Development of a new hadron identification method for **NA61/SHINE** experiment at the **CERN SPS**

Antoni Marcinek

**Layout:**
- General info about experiment
- Detector
- Physics goals
- Particle identification
General info

SHINE – SPS Heavy Ion and Neutrino Experiment

- Successor of NA49
- Fixed target experiment on a secondary beam
- Collaboration of 125 physicists, 24 institutes, 13 countries
Detector

NA61/SHINE

Super-conduction magnets

Time Projection Chambers

Beam

Target

Time of Flight Detectors

Projectile Spectator Detector
Physics goals

- Data for neutrino and cosmic rays experiments – $p/\pi+A$

*Precision measurements:*

  Measure hadron production in $p/\pi+C$ interactions needed for T2K and cosmic-ray, Pierre Auger Observatory and KASCADE, experiments

  Measure hadron production in the T2K target needed for the T2K (neutrino) physics
Physics goals

- Physics of strongly interacting matter – p+p/A, A+A

Discovery potential:
- Search for the critical point of strongly interacting matter

Precision measurements:
- Study the properties of the onset of deconfinement in nucleus-nucleus collisions
- Measure hadron production at high transverse momenta in p+p and p+Pb collisions as reference for Pb+Pb results
Data collected in 2009 for physics of strongly interacting matter

- p+p at 158 GeV/c: 4M events
- p+p at 80 GeV/c: 4M events
- p+p at 40 GeV/c: 6M events
- p+p at 31 GeV/c: 3M events
- p+p at 20 GeV/c: 2M events
Detector – particle identification

ToF – low momenta

\[ \sigma(p)/p^2 \approx 10^{-4} \text{ (GeV/c)}^{-1} \]
\[ \sigma(\text{ToF}) \approx 60-120 \text{ ps} \]
\[ \sigma(\text{dE/dx})/\langle\text{dE/dx}\rangle \approx 4\% \]

\( p \)

\( K \)

\( \pi \)

dE/dx – very low and high momenta

combined ToF and dE/dx – medium momenta

Positive particles

Negative particles

\[ \log(p / (1 \text{ GeV/c})) \]
Particle identification - dE/dx

- A slice of the plot on previous slide
- A lot of similar histograms to fit in numerous phase space bins. Some of them to be fitted simultaneously.
- Non-trivial choice of fitted function; numerous free parameters (~12).
- Several data sets.
- Need for good automation → good optimisation algorithms
Application
Present status, plans for near future