Commissioning of the HADES-RICH Detector ◇

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A fast Ring Imaging CHerenkov (RICH) detector will provide online e^+e^- pair identification in the new **H**igh **A**cceptance **DiE**lectron **S**pectrometer HADES [1] currently being set up at GSI Darmstadt. The electron identification capability of the RICH is of crucial importance for measurements aiming at lepton pair production in nuclear collisions induced by hadrons and relativistic heavy ions.

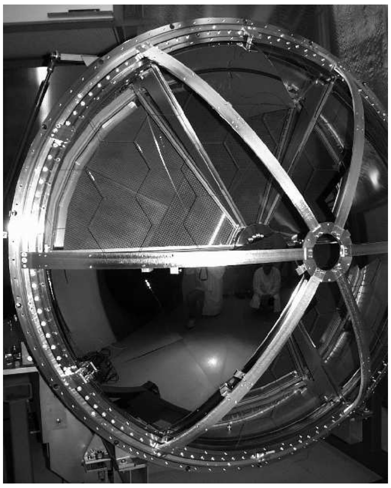

Fig. 1: Front view of the RICH (Ø1.5 m, radiator shell not mounted). The hexagonal CaF_2 crystals are seen in front of the photon detector. Two sectors (ll., ur.) are equipped with 3 mirror segments each.

Electrons or positrons with momenta $p_e > 10\,\mathrm{MeV/c}$ will produce Cherenkov radiation when passing the gaseous C_4F_{10}-radiator, while for all hadrons $\gamma < \gamma_{th} \simeq 18$. The radiator length varies from 36 cm ($\theta_{e^\pm} = 18°$) to 65 cm ($\theta_{e^\pm} = 85°$). The emitted Cherenkov radiation is reflected by a segmented spherical VUV-mirror and focused onto a position-sensitive photon detector with CaF_2 entrance window to form rings of almost constant radius. The photon detector consists of six multi wire proportional chambers with cathode pad readout and a solid CsI photon converter evaporated onto the pads. Photo electron conversion is limited to the VUV wavelength region $145\,\mathrm{nm} < \lambda < 210\,\mathrm{nm}$. For a detailed description see [1].

During 1999 the assembly of nearly all meachanical components was completed starting with the 300kg stainless steel tank and the support structures for photon detector and mirror segments. Due to technical problems the delivery of the novel mirror substrates was delayed. To allow for first measurements an intermediate backup solution of low cost float glas mirrors was installed. The 5 mm thick CaF_2-window (Ø= 1.5m) was glued from 64 hexagonal crystals individually checked for VUV transmission. A shell of 400μm Carbon fiber laminate mounted to the tank is used to close the radiator gas volume. A recirculating gas supply and purification system including a new gas quality monitoring device [2] was installed and tested successfully.

All six MWPC photon detector modules were assembled in the TUM detector lab with a wire pitch precision better than $50\mu m$. After the pad planes had been coated with the CsI layer the modules were brought to GSI and assembled into the RICH support frame under protective nitrogen atmosphere. Fig. 1 illustrates the present assembly status of the RICH. One sector was equipped with newly developed readout electronics (see also [3]).

In first measurements with radioactive sources a very uniform and high visible gain of $8 \cdot 10^4$ over the whole detector area was observed. During a first commissioning run with beam (Ar + Ti, E=1.75 AGeV) the RICH detector showed stable and reliable operation. One sector was read out in coincidence with the corresponding other HADES detectors and data for about $2 \cdot 10^5$ central collisions could be taken applying the new ATM based DAQ system [4].

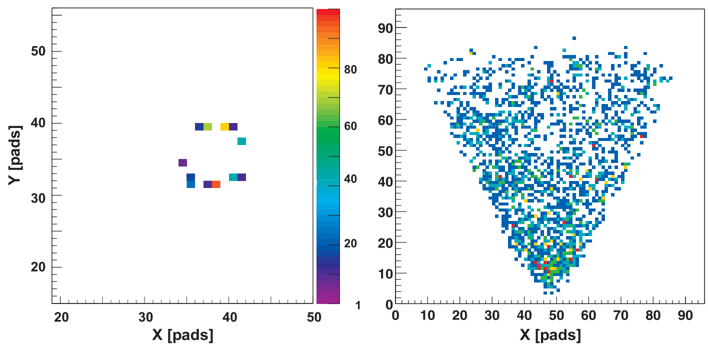

Fig. 2: *left*: Measured ring image for one lepton from Ar + Ti, E=1.75 AGeV. Colour indicates pulse height.
right: Distribution of ring centers of 2500 ring candidates.

In a very preliminary analysis about 2500 candidates for Cherenkov rings were found, one example being shown in Fig.2 (left). In almost all events the ring candidates were not obscured by pad signals due to electronic noise or particle background. A computation of all ring centers (see Fig.2 (right)) shows a rather homogeneous distribution slowly declining with increasing polar angle. Local deviations reflect the non adjusted arrangement of the glas mirrors as well as variations of the electronic noise level across the detector area. The overall results are in good qualitative agreement with GEANT simulations performed for 20000 UrQMD events.

Presently more mirror segments and the readout electronics are prepared for equipment of the whole detector. After a second commissioning test first physics runs of HADES will be performed in 2000.

References

[1] K. Zeitelhack *et al.*, Nucl. Instr. Meth. **A433** (1999) 201
[2] C. Wallner *et al.*, this report, p.28
[3] M. Böhmer *et al.*, this report, p.96
[4] M. Münch *et al.*, this report, p.116

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