Plan for discussion

Go over different types of processes/final states
Summarize physics objectives
Discuss rough outlines of kinematics, starting from proposition
Identify questions for quantitative study

Considerations

- Same process can address different physics at small/large $x$ (e.g. DVCS). Need to be clear about objectives!

- Some kinematic boundaries are determined by counting rates (e.g. high $Q^2$)

- Focus on role of CM energy and need for lower energies
  
  CM energy dependence of exclusive cross sections and observables?
  Methods for exclusive event reconstruction at $y \ll 1$?

- Focus on $t$-coverage needed for physics objectives
Types of processes for discussion

- DVCS

- Vector mesons $J/\psi, \phi, \rho^0$ (“diffractive”)

- Pseudoscalar and charged vector mesons $\pi, \eta, K, K^*, \rho^+$ (“nondiffractive”)

- Coherent processes on light and heavy nuclei

- High-$t$ and backward processes

- High-mass photoproduction TCS

- $N \rightarrow N^*$ transitions (considerations specific to $N^*$)

Follows organization of Yellow Report. Questions? Comments?
Deeply virtual Compton scattering DVCS

**Physics:** Valence quark GPDs spin/flavor at $x \gtrsim 0.1$
Sea quark and gluon GPDs at $x \lesssim 0.1$
Dispersion relations (= integrals over $\nu$) connect Im/Re, D-term ↔ EM tensor
Transverse imaging of nucleon

**Kinematics (proposed):**

$x_{(\text{low})} = \text{kin limit}, \quad x_{(\text{high})} = 0.1? \ 0.3?$

$Q^2_{(\text{low})} \sim 1 \text{ GeV}^2, \quad Q^2_{(\text{high})} = \text{rate limit} = \text{few 10 GeV}^2$

$\Delta_T_{(\text{low})} = 0, \quad \Delta_T_{(\text{high})} = 1-2 \text{ GeV}$?

**Questions:**

How important is lower CM energy for DVCS event reconstruction and observables?
How important is $\Delta_T$ coverage at zero and large values?
Vector meson production $J/\psi, \phi, \rho^0$

**Physics:** Gluon GPDs $J/\psi, \phi$; gluon + singlet quark GPDs $\rho^0$
Transverse imaging, $t$-dependence of gluon form factor
Soft-hard transition as function of $Q^2$
“Diffractive” channels, high rates at small $x$

**Kinematics (proposed):**

$x(\text{low}) = \text{kin limit}, \quad x(\text{high}) \sim 0.1$?

$Q^2(\text{low}) = 0, \quad Q^2(\text{high}) = \text{few } 10 \ \text{GeV}^2 = \text{rate limit}$

$\Delta_T(\text{low}) = 0, \quad \Delta_T(\text{high}) = 2-3 \ \text{GeV}$?

**Comments:**

Aim to measure all channels at same $(x, Q^2)$ for comparative studies

Special case: Near-threshold production of heavy quarkonia, incl. $\Upsilon$.
High-$t$ process! Benefits of lower CM energy?
Pseudoscalar and charged vectors $\pi, \eta, K, K^*, \rho^+$

**Physics:** Quark GPDs valence/sea, flavor separation, helicity and transversity
Emergence of Regge dynamics from QCD
Unexplored at $x < 0.1$, soft or hard regime
“Nondiffractive” channels, rates drop at small $x$, more challenging

**Kinematics (proposed):**

$x(\text{low}) = \text{rate limit}, \quad x(\text{high}) \sim 0.1? 0.3?$

$Q^2(\text{low}) = 0, \quad Q^2(\text{high}) = \text{few 10 GeV}^2 = \text{rate limit}$

$\Delta_T(\text{low}) = 0, \quad \Delta_T(\text{high}) \sim 1 \text{ GeV}$?

**Comments:**

Can we separate L/T through $\phi$-dependent response functions?
Advantages of lower CM energy?
Coherent processes on light nuclei

**Physics:** Nuclear quark GPDs $x \gtrsim 0.1$, spin structures, transverse imaging
Nuclear gluon GPDs $x \lessapprox 0.1$, nuclear shadowing as function of impact parameter
Nuclear targets with spin-0, 1/2, 1
Possible processes DVCS, $J/\psi$, others

**Kinematics (proposed):**

$x$(low) $\sim 10^{-3}$  $x$(high) $\sim 0.1$?

$Q^2$(low) $\sim 1$ GeV$^2$,  $Q^2$(high) = few 10 GeV$^2$ = rate limit

$\Delta_T$(low) = 0,  $\Delta_T$(high) $\sim$ few 100 MeV?

**Comments/questions:**

Need $\Delta_T$ coverage from 0 to $\sim$ few 100 MeV, good resolution
Beam momentum smearing effects likely important [→ this afternoon]
Advantages of lower CM energy?
Coherent processes on heavy nuclei

Physics: Nuclear gluon GPD $x \ll 0.1$, nuclear shadowing as function of impact parameter, possibly saturation effects
Possible processes $J/\psi, \phi$, others

Kinematics (proposed):

$x$(low) $\sim$ kin limit $~~ x$(high) $\sim 0.01$

$Q^2$(low) $\sim 0$, $~~ Q^2$(high) = few GeV$^2$?

$\Delta_T$(low) = 0, $~~ \Delta_T$(high) $\sim$ 100 MeV?

Comments/questions:

Coherent process identified by veto detection of nuclear breakup
Beam momentum smearing effects essential

$\Delta_T$ measurement through vector meson?

Likely very challenging measurement