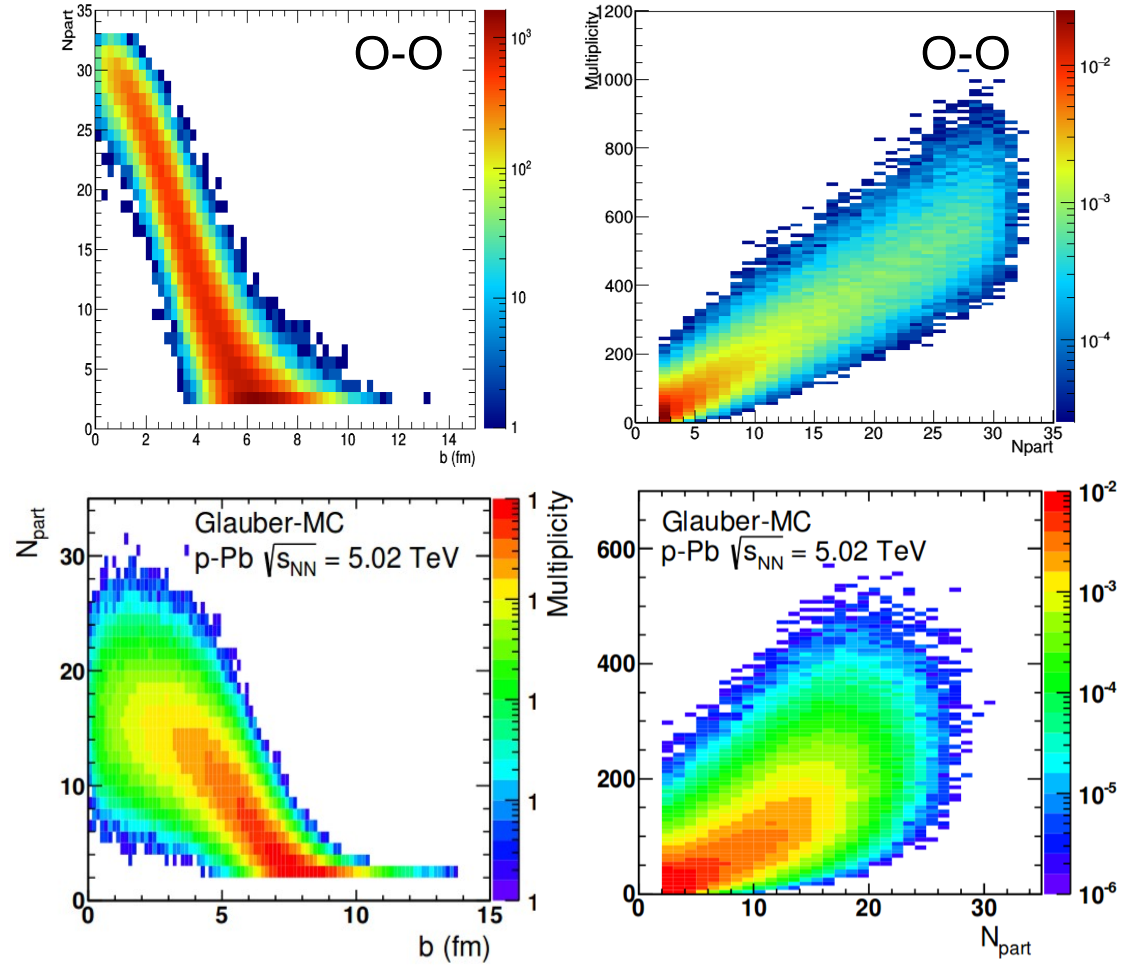
Possibilities with O-O collisions (CL , 19 June 2018)

Workshop on the physics of HL-LHC, and perspectives at HE-LHC
https://indico.cern.ch/event/686494/timetable/

Plots in this presentation were made for the 2018 configuration:
$\sqrt{s_{NN}}$= 6.37 TeV, σ_{NN}= 69.9±0.5mb, σ_{OO}= 1.3b
After LS2, $\sqrt{s_{NN}}$= 7 TeV

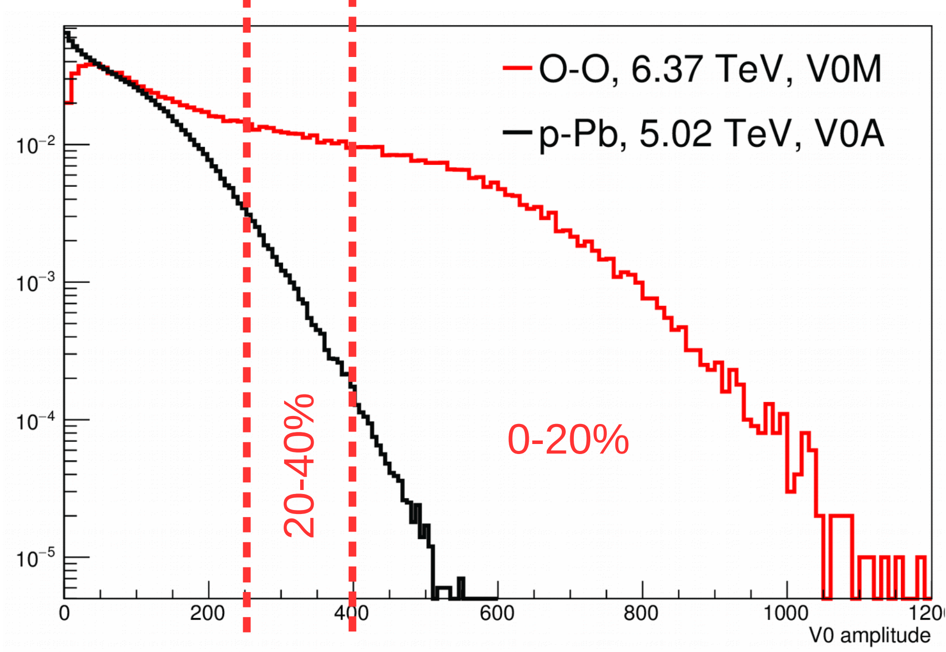
Why a small system like O-O?

- Smallest AA collision system attempted in collider mode, yet large average geometry (ie centrality plateau)
- Efficient-way to produce and study “low-multiplicity” AA collisions
- Use to explore “small system” physics
  - Jet quenching
  - IS vs FS flow
  - Strangeness enhancement
  - J/psi (non-)regeneration
  - Thermal radiation
  - CME control (central collisions)
  - A- and Z-dependence of vector-boson production
  - ...

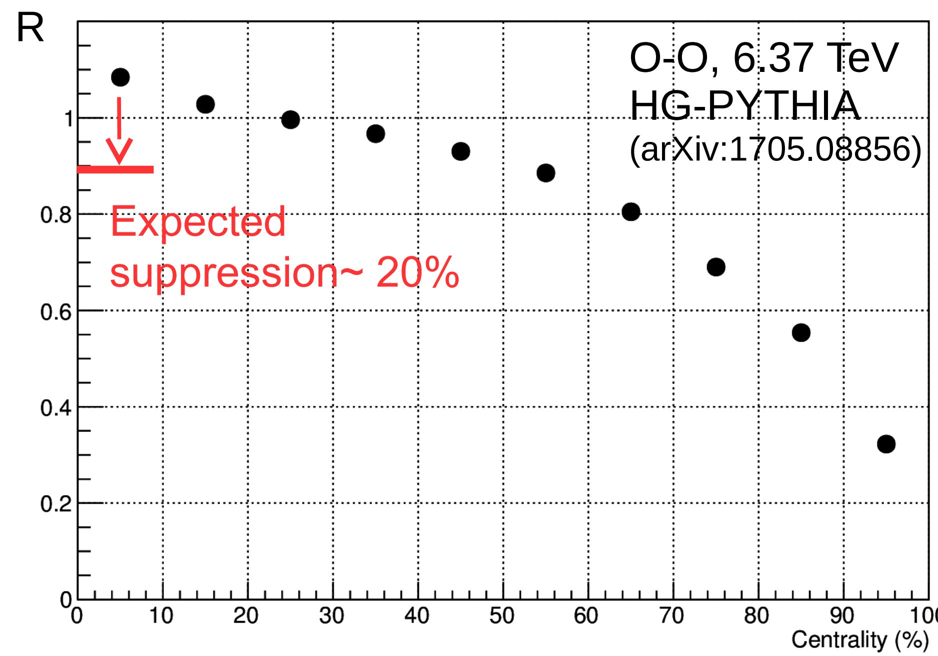


Why a small system like O-O?

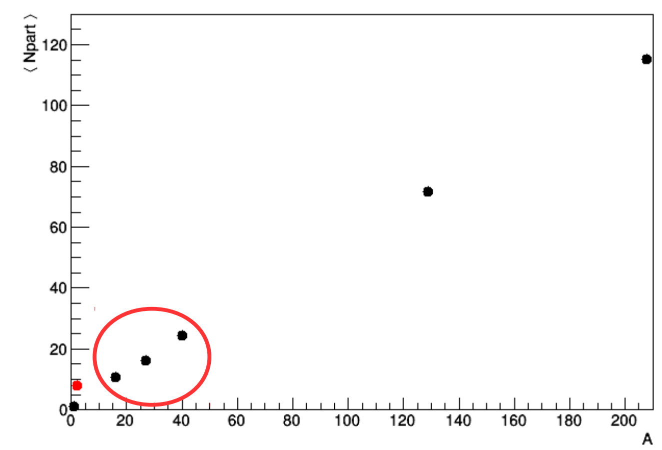
Expected centrality plateau



Expected centrality bias on R_{AA}



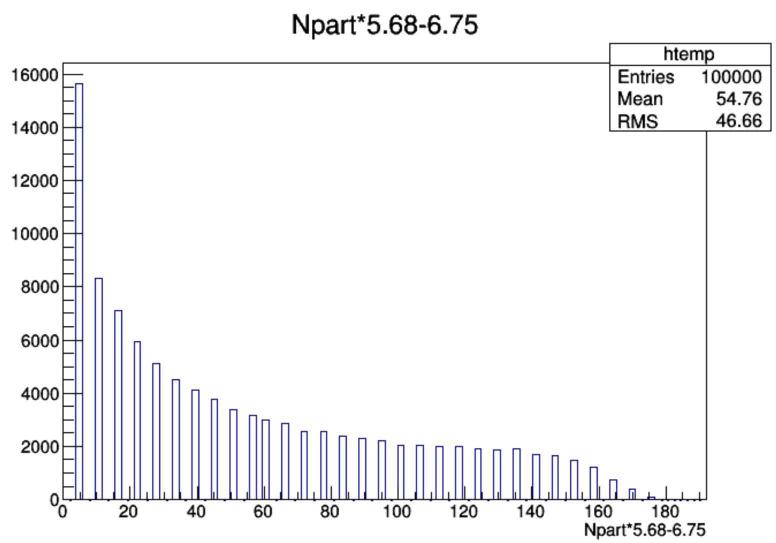
- Centrality shoulder allowing selection of geometry (Ncoll and ε_2)
  - Clear advantage over asymmetric system (pA, or others)
- System large enough to exhibit jet quenching
  - Measure also minbias OO, Ncoll~13
- System scan (OO,AlAl,ArAr)
  - Preferred double magic shell (CaCa)?
  - Integrated luminosity several 100/μb per species (driven by low pT charm and photons)



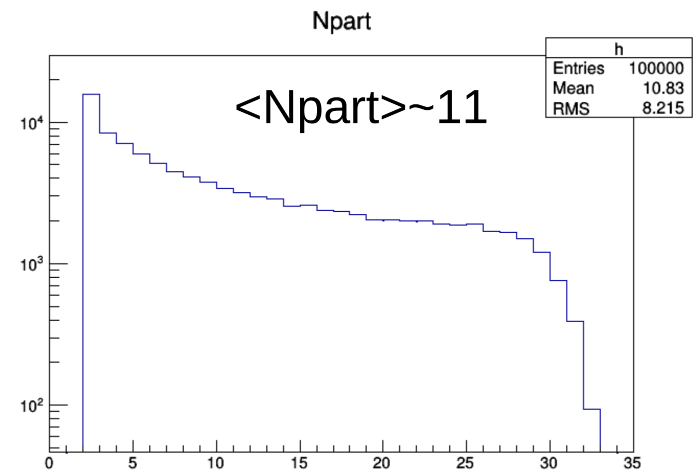
Backup

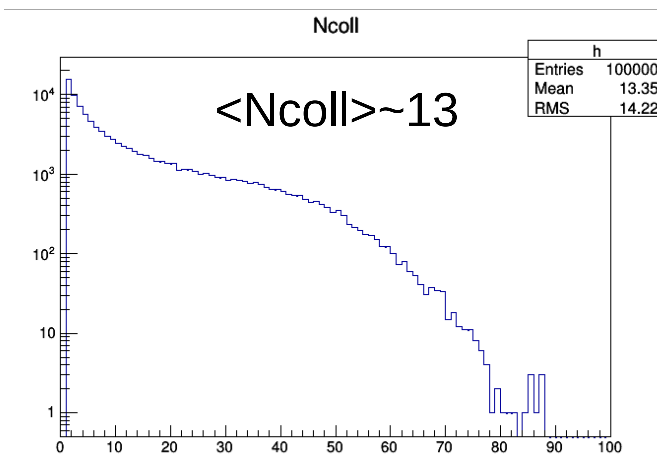
Key parameters for 2018

- $\sqrt{s_{NN}}$=6.37 TeV
- σ_{NN}=69.9±0.5mb
- σ_{OO}=1.3b
- Average dN/deta
  - Average = 50 - 55
  - Peripheral (pp) = 4.6
  - Central (2*AA/Npart) = 10.9
  - Interpolate using Npart dist

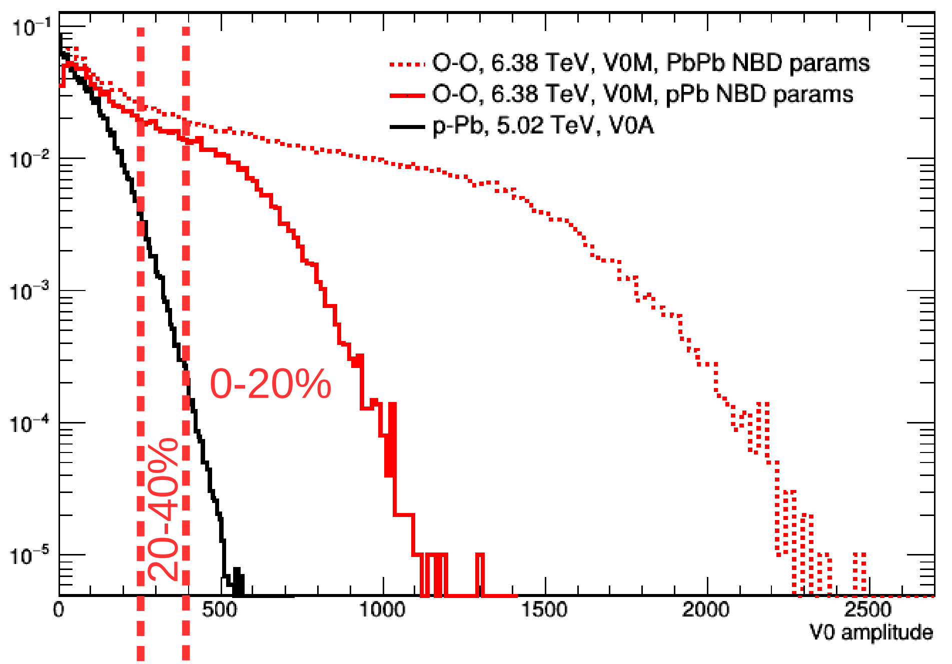


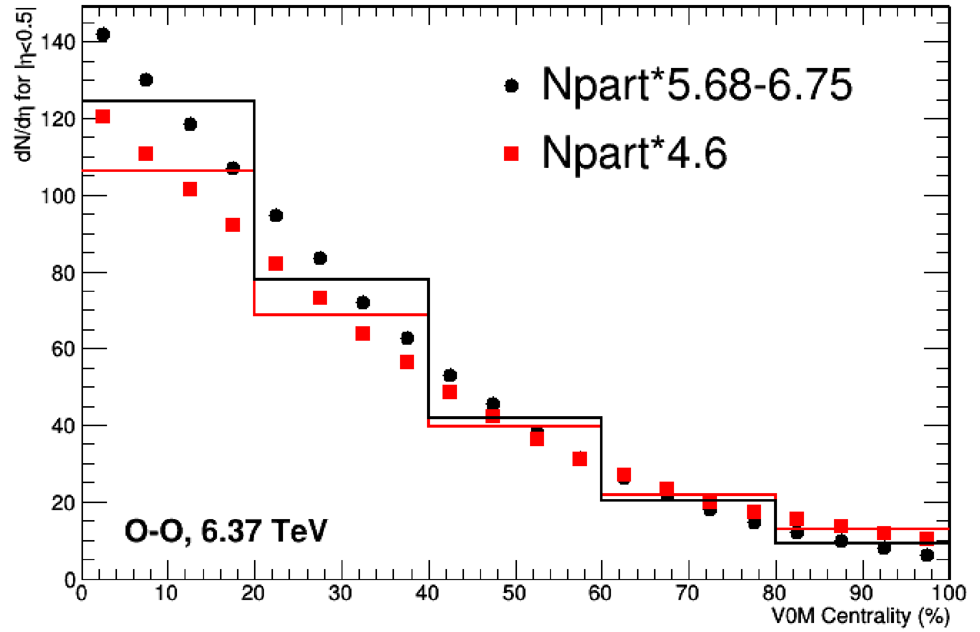
- Possible luminosity 50-100/μb for 6h, with peak int. rate ~5-6kHz
  - Recorded lumi
    - ~30/μb barrel (w/o trigger)
    - ~90/μb for muons

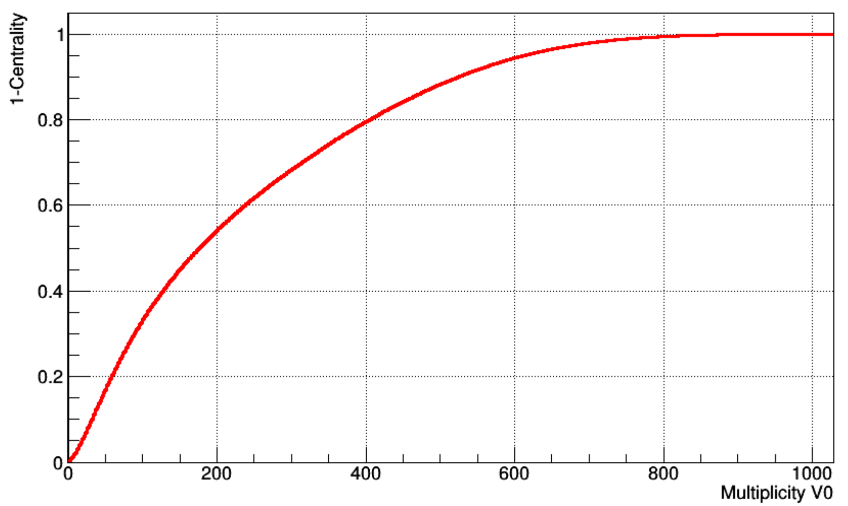




Centrality and multiplicity estimates







Cent	<Ncoll>	<dN/deta>
0-20%	34.6	106
20-40%	18.2	69
40-60%	8.4	39
60-80%	3.7	22
80-100%	1.7	13
0-100%	13	50
0-5% pPb	~15	~50
70-75% PbPb	19.3	53.4

NB: Ncoll from mult

Expected suppression from PbPb

from 1805.05212

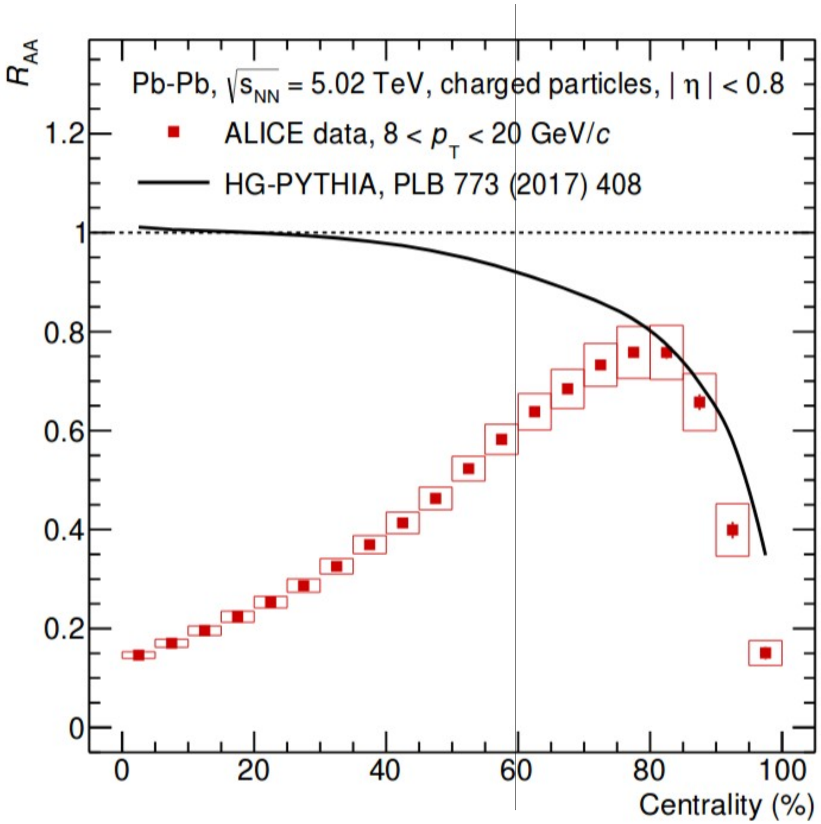
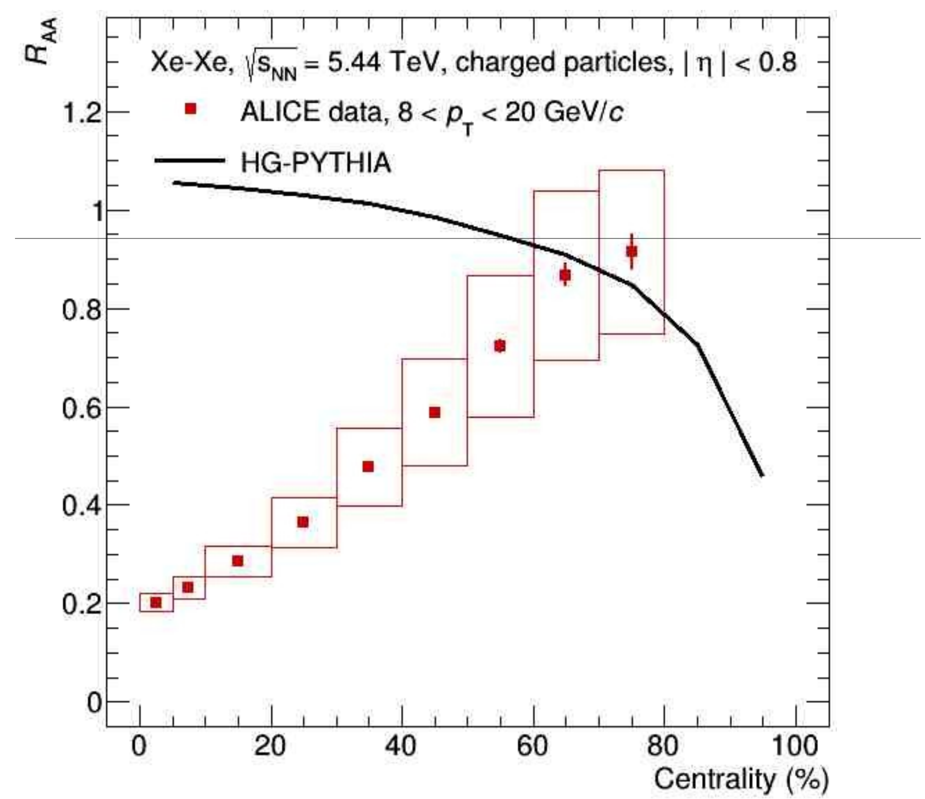


Fig. 3: Average R_{AA} for $8 < p_T < 20$ GeV/c versus centrality percentile in Pb–Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV compared to predictions from HG-PYTHIA [38]. Vertical error bars denote statistical uncertainties, while the boxes denote the systematic uncertainties.

The multiplicity range explored in central 0-40% O-O corresponds to 60-75% PbPb:

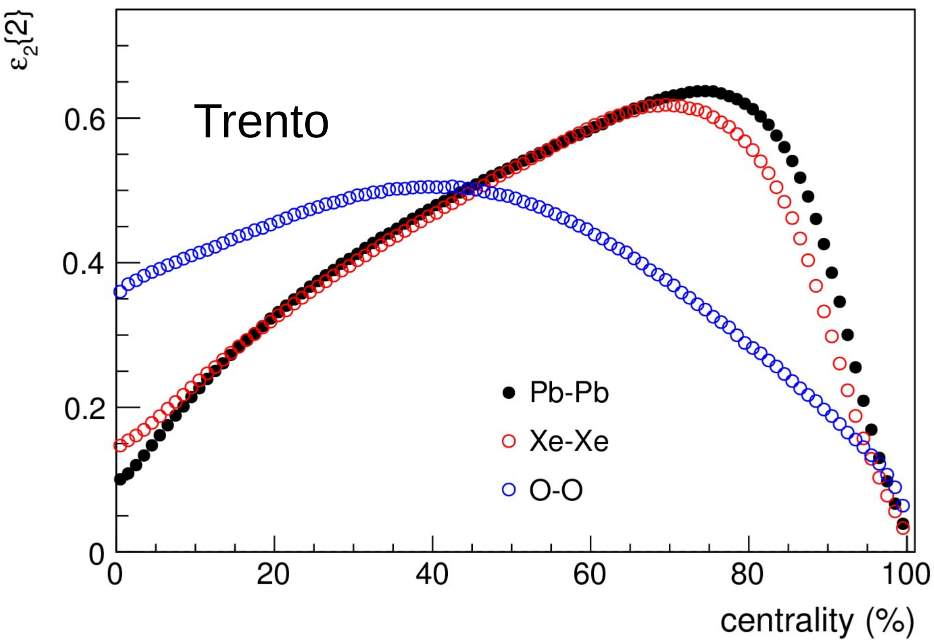
Measured Raa ~0.6-0.75
HG-corrected ~0.65-0.88

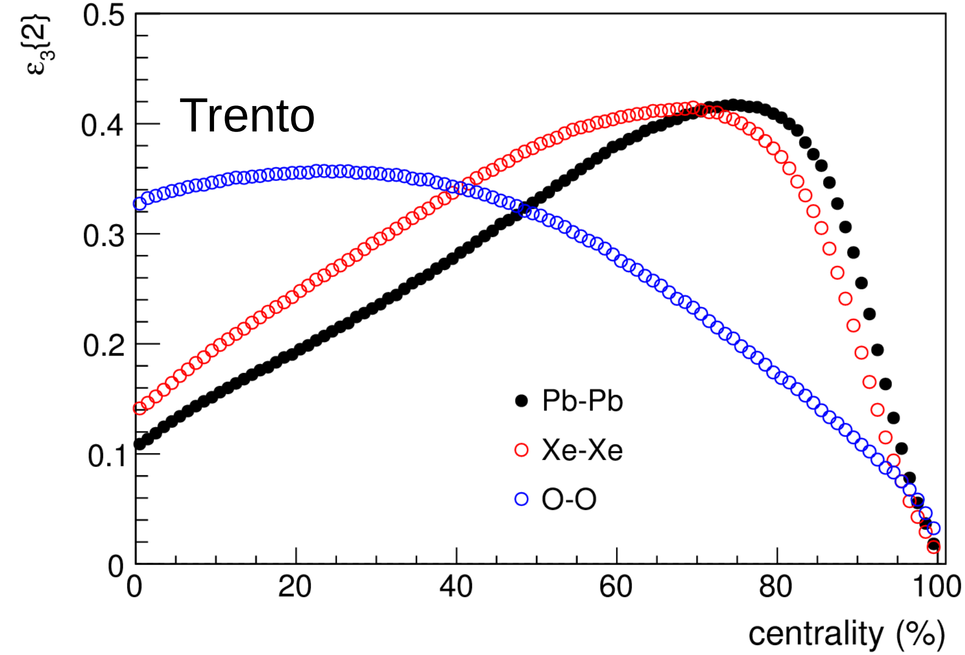


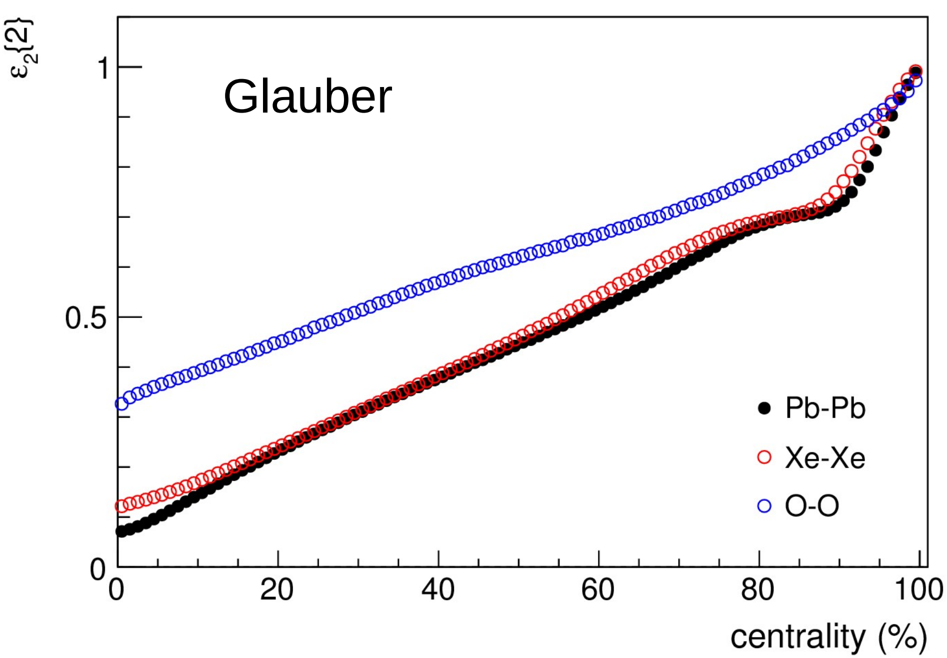
Measured Raa ~0.72-0.9
HG-corrected ~0.75- ~1

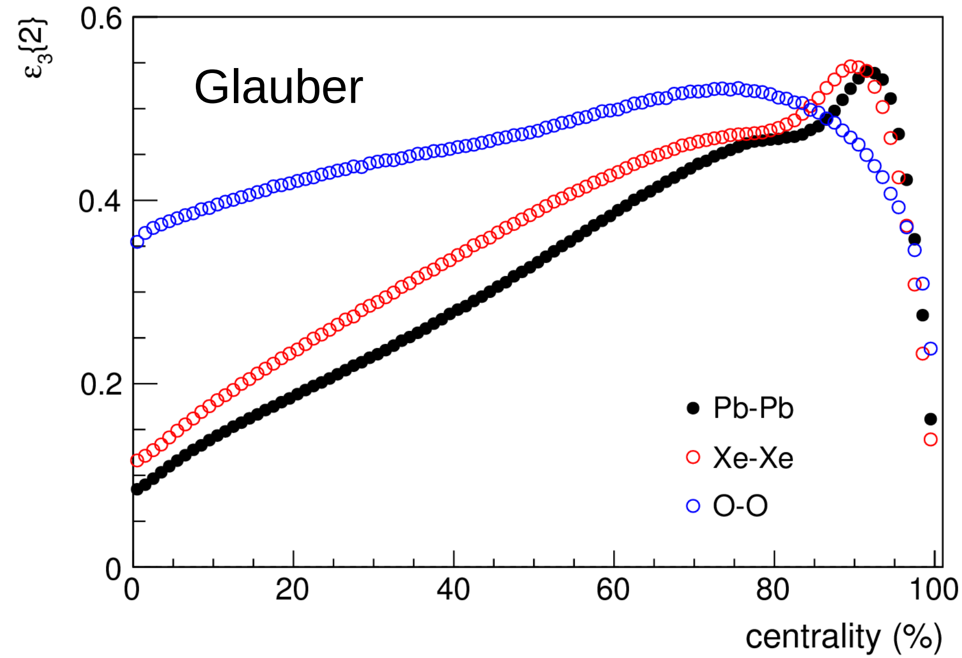
Initial state ecc2 and ecc3

(A.Dobrin)









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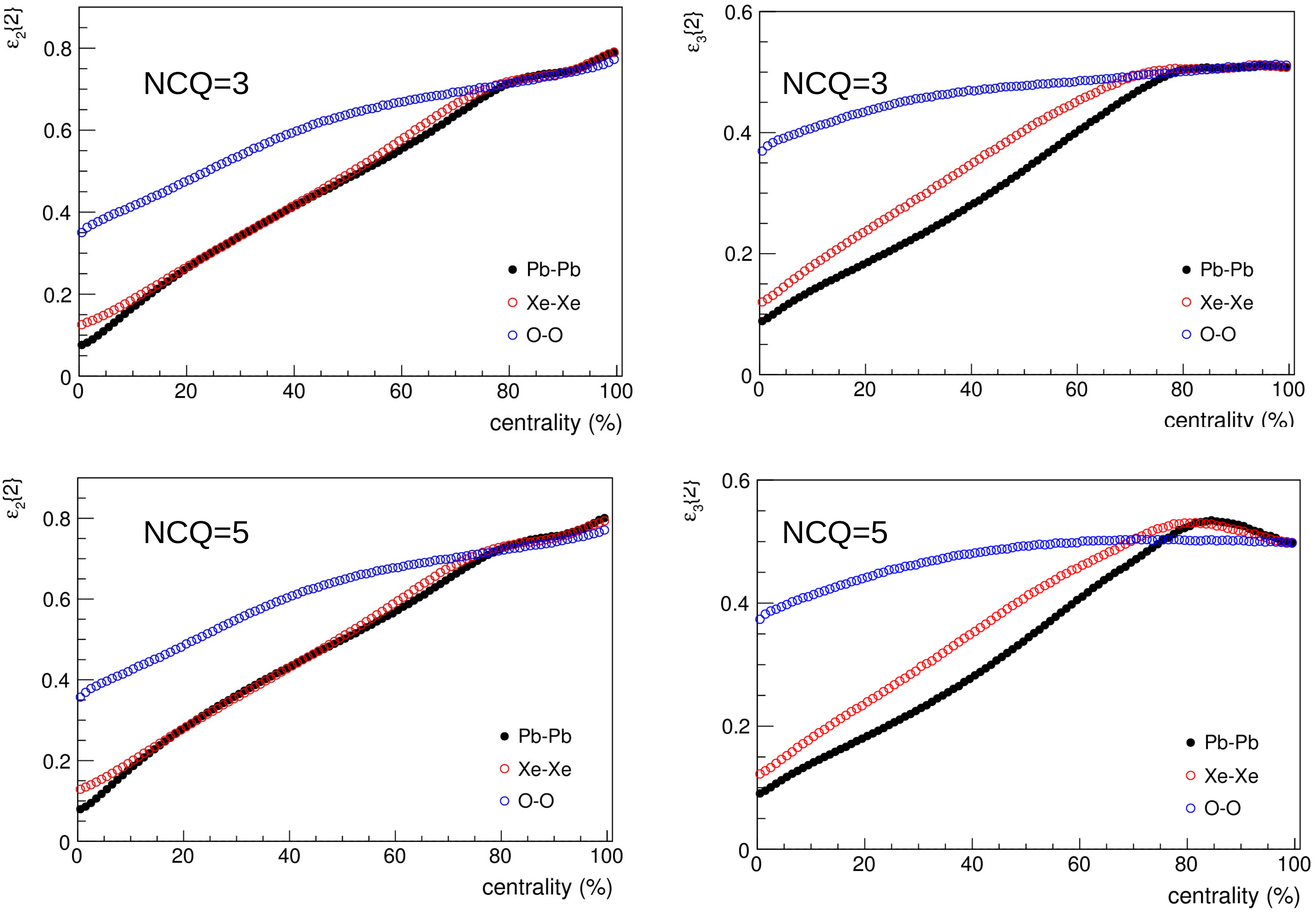
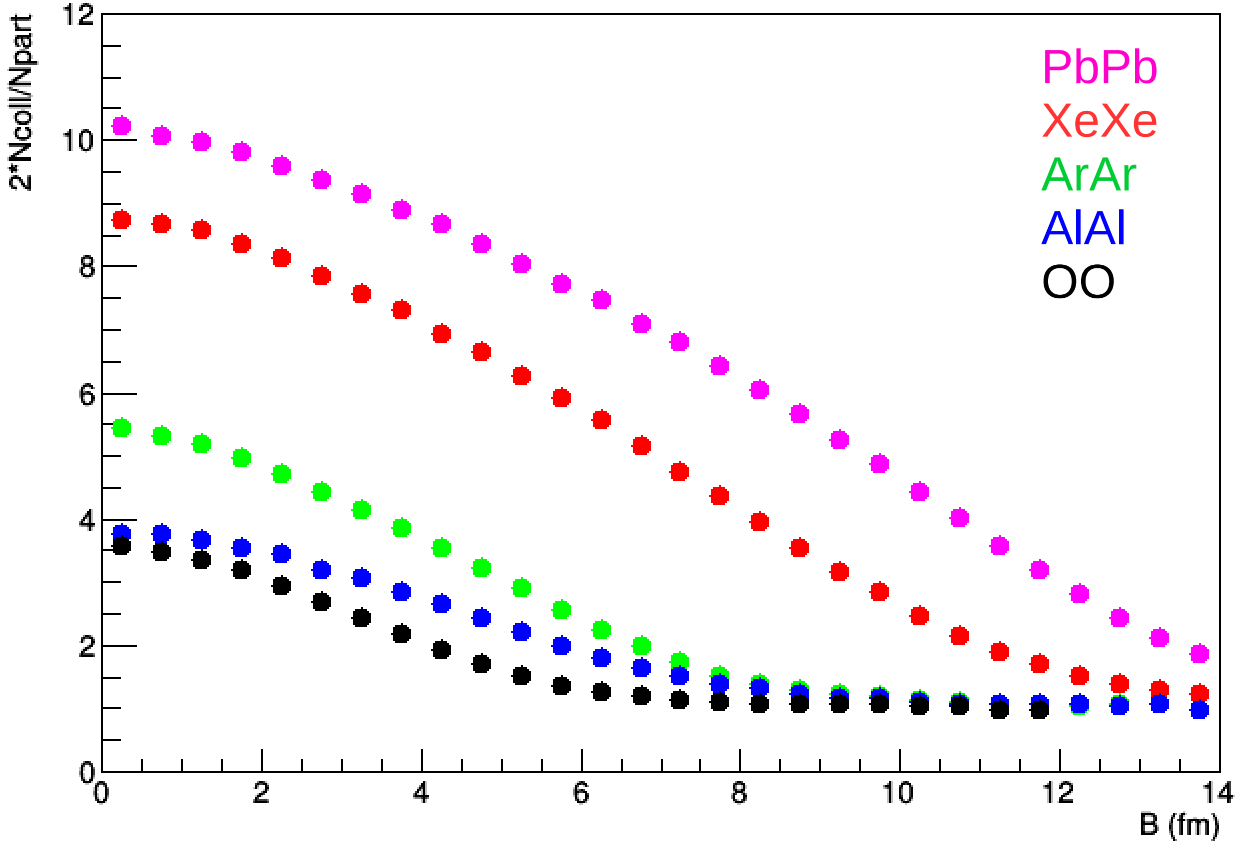


System scan

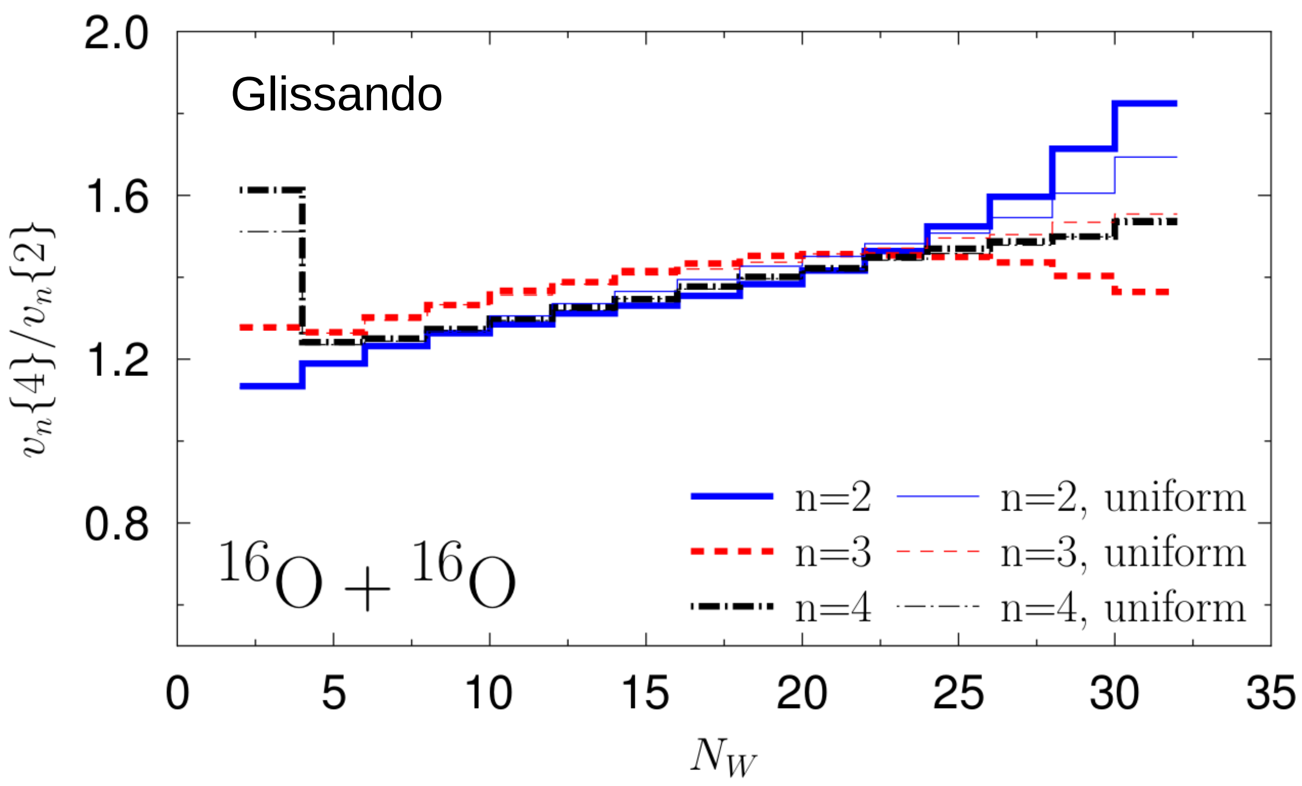


2*Ncoll/Npart
12
10
8
6
4
2
0
0
2
4
6
8
10
12
14
B (fm)
PbPb
XeXe
ArAr
AlAl
OO

Clustering in O

(M. Rybczynski, W.Bronioski, P. Bozek)

arXiv:1711.00438



Effect of alpha clustering in O only introduces small effect for very central collisions