Short Range Nuclear Structure:
Summary

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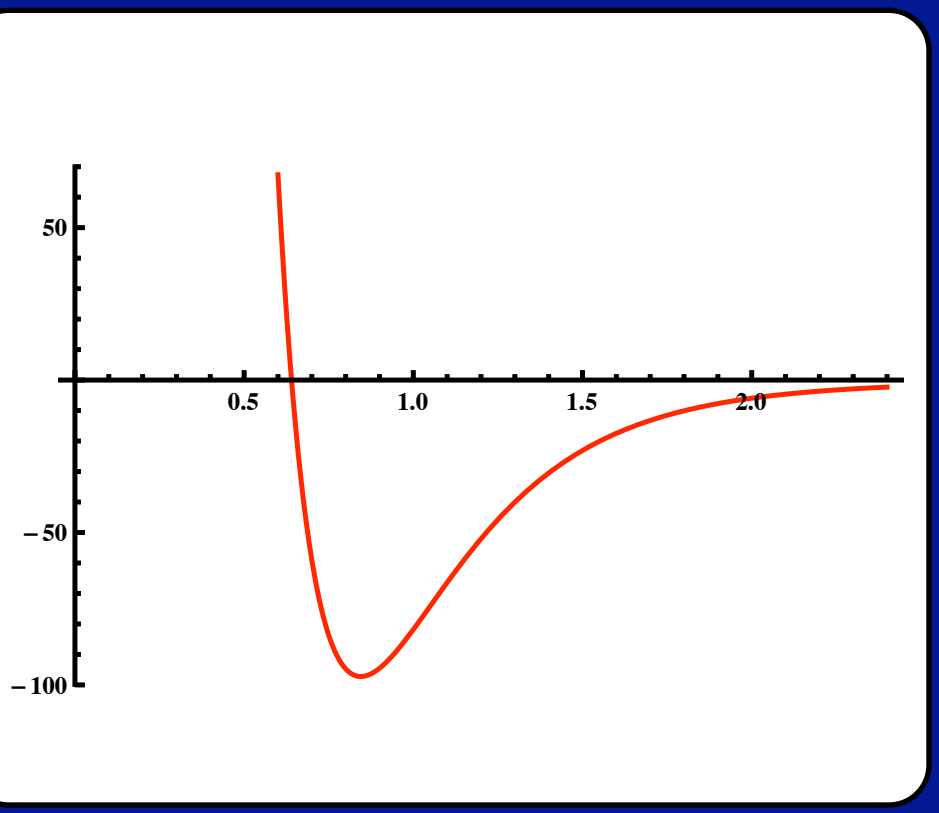
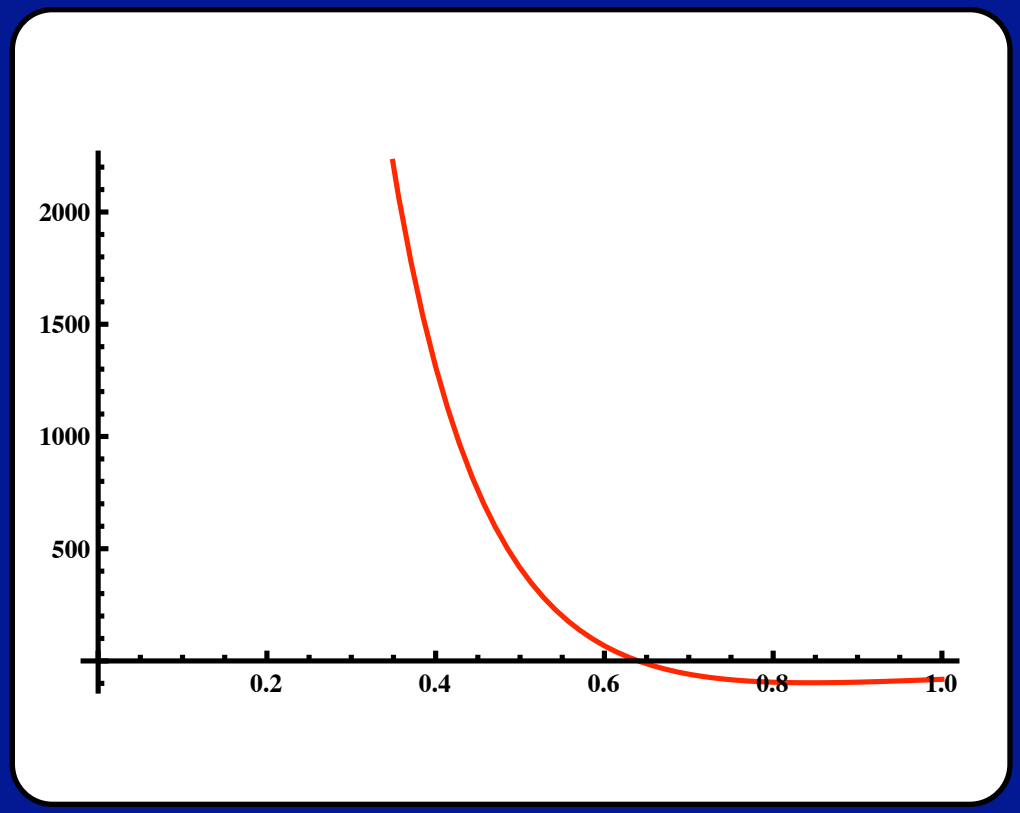
Expedition Into the Core



Attraction

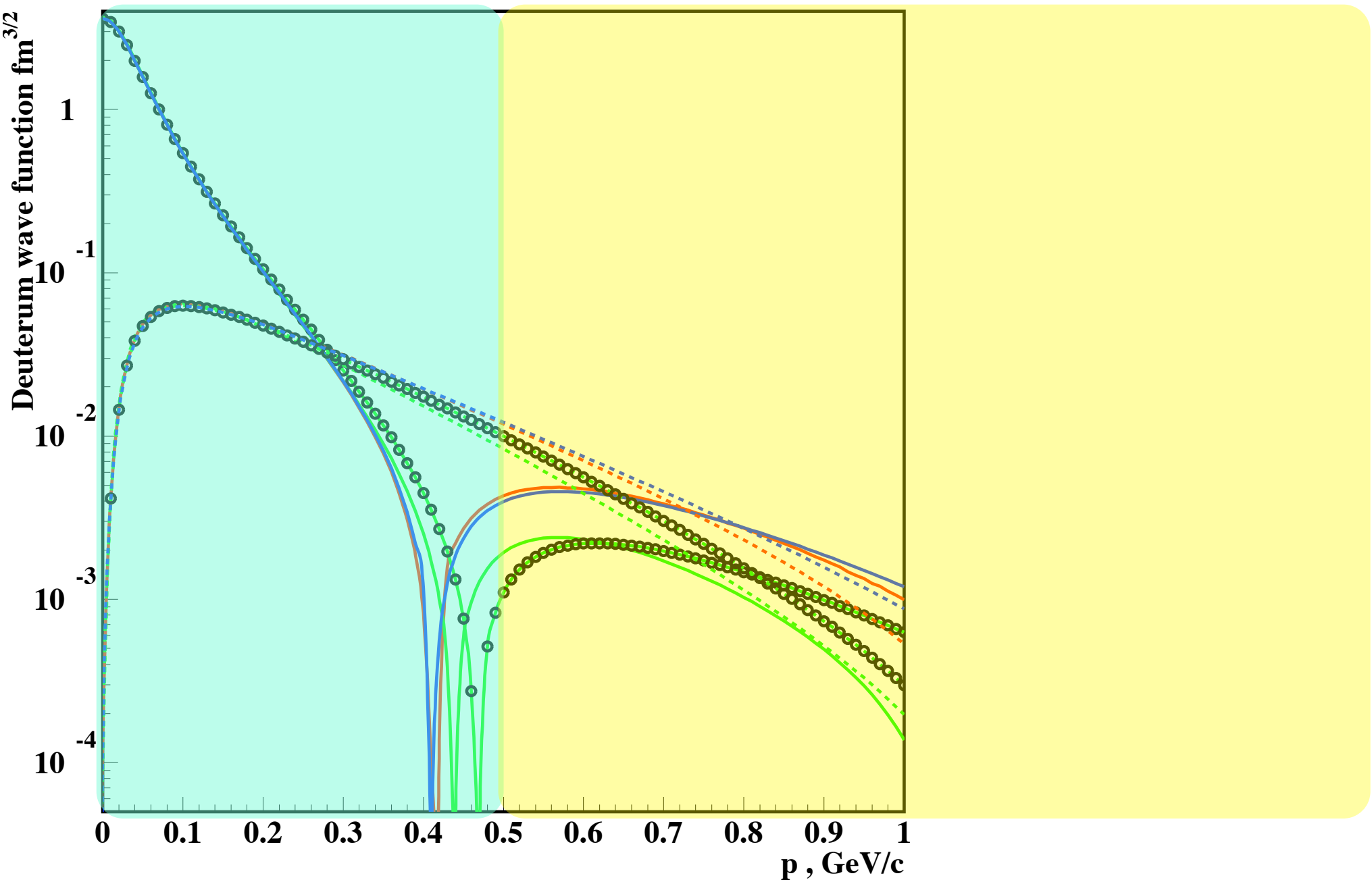
JLAB12, EIC



Repulsion/Core

EIC

Deuteron


JLAB6
JLAB12, EIC
EIC
Deuterum wave function fm^3/2
1
10^-1
10^-2
10^-3
10^-4
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
p , GeV/c

(a) What is Unique with EIC for Short Range Studies

- ☑ will cover largest Q2 range that was ever available for Nuclear Physics
- ☑ makes partonic evolution as a tool to probe the nucleus at short distances
- ☑ "road to the core is paved with baryonic resonances": collider configuration is unique for detecting them:

slow spectators in the Lab frame become fast fragments of the nuclear targets in Collider

- ☑ possibility of covering wide range of x allows to probe both quark and gluon structure of SRCs

(b) What can be probed

- QCD content of nuclear force
- quark, gluon content of the nuclear core
- energy gap of chiral symmetric and broken phases of cold nuclei
- hidden color component of nuclear wave function at short distances
- intrinsic strangness and charmness of nuclear WF
- multi-nucleon short range correlations

(c) Possible "Flagship" Reactions for SRCs

- ☑ Investigation of target and current fragments in semi-inclusive reactions (momenta, flavor, resonance)
- ☑ J/Psi - production from deuteron with spectator tagging
- ☑ Coherent J/Psi Production at large -t
- ☑ DIS at large x and superquarks
- ☑ different flavor productions in target and current fragmentation regions $\gamma + d \rightarrow p + \Sigma_c^+ + D_c^-$
- ☑ multi-nucleon short range correlations

(c) Possible "Flagship" Reactions for SRCs

☑ Investigation of current target fragments in semi-inclusive reactions (momenta, flavor, resonance)

Mark Strikman

At collider one needs to consider reaction with production of Δ with $\alpha_\Delta > 1$ like

$$e + {}^2H \to e + \Delta^{++} + X$$

$$e + {}^2H \to e + \Delta^{++} + leading\ \pi^{\pm} + X$$

measurement of pions tests whether γ scattered off d - quarks*

Tests possible to exclude rescattering mechanism: πN→Δ FS90

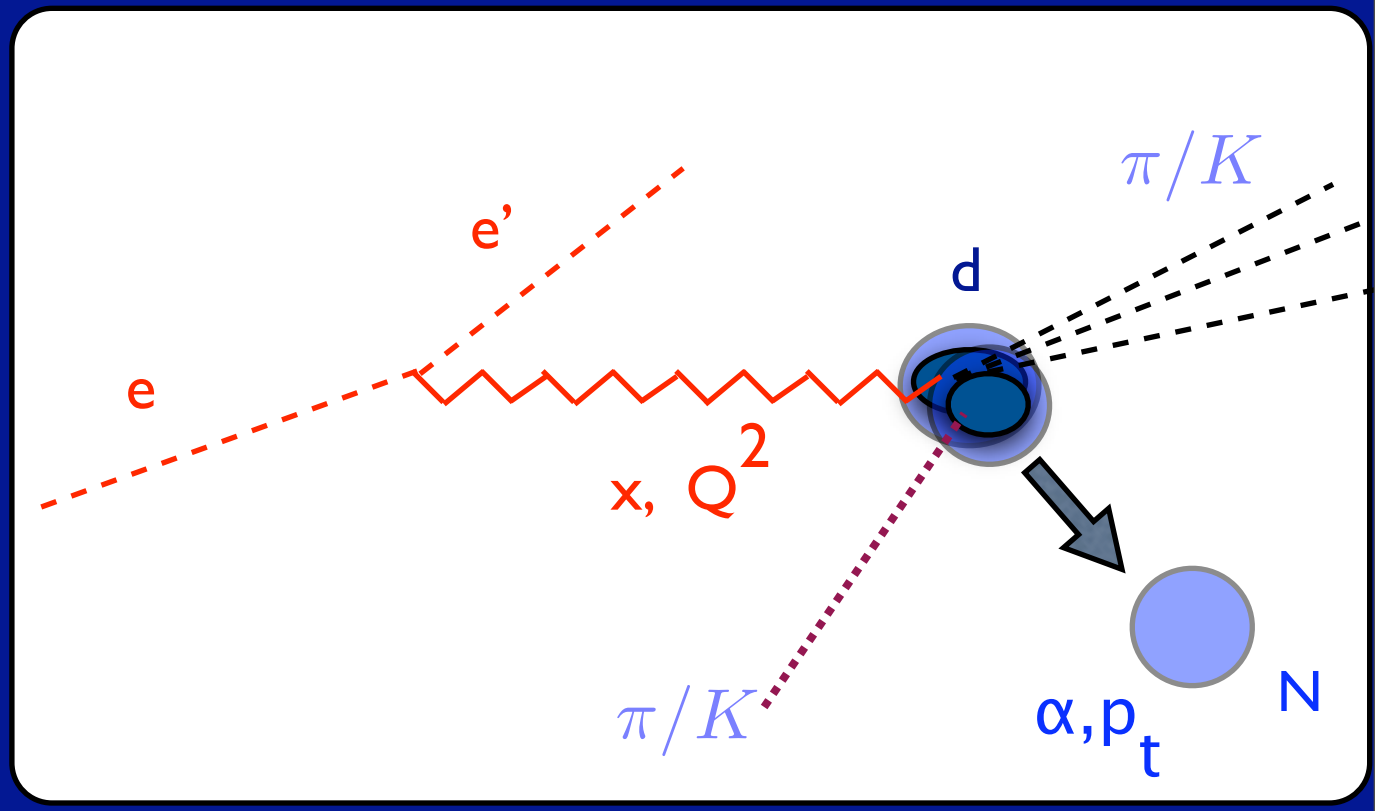
For the deuteron one can reach sensitivity better than 0.1 % for ΔΔ especially with quark tagging *(FS 80-90)*

Tagging for 3N SRC - $e + {}^3\vec{H} \to e + pp(pn) + X$

Semi-Inclusive (e,e'N): New Reactions

☑ Considering $e + A \rightarrow e' + p_N + \pi/K + X$

will allow us to measure the flavor dependence of nuclear modification effects. Measuring extra nucleon in specially chosen kinematics will allow control of the initial state.



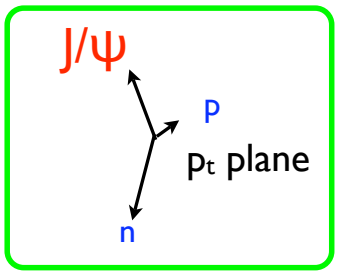
(c) Possible "Flagship" Reactions for SRCs

J/Psi - production from deuteron with spectator tagging

Tagging for 3N SRC - $e + {}^3\vec{H} \rightarrow e + pp(pn) + X$

- *Is the transverse size of bound nucleon quark/ gluon distribution in bound nucleons modified?*

$\gamma + {}^2H \rightarrow J/\psi + p + n$ at -t > 0. 3 GeV^2 in the spectator kinematics



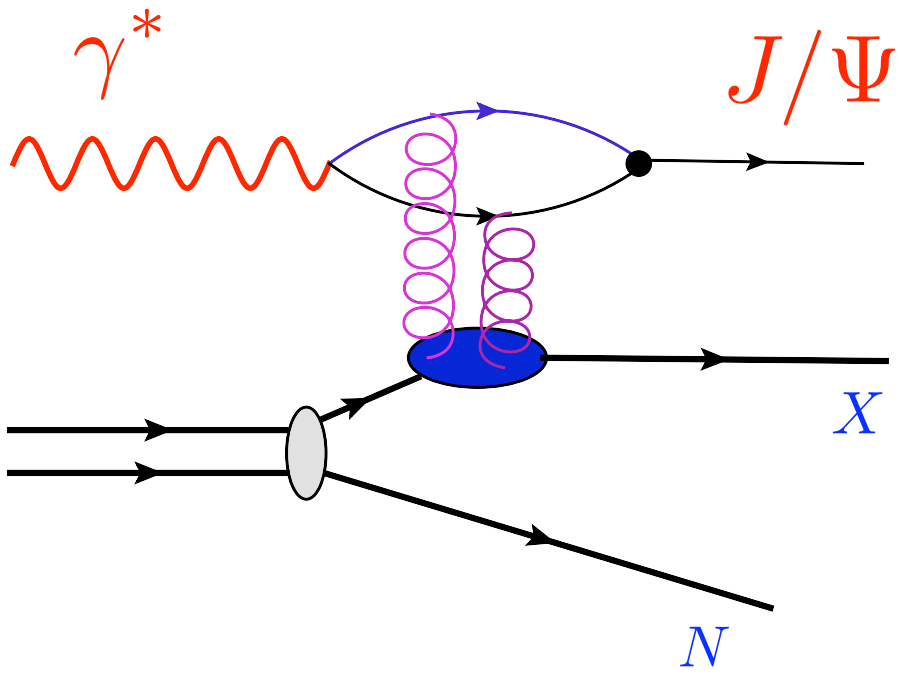
If t distribution is broader - swelling of gluon field in bound nucleons

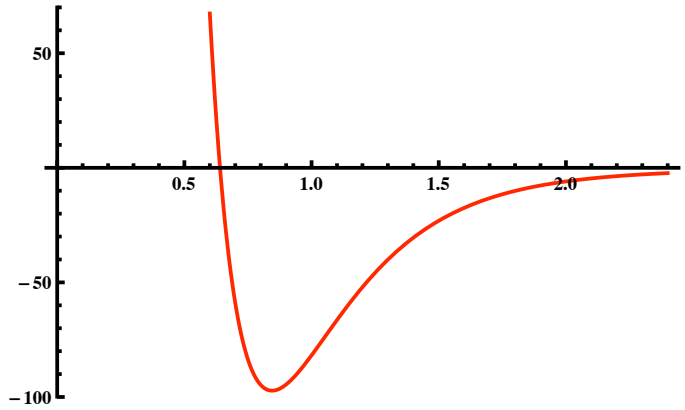
Mark Strikman

New Reactions (e,e'J/Psi):

☑ Considering $\gamma^* + d \to J/\Psi + p + n \quad \gamma^* + d \to J/\Psi + d'$

will probe the nuclear modification of gluonic field controlling the local density from where the J/Psi is produced.





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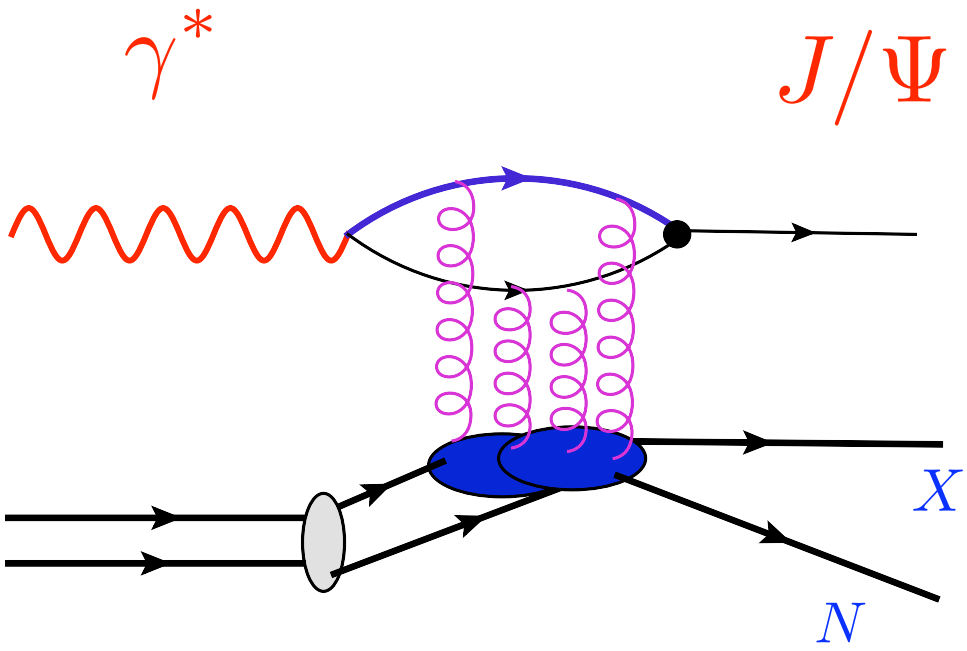
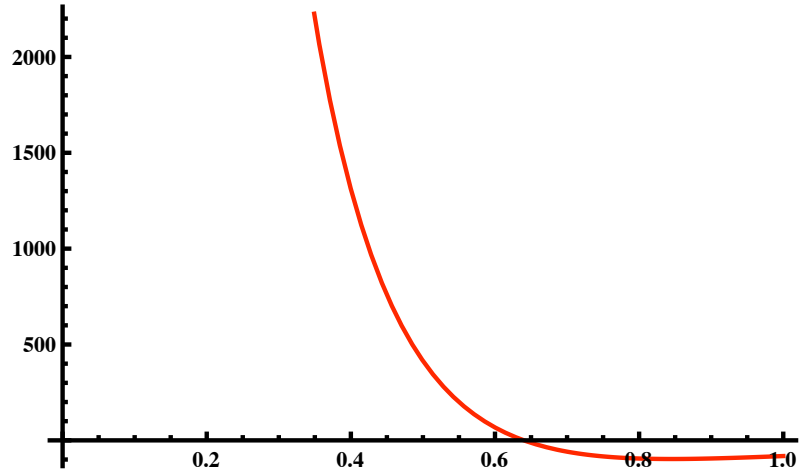
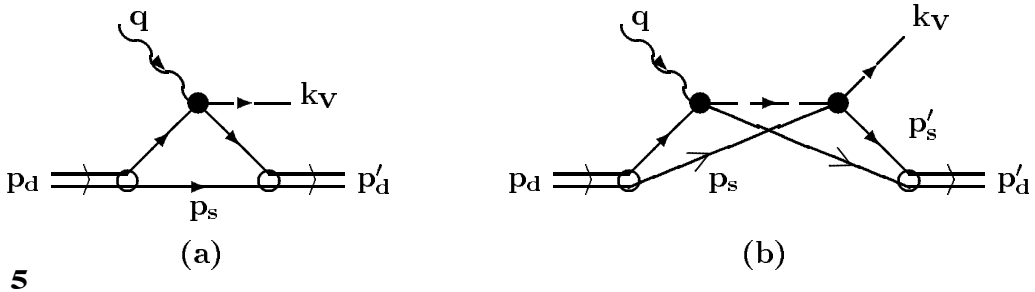
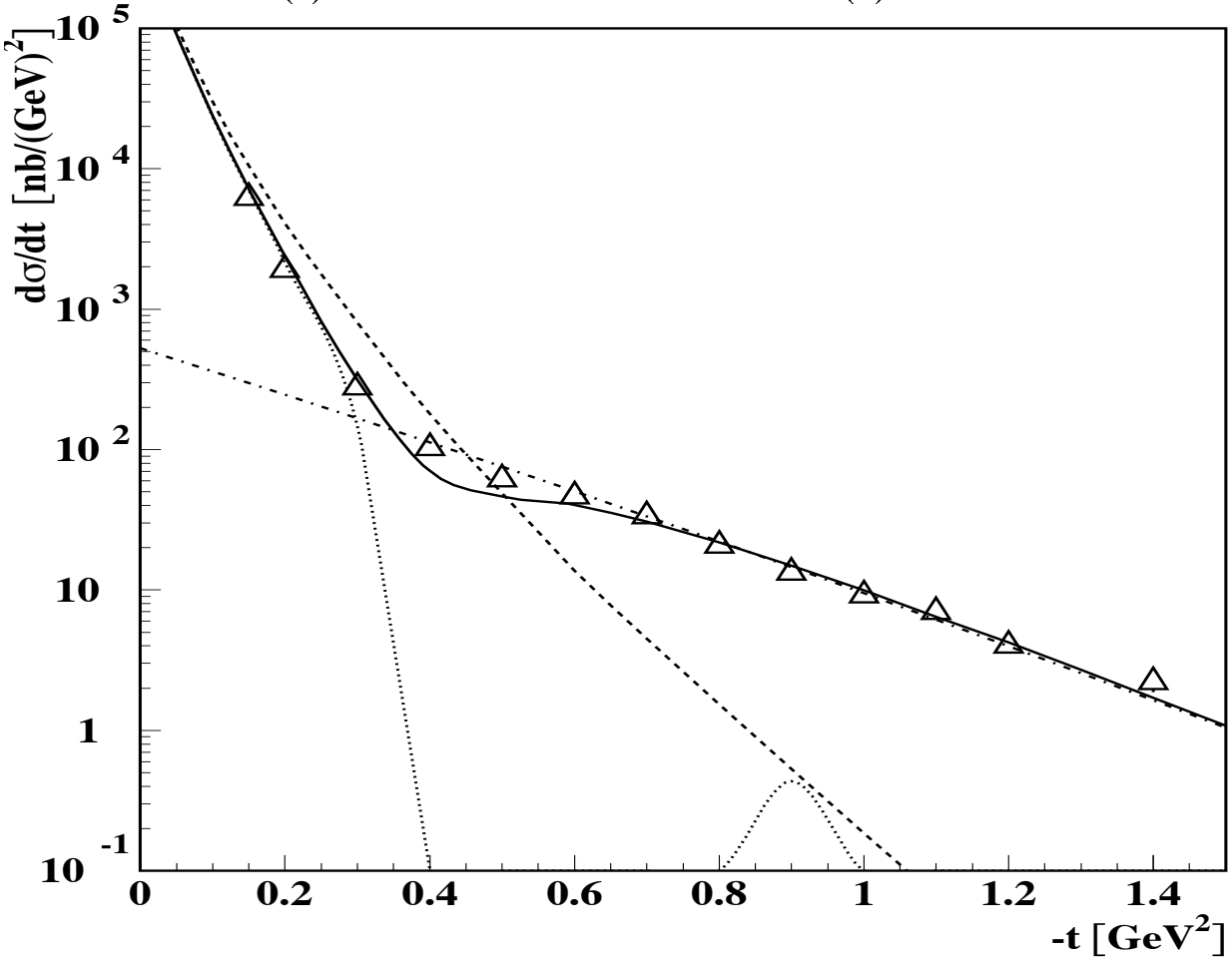




(c) Possible "Flagship" Reactions for SRCs

Coherent J/Psi Production at large -t $\gamma^* + A \rightarrow V + A'$





New Reactions (e,e'J/Psi):

Considering $\gamma^* + d \to J/\Psi + p + n \quad \gamma^* + d \to J/\Psi + d'$

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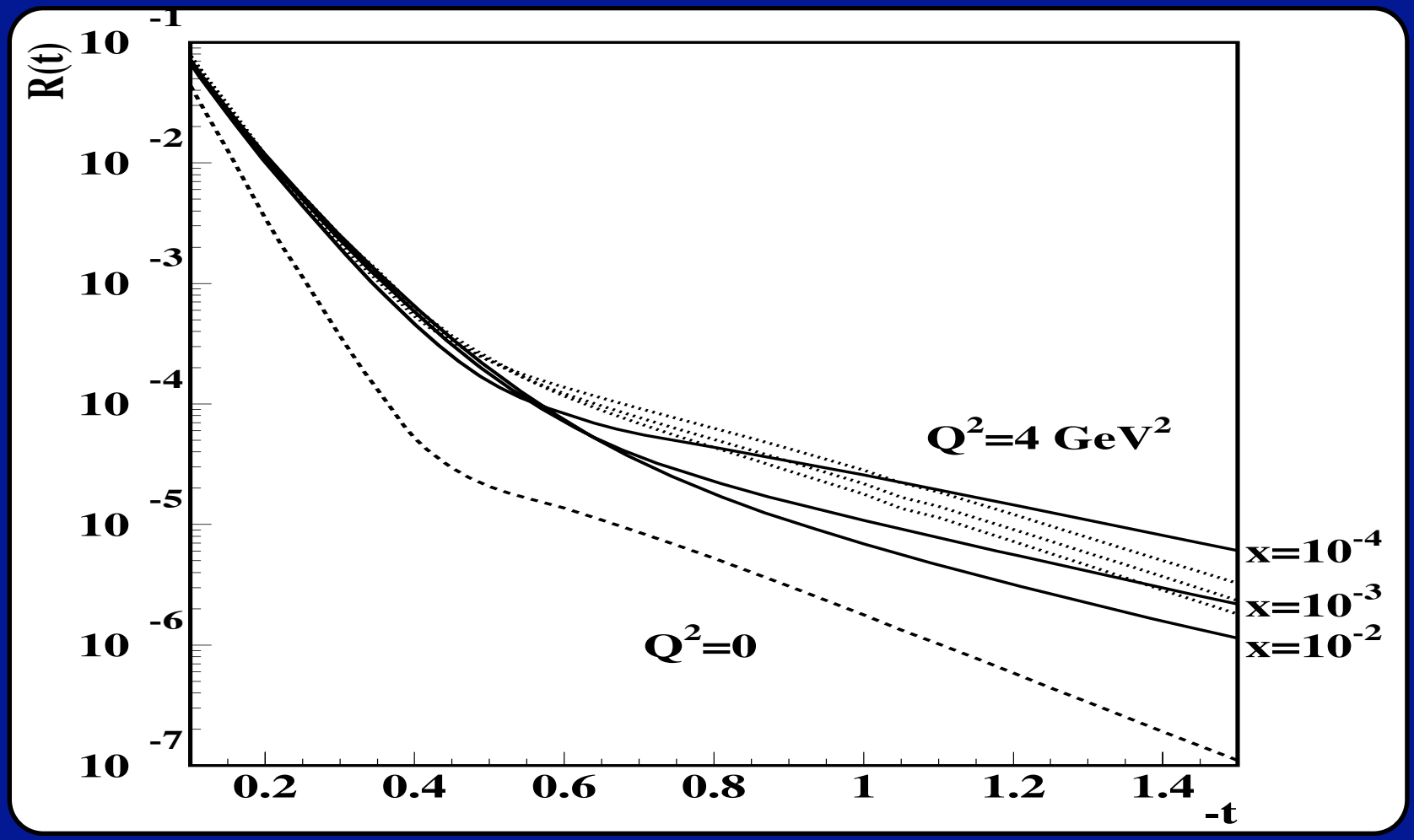
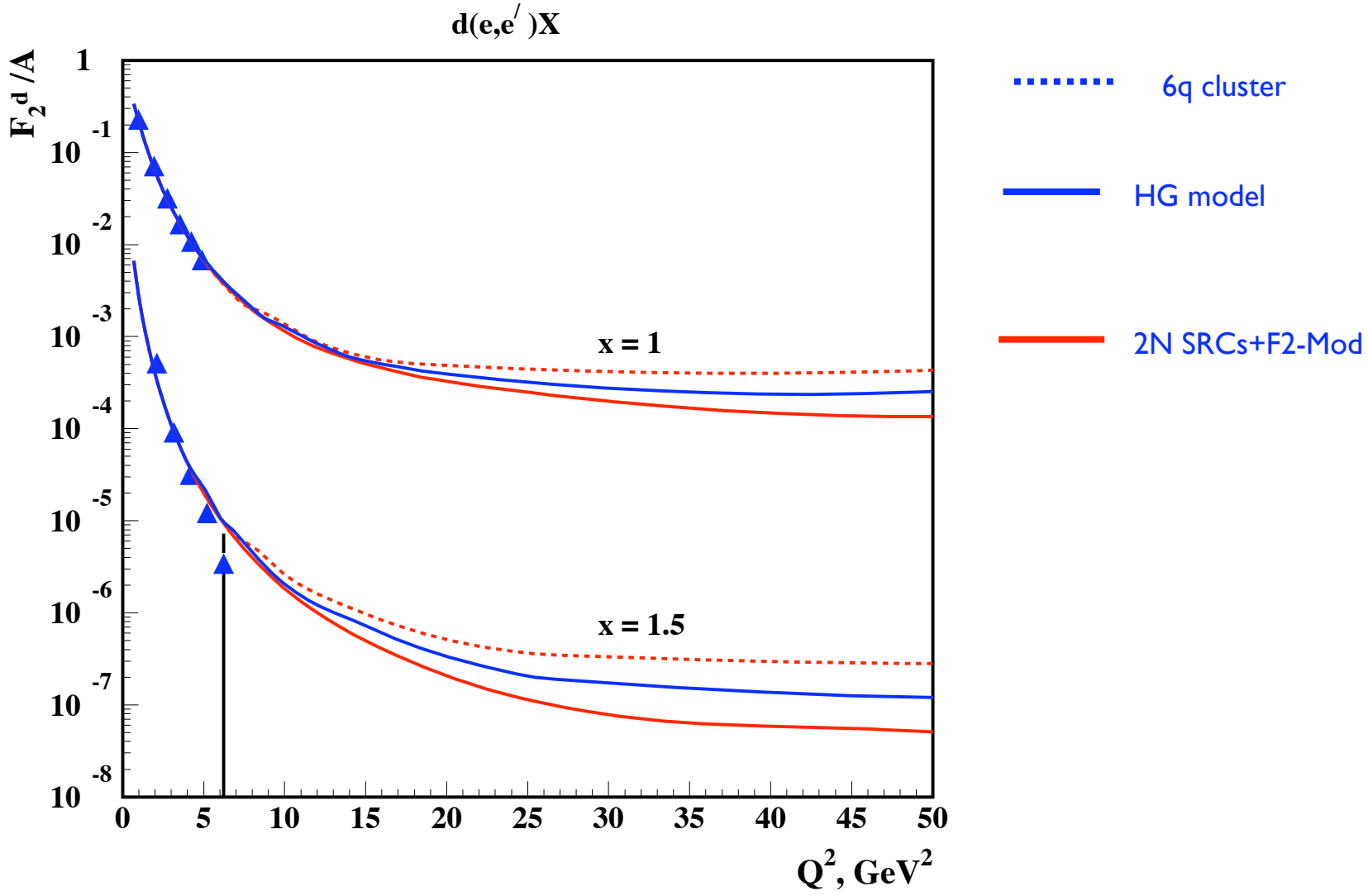


(c) Possible "Flagship" Reactions for SRCs

- DIS at large x and superquarks



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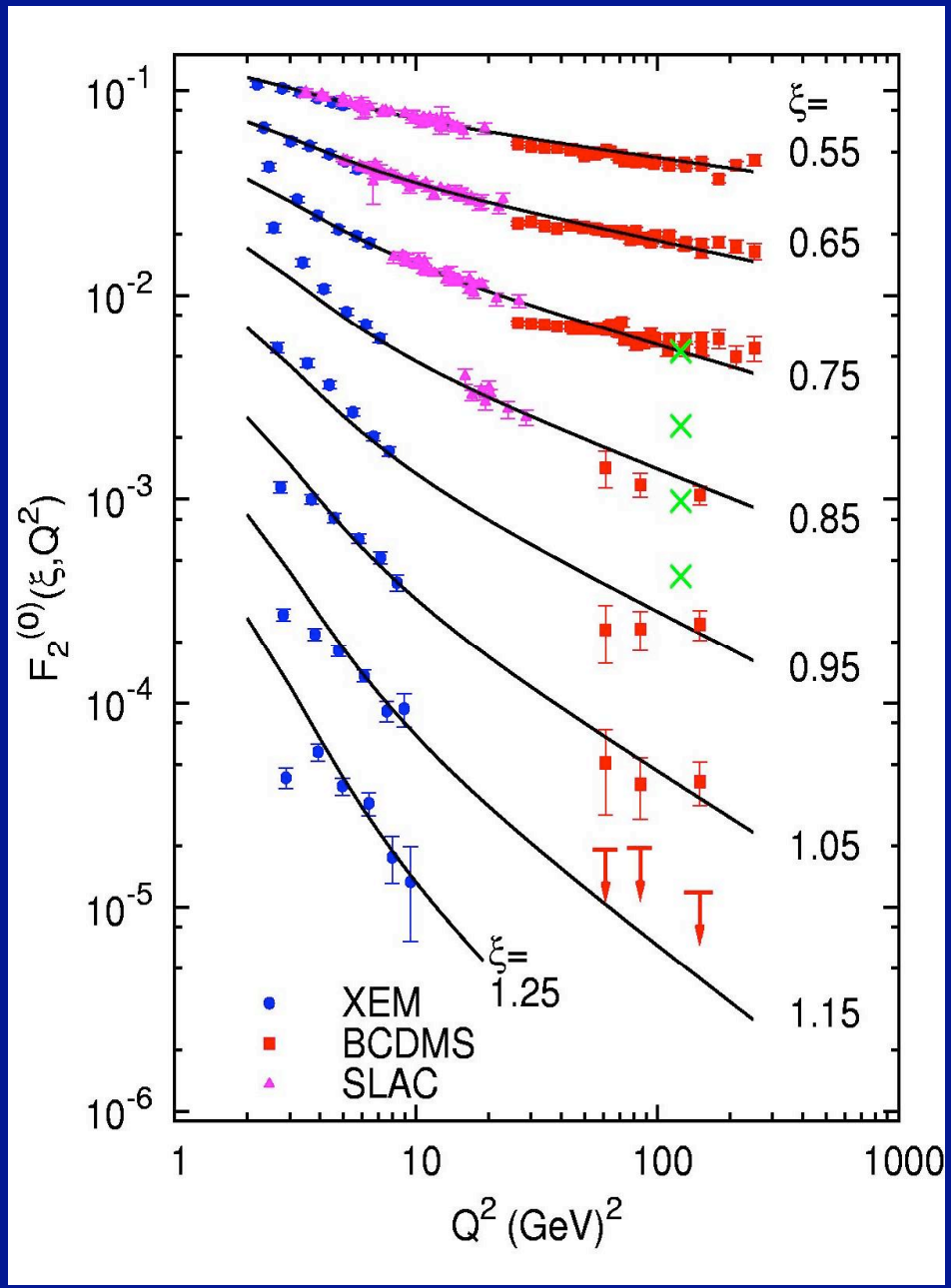
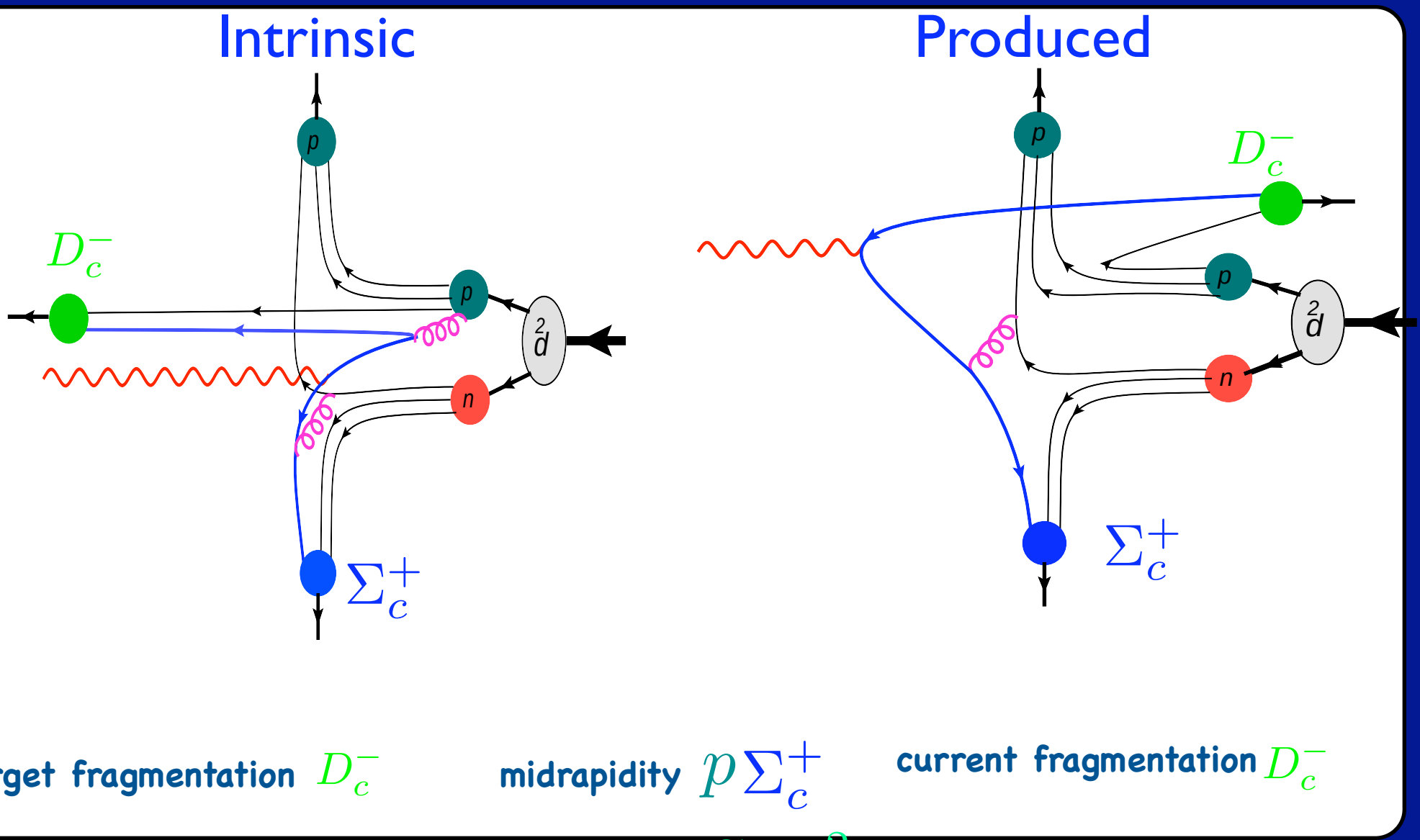


John Arrington

(c) Possible "Flagship" Reactions for SRCs

☑ Intrinsic Charm fragmentation region $\gamma + d \to p + \Sigma_c^+ + D_c^-$

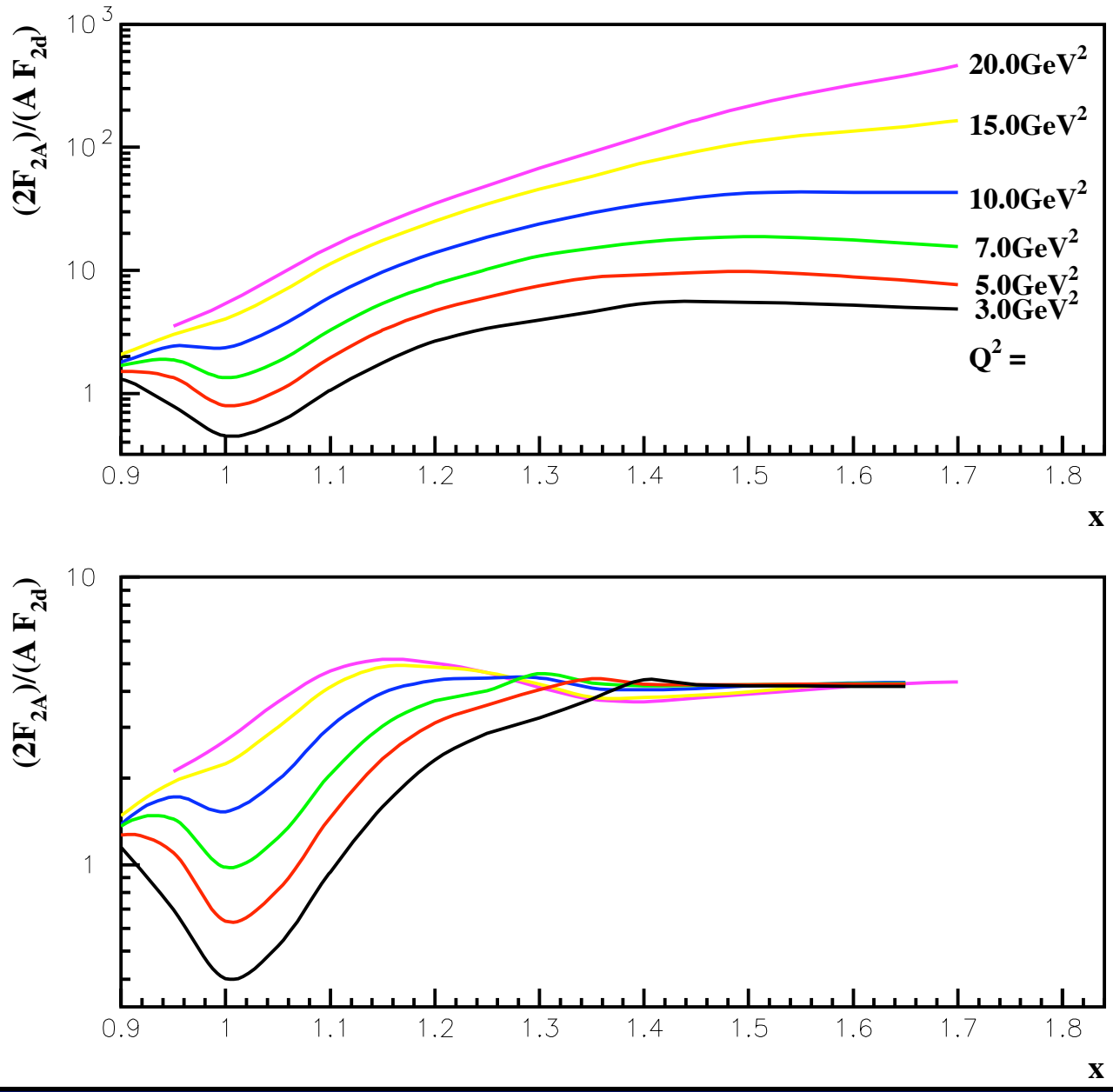


target fragmentation D_c^- midrapidity $p\Sigma_c^+$ current fragmentation D_c^-

$p_t = 2GeV/c$ $s = 412\ \mathrm{GeV}^2$

(c) Possible "Flagship" Reactions for SRCs

- multi-nucleon short range correlations



Outlook

- [x] Kinematics
- [x] Counting Rates
- [x] New Processes
- [x] People Involved/Strategy

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M. Strikman, J. Miller, R. Venugopalan,
C. Ciofi, W. Cosyn, C. Granados

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Calculations

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Simulations

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Criticism