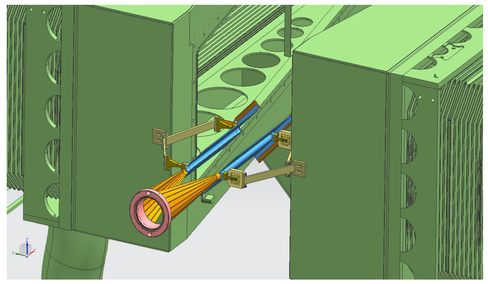
A laboratory for QCD and Hadron Tomography

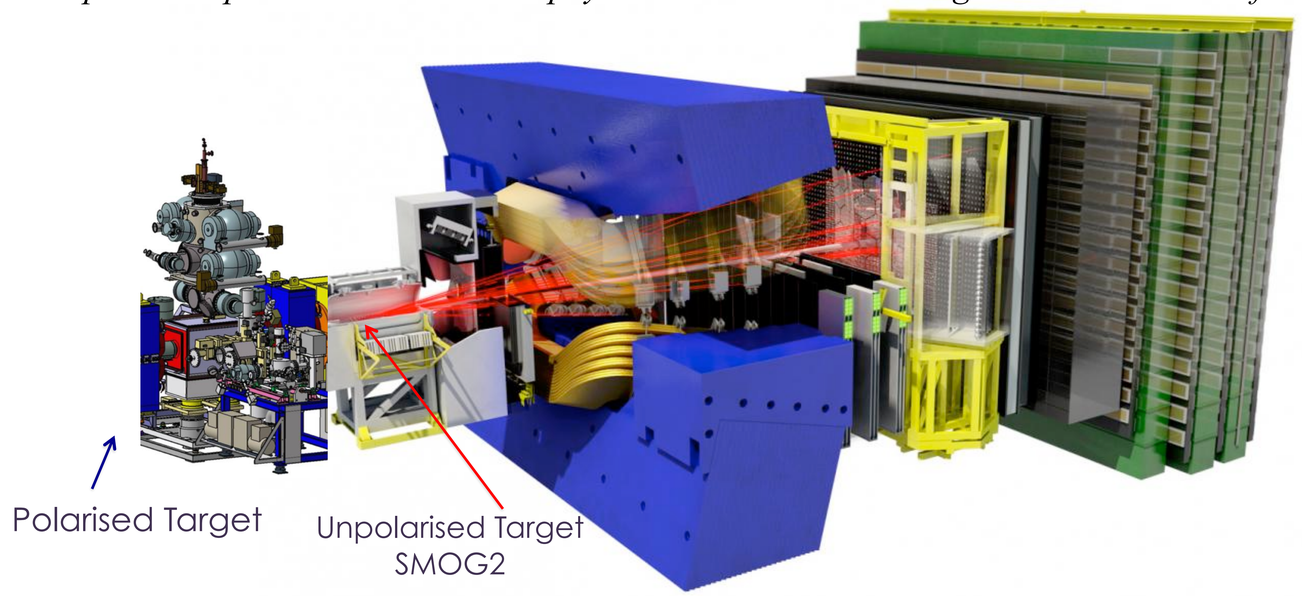
LHCb Frascati Group

INFN LNF
Istituto Nazionale di Fisica Nucleare

LHCb is the only experiment able to run pp and pA-fix target collisions, in synergy.
This opens new panorama in the LHC physics in a kinematical range never accessed before

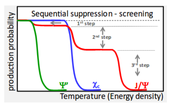
I Phase SMOG2



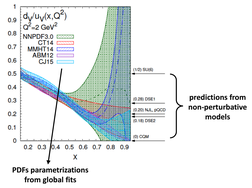


Unpolarised gas target:

-QGP and charmonia

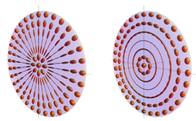


-QCD and nPDF



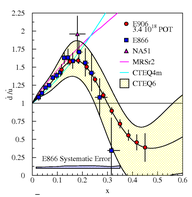
-xsection for cosmic rays and astroparticle

-linearly polarized gluons in hadronic collisions



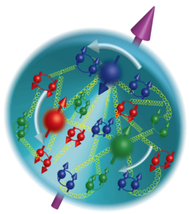
-dipole gluon distributions and saturation

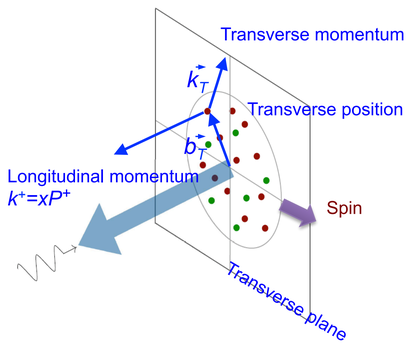
-anti-quark distribution functions



-Heavy partner of gauge bosons
- ....

Nucleons are emerging phenomena of the underlying theory of Quantum ChromoDynamics (QCD). They can be considered as the smallest complex systems of our Universe. In order to reliably compute observables involving hadrons, a knowledge of the multidimensional phase-space distribution of their internal constituents (quarks and gluons) is of paramount importance. Through pioneering results obtained in the last decade, we have learned how to reconstruct from experimental data the distribution of quarks and gluons in three-dimensional momentum space, encoded in the so-called Transverse Momentum Distributions (TMDs). LHCb is able to give unique and innovative contributions both from the physics and technological point of view





Total quark spin | gluon spin | angular momentum

$$\frac{1}{2}\hbar = \sum_q \frac{1}{2} S_q^z + S_g^z + \sum_q L_q^z + L_g^z$$

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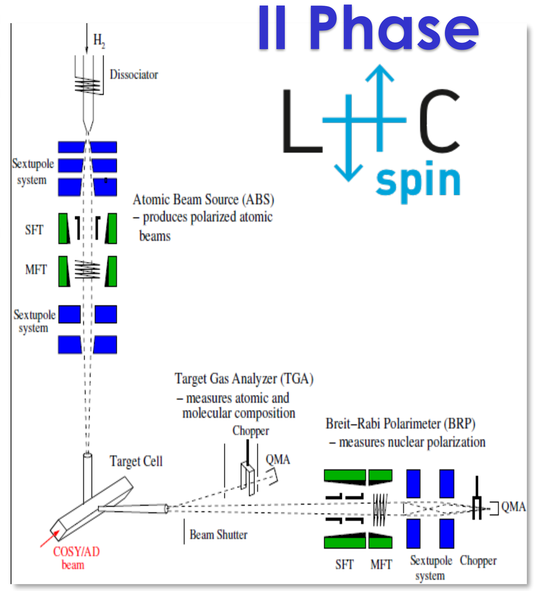
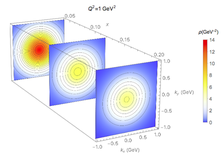
II Phase LHCspin



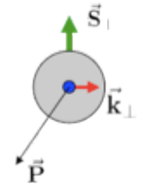
Polarised gas target:

- 3D nucleon structure



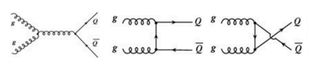
- quark and gluon Transverse Momentum Distribution functions

- fundamental tests of QCD (universality, factorization, etc)

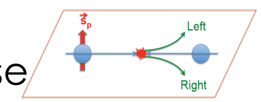


- probing the gluon PDFs

- gluon dynamics



-Single Transverse Spin Asymmetries



- low-pT Higgs sector