$(\gamma, \rho^- p)$ Rate Comparison between Event Generator and Data
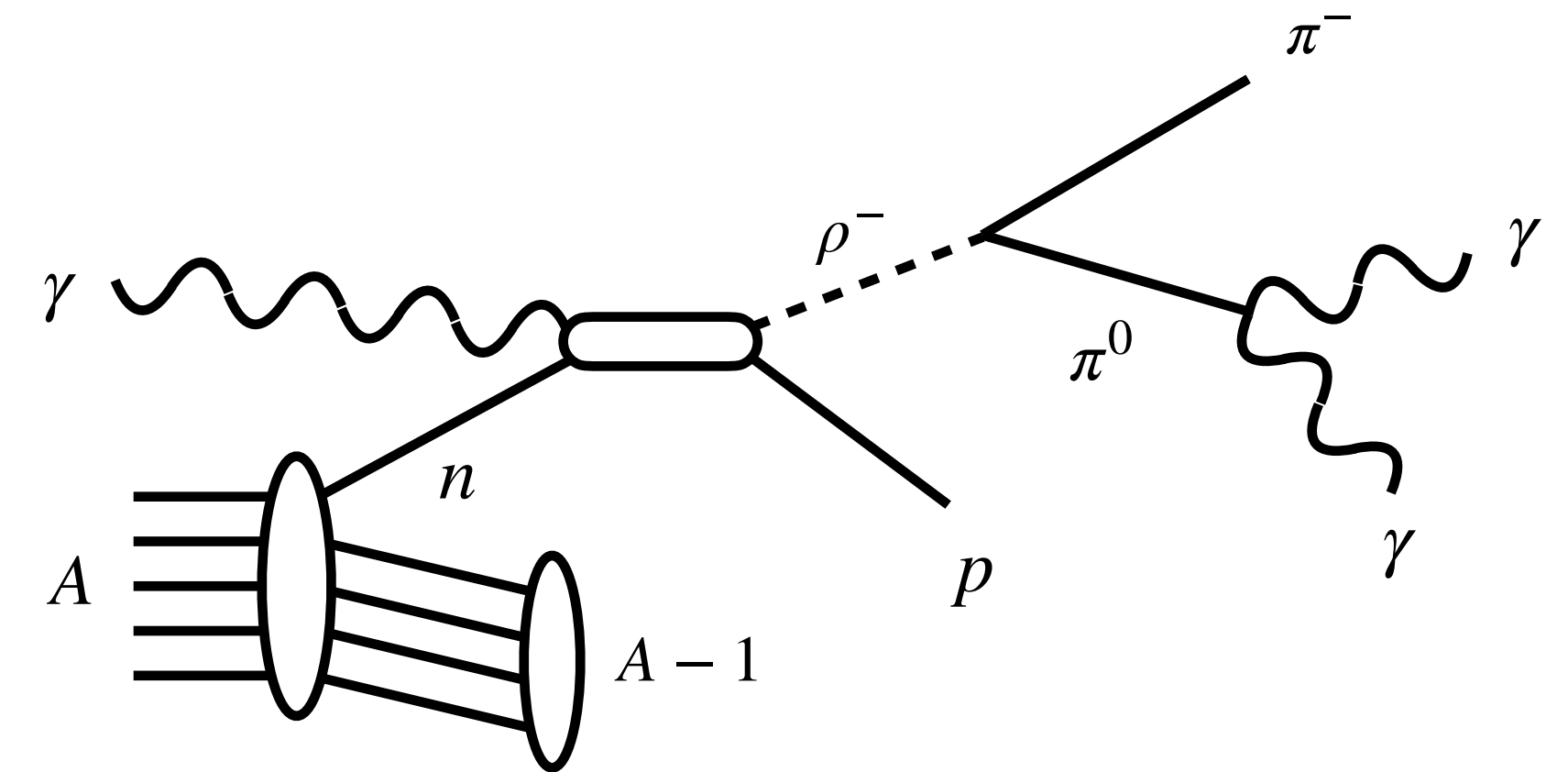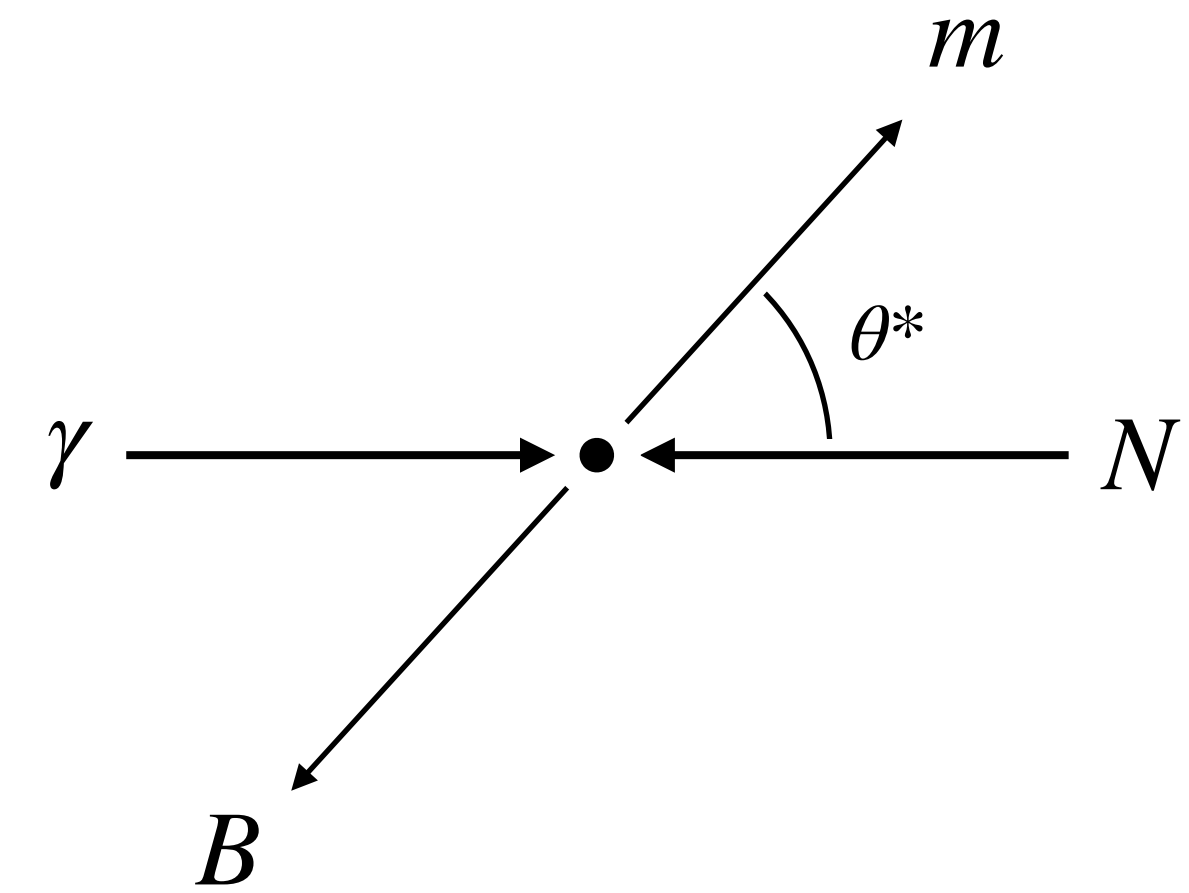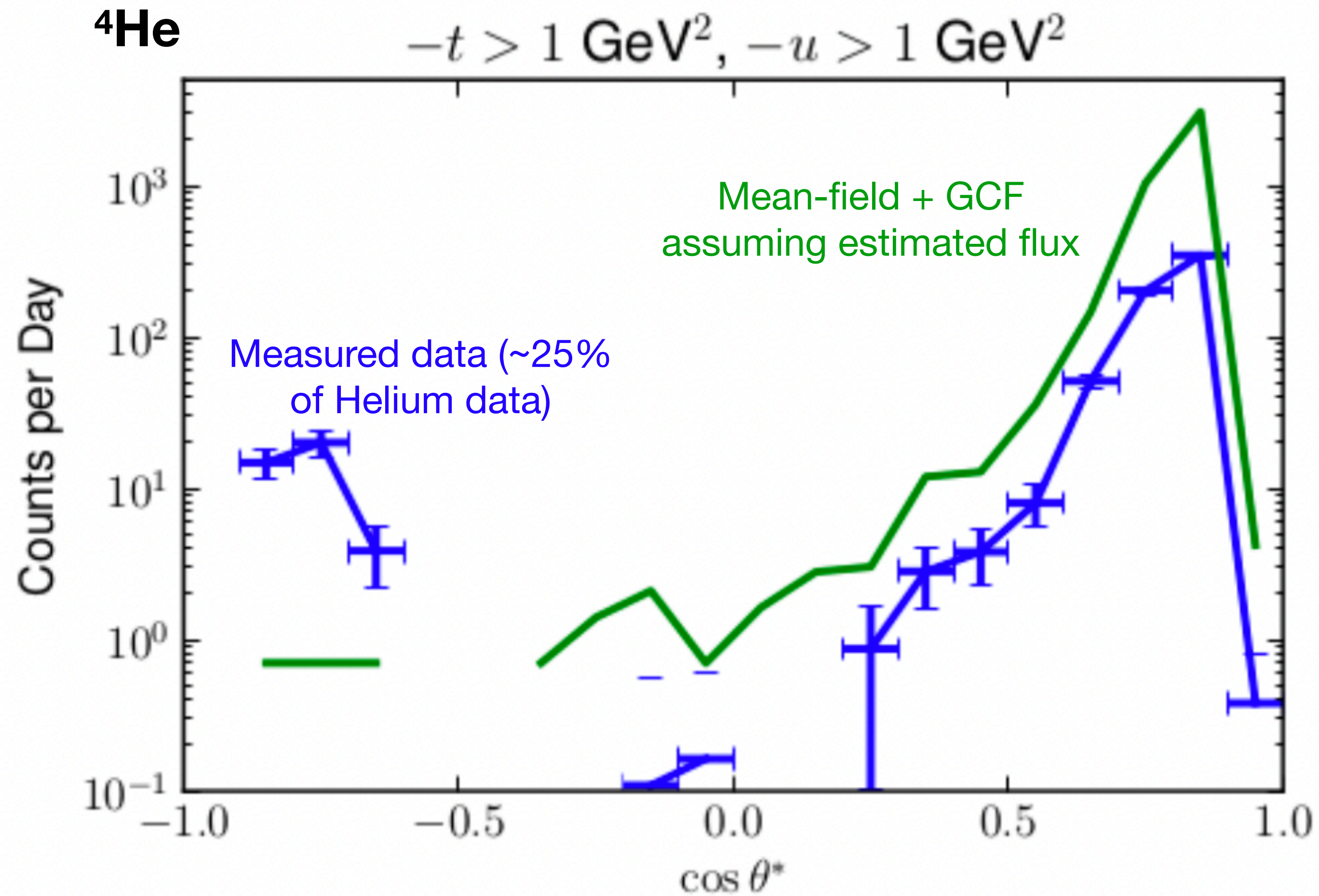
- GCF assumes $\dfrac{\sigma(\gamma p \to \rho^0 p)}{\sigma(\gamma n \to \rho^- p)} = 1$

- Bubble chamber data suggests $\dfrac{\sigma(\gamma p \to \rho^0 p)}{\sigma(\gamma n \to \rho^- p)} \approx 15$

- Generated events → GEANT3 model → Data reconstruction plugin (1p1π1π⁰)

- Normalization assumes 2×10^7 γ/s in coherent peak:

  - 400 nb⁻¹ luminosity for coherent peak

  - 1063 nb⁻¹ luminosity for full photon range

Cuts Applied

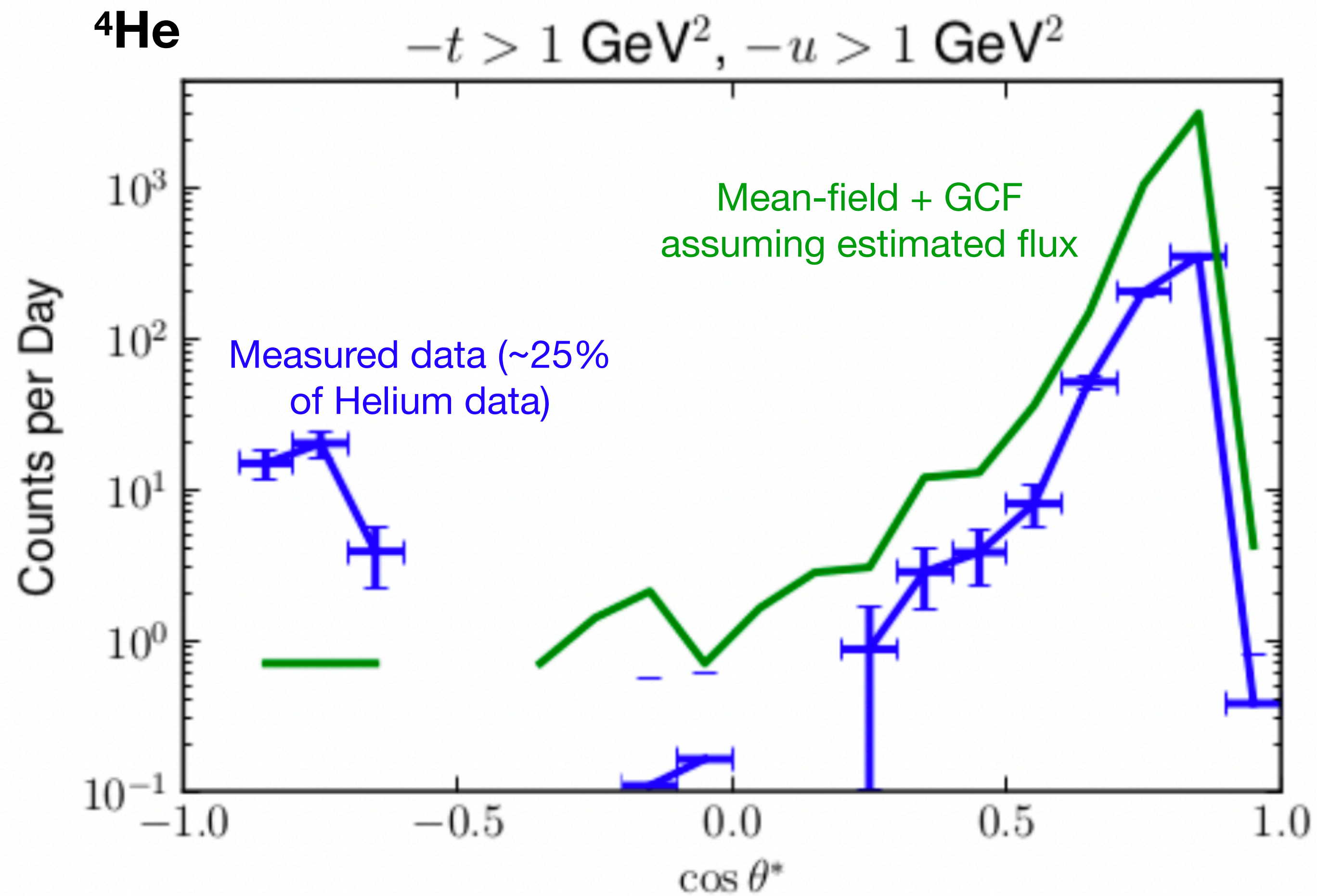- $CL > 0.0001$

- Vertex cuts:

- Calorimeter neutral shower position and timing cuts

- Background cuts for ω and 3π events

- $0.65 < m_{2\pi} < 0.9$ GeV

- $E_{measured} > 7$ GeV

- $E_\gamma > 6$ GeV

- $|E_{measured} - m_N - E_\gamma| < 1$ GeV

- $|t|, |u| > 1$ GeV^2

Theory-Data Comparison

^{4}**He**

$-t > 1\ \mathrm{GeV}^2,\ -u > 1\ \mathrm{GeV}^2$

Counts per Day

$\cos\theta^*$

Mean-field + GCF
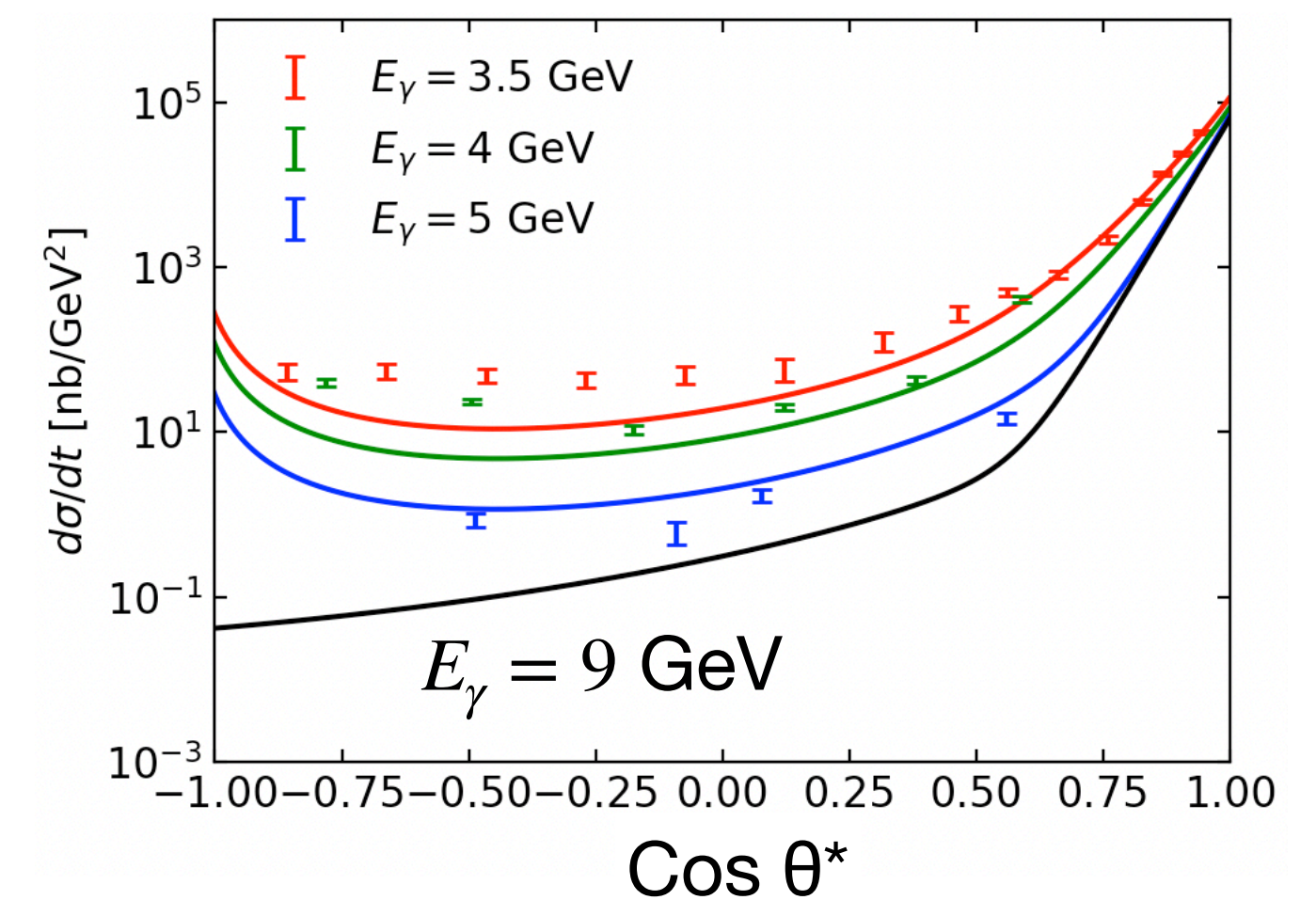assuming estimated flux

Measured data (~25%
of Helium data)

θ^* is the center-of-mass scattering
angle of the produced meson
$\theta^* = 0°\ \rightarrow$ minimum $|t|$
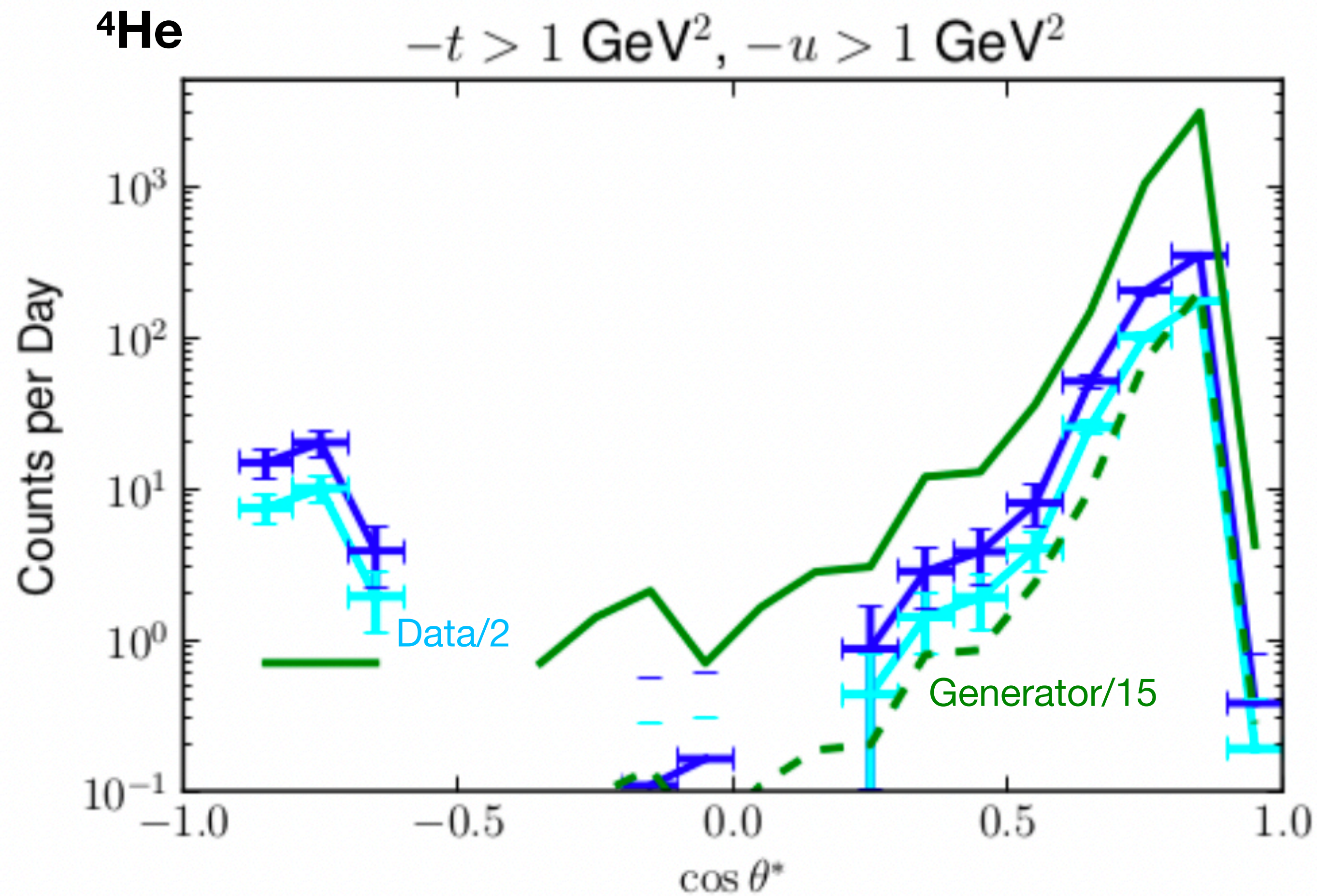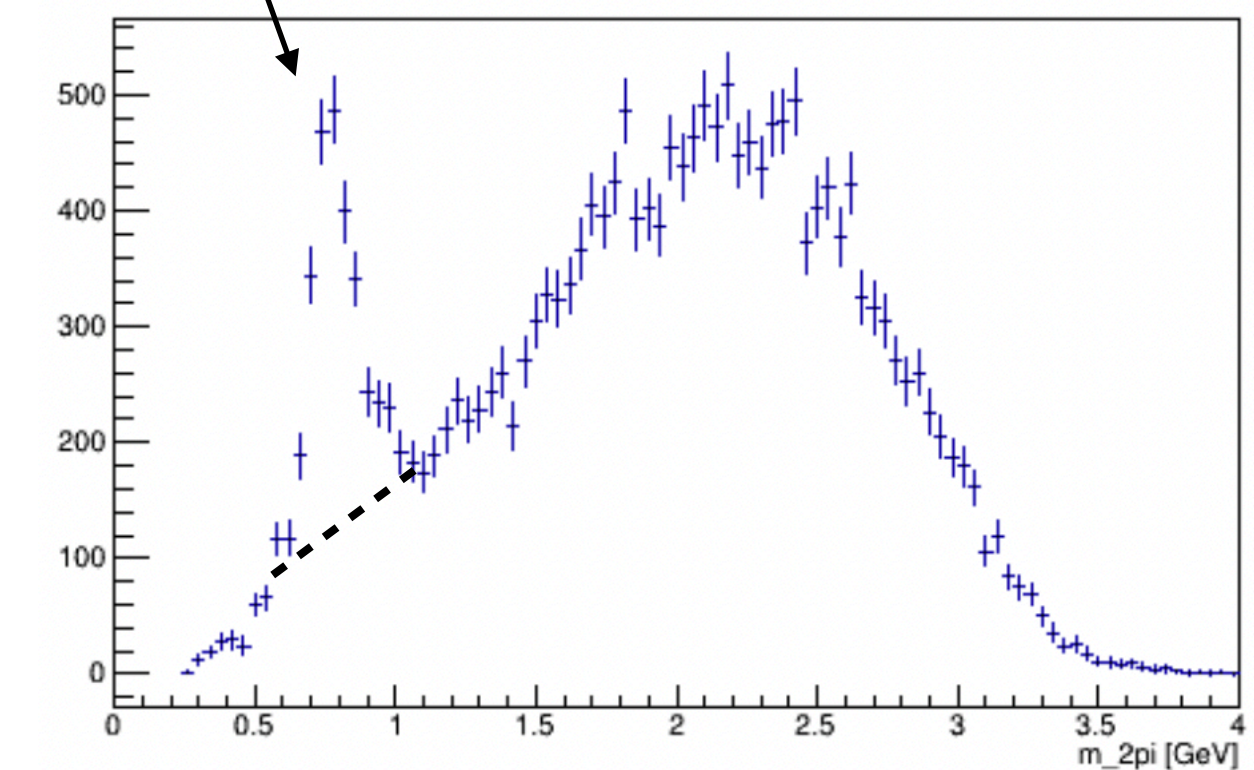$\theta^* = 180°\ \rightarrow$ minimum $|u|$

Theory-Data Comparison

⁴He

$-t > 1\ \text{GeV}^2,\ -u > 1\ \text{GeV}^2$

Mean-field + GCF assuming estimated flux

Measured data (~25% of Helium data)

Counts per Day

$\cos \theta^*$

Backward-scattering / u-channel production not reproduced in cross section fit at high energy

$E_\gamma = 3.5$ GeV
$E_\gamma = 4$ GeV
$E_\gamma = 5$ GeV

$E_\gamma = 9$ GeV

$d\sigma/dt$ [nb/GeV^2]

Cos θ*

Theory-Data Comparison

⁴He

$-t > 1 \text{ GeV}^2, -u > 1 \text{ GeV}^2$

Counts per Day

Data/2

Generator/15

$\cos\theta^*$

Data contains approximately 50% background under ρ^- peak

Reducing data by factor of 2 and theory by factor of 15 gives consistency in well-modeled range of t