Lecture notes

Accelerator set-up at University of Szczecin, Poland

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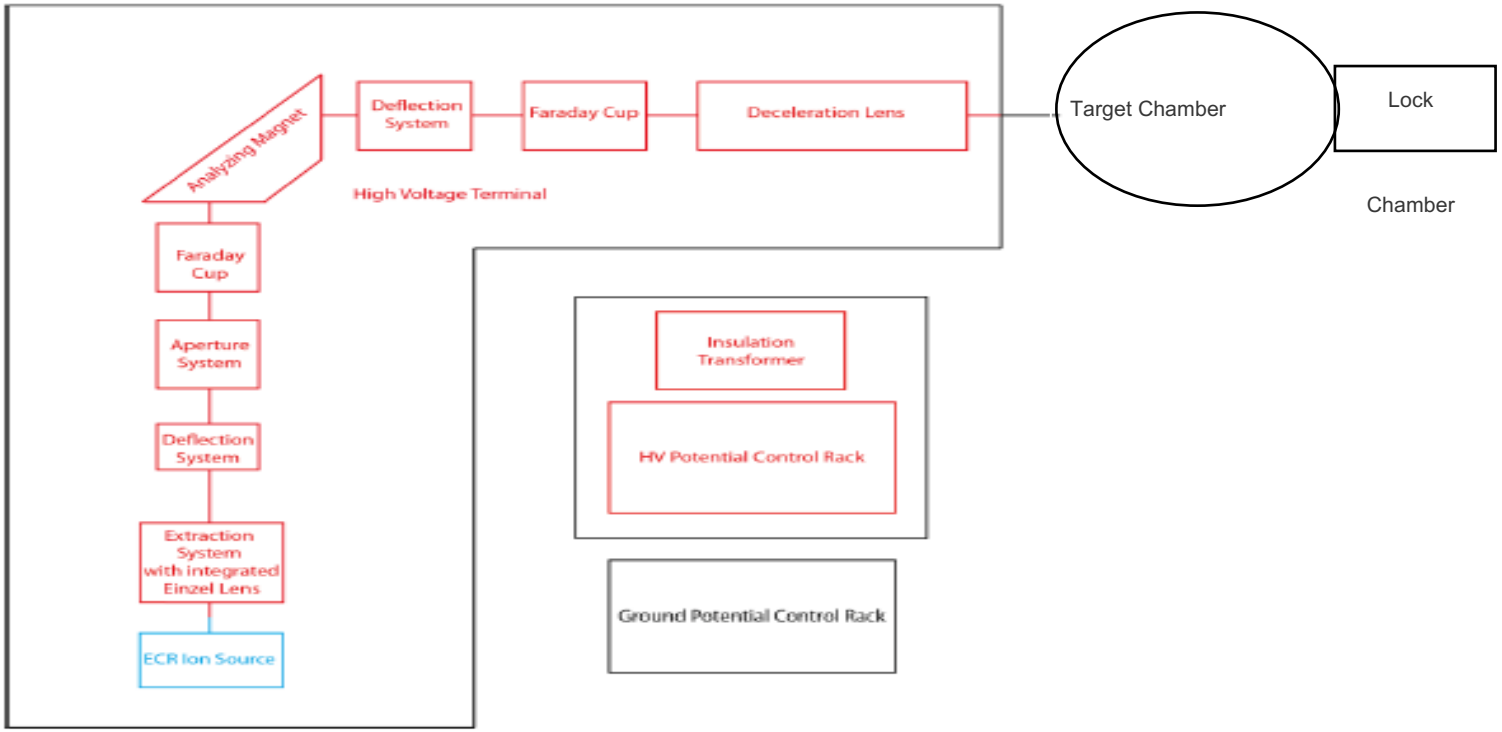
General Remarks

- Ion source
- Ion transfer
- Upgrade changes
- Analyzing chamber
- Vacuum system

System schematics

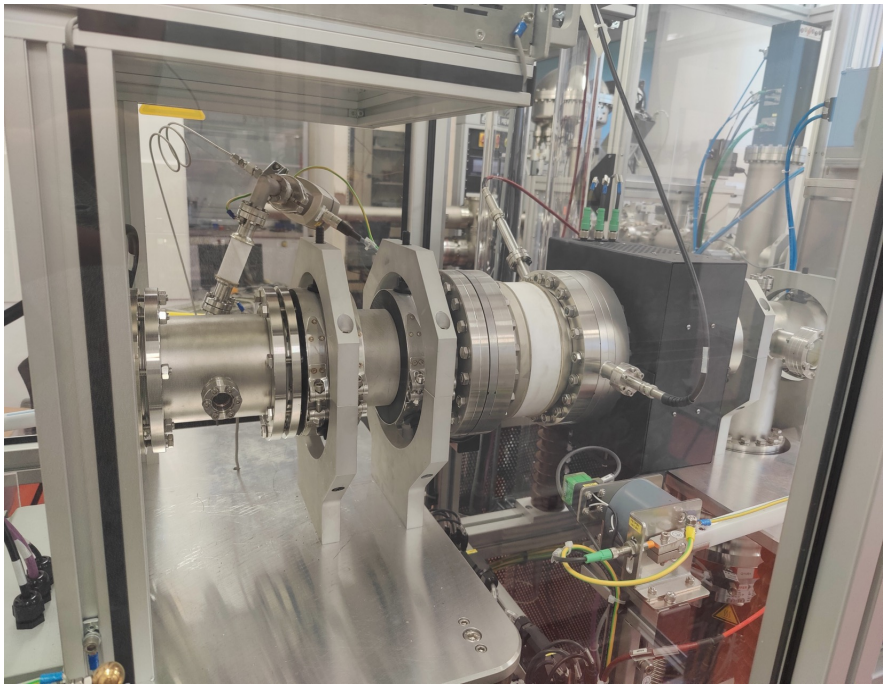


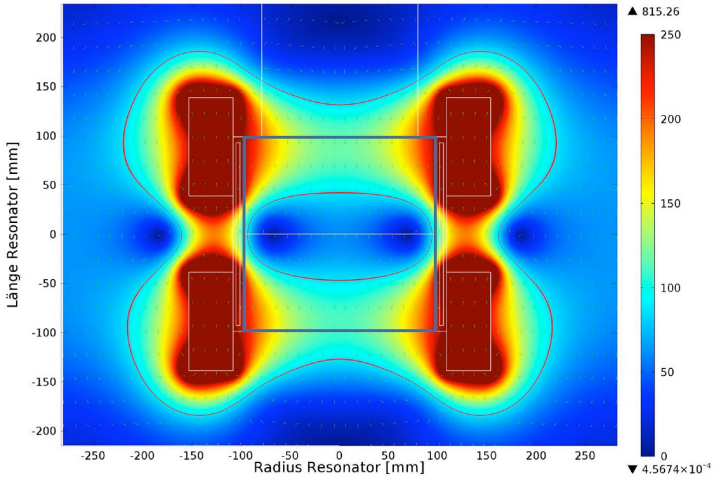
Ion source

Specification

- Electron Cyclotrone Resonance Ion Source
- Based on stable magnets
- Very high Energy resolution of only few eV
- High current up to 1mA
- Light gases with up to Ar
- Ion energies from 5keV> to 20 keV

Ion source




▲ 815.26
250
200
150
100
50
0
▼ 4.5674×10⁻⁴
Länge Resonator [mm]
200
150
100
50
0
-50
-100
-150
-200
-250
-200
-150
-100
-50
0
50
100
150
200
250
Radius Resonator [mm]

Ion transfer

1. Lenses

   To transfer ions from the source to target chamber there is focusing system consisting of 2 lenses. One is just right after ion source, the second is just before target chamber consisting of 2 einzel lenses.

   It allows to focus the beam on the target.

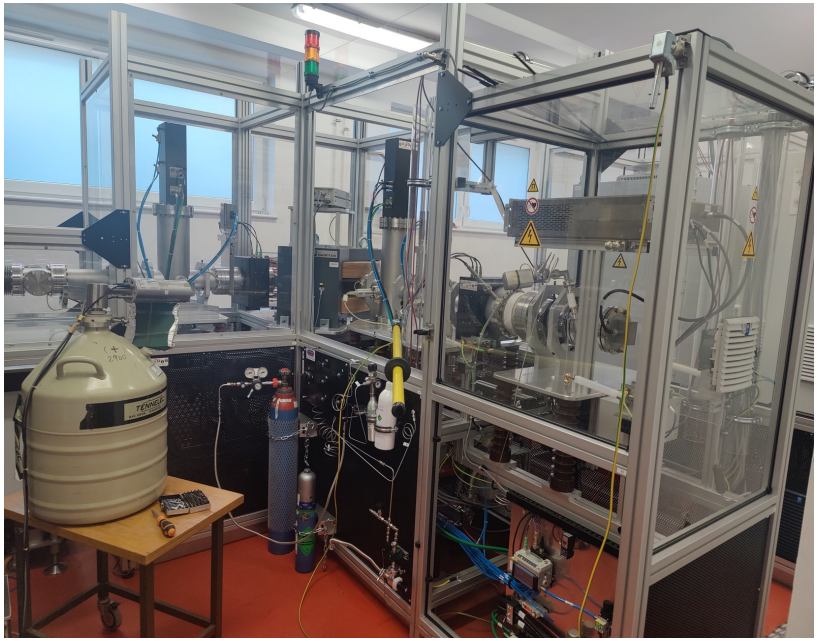
2. Steerers

   There are installed 2 steerers allowing to shift beam by few mm in X and Y directions

3. Anylizing magnet

   90° electromagnet allowing to precisiely choose wanted beam and control contamination

Ion transfer



Upgrade changes

1. High voltage on beamline

   To allow the lensing system to change ions energy on the target whole beamline was needed to be put on high voltage potential. Final lense was exchanged to widen the range of ions energies without compromising energy resolution or beam current. It allows us to change ions energy from 1keV> up to 26 keV.

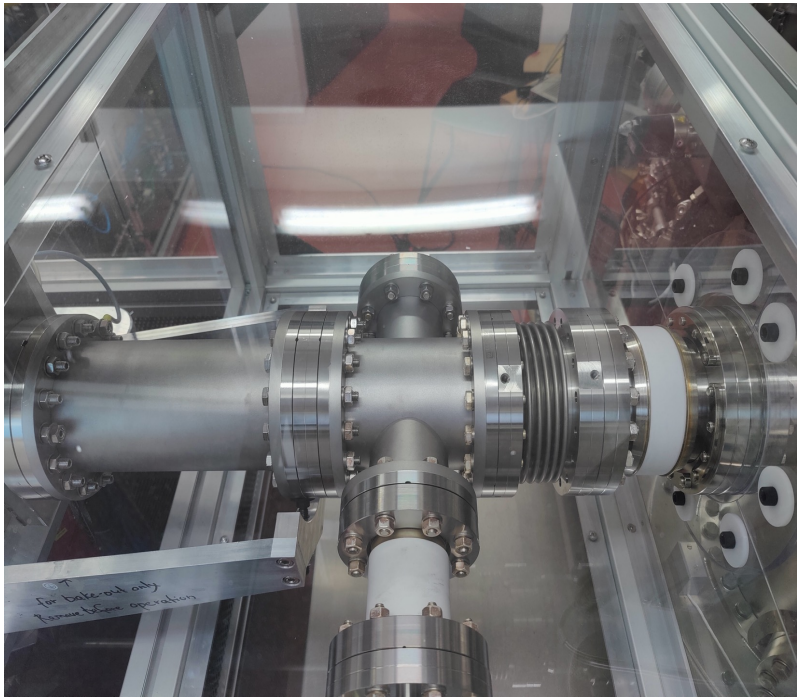
2. Lense

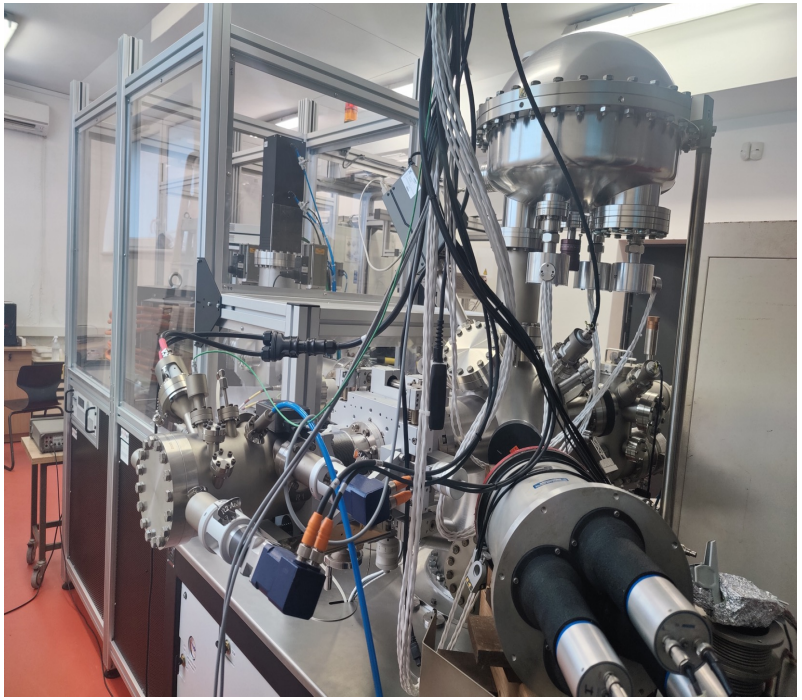
   Final lense was exchanged to widen the range of ions energies without compromising energy resolution or beam current. It allows us to fluently change ions energy from 1keV> up to 26 keV.

3. Software changes

   Software needed to be changed to accommodate all additional functionalities

Upgrade changes





Analyzing chamber

1. Chamber

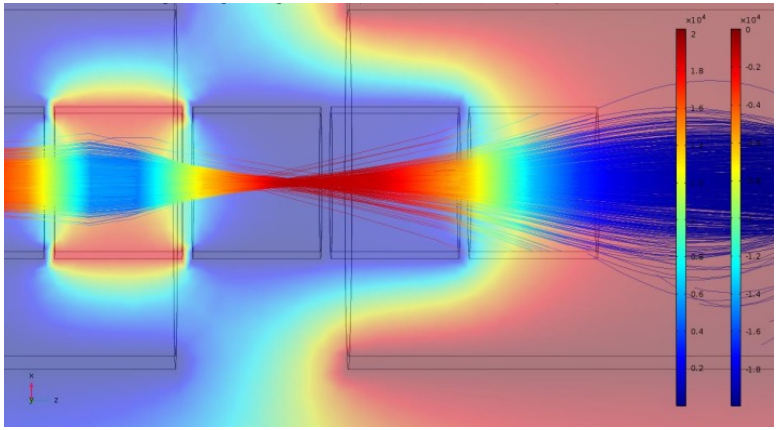
   Is build for mu-metal to shield detectros from influence coming from outside. It has 4 axis manipulator to enable target exchange and positioning for irradiation and different diagnostic methods. Manipulator also allows to measure target temperaturę, heat it up to 1000°C or cool it down to LN teamperature. Load – lock is allowing relatively fast target change.

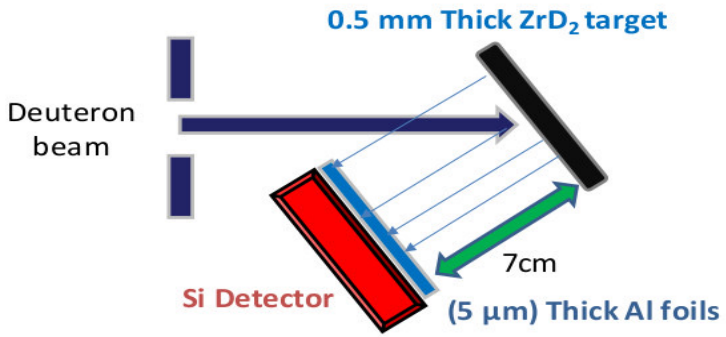
2. Diagnostics

   Chamber is equiped with Residual Gas Spectrometer to allow vacuum quality measurements.

   Electron detector and gun allows to use Auger Electron Spectroscopy for target surface contamination control.

Analyzing chamber





Vacuum system

1. Differential pumping system

   Whole accelerator system is divided to 4 parts, each isolated by diafragm with small hole in it. This kind of construction allows ions to cross but partialy isolates sections and allows the system to get better vacuum in each section. System consists of oil-free forevacuum pumps, booster turbomolecular pumps and turbomolecular pumps to reach initial pressure of 10^{-9} mbar.

2. Chamber pumps

   Chamber is additionaly equiped with ion pump, titanium sublimation pump and „cold pot” to boost vacuum quality to 10^{-11} mbar.

   To reach this values in chamber bakeout at 150 $^{\circ}$C is required.

   This conditions are required to ensure that contamination of target surface is controlled.

Thank you!
Any questions?

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