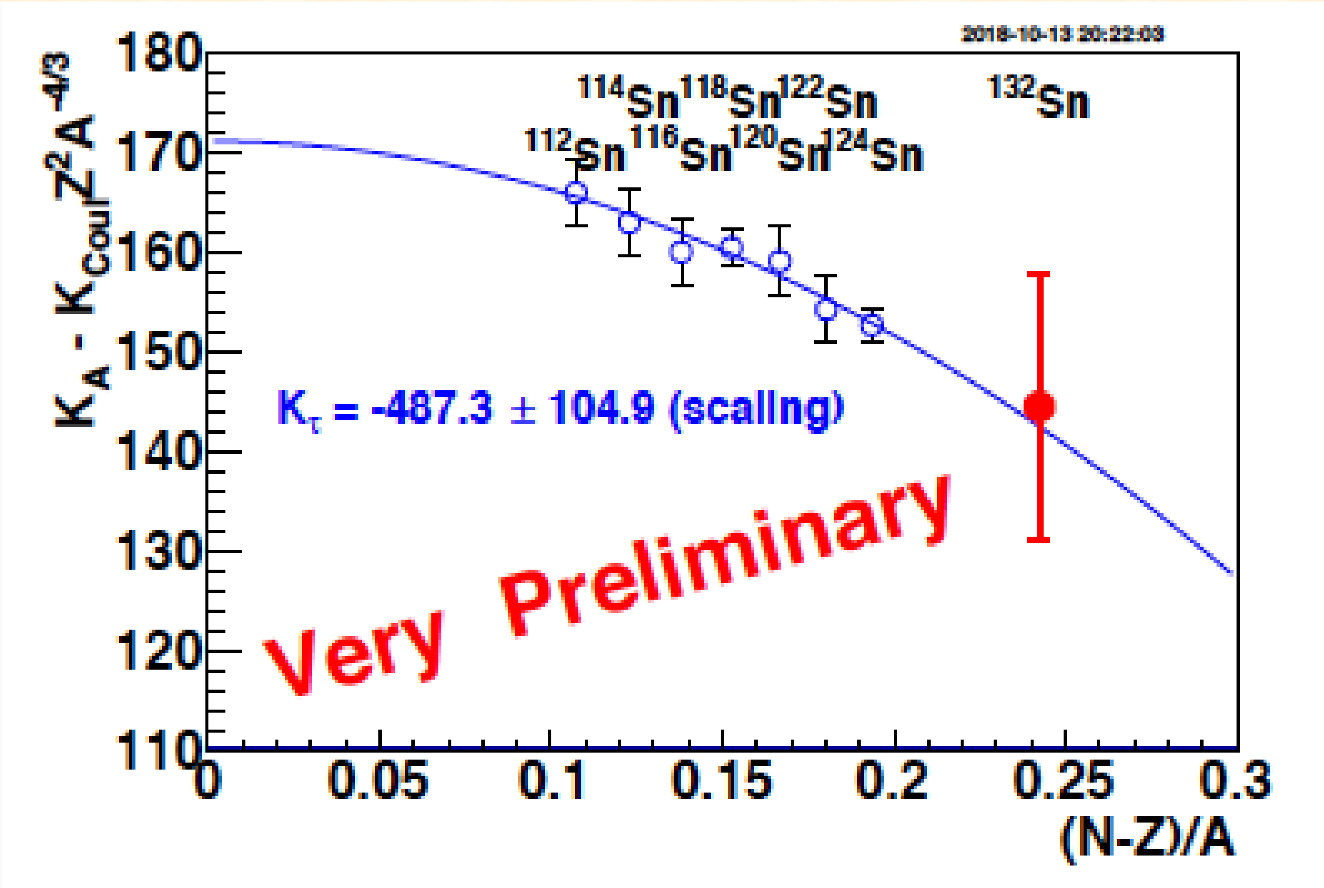




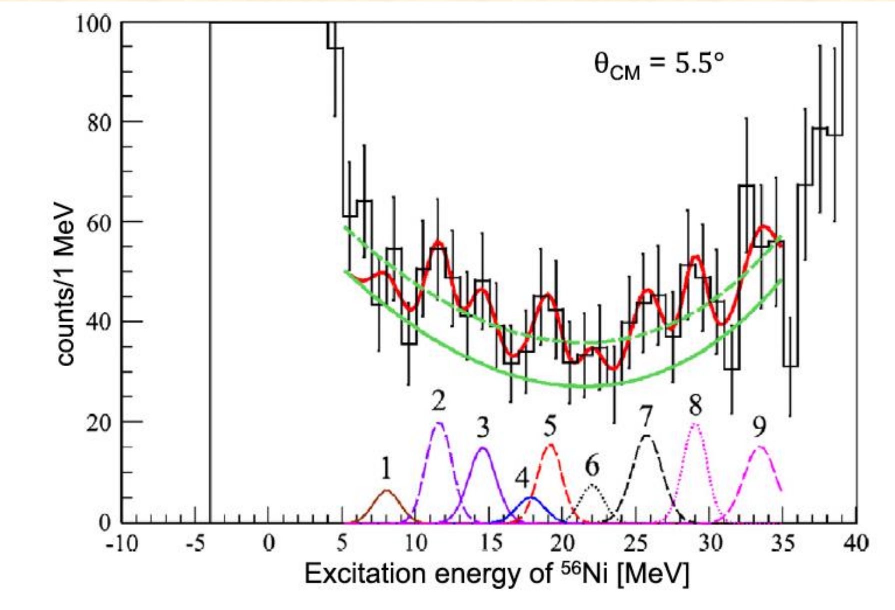
Preliminary results from RIKEN *d*(^{132}Sn, ^{132}Sn')*d* experiment



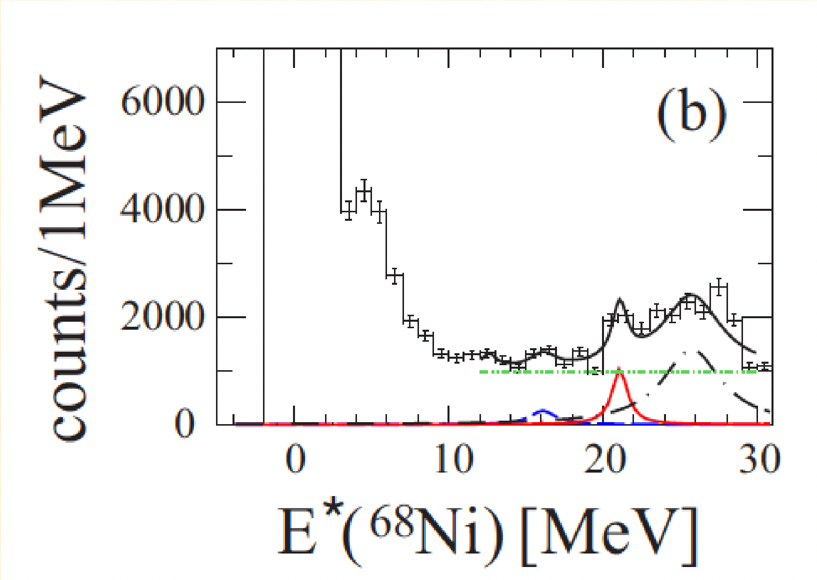
Preliminary results from RIKEN *d*(^{132}Sn, ^{132}Sn')*d* experiment



Preliminary results from RIKEN *d*(^{132}Sn, ^{132}Sn')*d* experiment



^{56}Ni
GANIL



^{68}Ni
GANIL

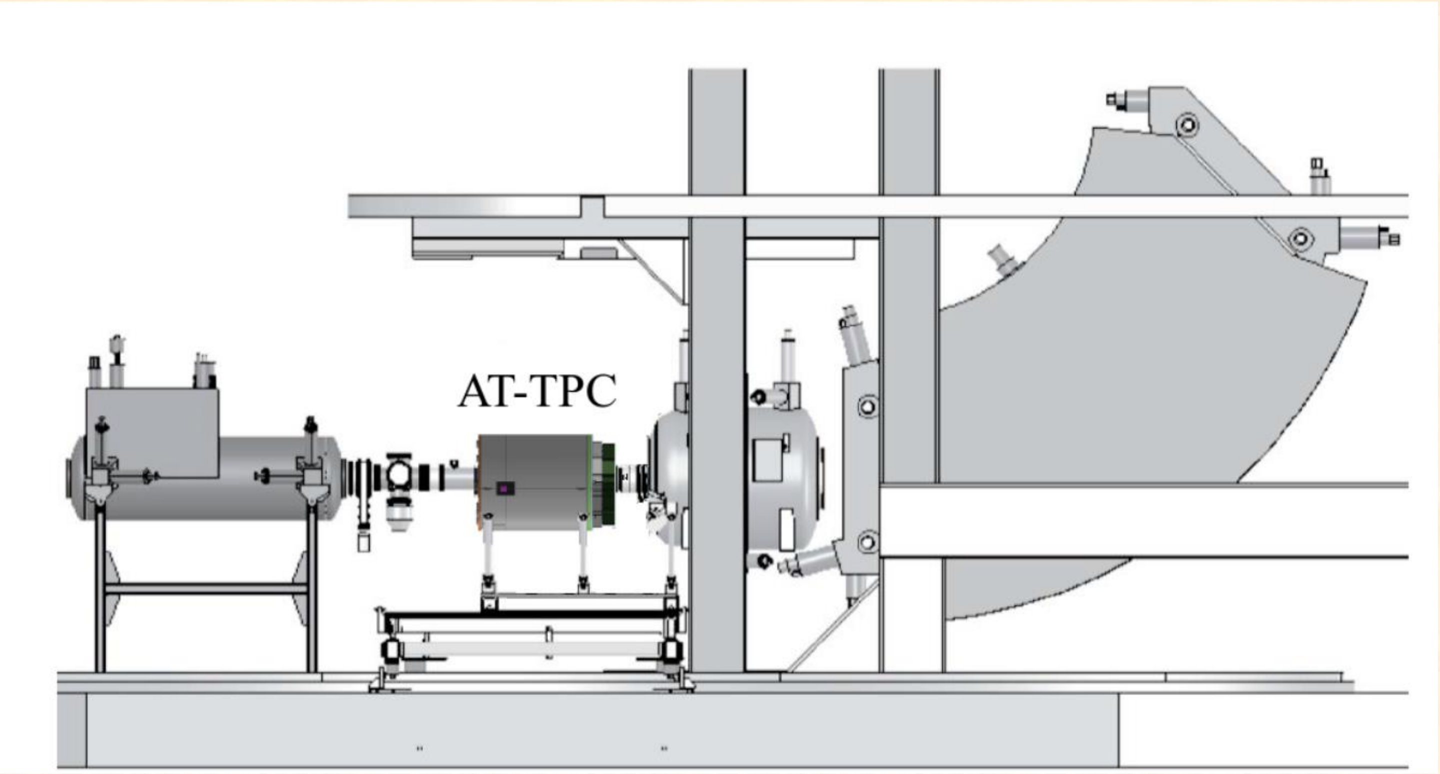
50 MeV/A (α, α'); He with 5% CF_4

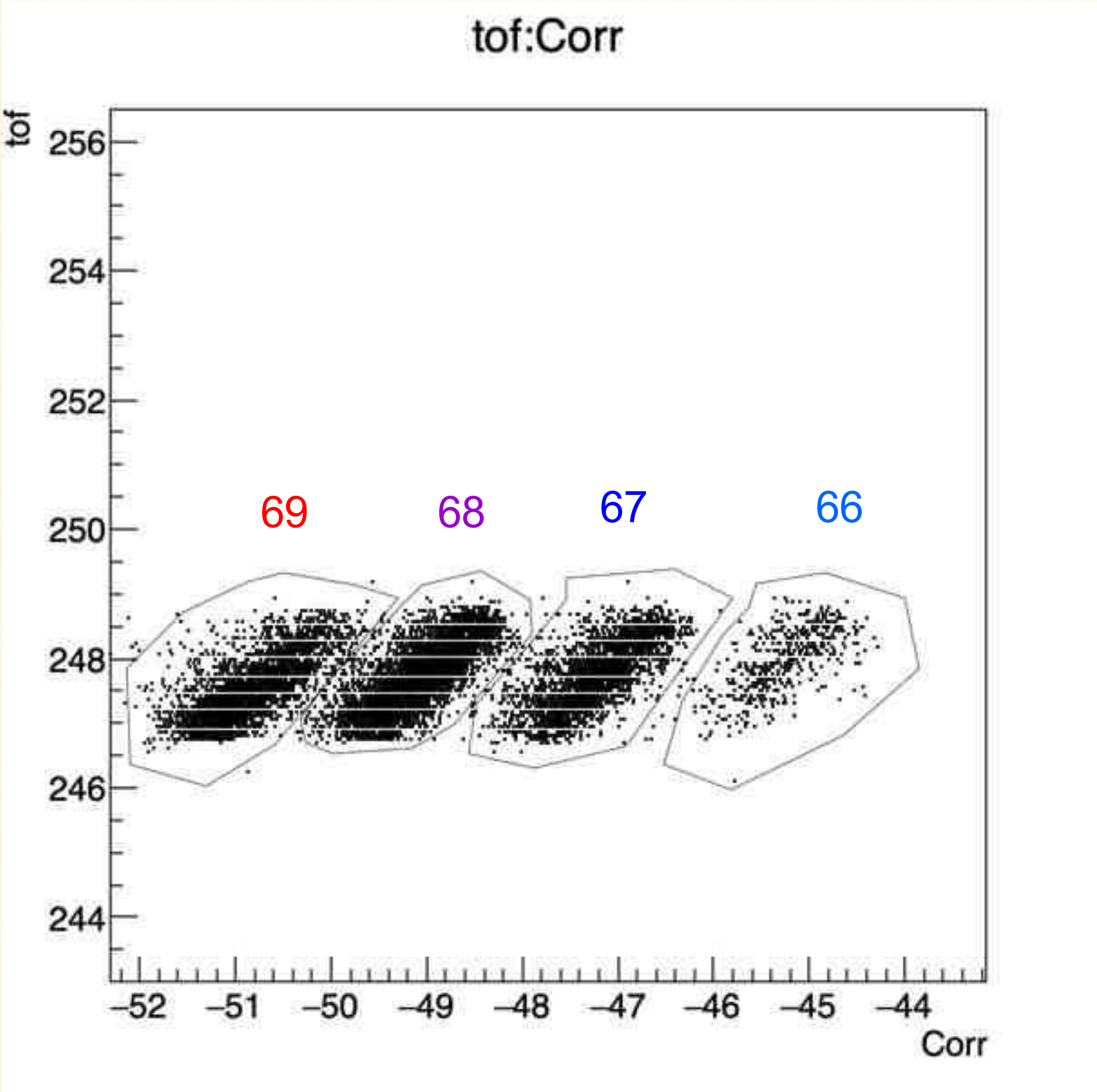
$^{4}He(^{70}Ni, ^{70}Ni')^{4}He$ @ NSCL

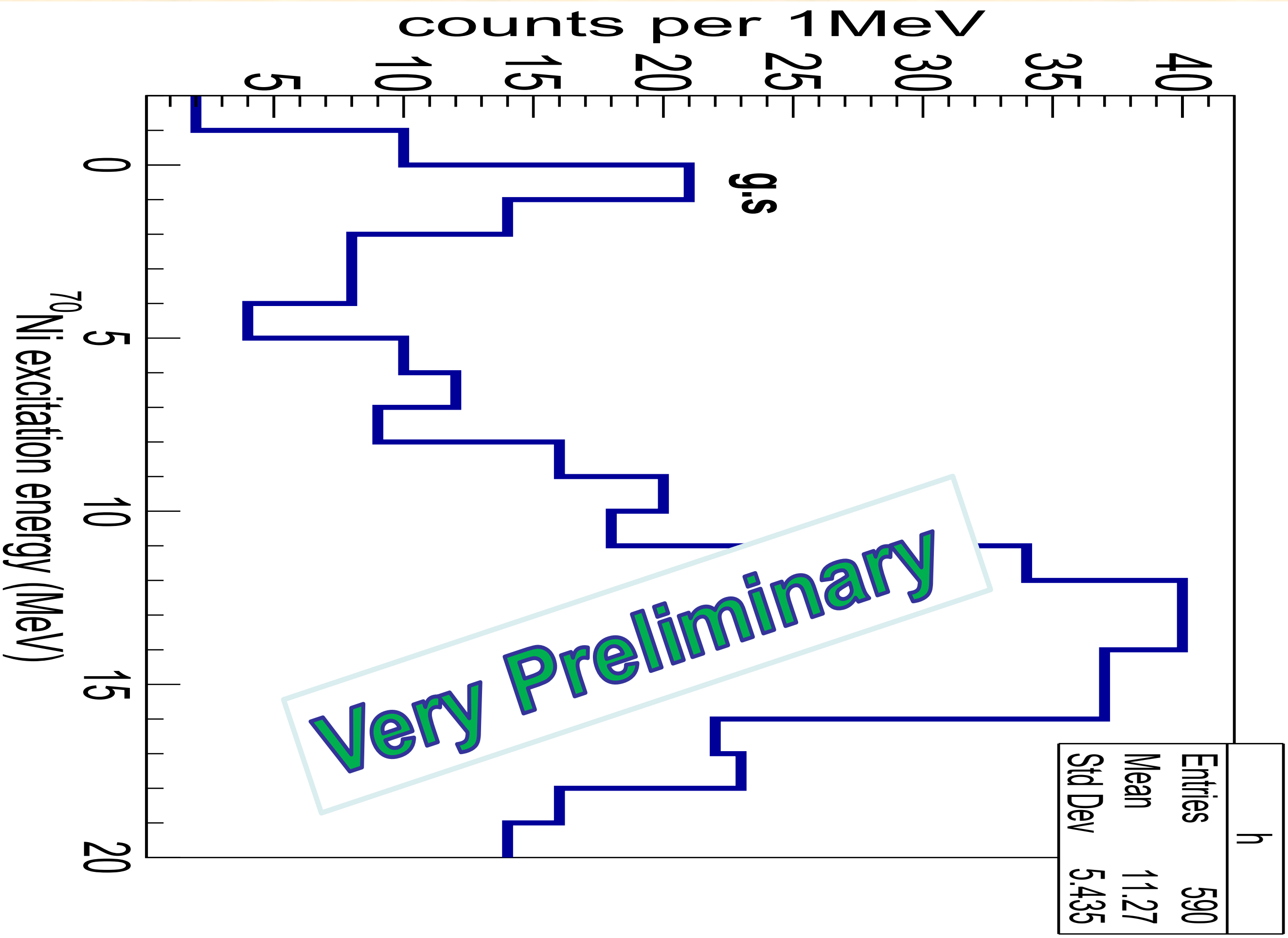
82 MeV/A; ~20k pps

e18207

$^{4}He(^{70}Ni, ^{70}Ni')^{4}He$ @ NSCL




tof:Corr
tof
256
254
252
250
248
246
244
69
68
67
66
−52
−51
−50
−49
−48
−47
−46
−45
−44
Corr



~40 hrs data

Preliminary results from J.S. Randhawa et al.

$^{4}He(^{132}Sn, ^{132}Sn')^{4}He$ @ FRIB

Aims

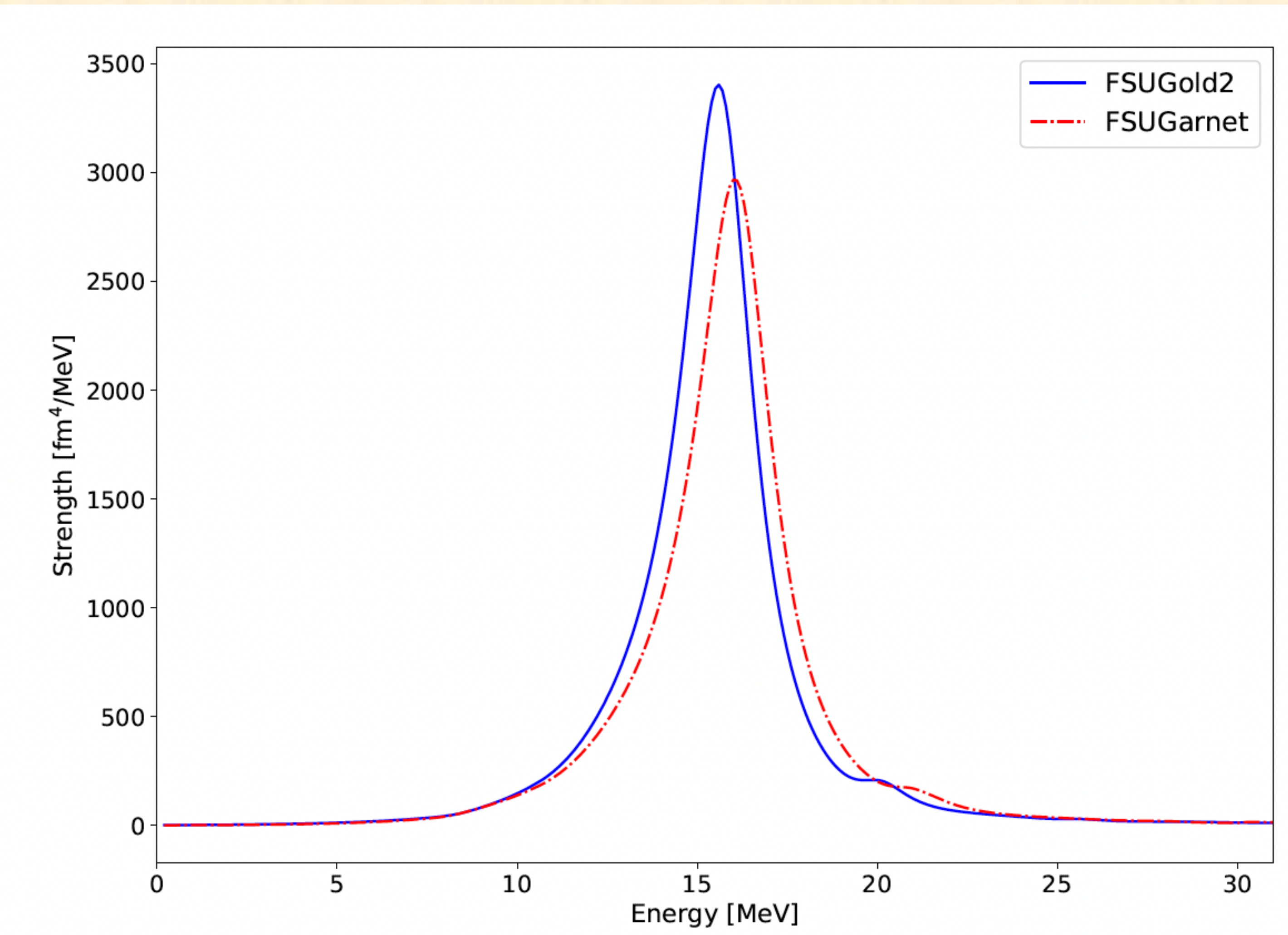
To investigate:

i) the asymmetry term in the nuclear incompressibility;

ii) the phenomenon of "softness" of open-shell nuclei as observed in the ISGMR strength distributions in the Sn and Cd nuclei; and,

iii) to directly test the impact of the recent results from PREX-II on the observed ISGMR strengths in very neutron-rich nuclei.

$^{4}He(^{132}Sn, ^{132}Sn')^{4}He$ @ FRIB

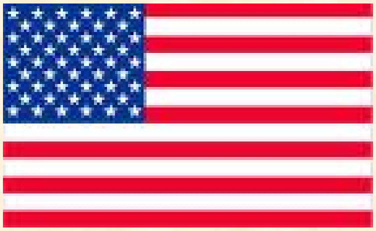


Calculations courtesy Prof. J. Piekarewicz.

- We have "experimental" values now for K_∞ (240±20 MeV) and K_τ (-550±50 MeV). There is a lot of room for "improvement" in the latter.
- We have completed a measurement at NSCL on ^{70}Ni using pure ^{4}He gas and trigger with S800. Very clean spectra have been observed with a "peak" at ~17 MeV consistent with GMR.
- An experiment to measure ISGMR in ^{132}Sn was approved in the "first round" proposals for FRIB.

धन्यवाद

Thanks!



The Question Kitten