Studies with lAger

J/Psi DVMP at ECCE
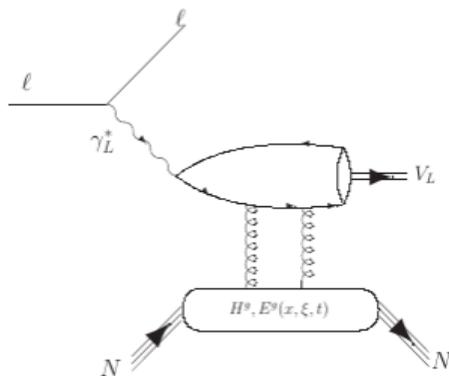
Stuart Fegan

University of York

August 6th, 2021

UNIVERSITY of York

DVMP with Vector Mesons

arXiv:1511.04535

- Exclusive vector meson channels ϕ and J/Psi identified for priority study by this group
- I've looked at J/Psi decays in a former life, so have fallen into the latter
- EIC offers the opportunity to study gluon GPDs with heavy vector mesons, such as J/Psi
- Potential to expand to higher mass VM, e.g. $\psi(2s)$, Υ, worth bearing in mind, but let's walk before we run

lAger

- lAger - Argonne generic l/A-event generator
  S. Joosten, Argonne l/A-event Generator (2021),
  GitLab repository,
  https://eicweb.phy.anl.gov/monte_carlo/lager
- A flexible generator system for electro- and
  photo-production off nucleons and nuclei.
- Distributed in singularity images, configured with
  `.json` files for a variety of models
- Basically good to go!

IAger Tests

- Small scale event generation tests completed using an EIC example job card (eP, 10 on 100 GeV)
- Using a rather lightweight Windows tablet, runing Ubuntu on WSL - heavier duty resourses are available and will be called upon in due course!
- Produced samples in the 1k-10k events range
    - ROOT tree outputs 2.5 MB for 1500 events, 20 MB for 10k
- Further conversion to EICSmear input has minimal additional overhead

Next Steps

- Optimise generation workflows
- Tune job card to EIC run conditions of interest (initial studies used an $\Upsilon \to \mu\mu$ job card, the only EIC one available at the time)
- Get events into EICSmear and perform a toy analysis (next slides)

Event Conversion

- Initial plan to read the hepmc output from lAger into eicsmear/fun4all eventually came undone
    - Version mismatches in ROOT, hepmc, etc, all ruled out
- Now reading lAger ROOT tree into the LUND format (converter macro derived from a version provided by R. Montgomery)
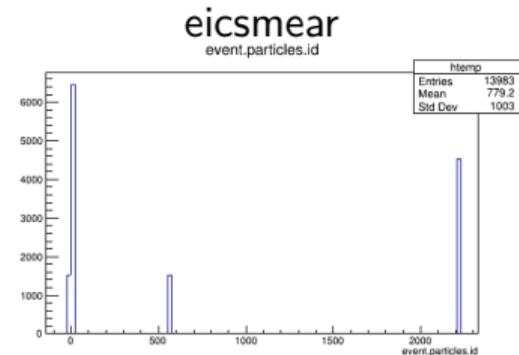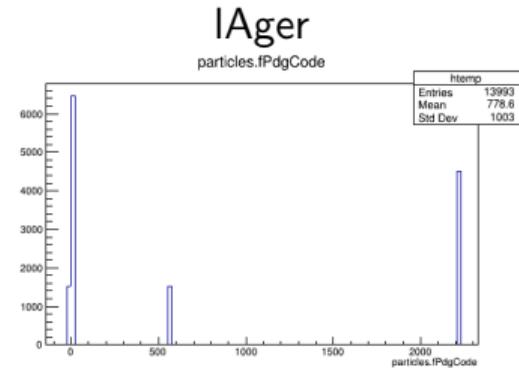
```
I, ievent, nParticles
=============================================
I  K(I,1)  K(I,2)  K(I,3)  K(I,4)  K(I,5)  P(I,1)        P(I,2)       P(I,3)        P(I,4)     V(I,1)        V(I,2)  V(I,3)
=============================================
0      0      11
=============================================
1     21         11      0      3      5          0              0           -10            10    0.000510999    0    0    0
2     21       2212      0      2      3          0              0        99.9956           100      0.938272    0    0    0
3     21         22      0      5      7    0.00785359    -0.00220345      -2.92493       2.92493             0    0    0    0
4      1         11      0     -1     -1   -0.00785359     0.00220345      -7.07507       7.07507   0.000510999    0    0    0
5     12       2212      1      0      0          0              0        99.9956           100      0.938272    0    0    0
6     22        553      3      7     11   -0.306674     -0.0134966        4.73428       10.5832        9.4603    0    0    0
7     14       2212      3      0      0    0.314527      0.0112932        92.3364       92.3417      0.938272    0    0    0
8     30        -13      5      0      0     2.1074        1.09055        -2.01181       3.11272      0.105658    0    0    0
9     30         13      5      0      0   -2.53948       -0.905427        6.68244       7.20659      0.105658    0    0    0
10     1         22      5      0      0  -0.000353848   -0.00627829     -0.0187697      0.019795             0    0    0    0
11     1         22      5      0      0    0.125756      -0.192339        0.082418      0.244134             0    0    0    0
============== Event finished ==============
0      1      22
```
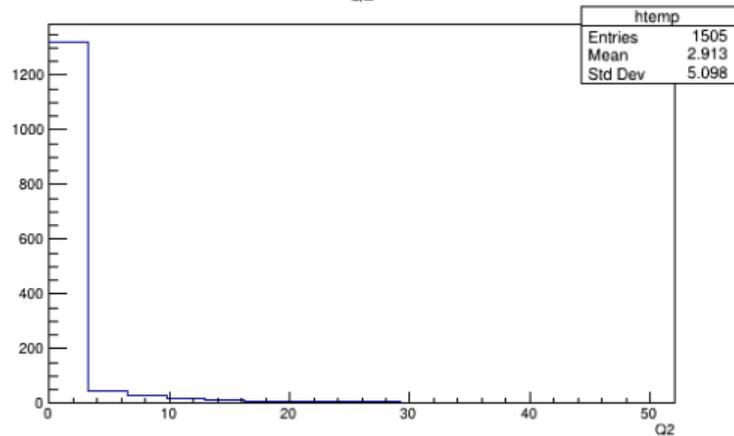
Event Conversion II

- Default particle ordering of IAger output doesn't follow the e,P,γ,e' ordering
- Unlike attempts to impose this order on hepmc files, converted ROOT tree is accepted by eicsmear
- Verifying parent/daughter indices and resulting distributions in smeared tree

IAger

eicsmear

Event Conversion III