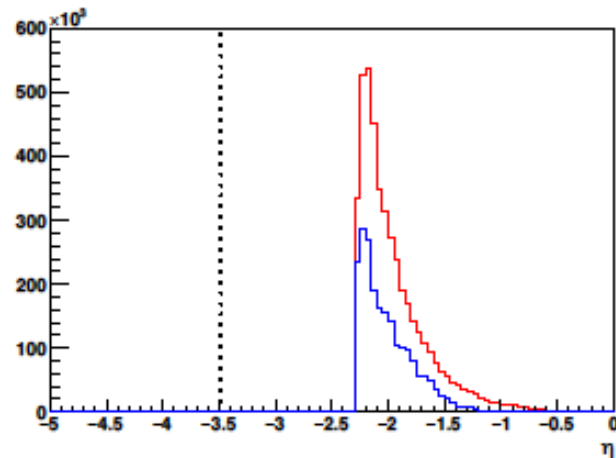# Complementarity
New input from exclusive processes

Raphael Dupré, Salvatore Fazio, Tuomas Lappi, Barbara Pasquini, Daria Sokhan

DVCS & pi0

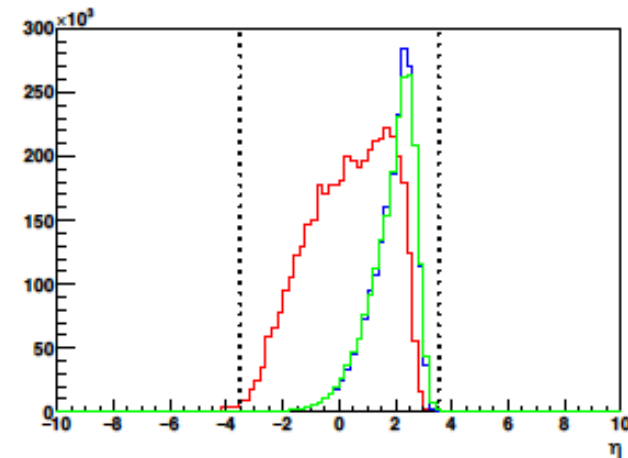pseudo-rapidity distributions for 5 GeV x 41 GeV beam energies

$Q^2 > 1$ GeV^2
$0.01 < y < 0.95$
$L = 10$ fb^{-1}

- DVCS: e'
- DVMP π^0: e'

- DVCS: γ
- DVMP π^0: π^0
- DVMP π^0: $\pi^0 \to \gamma\gamma$
  (histogram scaled by 0.5)

$Q^2 > 1$ GeV^2
$0.01 < y < 0.95$
$L = 10$ fb^{-1}

DVCS & pi0

pseudo-rapidity distributions for 18 GeV x 275 GeV beam energies

$Q^2 > 1$ GeV^2
$0.01 < y < 0.95$
$L = 10$ fb^{-1}

● DVCS: e'
● DVMP π^0: e'

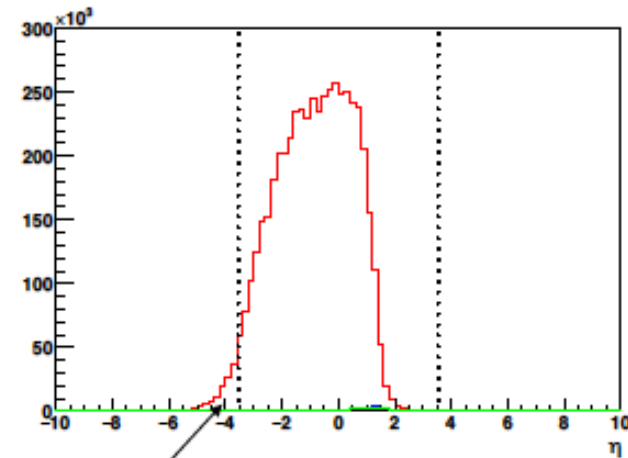● DVCS: γ
● DVMP π^0: π^0
● DVMP π^0: $\pi^0 \rightarrow \gamma\gamma$
(histogram scaled by 0.5)
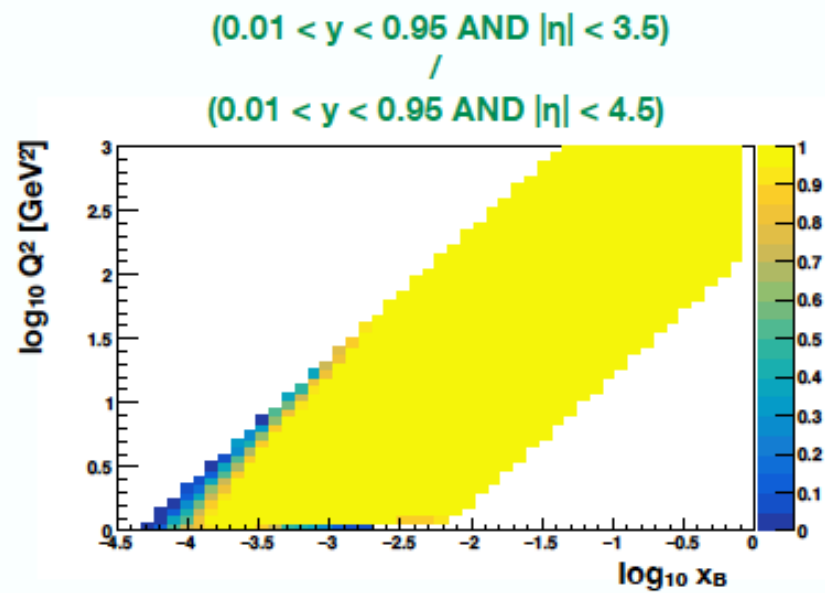
this will be lost
with |eta| < 3.5 acceptance

DVMP π^0 is totally suppressed at
these beam energies

DVMP π^0 measurement only possible
at low energies
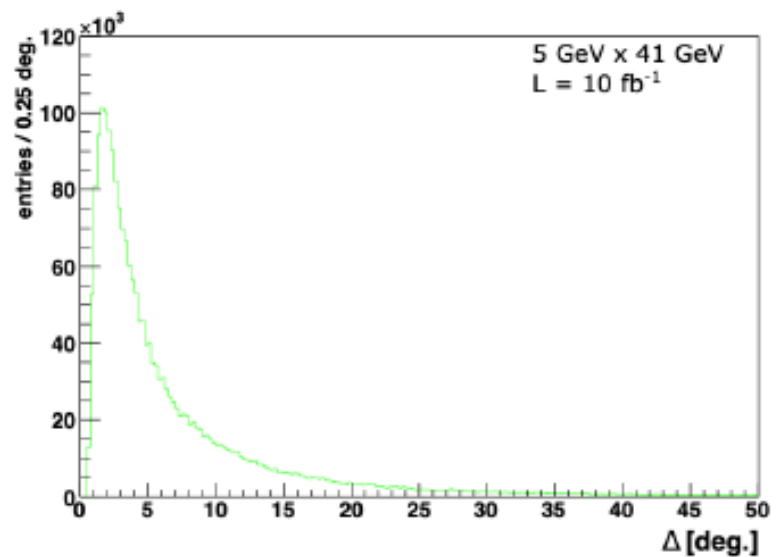
2

phase-space for 18 GeV x 275 GeV beam energies

here we show which part of phase-space
will be affected by |eta| < 3.5 acceptance

$(0.01 < y < 0.95$ AND $|\eta| < 3.5)$
/
$(0.01 < y < 0.95$ AND $|\eta| < 4.5)$

DVCS & pi0
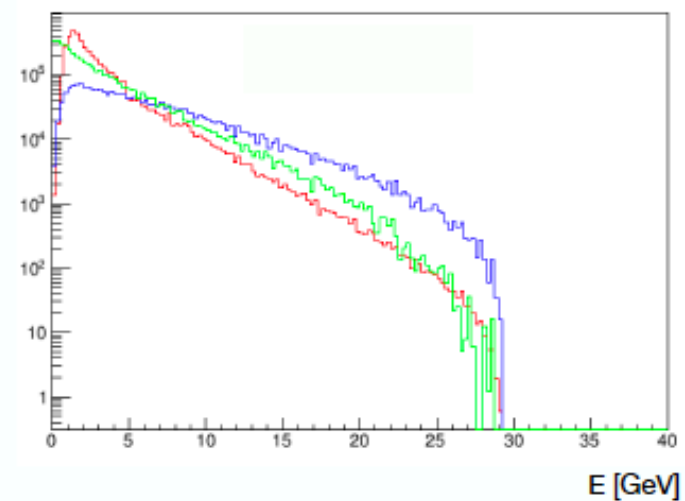
Q² > 1 GeV²
0.01 < y < 0.95
|eta| < 3.5
L = 10 fb⁻¹   • DVMP π^0: $\pi^0 \to \gamma\gamma$
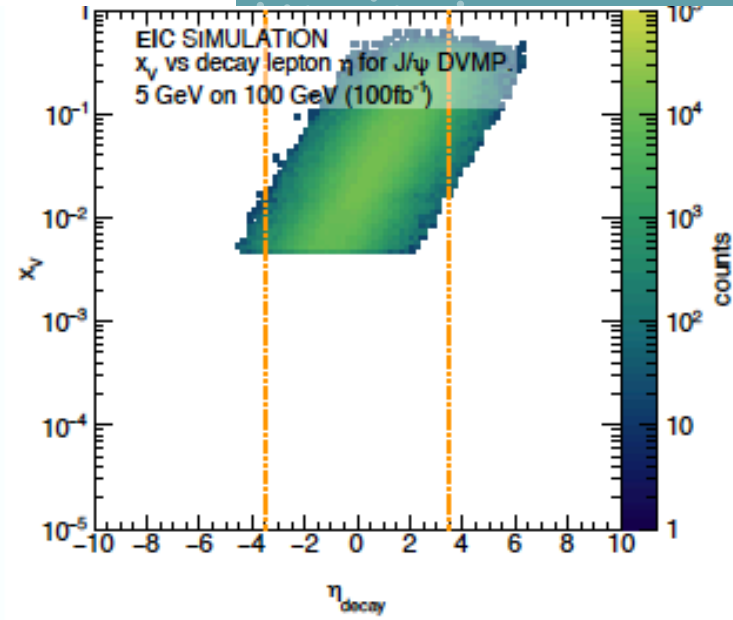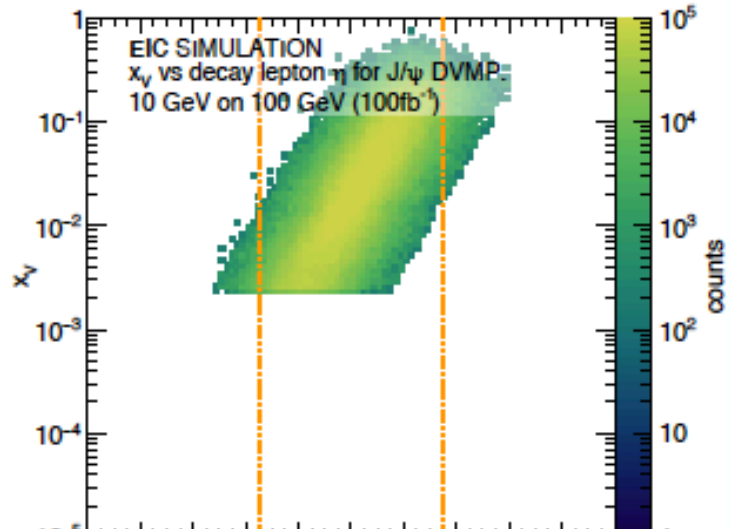

distributions of energy

5 GeV x 41 GeV

Q² > 1 GeV²   • DVCS: γ
0.01 < y < 0.95
|eta| < 3.5   • DVMP π^0: π^0
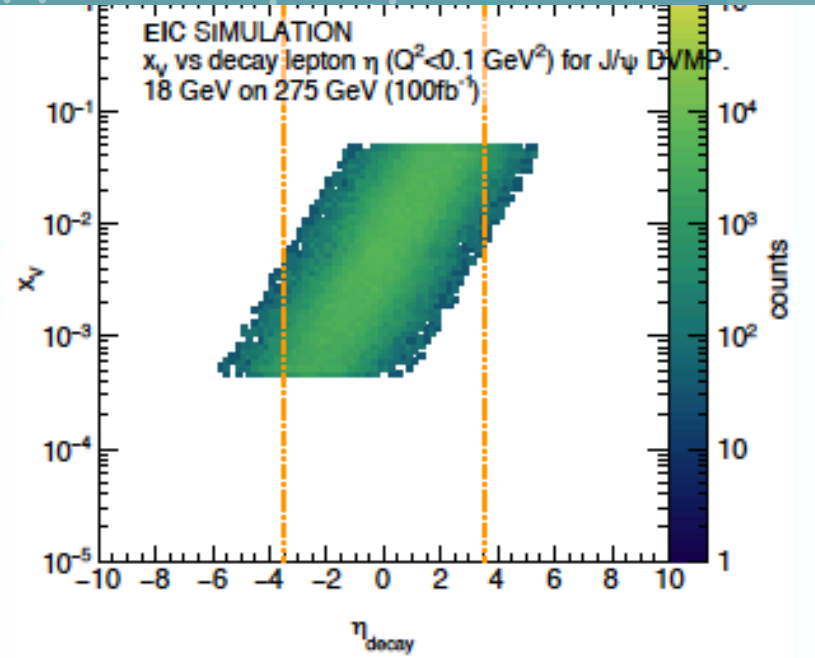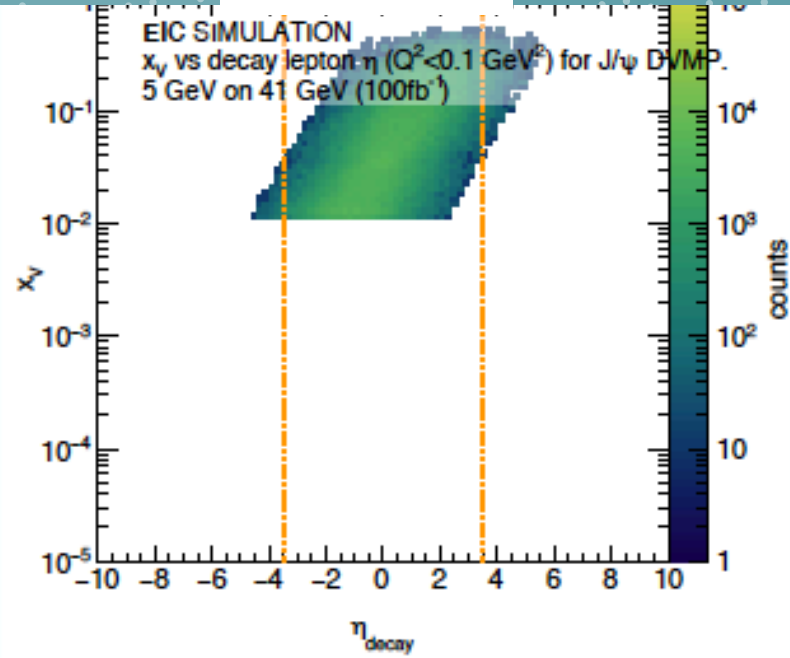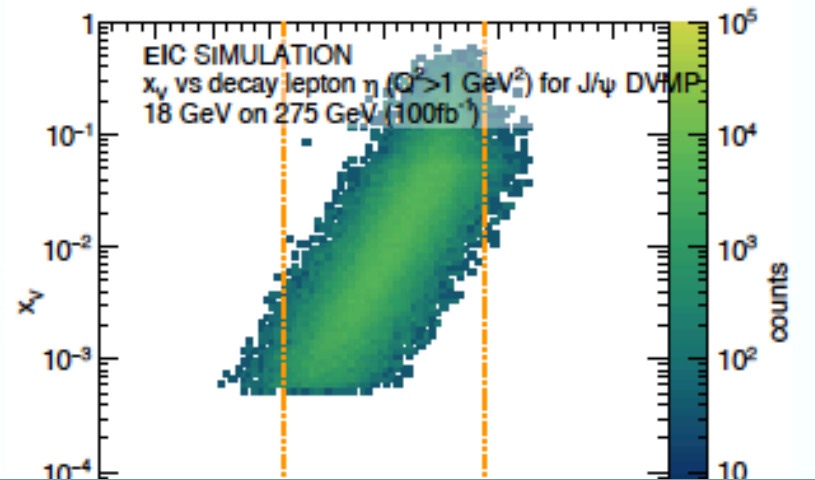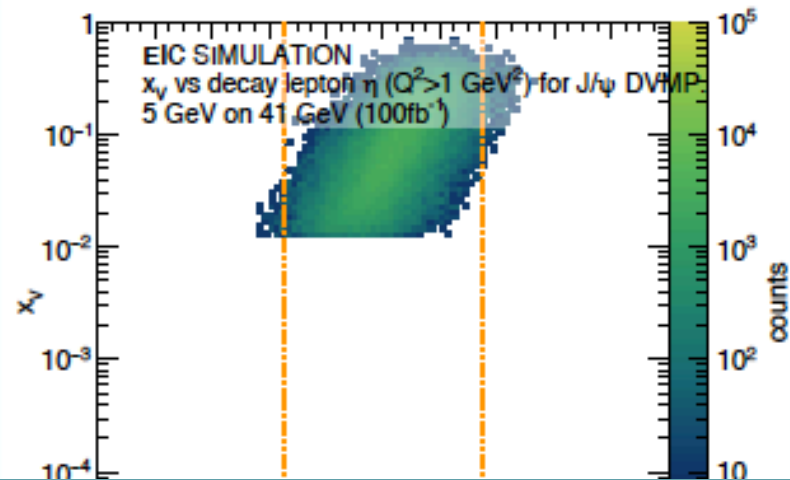L = 10 fb⁻¹   • DVMP π^0: $\pi^0 \to \gamma\gamma$
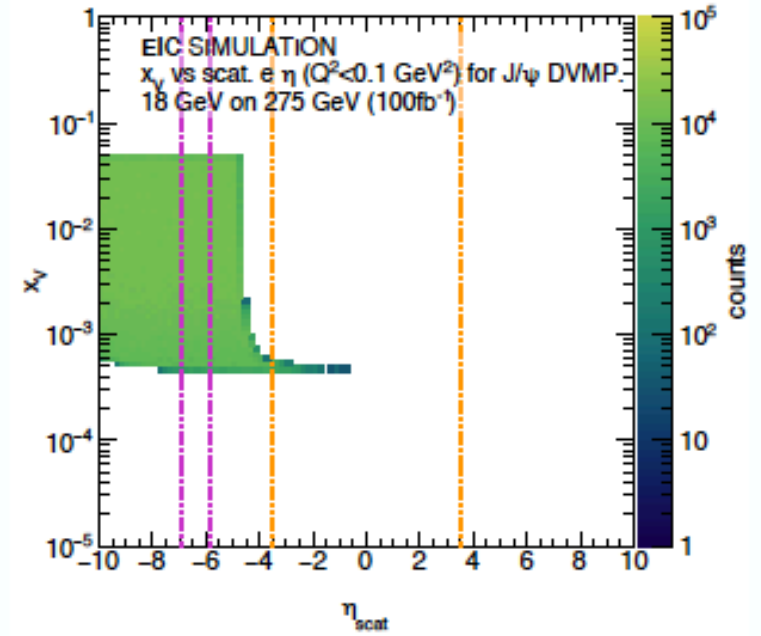
All events

DVMP

Photoproduction

Electroproduction

DVMP
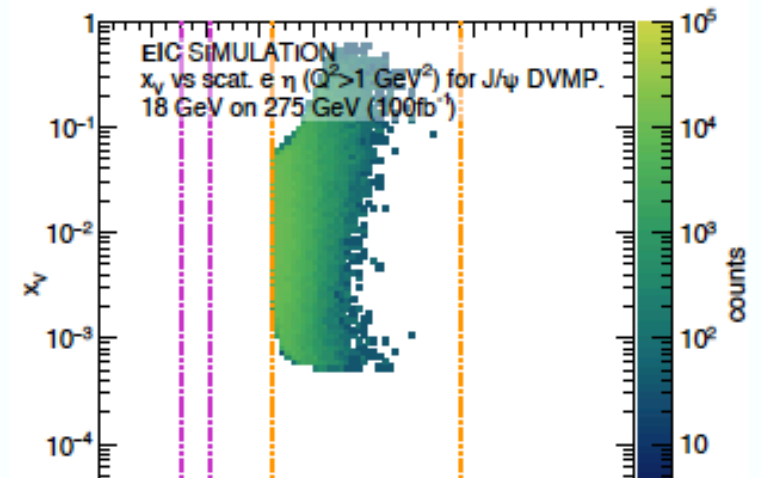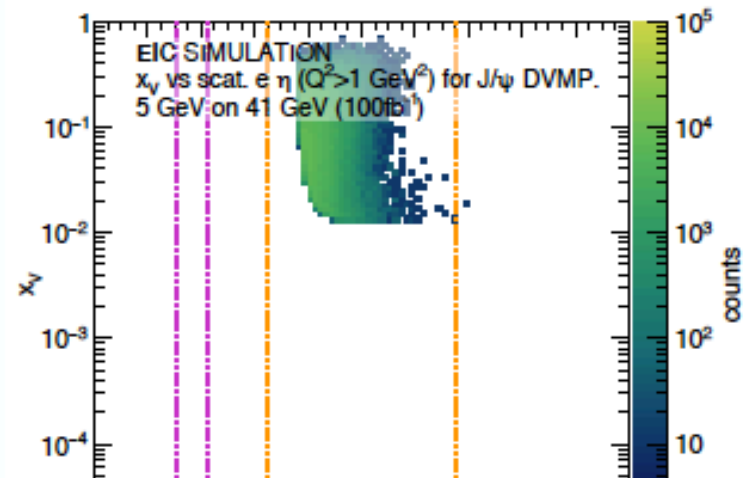

Photoproduction

Electroproduction

u-channel exclusive π^0 production at first IR

Two options:
1. Missing mass reconstruct the proton. resolution? in-elastic background?

2. **Dedicated detector here**
$\eta \sim 4.13$

White Circle: $|\eta| = 4.0$
White Circle: $|\eta| = 3.5$

Figures created by Alexander Kiselev

5 GeV electron on 100 GeV proton

beam pipe

p

Outside of the $\eta < |3.5|$ detector acceptance

$\pi \rightarrow 2\gamma$ (ZDC)

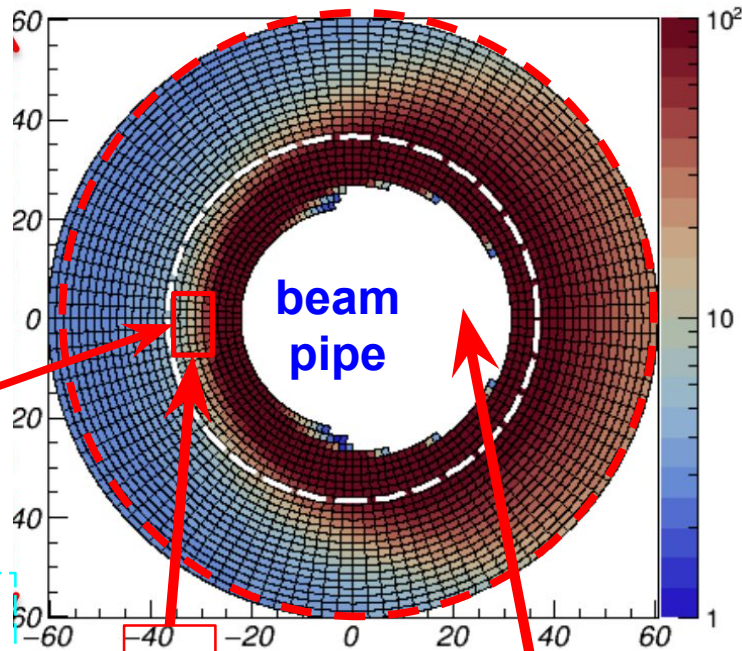| Q^2 (GeV^2)	W (GeV)	x_B	$\theta_{e'}$ (deg)	$\eta_{e'}$	$P_{e'}$ (GeV)	$\theta_{p'}$ (deg)	$\eta_{p'}$	$P_{p'}$ (GeV)	θ_{π^0} (deg)	η_{π^0}	P_{π^0} (GeV)	$-t$ (GeV^2)	$-u$ (GeV^2)
6.2	3.19		152	-1.39	5.31	-1.84	4.13	43.40	1.43	4.38	56.29	14.84	-0.37
7.0	3.19		150	-1.32	5.35	-1.92	4.09	45.50	1.43	4.38	54.12	16.19	-0.39
8.2	3.19		148	-1.24	5.40	-1.85	4.12	49.74	1.43	4.38	49.84	16.80	-0.42
9.3	3.19		146	-1.19	5.46	-1.92	4.09	51.90	1.43	4.38	47.60	18.19	-0.44
10.5	3.19		144	-1.12	5.52	-1.94	4.07	54.96	1.43	4.38	44.50	19.32	-0.47

@ 2 IR with different crossing point of 50 mRad

Table 1: 50 mrad, 5e on 100 p

Q^2 (GeV^2)	$\theta_{e'}$ (deg)	$\eta_{e'}$	$P_{e'}$ (GeV)	$\theta_{p'}$ (deg)	$\eta_{p'}$	$P_{p'}$ (GeV)	θ_{π^0} (deg)	η_{π^0}	P_{π^0} (GeV)	P_γ (GeV)
6.25	152	-1.39	5.336	0.43	5.59	43.3	2.86	3.69	56.35	28.18

This will not help with the proton detection

p

beam pipe

u-slope study

p

$\pi \rightarrow 2\gamma$ (ZDC)

$u \sim u_{min}$ study

$\pi \rightarrow 2\gamma$?
$\rho \rightarrow 2\pi$
$\omega \rightarrow 3\pi$
$\phi \rightarrow 2K$?
J/psi $\rightarrow 2e, 2\mu$