CNS Plunger device and life-time measurement at RIBF

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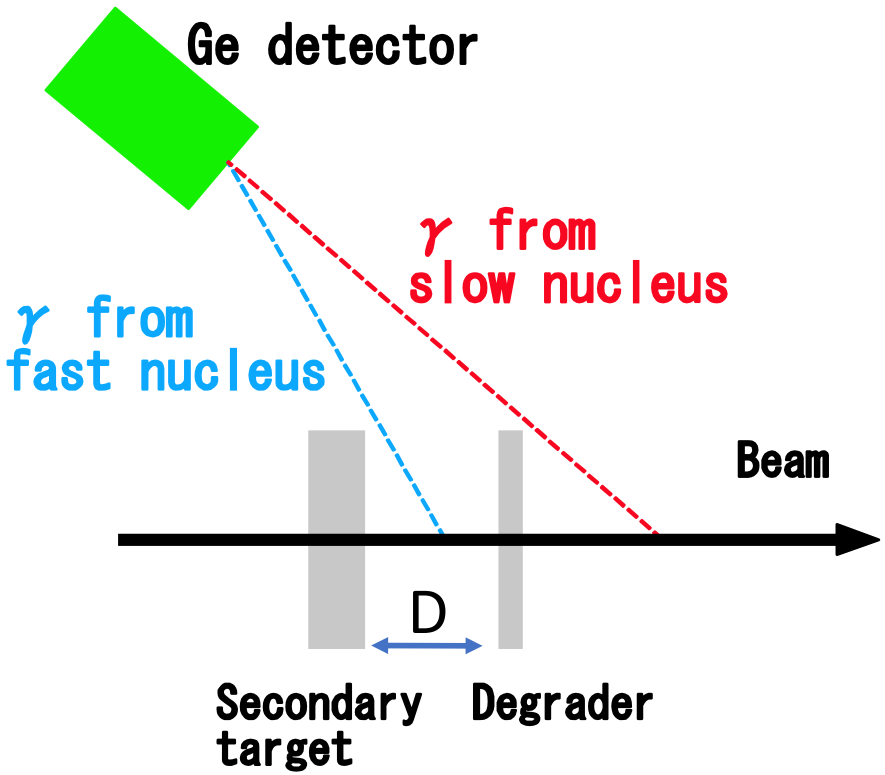
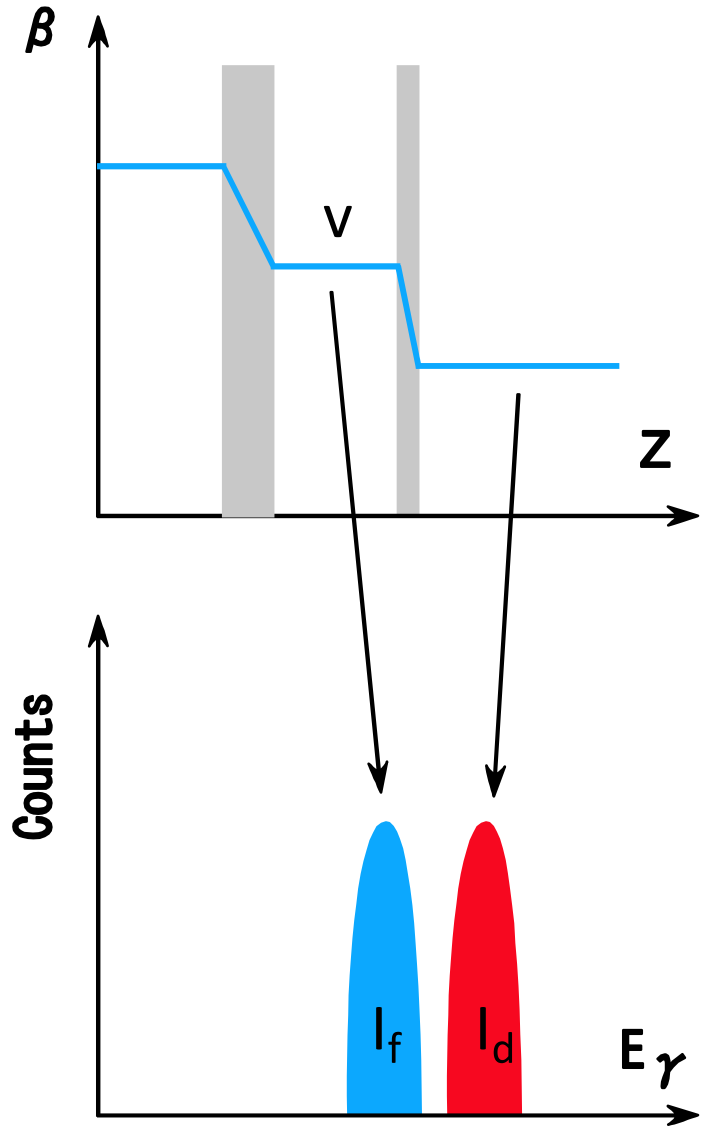
- CNS plunger device
  - NP0906-RIBF07
- Life-time measurement using plunger at RIBF

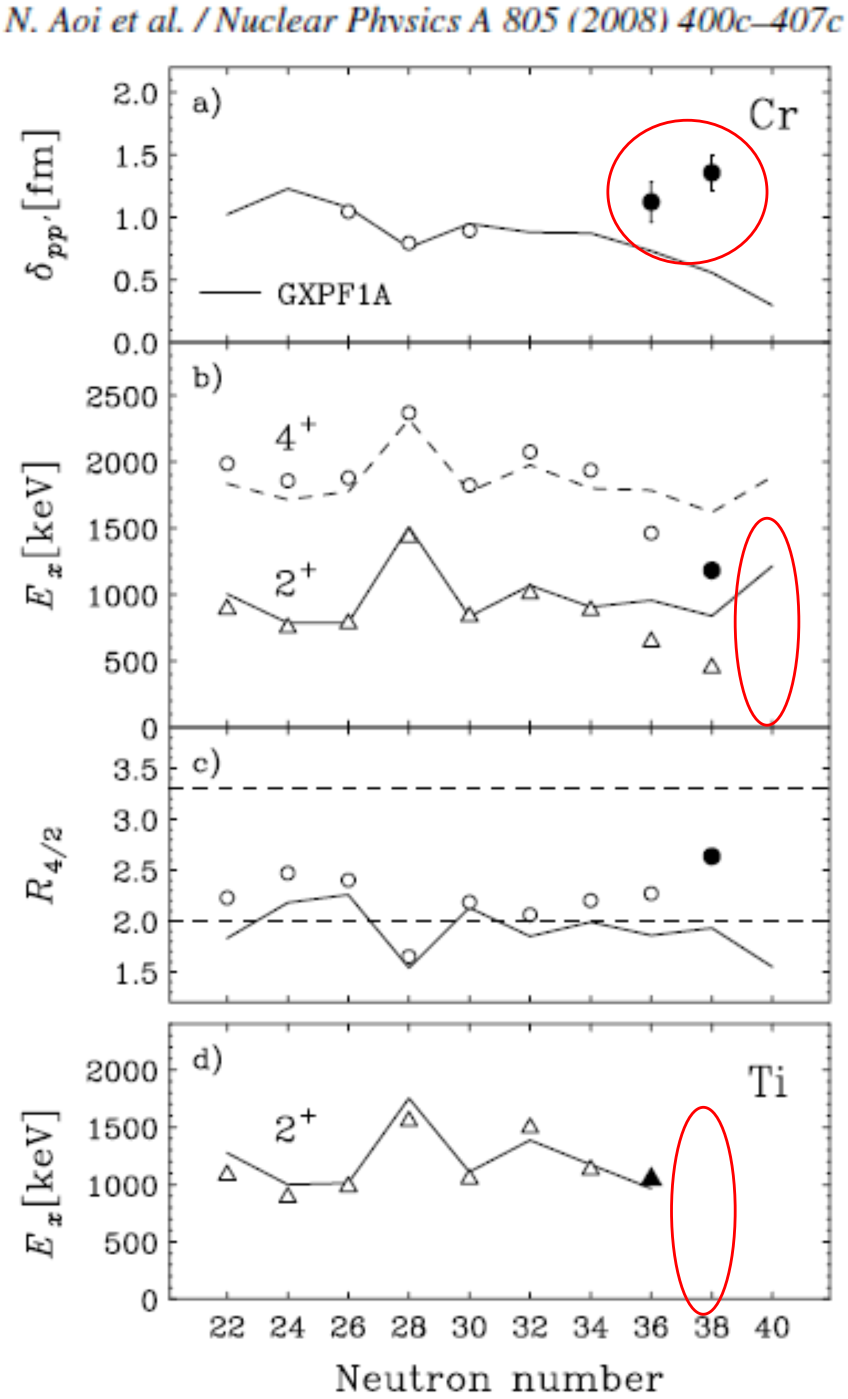
Method of the experiment

- Recoil distance method



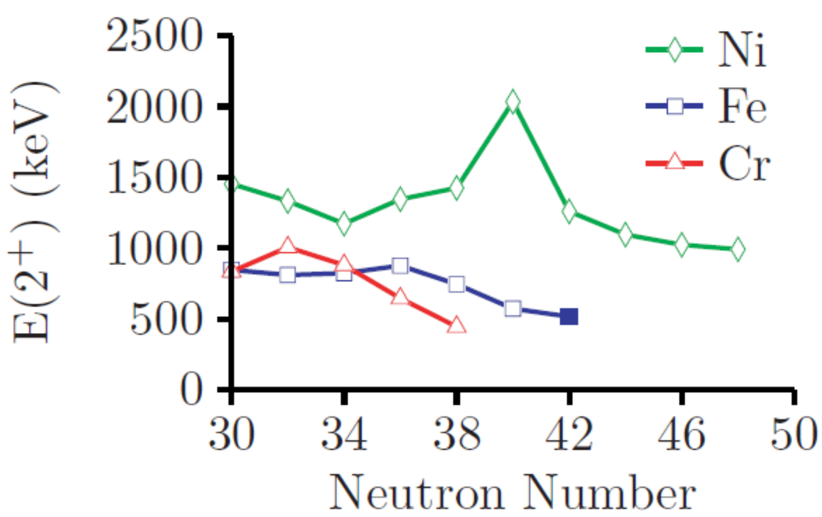


$$\frac{I_d}{I_f + I_d} = e^{-D/v\tau}$$



Objectives in NP0906-RIBF07 (2011): cancelled due to earthquake

- B(E2) by lifetime measurement
  → $^{60,62}Cr$, $^{64,66}Fe$
- 2^+, 4^+ energy of ^{64}Cr
- 2^+ energy of ^{60}Ti
- Level structure in neighbors
- Octupole collectivity (negative parity states)



P. Adrich et al., Phys. Rev. C77, 054306 (2008)

Reference: PRL 106, 022502 (2011)
W. Rother, A. Dewald et al., RDM for $^{62\text{-}66}Fe$

^{76}Ge 130AMeV + ^{9}Be →

^{62}Fe: 3.6 × 10^4 pps, 85%, 97.8 AMeV

v/c: 0.368 → 0.322

^{64}Fe: 6 × 10^3 pps, 65%, 95.0 AMeV

v/c: 0.364 → 0.298

^{66}Fe: 1 × 10^3 pps, 25%, 88.3 AMeV

v/c: 0.346 → 0.291

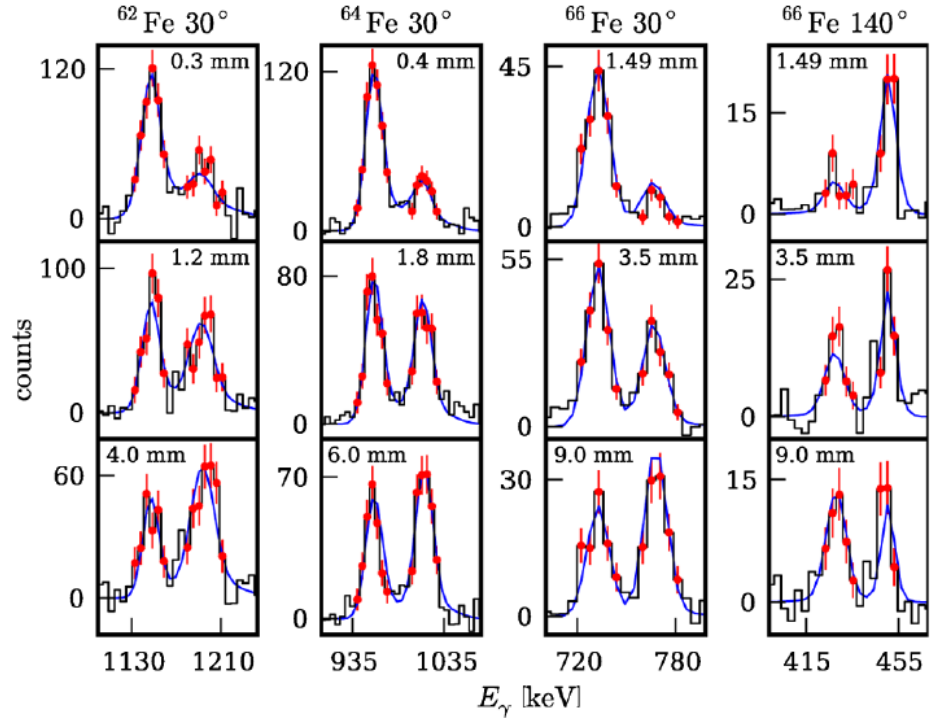
Target: 300μm Au

Degrader: 300 (400) μm Nb

Target – Degrader distance:

5-7 different distances,

Range = 0 to 20 mm



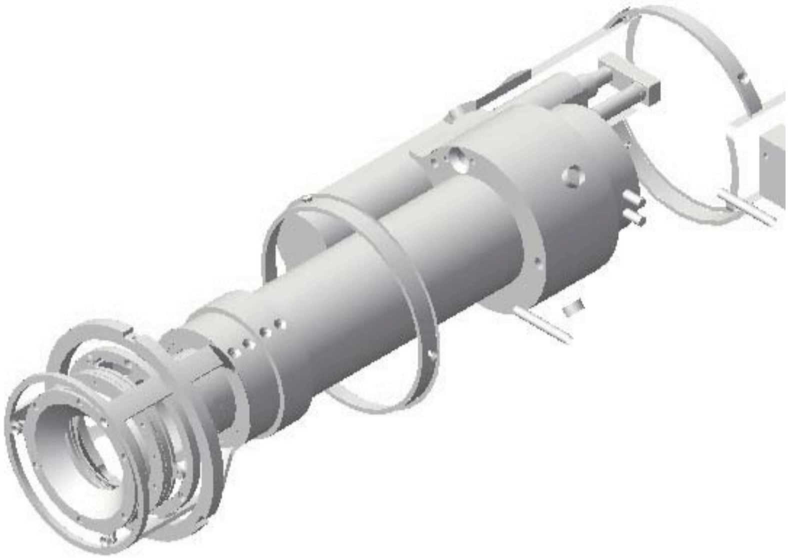
τ=8.0ps τ=10.3ps τ=39.4ps

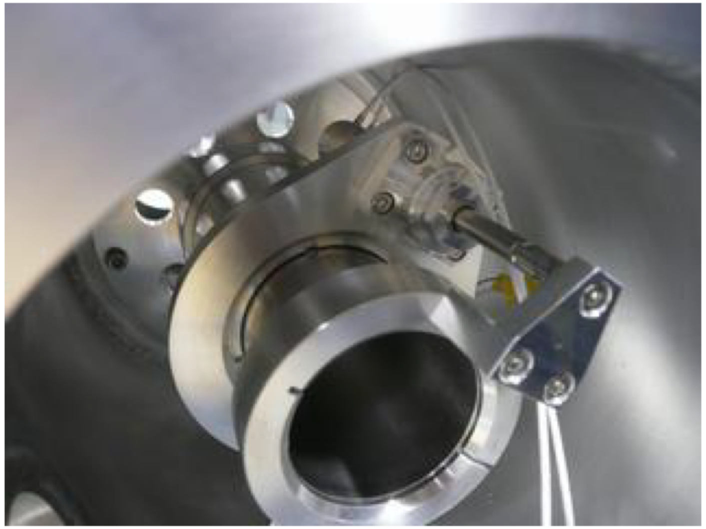
～640 counts ～560 counts ～210 counts ～110 counts

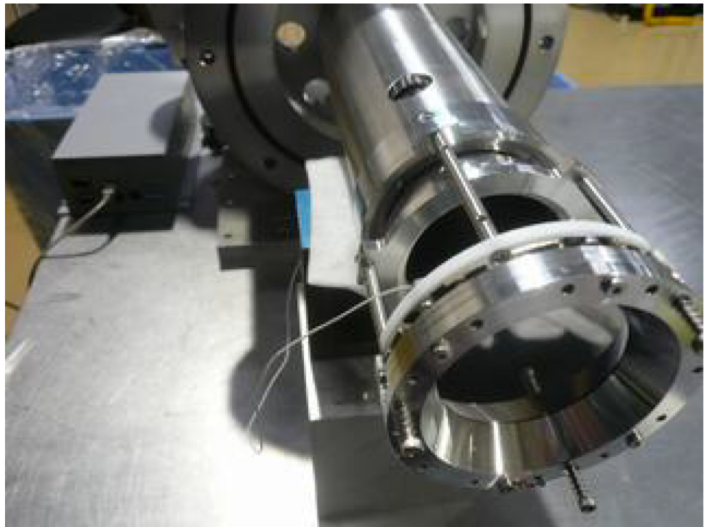
500～1000 counts with reasonably separated peaks will be necessary

CNS plunger device

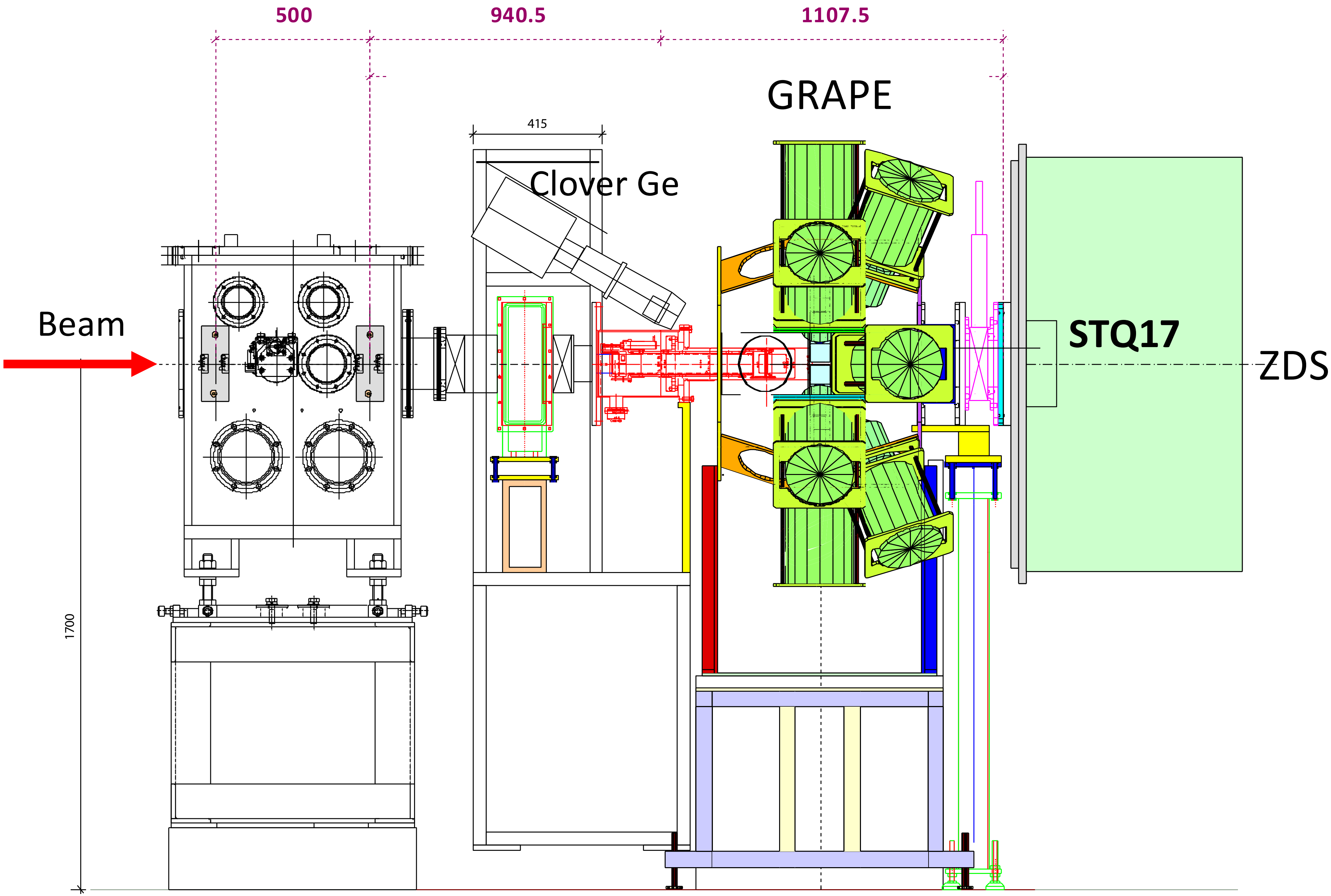
Originally Koeln Plunger design



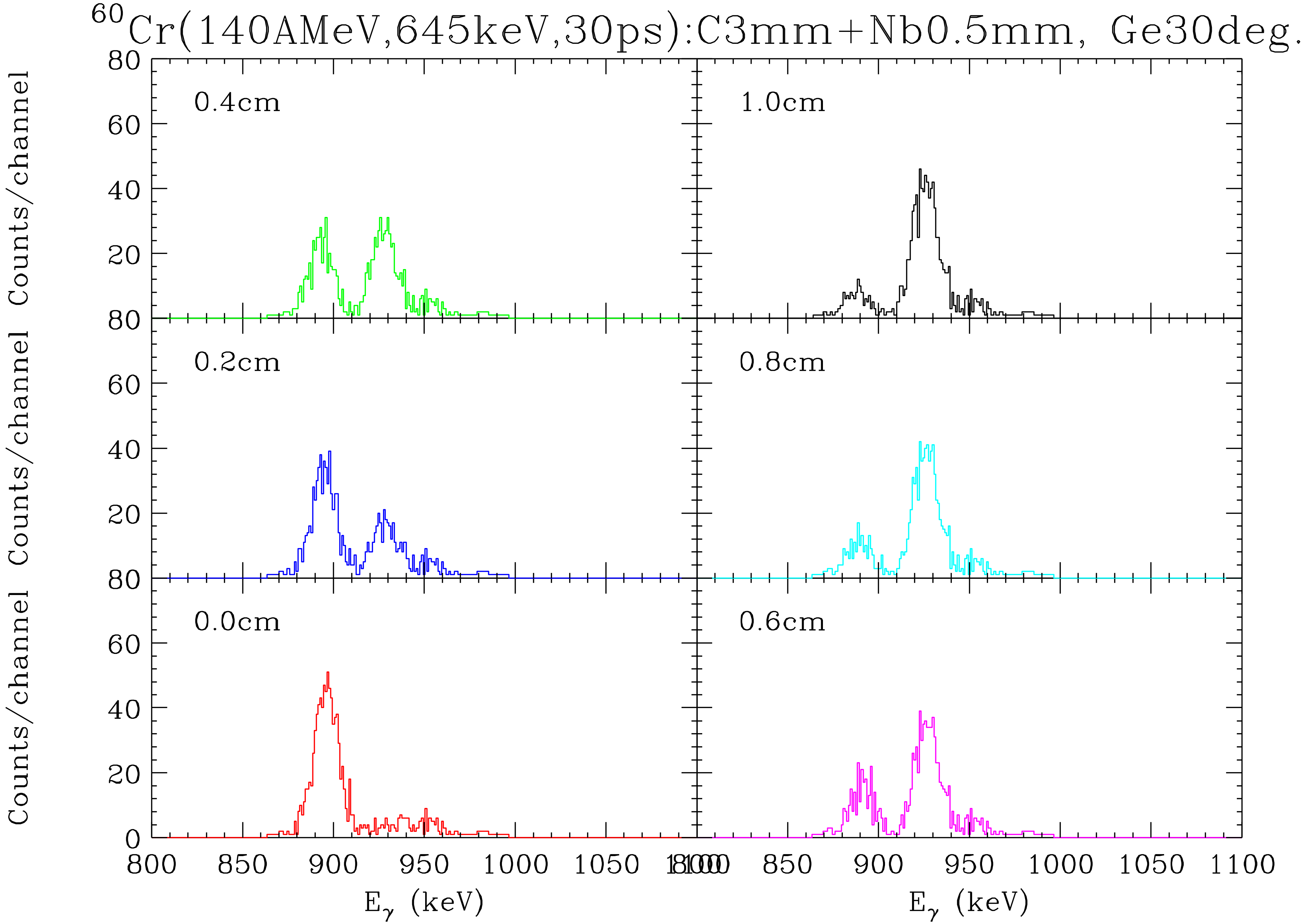




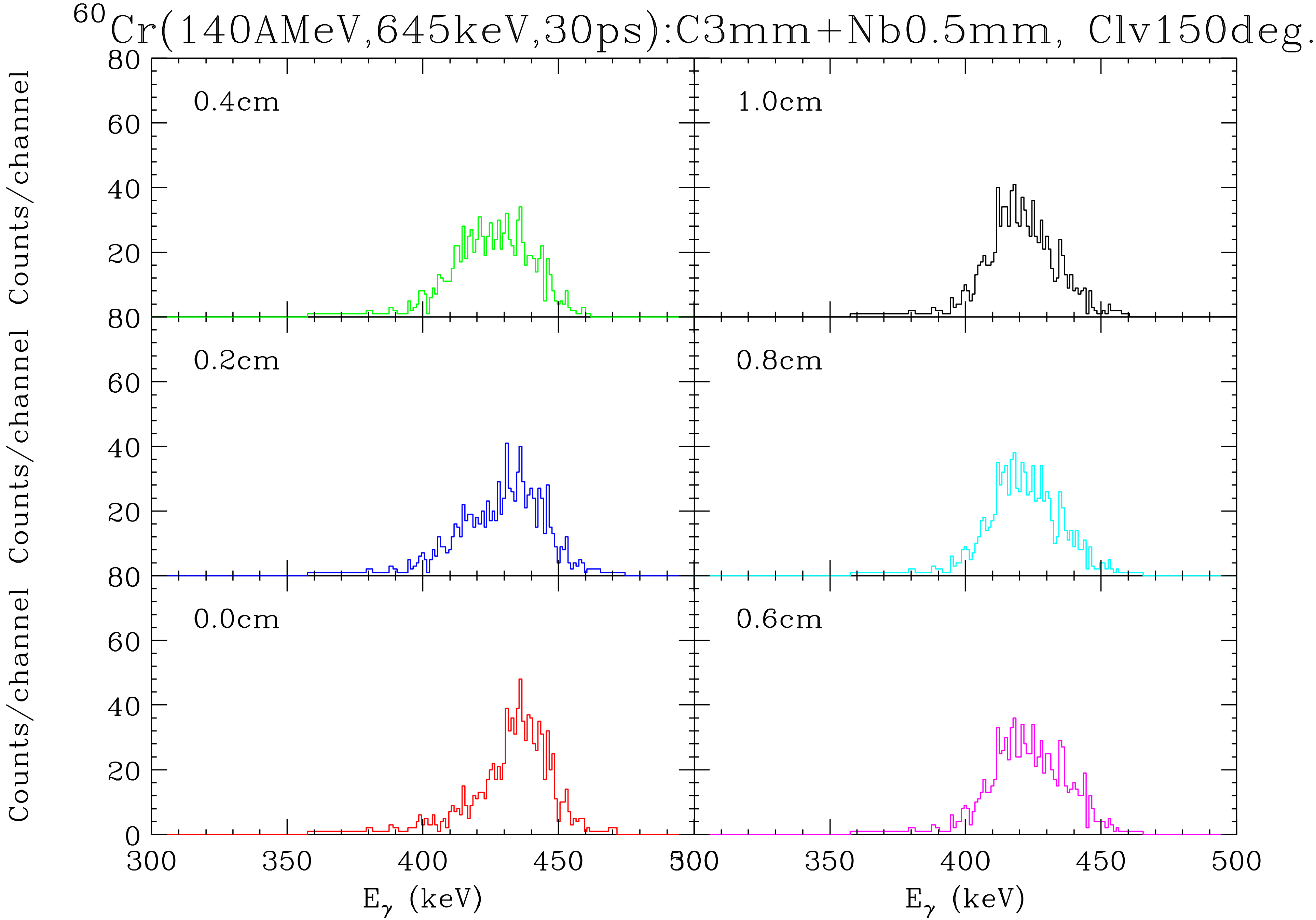
Stroke: 0 - 30 mm
Minimum pitch: 20nm
Maximum diameter: 60 mm
Beam pipe: 106.4mm outer diameter
Vacuum: 7.83×10^{-11} Pa・m^3/s



500
940.5
1107.5
GRAPE
415
Clover Ge
Beam
STQ17
ZDS
1700

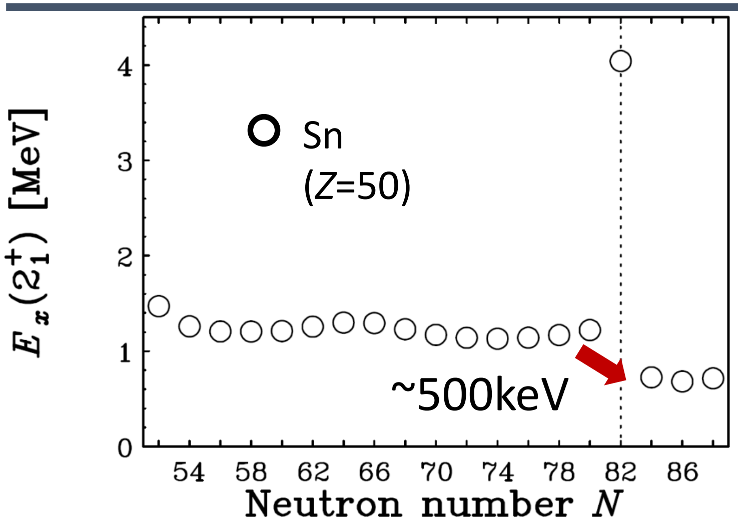


^{60}Cr(140AMeV,645keV,30ps):C3mm+Nb0.5mm, Ge30deg.
0.4cm
1.0cm
0.2cm
0.8cm
0.0cm
0.6cm
Counts/channel
Counts/channel
Counts/channel
0
20
40
60
80
800
850
900
950
1000
1050
1100
E_γ (keV)
E_γ (keV)

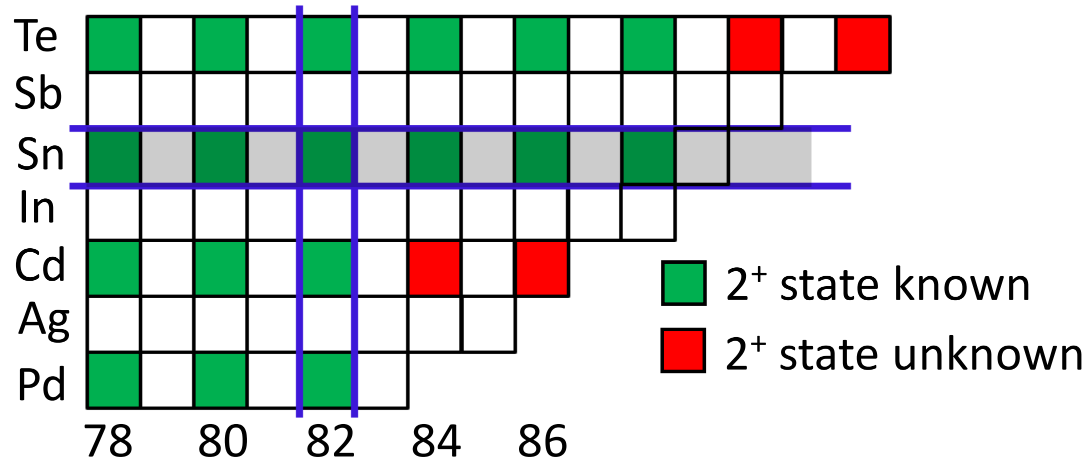


^{60}Cr(140AMeV,645keV,30ps):C3mm+Nb0.5mm, Clv150deg.
0.4cm
1.0cm
0.2cm
0.8cm
0.0cm
0.6cm
Counts/channel
E_γ (keV)

East of ^{132}Sn: $E_x(2^+)$ and neutron pairing



HW et al., PTEP 2014, 023D02(2014)



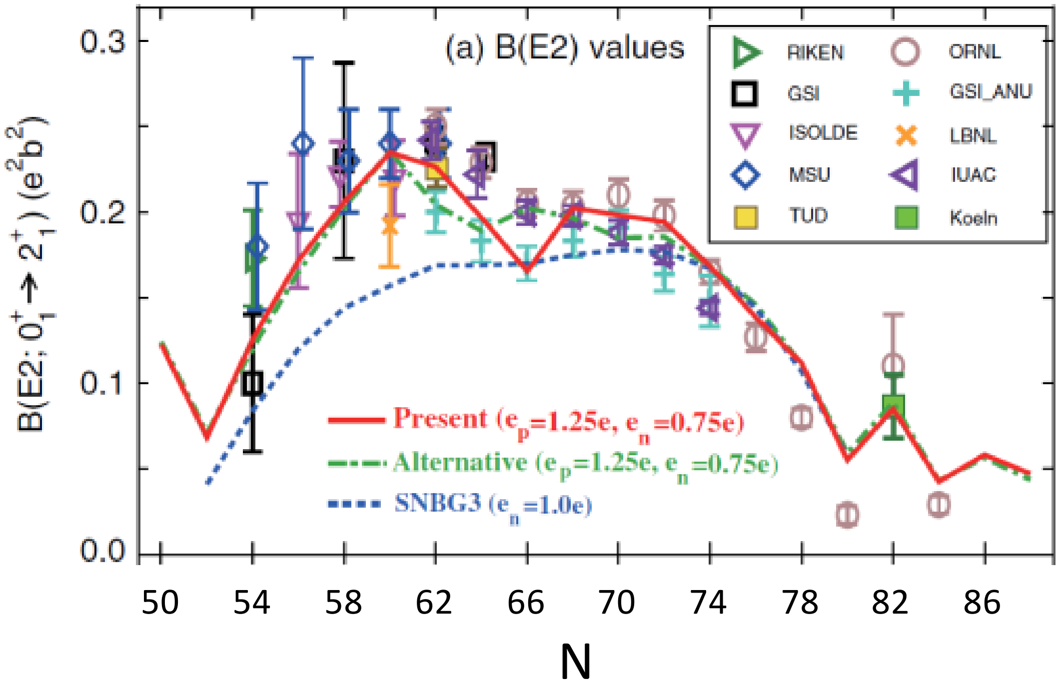
- Seniority scheme below and above N = 82
- $E_x(2^+)$ is determined by neutron pairing strength
- Small $E_x(2^+)$ suggests small neutron pairing

B(E2; $2^+ \rightarrow 0^+$) of ^{136,138}Sn(N=86,88) and ^{142}Te(N=90) by life-time measurements

Courtesy of Wang-san

Lifetime measurements or Coulex of $^{136,138}Sn$, ^{142}Te

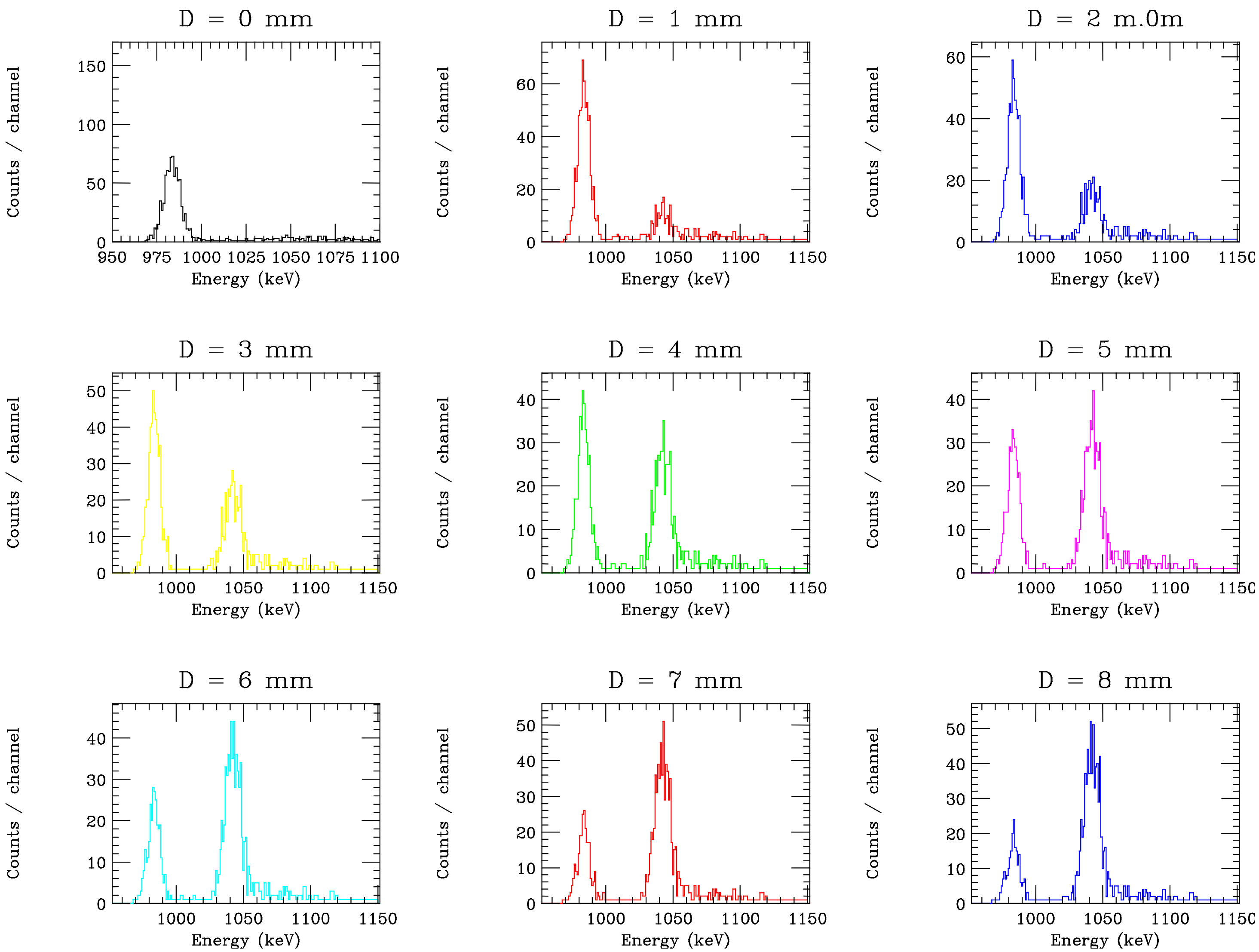
- ^{136}Sn 550count/second (cps)/50pnA U (Inelastic)
- ^{138}Sn 0.65cps/50pnA U (Inelastic)
- ^{142}Te 28cps/50pnA U(Inelastic)
- ^{137}Sb: 560cps/50pnA U (1p KO → ^{136}Sn)
- ^{139}Sb 190cps/50pnA U (1p KO → ^{138}Sn)
- ^{143}I: 38cps/50pnA U (1p KO → ^{141}Te)



T. Togashi et al.: PRL121, 062501 (2018)

$B(E2; 0^+ \rightarrow 2^+) \sim 0.05\ e^2b^2$ for N>82

Life-time measurement of ^{138}Sn by RDM



Use of plunger setup

- Ge detectors in forward angle are better
- Target, degrader should be prepared individually
  - Ex. Carbon 3mm + Nb 0.5 mm

END