

Incoherent Vetoing Efficiency in IR-6 with Different ZDC Acceptances

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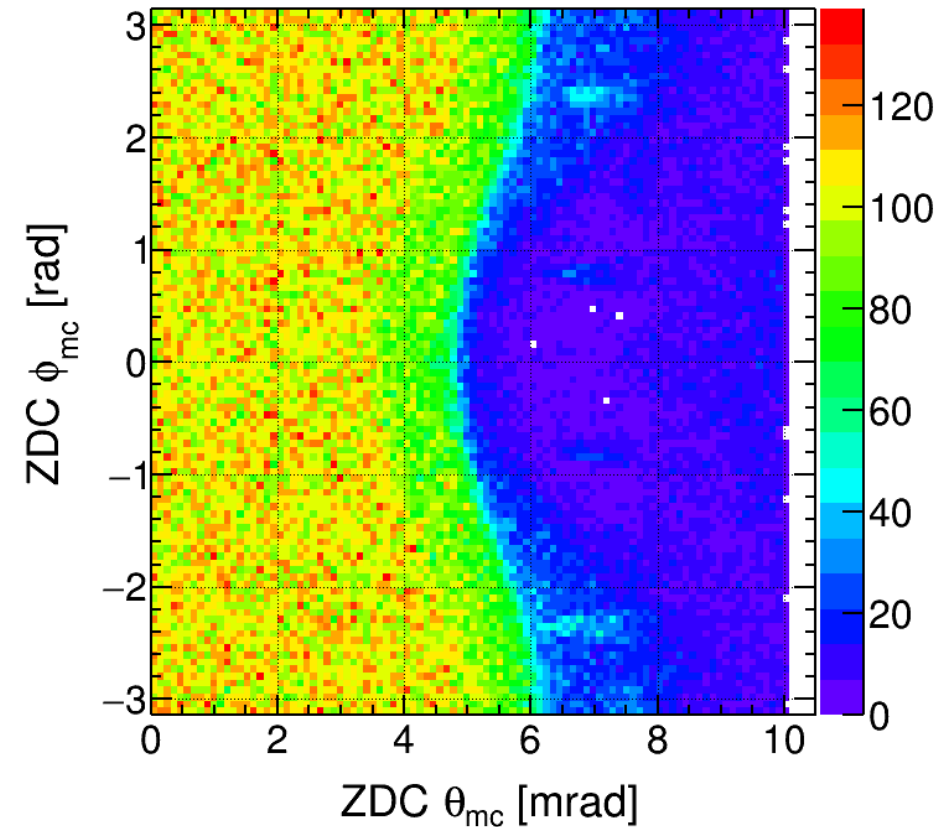
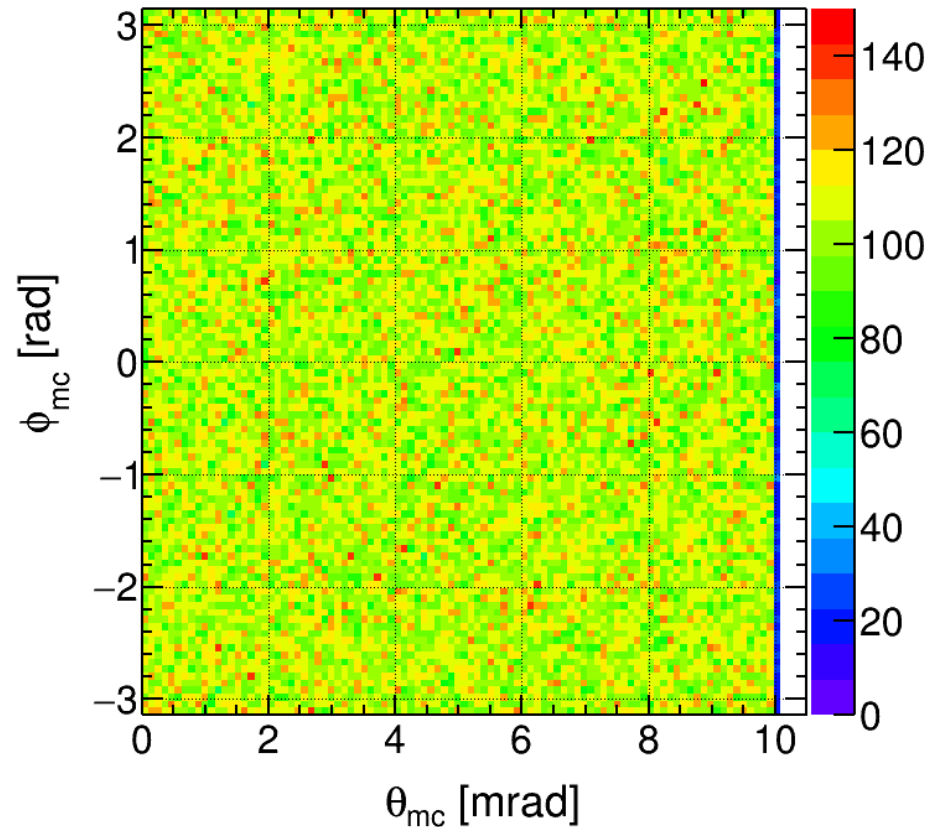
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Approach – Incoherent Vetoing Efficiency

- Evaluate impact on Incoherent Vetoing Efficiency in IR-6 with reduced ZDC acceptance
 - Different ZDC acceptances: 4 mrad, 3 mrad, 2 mrad, and 1 mrad
- Used `epic_ip6.xml` which includes only hadron lattice, central and hadron downstream beam pipes, and far-forward detectors (no central detector)
- Used BeAGLE sample v1.03.02 ePb $18 \times 110 \text{ GeV}^2 J/\psi$ production which is used for IP-8 study, but properly afterburned with IP-6 crossing angle
- ✓ Single particle simulation to examine detector acceptance (ZDC)
- ✓ Evaluate vetoing efficiency
- ✓ Evaluate ZDC acceptance by looking at MC neutrons

Current ZDC Detector Acceptance

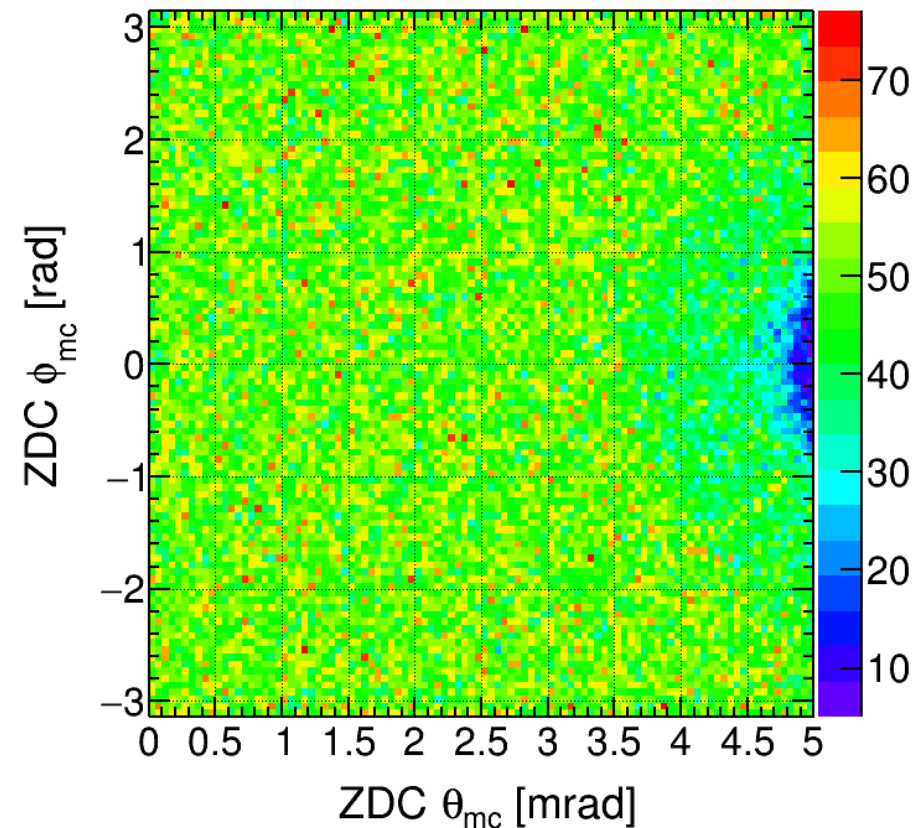
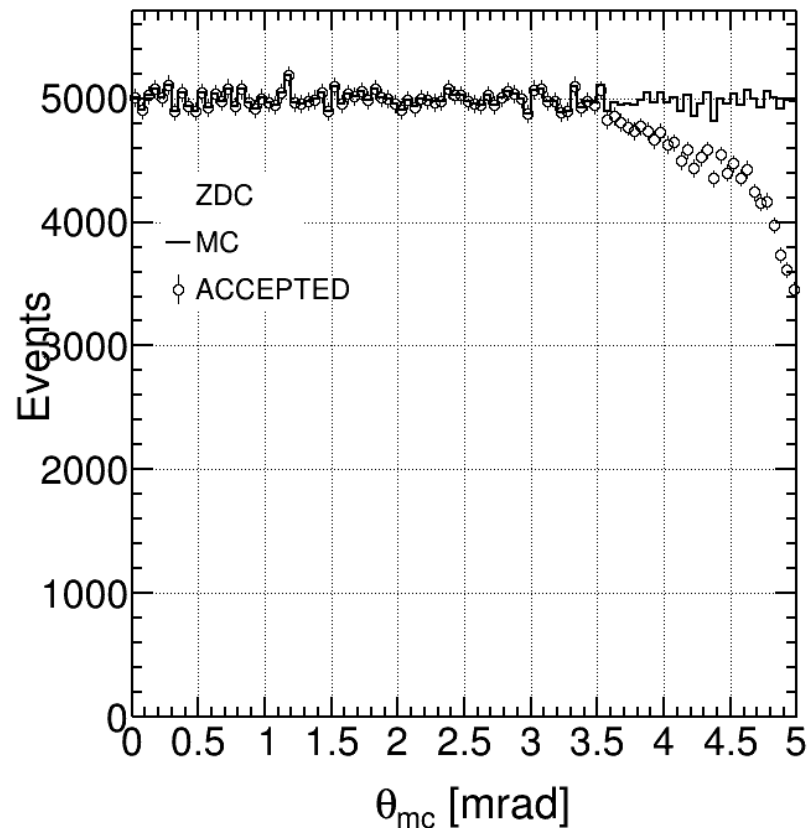
Single Neutron $E = 275 \text{ GeV}$ and $0 < \theta_{MC} < 10 \text{ mrad}$



In total, about **96.87 % (up to a range 5 mrad)** events were accepted.

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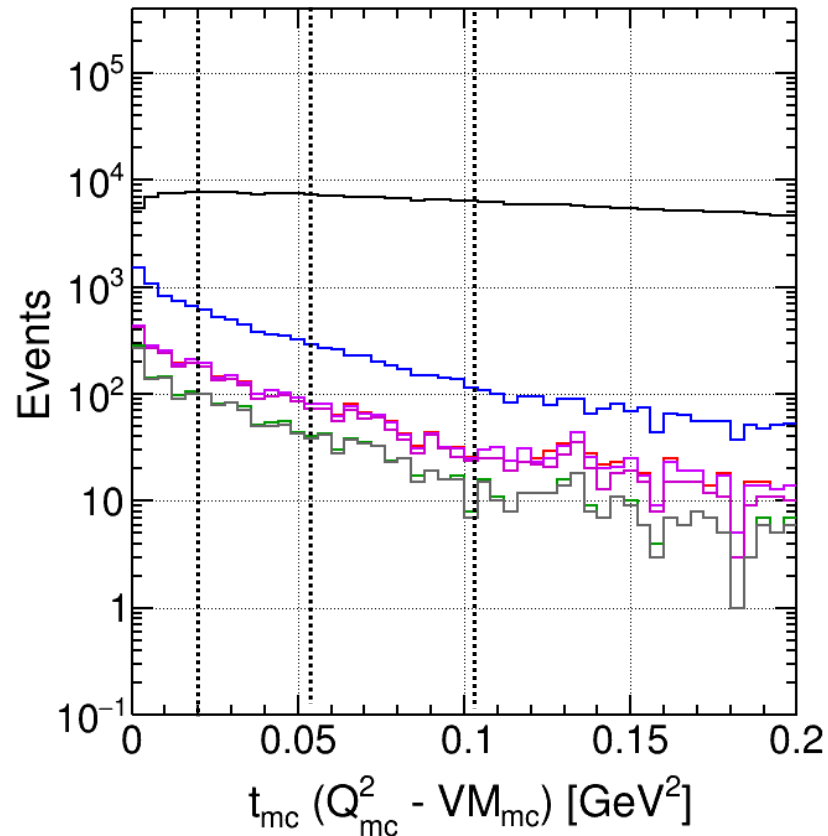
In total, about **96.87 %** (up to a range 5 mrad) events were accepted.
Full acceptance in θ_{MC} up to 3.5 mrad

(Same) Sample and Event Selection

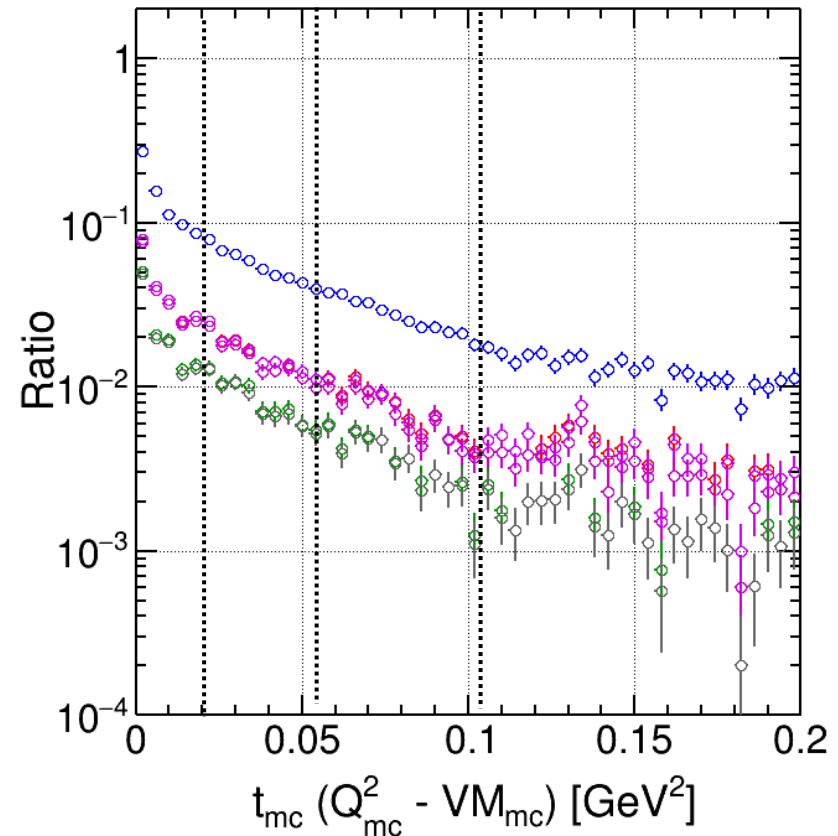
- Used **BeAGLE** v1.03.02 ePb $18 \times 110 \text{ GeV}^2 J/\psi$ production ($1 < Q^2 < 10$)
Incoherent events $ePb \rightarrow e' + J/\psi(ee/\mu\mu) + X$
- Passed through “**afterburner**” with **eAu** configuration **EIC CDR table 3.5**
Beam effects (25 mrad crossing angle, angular divergence, and momentum spread)
- Applied **10σ safe distance in detector geometry level**
- **Event selection for nuclear breakups – tagging purpose**
 - ZDC Hcal: **any registered RAW hits**
 - RPSF: **two layers** (actual four layers as redundancy) have registered RAW hits
 - OMD: **two layers** (actual four layers as redundancy) have registered RAW hits
 - B0 Tracker: **at least two out of four layers** have registered RAW hits
 - B0 Ecal: **energy** of all hits greater than **100 MeV**
 - ZDC Ecal: **energy** of all hits greater than **100 MeV**

Vetoing Efficiency

Veto inefficiency for incoherent events



Vetoing power for incoherent events

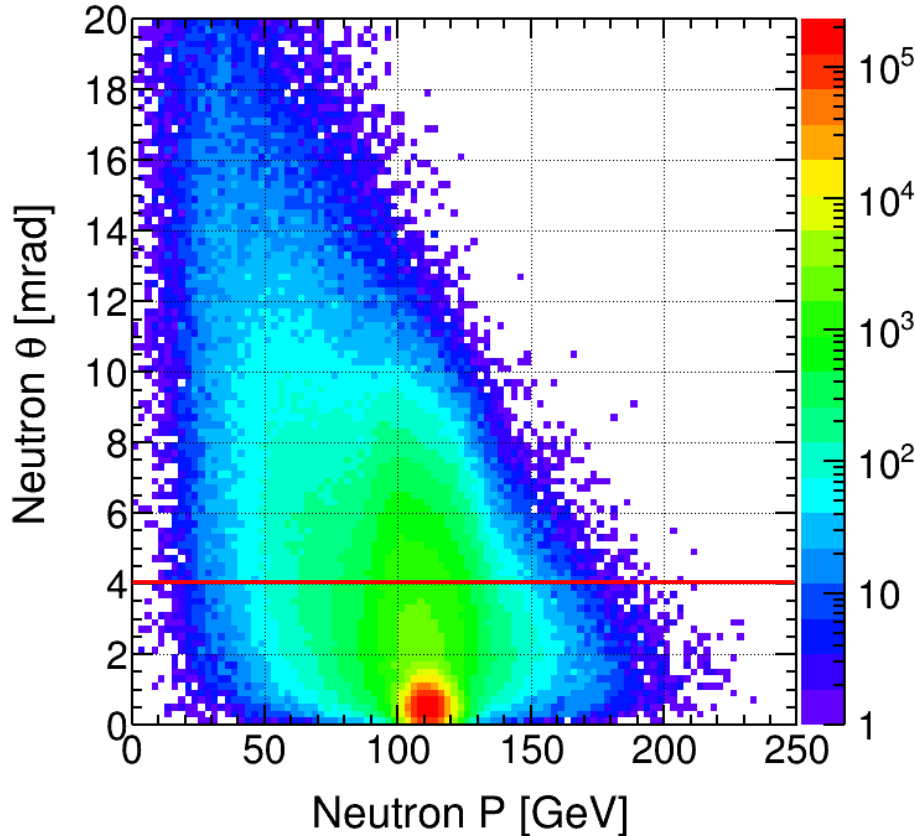


- ZDC hcal tagged (neutrons)
- RPSF tagged (protons, nuclear fragments)
- OMD tagged (charged particles)
- B0 tracker tagged (charged particles)
- B0 ecal tagged (photons)
- ZDC ecal tagged (photons)

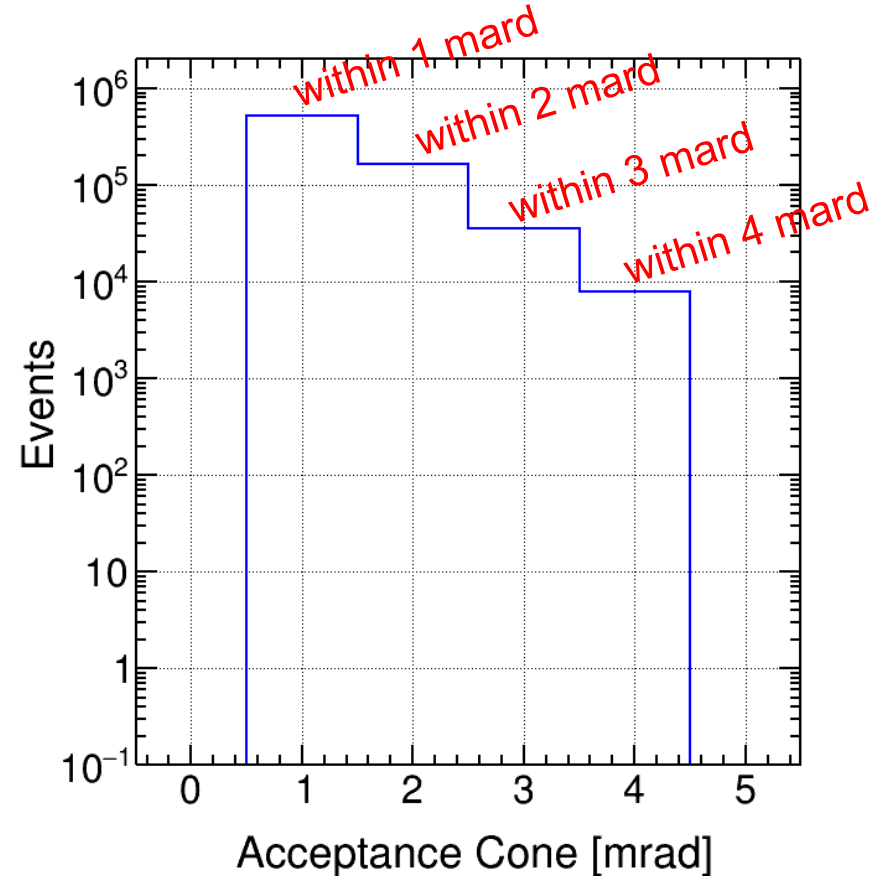
Vetoing Efficiency

Veto Selections	Surviving Events
All events	989162
Events with one scattered electron identified and $ \eta_{J/\psi} < 4$ and $1 < Q^2 < 10$	726115 (100 %)
ZDC HCAL tagged	17212 (2.37042 %)
+ RPSF tagged	4952 (0.681986 %)
+ OMD tagged	4886 (0.672896 %)
+ B0 tracker tagged	3826 (0.526914 %)
+ B0 ecal tagged	2128 (0.293067 %)
+ ZDC ECAL tagged	2021 (0.278331 %)

ZDC Acceptance Based on MCParticles



All neutrons are



Among neutrons within 4 mrad cone,
how many events fall into 1 mrad, 2 mrad, 3 mard, and 4 mrad acceptance bin

Summary

- ZDC neutron acceptance at IP-6
 - Full acceptance up to 3.5 mrad
- Incoherent vetoing efficiency with current version of IR-6 geometry was evaluated. Might need to compare with Micheal/Eden study.
 - Micheal/Eden use reconstructed hits/particles, while I use raw hits
- Neutrons are mostly concentrated within 2 mrad and each event can have multiple neutrons. Assume one of them is within acceptance, then it can be vetoed. Doesn't look like it affects much on vetoing efficiency even ZDC acceptance is reduced

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