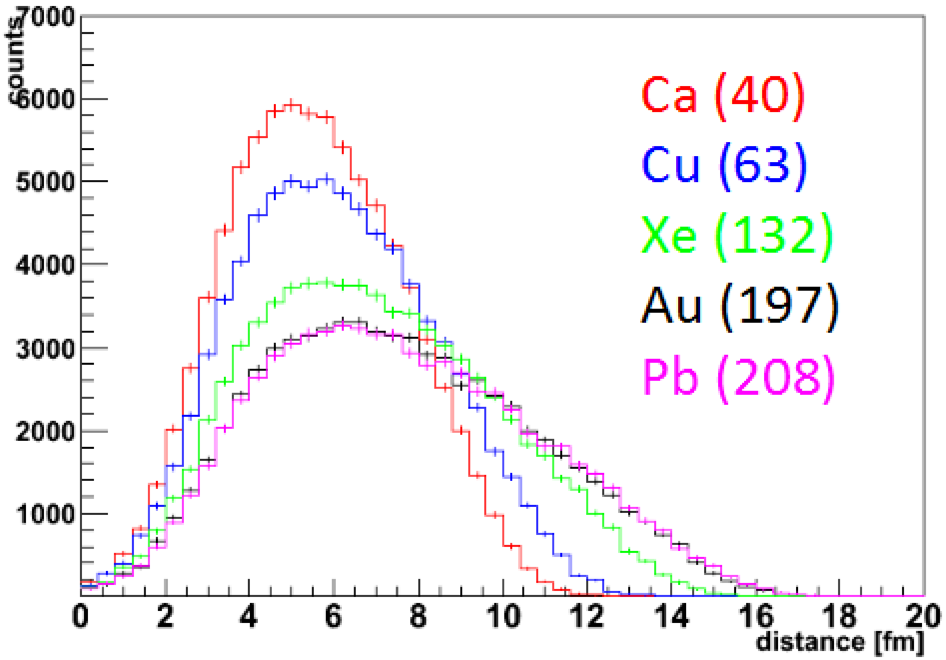
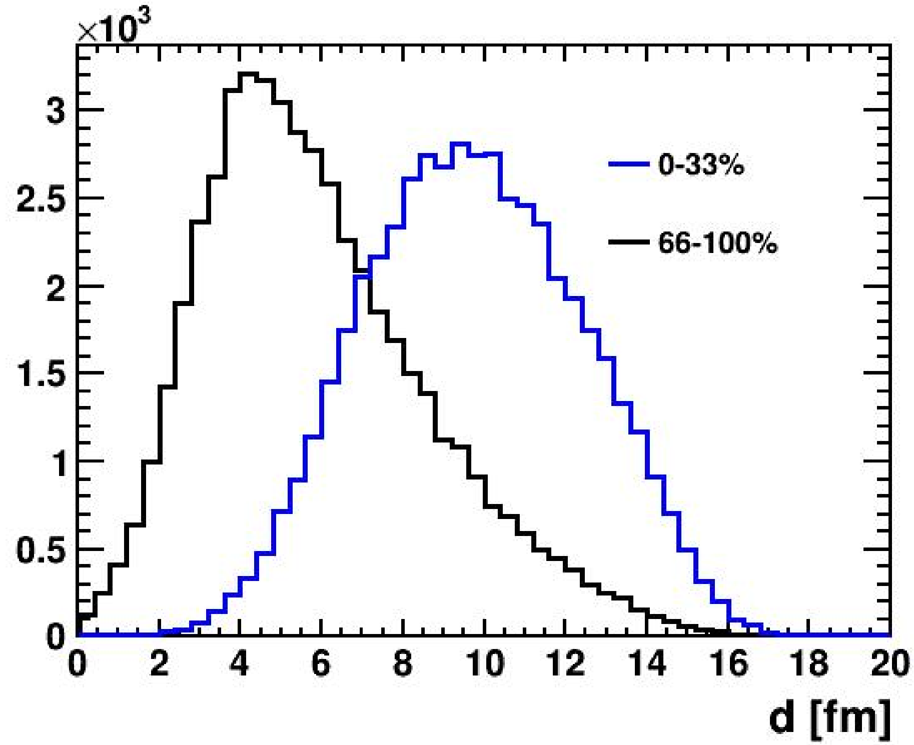
Geometry Tagging in eA

- Significant improvement over a simple A-scan.
  - Much bigger range in "d" – path length in medium for studies of parton propagation, medium modification, hadronization
    - Equivalent to ***? in minbias A
  - Extended reach in saturation scale
    - Equivalent to 675 in minbias A
    - Equivalent to 3.5 in E_{beam}
- Best signal to noise for coherent diffraction
  - Excellent channel for measuring gluon saturation

Geometry tagging much better than A scan



Zheng et al., EPJA 50 (2014) 189



Extrapolate <d>(A) to see effective A achievable
with evaporation neutrons alone (we should do better).

Improved saturation reach

50% increase in Q^2_{sat}

A_{eff} $x(1.5)^3$ I.e **A_{eff}=675**

Or equivalent to:

3.5x increase in x_{BJ}

3.5x increase in s

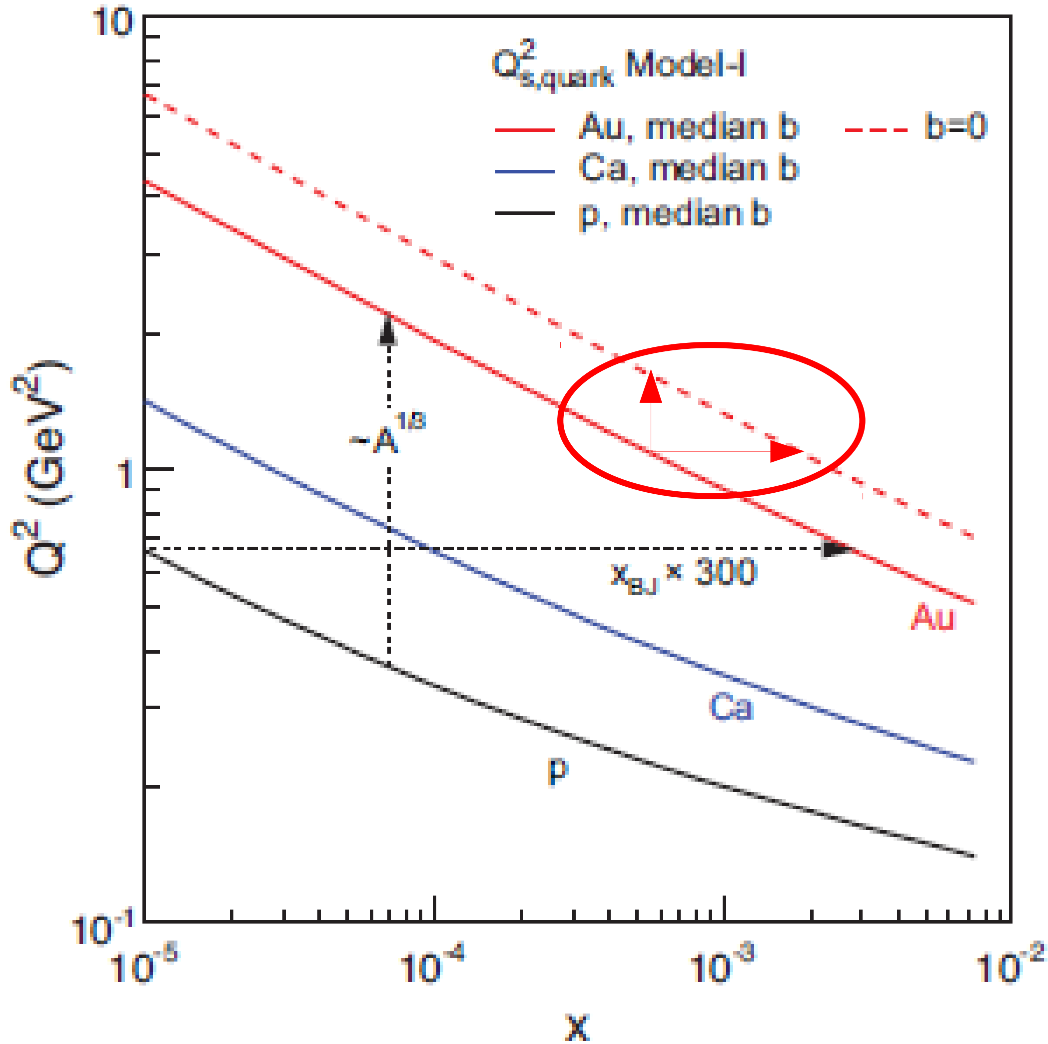
3.5x increase in E_{beam}

Phase I to Phase I.5

(Phase II ~ 10xPhase I)

White paper Fig. 3.9

Arxiv.org:1212.1701v3



Incoherent diffraction ratio

Lappi et al., PRL 114 (2015) 082301

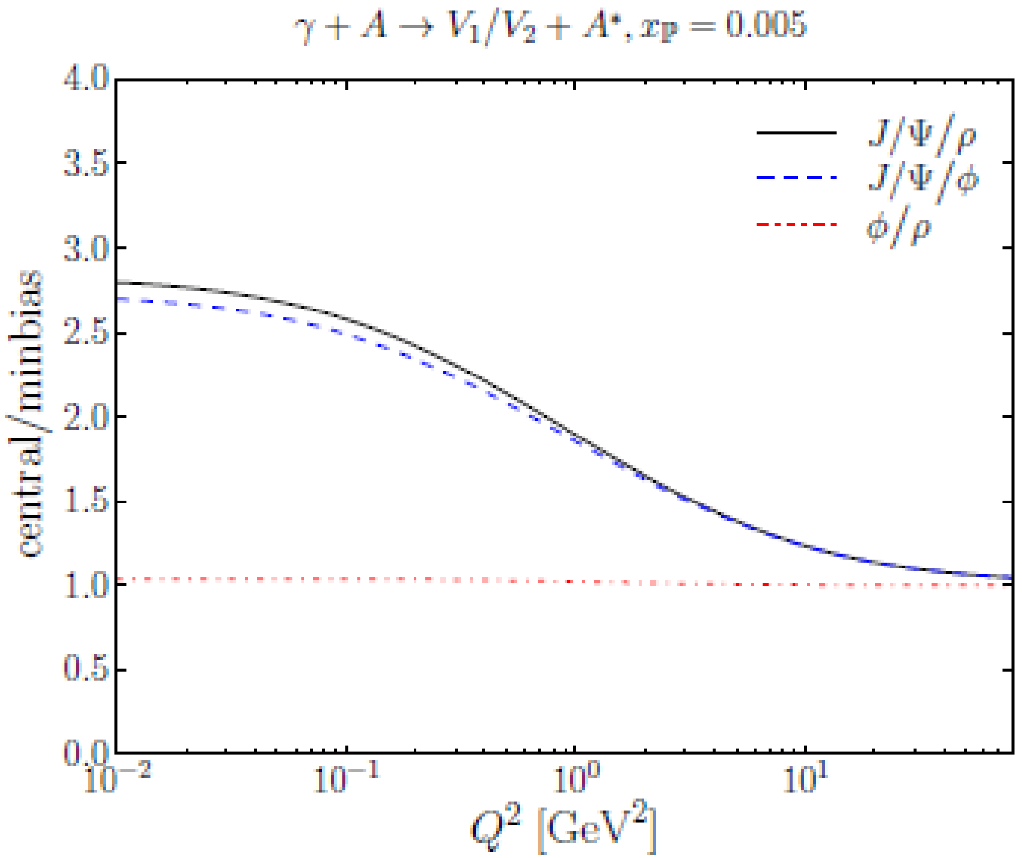


Figure 4: Ratio of two vector meson incoherent diffractive cross-sections in central events relative to minimum bias events as a function of Q^2. See text for details.

Coherent Diffraction tagging & t reach

White paper arxiv.org:1212.1701v3 from Toll, Ullrich

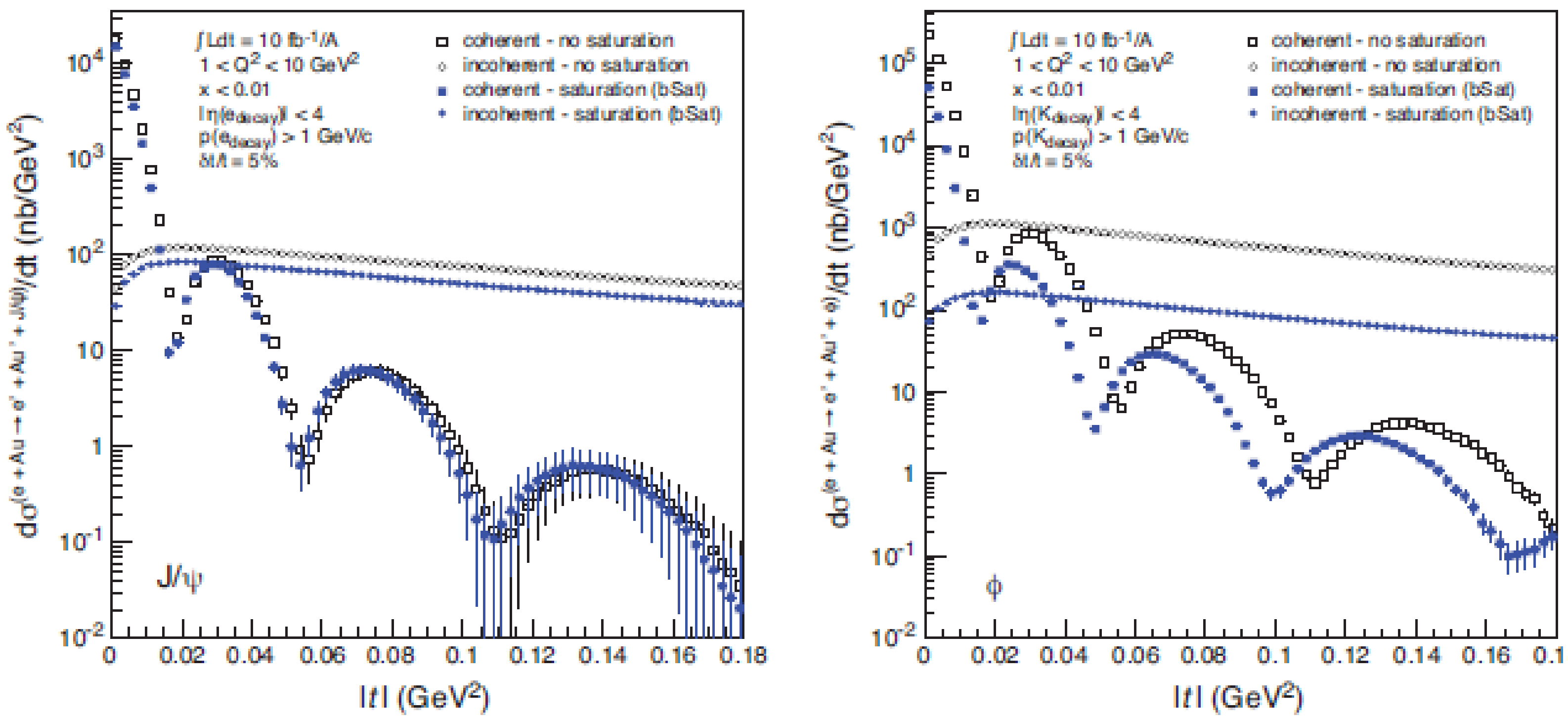


Figure 3.23: $d\sigma/dt$ distributions for exclusive J/ψ (left) and ϕ (right) production in coherent and incoherent events in diffractive e+Au collisions. Predictions from saturation and non-saturation models are shown.

Direct measure of gluon saturation

White paper arxiv.org:1212.1701v3 from Toll, Ullrich

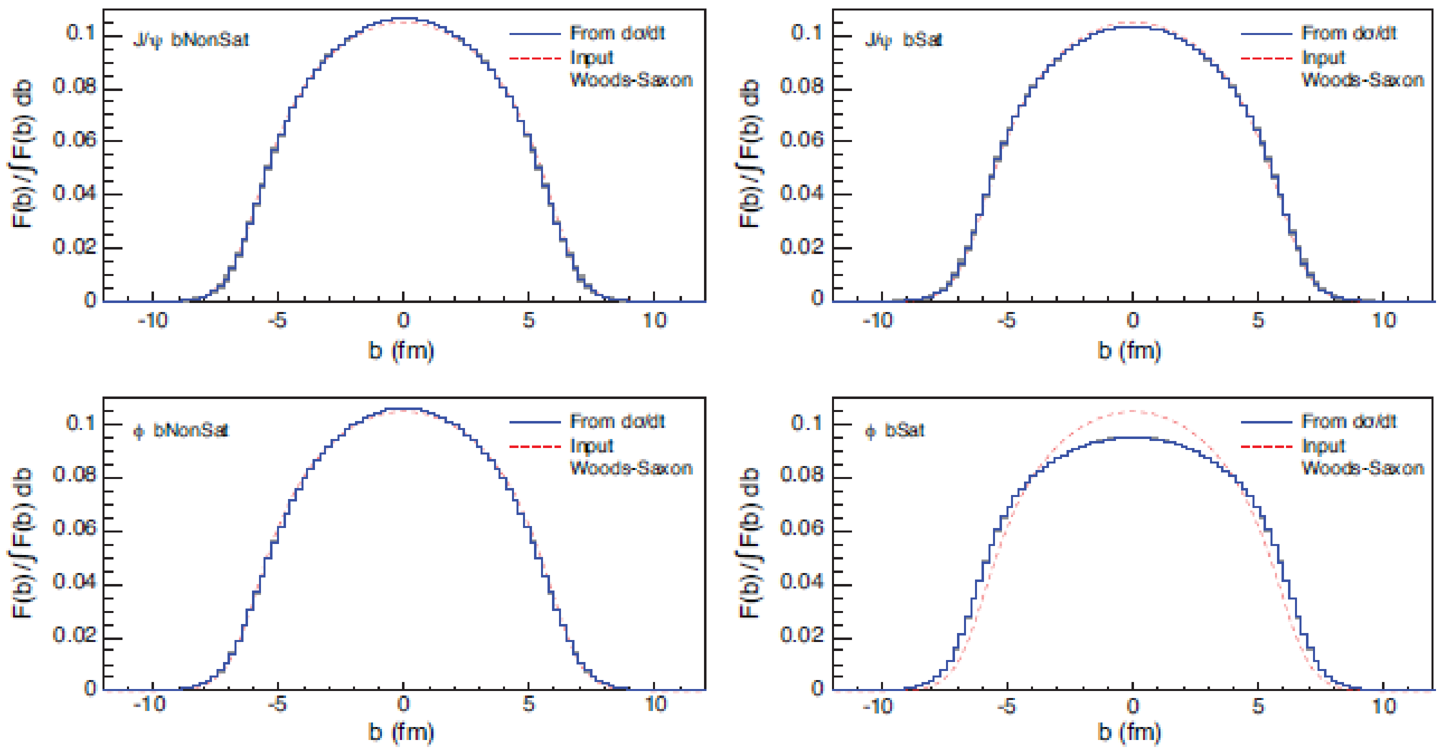


Figure 3.24: The Fourier transforms obtained in [201] from the distributions in Figure 3.23 for J/ψ-mesons in the upper row and ϕ-mesons in the lower row. The results from both saturation (right) and non-saturation (left) models are shown. The used input Woods-Saxon distribution is shown as a reference in all four plots.

Lost opportunity (so far)

- The Large Acceptance Detector @JLEIC should be the gold standard for geometry tagging (and coherent diffraction).
  - Inherent advantage of JLEIC IR characteristics
  - Detector design already well optimized for this
- Almost every eA theory paper should have a page mentioning the impact of geometry tagging on that physics and using resolution #s or figures from JLEIC-LAD to illustrate that, since it's close to an "ideal" detector for this physics.

Next opportunity

- JLAB12 should be able to access the "path length in medium" physics as well – and "now". This physics actually benefits from low energy where there is a larger effect.
  - Can we check E665's low average # of evaporation neutrons/event?
  - Can we do a higher statistics version of the "grey track" studies on INC-tagging?
  - Can we measure neutrons and grey tracks simultaneously?

Milestones

- 3/2017
  - Install, adapt, validate model codes (DPMJetHybrid & Sartre), including possible new partial Sartre grid.
  - Interface with JLAB detector model.
  - Identify best state of art A-scan based saturation study for implementation in year 2 geometry tagging.

Milestones

- 9/2017
  - Parton propagation studies for JLEIC
  - Coherent diffraction tagging purity/efficiency & gluon saturation physics
  - Incoherent diffraction ratio and saturation.

What about year 2

- DPMJetHybrid and "d" studies for JLAB12
- Convert best A-scan saturation study not already done by us to geometry tagging
    - Open charm?
    - Dihadrons?
- Are we doing too much in year 1?
    - Hard to see what to cut.
    - Note: sartre studies **should** be pretty easy.
    - Could promise them early in year 2 and then if we finish in year 1 it's OK?