# The Experiment

- A 4.75 and 5.9 GeV polarized electron beam scattering off a polarized $^3$He target
- Measure unpolarized cross section for $^3\vec{\mathrm{He}}(\vec{e}, e')$ reaction $\sigma_0^{^3\mathrm{He}}$ in conjunction with the parallel asymmetry $A_\parallel^{^3\mathrm{He}}$ and the transverse asymmetry $A_\perp^{^3\mathrm{He}}$ for 0.23 < x < 0.65 with 2 < $Q^2$ < 5 GeV$^2$.
  - ➡ Asymmetries measured by BigBite
  - ➡ Absolute cross sections measured by L-HRS
- Determine $d_2^n$ using the relation

$$
\begin{aligned}
\tilde{d}_2(x,Q^2) &= x^2[2g_1(x,Q^2)+3g_2(x,Q^2)] \\
&= \frac{MQ^2}{4\alpha^2}\frac{x^2y^2}{(1-y)(2-y)}\sigma_0\left[\left(3\frac{1+(1-y)\cos\theta}{(1-y)\sin\theta}+\frac{4}{y}\tan\frac{\theta}{2}\right)A_\perp+\left(\frac{4}{y}-3\right)A_\parallel\right]
\end{aligned}
$$

where,

$$A_\perp = \frac{\sigma^{\downarrow\Rightarrow}-\sigma^{\uparrow\Rightarrow}}{2\sigma_0} \qquad A_\parallel = \frac{\sigma^{\downarrow\Uparrow}-\sigma^{\uparrow\Uparrow}}{2\sigma_0}$$

$$A_\perp^{^3He} = \frac{\Delta_\perp}{P_bP_t\cos\phi} \qquad A_\parallel^{^3He} = \frac{\Delta_\parallel}{P_bP_t}$$

$$\Delta_\perp = \frac{(N^{\uparrow\Rightarrow}-N^{\uparrow\Rightarrow})}{(N^{\uparrow\Rightarrow}+N^{\uparrow\Rightarrow})} \qquad \Delta_\parallel = \frac{(N^{\downarrow\Uparrow}-N^{\uparrow\Uparrow})}{(N^{\downarrow\Uparrow}+N^{\uparrow\Uparrow})}$$

# Kinematics of the measurement

- Two beam energies 4.75 and 5.9 GeV (4 pass, 5 pass)
  - ➡ provides a handle on the $Q^2$ dependence of $g_2$
- BigBite fixed at single scattering angle (θ=45°) (data divided into bins during analysis)
- Avoid resonance region as much as possible.