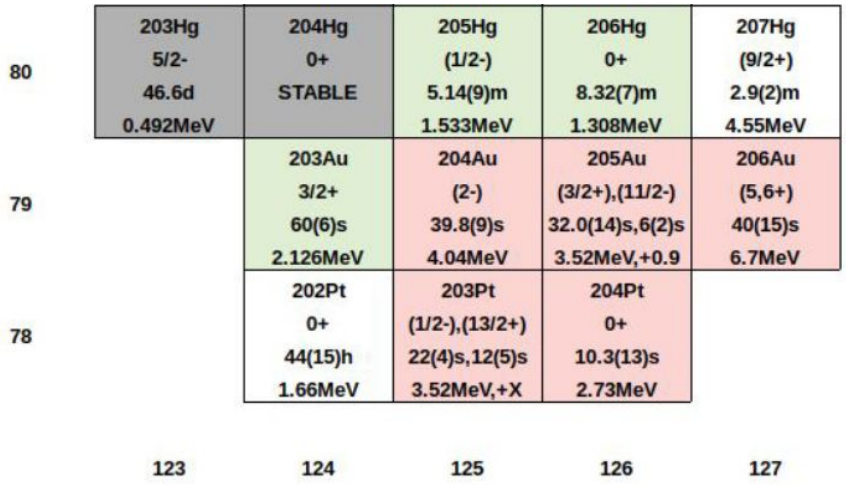
Status of S505 Experiment:

Investigation of the beta strength crossing N=126 and the formation of the third r-process abundance peak

Spokepersons: J.L. Tain, A.I. Morales, E. Nacher
PhD Thesis: D. Rodriguez

Goal: Measurement of the β-strength in the full Q_β window of ^{203,204}Pt, ^{204,205,206}Au, ^{207}Hg decay for comparison with state-of-the-art theoretical models

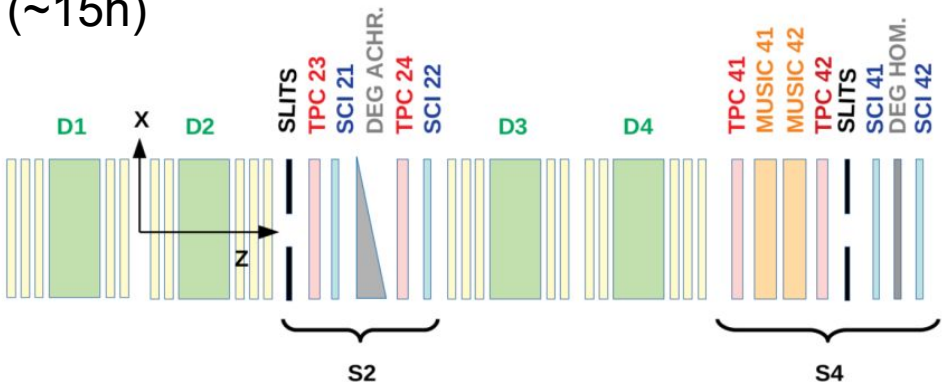


Performed: June 21-28, 2022

Beam/Target: ≤4.5x10^{8} ppb (1.6s/2.2s), 1GeV/u ^{208}Pb on 1.6 g/cm^{2} Be

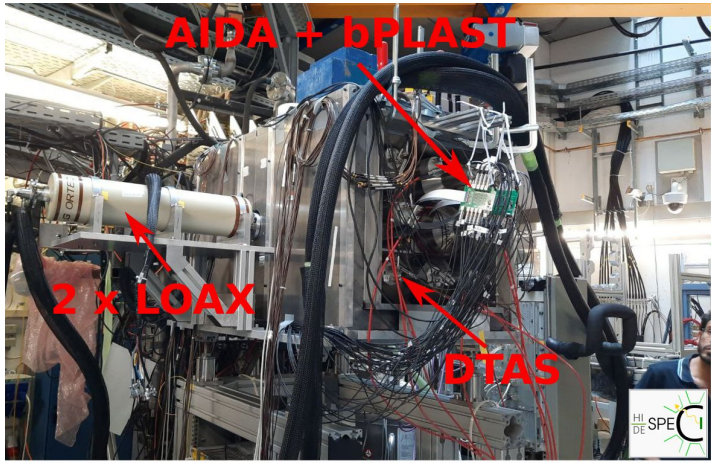
FRS Settings: ^{204}Pt(~125h), ^{207}Hg (~15h)

FRS setup:
(TPC23-24 only for calibration)

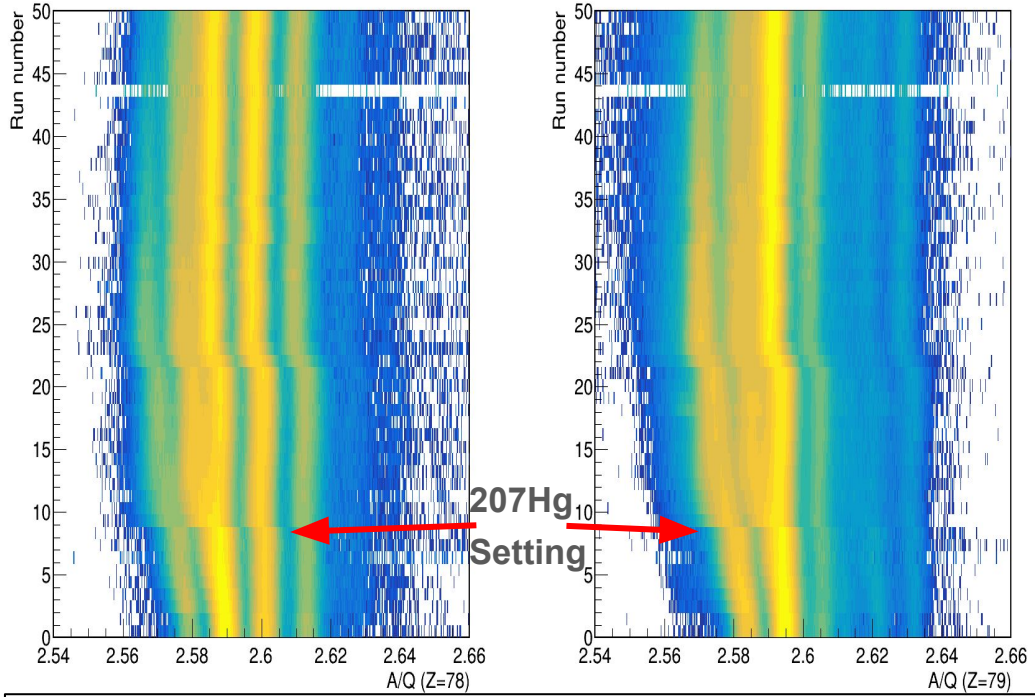


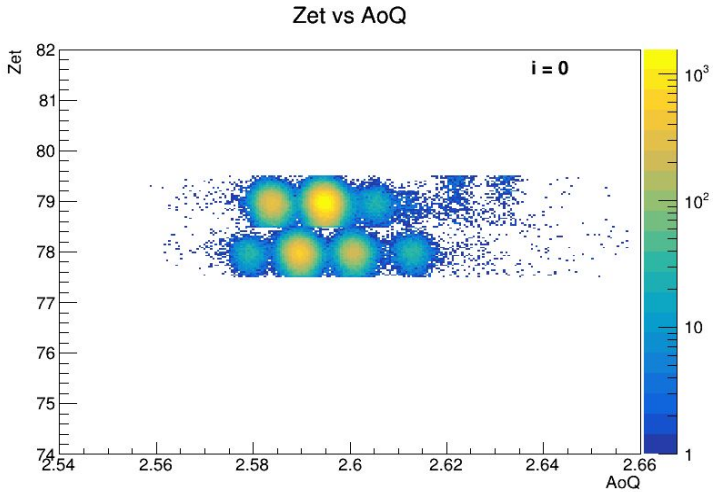
S4 setup:

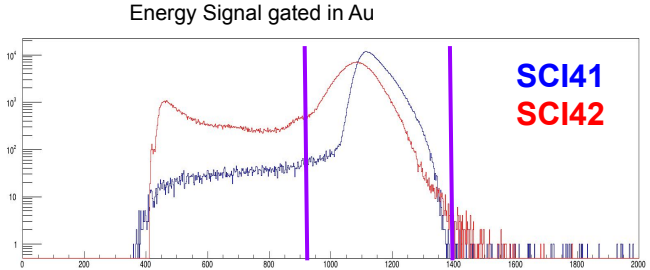
- **DTAS** (16xNaI(Tl) det.)
- **AIDA** (2xDSSSDs-80mmx80mm)
- 2x**bPast** detectors (not used)
- 2x**LOAX** HPGe (1 not operational)

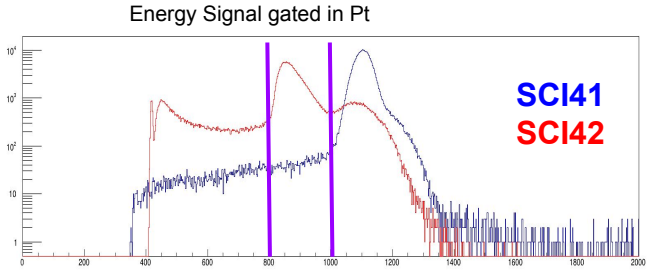


FRS: A/Q drift along experiment

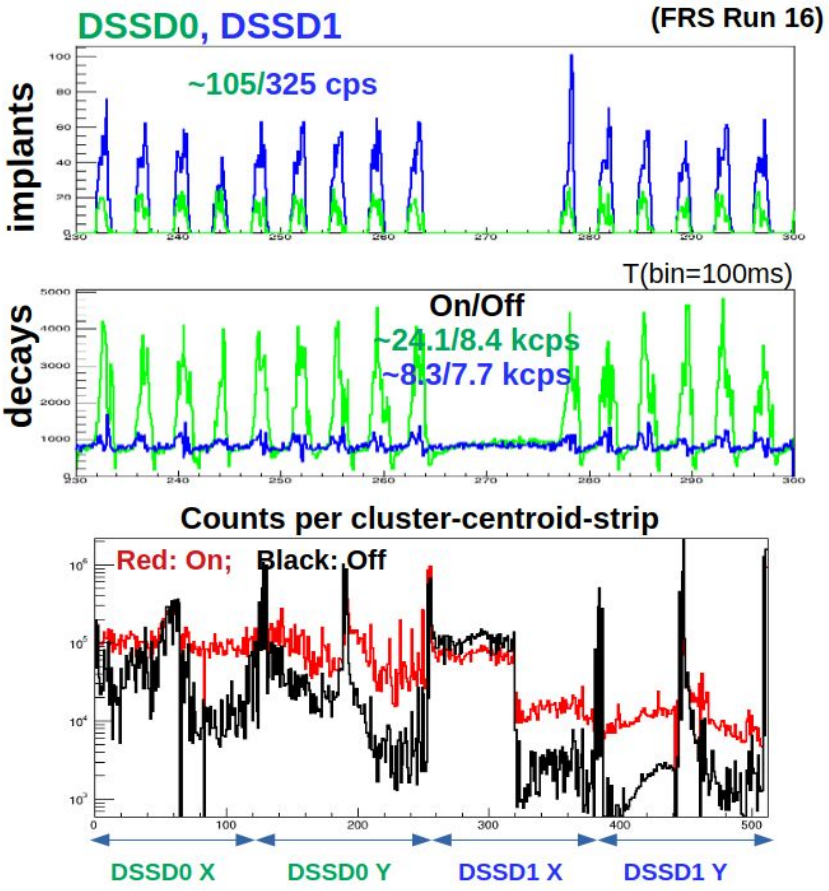






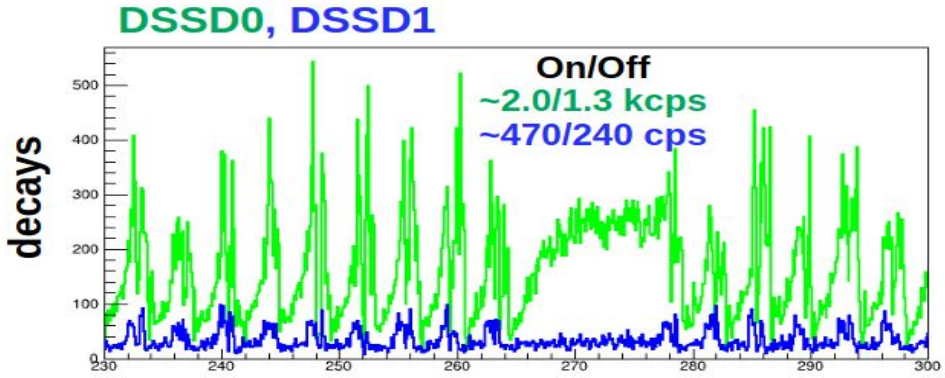


- Drift along the experiment due to damage in SCI21 and SCI22
- We added a energy condition in SCI42 to minimize the effect of secondary reactions in last degrader

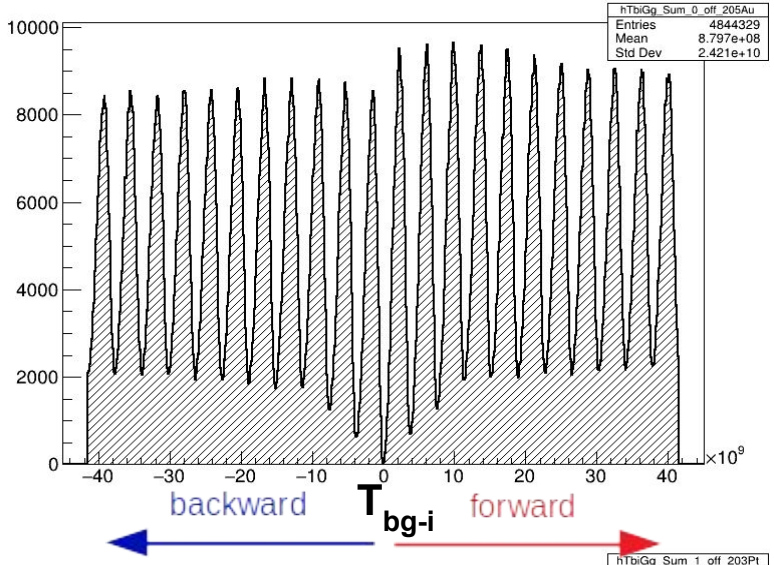


- Huge rate in decay branch, in particular for DSSD0 during spill
- Large noise on most FEE64s
- Noisy strips can be identified
- Large number of strips firing in one decay event

1. Increase threshold (currently 150keV)
2. Limit event strip multiplicity (nx,ny<6)
3. Only analyze off-spill data
4. γ-gating

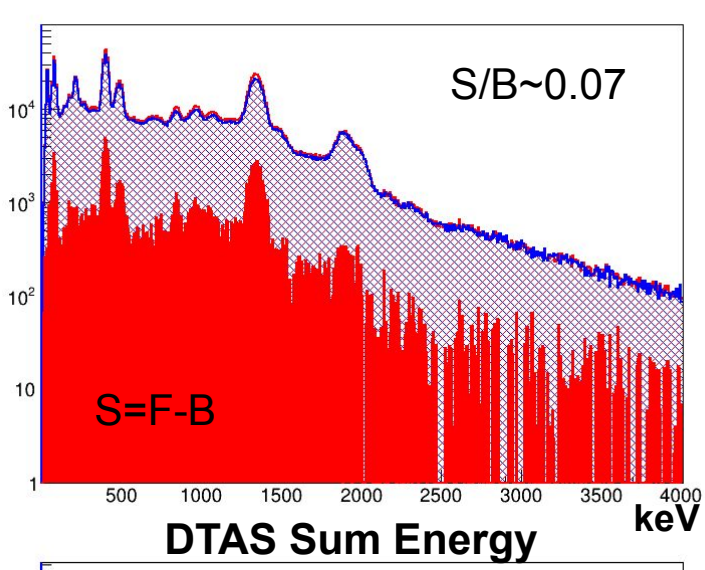


Strange effect on the rate during spill and first few seconds after spill for DSSD0

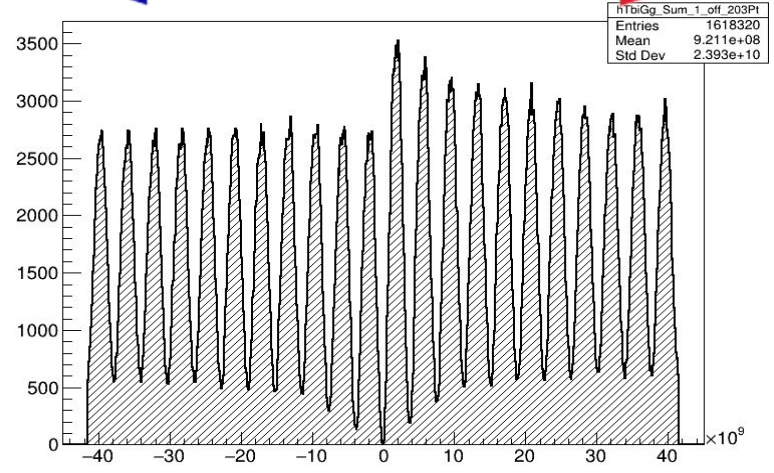


Off-Spill

205Au
DSSD0

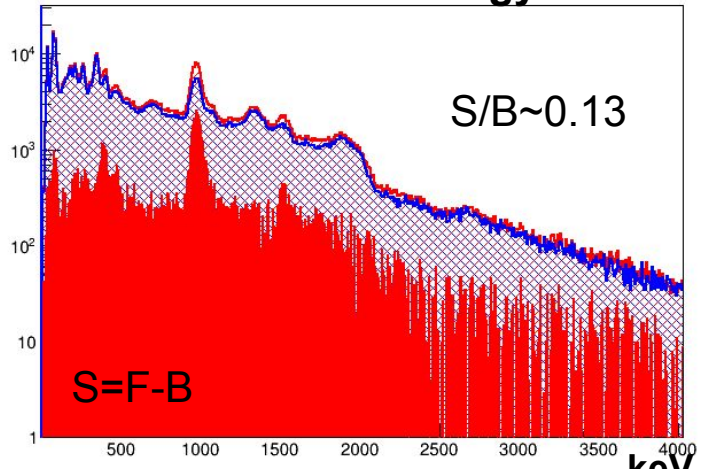


DTAS Sum Energy

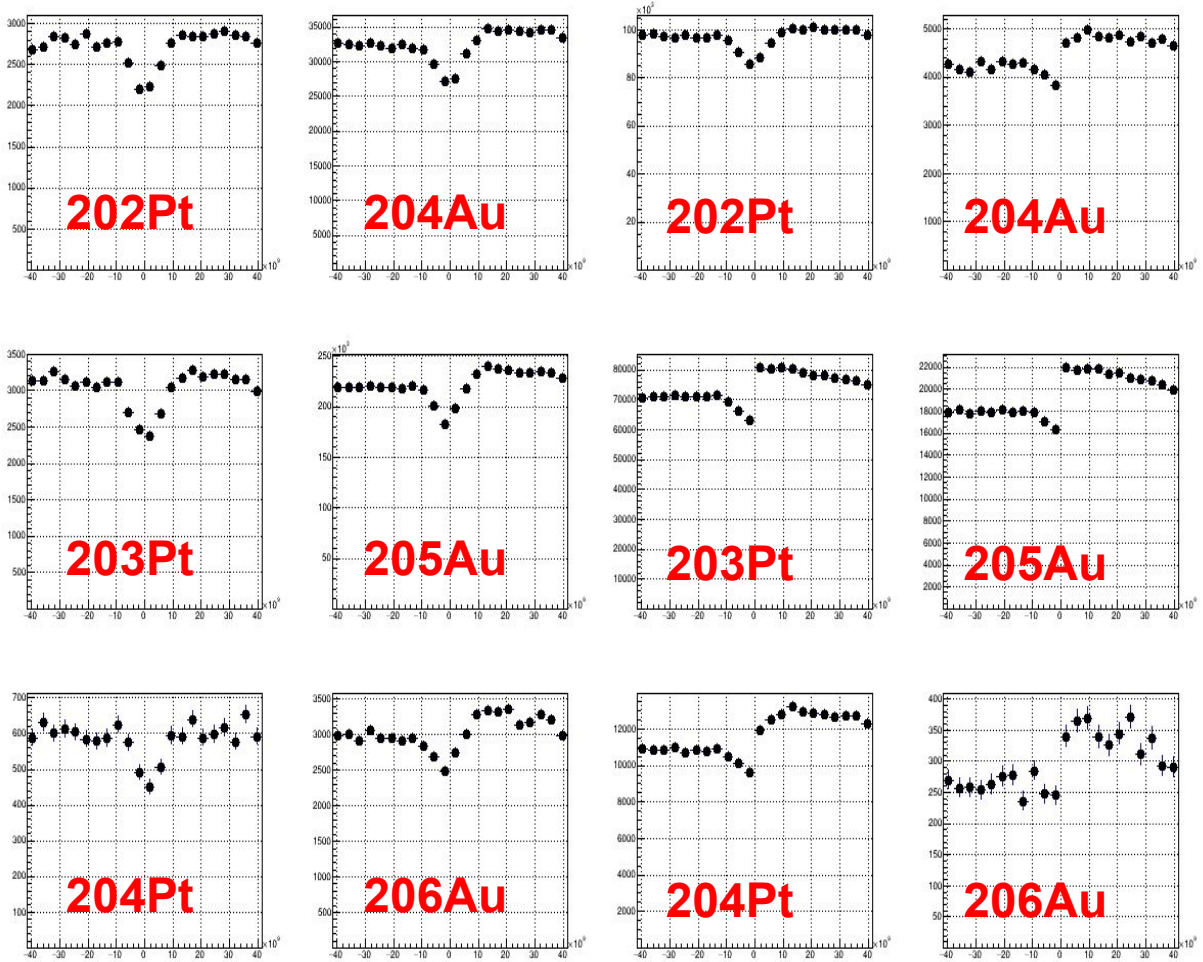


Full statistics

203Pt
DSSD1



DSSD0 (S/B~0.06) **DSSD1 (S/B~0.15-0.20)**

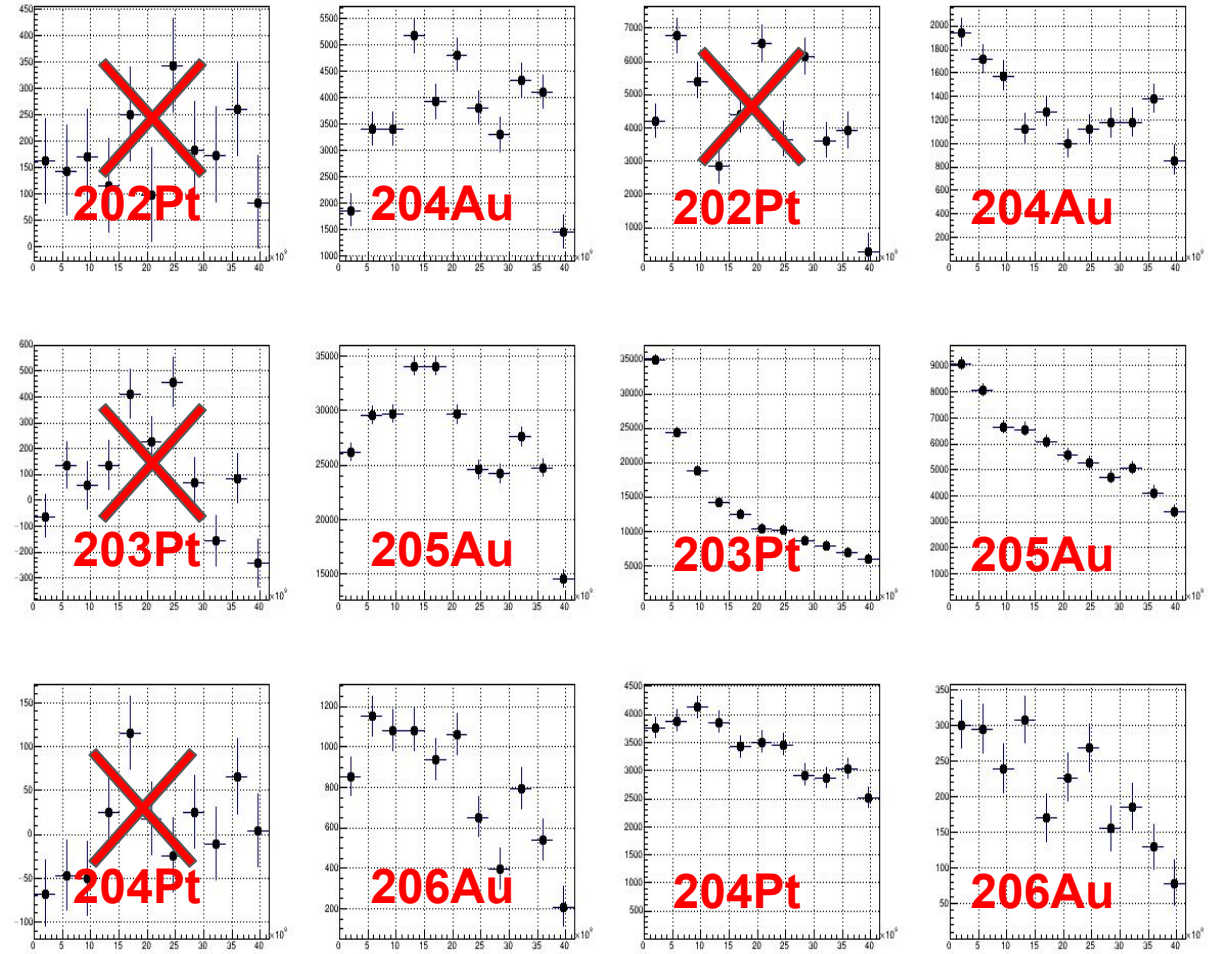


Implant-beta(gamma) time correlation window: ±41.5s

Large difference between DSSD0 and DSSD1, in signal-to-background and shape.

Reminder: We implanted Pt in DSSD1 and Au in both detectors
80% Au implants in DSSD0

DSSD0 (S/B~0.06) **DSSD1 (S/B~0.15-0.20)**



Difference forward - backward in the time correlation implant-beta(gamma).

Strange behaviour in DSSD0
DSSD1 has a better shape

We made a realistic MC simulation of implant-beta correlation trying to understand this behaviour.

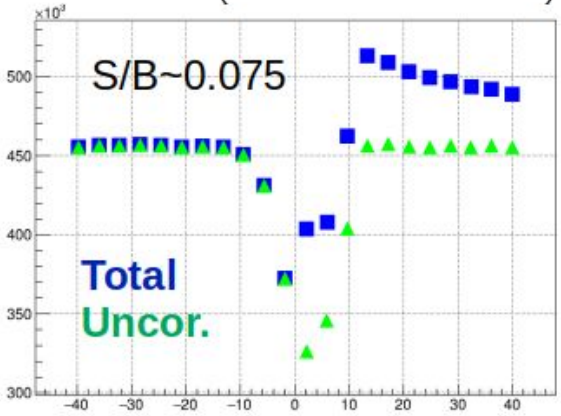
Experimental information used in the simulation:
Spill sequence (1.6s/2.2s), 18 delivered, 3 not delivered.
Implants: time distribution, experimental efficiency and rate XY distribution.
Decay: sequence to stability, experimental beta-gamma efficiency, dead-time and XY distribution.
Noise: rate variation over time and XY distribution.

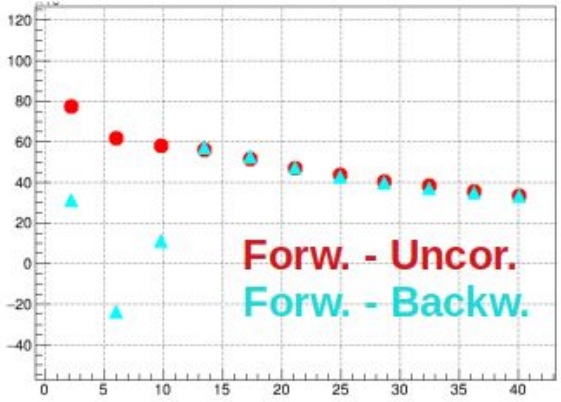
Reminder:
We implanted Pt in DSSD1 and Au in both detectors.
$T_{1/2}$ 202Pt = 45(15)h
80% Au implants in DSSD0

205Au case (10% 205mAu)

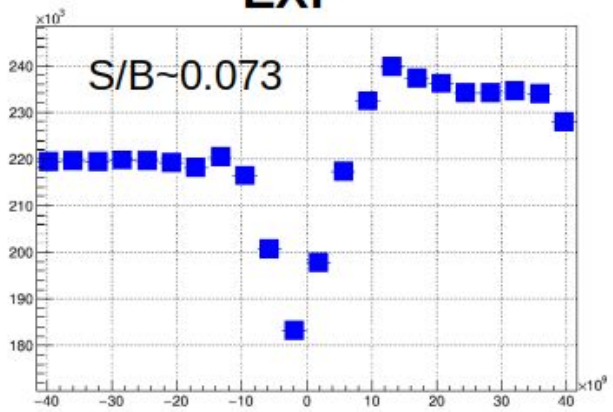
DSSD0:

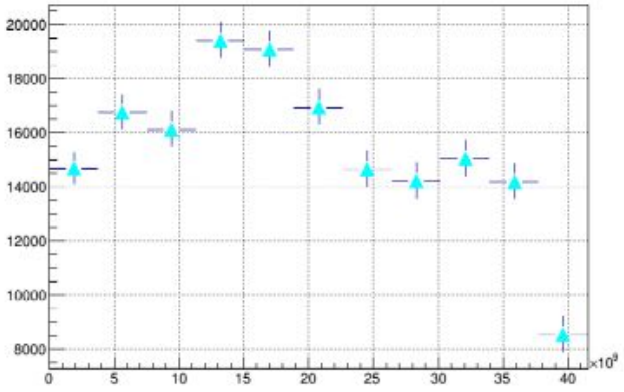
MC (Noise-rate x 4.6!)





EXP



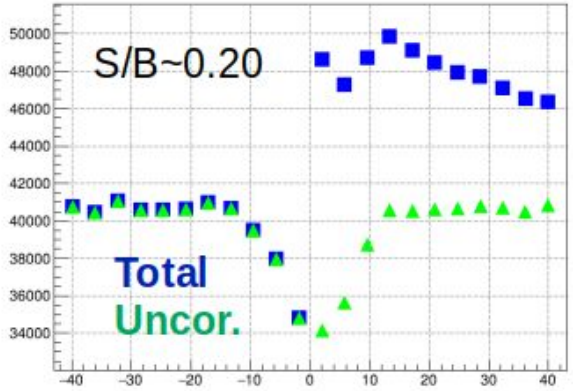


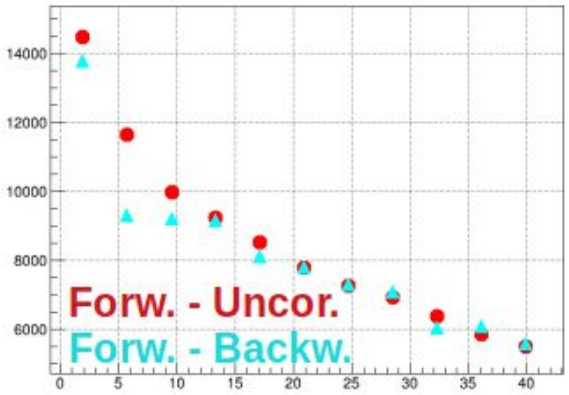
Need to increase the noise-rate value for a factor 4.6 to reproduce the experimental S/B

205Au case (10% 205mAu)

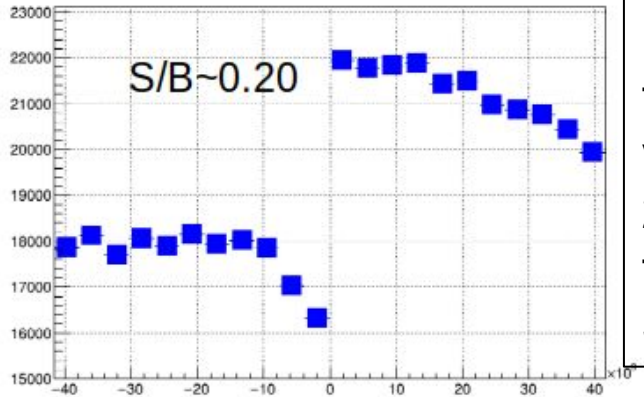
DSSD1:

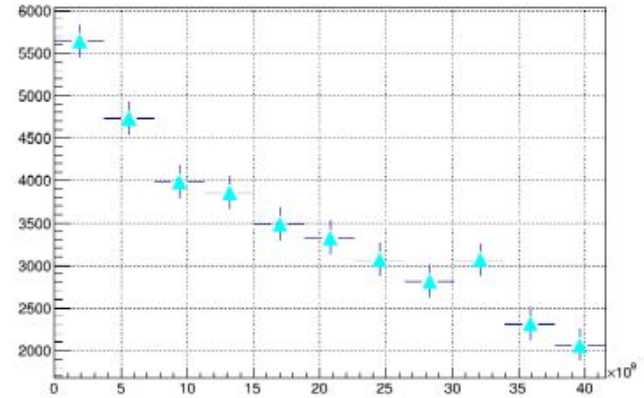
MC (Noise-rate x 2.9!)





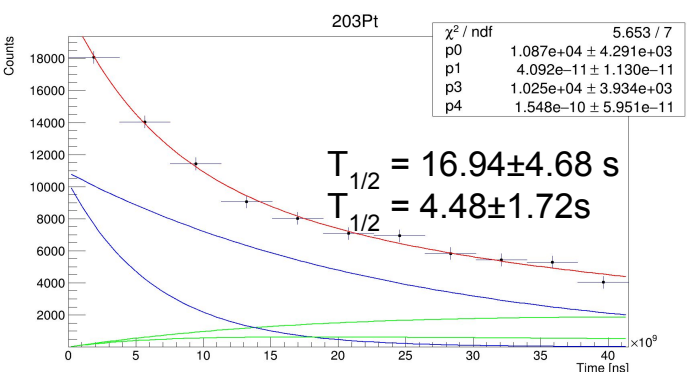
EXP

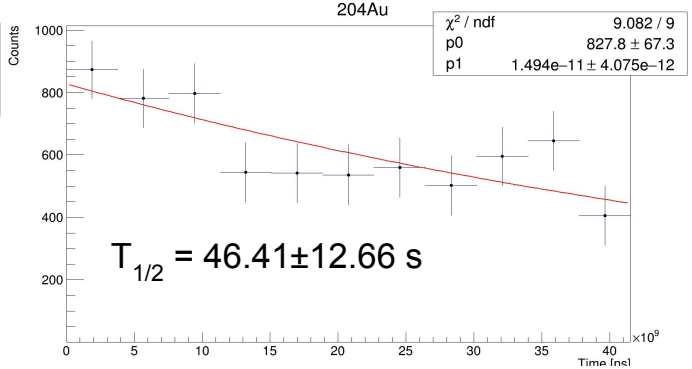




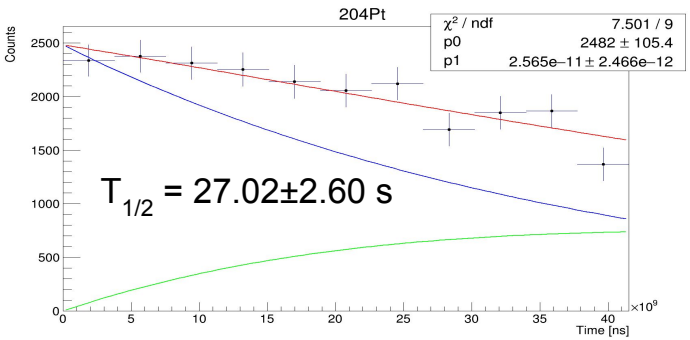
Need to increase the noise-rate value for a factor 2.9 to reproduce the experimental S/B

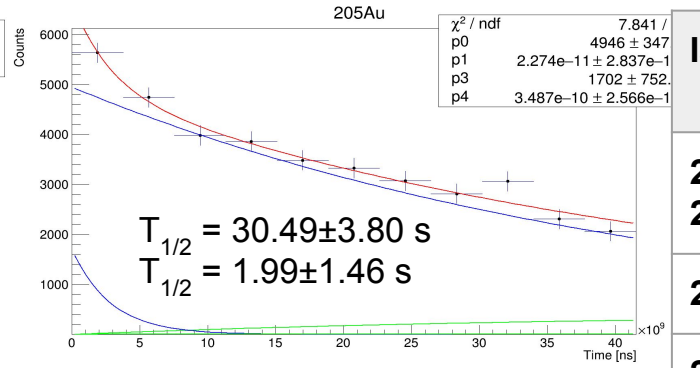
Next we show the fits of half-lifes with DSDD1

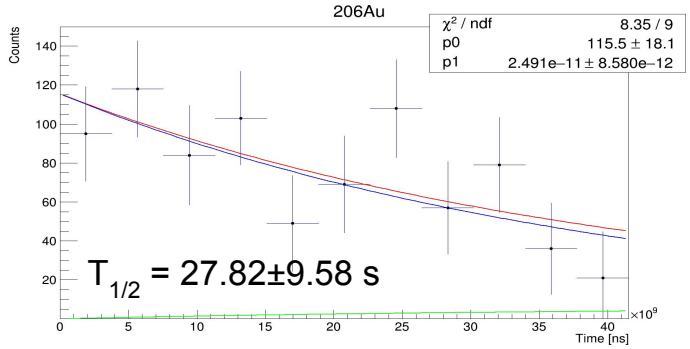




PRELIMINARY







Short (isomer) half-lifes affected by background subtraction (!?)

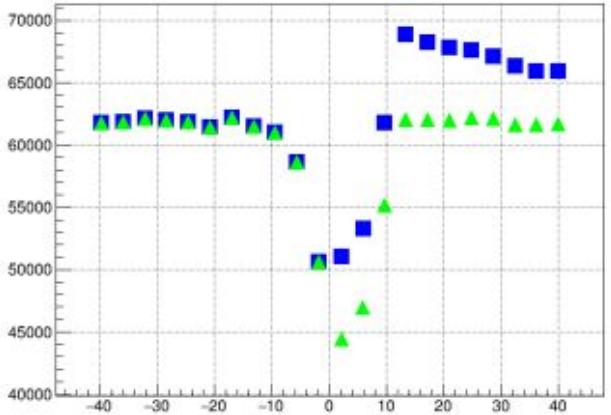
Isotope	Previous (ENSDF)	This work
203Pt **203mPt**	22(4); 12(5)	17(5); 4.5(17)
204Pt	10.3(13)	27(3)
204Au	39.8(9)	46(13)
205Au **205mAu**	32.0(14); 6(2)	30.5(38); 2.0(15)
206Au	40(15)	28(10)

MC simulation: 205Au (no isom.)

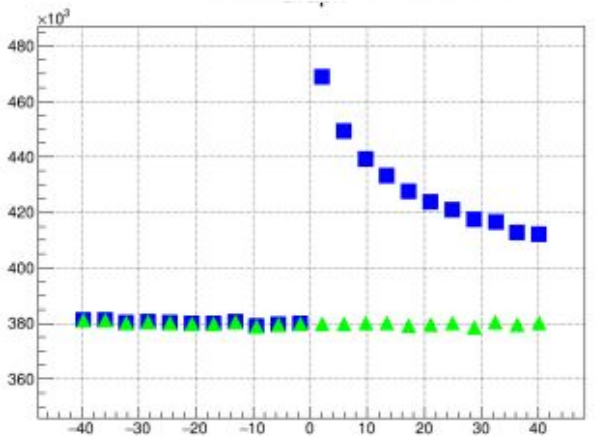
MC simulation: 205Au (10% isom.)

Important remark

18-of-21 spills

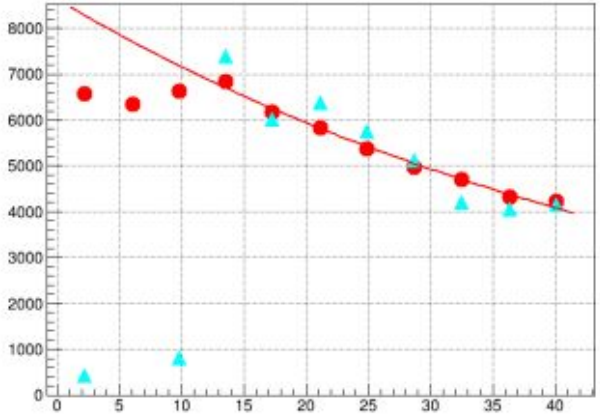


21-of-21 spills

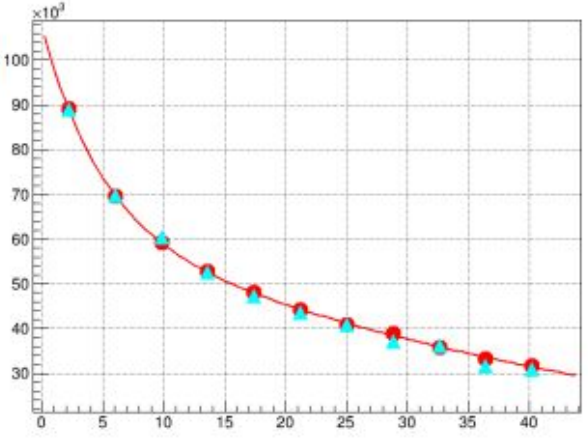


Deformation of uncorrelated background due to 3 missing spills

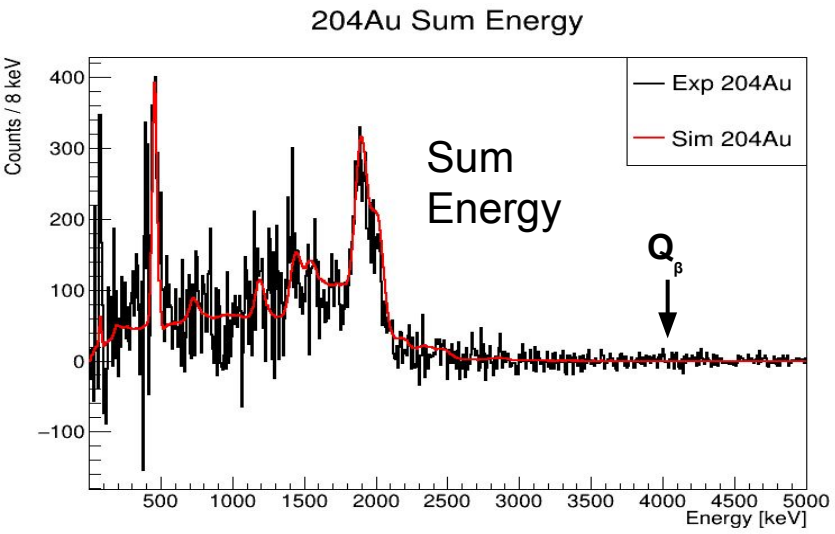
DSSD0

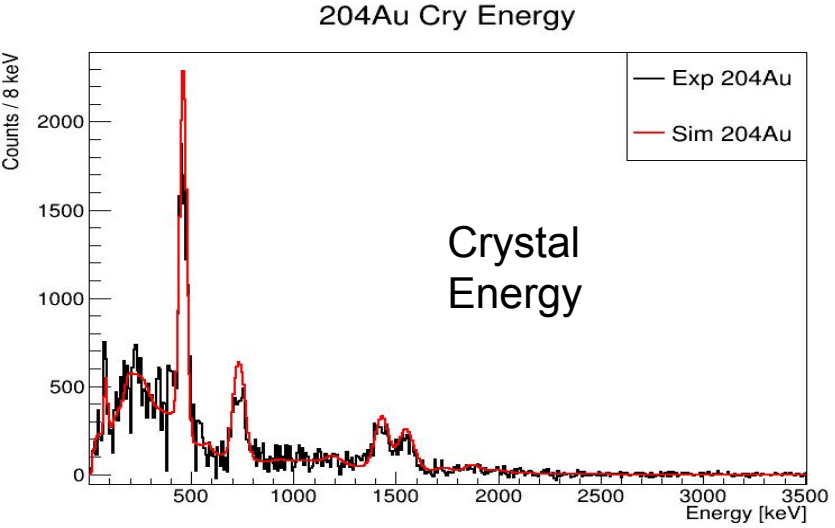


The true correlated distribution is deformed due to 3 missing spills



Preliminary analysis of beta intensity distribution of ^{204}Au and ^{205}Au

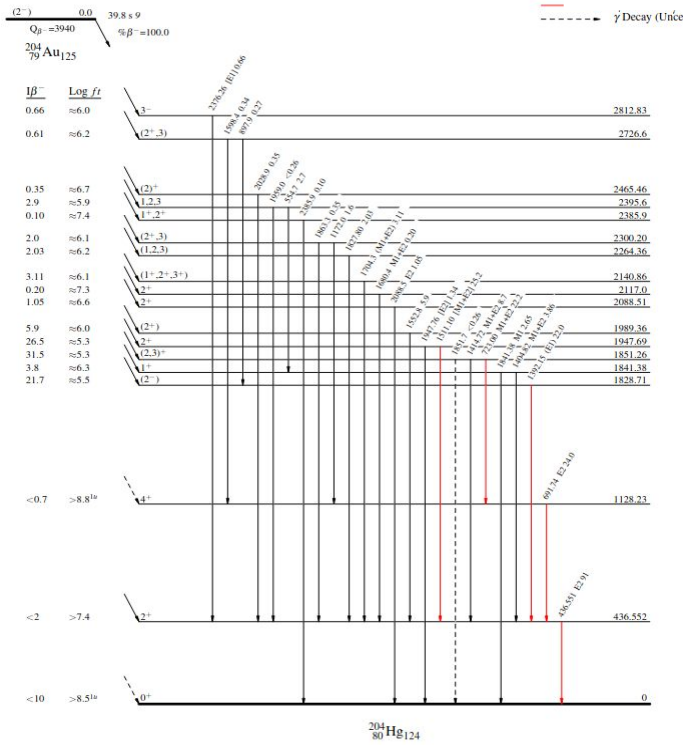




204Au

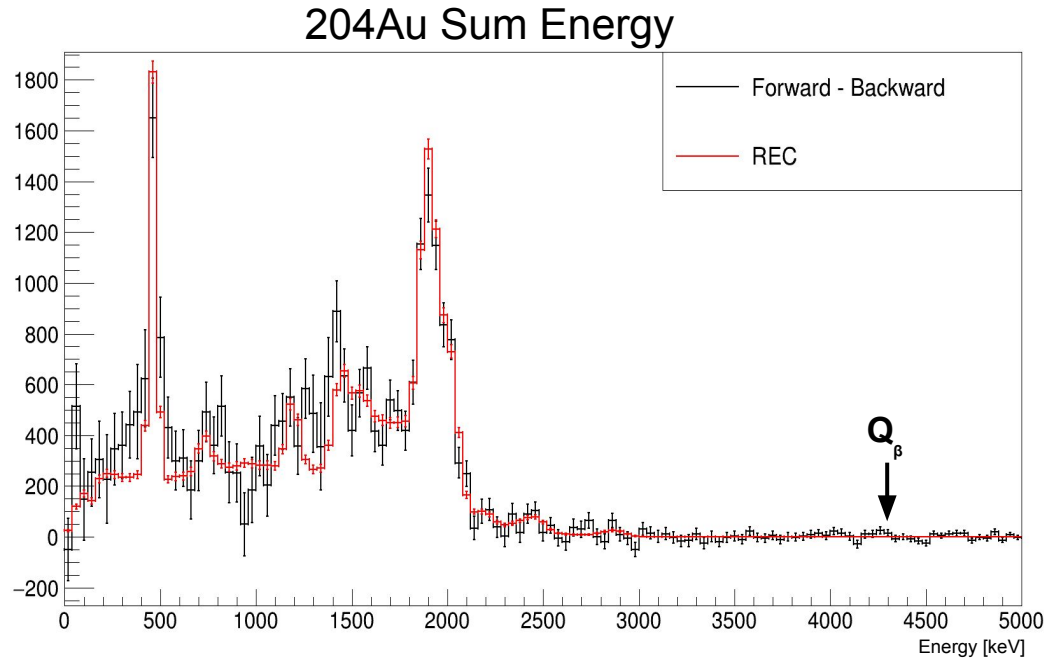
Full statistics: 26.8k counts

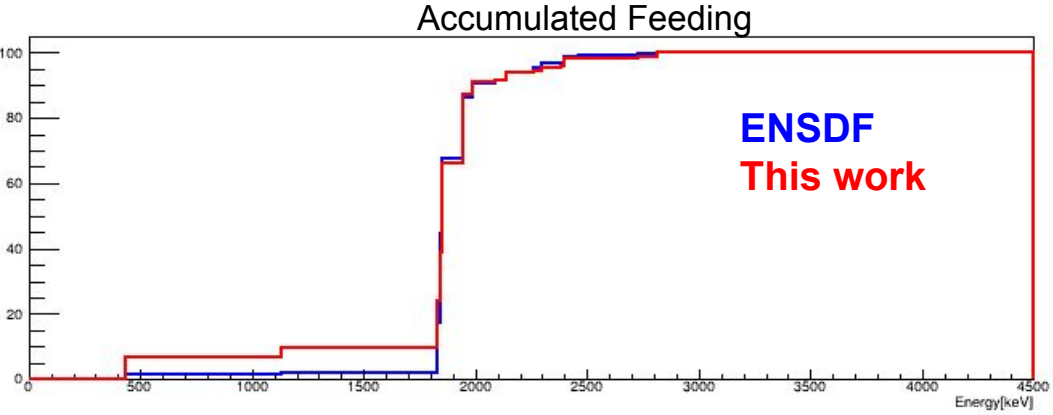
Comparison with previous knowledge



D.A. Craig and H.W. Taylor 1984 *J. Phys. G: Nucl. Phys.* **10** 1133

Within our sensitivity, no additional beta intensity



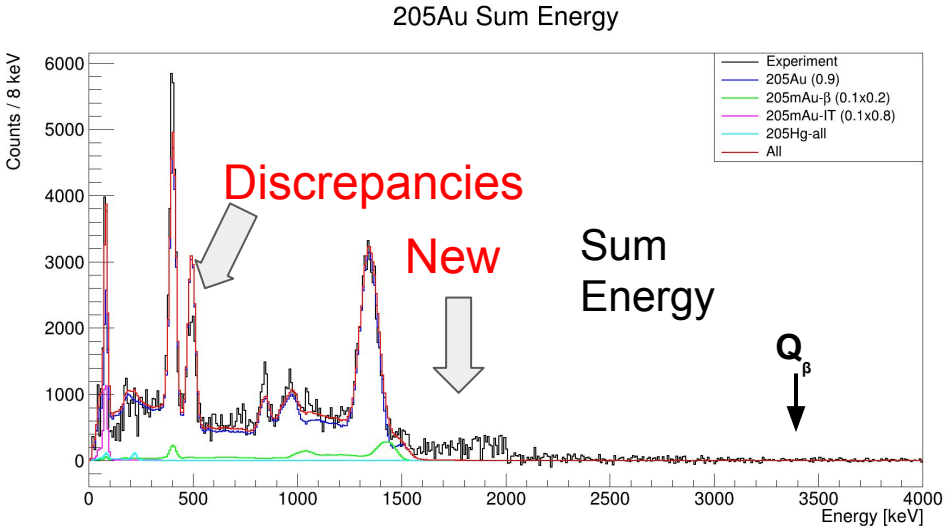


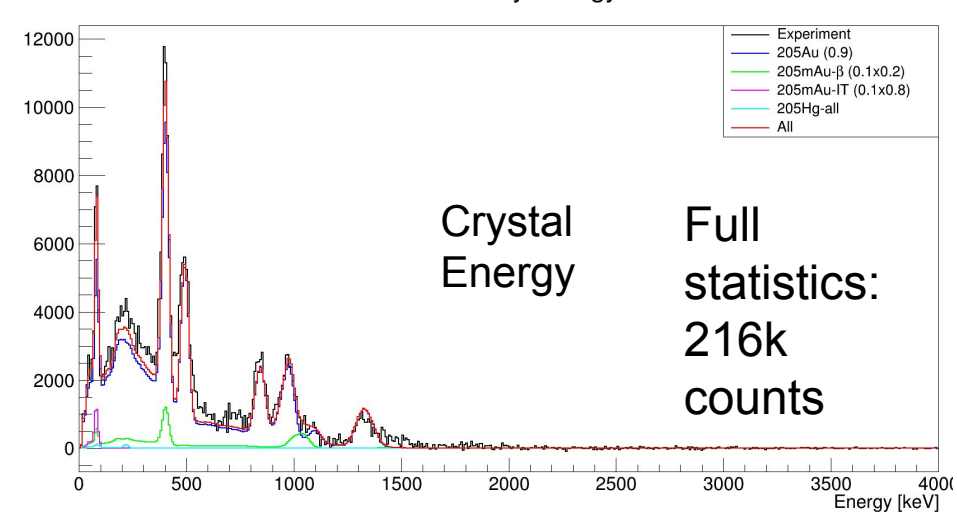
Preliminary beta intensity distribution results for 204Au.

The feeding to g.s. fixed to 0 (Craig et al.)

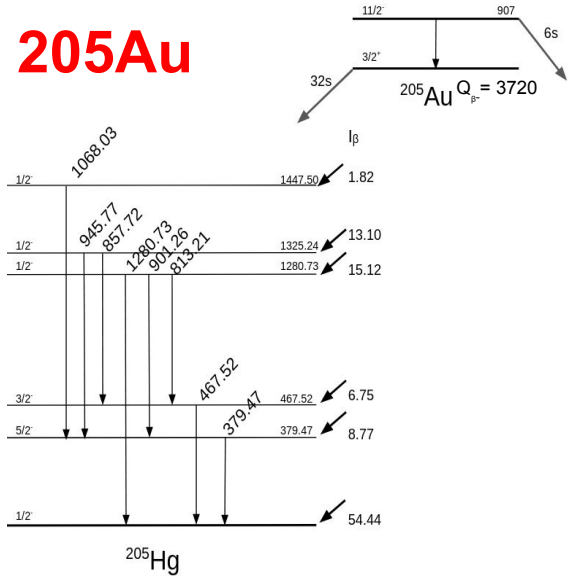
In good agreement with Craig et al., but some feeding to first and second excited states

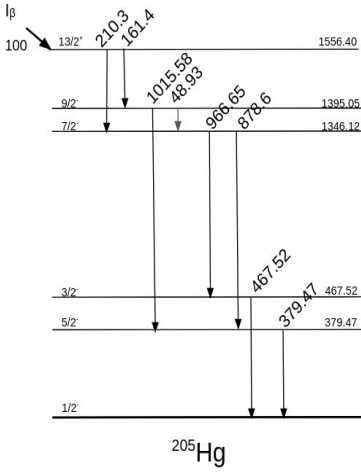
PRELIMINARY





205Au

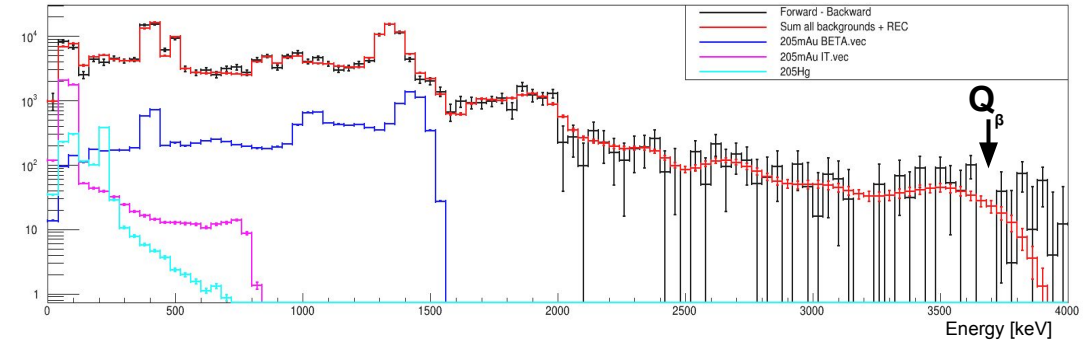




Comparison with previous knowledge

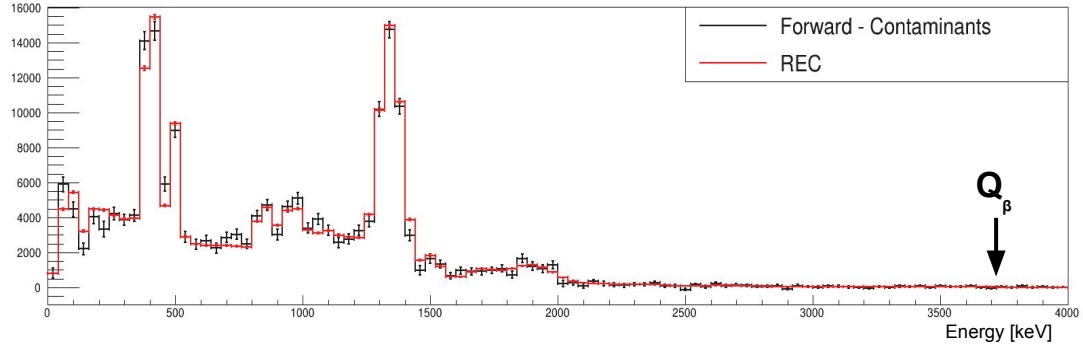
C. Wennemann et al. Z.Phys. A 347, 185-189 (1994)
Z. Podolyák et al. PLB. 672 (2009) 116-119

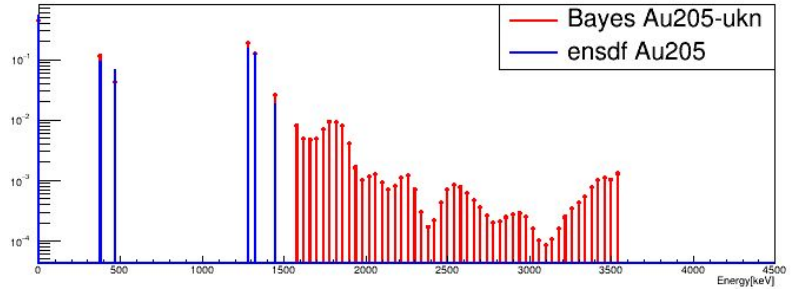
We see additional beta intensity

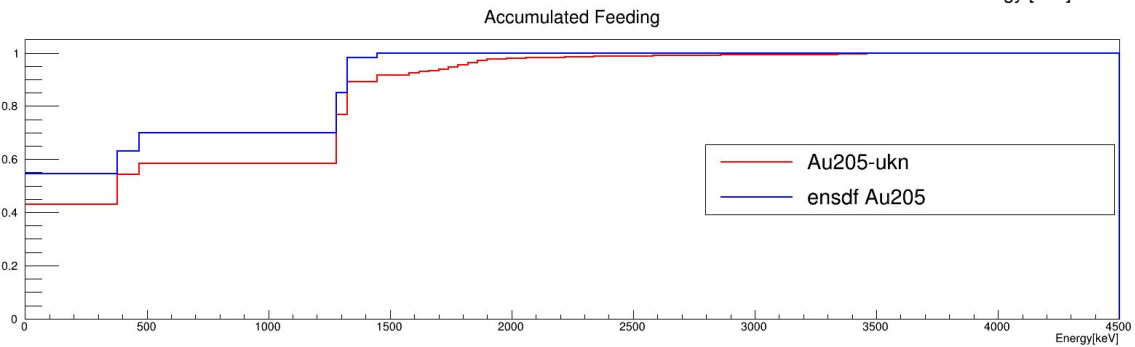


Preliminary beta intensity distribution results for 205Au.

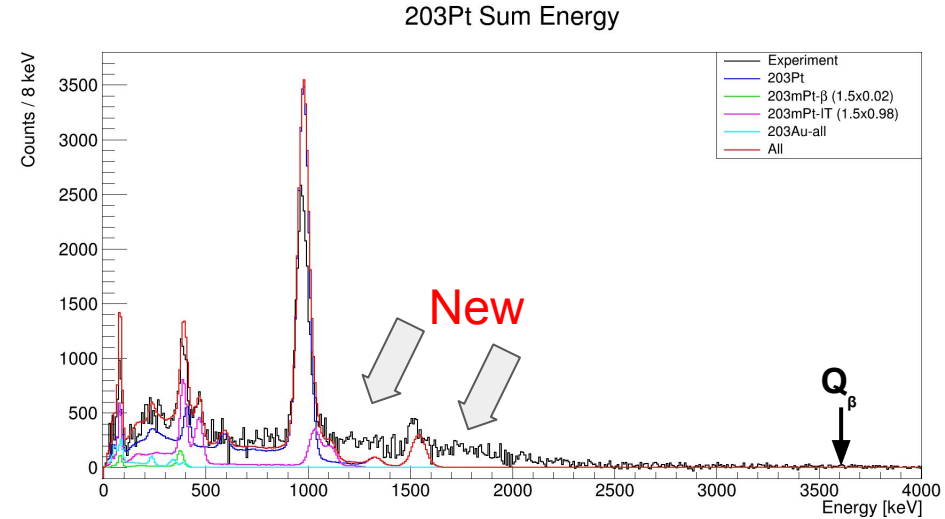
Additional beta intensity above 1.55 MeV, lower g.s. feeding intensity

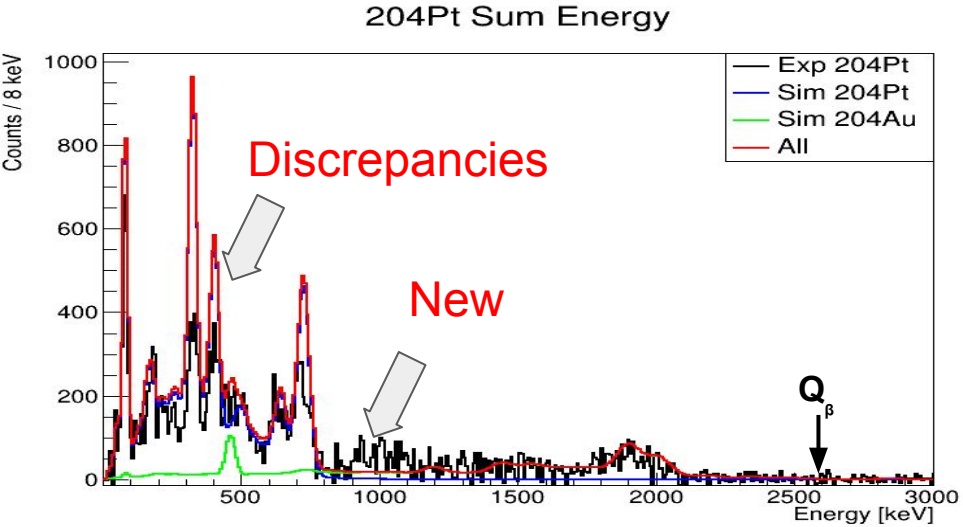






PRELIMINARY





Next steps:

- Analysis to obtain beta intensity distribution of 203-204Pt
- Analysis of 206Au: complicated because of 2us isomer in 206Hg

S505 Collaboration:

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