Spectroscopy in the Neighbourhood of ^{100}Sn

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for the S330 and
RISING collaboration

S330

^{100}Sn: Gamov-Teller Strength in its Decay Search for its Isomer Particle Stability of Neighbours

TUM
GSI
Edinburgh
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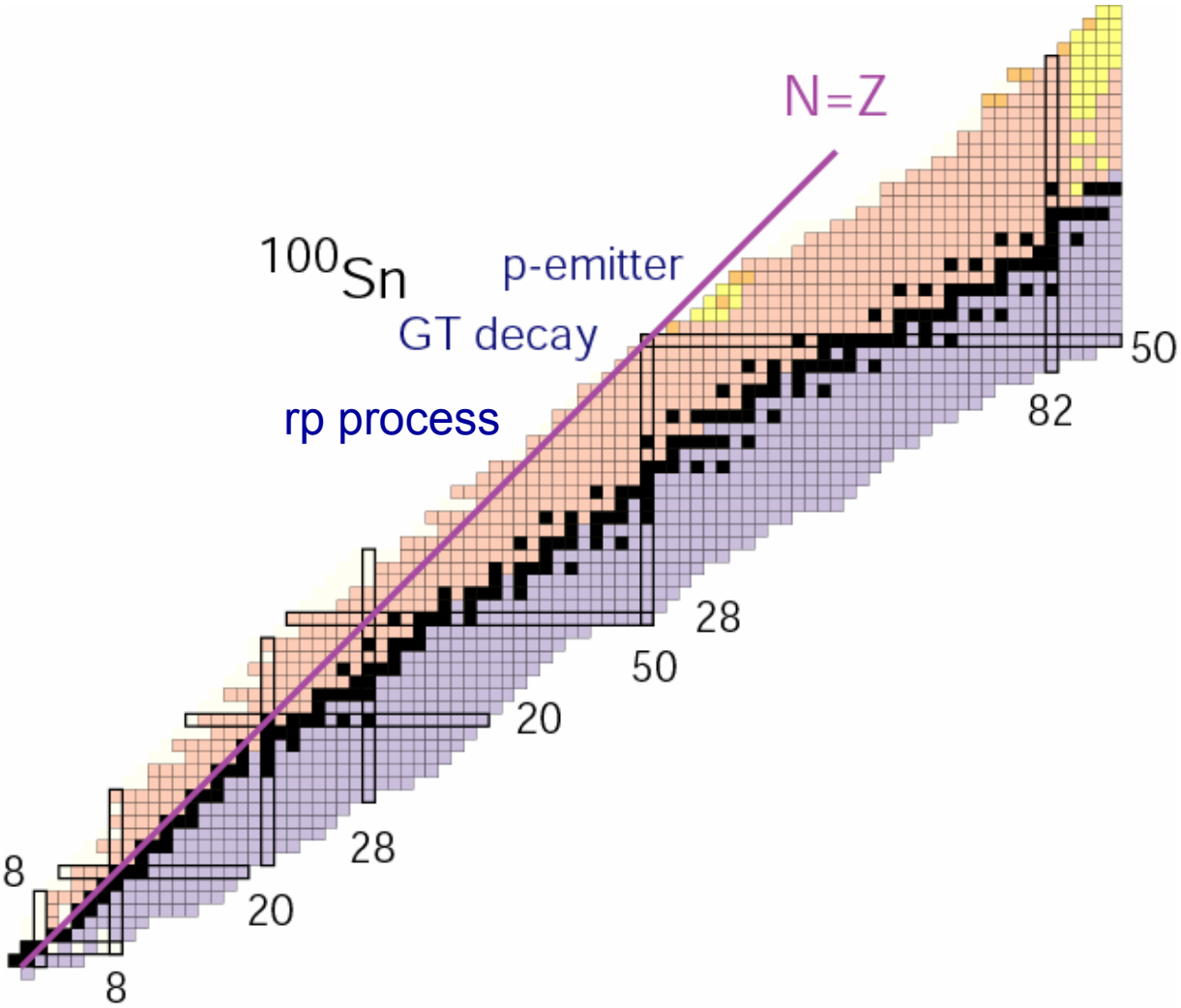
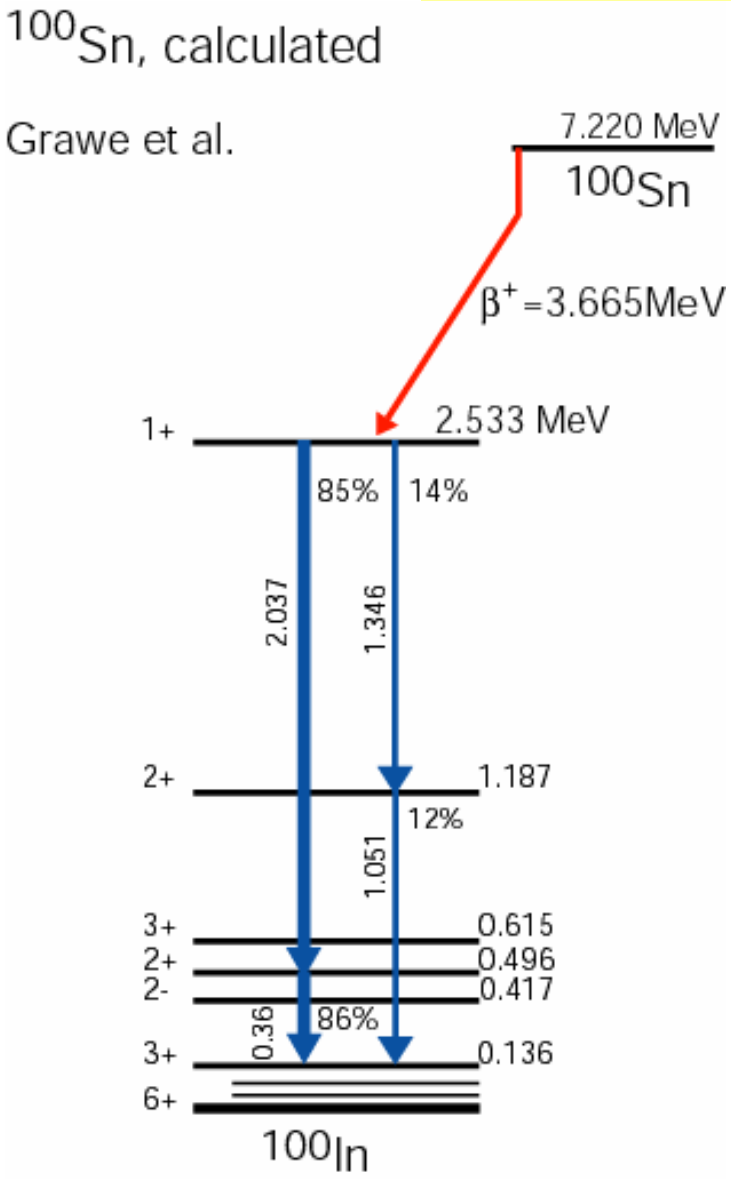
Köln
Krakow
MSU
RIKEN
Surrey
Uppsala
Warsaw

+
RISING



^{100}Sn



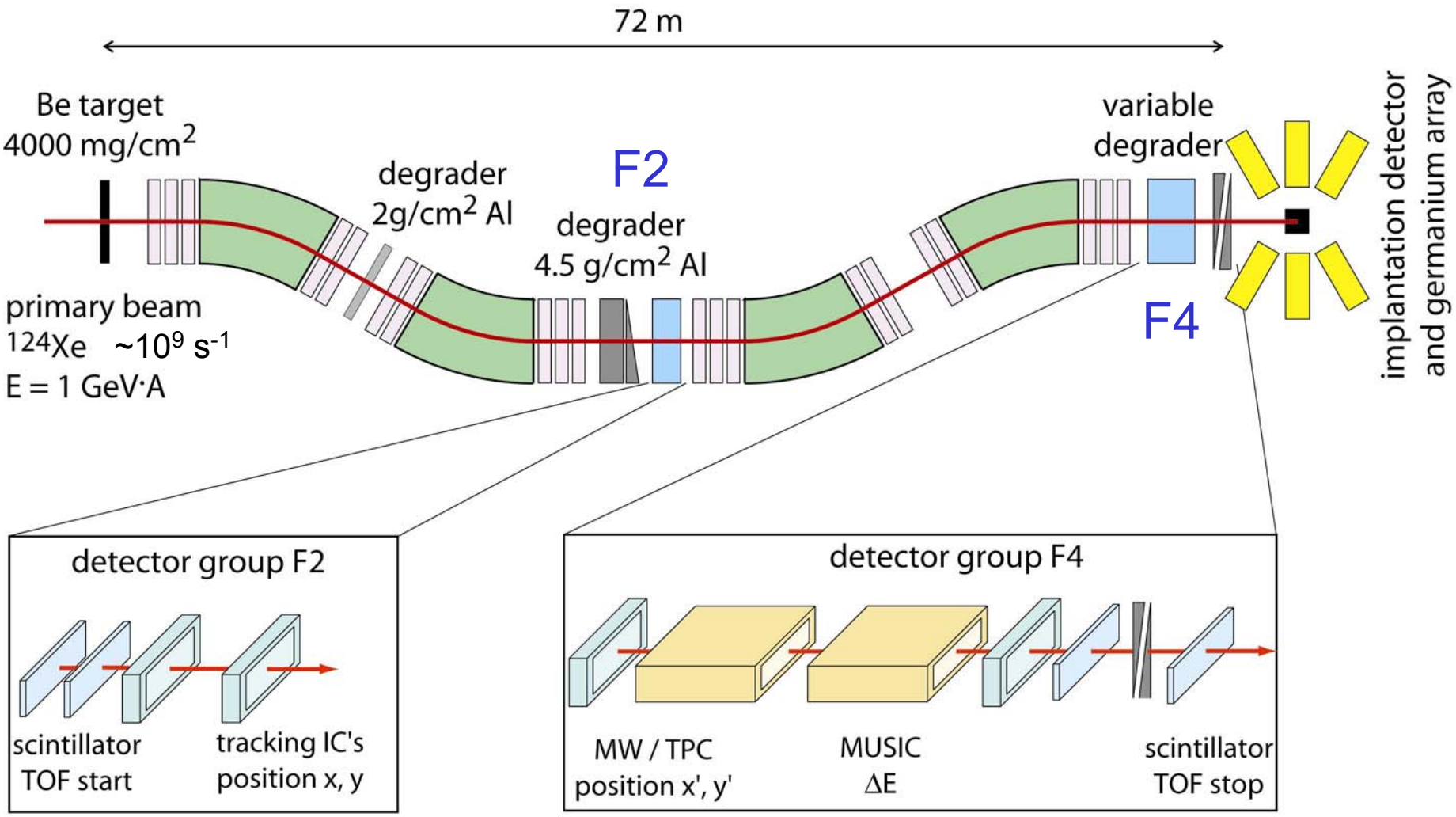
ideal testing ground
for GT-strength:

pure spin-flip transition
$0^+ \Rightarrow (\pi g_{9/2}^{-1}\, \nu g_{7/2})1^+$

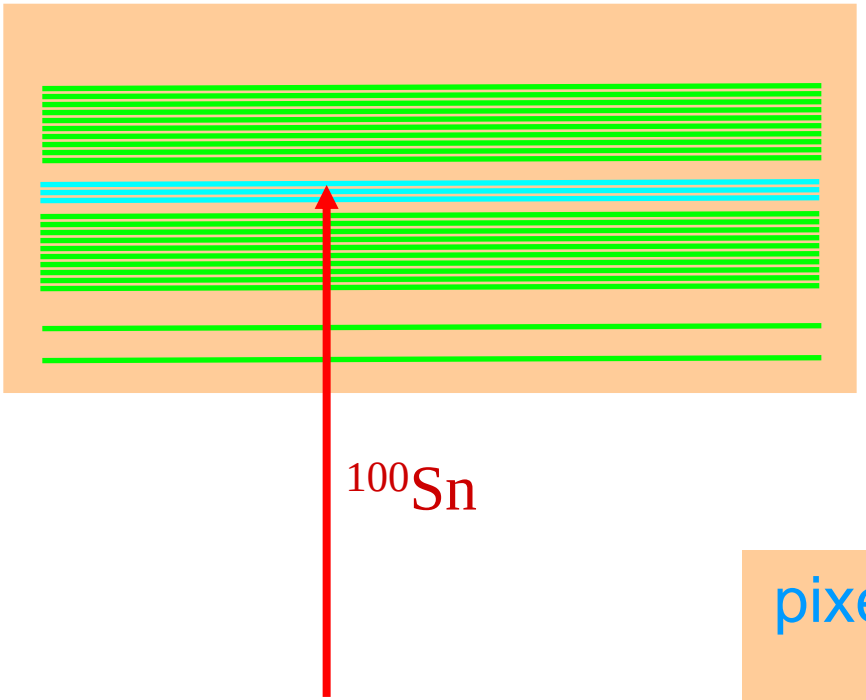
large decay energy
=> most of GT resonance
in β-decay window

a) measure:
$T_{1/2}$
endpoint energy
(branching)
=> GT-strength

the FRagment Separator (FRS)



Silicon Implantation Detector and Beta Absorber SIMBA



7 x-strips

10 SSSD 60x40x1 mm^3

3 DSSD 60x40x0.7 mm^3

10 SSSD 60x40x1 mm^3

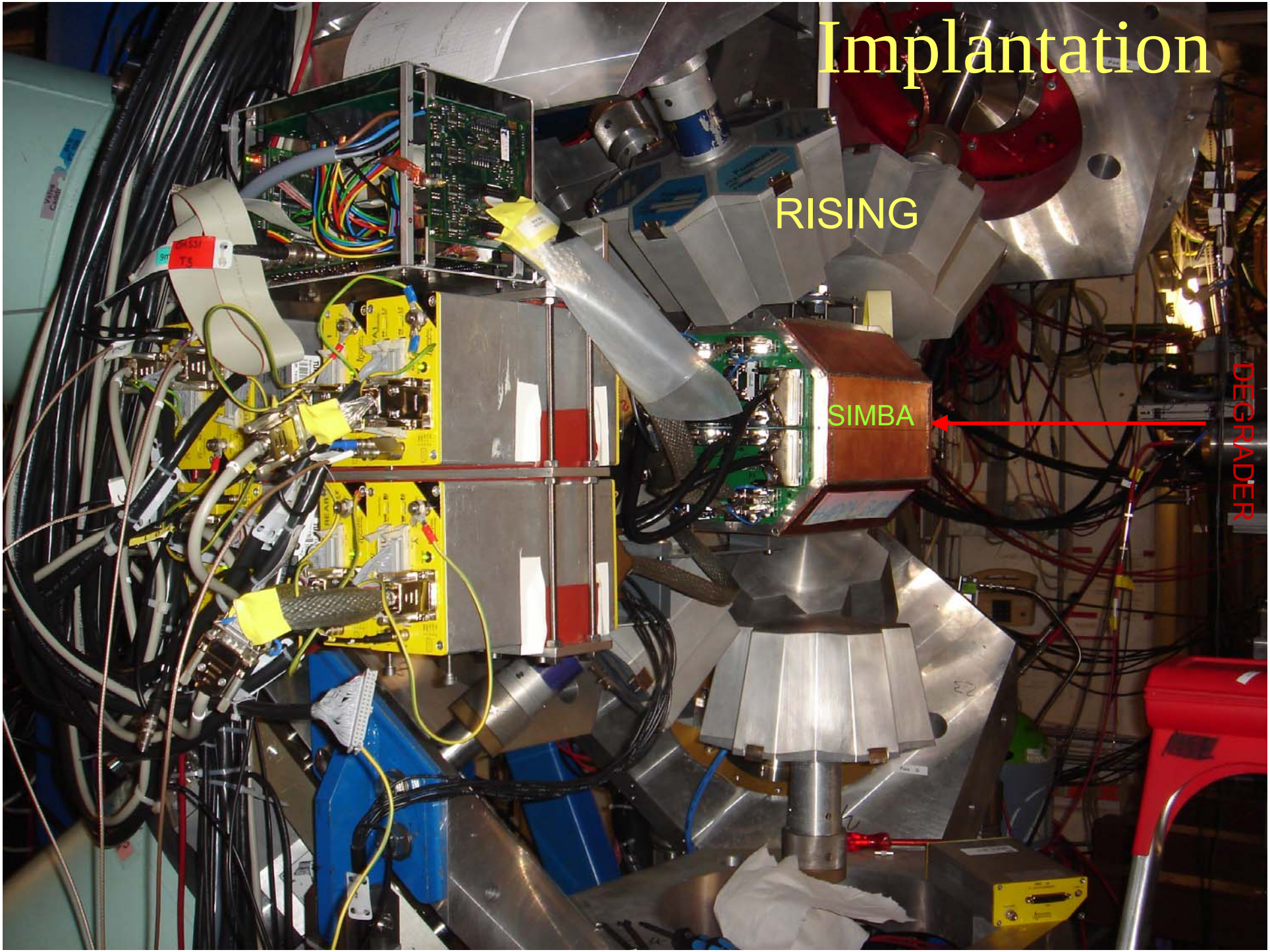
} Gassiplex + Mesytec

Y SSSD 60x60x0.3 mm^3

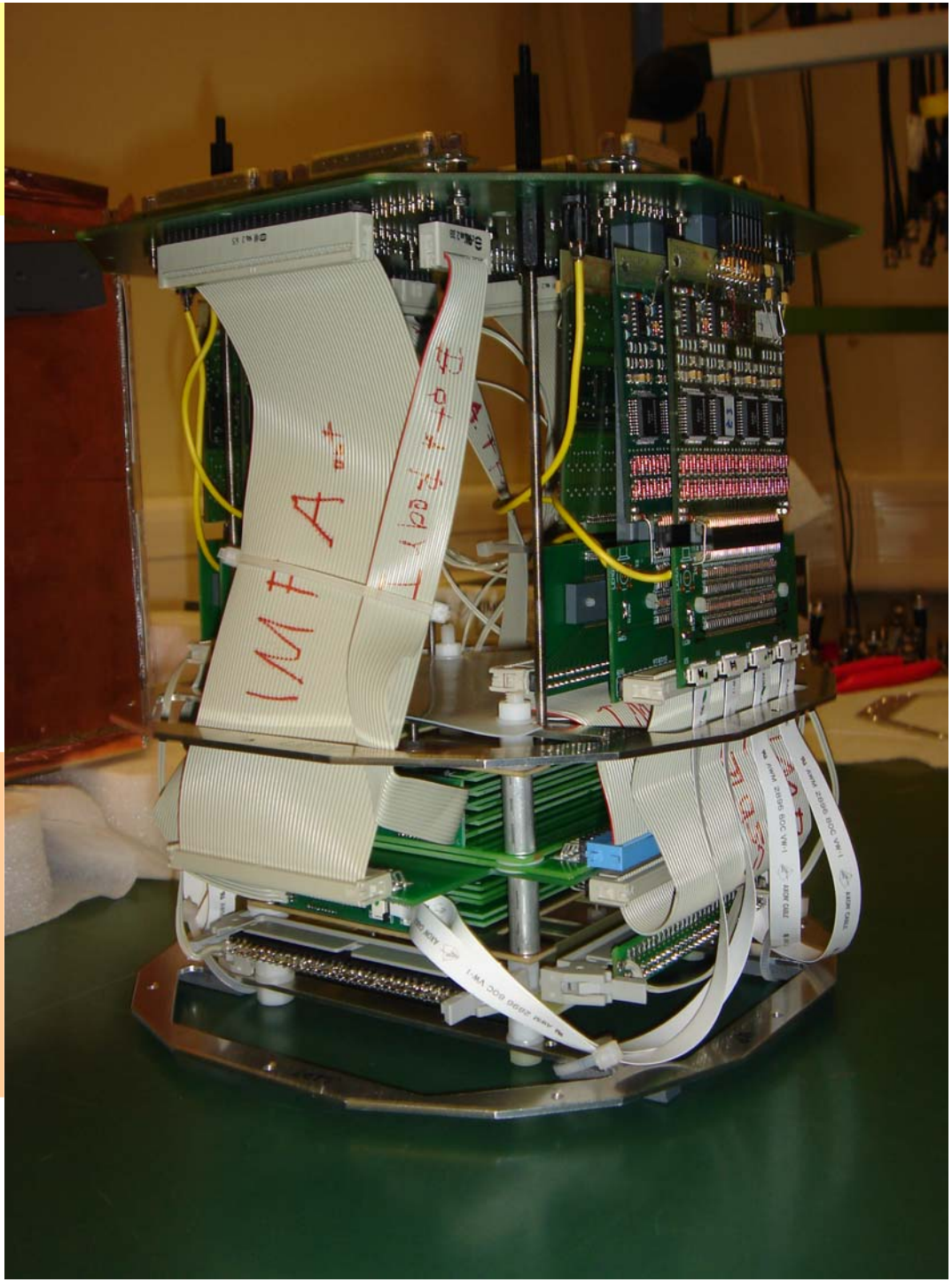
X SSSD 60x60x0.3 mm^3

} R - chain

pixels in implantation zone:
3x60x40 = 7200


Implantation
RISING
SIMBA
DEGRADER

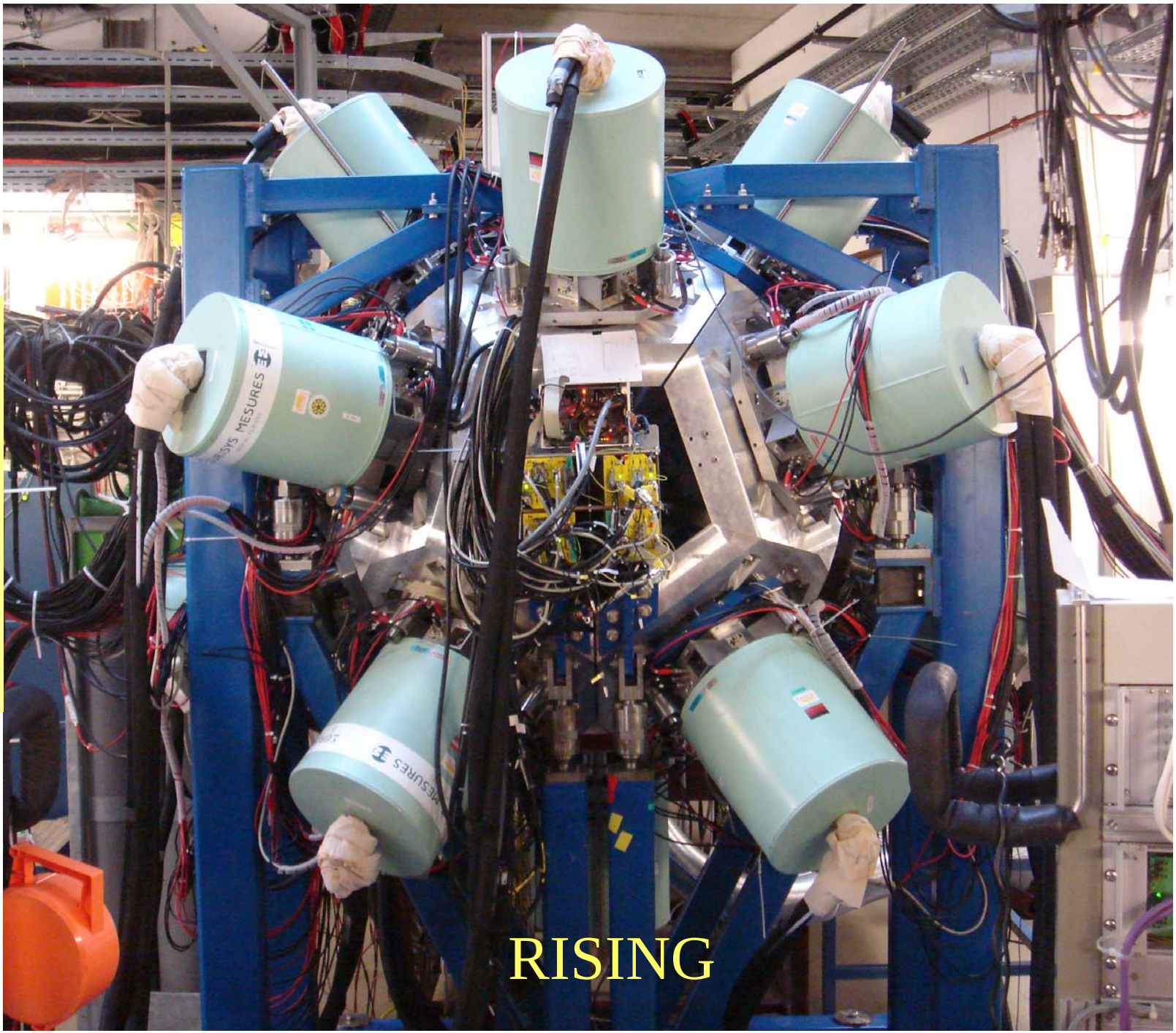
and how it looks inside



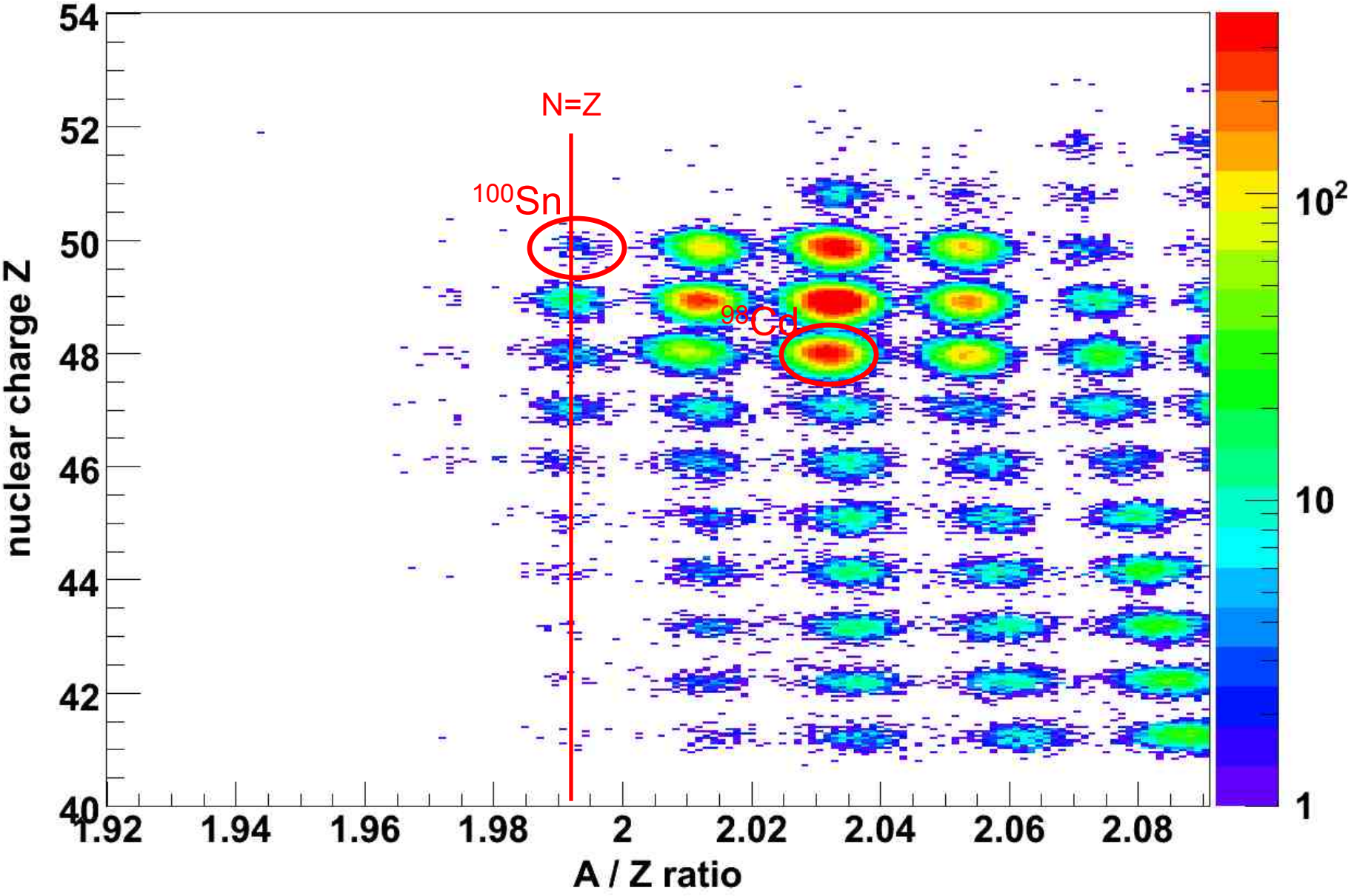
15 x 7

Germanium detectors

ε_{Photo}~ 15%



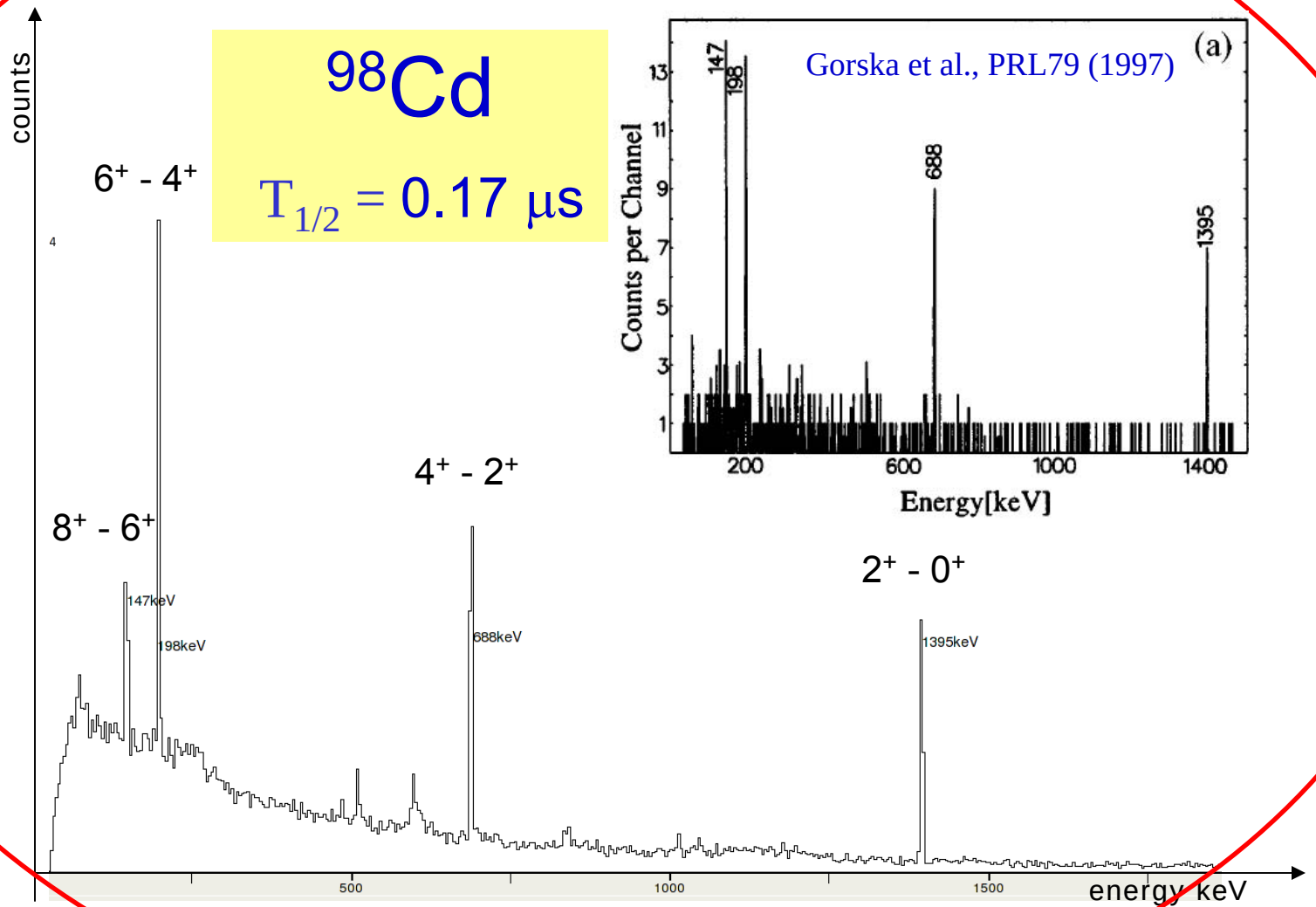
Particle identification



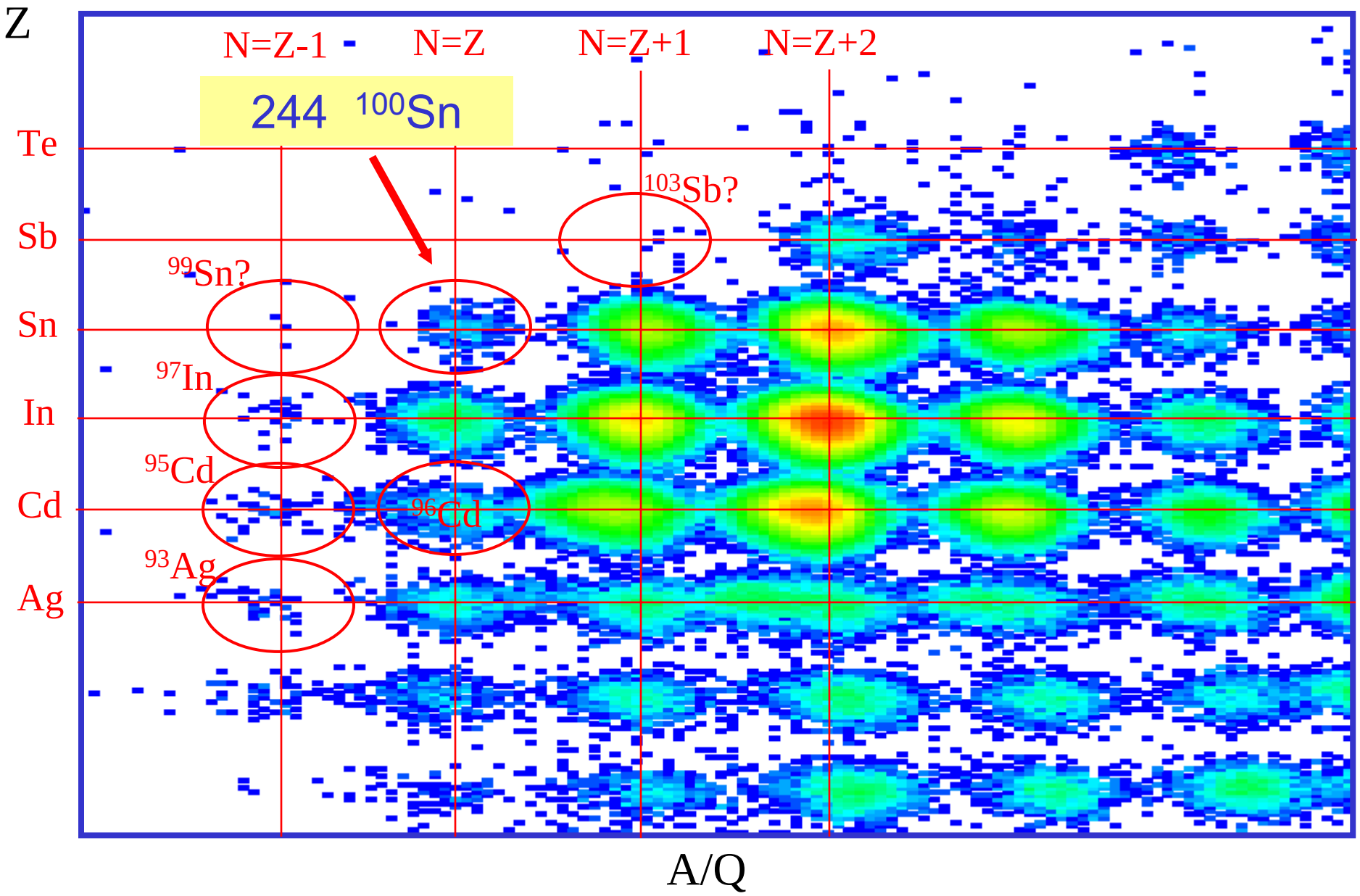
delayed gammas

^{98}Cd

$T_{1/2}$ = 0.17 μs

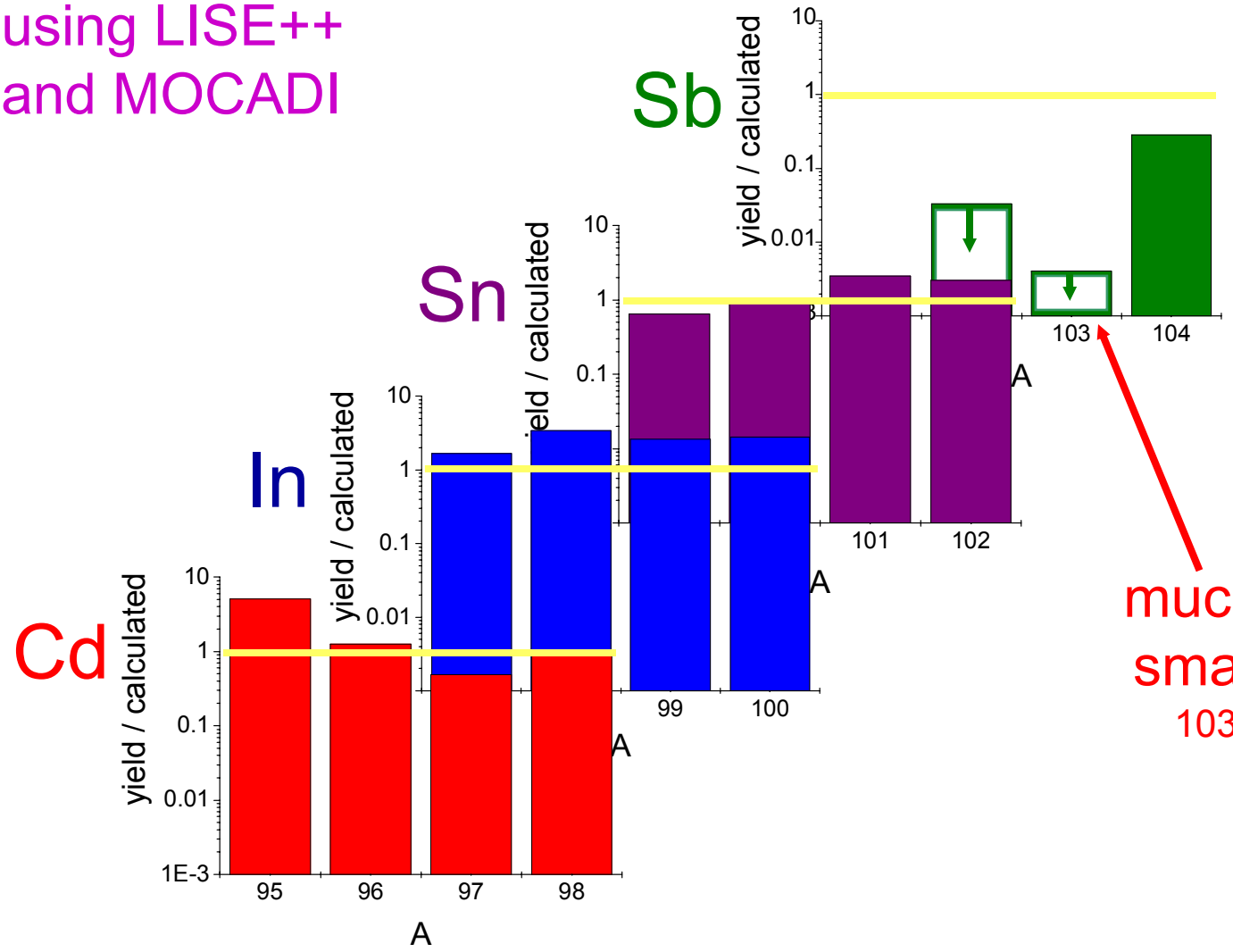


^{100}Sn setting (full statistics, 15 days)

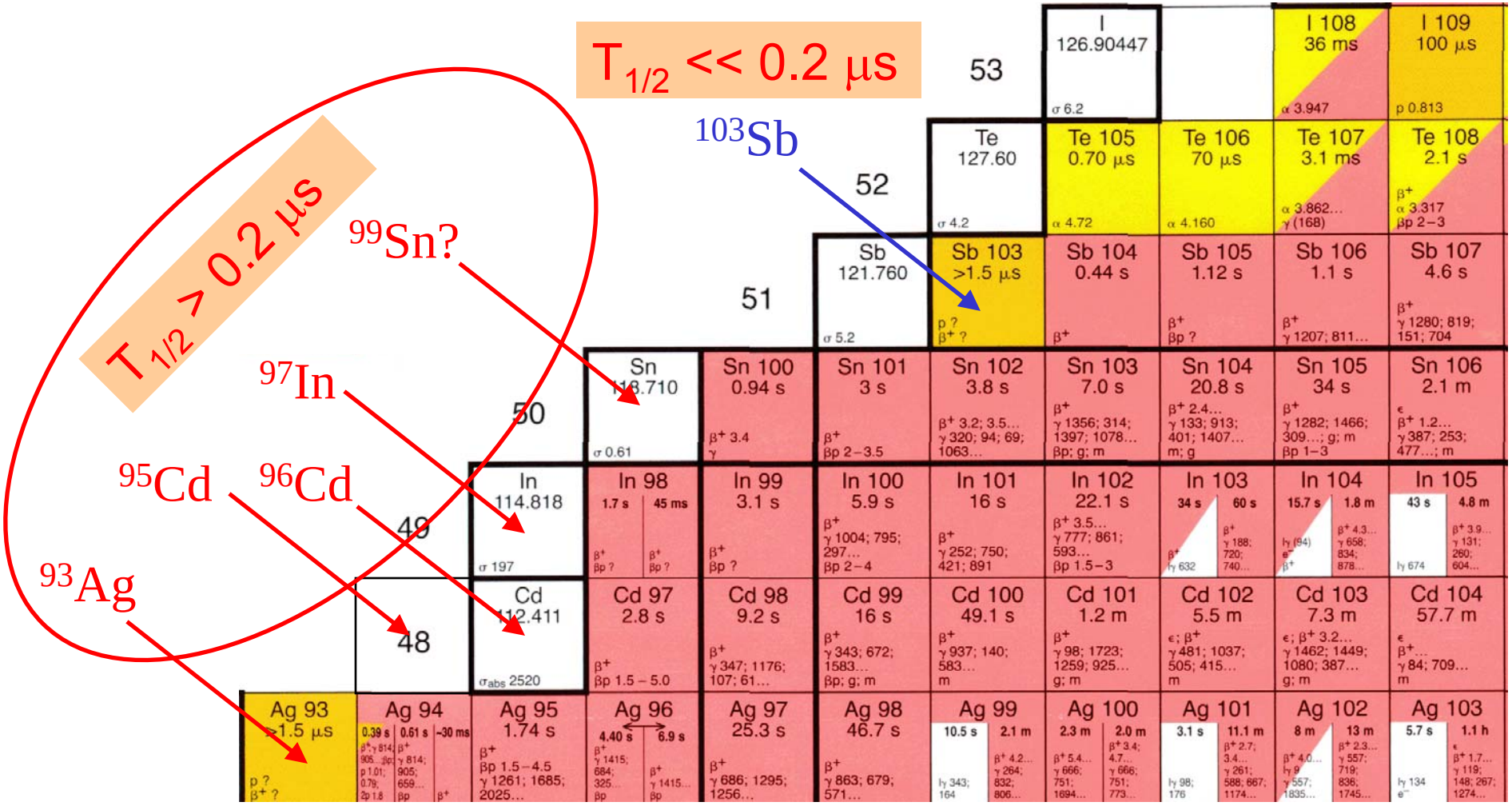


Measured yield / calculation

using LISE++
and MOCADI



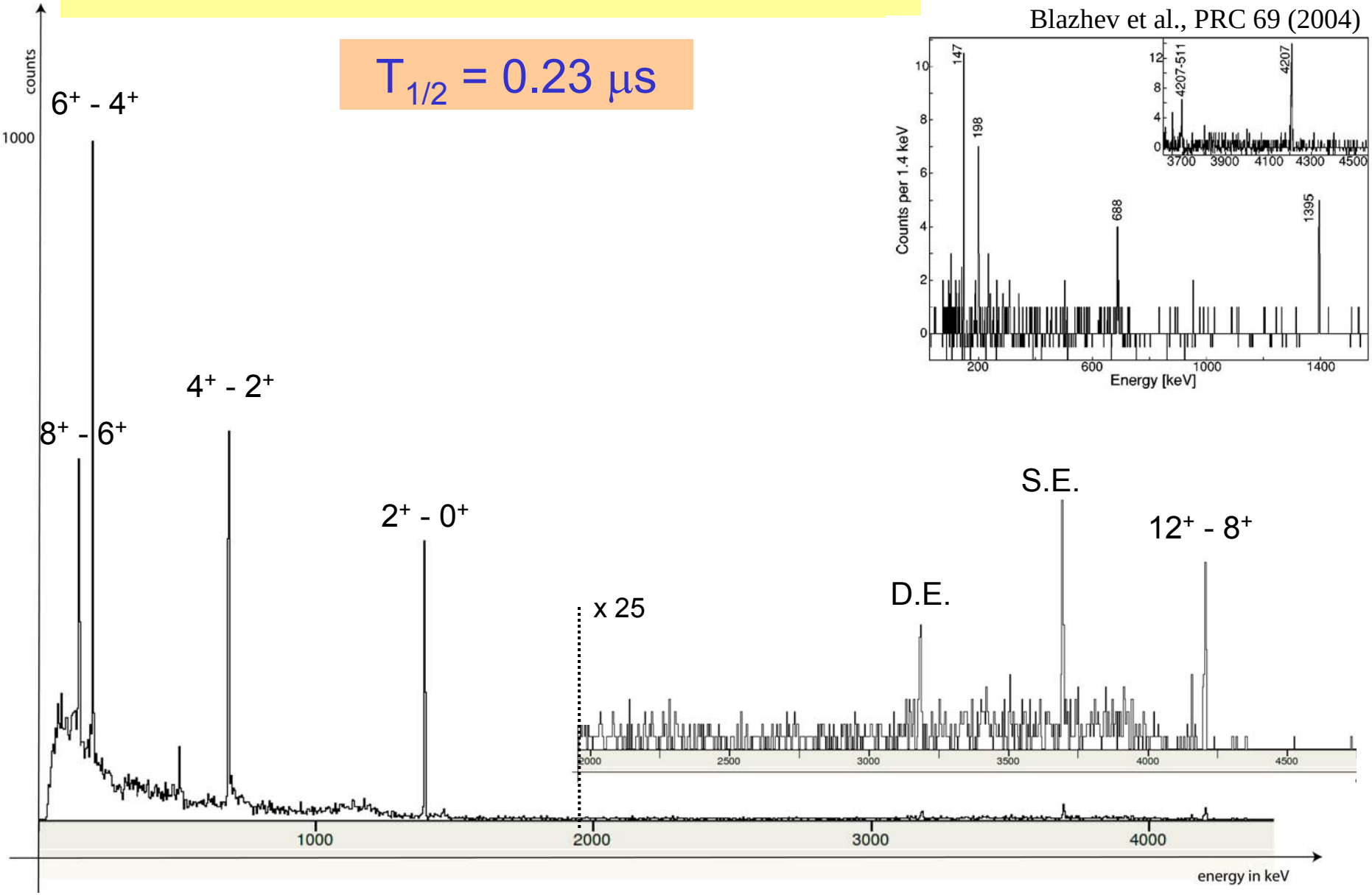
what‘s new?


T1/2 << 0.2 µs
T1/2 > 0.2 µs
103Sb
99Sn?
97In
95Cd
96Cd
93Ag
53
52
51
50
49
48
I 126.90447 σ 6.2
I 108 36 ms α 3.947
I 109 100 µs p 0.813
Te 127.60 σ 4.2
Te 105 0.70 µs α 4.72
Te 106 70 µs α 4.160
Te 107 3.1 ms α 3.862… γ (168)
Te 108 2.1 s β+ α 3.317 βp 2–3
Sb 121.760 σ 5.2
Sb 103 >1.5 µs p ? β+ ?
Sb 104 0.44 s β+
Sb 105 1.12 s β+ βp ?
Sb 106 1.1 s β+ γ 1207; 811…
Sb 107 4.6 s β+ γ 1280; 819; 151; 704
Sn 118.710 σ 0.61
Sn 100 0.94 s β+ 3.4 γ
Sn 101 3 s β+ βp 2–3.5
Sn 102 3.8 s β+ 3.2; 3.5… γ 320; 94; 69; 1063…
Sn 103 7.0 s β+ γ 1356; 314; 1397; 1078… βp; g; m
Sn 104 20.8 s β+ 2.4… γ 133; 913; 401; 1407… m; g
Sn 105 34 s β+ γ 1282; 1466; 309…; g; m βp 1–3
Sn 106 2.1 m ε β+ 1.2… γ 387; 253; 477…; m
In 114.818 σ 197
In 98 1.7 s 45 ms β+ βp ? β+ βp ?
In 99 3.1 s β+ βp ?
In 100 5.9 s β+ γ 1004; 795; 297… βp 2–4
In 101 16 s β+ γ 252; 750; 421; 891
In 102 22.1 s β+ 3.5… γ 777; 861; 593… βp 1.5–3
In 103 34 s 60 s β+ Iγ 632 β+ γ 188; 720; 740…
In 104 15.7 s 1.8 m Iγ (94) ε β+ β+ 4.3… γ 658; 834; 878…
In 105 43 s 4.8 m Iγ 674 β+ 3.9… γ 131; 260; 604…
Cd 112.411 σabs 2520
Cd 97 2.8 s β+ βp 1.5 – 5.0
Cd 98 9.2 s β+ γ 347; 1176; 107; 61…
Cd 99 16 s β+ γ 343; 672; 1583… βp; g; m
Cd 100 49.1 s β+ γ 937; 140; 583… m
Cd 101 1.2 m β+ γ 98; 1723; 1259; 925… g; m
Cd 102 5.5 m ε; β+ γ 481; 1037; 505; 415… m
Cd 103 7.3 m ε; β+ 3.2… γ 1462; 1449; 1080; 387… g; m
Cd 104 57.7 m ε β+… γ 84; 709… m
Ag 93 >1.5 µs p ? β+ ?
Ag 94 0.39 s 0.61 s ~30 ms β+ γ 814; 905… β+ γ 814; 905; 659… βp β+
Ag 95 1.74 s β+ βp 1.5–4.5 γ 1261; 1685; 2025…
Ag 96 4.40 s 6.9 s β+ γ 1415; 684; 325… βp β+ γ 1415… βp
Ag 97 25.3 s β+ γ 686; 1295; 1256…
Ag 98 46.7 s β+ γ 863; 679; 571…
Ag 99 10.5 s 2.1 m Iγ 343; 164 β+ 4.2… γ 264; 832; 806…
Ag 100 2.3 m 2.0 m β+ 5.4… γ 666; 751; 1694… β+ 3.4; 4.7… γ 666; 751; 773…
Ag 101 3.1 s 11.1 m Iγ 98; 176 β+ 2.7; 3.4… γ 261; 588; 667; 1174…
Ag 102 8 m 13 m β+ 4.0… Iγ 9 γ 557; 1835… β+ 2.3… γ 557; 719; 836; 1745…
Ag 103 5.7 s 1.1 h Iγ 134 e⁻ ε β+ 1.7… γ 119; 148; 267; 1274…

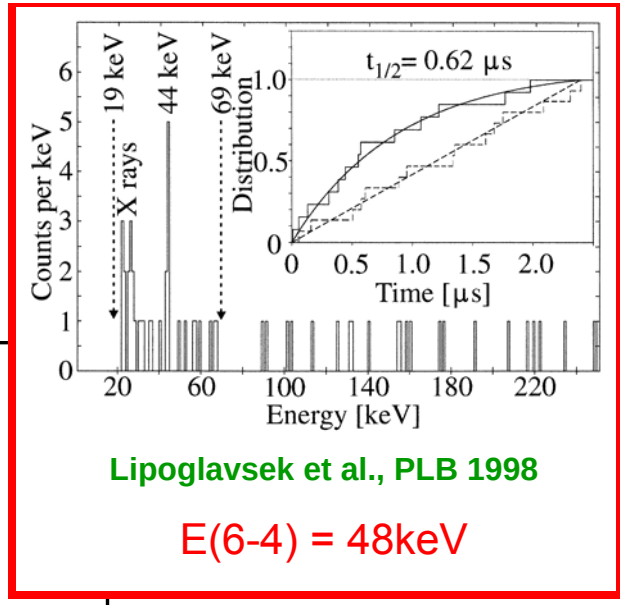
12^+ isomer in ^{98}Cd

$T_{1/2}$ = 0.23 μs

Blazhev et al., PRC 69 (2004)

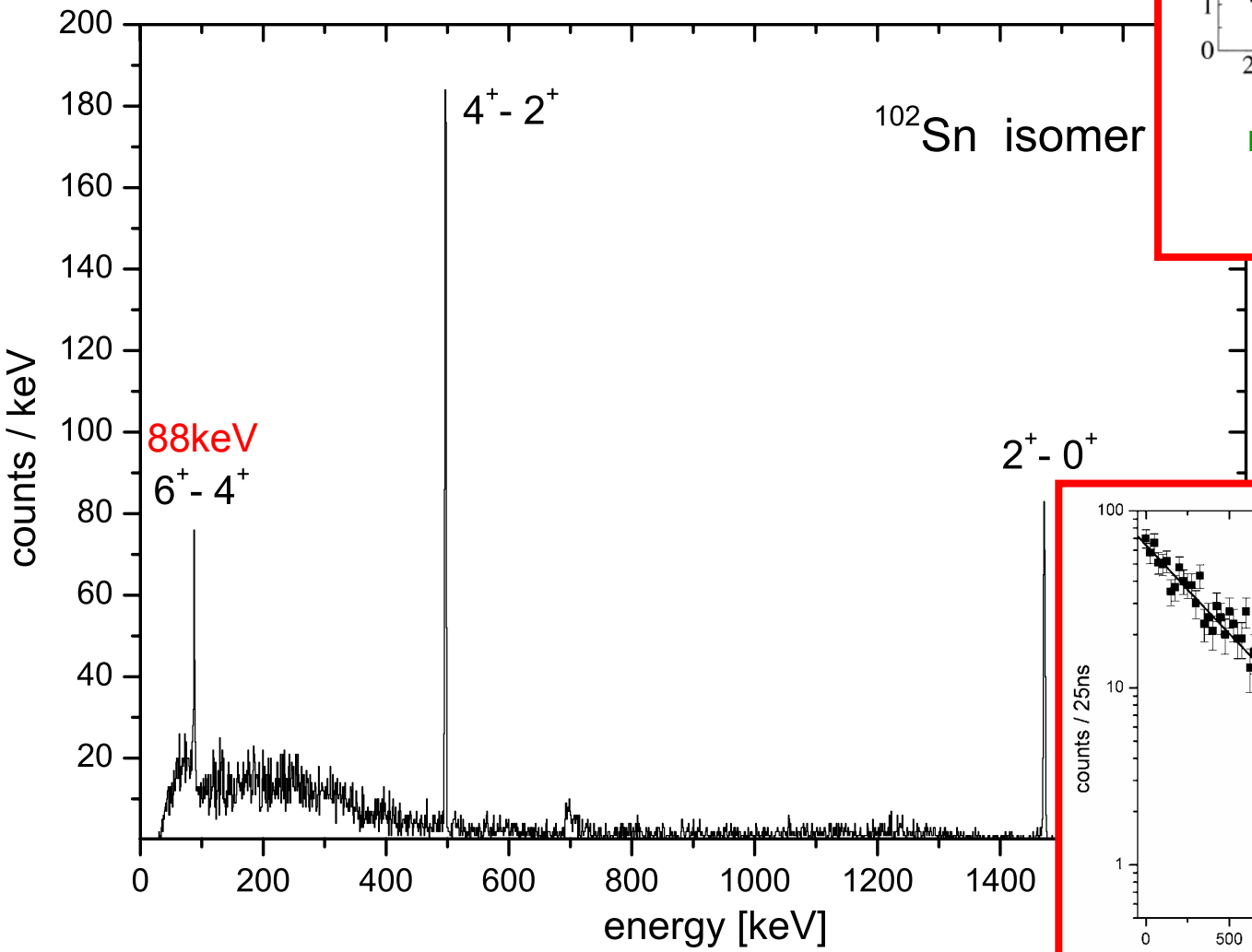


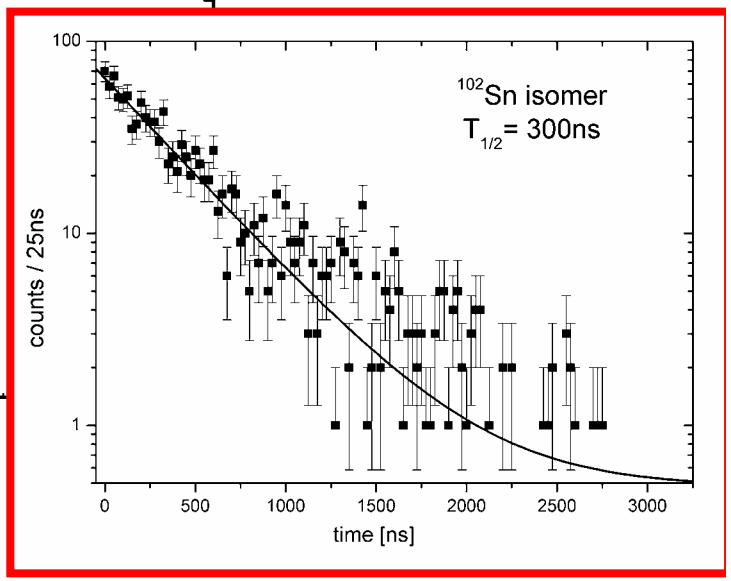
6^+ isomer in ^{102}Sn



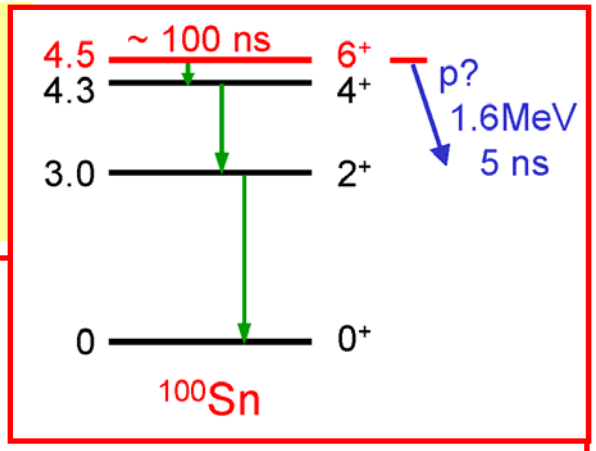
Lipoglavsek et al., PLB 1998

E(6-4) = 48keV

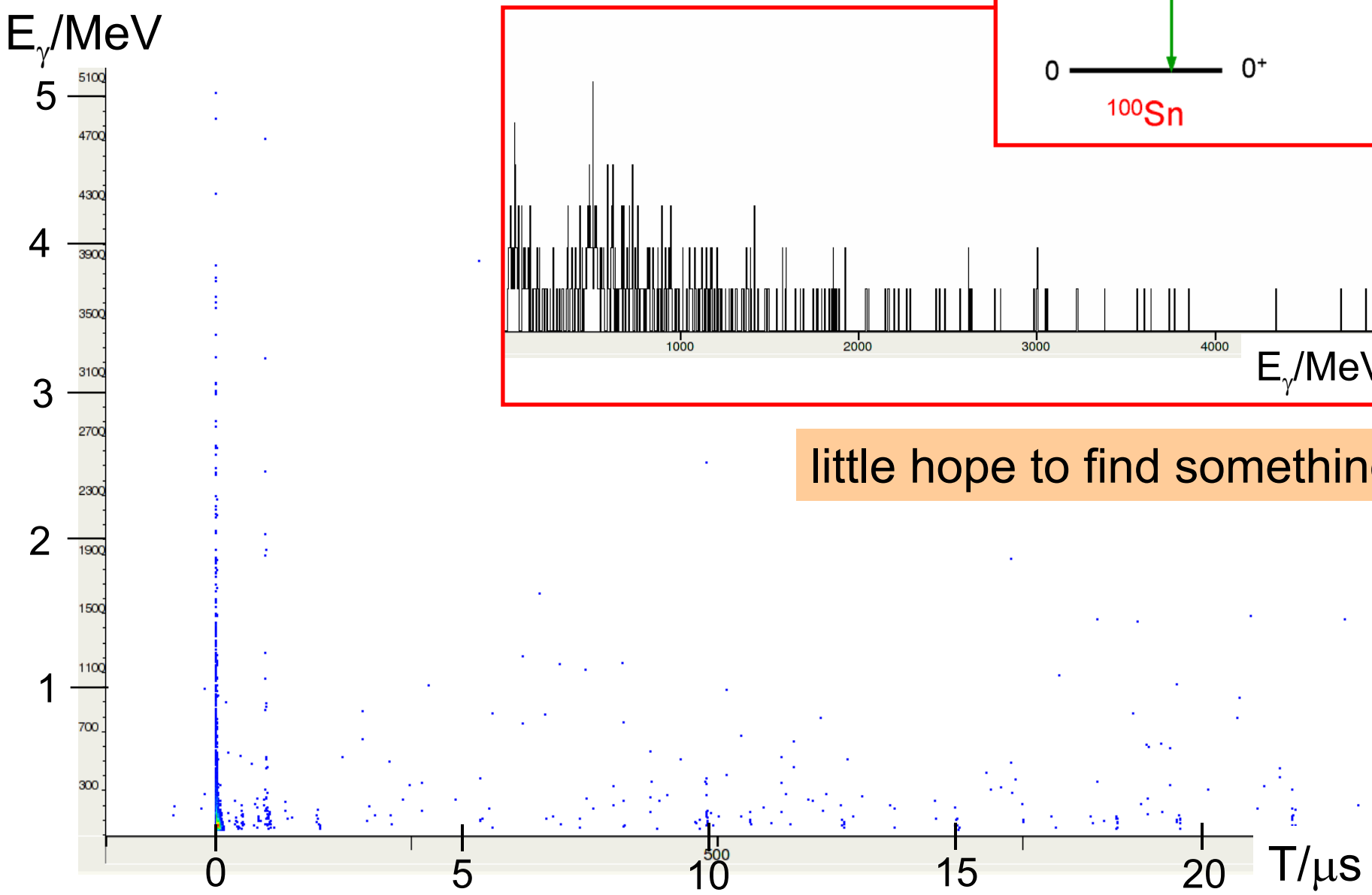




Search for 6^+ isomer in ^{100}Sn



little hope to find something



Conclusions

- Already now possible at GSI: 1 ^{100}Sn / hour
- First observation of ^{95}Cd, ^{96}Cd, ^{97}In
- Non-observation of ^{103}Sb: $T_{1/2} << 100$ ns
- Isomeric transition in ^{102}Sn

We will get:

- Several new half lives
- Better statistics on ^{100}Sn GT strength

the team

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and the RISING collaboration

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(6) U of Ankara, (7) U of Köln (8) Inst. Vinca Belgrade, (9) RIKEN, (10) GANIL,
(11) U of Bratislava, (12) U of Warsaw, (13) U of Uppsala, (14) KVI - U of Groningen, (15) MSU

supported by the MLL, BMBF (06MT238), DFG (EXC153), EPSRC, STFC (UK), and EURONS

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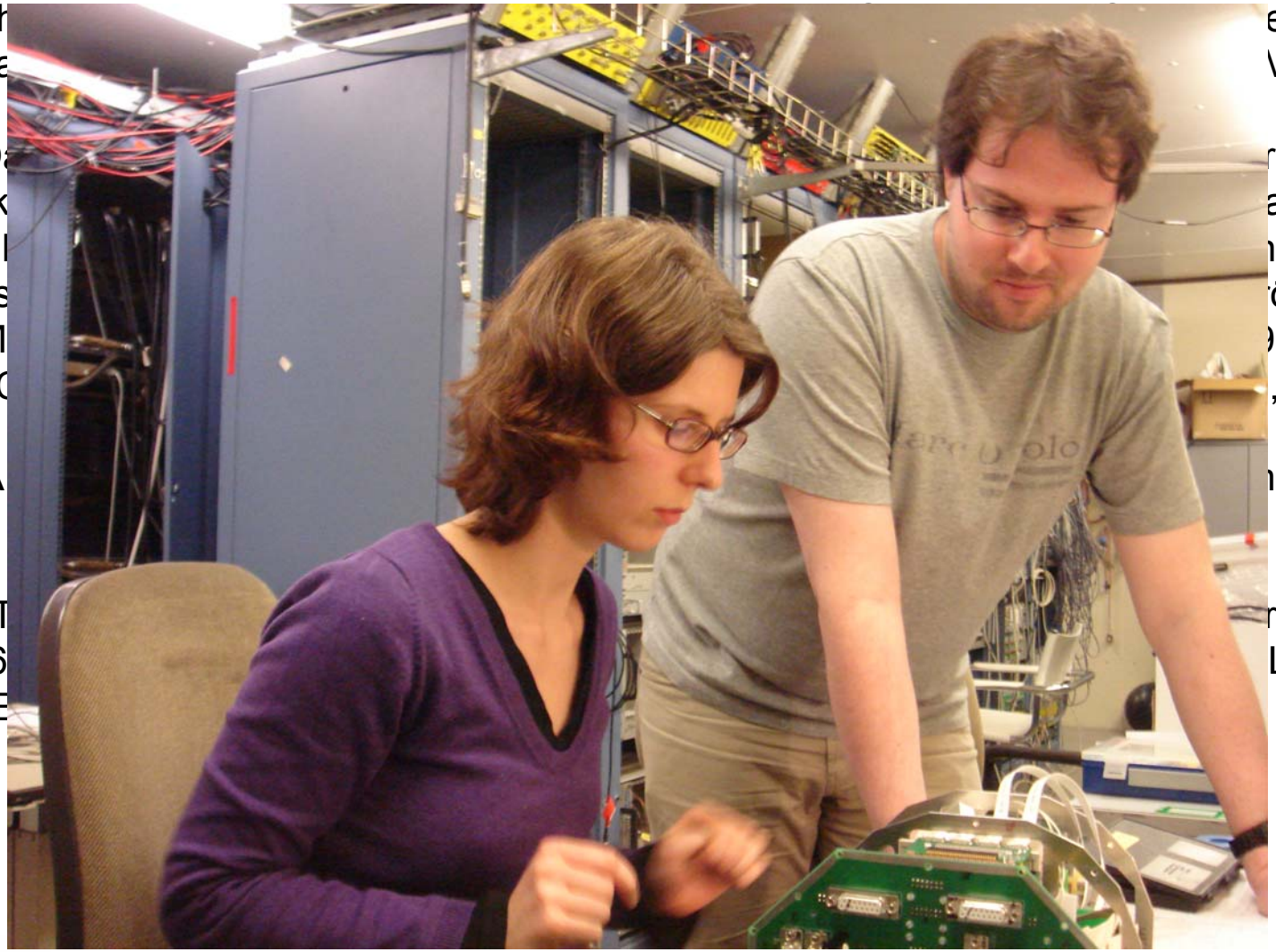

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