# Status on vertexing performance

*Sooraj Radhakrishnan (for the vertexing group)*
*Kent State University/Lawrence Berkeley National Laboratory*

SW Meeting, June 26, 2024

BERKELEY LAB

KENT STATE UNIVERSITY

# Current workforce and meetings

- Current Work Force:
  - Lokesh Kumar (Panjab U.)
  - Harsimran Singh (Panjab U.)
  - Khushi Singla (Panja U.)

+ Shujie Li, Barak Schmookler (LBNL, UCR)
+ Ernst Sichtermann (LBNL)

  - Joe Osborn (BNL)
  - Rongrong Ma (BNL)
  - Sooraj Radhakrishnan (KSU/LBNL)
  - Xin Dong (LBNL)

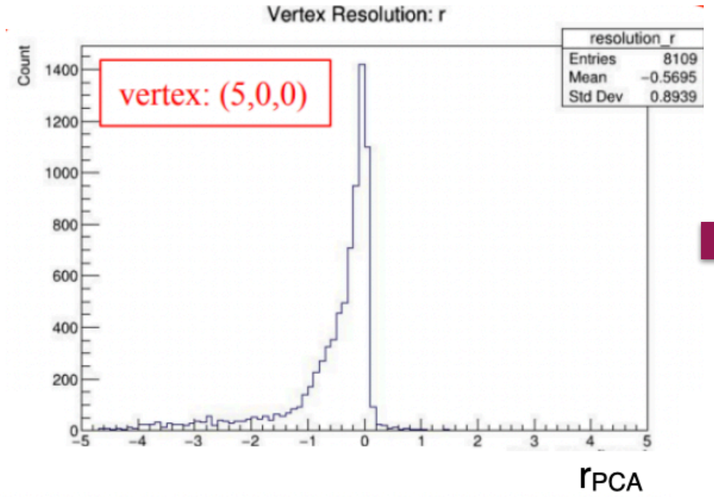
Bi-Weekly Focus Meeting:

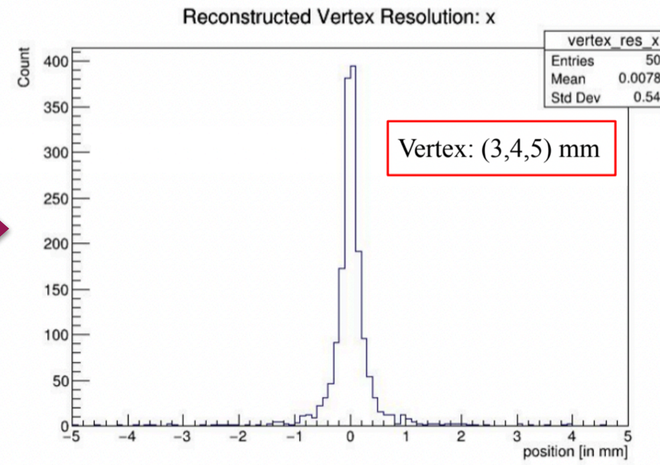
Thursdays, 12pm BNL Time

+ Track Reconstruction weekly meeting (Thursdays, 10am BNL Time)

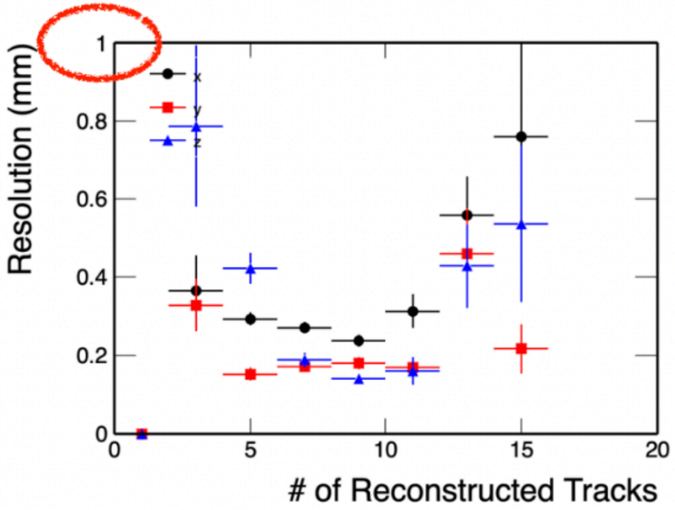
# Last update

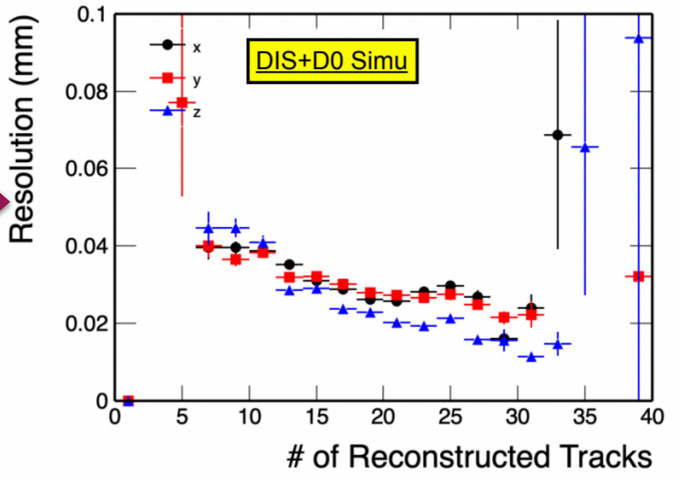
- Off-axis tracking issue, impacting resolutions and PCA
- Arising from track seeding parameters, fix PR #1291




- Large vertex resolution seen earlier resolved, mainly from update in epic geometry version

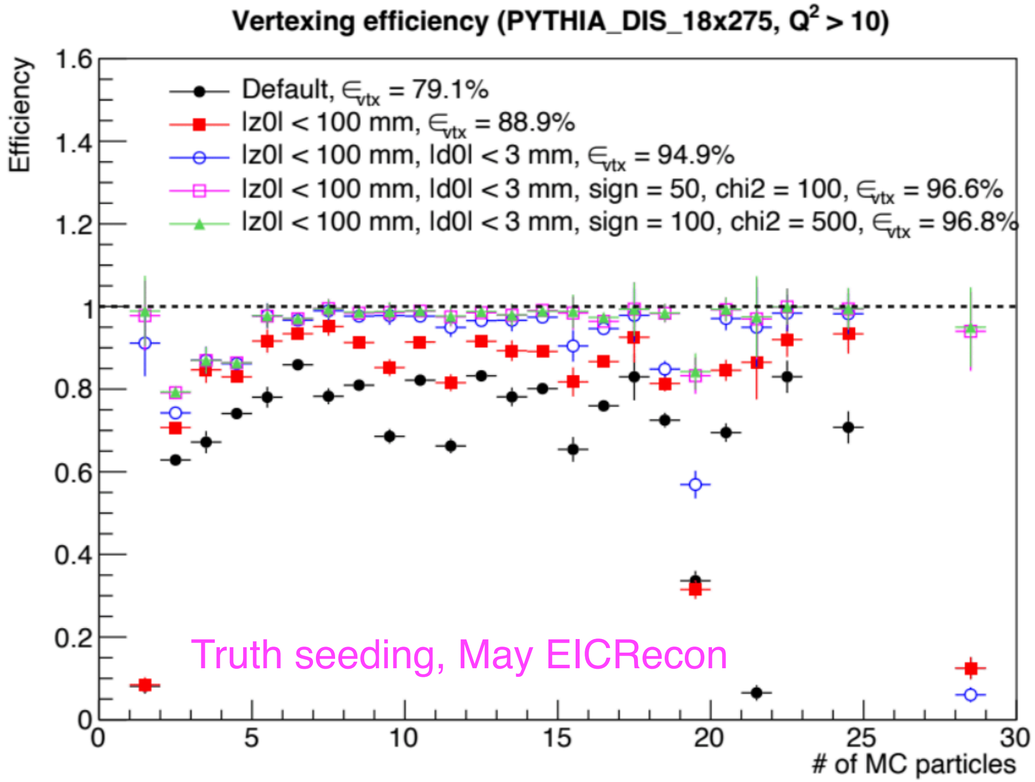


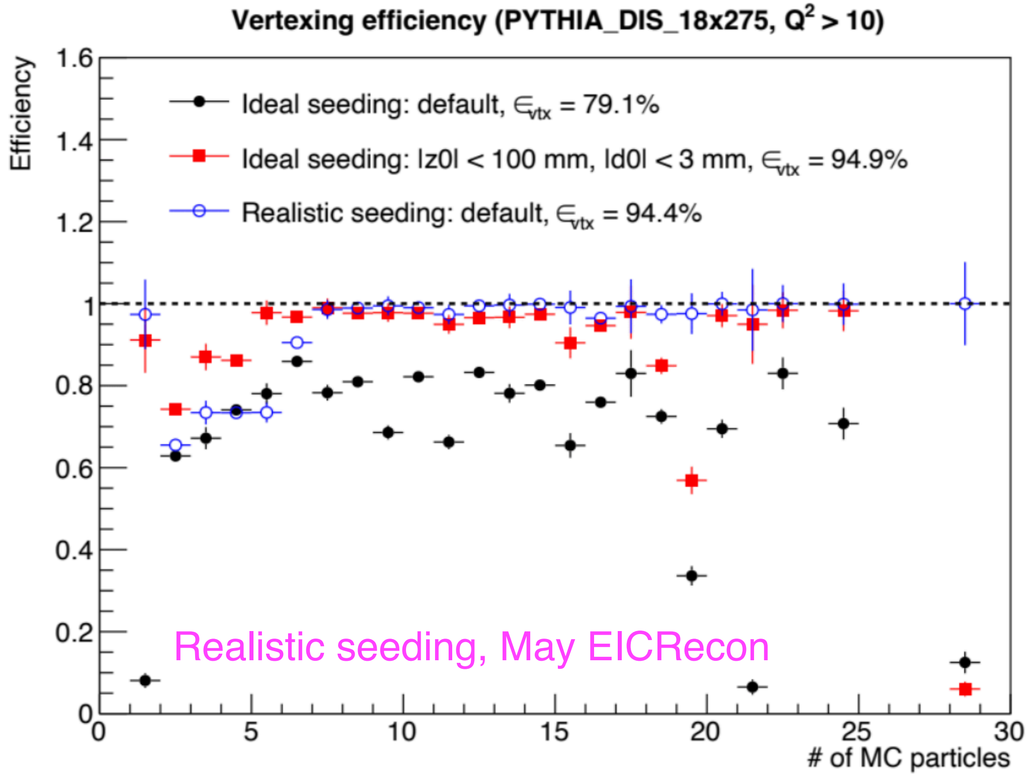




- Recent efforts:
  - Optimization of vertexing resolution and efficiency
  - Improving off-axis vertexing

# Optimization studies - DIS events at (0,0,0)

- Exclude tracks with $|z_0| > 100$ cm from center and $|d_0| > 3$ cm from beam line in vertexing




*Plots from Rongrong Ma*

- Improvement in vertexing efficiency with $d_0$ and $z_0$ selections. 95% efficiency for both truth and realistic seeding

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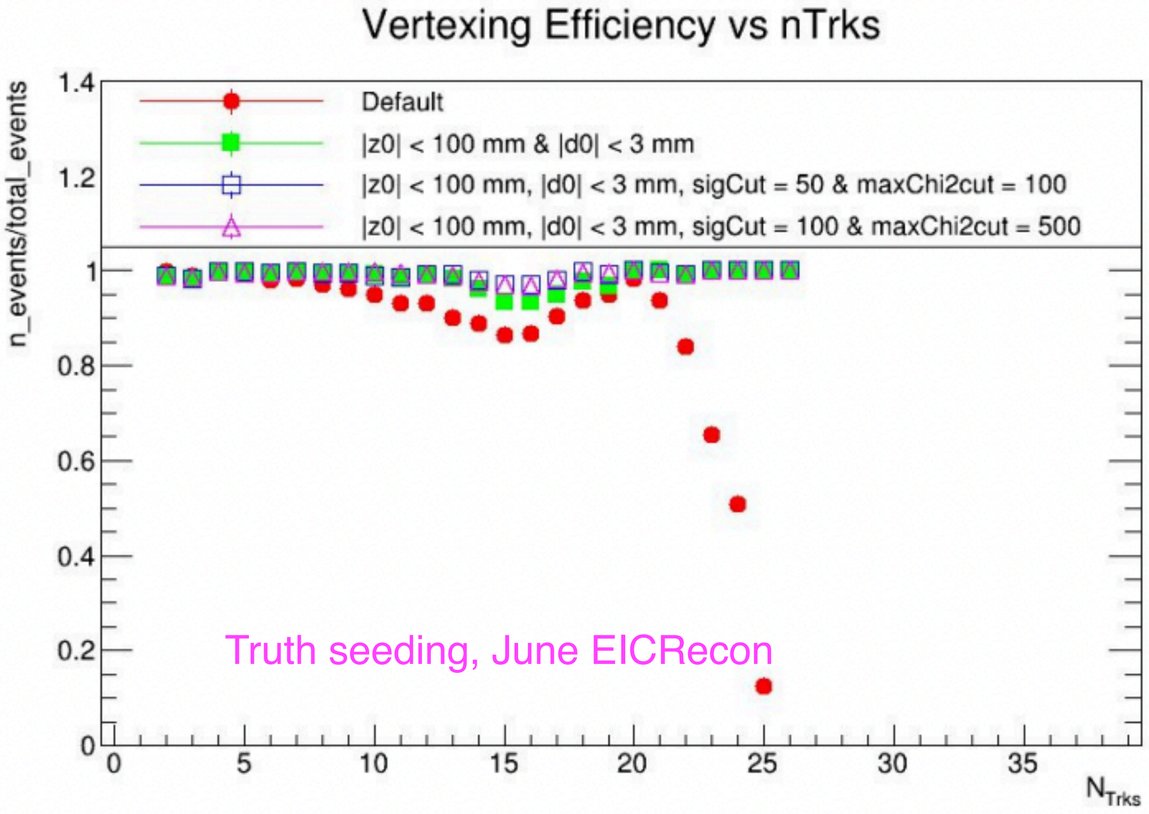
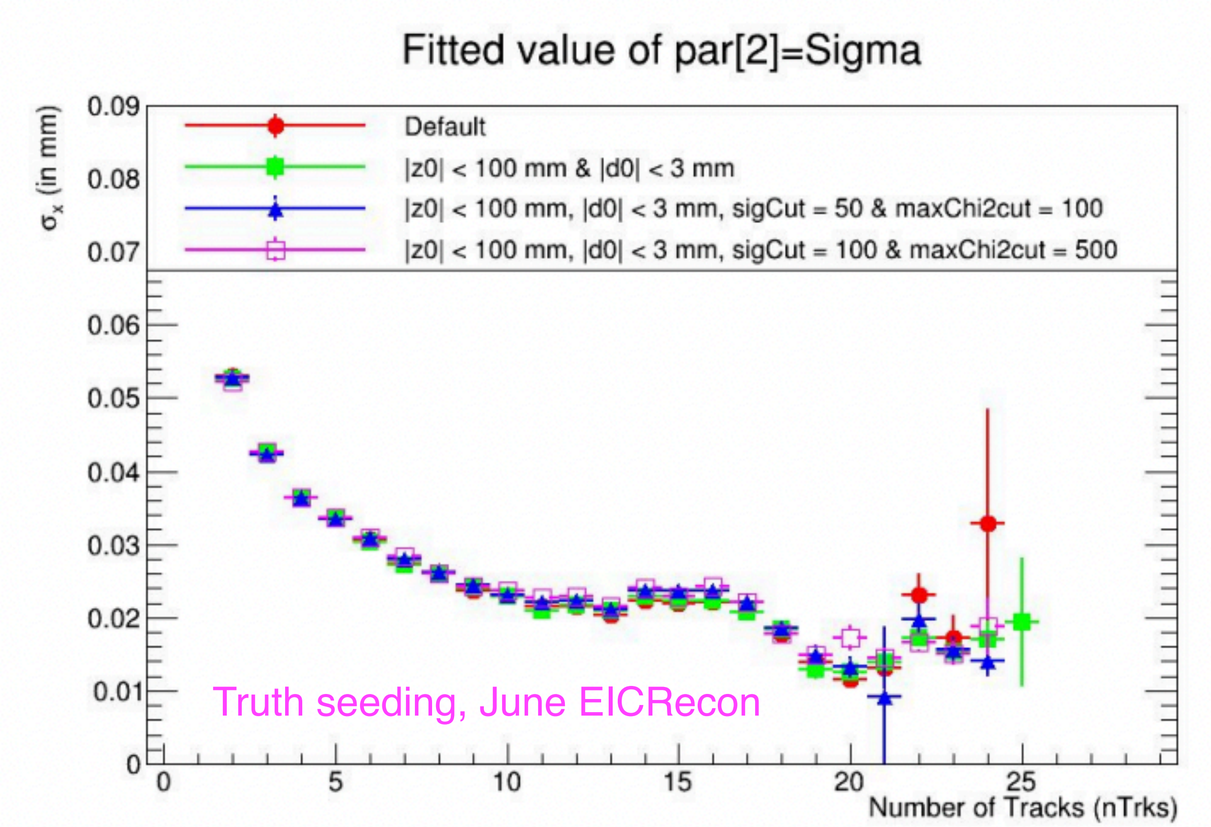
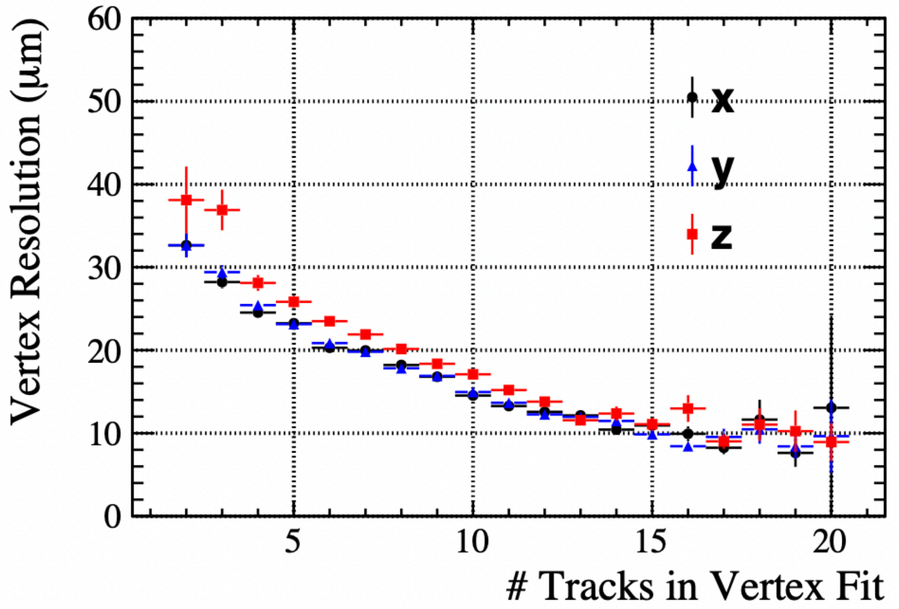



*Plot from Khushi Singla*

- Improvement in vertexing efficiency with $d_0$ and $z_0$ selections. 94% efficiency for both truth and realistic seeding.
- Default efficiency higher using June EICRecon

# Optimization studies - DIS events at (0,0,0)



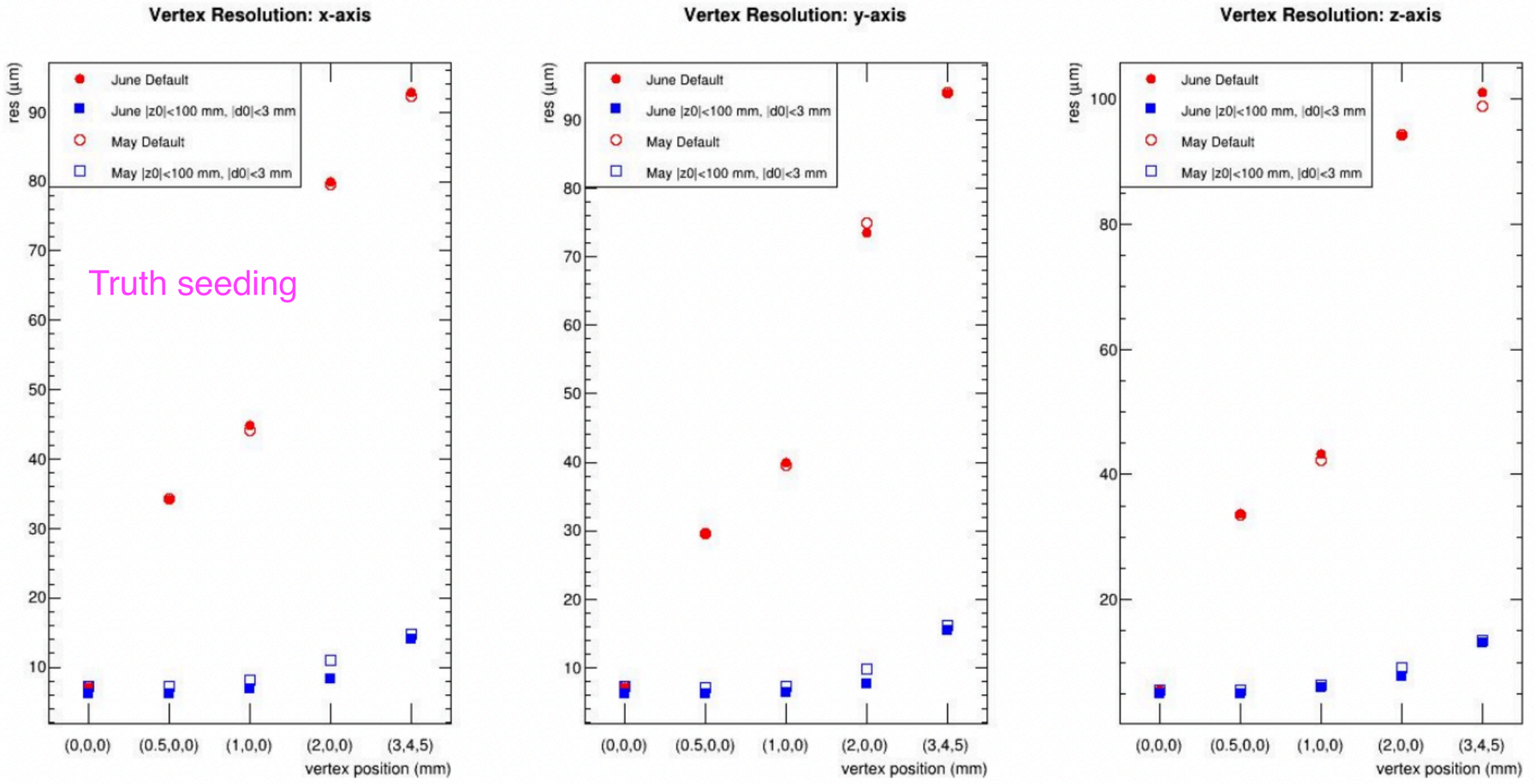




*Phys. Rev. D 104, 054002 (2021)*

*Plot from Khushi Singla*

- Can achieve vertexing resolution comparable to that in EIC YR (most studies used a 20 μm vertex resolution)

# Off axis vertexing




*Plots from Harsimran Singh*

- Study using events with tracks thrown at a fixed vertex at different positions
- Significant improvement in off-axis vertexing with $d_0$, $z_0$ selections
- Impact of some options still being checked. Also evaluate with realistic seeding and in DIS events

# Summary/Outlook

- Could achieve vertexing resolution comparable to that in YR for DIS events generated at (0,0,0)
- High vertexing efficiency as well, ~95%
- For off axis events also, vertexing resolution much improved with track selection

- For DIS events close to (0,0,0) vertexing performance is already very good, can be used in physics analyses

- Next:
  - Finalize optimization studies
  - Study off-axis vertexing for DIS events
  - Merge changes to EICRecon

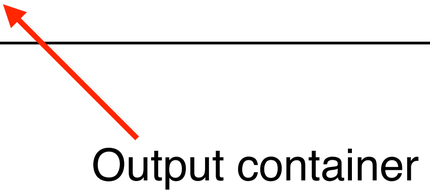
## Thank You!!

# Primary vertex container

Vertex reconstruction (implemented by Joe):
Acts::IterativeVertexFinder implemented in EICRecon

Using Trajectories as input

```
app->Add(new JChainFactoryGeneratorT<IterativeVertexFinder_factory>(
            {"CentralCKFTrajectories"}, “CentralTrackVertices"));
```



Output container