Studies of nuclear structure using the ISOLTRAP mass spectrometer

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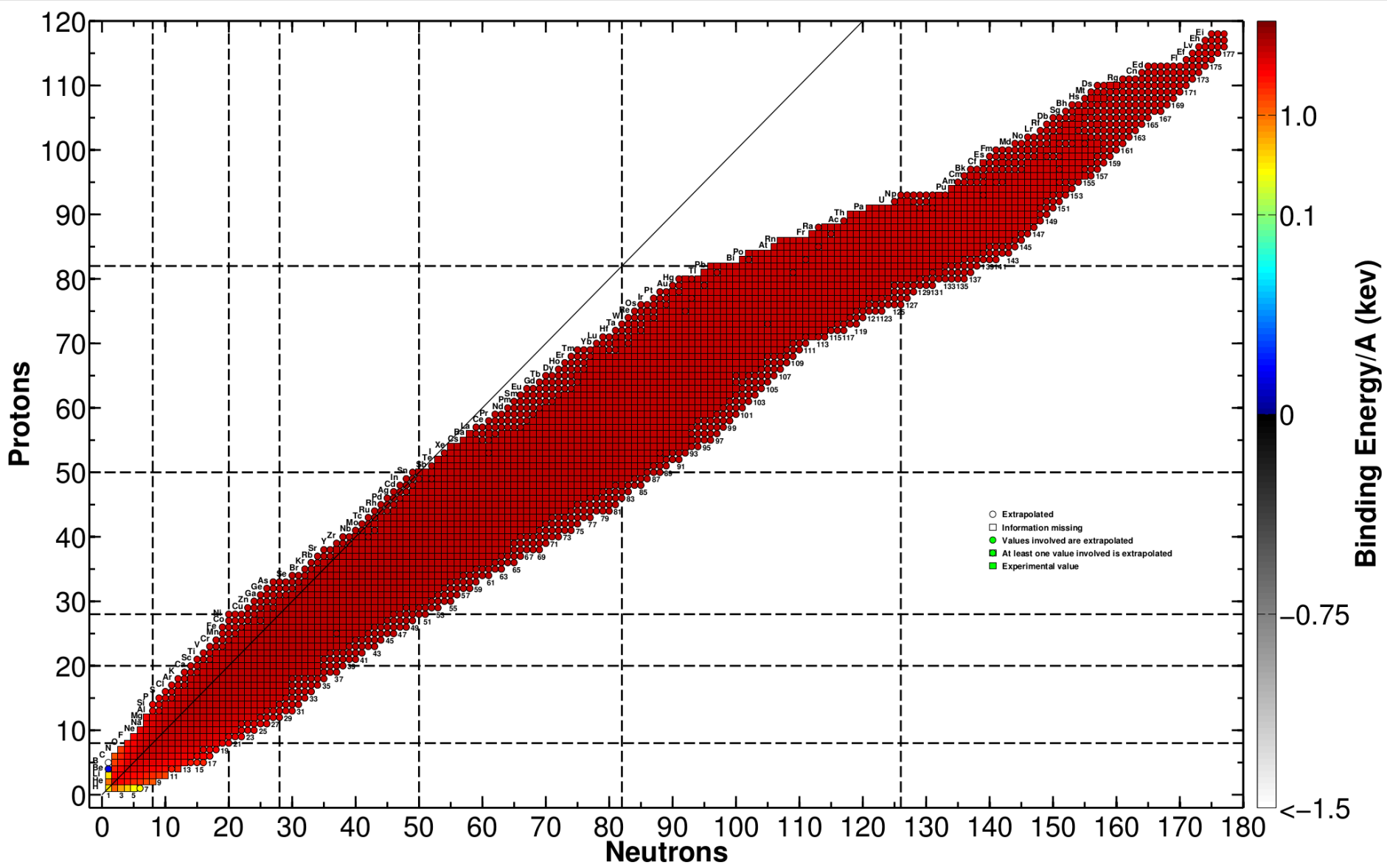
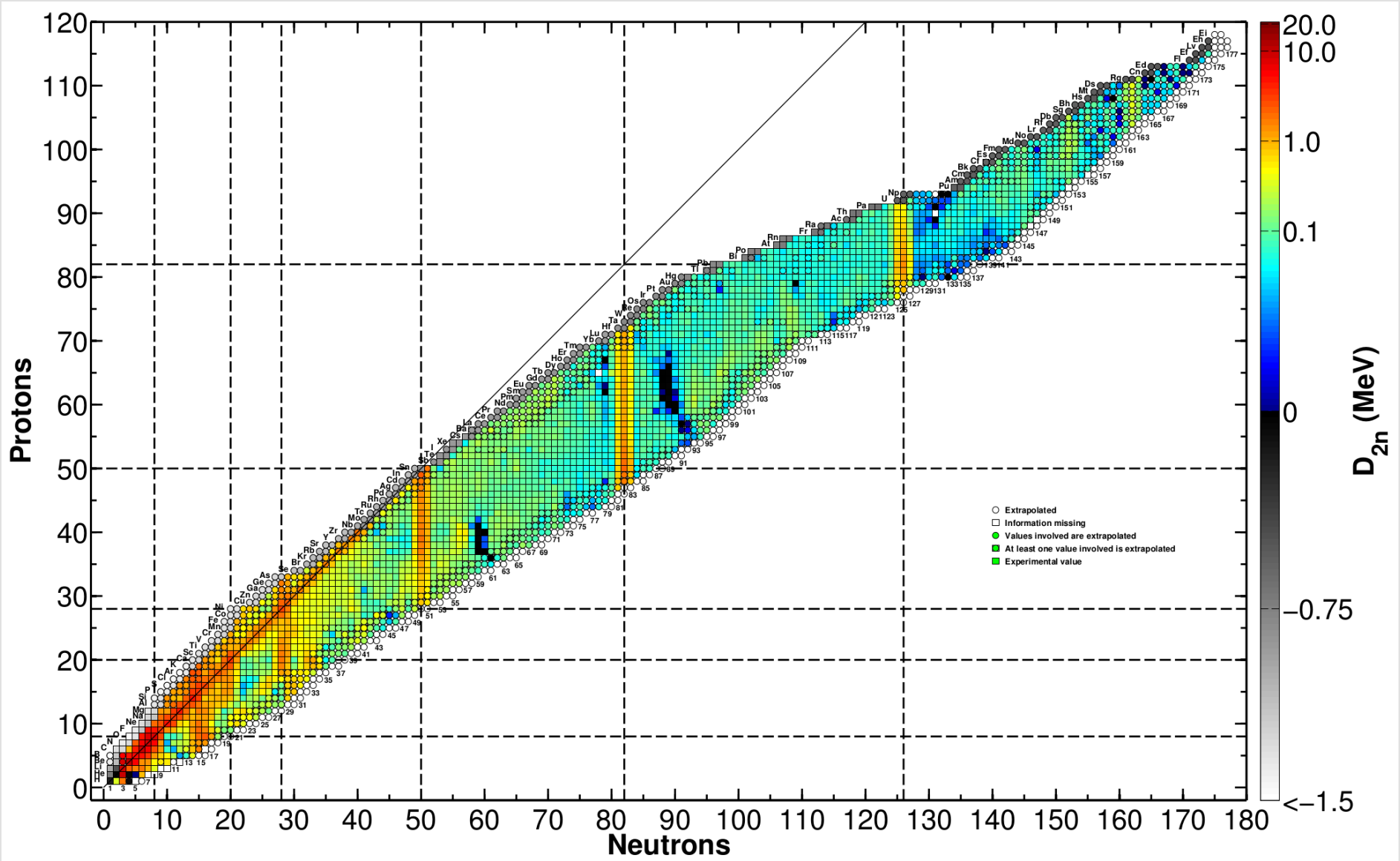
Mass Surface



Mass surface looked through the binding energy per nucleon

Mass filters



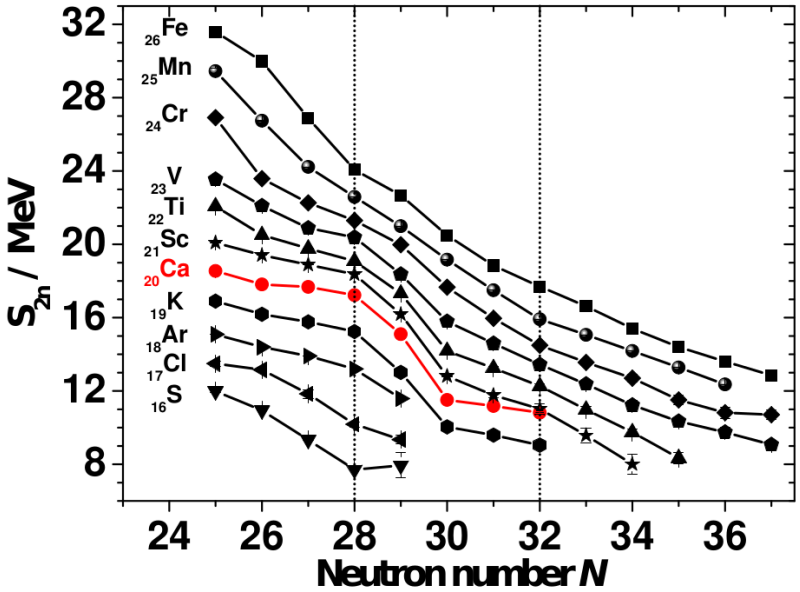
Two neutron shell gap - $D_{2N} = 2B(Z,N) - B(Z,N-2) - B(Z,N+2)$, *where* $B(Z,N)$ *-binding energy*

Recent Studies on ^{54}Ca

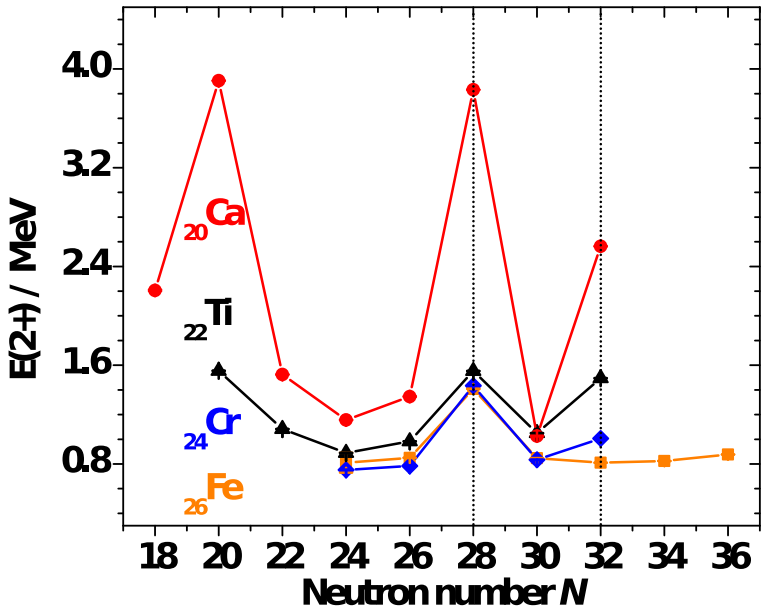
Experimental observables

Two neutron separation energy

$S_{2N} = B(N,Z) - B(N-2,Z)$



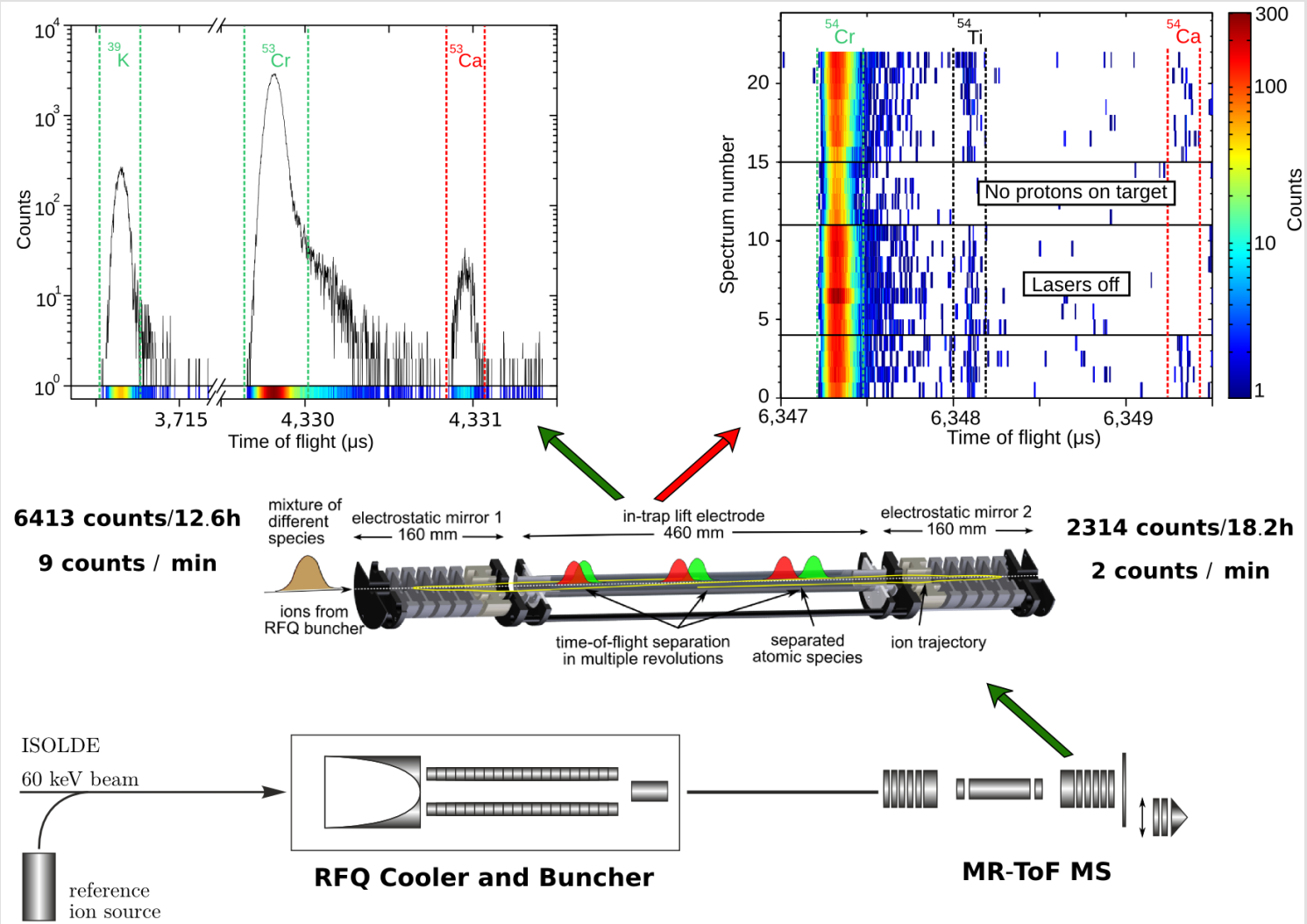
Energy of the first 2^+ excited state



Gallant *et al.*, PRL **109**, 032506 (2012); Wang *et al.*, CPhys. C **36**, 1603 (2012);

Multi-Reflection Time of Flight Mass Spectrometry

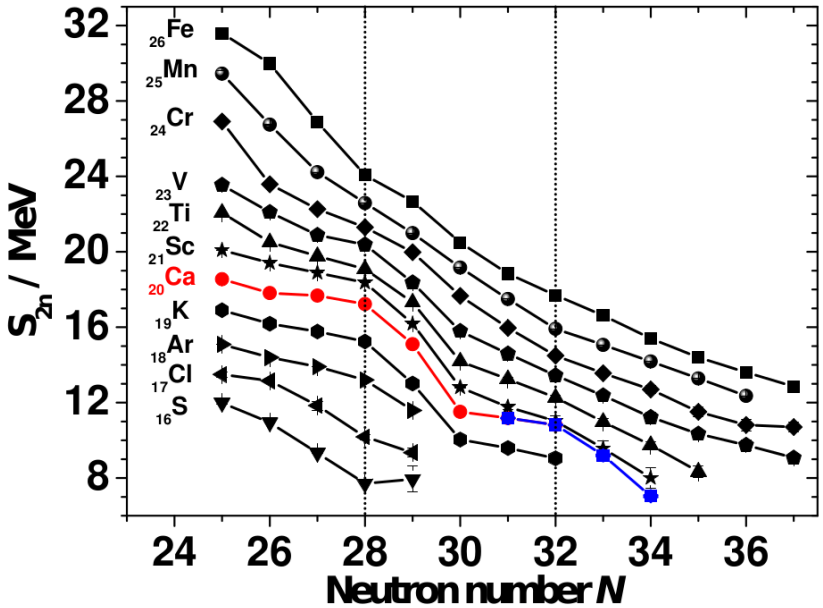
Mass is determined by a simple relation to the time-of-flight of the ions: $t_i = a\sqrt{m_i/q_i} + b$



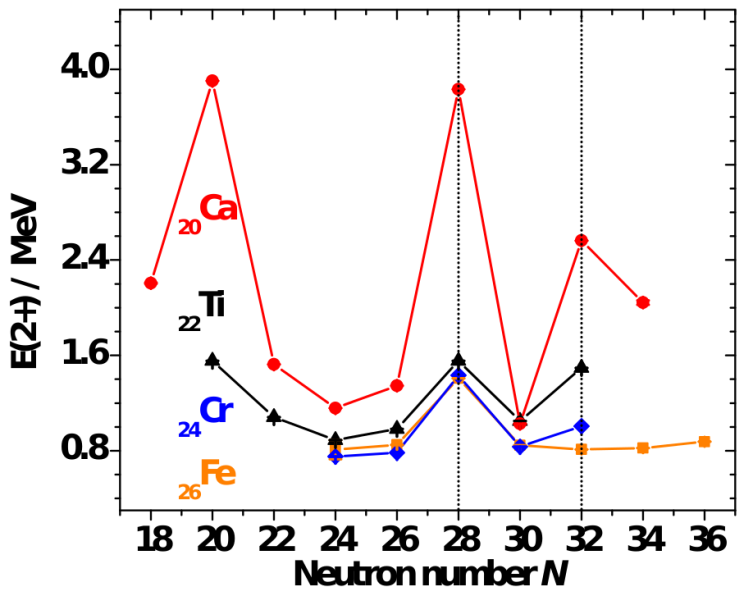
Wienholtz *et al.*, Nature **498**, 346-349 (2013)

Recent Studies on ^{54}Ca

Results



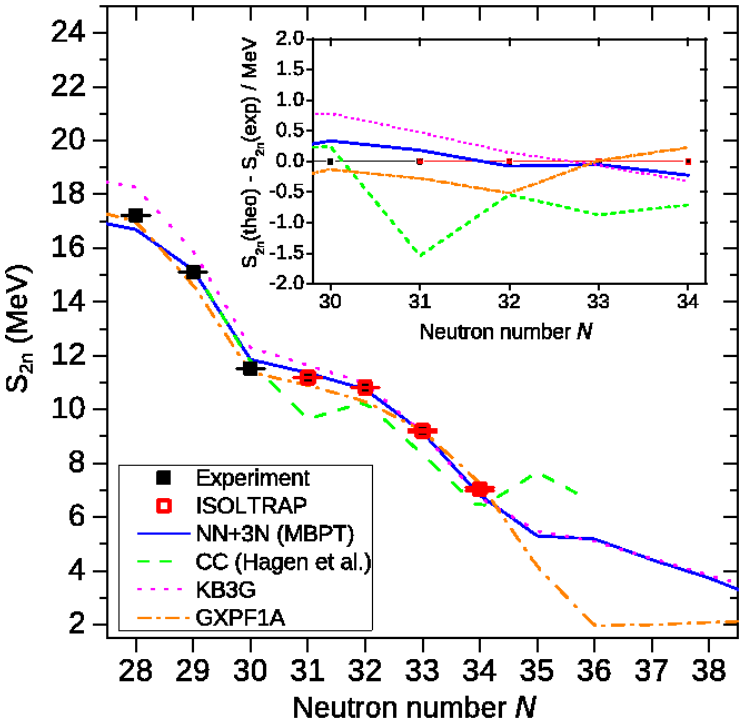
Energy of the first 2^+ excited state

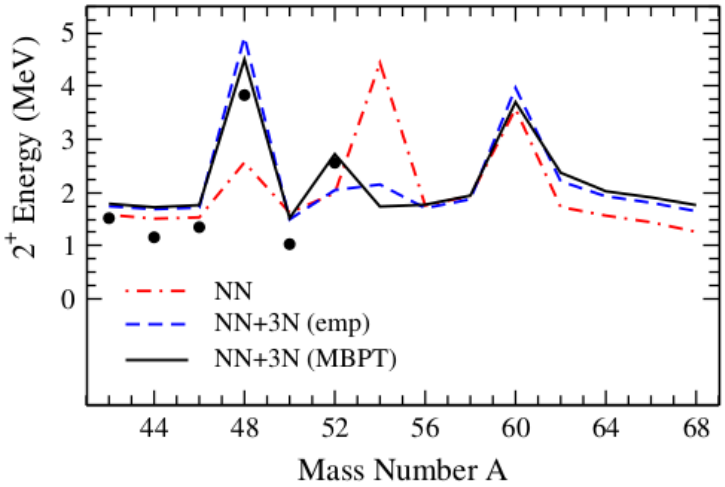


Wienholtz *et al.*, Nature **498**, 346-349 (2013); Steppenbeck *et al.*, Nature **502**, 207-210 (2013)

Recent Studies on ^{54}Ca

Theoretical descriptions available today



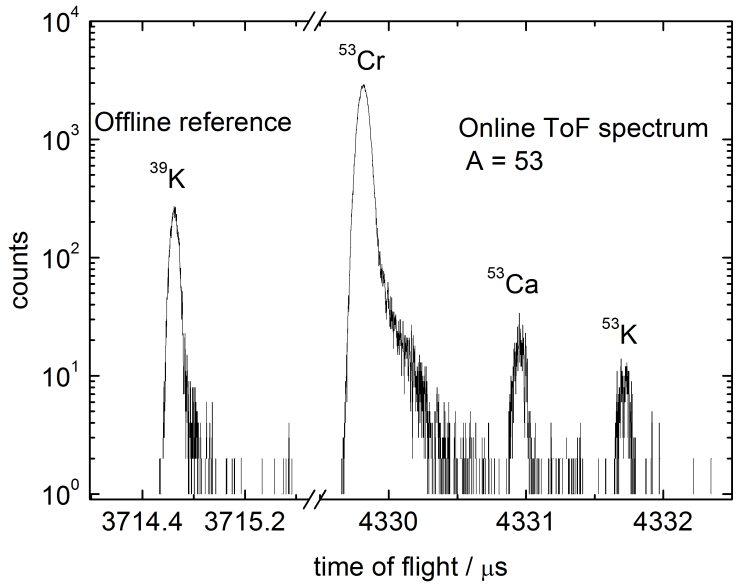


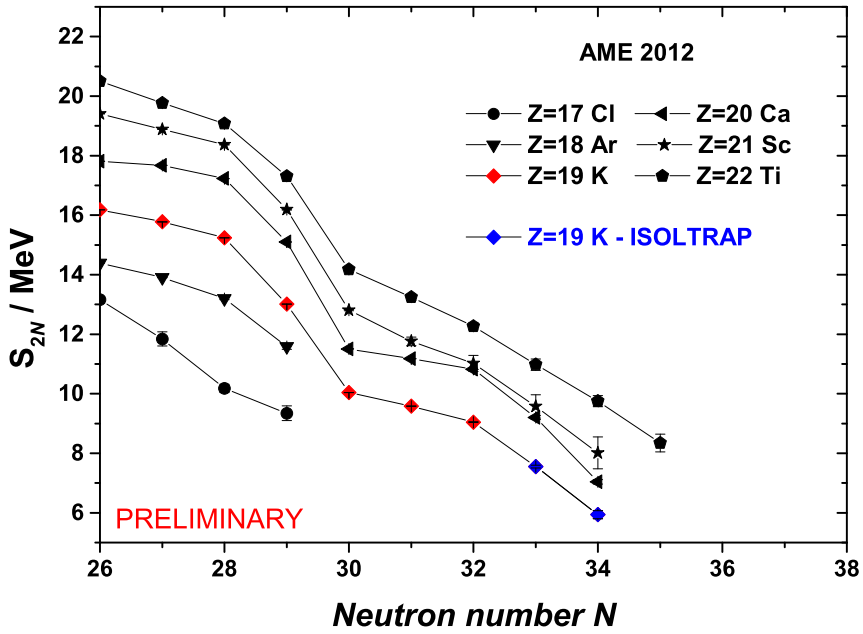
- Description by phenomenological potential (KB3G/GXPF1A)
- Chiral effective field theory with higher order corrections included (of type NN+3N interactions)

Gallant *et al.*, PRL **109**, 032506 (2012); Wienholtz *et al.*, Nature **498**, 346-349 (2013)

Mass measurements of neutron-rich ^{52,53}K

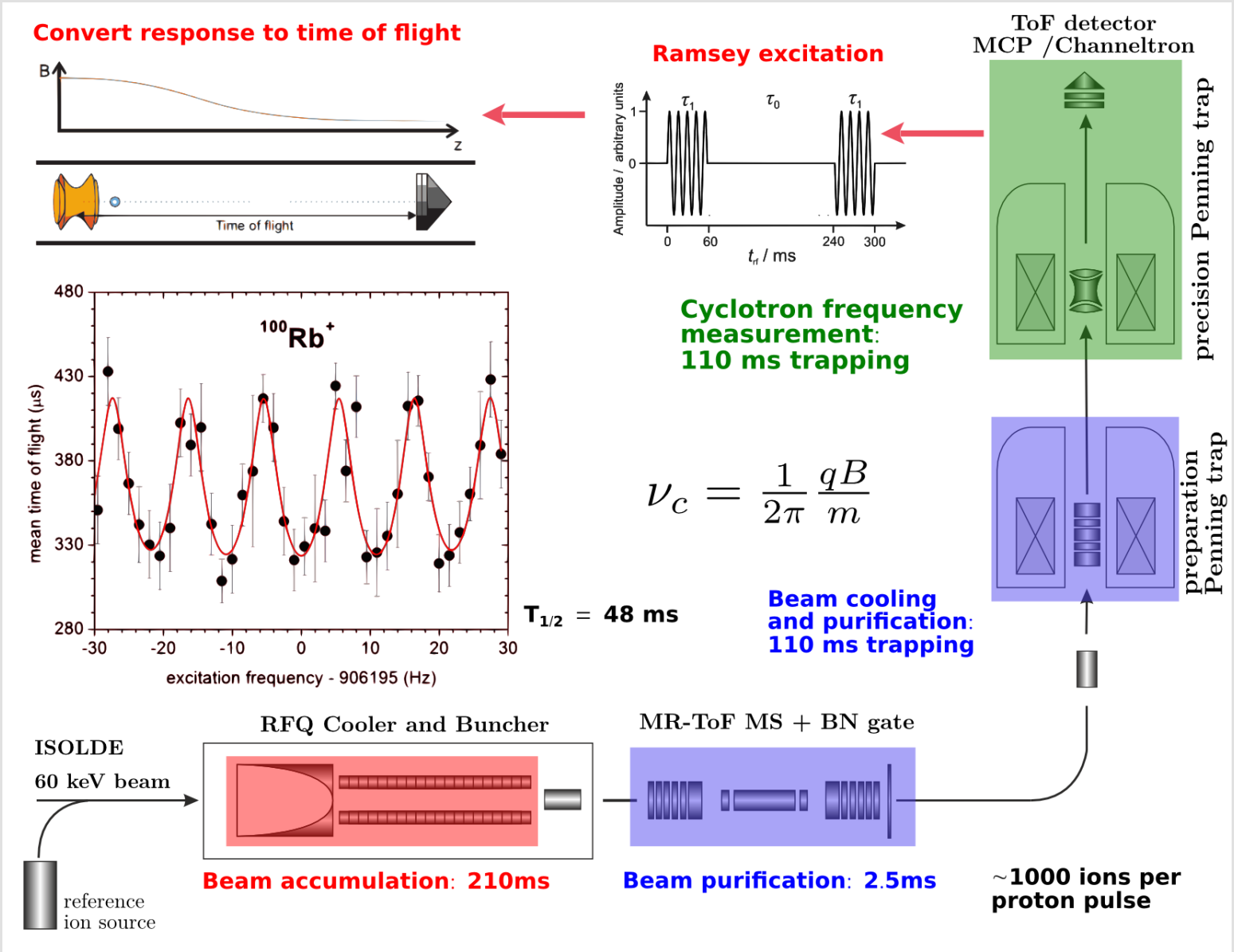
Obtained ToF Spectrum and Some Preliminary Results





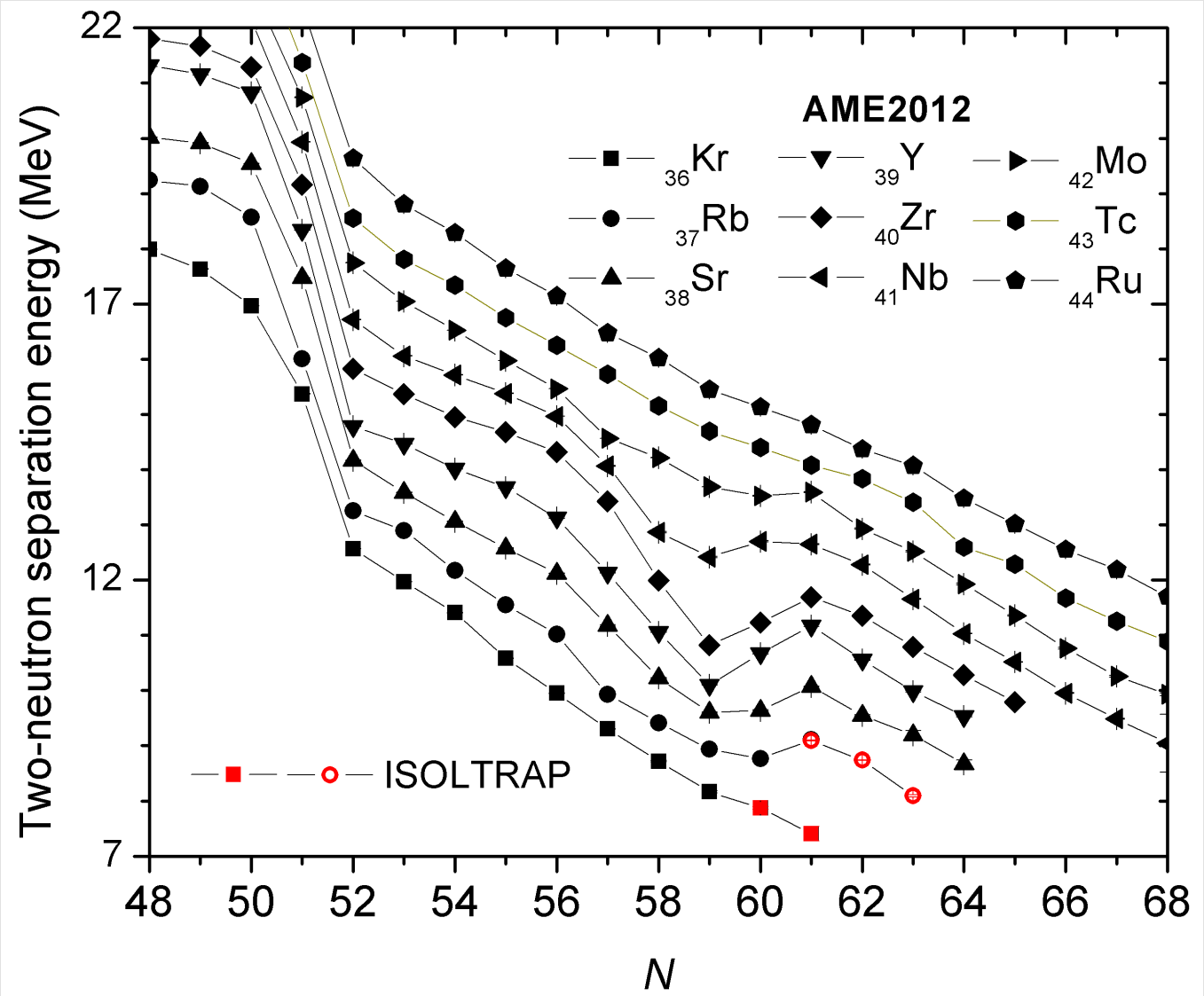
Further details available on the poster (ID = 64) by Marco Rosenbusch.

Mass determination of neutron-rich ^{100}Rb



Manea *et al.*,PRC **88**, 054322 (2013); Kreim *et al.* NIM B in press (2013); Wolf *et al.*, IJMS **349-350**, 123-133 (2013)

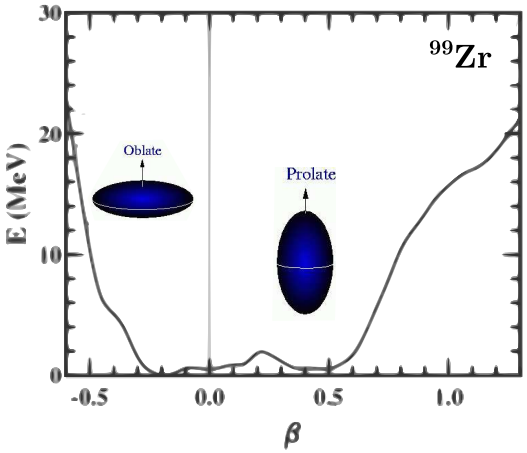
Mass determination of neutron-rich ^{100}Rb

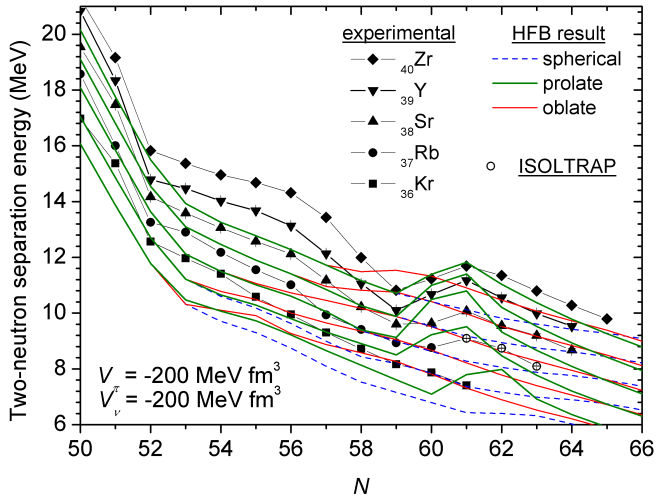


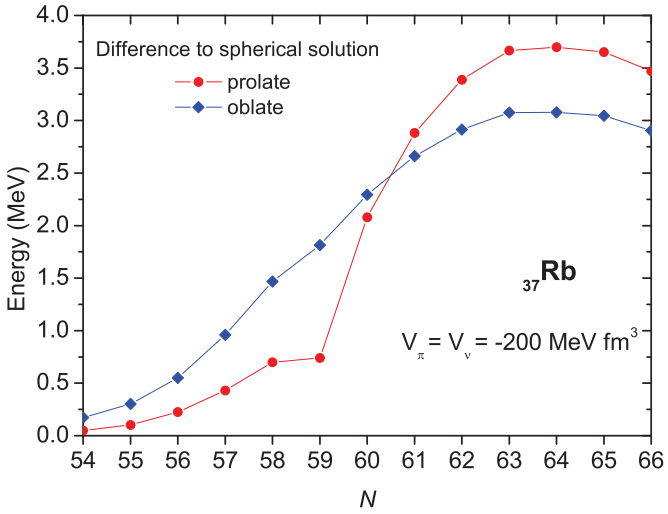
Naimi *et al.*, PRL **105**, 032502 (2010); Manea *et al.*,PRC **88**, 054322 (2013)

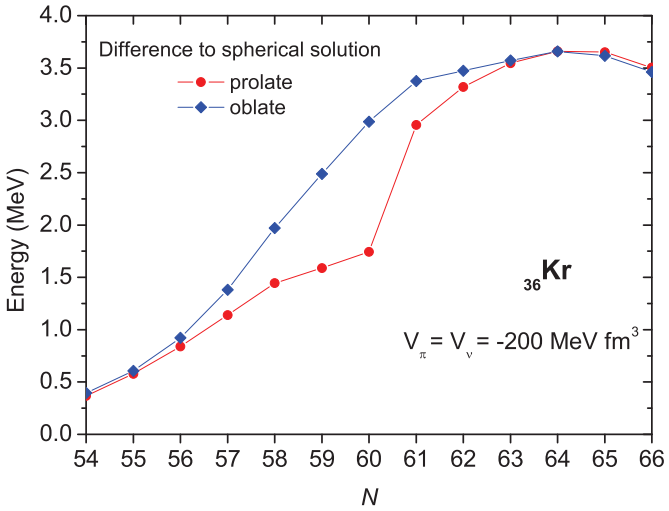
Theoretical description of Rb and Kr

Hartree-Fock-Bogoliubov calculations



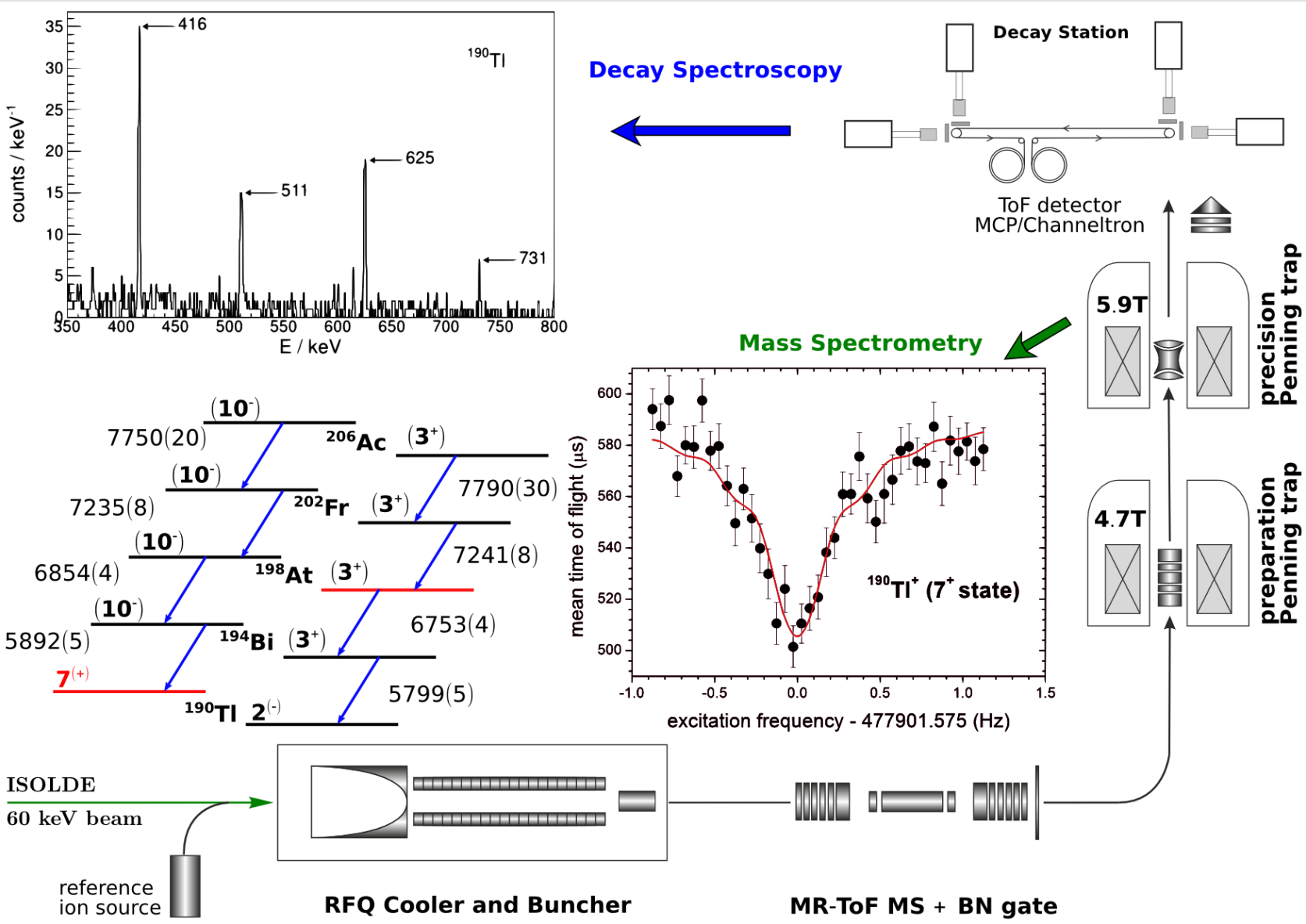






Manea *et al.*,PRC **88**, 054322 (2013); Hilaire and Girod Eur. Phys. J A **33**, 237 (2007)

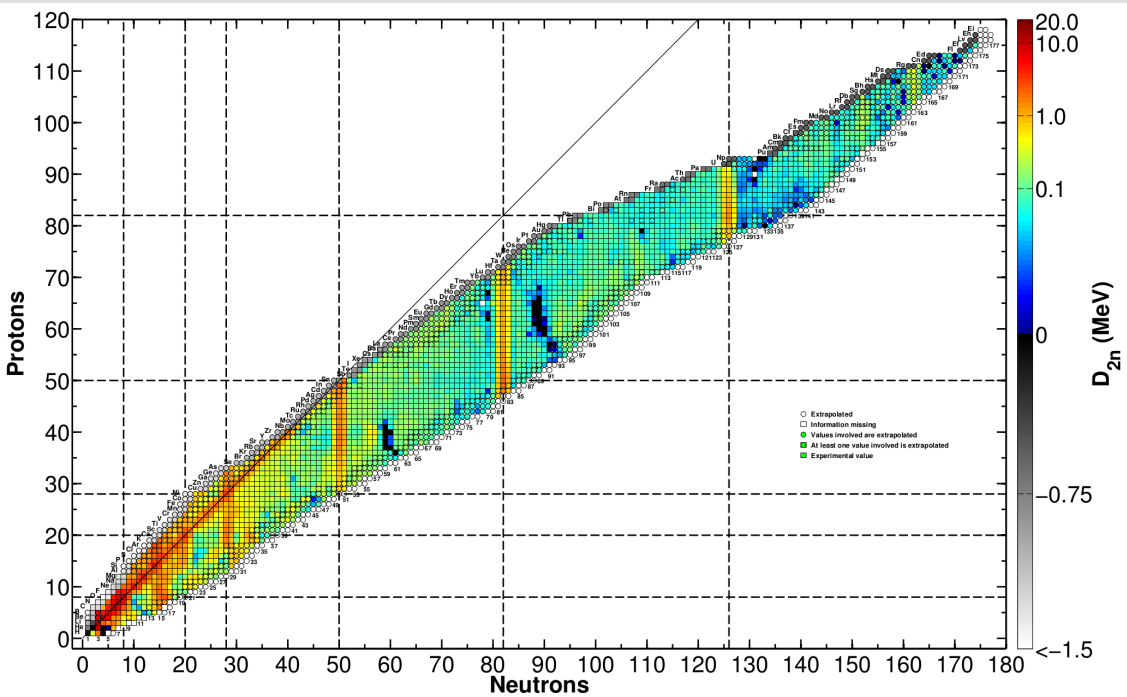
Trap assisted decay spectroscopy

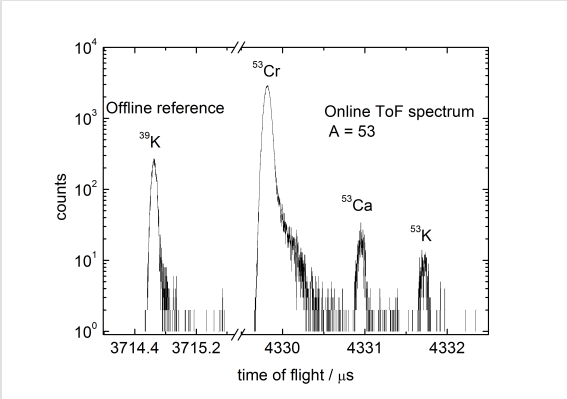


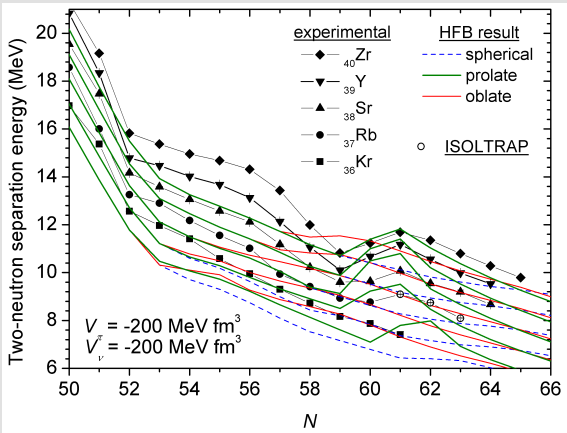
Stanja, Borgmann *et al.*, PRC **88** 054304 (2013)

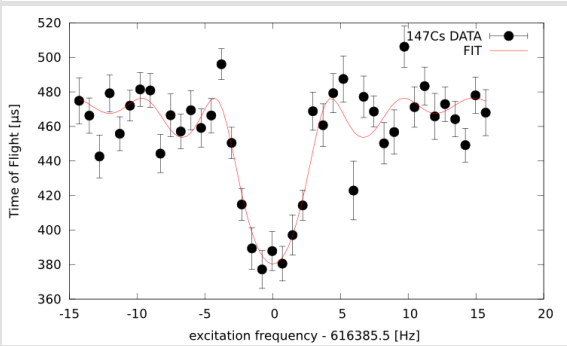
Summary and Outlook

- Conclude the analysis of shell gap around $N = 32$ (neutron-rich ^{52,53}K)
- Information about deformation in the region of neutron-rich Kr is needed
- Neutron-rich ^{147,148}Cs isotopes are under investigation



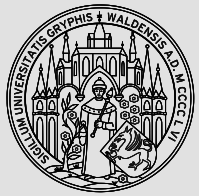






Collaboration

Pauline ASCHER, Dietrich BECK, Klaus BLAUM, Christopher BORGMANN, Martin BREITENFELDT, Christine BÖHM, R. Burcu CAKIRLI, Thomas COCOLIOS, Sergey ELISEEV, Tommi ERONEN, Sebastian GEORGE, Frank HERFURTH, Alexander HERLERT, Dmitry KISLER, Magdalena KOWALSKA, Susanne KREIM, Yuri LITVINOV, David LUNNEY, Vladimir MANEA, Enrique Ramirez MINAYA, Sarah NAIMI, Dennis NEIDHERR, Marco ROSENBUSCH, Lutz SCHWEIKHARD, Juliane STANJA, Frank WIENHOLTZ, Robert Norbert WOLF, Kai ZUBER



http://isoltrap.web.cern.ch