Masses of tripline nuclei

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Mass measurements

INDIRECT

- Reaction

A(a,b)B

$Q = M_A + M_a - M_B - M_b$

- Alpha-decay

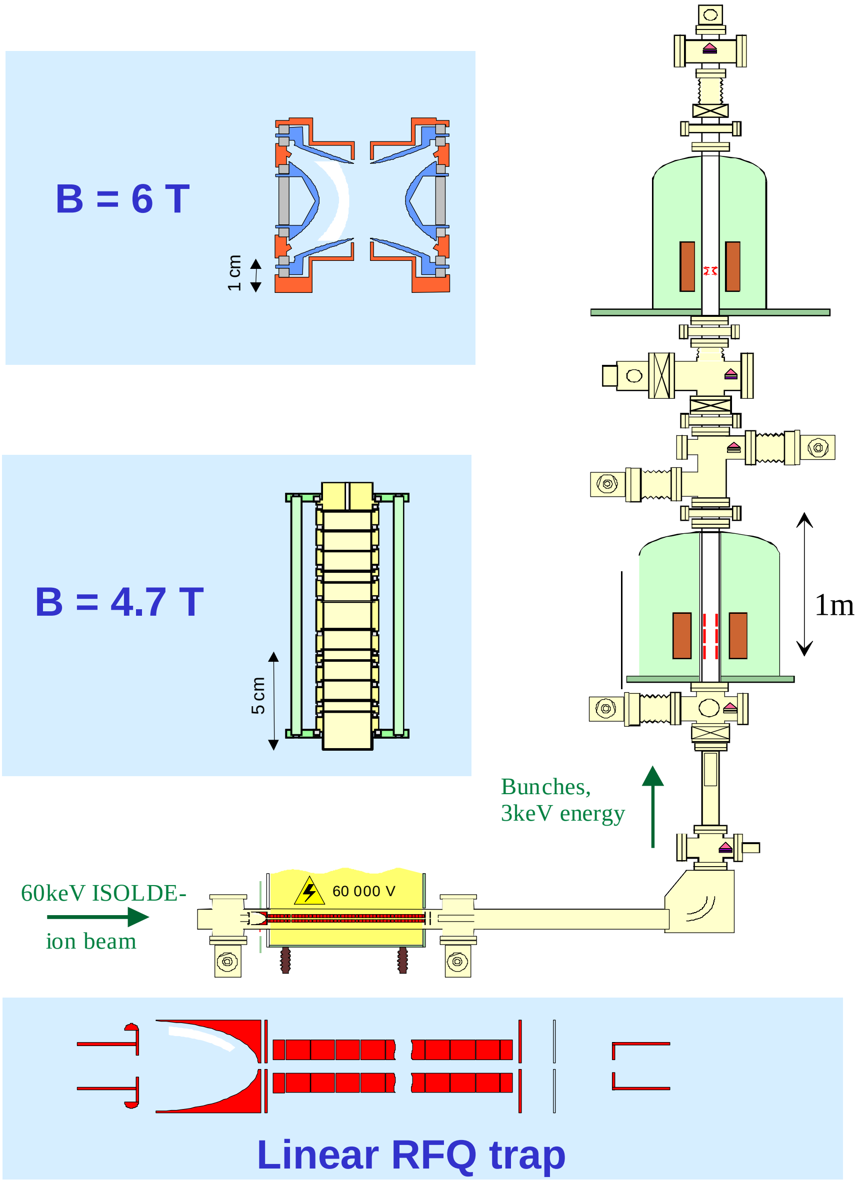
$A \rightarrow B + \alpha$

$Q = M_A - M_B - M_\alpha$

DIRECT (mass spectrometry)

- Time of flight
  - TOFI (LANL)
  - SPEG/CSS2 (Ganil)
  - SARA (ISN)
  - ESR (GSI)
- Cyclotron frequency
  - Penning traps
  - MISTRAL (ISOLDE)
- Schottky noise analysis
  - ESR (GSI)

ISOLTRAP



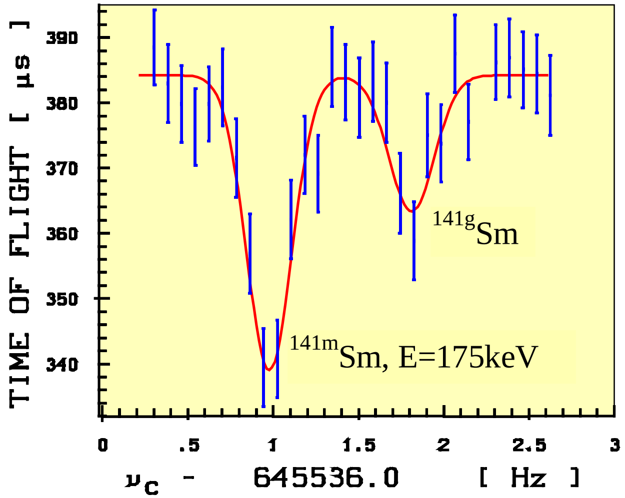
determination of cyclotron frequency

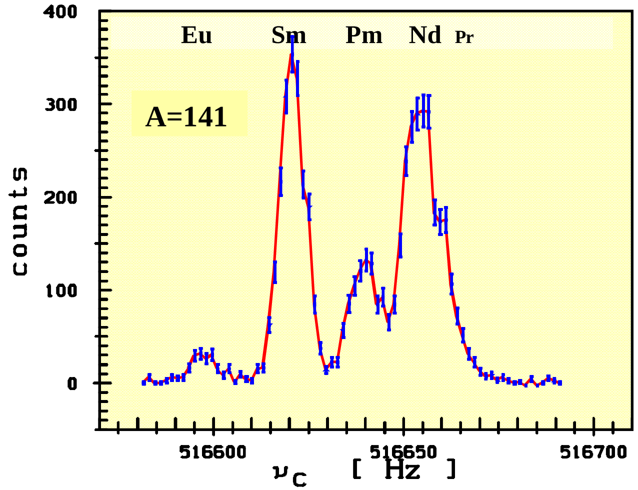
$$R = \frac{m}{\Delta m} = 5 \cdot 10^6$$

cooling
isobar separation

$$R = \frac{m}{\Delta m} = 1 \cdot 10^5$$

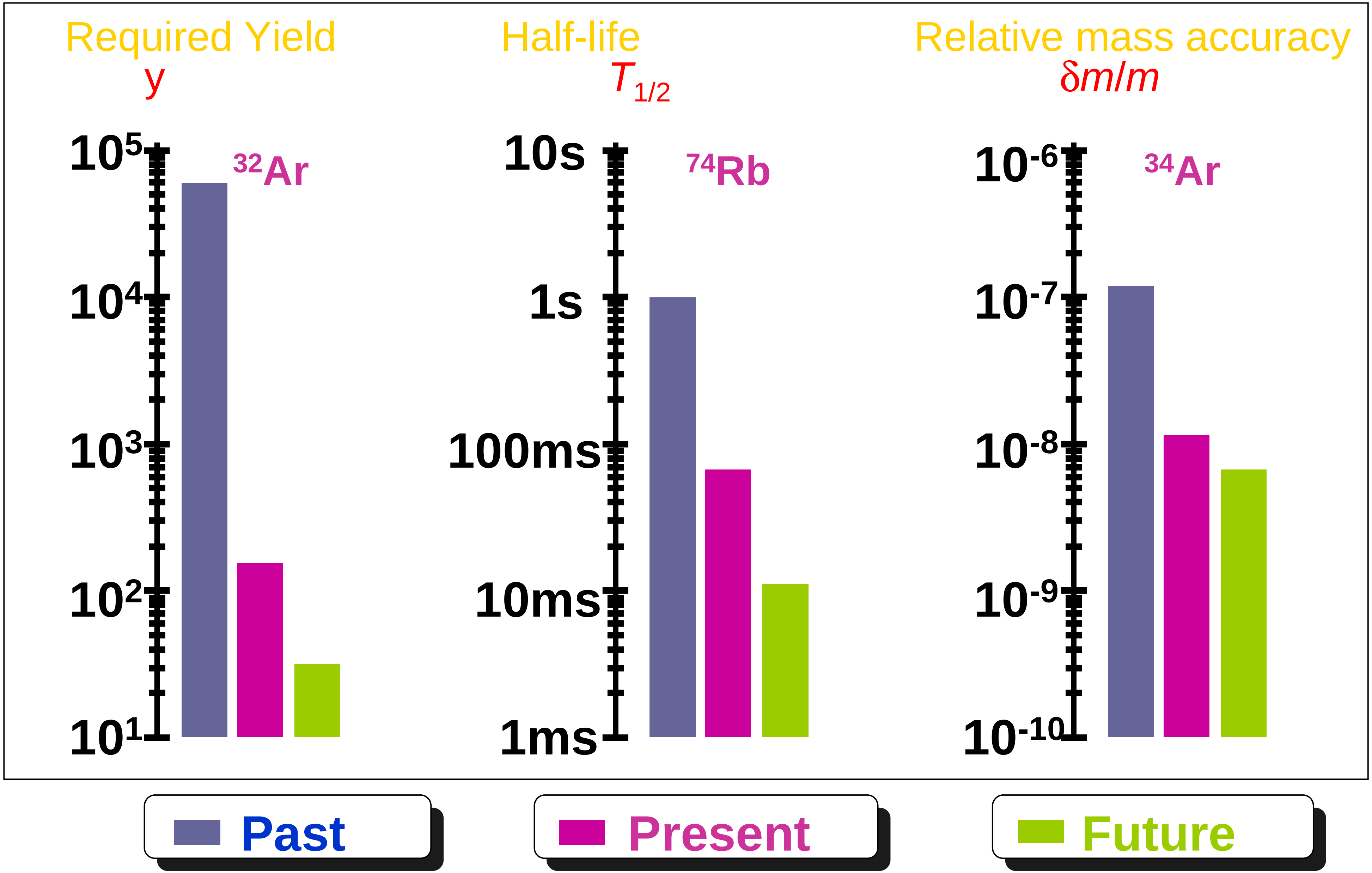
accumulation & bunching of ISOLDE 60 keV beam





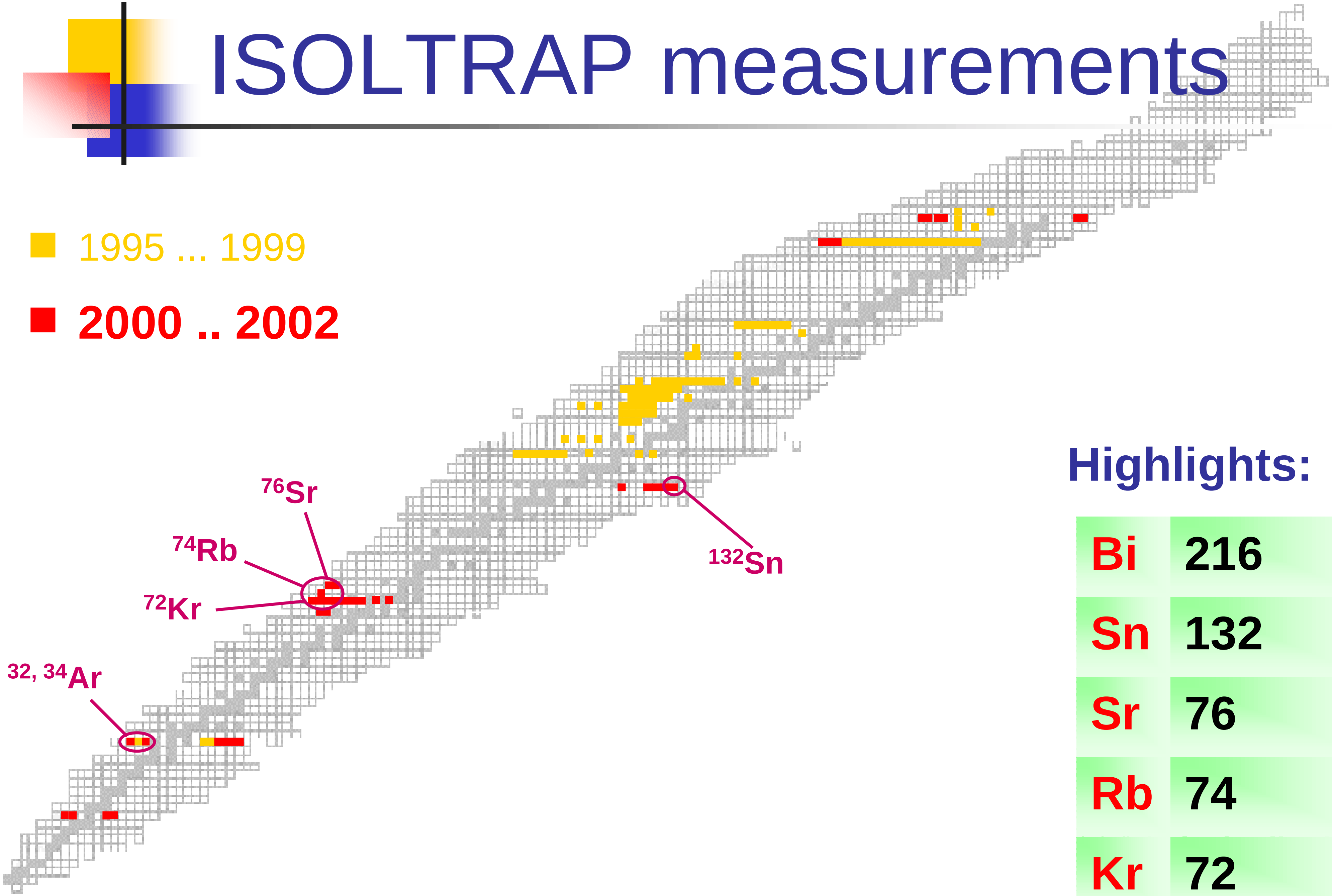
G. Bollen et al., NIM A 368 (1996) 675
H. Raimbault-Hartmann, NIM B 126 (1997) 378
F. Herfurth et al., NIM A 469 (2001) 254

ISOLTRAP performance



ISOLTRAP measurements

- 1995 ... 1999
- **2000 .. 2002**

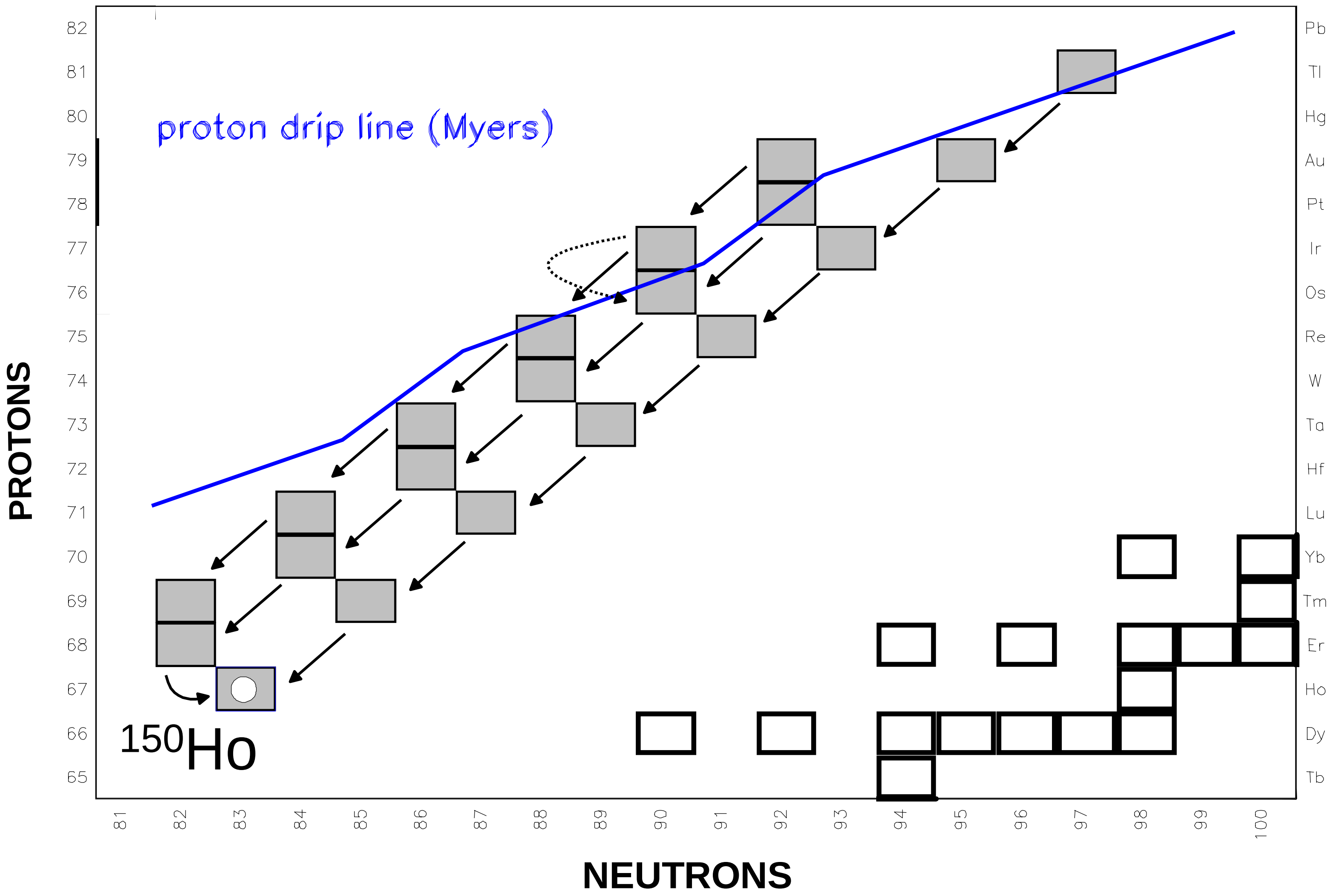


Highlights:

Bi	**216**
Sn	**132**
Sr	**76**
Rb	**74**
Kr	**72**
Ar	**32, 34**

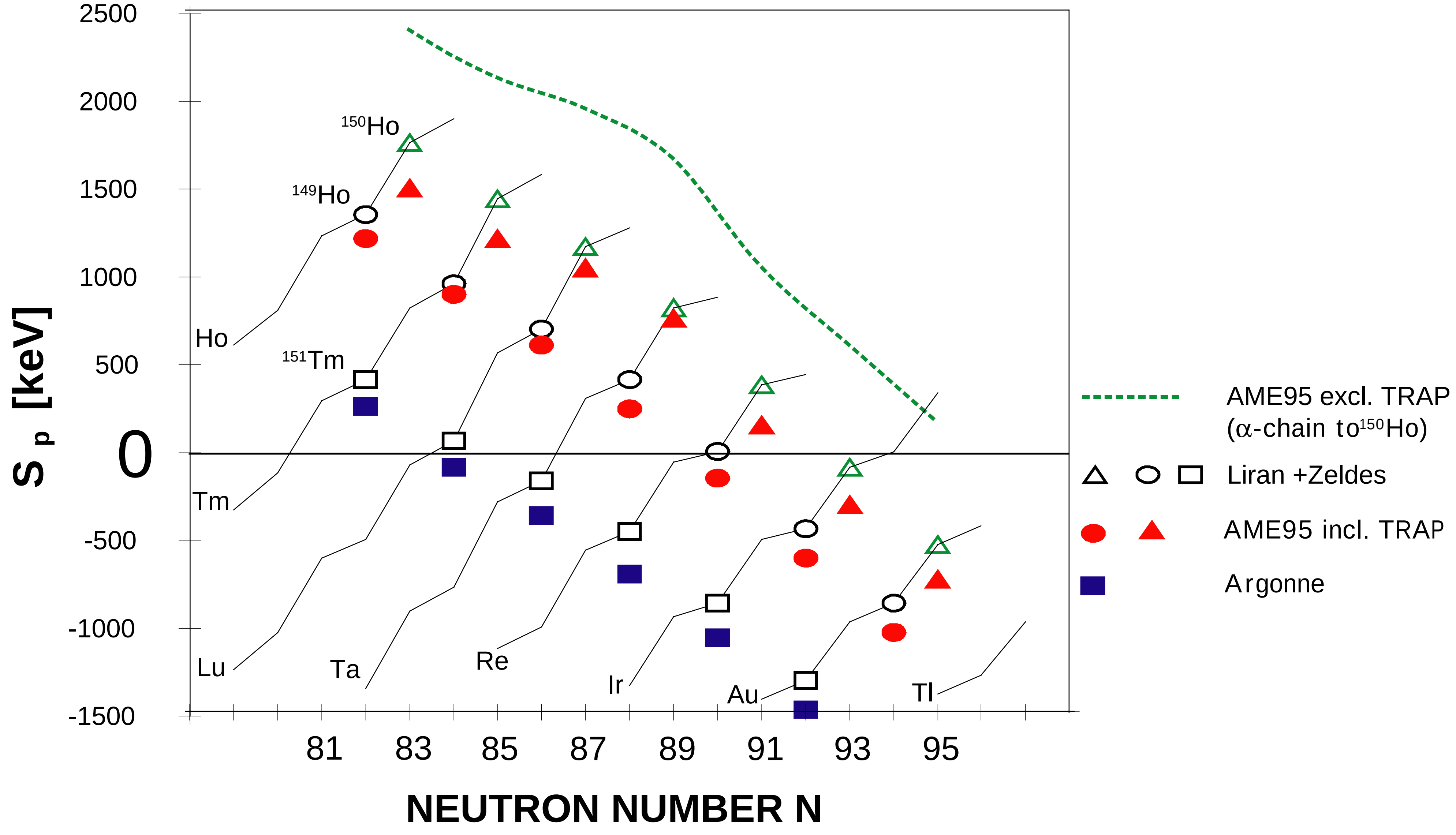
^{150}Ho and the dripline

^{150}Ho is an anchor point for long decay chains

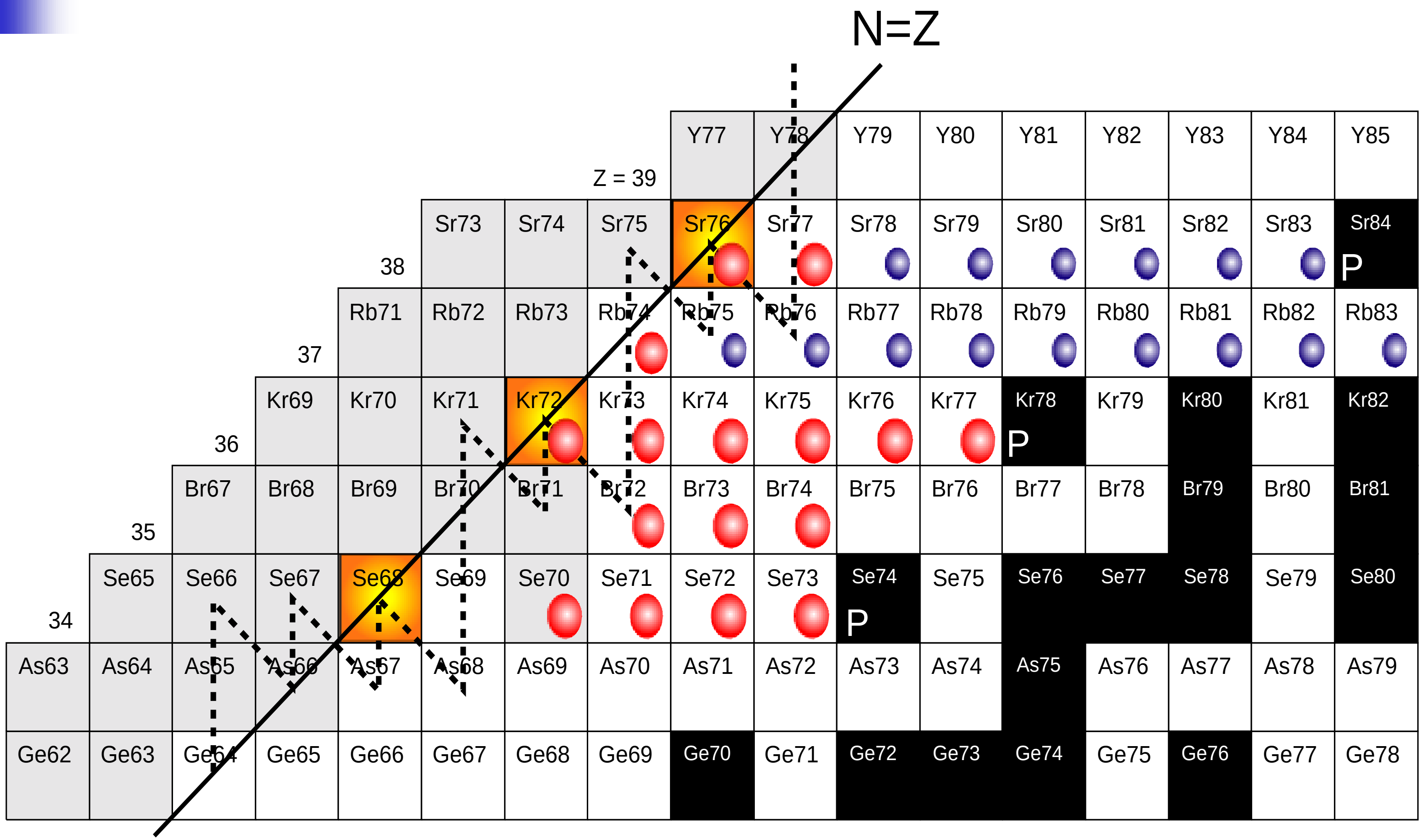


Influence of ISOLTRAP data

Dripline changed by the ISOLTRAP measurement of ^{150}Ho



rp-process above Z = 32



----- possible rp - process main path

(H. Schatz et al. Phys. Rep. 294 (1998) 167)

possible waiting points

mass excess not yet measured

(AME95)

ISOLTRAP measurements

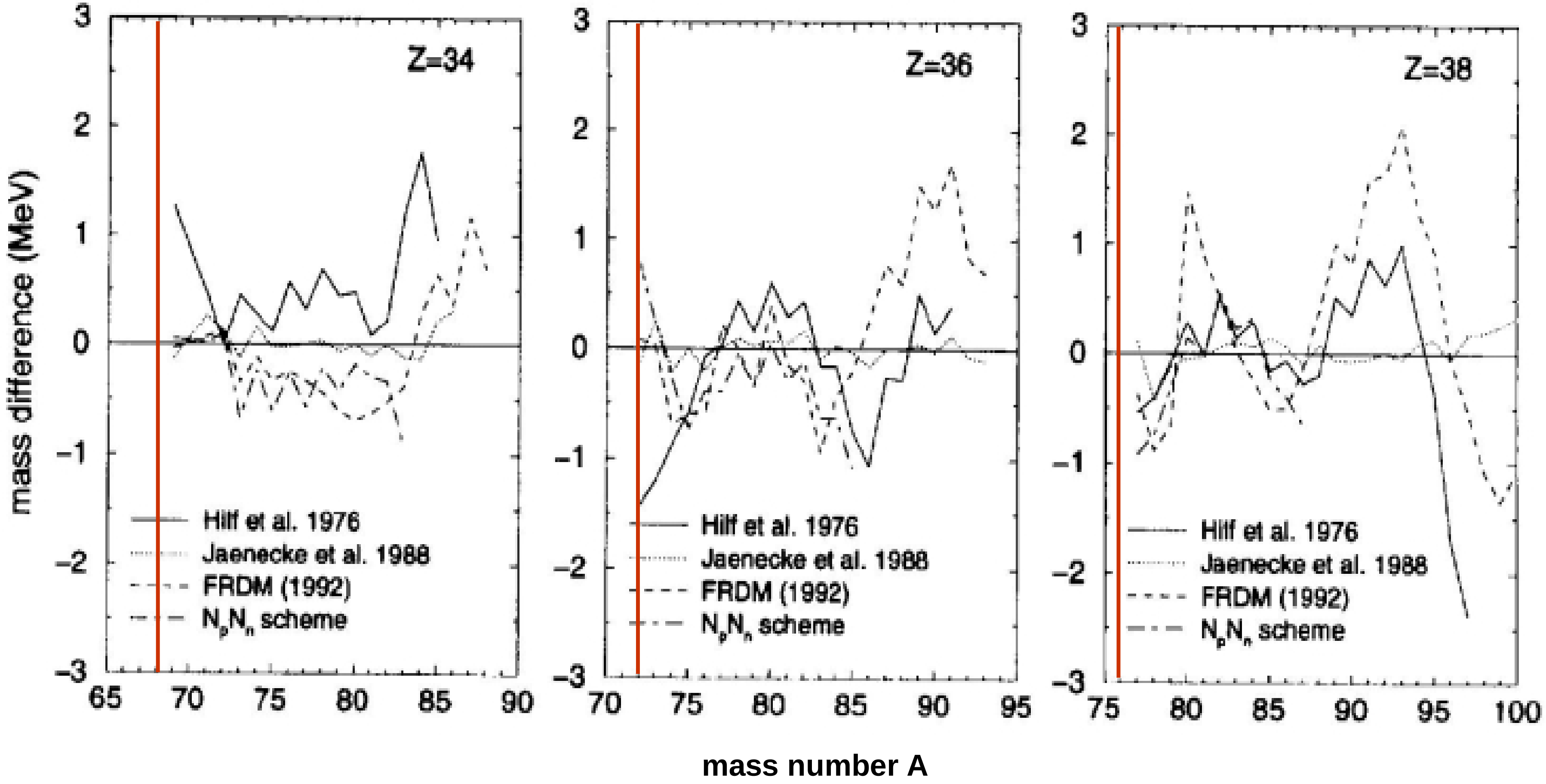
2000 - 2002

before 2000

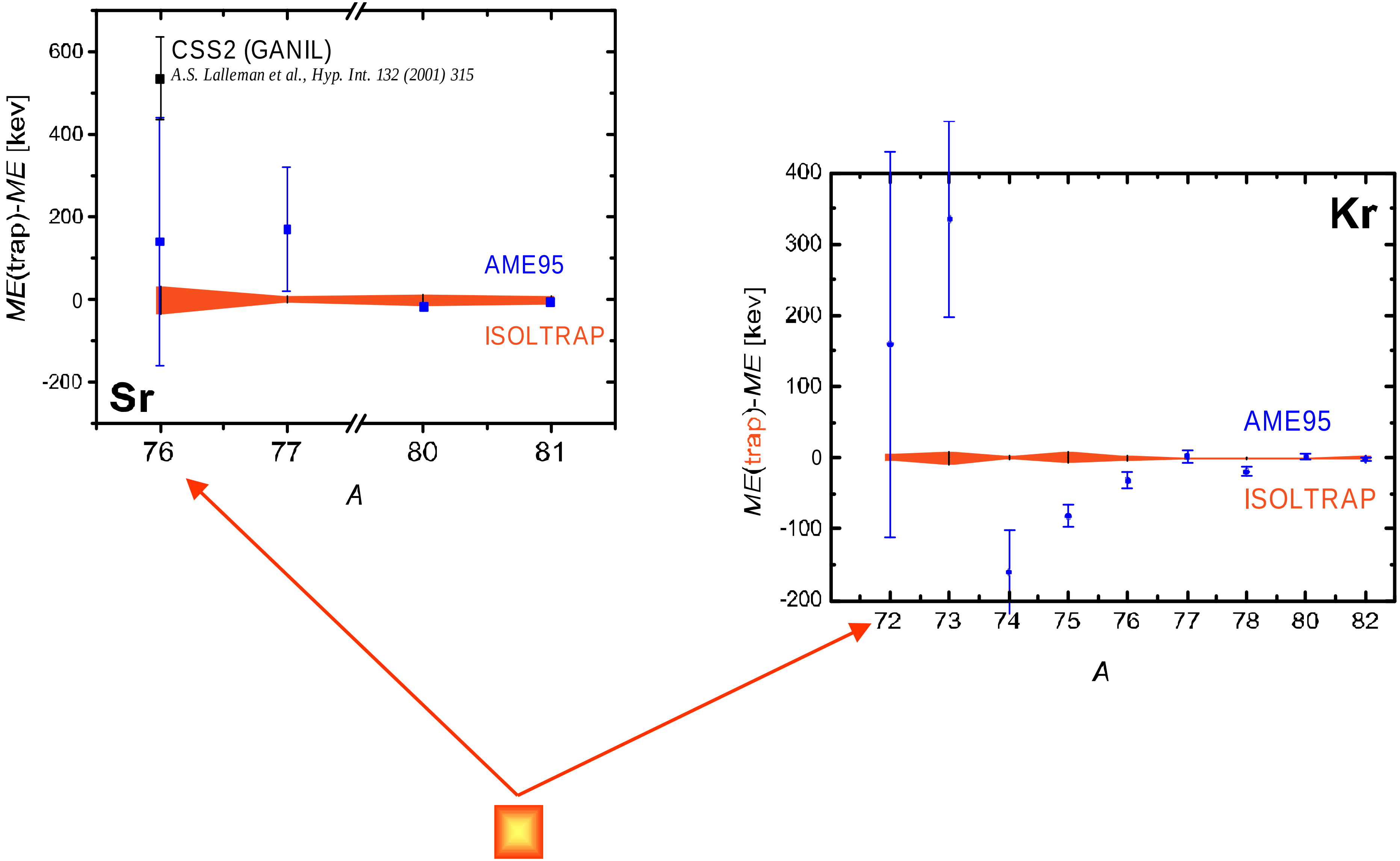
Mass model – experiment comparison

H. Schatz et al. Phys. Rep. 294 (1998) 167

——possible waiting point

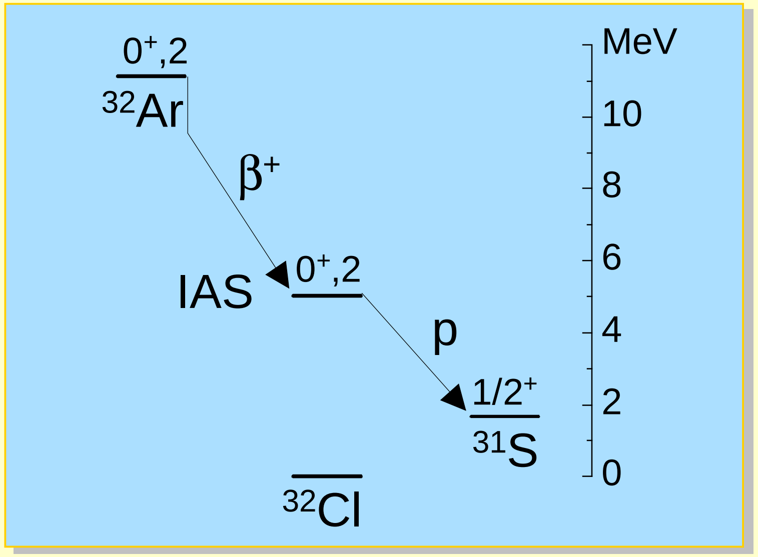


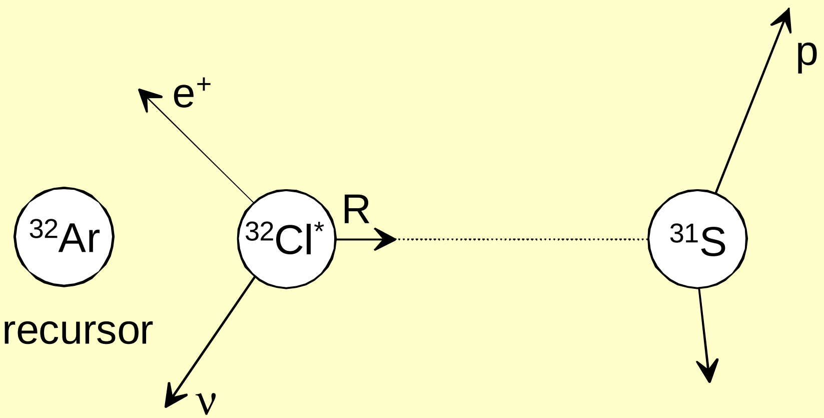
Sr and Kr results



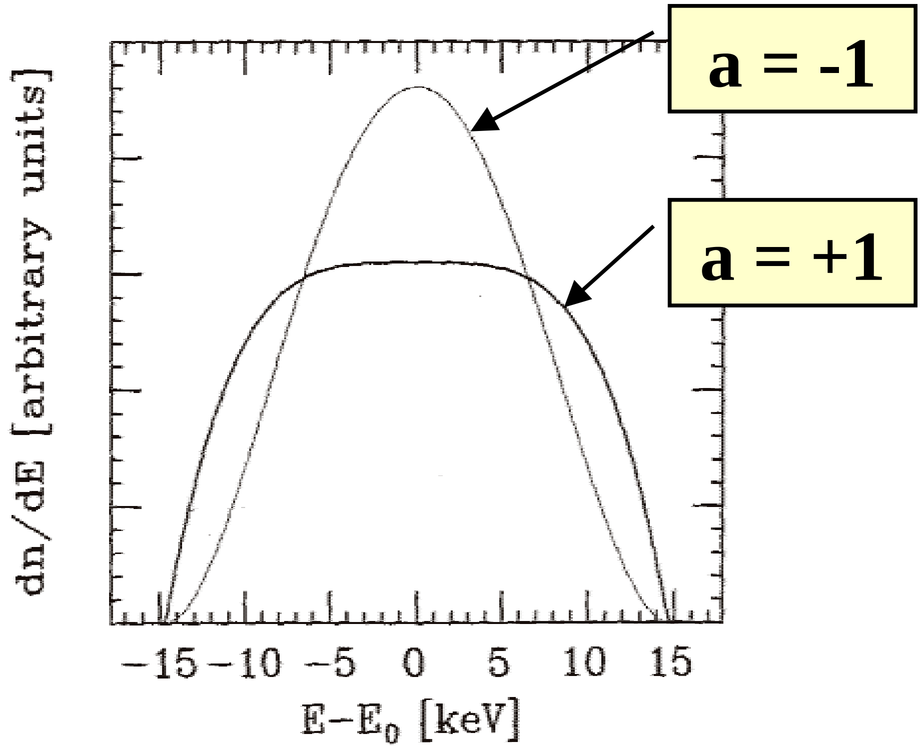
possible waiting point

β-ν correlation – ^{32}Ar decay



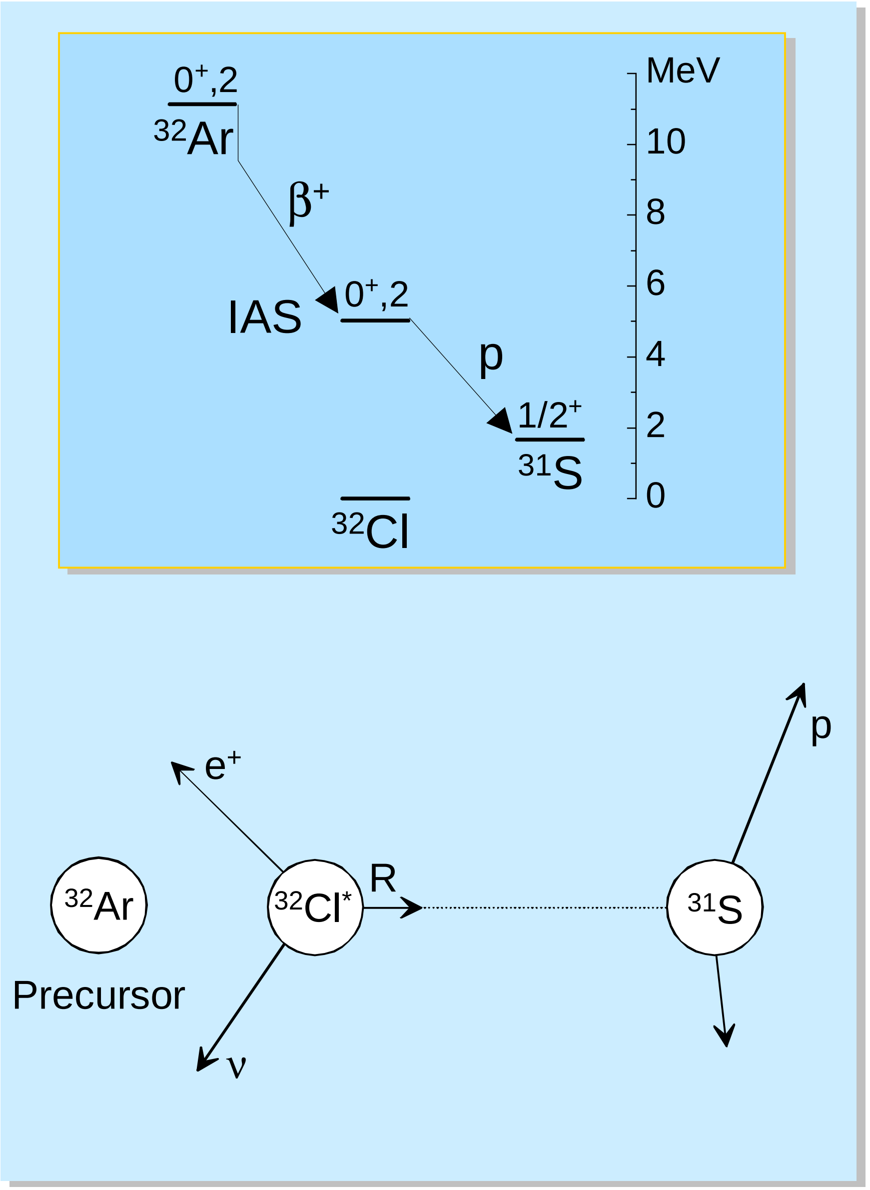


Intrinsic shape of the proton-group



E.G. Adelberger et al., Phys. Rev. Lett. 83 (1999) 1299

32Ar – search for scalar currents

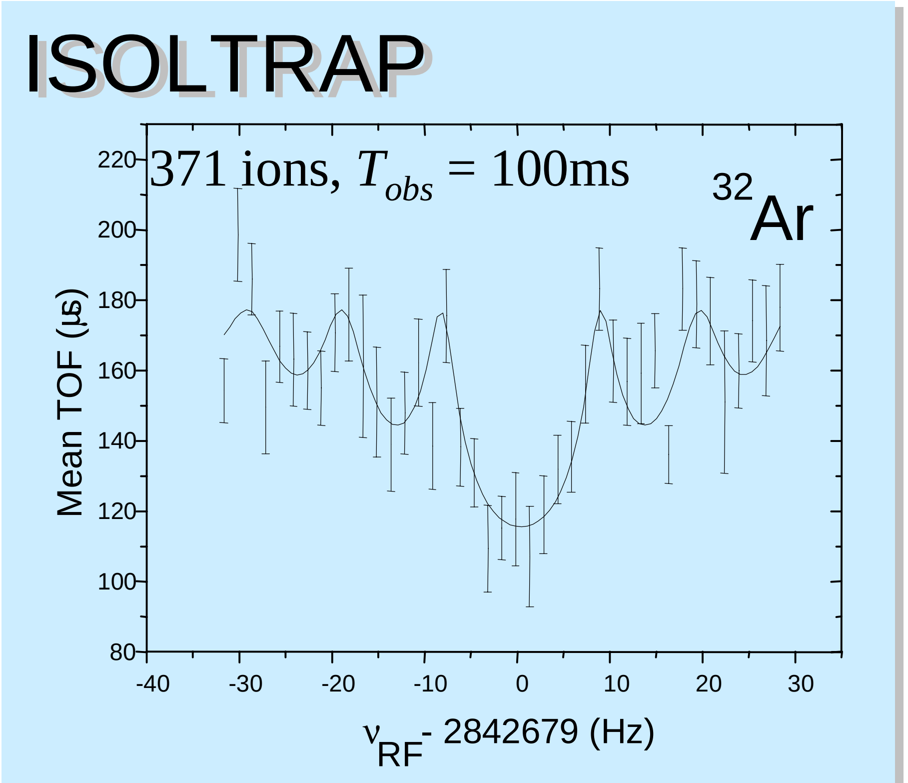


present limit:

a = 0.9989 ± 0.0052(stat) ± 0.0039(sys)

but Q from IMME and:

$\delta a/\delta Q = -1.2 \cdot 10^{-3}\ keV^{-1}$

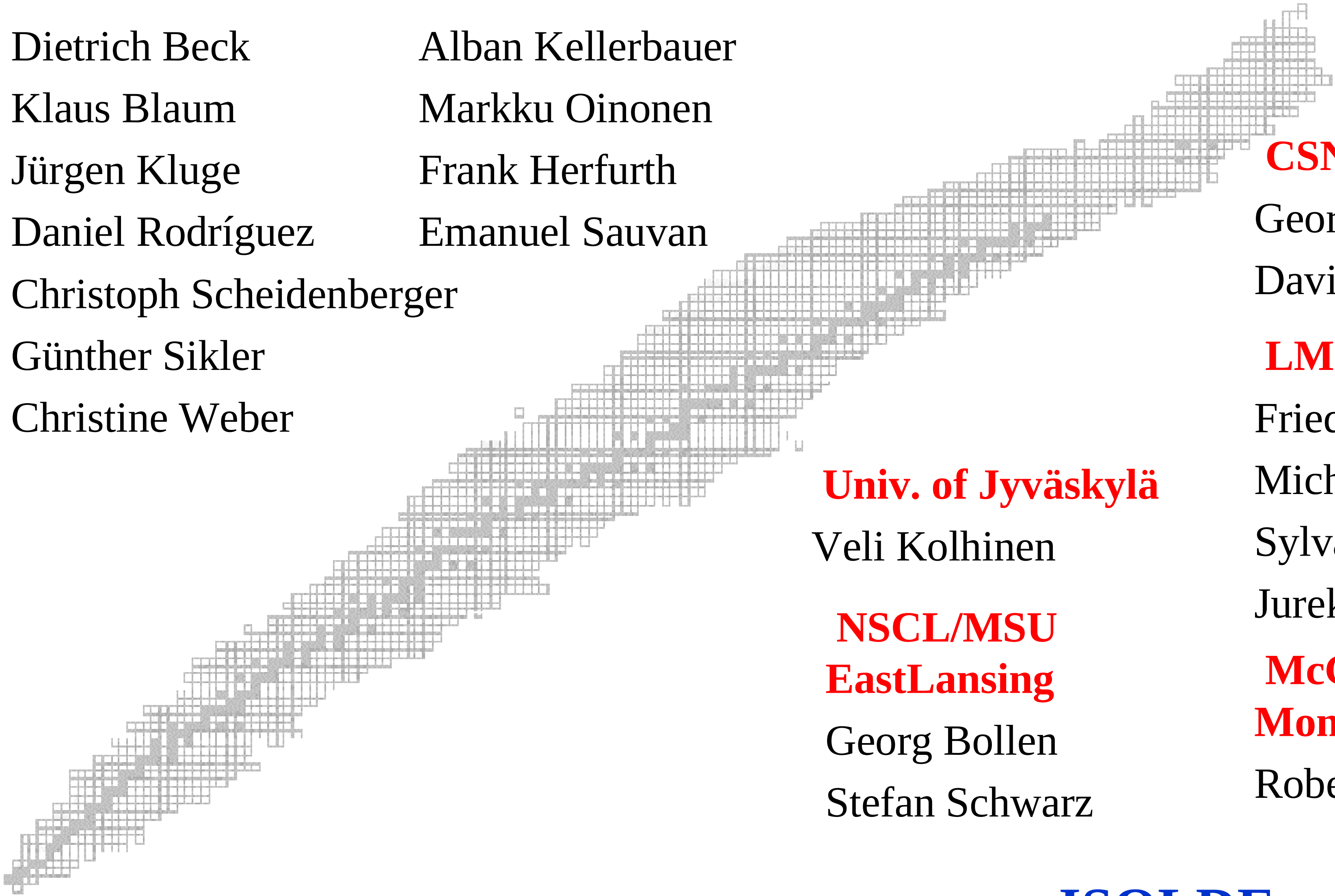


$\delta m/m \sim 1 \cdot 10^{-7}$, i.e. $\delta m \sim 3$ keV

Summary

- Direct and indirect techniques are needed to access dripline nuclei
- ISOLTRAP provides both
  - very precise measurements to anchor long decay chains
  - direct access to nuclei very close to the dripline

The ISOLTRAP collaboration



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