

# Low-Q<sup>2</sup> Tagger and Photoproduction at EIC

Simon Gardner

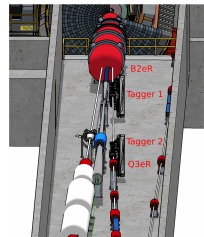
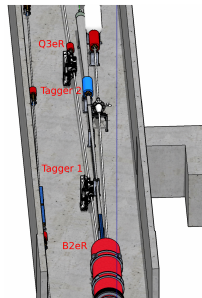
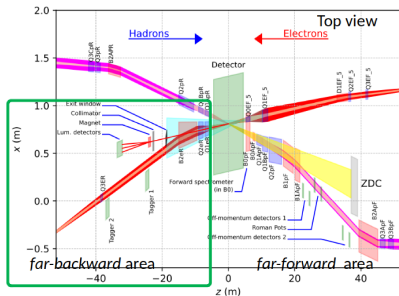
Exotic Heavy Meson Spectroscopy and Structure with EIC  
Stony Brook  
18 August 2022



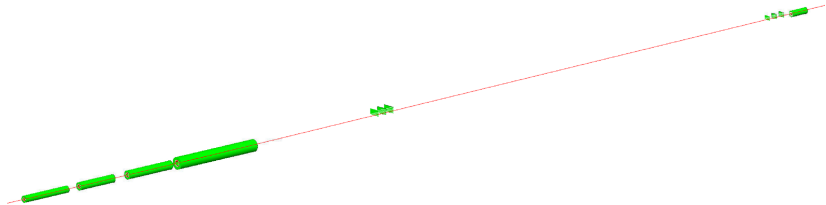
University  
of Glasgow

What/Where is the Low  $Q^2$  tagger?

What can we expect regarding acceptance and resolutions?

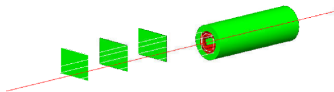


Low  $Q^2$  electrons pass through recirculation machine magnets.  
Electrons with reduced energy are separated from main beam.  
Tagger stations @ -20 m and -37 m.

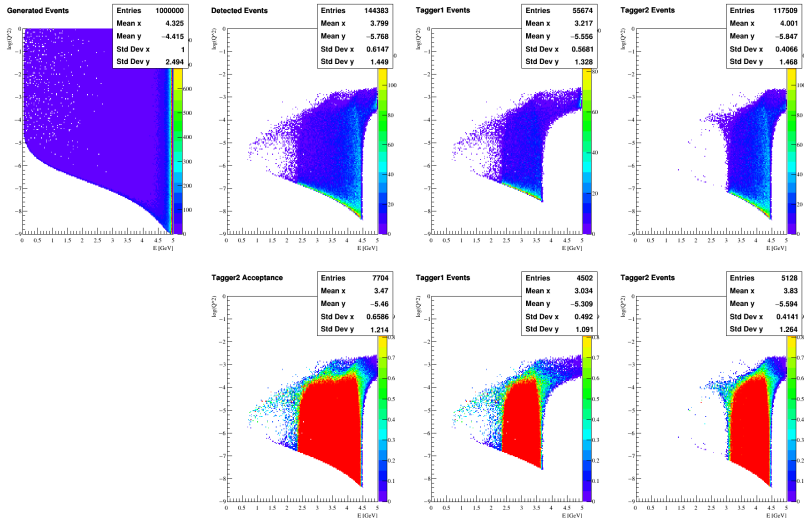


## Limitations

Low E does not escape dipole.  
High E too close to main beamspot.  
High  $Q^2$  caught by beampipe.

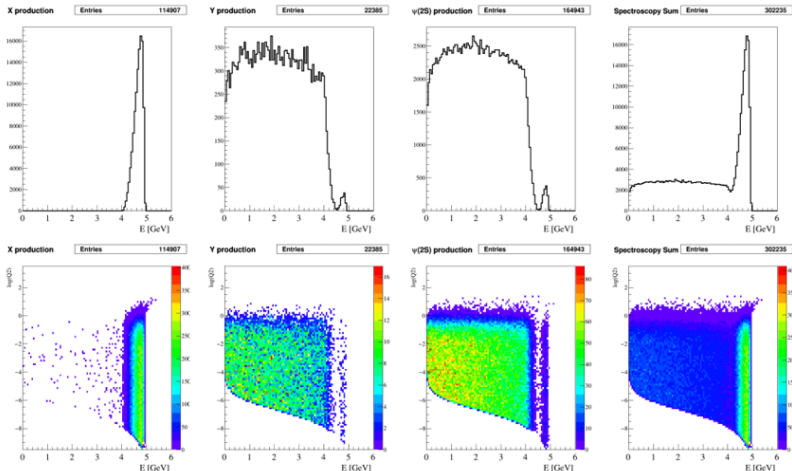


# Quasi-Real Acceptance



Events from Jaroslav Adam

<https://github.com/adamjaro/GETaLM/>

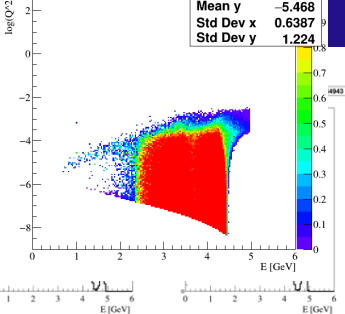


Events from Derek Glazier

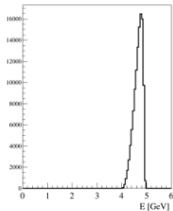
<https://github.com/dglazier/elSpectro/>

Detected Events

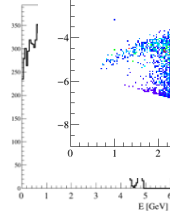
Entries	4867
Mean x	3.495
Mean y	-5.468
Std Dev x	0.6387
Std Dev y	1.224



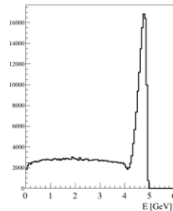
X production Entries 114907



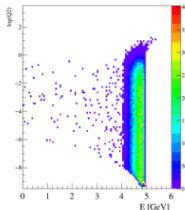
Y produc



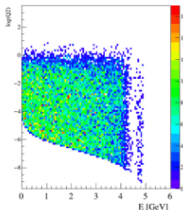
Spectroscopy Sum Entries 302235



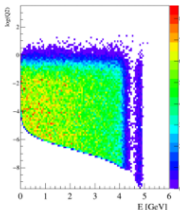
X production Entries 114907



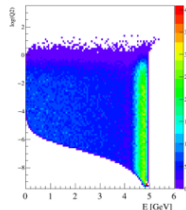
Y production Entries 22285



v(2S) production Entries 164943



Spectroscopy Sum Entries 302235

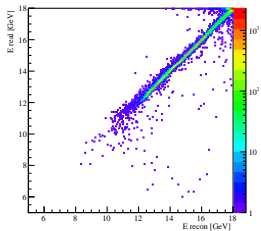


Conservative positioning of tagger 2.  
Options to extend in order to accept X events.

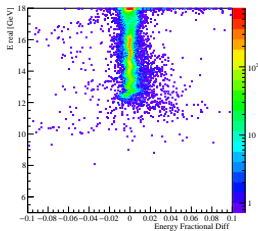
# Energy Resolutions - Tagger 2 - 18 GeV

Energy, Q2 and phi reconstructed using TMVA DNN.  
Hit positions on detector planes with perfect resolution.  
Everything in beam vacuum.

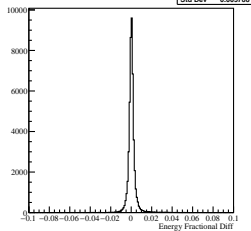
Real Hit Energy Reconstruction



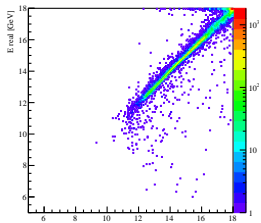
Real Hit Energy Reconstruction



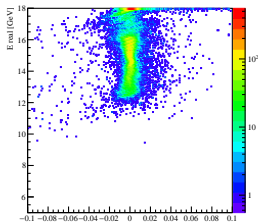
Real Hit Energy Reconstruction



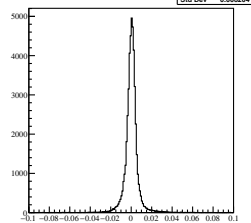
55um pix Energy Reconstruction



55um pix Energy Resolution

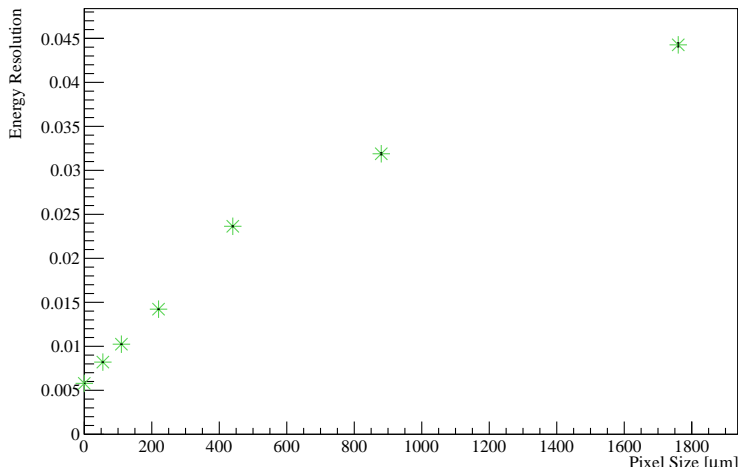


55um pix Energy Resolution



# Energy Resolutions - Tagger 2 - 18 GeV

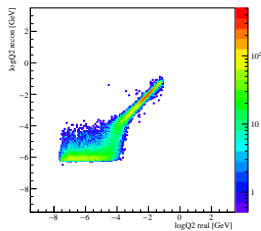
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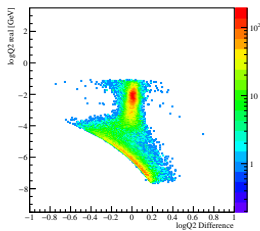


# logQ<sup>2</sup> Resolution - Tagger 2 - 18GeV

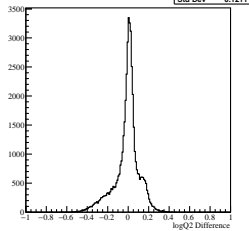
Real Hit Q2 Reconstruction



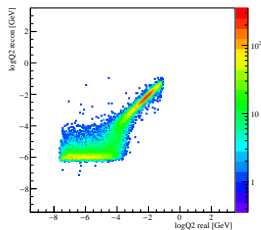
Real Hit Q2 Reconstruction



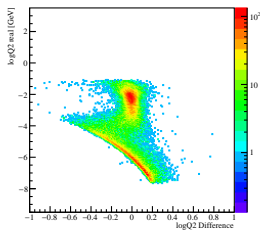
Real Hit Q2 Reconstruction



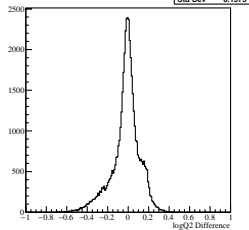
55um pix Q2 Reconstruction



55um pix Q2 Resolution



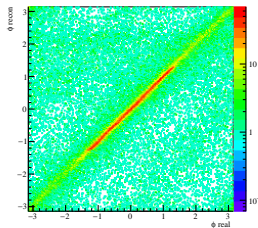
55um pix Q2 Resolution



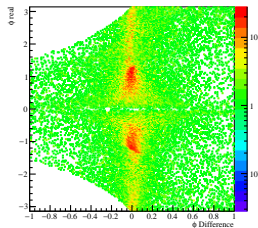
# Phi Resolutions - Tagger 2 - 18 GeV



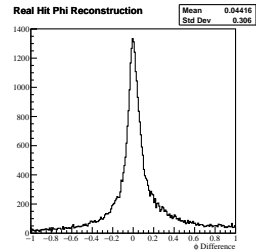
Real Hit Phi Reconstruction



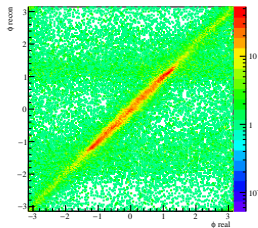
Real Hit Phi Reconstruction



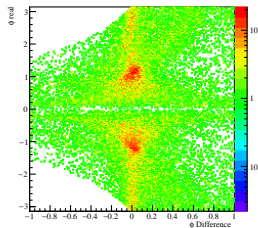
Real Hit Phi Reconstruction



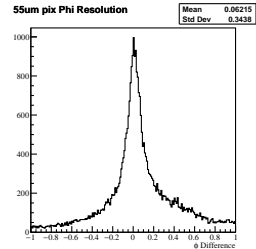
55um pix Phi Reconstruction



55um pix Phi Resolution



55um pix Phi Resolution

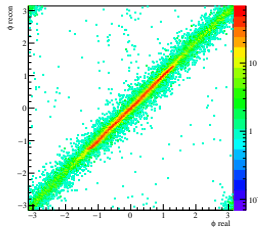


# Phi Resolutions - Tagger 2 - 18 GeV

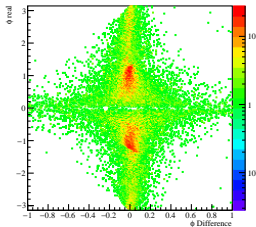


Cut  $\log(Q^2) > -4$

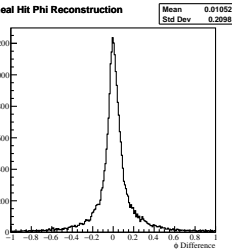
Real Hit Phi Reconstruction



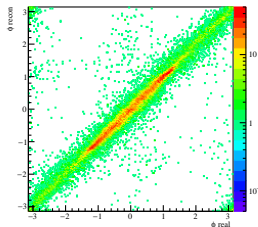
Real Hit Phi Reconstruction



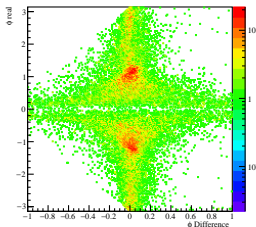
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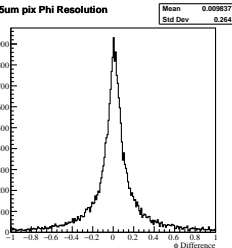
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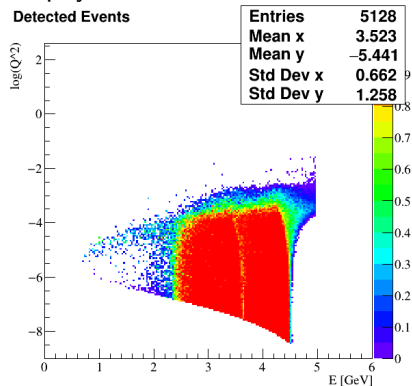
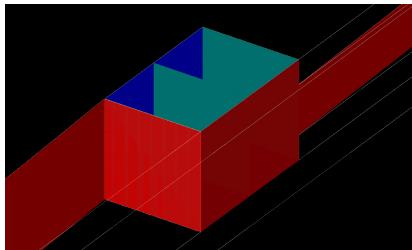
55um pix Phi Resolution



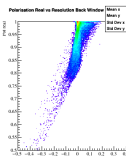
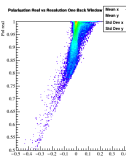
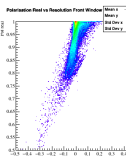
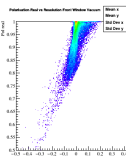
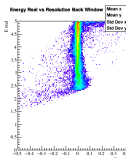
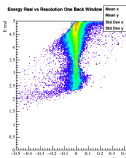
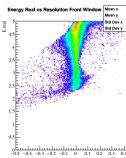
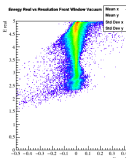
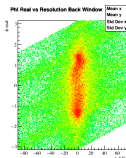
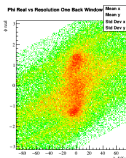
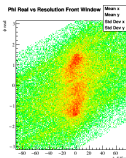
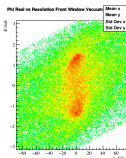
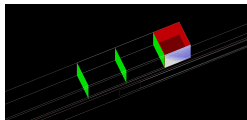
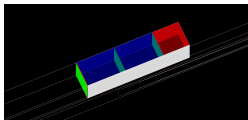
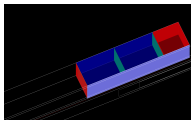
55um pix Phi Resolution



Simplifies implementation but impacts physics.



# Out of vacuum design - Resolutions



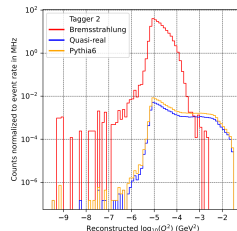
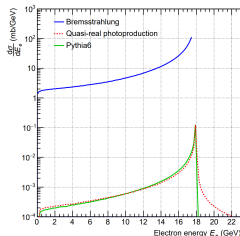
## Synchrotron radiation

Direct and scattered.

Coincidence conditions can make false tracks negligible with small pixel pitch and 3+ layer track reconstruction.

## Bremsstrahlung electrons

Indistinguishable from photoproduction electrons below beam divergence. Coincidence with other detectors, (e.g. luminosity Bremsstrahlung monitor) will provide scope for statistical separation.



END