

COLUMBUS - a Small Cyclotron for School - and Teaching Purposes

Cyc22, Beijing, China

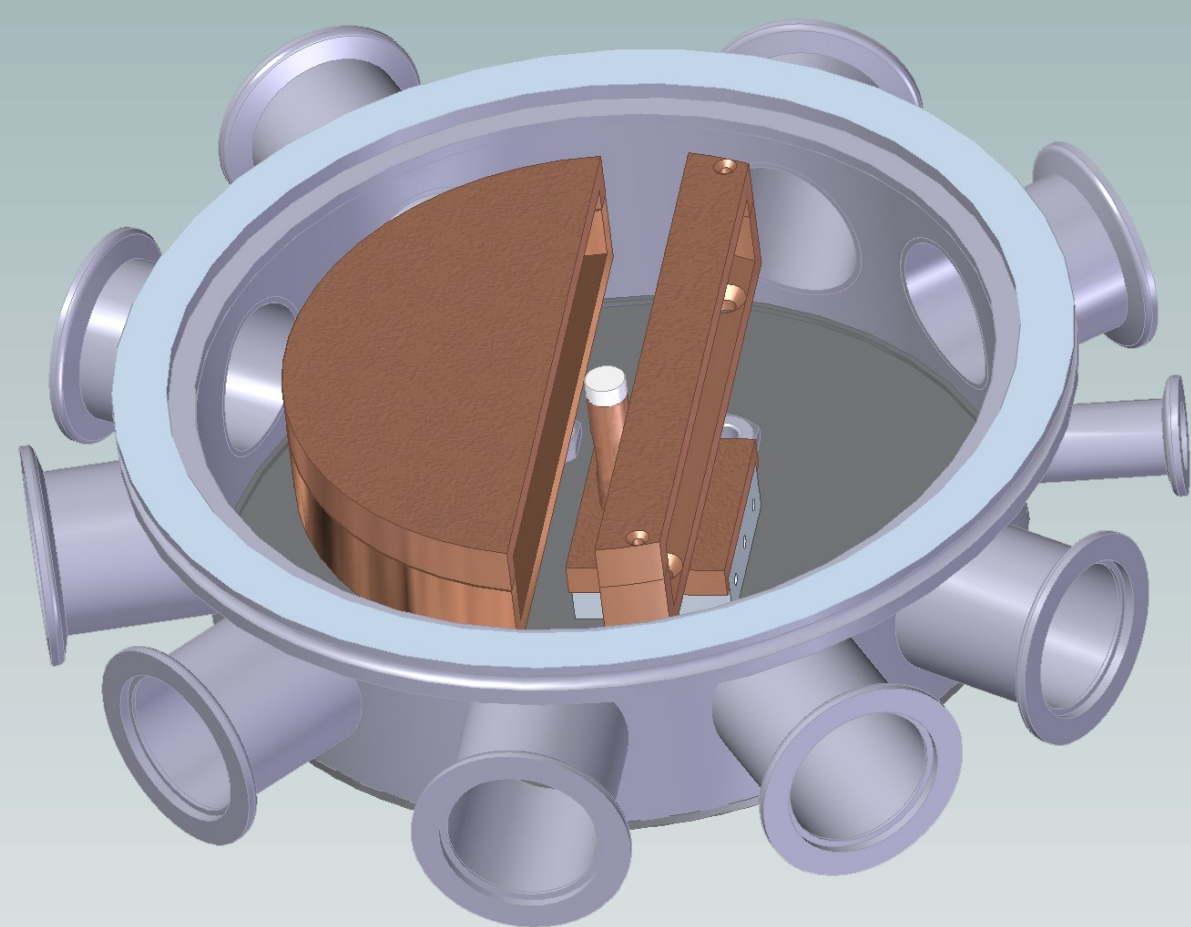
Program Code: THPO 001

2012

Ch. Wolf, M. Prectl

University of Applied Sciences, Coburg, Germany

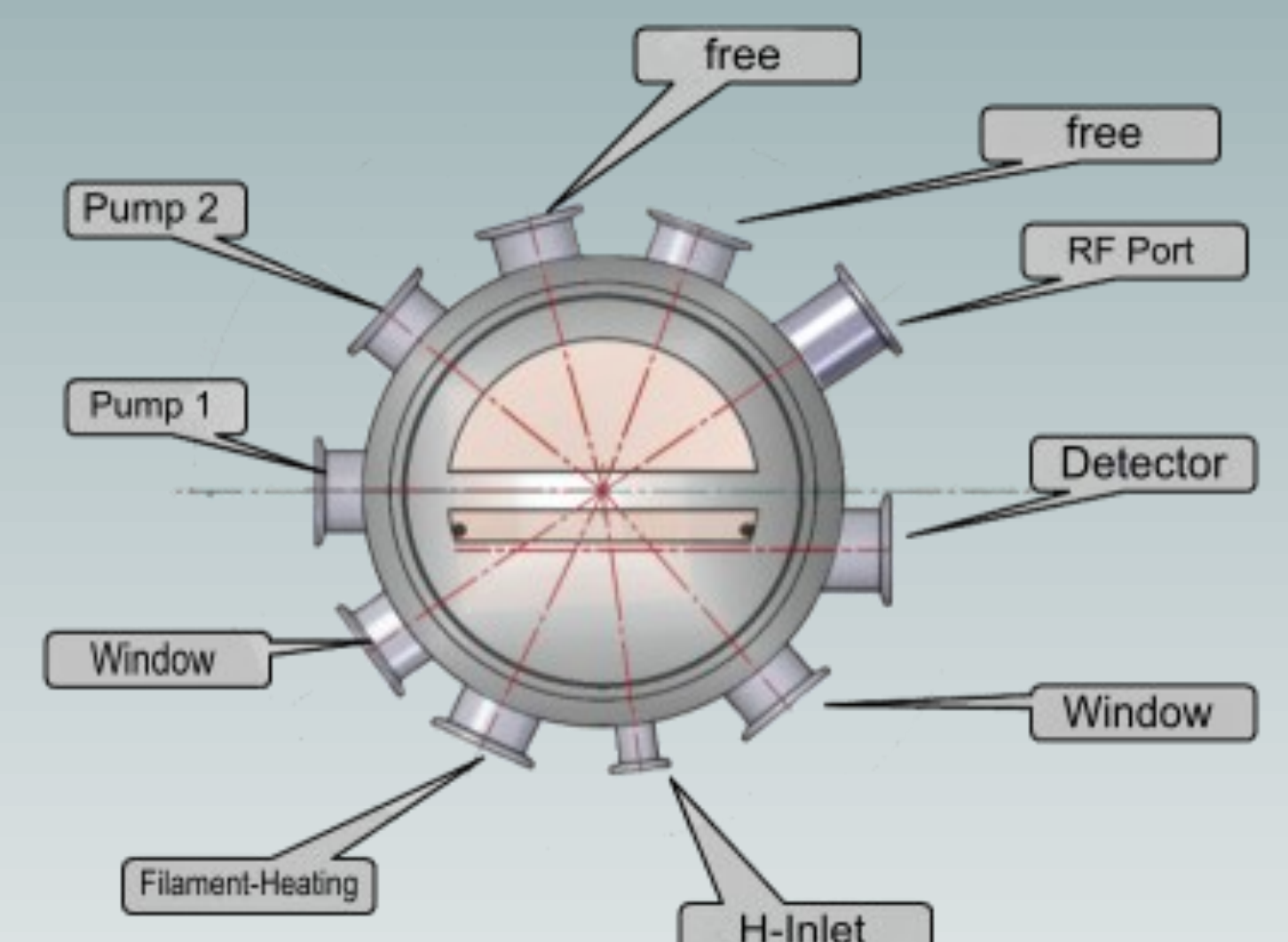
2022



A cyclotron is an accelerator which can be understood easily. Therefore, the principle is found in every textbook of secondary schools in Germany as one of the typical applications of electromagnetic fields.

A real cyclotron, however, is a very complex device consisting of many sophisticated subsystems which are carefully coordinated. For this reason, hardly any pupil or student has ever seen a real cyclotron, let alone carried out his own experiments with it.

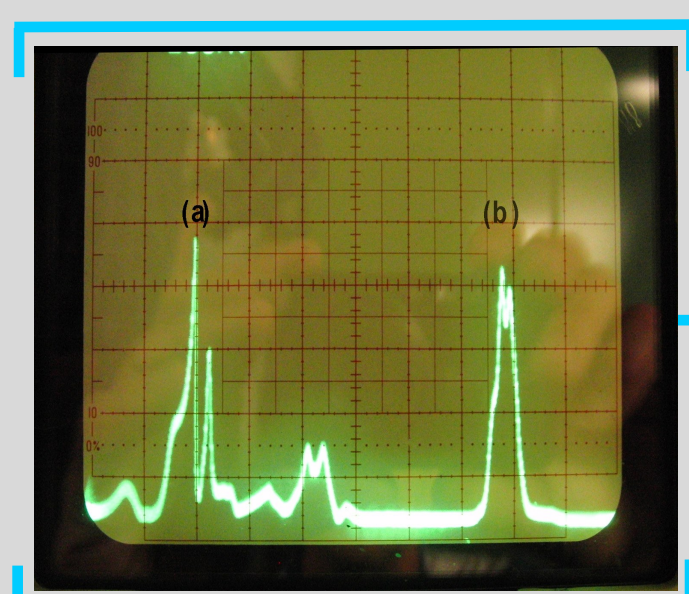
This is where the COLUMBUS-project comes in, providing students with a functioning small cyclotron with which they can learn accelerator physics and even carry out their own experiments.



Technology

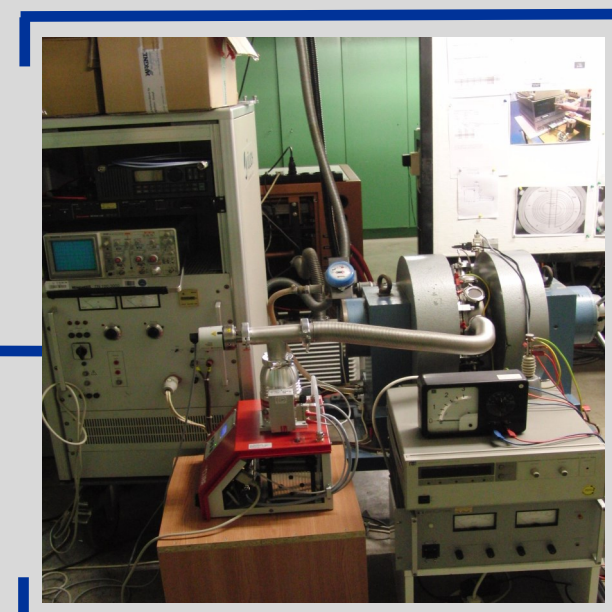
In the year 2012, 10 years ago, the project **COLUMBUS** started.

The FZ Julich made a magnet available, VACOM built and sponsored a vacuum-chamber and the University of Coburg bought a pumping station.



Technical Data of the Cyclotron COLUMBUS	
Diameter of the Dees	140 mm (5.5 inch)
Magnetic Fluxdensity	185 mT (H^+) 370 mT (H_2^+)
Vacuum in the chamber cto with H_2	10^{-7} mbar 10^{-6} mbar
Cyclotron frequency	2.82 MHz 5.64 MHz
Voltage between the Dees	0.50 - 3.0 kV
Final energy	~ 4.1 keV (H^+) ~ 7.5 keV (H_2^+)

2012



In April 2014 the first beam was registered. The two peaks belong to protons, i.e. H^+ - ions (Peak a) and to H_2^+ - ions (Peak b).

The double-peak in the middle was caused by ions which directly hit the detector.

2014



2022

Educational-Concept

Workshops

Formats:

- Two-days in depth
- One-day
- Online

Structure:

- Presentation
- Handling
- Experiment

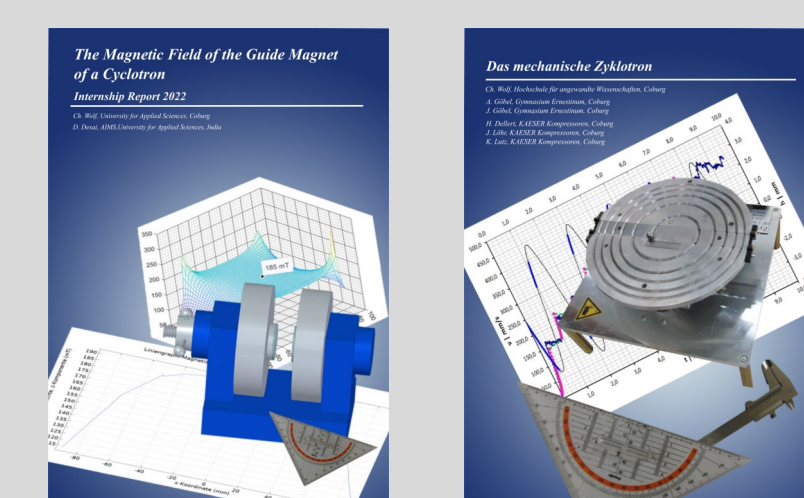
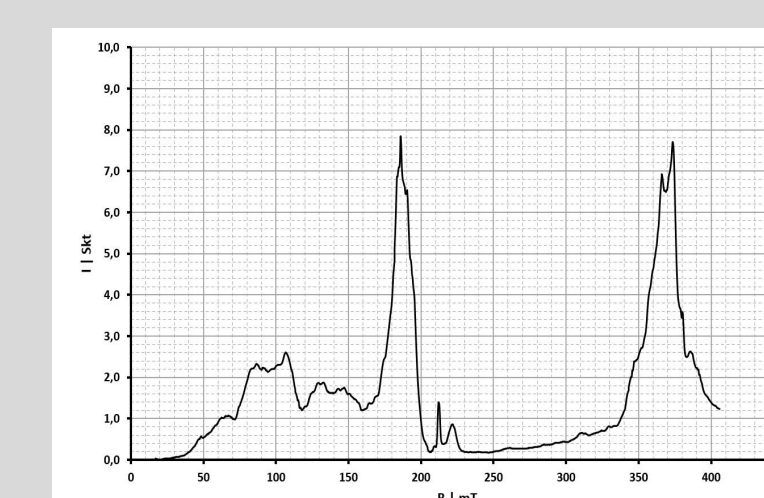
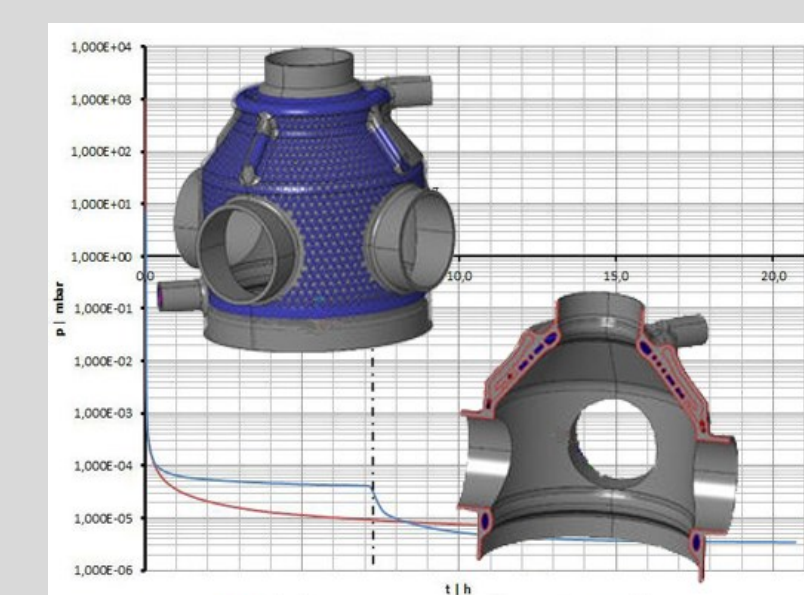
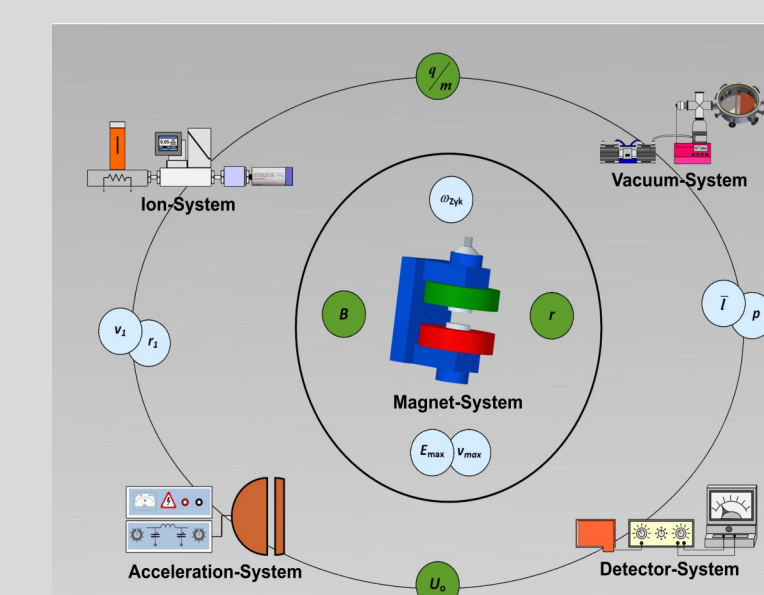
Internship

Contents:

- Researches in depth
- Experiments
- Supplement devices

Aims:

- Reports
- Papers
- Thesises (Bachelor, Master)

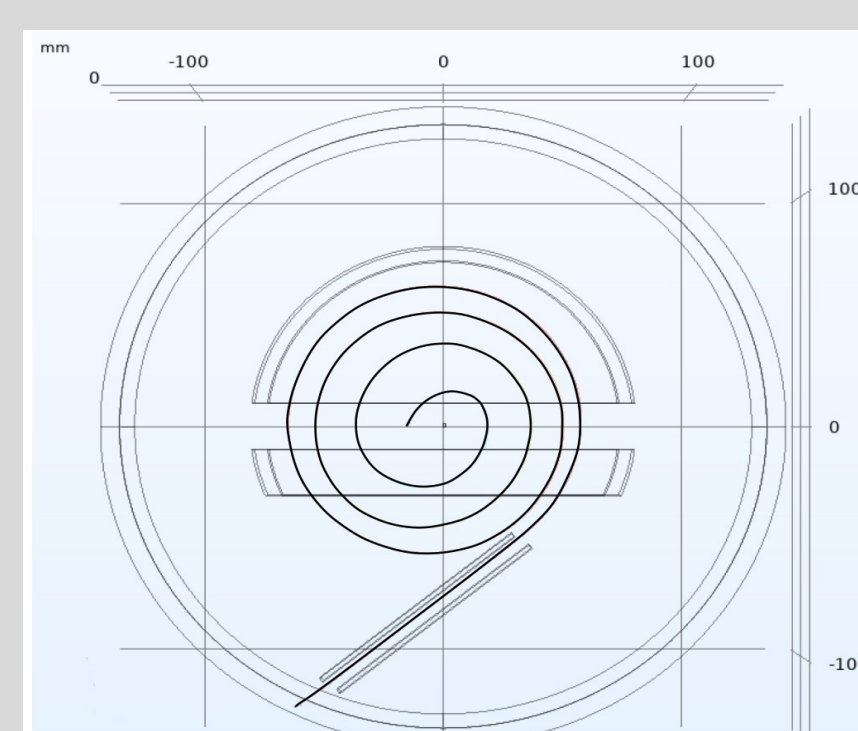


Future-Projects

Extraction System

In August 2021 the construction of an **extraction system** started with the support of IBA, Belgium.

The beam shall be extracted by an electrostatic deflector and sent through a **Wien-Filter** to measure the speed of the particles to compare it with its theoretical value.



Questionnaire

It is planned to work up a **questionnaire** to improve the educational concept.

It should be filled in by students before and after the workshop. From the difference in the answers, you can see which parts of the workshop have been understood and how much the students have caught.

