How to benchmark scattered electron acceptance and resolution in simulation

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Proposed way to compare detector configurations and scattered electron reconstruction algorithms – resolution

- Variables such as purity and stability – which vary between 0 and 1 and are sensitive to the cross-section distribution – can be difficult to interpret in a straightforward way. Studying the x and Q^2 resolution is probably the simplest approach.
- Using a standard binning of 5 bins per decade in both x and Q^2, we can compare the scattered electron resolution to the bin size.
- This is easy to do for the scattered electron if the momentum and angle resolutions are measured.
- For other reconstruction methods, the same benchmarking can be performed.

Example configurations

Tracker setting 1

η range	$\sigma_p/p\,[\%]$	σ_θ [Rad]
-4.0 – -2.0	$0.1 \cdot p \bigoplus 0.5$	
-2.0 – -1.0	$0.05 \cdot p \bigoplus 0.5$	
-1.0 – +1.0	$0.05 \cdot p \bigoplus 0.5$	$0.01/\left(p \cdot \sqrt{\sin\theta}\right)$
+1.0 – +2.5	$0.05 \cdot p \bigoplus 1.0$	
+2.5 – +4.0	$0.1 \cdot p \bigoplus 2.0$	

Tracker setting 2

η range	$\sigma_p/p\,[\%]$	σ_θ [Rad]
-4.0 – -2.0	$0.5 \cdot p \bigoplus 2.5$	
-2.0 – -1.0	$0.25 \cdot p \bigoplus 2.5$	
-1.0 – +1.0	$0.25 \cdot p \bigoplus 2.5$	$0.01/\left(p \cdot \sqrt{\sin\theta}\right)$
+1.0 – +2.5	$0.25 \cdot p \bigoplus 5.0$	
+2.5 – +4.0	$0.5 \cdot p \bigoplus 10.0$	

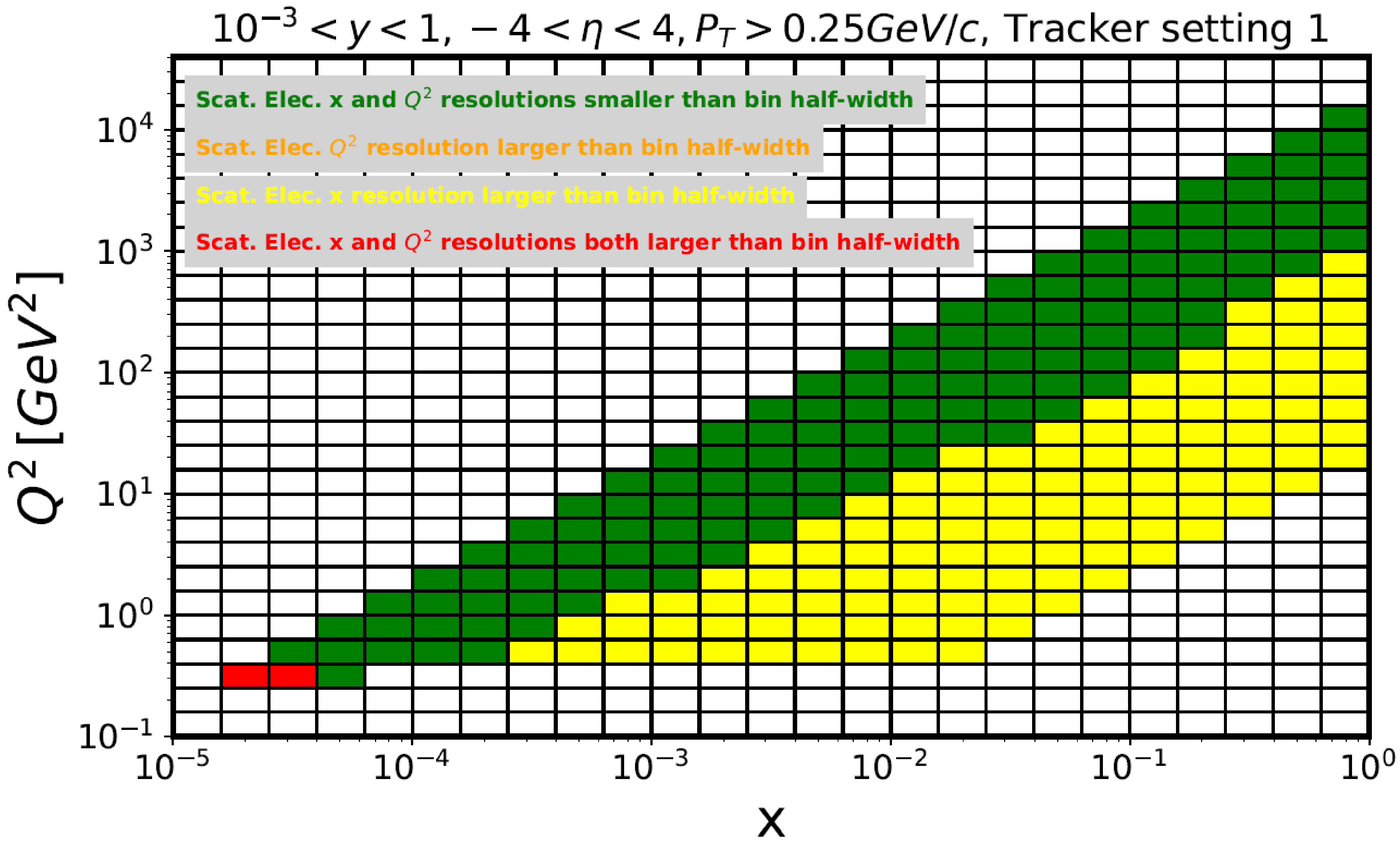
EMcal setting 1

η range	$\sigma_E/E\,[\%]$	σ_θ [Rad]
-4.0 – -2.0	$2/\sqrt{E} \bigoplus 1.0$	
-2.0 – -1.0	$7/\sqrt{E} \bigoplus 1.0$	
-1.0 – +1.0	$12/\sqrt{E} \bigoplus 1.0$	$0.01/\left(p \cdot \sqrt{\sin\theta}\right)$
+1.0 – +2.5	$12/\sqrt{E} \bigoplus 1.0$	
+2.5 – +4.0	$12/\sqrt{E} \bigoplus 1.0$	

$$\frac{\delta x_e}{x_e} = \frac{1}{y_e} \cdot \frac{\delta E'_e}{E'_e} \bigoplus \left[\frac{1-y_e}{y_e} \cdot \cot\frac{\theta_e}{2} + \tan\frac{\theta_e}{2}\right] \cdot \delta\theta_e$$

$$\frac{\delta Q_e^2}{Q_e^2} = \frac{\delta E'_e}{E'_e} \bigoplus \tan\frac{\theta_e}{2} \cdot \delta\theta_e$$

Example configurations – results



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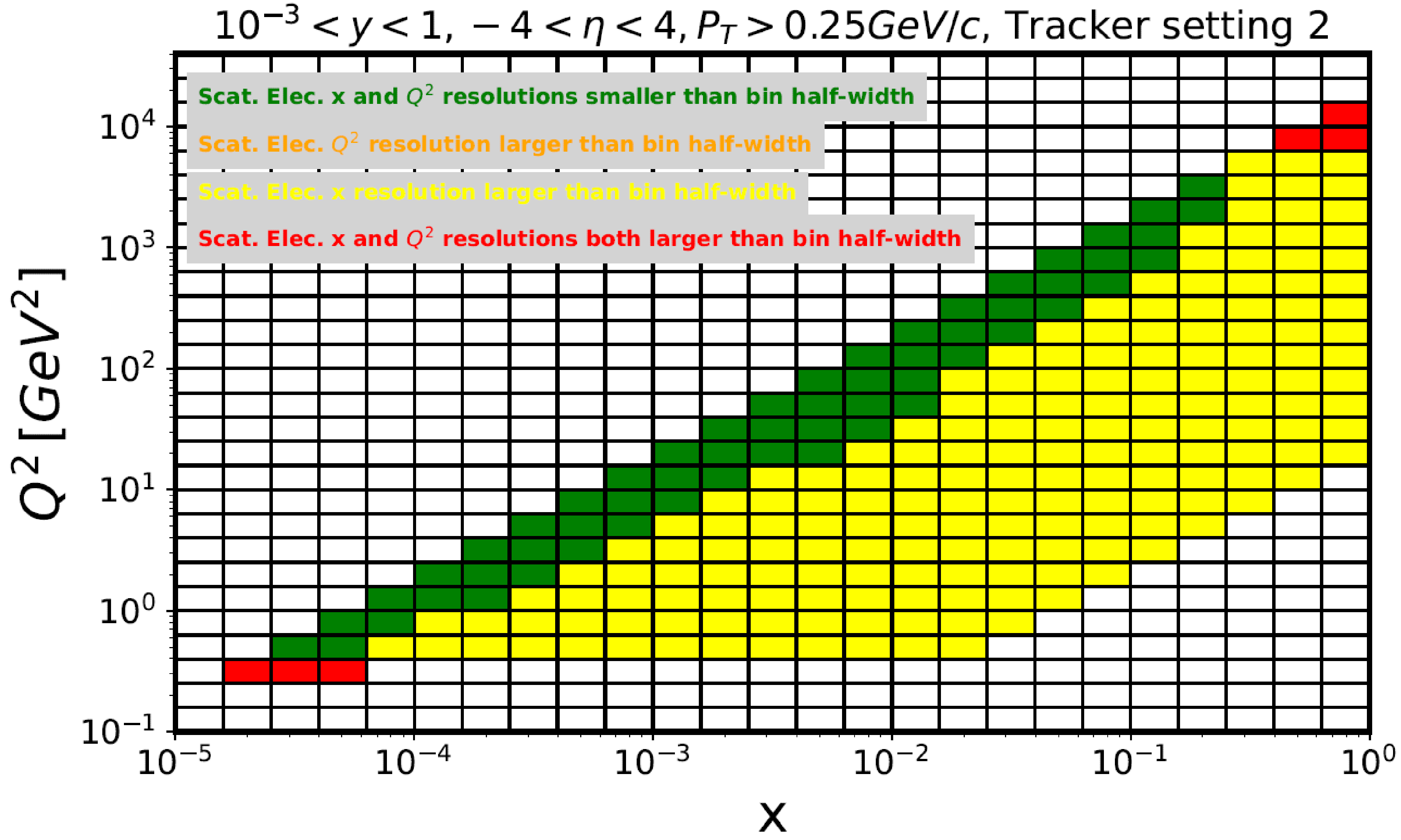
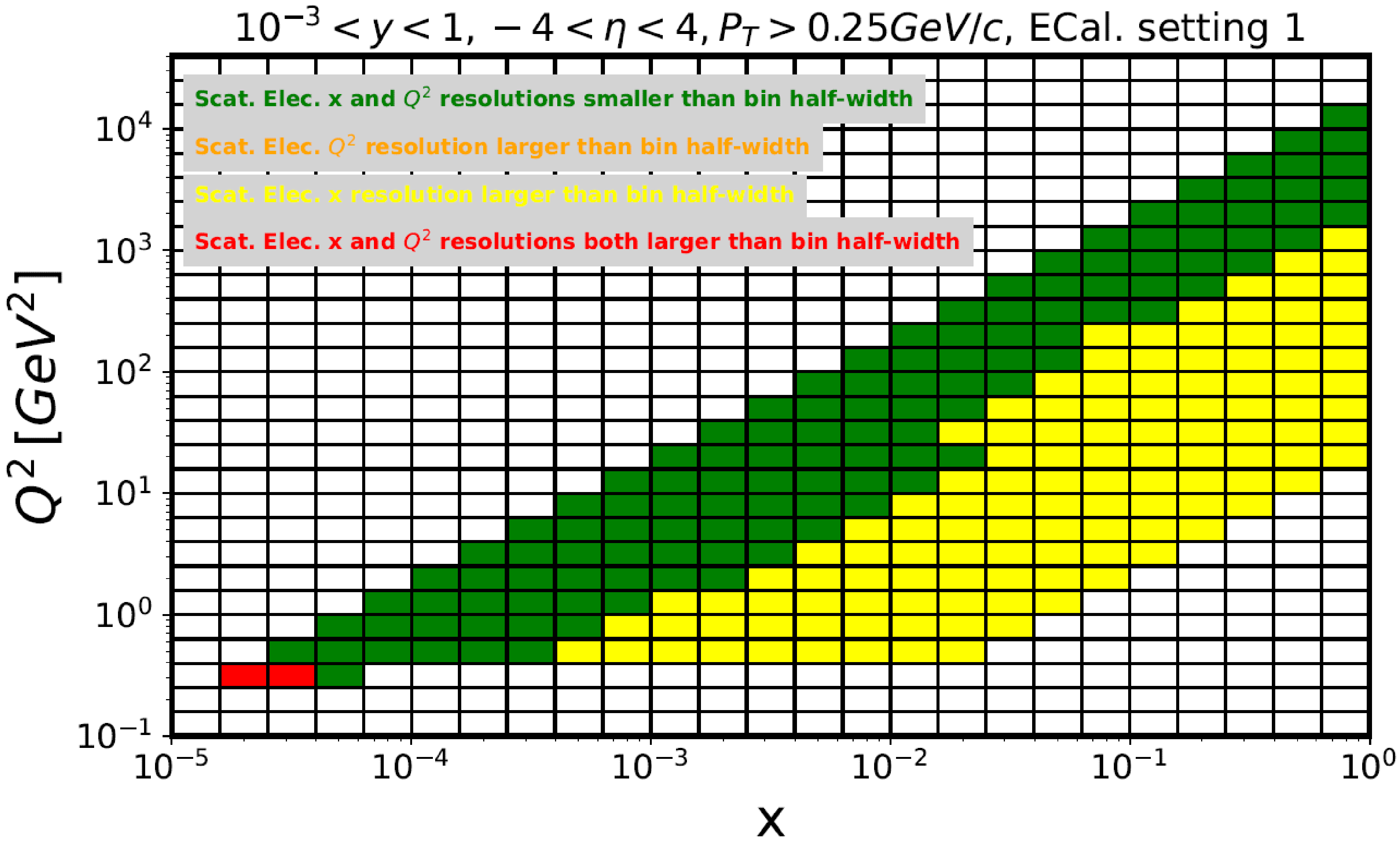
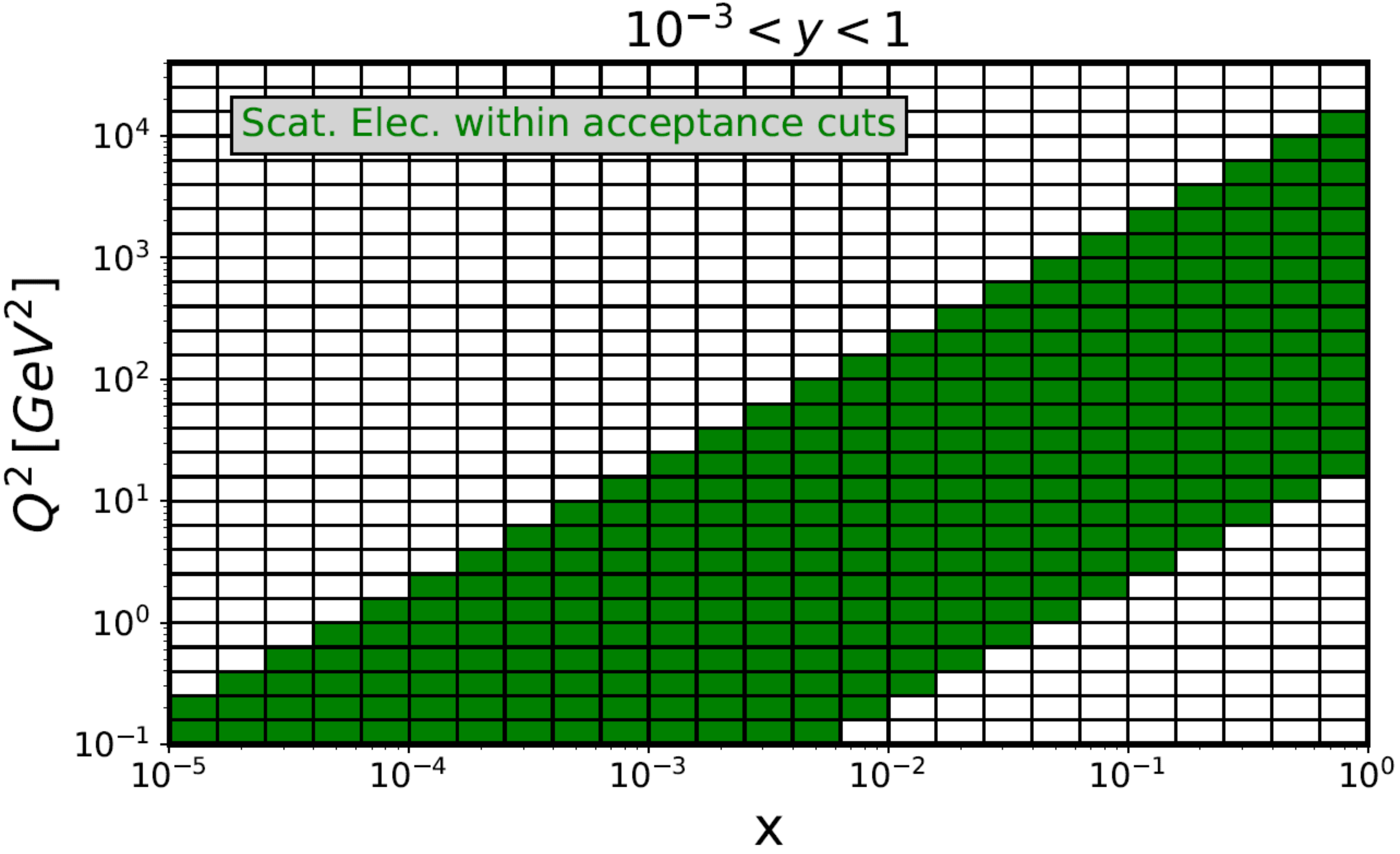


Example configurations – results



Example configurations – acceptance only



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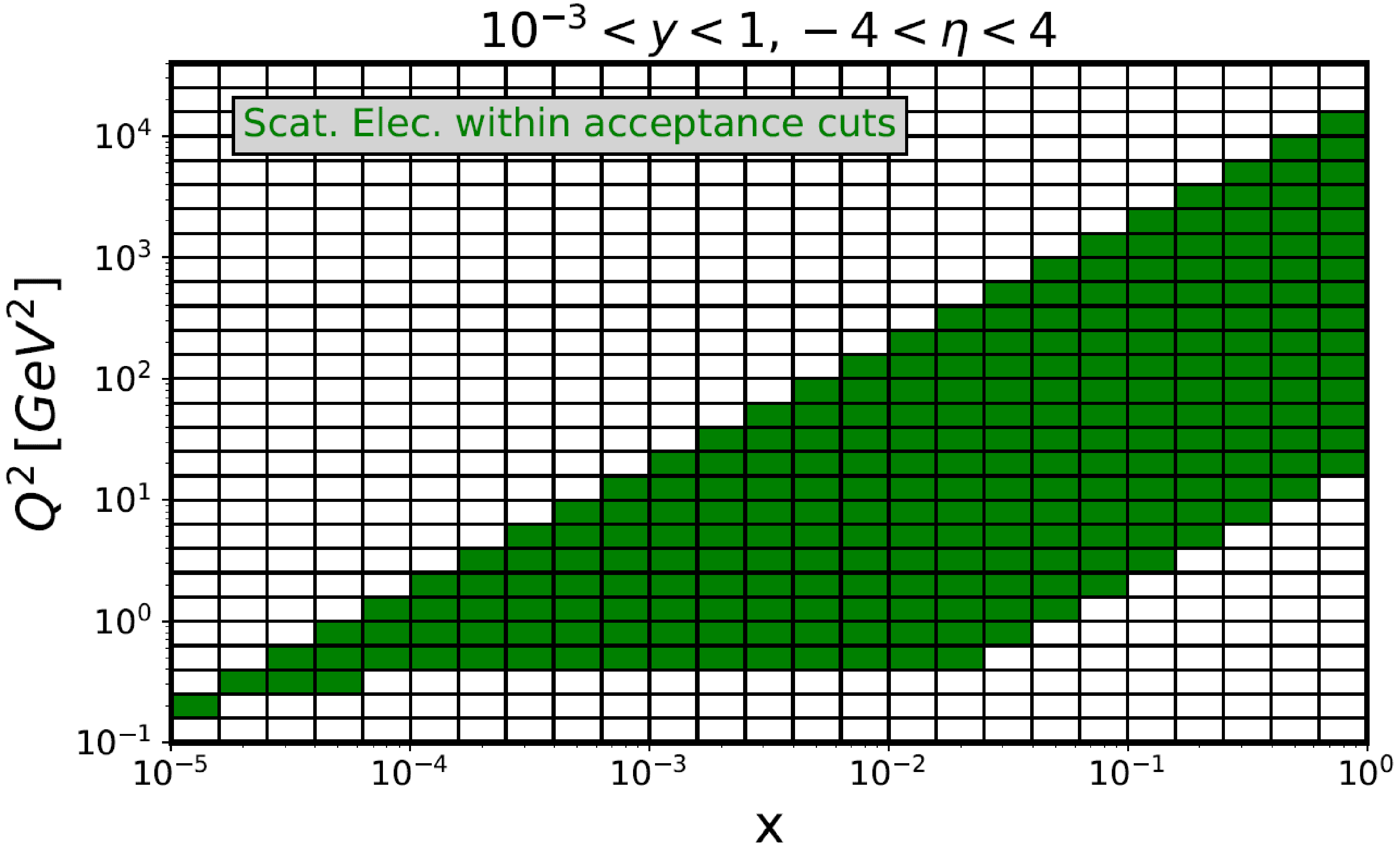

Example configurations – acceptance only