JÜLICH FORSCHUNGSZENTRUM

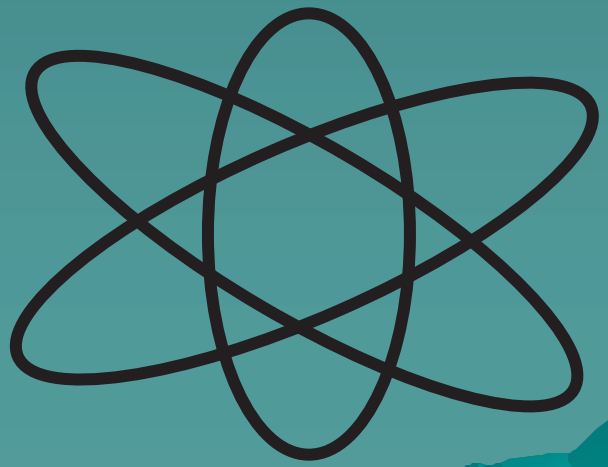
GYMNASIUM ERNESTINUM COBURG

HOCHSCHULE COBURG university of applied sciences

COLUMBUS

A Cyclotron for School- and Teaching Purposes

Christian Wolf, Gymnasium Ernestinum Coburg
Maximilian Frank, Gymnasium Ernestinum Coburg
Ellen Held, Gymnasium Ernestinum Coburg



JÜLICH FORSCHUNGSZENTRUM

GYMNASIUM ERNESTINUM COBURG

HOCHSCHULE COBURG university of applied sciences

Outline

- Motivation
- Technical Data
- Subsystems
  - Magnet, Vacuum Chamber
  - Ion Source
  - RF System
- Current State

JÜLICH FORSCHUNGSZENTRUM

GYMNASIUM ERNESTINUM COBURG

HOCHSCHULE COBURG university of applied sciences

COLUMBUS

A Cyclotron for School- and Teaching Purposes

JÜLICH FORSCHUNGSZENTRUM

COLUMBUS

GYMNASIUM ERNESTINUM COBURG

HOCHSCHULE COBURG university of applied sciences

Conditions:

- standard components
- no radiation

GYMNASIUM ERNESTINUM COBURG

JÜLICH FORSCHUNGSZENTRUM

HOCHSCHULE COBURG university of applied sciences

Technical Data of COLUMBUS

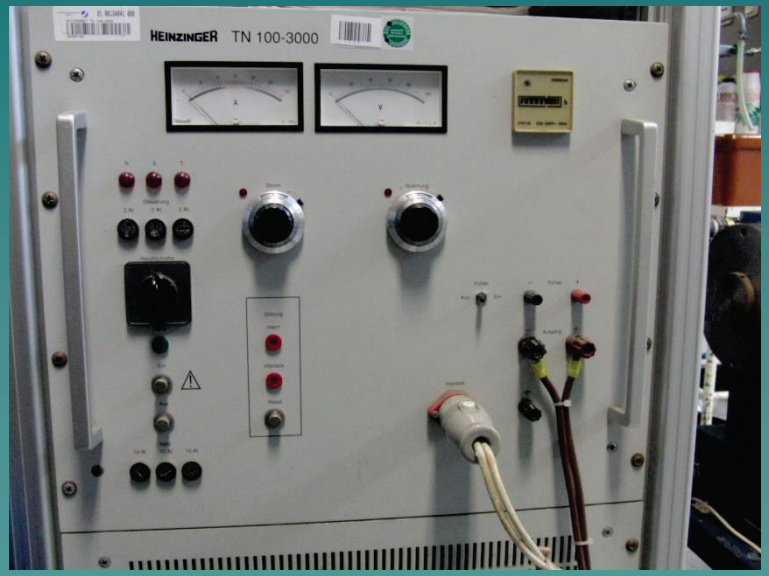
Diameter of the Dees	140 mm (5.5 in)
Flux-density of the magnetic field	0.38 T
Vacuum in the chamber dto with H_2	10^{-5} mbar 10^{-4} mbar
Cyclotron frequency	5.63 MHz
Number of revolutions	6 - 8
Voltage between the dees	2.0 -3.0 kV
Final energy	24 - 48 keV

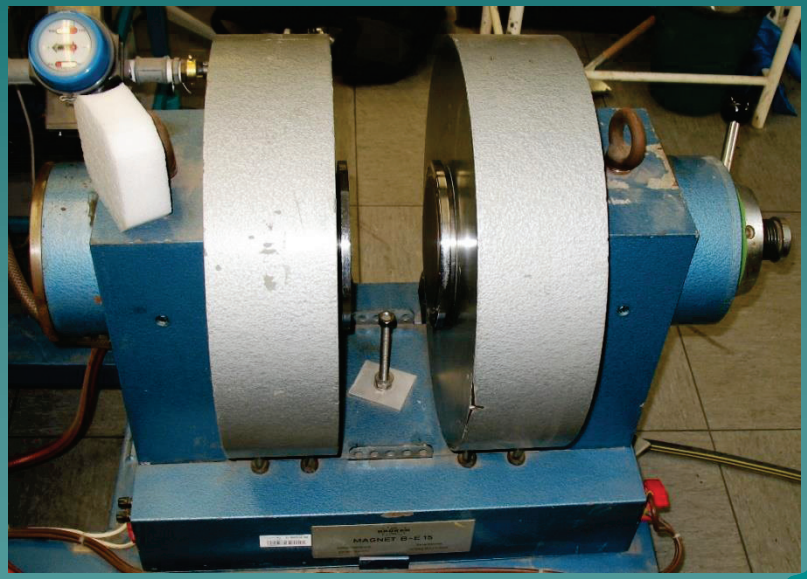
GYMNASIUM ERNESTINUM COBURG

JÜLICH FORSCHUNGSZENTRUM

HOCHSCHULE COBURG university of applied sciences

The Magnet: BRUKER BE-15





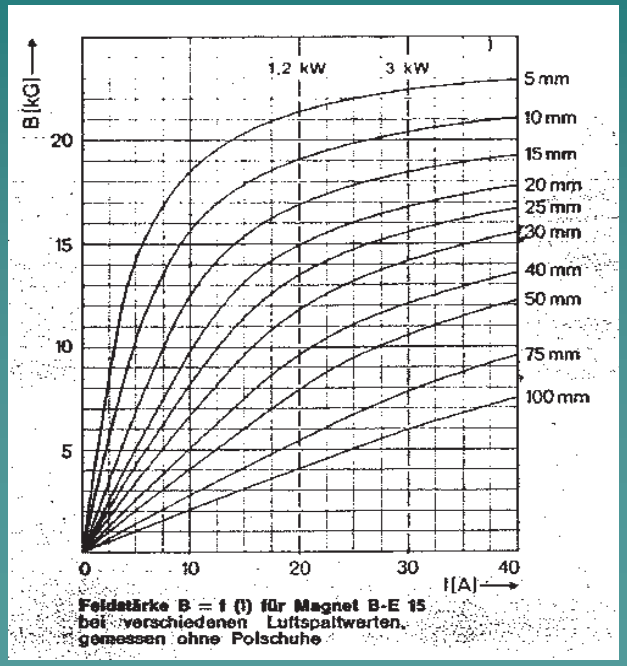
JÜLICH FORSCHUNGSZENTRUM

GYMNASIUM ERNESTINUM COBURG

HOCHSCHULE COBURG university of applied sciences

The Magnet: BRUKER BE-15

Fluxdensity



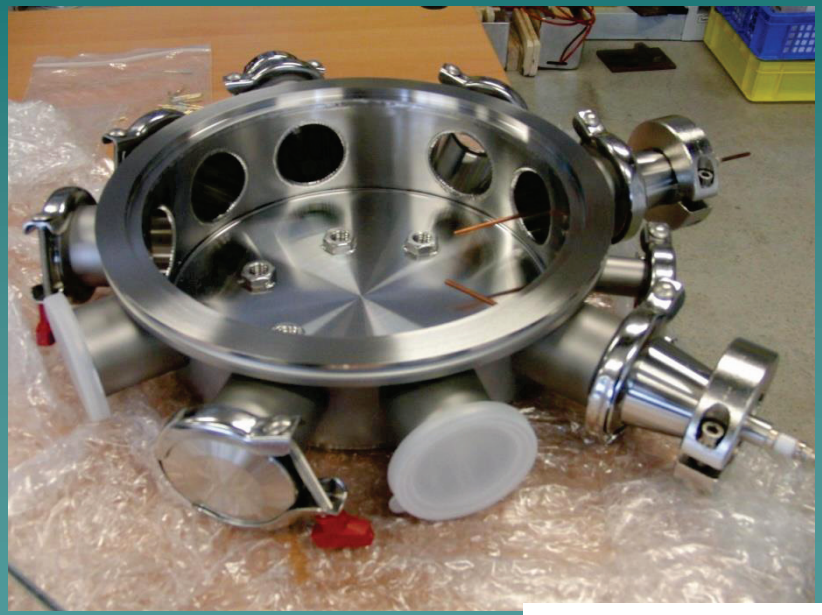
Feldstärke B = f (I) für Magnet B-E 15 bei verschiedenen Luftspaltwerten, gemessen ohne Polschuhe

GYMNASIUM ERNESTINUM COBURG

JÜLICH FORSCHUNGSZENTRUM

HOCHSCHULE COBURG university of applied sciences

The Vacuum Chamber



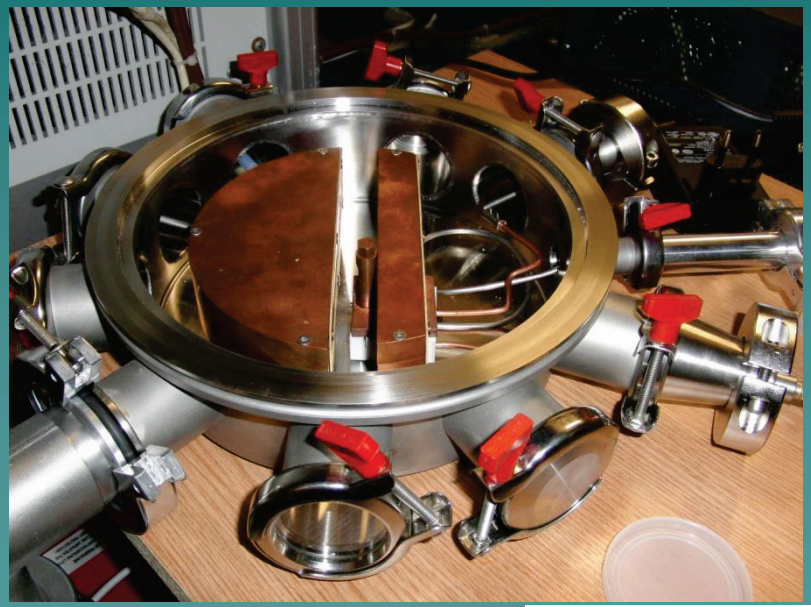
10^{-n} mbar VACOM®

GYMNASIUM ERNESTINUM COBURG

JÜLICH FORSCHUNGSZENTRUM

HOCHSCHULE COBURG university of applied sciences

The Vacuum Chamber



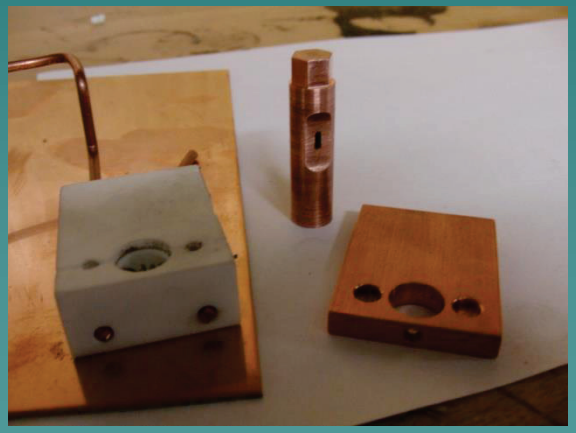
10^-n mbar VACOM®

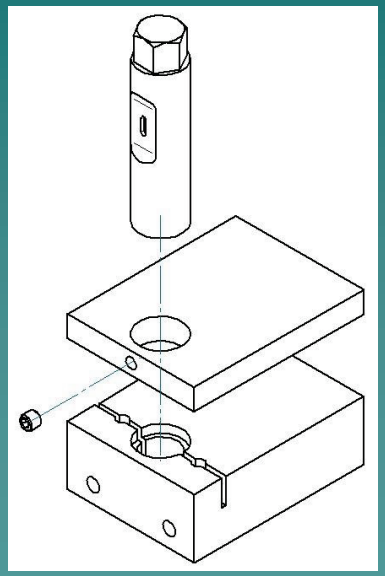
GYMNASIUM ERNESTINUM COBURG

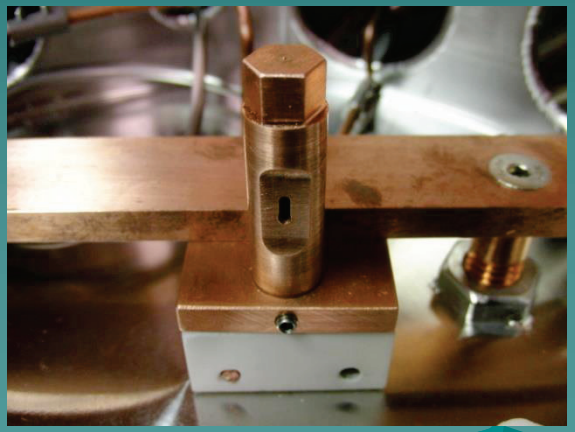
JÜLICH FORSCHUNGSZENTRUM

HOCHSCHULE COBURG university of applied sciences

The Ion Source







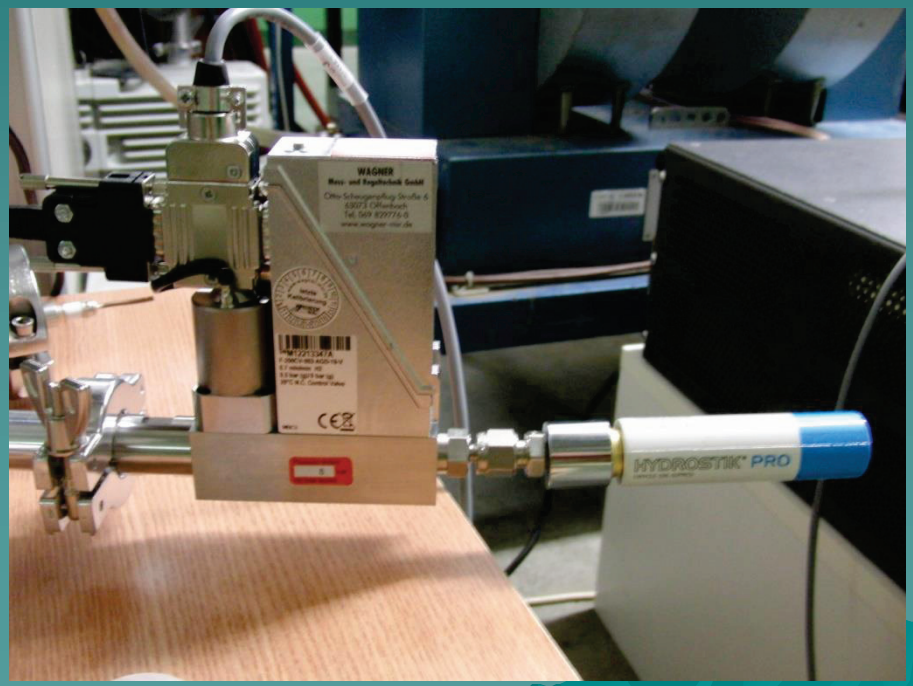
GYMNASIUM ERNESTINUM COBURG

JÜLICH FORSCHUNGSZENTRUM

HOCHSCHULE COBURG university of applied sciences

The Ion Source

The Mass Flow Controller

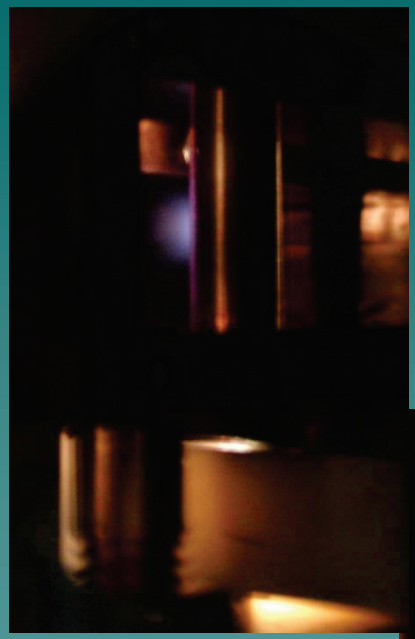


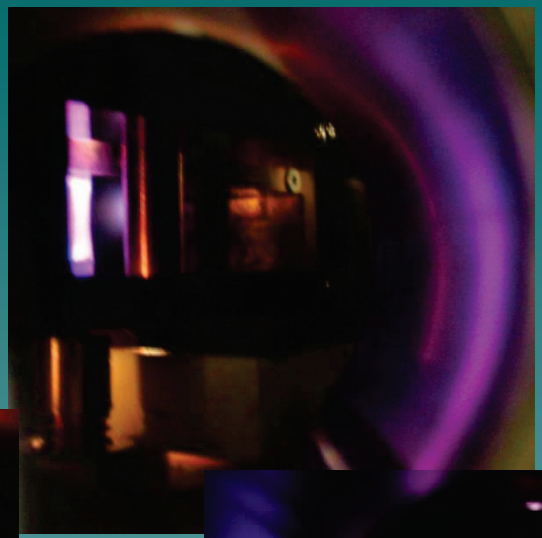
GYMNASIUM ERNESTINUM COBURG

JÜLICH FORSCHUNGSZENTRUM

The Plasma

HOCHSCHULE COBURG university of applied sciences



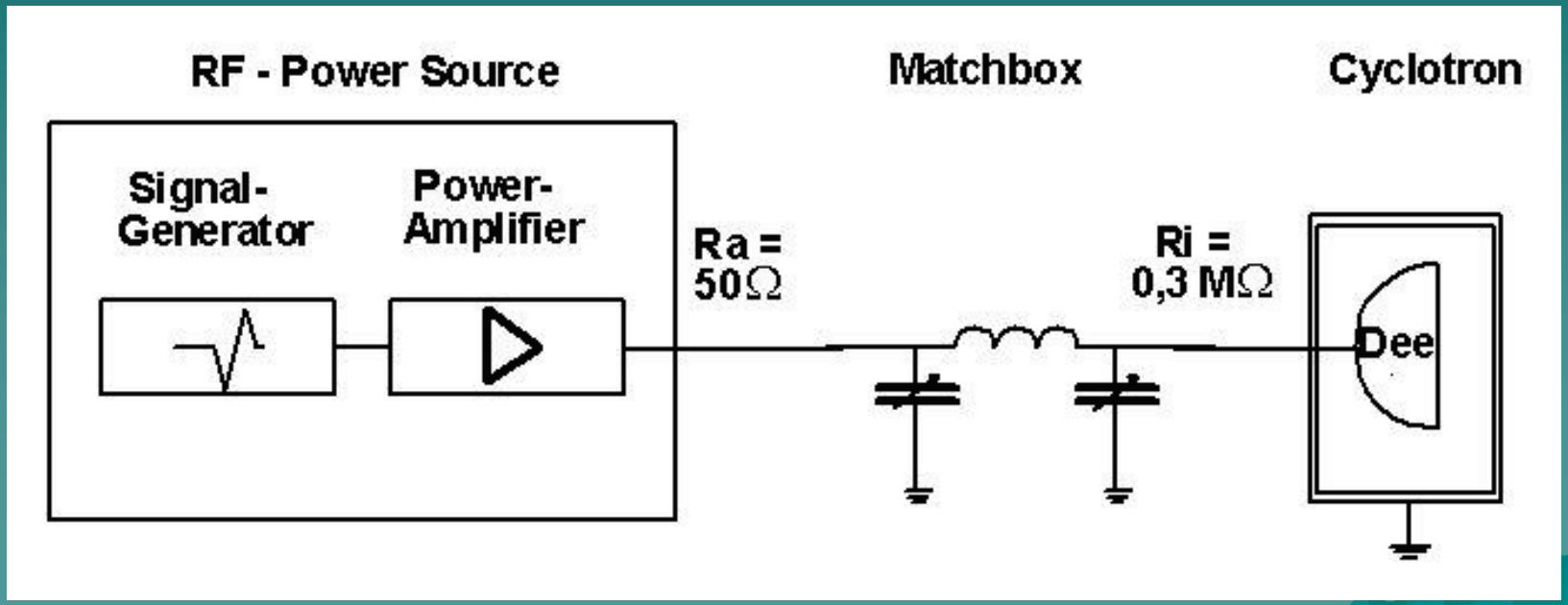


GYMNASIUM ERNESTINUM COBURG

JÜLICH FORSCHUNGSZENTRUM

HOCHSCHULE COBURG university of applied sciences

The RF - System

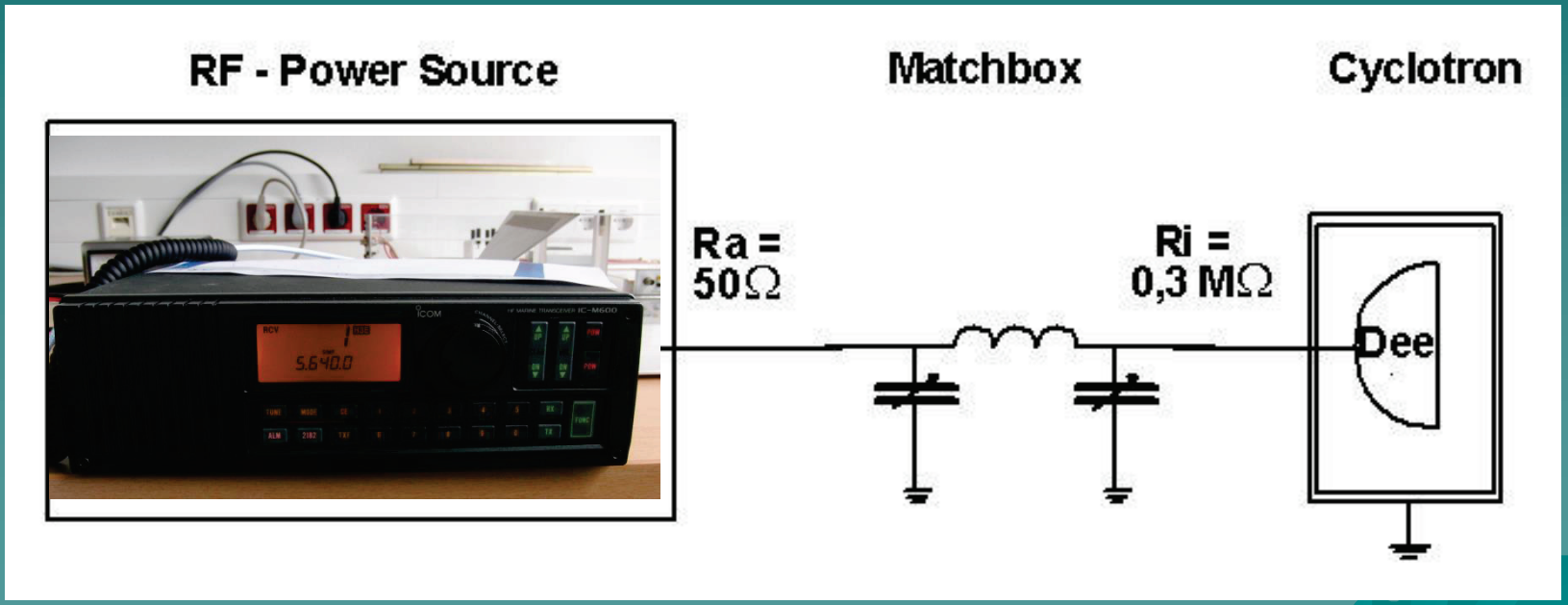


GYMNASIUM ERNESTINUM COBURG

JÜLICH FORSCHUNGSZENTRUM

HOCHSCHULE COBURG university of applied sciences

The RF - System



GYMNASIUM ERNESTINUM COBURG

JÜLICH FORSCHUNGSZENTRUM

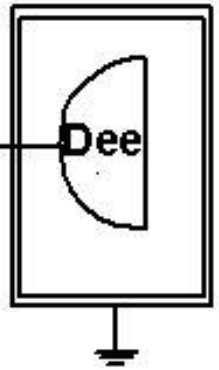
HOCHSCHULE COBURG university of applied sciences

The RF - System

RF - Power Source

Matchbox

Cyclotron



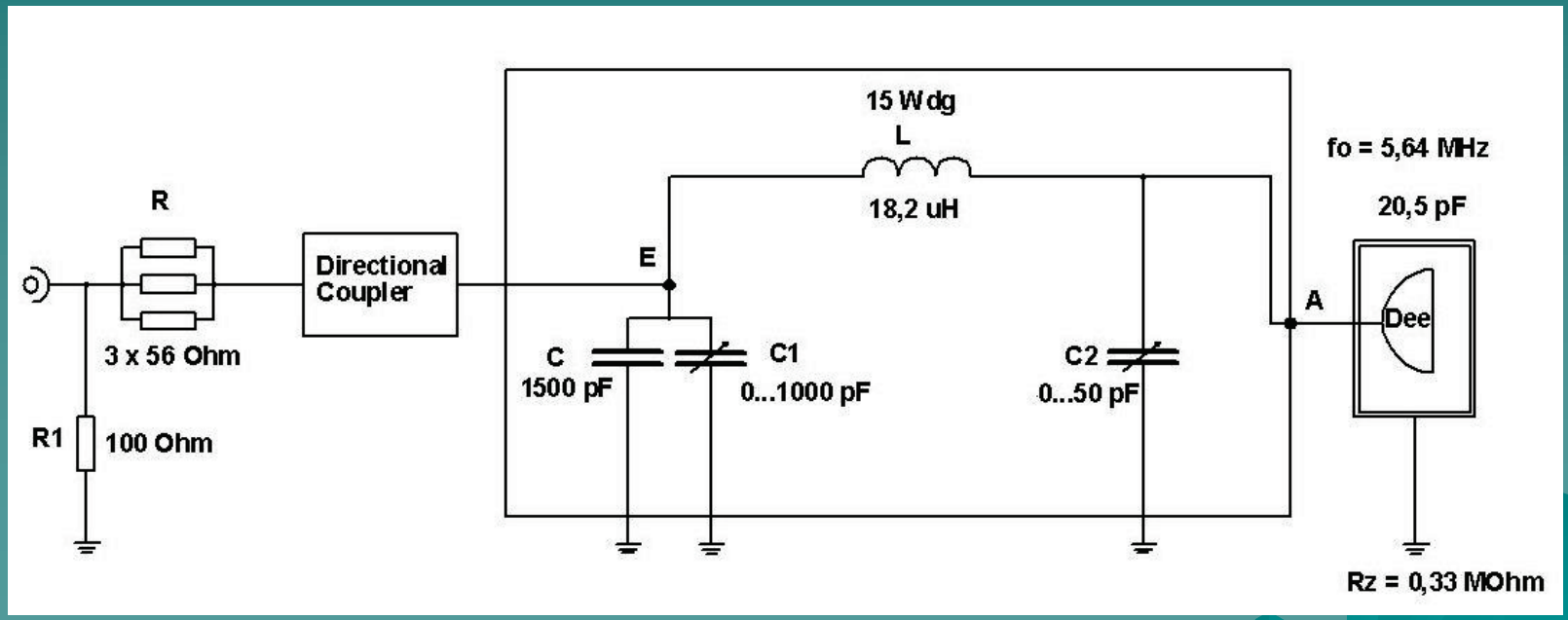
GYMNASIUM ERNESTINUM COBURG

JÜLICH FORSCHUNGSZENTRUM

HOCHSCHULE COBURG university of applied sciences

The RF - System

The Matchbox



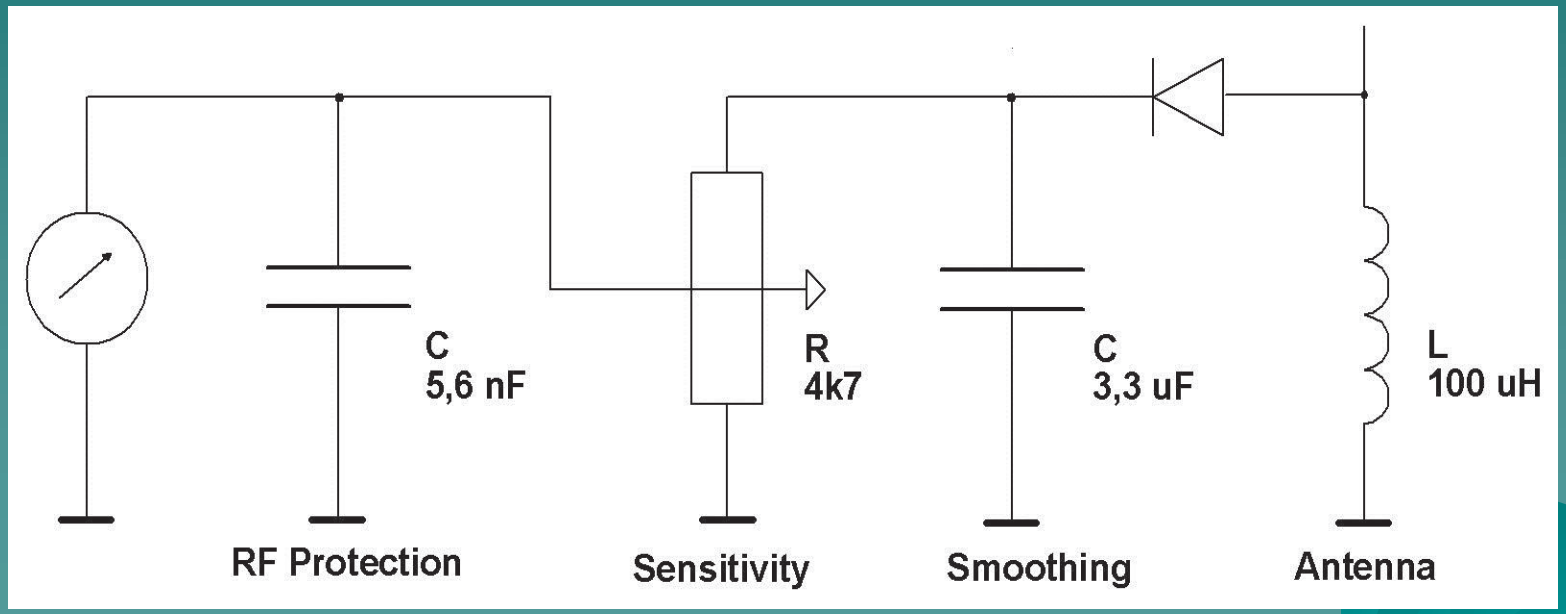
JÜLICH FORSCHUNGSZENTRUM

GYMNASIUM ERNESTINUM COBURG

HOCHSCHULE COBURG university of applied sciences

The RF - System

The RF-PickUp

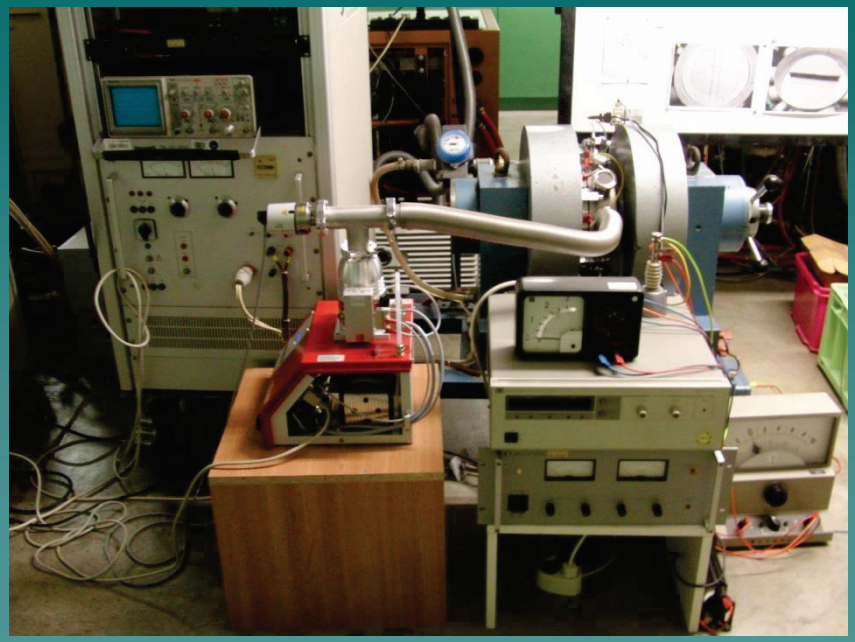


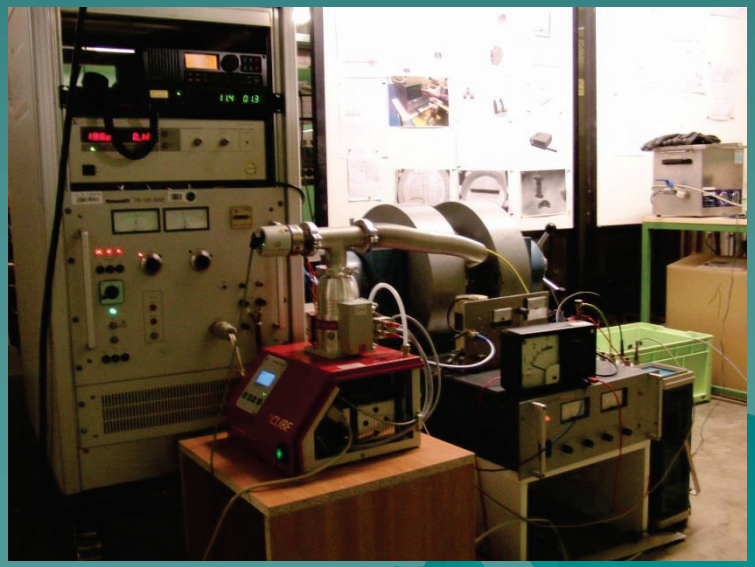
GYMNASIUM ERNESTINUM COBURG

JÜLICH FORSCHUNGSZENTRUM

The Cyclotron

HOCHSCHULE COBURG university of applied sciences



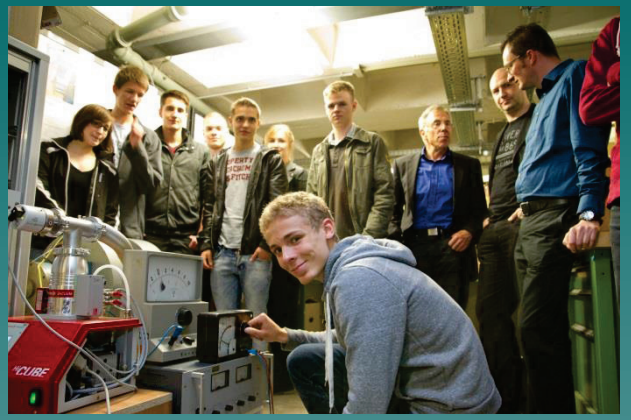


GYMNASIUM ERNESTINUM COBURG

JÜLICH FORSCHUNGSZENTRUM

The Team

HOCHSCHULE COBURG university of applied sciences



JÜLICH FORSCHUNGSZENTRUM

GYMNASIUM ERNESTINUM COBURG

HOCHSCHULE COBURG university of applied sciences

Conclusion

- Magnet is working properly
- RF-System is working properly
- Ion Source is to be improved
- no beam until now
- ... has many students excited for Cyclotrons

GYMNASIUM ERNESTINUM COBURG

JÜLICH FORSCHUNGSZENTRUM

HOCHSCHULE COBURG university of applied sciences

Thank you for

- the invitation
- your attention