Deep subthreshold neutral pion production in Ar+Au collisions

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One interesting issue of meson production at intermediate energies is the not yet fully understood phenomenon of pion production in nucleus-nucleus collisions at beam energies per nucleon significantly lower than the free nucleon-nucleon threshold (E^{π}_{Th} = 280 MeV). An explanation of the subthreshold pion production has been given in terms of coupling the bound nucleon Fermi momenta to the momentum of relative motion of the colliding nuclei [1]. This mechanism, however is not expected to explain the observation s at arbitrarily low beam energies per nucleon. In the deep subthreshold energy

regime one might expect collective phenomena in nucleus-nucleus collisions pla y a decisive role in pion production.

We would like in this contribution to present an experiment of deep subthreshold neutral pion production measured in collisions of argon beams of 25A and 35A MeV on gold target using the spectrometer TAPS (Tow-Arm-Photon-Spectrometer)[2] at the accelerator AGOR at KVI (The Netherlands). This experiment aimed at extending the existing meson production systematics at the lowest energy regime ever measured by TAPS meson production experiments, i.e. at beam energies $\approx$ 7% of the pion production threshold. It aimed also at providing new and more accurate data than the existing ones at similar beam energies and lighter nuclear systems [3] taking advantage of the unprecedented performance of the spectrometer TAPS in gamma ray identification and cosmic ray rejection [4].

We would like to describe the experimental setup and data analysis which challenging issue was to detect neutral pion signals much weaker than the hadronic background and comparable to the cosmic ray background. We also would like to discuss the new insights on the problem of production of deep subthreshold pions this experiment provides, especially by the measurement of the inclusive pion differential cross sections.

[1] G. F. Bertsch, Phys. Rev. C15, 713 (1977).

[2] R. Novotny. IEEE Trans. Nucl. Sci. NS-38 (1991) 379.

[3] J. Stachel et al., Phys. Rev. C33 (1986) 1420.

[4] N. Yahlali, José Díaz, submitted to Nucl. Instr. and Meth. A (2003)

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