

Field Ionization Unit (FIU) Upgrades for 2025

CRIS Collaboration meeting 2025

Osama Ahmad

Supervisor: Prof. dr. Gerda Neyens
Co-supervisor: Dr. Jessica Warbinek

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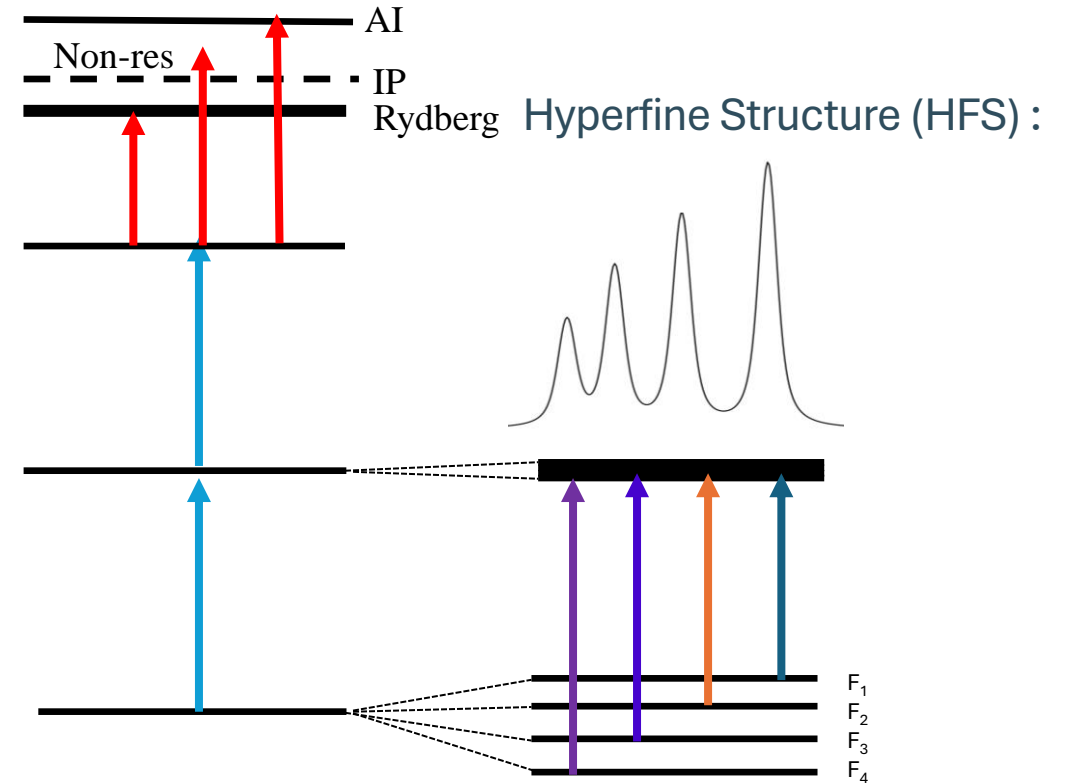
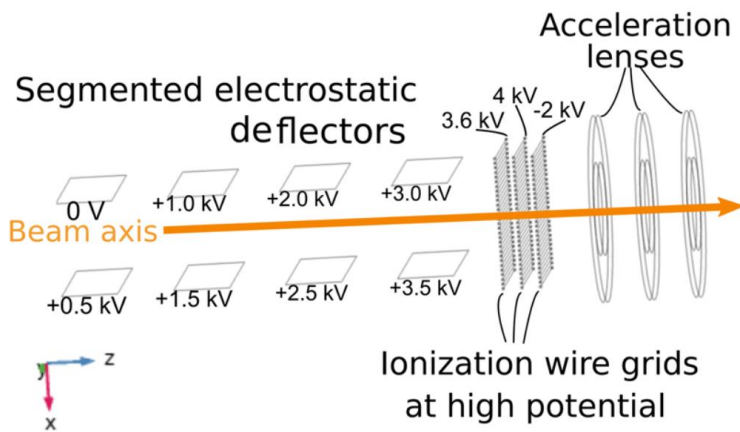
- Field Ionization (The idea)
- FIU 2024 (Results)
- FIU@CRIS (Current design)
- Technical upgrades
- Outlook

Field Ionization

Reducing the background contributions from:

- Collisional ionization
- Laser related background, especially from high power non-resonant step
- FIU via Rydberg state makes high power laser obsolete

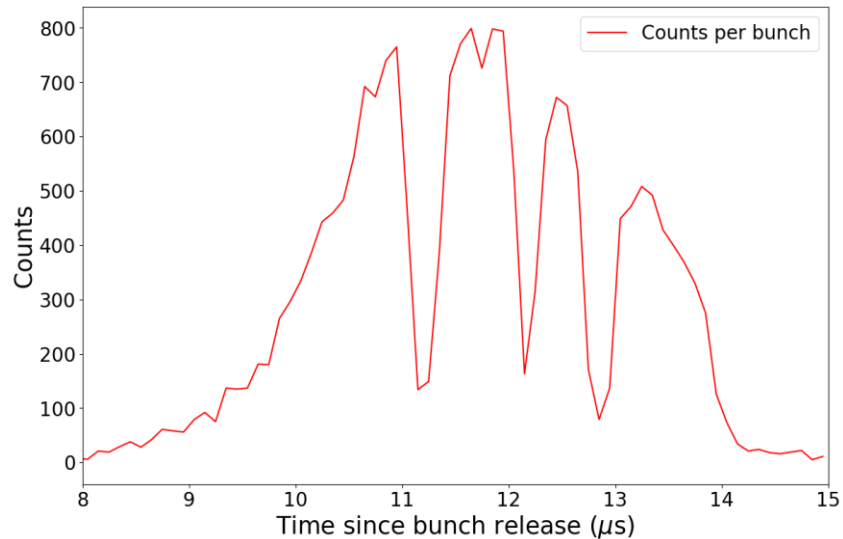
Electric field ionization of Rydberg states in a collinear geometry



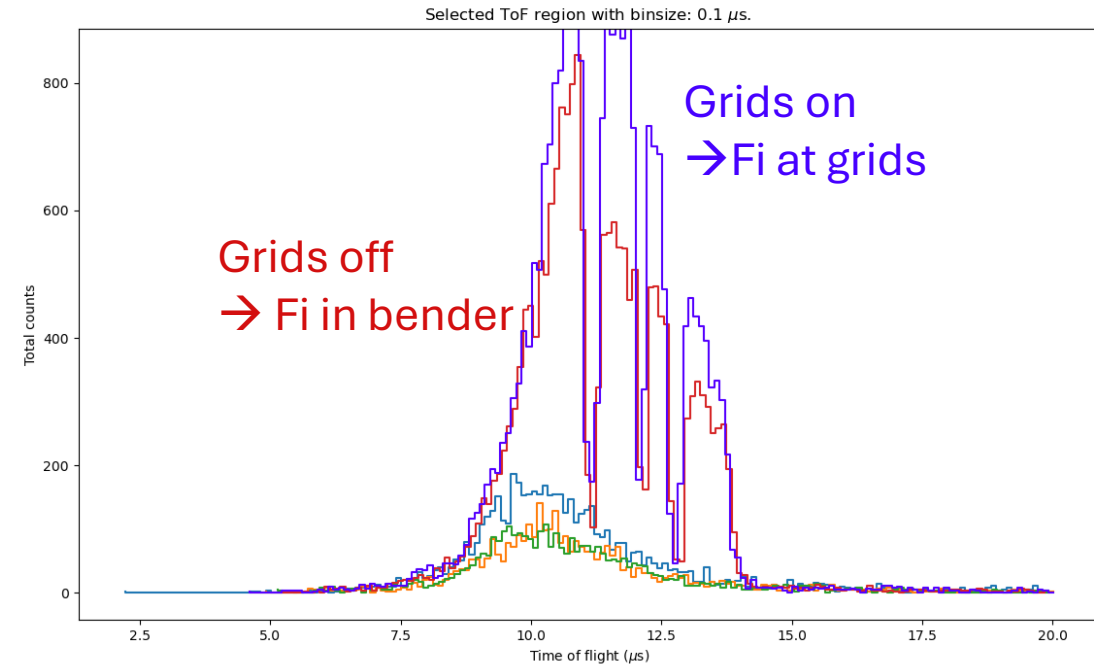
Online commissioning

Field ionized K observed with beam from ISOLDE

See dips in ion bunch, not understood first



courtesy Osama



courtesy Pierre

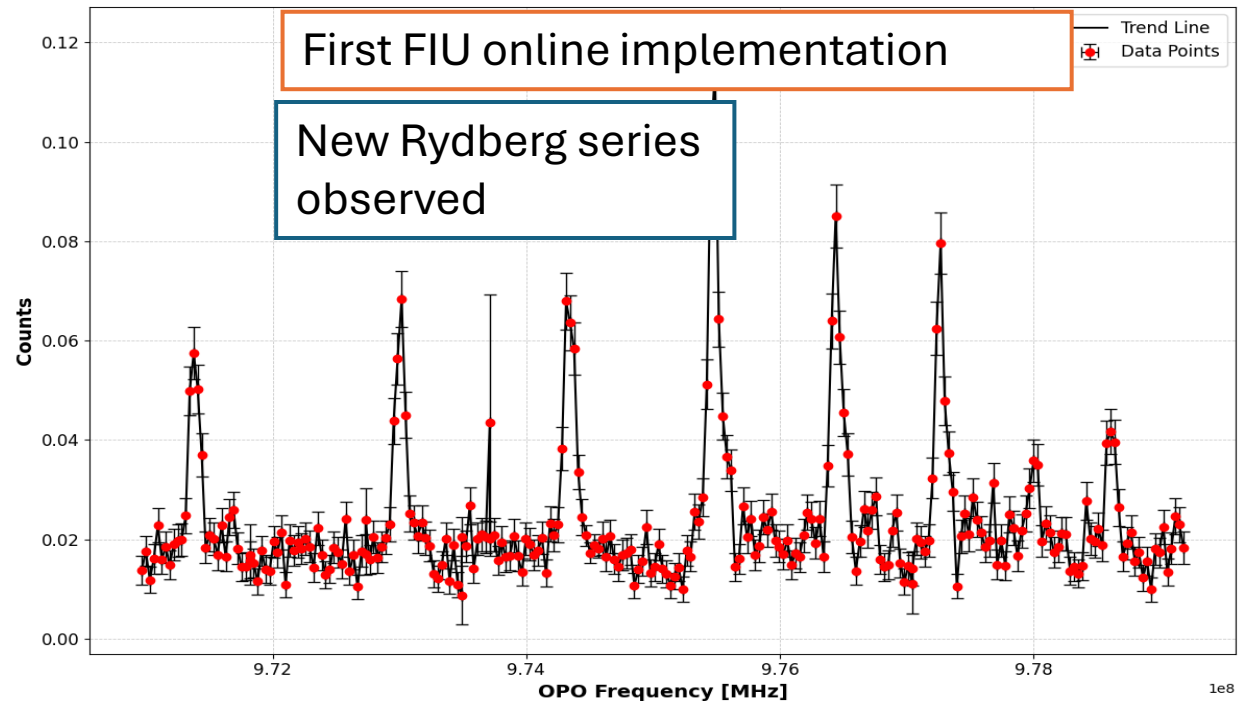
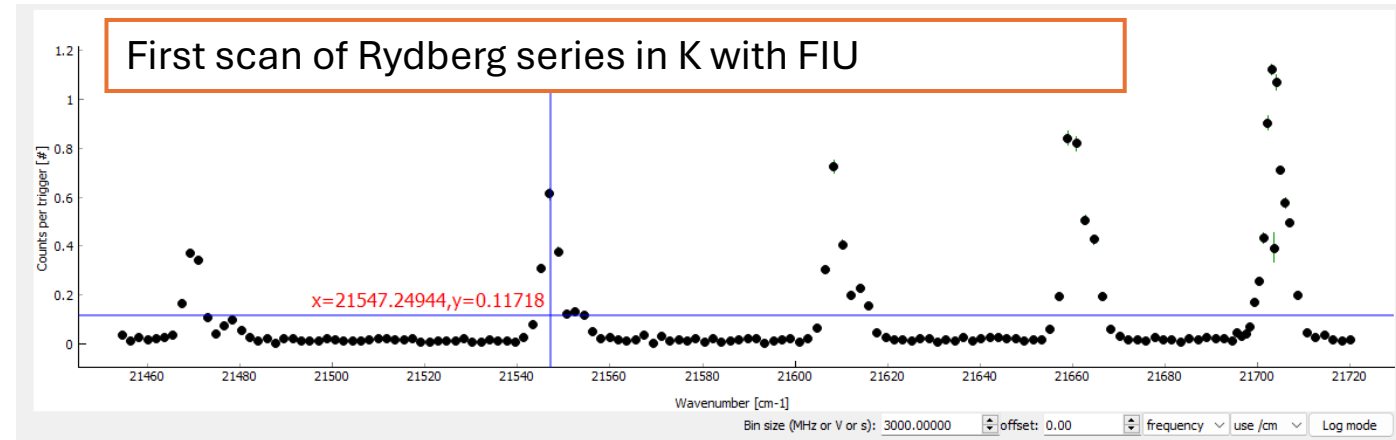
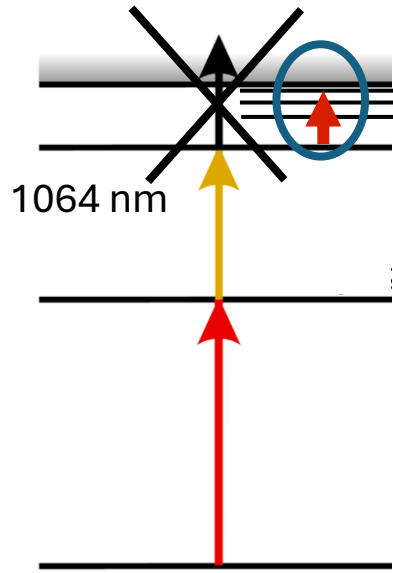
High-lying Rydbergs ($n=24$) affected strongly by Stark shift

Atoms at locations with strong field along beamline not Rydberg excited

\rightarrow field ionization not effectful

Resolved with lower CEC deflector potentials and lower Rydbergs ($n=18$, K)

First results



FIU via Rydberg state makes high

power laser obsolete

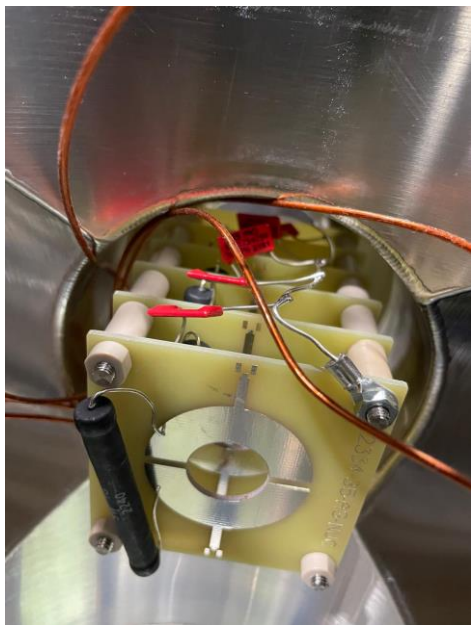
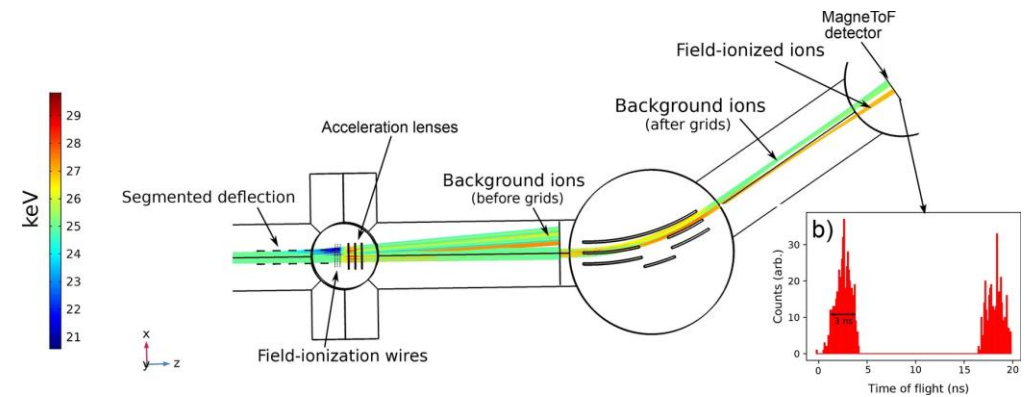
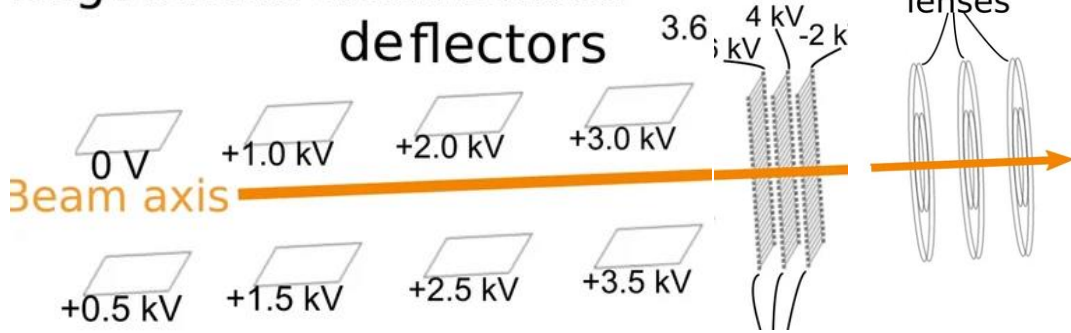
Field ionization unit successfully implemented

Principle shown with stable K beam

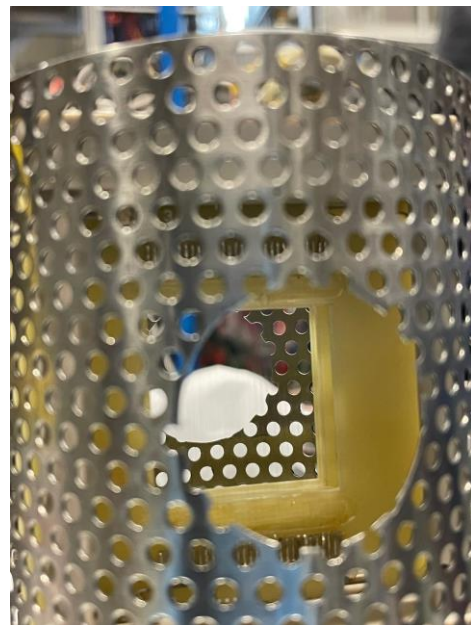
Successful for Fr during winter physics 2024.

Current design

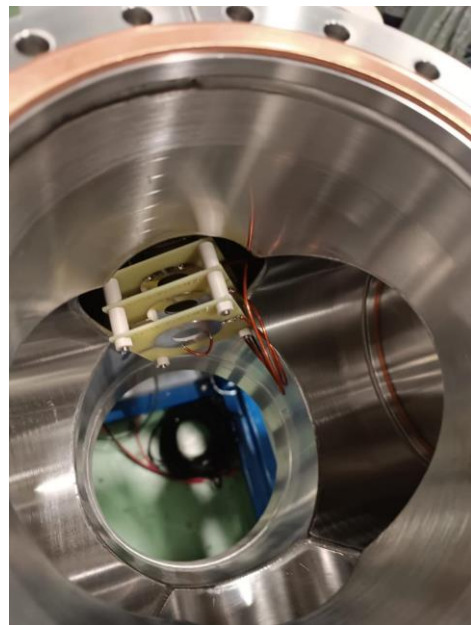
Segmented electrostatic deflectors



Deflectors



Grids



Acceleration lenses

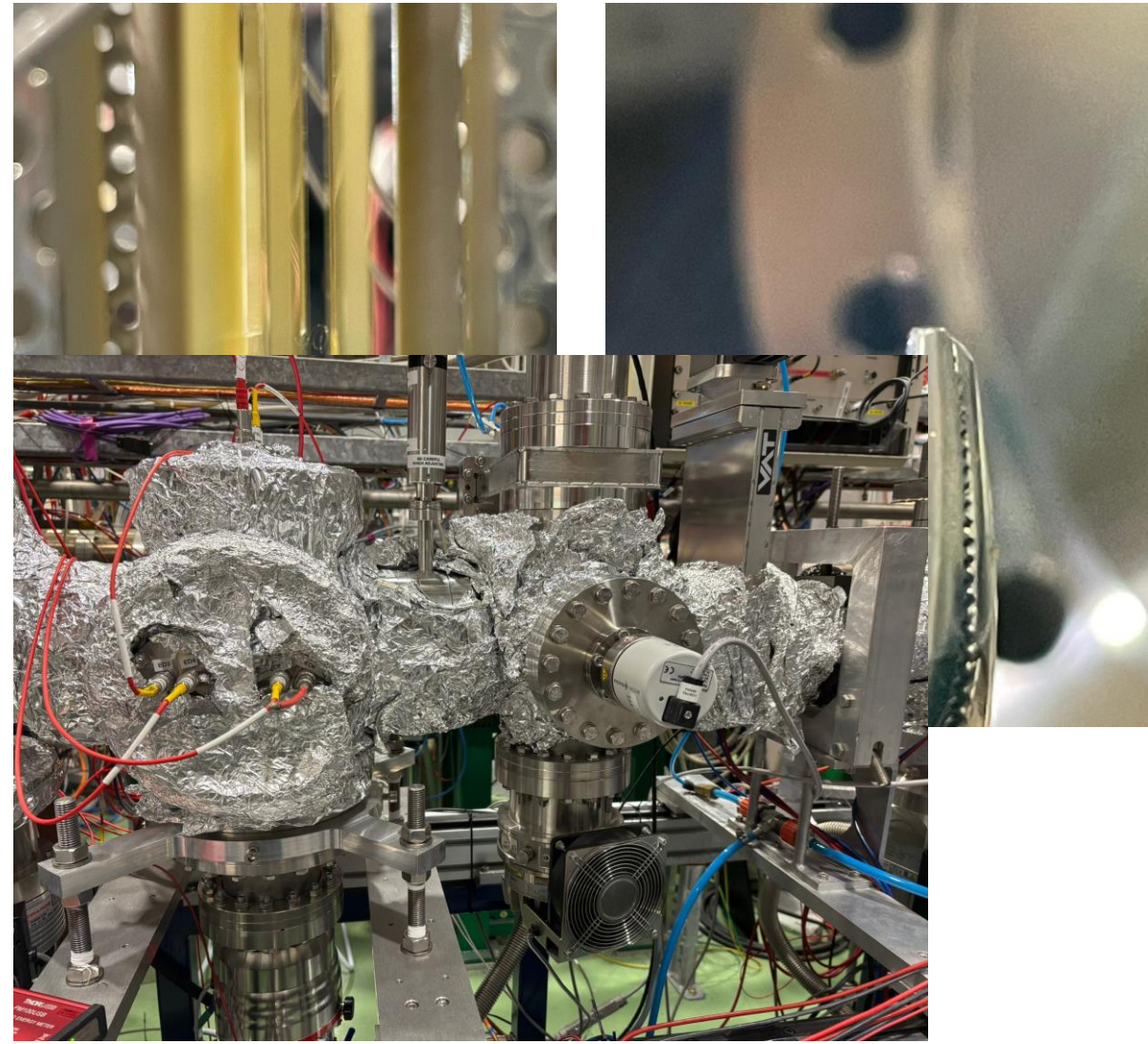
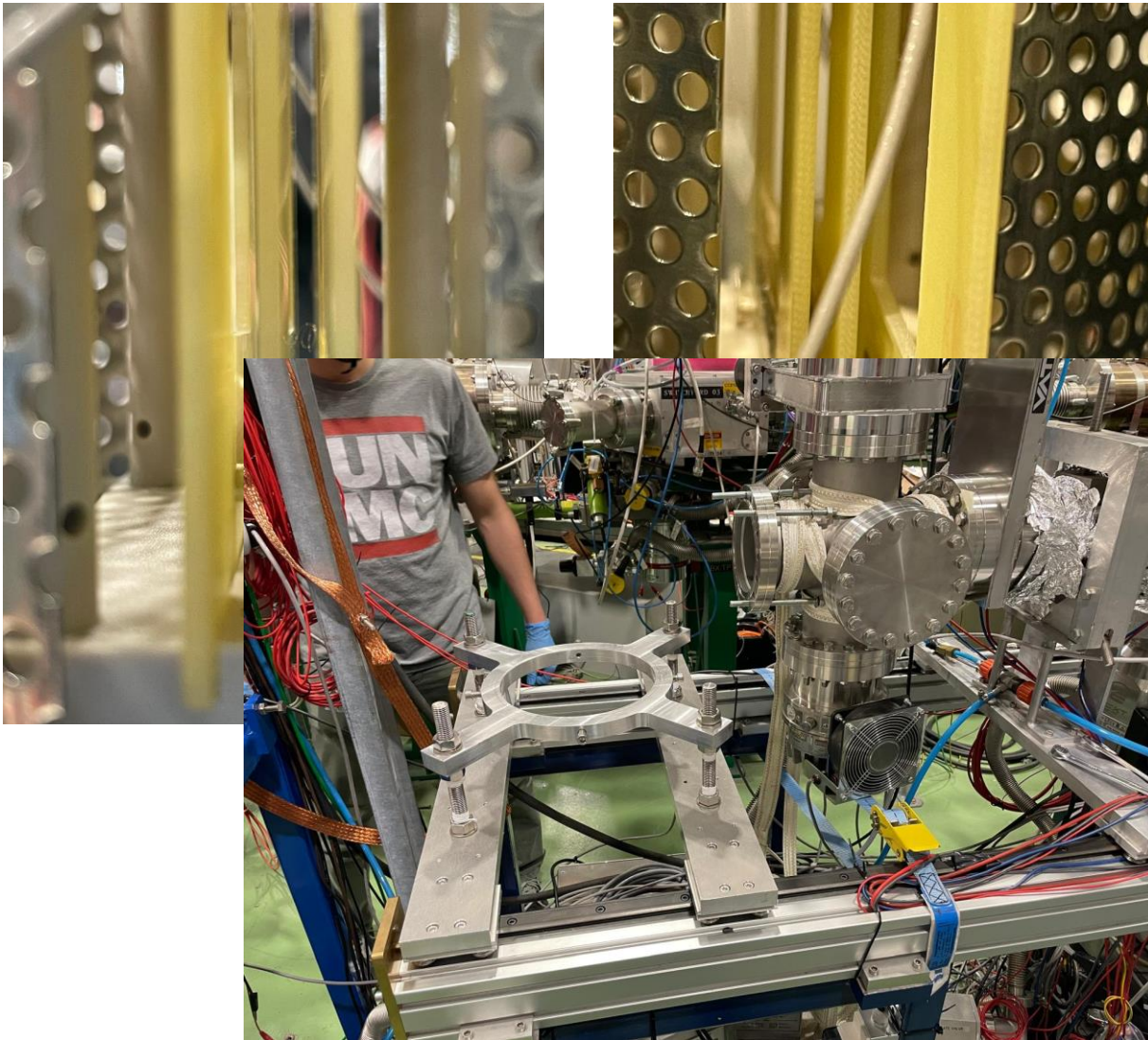
- Acceleration lenses are redundant with our bunch width.
- Limitation in vacuum in IR
- Grids shortening issues.

Problems

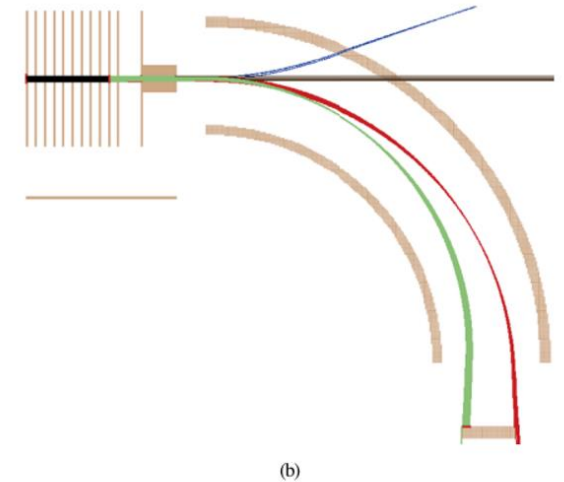
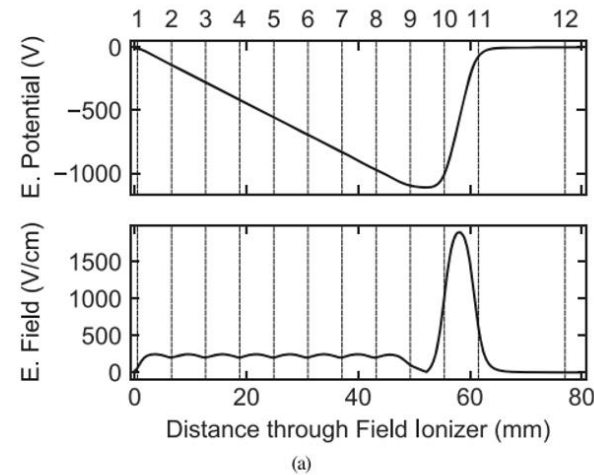
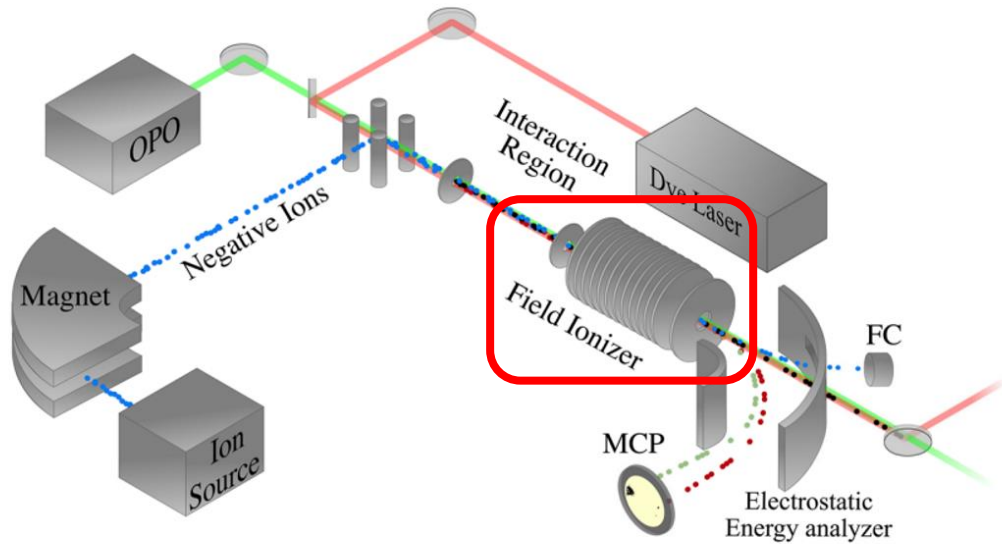
GRIDS SHORTENING



ASSEMBLY

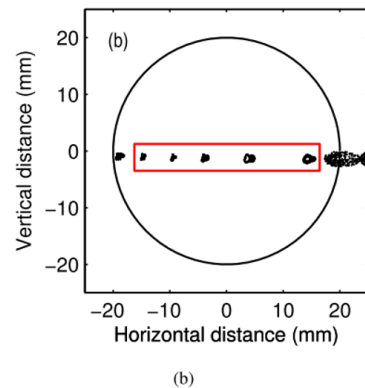
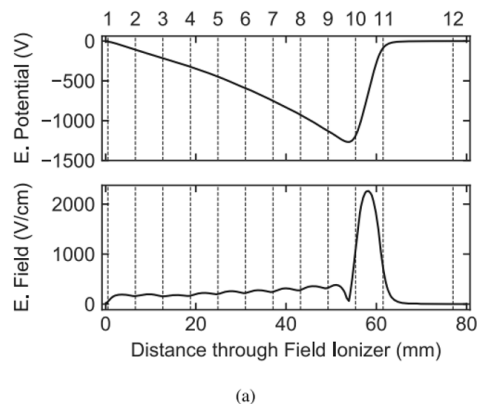


New design

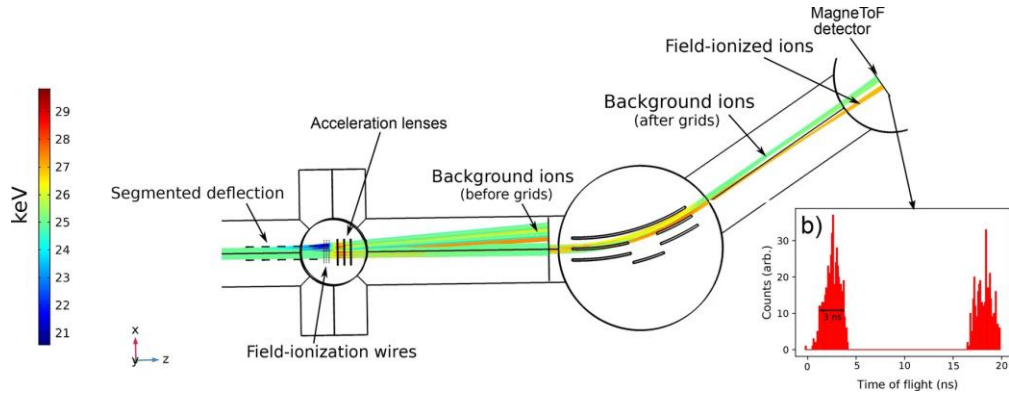


Based on GUNILLA setup @ Gothenberg.

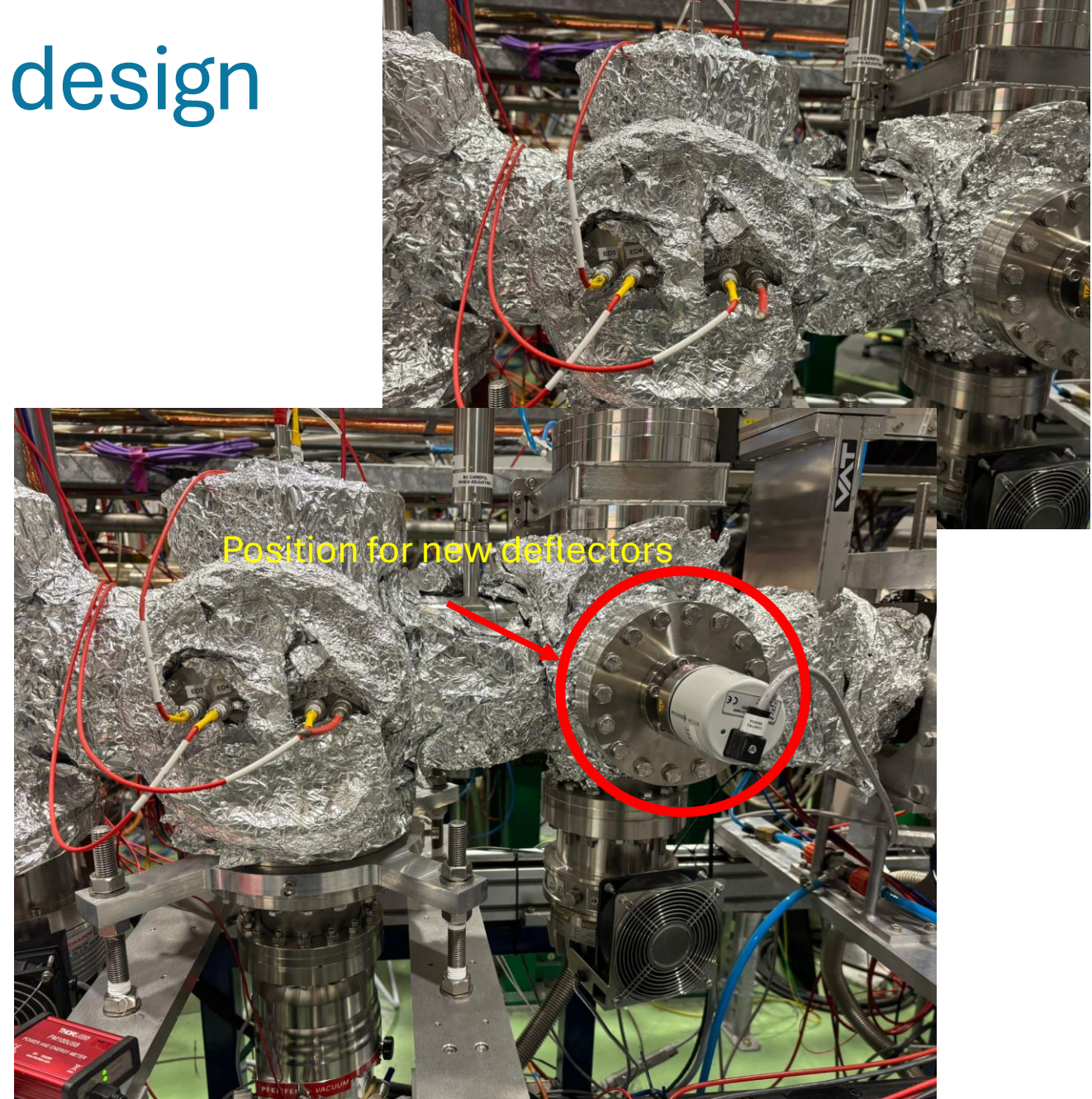
- Instead of GRIDS, using a set of parallel coaxial circular plates.
- First plate is at ground potential, ensuring a field free interaction region.
- All the other plates can be individually biased.
- Different Rydberg states being ionized at different location in the Field Ionizer which can be identified with MCP.



New design

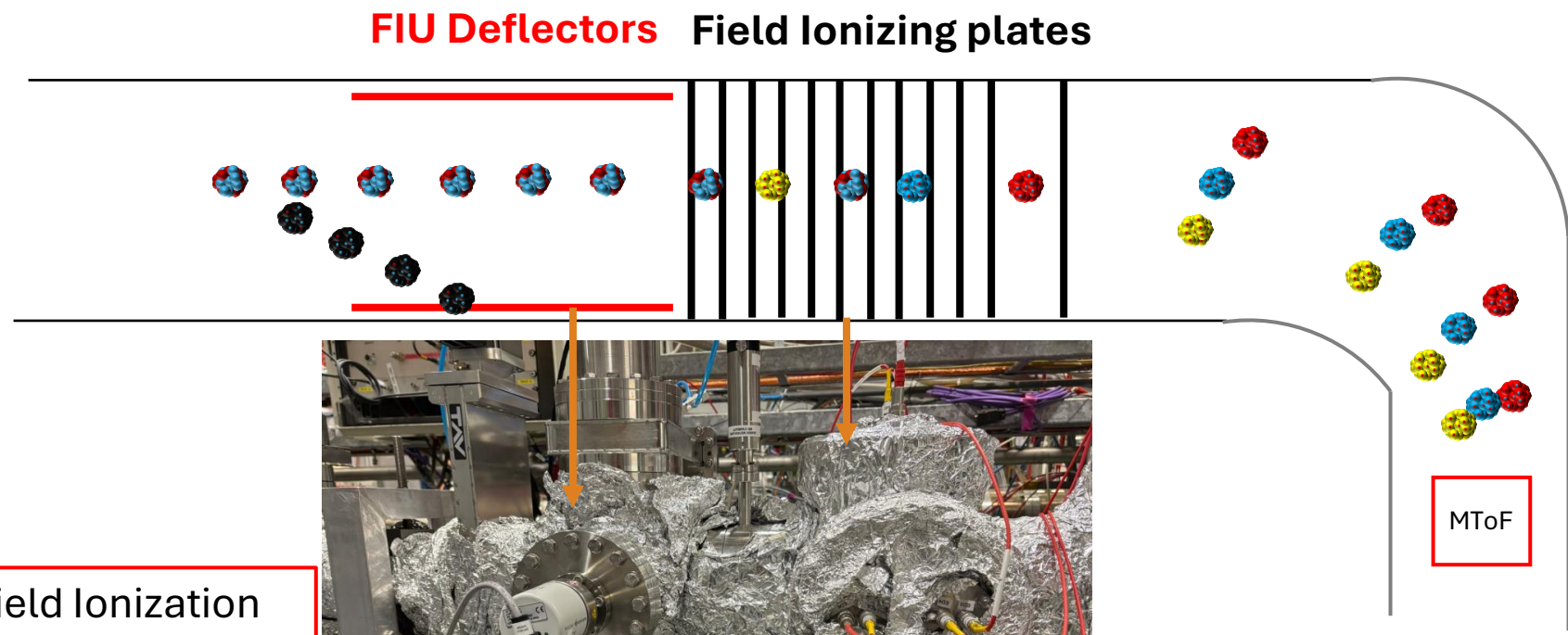


- Getting rid of the acceleration lenses.
- Change in the design of the deflectors design and assembly.
- Designing the deflectors like plates, similar to the ion source bender (instead of rings with PCB)

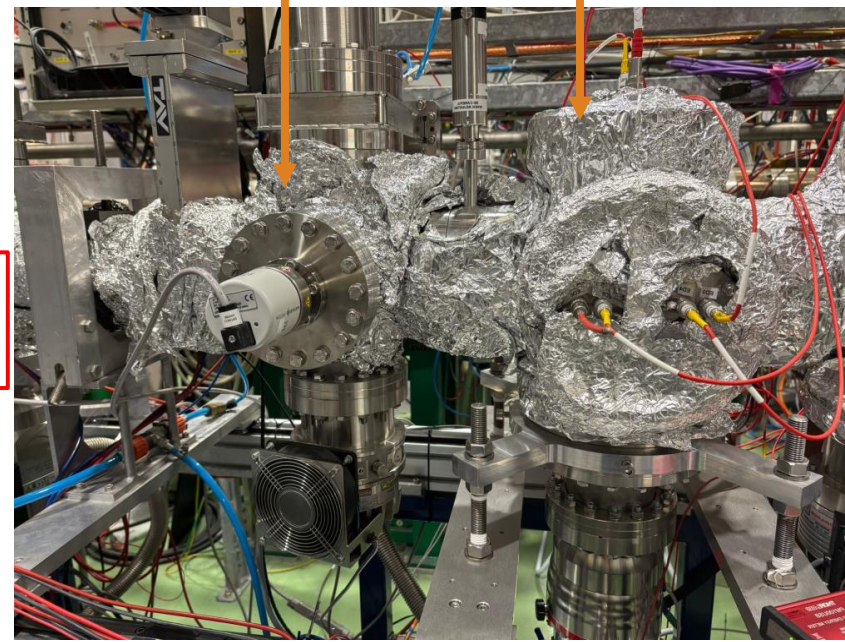


New working design

- Collisionals
- Rydbergs
- High n-rydbergs
- Medium n-rydbergs
- Low n-rydbergs



Separate assembly of Field Ionization plates and the deflectors



Outlook

- Work already started on the new design of the FIU
- Need the CAD drawings of the CEC deflectors
- SIMION simulations to be performed for the number of ionization plates

Advantages

- Better vacuum in the Interaction Region (IR).

- B

- R

- R

- More accessible IR.

Next step

Laser spectroscopy of K isotopes with 3 step scheme and FIU during ISCOOL commissioning (Technical paper) and In (Jessica's proposal).

THANK YOU

CRIS collaboration



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sck cen

