Status of MATS: High-Precision Experiments Using Ion Traps at FAIR

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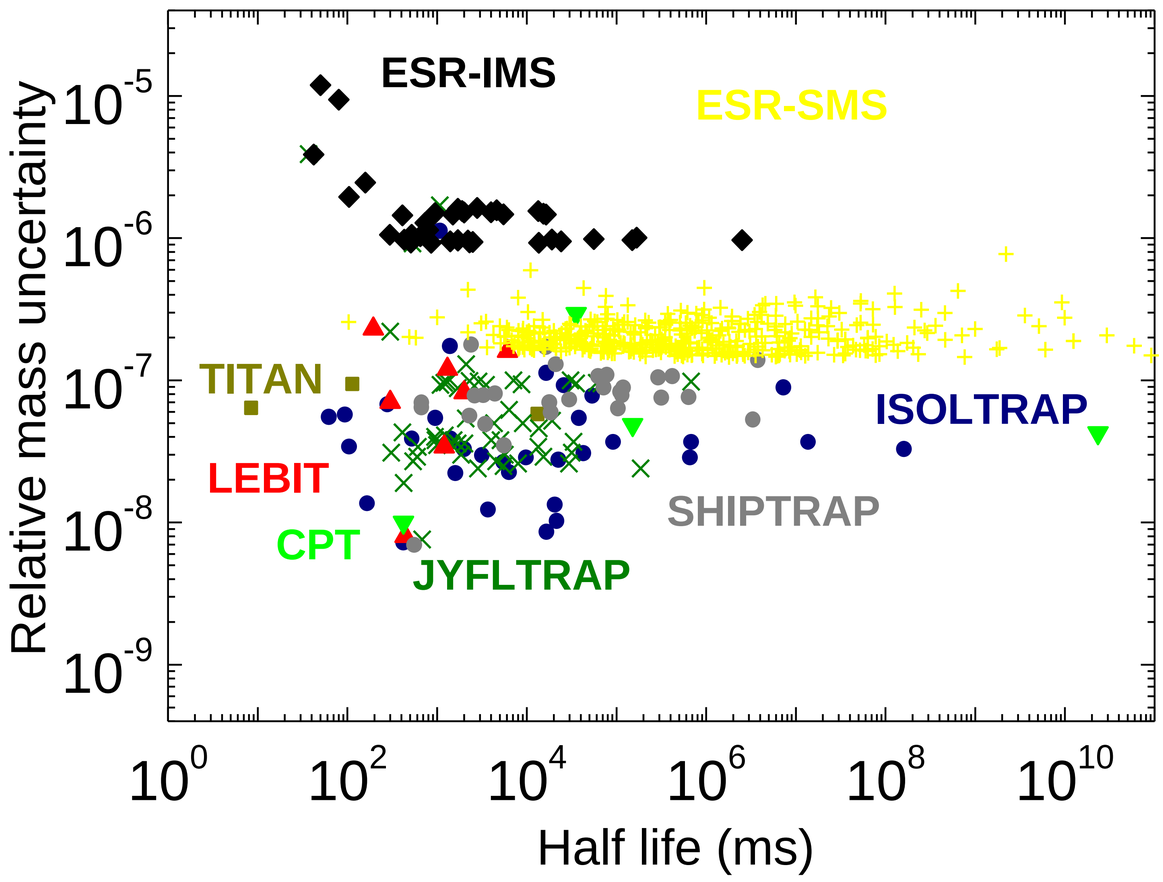
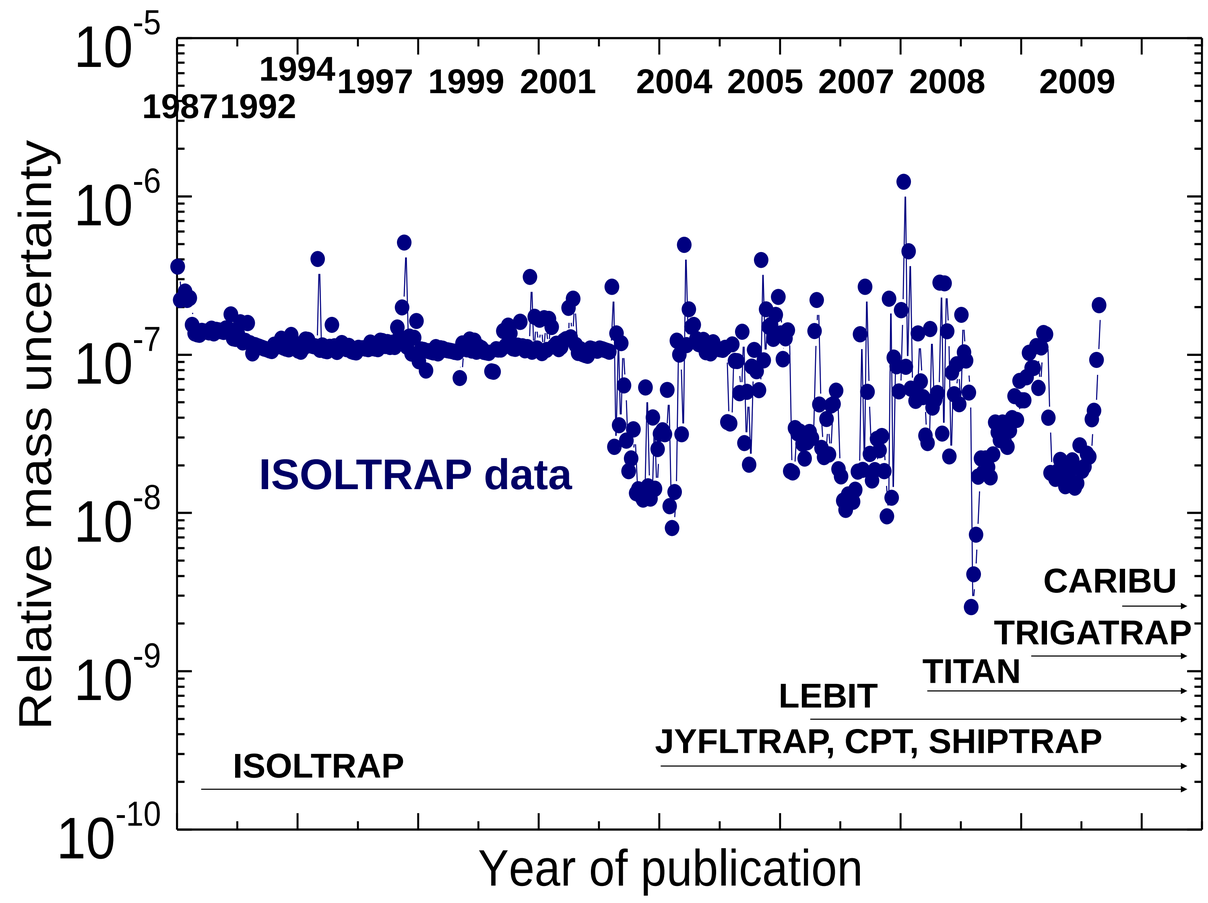
MASS MEASUREMENTS AT ACCELERATORS



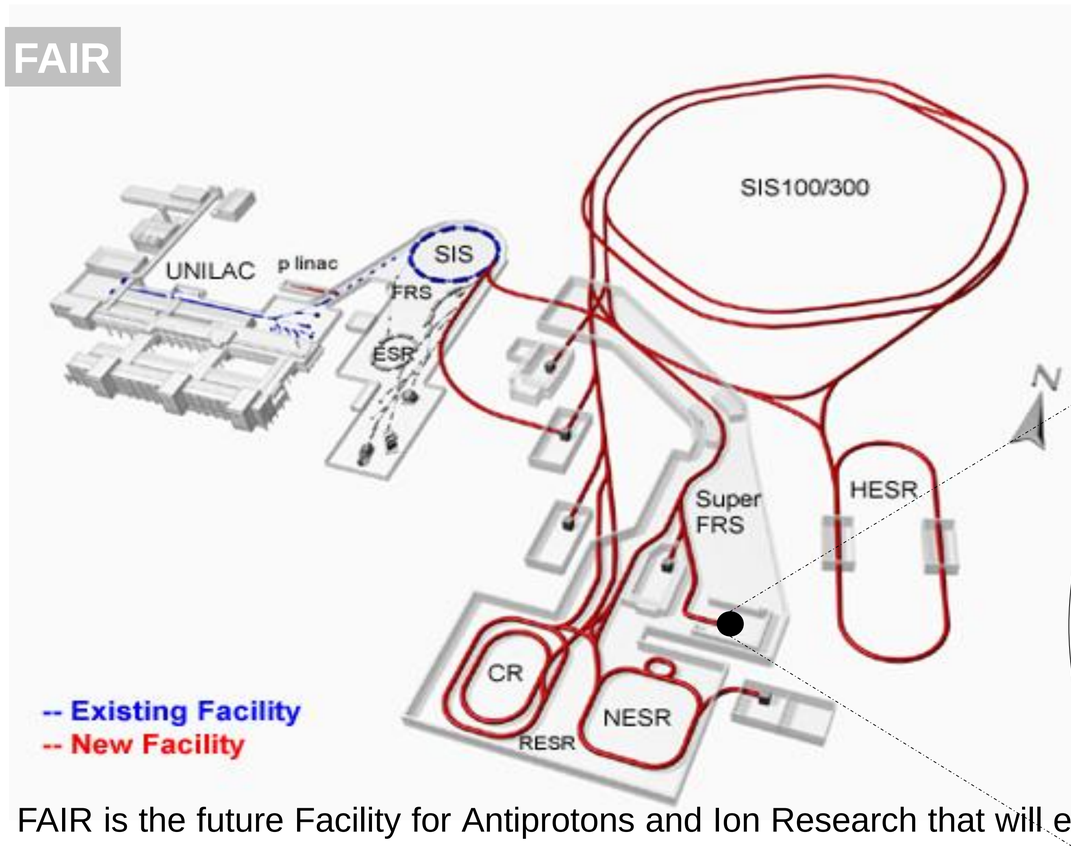
Recent highlights: M. Block *et al.,* Nature 463, 785 (2010); D. Neidher *et al.,* Phys. Rev. Lett. 102, 112502 (2009); S. Rahaman *et al.,* Phys. Rev. Lett. 103, 042501 (2009); M. Block *et al.,* Phys. Rev. Lett. 100, 132501 (2008); M. Smith *et al.,* Phys. Rev. Lett. 101, 202501 (2008)

ADVANCED TRAPPING TECHNIQUES AT ACCELERATORS



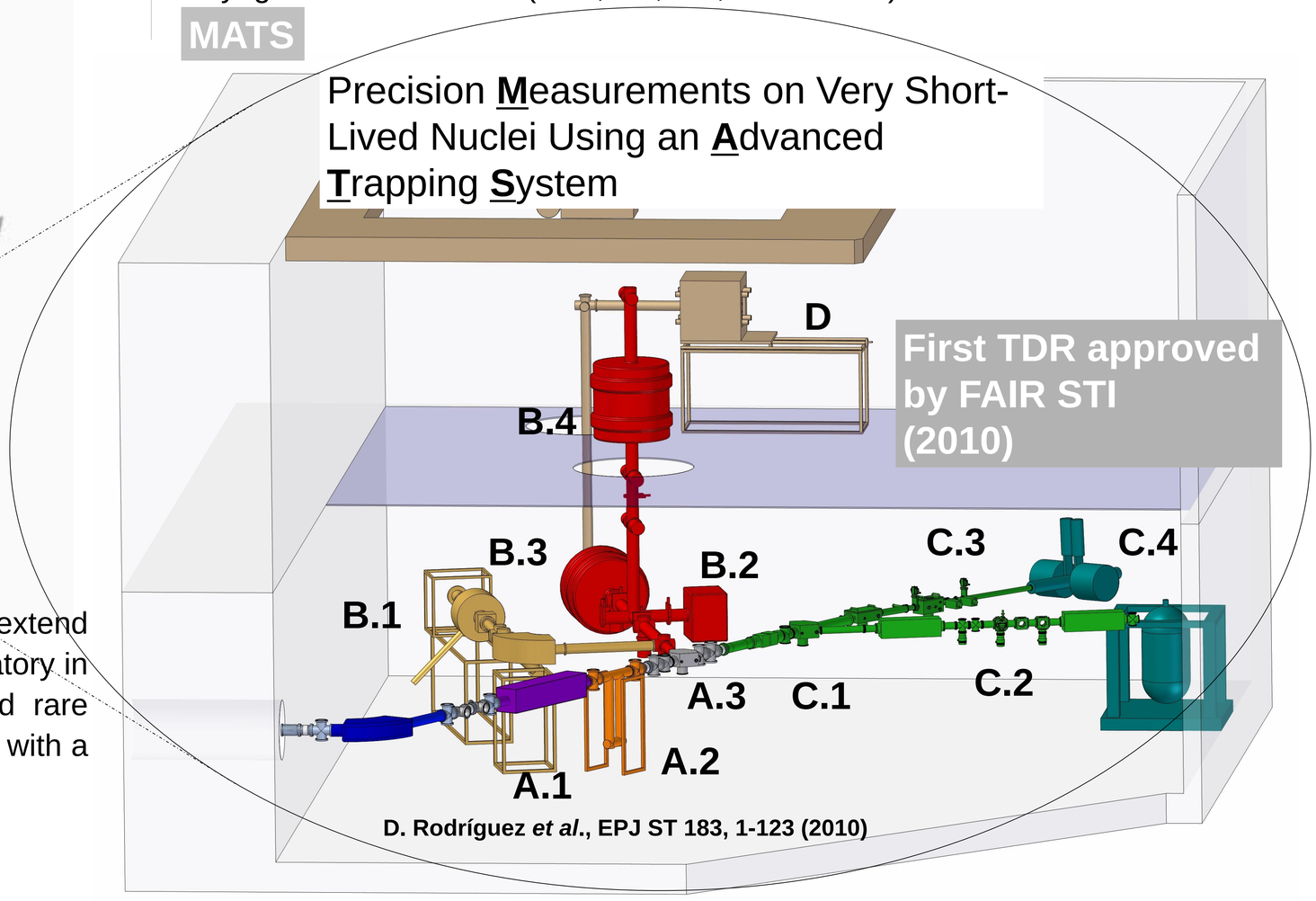
2001: RFQ (ISOLTRAP, JYFL, EU); **2001-2002:** Carbon clusters (ISOLTRAP); **2002-2005:** Gas catchers (EU); **2006:** Octupole excitation (LEBIT, SHIPTRAP); **2006:** Cryogenic RFQ (LEBIT); **2007:** Ramsey technique (ISOLTRAP); **2010:** Use of highly-charged ions for mass spectrometry (TITAN); **201x:** Manipulation of highly-charged ions (TITAN, HITRAP); **201x:** FT-ICR with single ion (TRIGATRAP, SHIPTRAP); **201x:** Cryogenic Gas catchers (ANL,KVI,GSI, SHIPTRAP)

FAIR



FAIR is the future Facility for Antiprotons and Ion Research that will extend and multiply the possibilities of GSI, the heavy-ion accelerator laboratory in Darmstadt, Germany. One focus of FAIR is to reach unexplored rare isotopes produced in fragmentation reactions and separated in-flight with a Superconducting-FRagment Separator (Super-FRS).

MATS



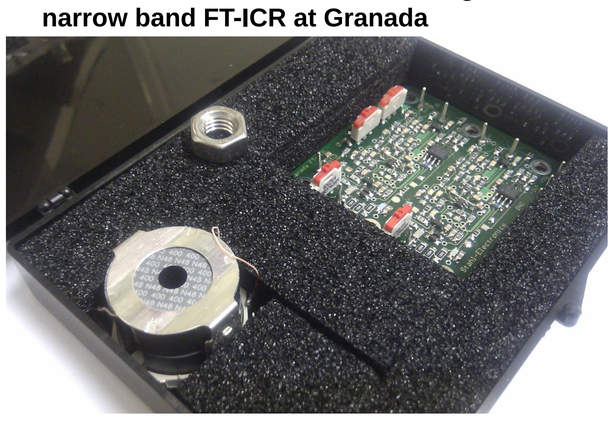
D. Rodríguez *et al*., EPJ ST 183, 1-123 (2010)

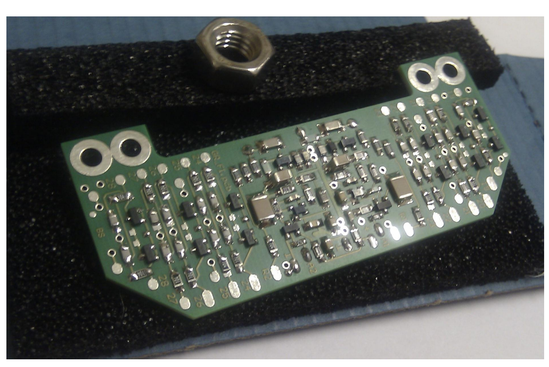
MATS and LaSpec experiments at the end of the low-energy beamline of the Super-FRS. The Buncher section (A.1), the multi-reflection time-of-flight mass spectrometer (A.2), and the switchyard (A.3) are the common components. The MATS beamline is shown schematically in red: (B.1) is the EBIT junction, (B.2) the off-line ion source, (B.3) the Preparation Penning trap section, and (B.4) the Measurement Penning Trap section. The LaSpec beamline is represented by the green components: (C.1) is the common supply line, (C.2) the ion beam line, (C.3) is the atom beam line with beta-NMR (C.4). D is a setup for neutron decay and total absorption spectroscopy.

PRESENT STATUS AND NEXT STEPS

The technical design report, where the different responsibilities, time table and cost matrix are defined, was approved in May 2010. Most recent developments pertain to Fourier-Transform Ion-Cyclotron-Resonance. This is a common effort from several groups: Granada, MPIK and Greifswald.

Detection Resonator Coil & Biasing for narrow band FT-ICR at Granada





Amplifier & Filter for broad band FT-ICR at Granada

Circuits made by Stahl Electronics

Further developments on this system will be carried out at the UGR, where very recently a set of two electromagnets delivering up to 1.2 T has been built in order to use it as a test bench for this detection method. The ion source and the vacuum system are currently under development and are part of the PhD Thesis of J. M. Cornejo.

MATS COLLABORATION

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