The   goal of the "GPDs @ COMPASS" workshop

at CERN on 4 March 2010
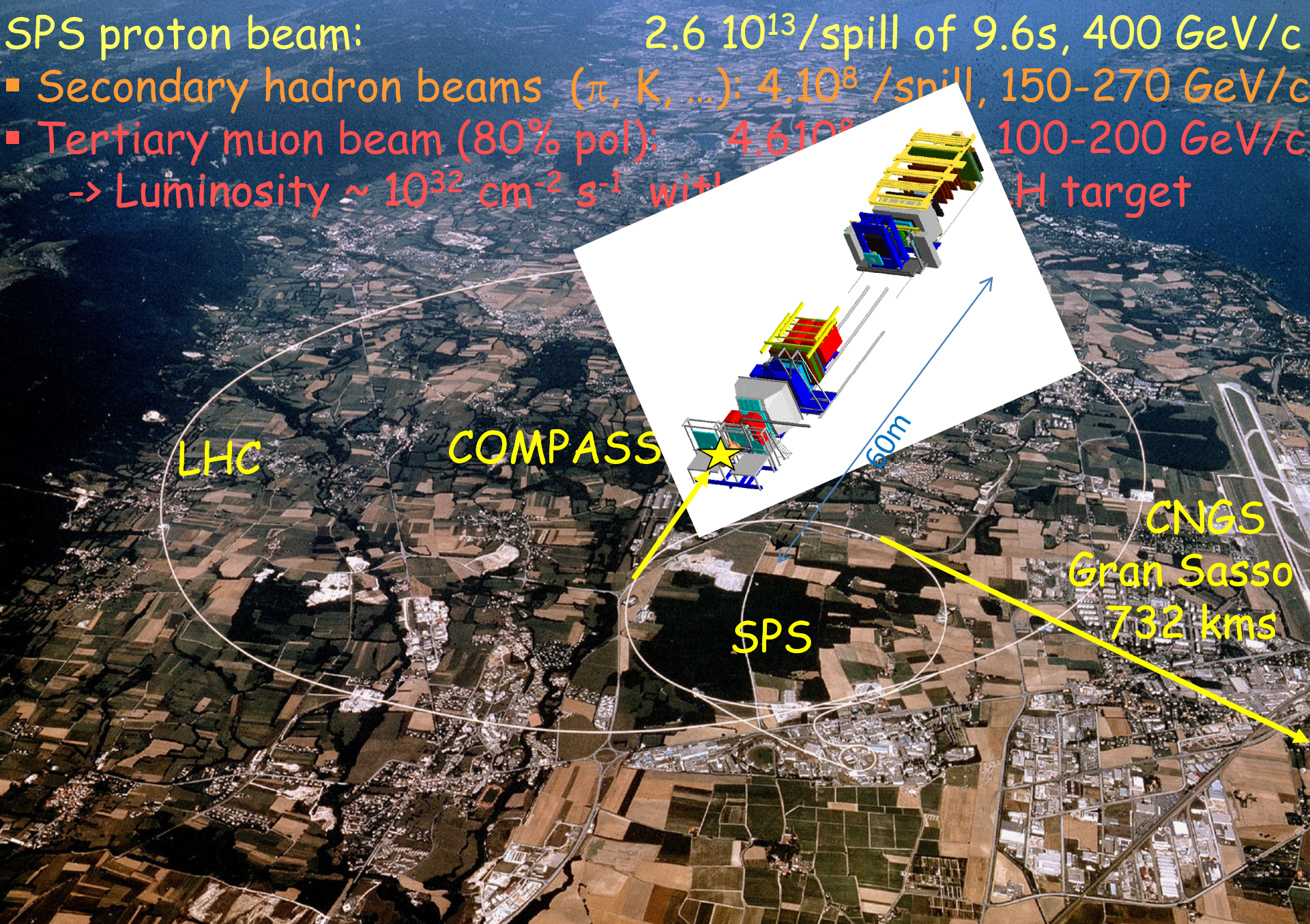
is to better define the key measurements and their outcomes

with together theoreticians and experimentalists

SPS proton beam: $2.6 \, 10^{13}$/spill of 9.6s, 400 GeV/c

- Secondary hadron beams (π, K, …): 4.10^8 /spill, 150-270 GeV/c
- Tertiary muon beam (80% pol): $4.6 \, 10^8$ 100-200 GeV/c
  -> Luminosity ~ 10^{32} cm^{-2} s^{-1} with   H target
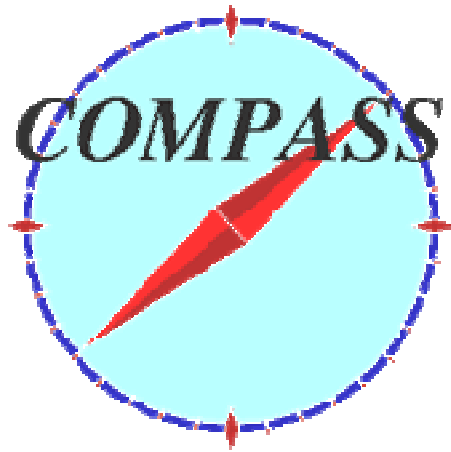

LHC

COMPASS

60m

SPS

CNGS
Gran Sasso
732 kms

high energy beam(s), broad kinematic range, large angular acceptance

COMPASS: a Facility to study QCD

A Collaboration of 240 Physicists of 12 countries

COMMON
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PROTON
APPARATUS for
STRUCTURE and
SPECTROSCOPY

Studies until Now:

➤ **Nucleon Spin** with high energy polarized μ beams:

- The gluon contribution to the Nucleon spin
- The polarized valence quark contr.
- The light quark sea polarization
- The transverse spin effects

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

quark   gluon   orbital momentum

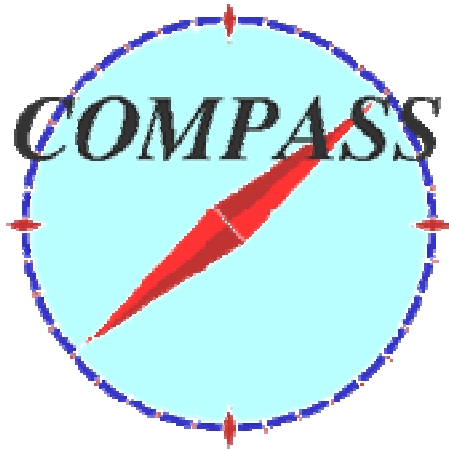----➤ How large are the orbital angular mom. contributions?

➤ **Spectroscopy** with hadron beams:

Search of hybrids and glueballs to better understand

quark and gluon confinement

COMPASS: a Facility to study QCD

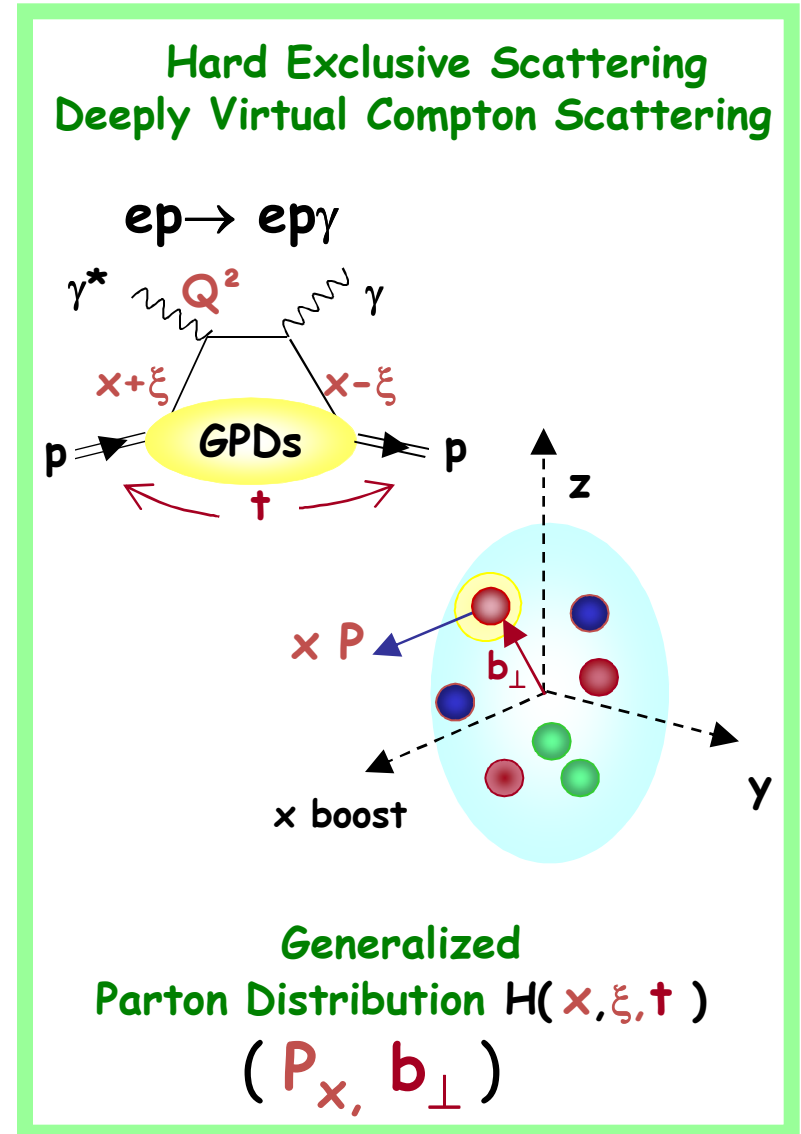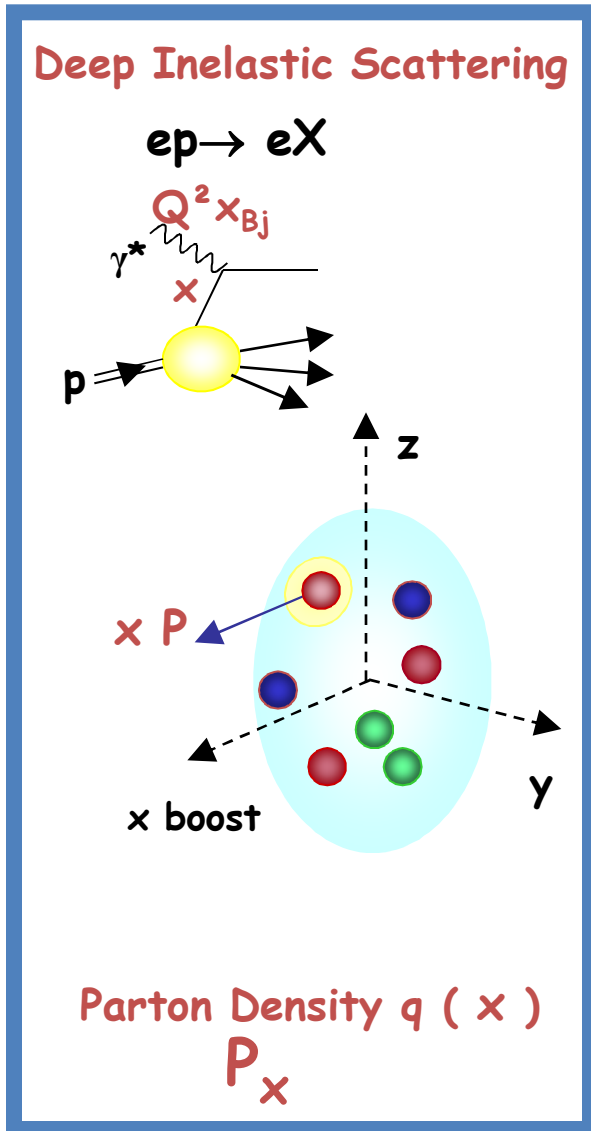## A Collaboration of 240 Physicists of 12 countries

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Long Term Plans ≥2012:

LoI submitted to CERN/SPSC in January 2009
*Proposal in preparation*

- ✓ **Transv. Spatial Distrib. GPDs with DVCS and DVMP with μ beams**

- ✓ Strange PDF and Transv. Mom. Distrib. with SIDIS
      simultaneously with the GPD program

- ✓ Transv. Mom. Distrib. with Drell-Yan with π and in far future $\bar{p}$, K

- ✓ Test of Chiral Perturb. theory through Primakoff exp. with π, K beam

# From Inclusive and Semi-Inclusive exp. to Exclusive experiments

Deep Inelastic Scattering

$ep \rightarrow eX$

$Q^2 x_{Bj}$

γ^*

x

p

z

$x P$

x boost

y

Parton Density $q(x)$

P_x

Hard Exclusive Scattering
Deeply Virtual Compton Scattering

$ep \rightarrow ep\gamma$

γ^* Q^2 γ

$x+\xi$ $x-\xi$

p **GPDs** p

t

z

$x P$

$b_\perp$

x boost

y

Generalized
Parton Distribution $H(x, \xi, t)$

$(P_x, b_\perp)$

Generalised Parton Distribution functions (H,H̃,E,Ẽ):

- Allow for a unified description of form factors and parton distributions
- Allow for transverse imaging (nucleon tomography)
  and give access to the quark angular momentum (through E)
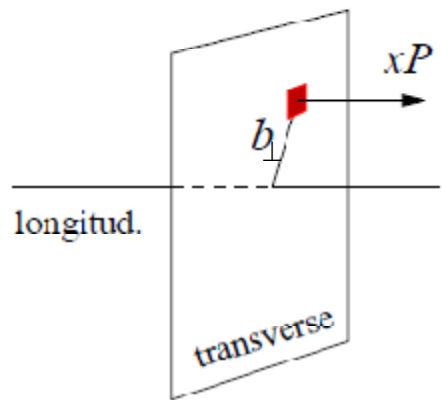
Impact parameter b_⊥
Longitudinal momentum fraction x

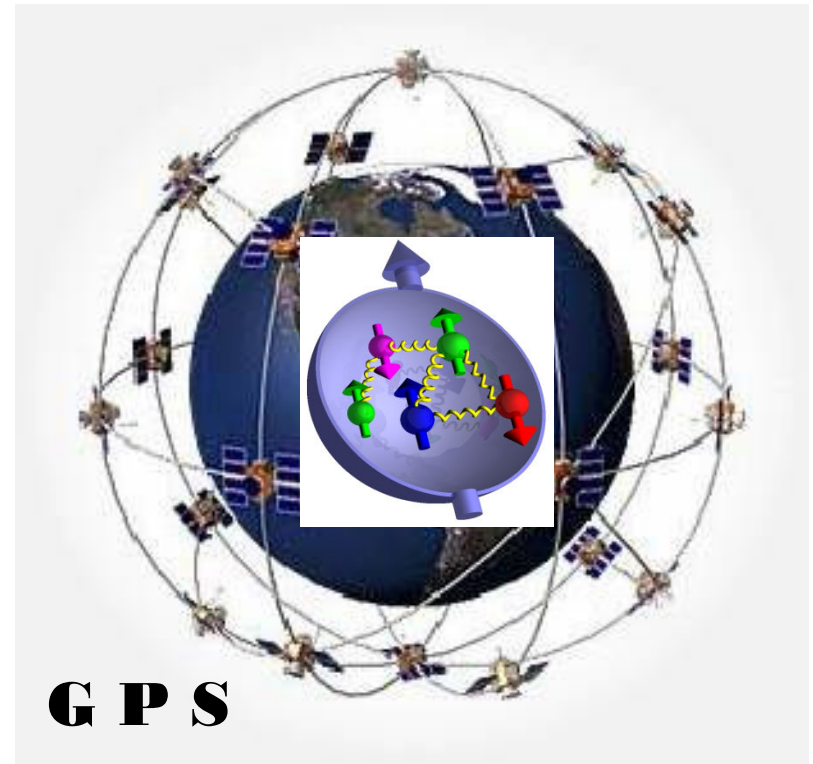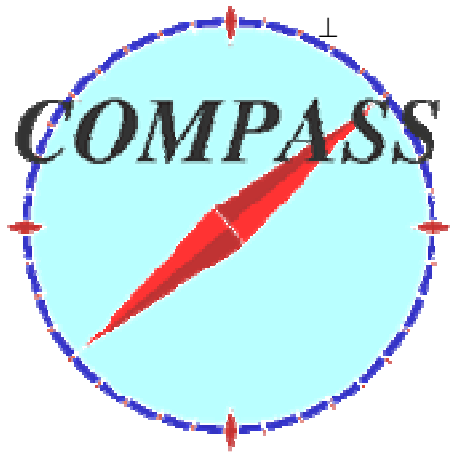$x < 0.01$ $x \sim 0.1$ $x \sim 0.3$
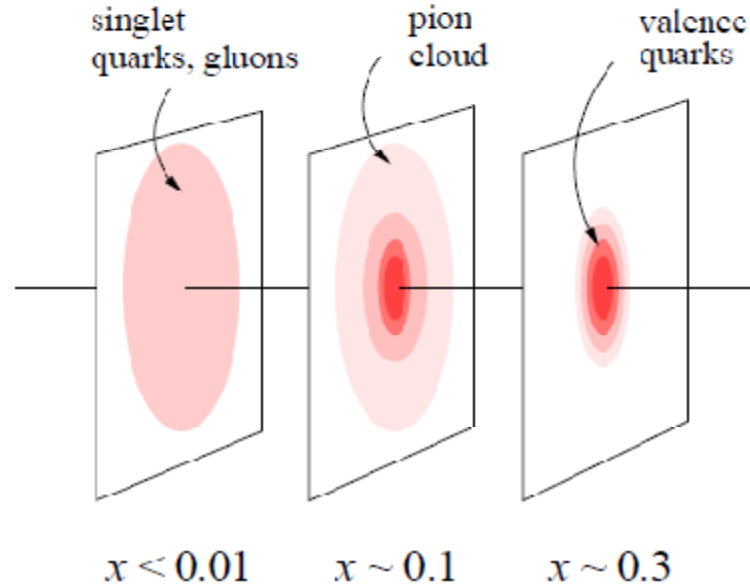
Tomographic parton images of the nucleon

Generalised Parton Distribution functions (H,$\tilde{H}$,E,$\tilde{E}$):

- Allow for a unified description of form factors and parton distributions
- Allow for transverse imaging (nucleon tomography)
  and give access to the quark angular momentum (through E)

Tomographic parton images of the nucleon

GPS

Generalised Parton Distribution functions $(H, \tilde{H}, E, \tilde{E})$:

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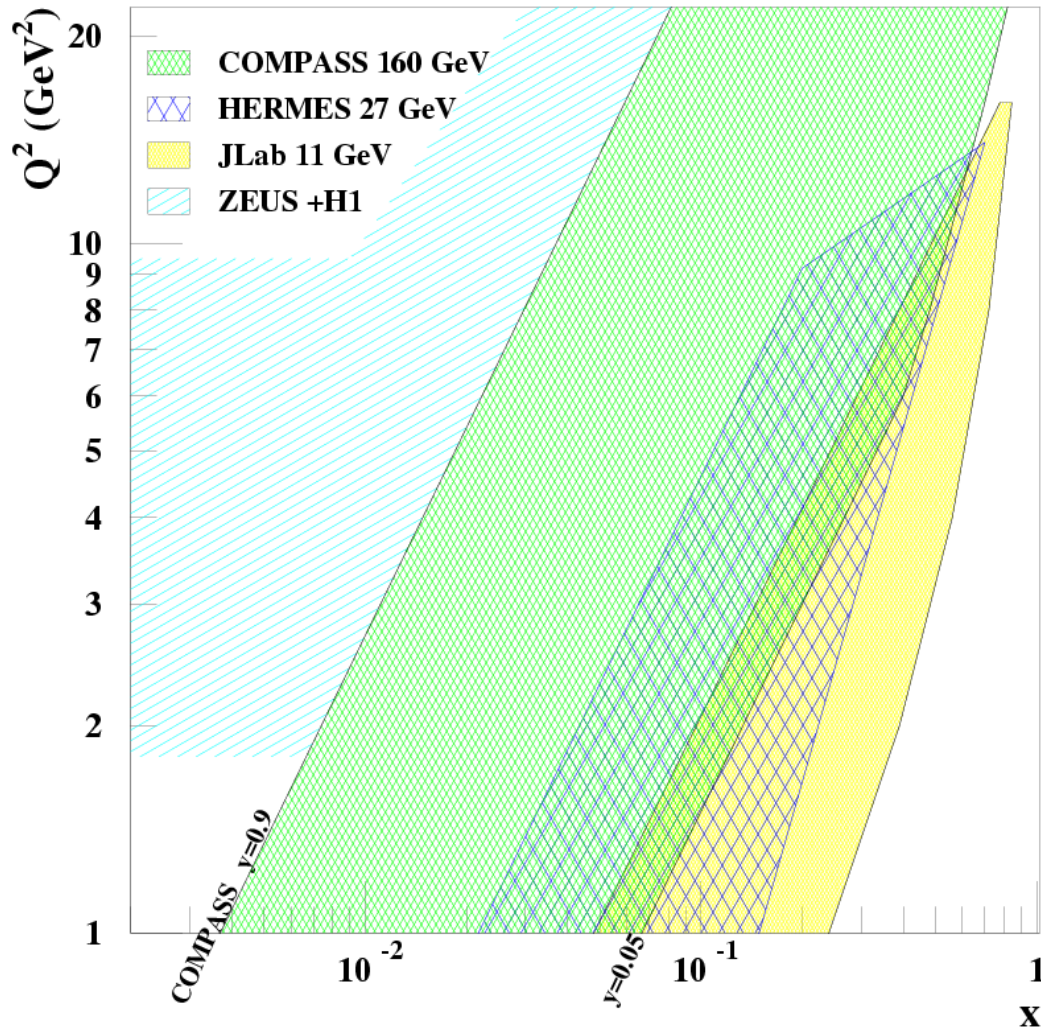 and give access to the quark angular momentum (through E)

➢ Matthias Burkardt: *GPDs as a tool to Study Nucleon Structure*

➢ Christian Weiss: *Transverse Size and Partonic Structure at Intermediate x*

➢ Philipp Haegler: *Lattice Calculations*

➢ Dieter Mueller: *Global GPD fits*

➢ Peter Kroll: *Phenomenological Experience*

Kinematic domains for the world GPD experiments

- ➢ H1/ZEUS: Laurent Schoeffel

  transv size of nucleon through many results on DVMP and DVCS

- ➢ HERMES/Jlab: Delia Hasch

  review of DVCS experiments

- ➢ COMPASS: Etienne Burtin

  high energy polarized μ+ and μ- relative yield of DVCS and BH

  projections and tests for DVCS