Contribution ID : **117** Type : **Oral talk**

Clustering in oxygen nuclei and spectator fragments in O–O collisions at the LHC

Thursday, 1 December 2022 18:00 (15)

Collisions of oxygen nuclei are planned in future LHC runs to scan the size of colliding systems at ultrarelativistic energies [1]. As shown by calculations [2,3], the admixture of the alpha-clustered states in O-16 leads to a triangular modulation of elliptic flow from the overlap region of colliding nuclei. The measurements [4] and modelling [5,6] of fragmentation of O-16 projectiles of lower energies of few GeV/nucleon demonstrated the enhanced production of spectator alpha-particles resulting from the alpha-clusterization in O-16.

In the present work a new version of the Abrasion-Ablation Monte Carlo for Colliders model (AAMCC-MST) is used to simulate O-16–O-16 collisions at the LHC. The model takes into account pre-equilibrium clusterization of spectator matter [7,8] and the admixture of alpha-clustered states in O-16 (AAMCC-MST) [5]. Three nuclear density profiles in O-16 were implemented in AAMCC-MST to sample the positions of neutrons and protons in O-16 [5]. The cross sections to produce various spectator nuclei (He, Li, Be, B, C, N) at the LHC and the multiplicity distributions of spectator alpha-particles are calculated and compared to the results obtained at lower collision energies. The production of spectator deuterons is also investigated as a possible indicator of the short-range correlations in nuclei [9]. The obtained results can help in evaluating the performance of Zero Degree Calorimeters in future LHC experiments on O-16–O-16 collisions.

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Session Classification : Heavy Ion Physics

Track Classification : Heavy ion physics