DIRC Related Research Timeline

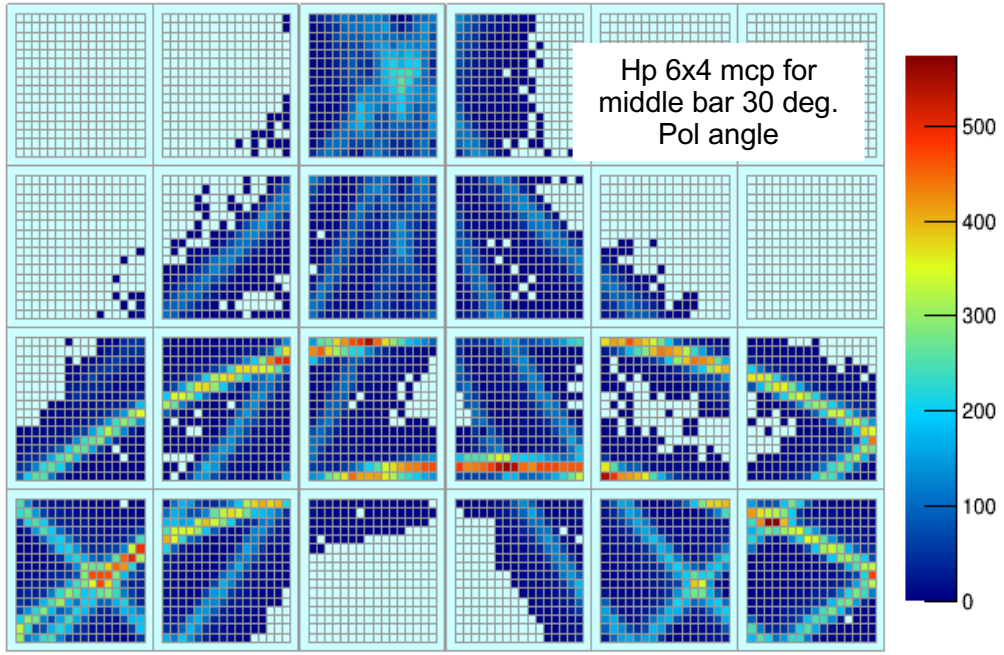
- June/July, 2023: Start at CUA
  - Initiated software installation on local machine (Geant4, root, QT5), Engaged in coding (standalone),
  - Debugging code
  - Learning UNIX, C++, ROOT, Geant4, Git
  - Looking at first histograms
- August – December, 2023:
  - Gained access to Jlab,
  - Using ifarm at Jlab (Python scripts)
  - Learning about EIC DIRC and related performance plots
  - Studying impact of tracking resolution and timing precision
- From January, 2024:
  - Studying MCP-PMT coverage and potential reduction of number of sensors per prism

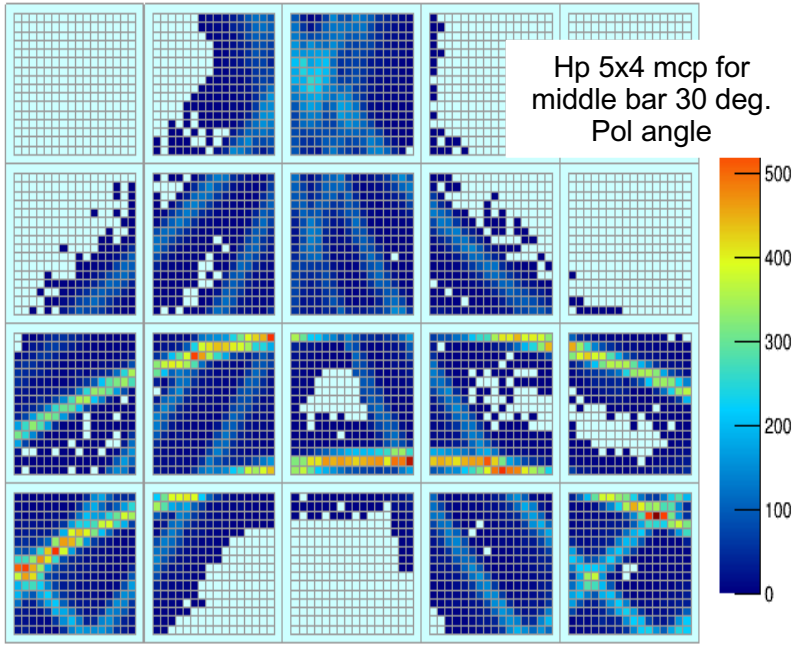
MCP-PMT Coverage Study

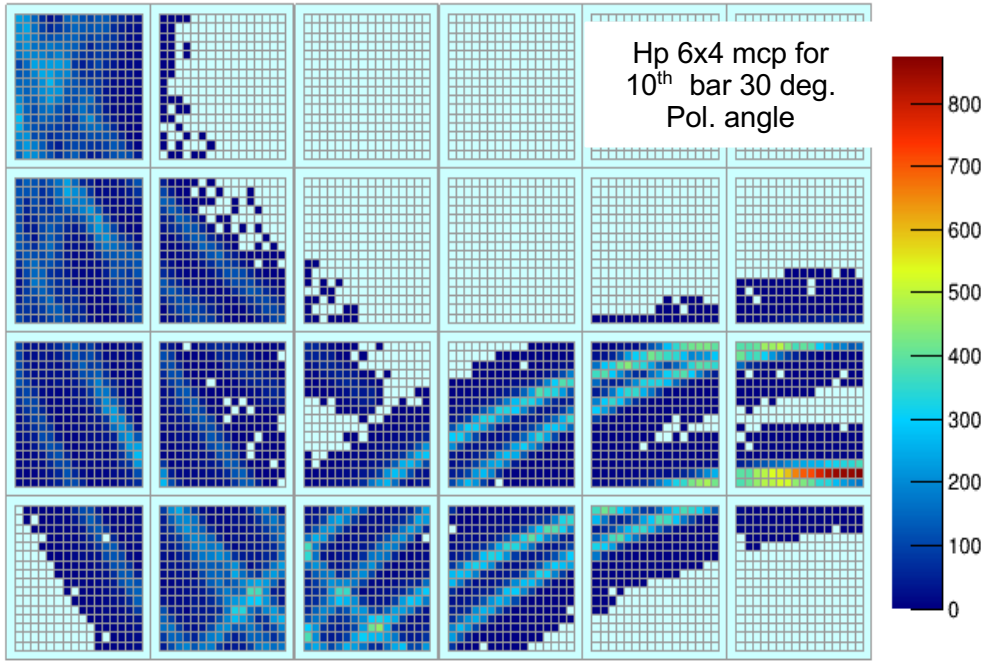
- Objective:

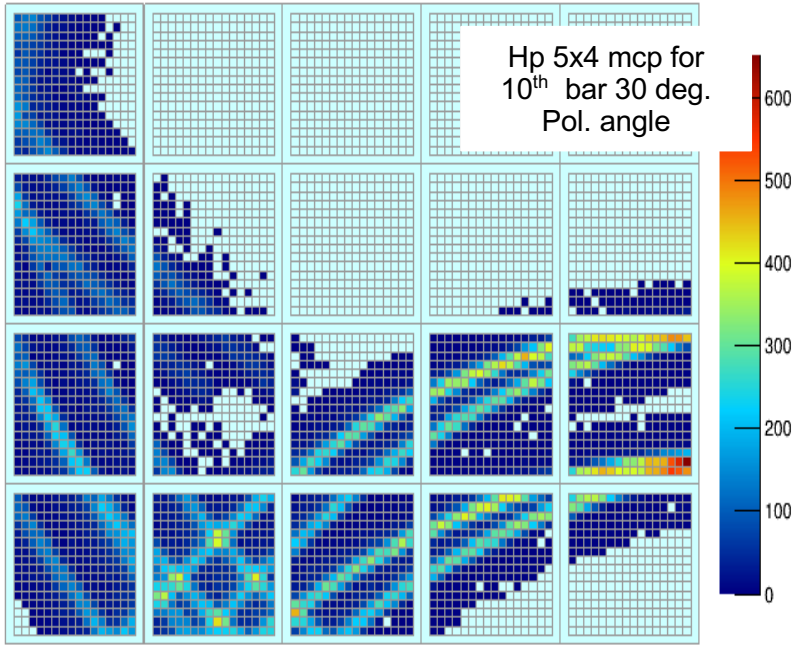
  Can we reduce number of sensors without significant drop of performance?

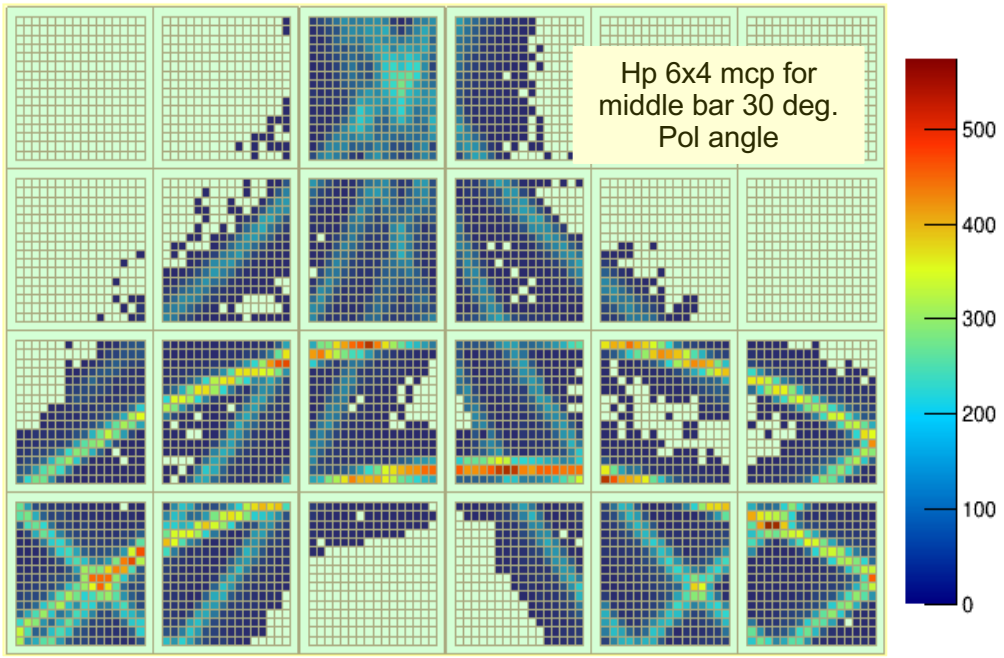
- Details:
  - Initial evaluation with commercial MCP-PMTs (100ps time resolution)
  - ePIC hpDIRC geometry
  - no magnetic field
  - Particles hitting middle and edge bar
  - 0.5 mrad track resolution

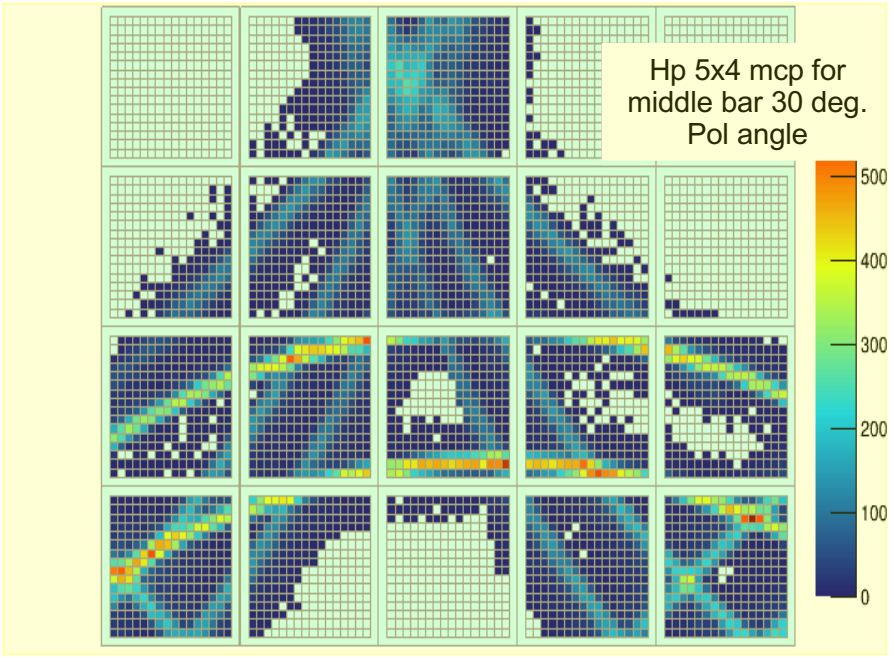

Hp 6x4 mcp for
middle bar 30 deg.
Pol angle
500
400
300
200
100
0


Hp 5x4 mcp for
middle bar 30 deg.
Pol angle
500
400
300
200
100
0

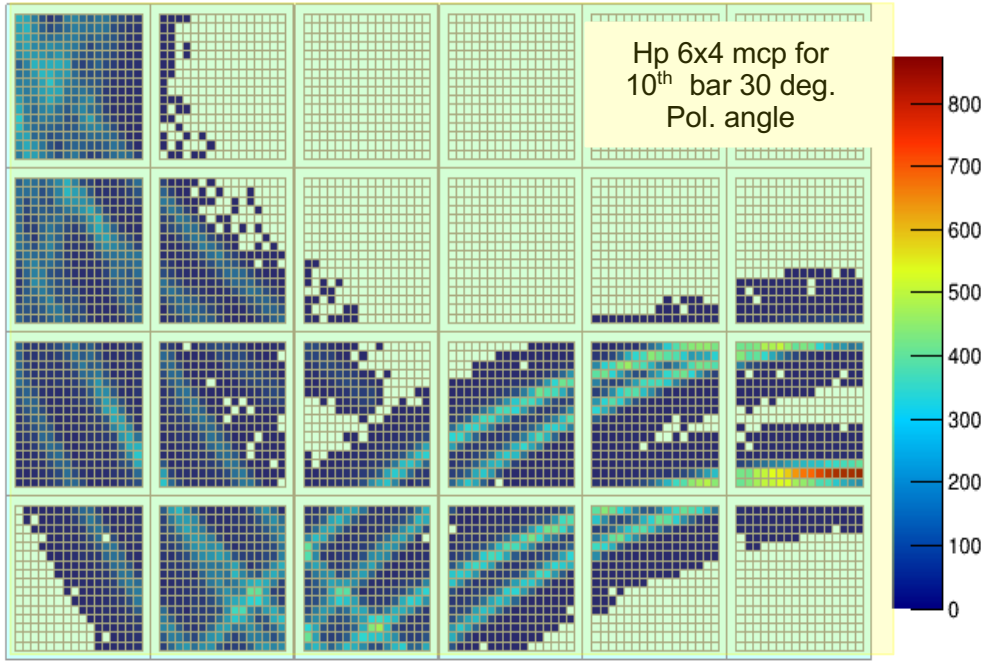

Hp 6x4 mcp for
10th bar 30 deg.
Pol. angle
800
700
600
500
400
300
200
100
0

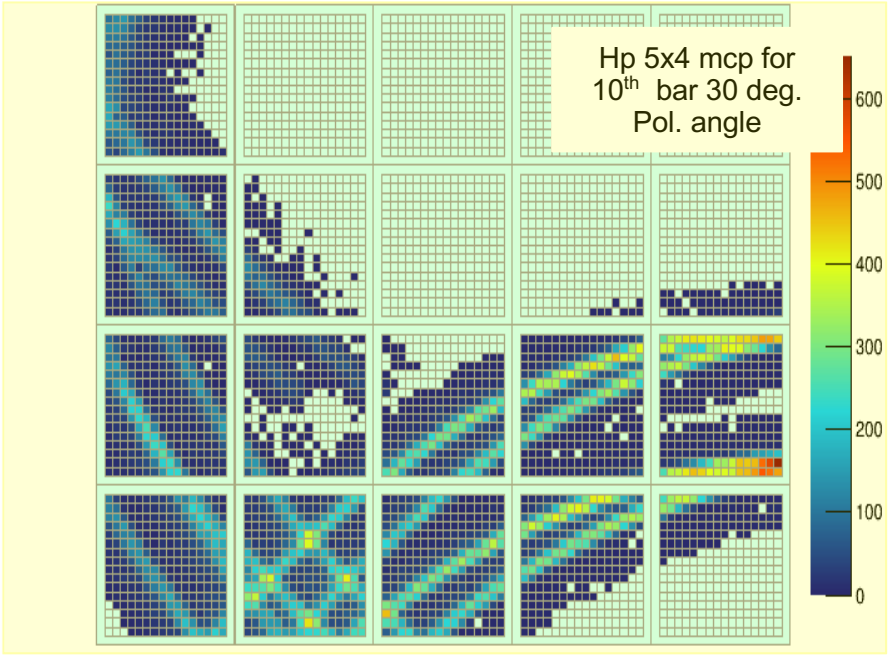

Hp 5x4 mcp for
10th bar 30 deg.
Pol. angle
600
500
400
300
200
100
0

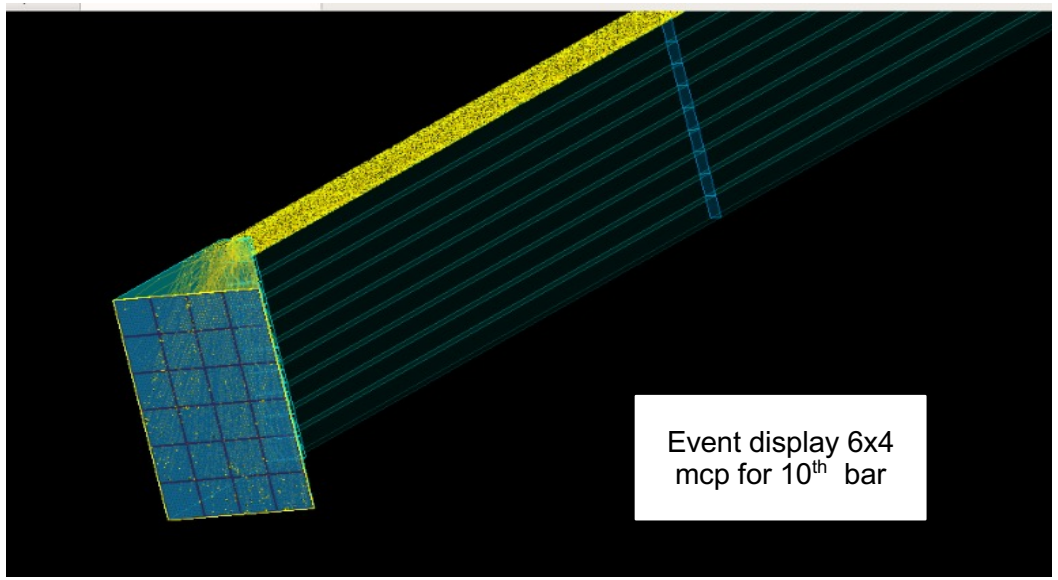

Hp 6x4 mcp for
middle bar 30 deg.
Pol angle
500
400
300
200
100
0

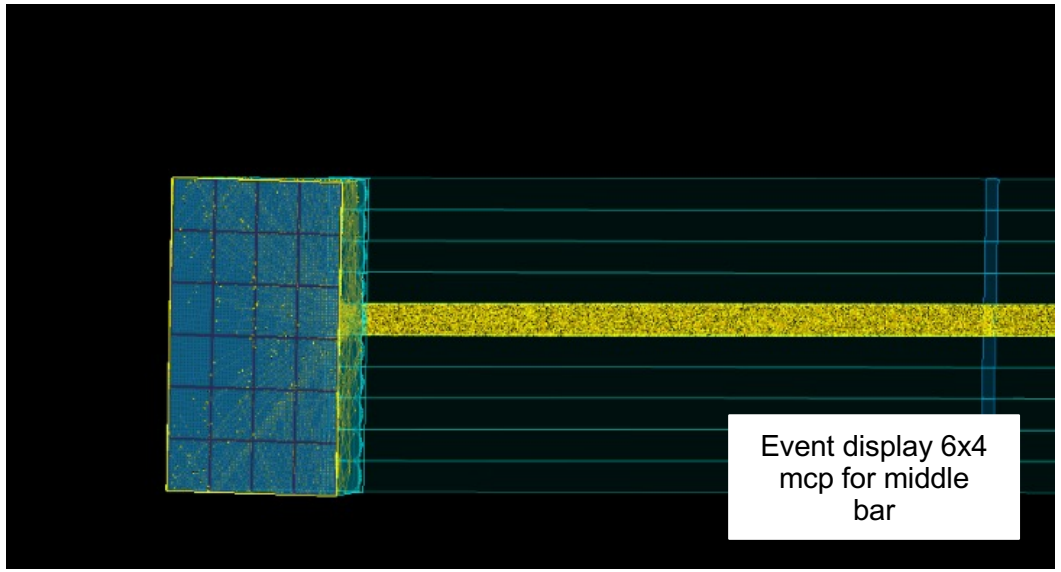

Hp 5x4 mcp for
middle bar 30 deg.
Pol angle
500
400
300
200
100
0

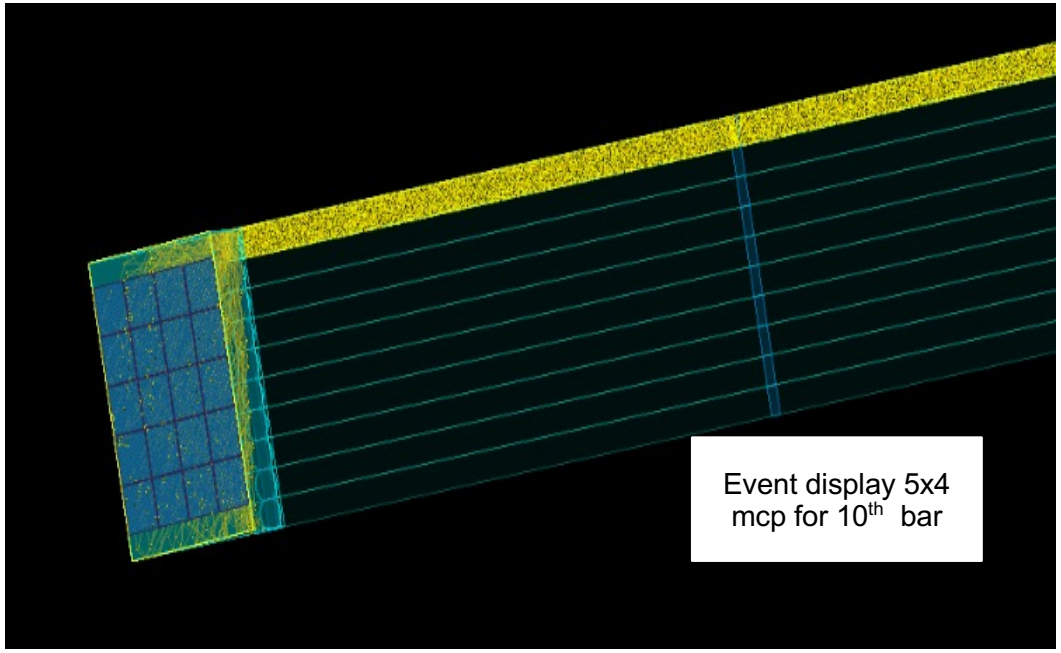
Prism

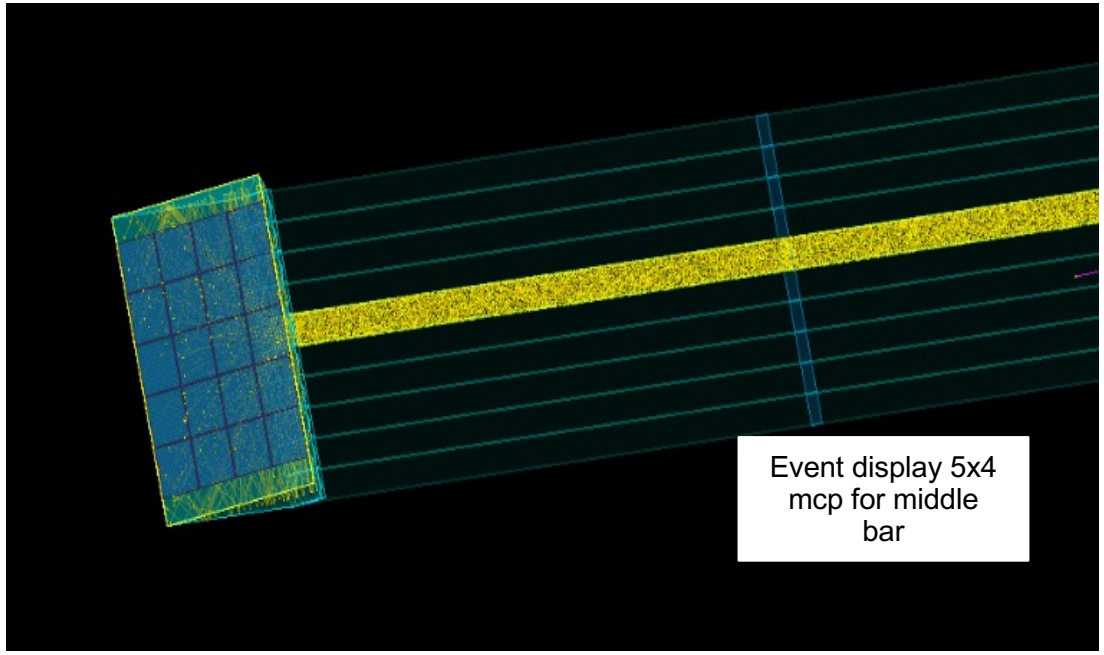

Hp 6x4 mcp for
10th bar 30 deg.
Pol. angle
800
700
600
500
400
300
200
100
0


Hp 5x4 mcp for
10th bar 30 deg.
Pol. angle
600
500
400
300
200
100
0

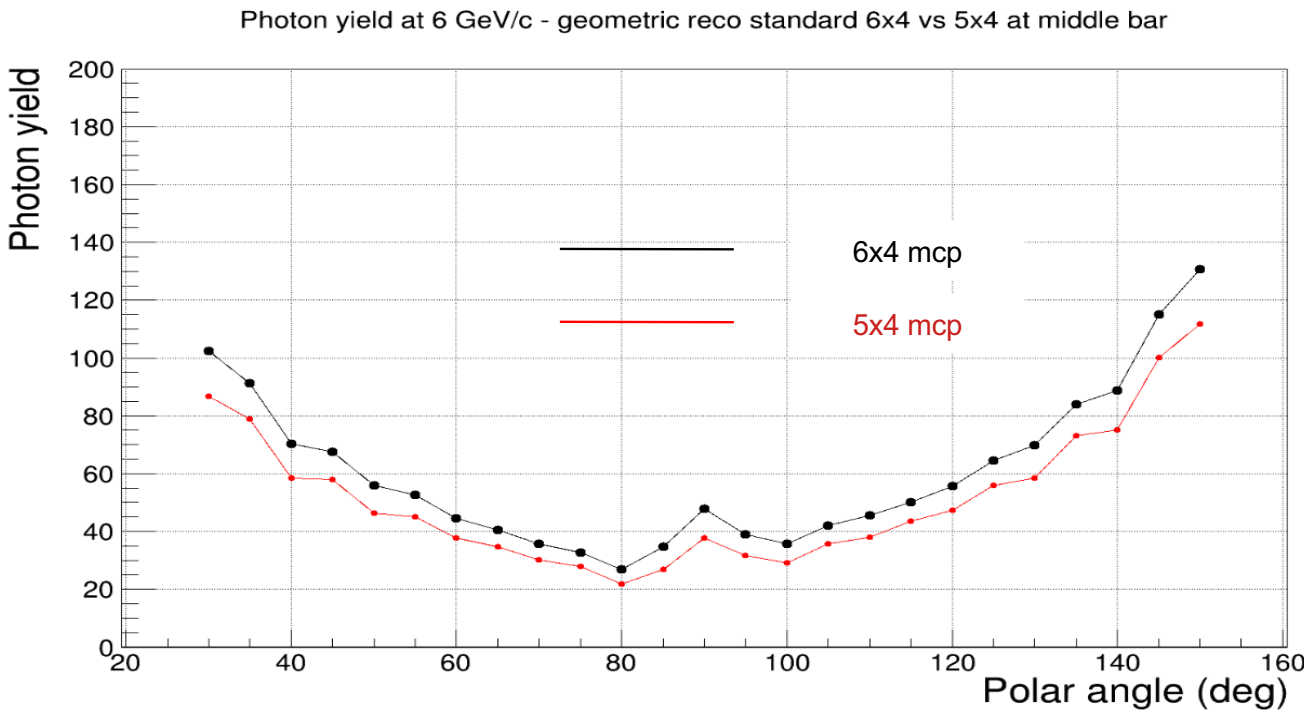

Event display 6x4 mcp for 10th bar

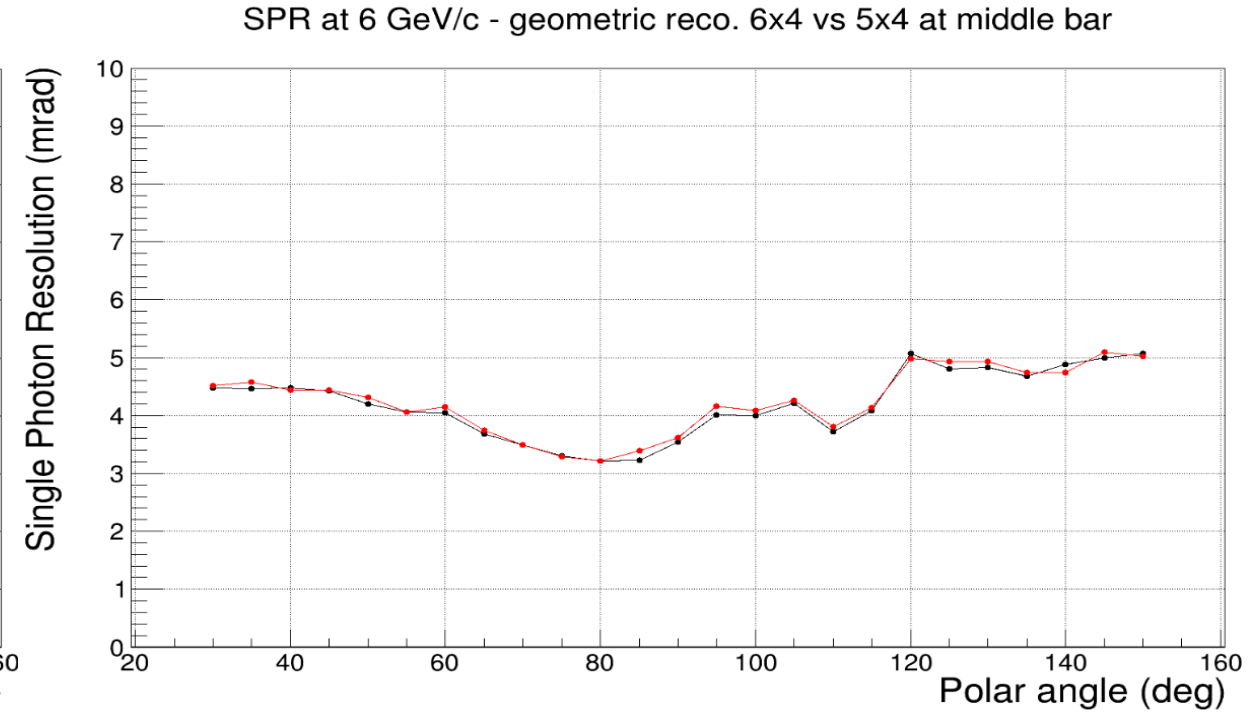

Event display 6x4 mcp for middle bar

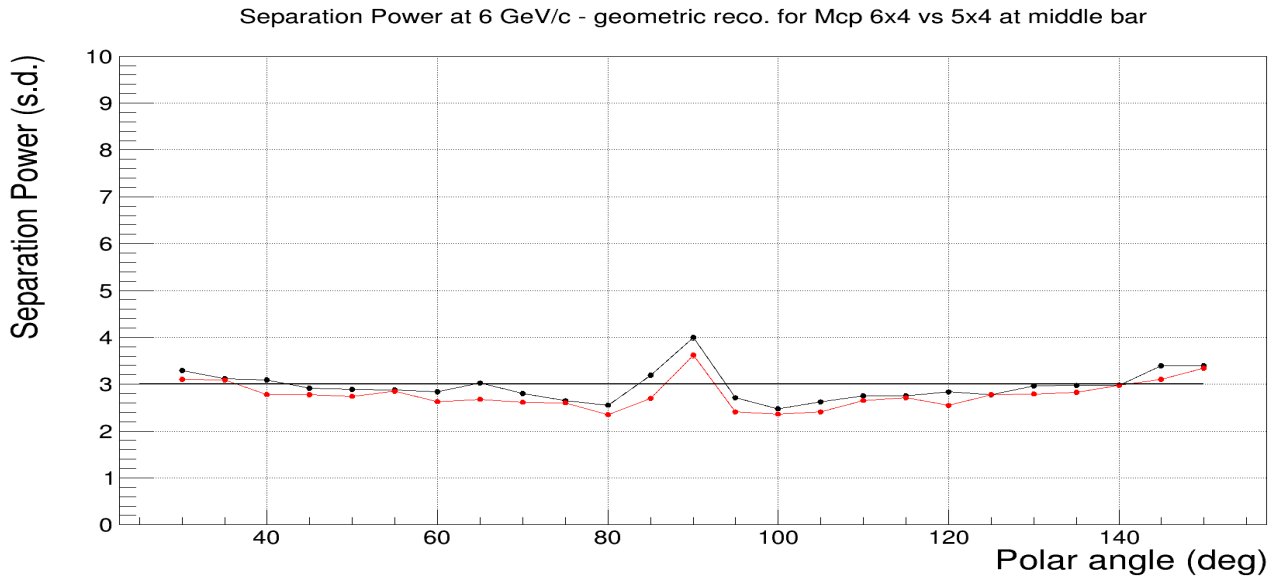

Event display 5x4 mcp for 10th bar


Event display 5x4 mcp for middle bar

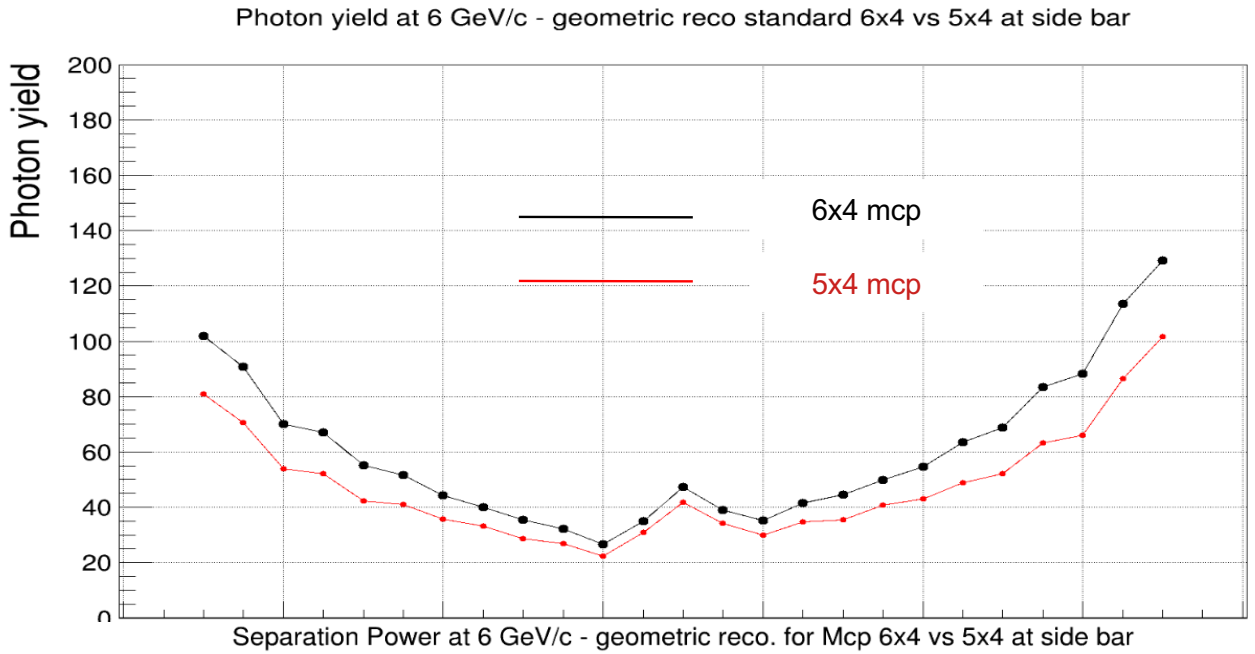
Comparison of performance for 6x4 MCP vs 5 x4 MCP arrangement at middle bar

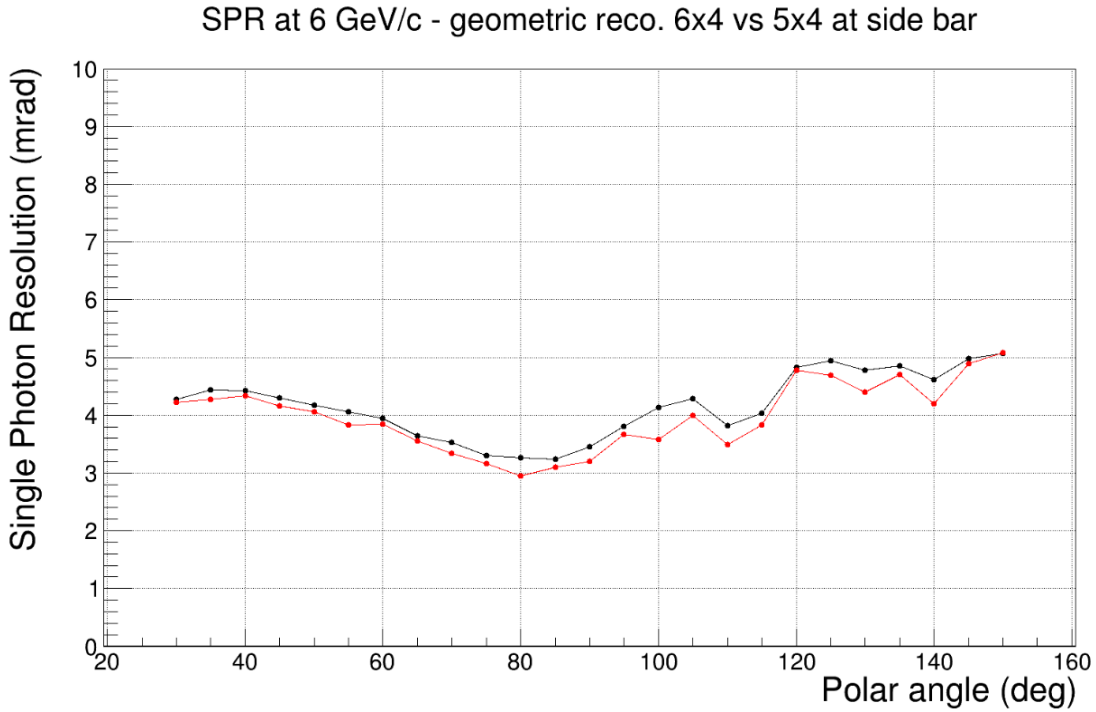


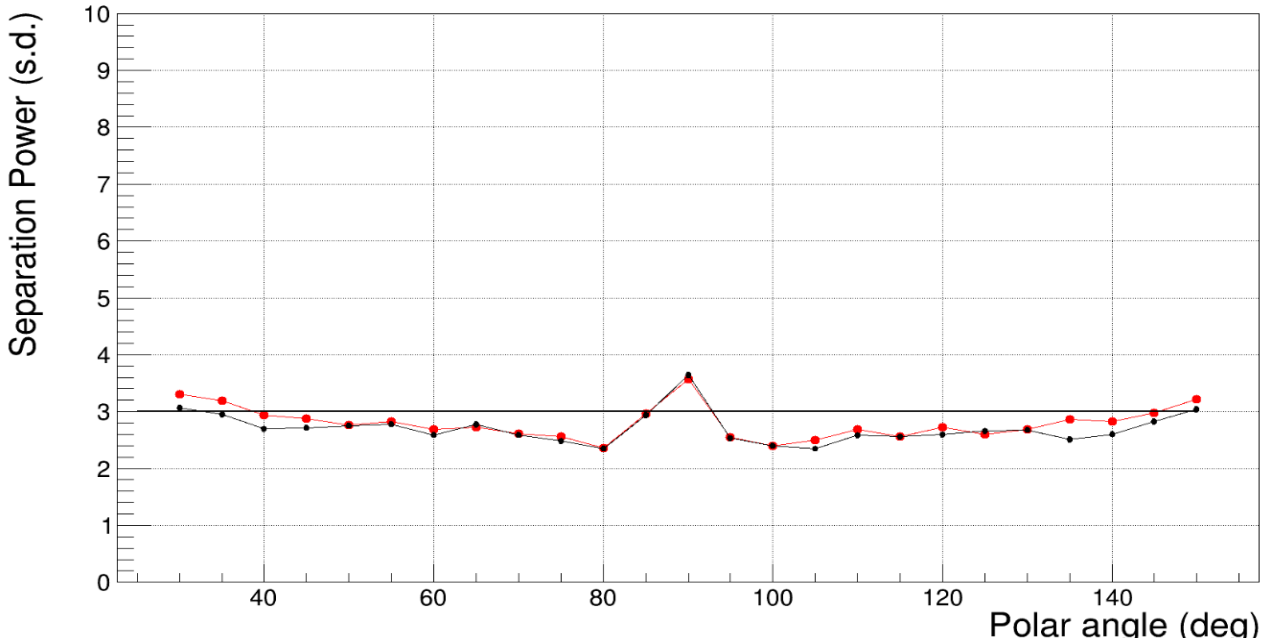


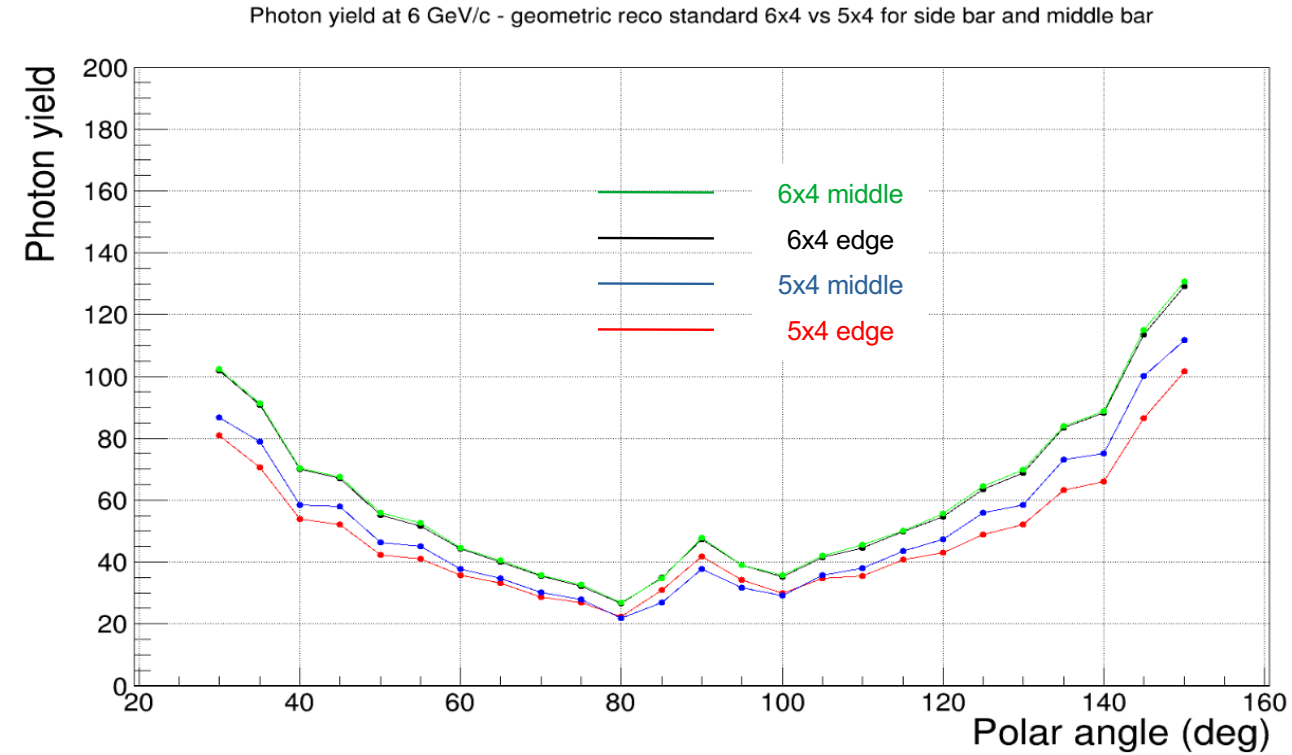


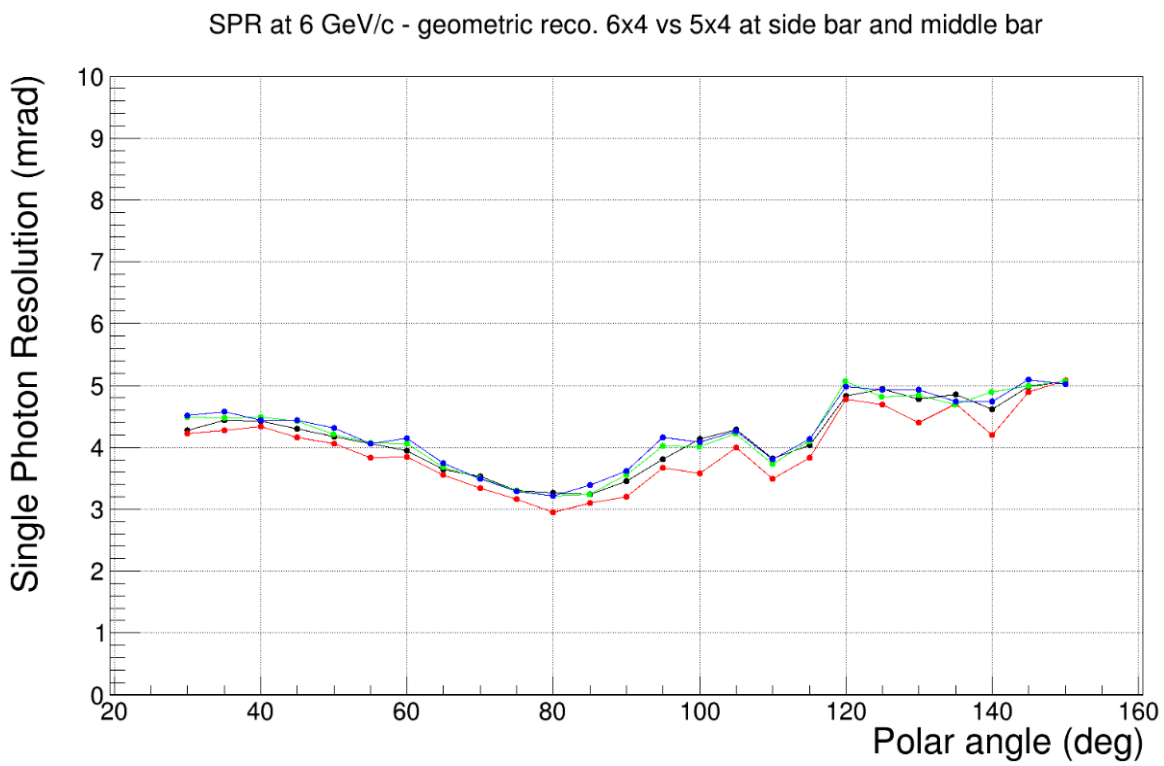
Comparison of performance for 6x4 MCP vs 5 x4 MCP arrangement at side bar

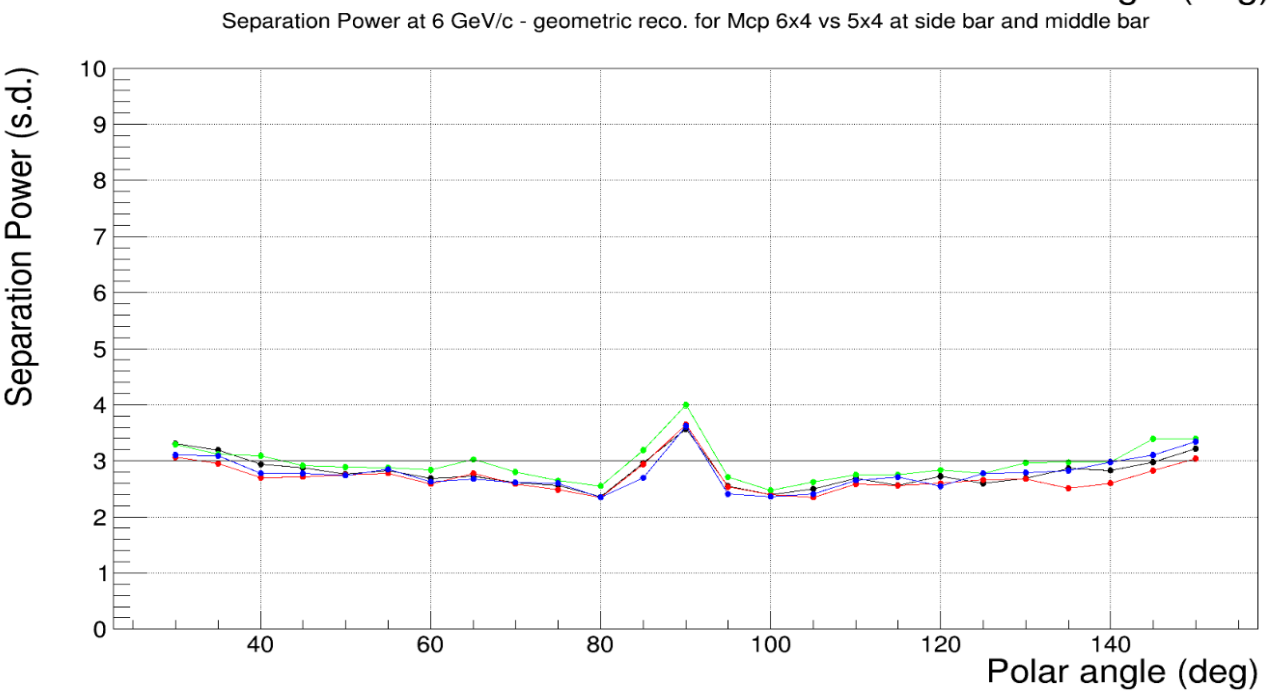


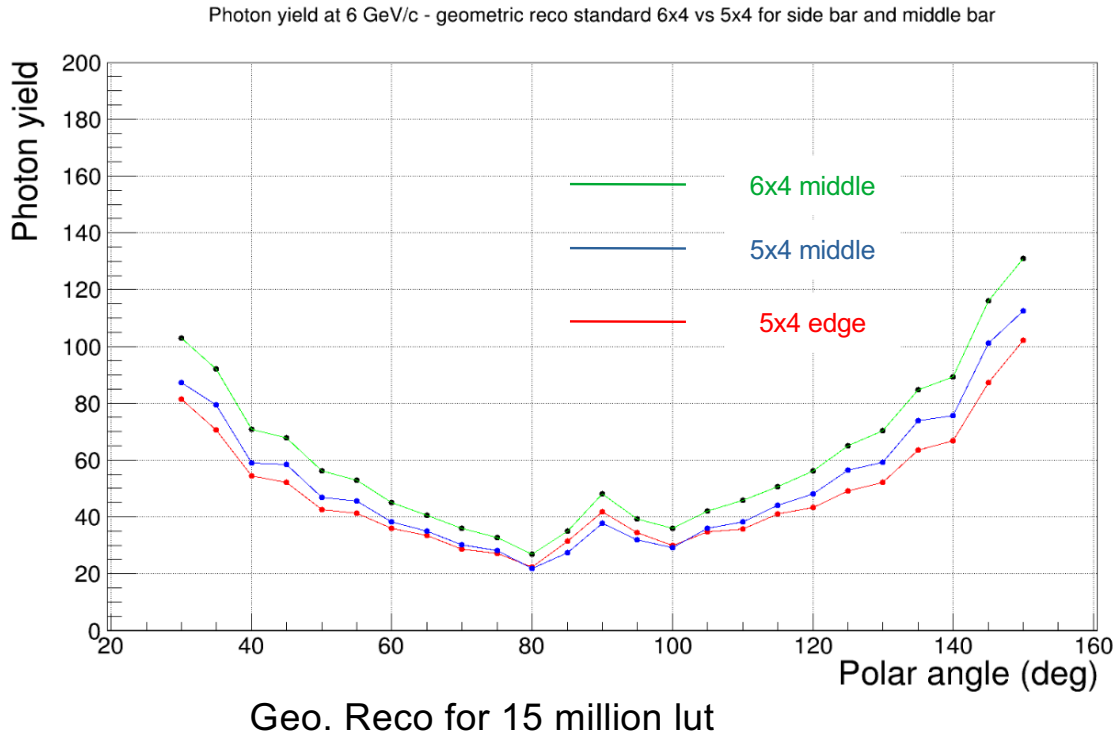


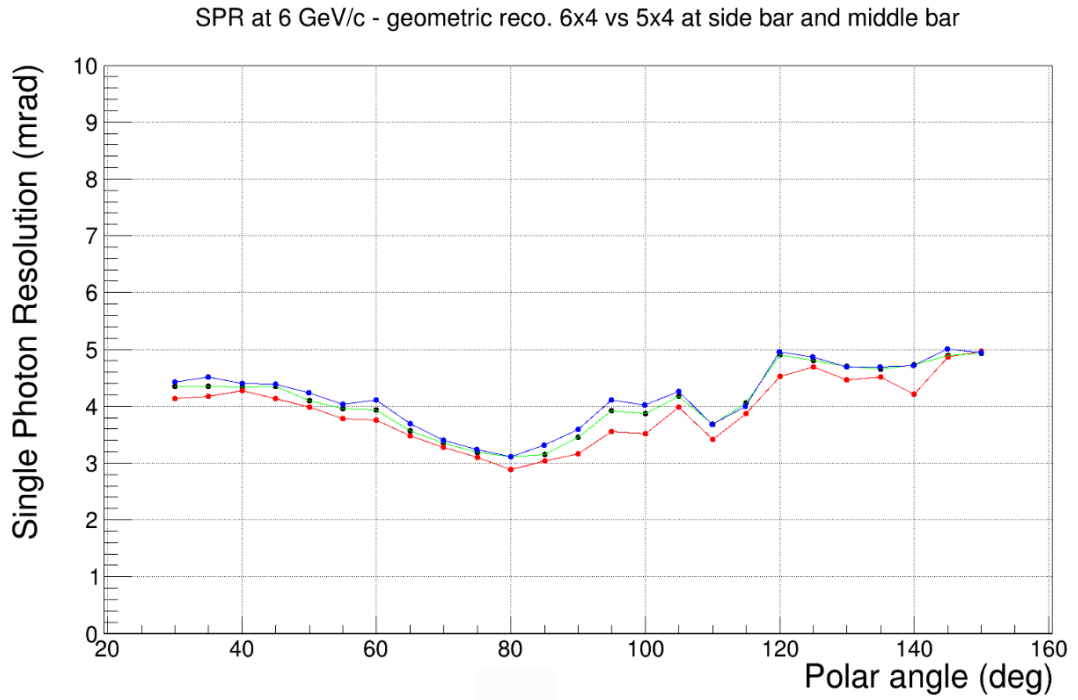


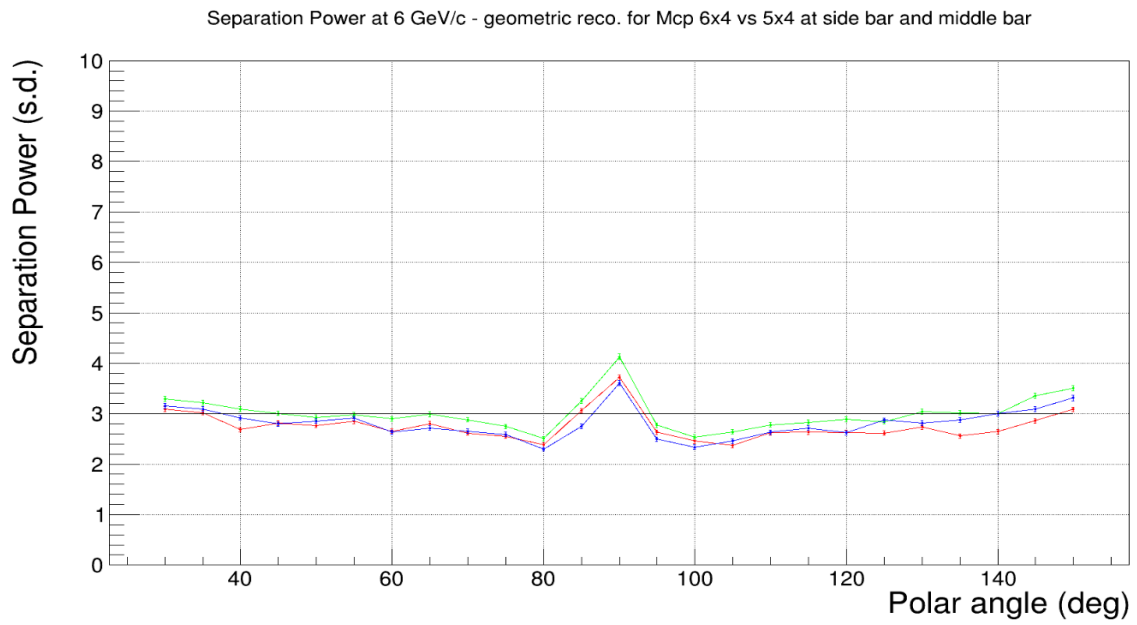

Photon yield at 6 GeV/c - geometric reco standard 6x4 vs 5x4 for side bar and middle bar
Photon yield
Polar angle (deg)
6x4 middle
6x4 edge
5x4 middle
5x4 edge

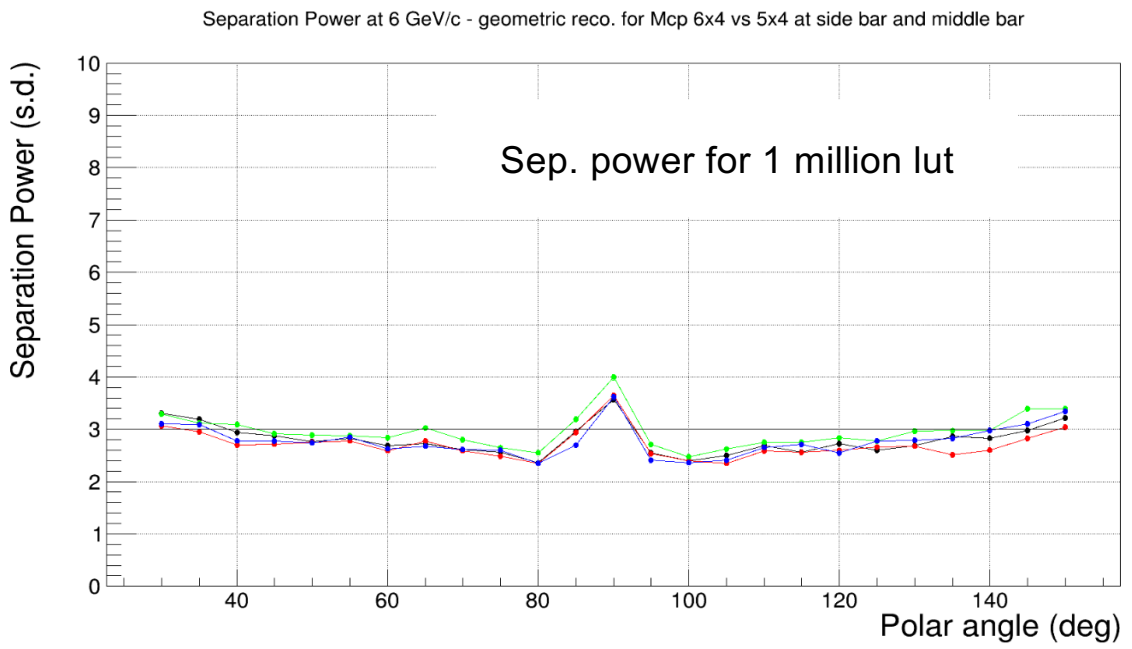

SPR at 6 GeV/c - geometric reco. 6x4 vs 5x4 at side bar and middle bar
Single Photon Resolution (mrad)
Polar angle (deg)


Separation Power at 6 GeV/c - geometric reco. for Mcp 6x4 vs 5x4 at side bar and middle bar
Separation Power (s.d.)
Polar angle (deg)


Photon yield at 6 GeV/c - geometric reco standard 6x4 vs 5x4 for side bar and middle bar
Photon yield
Polar angle (deg)
6x4 middle
5x4 middle
5x4 edge
Geo. Reco for 15 million lut

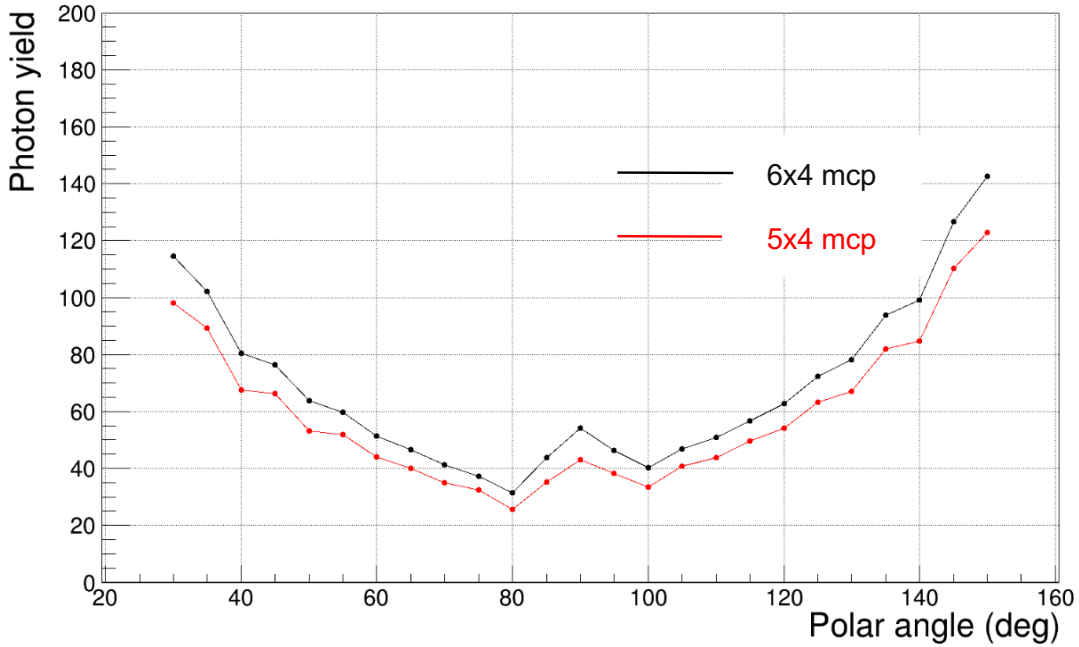

SPR at 6 GeV/c - geometric reco. 6x4 vs 5x4 at side bar and middle bar
Single Photon Resolution (mrad)
Polar angle (deg)


Separation Power at 6 GeV/c - geometric reco. for Mcp 6x4 vs 5x4 at side bar and middle bar
Separation Power (s.d.)
Polar angle (deg)

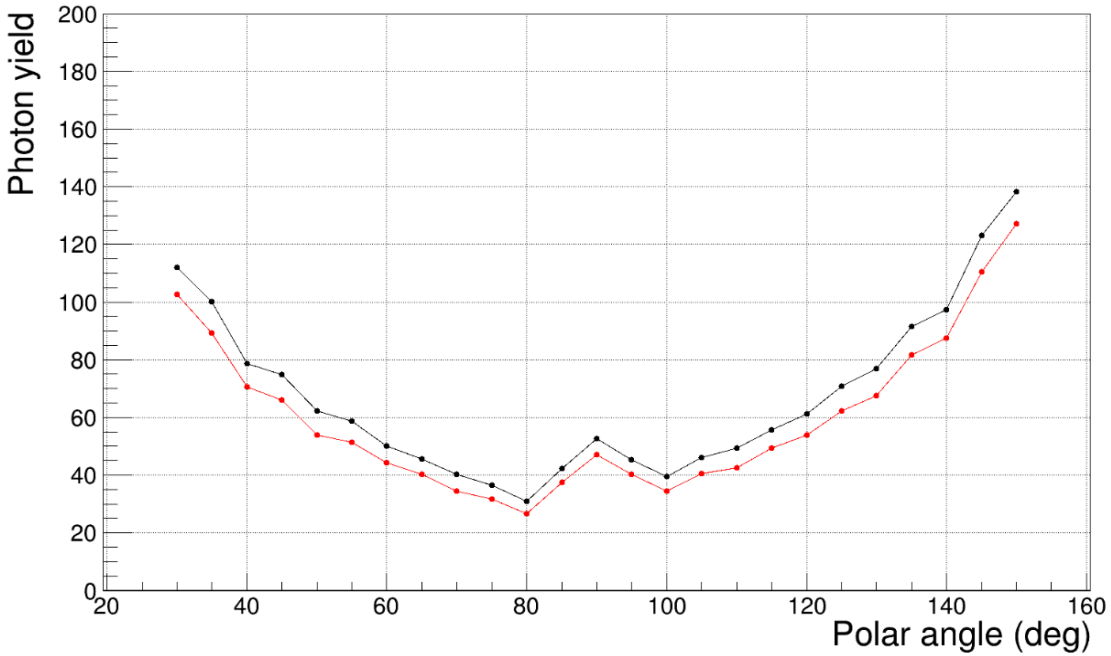

Separation Power at 6 GeV/c - geometric reco. for Mcp 6x4 vs 5x4 at side bar and middle bar
Separation Power (s.d.)
Sep. power for 1 million lut
Polar angle (deg)

Comparison of performance for 6x4 MCP vs 5 x4 MCP arrangement for Time imaging reco.

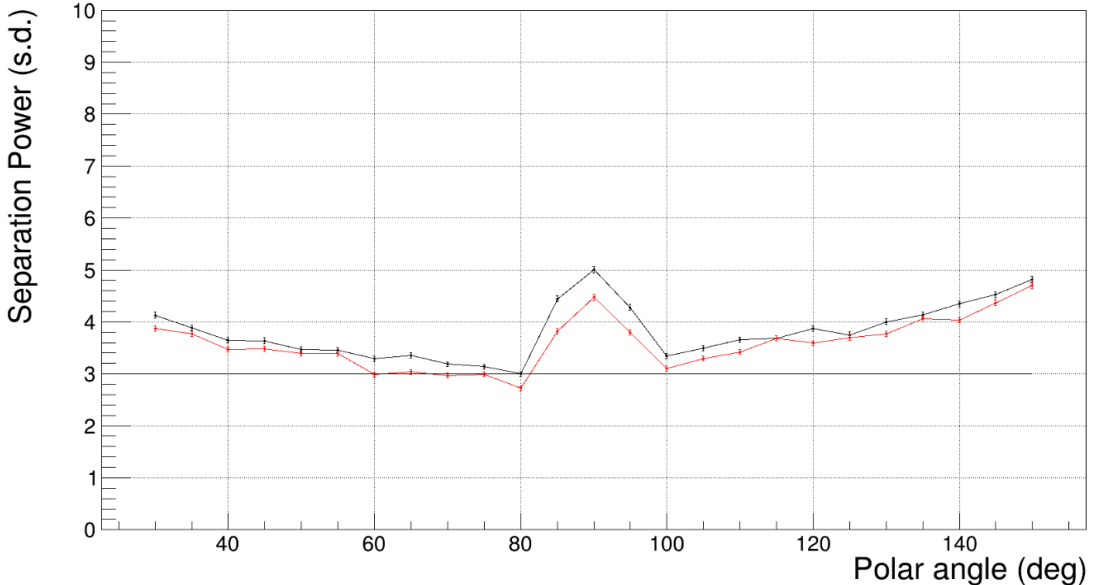
Photon yield at 6 GeV/c - Time Imaging reco. 6x4 vs 5x4 mcp at middle bar



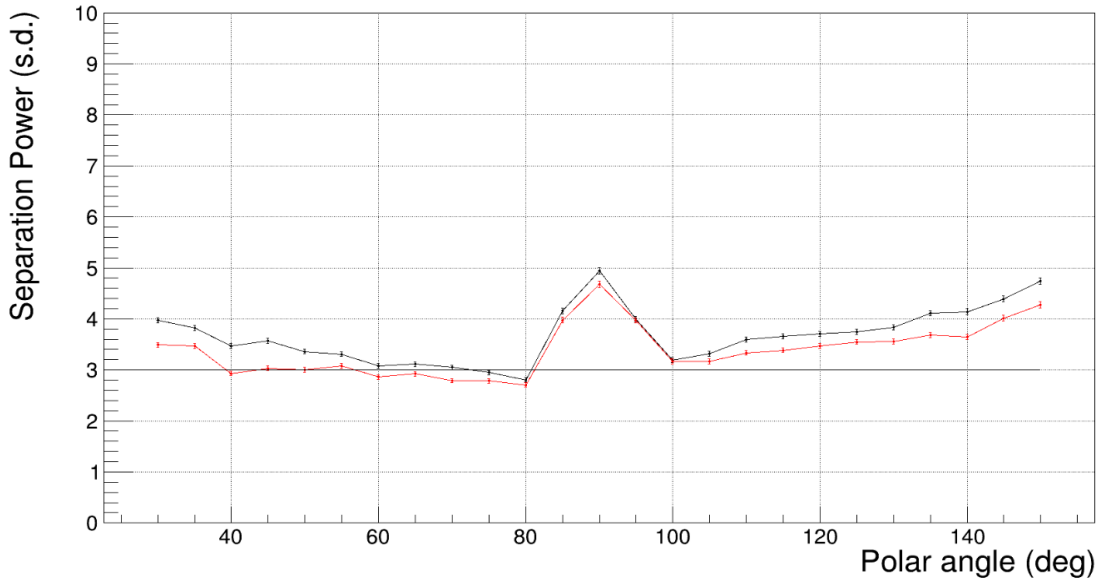
Photon yield at 6 GeV/c - Time Imaging reco. 6x4 vs 5x4 mcp at 10th bar



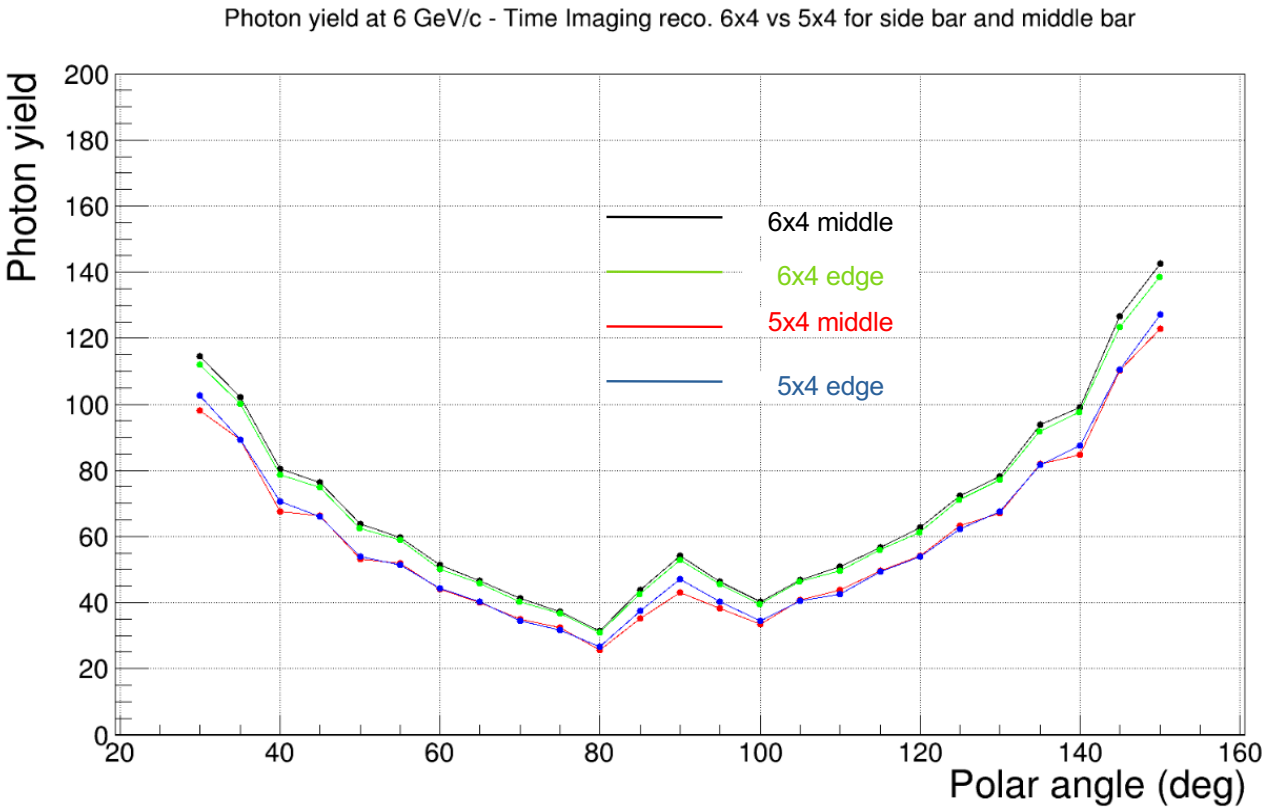
Separation Power at 6 GeV/c - Time imaging reco. for Mcp 6x4 vs 5x4 at middle bar

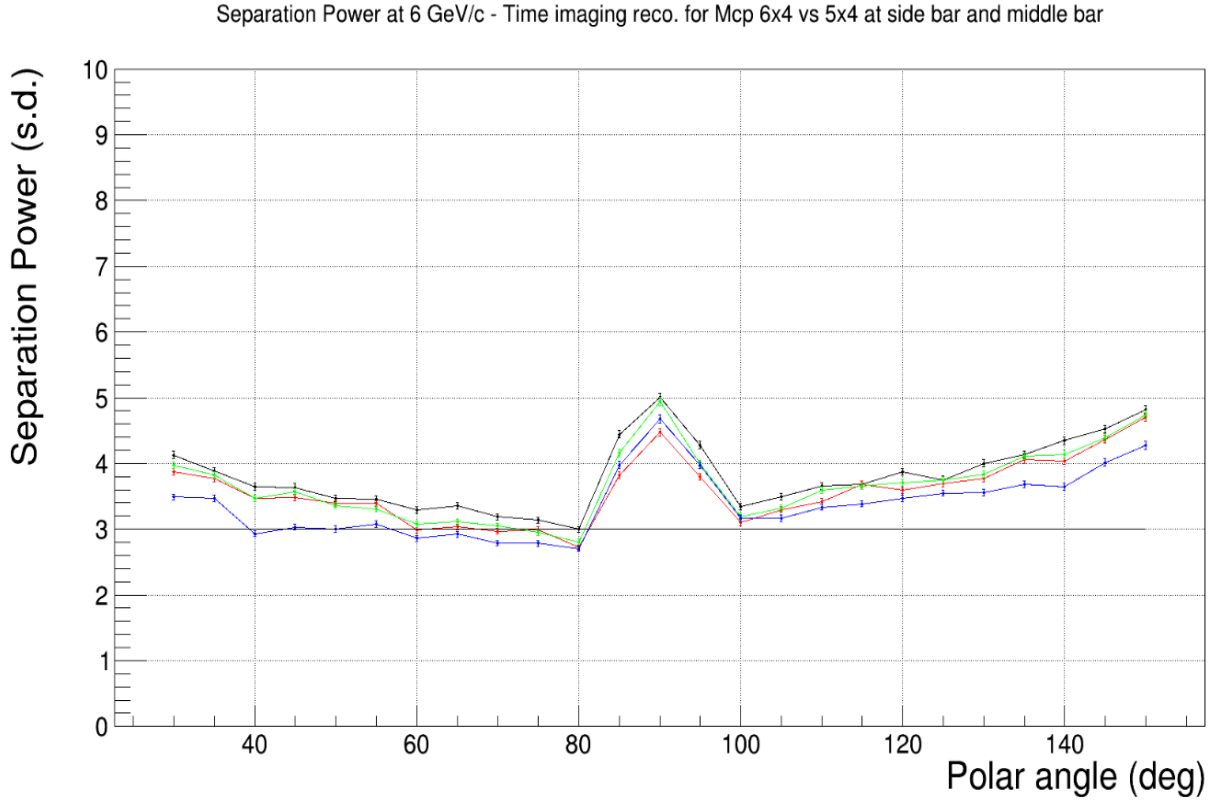


Separation Power at 6 GeV/c - Time imaging reco. for Mcp 6x4 vs 5x4 at 10th bar



Time imaging reco





Further Work

1. Expanding MCP study to include enabled magnetic field (conclusion is one of the Generic R&D deliverables)

2. Keep on learning about DIRC Technology and EIC

3. Potentially engaging in GlueX data analysis (using GlueX DIRC)

4. Hardware work in Jlab in Spring 2025