Experiences from the 1^{st} HADES Production Run with 2AGeV ^{12}C Beam

The HADES collaboration

During the year 2002 the commissioning of the e^+e^- pair spectrometer HADES has continued with a strong emphasis on optimization of detector readout speed and 2nd level trigger tests. In parallel, further modules of the large size Mini Drift Chambers (MDC) were installed between the magnet and the already completed outermost detector plane, the Multiplicity Electron Trigger Array (META). The analysis of data taken in the full system commissioning run of December 2001 proceeded significantly with the consolidated software package HYDRA and led to the production of data summary tapes (DST) for altogether 50 Million events of recorded C+C collisions at E = 1 and 2 A GeV. Sample results of the data analysis are given in separate contributions to this GSI annual report [1, 2, 3].

In the present contribution we report on experiences gained in the first HADES production run performed over a period of 4 weeks in November and December 2002 in parallel to GSI cancer therapy operation. In off-line tests with a random pulse generator the data acquisition saturates at an accepted first level trigger (LVL1) rate of 18 kHz, having all detectors integrated. LVL1 triggered data is transported up to distributed front-end memory and, except for the drift chambers, to the image processing units. Depending on event size the level 2 triggered data transport saturates typically at rates a factor of 5 to 10 smaller. In the production beam time a C beam of typically 10^7 ions/spill at $E = 2$ AGeV was directed and focussed to a twofold segmented C - target of 6% interaction length. The target consisted of two 3 mm thick pellets of 3 mm diameter separated at 20 mm distance (see insert of figure 1). Two diamond (CVD) strip detectors are used to monitor the beam position and to provide excellent time zero information. In addition we installed a 4-fold segmented halo detector 20 cm upstream from the target for beam focus optimization. It has a central hole of 0.5 mm diameter and is made from the same material. All diamond detectors were provided by the GSI detector laboratory.

The LVL1 trigger condition was set to charged particle multiplicity $M_{ch.p.} \geq 4$ (measured in the TOF wall). While the free LVL1 trigger rates were typically 30 - 35 kHz, only about 7-9 kHz were accepted by the data acquisition. These rates are by a factor 2 smaller as compared to the off-line tests and follow partly from larger event sizes and from the micro structure of the extracted carbon beam, which effectively increase the instantaneous rates. The LVL2 trigger reduction factor for events containing $e^{\pm}$ candidates was about 8 (see also [4]). Lepton identification by online ring recognition in the RICH was affected by charge particles from reactions in upstream material inducing pad patterns in the photon detector, which led to enlarged fake contributions to candidates recognized by the minimum bias algorithm running on the image processing unit.

Throughout the beam time a total of 213 million events were recorded. About 45% (i.e. 93 M) of these are LVL2 triggered events, the remaining represent downscaled LVL1 events . The total recorded event statistics (2 TByte) corresponds to roughly $1 \cdot 10^9$ collisions with a fraction of about $80 - 85\%$ stemming from C+C interactions (see Fig. 1). The detector performances and the integrity of the data stream was monitored online with a new Go4 based package [5]. Parallel to data taking the recorded files were analyzed with the full HADES analysis code HYDRA to yield data with detector information on particle hit level. Here we could make efficient use of fast and automatic parameter retrieval from the ORACLE data base in which calibration and alignment parameters were stored and updated continuously.

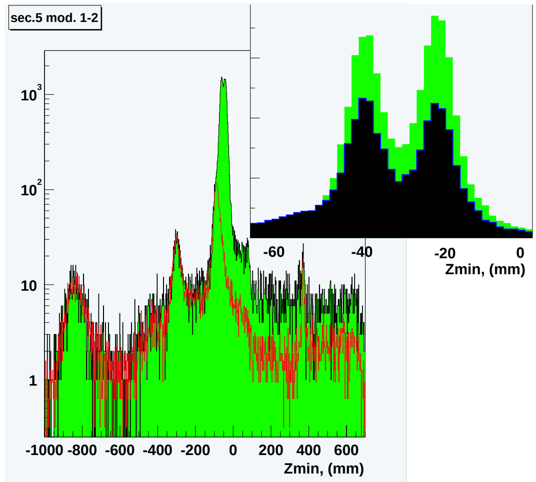

Figure 1: Reconstruction of interaction points along the beam axis z from single particle hits in MDC I and MDC III chambers for C+C at 2A GeV. In beam start detector and foils are clearly visible upstream of the target. The empty target measurement shows that $\simeq 15 - 20\%$ of the vertices are located in the target frame. The insert depicts an blow-up of the target region (linear scale). The dark and the pale histograms refer to LVL2 triggered and downscaled events, respectively.

References

[1] A.C. Agodi et al., this report
[2] J. Bielcik et al., this report
[3] T. Eberl et al., this report
[4] I. Fröhlich et al., this report
[5] J. Markert et al., this report