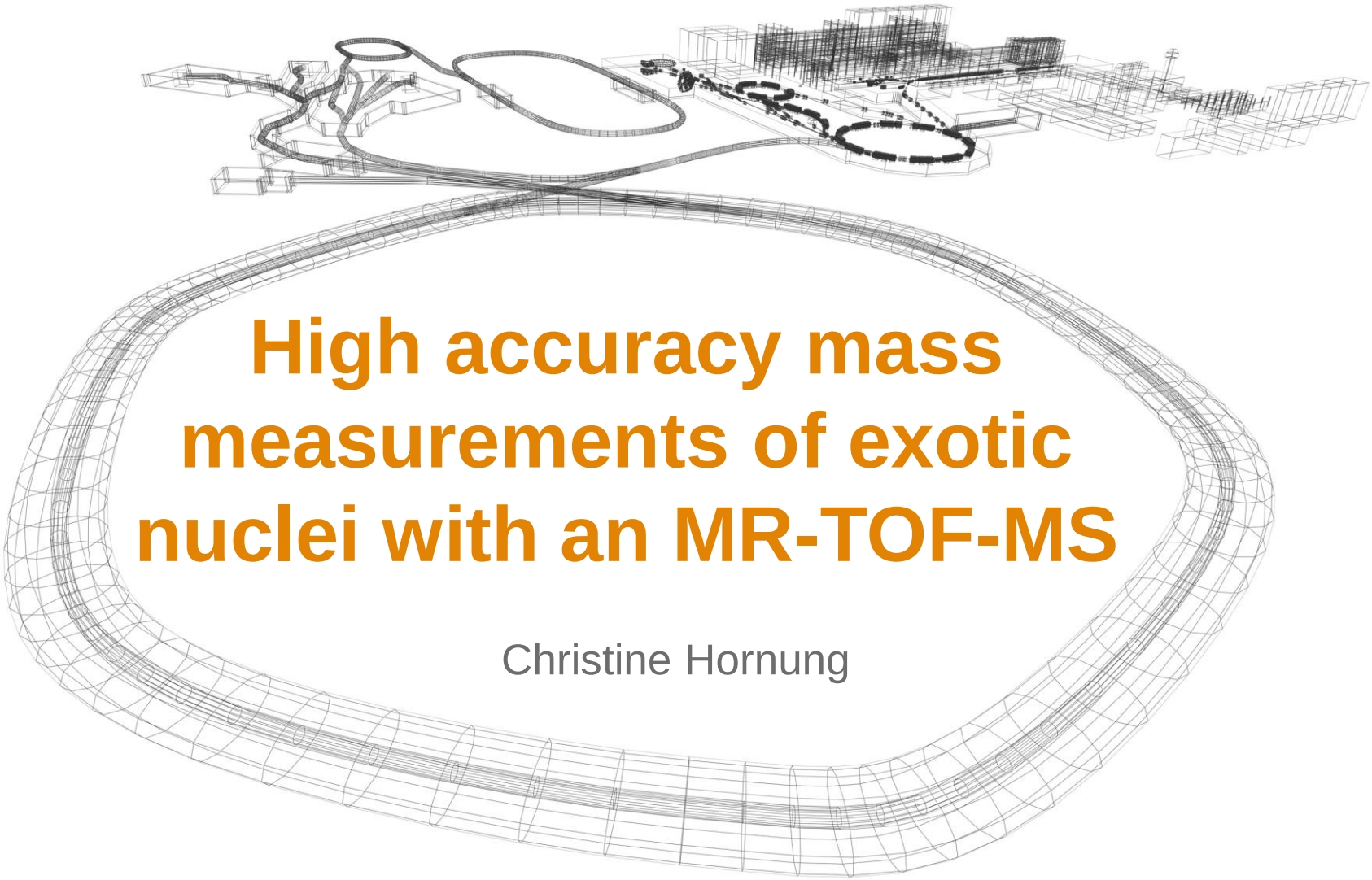
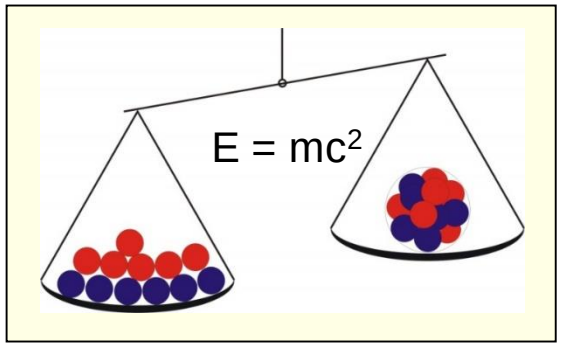


High accuracy mass measurements of exotic nuclei with an MR-TOF-MS

Christine Hornung

Why we need mass measurements?



Nuclear mass ↔ nuclear binding energy:

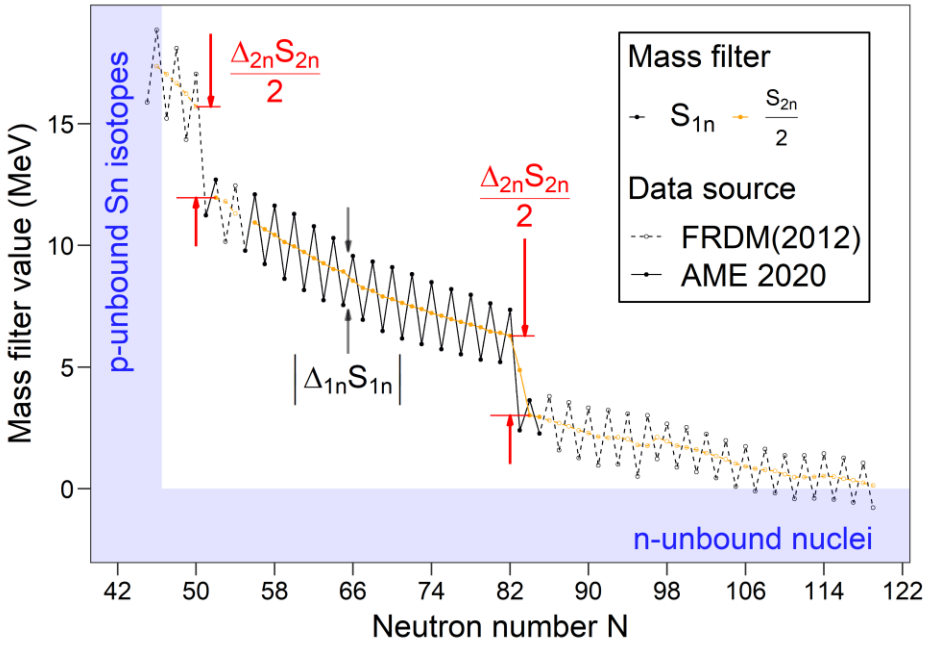
$$M(N,Z) = Z \cdot m_p + N \cdot m_n - B(N,Z)/c^2$$

Z Protons (Proton number)

N Neutrons (Neutron number)

A = N + Z (Mass number)

B = Binding energy

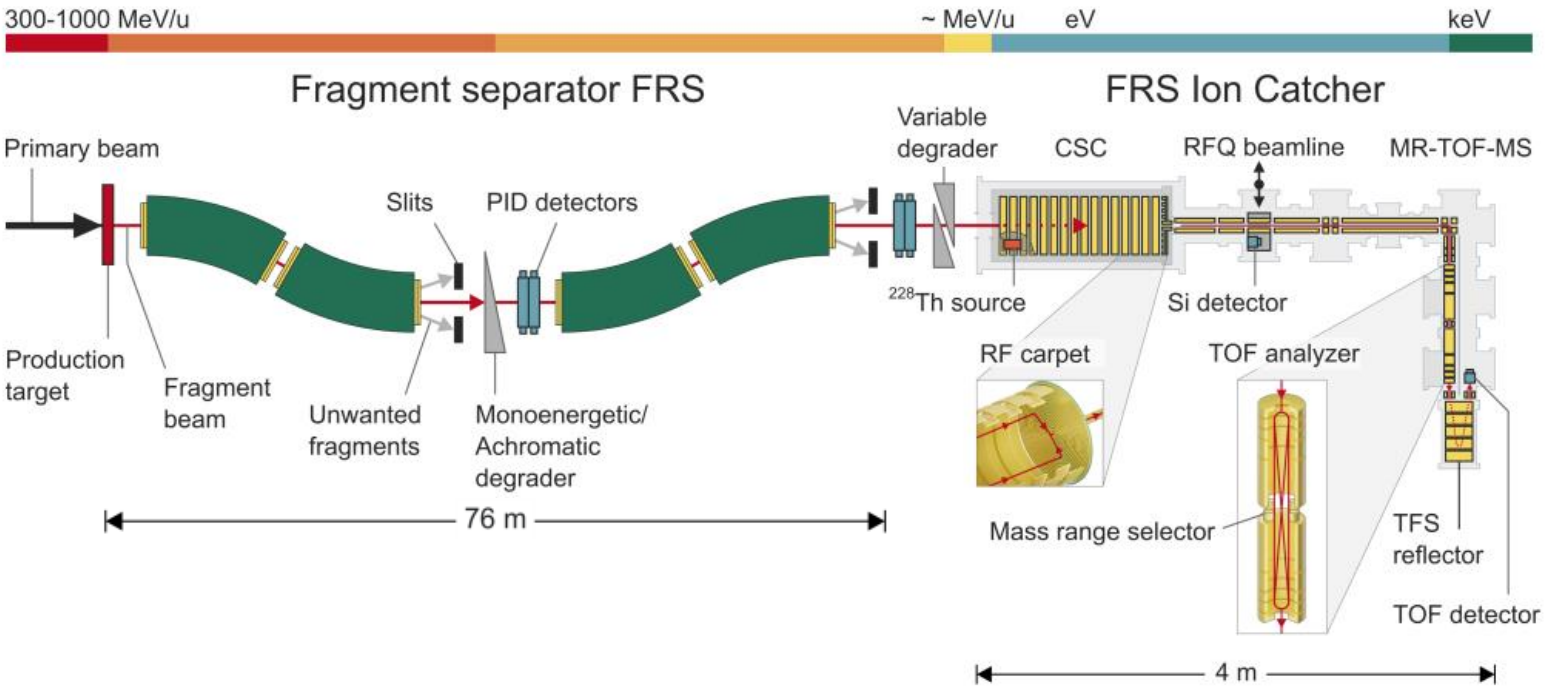


Several masses ↔ separation energies:

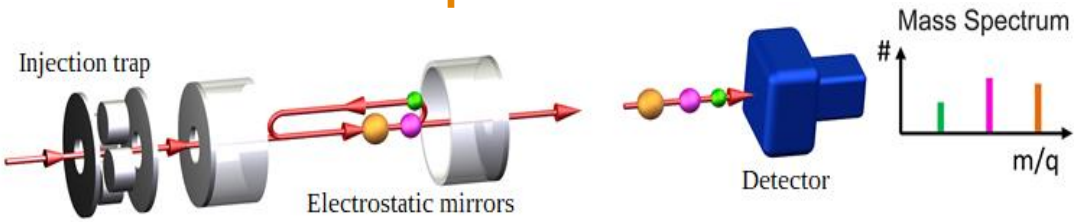
$$S_{1n}(N,Z) = B(N,Z) - B(\mathrm{N}-1,\mathrm{Z})$$

Structure & Dynamics of Exotic Nuclei

MR-TOF-MS at the FRS Ion Catcher at GSI



MR-TOF-MS Concept:



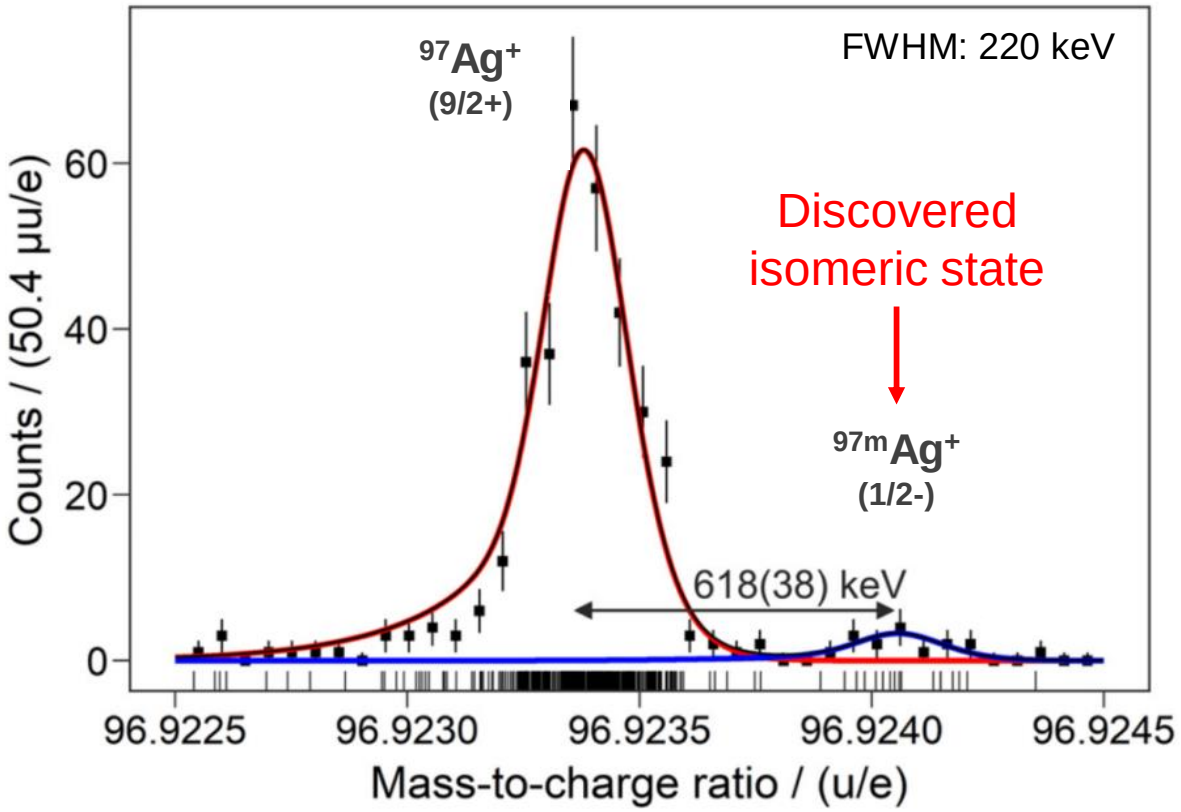
Fast	Broadband and non-scanning
Sensitive	High mass resolving power

W.R. Plaß *et al.*, NIM B 317 (2013) 457; W.R. Plaß *et al.*, Int. J. Mass Spectrom. 394 (2013) 134; T. Dickel *et al.*, NIM A 777 (2015) 172

Isomeric states below ^{100}Sn

MR-TOF-MS ↔ ideal device for the search for new isomers

^{97g,m}Ag – the first discovery of a nuclear isomeric state by an MR-TOF-MS



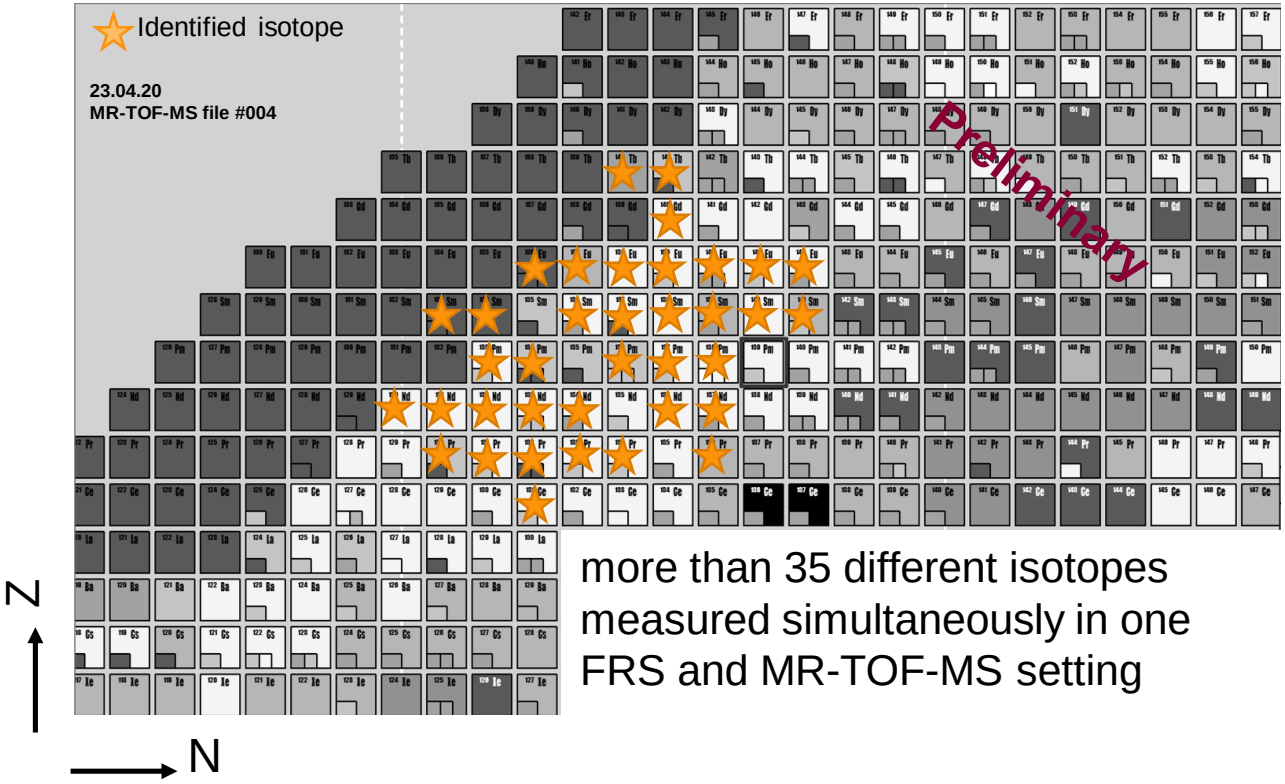
C. Hornung et al., PLB 802, 135200 (2020)

Efficient data taking with an MR-TOF-MS

→ **Broadband characteristic of the MR-TOF-MS**

→ **Mean range bunching in the FRS:**

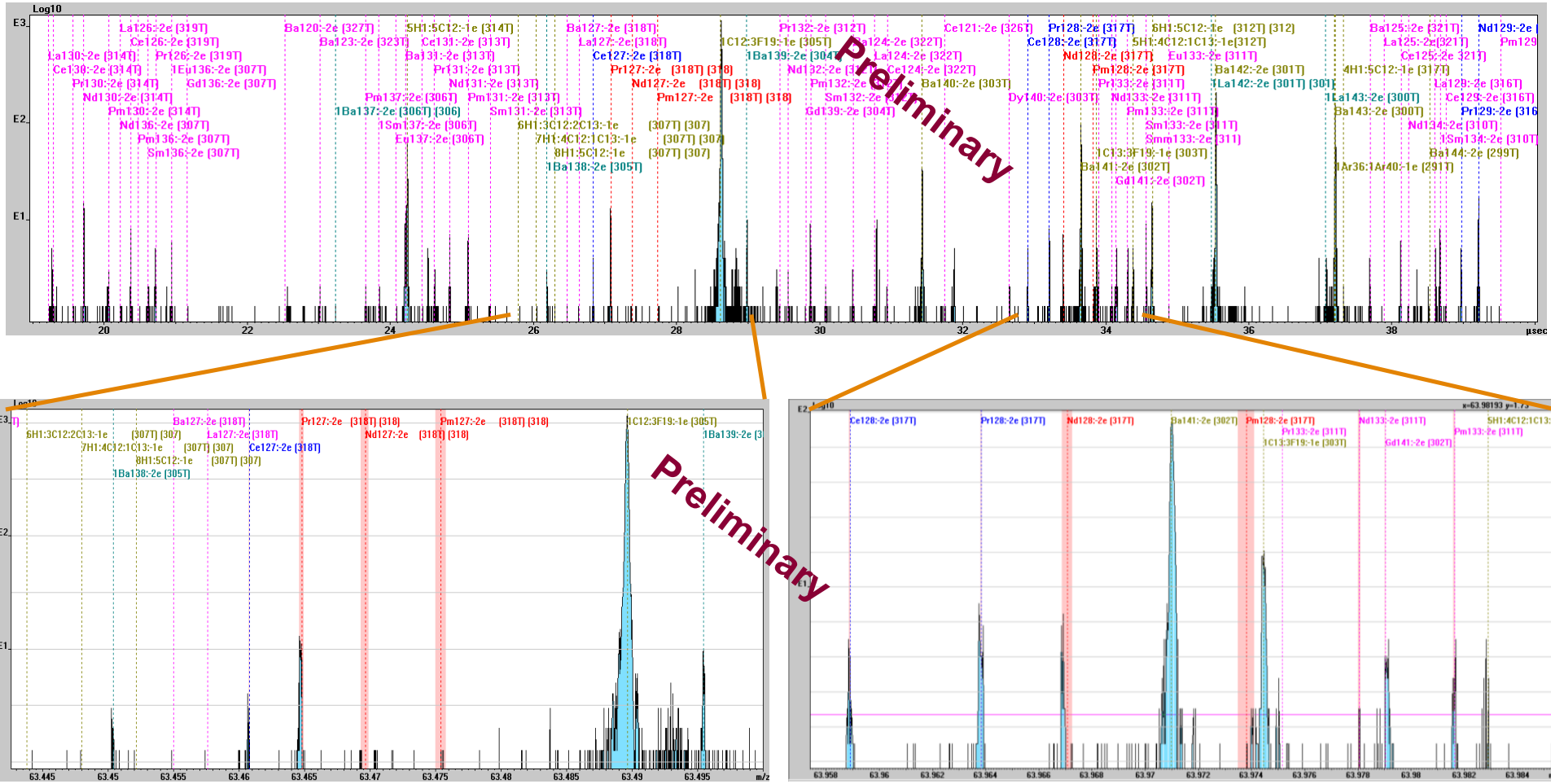
- **new method to stop several isotopes simultaneously**



more than 35 different isotopes measured simultaneously in one FRS and MR-TOF-MS setting

Online mass spectrum of MR-TOF-MS data

Online spectrum of complex MR-TOF-MS data:
Covering a large mass range (>10u) and doubly charged ions



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FRS Ion Catcher Collaboration

D. Amanbayev, B. Ashrafkhani, O. Aviv, S. Ayet San Andrés, J. Äystö, S. Bagchi, D. Balabanski, S. Beck, J. Bergmann, A. Blazhev, Z. Brencic, S. Cannarozzo, O. Charviakova, P. Constantin, D. Curien, D. Das, I. Dedes, M. Dehghan, T. Dickel, J. Dobaczewski, J. Dudek, T. Eronen, T. Fowler-Davis, Z. Gao, Z. Ge, H. Geissel, S. Glöckner, M. Górska, T. Grahn, F. Greiner, L. Gröf, M. Gupta, E. Haettner, O. Hall, M. Harakeh, C. Hornung, J.-P. Hucka, Y. Ito, A. Jokinen, B. Kaizer, N. Kalantar-Nayestanaki, A. Kankainen, A. Karpov, Y. Kehat, L. Kilmartin, D. Kostyleva, G. Kripkó-Koncz, D. Kumar, N. Kuzminchuk, K. Mahajan, I. Mardor, A.A. Mehmandoost-Khajeh-Dad, N. Minkov, A. Mollaebrahimi, D. Morrissey, I. Moore, I. Mukha, G. Münzenberg, T. Murböck, M. Narang, D. Nichita, Z. Patyk, A. Perry, S. Pietri, A. Pikhtelev, W.R. Plaß, I. Pohjalainen, S. Pomp, S. Purushothaman, M.P. Reiter, M. Reponen, S. Rinta-Antila, H. Rösch, A. Rotaru, C. Scheidenberger, T. Schellhaas, P. Schury, A. Shrayer, S.K. Singh, A. Solders, A. Spataru, A. State, Y. Tanaka, P. Thirolf, N. Tortorelli, E. Vardaci, L. Varga, M. Vencelj, V. Virtanen, M. Wada, M. Wasserheß, H. Weick, M. Wieser, M. Will, H. Wilsenach, O. Yaghi, M.I. Yavor, J. Yu, A. Zadvornaya, J. Zhao

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