Elliptic flow of light nuclei in Au+Au collisions at $\sqrt{s_{NN}}$ = 27 and 54.4 GeV

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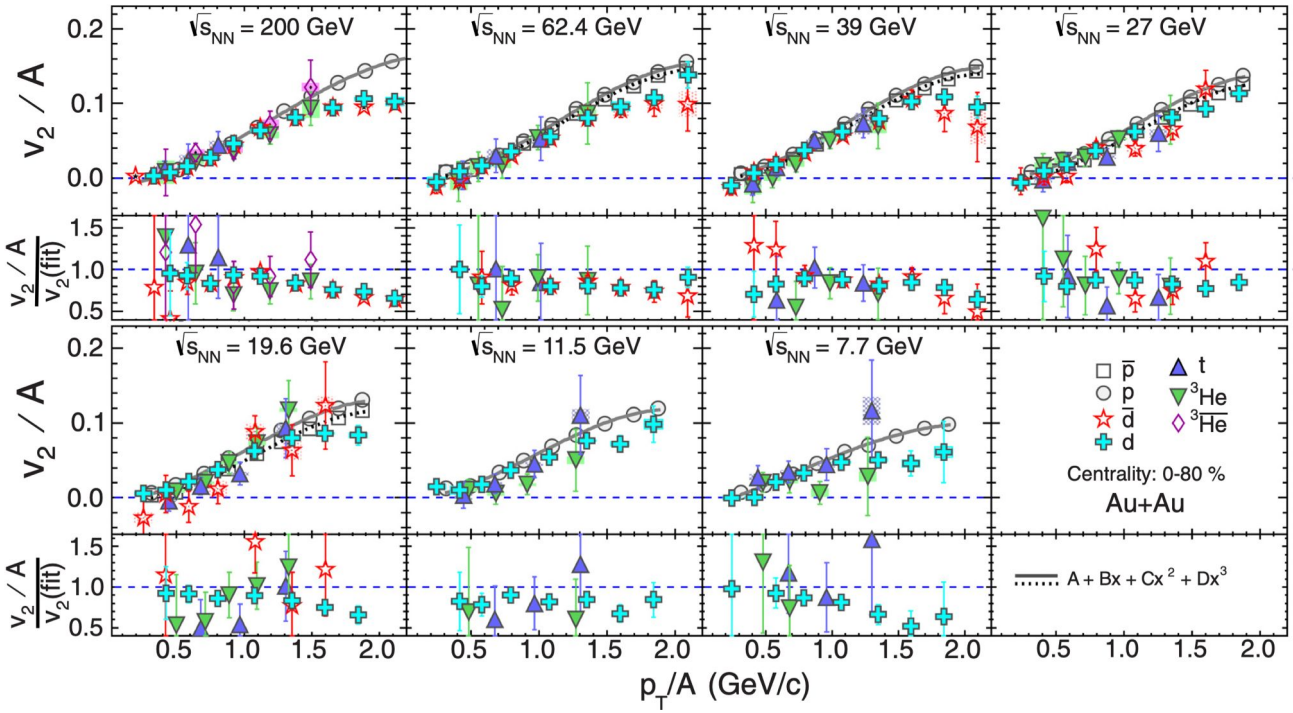

[1] A. Andronic et al. Phys. Lett. B 697, 203 (2011).
[2]S. T. Butler et al. Phys. Rev. Lett., vol. 129, no. 836 (1963).
[3] L. Adamczyk *et al.* (STAR), Phys. Rev. C 94 3, 034908 (2016).

★ Light nuclei production in heavy-ion collisions can be explained either by the thermal model [1] or the final-state coalescence of nucleons [2]
★ v_2/A of light nuclei was observed to be close to v_2 of protons for p_T/A < 1.5 GeV/c in BES-I data [3]
★ Higher statistics dataset available in BES-II program will allow us to better understand the production mechanism of light nuclei

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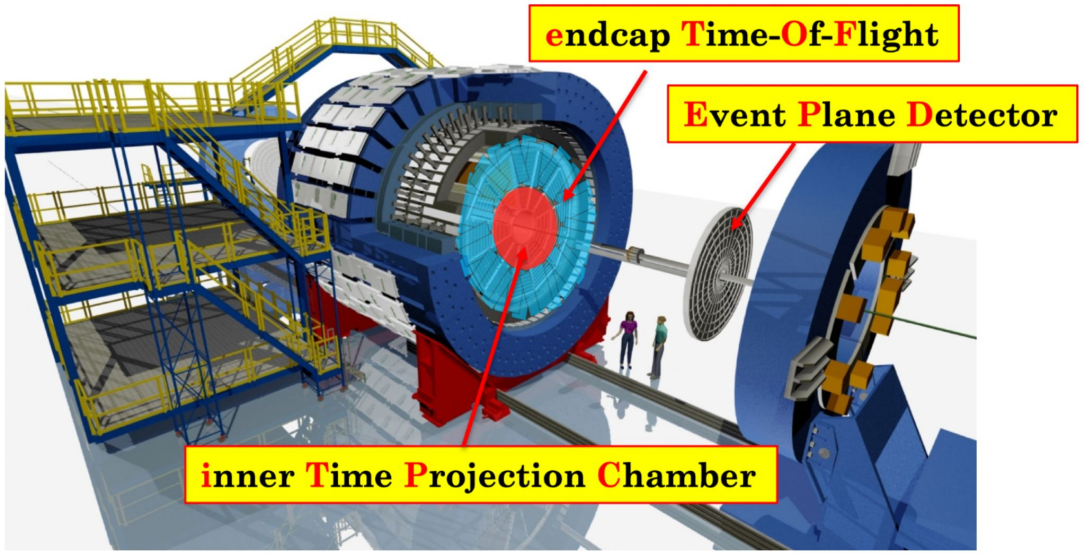
STAR Presentations: https://drupal.star.bnl.gov/STAR/presentations

STAR Experiment

- ★ Solenoidal Tracker at RHIC (STAR) is one of the large detector systems at RHIC consisting of several sub-detectors
- ★ Time Projection Chamber (TPC) and Time of Flight (TOF) are two sub-detectors used for particle identification at STAR [4]
  - dE/dx information from TPC and m^2 information from TOF are used for particle identification
- ★ High statistics dataset was recorded by the STAR Collaboration in the year 2017 and 2018 from Au+Au collisions at $\sqrt{s_{NN}}$ = 54.4 and 27 GeV, respectively



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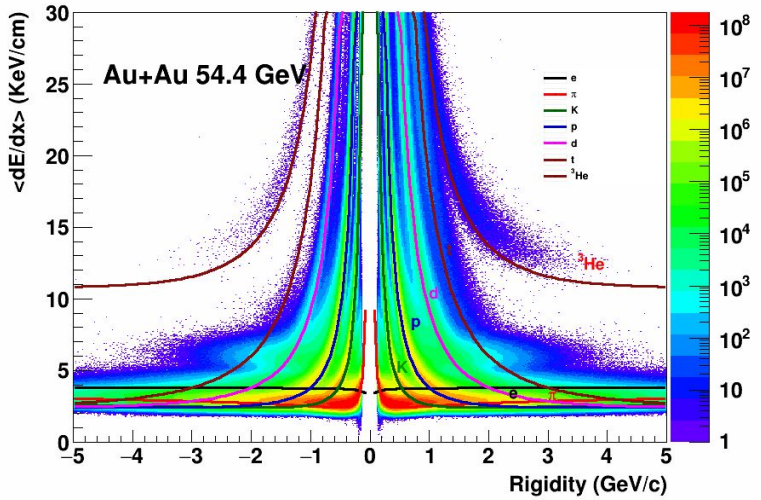
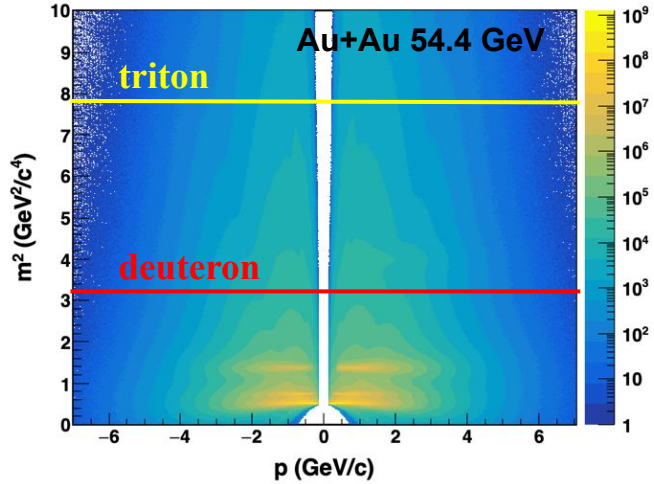




[4] H. Bichsel Nucl. Instr. Meth. A 562, 154 (2006).

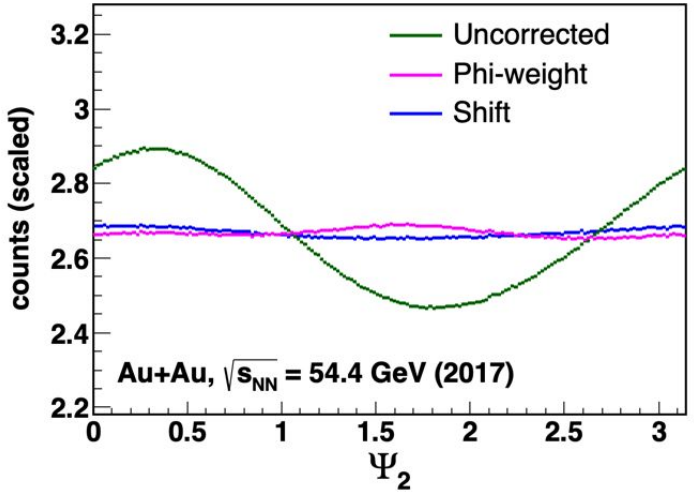
Analysis method and results

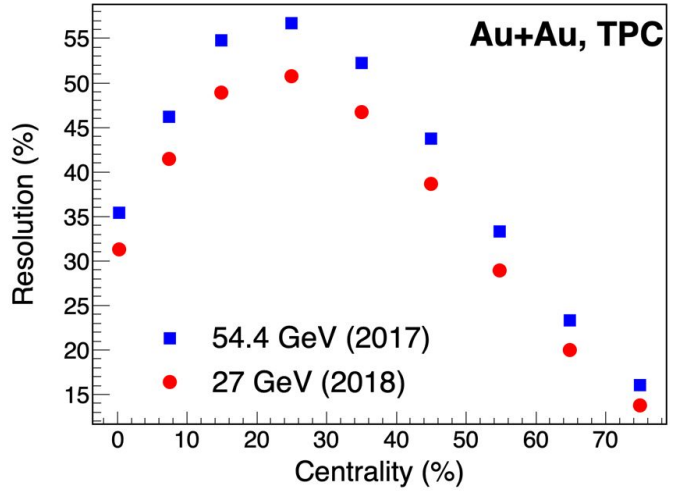
- ★ The particle azimuthal distribution can be written in the form of fourier series [5]:

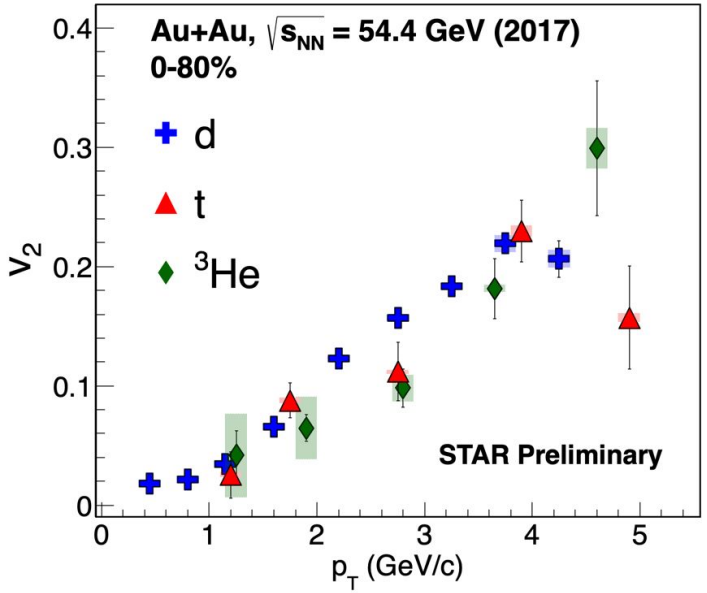
$$E\frac{d^3N}{d^3p} = \frac{1}{2\pi}\frac{d^2N}{p_T dp_T dy}(1+\sum_{n=1}^{\infty} 2v_n \cos(n(\phi - \Psi_{RP})))$$

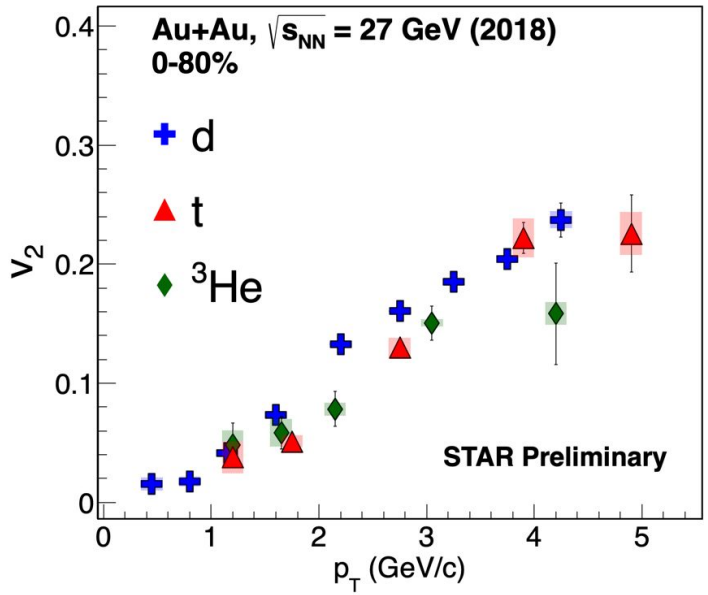
$$v_n = \langle \cos[n(\phi_i - \Psi_{RP})] \rangle$$

- ★ v_n is the n^{th} flow harmonic and Ψ_{RP} is the reaction plane angle
- ★ η-sub event plane method has been used to calculate the event plane angle (Ψ_2) which acts as a proxy to the Ψ_{RP}
- ★ Observed v_2 has been corrected for the event plane resolution
- ★ The $v_2(p_T)$ for all nuclei species increases with increasing p_T for both the collision energies



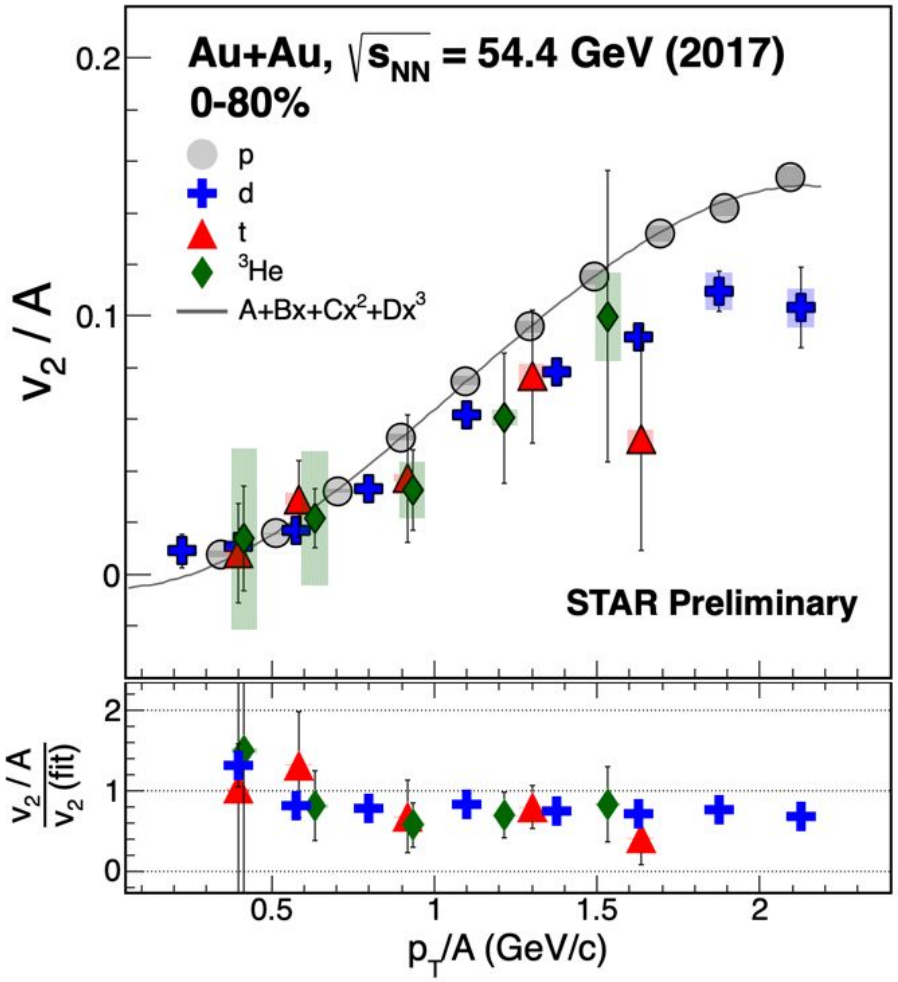


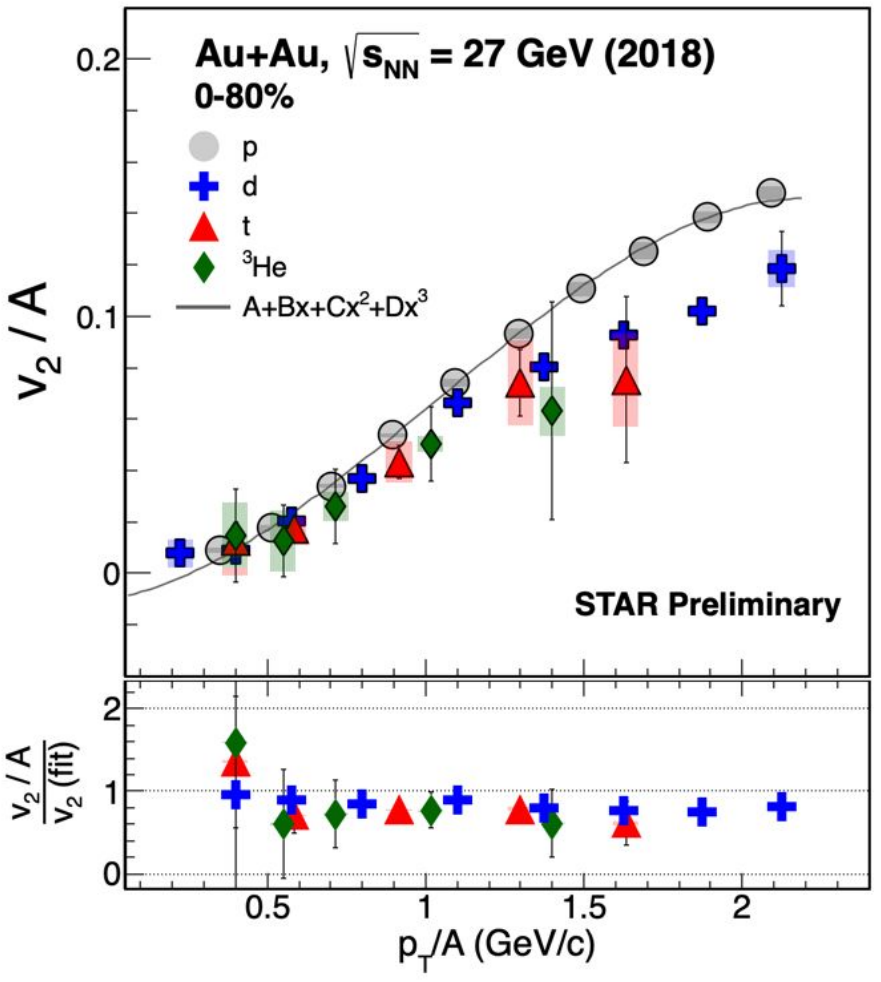




[5] R. Snellings, New J.Phys. 13, 055008 (2011).

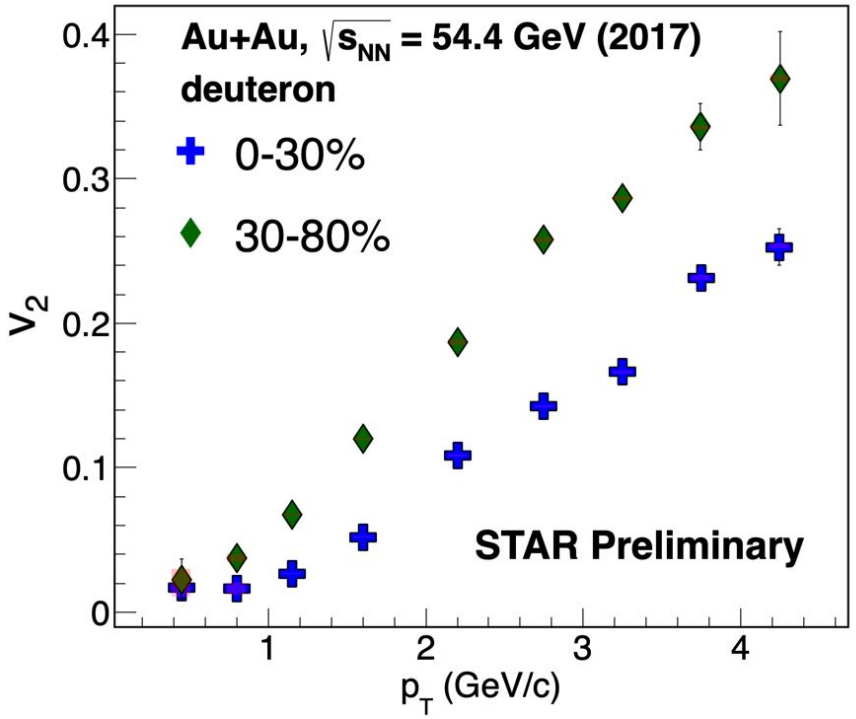
Mass number scaling

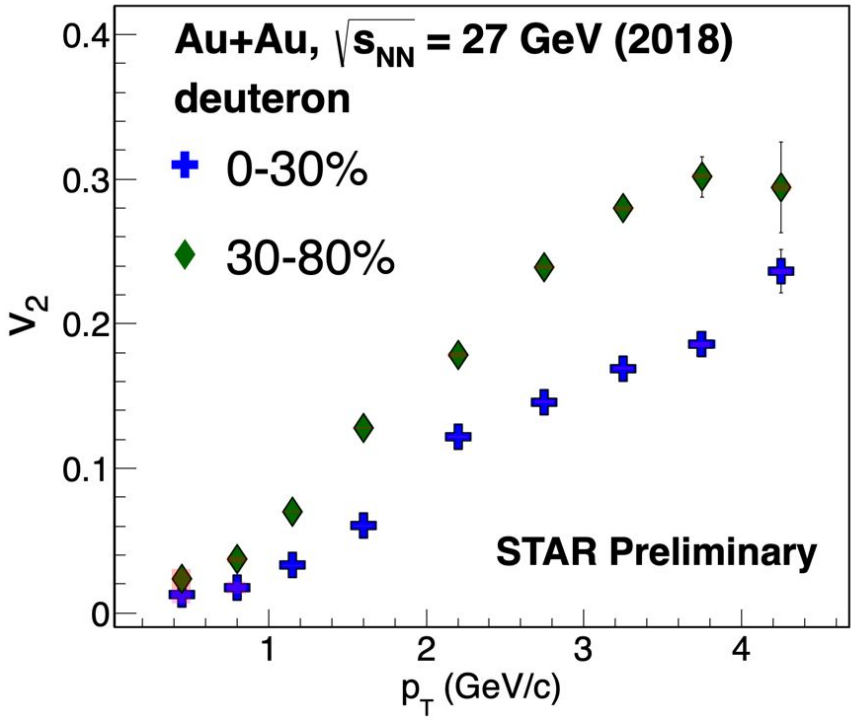




★ A systematic deviation of around 10-20% from mass number scaling is observed for all light nuclei species

Centrality dependence





★ A clear centrality dependence of v_2 of deuterons for all energies is observed
- v_2 in central collisions is consistently lower than peripheral collisions

Summary

★ Elliptic flow of d, t, and ^{3}He have been calculated in Au+Au collisions at $\sqrt{s_{NN}}$= 27 and 54.4 GeV
★ Deviation from mass number scaling is observed for all the light nuclei species for both center of mass energies
★ Clear centrality dependence has been observed for deuterons for both collision energies