

COMPASS – a facility to study QCD



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COMPASS @ CERN

COmmon Muon and Proton Apparatus for Structure and Spectroscopy





230 physicists from 12 countries







A fixed target experiment







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Polarized targets



- NH₃: polarised protons; ⁶LiD: polarised deuterons
- Spin flips forced by applied microwave
- 2.5 T superconducting solenoid field to align
- 60 mK temperature to freze spin state

COMPASS: Unveiling QCD misteries

- The nucleon has a structure quarks, gluons and their dynamics
- The nucleon has spin 1/2: how its continuents contribute to it?
- The nucleon mass is 1000 times larger than the pion mass. Why?

Some favorites for probing the nucleon:

Quarks fragmenting into hadrons

Fragmentation Function: probability that a **quark** i fragments into a **hadron** h carrying a fraction z of the parent's momentum.

In COMPASS we compare the amounts of charged kaons and pions produced, to access these fragmentation functions.

COMPASS data taken in 2016 and 2017 with μ^{\pm} beams on a liquid

hydrogen target to be analysed.

 \hookrightarrow Come and join this effort!

Spin and transverse momentum of quarks in the proton

Parton distribution functions give the probability to find a **quark** i inside a **nucleon** N carrying a fraction x of its parent's momentum.

But quarks and gluons might not be collinear with the proton: a transverse momentum k_T

8 quark TMD PDFs of the proton: correlations between spin of the nucleon, spin of the quarks, and transverse momentum.

TMDs: the dynamics inside the proton

Drell-Yan: $q\bar{q} \to \gamma^* \to \mu^+ \mu^-$

- From April to November: COMPASS polarized Drell-Yan measurements
- Access 4 TMD PDFs and from this, test the TMD approach of QCD
- Learn also how quarks distributions inside the pion behave differently from those inside the proton

 \hookrightarrow Lots of new data, come join this effort!

