## Compton IP location (V3)

Ciprian Gal

## New lattice



- The current configuration that Zhengqiao suggested has the IP in the middle of Q9EF, the electron detector in front of Q7EF ( $\sim 9.3 \mathrm{mDS}$ from IP) and the photon detector in front of Q3EF ( $\sim 44 \mathrm{~m}$ DS from IP)
- This configuration has the Q8EF magnet (after the dipole) being focusing for electrons which significantly reduces the horizontal width at the electron detector location
- Simulation ran with $\sim 45$ degree angle for spin direction (in the xz plane)
uXsec q08US :4999964


## gamma

- The magnets are coded as having a IR of 60 mm and an OR of 250 mm
- By these sizes everything beyond Q7 would need to have a horizontal hole to allow the photon envelope to reach the detector


UXsec q05DS :4996274



uXsec q06US :4999964


uXsec q06DS :4999964


UXsec q04DS :4996266



UXsec q05US :4996278


UXsec q03US :4996124


## gamma

- The transverse size at the photon detector would be on the level of 8mm


UXsec q05DS :4996274


Xsec q04US :4996269


uXsec q07US :4999964
uXsec q08DS :4999964


## Compton photons at the detector location <br> pXsec q03US :499618



- The sensitivity to the transverse component would be increased in this configuration
- The distance between the "peaks" is 2 mm compared to the
 previous $\sim 1.2 \mathrm{~mm}$
uXsec q09DS :5000000


## electrons

- Compton scattered electron envelope (5e6 events) weighted by unpolarized cross sections at all locations
downstream of the IP
- The "*" (stars) are the locations where a 18 GeV electron starting in the middle of the Q9EF quad interacts with each detector


UXsec q07DS :5000000


UXsec q05DS :5000000


uXsec q06US :5000000

uXsec q04US :5000000

uXsec q07US :5000000


UXsec q06DS :5000000


UXsec q04DS :5000000



UXsec q05US :5000000


UXsec q03US :2157497

pXsec q09DS :500000

## electrons

- Asymmetry as a function of position for Compton electron at each detector location

pXsec q07DS :500000

pXsec q05DS :500000


pXsec q06US :500000

pXsec q04US :500000

pXsec q08DS :500000
pXsec q07US :500000

pXsec q06DS :500000

pXsec q04DS :500000


pXsec q05US :500000

pXsec q03US :215435



## Compton electrons at detector location

- Because the low energy (high positive
pXsec q07US :500000 analyzing power) electrons are more affected by the focusing quad we can see we have about 7 mm of clearance from the main beam o be able to catch the 0-crossing
- If we assume similar divergences as before (500um) then 10 sigma is already at 5 mm
- We can expect that this would be worse at 5 GeV
- The distortion could potentially add to our systematic budget



## New lattice(V3p1)

- I would like to suggest a different configuration where the IP would be upstream of the Q6 quad
- The electron detector would be in front of Q4 (about the same distance from IP) but behind a defocusing quad
- The photon detector would remain in front of Q3 with a distance for about 29 m from the IP
- The IP would be on the beamline and NOT in a quad which should simplify the engineering and construction
gamma

uXsec q05DS :999996

- In this configuration we would need to "holes" in Q4 only

uXsec q04US:999996



UXsec q05US :999996

uXsec q03US :996942


## gamma

pXsec q03US :996942



UXsec q05DS :999996

uXsec q06US :1000000

uXsec q04US:999996




- The transverse size of the photons would be about 5 mm (at 18 GeV )
- The distance between the peaks would be 1.2 mm (comparable to the previous setup)


## Compton scattered electrons

pXsec q04US :1000000


uXsec q04US: 1000000

uXsec q06US - 100000



uxsec q04DS : 1000000

uxsec q05US -1000000

uxsec q03US: :881303


- We can see that the spread at the electron detector is roughly 100 mm
- The defocusing quad helps a lot
- We would need to get as close as 30 mm to the beam which would give us plenty of room
- The previous configuration had to get as close as 22 mm

18 GeV eDet(bQ9) polXsec


## Conclusions

- Having the IP in the middle of Q9 would basically mean abandoning an electron measurement
- A high precision longitudinal measurement with the photon detector alone would be rather challenging
- In contrast putting the IP before the last Q6 seem to preserve about the same FOM as we have studied in detail in the previous lattice, with some important additional advantages
- Studies should be done at 5 GeV to see how things stand up, but I am hopeful
- We should get the spin direction at the different IP locations to extract the appropriate analyzing power
- This configuration puts the electron detector in front of the sync spray from the US dipoles, but we should be able to shield that effectively if it is proven to be an issue


## Backup

$\square$
D.Cu_

\section*{| DaCKU |
| :--- | <br> $\square$ <br> }


$\qquad$
$\square$

## X-check beam simulation (V3)



- Beam started at middle of Q09
(0.246,0,85.8796) with angle of -0.00024298 rad (same as quad angle)
- Deviations from calculated center at each detector plane are under mostly under 1 mm
pXsec q09DS :500000
pXsec q08US :499999


## photons

- V3
- The sensitivity to the transverse component would be increased in this configuration






pXsec q06DS :499999

pXsec q04DS :499638

pXsec q05US :499641

pXsec q03US :499618



## X-check beam simulation (V3p1)


q06US__hits. $x$-426.799988





- Beam started at middle of Q09 (0.246,0,85.8796) with angle of -0.00024298 rad (same as quad angle)
- Deviations from calculated center at each detector plane are under mostly under 1 mm
photons
- V3p1


pXsec q05DS :999996


pXsec q06US :1000000

pXsec q04US :999996


pXsec q06DS :1000000

pXsec q04DS :999996


pXsec q05US :999996

pXsec q03US :996942

electrons

pXsec q05DS :1000000



pXsec q04DS :1000000


pXsec q03US : 881303

- V3p1

