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Status of the PANDA DIRC Detectors

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Among other physics goals, the PANDA experiment at the FAIR facility at GSI will perform charmonium spectroscopy and search for gluonic excitations using high luminosity antiproton beams from 1.5 to 15 GeV/c. To achieve these scientific objectives, a high performance particle identification (PID) system is required, in particular a kaon/pion separation up to 4 GeV/c. Because of space limitations the main components of the PID system will consist of DIRC (Detection of Internally Reflected Cherenkov light) detectors located in a magnetic field of about 1 Tesla. A barrel DIRC with fused silica radiator bars will surround the target at a radial distance of about 50 cm and cover a polar angle range of 22 to 140 degrees; an endcap DIRC, consisting of a four-fold segmented fused silica disk with a diameter of about 2.1 m, will be installed in the forward region to cover polar angles from 5 to 22 degrees.

During the R&D phase, the PANDA DIRCs had to overcome several challenges, which will be discussed in this presentation: the photon rates can reach MHz/cm^2 and photon detection with high spatial and temporal resolution is required within the magnetic field. The limited space available for both DIRCs forced the development of specialized optics to focus the Cherenkov photons onto a compact readout area that allows a straightforward and efficient reconstruction of the Cherenkov angle. Design and testing of the specific optical elements are discussed. High rate and magnetic field capable multi-anode microchannel-plate (MCP) PMTs were selected as photon sensors to read out the ultrafast signals using specially designed frontend boards.

The different design and readout options for both DIRCs were investigated with small-scale prototypes using particle beams in different laboratories. Important results of these test runs will be presented and compared with simulations. While further development of the endcap DIRC is currently paused, the construction of the barrel DIRC is underway. The components such as radiator bars and MCP-PMTs are already available or are currently being delivered and quality-tested. Other components such as lenses, expansion prism, bar boxes and readout electronics are still in an optimisation phase.

The current status of both the endcap DIRC and the barrel DIRC will be reviewed in this contribution.

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