Mechanics and detector integration in the PANDA Micro-Vertex-Detector

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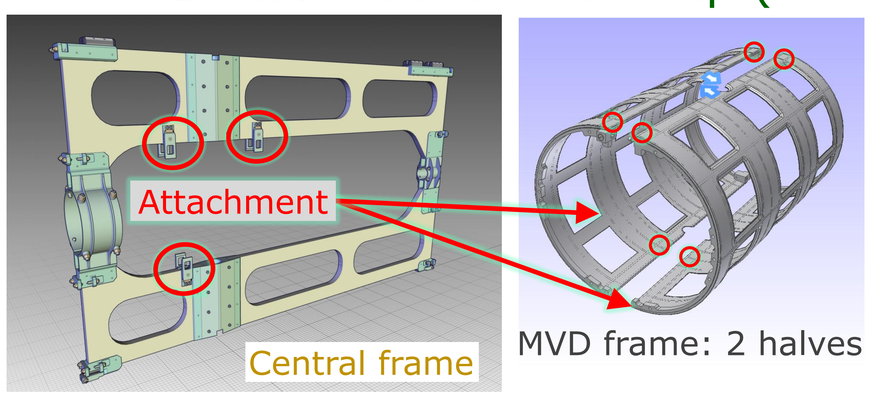
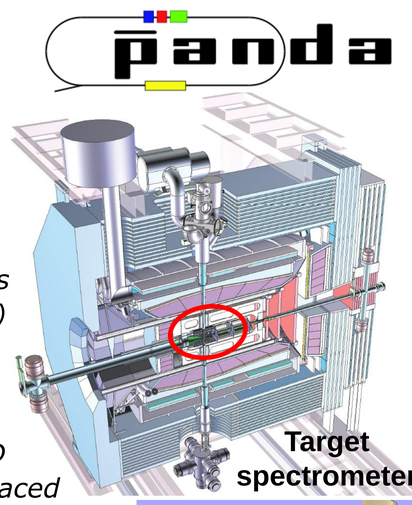
Supported by BMBF and EU FP6 "Dirac Secondary Beams"

Micro-Vertex-Detector (MVD)

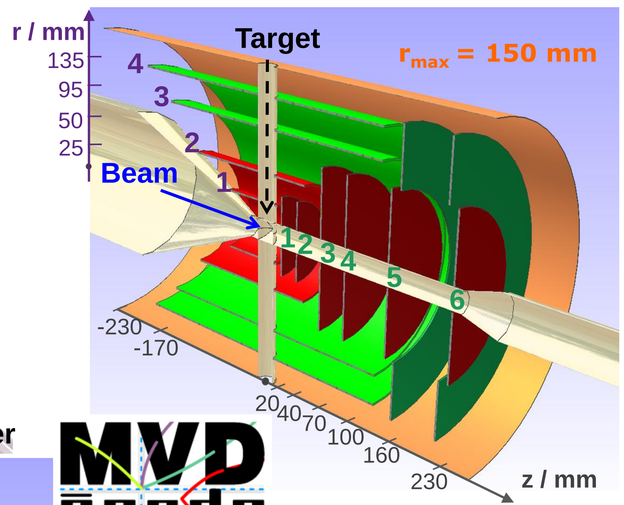
- Tracking charged particles close to vertex
- Innermost detector of target spectrometer
- Basic layout: 6 disk layers and 4 barrel layers
- Silicon detectors: Hybrid pixel (inner layers)
  Double-sided microstrip (outer layers)

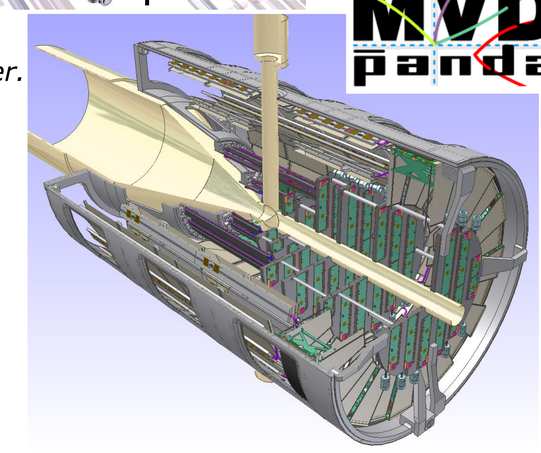


MVD frame: 2 halves



Schematics (top, right) and CAD model (bottom) of the MVD which is placed inside the PANDA target spectrometer.





Other contributions at TWEPP conference: ID 40 / ID 41

Main MVD parts

2 pixel half-barrels
2 strip half-barrels
6 pixel half-disks
2 strip half-disks

Readout channels:

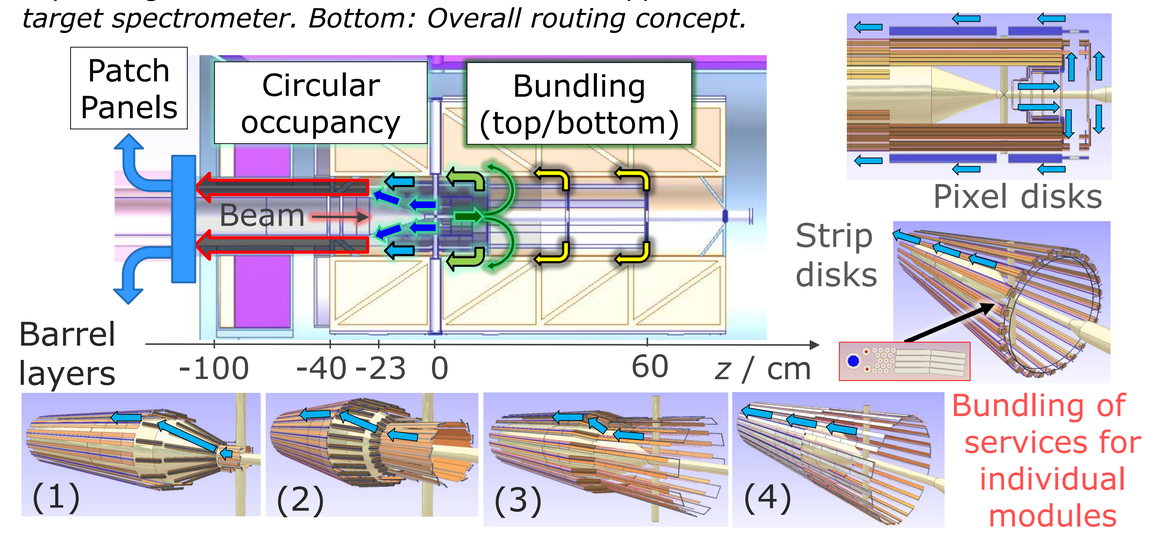
10 million (pixel)

0.2 million (strip)

Total silicon area:

$\propto$1 m^2

Top: Integration of the MVD to the central support frame inside the target spectrometer. Bottom: Overall routing concept.

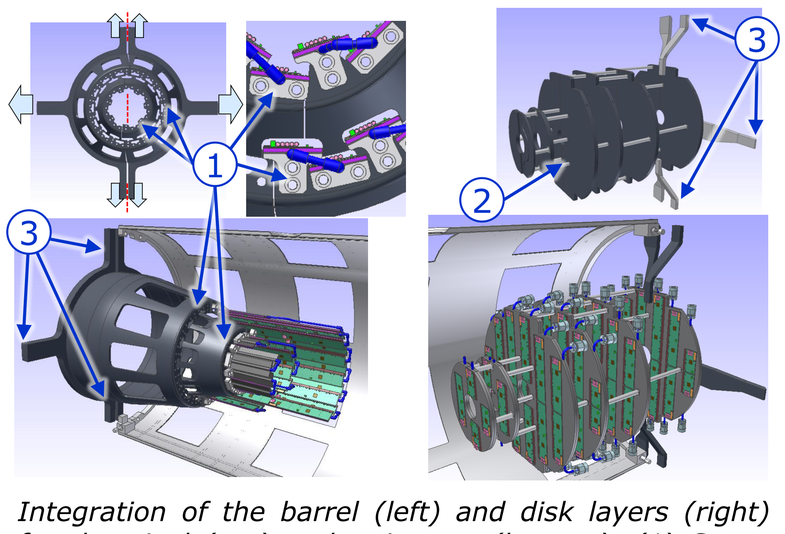


Requirements

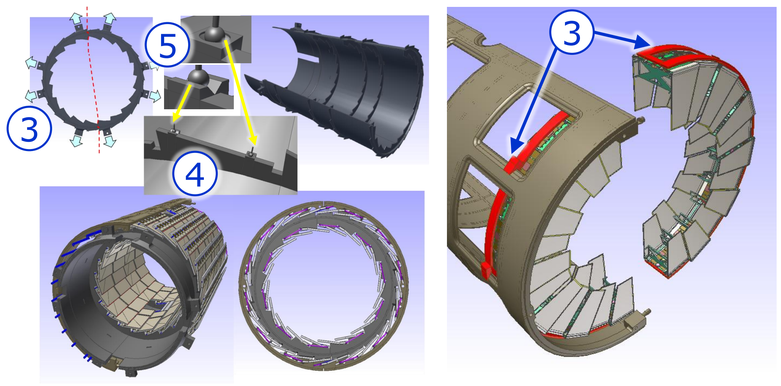
- High compactness and low material budget
- Stringent boundary conditions for integration
- Radiation tolerant components $\propto$1 Mrad (TID)
- Active cooling of readout electronics
- Precise alignment and high reproducibility

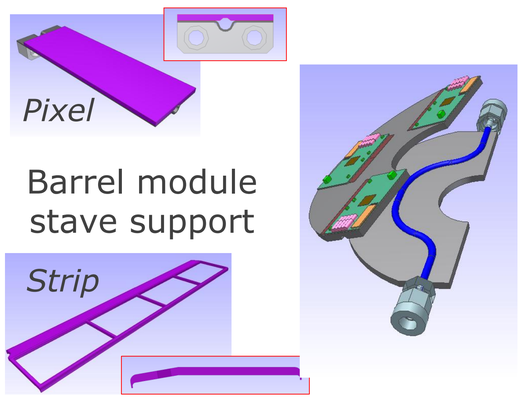
Detector integration

- Local detector module support
- Separate holding structure for barrel layers and forward disks of pixel and strip part



Integration of the barrel (left) and disk layers (right) for the pixel (top) and strip part (bottom). (1) Screw connections to the support cone; (2) spacers; (3) Connection to MVD frame, (4) Support surface for barrel modules fixed with a clip connection (5).

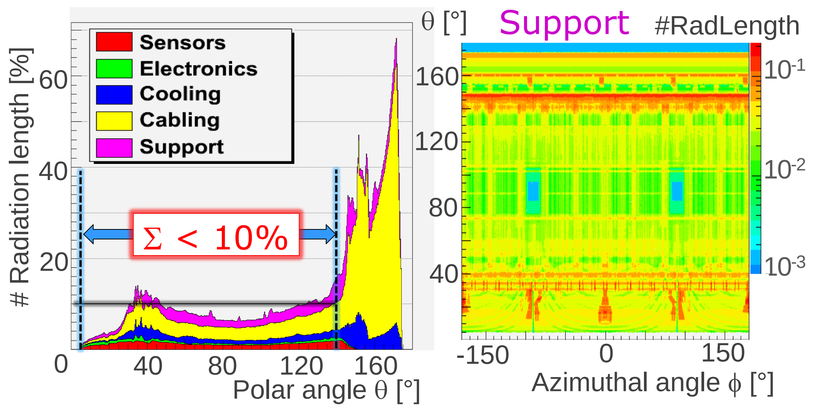




Development

- Lightweight carbon support structures
  - Sandwich structure: Carbon fibre / Carbon foam
- Micro fittings

Developed prototypes of various support components.



Simulation results of radiation length studies with a detailed model: Material budget along the polar angle and 2D distribution of contributing support structures.

Results

- Evaluated concept for support and integration
- Radiation length studies: Optimized material budget
- Prototyping started

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