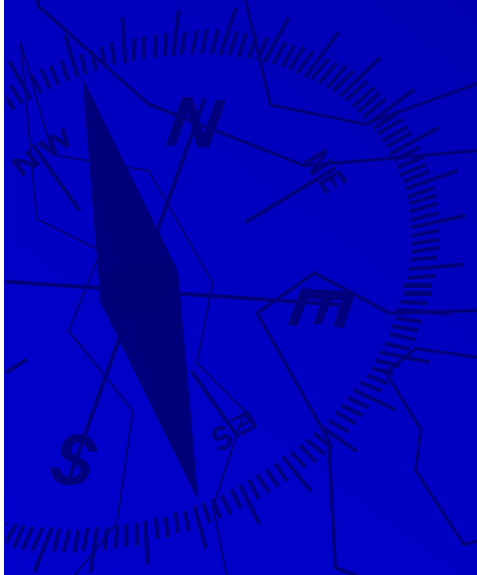
The gluon polarisation ΔG/G at COMPASS

Colin Bernet (DAPNIA/SPHN),
on behalf of the collaboration

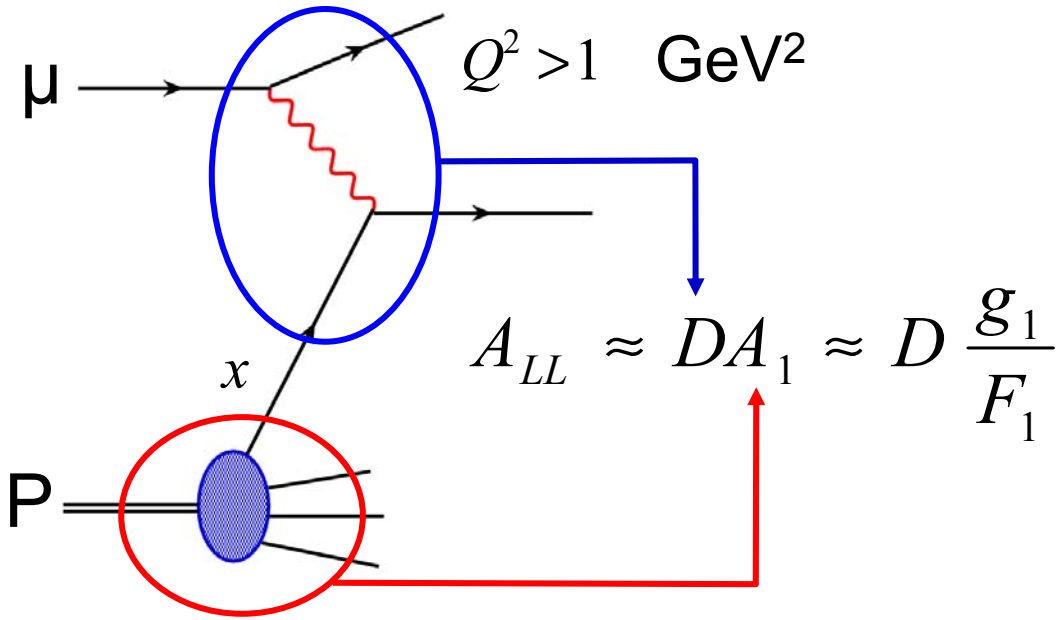


The nucleon longitudinal spin structure

$$\frac{1}{2} = \underbrace{\frac{1}{2}\Delta\Sigma}_{\text{Quarks spin}} + \underbrace{\Delta G}_{\text{Gluons spin}} + \underbrace{L_z^q + L_z^g}_{\text{Orbital momentum}}$$

Quarks : the spin crisis

- Prediction (Ellis, Jaffe) $\Delta\Sigma \approx 0.6$
- 1988 – EMC:

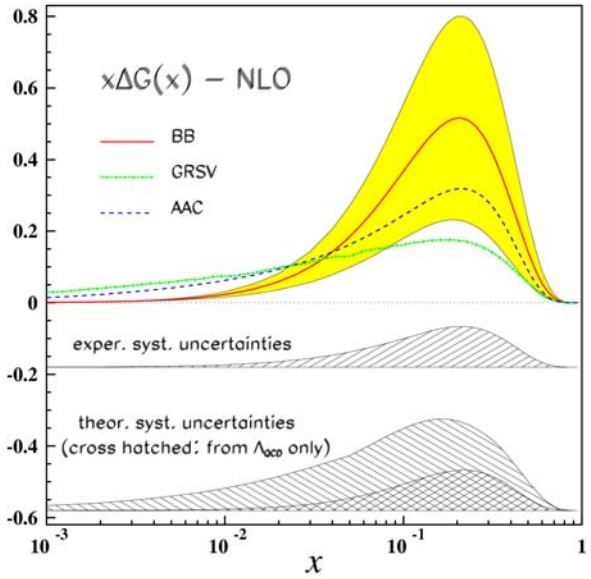


$$g_1 \rightarrow a_0^{PM} = \Delta\Sigma = 0.06 \pm 0.12 \pm 0.17$$

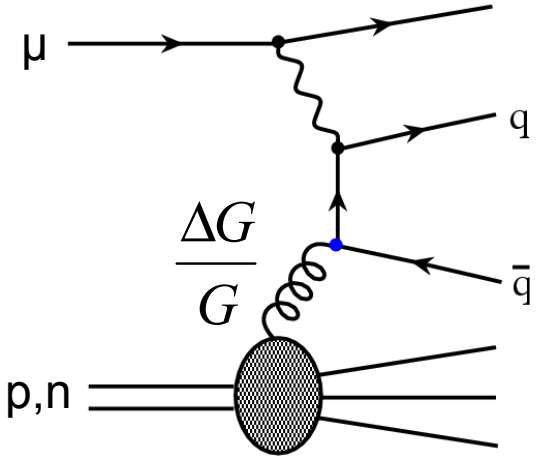
- Axial anomaly $$a_0 = \Delta\Sigma - \frac{3\alpha_s(Q^2)}{2\pi}\Delta G(Q^2)$$

Gluons

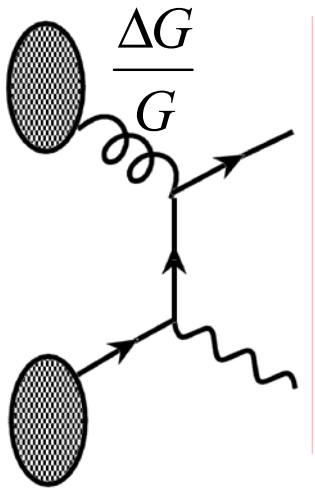
QCD evolution of g_1

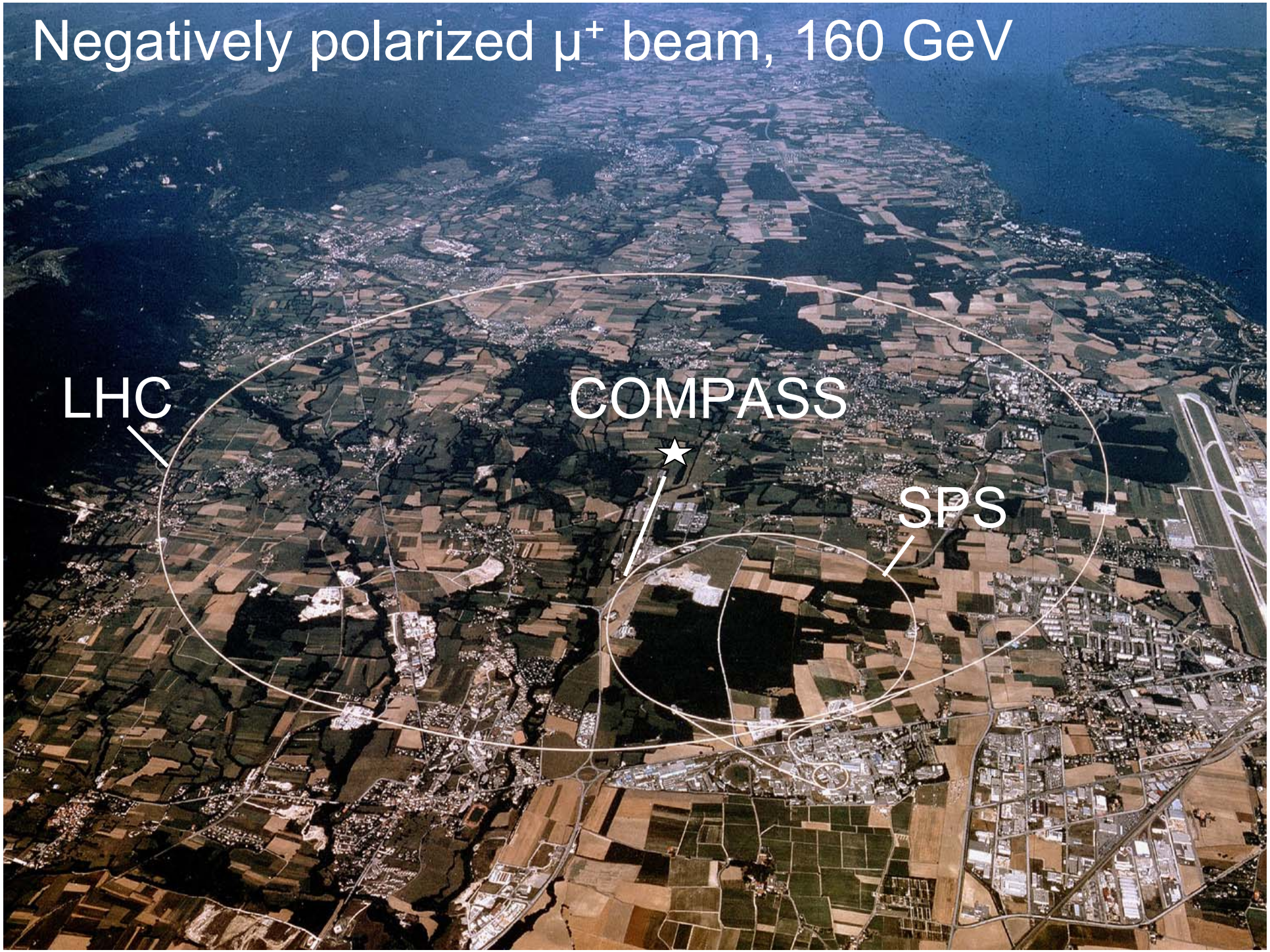


Polarized SIDIS
Photon-gluon fusion
(COMPASS,HERMES)

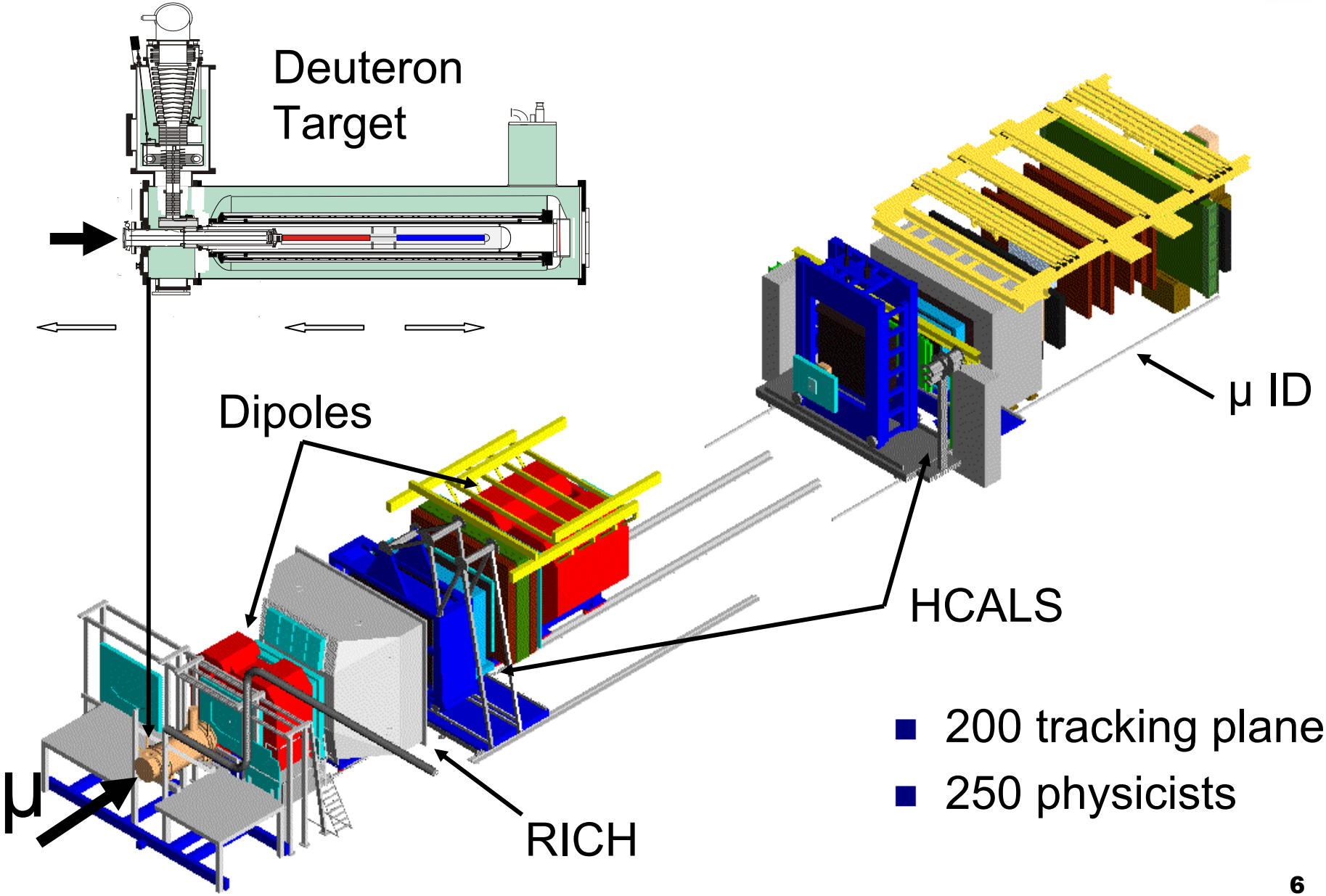


Polarized p-p
(PHENIX, STAR)



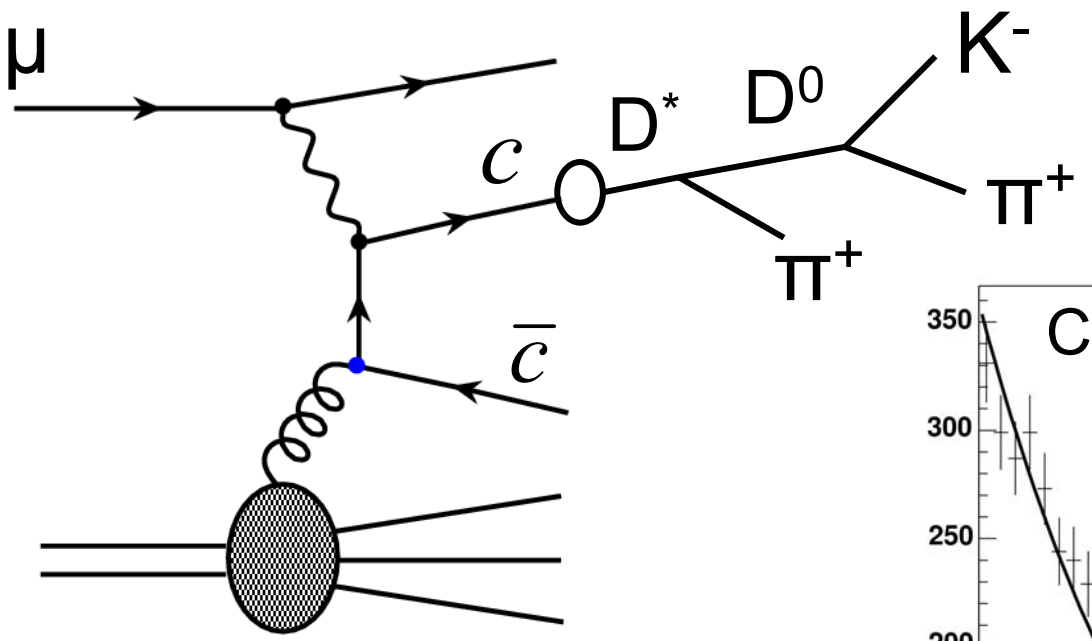

Negatively polarized μ+ beam, 160 GeV
LHC
COMPASS
SPS

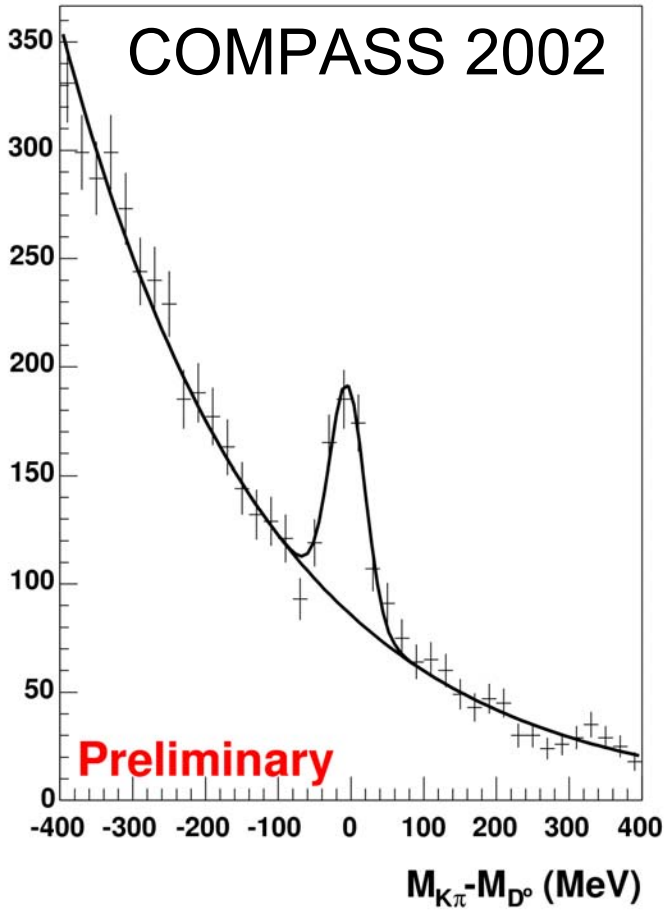
Experimental setup



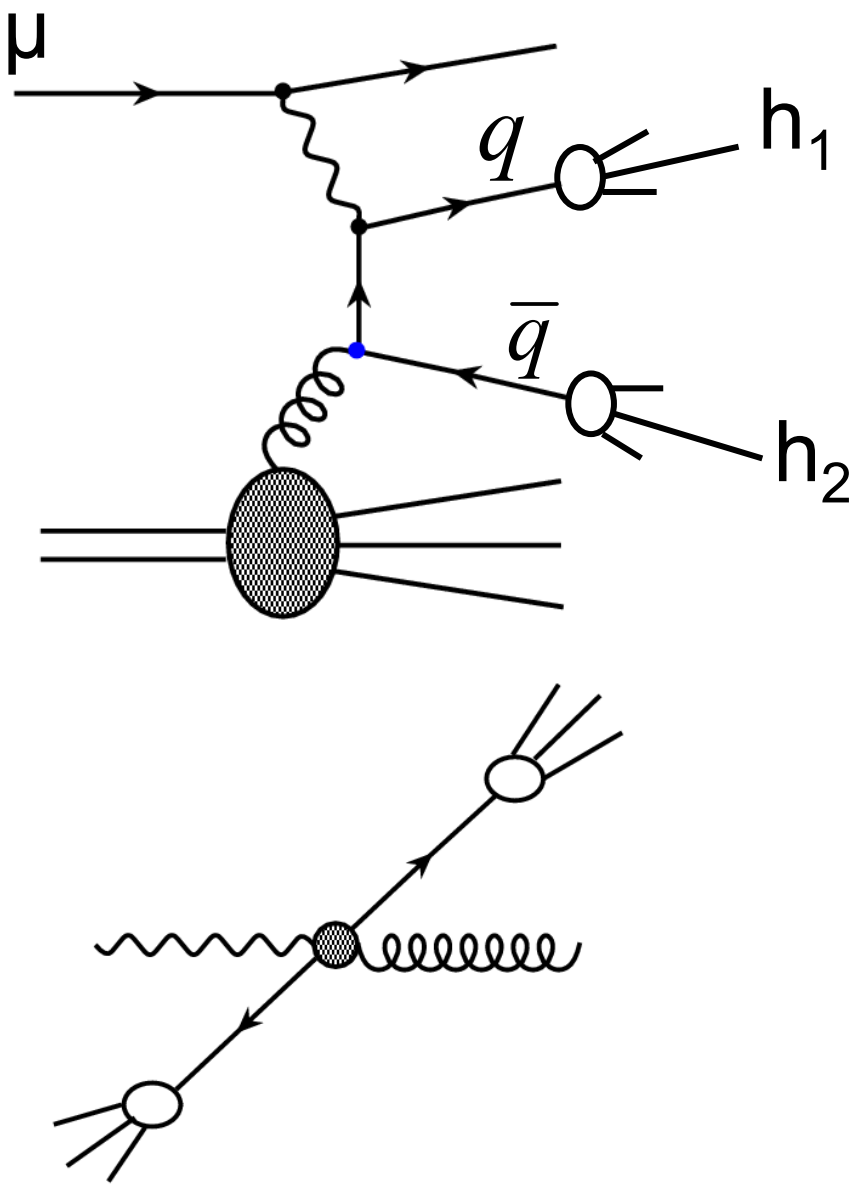
- 200 tracking planes
- 250 physicists

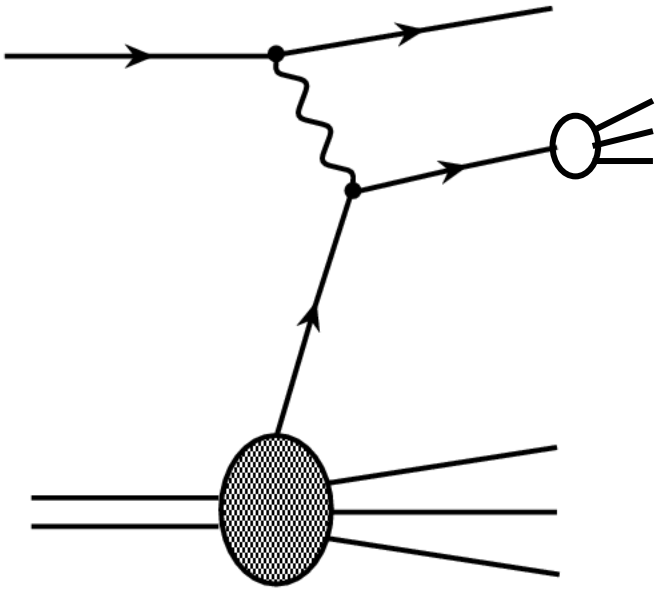
Open-charm tagging



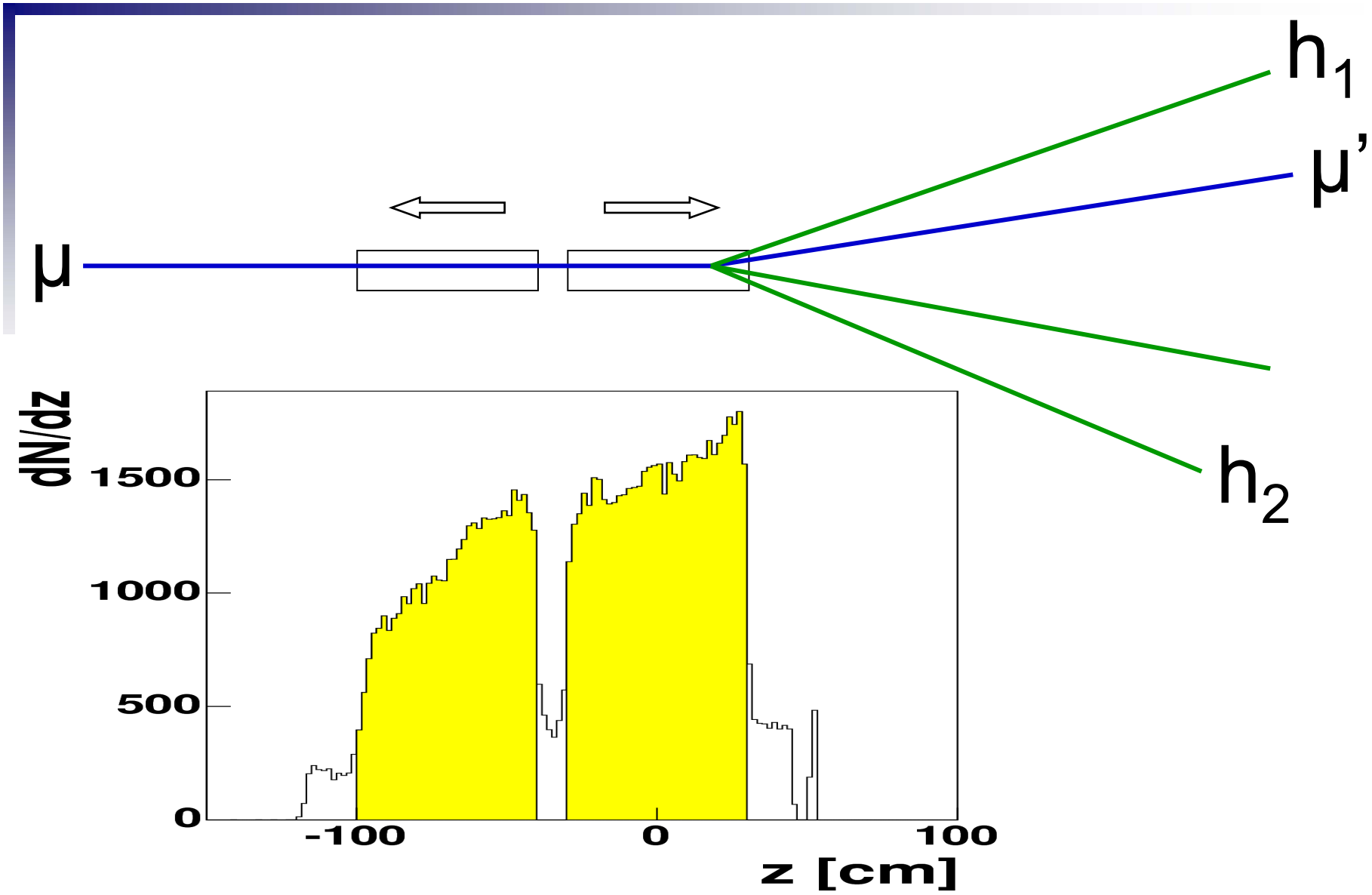


High p_T tagging

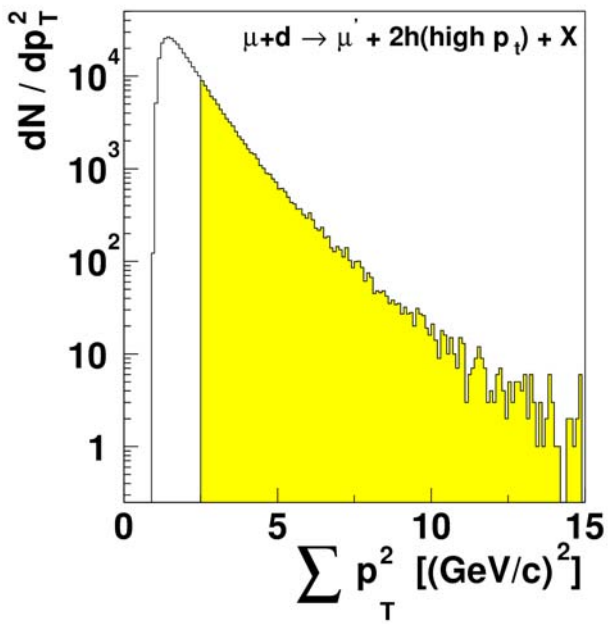


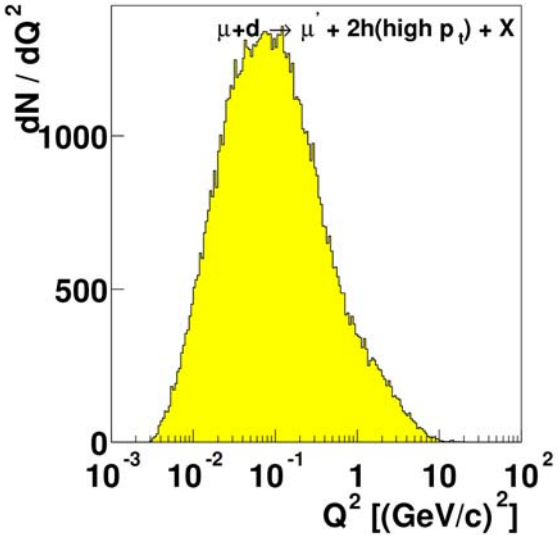


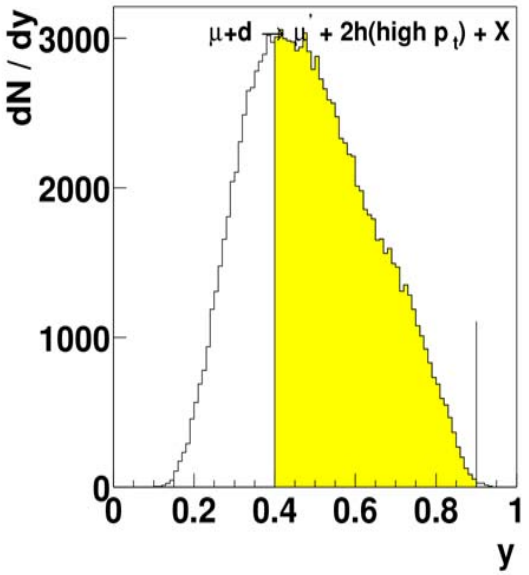
Selection of *high* p_T events



Selection of *high* p_T events







- $p_{T1}, p_{T2} > 0.7$ GeV/c
- $p_{T1}^2 + p_{T2}^2 > 2.5$ (GeV/c)²
- $x_F, z > 0.1$
- No Q^2 cut
- $0.4 < y < 0.9$

Preliminary results

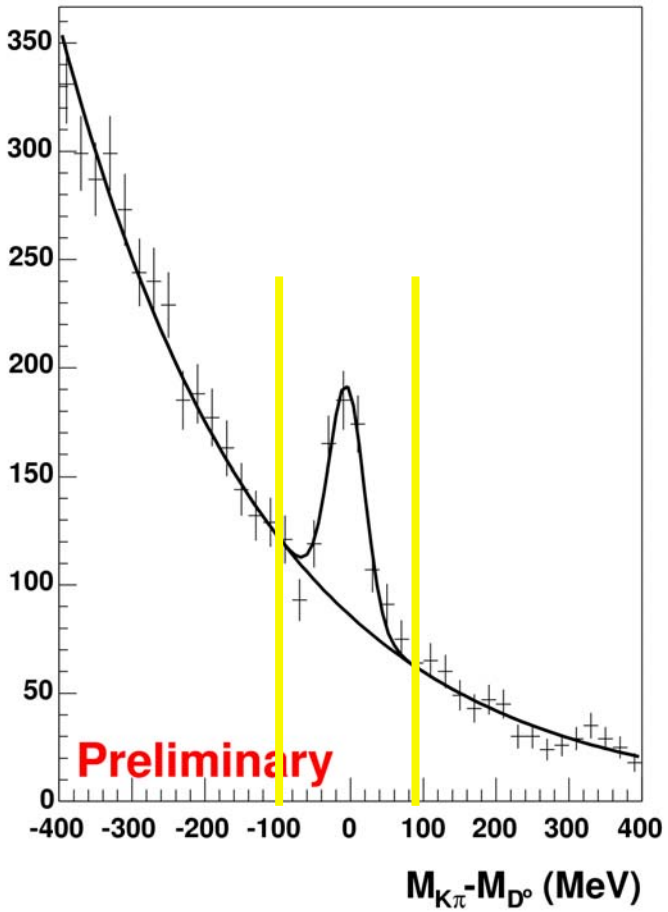
- Helicity asymmetry for high p_T events, 2002 data

$$\frac{A_{LL}^{\mu N \to hh}}{D} = -0.065 \pm 0.036(stat.) \pm 0.01(syst.)$$

- Careful study of false asymmetries

Gluon polarisation $\Delta G/G$

$$\frac{A_{LL}^{\mu N \to hh}}{D} = R_{pgf} \left\langle \frac{\hat{a}_{LL}^{pgf}}{D} \right\rangle \frac{\Delta G}{G} + \frac{A_{LL}^{background}}{D}$$



- Monte-Carlo simulation (PYTHIA)

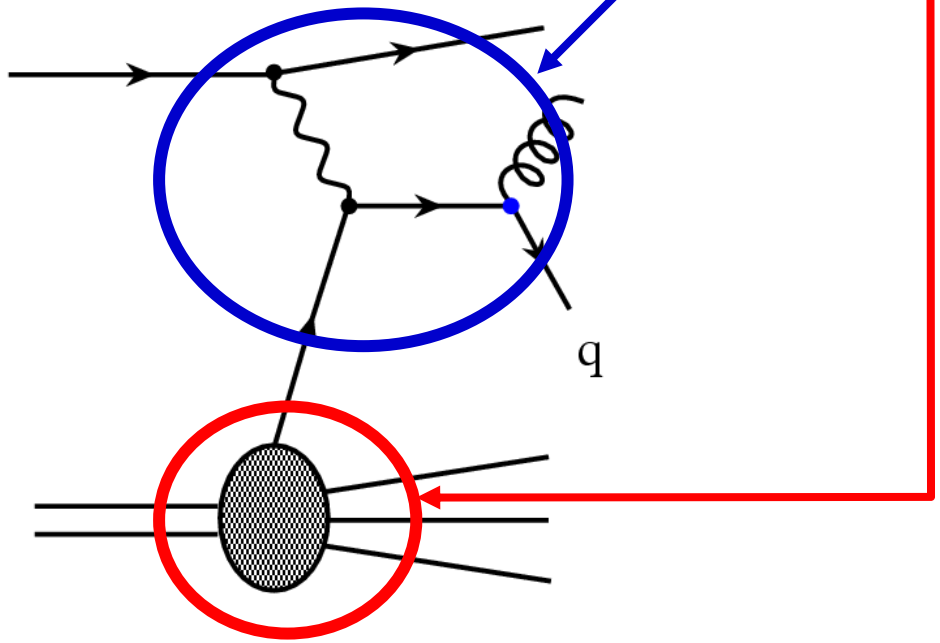
R_{pgf}

$A_{LL}^{background}$

Background – QCD Compton

- Contribution to the asymmetry :

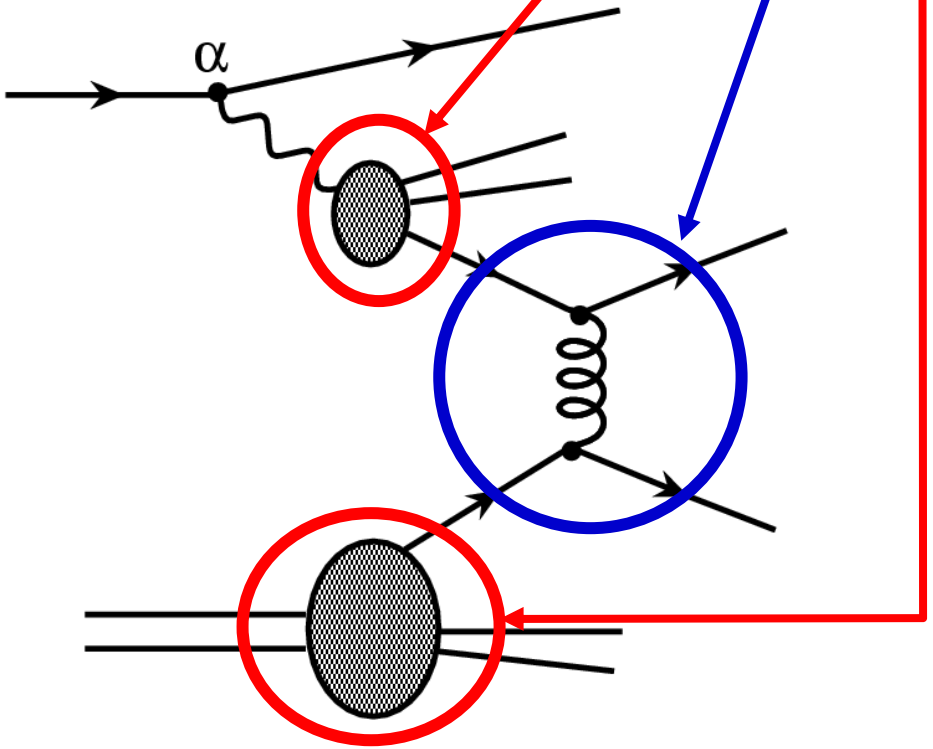
$$R_{QCDC}\left\langle \frac{\hat{a}_{LL}^{QCDC}}{D} A_1 \right\rangle$$



Background – Resolved photons

- Contribution to the asymmetry :

$$R\left\langle ?\,\frac{\hat{a}_{LL}}{D}\,A_1\right\rangle$$



Conclusion

$$\frac{A_{LL}^{\mu N \to hh}}{D} = -0.065 \pm 0.036(stat.) \pm 0.01(syst.)$$

$$= R_{pgf} \left\langle \frac{\hat{a}_{LL}^{pgf}}{D} \right\rangle \frac{\Delta G}{G} + \frac{A_{LL}^{background}}{D}$$

- + 2003, 2004, f.o.m. improvements

  → stat. < 0.018

- Monte-Carlo
  - Background
  - LEPTO