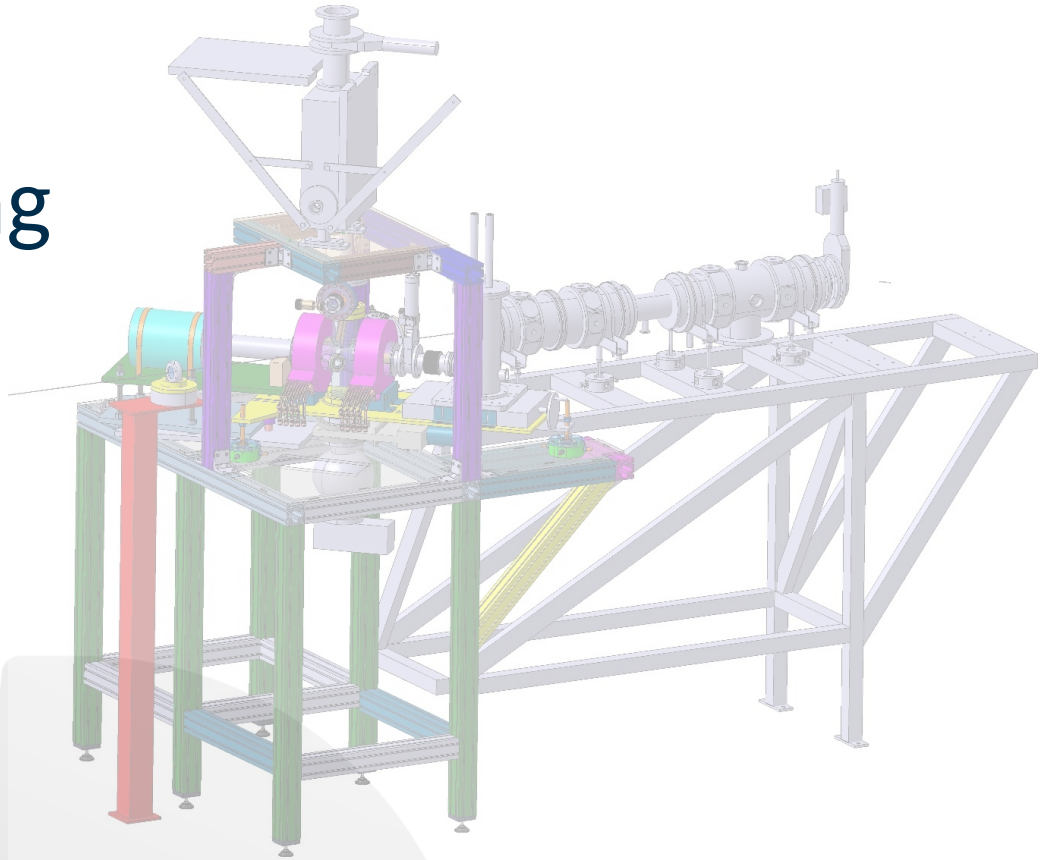
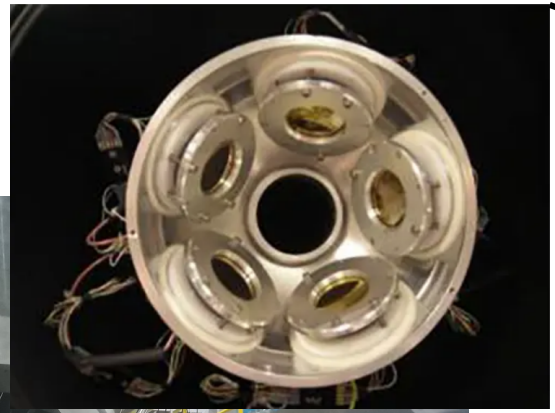
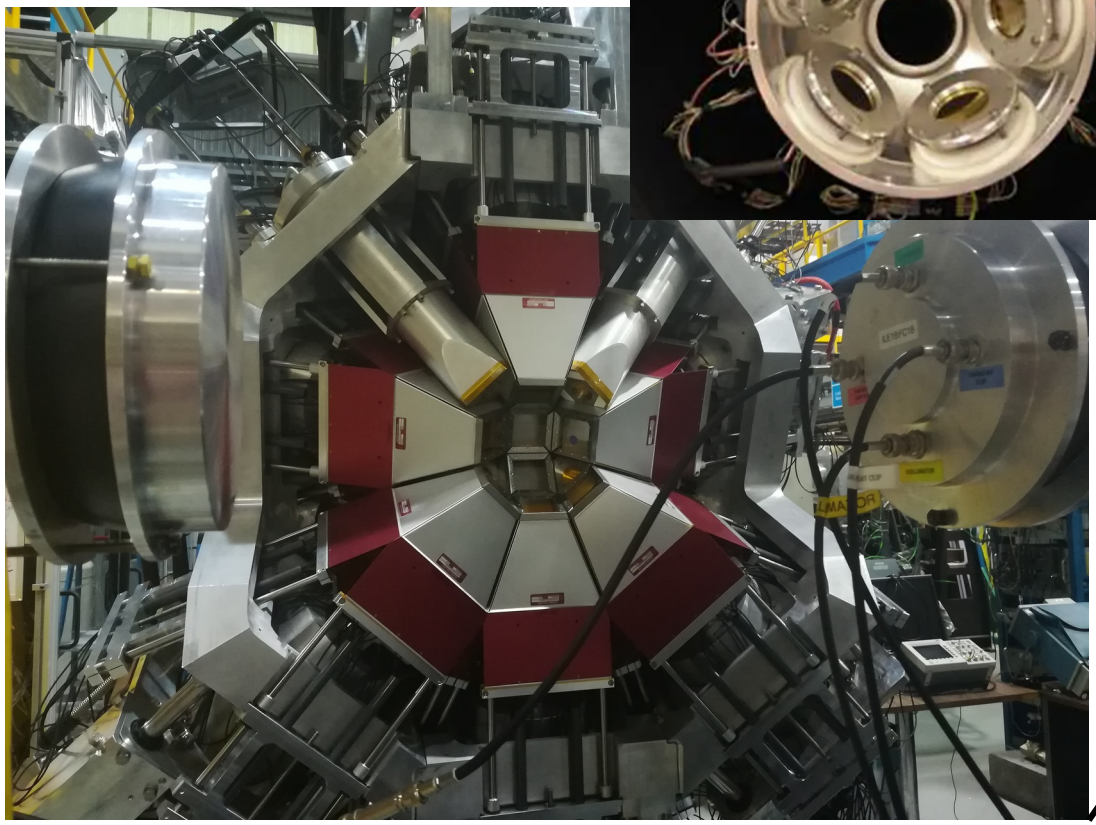
COnversion electrons Chasing @ Orsay :

The COeCO project

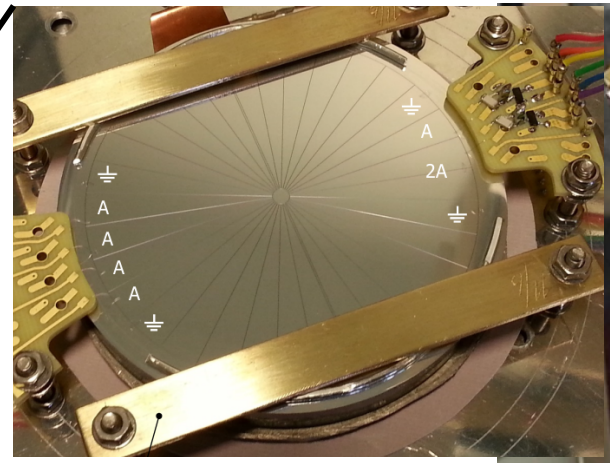


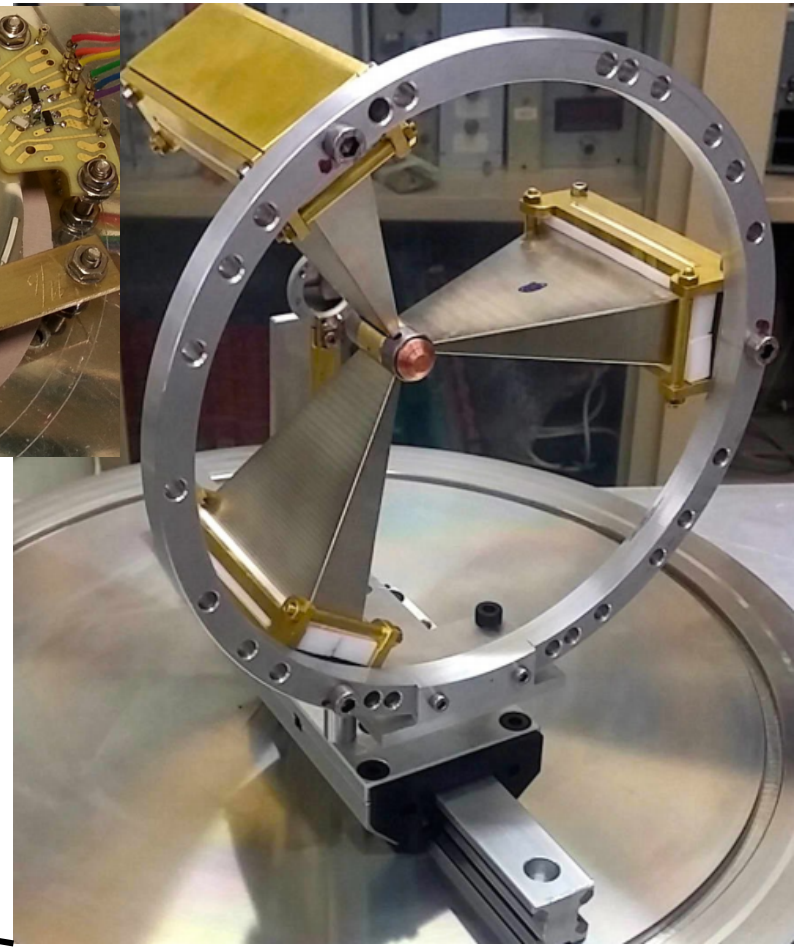
Conversion electrons measurements



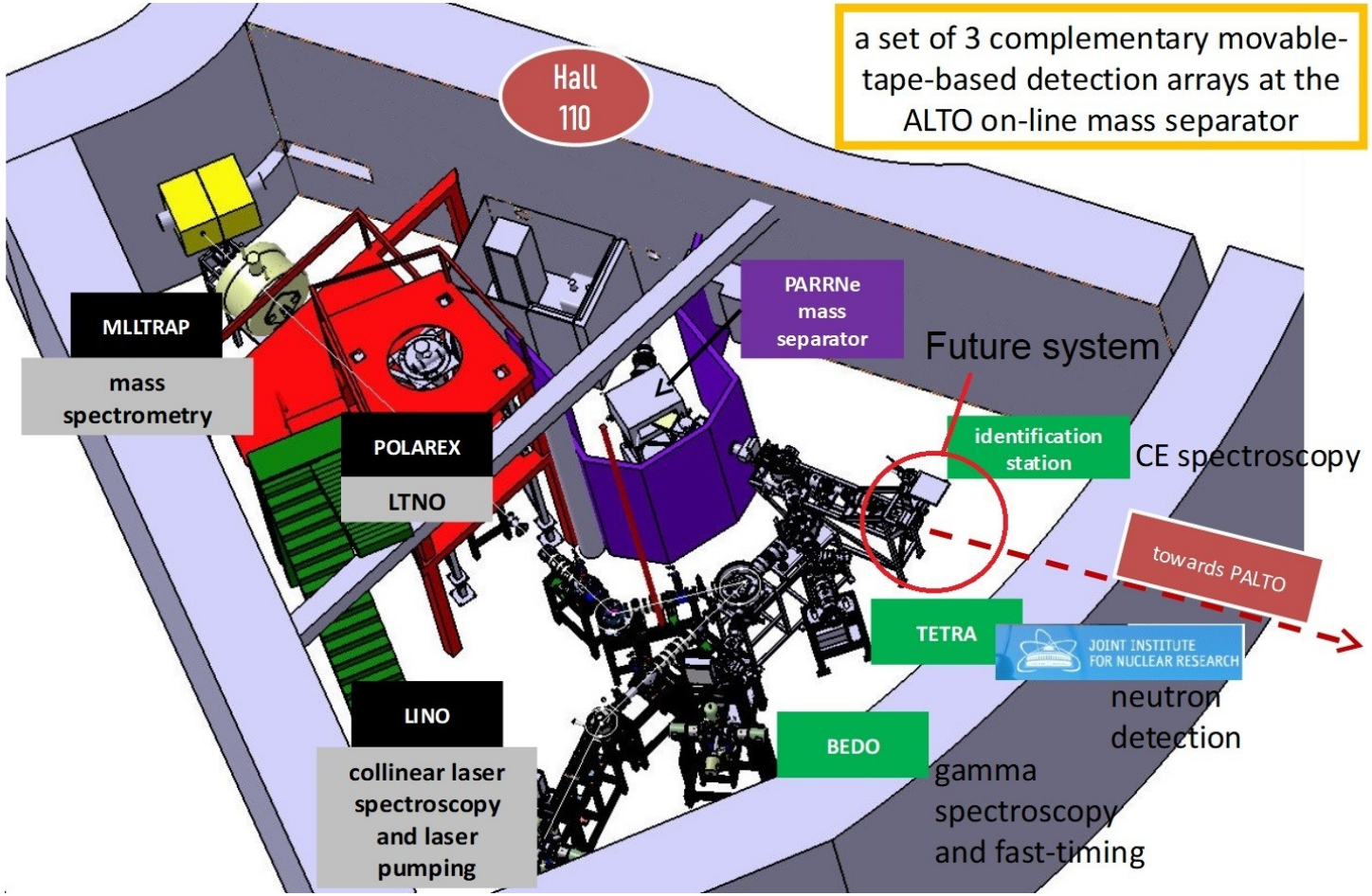


Conversion electrons measurements





The ALTO facility

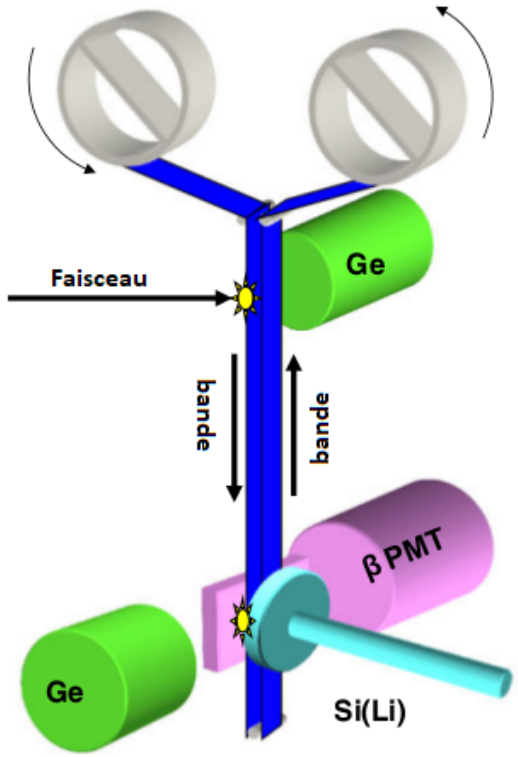


The current electron spectroscopy setup

- Upper part for production yield

- Lower part for conversion electron spectroscopy

ISOL beam
(laser ionized)



β-detection

γ-detection

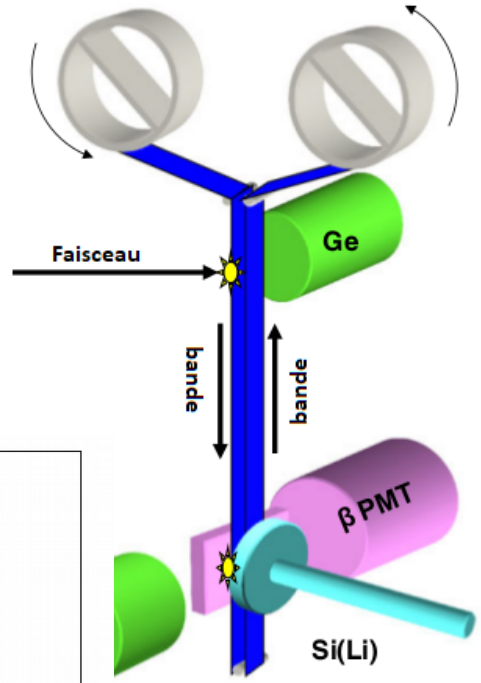
X and e⁻ detection

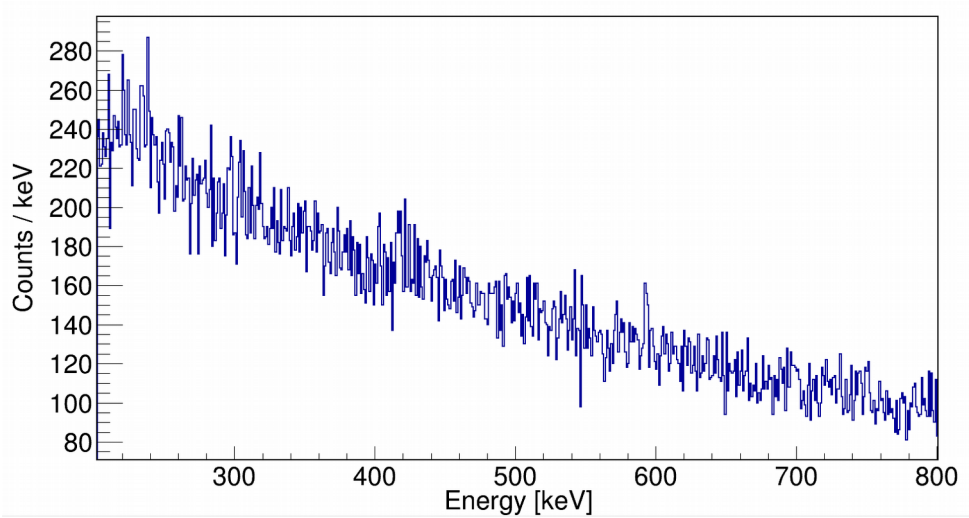
The current electron spectroscopy setup

Two main limitations :

- Short lifetimes inaccessible
- Huge background in the electron spectra from the Si(Li) detector

~ 1 second to move the source from collection to measuring point





Si(Li) spectrum of a ^{82}Ga source

ELLI, COeCO's Finnish sister

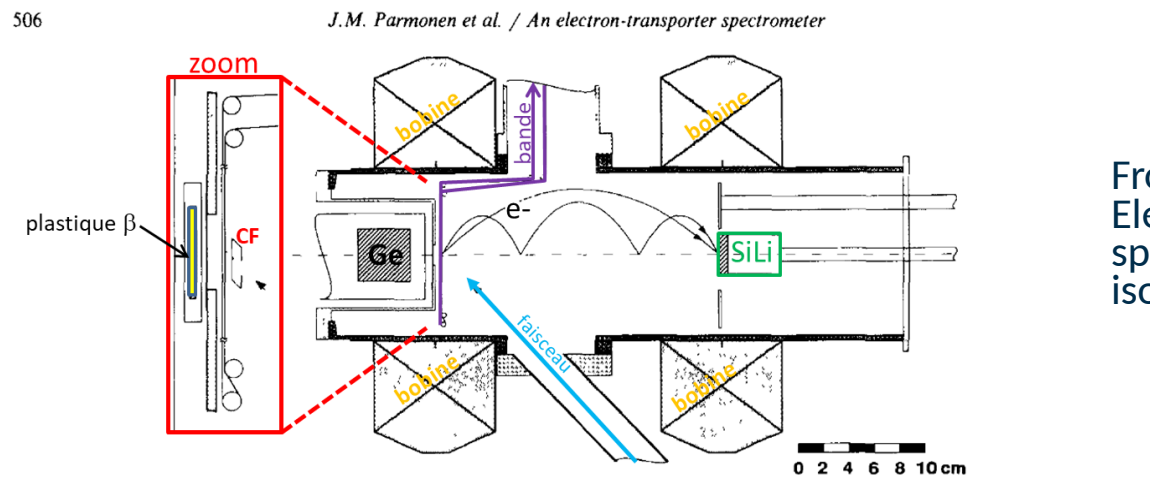


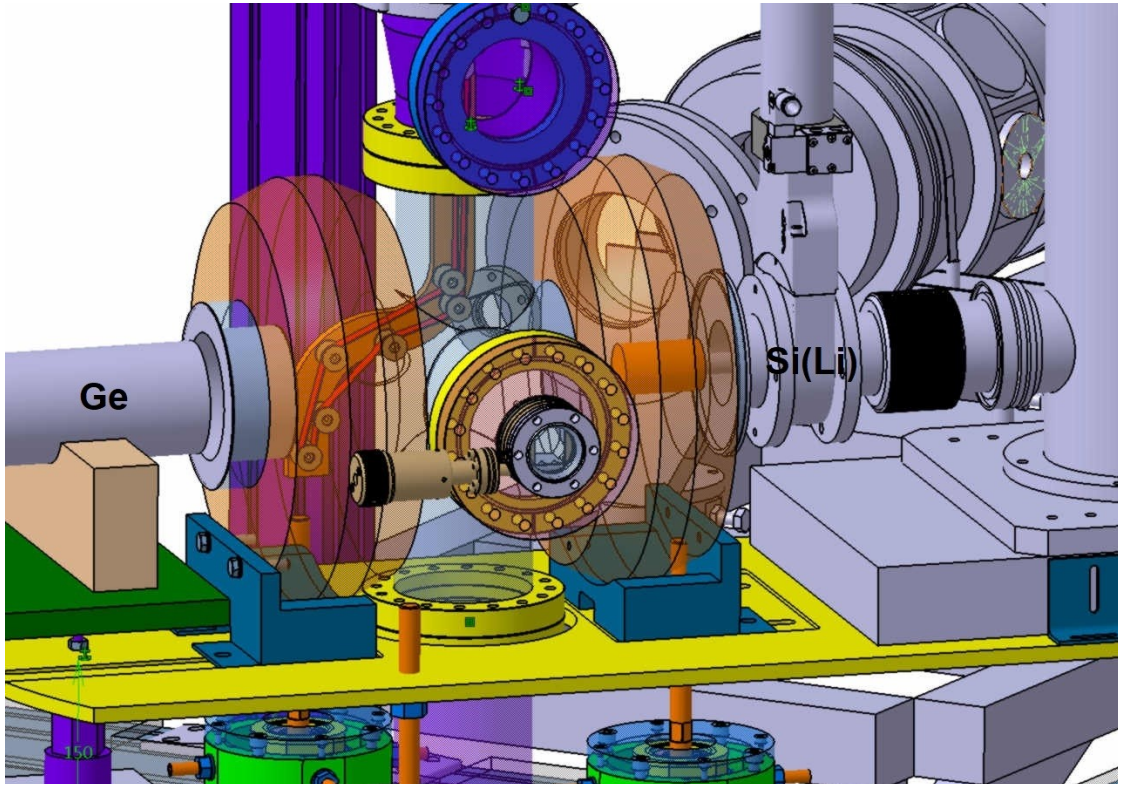
Fig. 1. Layout of the ELLI spectrometer. The radioactive ion beam enters the spectrometer at 45° angle with respect to the symmetry axis. The ions are implanted on a movable tape. A broad range of conversion electrons (up to 2.5 MeV) spirals down in the magnetic field, generated by the pair of coils, towards a cooled Si(Li) detector operated as an energy-dispersive unit. A cooled ring-shaped cold trap is placed in the vicinity of a cooled Si(Li) detector. The inset shows a removable mini Faraday cup, which is used to tune the separator with a stable ion beam, and a surface barrier detector, that can be placed only 7 mm away from the implantation spot

From J.M. Parmonen *et al.*, Electron-transporter spectrometer for on-line isotope separator

Magnetic lens to tackle both limitations :

- Collection point = measuring point
- Guiding electrons in a magnetic field getting rid of gamma

Simulations with Comsol Multiphysics



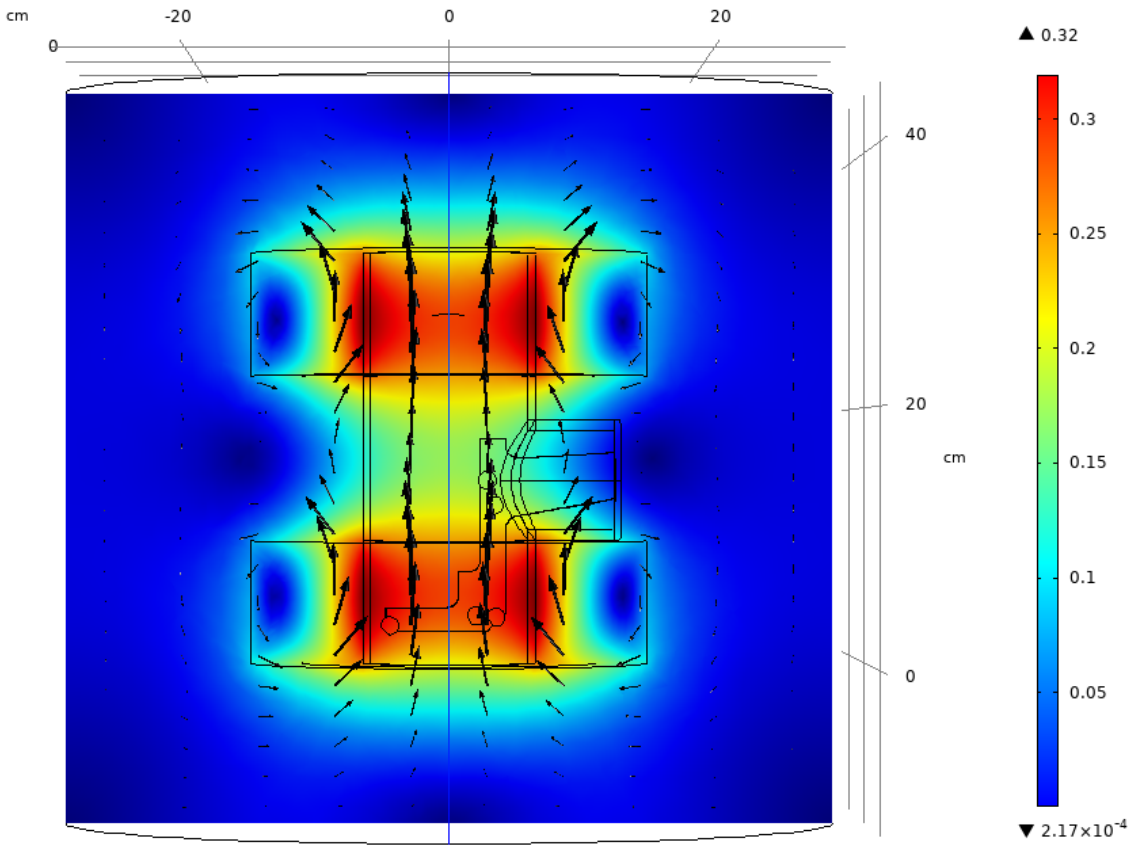
First version of the COeCO setup

- Adapt the system to the existing beam line
- Fit all the detectors in the system
- Get an idea of the transportation of the electrons

Simulations with Comsol Multiphysics

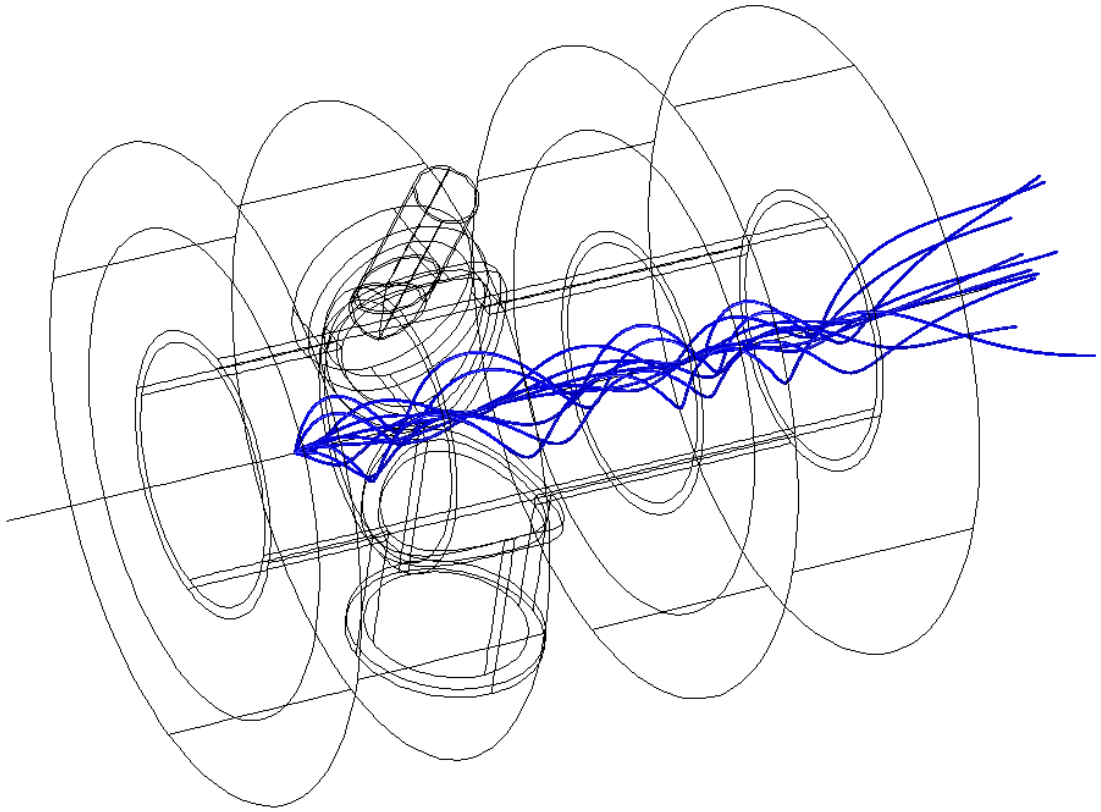
Multiphysics program to :

- Simulate $\overline{B}$ field created by two coils around a stainless steel chamber
- Add an electron source and compute electron trajectories inside the field



Magnetic field map of the two coils system

Simulations : electron transport efficiency

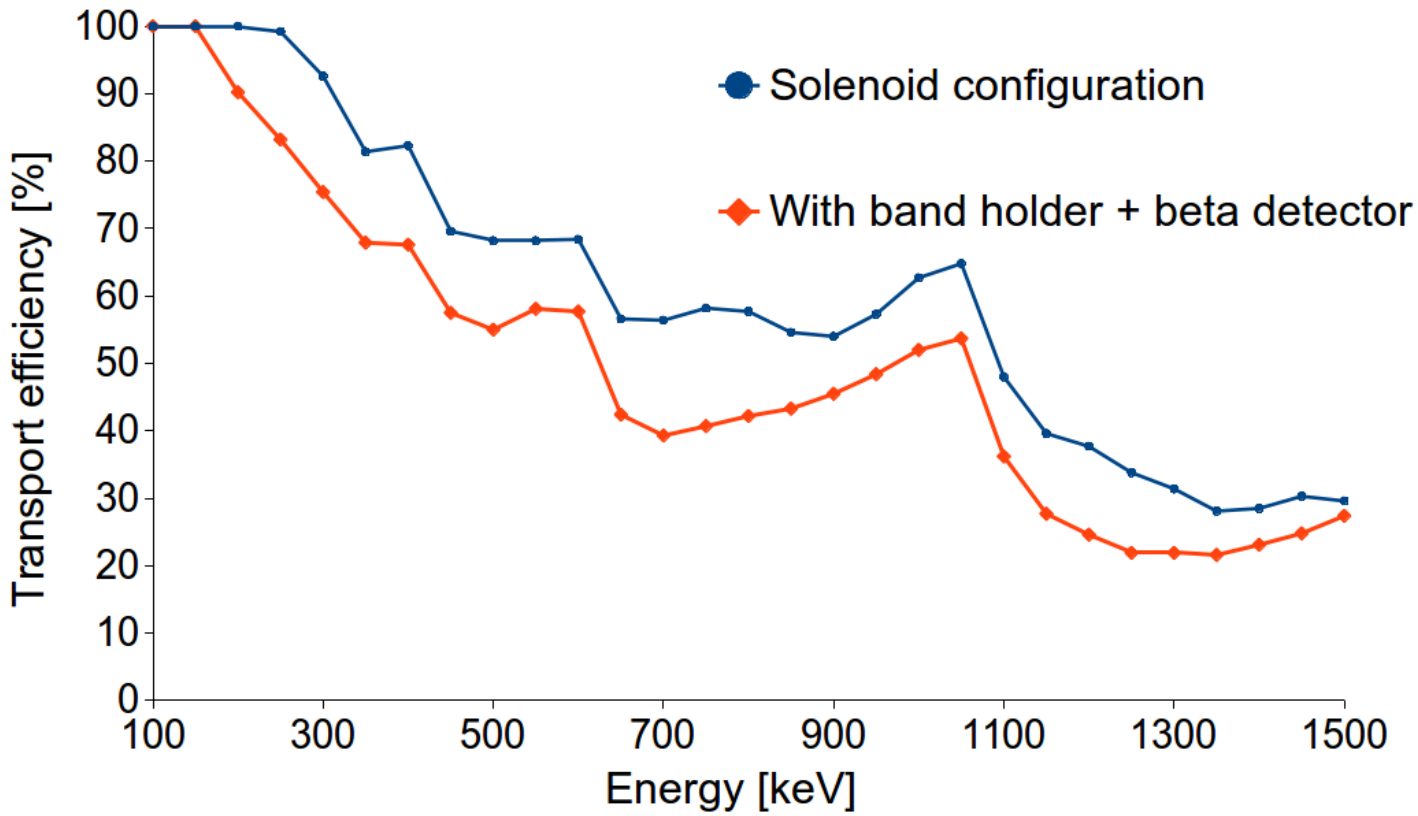


Trajectories of electrons of 700 keV through the system

- Punctual source, emitting mono-energetic electrons in a $\pi/3$ cone in the center of the first coil
- Si(Li) detector placed in the center of the second coil

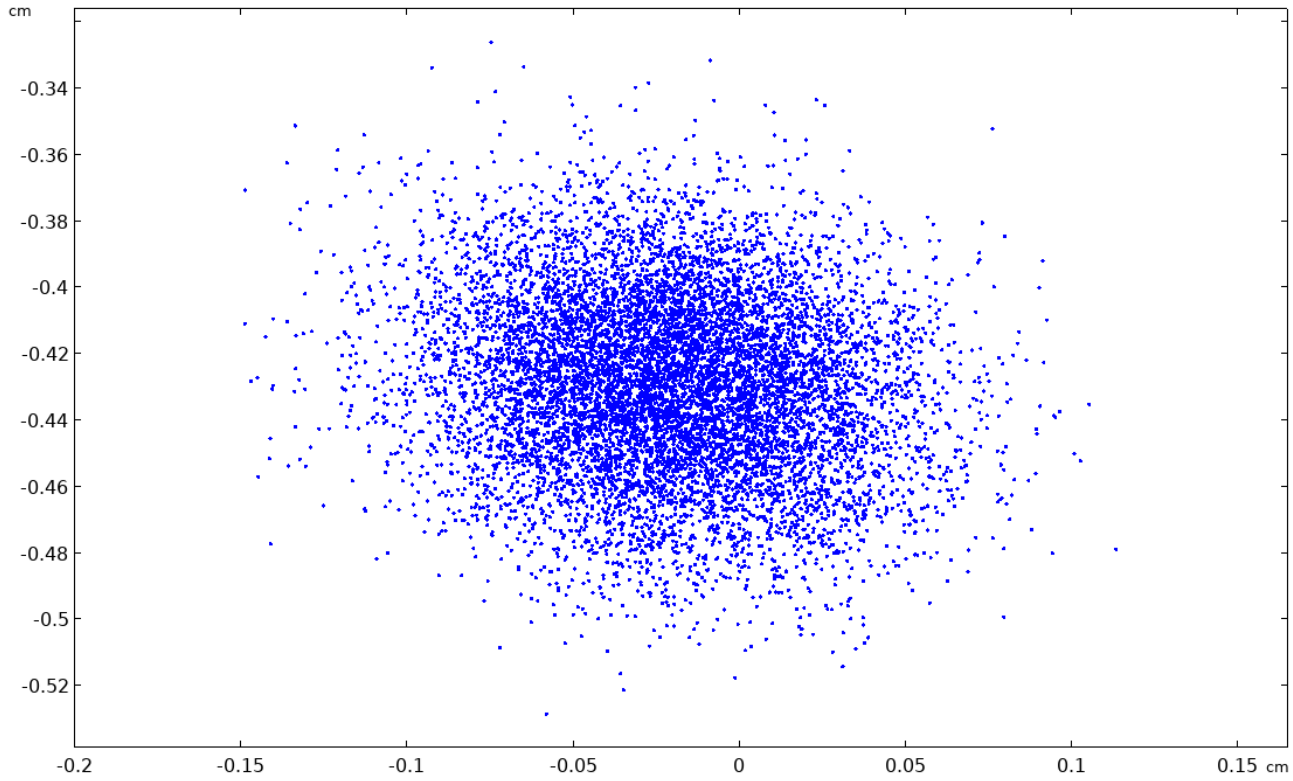
Simulations : electron transport efficiency

- Above 40% transport efficiency in the region of interest compared to a Si(Li) detector placed less than a centimeter from the source



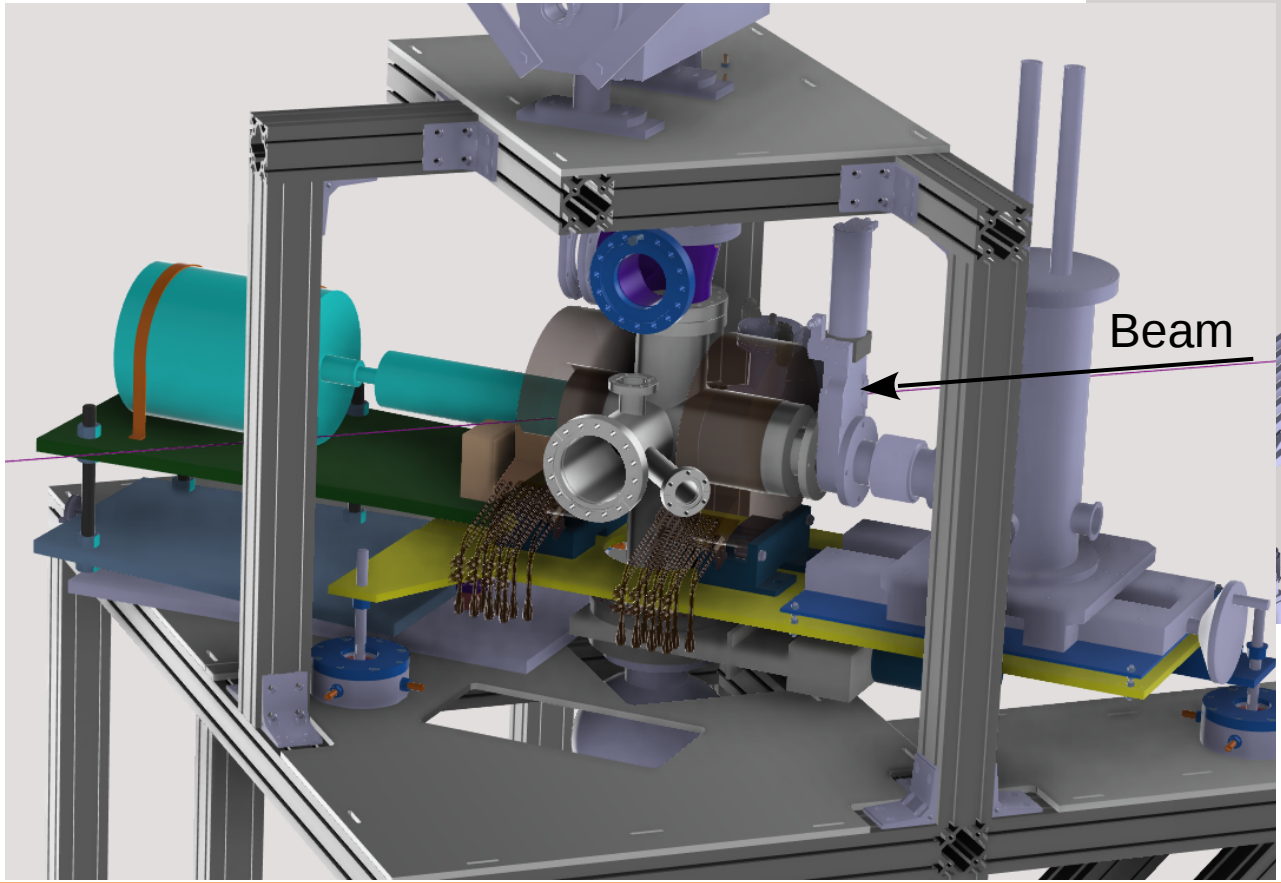
Simulations : beam deviation

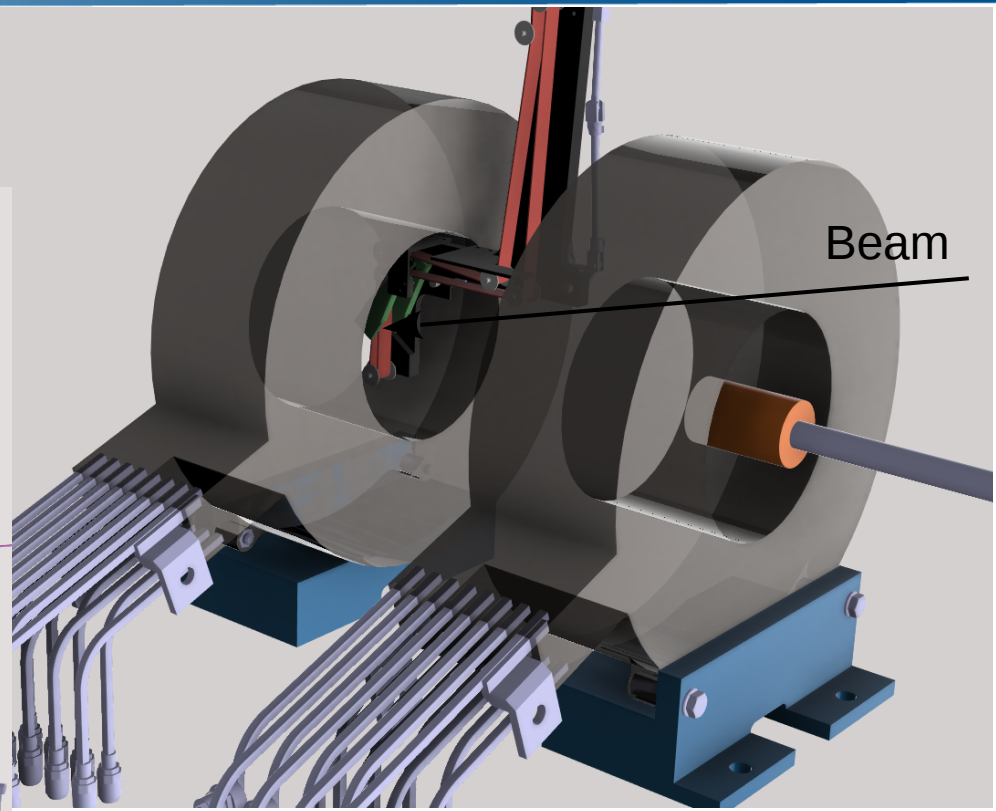
- Due to the magnetic field, the beam is deviated before beeing implanted on the tape
- Steerers in both x and y directions are added before the chamber



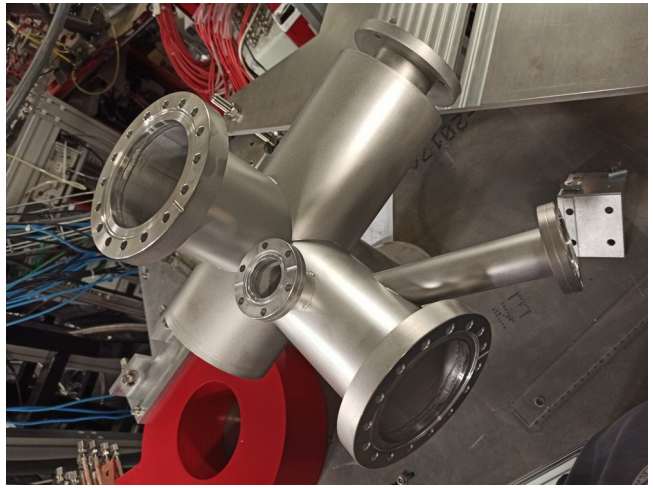
Section of the beam in the plane of the tape

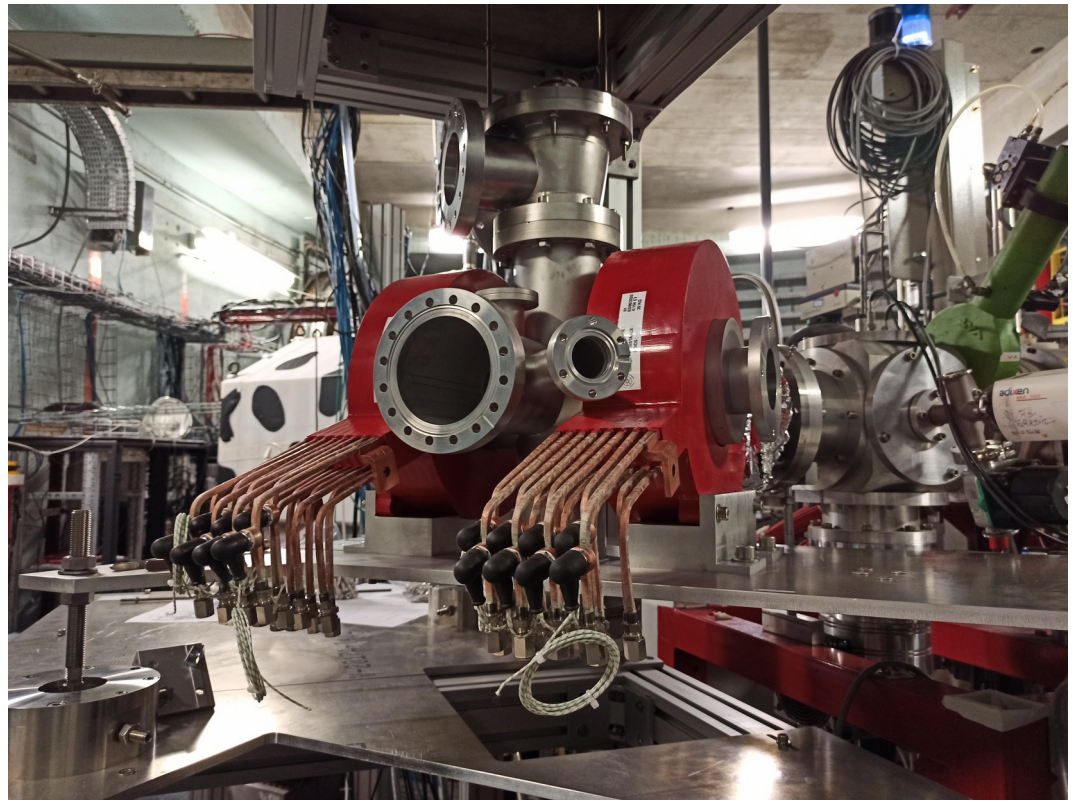
The complete COeCO system

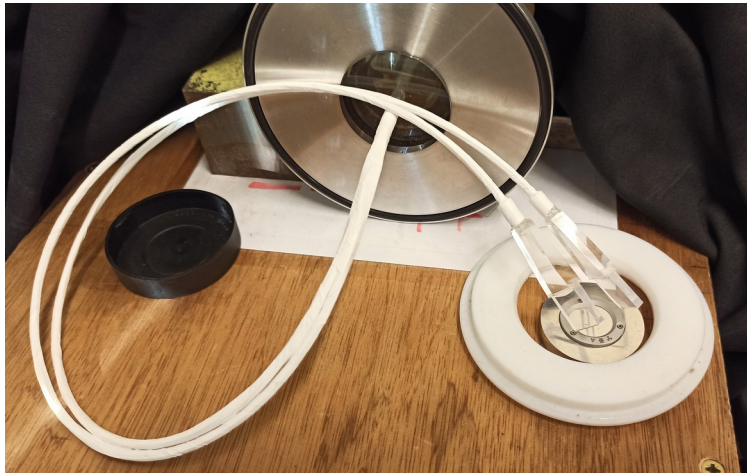




Current situation







Timeline

MOUNTING
- Water-cooling system
- Chamber inside
- Tape station
- Steerers and connection to beam-line

ALIGNMENT

OFF-LINE TESTS
- Magnetic field
- β-detector
- Electron transport

BEAM TIME (3 WEEKS)
- Production yields
- Galium beam
- Silver beam

Summary

- Upgrade of the existing conversion electron spectroscopy set-up
- Remove background and access short lifetimes
- Project is ongoing, all the pieces are here, first beam for COeCO in May
- Settled system with its beamline, built for future ISOL experiments