Romanian Collaboration at ISOLDE-CERN

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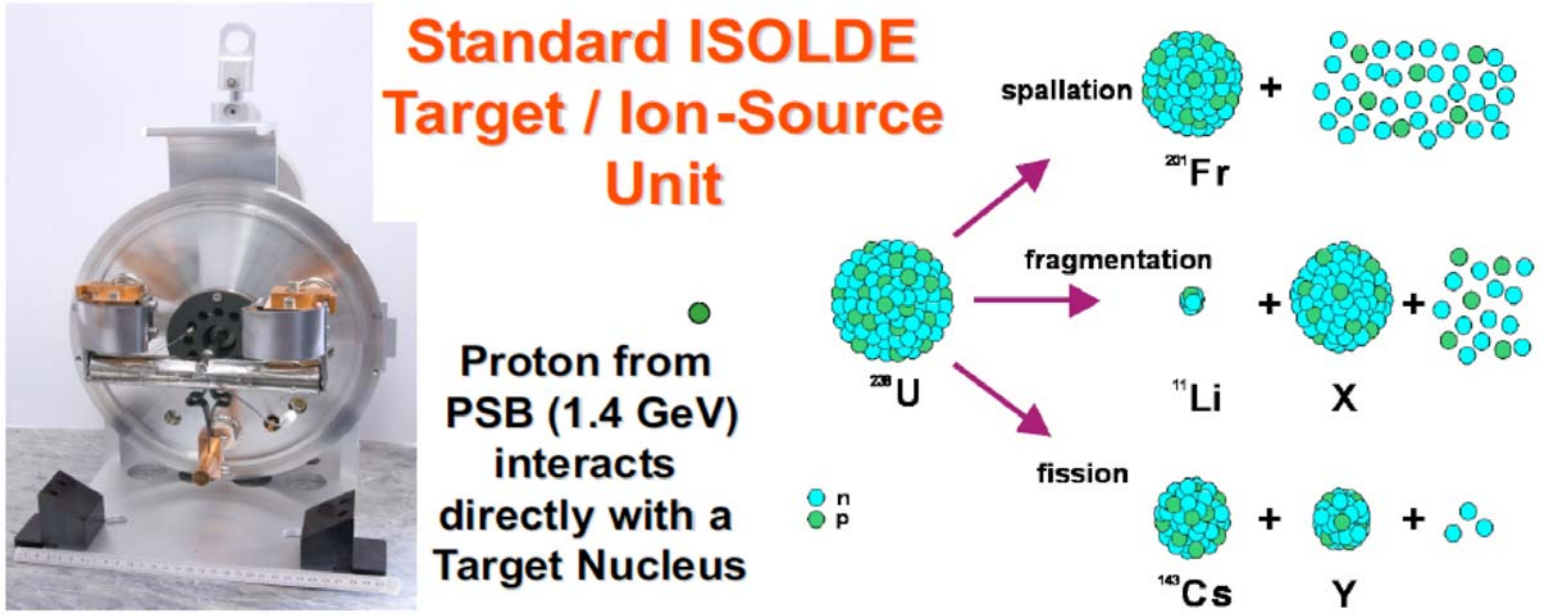
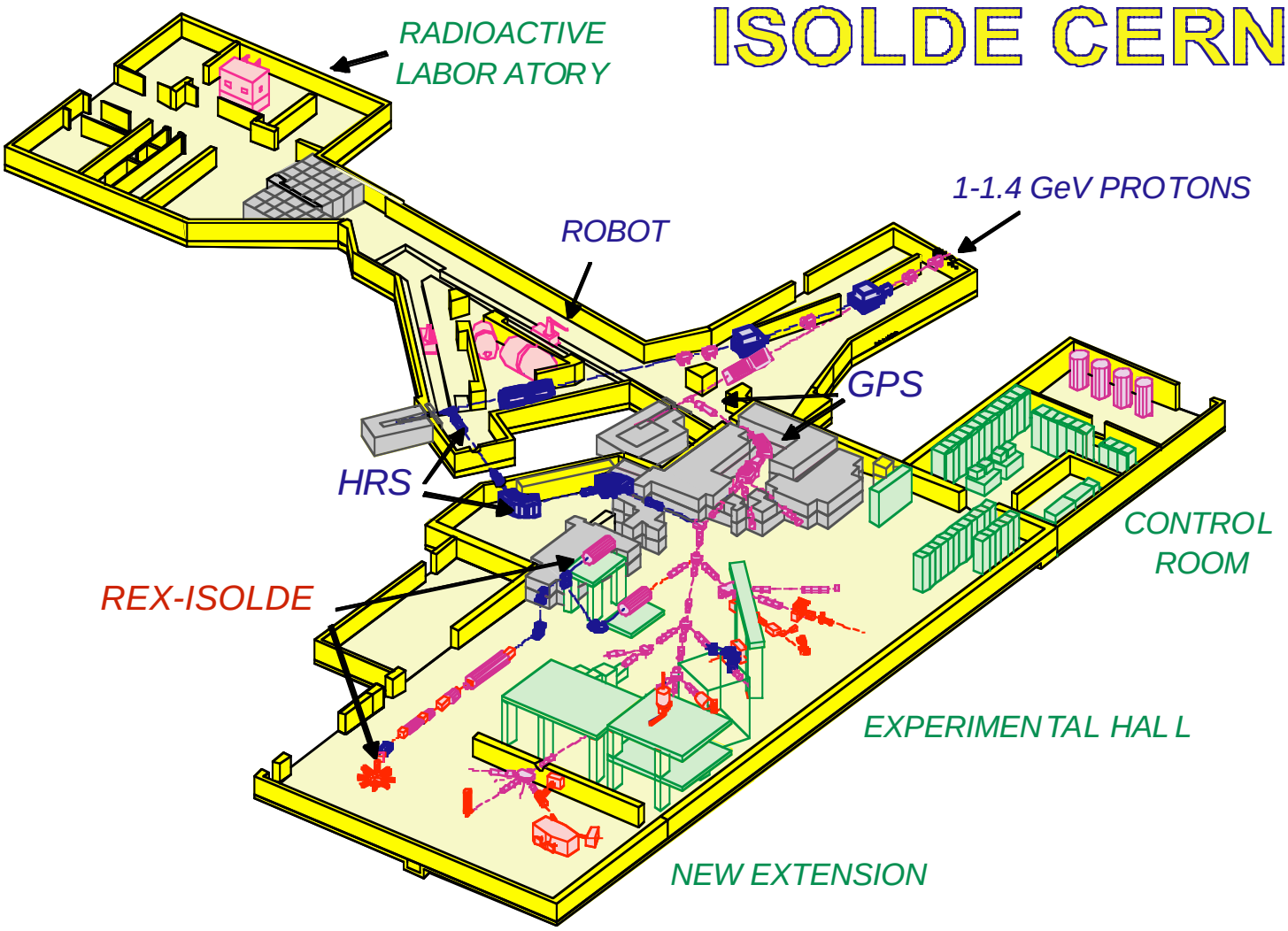
ISOLDE - Radioactive Beam ISOL Facility

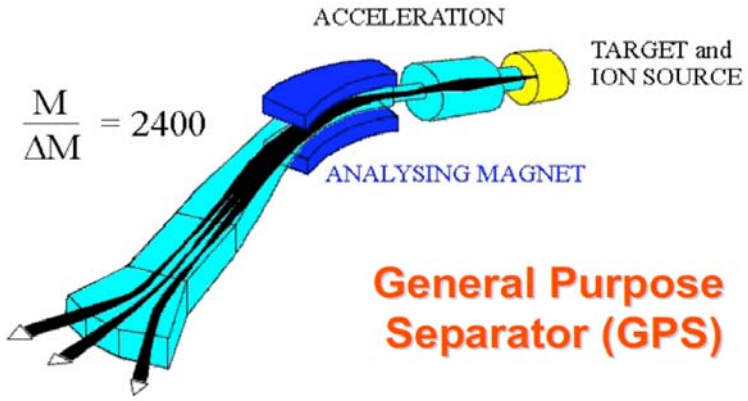


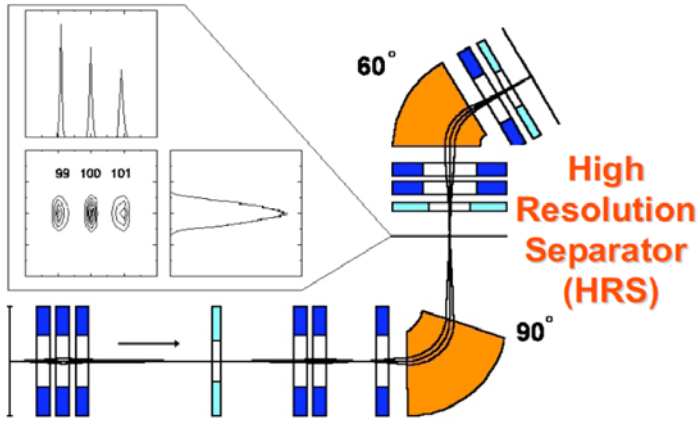
Selected reaction products are extracted and further accelerated at 60 keV

Layout of ISOLDE Facility



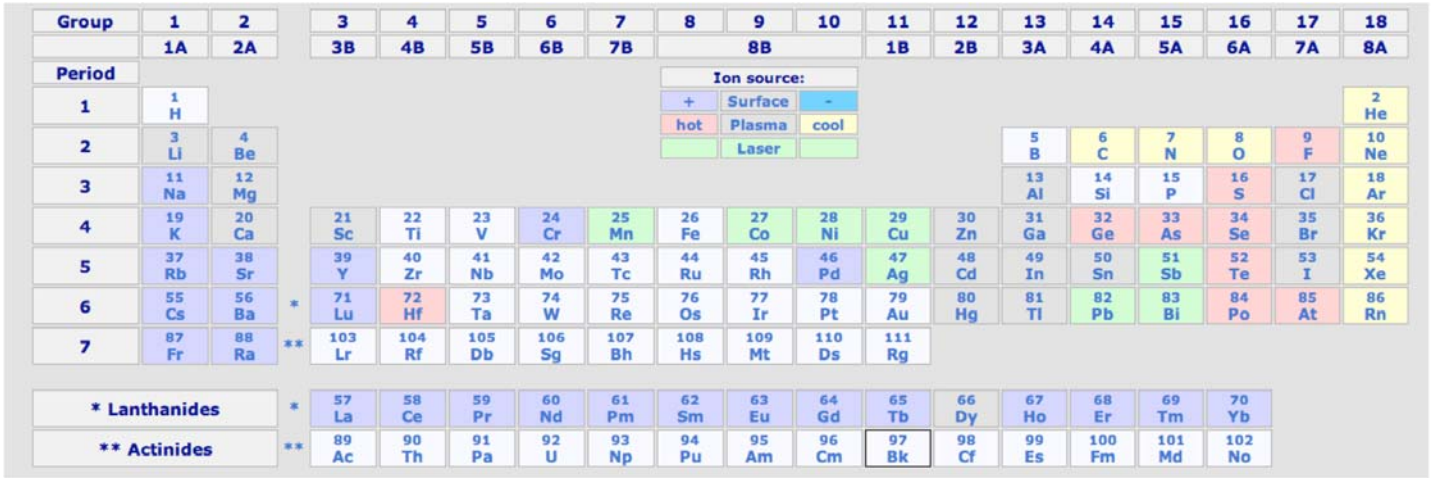
Mass Separators





- Each of the two separators has its own production target
- GPS can deliver simultaneously three different beams
- A central beam line is constructed to allow either of the two separators to be used

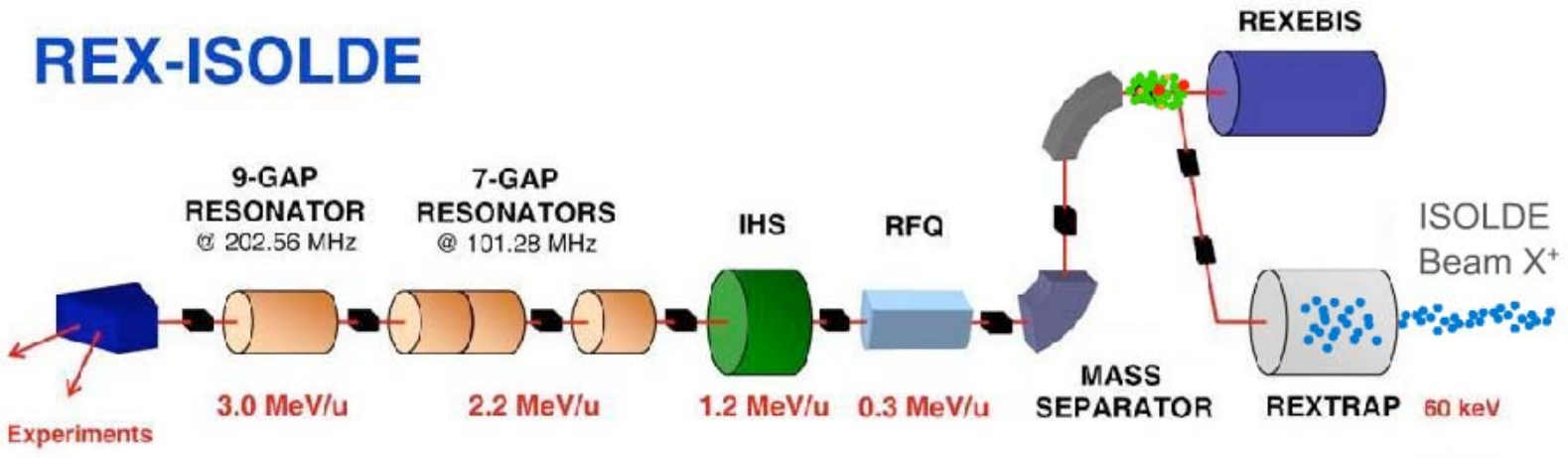
Wide Range of Elements Produced



Group	1	2		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	1A	2A		3B	4B	5B	6B	7B	8B			1B	2B	3A	4A	5A	6A	7A	8A
Period									Ion source:										
1	1 H								+	Surface	-								2 He
2	3 Li	4 Be							hot	Plasma	cool			5 B	6 C	7 N	8 O	9 F	10 Ne
3	11 Na	12 Mg								Laser				13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
4	19 K	20 Ca		21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
5	37 Rb	38 Sr		39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
6	55 Cs	56 Ba	*	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
7	87 Fr	88 Ra	**	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg							
* Lanthanides			*	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb		
** Actinides			**	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No		

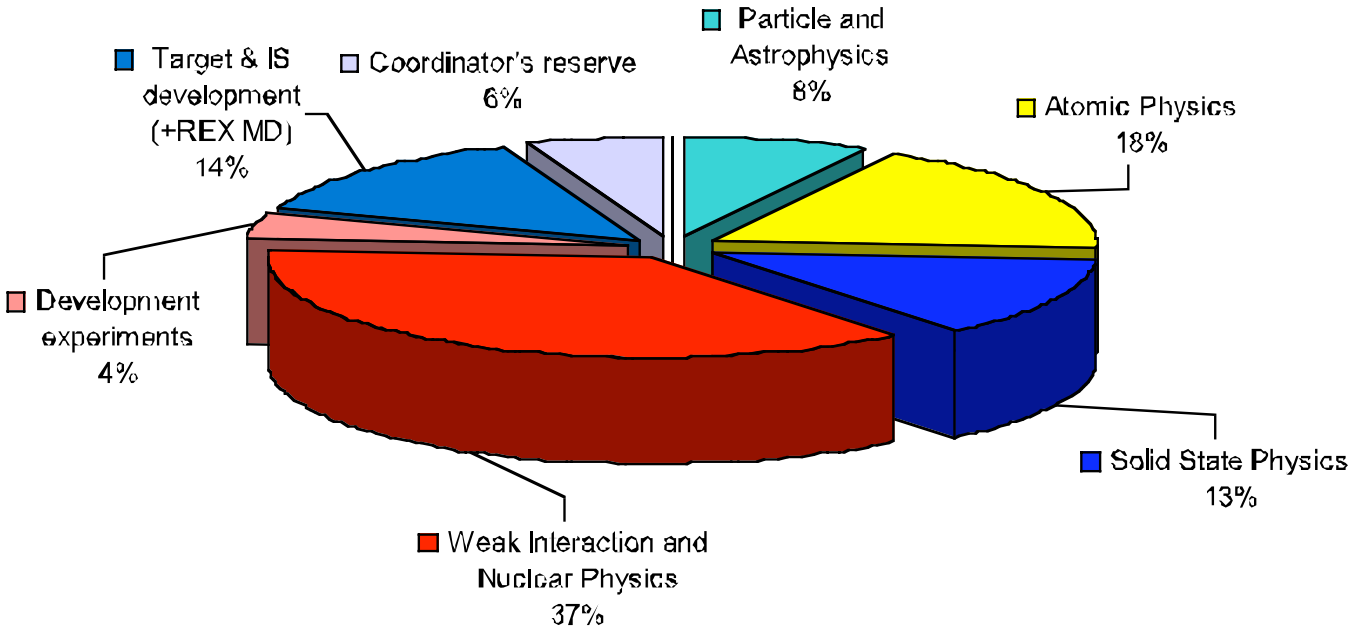
- About 70 chemical elements can be extracted
- Over 600 isotopic species with lifetimes down to milliseconds can be separated
- Radioactive Ion Beam intensities up to 10^{11} ions/μC of proton beam

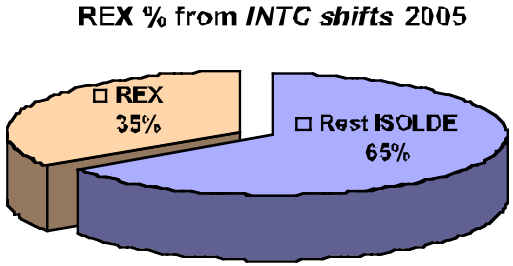
Post-accelerated beams: REX-ISOLDE



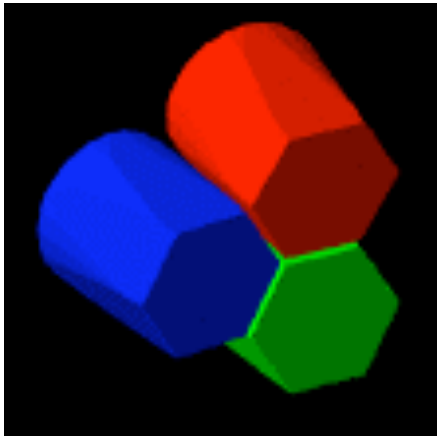
- ISOLDE beam is cooled and bunched in a Penning trap
- Ions are charge bred in REXEBIS, then separated with a mass separator
- Finally the beam is accelerated between 0.8-3.0 MeV/A

Main Physics Directions at ISOLDE





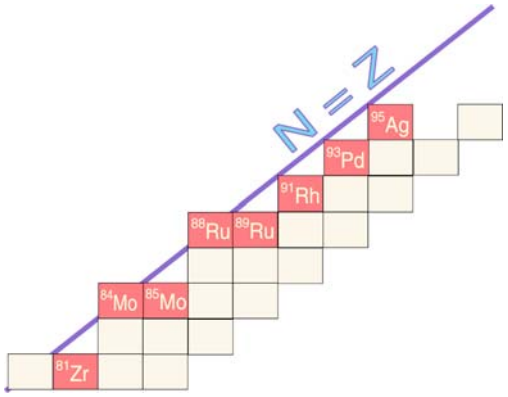
Gamma-ray Detectors : MINIBALL Collaboration



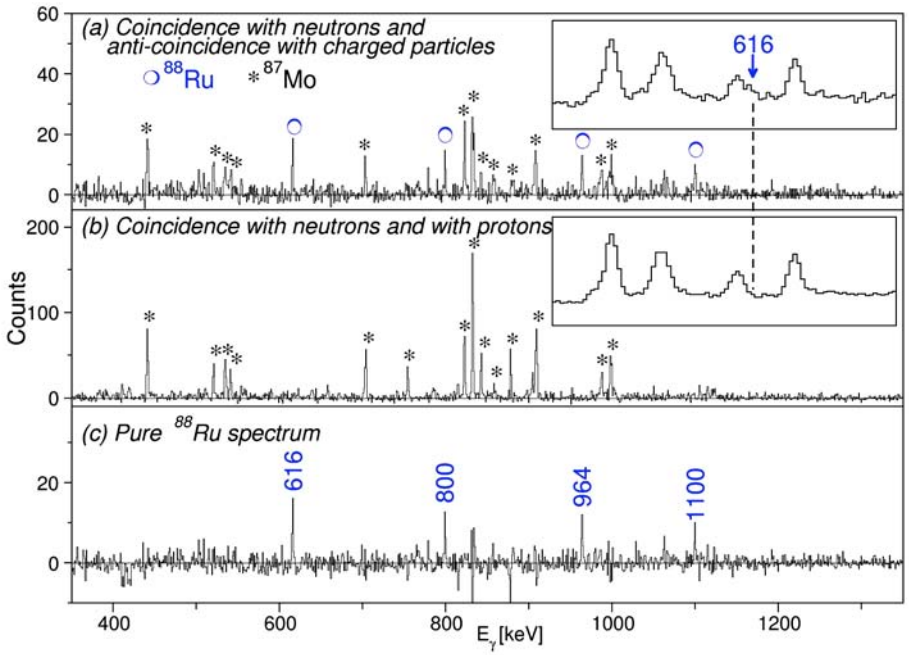
- 8 triple clusters
- 6-fold segmented HPGe crystals
- Multiplicity < 15
- Energy resolution ~ 2-3 keV
- Absolute efficiency ~ 20% for 1.33 MeV gamma ray

Physics we propose at ISOLDE

- Study of the nuclear structure in the Z~30-50 and N~40-60, mainly by gamma spectroscopy
  - Natural extension of our previous studies (Tandem/IFIN, INFN-LNL, etc.) toward more exotic nuclei
  - Concerns both neutron-rich and proton-rich nuclei in the region

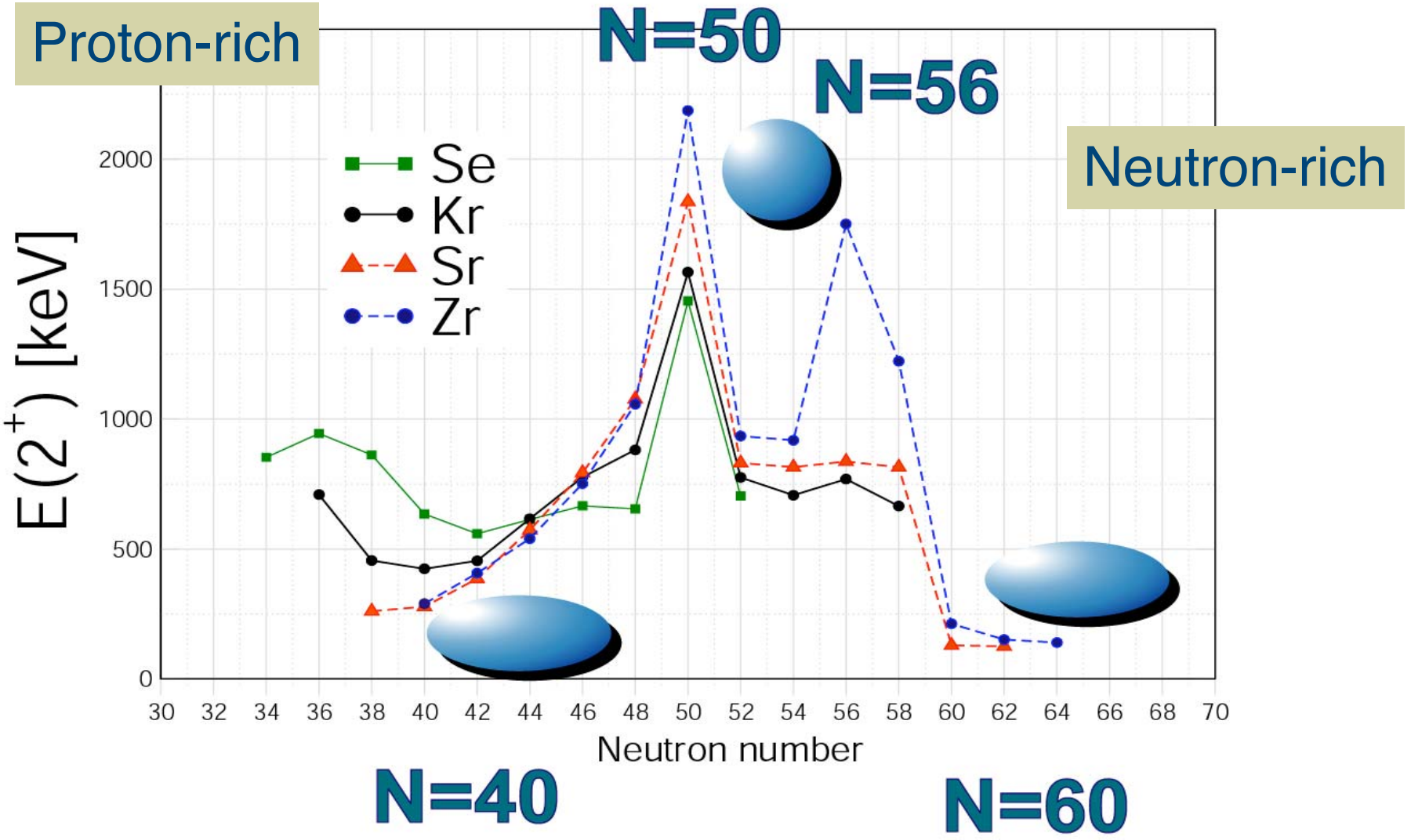


GASP array
Laboratori Nazionali di Legnaro

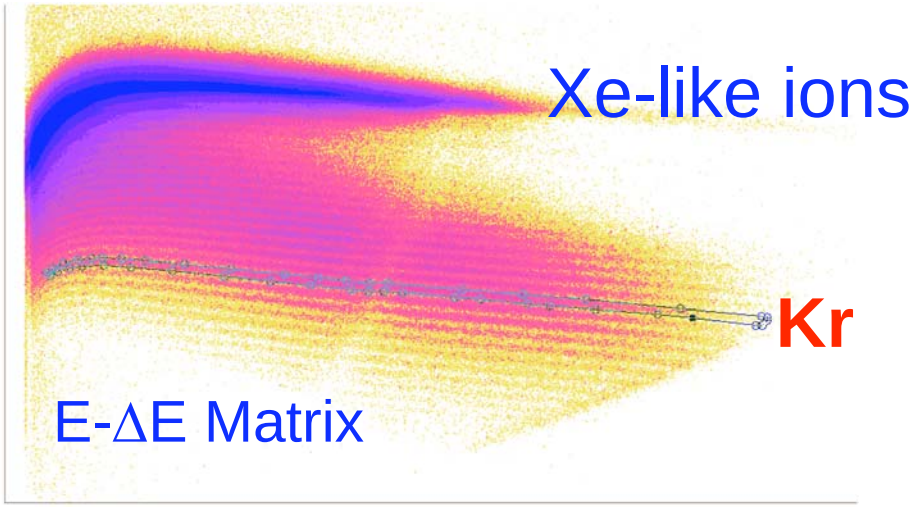


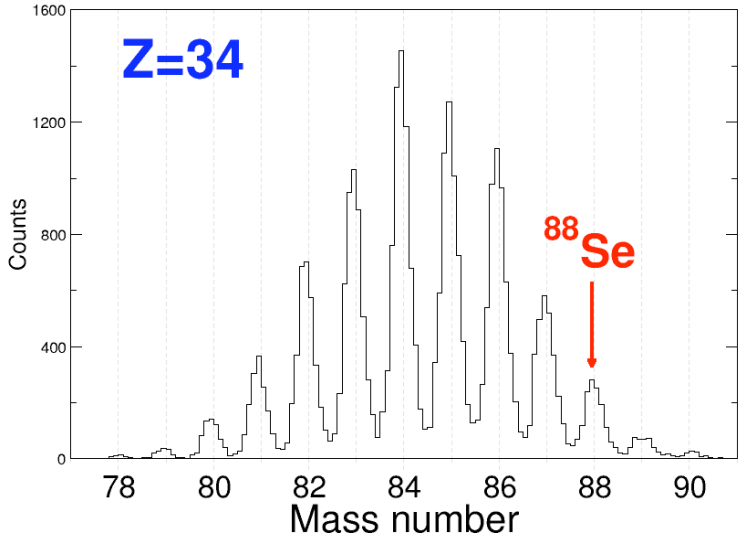
N=Z=44 ^{88}Ru

Phase Transition in the N=60 Region



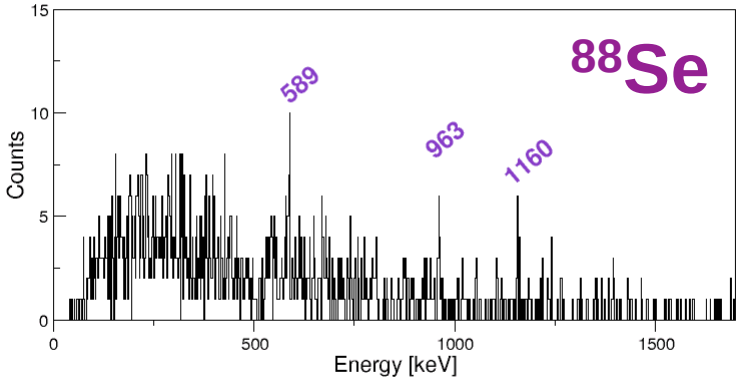
Recent PRISMA/CLARA experiment for ^{96}Kr

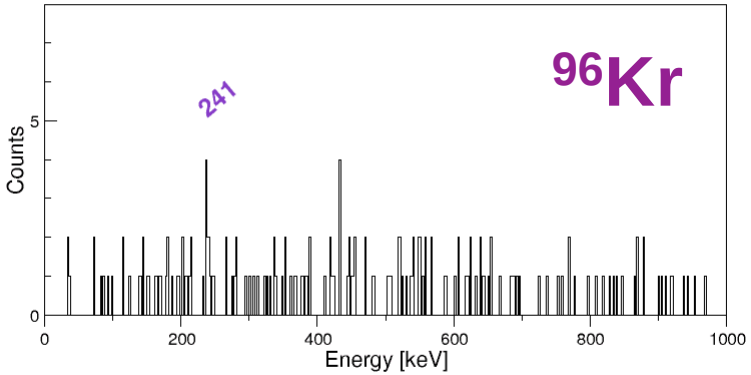


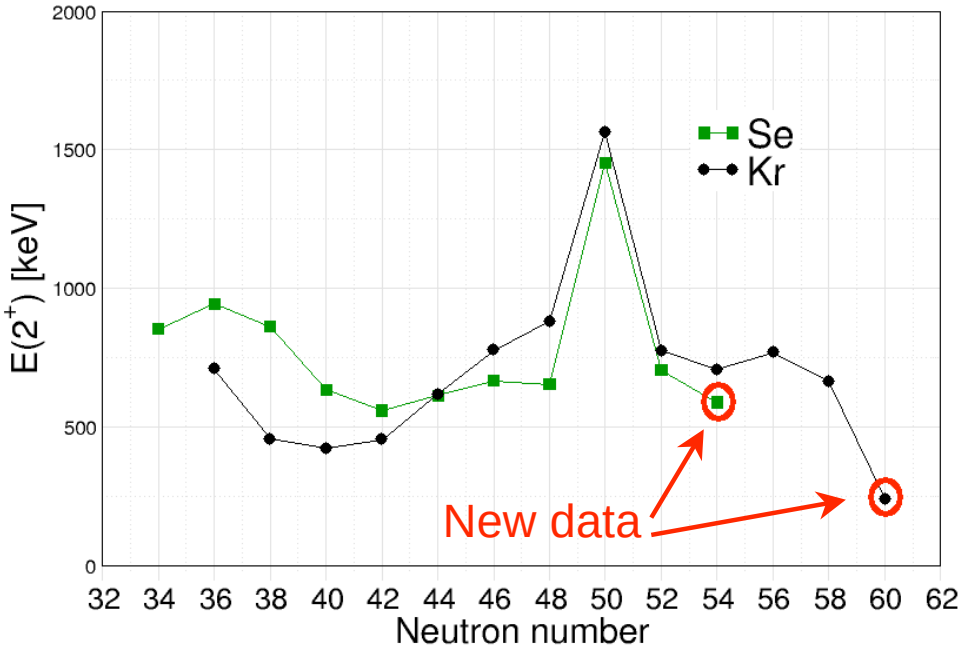


- Experiment performed in March 2008 at PRISMA/CLARA, Laboratori Nazionali di Legnaro
- Neutron-rich nuclei produced in the fission of ^{238}U target induced by 1 GeV ^{136}Xe ions

First Observation of ^{88}Se and ^{96}Kr

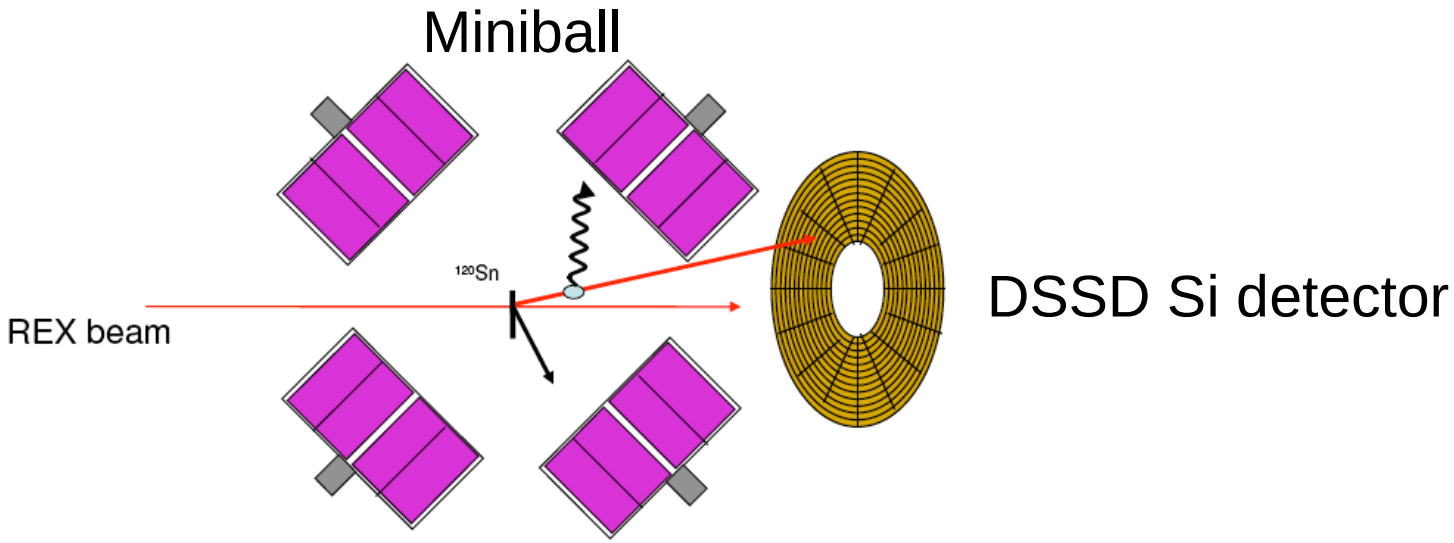






- The N=60 ^{96}Kr nucleus is deformed
- N=56 sub-shell closure might not be effective below Z=36

ISOLDE : Coulex of n-rich Kr isotopes



- ISOLDE intensities of 10^5 part/μC allow Coulex experiments with ^{96}Kr beam
- With the standard thin target setup precise B(E2) values might be obtained through normalization to target Coulex
- B(E2) values will allow a more accurate understanding of nuclear structure in the heavy Kr region

Summary

- ISOLDE-CERN is a world-class RIB facility, providing good quality and rather high intensity radioactive beams for a wide range of nuclear species
- Post-acceleration system REX and powerful detectors allow in-beam gamma spectroscopy experiments
- For the near future, we intend to carry on nuclear structure studies for Z~30-40, N~40-60 nuclei
- One proposal for Coulex of ^{96}Kr, based on very recent experimental results, is in preparation