O+O collisions at RHIC & Monte-Carlo Modeling

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STAR Beam Use Request: https://indico.bnl.gov/event/7881/attachments/30176/47224/BUR2020_final.pdf
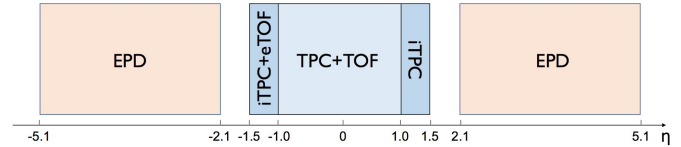sPHENIX Beam Use Proposal: https://indico.bnl.gov/event/7881/attachments/30176/47160/sPH-TRG-2020-001.pdf

RHIC Projections: https://www.rhichome.bnl.gov/RHIC/Runs/RhicProjections.pdf

Program Advisory Committee Report: https://www.bnl.gov/npp/docs/RHIC-2020-PAC-Report.pdf

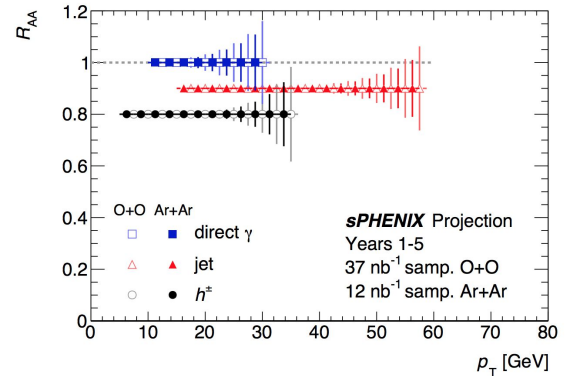| mode	beam energy [GeV/nucleon]	no of colliding bunches	ions/bunch [10^9]	β^* [m]	rms emittance [µm]	L_{peak} [cm^{-2}s^{-1}]	$L_{store\,avg}$ [cm^{-2}s^{-1}]	L_{week}
O+O	100	111	12	0.7	2.5	55×10^{28}	33×10^{28}	120 nb^{-1}

- RHIC-LHC synergy, what is the advantage of having the same system ?
  - RHIC 2021 & >2023, STAR (O+O 200, Au+O FXT), sPHENIX (O+O 200)
- v_n with STAR-PHENIX kinematics, longitudinal de-correlation, role of sub-nucleonic fluct.
  - Geometry engineering in p/d/He+A and strong η dependence of v_n, how can O+O help ?

- Jet quenching at RHIC, v_2-R_{AA} puzzle
  - $R_{AA}(p_T, \Psi)$, γ+Jet, inclusive jet, high p_T-v_2 (O+O, p+A, A+A peripheral)

- Ultra-peripheral collisions, α clustering & photoexcitation of Oxygen
  - A (large Z)+O vs. O+O vs. A+A, coherent vs incoherent
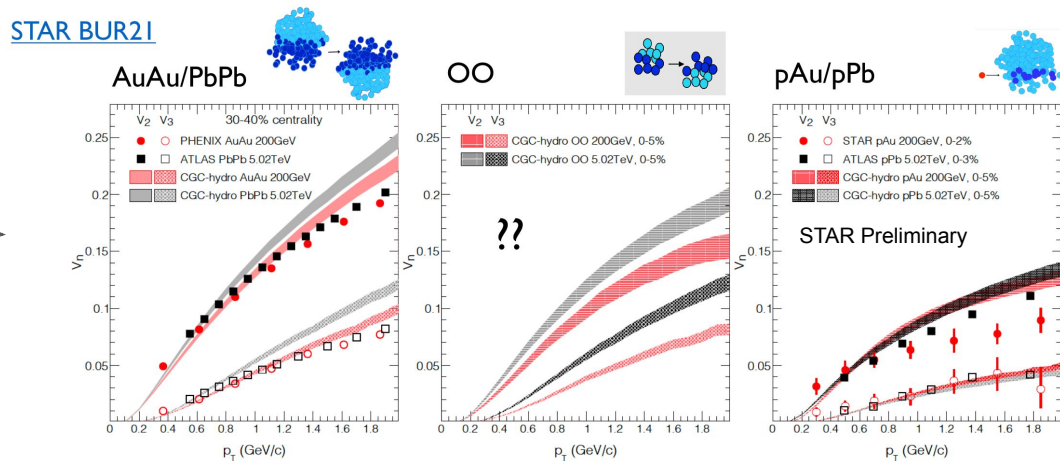

- Monte-Carlo modeling at RHIC
  - Collective effects from PYTHIA
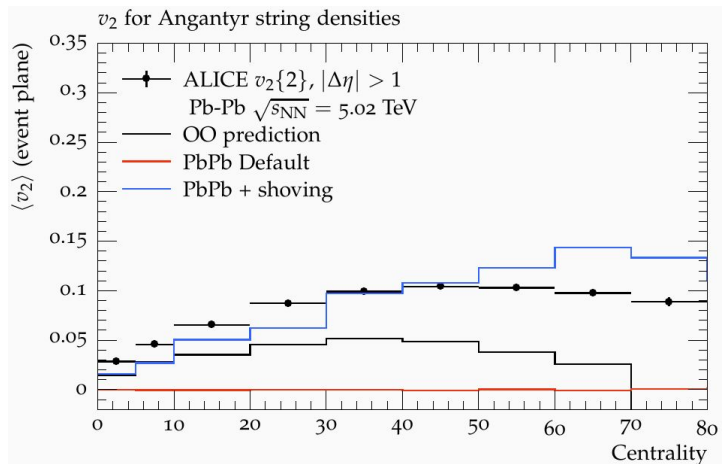 - Monte Carlo modeling of Jets

O+O is an intermediate system

- Soft dynamics in big systems (PbPb, AuAu) is relatively settled

  Hydrodynamics works well from central up to peripheral collisions

  Jet quenching is generally understood, but there are puzzles

- Small systems (pPb, pAu, pp) are puzzling: there are signatures of collectivity, but R_{AA} is ~1 and there is generally no jet/high-pT hadron quenching.

- O+O is an intermediate system between the two:

  O+O is smaller than (mid-)central PbPb and is comparable to peripheral PbPb. But the centrality biases may be smaller.

Wei Li / STAR talk

Elliptic flow in OO vs PbPb from Pythia/Angantyr

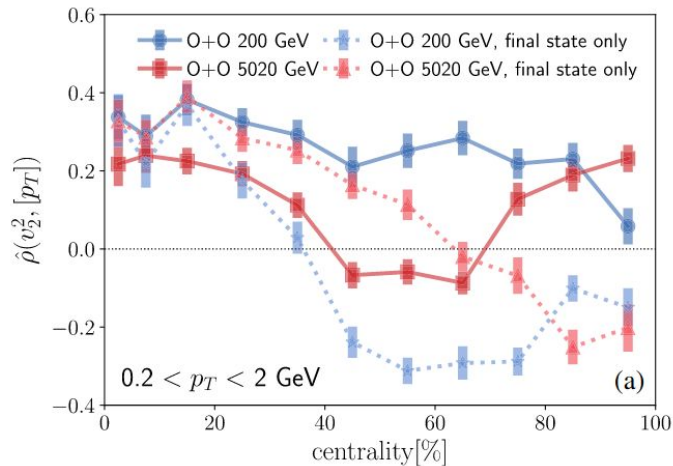c_2{4} - whether it is positive or negative in O+O?

HBT: Radii in O+O should be in between PbPb and pPb (slide from Christopher Plumberg for the Friday discussion)

Jet modification in O+O predicted by JEWEL (mentioned by Dennis)

Some high-pT hadron suppression predicted

v_2 for Angantyr string densities

- ALICE $v_2\{2\}$, $|\Delta\eta| > 1$
  Pb-Pb $\sqrt{s_{NN}} = 5.02$ TeV
- OO prediction
- PbPb Default
- PbPb + shoving

Non-trivial correlation between v_2 and pT due to interplay of iniial-state correlations and final-state collective response

arXiv:2006.15721

arXiv:2007.13754