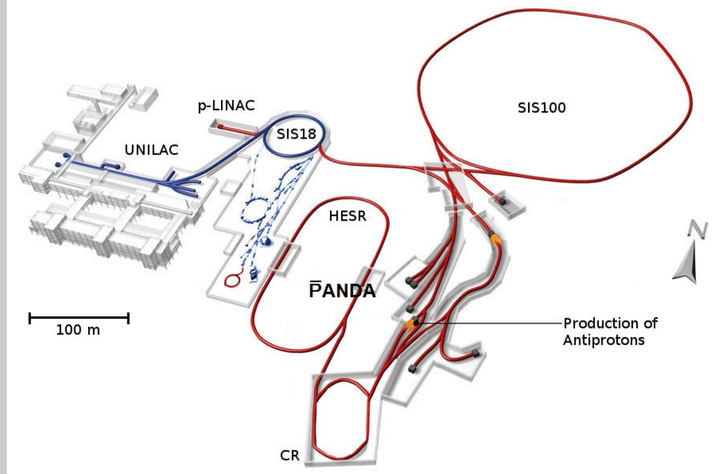
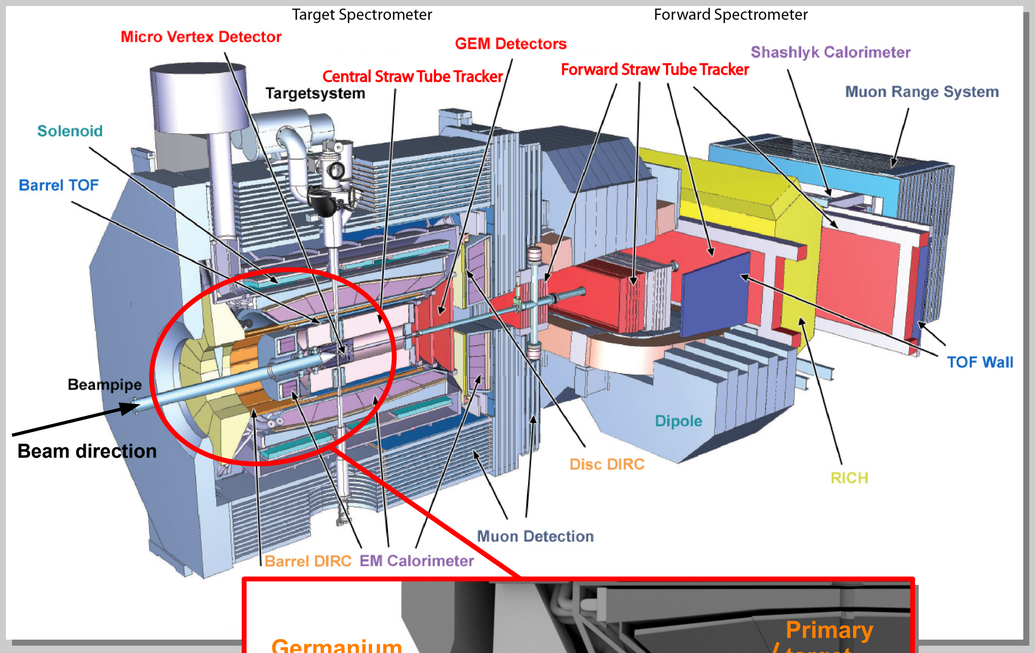
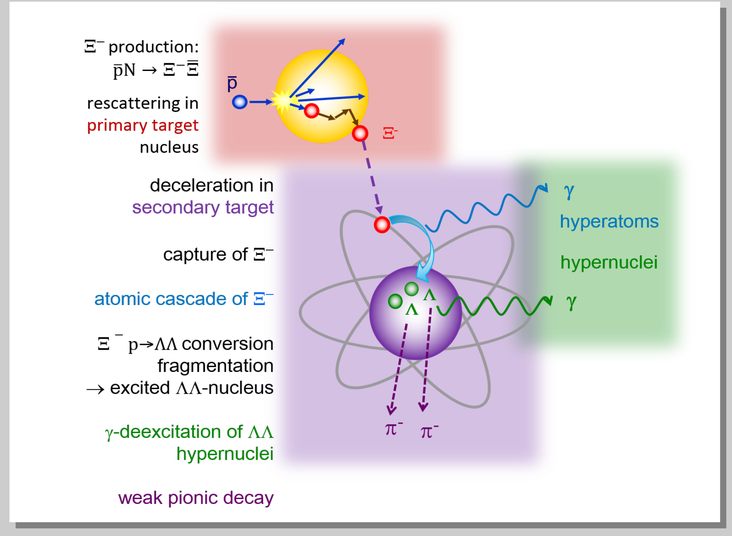
The primary target system for the hypernuclear experiment at $\bar{P}$ANDA@FAIR

***Falk Schupp[1], Patrick Achenbach[1,2], Sebastian Bleser[1], Michael Bölting[1], Jürgen Gerl[3], Ivan Kojouharov[3], Josef Pochodzalla[1,2], Birte Sauer[1], Marcell Steinen[1], Christian Tiefenthaler[1]**

[1]Helmholtz-Institut Mainz, Germany; [2]Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Germany; [3]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany



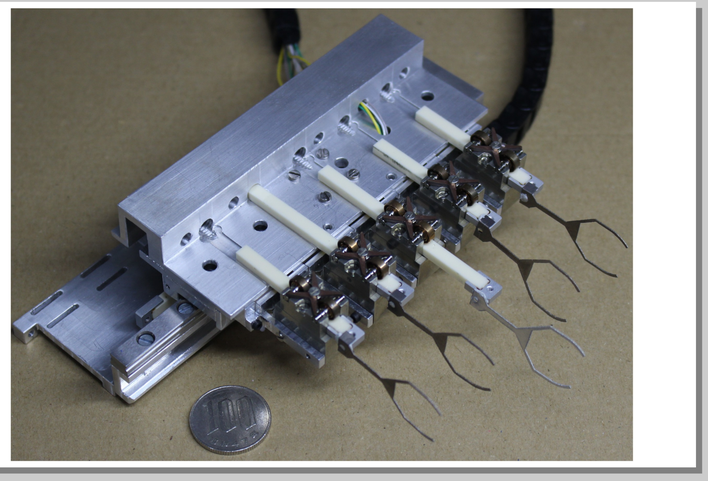




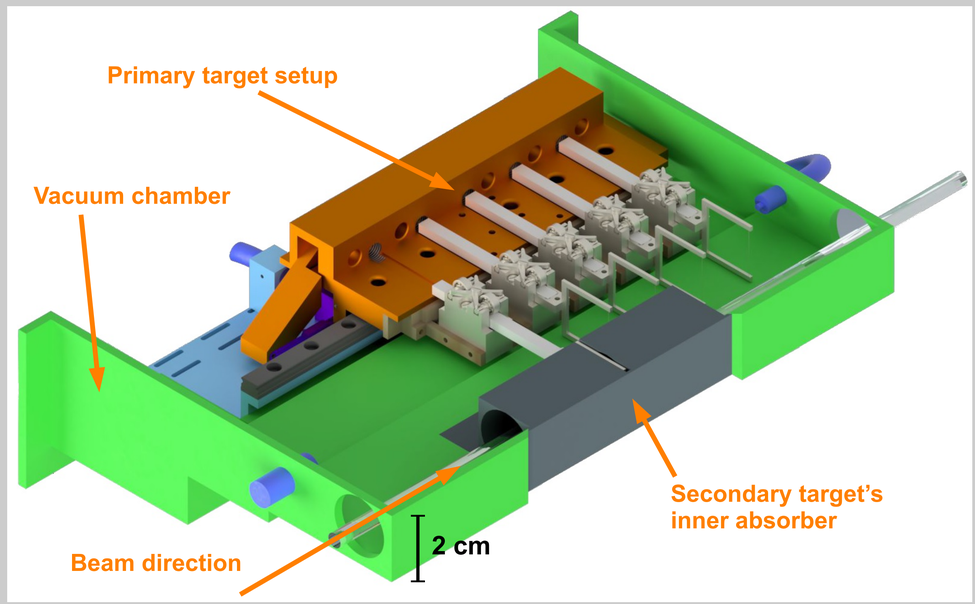
- Antiproton storage ring HESR
- Momentum of 1.5 to 9.0(15.0) GeV/c
- $\Delta p/p = 10^{-5}$
- Up to 10^{10} antiprotons can be stored
- Luminosity ~$10^{31}/cm^2s$

- Fixed target experiment
- Barrel and forward spectrometer
- Modular setup: Allows replacement of components with specialized hardware
- Dedicated hypernuclear detector setup

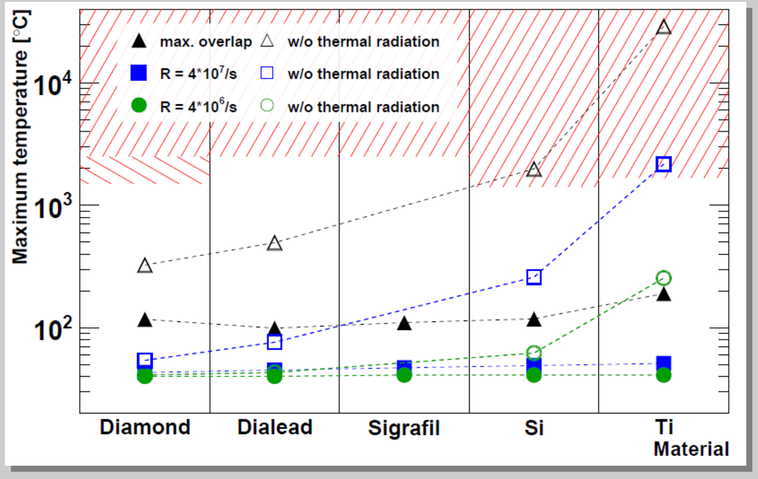
- Production of slow Ξ^- in the primary target via $\bar{p}$A reaction
- Stopping and capture of Ξ^-. Production of $\Lambda\Lambda$-hypernuclei in the secondary target
- Measurement of deexcitation photons with high resolution germanium detectors
- Decay pions will be detected in the secondary target for $\Lambda\Lambda$-hypernuclei identification



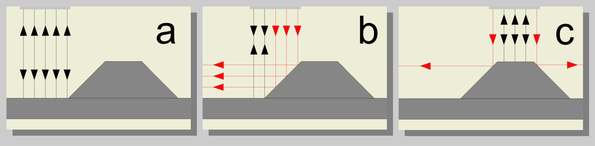
- Short lifetime of Ξ^- requires compact design
- Resistant to radiation, magnetic fields and vacuum
- Thin target filaments due to high beam rates

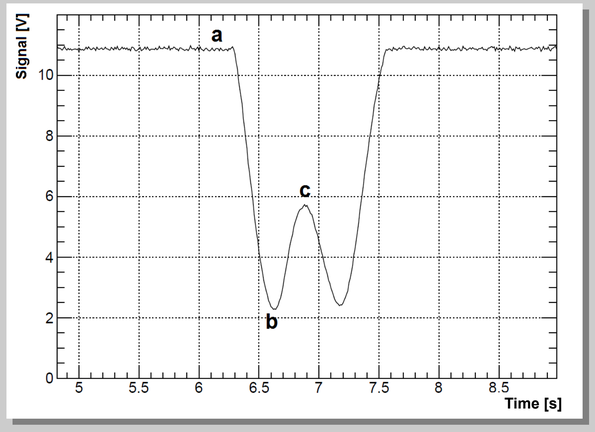


- Two dimensional motion with piezo motors
- Position control by additional sensors required
- Stores up to five filament targets
- Replacement of damaged targets during beam time

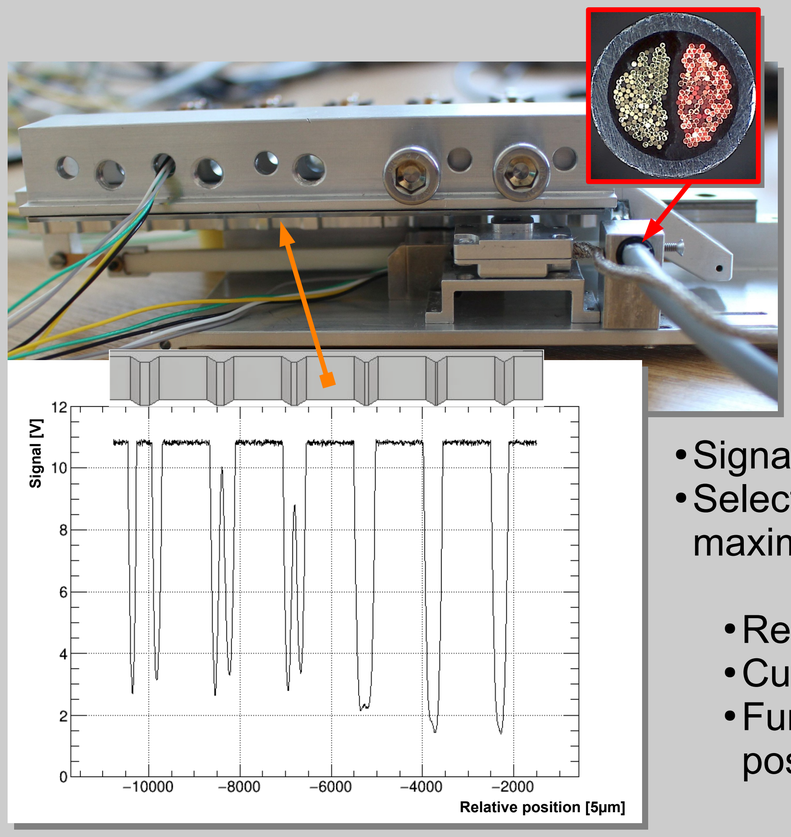


- Primary target material selection:
  - Must not be destroyed in beam
  - Effective production of slow Ξ^-
  - Minimal background and beam degradation
- Best candidate: carbon





- Position detection using infrared light
- Measurement of reflected light on structured surface
- Elevations create specific signals



Backside view of primary target setup:

- Optical fibers transport infrared light
- Bisected light guide used (incident and reflected)
- Active components outside $\bar{P}$ANDA detector
- No special requirements (vacuum/magnetic field/radiation)
- Unpolished aluminum as reflector

- Signal for various geometries
- Select signal with local maximum

  - Required precision: 100 µm
  - Current precision: 62 µm
  - Further improvements still possible