Production of p, d and t in Ar+KCl at 1.76 AGeV*

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This contribution presents preliminary data on proton, deuteron and triton production in Ar+KCl reactions at 1.76 AGeV. The interpretation of HI collisions by means of theoretical models, often focusing on rare observables in this energy regime, such as strangeness or vector mesons, needs to be contrasted to global event characteristics, probing the dynamics of a HI collision. Rapidity distributions of protons and heavier fragments, such as d and t, comprise a direct view on the HI dynamics. At SIS energies valuable systematics have been collected and published by the FOPI collaboration in [1] mostly for central Au+Au collisions. Data of HADES on Ar+KCl at 1.76 AGeV extends this study to a system of medium size.

The protons, deuterons and tritons have been identified by means of three independent informations provided by different sub-systems of the spectrometer. The first selection has been performed with cuts on the energy loss of the particles in the Multiwire Drift Chambers (MDC) and Time of Flight detectors (TOF and TOFino). To improve on that particle identification, the time of flight information and momentum reconstruction is used by cutting on mass windows of the selected particle species in different phasespace regions. After background subtraction and corrections for acceptance and efficiency, one obtains the transverse mass spectra for different rapiditiy regions.

In order to extrapolate to unmeasured m_t-regions, the corrected transverse mass spectra are fitted simultaneously with Siemens-Rasmussen-functions [2]. The resulting parameters for the system are T = (72 $\pm$ 9) MeV and β = 0.40 $\pm$ 0.03, Which is in fair agreement with the chemical freezeout temperature T = 73 MeV of a statistical model fit to the yields and the radial flow velocity of β = 0.39 estimated from the inverse slope parameters of light particles [3].

Fig.1 shows the rapidity distributions of the particles after extrapolation from $0 \leq m_t \leq \infty$ (red), in comparison to the measured data in the HADES acceptance (blue). After integration of the extrapolated rapidity distributions, the multiplicities can be determined to (19.19 $\pm$ 0.92 $\pm$ 0.80) protons, (3.09 $\pm$ 0.03 $\pm$ 0.16) deuterons and (0.45 $\pm$ 0.01 $\pm$ 0.03) tritons (per event). The systematical errors have been estimated by varying the parameters of the extrapolation. The rapidity distributions show a clear two peak structure, not supporting the assumption of a thermal source at mid-rapidity.

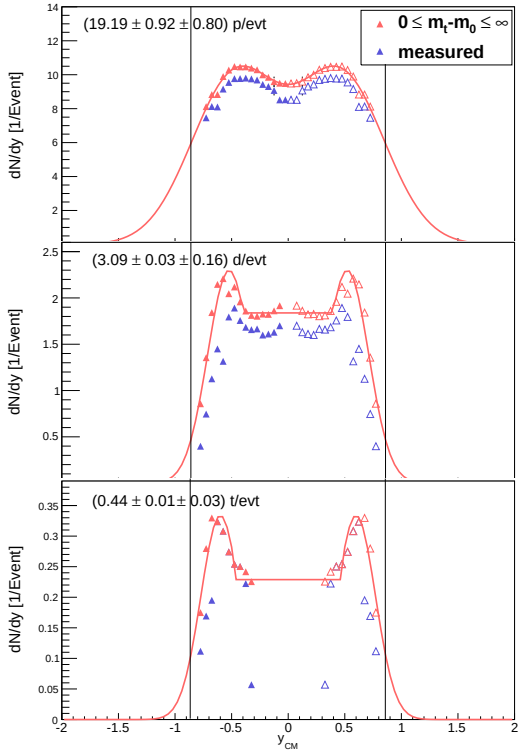

Figure 1: dN/dy-distributions of protons (top), deuterons (middle) and tritons (bottom) in the HADES acceptance (blue) and extrapolated with Siemens-Rasmussen fits from m_t-m_0=0 to m_t-m_0=∞ (red). Open triangles show reflected data around mid-rapidity. The lines at y=$\pm$0.86 represent projectile and target rapidity.

References

[1] W. Reisdorf *et al.* (FOPI Collaboration), Nucl. Phys. A **876** 1 (2012).

[2] Ekkard Schnedermann and Josef Sollfrank and Ulrich Heinz, "Thermal phenomenology of hadrons from 200 AGeV S+S collisions", PHYS.REV.C, 48, 2462, doi:10.1103/PhysRevC.48.2462, (1993).

[3] M. Lorenz, "Vector meson production in p+Nb reactions and statistical particle production in Ar+KCl collisions", PhD-Thesis, Goethe-Universität Frankfurt, (2012).

*Work supported by BMBF 06FY9100I 06FY7114, HIC for FAIR, HQM, HGS-Hire, EMMI and GSI.