The PANDA Detector
- PANDA (AntiProton ANnihilation at DArmstadt)
  - fixed target experiment with 4π acceptance
  - cooled Antiproton beam with 1.5 to 15 GeV/c
  - detector divided into
    - Target Spectrometer
    - Forward Spectrometer

- MVD (Micro Vertex Detector)
  - tracking detector for charged particles
  - silicon pixel and strip detectors
  - main tasks
    - vertex reconstruction for primary and secondary vertices
    - improvement of momentum resolution and input for PID
  - requirements to materials
    - low radiation length
    - high thermal conductivity
    - mechanical stability
    - stable under high radiation levels

Sensors
- double-sided silicon strip detectors
  - CiS GmbH (Erfurt, Germany)
  - FZ Si, 4", p-in-n
  - 2.85 ± 0.10 μm
  - 2.3 … 5.0 kΩcm
  - p-spray isolation
  - 8 guard rings
  - punch-through biasing
  - AC-coupling
  - 90° stereo angle
  - 65/50 μm pitch
  - sensors being tested by means of
    - probe-station and
    - prototype modules
    - irradiation tests

Hybridization
- pitch-adapter based on flex-PCB
  - Manufacturer: GS Swiss PCB
  - 2 layer Flex-PCB
  - dielectric thickness: 50μm polyimide
  - laser drilling: 50μm
  - smallest wire: 35μm
  - smallest distance between wires: 35μm
  - copper thickness: 2x12μm
  - surface chem. Ni/Au for bonding
  - integration of pitch-adapter into hybrid PCB planned
    → one multi-layer flex PCB at stave-level

MVD Mechanical Design
- the MVD comprises 4 sub-structures
  - pixel barrels
  - pixel disks
  - strip barrels
  - strip disks
- requirements to materials
  - low radiation length
  - high thermal conductivity
  - mechanical stability
  - stable under high radiation levels

Materials Chosen
- barrel holding structure:
  - sandwich structure of carbon fibers (M55J) and Rohacell foam core
- barrel staves:
  - sandwich of carbon fibers (M55J) and carbon foam (POCO HTC)
  - embedded cooling pipe

Electronics
- MVD strip part contains 200,000 channels
  → highly integrated front-end needed
- front-end development
  - ASIC design at INFN, Torino
  - self-triggering
  - fully digital
  - digitization using time-over-threshold (ToT)
  - multiple ToT-stages to reduce pile-up probability
  - low power consumption
  - precise time resolution
  - radiation hard up to 10 MRad

Data Acquisition
- event rate of 2x10^7 events/s requests fast and effective DAQ
  → use a Module Data Concentrator at stave level
- ASIC design carried out at FH-SWF, Iserlohn
  - decoding of front-end data
  - time-ordering of data
  - mapping
  - clustering
  - slow control functions
  - interfacing DAQ via serial GBT E-links
  - Strip-DAQ-chain
    - reduce length of copper lines
    - reduce amount of copper lines
    - use fast optical data links
    - utilize GBT (CERN)
    - off detector electronic:
      - MVD Multiplexer Board (MMB) to implement time distribution system (SODA)
      and link to Compute Nodes

Hybridization schematic setup for irradiation at the Bonn cyclotron
schematic setup for irradiation at the Bonn cyclotron
volume leakage current (left) and full depletion voltage (right) at different neutron fluences