Targetry challenges for HIE-ISOLDE

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Group for Upgrade of Isolde

EN-STI-RBS

Important items and « subtasks »

- ISOLDE today:
  Strengths and weaknesses

- Technical challenges coming with the increased intensity for HIE-ISOLDE:

  Compatibility

  Reliability

ISOLDE Today

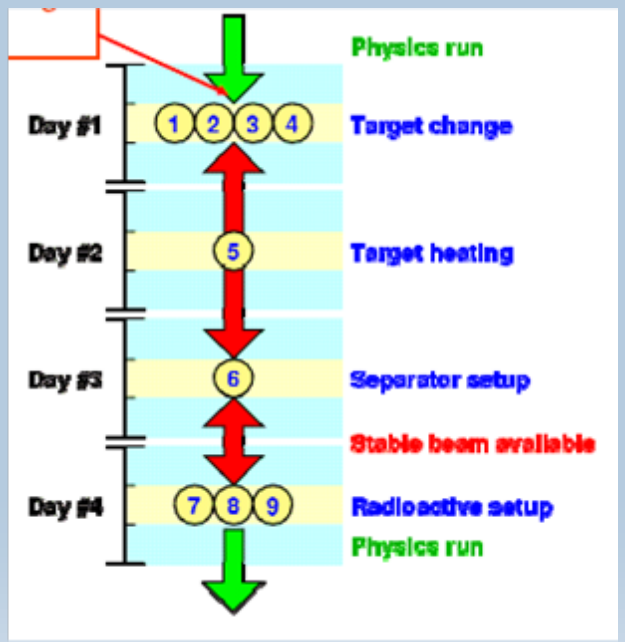
- 30 target materials: foils, fibers, pellets, solid monoliths, liquids
- 4 lines: hot, temp. regulated *(at least 2)*, cold. (Ta, C, SiO2)
- 10 ion sources: Surface (W, Ta, Nb, GdB_6), MK/VD(3,5,7), ECR 1^+, Negative, RILIS (~25 beams)
- Neutron convertor
- 70 elements (850 isotopes)

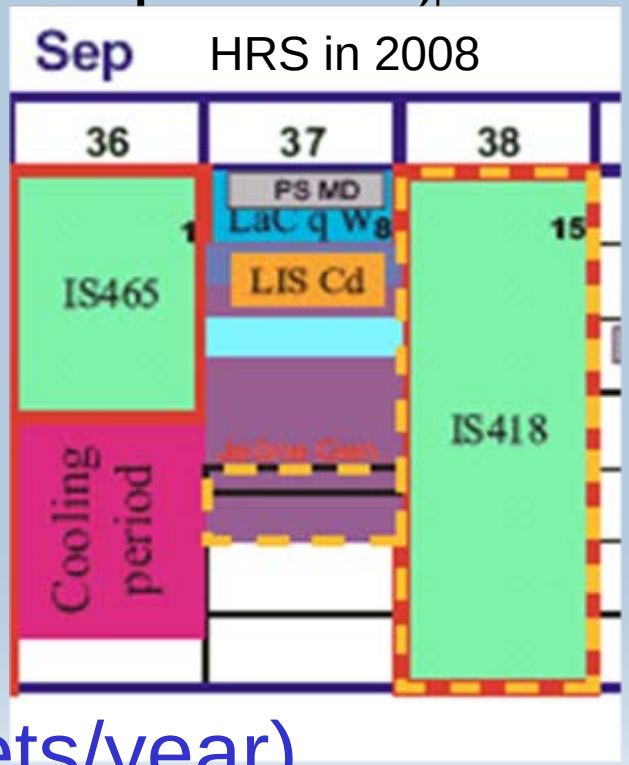
Largest variety of beams world-wide

ISOLDE Operation

- Increase of the complexity to set up the beam (+ quality control of target unit before operation)

	Action	Allow
1	Cool old target	2 hr
2	Frontend to atmosphere and ventilation on access mode	1 hr
3	Put new target in zone	1 hr
4	Swap targets (robot)	2 hr
5	Pump / heat / outgas target	~40 hr
6	Setup source and separator	8 hr
7	Proton scan	2 hr
8	Yield check	5 hr
9	User consultation & beam handover	1 hr

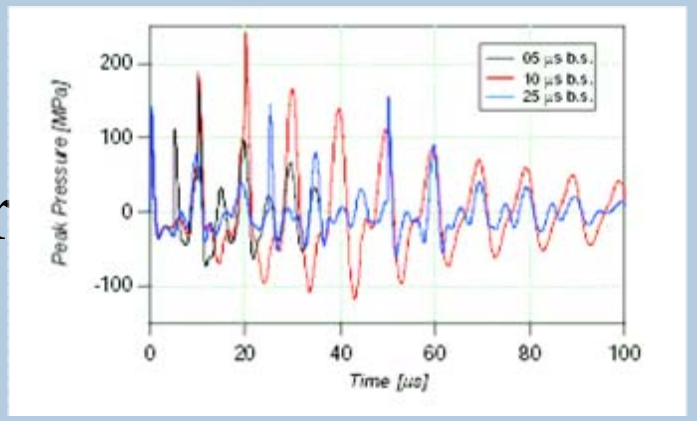




Still flexibility (25-30 targets/year)

Pulsed beam operation (ISOLDE)

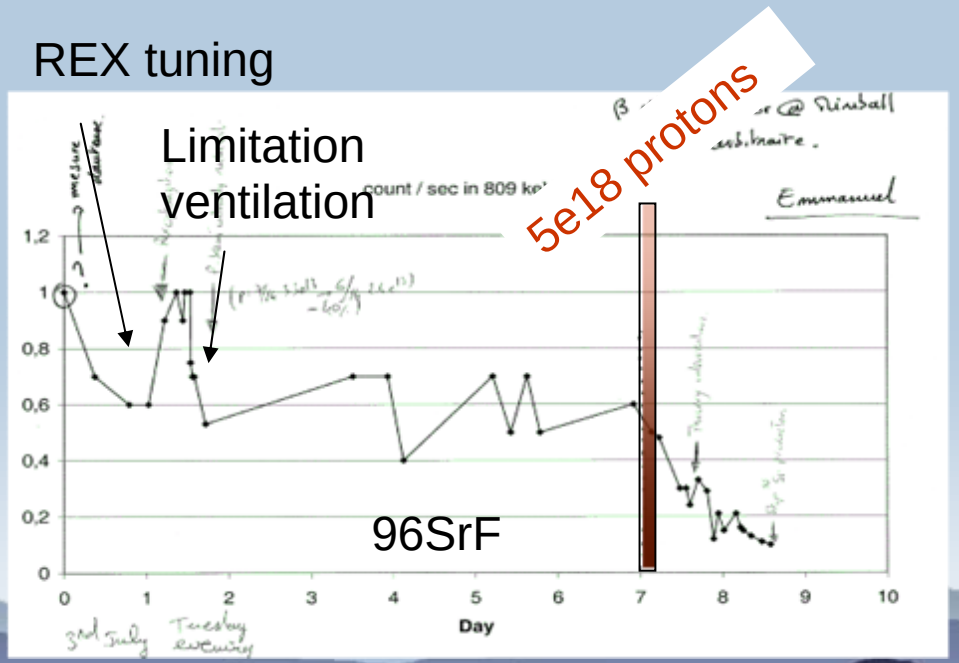
- Molten metal: 8e12ppp
  Staggered beam from PS booster
  (STAGISO 10 μs)



- Ageing of units

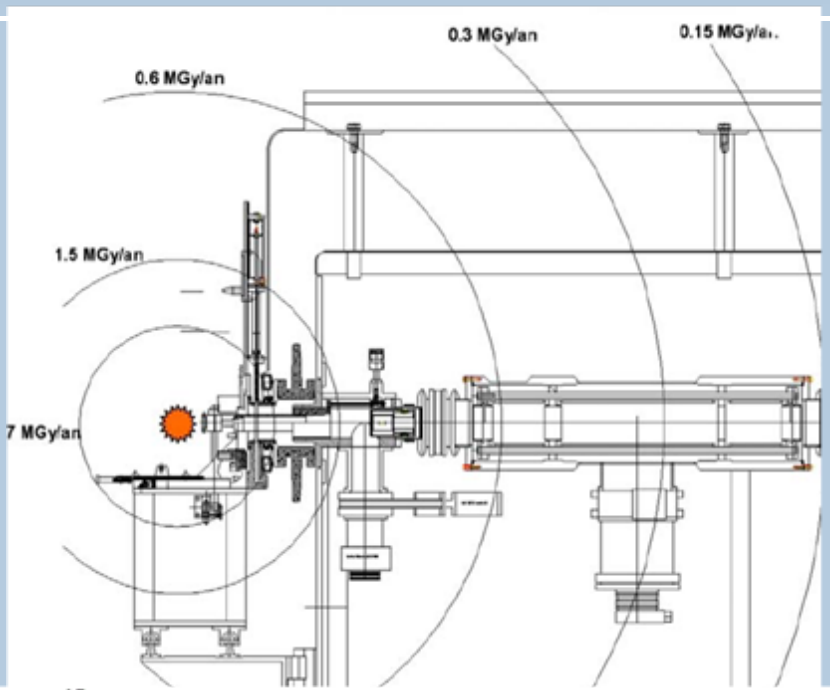
  UC355 (July 2007)
  Surface ion source + gas leak CF4
  ^{96}SrF

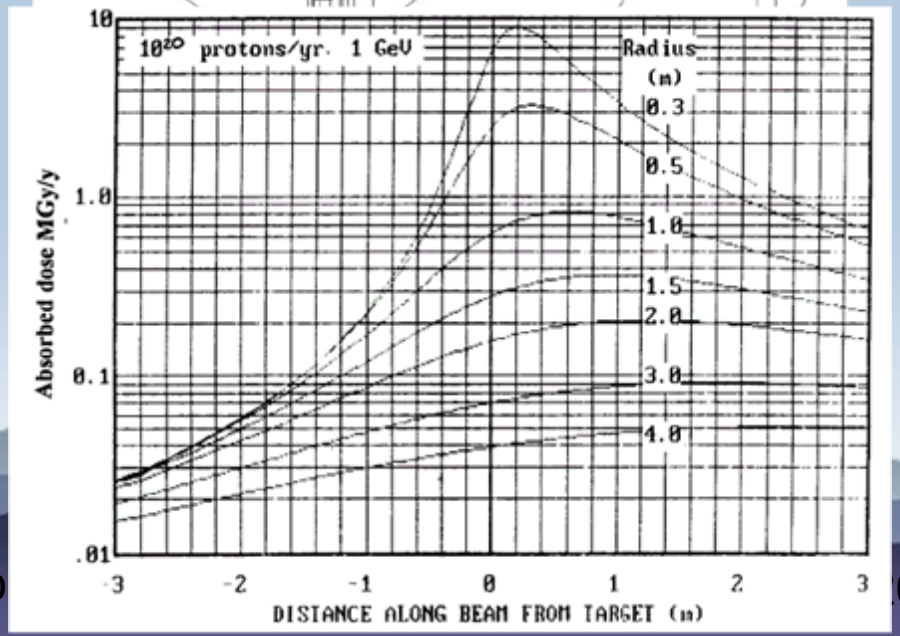
REX tuning



Post irradiation examin.

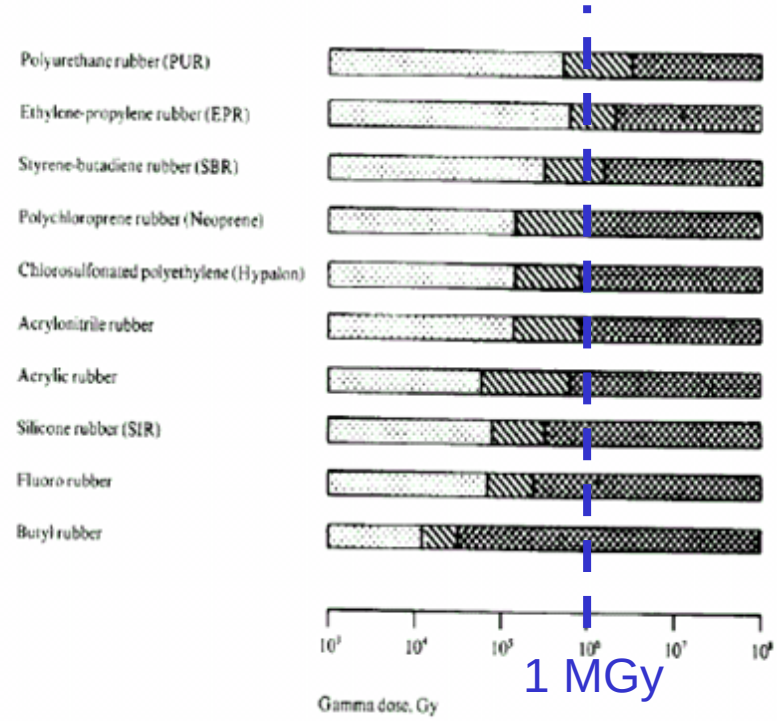
Reliability (ISOLDE)





Elastomer O-rings

These appreciations are taken from the references cited and can only serve as a general guideline. Atmospheric and other environmental conditions such as temperature and dose rate are not taken into consideration. See also Sections 2 and 3.

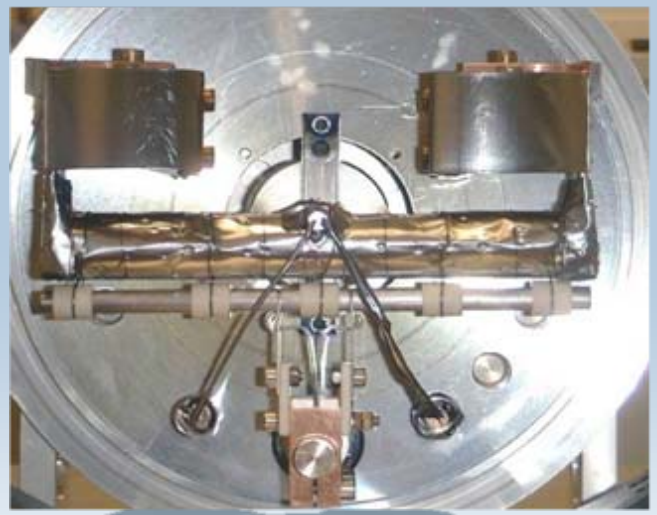


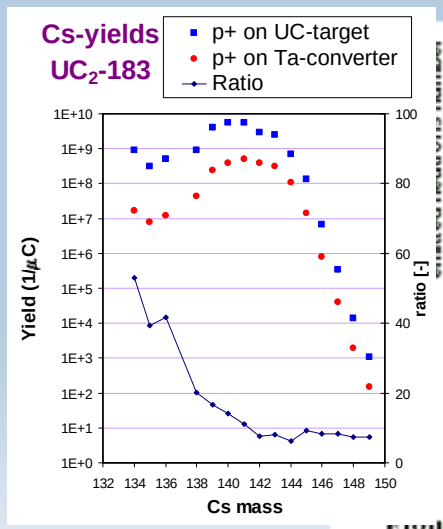
1 MGy

Vacuum leaks
maintenance of pumps

Neutron converter (ISOLDE)

- Decoupling beam-induced thermal shocks from target material, suppression of contaminants
- Geometry (solid angle > 45°, double container), reflection, moderation, secondary particles spectrum, …





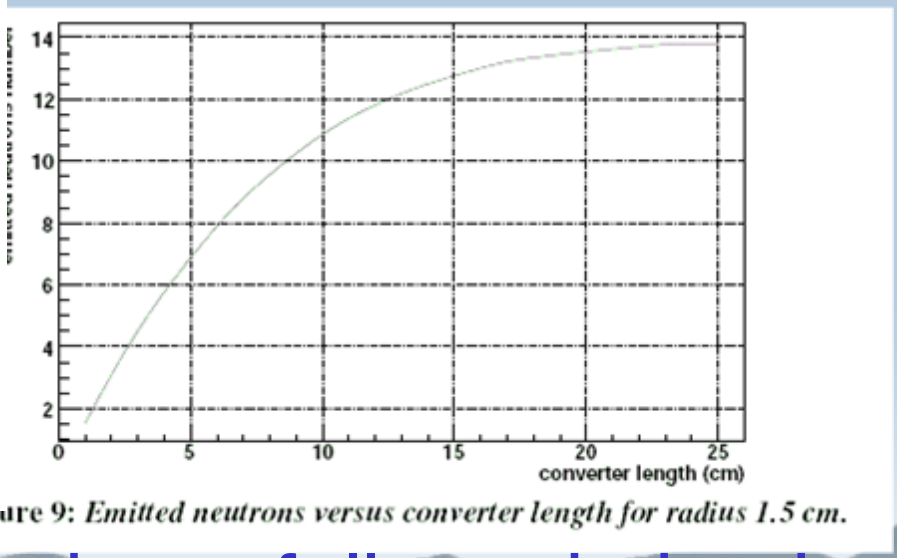
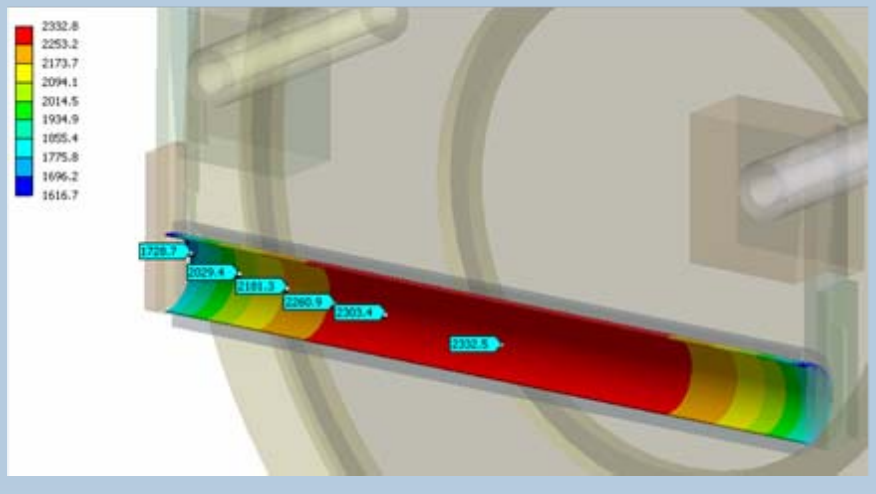


Figure 9: *Emitted neutrons versus converter length for radius 1.5 cm.*

Frequently requested, not fully optimized

Thermo-mechanical issues (ISOLDE)

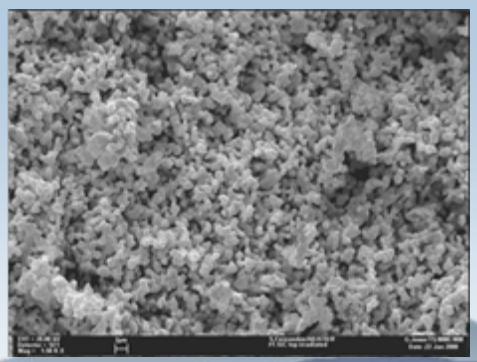
- Simulation of heat dissipation (thermal screens) and induced shock waves/thermal stresses



Temperature profile in the target, ageing of heat screens

Beam variety at HIE-ISOLDE

- Analysis for compatibility of present target and ion source unit technology with HIE.
- Some obvious directions : UCx and molten metal targets
- <u>Benefit from the present unit dismantling campaign</u>
- (Many) sinergies with EURISOL-DS

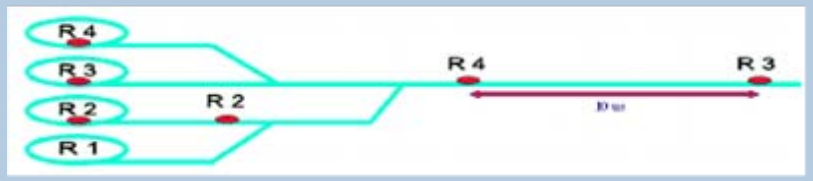


Operation at HIE-ISOLDE

- Must define some operation guidelines for the new facility:
  Beam variety
  Experiment duration
  time in between two targets
  possible reuse of spent targets
- operation of two separators in parallel

Pulsed beam at HIE-ISOLDE

- Definition of the exact intensity, repetition, time structure

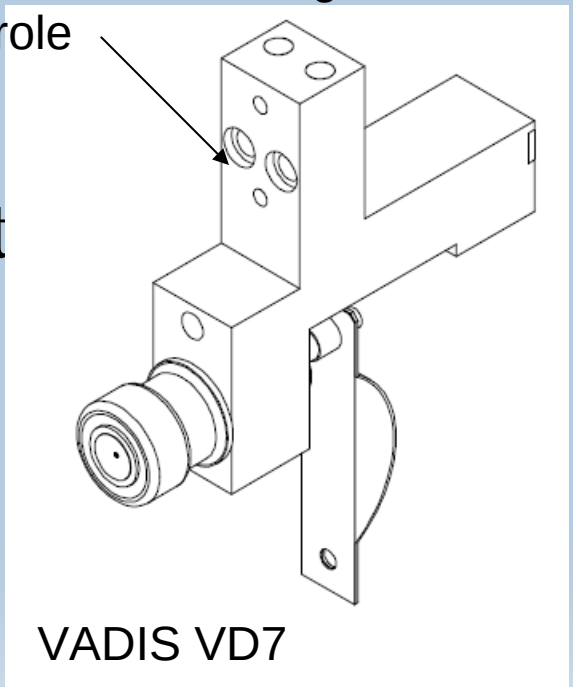


- Impact on ageing, fatigue by
  numerical simulation
  post irradiation analysis
  in-beam tests

Reliability, vacuum –HIE ISOLDE

- 2 weeks of operation at 6.4 μA = 5e19 protons, 7.5 10^5 shocks

- Exchange of all polymeric part (inflatable metallic sealings)
- Closing valve for unit transport/sotrage after decoupling



Neutron converter (HIE-ISOLDE)

- For fission products and new reactions (n, alpha)
- Reduces impurities
  Decouple thermal shocks from the target material
  Improve yields beyond the increase of proton intensity

Thermal management (HIE-ISOLDE)

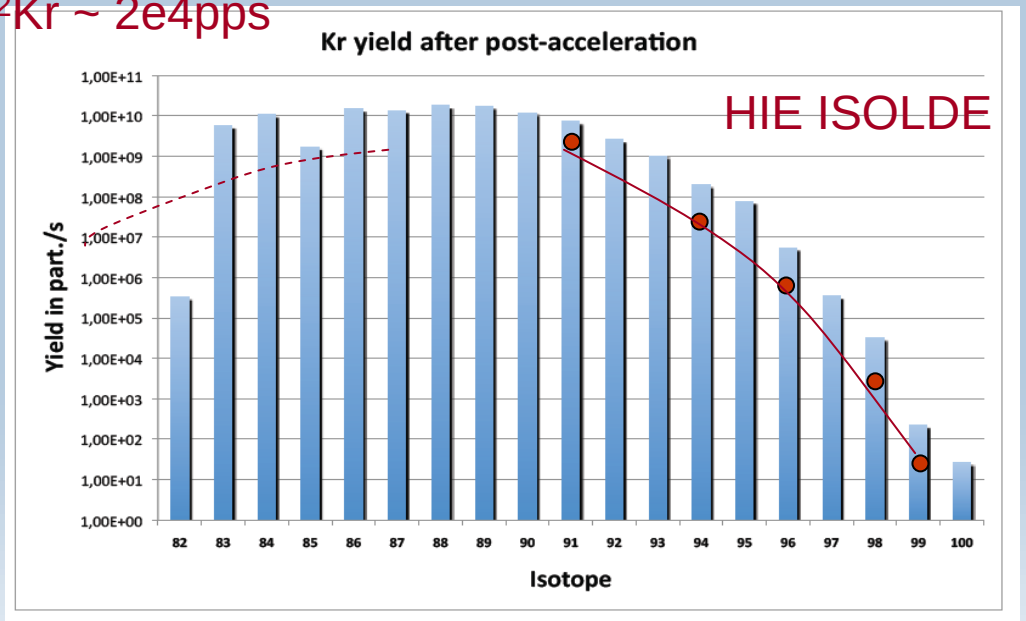
- New design to cope with increased heat load (some oxides, molten metals)
- Better homogeneity for higher yields of exotic isotopes
- Heat screen system to sustain longer irradiation periods without degradation

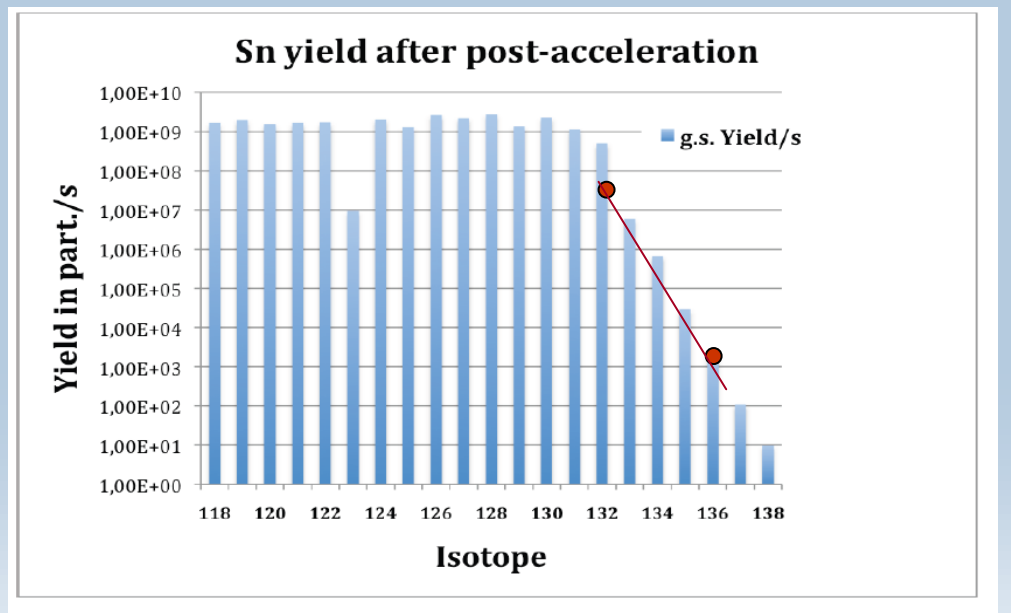
Updated yields – HIE ISOLDE

- Ca x5 on Rn (VD7), x3 on Be (RILIS), etc

SPIRAL 2 yields, from M. Lewitowicz

^{72}Kr ~ 2e4pps





Conclusion

- Analysis of present ISOLDE (risks, advantages, drawbacks)
- Identify/define sub-tasks related to
  adaptation of the unit to HIE (ie beam characteristics, remote handling)
  Improvement of present technology (ie n-conv)
  Improvement of reliability (ie vacuum sealings)

Acknowledgment

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