Research opportunities in COMPASS & AMBER

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COMPASS/AMBER LIP group

- The Group
  - C. Quintans (group leader), P Faccioli, M. Stolarski (researchers)
  - R. Sivla, G. Almeida, C. Corte-Real (students)
  - Ch. Pires (engineer)

- Responsibilities:
  - Various analysis tasks
    - Analysis of real data
    - MC simulations (physics, detectors)
    - Software improvements of the existing hardware
  - Detector Control System of COMPASS/AMBER experiment

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COMPASS CERN

LHC

COMPASS

SPS
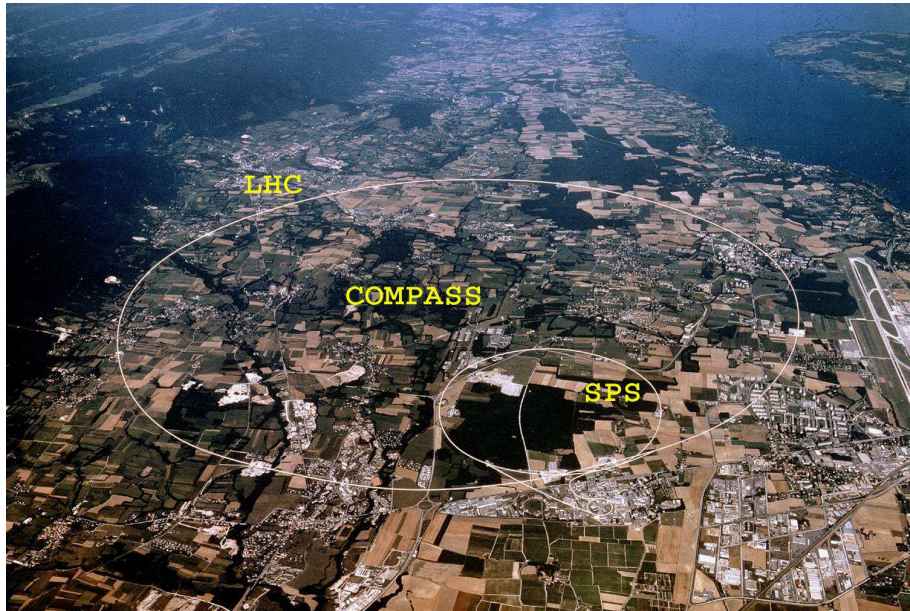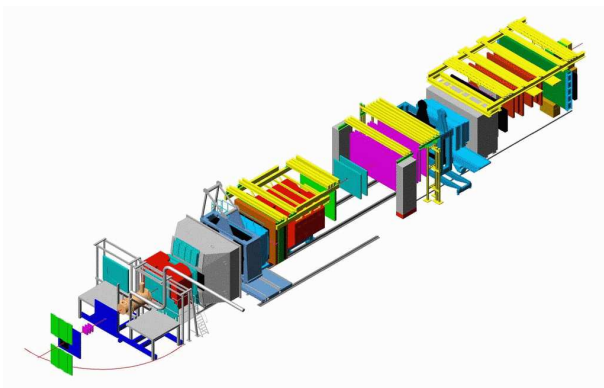
- COLLABORATION
    - about 210 physicists
    - 13 Countries

- DETECTOR
    - 60 m length
    - 2 (3) magnets
    - about 350 detector planes
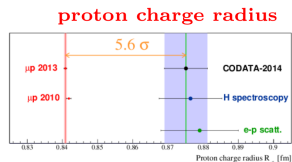
- BEAM
    - μ beams 80-200 GeV
    - π, p, K beams

- TARGET
    - polarised LiD, NH_3
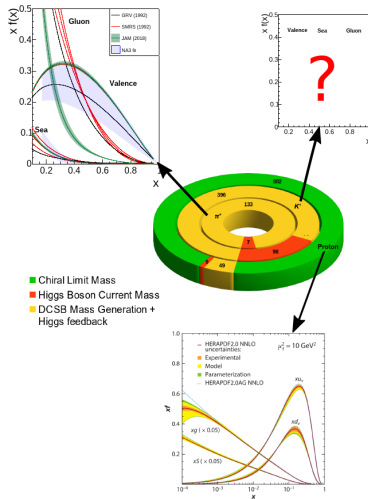   - unpolarised LH, Tungsten, Pb, Ni, Cu...

- Where does mass of hadrons comes from?

- Why pion is 7x lighter than proton?

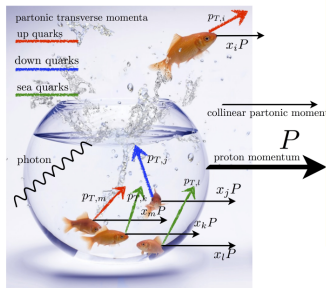- How quarks dress into hadrons?

- What is radius of the proton...?

proton charge radius

...from muon-proton elastic scattering

- Chiral Limit Mass
- Higgs Boson Current Mass
- DCSB Mass Generation + Higgs feedback
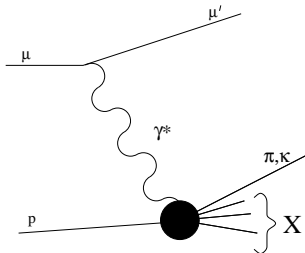
- Protons are quite complex objects...

- other hadrons too...
- still a lot of mysteries awaits to be discovered and understood...
- Drell-Yan and SIDIS processes can help reveal some of them...

- Quark-anitquark annihilation with production of leptons in the final state
- COMPASS took data in 2014, 2015 and 2018
- Future AMBER data with pion, kaon, proton beams!
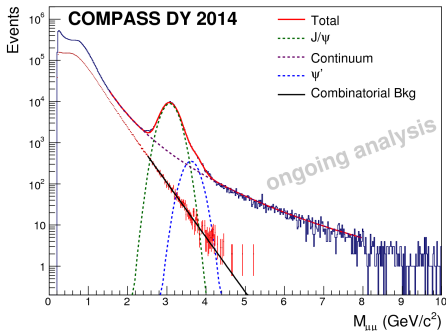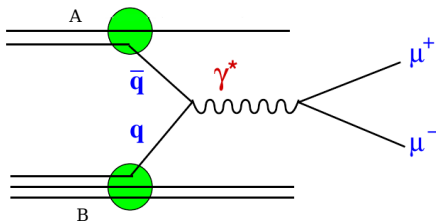
- **S**emi-**I**nclusive **D**eep **I**nelastic **S**cattering (**SIDIS**)

- what is probability that a quark of type q fragments into a hadron type h?

- a new non perturbative object needed - Fragmentation Functions

- Fragmentation functions can be extracted from measurements of kaon multiplicities, i.e. number of kaons per DIS event

- QCD predicts that:

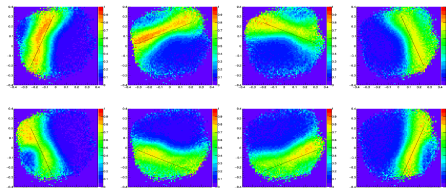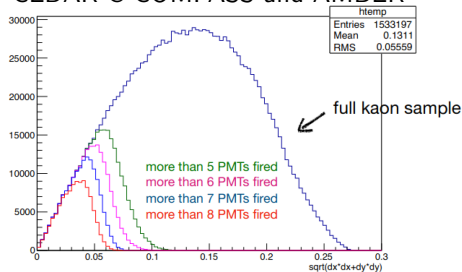- $\dfrac{M^{K^-}}{M^{K^+}} > \dfrac{\bar{u}+\bar{d}}{u+d}$

- Reality ???
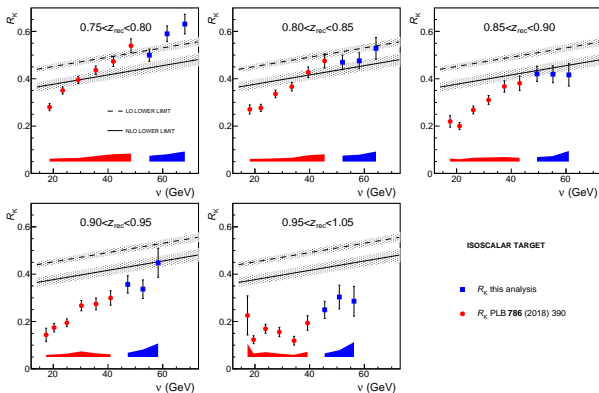
- It turned out that data are below expected lower limit...

- z is momentum fraction of the virtual photon energy ν carried by kaon

- Is it mistake?.. We have new 2018 data on proton target

- you may check it by yourself ;-)

Interested in Neural Networks applications...

RICH @ COMPASS
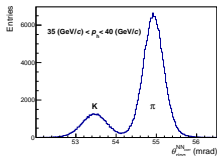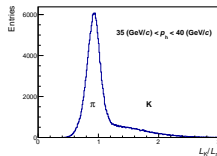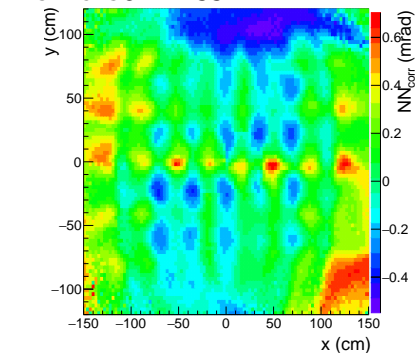
CEDAR @ COMPASS and AMBER

Thank you!