



# The Proton Charge Radius Measurement at

A000BER

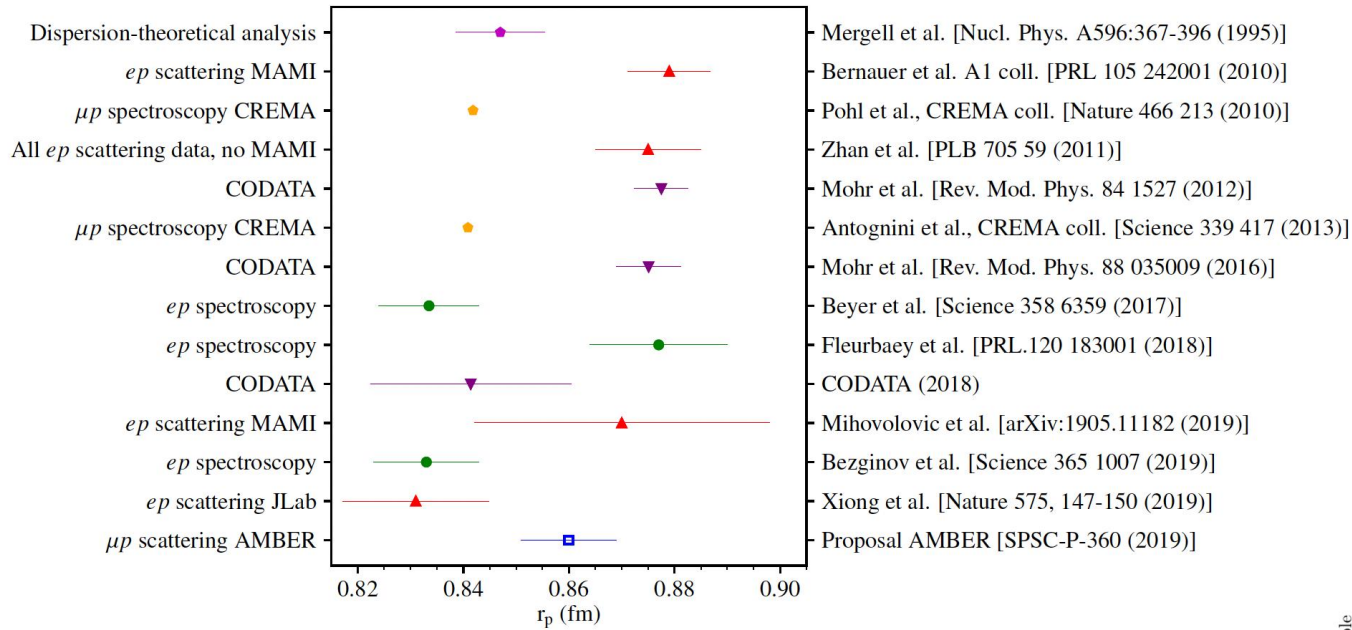
Apparatus for Meson and Baryon  
Experimental Research

Jan Friedrich

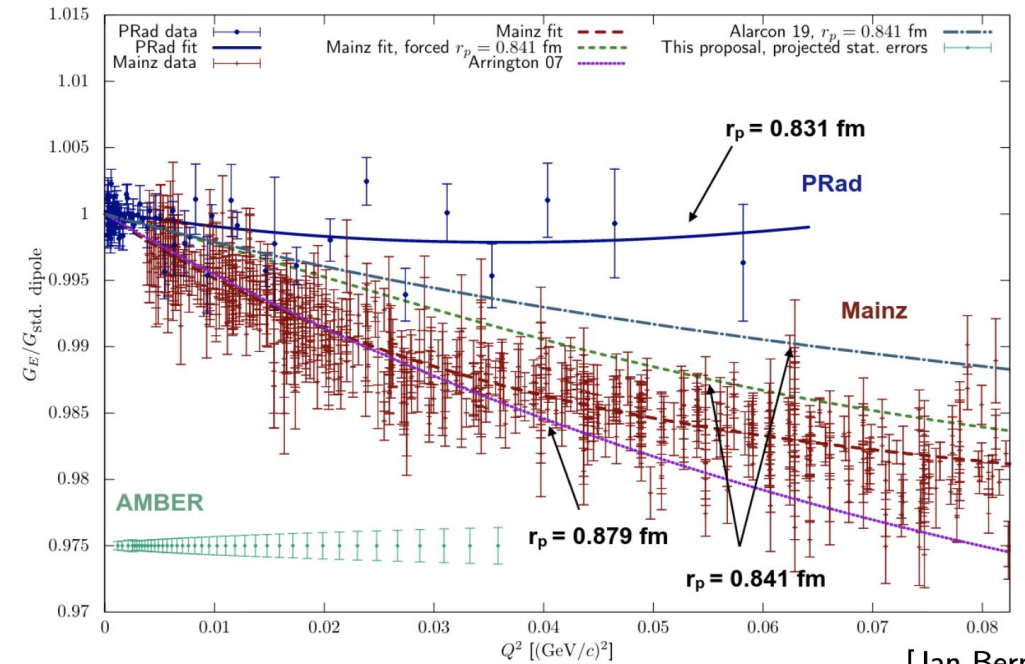
*Technische Universität München*



# Proton Charge Radius

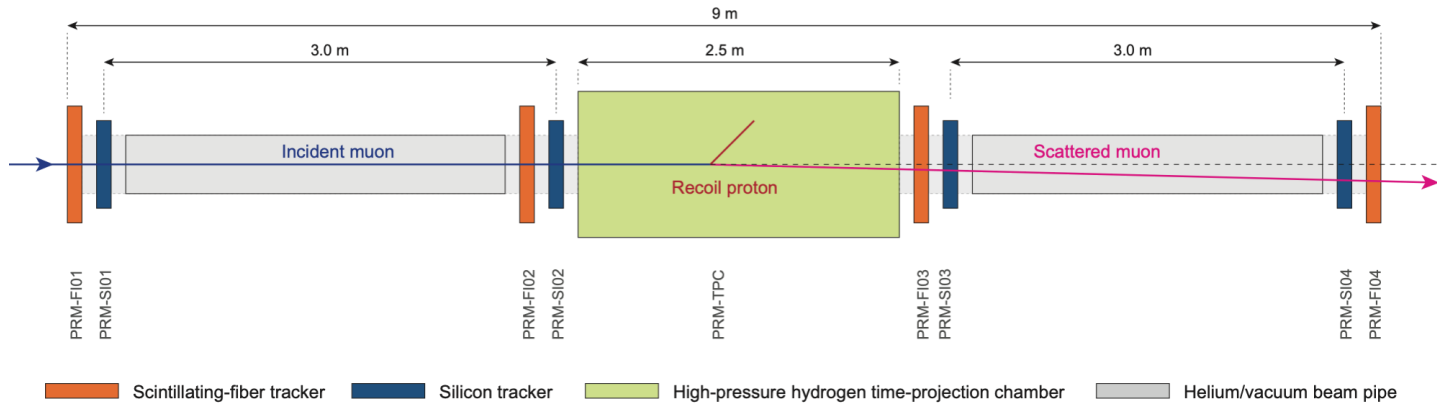


- since the first measurement of the proton charge radius of about 0.8 fm (Hofstadter 1956), a wealth of measurements with different techniques have been done
- the charge radius is defined as the slope of the electric form factor at vanishing momentum transfer
- the most detailed information about the el-mgn form factors of hadrons can be collected in lepton scattering

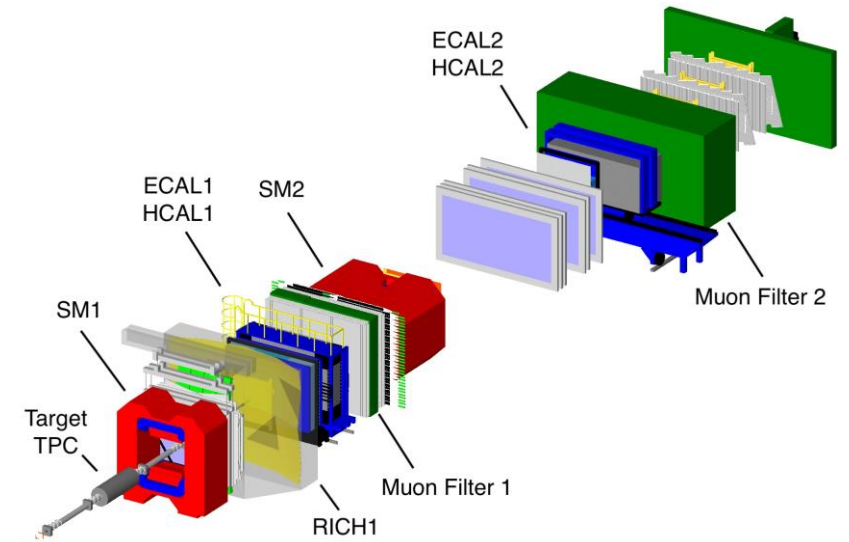


[Jan Bernauer]

# Proton Radius at AMBER



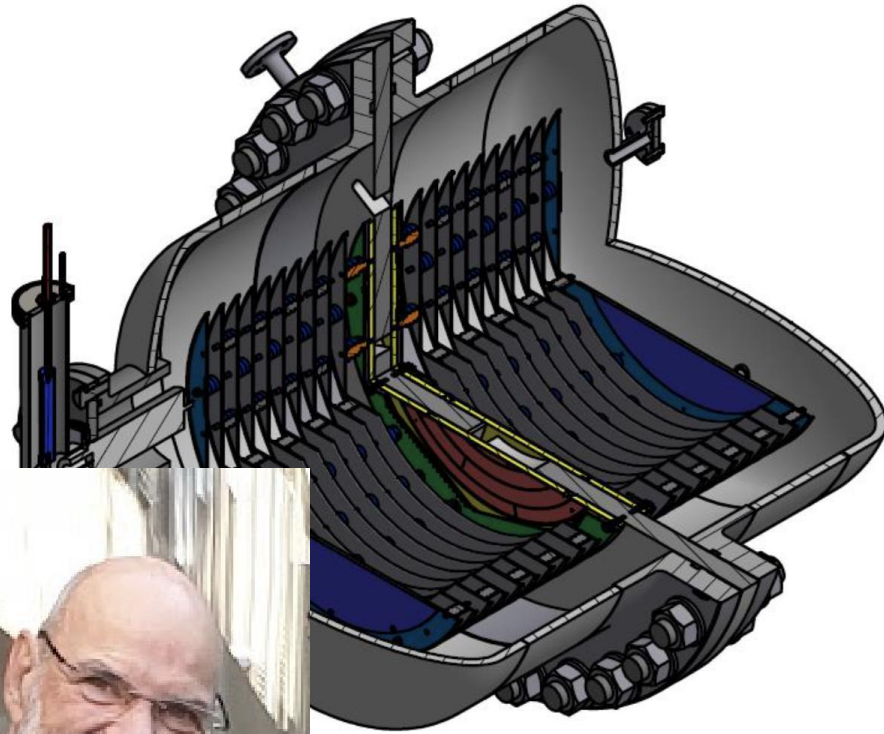
- 100 GeV muon beam
- Active-target TPC with high-pressure H<sub>2</sub>
- goal: 70 million elastic scattering events in the  $10^{-3} < Q^2 < 4 \cdot 10^{-2} \text{ GeV}^2$  range
- Precision on the proton radius  $\sim 0.01 \text{ fm}$
- unexplored and presumably favourable territory of systematics: muon interaction with material and radiative corrections small



New device: Unified Tracking station



# The active-target TPC



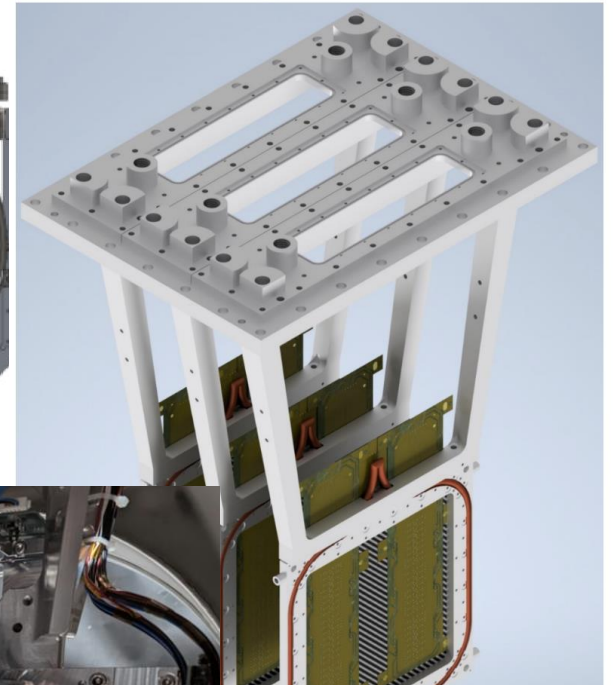
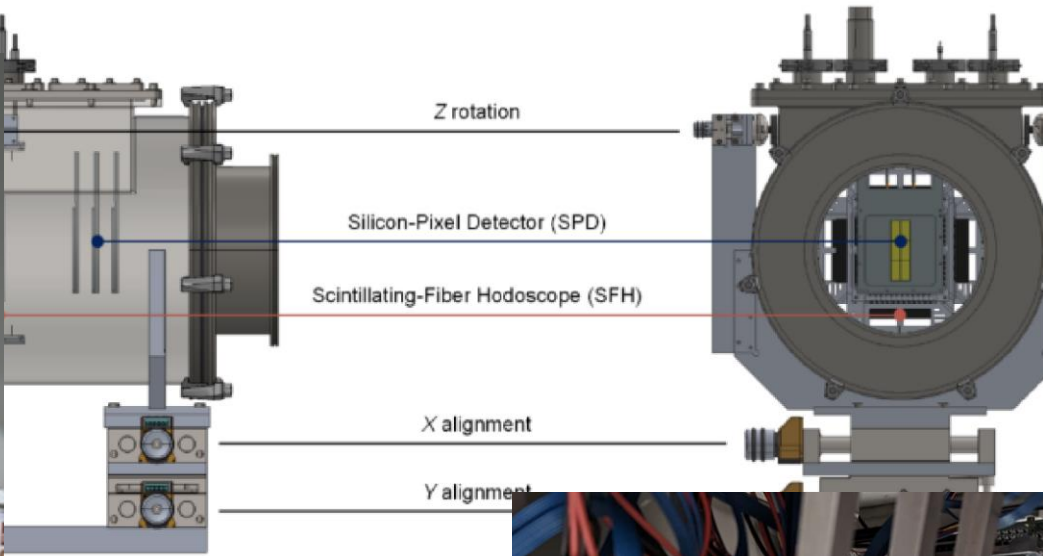
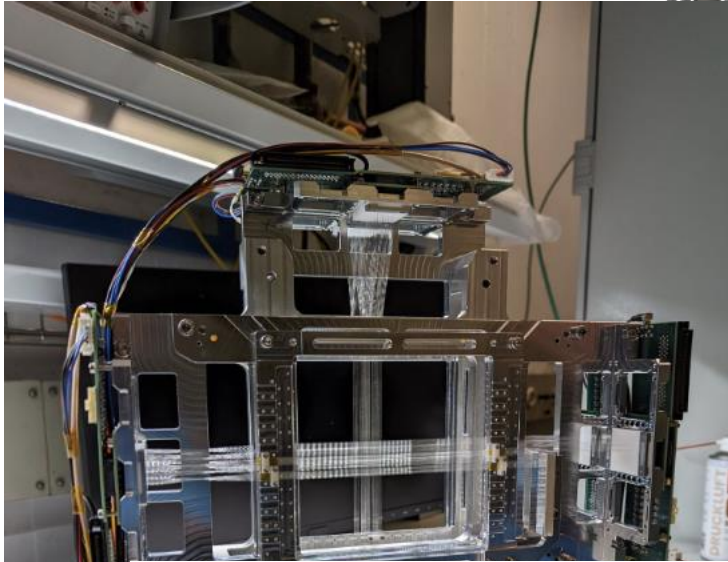
Stephan Paul

production in cooperation with GSI,  
coordination: Oleg Kiselev



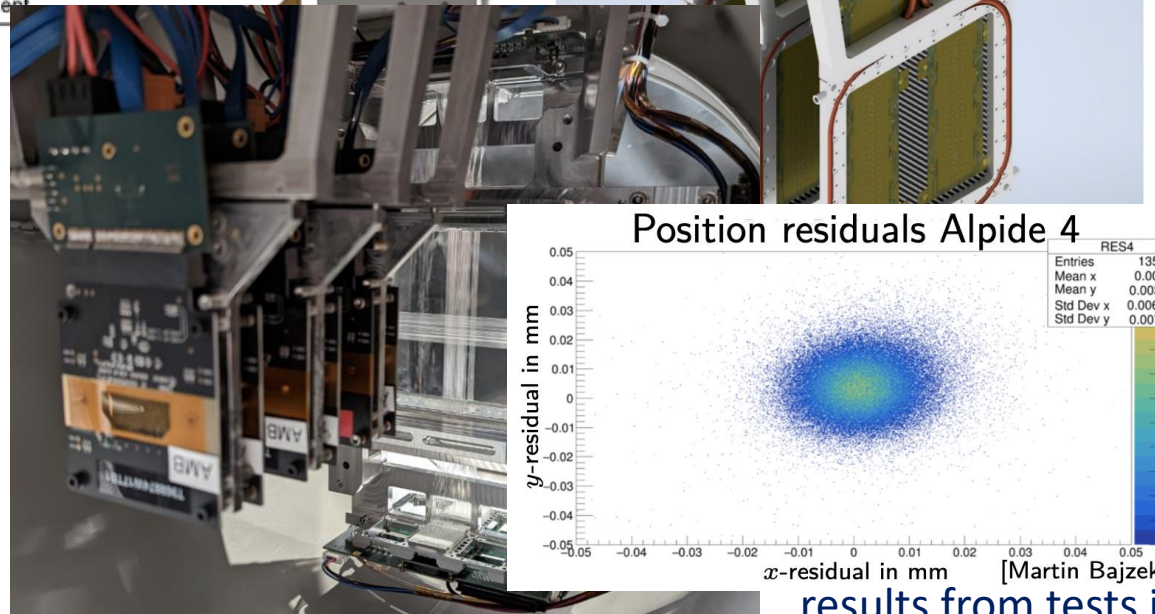
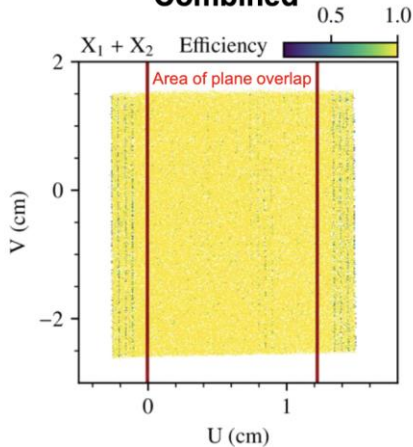
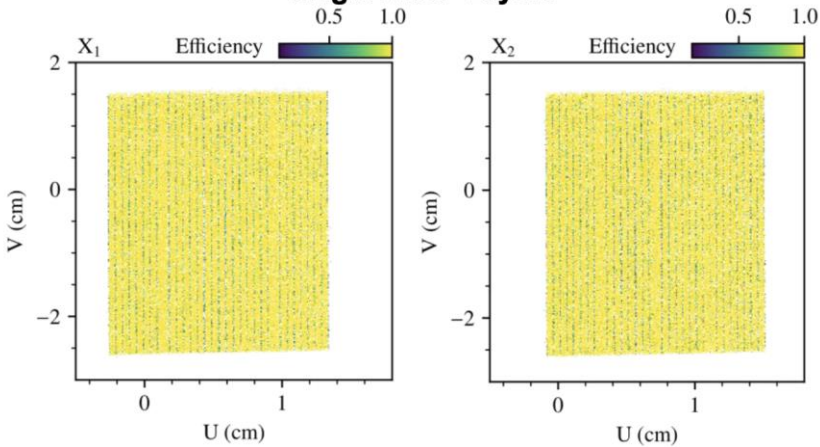
Alexey Alexeevich Vorobyov  
20.12.1931 – 2.11.2021

# Highlights from test beams



Single Fiber Layers

Combined

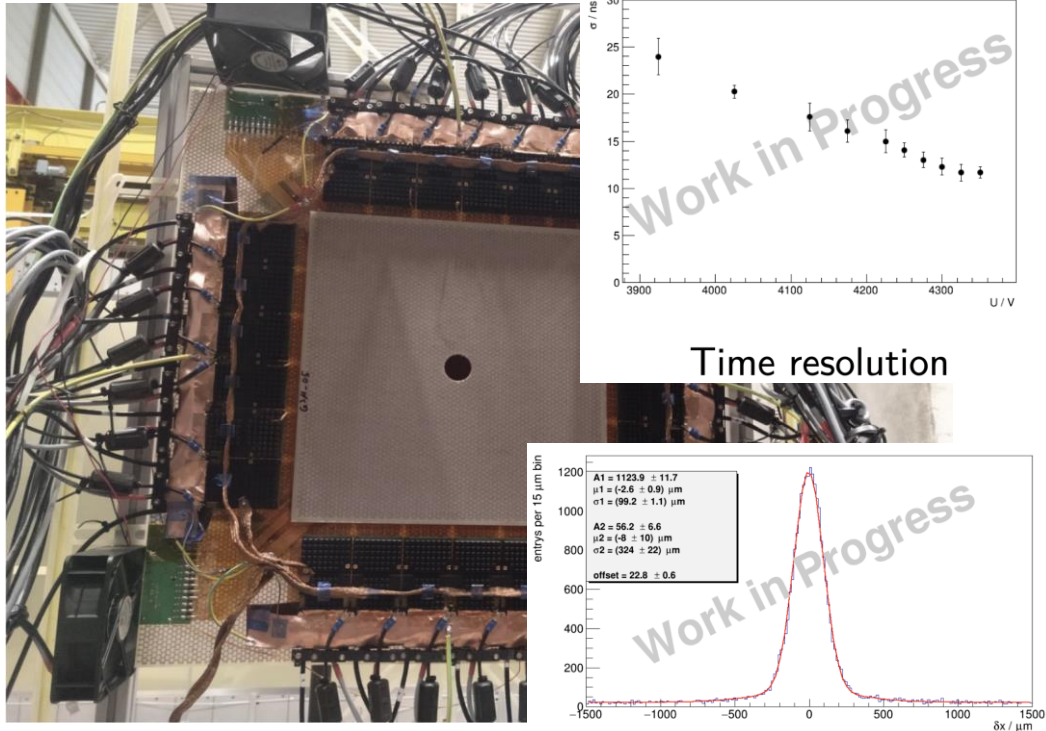


Position residuals Alpipe 4

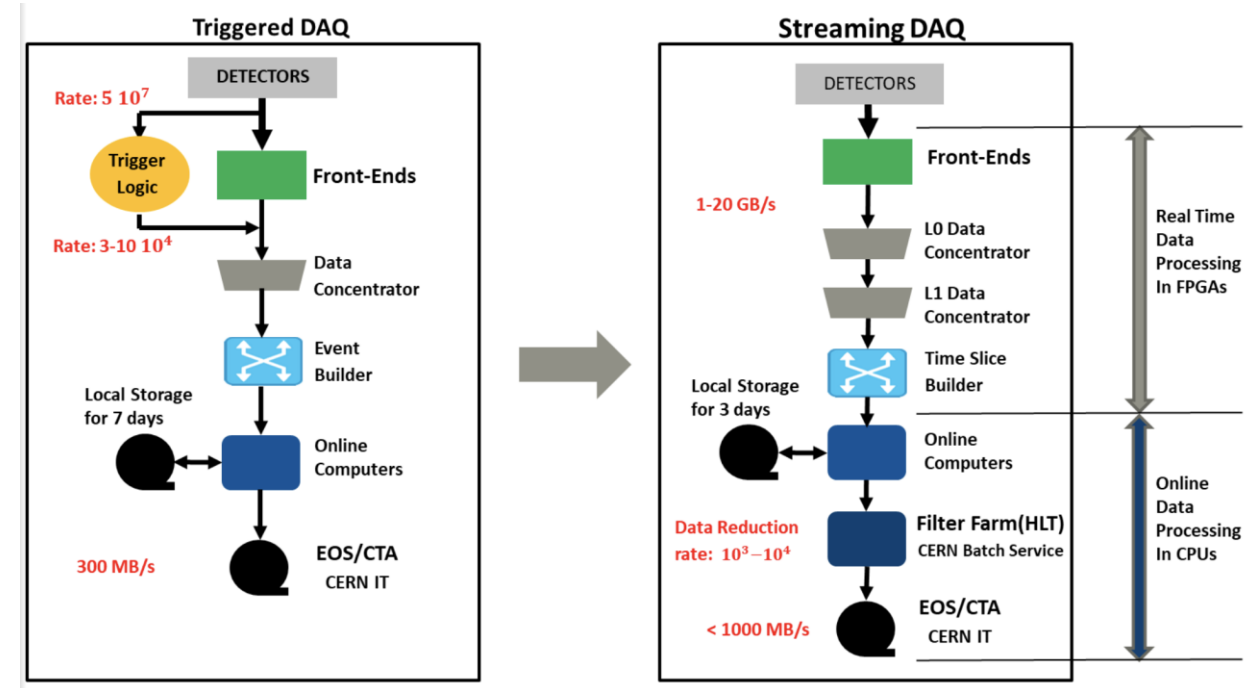
RES4	
Entries	135119
Mean x	0.00129
Mean y	0.003921
Std Dev x	0.006337
Std Dev y	0.007971

[Martin Bajzek]  
results from tests in  
muon beam 2022

# Highlights from test beams and plans



Test of new GEM detectors with VMM readout in the beam 2023



Implementation of the new streaming acquisition system FriDAQ

*Many new components are planned to be realized in 2024, with challenging timelines, aiming at PRM physics data taking in 2025*