

EIC LDRD Proposal:

Realization of an eA Physics Event Generator

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Needs

- Success of the EIC is closely tied to the strength of the physics case for an e+A physics program
- e+A collision more complex than e+p
 - ▶ nuclear initial and final state effects (A, b dependence?)
 - ▶ amplification of gluon saturation (A, b dependence?)
- Broad range of compelling measurements
 - ▶ simple inclusive measurements in DIS \Leftrightarrow exclusive measurements in diffractive events
- An e+p simulator for e+A is not enough
 - ▶ Need to test models: linear QCD/DGALP versus non-linear QCD/saturation/CGC
 - ▶ Can we get a handle on b (multiplicity) ?
 - ▶ Nuclear breakup (incoherent diffractive events)
 - ▶ Parton energy loss in medium

Impact on: machine (\mathcal{L} , E_{beam})

detector (acceptance, PID, tracking)

Needs

- Success of the EIC is closely tied to the strength of the physics case for an e+A physics program
- e+A collision more complex than e+p

- E No such generator exists to-date

If we (EIC) do not pursue this it's not going to happen

- A

It is vital for the e+A program

- ▶ Nuclear breakup (incoherent diffractive events)
- ▶ Parton energy loss in medium

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Requirements

The minimum requirements for an e+A generator are:

- Handle inclusive DIS as well as semi-inclusive and diffractive final states
- Reflect the nuclear geometry of various ions (inc. Uranium)
- Simulate initial (e.g. shadowing) and final state (E-loss, color transparency, medium modified hadronization) nuclear effects
- Simulate the breakup of the nucleus to allow for studies of b sensitivity of various measurements and energy deposition in ZDC
- Allow for the implementation of alternative models (e.g. CGC) to study the sensitivity to new physics
- Implements relevant QED effects like radiative corrections that may be significant for large nuclei

Needs lots of expertise (not available locally)

Some efforts so far (Matt, Cyrille) but to have something in time need massive effort

Proposal

- (i) hire a **postdoc** with expertise in this field and experience in event generators to write such a generator *and*
- (ii) augments his efforts by **inviting** known **experts** to BNL, each for several weeks or month, to work in collaboration with him on the program.

There are several candidates for (i) and (ii)

Who depends on choice of path:

- add e+p to existing pA/AA generator
- add A to existing ep generators

Costs: ~\$250k over 2 years for postdoc and visitors

N.B.: Possible collaboration with LHeC?