

STATUS OF PANDA MUON SYSTEM SOFTWARE

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PANDA Collaboration Meeting

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GENERAL REMARKS

Panda Muon system TDR:

Software packages like simulation, track reconstruction, online muon selection, calibration and others are under responsibility of the University and INFN Torino with support from JINR/Dubna and GSI/FAIR. Software implementation and physics cases will be jointly developed by JINR, and INFN Torino.

Stefano Spataro's report (November, 2016):

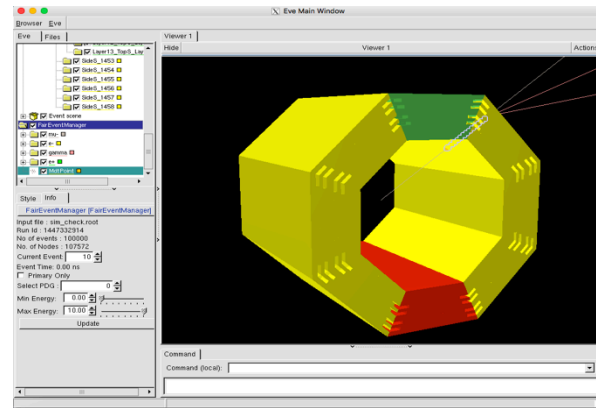
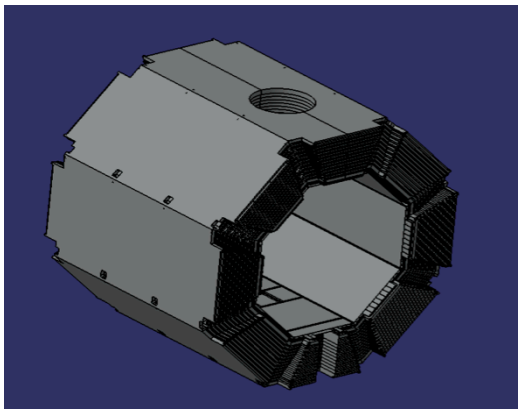
The Muon detector is build by Dubna and the first software version was developed in Torino.

**JINR/Dubna takes full responsibility on software
DE FACTO**

GEOMETRY

It is important to have the physical model of the Muon System in PANDARoot software for **full MC simulation of PANDA setup**.

There is no a direct way to transfer geometry from Computer-Aided Design (CAD) systems to Geant4 or Root



Geometry status (S. Spataro):

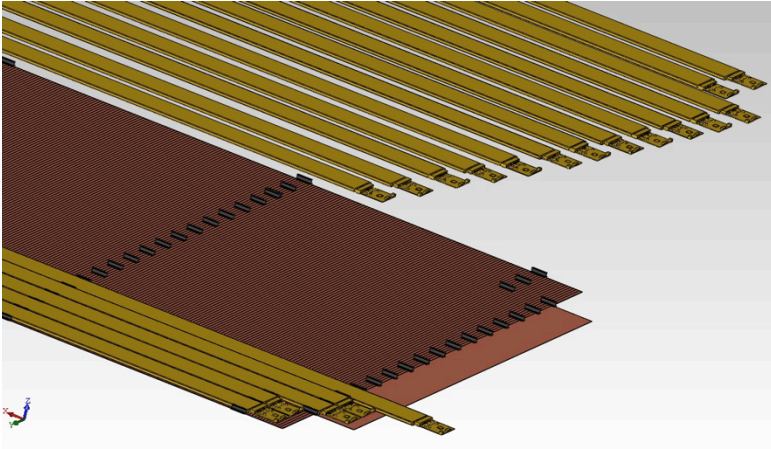
- 1) Simple: geometry with gas planes inside yoke without any other support material → default for simulation
- 2) Full: geometry with tubes but without support structures or electronics → still fast simulation

GEOMETRY

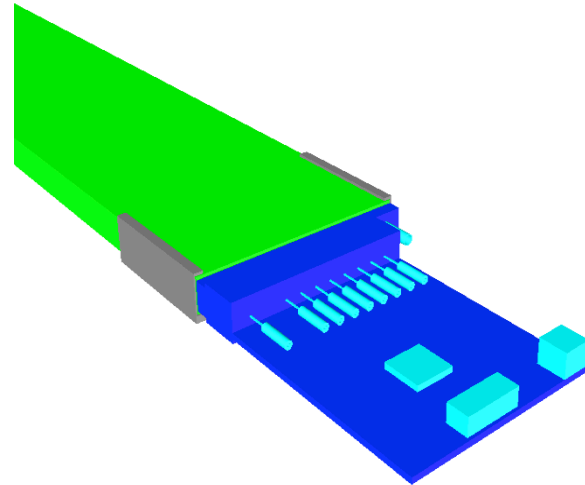
Current geometry issues:

- 1) The Muon detector is integrated into the Yoke of the Solenoid Magnet which will now be designed by the Budker Institute → need a discussion with BINP colleagues.
- 2) Old geometry which doesn't match the current design and doesn't contain all materials in a realistic way!
 - a) Full models for Panda Muon system parts (Barrel, FRS, MF) are ready and were send in mid 2015 by L. Vertogradov, **not integrated yet.**
 - b) Even more sophisticated geometrical models for Barrel and Prototype are ready by A.Verkhhev.
 - c) Model for FRS, MF is under construction now (G. Golovanov)

CAD AND GEANT4 MODELS

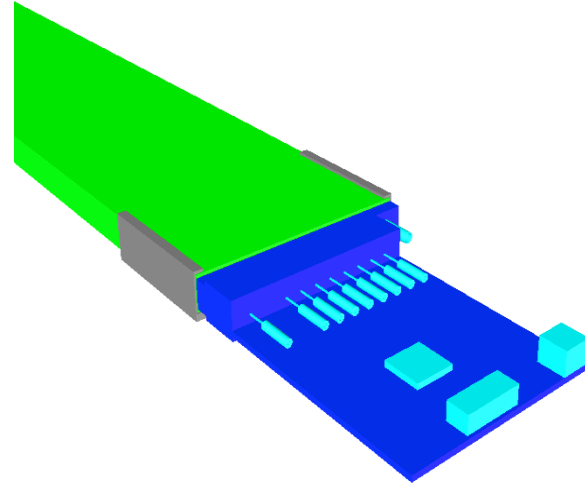
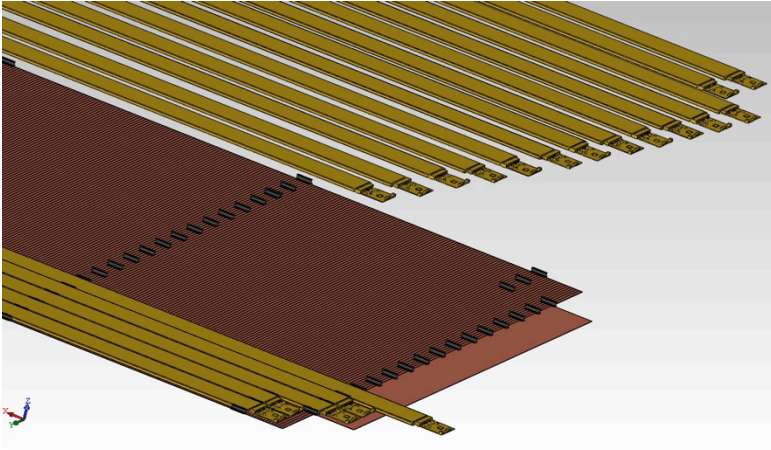


Detector geometry
(CAD format) systems



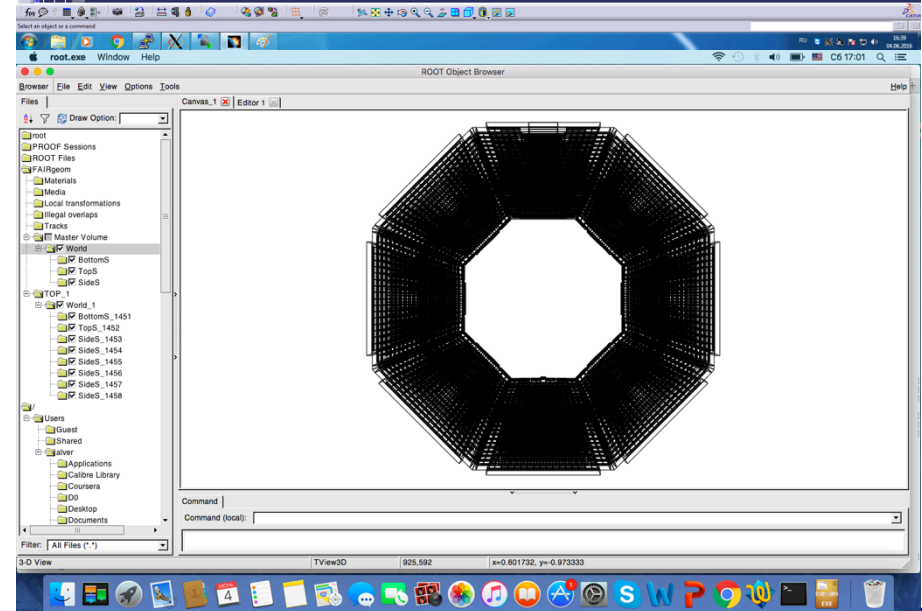
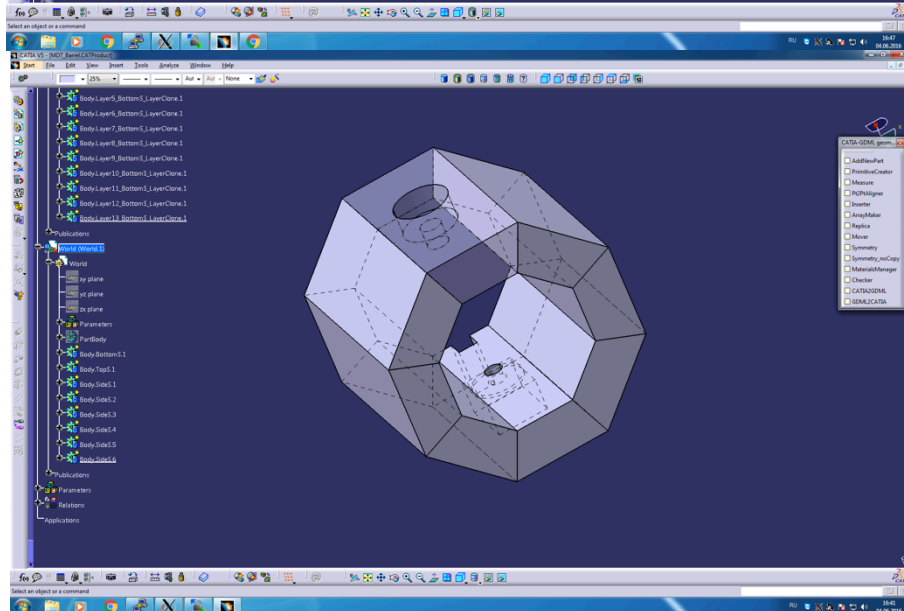
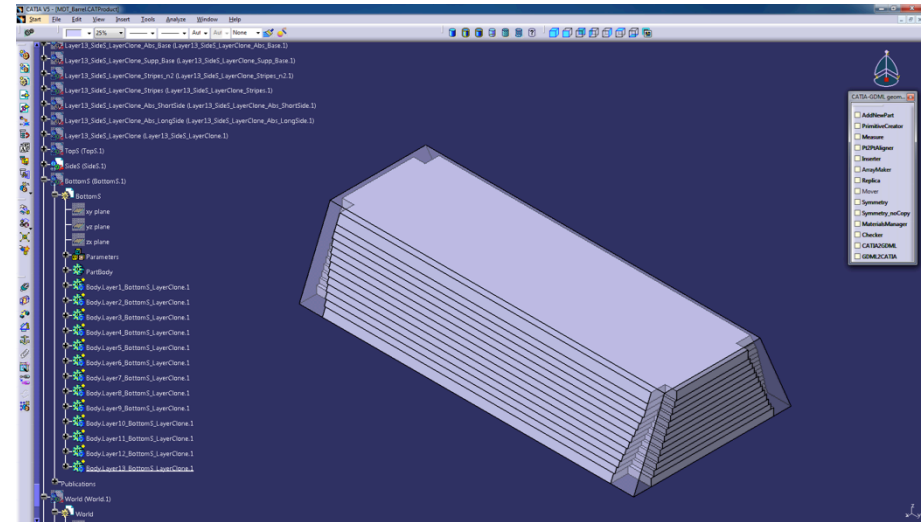
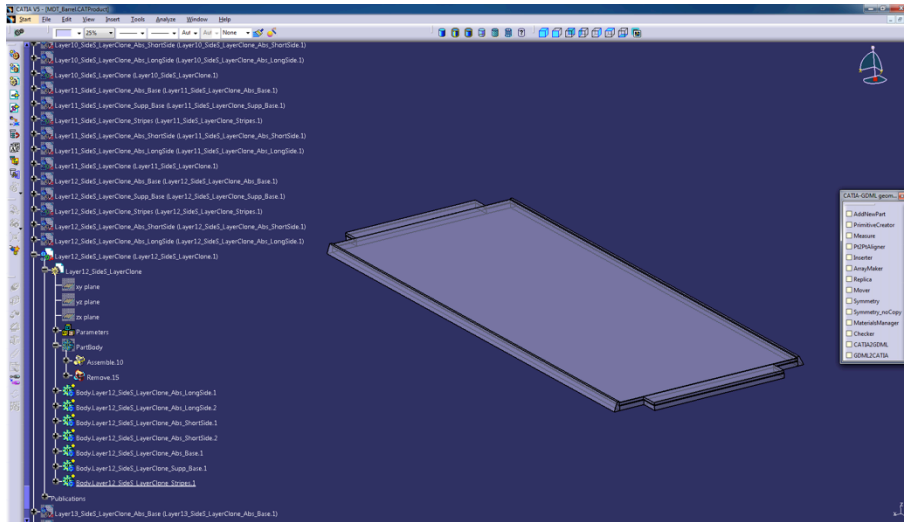
Physical model - particle
transport Monte Carlo
codes like GEANT4 and
ROOT

CAD AND GEANT4 MODELS



Set of tools allows to exchange the CAD-geometry to G4/ROOT compatible geometry using Geometry Description Markup Language (GDML).

STEPS OF MODELING



DIGITIZATION

Software for conversion of the simulated information into digital signals!

Digitization status (S.Spataro):

- 1) Simple: smearing the position of each MDT hit by 0.3 cm, corresponding to the cell size (1 cm) divided by $\sqrt{12}$ cm
- 2) Full: position based on tube, realistic signal simulation including time information

Current digitization issues:

- 1) Digitization procedure will be cross-checked on the Prototype.
- 2) T0 information is needed as additional input parameter

RECONSTRUCTION / SIMULATION

Reconstruction status (S.Spataro):

- 1) Simple: No clustering, real pattern recognition, hard cuts for PID -> Hard cuts are working
- 2) Full: Clustering, real pattern recognition but not cross-checked

Current reconstruction issues:

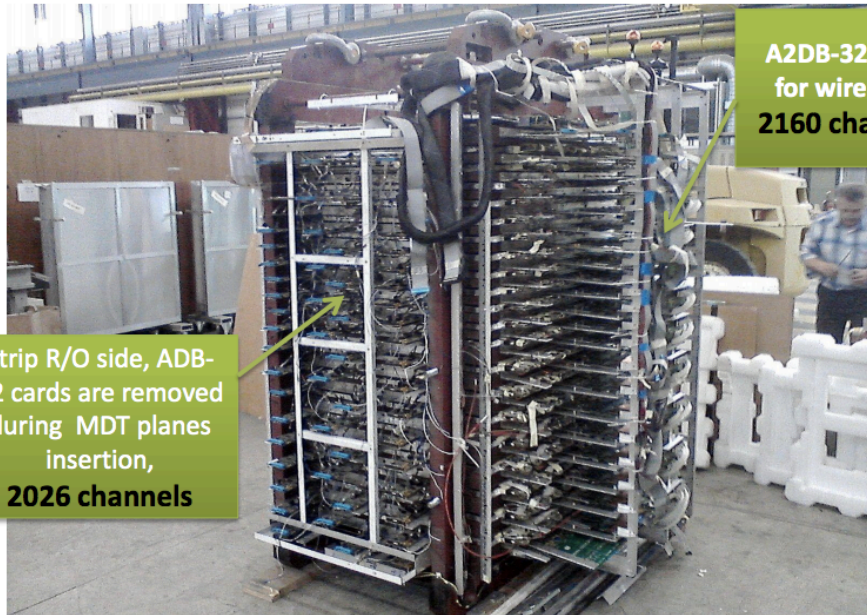
- 1) A big question to discuss (which algos to use)
- 2) No cross-check with test beam data from the Prototype

Current simulation issues:

- 1) Time-based reconstruction is not clear - if it is working because the developer (Torino) left
- 2) Serious PID algorithm is absent.

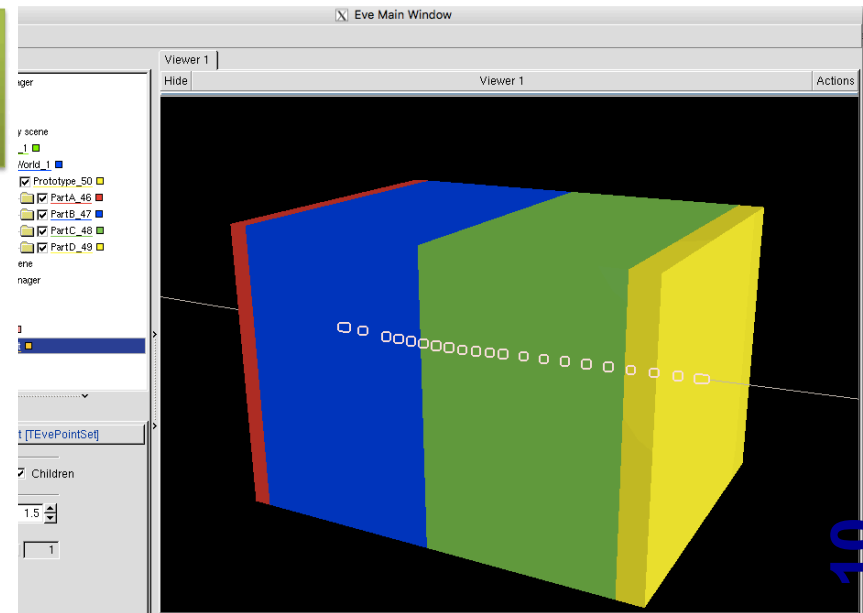
RANGE SYSTEM PROTOTYPE STUDY @ CERN

- Calibration of the system's response to the different particles and energies.
- Test of algorithms for μ/π separation
- Tune digitization algorithm
- Technical issues

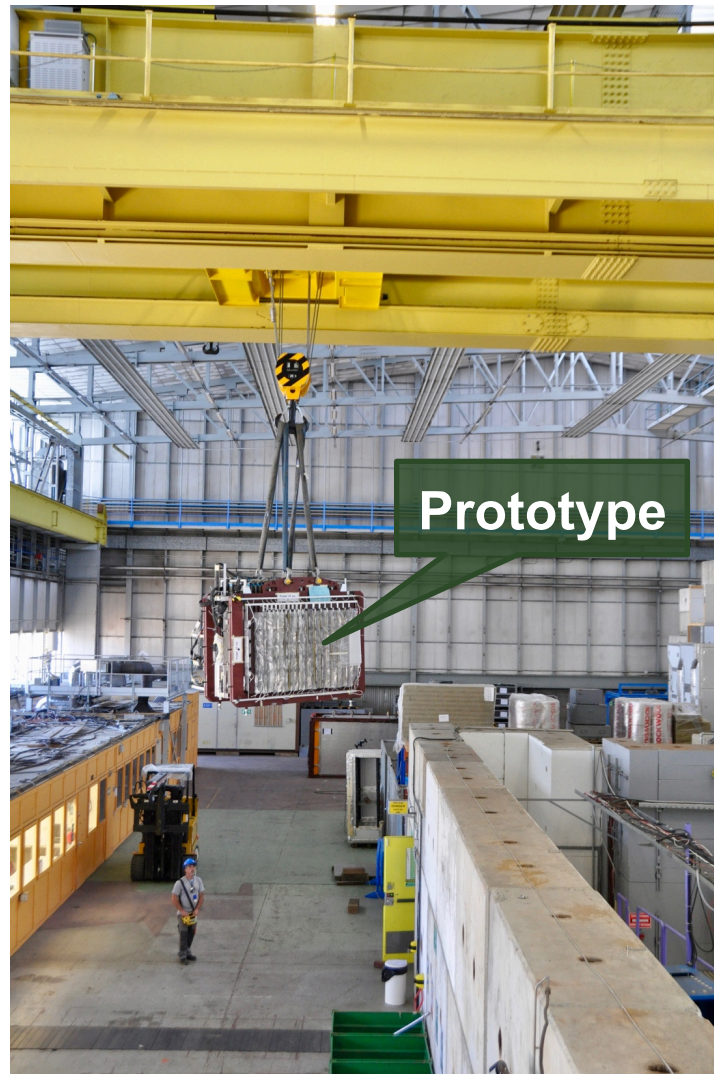


A2DB-32 cards
for wire R/O,
2160 channels

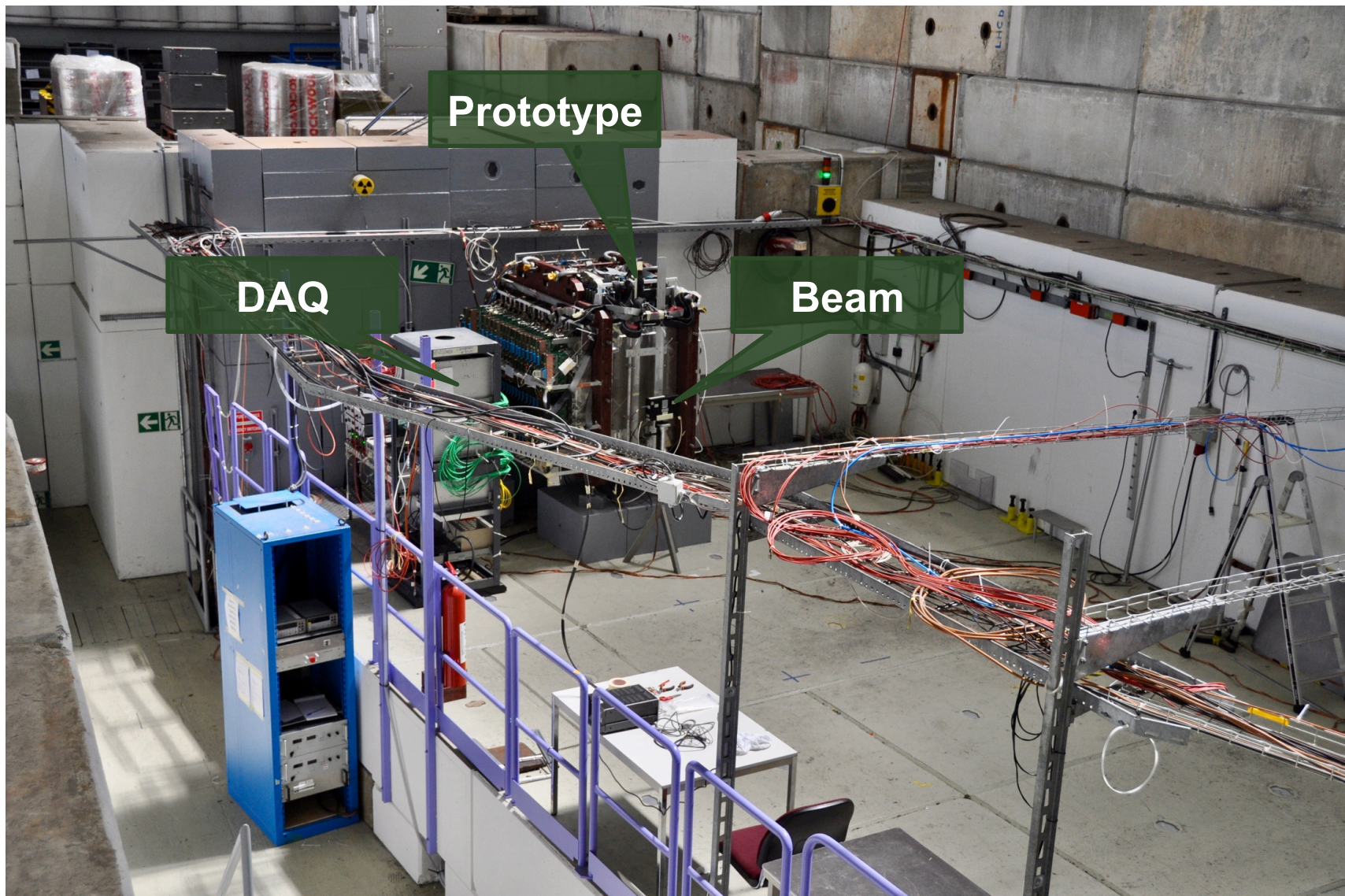
Strip R/O side, ADB-
32 cards are removed
during MDT planes
insertion,
2026 channels



MOUNTING OF PROTOTYPE @ PS/ EXPERIMENTAL HALL

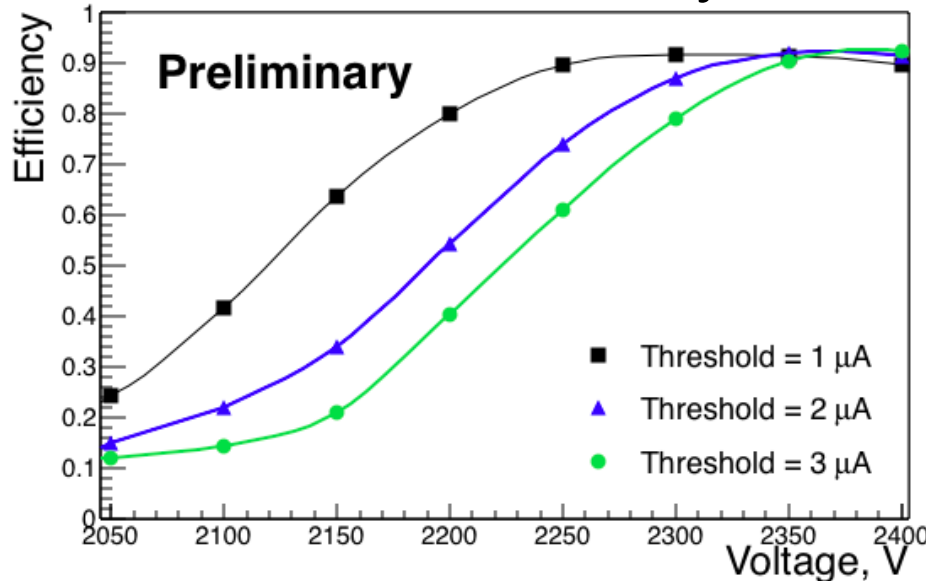


TEST BEAM @ PS/T9 BEAM LINE



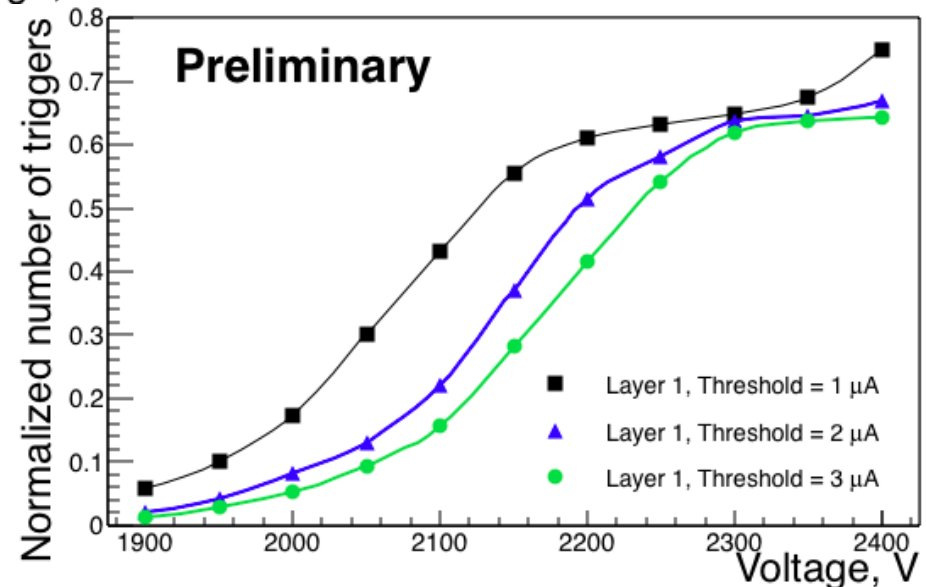
PROTOTYPE DATA (MAY 2017 RUN)

Tube's efficiency



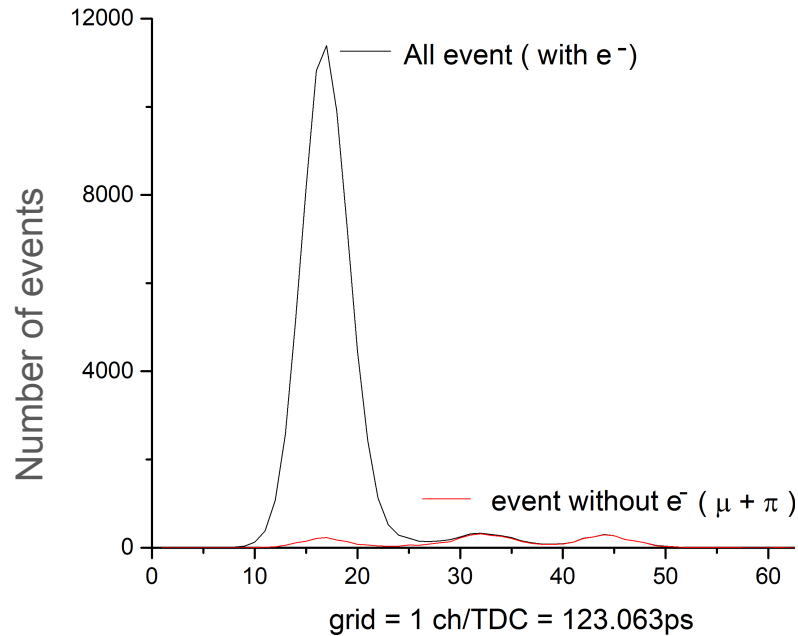
Beam: μ ,
 $E = 2.5 \text{ GeV}/c$

Tube's counting rate



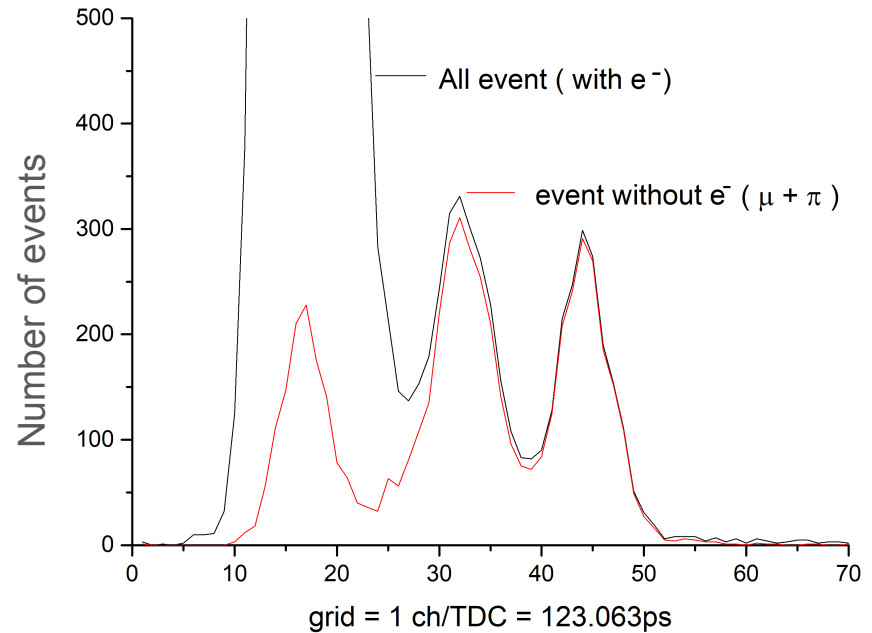
PROTOTYPE DATA FROM BEAM ToF

Run 605 -0.5GeV/c 04.06.2017



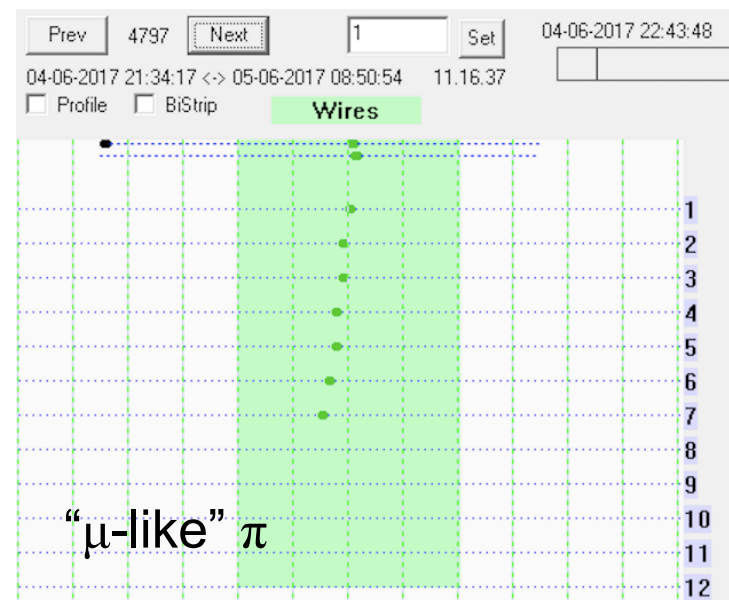
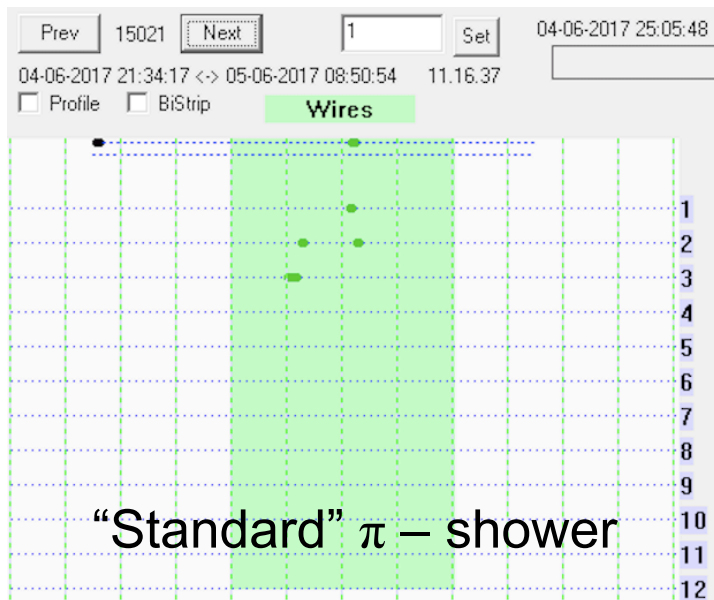
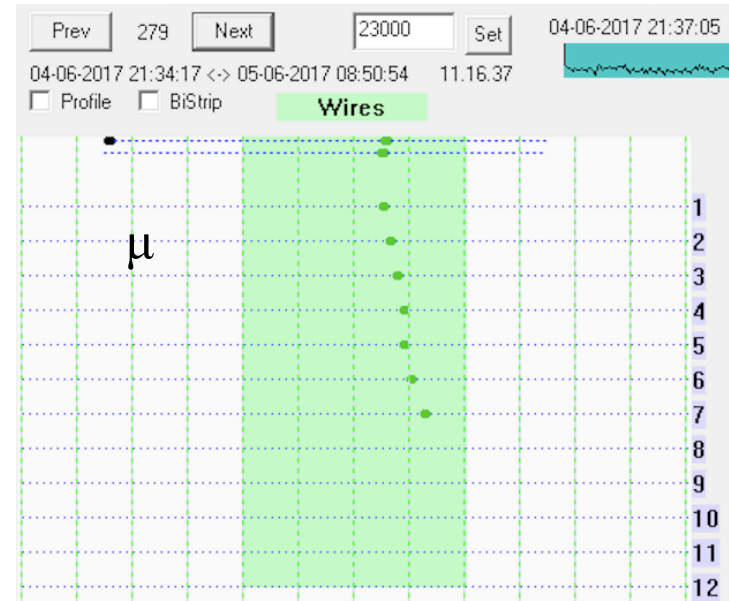
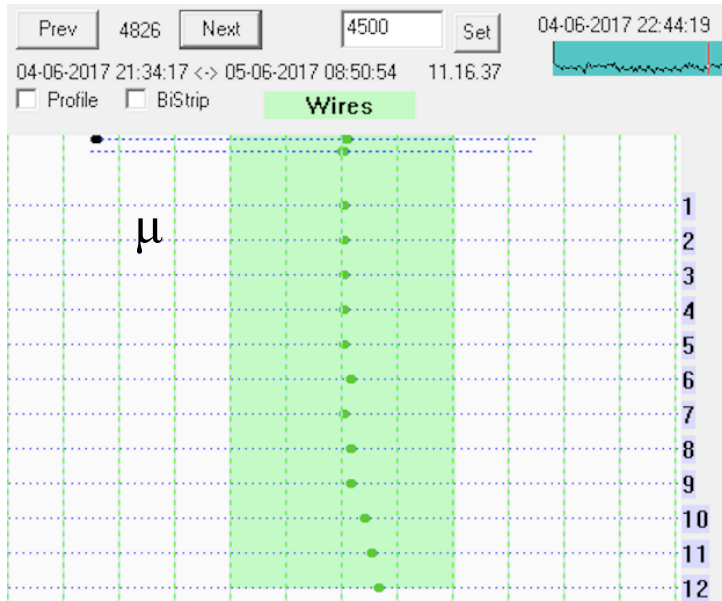
ZOOM

Run 605 -0.5GeV/c 04.06.2017



PROTOTYPE DATA (μ vs π)

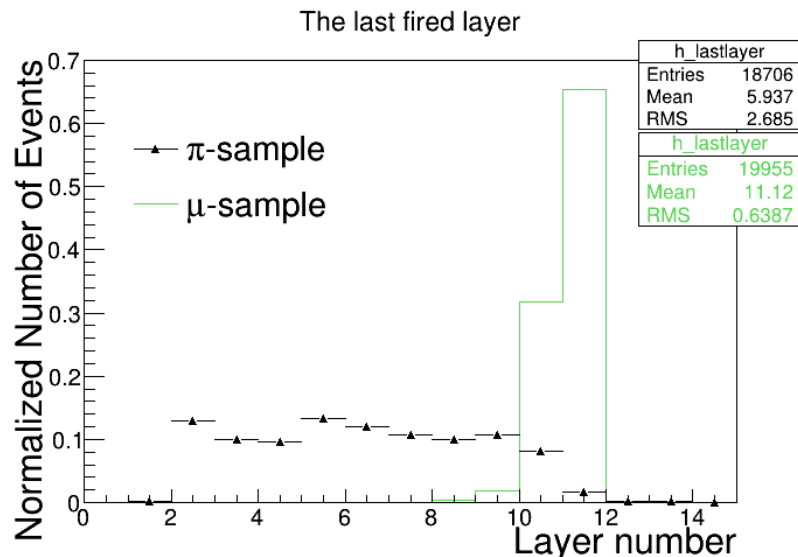
Run 605
 $E = 0.5 \text{ GeV}/c$



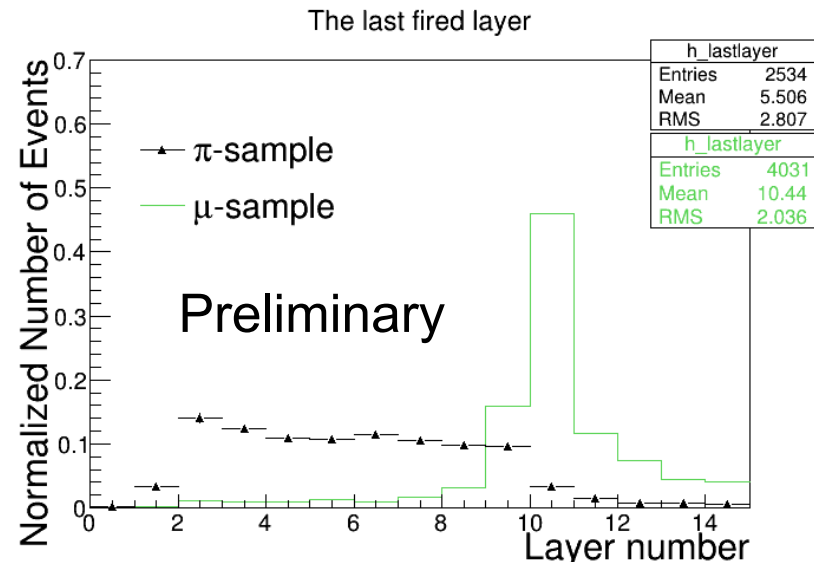
RESULTS FROM THE PROTOTYPE

We have developed the class for Prototype in PANDARoot framework which describes the Prototype's geometry and allows to get MC.

E = 0.5 GeV/c MC



DATA, 2017



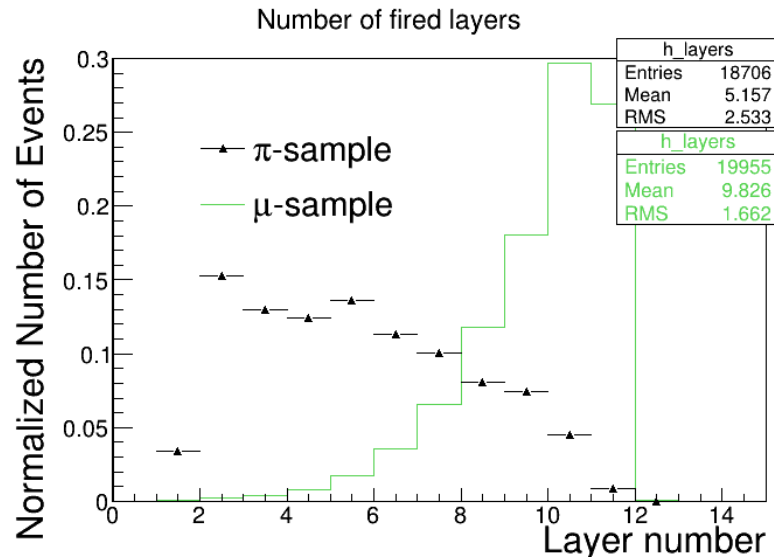
SUMMARY

- The model of the Panda Muon System Prototype is ready to transfer to PANDARoot software
- We have performed simulation of events with μ and hadrons.
- Prototype will be modified and new planes will be added for autumn 2017 run.



RESULTS FROM THE PROTOTYPE

MC



DATA, 2017

