MINISTERUL CERCETĂRII ȘI INOVĂRII

www.ifin.ro

- *Activities and achievements in the past 2 years*
- *Remarks on additional activities*
- *2018 perspectives*
- *2017 financial status*
- *2018 financial status*

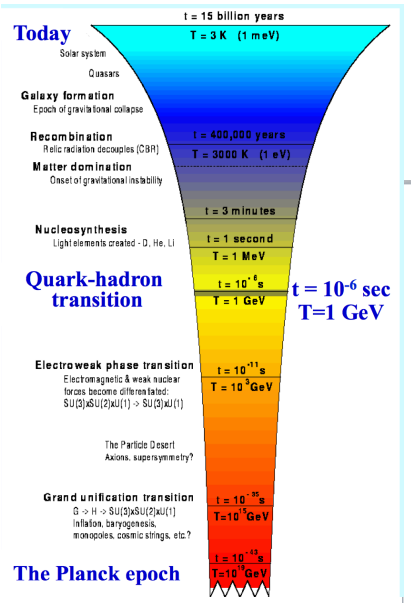
HADRON PHYSICS DEPARTMENT

Natinal Institute for Physics and Nuclear Engineering – IFIN-HH

http://niham.nipne.ro

ISAB Meeting, January 23, 2018

Motivation



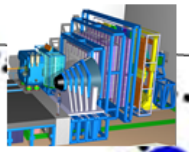
Expectations based on QCD

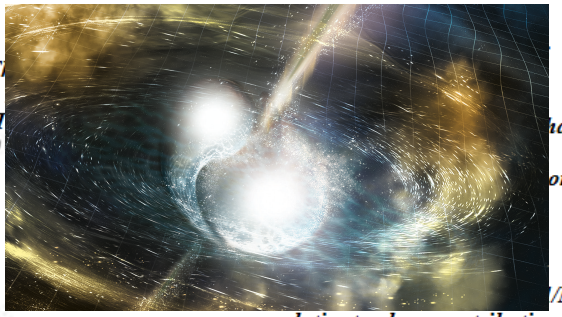
QCD Critical Points

T

H

μ_H=350 -400 MeV,
T_H = 150-160 MeV



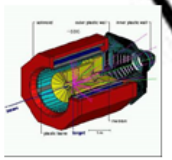


Statistical model:
- *for μ_B << m_N the thermal degrees of freedom dominated by mesons*
- *for higher μ_B more baryons are excited*

E

relative to gluon contribution
⇒ cold dense matter in the N_c=∞ world for μ_B >> m_N quarkyonic matter

Chiral transition:
μ_B > μ_E - first order
μ_B < μ_E - crossover
realistic u,d,s masses



Quark-Hadron continuity:

F

G

Liquid-gas phase transition:
μ_{NM} ≅ 924 MeV
n_0 = 0.17 fm^{-3}

Superfluid nuclear matter ⇒ *Superconducting quark matter*

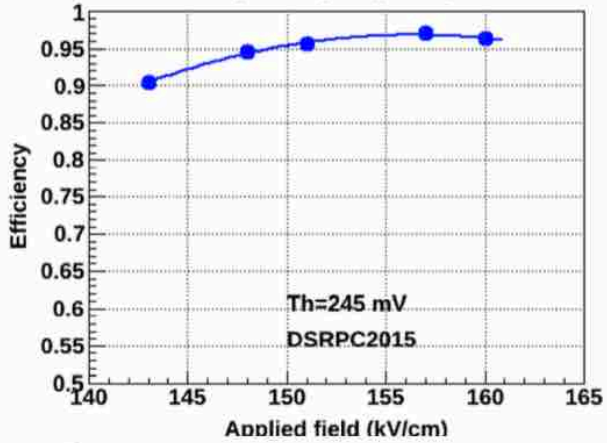
μ_B

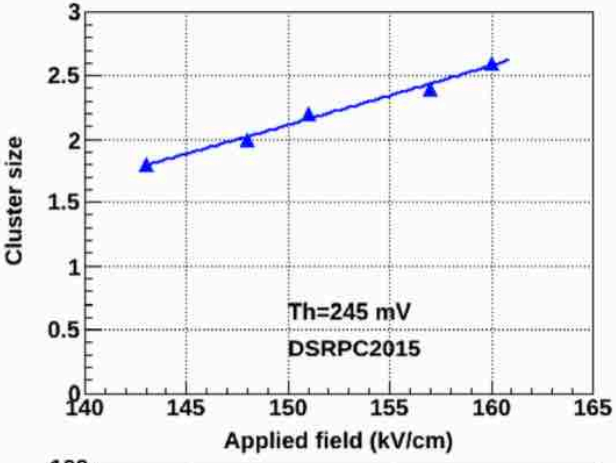
R&D

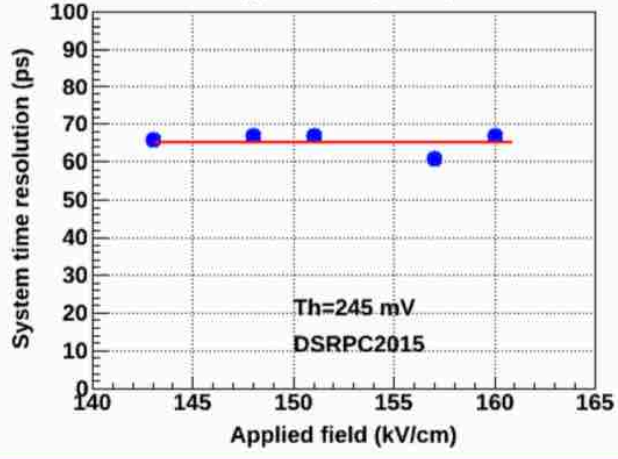
Calibration & analysis of November-December 2015 in-beam tests @ SPS

Pb beam of 30A GeV on a Pb target

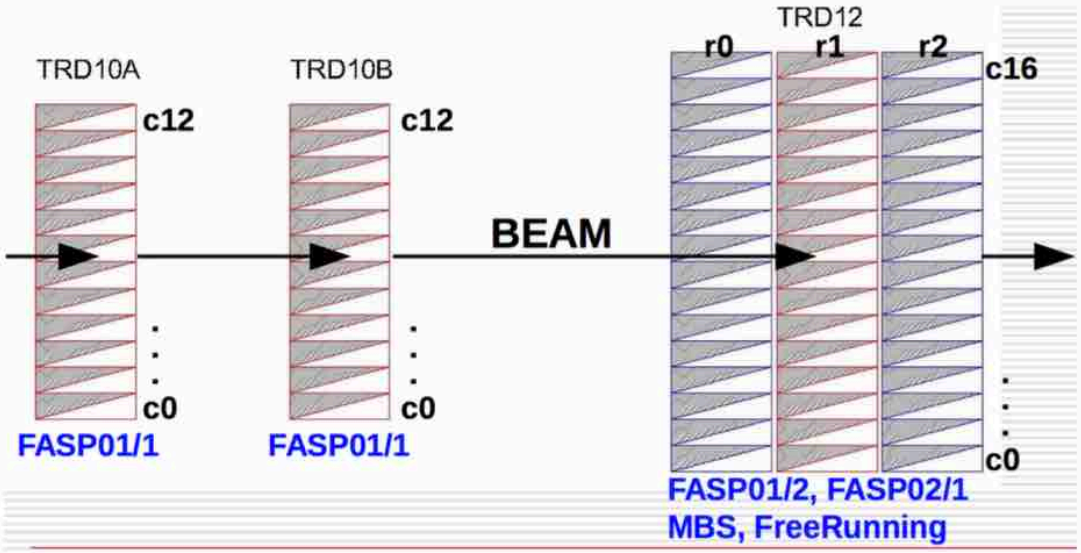
HCRMGMSRPC



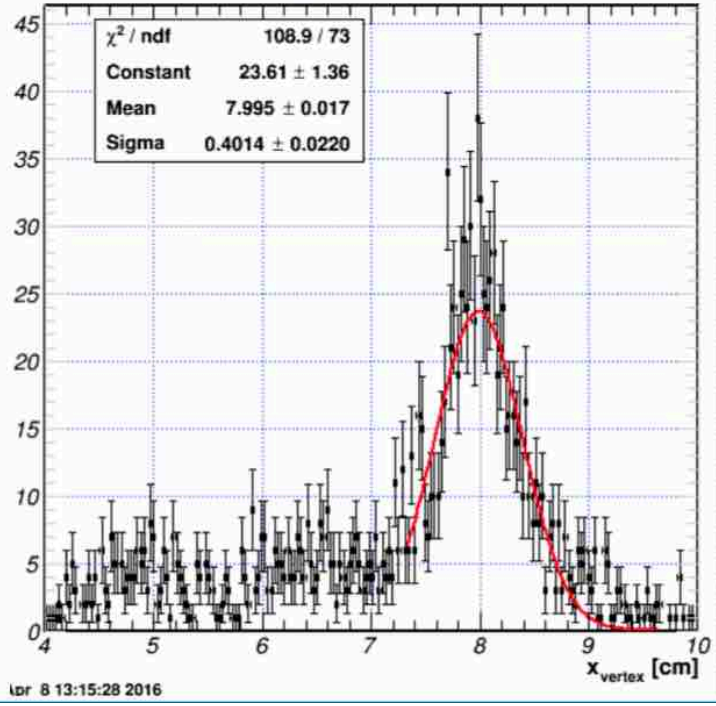




HCRTRD

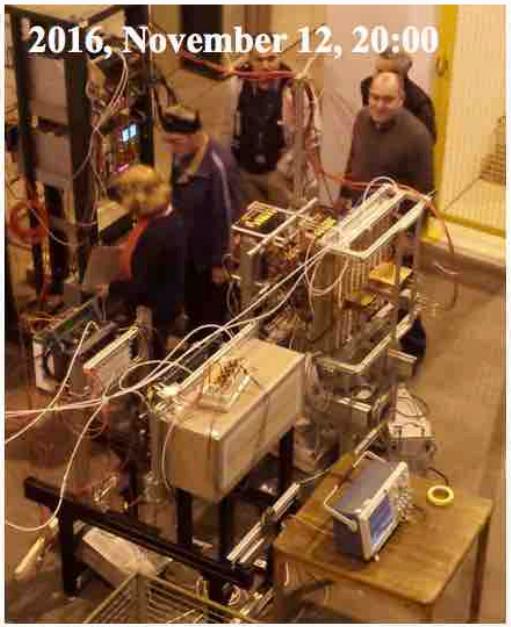


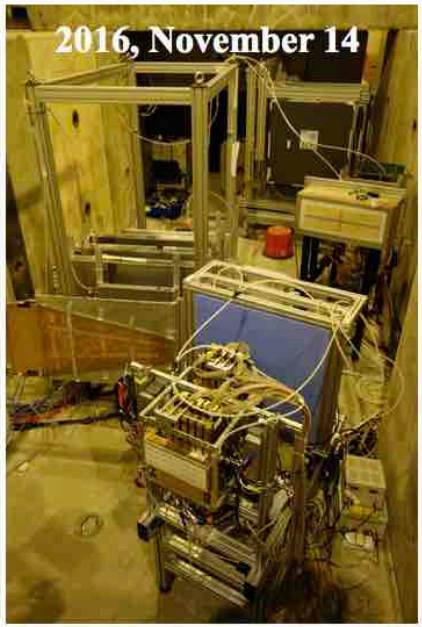
Interaction point reconstruction

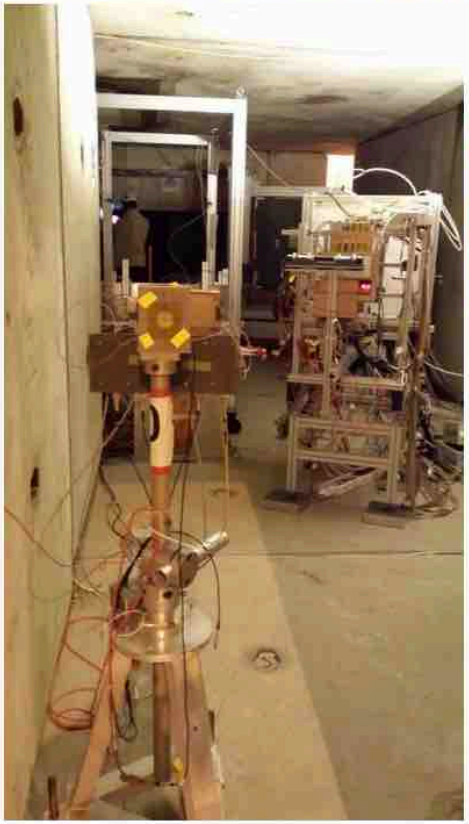


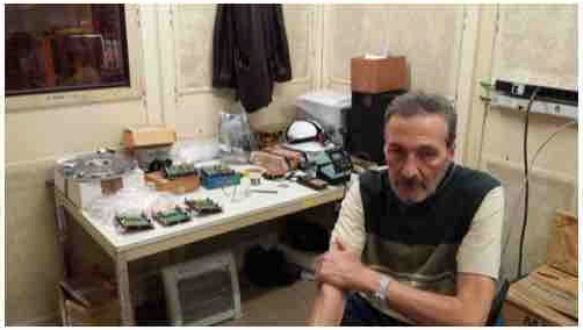
R&D

November-December 2016 in-beam tests @ SPS



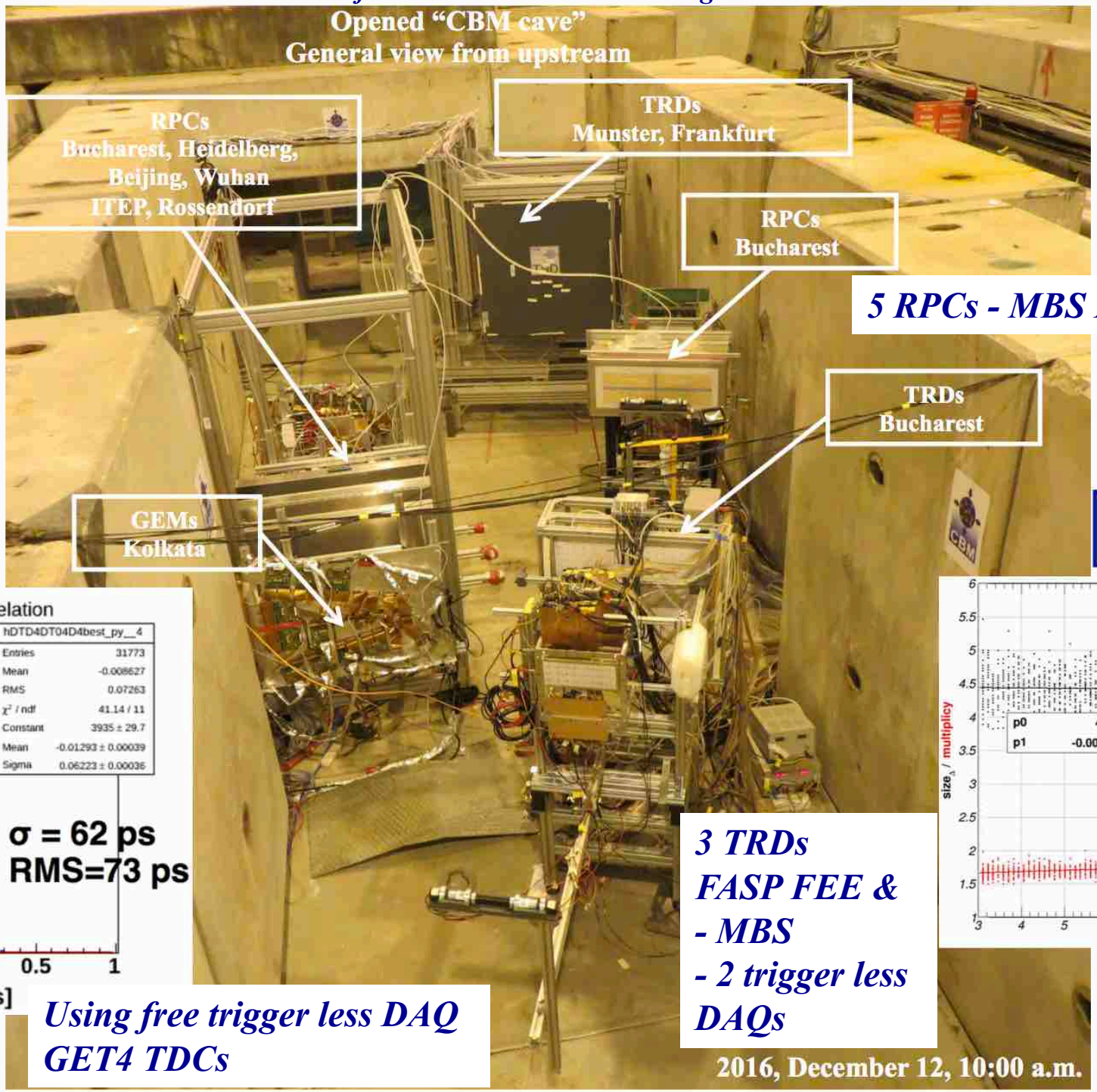






R&D

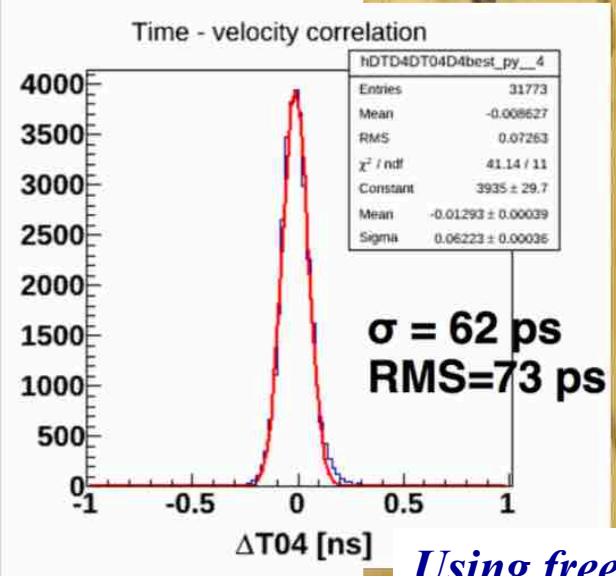
November-December 2016 in-beam tests @ SPS
Pb beam of 13/30/150 AGeV on a Pb target

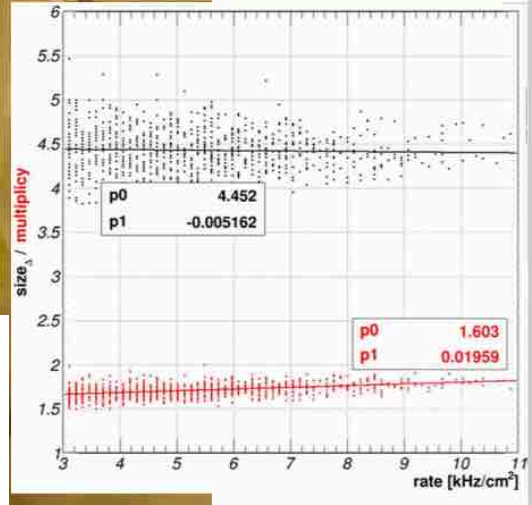


RPCs Bucharest

5 RPCs - MBS DAQ

TRDs Bucharest





3 TRDs
FASP FEE &
- MBS
- 2 trigger less DAQs

Using free trigger less DAQ
GET4 TDCs

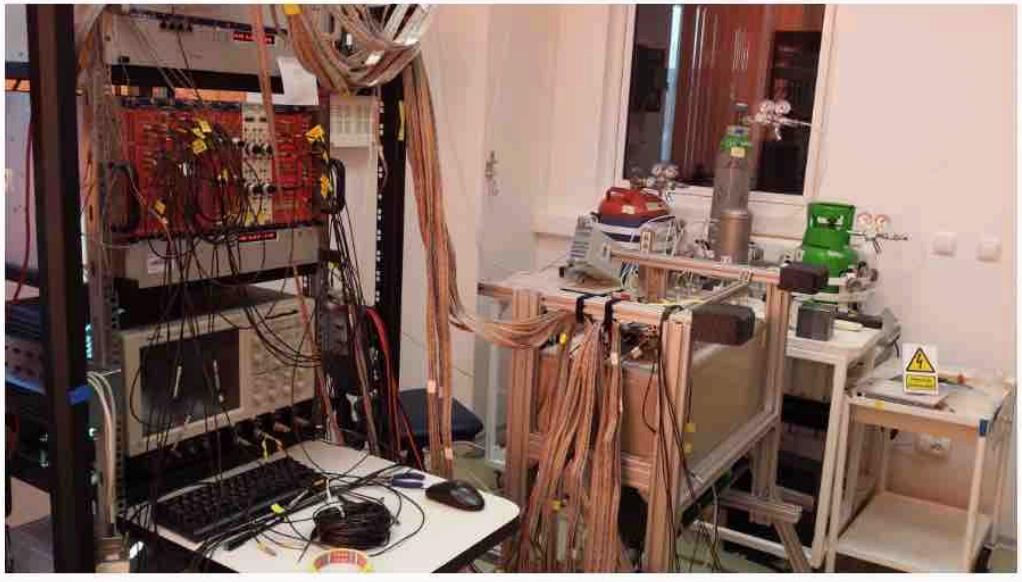
2016, December 12, 10:00 a.m.

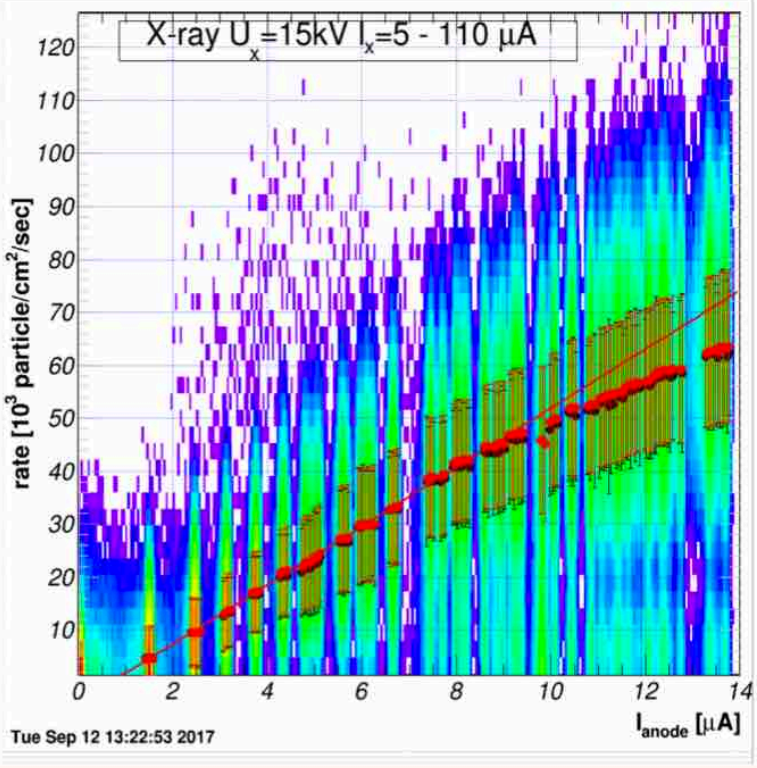
R&D

In-house tests

TRD

RPC



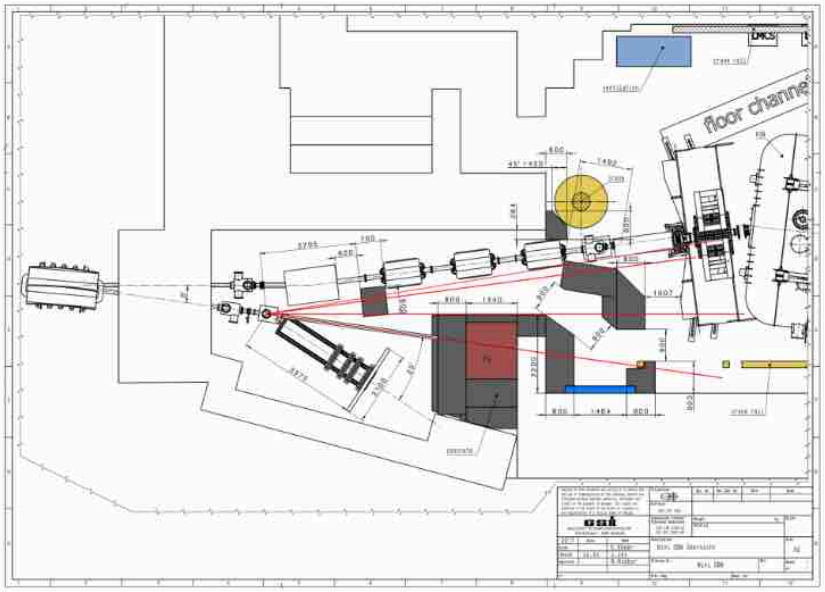


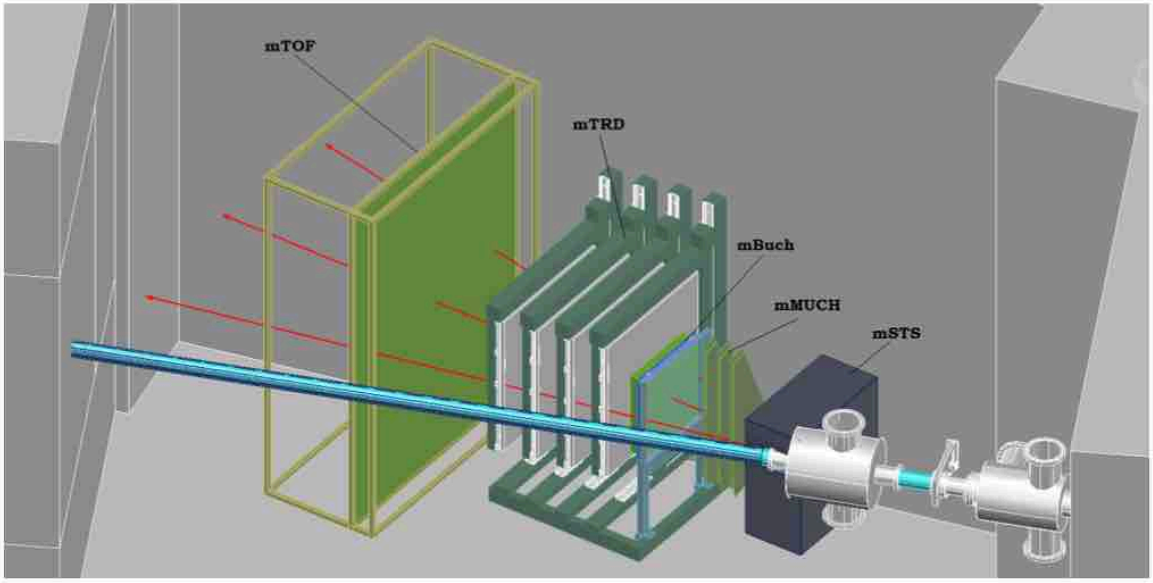
$$eff = \frac{RPC\ \&\ PMT(1\&2)\&\ PMT(3\&4)}{PMT(1\&2)\&\ PMT(3\&4)}$$

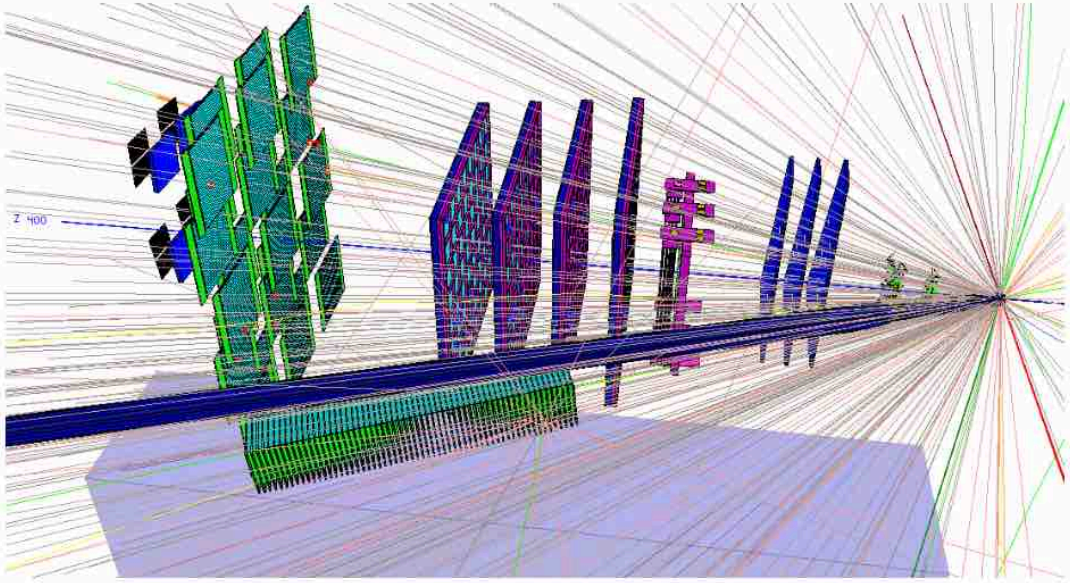
$$eff = \frac{84\ events}{90\ events} = \mathbf{93.3\ \%}$$

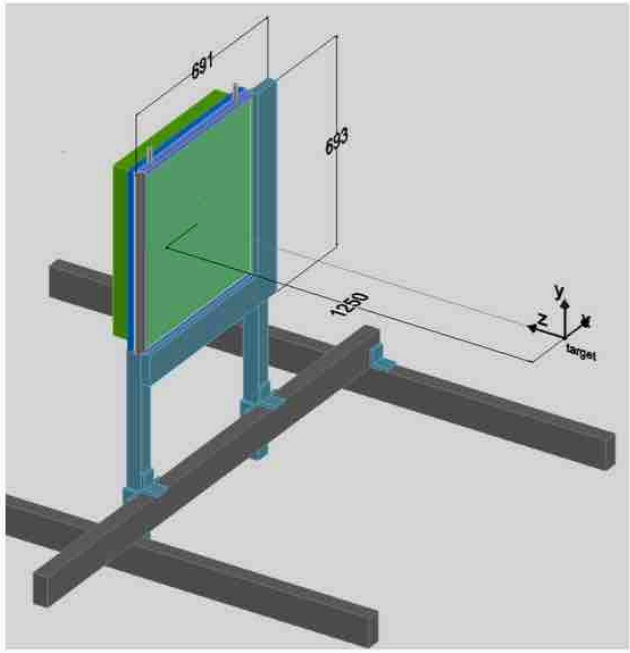
R&D

Integration of Bucharest TRD in mCBM Experiment @ SIS18
FAIR Phase0



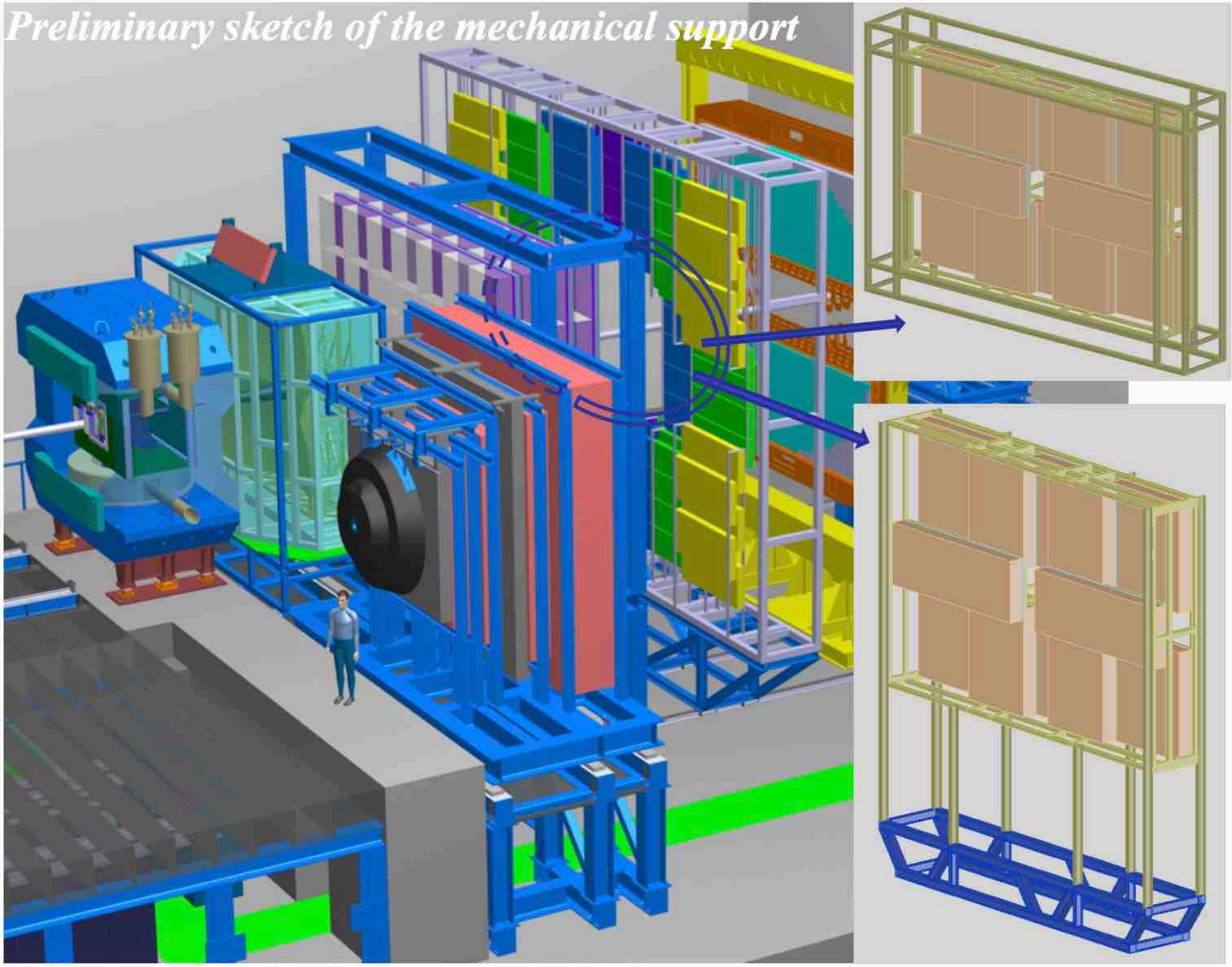






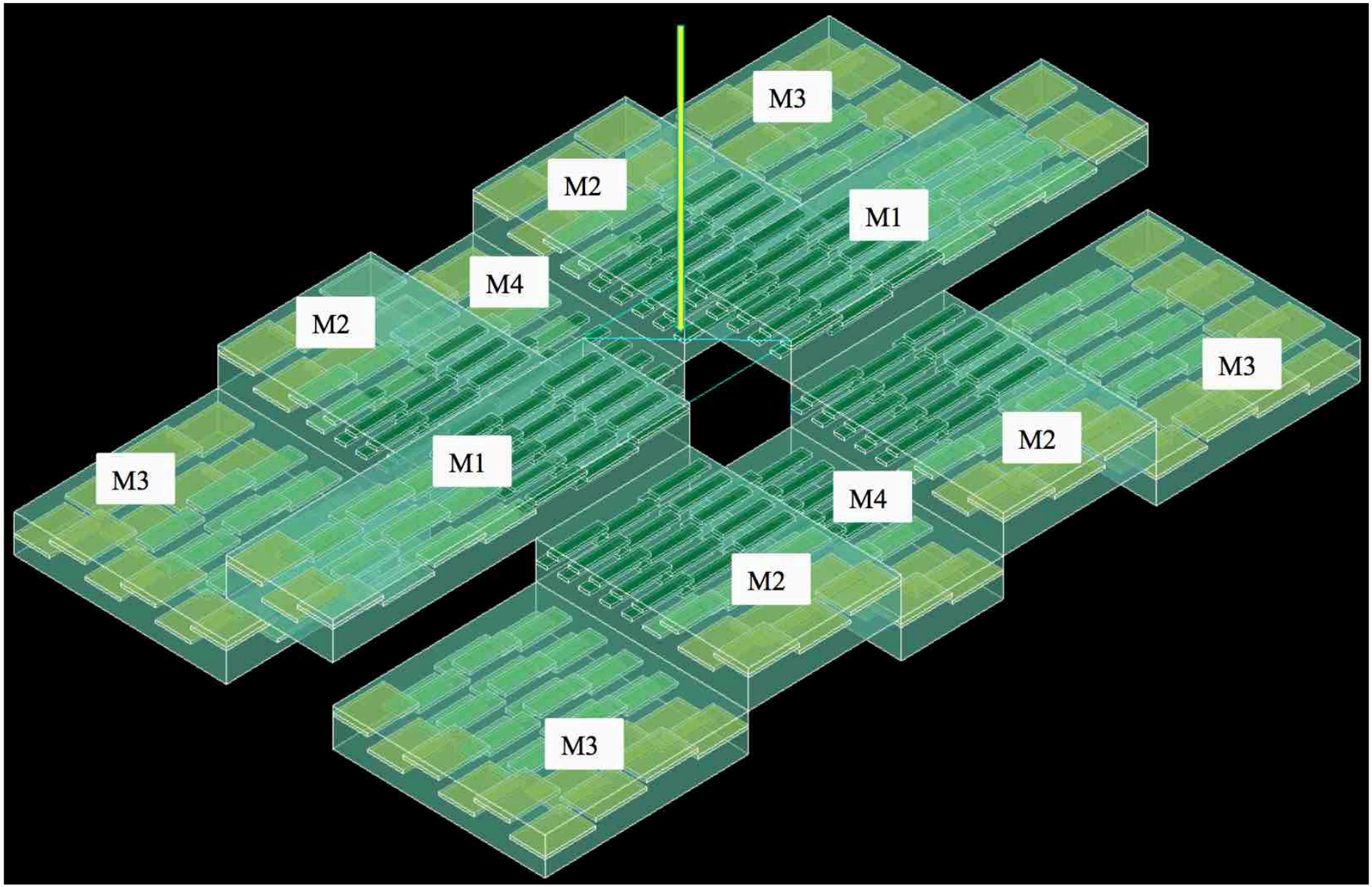
R&D

Inner zone of the CBM-ToF



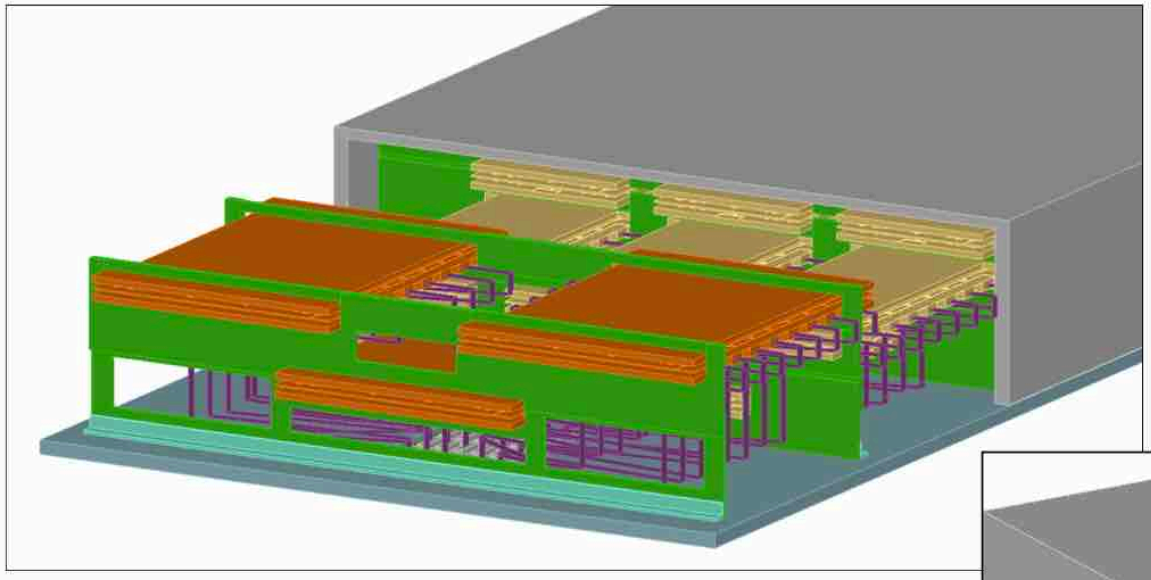
R&D

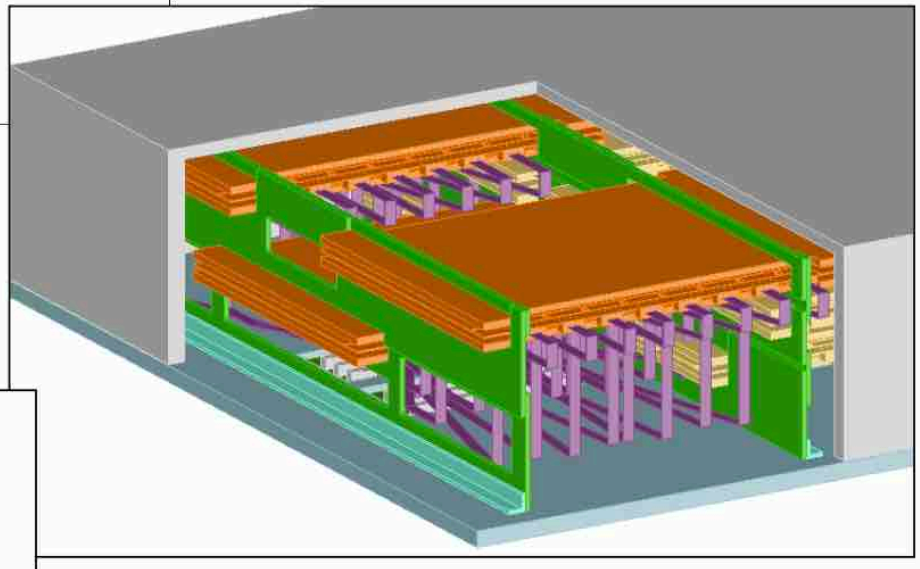
Inner zone of the CBM-ToF



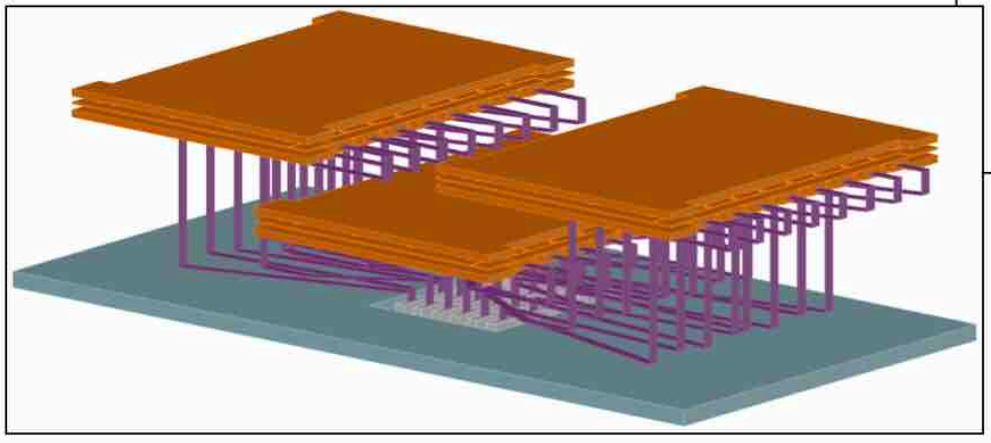
R&D

Inner zone of the CBM-ToF





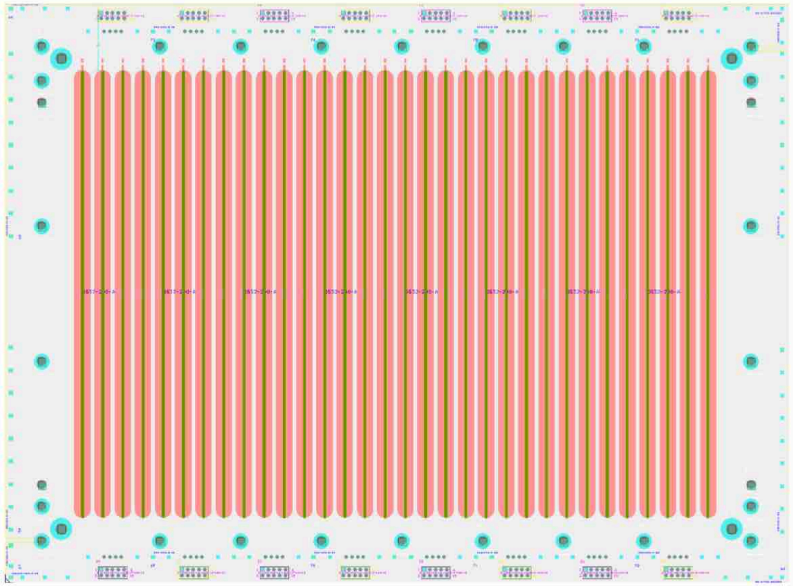
Signal cables routing



R&D

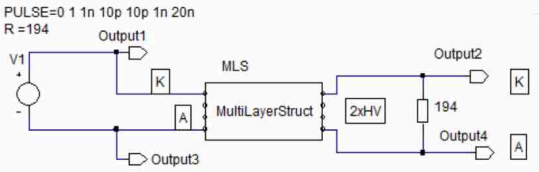
Integration of Bucharest RPC in mCBM Experiment @ SIS18
FAIR Phase0

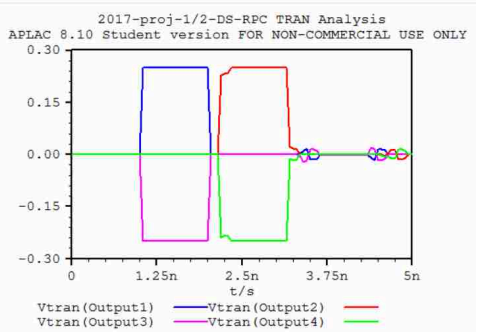
New RPC2017DS prototype design



Readout electrode: 9.02 mm pitch= 1.27 mm width + 7.75 mm gap
High Voltage electrode: 9.02 mm pitch= 7.37 mm width + 1.65mm gap

APLAC simulation of transmission line impedance





Input/Output signals are recorded for different values of the readout strips width

If R = Z_0= Z_L ➡ the transmission line is matched;

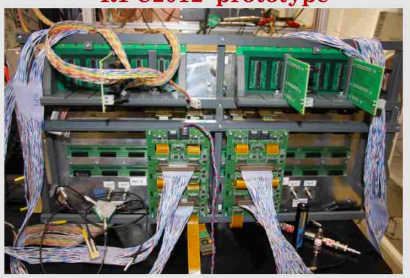
APLAC predicted 194 Ω for 1.27/7.4 mm readout/HV strip width

The two stacks in parallel will have an equivalent impedance of 97 Ω

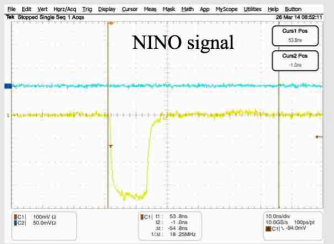
D. Bartos et al., arXiv:1708.02707v1

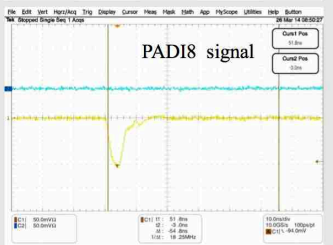
Signals delivered by NINO and PADI FEE (March 2014)

RPC2012 prototype



CAEN TDCs cannot process PADI signals for both leading and trailing edges.





Assembling & Tests of important components of large scale experiments

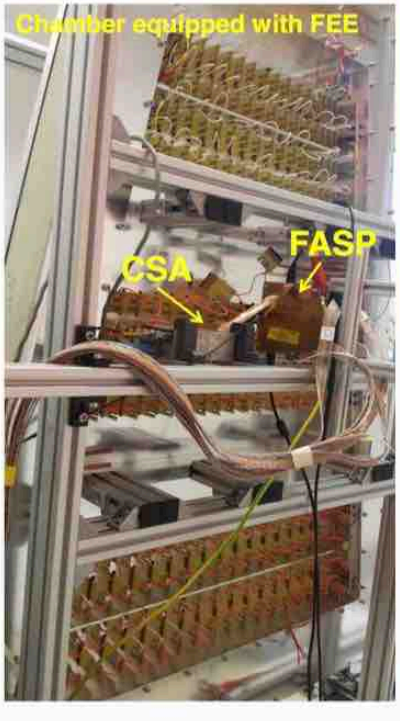
Upgrading the DetLab ceiling

Assembling & Tests of important components of large scale experiments
ALICE-TPC Upgrade

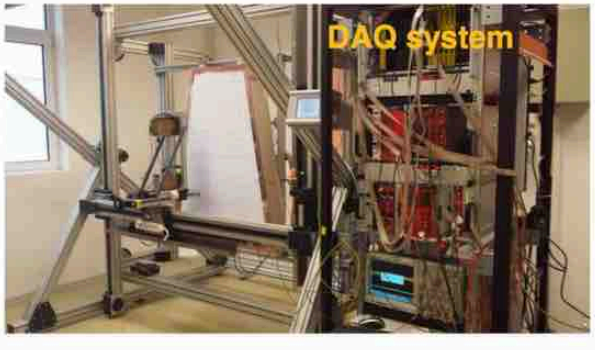
Assembled OROC

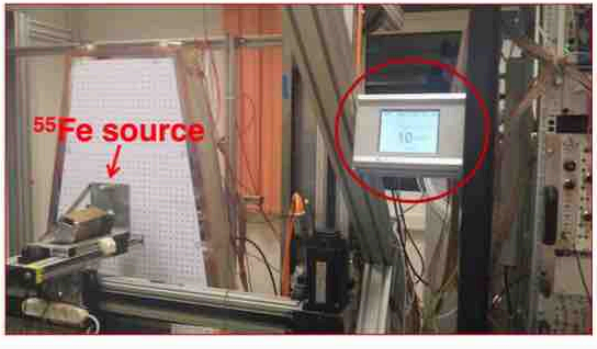
OROC Transport to the test laboratory

cabled OROC



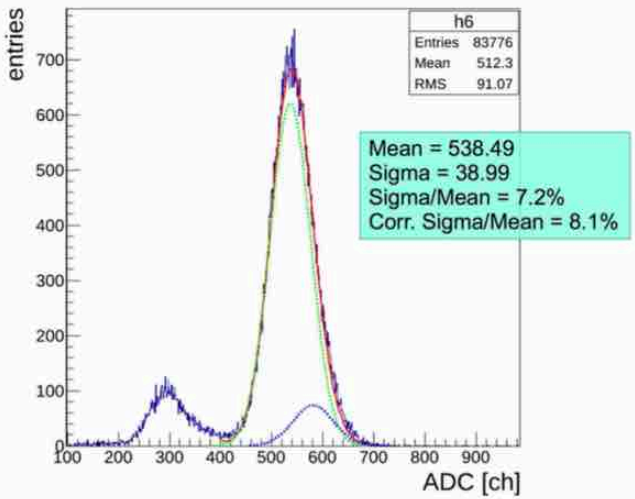
OROC testing insfrastructure



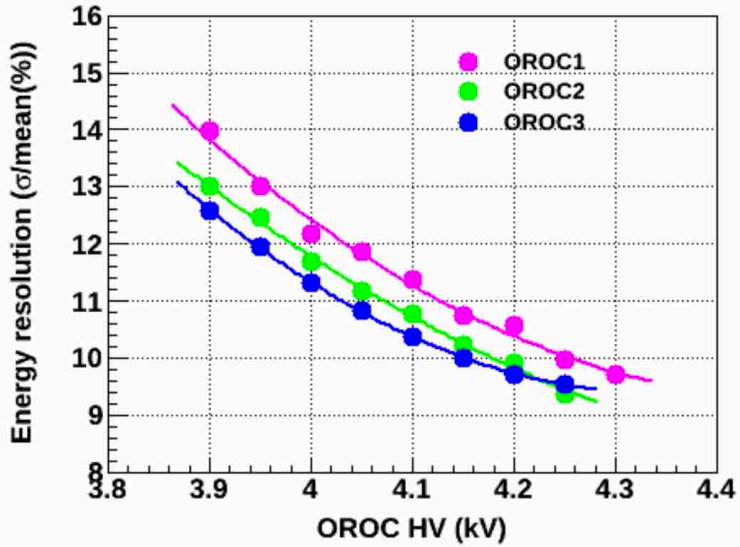


Assembling & Tests of important components of large scale experiments
ALICE-TPC Upgrade

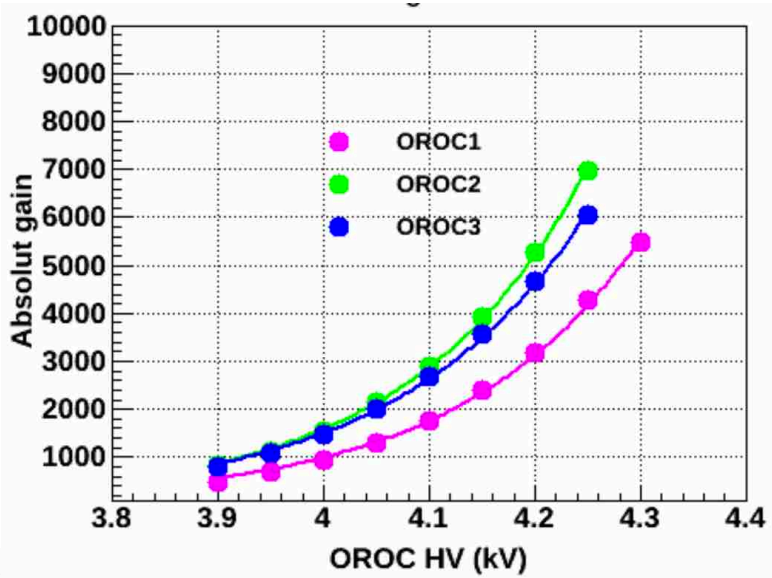
Test energy resolution
90%Ar + 10% CO_2



Resolution as a function of HV
Ne/CO2/N (90/10/5)



Gain as a function of HV
Ne/CO2/N (90/10/5)



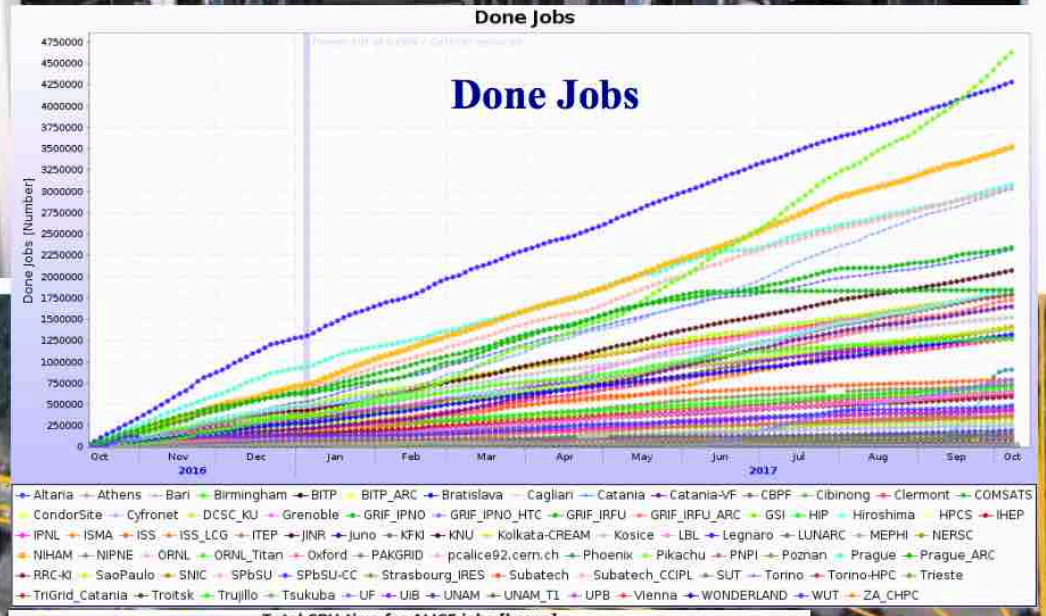
Research Infrastructure

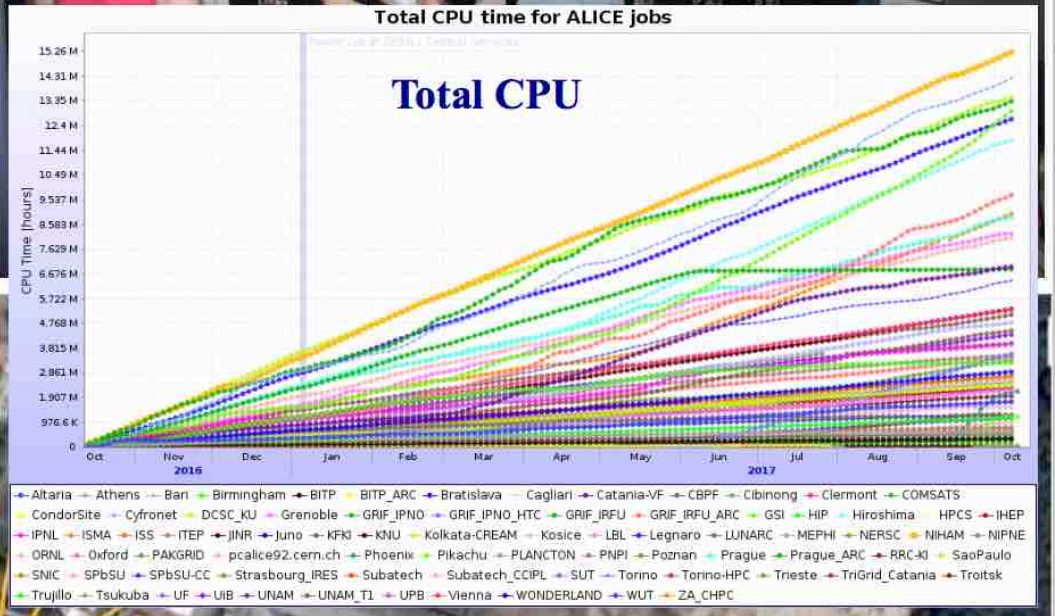
Research Infrastructure

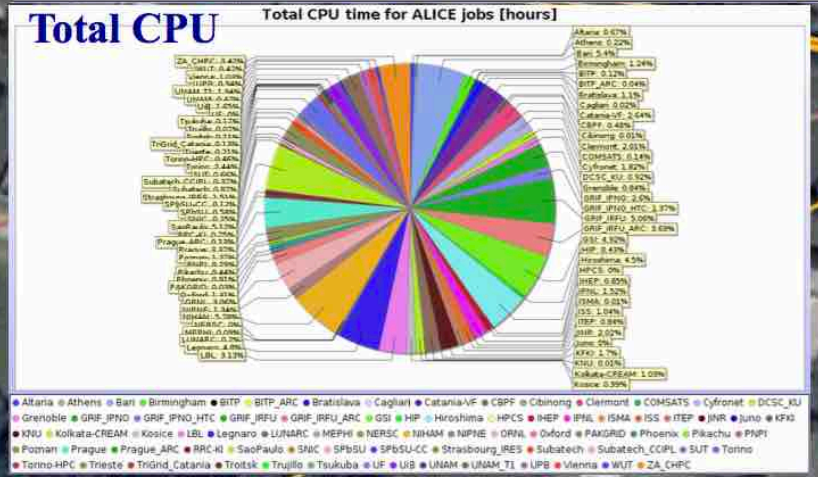
NIHAM
Tier2 component of ALICE GRID

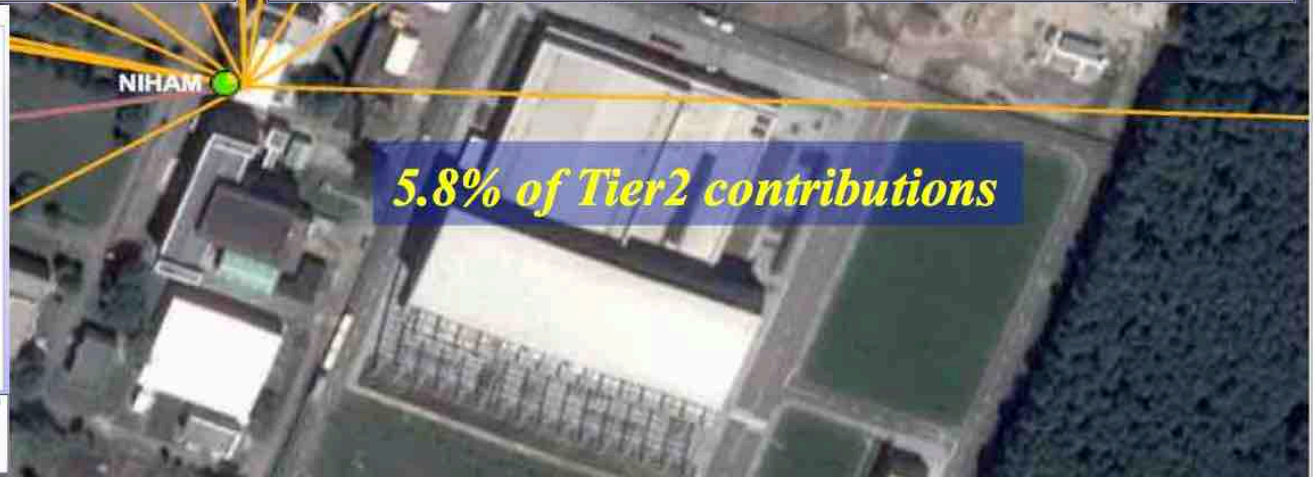
NAF (Niham Analysis Facility)

- Software development for an efficient and flexible local data analysis
- Analysis - efficiencies, contaminations
  - multiplicity & event shape
  - two-particles correlations
- Theoretical Models calculations







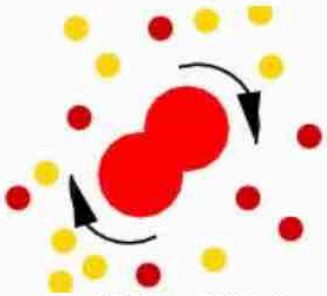


HPD Physics within CBM

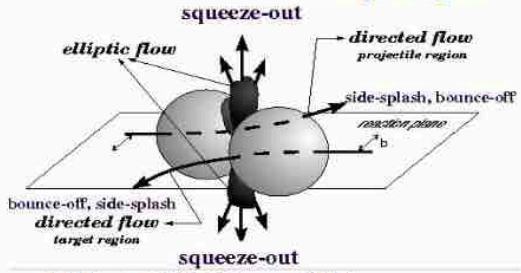
Elliptic flow

SIS-100 accelerator will deliver:

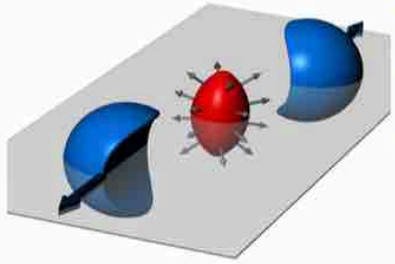
- heavy ions (Au) up to 11A GeV
  $\sqrt{s_{NN}}$ = 4.7 GeV
- light ions (e.g. Ca) up to 14A GeV
  $\sqrt{s_{NN}}$ = 5.3 GeV
- protons up to 29 GeV
  $\sqrt{s_{NN}}$ = 7.5 GeV)



< 100 A•MeV

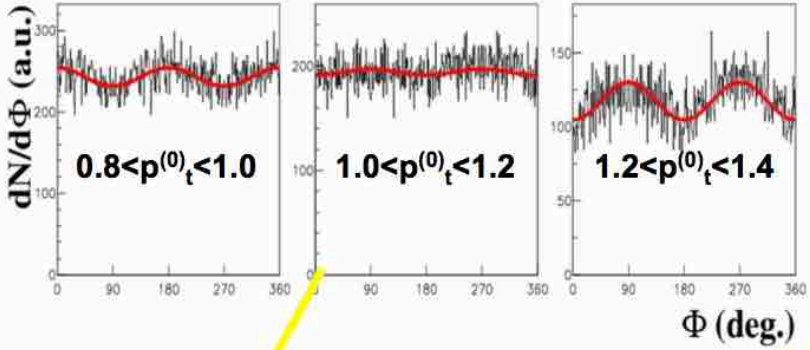


100 A•MeV - ~600 A•MeV



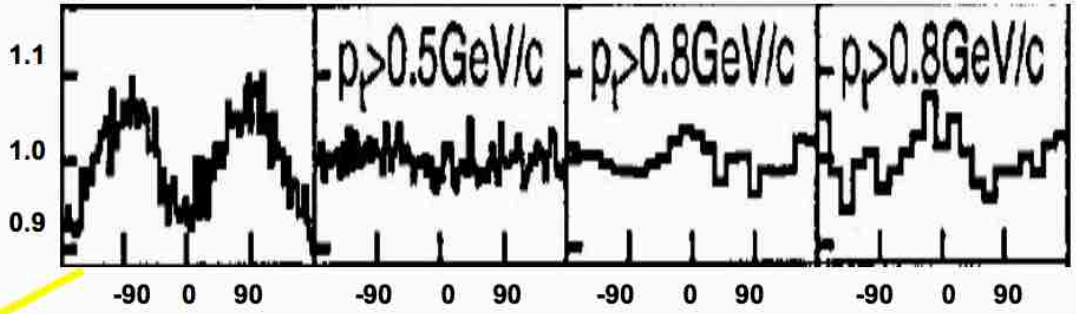
~4 A•GeV

Au+Au 120 MeV/u, CM3



A.Andronic, G.Stoicea, M.Petrovici &FOPI Coll. NPA679(2001)765

2 A•GeV 4 A•GeV 6 A•GeV 8 A•GeV

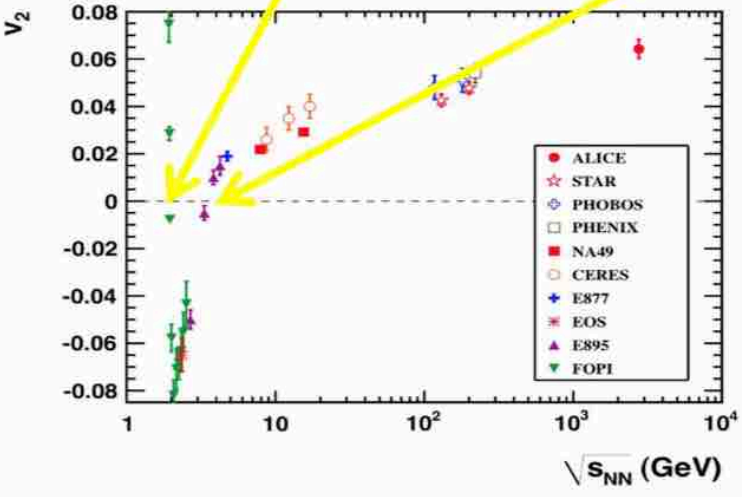


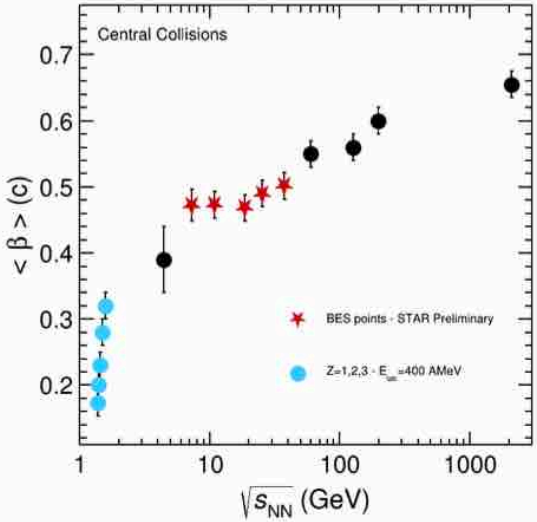
C.Pinkenburg & EOS Coll. Phys.Rev.Lett. 83(1999)1295

"Radial flow" flow

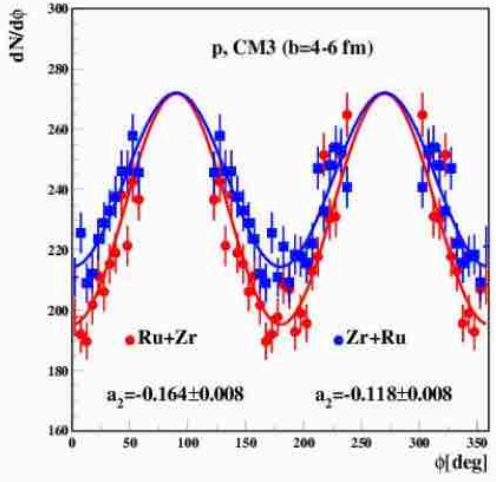
M. Petrovici Carpathian Summer School 2007

K. Aamodt et al, ALICE Collaboration PRL105(2010)252302

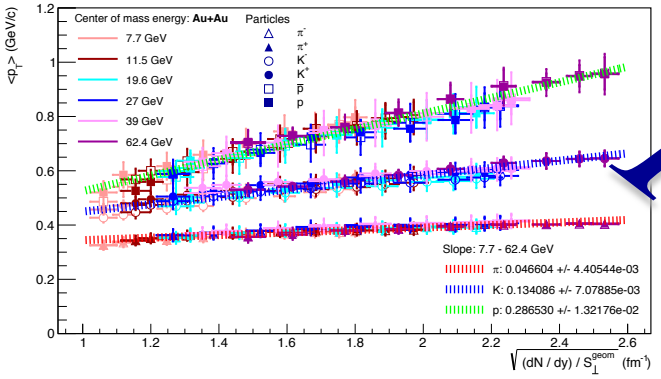


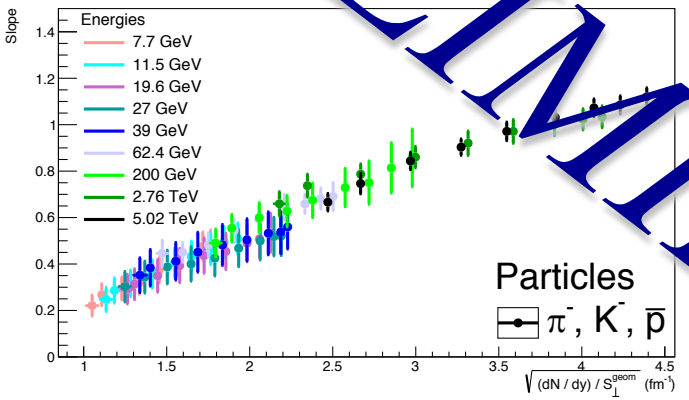


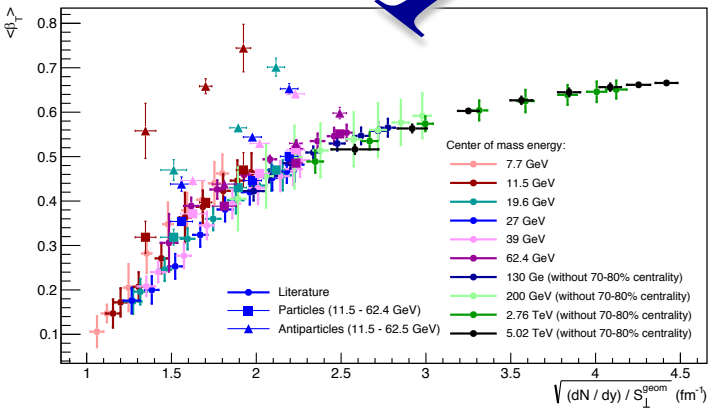
Isospin effects



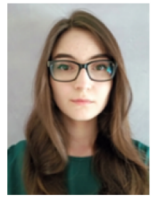
HPD Physics within CBM







Teaching & Summer Student Program



Teaching & Summer Student Program

Outreach

- *Interview on TVR International*

- *Numerous visits of Romanian and foreign delegations, gymnasium pupils, students of the Romanian Physics Faculties network*

- *Posters at Researchers Night, September 2017*

Team:

- *Prof. Dr. Mihai Petrovici (physicist) – team leader - Scientific Researcher III*
- *Dr. Cristian Andrei (physicist) - Senior researcher III Daniel Bartos (physicist)*
- *Senior researcher II Dr. Alexandru Bercuci (physicist)*
- *Senior researcher II Gheorghe Caragheorgheopol (electronics engineer)*
- *Senior researcher II Dr. Vasile Catanescu (electronics engineer)*
- *Senior researcher II Dr. Florin Constantin (physicist)*
- *Senior researcher II Viorel Duta (mechanical engineer)*
- *Scientific Researcher III Dr. Andrei Herghelegiu (physicist)*
- *Senior Engineer I Dr. Gheorghe Mateescu*
- *Senior researcher II Dr. Mariana Petris (physicist)*
- *Prof. Dr. Alexandrina Petrovici (physicist)*
- *Senior researcher I Dr. Amalia Pop (physicist)*
- *Senior engineer II Dr. Laura Radulescu (mechanical engineer)*
- *Senior researcher II Dr. Victor Simion (physicist)*
- *Computing coordinator Claudiu Schiaua (physicist)*
- *PhD student Madalina Tarzila (physicist)*
- *Technician Valerica Aprodu*
- *Technician Lucia Prodan*
- *Technician Andrei Radu*
- *Technician Constanta Dinca*
- *Turner Dima Gheorghe*
- *Financial coordinator Georgiana Toma (economist)*

Highlights of accomplishments in the last year

- Data analysis of CERN-SPS in-beam tests campaign.

- Laser monitoring system.

- Construction and tests of the CBM compliant DAQ of TRD.

- Construction and tests of a new motherboard for electronic tests of FASP-0.2 ASIC.

- In beam tests of MSMGRPC prototypes with the granularity required by the inner zone of the CBM-TOF wall, using Pb beam of 30A· GeV at SPS-CERN.

- 6 contributions to CBM Progress Report/GSI Scientific Report

- 5 presentations to CBM Collaboration Meetings

- 2 presentations to the CBM TRD TDR Review

- 2 paper drafts, one accepted for publication, one is still under internal reviewing

- A summer Student Program with 8 participants was successfully accomplished.