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The ASY-EOS-II experiment (S122) at GSI/FAIR: studying the EoS (Equation-of-State) of neutron rich matter at high baryon densities.

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Constraining the asymmetry term of the EoS is important, among other reasons, for its strict connection with multi-messenger astrophysics, such as compact stars and core collapse supernovae phenomena. By using as main observable the elliptic flow ratio of neutrons and charged particles [1,2], the ASY-EOS experiment probed the isospin dependent component (asymmetry term) of the EoS at densities slightly above ρ_0 in Au + Au reactions at 400 MeV/A. The ASY-EOS-II experiment was performed in March 2025 at GSI/FAIR by using gold beam energies at 280, 400, 600, 1000 MeV/A and proposes to extend the knowledge of the symmetry energy to higher densities near to $2\rho_0$ and to improve the measurement precision with respect to the previous one. This last aspect can be reached by using innovative and powerful detectors inside the R3B cave. KRAB is a new detector, developed at IFJ PAN, Krakow, constituted by 5 rings of $4 \times 4 \text{ mm}^2$ fast scintillating fibers placed around the target. It provides a fast trigger based on multiplicity and charged particles azimuthal distributions for event-by-event reaction plane reconstruction together with four rings (320 CsI(Tl) telescopes) of the CHIMERA array. Among the R3B collaboration devices, the NeuLAND detector for high efficiency neutrons and H isotopes detection and two frames of the time-of-flight ToFD, made by plastic scintillator paddles, were used. The first ToFD frame in order to measure particles velocity and charge at very forward angles, and the second one as a charged particles veto for the NeuLAND detector. A description and first preliminary results of the S122 experiment will be shown.

[1] P. Russotto et al. Phys. Rev. C94, 034608 (2016).

[2] P. Russotto, M.D. Cozma, E. De Filippo, A. Le Fèvre, Y. Leifels and J. Łukasik, La Riv. del Nuovo Cimento, 46, 1-70 (2023).

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