

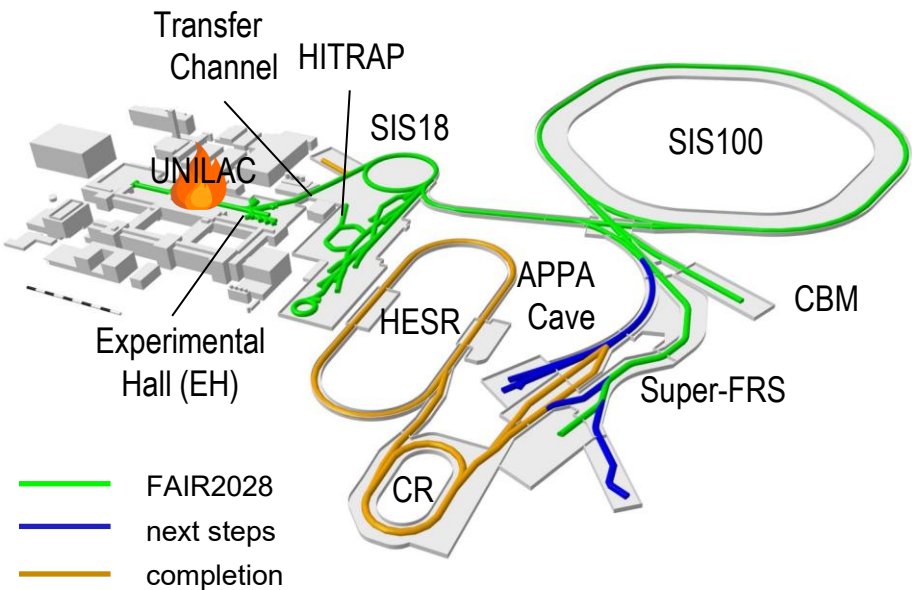
Strategy of HI Jena to Deal with the UNILAC Accident



Thomas Stöhlker



FIRE INCIDENT AT UNILAC (FEB. 2026)



No persons have been harmed

No toxic substances observed

Date & time

February 5th 2026
6 am

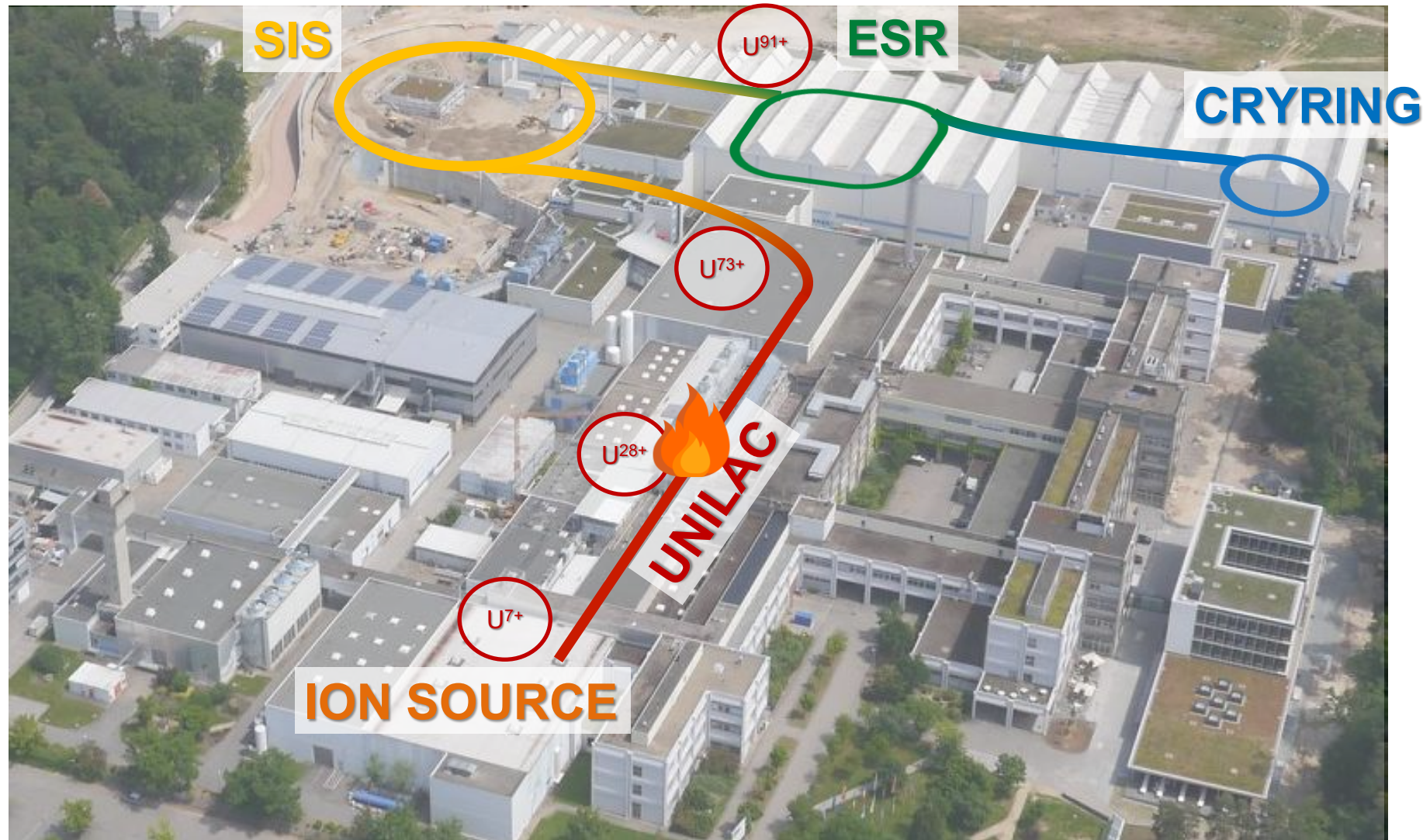
location

High-frequency (HF) operation area for the UNILAC accelerator

Not affected:

- SIS18 synchrotron & experiments (ESR, FRS, CRYRING, HITRAP)
- PHELIX high-power laser
- FAIR construction site

GSI FACILITY



IMMEDIATE EFFECTS ON THE RESEARCH ACTIVITIES OF HI JENA AT THE CAMPUS OF GSI

Experiment [ESR, CRYRING]: G-24-00294 “Precise measurement of the 1s Lamb shift in hydrogen-like uranium”

- Two PhD Students: => not before 2030/31; alternative projects needed

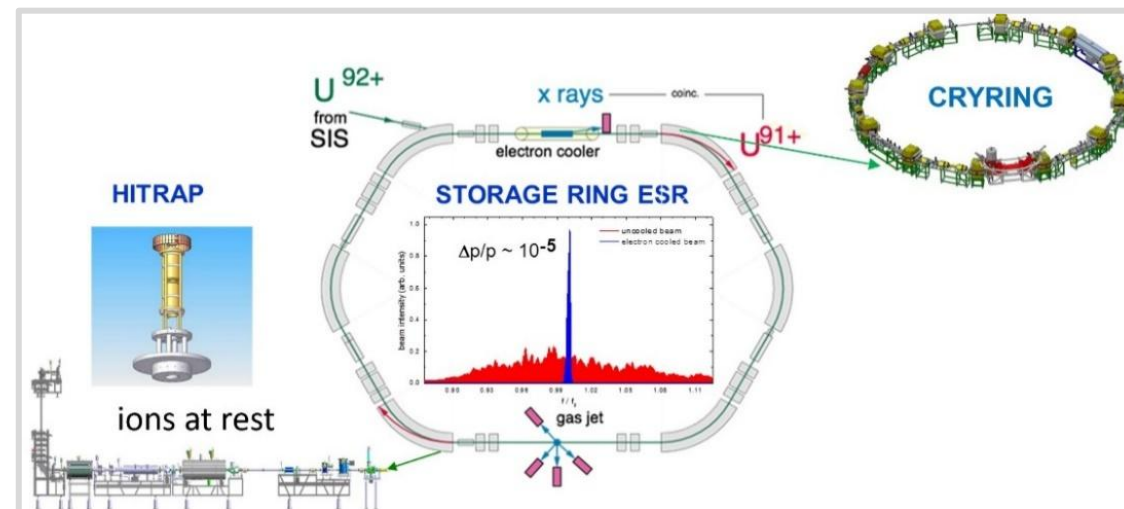
Experiment [ESR]: G-24-00307/UR Performance test of a novel SPARC Compton (telescope) polarimeter at the internal target of the ESR

- One PhD student => not before 2030/31; alternative projects needed

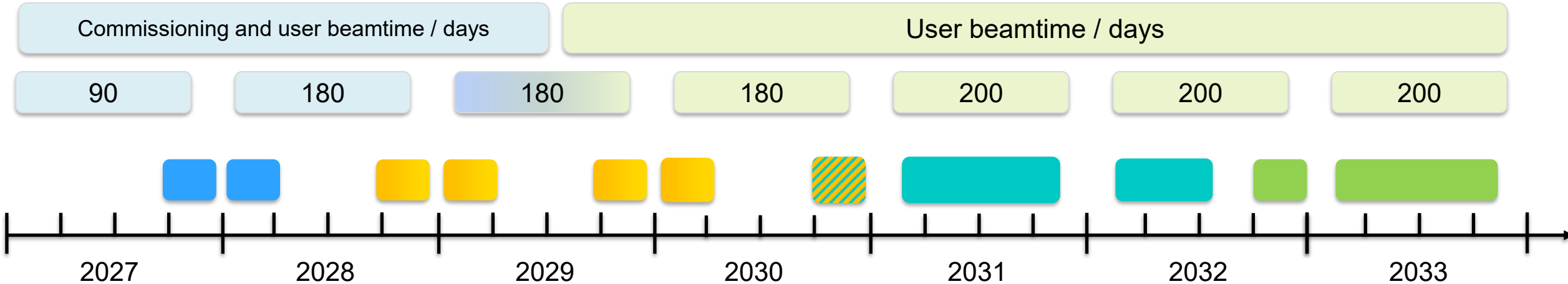
HYIG Peter Micke [ESR, HITRAP]: Quantum logic spectroscopy of heavy highly charged ions

HIG Rima Schüssler [ESR, HITRAP]: QED tests: Binding energy via mass measurement

ERC AdG HiTHOR [ESR, HITRAP] “Highly Ionized Trapped 229-Thorium” => not before 2030/31; fiscally neutral prolongation by two years



EXPECTED INJECTOR AVAILABILITY



HITRAP I PARTIH

p – min. C beams, low intensity



InterLAC

p – min. Xe beams, medium intensity



UNILAC

p – U beams, high intensity (only short pulse operation)



UNILAC + HELIAC

full operation

**Fully
operational**

**PHELIX,
CRYRING**

Internal facilities



External facilities



Highest priority

- PhD projects and young scientists affected by the accident
- 2 Young Investigator Groups and ERC project HiThor

- In 2028, HITRAP needs to be recommissioned after its use as PARTIH !
- **Interlac (2028): Ions from ESR**

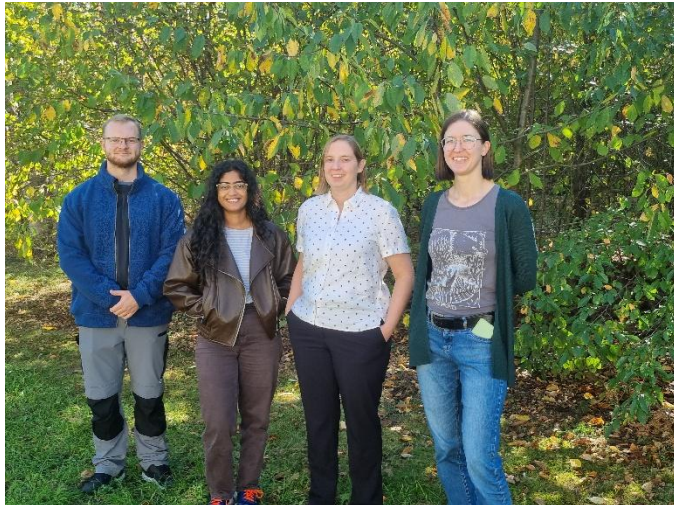
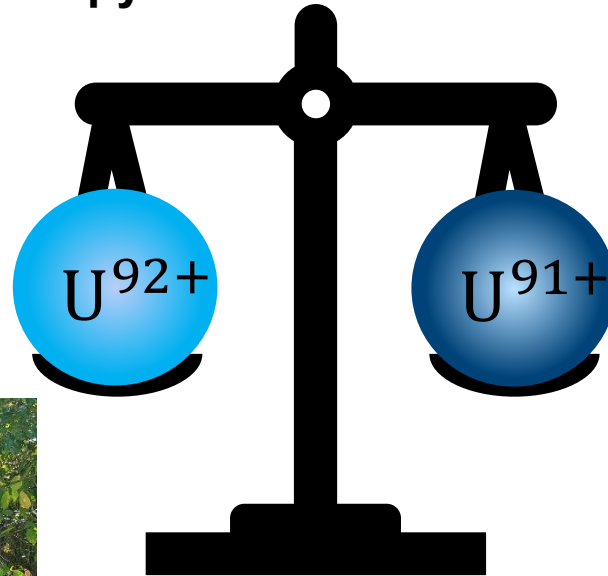
Kr/Xe for HITHOR G24-00277: [A] – Brandau, Stöhlker
Sn for HITRAP G24-00257: [A] – Vogel
Sn for HITRAP G24-00300: [A-] – Micke

- **Short and mid term: EBIT sources will provide highly-charged ions for commissioning and first experiments at the experiment stations/traps**
- 232-Thorium ion source is of great importance in terms of intensity and beam operation

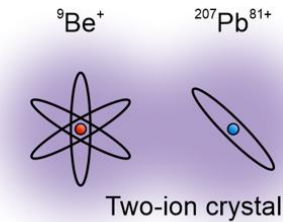


2030/2031: 2 Helmholtz Young Investigator Groups and ERC AdG HiThor need to run their experiments with high-Z ions (^{238}U , ^{208}Pb , ^{229}Th)

**Goal: Quantum logic spectroscopy of
heavy highly charged ions:
Rima Schüssler**

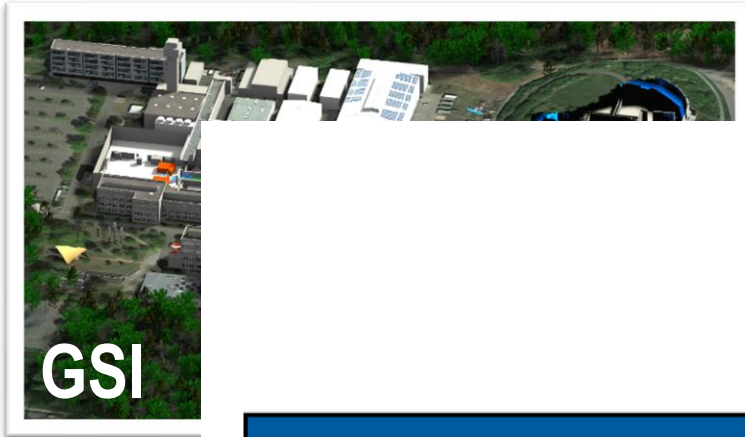


**Goal: Quantum logic spectroscopy
of heavy highly charged ions:
Peter Micke**

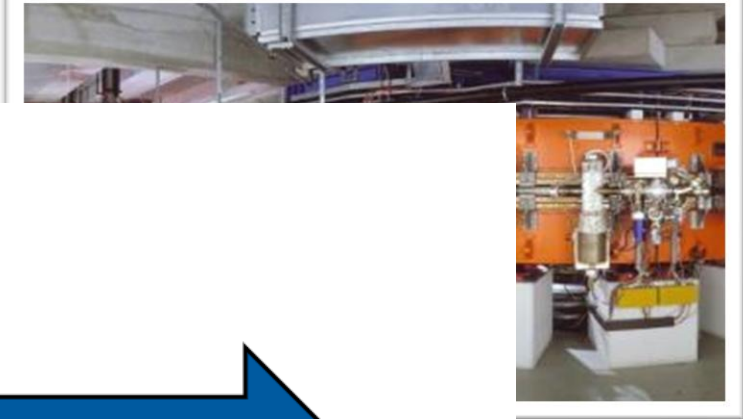


Hiroshi
Hayakawa
(Master student),
Peter Micke
(group leader),
Lukas Kau
(PhD student),
Nadine Homburg
(PhD student)

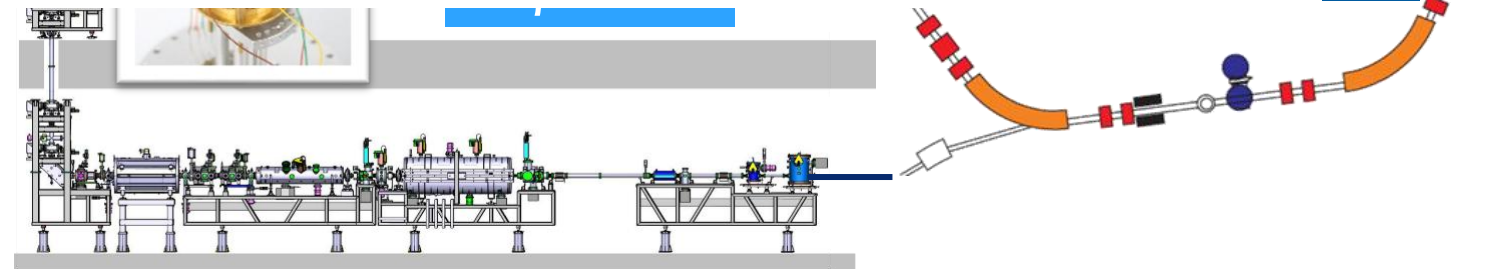
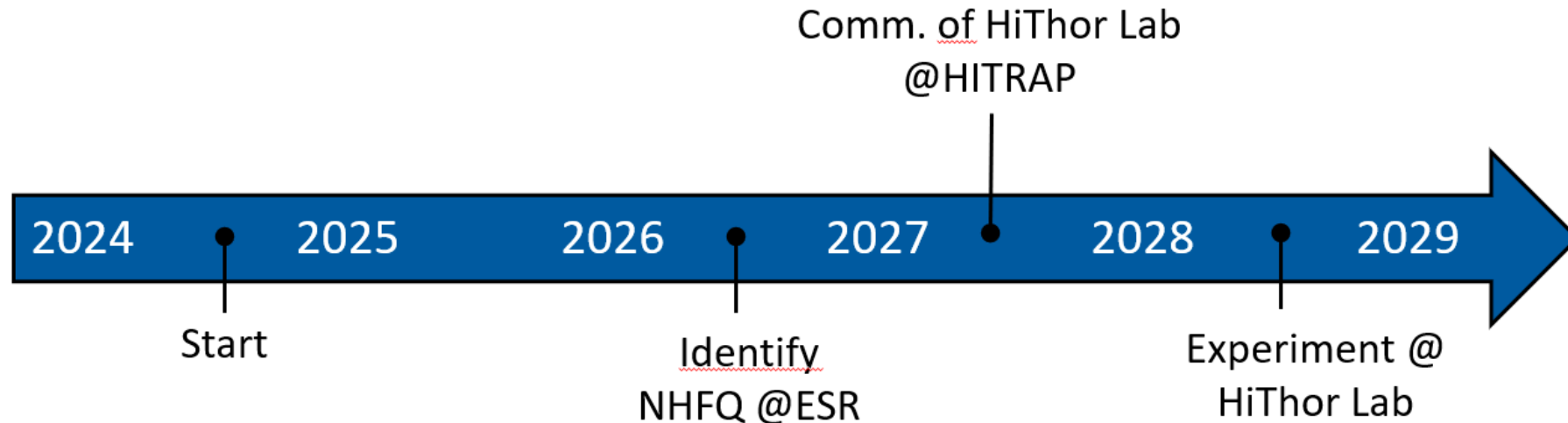
HiThor: Can Only be Realized at GSI – One-Electron $^{229}\text{Th}^{89+}$



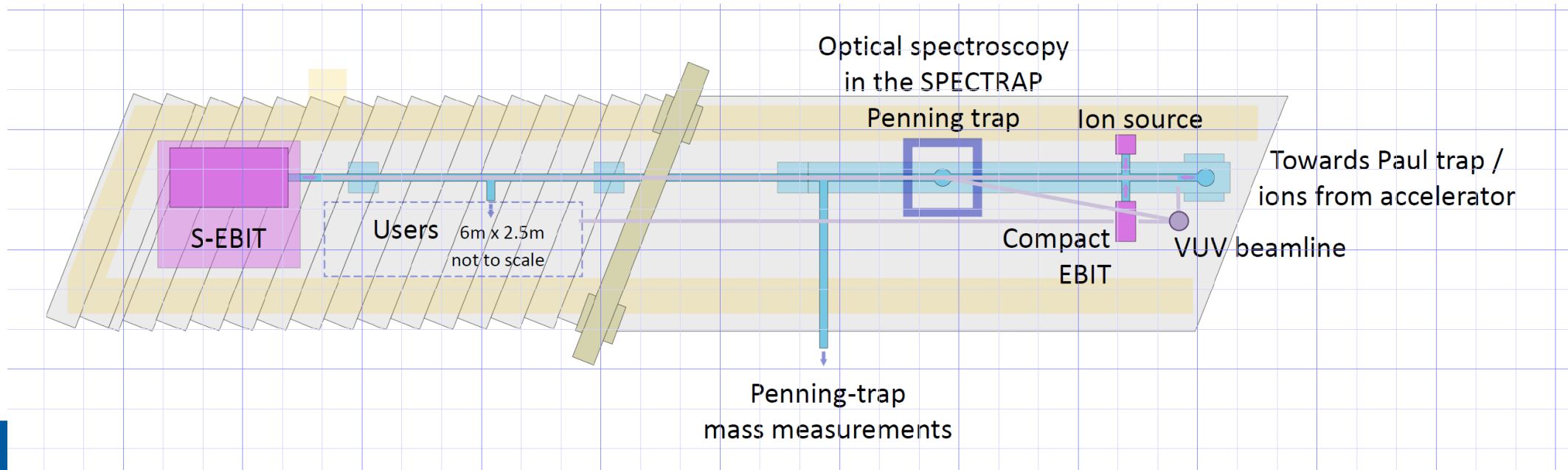
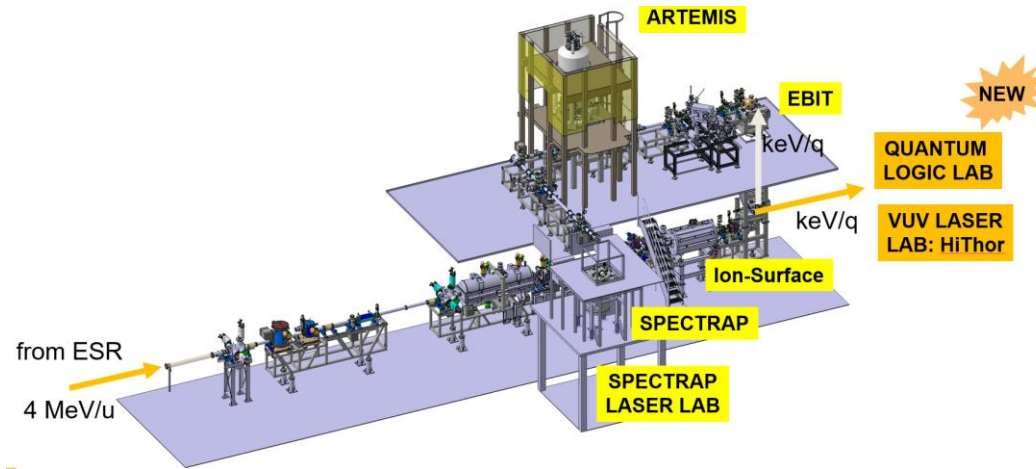
Ion storage ring and traps at GSI



Uranium
from syn



RESTRUCTURING OF HITRAP PLATFORM



STOCKHOLM EBIT: ION SOURCE FOR HITRAP

Stockholm-EBIT: Ion source for highly charged ions: Stand-alone operation of HITRAP



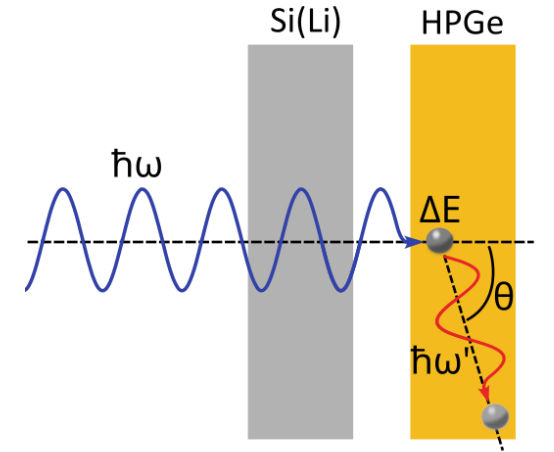
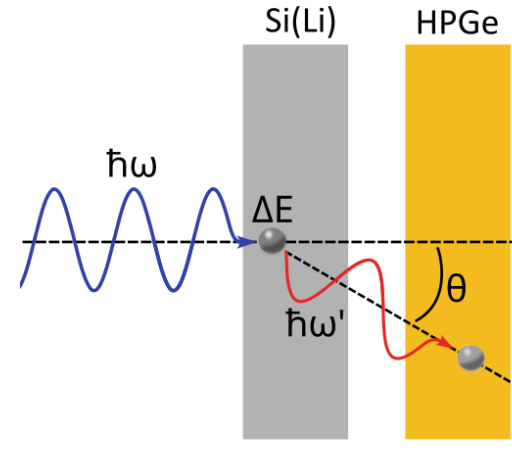
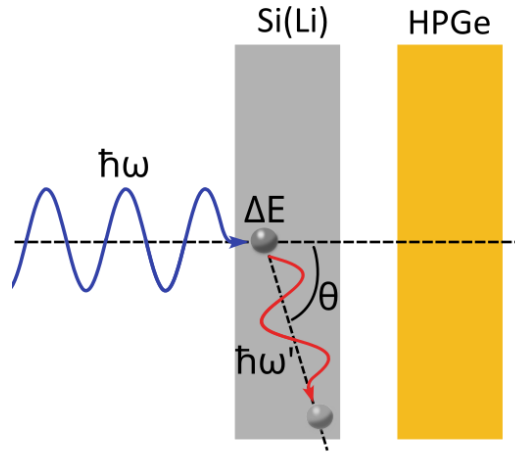
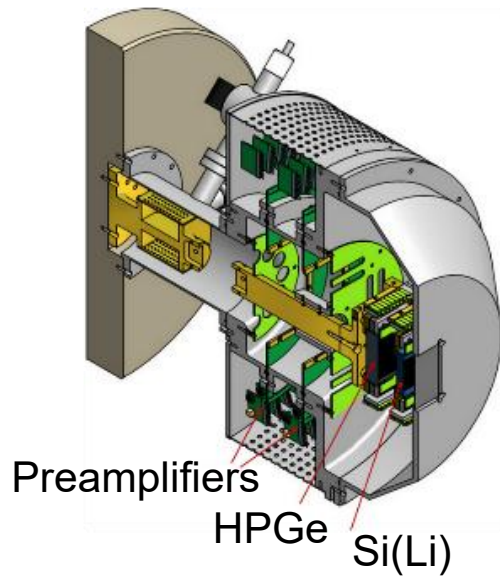
Ion source S-EBIT II for local operation of HITRAP experiments. Ions up to U^{89+} can be produced. Provided by Stockholm Univ. and HI Jena. Currently, limited to 10 kV operation voltage.



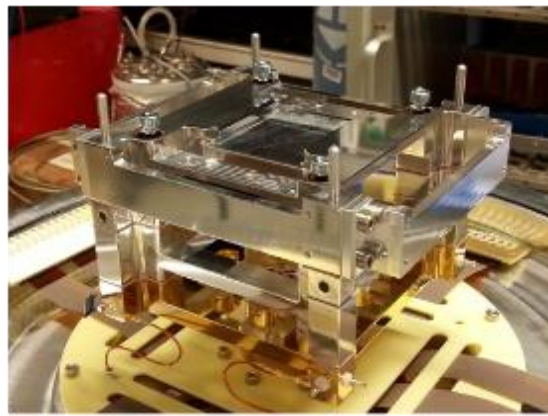
Sonja Bernitt

Design Parameter	S-EBIT II
Type	Cryogenic (LHe free)
Magnetic field	4T
Electron beam energy	260 keV
Electron beam current	250 mA
Electron beam radius	37 μ m
Trap length	2 cm
Ions per pulse	10^6 - 10^7
Characteristic	Electron gun/ collector + trap on HV-platforms

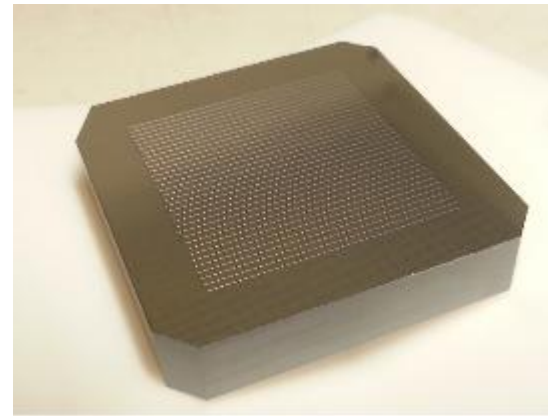
COMPTON TELESCOPE FOR $\hbar\omega > 200$ KEV



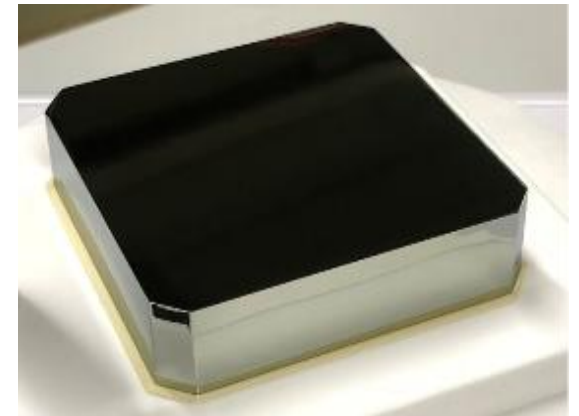
Compton Telescope



Crystal placement



Si(Li) crystal

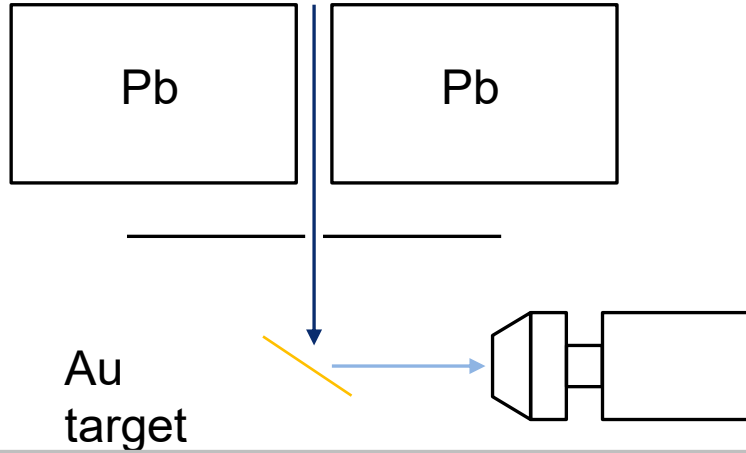


HPGe crystal

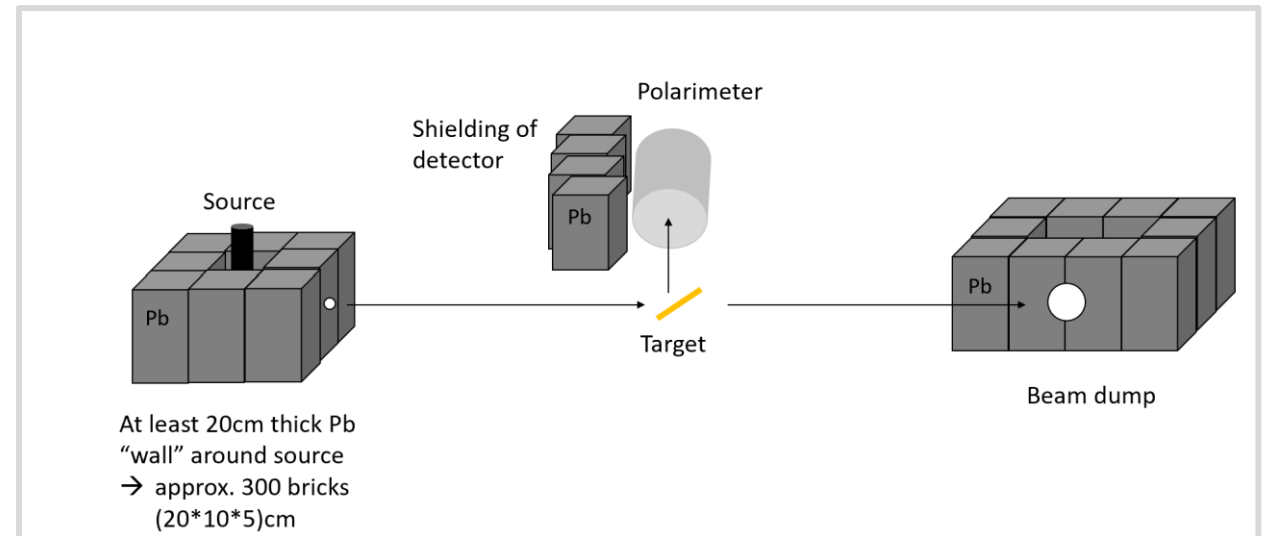
INTENSE ^{60}Co SOURCE AT THE UNIVERSITY OF GIESSEN

^{60}Co : γ source

For Compton scattering of $\hbar\omega = 1173 \text{ keV}$



θ	$\hbar\omega'$ [keV]	P_1
39	776	-0.22
63	521	-0.42
88	365	-0.40



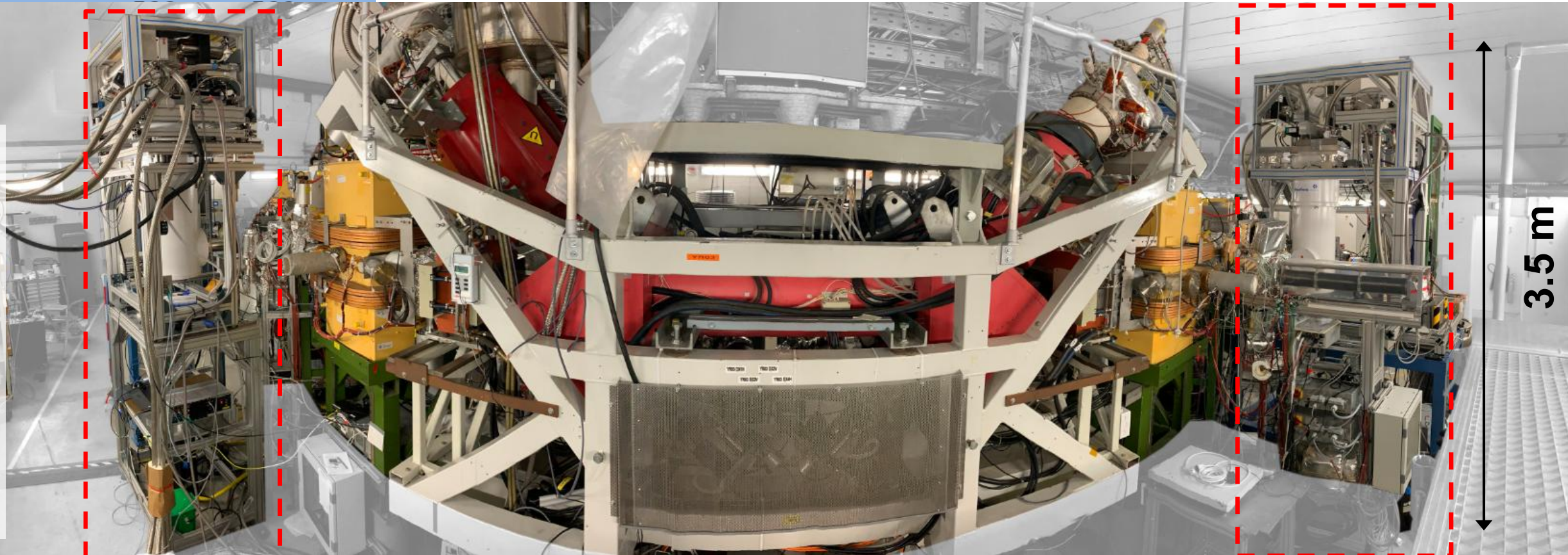
MMC/SPECTROSCOPY SETUP AT CRYRING@ESR

180° detector

CRYRING electron cooler

0° detector

P. Pfäfflein et al., Phys. Scr. 97, 114005 (2022)



3.5 m

Excellent **linearity**
Good **timing** capabilities

P. Pfäfflein et al., Phys. Rev. Lett. 134, 153001 (2025)

PRECISION SPECTROSCOPY OF TWO-ELECTRON ONE-PHOTON TRANSITIONS

Proposal@PETRA III: High-resolution spectroscopy of x-ray fluorescence following excitation of two-electron-one-photon transitions with a MMC detector (K $\rightarrow$ L transitions in He-, Li- and Be-like Krypton ions)

Challenge: To resolve the higher-order TEOP transitions from the nearby first order K $\rightarrow$ L transitions.



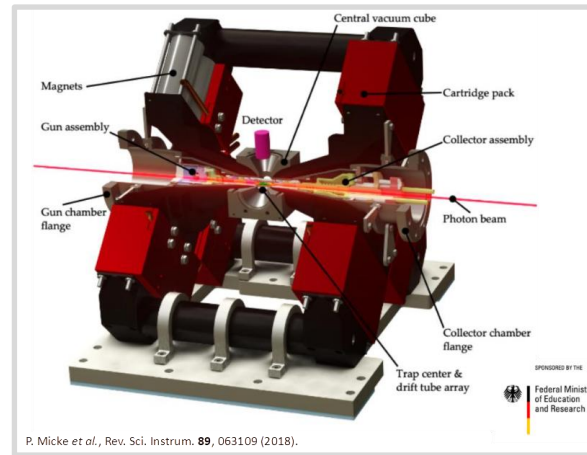
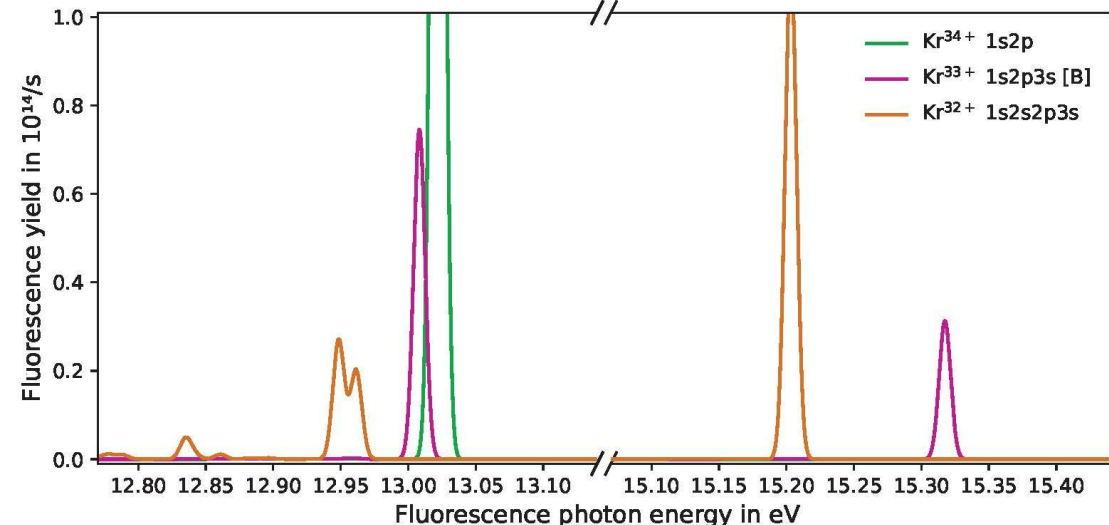
Daniel Müller



Johanna Walch

Experiment proposal submitted

PolarX-EBIT as an ion target at PETRA III / S. Bernitt



- **Li- and Be-like TEOP transitions** that result in doubly-excited states whose are expected to be strongly influenced by multi-electron effects

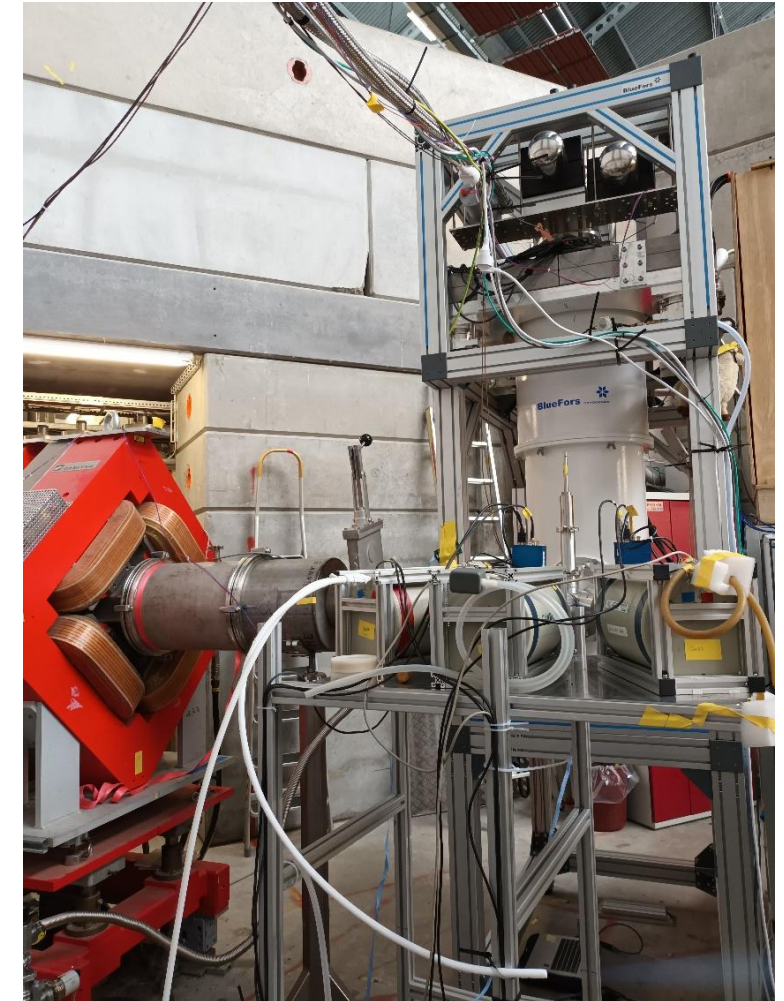
Well aligned with the innovation pool project **QS4Physics**

MICRO-CALORIMETER EXPERIMENTS AT PSI

Nuclear Charge Radius of ^9Be from Muonic Atom Spectroscopy Using a Microcalorimeter

Ofir Eizenberg^{1,2}, Shikha Rathi^{1,3}, Andreas Abeln⁴, Sonia Bacca^{5,6}, Gonçalo Baptista³,
Nir Barnea⁷, Noam Burger^{1,2}, Thomas Elias Cocolios⁸, Marie Deseyn⁸, Tim Eger^{5,6},
Christian Enss⁴, Andreas Fleischmann⁴, Loredana Gastaldo⁴, César Godinho^{3,9}, Nitzan Goldberg,⁷
Michael Heines⁸, Daniel Hengstler⁴, Paul Indelicato³, Weiguang Jiang^{5,6}, Klaus Kirch^{10,11},
Andreas Knecht¹⁰, Daniel Kreuzberger⁴, Jorge Machado⁹, Ulf-G. Meißner^{12,13,14},
Ben Ohayon^{1,2,*}, Nancy Paul³, Randolph Pohl^{15,6}, Tim Redelbach¹⁵, Michael Roosa³,
Katharina von Schoeler¹¹, Quentin Senetaire³, Shihang Shen¹⁴, Daniel Unger⁴,
Stergiani Marina Vogiatzi^{15,16,5}, **Johanna Walch^{17,18,19}**, Frederik Wauters^{5,6} and Aziza Zendour^{10,11}

Submitted to PRL; <https://doi.org/10.48550/arXiv.2607.13690>



SUMMARY

- UNILAC incident has a substantial impact on our research at HI Jena.
- Running PhD projects redirected to external research infrastructures and are progressing.
- Young investigator groups can continue to develop their research environment at HITRAP. First experiments rely on EBIT sources and mid-Z ions from the ESR.
- ERC projects HiTHOR will be prolonged by two years and concentration on the development of the required infrastructure.
- Goal: HITRAP as a research platform for metrology and precision experiments based on trapped highly-charged ions from local ions sources and from the ESR.

