Dijet Analysis of Polarized Proton – Proton Collisions at $\sqrt{s}$ = 510 GeV at STAR

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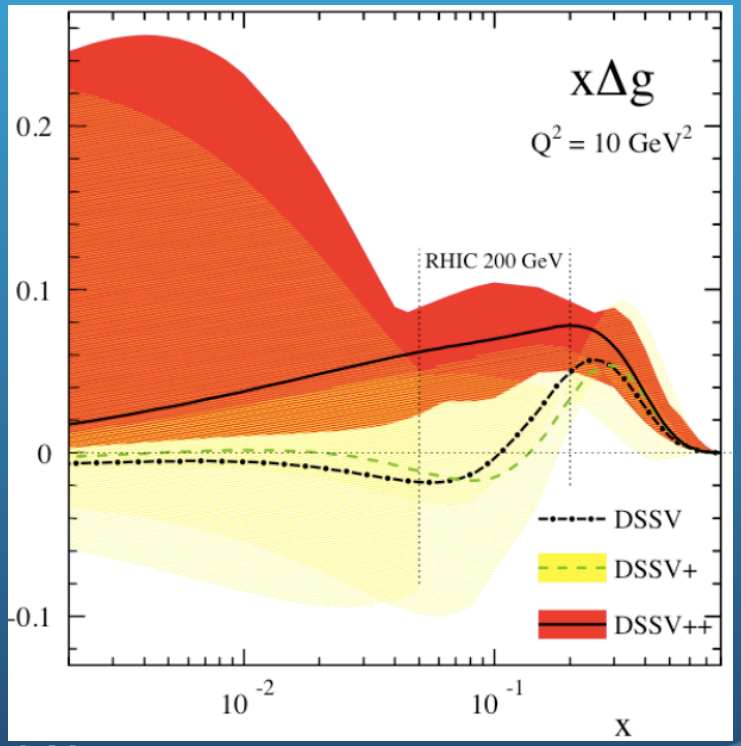
Motivation: Proton Spin Puzzle

Polarized DIS experiments determined the quark contribution to the spin of the proton is ~30%.

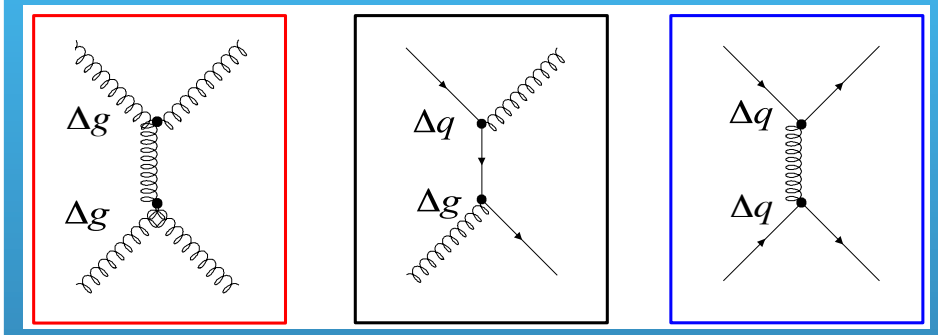
$$\frac{1}{2}\Delta\Sigma + L_q + \Delta G + L_g = \frac{1}{2}$$



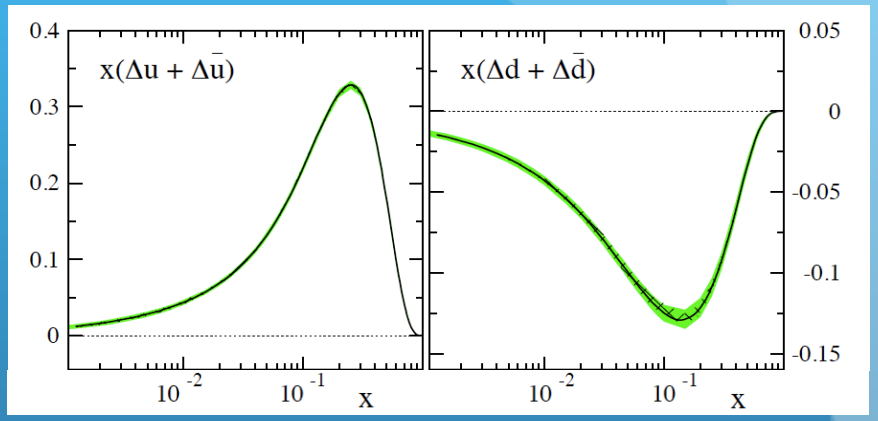
DSSV++

arxiv:1304.0079

Accessing ΔG at a polarized $\vec{p}\vec{p}$ collider



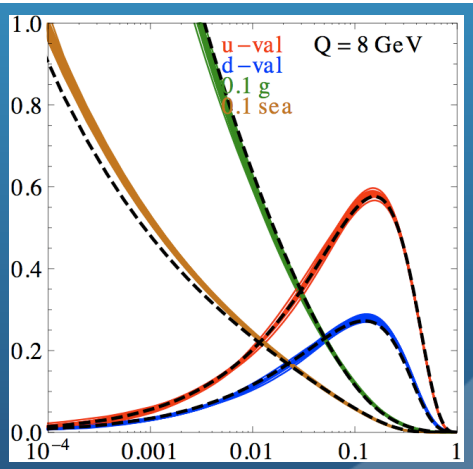
DSSV



PRL 101:072001, 2008

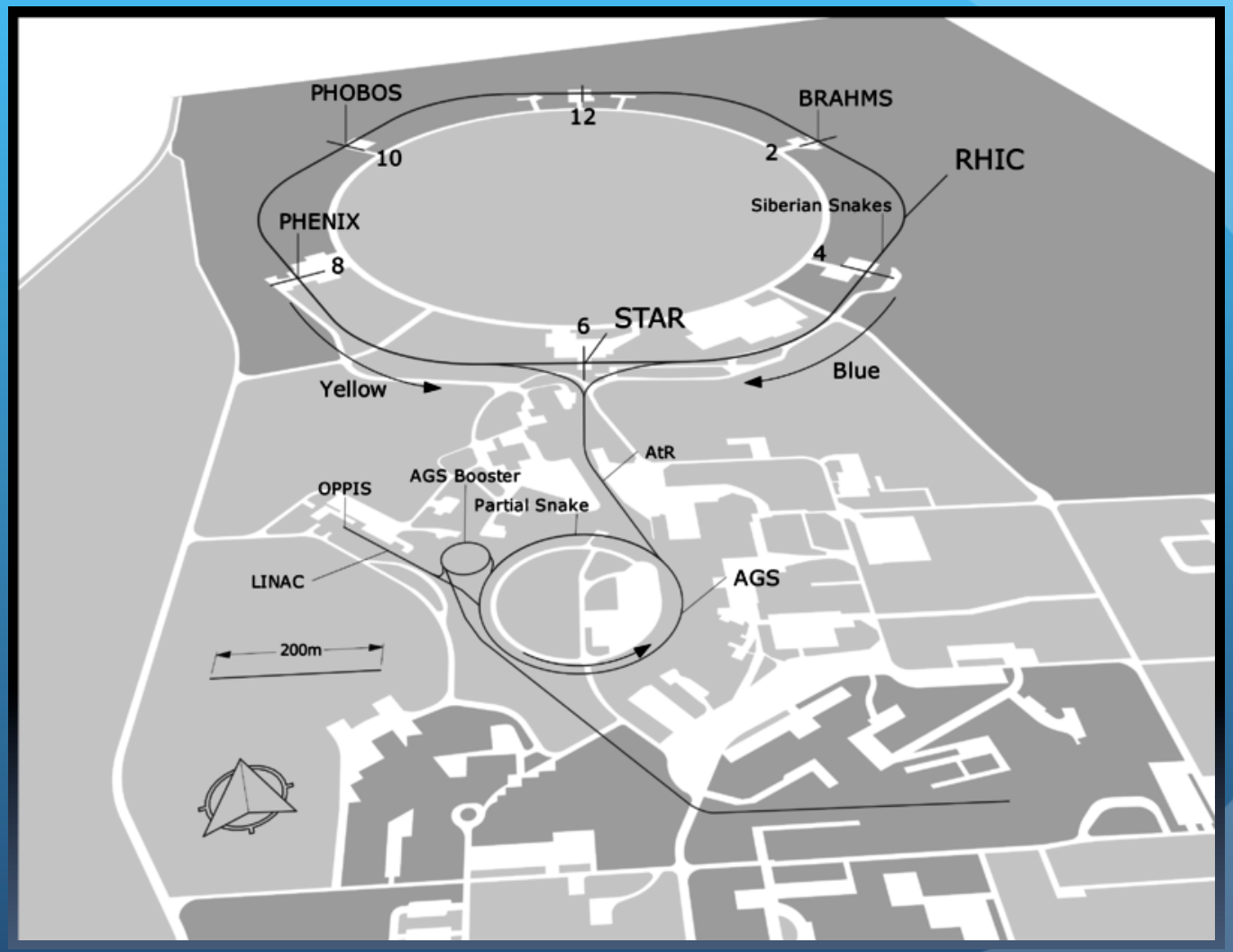
$$A_{LL} = \frac{\sigma^{++} - \sigma^{+-}}{\sigma^{++} + \sigma^{+-}} \propto \sum \frac{\Delta f_a \Delta f_b}{f_a f_b} \hat{a}_{LL}$$

Δf: helicity distribution functions

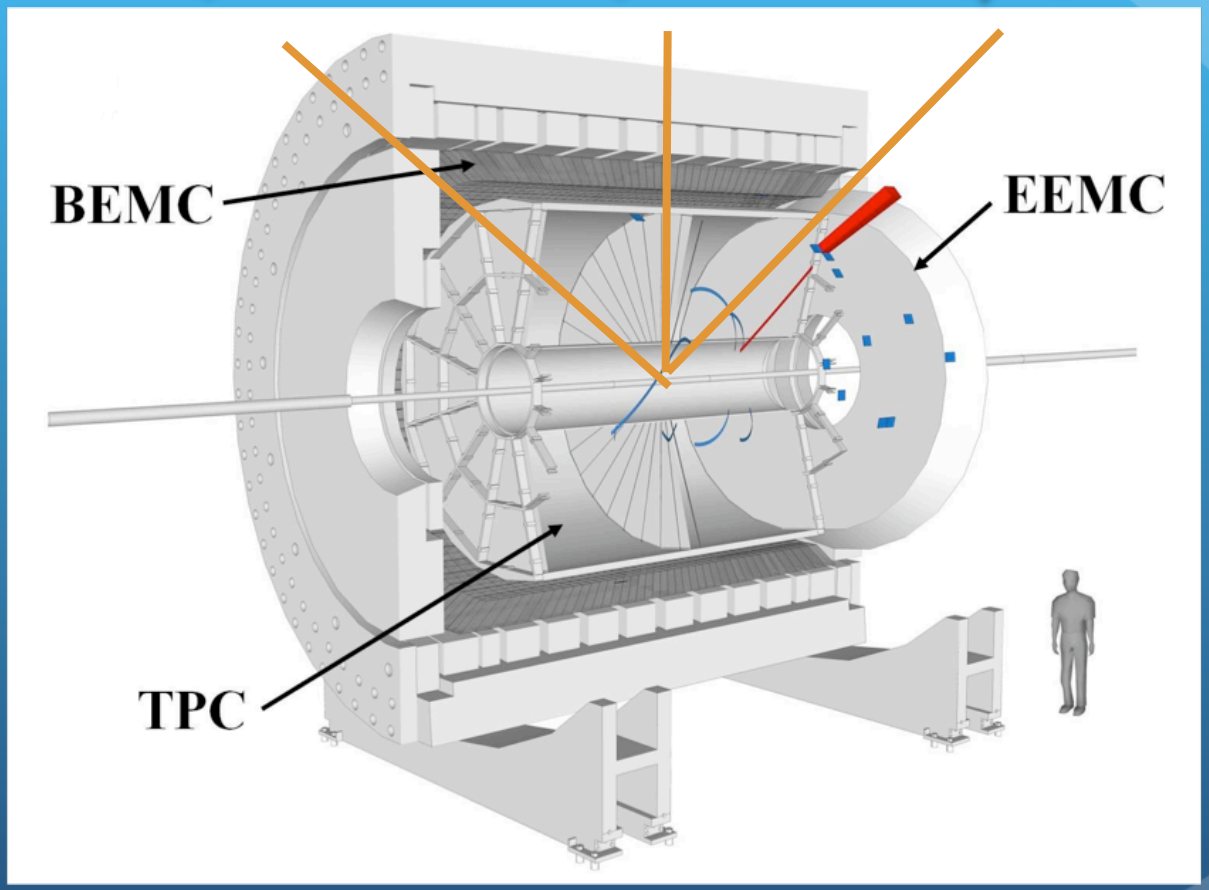


CT10 arxiv:1302.6246

Relativistic Heavy Ion Collider



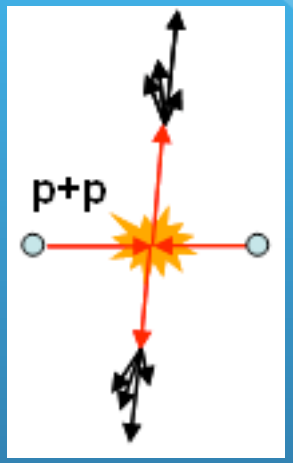
Solenoidal Tracker At RHIC



$\eta = -\ln[\tan(\Theta/2)]$

Dijet Analysis at 510 GeV

- What are jets?
- Inclusive jets, Dijets
- Why dijets?



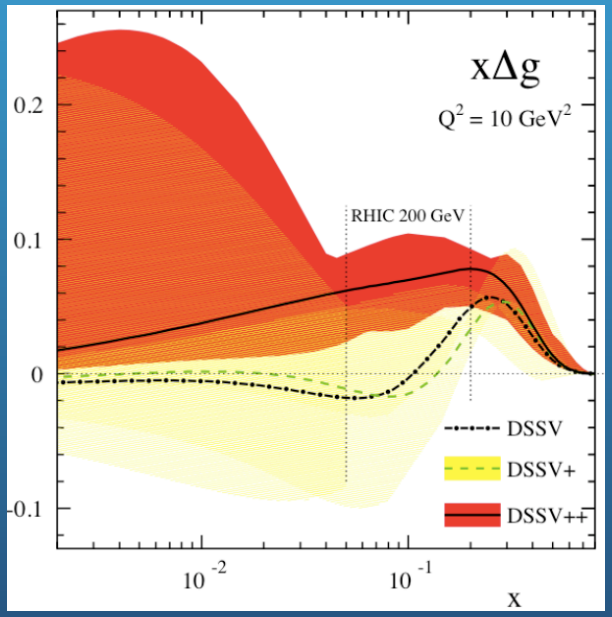
- Reconstructing dijets give access to initial partonic kinematics

$$x_1 = \frac{1}{\sqrt{s}}\left(p_{T3}e^{\eta_3} + p_{T4}e^{\eta_4}\right) \qquad x_2 = \frac{1}{\sqrt{s}}\left(p_{T3}e^{-\eta_3} + p_{T4}e^{-\eta_4}\right)$$

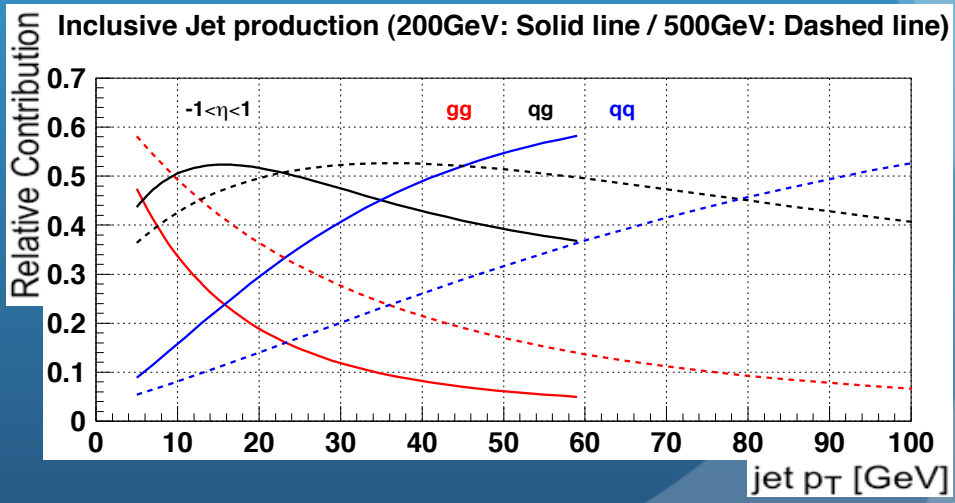
Dijet Analysis at 510 GeV

- Why dijets at 510 GeV ?

- The dijet A_{LL} at 510 GeV is sensitive to lower x values thus providing information on ΔG in a new kinematic regime.



DSSV++ *arxiv:1304.0079*



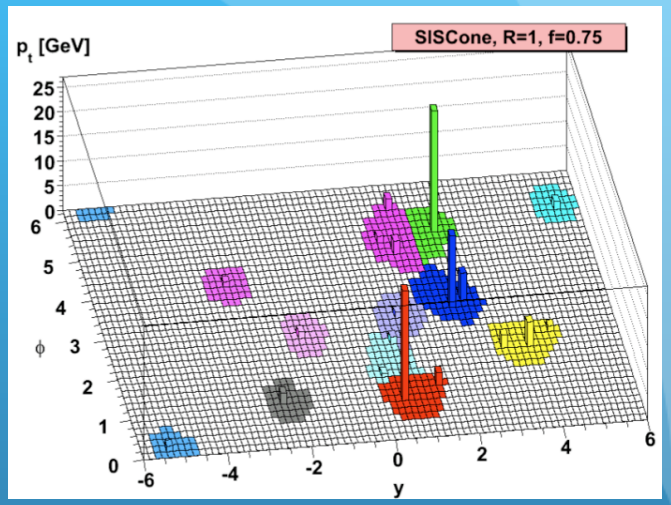
Jet Reconstruction

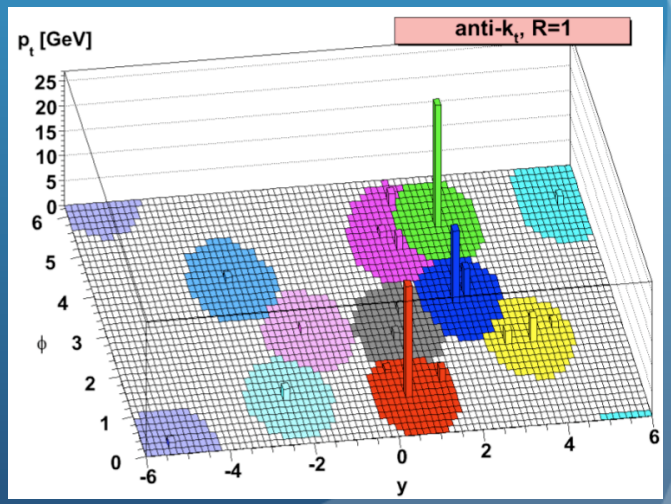
- MidPoint Cone Algorithm

  - Aggregate of all entities that lie within a certain R in the η-φ plane, starting with a seed

- Anti kT Algorithm

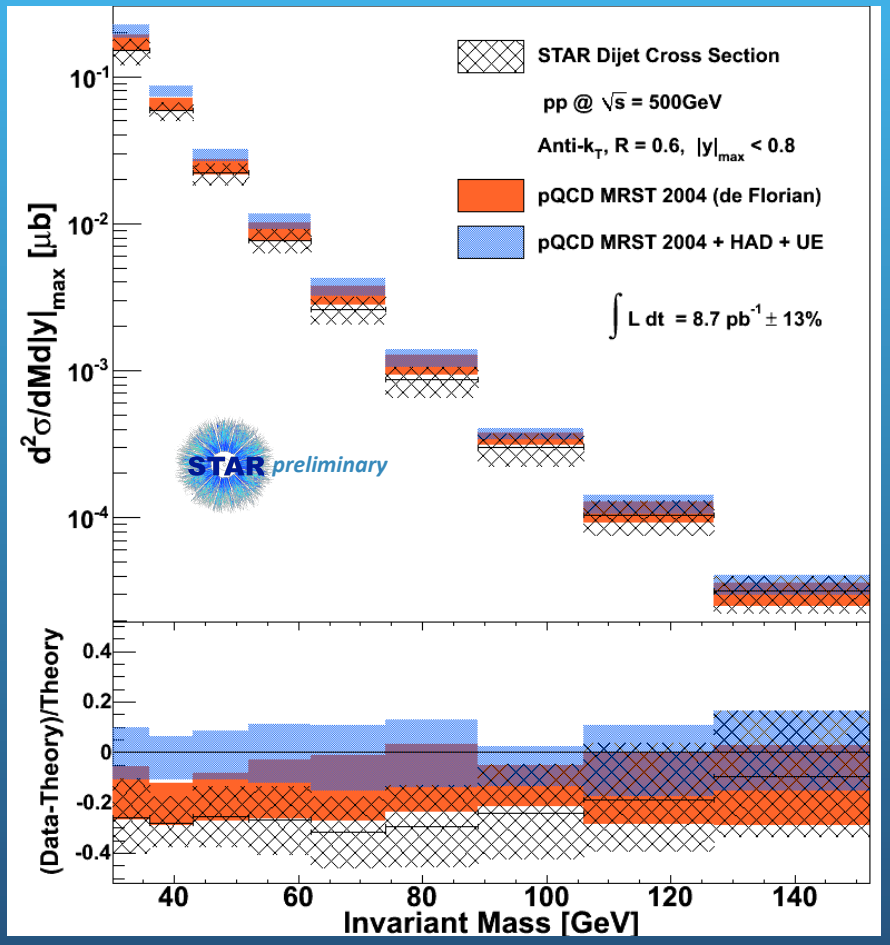
  - Aggregated on the basis of inverse momentum of each entity
  - Less susceptible to pileup
  - Smaller underlying event contributions
  - IR and Collinear safe to all orders





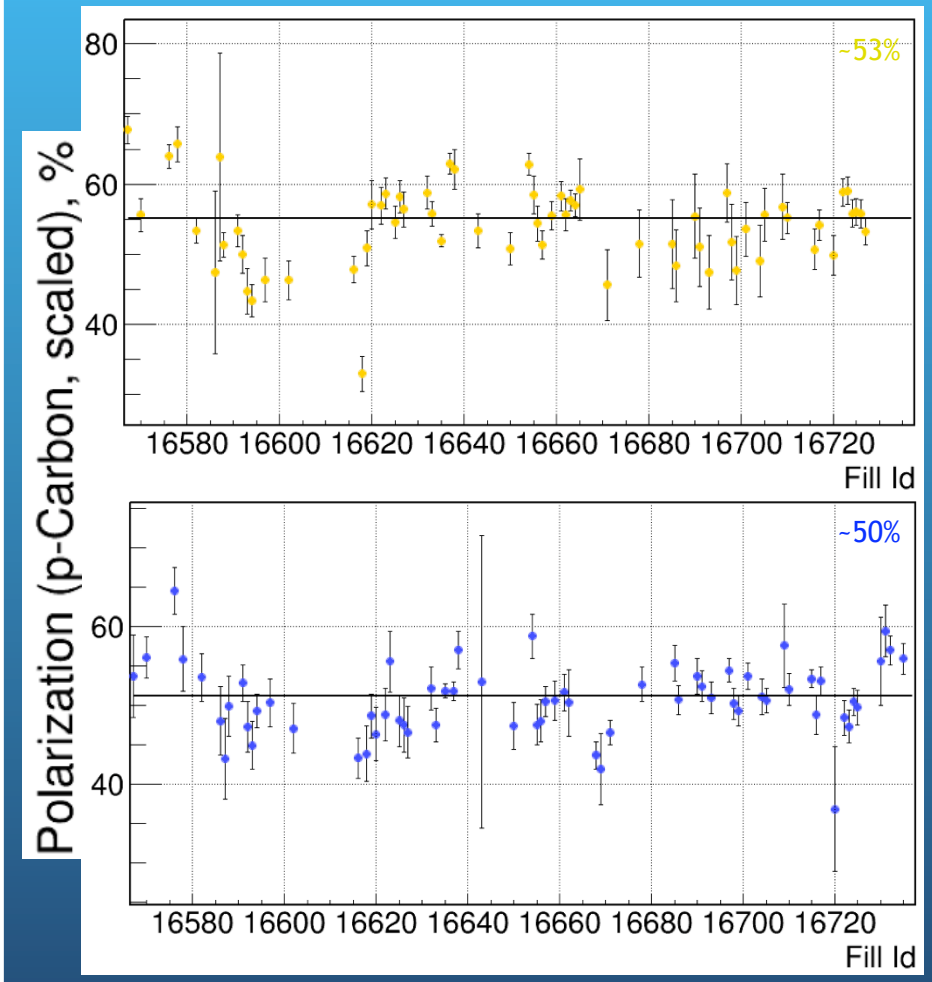
JHEP 0804 063(2008)

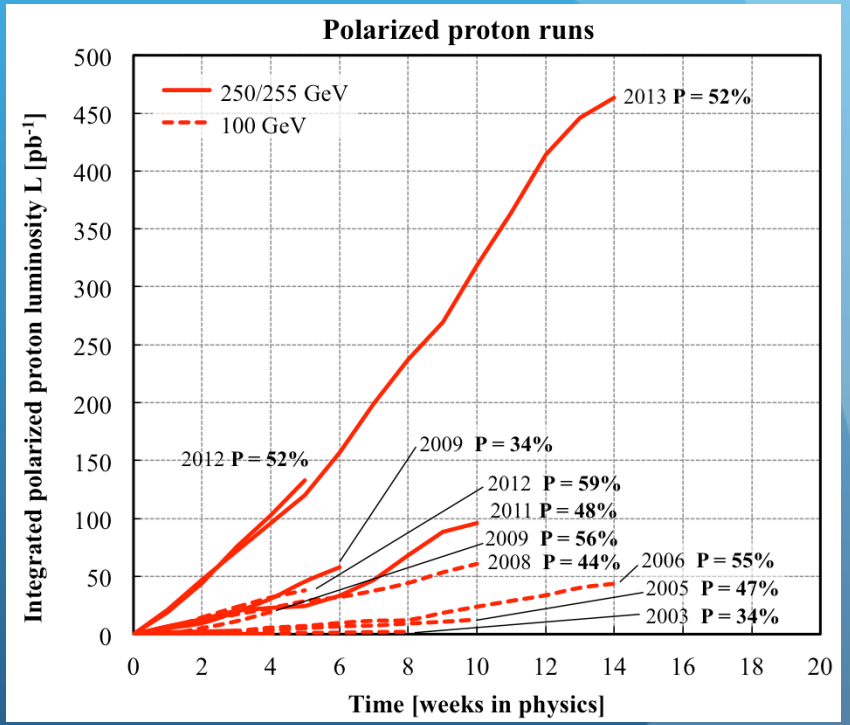
Dijet Cross section results for 510 GeV



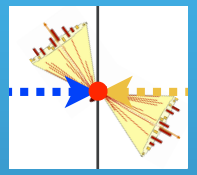
DIS 2013

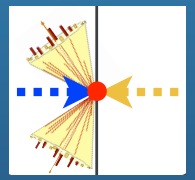
Run 2012 510 GeV data

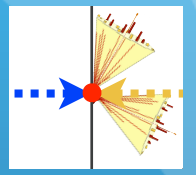


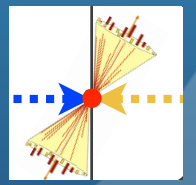


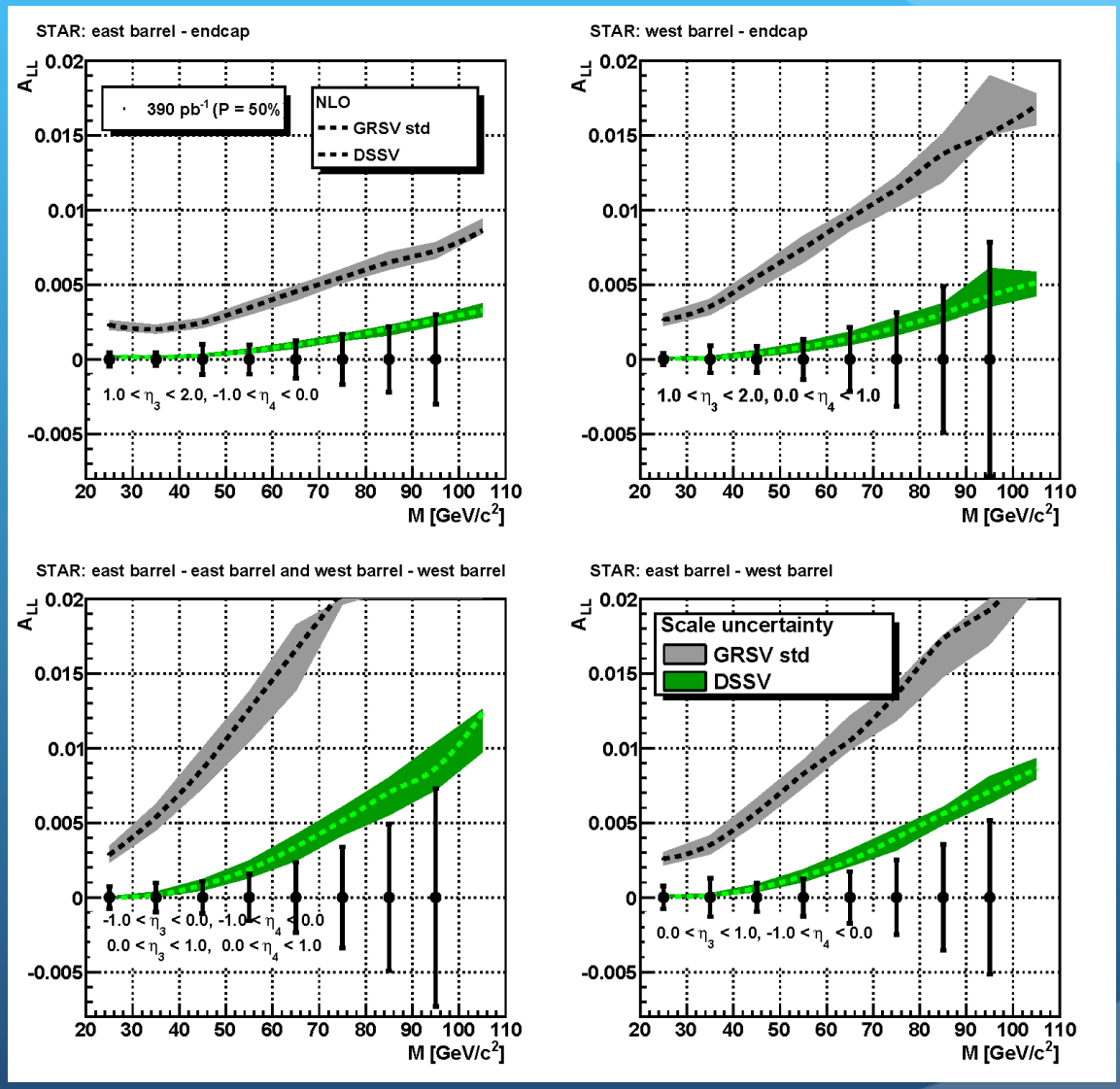
Projected dijet A_{LL} sensitivities from combined Run12 + Run 13 data











Summary

- Quark contribution to proton spin has been well constrained by DIS experiments
- During the past decade, RHIC has significantly reduced the uncertainties on ΔG
- Way to move forward – analyzing 510 GeV dijets, thus accessing lower x
- Dijet Cross Section was measured and shows good agreement with theory
- The dijet A_{LL} analysis for 2012 is ongoing