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The DIRC Detectors of the PANDA Experiment at FAIR

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The PANDA experiment at FAIR will address fundamental questions of the strong force, explore the structure of the nucleon, investigate Charmonium states, and search for new forms of matter using cooled antiproton beams of unprecedented intensities in the momentum range of 1-15 GeV/c.

Particle identification (PID) will play a crucial role in reaching the physics goals.

The charged PID in the barrel and endcap regions needs thin detectors operating in a strong magnetic field, capable of pion-kaon separation with more than three standard deviations up to 4 GeV/c momentum.

Ring Imaging Cherenkov detectors using the DIRC (Detection of Internally Reflected Cherenkov light) principle are an excellent match to those requirements.

The PANDA experiment will therefore contain two DIRC detectors: the Barrel DIRC, based on the design of the BaBar DIRC with many important improvements, covers the polar angle range from 22 deg to 140 deg, and the Disk DIRC, for polar angles between 5 deg and 22 deg, combines several novel techniques.

Challenges include the design of focusing optics, mitigation of the chromatic dispersion in the fused silica radiator, and selection of sensors capable of single photon detection with better than 100 ps resolution in a 1-1.5 T field at hit rates of up to 2 MHz/cm².

We present details of the design of the PANDA DIRC detectors and discuss the performance of barrel and disk DIRC prototypes in particle test beams.

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