

# Software EIC collaboration: tools & accessibility

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# How can you work on EIC at BNL?

1. You require an active BNL Life or Guest Number

▶ <https://fsd84.bis.bnl.gov/guest/guest.asp>

2. Obtain an RACF account

▶ <https://www.racf.bnl.gov/experiments/rhic/useraccounts>

That's it!

# Andrew File System (AFS)

- You also get an AFS account and working area.
- EIC has its own AFS area
  - `/afs/rhic.bnl.gov/eic/`
- This contains directories
  - `DATA/` - for storing large files
  - `PACKAGES/` - the EIC code repository

# eRHIC Wiki

The screenshot displays the eRHIC Wiki Main Page. The browser address bar shows the URL [https://wiki.bnl.gov/eic/index.php/Main\\_Page](https://wiki.bnl.gov/eic/index.php/Main_Page). The page title is "Main Page" and the main heading is "Welcome to eRHIC".

The central diagram, titled "(M)eRHIC", illustrates the accelerator layout. Key components and parameters are labeled:

- (4) 10 to 20 GeV e x 325 GeV p - 130 GeV/u Au**: Beam energy and species.
- 2 x 200 m SRF linac**: Superconducting Radio Frequency linac.
- 4 (5) GeV per pass** / **5 (4) passes**: Linac energy and number of passes.
- Polarized e-gun**: Source of polarized electrons.
- Beam dump**: Target for the electron beam.
- eRHIC detector**: Main detector for the electron-ion collisions.
- MeRHIC detector**: Detector for the heavy-ion collisions.
- PHENIX**: Detector for heavy-ion collisions.
- Coherent e-cooler**: Cooling system for the electron beam.
- Gap 5 mm total, 0.3 T for 30 GeV**: A specific gap parameter.
- Possibility of 30 GeV low current operation**: A note on operational flexibility.
- 4 to 5 vertically**: A note on vertical beam parameters.

The diagram shows a circular path with various components and detectors. A sidebar on the left provides navigation and simulation links.

► [https://wiki.bnl.gov/eic/index.php/Main\\_Page](https://wiki.bnl.gov/eic/index.php/Main_Page)

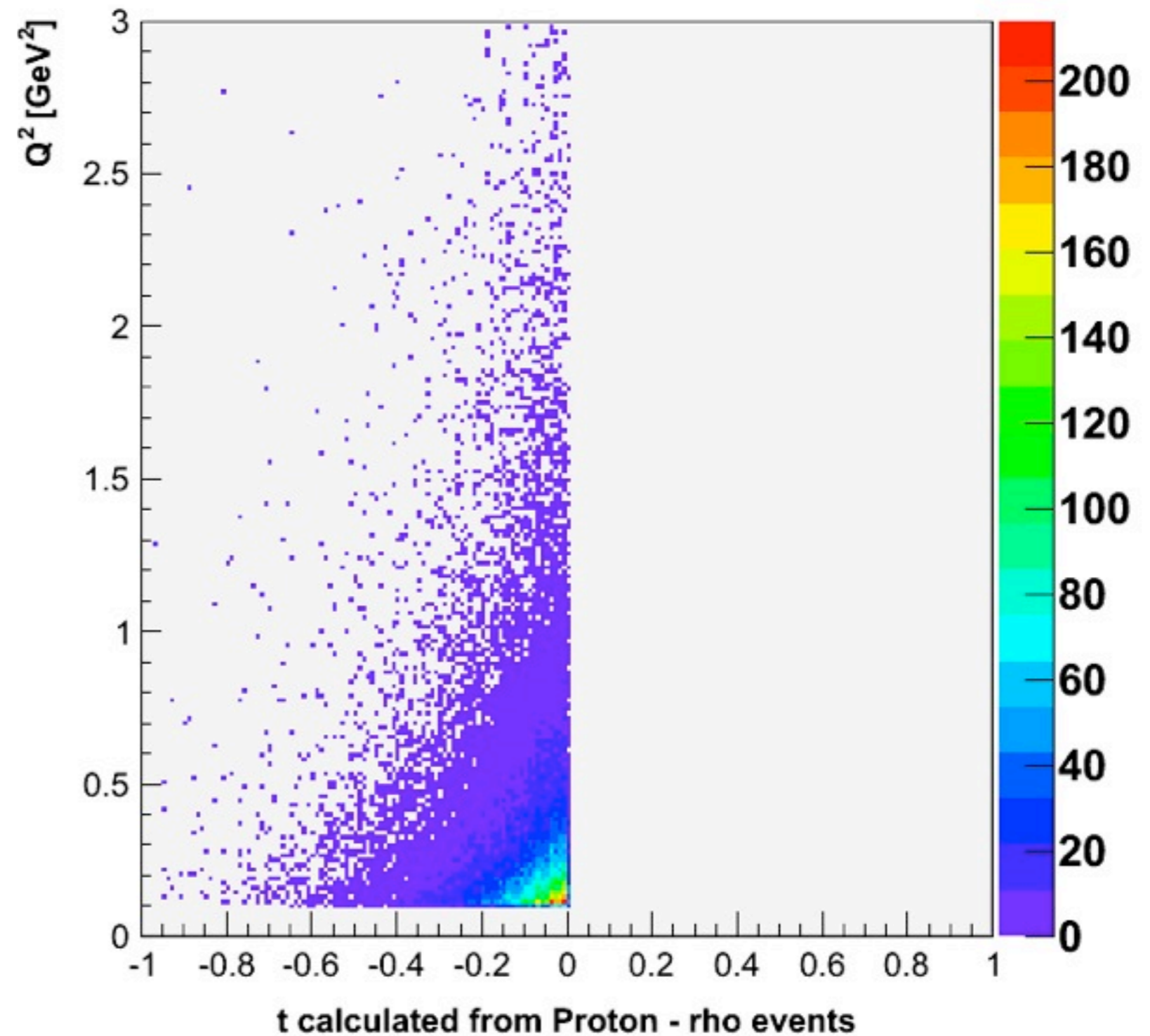
# PYTHIA

- High-energy event generator for  $e^+e^-$ ,  $e-p$  and  $p-p$  collisions.
- Simulates parton distributions, hard processes, initial- and final-state radiation, beam remnants and hadronisation.
- PYTHIA version 6.4 is the latest supporting ep collisions.
- PYTHIA 6.4.13, including optional radiative corrections, is available on the EIC AFS region:

`/afs/rhic.bnl.gov/eic/PACKAGES/PYTHIA-RAD-CORR`

# PYTHIA

- See Peter Schnatz's talk



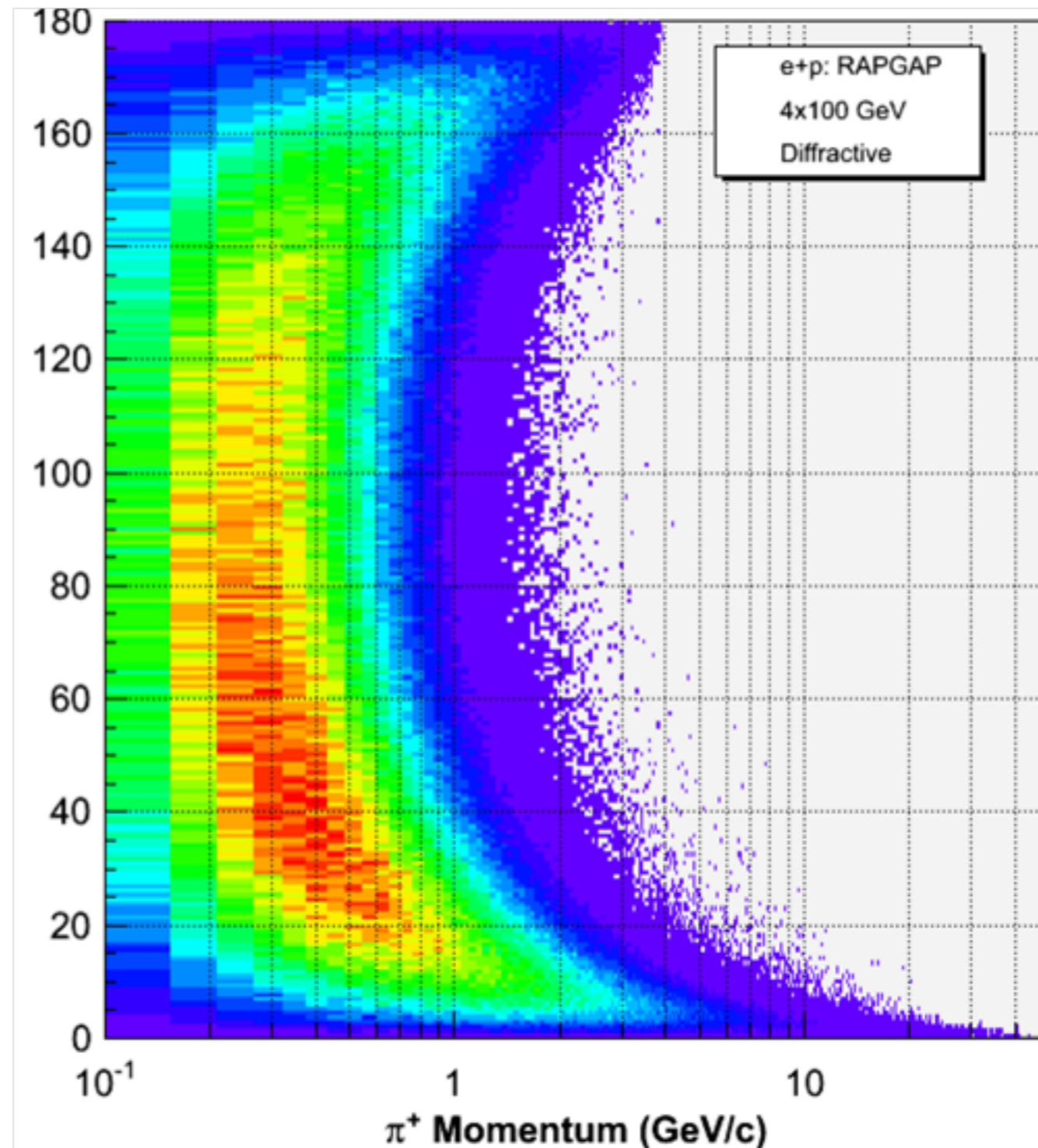
# RAPGAP

- Monte Carlo for DIS, including diffractive scattering (“rapdity gap”) events.
- Contains a number of models for diffractive scattering, including support for user-defined models.
- Supports QED radiative corrections, simulated with HERACLES.
- RAPGAP 3.1 is available on the EIC AFS region:

[/afs/rhic.bnl.gov/eic/PACKAGES/RAPGAP/rapgap31](https://afs/rhic.bnl.gov/eic/PACKAGES/RAPGAP/rapgap31)

# RAPGAP

- See William Foreman's talk.



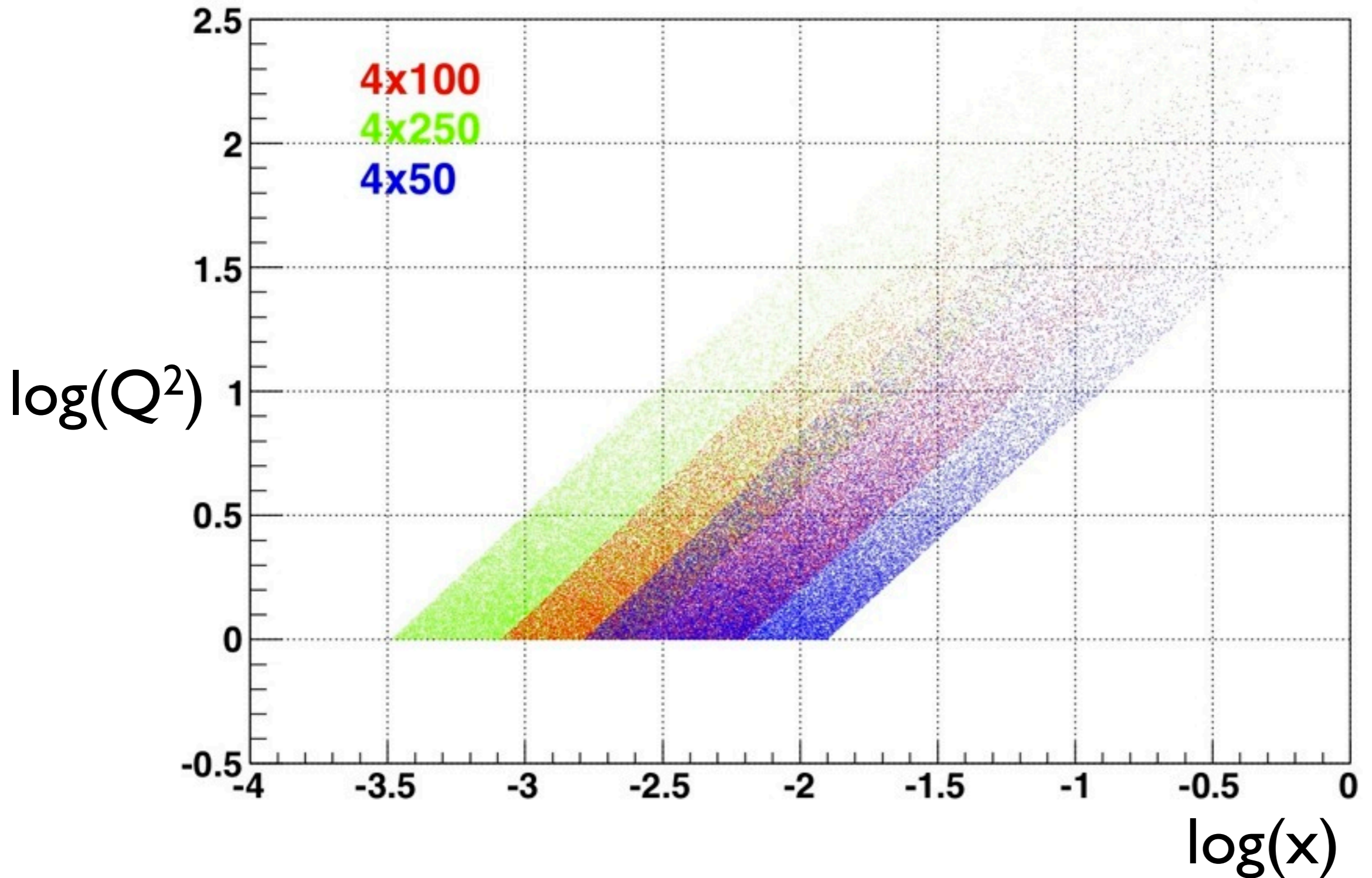


# PEPSI

- **Polarised Electron Proton Scattering Interaction.**
- Monte Carlo for polarised deep inelastic leptonproduction via EM interaction based on LEPTO.
- Generates hard  $\gamma^*$ -parton scattering according to polarisation-dependent cross section.
- Has inbuilt  $\Delta q(x)$  and  $\Delta g(x)$  distributions and supports user-implemented distributions.
- PEPSI is available on the EIC AFS region:

`/afs/rhic.bnl.gov/eic/PACKAGES/PEPSI/`

# PEPSI

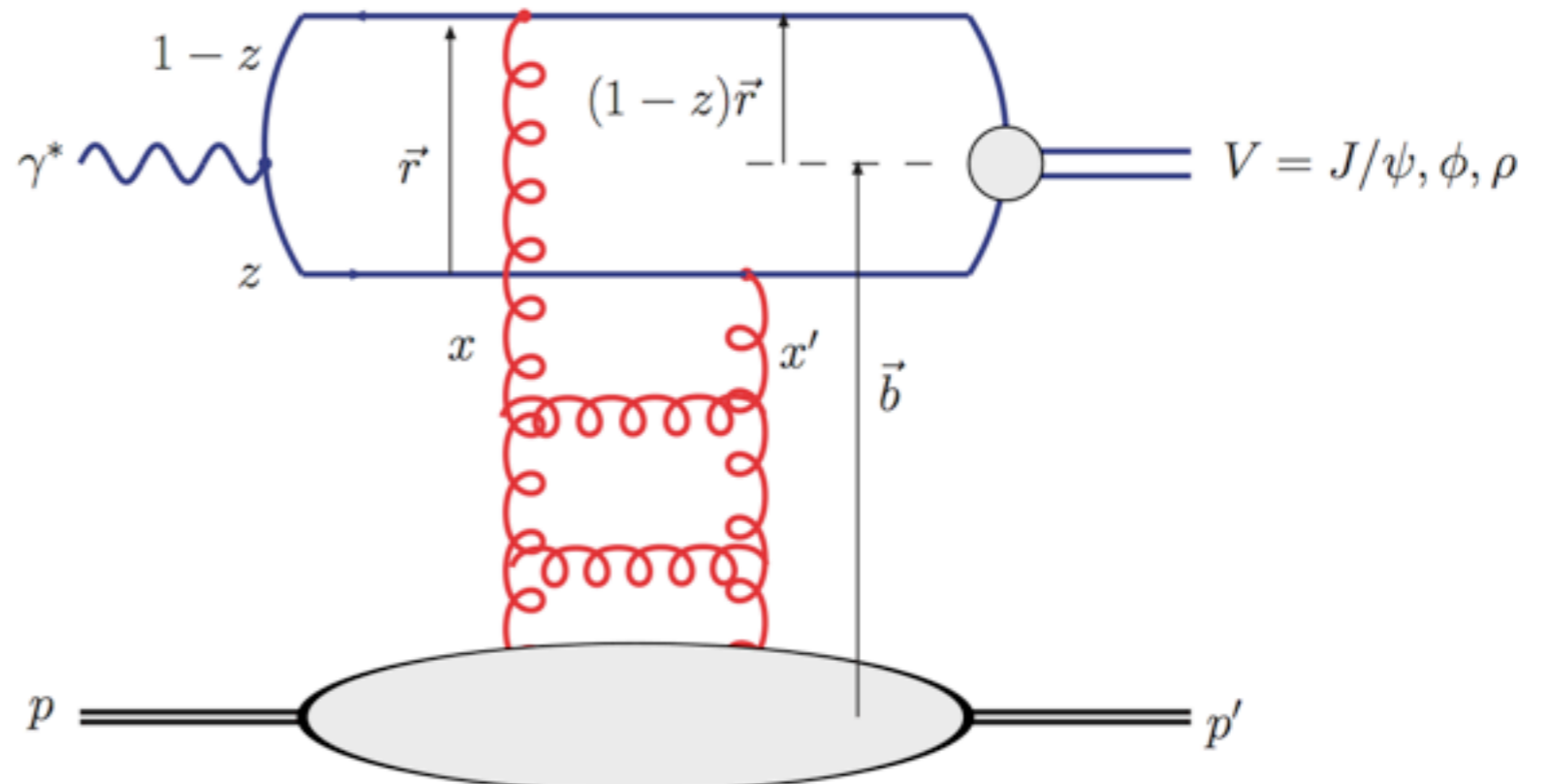


# ROOT

- Object-oriented analysis framework written in C++.
- PYTHIA, RAPGAP and PEPSI output can all be converted to ROOT TTrees for analysis.
- Use a uniform track-wise format to simplify analysis.

# xdvmp

- e**X**clusive **D**iffractive **V**ector **M**eson **P**roduction.
- Based on Kowalski/Motkya/Watt dipole model.
- Implements the b-Sat and b-CGC models for dipole cross section.
- See talk by Michael Savastio.



Kowalski,  
Motkya,  
Watt.  
PRD 74, 074016, 2006

# xdvmp

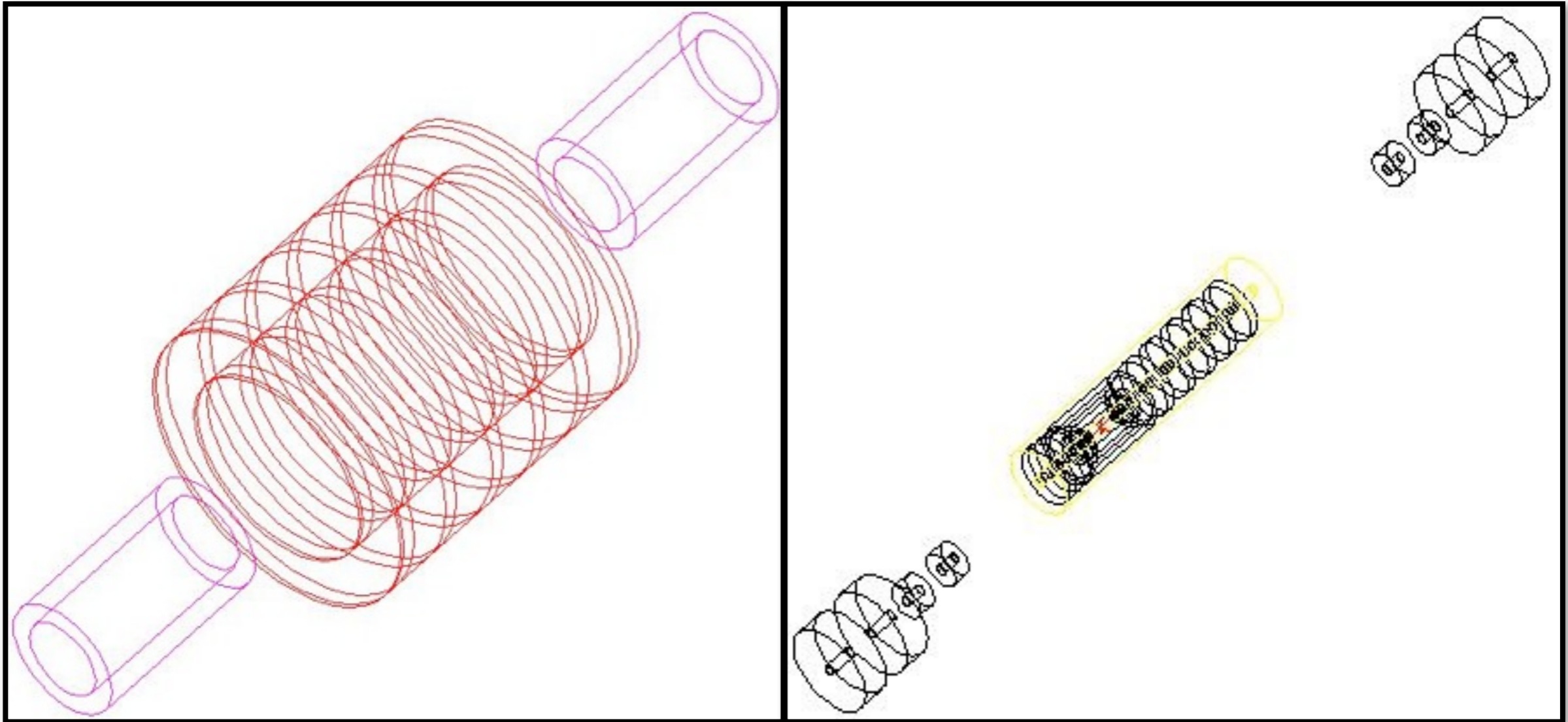
- Requires ROOT libraries and headers and GNU Scientific Library.
- Output is ROOT histograms.
- For  $J/\psi$ ,  $\varphi$  and  $\rho$  production, e-p and e-A collisions.

# ESIM

- Detector simulation for eRHIC based on GEANT 3.
- Uses a “geant language” to simplify the geometry description.
- The geometrical description of each part of the detector is written as a module that is then loaded into the framework.
- ESIM is available on the EIC AFS region:

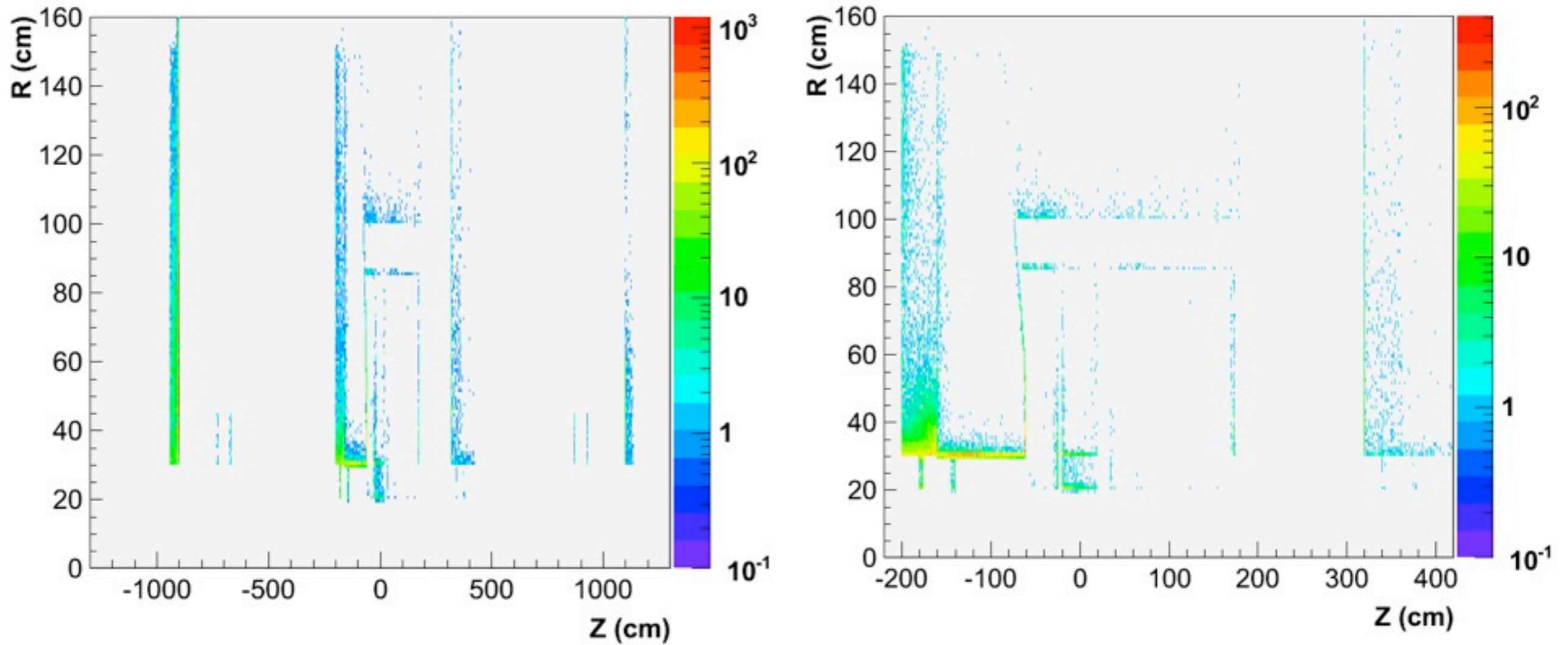
`/afs/rhic.bnl.gov/eic/PACKAGES/ESIM`

# ESIM



- See talk by Anders Kirleis.

# ESIM



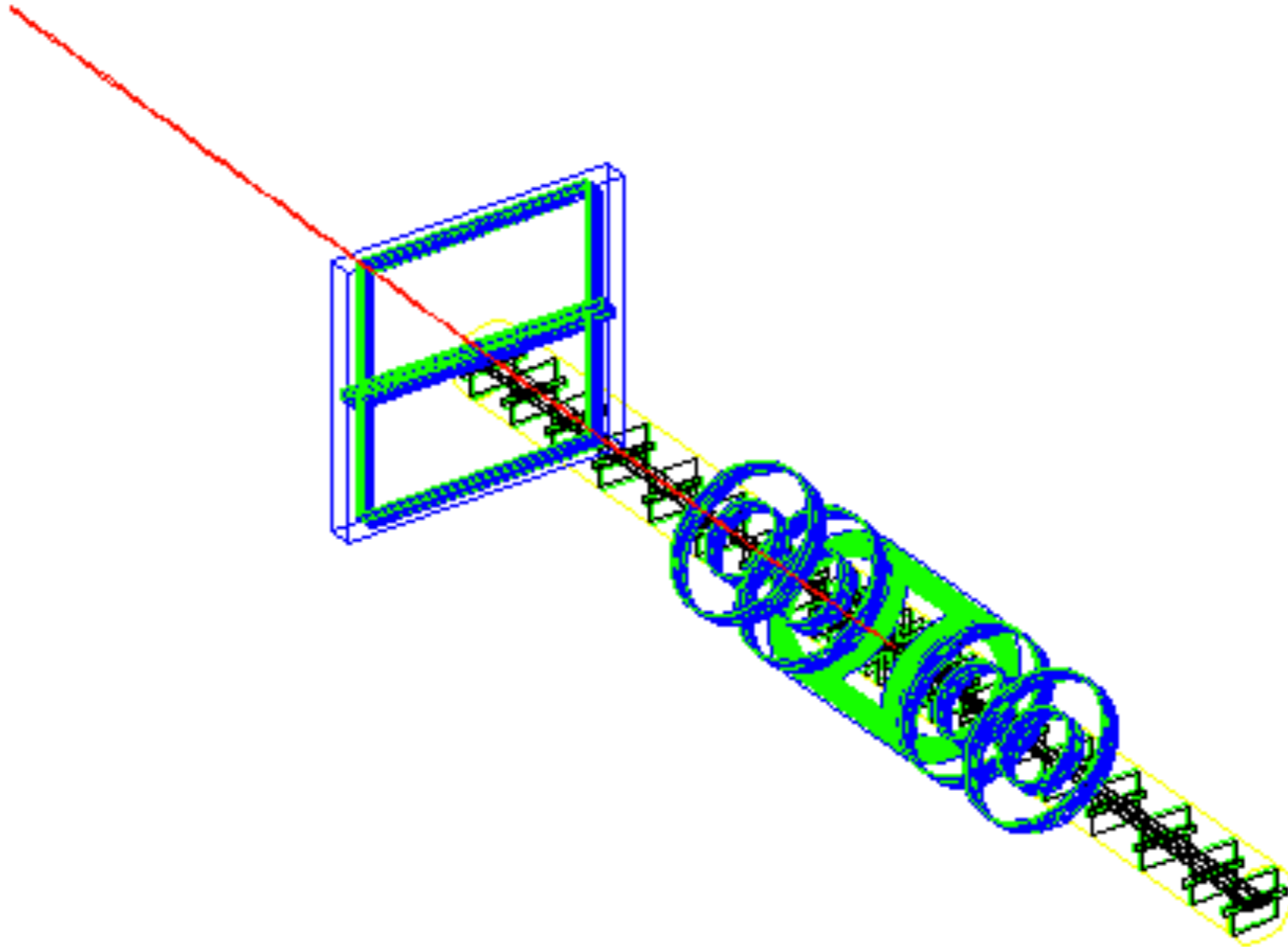
- See talk by Anders Kirleis.



# Event generators in ESIM

- ESIM contains a particle gun.
- PYTHIA can be run directly in ESIM
- code is compiled and loaded into ESIM as a shared library and can be run interactively.
- RAPGAP and PEPSI events can be replicated in ESIM.

# Caldwell Detector



# More on the way...

- A Monte Carlo event generator for e-A collisions is to be written.
- Investigating the study of Generalised Parton Distributions (GPDs) via Deeply Virtual Compton Scattering (DVCS) +....
- Investigating transverse spin physics in semi-inclusive DIS.

# Getting involved

- RACF/AFS account.
- **Sign up** for the BNL EIC mailing list:  
[eic-bnl-tf-1@lists.bnl.gov](mailto:eic-bnl-tf-1@lists.bnl.gov).
- **BNL EIC Task Force meetings: Thursdays at 14:00 Eastern Time.**