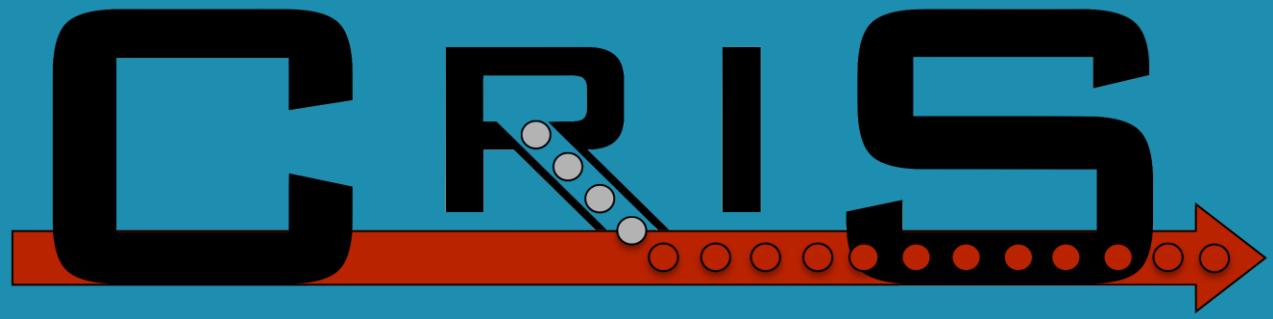
KU LEUVEN

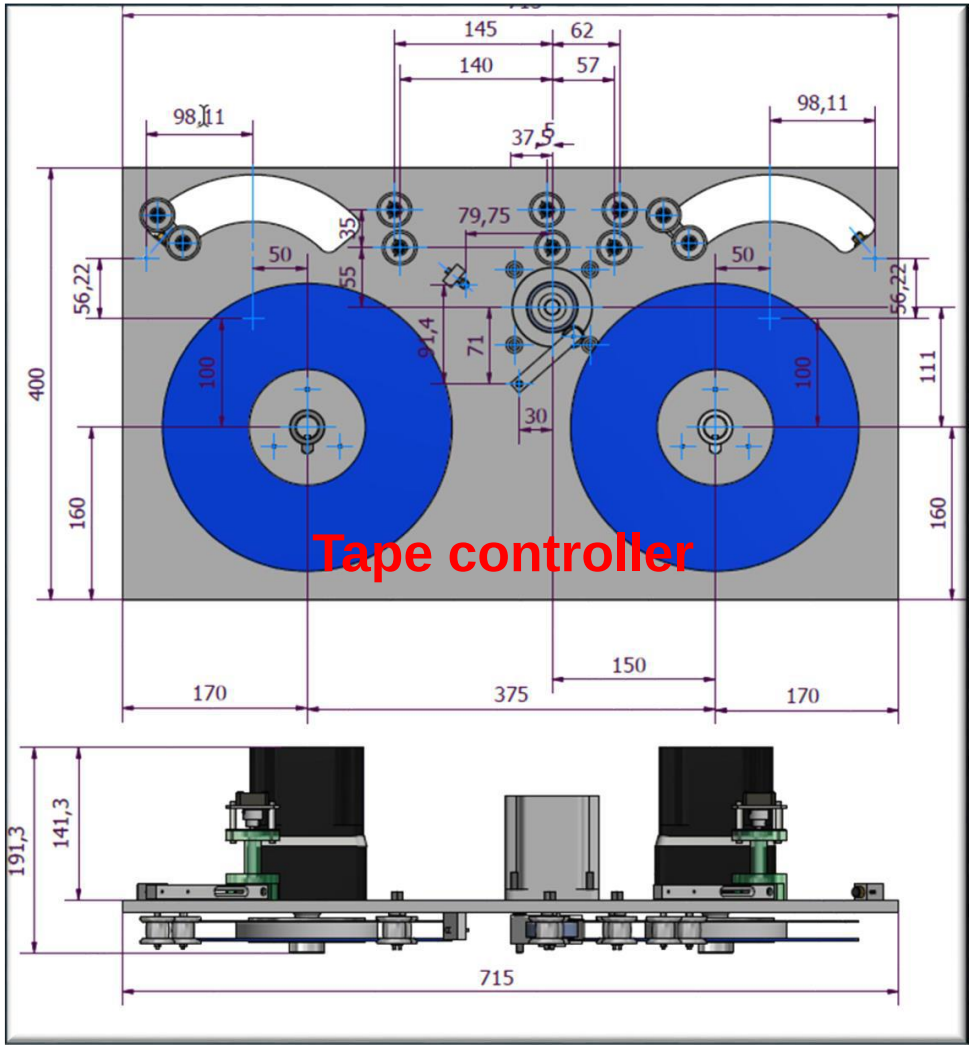
Commissioning of DSS at CRIS

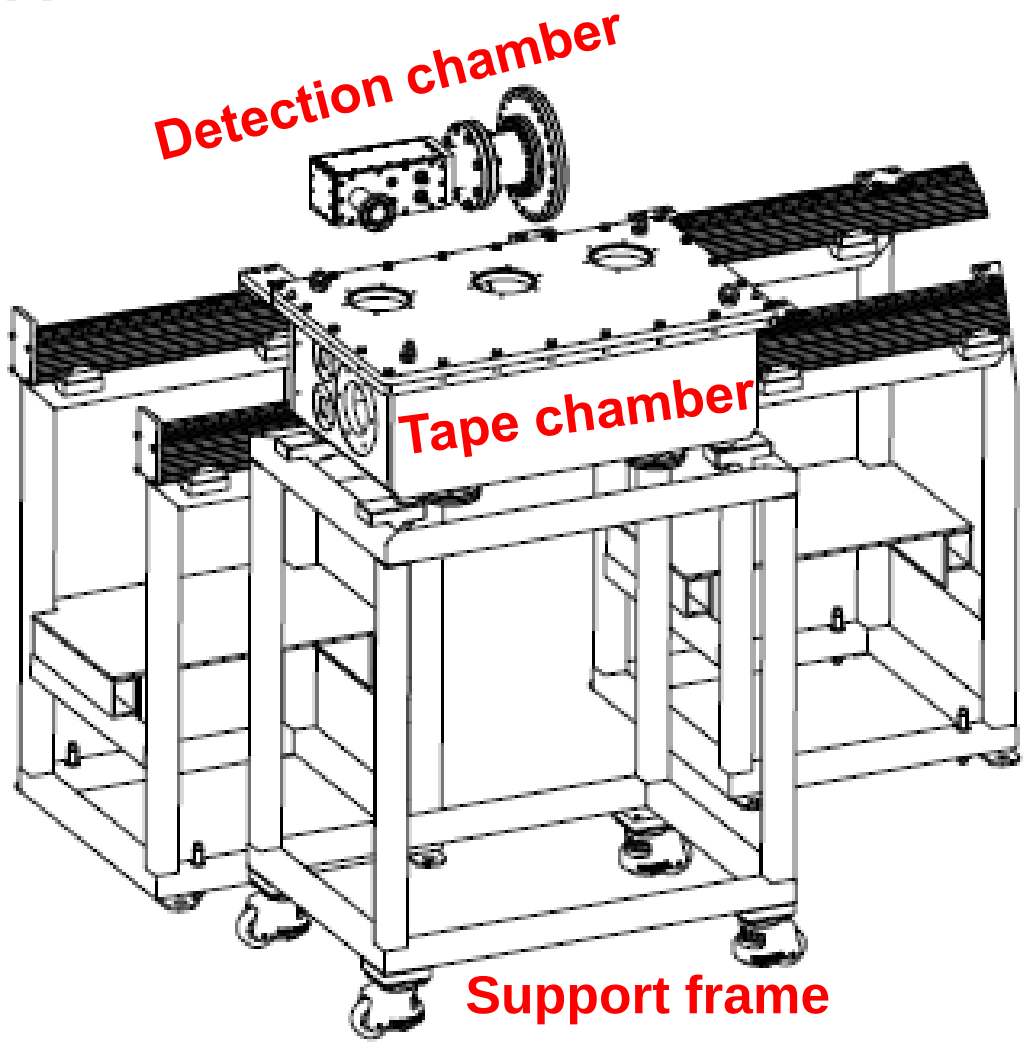


Bram van den Borne, Simone Casci

CRIS collaboration meeting 2025

Decay Spectroscopy Station





Introduction to DSS

Decay assisted laser spectroscopy

- Select isomer with certain decay channel
- Purify spectra based on decay[1]

Laser assisted decay spectroscopy

Measure both decay and ion counts

- Selectively ionise isomer of interest
- Purify spectra based on hyperfine structure[2]

[1] Koszorús Á., *et al.* Charge radii of exotic potassium isotopes challenge nuclear theory and the magic character of N = 32, Nature Physics **17**, 439-443 (2021).
[2] Lynch K.M., *et al.* Decay-assisted laser spectroscopy of neutron-deficient francium, Phys. Rev. X **4**, 011055 (2014).

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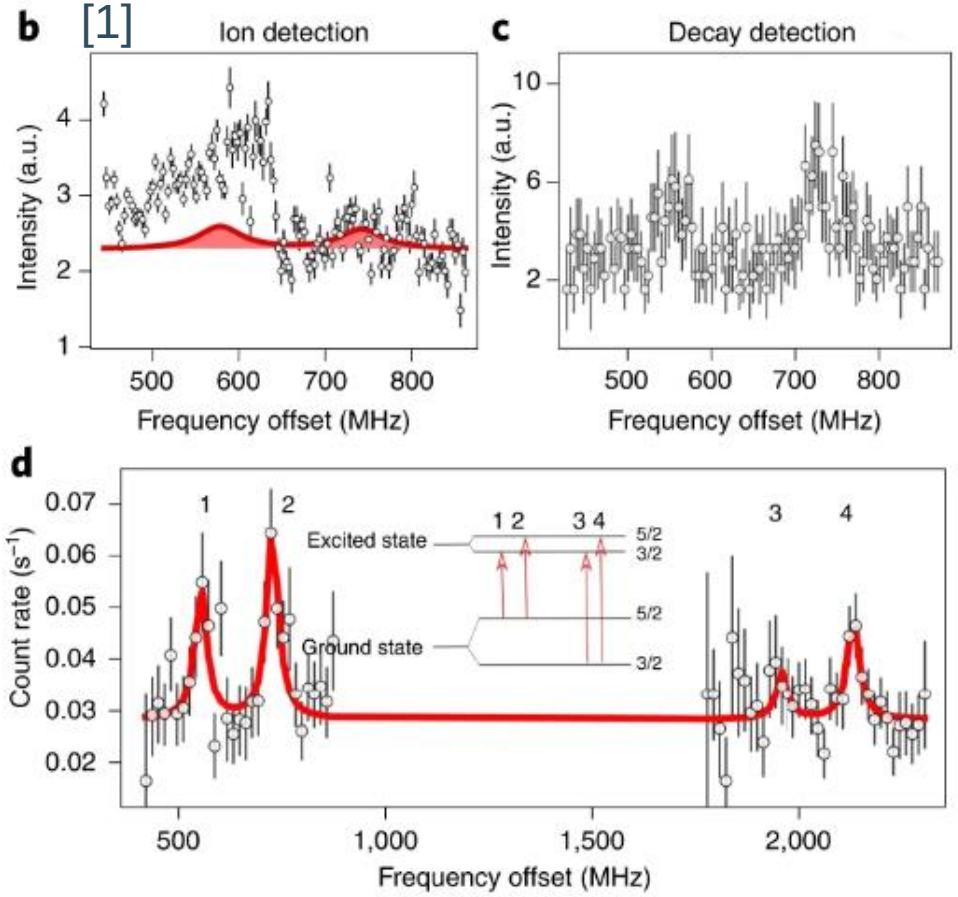
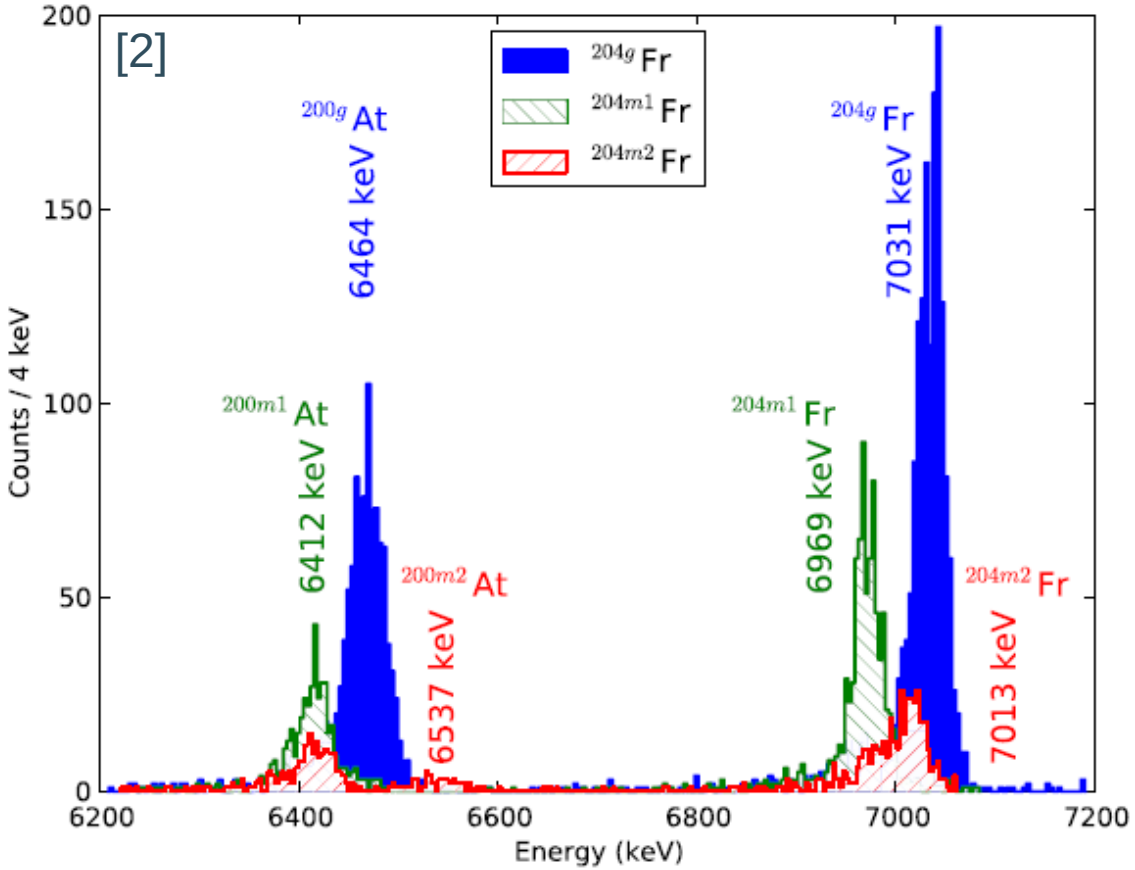
- [1]



- [2]



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Why tape station?

Move long-lived contaminants away from detector
No increasing background over time

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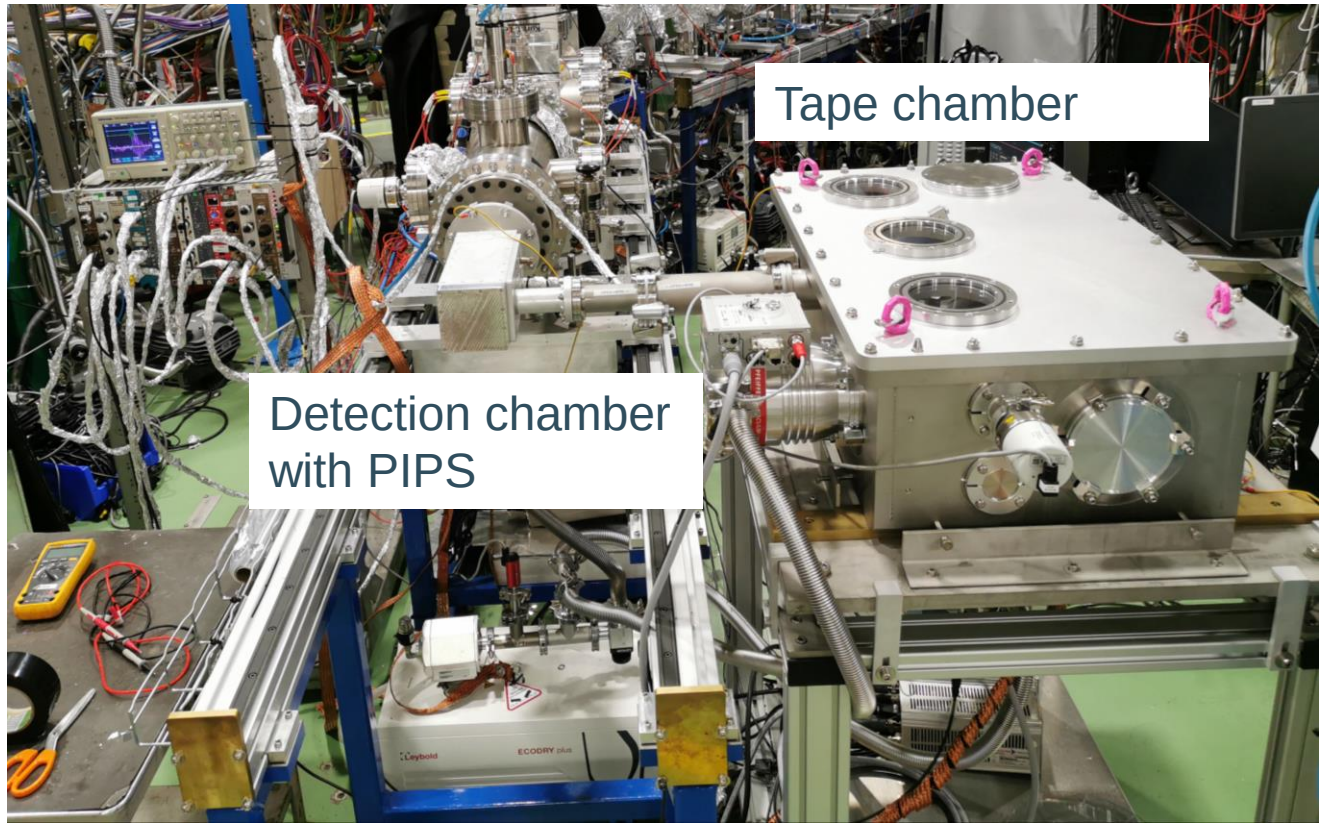
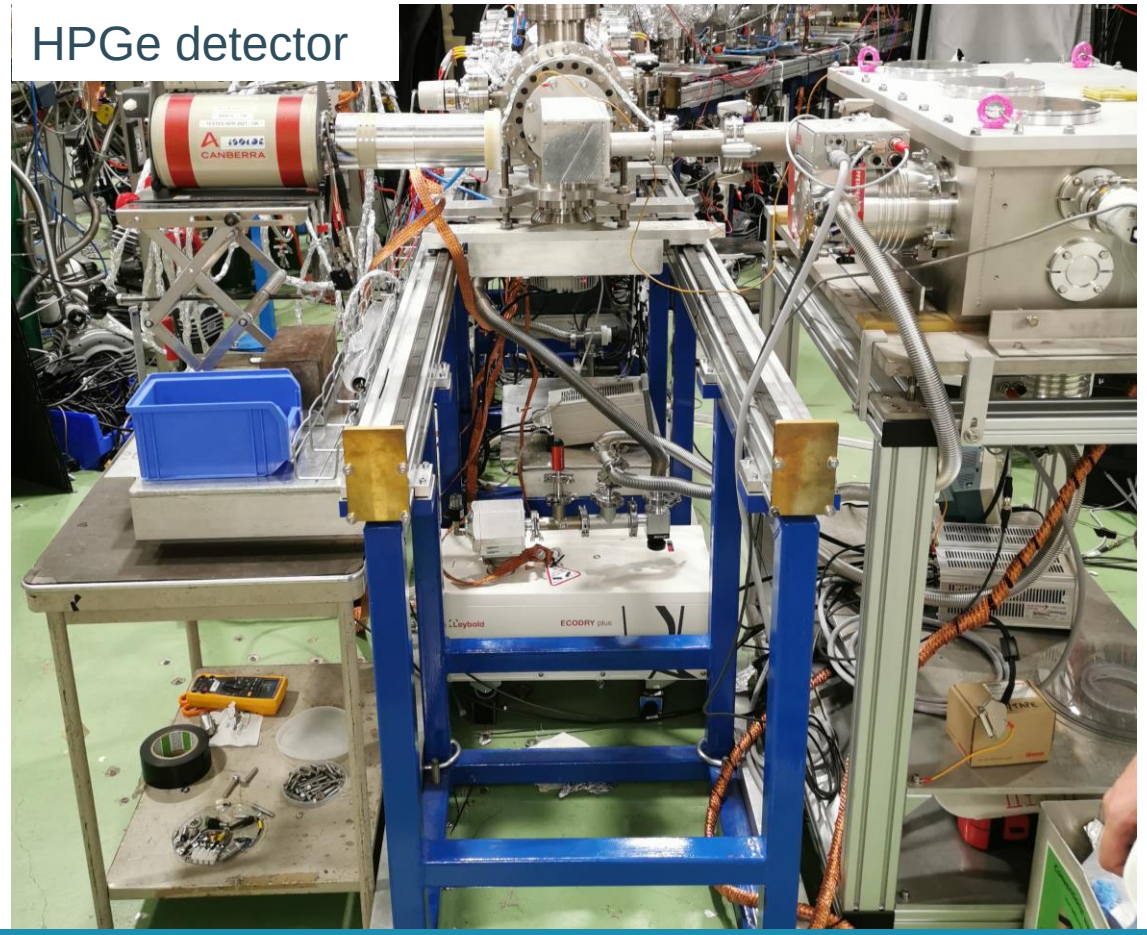
Zn beamtime in August 2023

- Test commission DSS tape station on ^{75}Zn



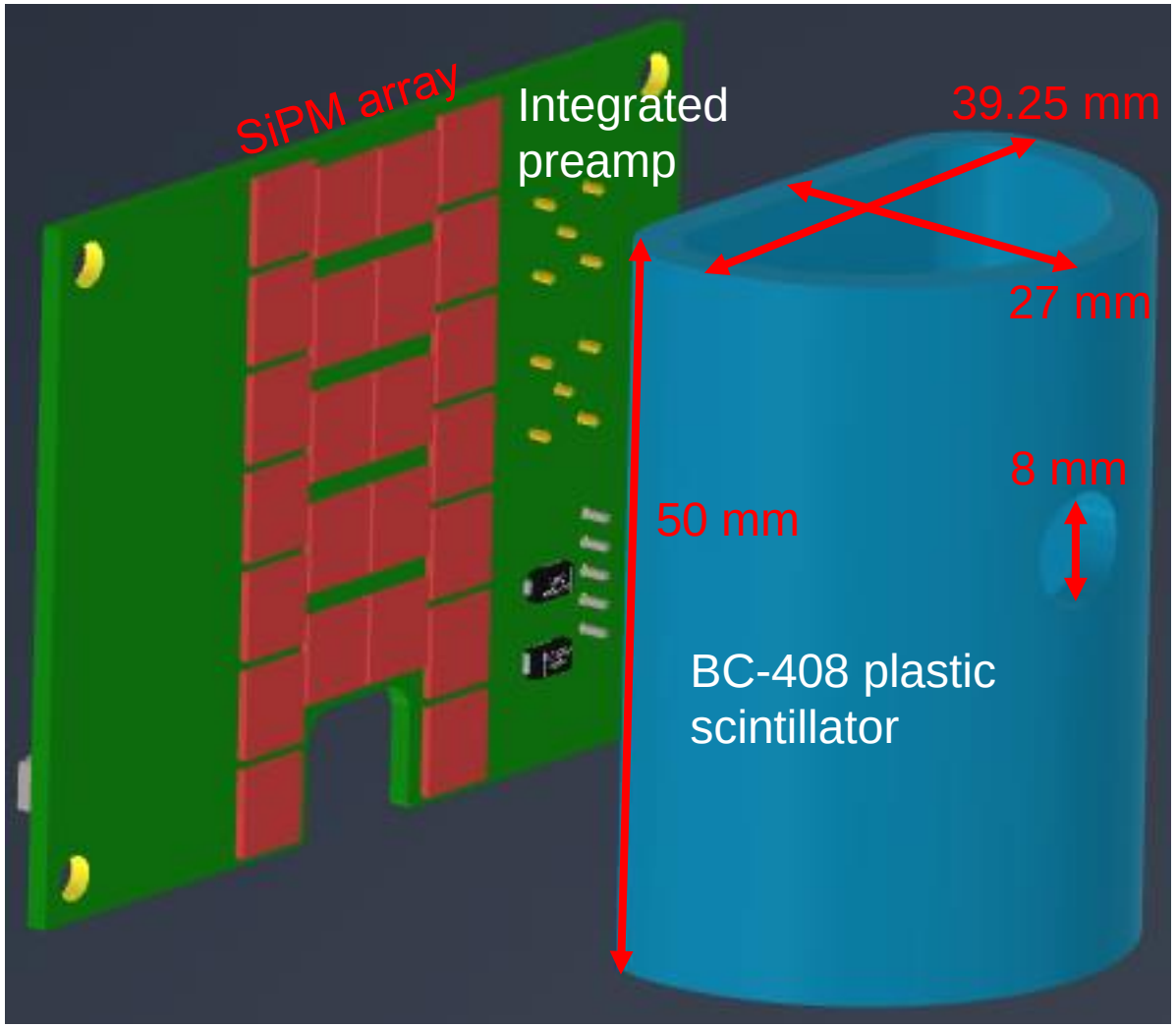


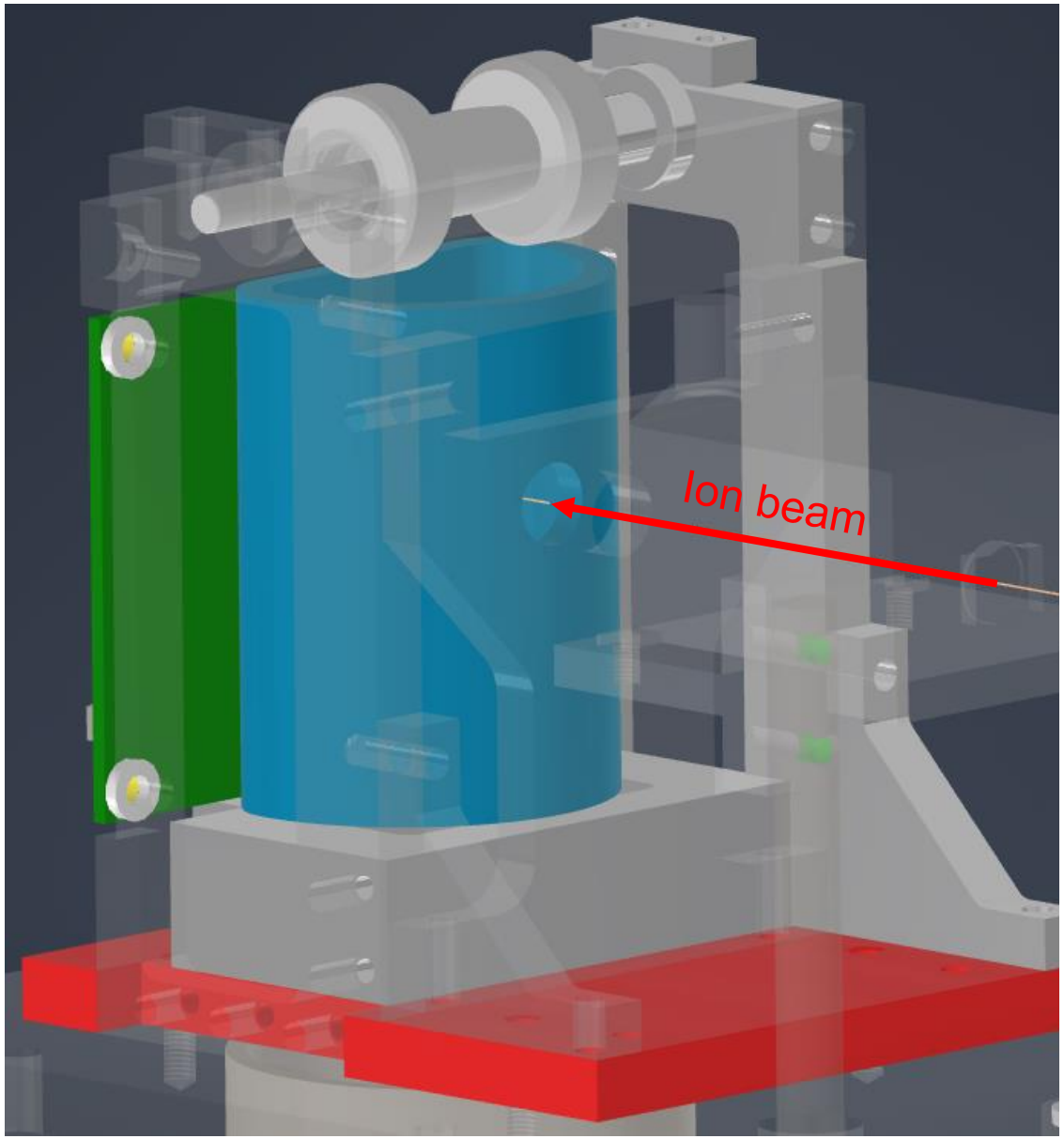
Shortcomings DSS during beam time

1. Detection efficiency of beta's
   - Plastic scintillator with SiPM
2. Beam diagnostics in detection chamber
   - MicroTOF in detection chamber
3. No CRIS owned controller for timing tape movement yet
   - Arduino for timing control

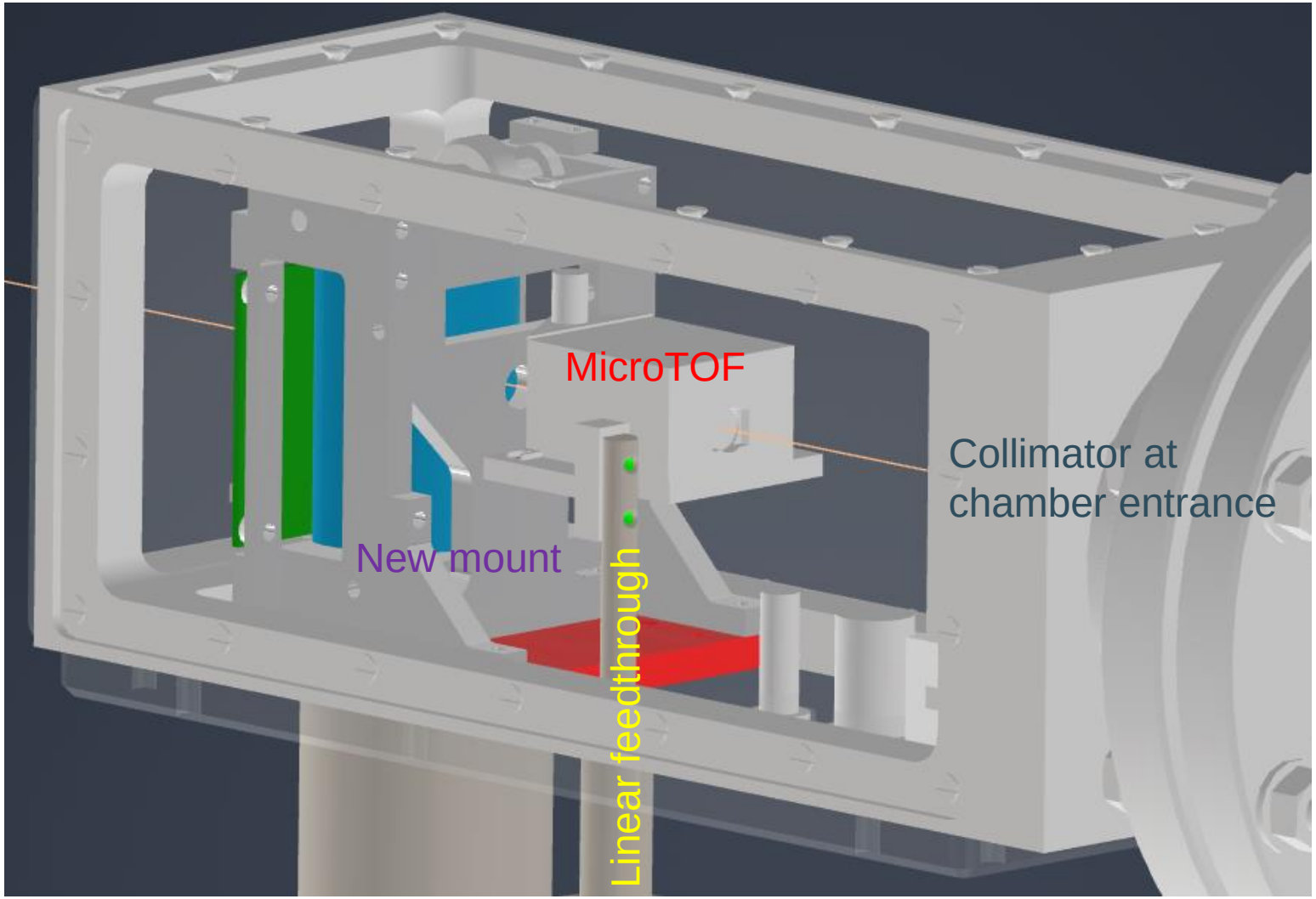
New Design DSS

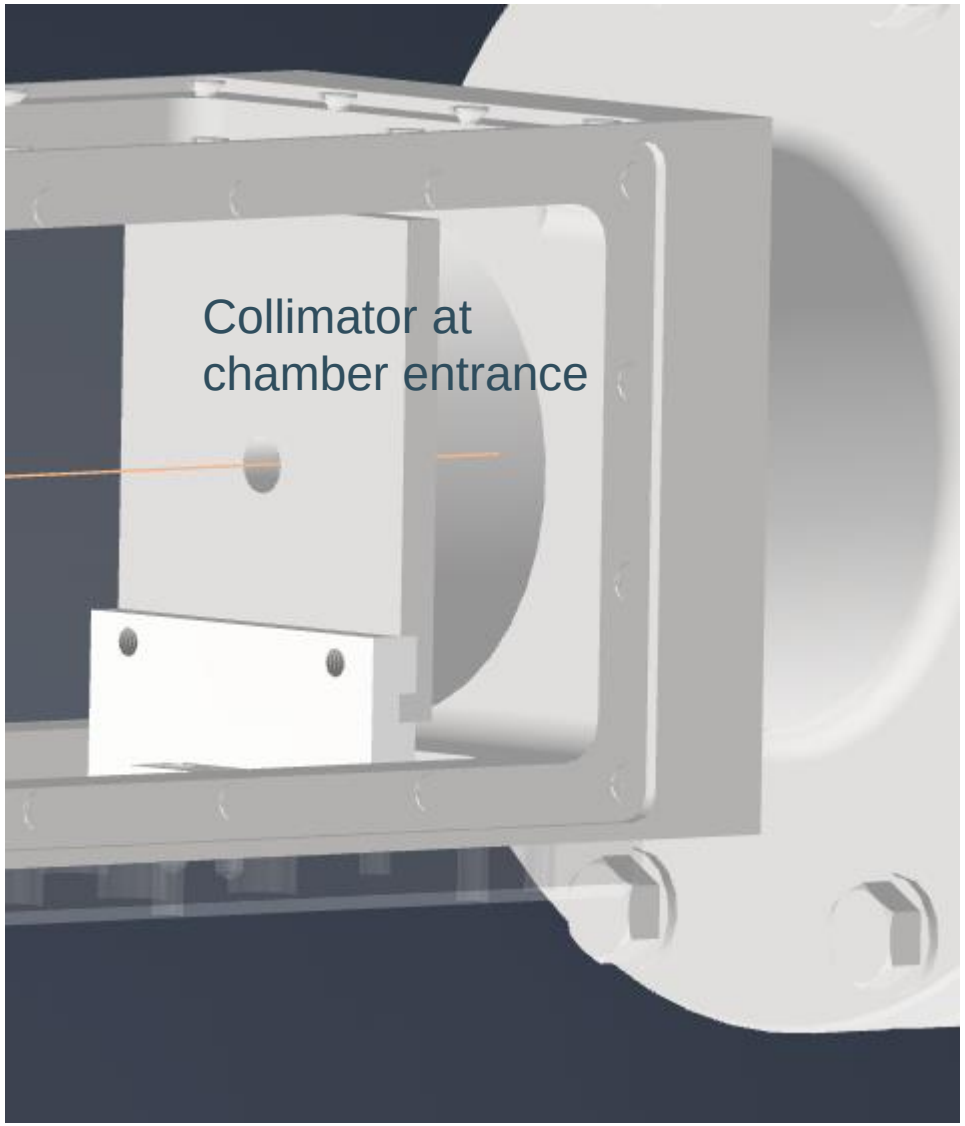
Design beta detection





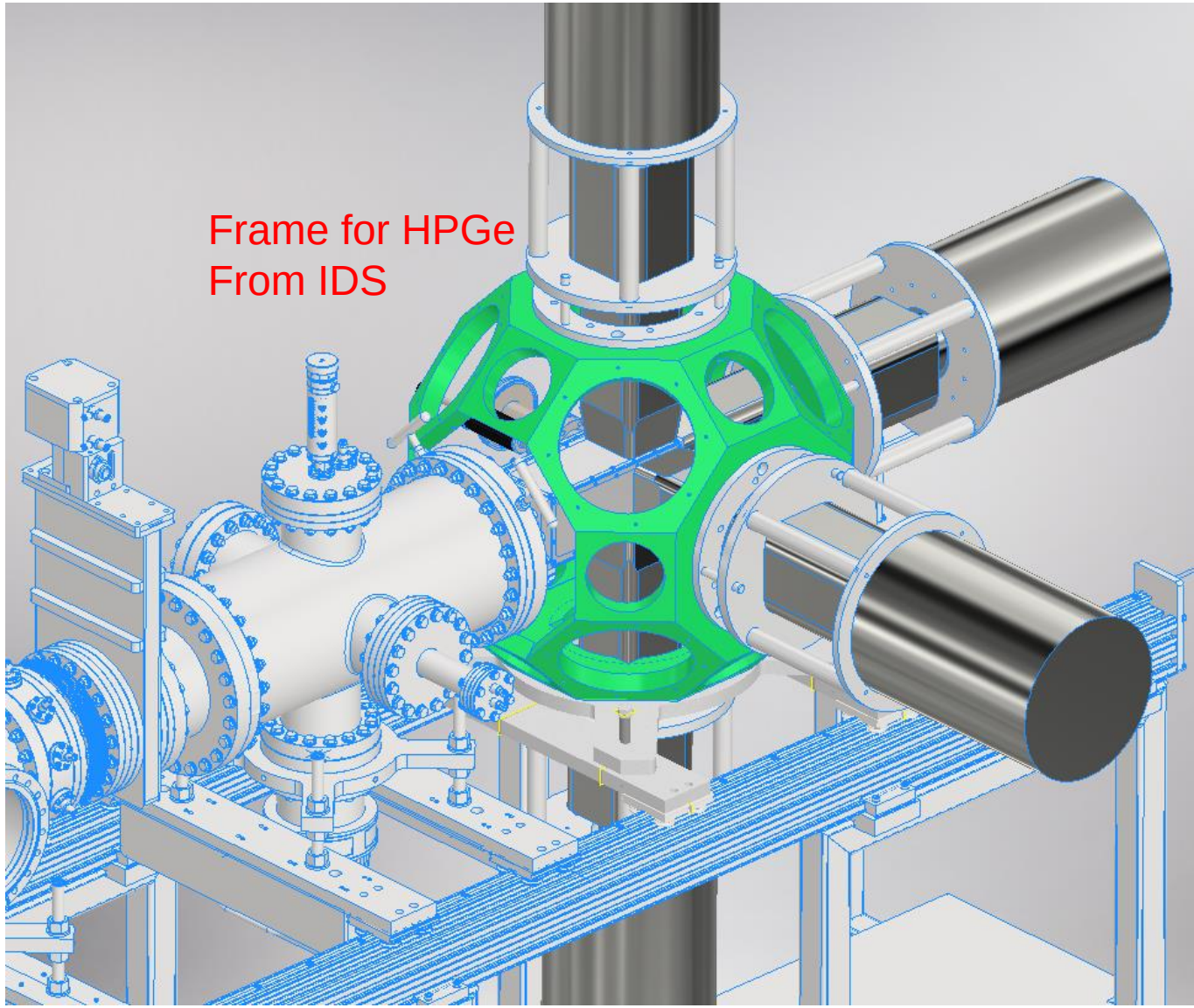
Design detection chamber





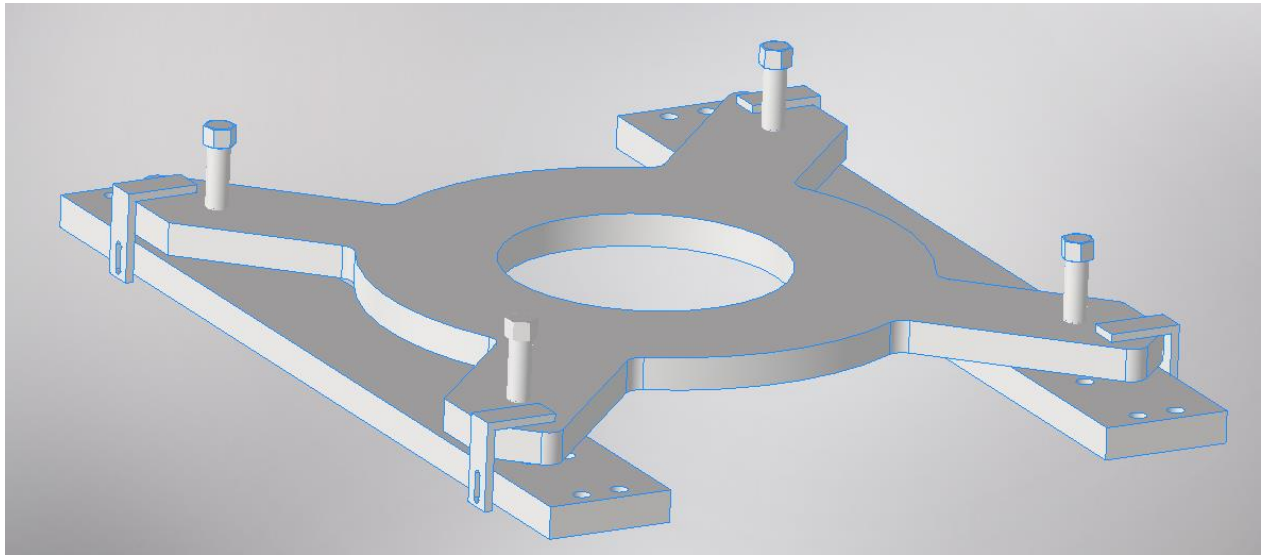
Design gamma detection

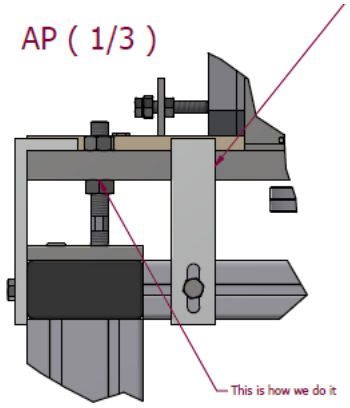
- HPGe frame from IDS (long-term storage):
  - Support structure on rails,
  - 3 – 4 HPGe Clovers from IDS
- OSIRIS faces can be removed to fit on the chamber

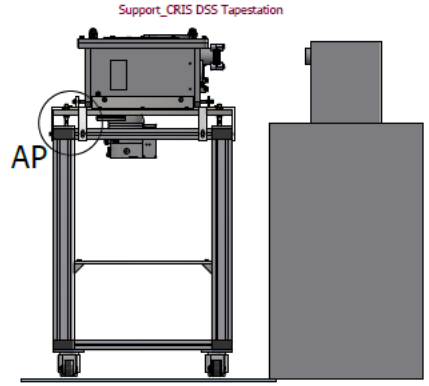


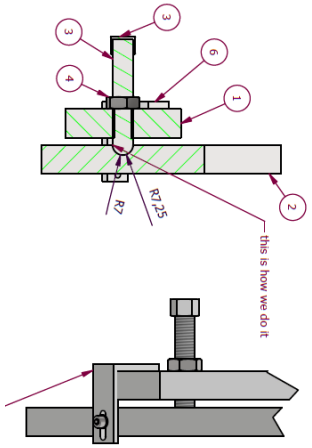
Design gamma detection support

- Mechanical support similar to that of DSS tape box
- Height-adjustable
- Safety file to be prepared
- To be manufactured by KUL workshop









DSS Commissioning

Commissioning plans 2025

22-28 January	18-26 February
• Vacuum test of the new baseplate • Paint and mount the scintillator • Offline test of the scintillator • Assemble scintillator + test vacuum • Setup Arduino timer for tape move	• Setup DSS signals to CRIS DAQ • Offline test under vacuum with non-resonant laser on

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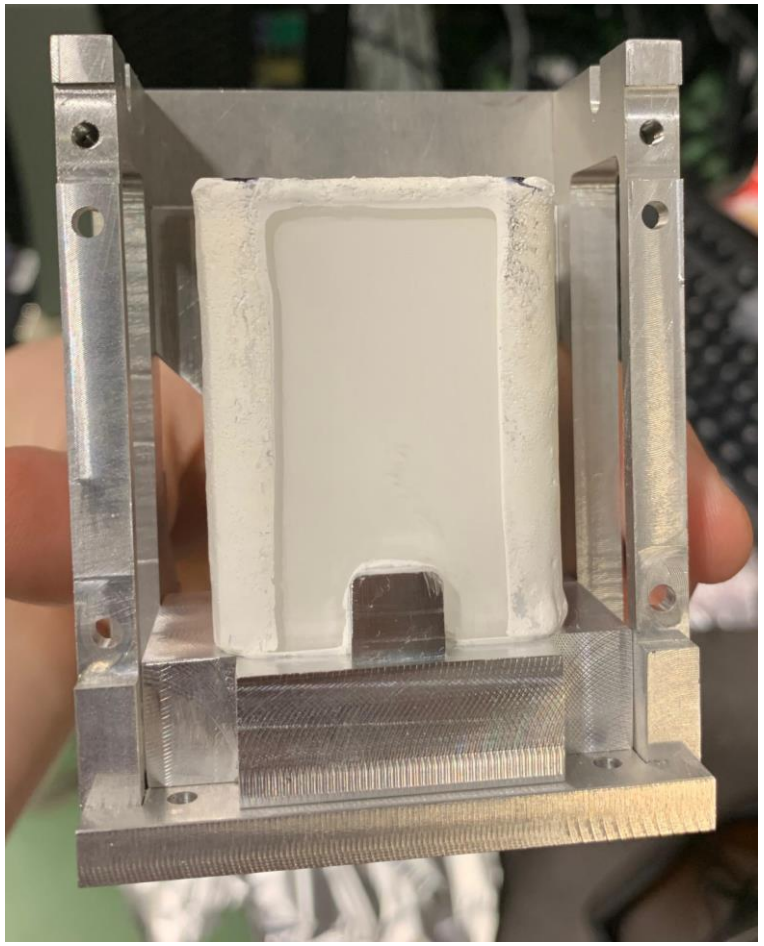
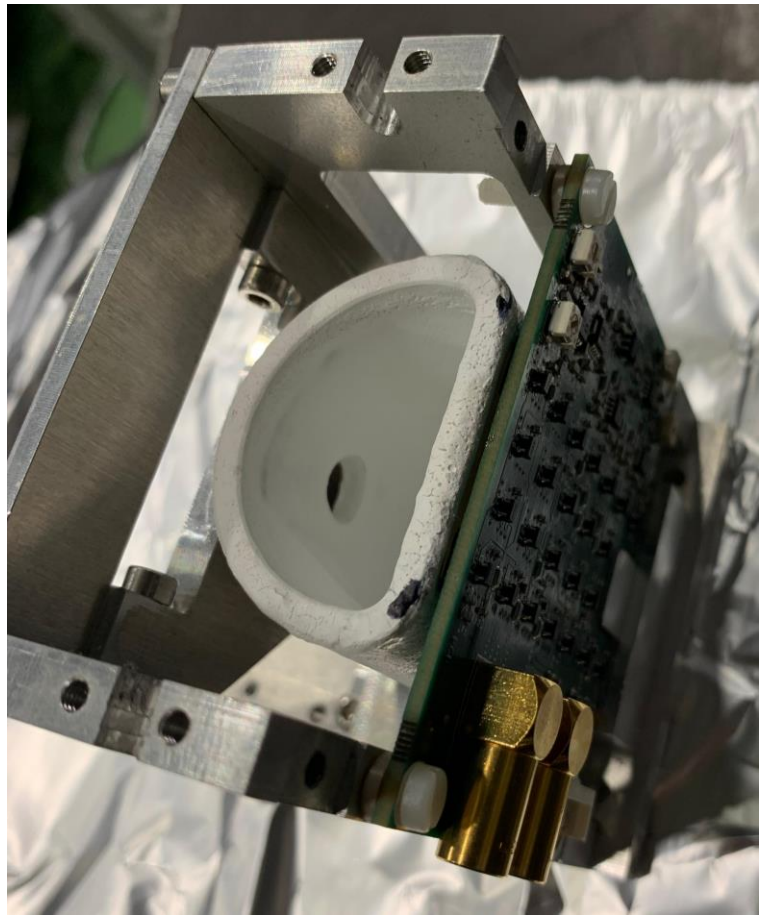
Plastic scintillator status

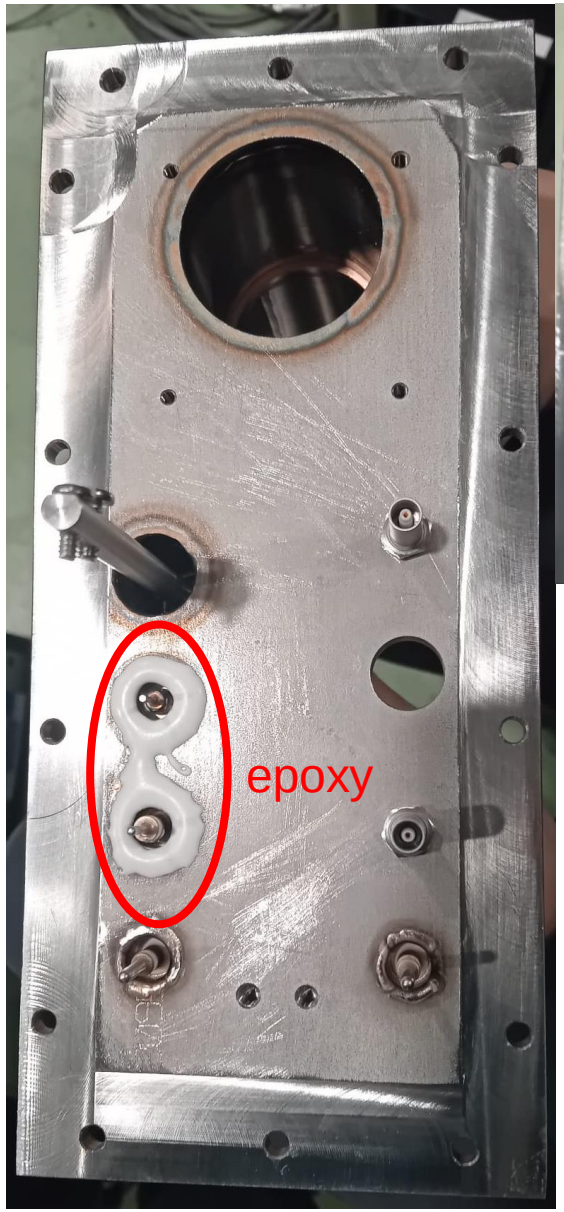
- BC-408 plastic scintillator
- Painted with reflective paint
- Glued to Al piece
- 2x copies

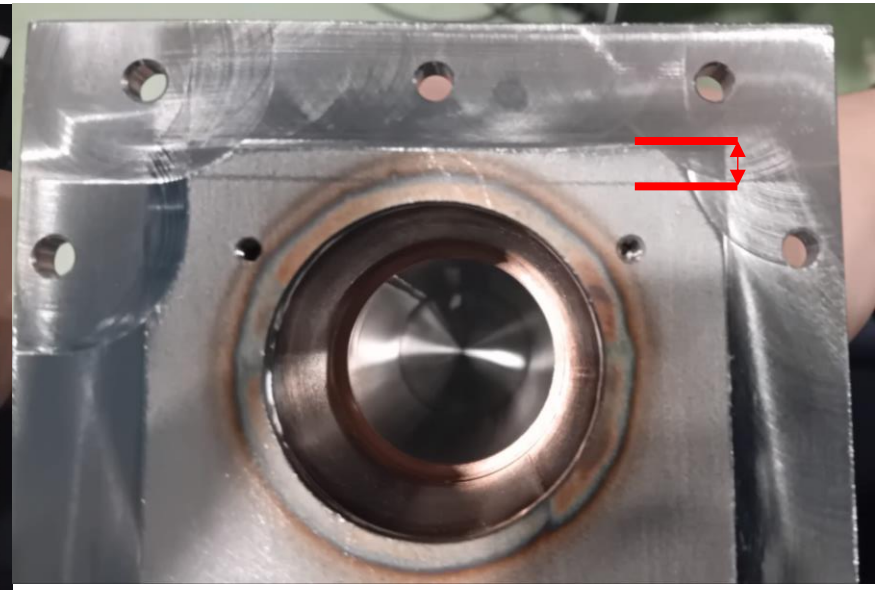


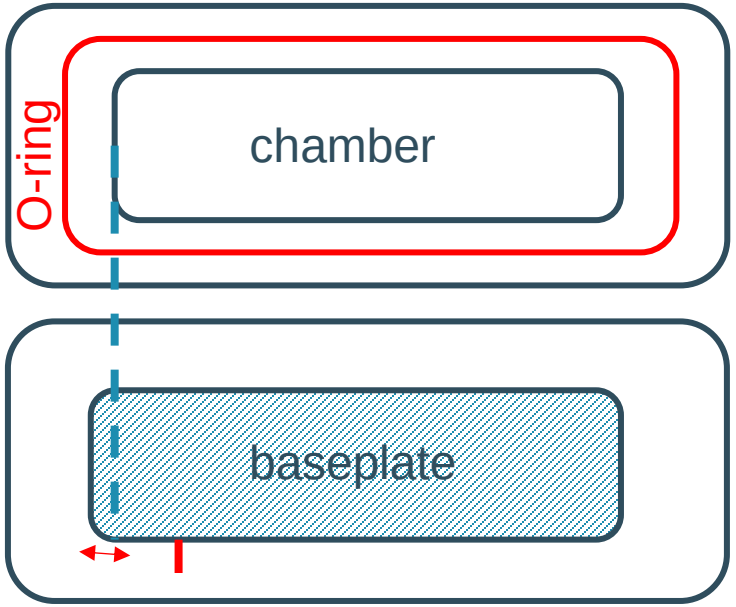


Vacuum problems

- Support designed with vacuum-compatible, weldable feedthroughs
- Scarce quality manufacture by the KU Leuven workshop
  - ➢ Leaks from the welds
  - ➢ Plate warped in welding process
  - ➢ Sides milled with errors of few mm
- Test no epoxy → 0.6 mbar
- Test with epoxy → 4e-6 mbar
- Will be milled and fixed by the ISOLDE technical workshop







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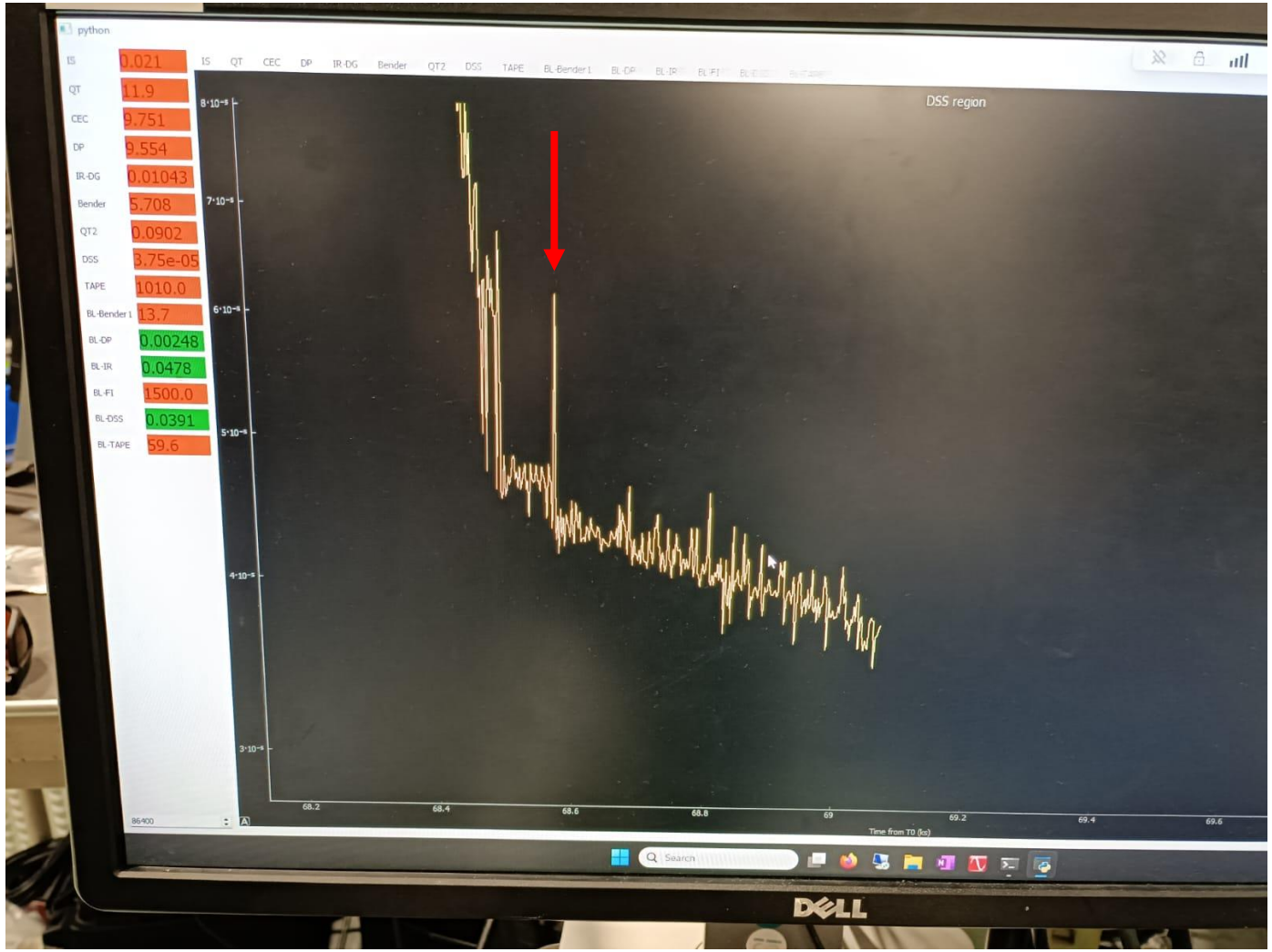


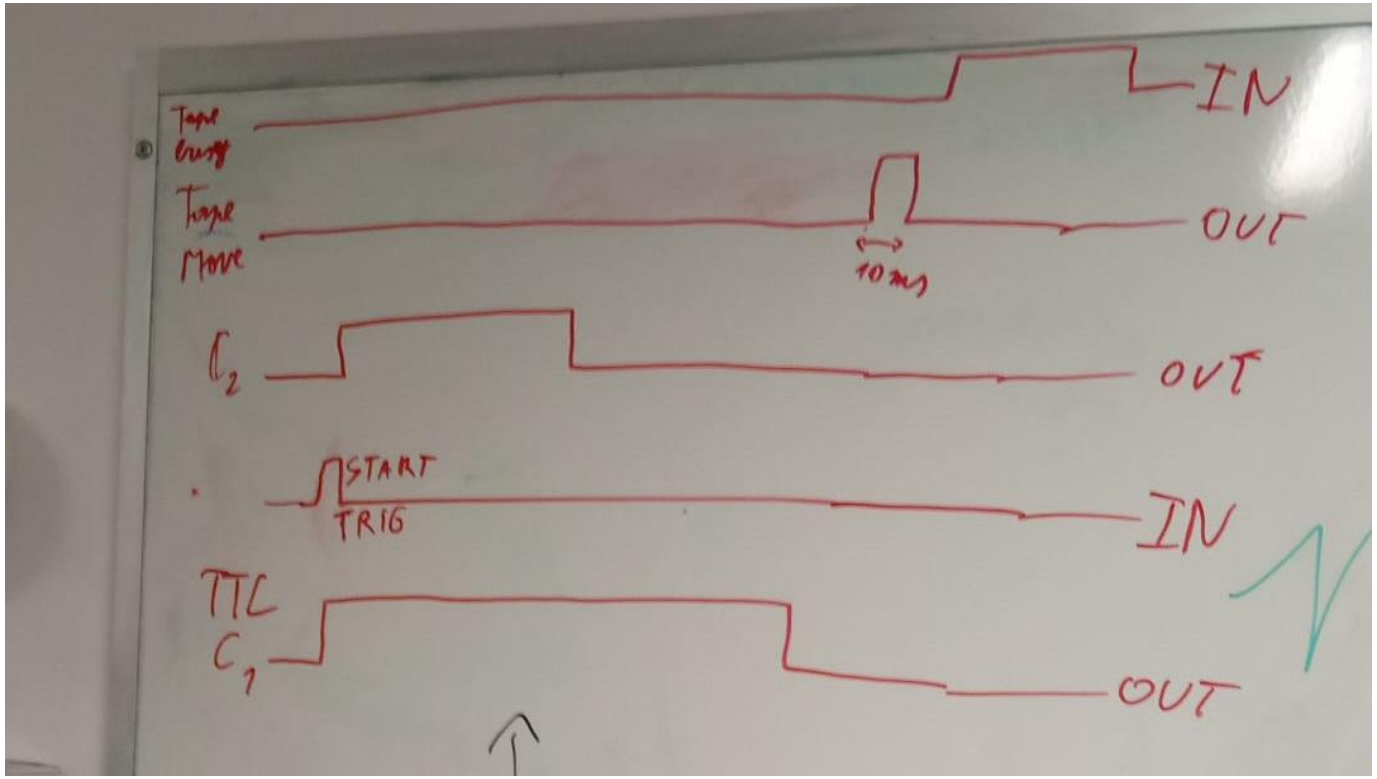
Commissioning plans updated

3-18 February (local team)	18-26 February
• Vacuum test of the baseplate from the ISOLDE technical workshop	• Offline test of the scintillator • Setup DSS signals to CRIS DAQ • Offline test under vacuum with non-resonant laser on → Efficiency measurements

Thank you for your attention
Questions?

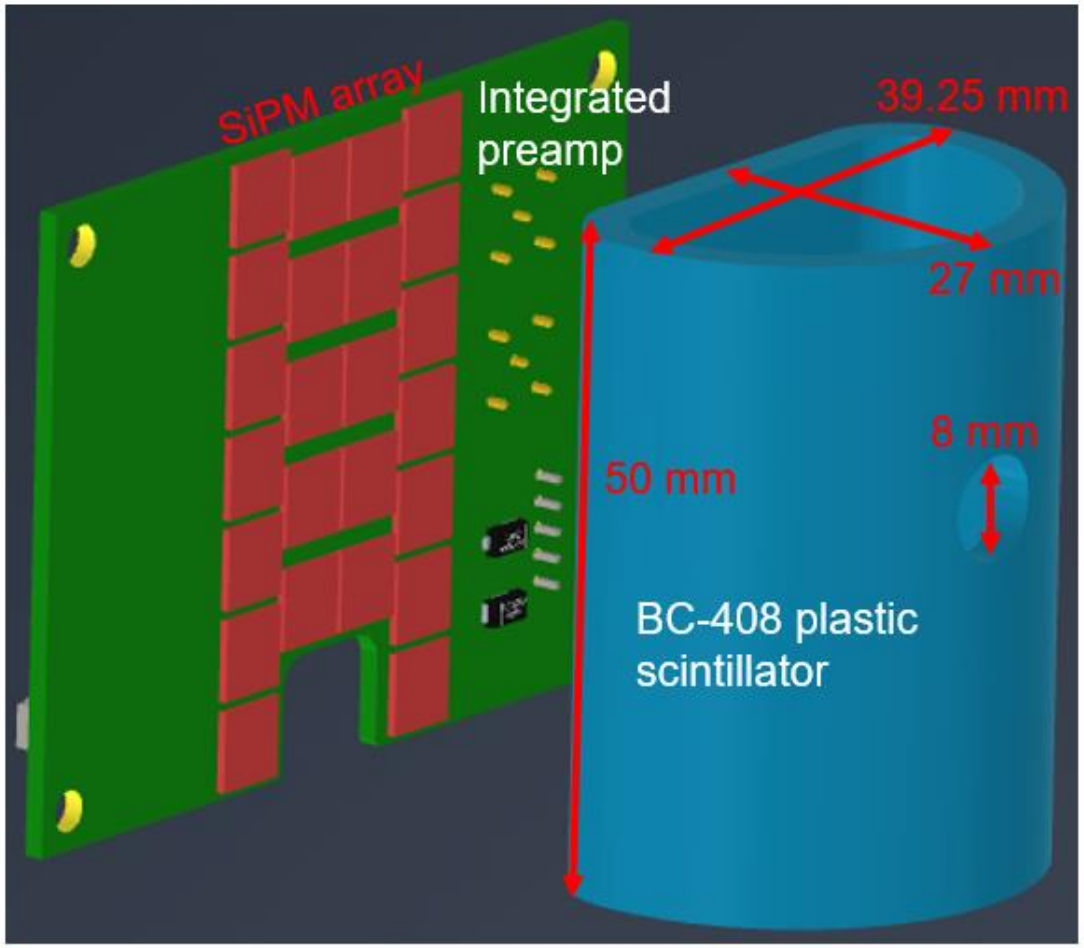
Arduino timer setup

- Figured out correct timing for the tape move



Offline test scintillator

- Bias supply not compatible with SiPM



NEED FOR Zn

- Plastic scintillator with SiPM
  - Get quote and scintillator from Luxium Solutions (Time: at least 1 month - waiting)
  - Paint with reflective paint from IDS (Time: 1 day)
  - Assemble onto beta detection mount (Time: 1 day)
  - Commission scintillator + SiPM (can be done offline) (Time: 1-2 days)
- MicroTOF in detection chamber
  - Make mount to hold MicroTOF (KU Leuven workshop or 3D printed if 10^{-6} vacuum is fine) (Time: 1-2 weeks)
  - Power supply? (2000 V bias) (Time: ?)
  - Commissioning needed? (Time: during a beamtime when protons are off?)
- Simple Arduino setup for control tape movement
  - Arduino on my desk but feedthroughs + box need to be acquired (Time: 2 weeks)
  - Test and merge with CRIS DAQ (Time: 1-4 days)
- New baseplate
  - Feedthroughs + mechanical parts are on my desk
  - Make baseplate + weld feedthroughs/mechanical parts on it (KU Leuven workshop) (Time: 2-5 weeks)
  - Make collimator (KU Leuven workshop) (Time: 1 week)
  - Assembly (Time: 1-3 week)
    - Test non-resonant light influence on plastic with collimator in place
    - Test vacuum of new baseplate
- IDS gamma array not needed, but would be nice (Time: loads..)
  - Support structure on rails design + assembly
  - Support HPGe structure design + assembly

Setup at CERN at least 2 weeks

Other PhD student to work on the HPGe array?