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PLEPS: Pulsed low energy positron system

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Abstract: PLEPS, operated by the Universität der Bundeswehr München, located at NEPOMUC, is a unique tool for depth profiling of defects with positron annihilation lifetime spectroscopy using a pulsed positron beam of variable energy.

1 Introduction

Positron lifetime measurements allow to determine type and size of open volume defects (such as vacancies, vacancy-clusters, dislocations, grain boundaries etc., and free volumes in polymers) in a wide variety of materials and provide information on defect-concentration. In combination with a monoenergetic positron beam of variable energy depth-resolved defect analysis becomes possible.

2 Typical applications

- Defect identification in thin layers and layered structures of semiconductors and insulators
- Radiation induced defects in materials for fusion and fission reactors
- Characterisation of free volumes in polymers and glasses

3 Technical Data

3.1 Beam properties

- Positron implantation energy: E = 0.5 – 20 keV
- Beam spot Ø ∼ 1 mm
- Count rate: ∼ 5000 – 10000 cps

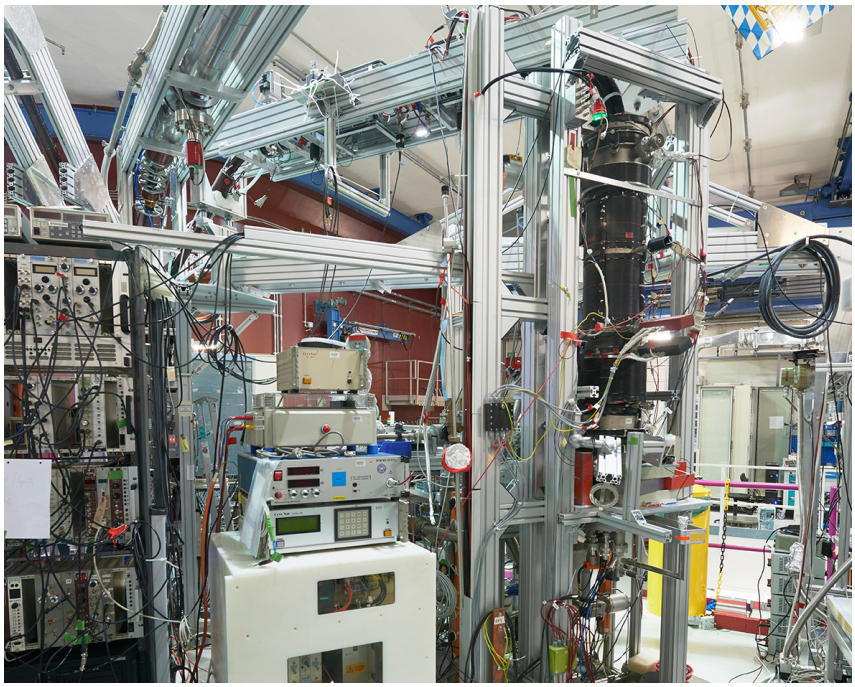

Figure 1: Instrument PLEPS at NEPOMUC (Copyright by W. Schürmann, TUM).

3.2 Sample

- Limited to 5 x 5 mm^2 – 9 x 9 mm^2

3.3 Typical measurement times

- $<$ 10 min per spectrum
  ($> 3 \cdot 10^6$ counts in the spectrum)
- Depth-profile: 4 – 5 h
  (15 – 20 implantation energies, $> 3 \cdot 10^6$ counts in the spectrum)
- Time-window: 20 ns or 40 ns
- Time-resolution: 260 – 280 ps
- Peak/ background $>$ 50000 : 1