# EXPERIMENT E910 AT THE BNL AGS

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E910 is a fixed-target proton-nucleus (p-A) experiment performed at the AGS in the spring and summer of 1996. Only in p-A collisions, with a single projectile nucleon, can one study multiple collisions and re-interactions within the nucleus in detail. The primary goal of E910 is to investigate particle production as a function of the number of projectile collisions ($\nu$). This would help improve understanding of the physics in A-A collisions (where all of these processes occur simultaneously). In particular, the experiment was designed to:

- Search for $H^0$ production.
- Elucidate strangeness production mechanisms.
- Measure rapidity loss ($\Delta y$) of the incident proton as function of the number of binary nucleon-nucleon collisions ($\nu$) suffered by the incident proton during the reaction.
- Measure strange meson, vector meson and baryon production as function of $\Delta y$ and $\nu$.
- Make high statistics measurements of $\bar{\mathrm{p}}$ production and absorption as a function of both $\Delta y$ and $\nu$.

The experiment, shown in Fig.1, used a time projection chamber (the EOS TPC) housed in a dipole magnet for primary tracking. Particle identification (PID) in the TPC is done by calculating the ionization energy loss. For downstream tracking and PID, there were three drift chambers followed by a Cerenkov counter and a time-of-flight wall and finally two more drift chambers. Upstream of the target, there were six proportional wire chambers along the beamline, A1-A6. A1-A4 are used to measure the beam momentum, and A5 and A6 are used to measure the incident angle of the beam at the target plane. Data were collected with several targets (Be, Cu, Au, and U) at three different proton beam momenta, 6, 12 and 18 GeV/c.

Since the last progress report, ORNL has contributed sections on the geometry and the performance of the beamline proportional wire chambers to a future NIM paper under preparation which describes the E910 experimental apparatus. E910 completed two analysis passes on the data: a calibration pass and a very preliminary tracking/PID pass. The calibration pass was coordinated by ORNL. The preliminary tracking/PID pass was performed on a subset of the entire data set and used primarily the information from the TPC. ORNL was one of the four data production facilities for both passes. E910 is presently beginning the next analysis pass which will provide tracking and PID for the entire data set.

In order to quantify $\nu$, we have been studying slow proton and slow deuteron distributions. A slow proton is defined for this analysis to be a proton with $0.25 < p\,(\mathrm{GeV/c}) < 1.2$, and a slow deuteron has $0.5 < p\,(\mathrm{GeV/c}) < 2.4$. When the projectile proton collides with a nucleon, the nucleon recoils and experiences secondary collisions. The products of such secondary collisions are often slow protons and deuterons. Past experiments

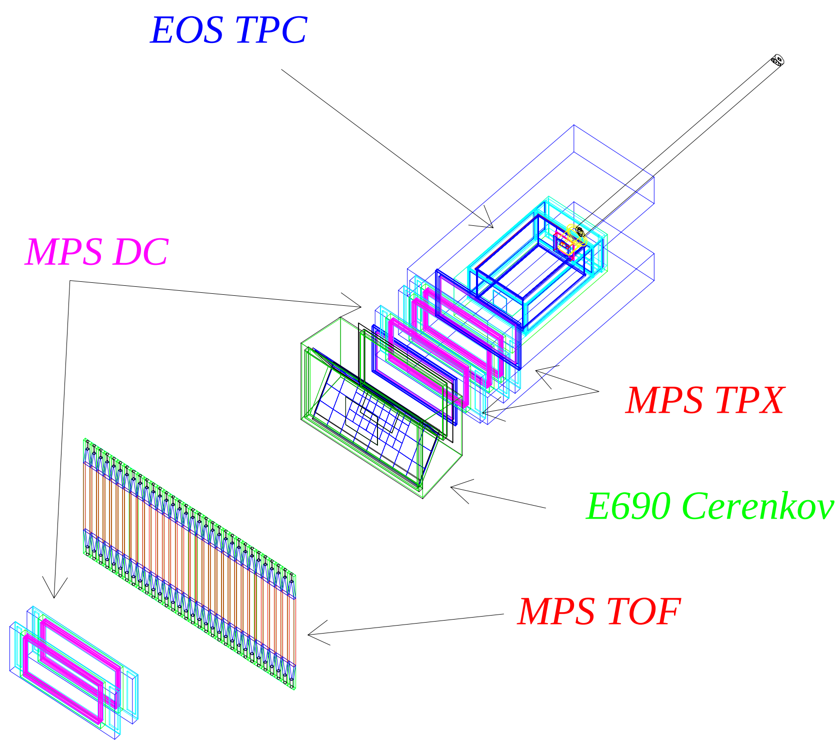


Figure 1: The E910 Spectrometer.

and theoretical calculations indicate that $\nu$ is related to the number of slow protons and deuterons produced in the event. Historically, these slow singly-charged fragments are called “grey tracks” because they were first observed in emulsion experiments. E910 is currently preparing a paper on characterizing event centrality using the number of grey ($N_g$) tracks. We form the distribution $\mathcal{P}(\nu, N_g)$ using a Glauber model to determine the distribution of $\nu$ and assuming a second-order polynomial relationship between $\nu$ and $N_g$. The polynomial coefficients for each target are fit to the data. From $\mathcal{P}(\nu, N_g)$ we can extract the mean value of $\nu$ for a given value of $N_g$, $\bar{\nu}(N_g)$. This is our centrality measure. We can also extract the dispersion in this quantity, $\sigma_\nu(N_g)$. $\bar{\nu}(N_g)$ and $\sigma_\nu(N_g)$ are shown in Fig. 2. Much of this analysis was done at ORNL.

ORNL is also evaluating current TOF calibrations in order to assess whether they are sufficient for $\bar{\mathrm{p}}$ analysis, another analysis topic to be addressed at ORNL. Questions regarding the production mechanisms of anti-baryons as well as their re-absorption in baryon rich matter are currently of great interest in the heavy ion community. Studies using the cascade model RQMD indicate that E910 will have a world-class data sample (for varying target sizes and beam momenta) with which to address these questions. Figure 3 shows the $\bar{\mathrm{p}}$ yield per interaction as a function of target as predicted by RQMD.

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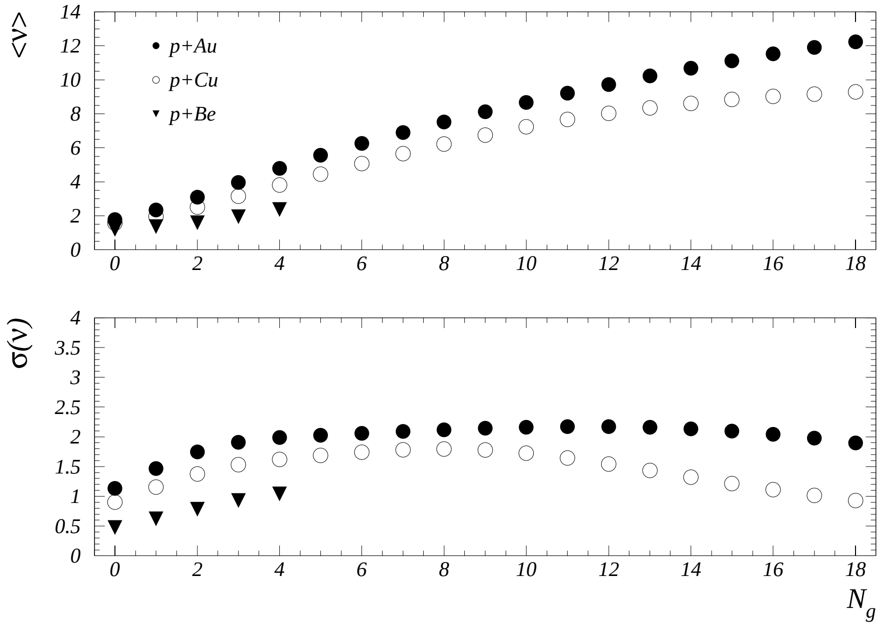


Figure 2: $\overline{\nu}(N_g)$ and $\sigma_\nu(N_g)$ for p+Be, p+Cu, and p+Au.

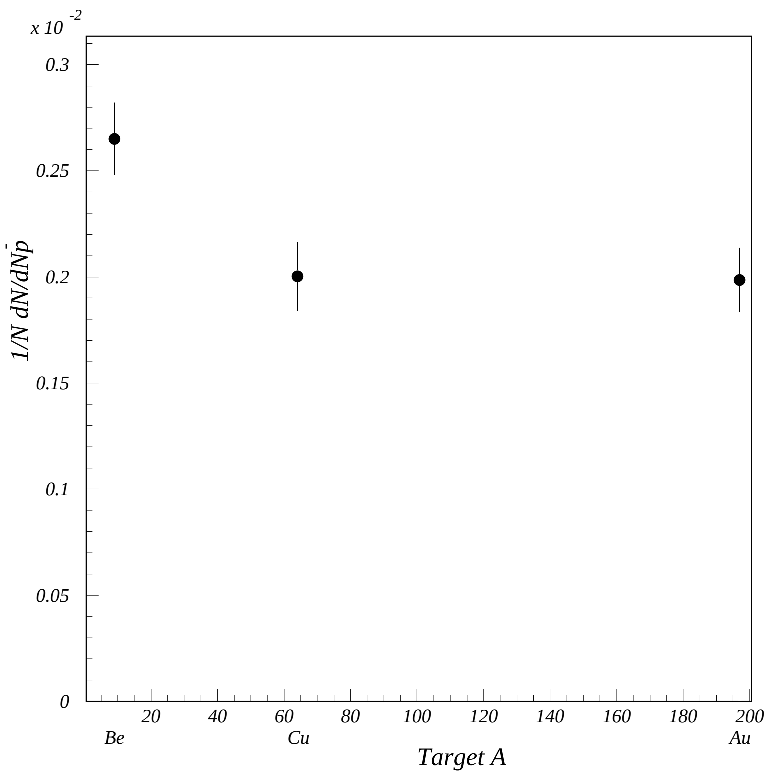


Figure 3: RQMD predicted $\bar{\mathrm{p}}$ yields.