### Elastic Form Factors:

- Transverse current and charge density
- Quark longitudinal momentum and helicity distributions
- Correlated distributions in transverse space

### DIS Parton Distribution Functions:

- \( H(x, \xi) \)
- \( E(x, \xi) \)
- \( F(x, \xi) \)

### Elastic Form Factors:

- \( M(x, \xi) \)
- \( H(x, \xi) \)
- \( E(x, \xi) \)
- \( F(x, \xi) \)

### Chiral even GPDs:

- \( c.m. \) and helicity distributions
- Functions:
  - \( V_1, V_2, V_3, V_4 \)
  - \( A_1, A_2, A_3, A_4 \)
  - \( F_1, F_2, F_3, F_4 \)

### Accessing GPDs experimentally:

- Spin asymmetries \((x, \xi)\) HERMES, CLAS and Hall A (JLab)
- \( H(x, \xi) \), \( E(x, \xi) \), \( F(x, \xi) \)
- \( \xi \) and \( x \) are selected by reconstructing the final-state leptons and their missing four-momentum.

### Selection of TCS-BH events:

- After kinematic selection of events, the invariant mass of the lepton pairs is constructed. The invariant mass is also a measure of the virtuality of the final-state photon, \( M_{\gamma^*} \), which provides the hard scale for the collinear process.

### Experimental determination of \( R \):

\[
R = \frac{\sum \cos(\xi) \cdot Y_6}{\sum \sin(\xi) \cdot ReM^-}
\]

where \( Y_6 \) is defined as:

\[
Y_6 = \sum \frac{L(0)}{L(0)} \int \Phi(\theta) \cos(\phi) d\phi
\]

Events with \( 0 < \theta < 3\pi/4 \) and \( \phi < \pi/4 \), of which the latter fall outside of the CLAS acceptance, are excluded from the calculation of \( R \) due to an unfavorable TCS/BH ratio.

### Observables in TCS:

- \( \bar{R}(x, \xi, \eta) \)
- \( \frac{d^2s}{d\eta d\xi} \cos(\xi) \int \frac{d\Phi}{2\pi} \Phi(\theta) \int \sin^2(\xi) d\xi \)
- \( \frac{d^2s}{d\eta d\xi} \int \frac{d\Phi}{2\pi} \Phi(\theta) \int \cos^2(\xi) d\xi \)

### Comparison with theory:

- Preliminary
- D
- NOD
- Dual
- Data

### Summary:

- Photoproduction of \( e^+e^- \) has been studied using CLAS 6 GeV data with both tagged and untagged photon beams. This analysis used the latter approach, selecting quasi-real photoproduction events from electroproduction data. The success of this method, essential for 12 GeV CLAS experiments, is shown by the analysis of the missing four-momentum distribution and the invariant-mass distribution of the final-state lepton pairs in the reaction \( ep \rightarrow e^+e^-\pi^0 \).
- The data was measured over a range in the c.m. energy \( Q^2 \) and in the outgoing photon virtuality \( Q^2 \). The average values were \( s < 7 \times 10^4 \) GeV\(^2\) and \( Q^2 > 1.34 \times 10^4 \) GeV\(^2\), with \( x < 0.2 \) and \( M_\pi \), where \( M_\pi \) is the proton mass. These are the first experimental results on TCS angular asymmetries and the first comparison of the data with GPD-based models.
- The 12 GeV upgrade at Jefferson Lab will give access to higher virtualities of the outgoing timelike photon, placing it in a resonance-free region, and a larger range in \( x \), extending the coverage to lower values of \( x \).