

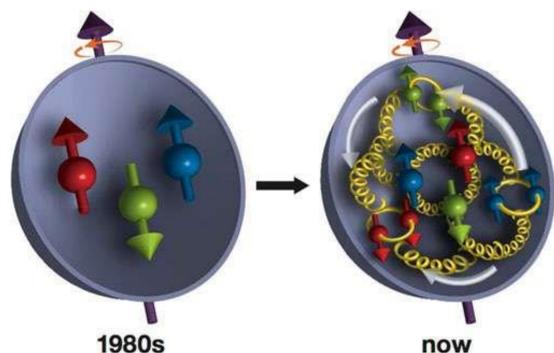
PHENIX results on direct photon cross section in pp at $\sqrt{s} = 510$ GeV

and upcoming longitudinal double-spin asymmetry A_{LL}

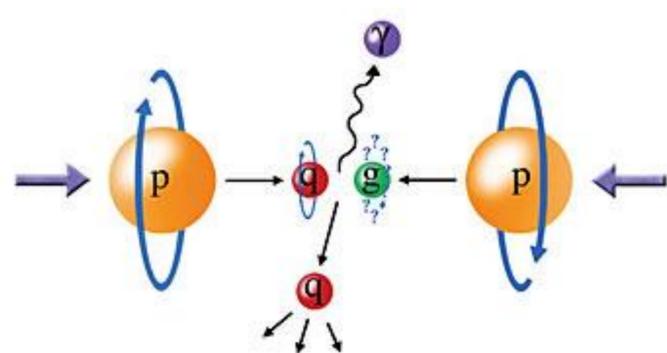
Zhongling Ji for PHENIX Collaboration



"Golden" channel



Proton is not simply made from uud quarks, but also sea quarks and gluons.

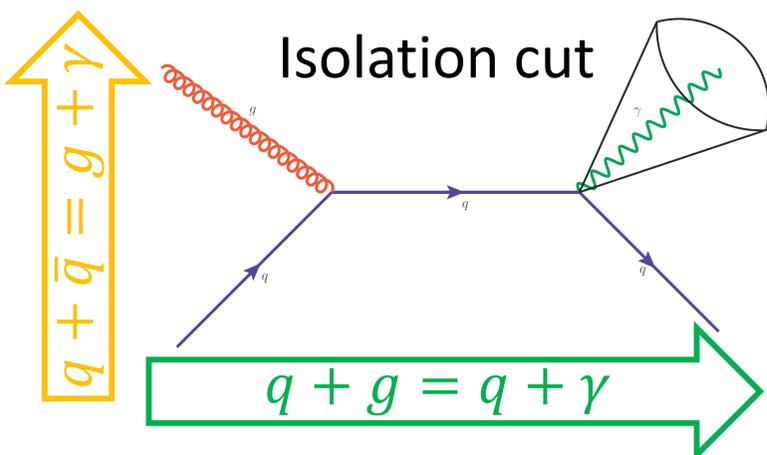


Direct photons probe the gluon distributions at leading order without fragmentation.

Signal and isolation cut

Wanted signal in γ^{direct} : $q + g = q + \gamma$ (~85%)

Other sources of γ^{direct} : $q + \bar{q} = g + \gamma$ Parton fragmentation to γ



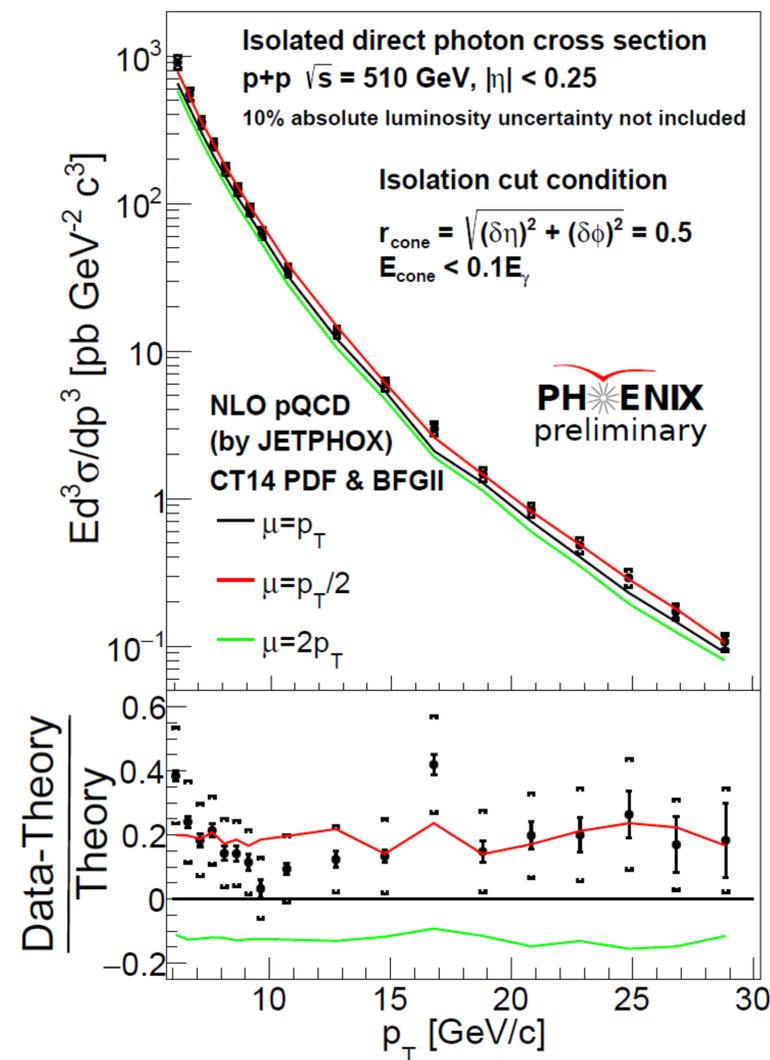
Particles other than γ within

$$r_{cone} = \sqrt{(\delta\eta)^2 + (\delta\phi)^2} = 0.5$$

Satisfy: $E_{cone} < 0.1 E_\gamma$

Isolation cut can reduce:

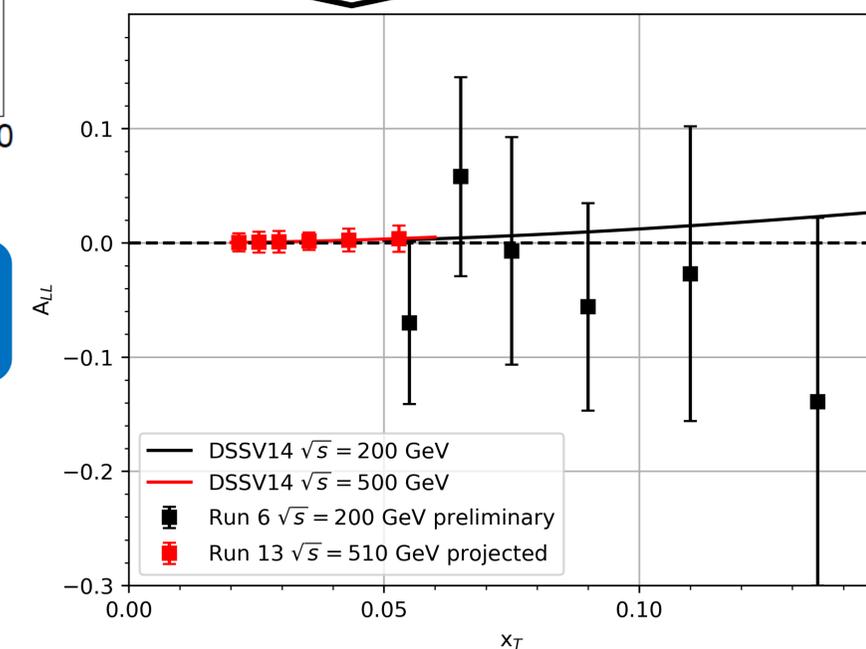
- π^0 background
- Parton fragmentation



Cross section

- NLO pQCD at $\mu = p_T/2$ agrees well with our measurement.
- Could be included in the future global fits for unpolarized gluon distribution and will constrain the distribution at high x .

Projected uncertainty for direct photon A_{LL} measurement



Upcoming A_{LL}

- 20 times larger luminosity.
- Reach much lower x .
- Additional constraints on gluon polarization.