Final Report

- ***Project team :***

- Prof. Dr. Mihai Petrovici (physicist) – team leader
- Senior 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 Viorel Duta (mechanical engineer)
- Senior researcher III Dr. Andrei Herghelegiu (physicist)
- Master student Amelia Lindner (physicist)
- 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 Lucica Prodan
- Technician Andrei Radu
- Technician Constanta Dinca
- Financial coordinator Georgiana Toma (economist)
- Visiting senior scientist Dr. Vasile Pop Topor (physicist)
- Lathe and milling machine operator, Gheorghe Dima (mechanical worker)

- ***Specific scientific focus:***

- Multiplicity and event shape analysis in pp collisions – subject proposed by our group within ALICE Spectra-PAG PWG-LF since 2009 (https://twiki.cern.ch/twiki/bin/view/ALICE/PWGLFPAGSPECTRAMultiplicityEventShapePP7). The aim is to evidence collective type phenomena in high charged particle multiplicity and close to azimuthal isotropy events in pp collisions at LHC energies and understand their origin.

- ***Highlights of accomplishments:***

2017

- Studies for obtaining p_T spectra simultaneously conditioned on multiplicity, directivity and within same-side, away side and in between relative to the leading particle for identified charged hadrons in pp collisions at $\sqrt{s}$ = 7 TeV.

- Finalization of the charged particle p_T spectra as a function of multiplicity in pp collisions at $\sqrt{s}$ = 7 TeV which are included in the long paper on multiplicity dependence.
- Studies of two charged particles correlations as a function of multiplicity, and directivity or sphericity in pp collisions at $\sqrt{s}$ = 7 TeV
- Core-corona interplay in Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV
  M. Petrovici, I. Berceanu, A. Pop, M. Târzila, and C. Andrei; Phys.Rev. C96(2017)014908
- Extracting information on core contribution at LHC and RHIC energies – in progress
- GRID activities: maintaining NIHAM in a leading position among Tier2 ALICE GRID Centers.
- upgrading different working areas of the DetLab in terms of clearness class
- construction of OROC in-house test boxes and a prototype of a transport box
- procurement of different equipments , instruments, consumables for starting the activity of assembling and testing the OROCs
- TPC upgrade contribution – assembling an OROC at GSI.
- Participation to detector operation : 18 shifts till now.
- A Summer Student Program with 8 participants was successfully accomplished. A master student joined us this summer
- Outreach activities
- 12 presentations in ALICE meetings

- ***Experimental data analysis:***

- Studies of efficiency corrections for obtaining p_T spectra for simultaneous cuts in multiplicity, directivity and $\Delta\varphi$ relative to the leading particle for a multi differential analysis of identified charged hadron spectra properties. The obtained p_T distributions were fitted and compared within the Blast Wave Boltzmann-Gibs and Tsallis phenomenological models. Very preliminary results were presented in the High-Multiplicity mini-workshop, 5 May 2017, CERN, Geneva.

- The results for the inclusive charged particles were presented in five SPECTRA, PWGLF and Long Paper meetings. The study of the charged particle transverse momentum distributions as a function of centrality was finalized and the results were approved as preliminary in the ALICE Physics Forum and were included in the paper "Multiplicity dependence of light flavour hadron production in pp collisions at $\sqrt{s}$ = 7 TeV". This paper is currently evaluated by the internal review committee - IRC. The study of the charged particles is now being extended by using several event shape observables (sphericity, thrust, directivity and modified Fox-Wolfram moments) in parallel with attempts to increase the analysis speed on local computers.

- Two-particle correlation studies as a function of charged particle multiplicity and event shape selection based on directivity and sphericity for pp collisions at 7 TeV data taken by the ALICE experiment at LHC is currently investigated. Complete $\Delta\eta\Delta\varphi$-correlation pattern

for various combinations of trigger and associated particles and event shapes requires a huge amount of information which has to be handled at the same time.

- In order to obtain a meaningful information on the behaviour of different observables in pp, p-Pb and Pb-Pb collisions at LHC energies, trivial effects like core-corona interplay have to be understood. We have done a systematic study of the core-corona interplay as a function of impact parameter (N_{part}, $dN_{ch}/d\eta$) for Pb-Pb at $\sqrt{s}$ = 2.76 TeV and the preliminary results were published in Phys.Rev. C96(2017)014908. We continue the investigations and presently we are working on extracting different observables attributed to the core in Pb-Pb at LHC and Au-Au at RHIC and on the possibility to evidence different scalings .

- ***GRID activities***

NIHAM Data Centre continues to be one of the most efficient Tier2 components of ALICE GRID. This is a result of a continuous effort to improve the monitoring tools, in due time interventions, replacement of failing hardware components, efficient interaction with offline ALICE experts. Formalities for procurement of a rather significant computing and storage capacity and two cooling units were finalized.
The internet connection was upgraded from 10 to 40 GB.

- ***TPC upgrade contribution****:*

The necessary infrastructure in terms of cleanliness of different rooms of the Detector Laboratory, equipment, tools and specific consumables were finalized. An OROC was assembled at GSI by a joint German-Romanian team. The components of other 2 OROCs arrived, they were properly prepared and fixed in order to start the assembling and tests. Significant progress is expected until the ISAB meeting. The expectation for this year is to assemble and test 5 OROCs.
Up to now we produced three OROC in-house test boxes, one is in use for testing an OROC in the pit of ALICE Experiment, the second is in use at GSI and the 3rd one is in our DetLab.
The construction and test of other in-house test boxes is in progress. Three new special top covers for these boxes were produced and a prototype of a transport box was designed, realised and successfully tested.

- ***Participation to detector operation***

In parallel with the above mentioned activities which are keeping rather busy all members of our group, we are trying to fulfil also the duties related to the shifts necessary to run the ALICE experiment. This year we booked 48 shifts as Shift Leader, Detector Control System and Data Acquisition Control System operators and made 18 until now, according to the schedule.

• ***Papers:***

- Institutional review

Our group studies

- Core-corona interplay in Pb-Pb collisions at √sNN=2.76 TeV
M. Petrovici, I. Berceanu, A. Pop, M. Târzilă, and C. Andrei
Phys. Rev. C 96(2017) , 014908

GRID (computation and storage) and detector operation support:

- Measurement of azimuthal correlations of D mesons and charged particles in pp collisions at $\sqrt{s}$ =7 TeV and p-Pb collisions at $\sqrt{s_{NN}}$ =5.02 TeV, ALICE Collaboration, Eur. Phys. J. C 77 (2017) 245
- Anomalous broadening of the near-side jet peak in Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV, ALICE Collaboration, Phys.Rev.Lett. 119 (2017) 102301
- Azimuthally differential pion femtoscopy in Pb-Pb collisions at $\sqrt{s_{NN}}$=2.76 TeV, ALICE Collaboration, Phys. Rev. Lett. 118 (2017) 222301
- Centrality dependence of the pseudorapidity density distribution for charged particles in Pb-Pb collisions at $\sqrt{s_{NN}}$ =5.02 TeV
ALICE Collaboration, Phys.Lett. B 772 (2017) 567-577
- Charged-particle multiplicities in proton-proton collisions at $\sqrt{s}$= 0.9 to 8 TeV, ALICE Collaboration, Eur. Phys. J. C 77 (2017) 33
- Determination of the event collision time with the ALICE detector at the LHC, ALICE Collaboration, Eur. Phys. J. Plus 132 (2017) 99
- Energy dependence of forward-rapidity J/ψ and ψ(2S) production in pp collisions at the LHC, ALICE Collaboration, Eur. Phys. J. C 77 (2017) 392
- Enhanced production of multi-strange hadrons in high-multiplicity proton-proton collisions, ALICE Collaboration, Nature Physics 13 (2017) 535-539
- Evolution of the longitudinal and azimuthal structure of the near-side jet peak in Pb-Pb collisions at $\sqrt{s_{NN}}$ =2.76 TeV, ALICE Collaboration, Phys. Rev. C 96 (2017) 034904
- Flow dominance and factorization of transverse momentum correlations in Pb-Pb collisions at the LHC, ALICE Collaboration, Phys. Rev. Lett. 118 (2017) 162302
- Insight into particle production mechanisms via angular correlations of identified particles in pp collisions at $\sqrt{s}$ =7 TeV, ALICE Collaboration, Eur.Phys.J. C77 (2017) 569
- φ-meson production at forward rapidity in p-Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV and in pp collisions at sqrt(s) = 2.76 TeV, ALICE Collaboration, Phys. Lett. B 768 (2017) 203-217

- J/ψ suppression at forward rapidity in Pb-Pb collisions at $\sqrt{s_{NN}}$=5.02 TeV, ALICE Collaboration, Phys. Lett. B 766 (2017) 212-224
- K∗(892)0 and φ(1020) meson production at high transverse momentum in pp and Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV, ALICE Collaboration, Phys. Rev. C 95 (2017) 064606
- Linear and non-linear flow modes in Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV, ALICE Collaboration, Phys.Lett. B773 (2017) 68
- Measurement of D-meson production at mid-rapidity in pp collisions at $\sqrt{s}$=7 TeV, ALICE Collaboration, Eur.Phys.J. C77 (2017) 550
- Measurement of electrons from beauty-hadron decays in p-Pb collisions at $\sqrt{s_{NN}}$ =5.02 TeV and Pb-Pb collisions at $\sqrt{s_{NN}}$ =2.76 TeV, ALICE Collaboration, JHEP 07 (2017) 052
- Measurement of the production of high-pT electrons from heavy-flavour hadron decays in Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV,
ALICE Collaboration, Phys. Lett. B 771 (2017) 467-481
- Production of π0 and η mesons up to high transverse momentum in pp collisions at 2.76 TeV, ALICE Collaboration, Eur. Phys. J. C 77 (2017) 339
- Production of Σ(1385)± and Ξ(1530)0 in p-Pb collisions at $\sqrt{s_{NN}}$=5.02 TeV, ALICE Collaboration, Eur. Phys. J. C 77 (2017) 389
- Production of muons from heavy-flavour hadron decays in p-Pb collisions at $\sqrt{s_{NN}}$ =5.02 TeV, ALICE Collaboration, Phys. Lett. B 770 (2017) 459-472
- Searches for transverse momentum dependent flow vector fluctuations in Pb-Pb and p-Pb collisions at the LHC, ALICE Collaboration, JHEP 09 (2017) 032
- W and Z boson production in p-Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV
ALICE Collaboration, JHEP 02 (2017) 077

Conferences:

- From pp to AA ultra-relativistic collisions
M. Petrovici, A. Pop, C. Andrei, I. Berceanu, A. Bercuci, A. Herghelegiu and M. Tarzila, AIP Conference Proceedings **1852**, 050003 (2017); doi: http://dx.doi.org/10.1063/1.4984864
- Overview of Light-Flavor Hadron Production at ALICE,
33rd Winter Workshop on Nuclear Dynamics - WWND2017 (Snowbird Resort, Utah, USA, 2017-01-08)
- Transverse momentum spectra of primary charged particles in pp collisions measured by ALICE at the LHC - poster, QM 2017 (Chicago, USA, 2017-02-06)
- Multiplicity dependence of identified particle production in pp collisions with ALICE, QM 2017 (Chicago, USA, 2017-02-06)
- Energy and multiplicity dependence of the inclusive charged particle production in pp collisions, QM 2017 (Chicago, USA, 2017-02-06)
- The ALICE TPC Upgrade Project, QM 2017 (Chicago, USA, 2017-02-06)
- Light flavour results in pp, p-Pb and Pb-Pb collisions at ALICE,

QCD challenges in pp, pA and AA collisions at high energies (ECT*, Trento, 2017-02-27)
- Multiplicity dependence of identified particle production and strangeness in pp collisions with ALICE, Rencontres de Moriond (QCD) 2017 (La Thuile, Aosta valley, Italy, 2017-03-25)
- Light-flavour particle production in pp, p-Pb and Pb-Pb collisions with ALICE at the LHC, 2017 KPS Spring Meeting (Daejeon Convention Center in South Korea, 2017-04-19)
- Multiplicity dependence of particle production,
The fifth annual Large Hadron Collider Physics (LHCP2017) conference (Shanghai, 2017-05-15)
- New results on collectivity with ALICE,
The fifth annual Large Hadron Collider Physics (LHCP2017) conference (Shanghai, 2017-05-15)
- New results on the multiplicity and centre-of-mass energy dependence of identified particle production in pp collisions with ALICE
European Physical Society Conference on High Energy Physics 2017 (EPS-HEP) (Venice, Italy, 2017-07-05)
- Energy and multiplicity dependence of inclusive and identified particle production, 17th International Conference on Strangeness in Quark Matter (SQM 2017) (Utrecht University, 2017-07-10)
- Multiplicity dependence of pion, kaon and proton production in pp collision at $\sqrt{s}$ = 7 and 13 TeV-poster, 17th International Conference on Strangeness in Quark Matter (SQM 2017) (Utrecht University, 2017-07-10)
- Energy and multiplicity dependence of strange and non-strange particle production in pp collisions at the LHC with ALICE, 17th International Conference on Strangeness in Quark Matter (SQM 2017) (Utrecht University, 2017-07-10)
- Small systems at the LHC, 17th International Conference on Strangeness in Quark Matter (SQM 2017) (Utrecht University, 2017-07-10)
- Collectivity and blast-wave in pp, p-Pb and Pb-Pb collisions with the ALICE experiment, 4th International Conference on the Initial Stages in High-Energy Nuclear Collisions (Cracow, Poland, 2017-09-18)
- ALICE results on small systems, 4th International Conference on the Initial Stages in High-Energy Nuclear Collisions (Cracow, Poland, 2017-09-18)

- ***List talks of group members:***

- "Multi-differential analysis of pT spectra of π, K and p in pp collisions at 7 TeV", C. Andrei, High-Multiplicity 'mini-workshop', 5 May 2017, CERN, Geneva

-"Two-particle correlations in pp collisions at 7 TeV measured with ALICE at LHC", M. Tarzila, Scientific Communications Session of the Bucharest Faculty of Physics, June 3rd 2017 ALICE PWG-s

Data Analysis:

- Charged particle pT spectra as a function of multiplicity in pp collisions at 7 TeV
A. Herghelegiu, C. Andrei, I. Berceanu, A. Bercuci, M. Petrovici, A. Pop
PWG-LF meeting, December 12th 2016
https://indico.cern.ch/event/592525/contributions/2391768/
- Charged particle pT spectra as a function of multiplicity in pp collisions at 7 TeV
A. Herghelegiu, C. Andrei, I. Berceanu, A. Bercuci, M. Petrovici, A. Pop
Long Paper meeting, December 9th 2016
https://indico.cern.ch/event/594220/contributions/2401609/
- Charged particle pT spectra as a function of multiplicity in pp collisions at 7 TeV
A. Herghelegiu, C. Andrei, I. Berceanu, A. Bercuci, M. Petrovici, A. Pop
Long Paper meeting, December 2nd 2016
https://indico.cern.ch/event/591686/contributions/2392100/
- Charged particle pT spectra as a function of multiplicity in pp collisions at 7 TeV
A. Herghelegiu, C. Andrei, I. Berceanu, A. Bercuci, M. Petrovici, A. Pop
PWG-LF meeting, November 21st 2016
https://indico.cern.ch/event/586662/contributions/2363596/
- Charged particle pT spectra as a function of multiplicity in pp collisions at 7 TeV
A. Herghelegiu, C. Andrei, I. Berceanu, A. Bercuci, M. Petrovici, A. Pop
Spectra meeting, November 19th 2016
https://indico.cern.ch/event/589439/contributions/2376714/

TPC Upgrade:

- OROC assembly and commissioning – 29.08.2017
https://indico.cern.ch/event/653116/contributions/2696256/attachments/1515035/2364028/2017-08-29.pdf
- Reconditioning of the OROC test box in Bucharest – 22.08.2017
https://indico.cern.ch/event/651102/contributions/2697357/attachments/1510963/2356275/in-house-test-box_with__extra_drift_electrode_220817.pdf
- 1st OROC assembly in GSI – 04.07.2017
https://indico.cern.ch/event/651095/contributions/2649952/attachments/1487387/2310508/2017-07-04.pdf
- Status of the polycarbonate transport box – 23.05.2017
https://indico.cern.ch/event/623136/contributions/2603465/attachments/1533391/2401026/transport_box_300517.pdf
- OROC transportation box: flange, vessel, design/order – 16.05.2017
https://indico.cern.ch/event/623135/contributions/2594211/attachments/1460452/2255638/new_design_alu_flange.pdf
- Progress report from HPD Bucharest – 11.04.2017
https://indico.cern.ch/event/623130/contributions/2553491/attachments/1443021/2401028/changes_test_box.pdf

Further group activities:

R&D activities for a new generation of high counting rate RPC and TRD detectors, associated frontend electronics and free running mode data processing
- a successful in-beam test at SPS was done, November-December 2016
- a new TRD prototype and a laser monitoring system were finalized, installed and the first results in high intense X-ray tube flux were obtained
- a new architecture of the inner zone of the CBM-ToF was designed
- 5 presentations at CBM Collaboration meetings

Summer Student Program:
Quite successful, i.e. 8 participants: 2 students from Birmingham University, 2 from Oxford University, 2 from "Babes-Bolyai" University - Cluj - Romania, 1 from Bucharest Technical University and 1 from Physics Faculty of Bucharest University were involved in our activities in this summer. They participated in physics analysis for heavy-ion collisions at ultrarelativistic energies (2), TRD and RPC for CBM (3) CBM experiment design (1) TRD front-end electronics (1), nuclear structure and dynamics (1). Their activity was finalized with presentations. A booklet and a poster will be issued. Presentations concerning the detection and identification methods in nuclear and particle physics, data analysis using ALICE, introduction to heavy ion physics, two-particle correlations in pp collisions at 7 TeV, RPC for CBM were given by members of our group .

Outreach:

- Numerous visits of Romanian and foreign delegations, Romanian pupils winners of International Competitions in Physics, students of the Romanian Physics Faculties
- Pentagon - network

- "My experience within the ALICE experiment at LHC"
A. Herghelegiu
Summer School for pupils, prepared for International Competitions in Physics
Busteni, July 25-26, 2017

- Interview for TVR International
Corina Dobre vă prezintă cercetătorii români care fac istorie în cadrul Organizaţiei Europene pentru Cercetare Nucleară.

2018

Physics:

- Studies for obtaining p_T spectra simultaneously conditioned on multiplicity, directivity and within same-side, away side and in between relative to the leading particle for identified charged hadrons in pp collisions at $\sqrt{s}$ = 7 TeV - close to be finalized

- Studies for obtaining p_T spectra simultaneously conditioned on multiplicity, directivity and within same-side, away side and in between relative to the leading particle for identified charged hadrons in pp collisions at $\sqrt{s}$ = 7 TeV - close to be finalized

- Studies of two charged particles correlations as a function of multiplicity and directivity in pp collisions at $\sqrt{s}$ = 7 TeV
PhD thesis finalized – presentations in the corresponding PAG and PWG on the way

- Studies on the core-corona interplay at LHC and RHIC energies based on experimental data and Glauber MC estimates - close to be finalized

- >46 presentations in ALICE meetings (TPCU)
- Contribution to 14 conference presentations
- Co-authors to 17 ALICE published papers

- On similarities as a function of system size in heavy ion collisions – invited lecture
M.Petrovici, A.Lindner and A.Pop
Carpathian Summer School of Physics, July 1-14, 2018, in print at AIP Proceedings

- Core-Corona and Geometrical scaling from RHIC to LHC energies, pp - (A-A) similarities
M. Petrovici, Light-Up Workshop, CERN, June 14-16, 2018

- IFIN-HH/HPD within ALICE and CBM
M. Petrovici, NuPECC Meeting - Bucharest, October 12, 2018

- Geometrical scaling from RHIC to LHC energies
A. Lindner, Anual Scientific Meeting, University of Bucharest, June 21st, 2018

- Geometrical scaling for energies available at the BNL Relativistic Heavy Ion Collider to those at the CERN Large Hadron Collider
M. Petrovici, A. Lindner, A. Pop, M. Târzila and I. Berceanu,
Phys. Rev. C98(2018)024904

- Multiplicity dependent p_T distributions of identified particles in pp collisions at 7 TeV within HIJING/$B\bar{B}$ v2.0 model
V. Topor Pop and M.Petrovici
arXiv:1806.00359v2 [hep-ph]; accepted at Phys.Rev. - in print

- Geometrical scaling for pions, kaons and protons and strange particles in pp collisions at $\sqrt{s}$=7 and $\sqrt{s}$=13 TeV - preliminary results

- PC members - Multiplicity dependence of light-flavor hadron production in pp collisions at $\sqrt{s}$ = 7 TeV
arXiv:1807.11321v1 [nucl-ex]; provisionally accepted at Phys.Rev.C

ALICE upgrade:

- 2nd in-house test box was produced
- The extra drift electrode of one in-house box was changed such that a direct irradiation of the whole gas volume around the HV wires is now possible
- Many features of the in-house tests monitoring and the on-line representation of the results were implemented
- Components of three OROC in-house test boxes were produced
- 19 OROCs were successfully assembled and 18 successfully tested; 15 already transported at CERN, passing the upon arrival tests.

Computing:

- Maintaining NIHAM in a leading position among Tier2s ALICE GRID centers, NAF efficient management

ALICE shifts:

59.5 shifts done as Detector Control System, Data Acquisition Control System operators, Run Manager.

- ***Experimental data analysis and interpretation****:*

- "Multiplicity dependence of light flavour hadron production in pp collisions at $\sqrt{s}$ = 7 TeV" is provisionally accepted at Phys.Rev.C

- Two-particle correlation studies as a function of charged particle multiplicity and event shape selection based on directivity and sphericity for pp collisions at $\sqrt{\mathbf{s}}$=7 TeV. Comparison with PYTHIA, PHOJET and EPOS predictions. A PhD thesis was finalized.

- We continued the investigations of core-corona interplay and presently we are working on extracting different observables attributed to the core in Pb-Pb at LHC and Au-Au at RHIC.

- Geometrical scaling suggested by the CGC model was studied in terms of $\langle p_T \rangle$, the slope of $\langle p_T \rangle$ mass dependence for pions, kaons and protons and the average transverse expansion $\langle \beta_T \rangle$ dependence on the charged particle density per unit of rapidity and unit of overlapping area starting from BES at RHIC up to LHC energies for Cu-Cu, Au-Au, Xe-Xe, Pb-Pb and pp collisions.

- ***GRID activities:***

NIHAM Data Centre continues to be one of the most efficient Tier2 components of ALICE GRID. This is a result of a continuous effort to improve the monitoring tools, in due time

interventions, replacement of failing hardware components, efficient interaction with offline ALICE experts. Procurement of a rather significant computing and storage capacity and two cooling units were finalized.

- ***TPC upgrade contribution:***

The assembling and test activities in our Department were very successful in many respects. The local infrastructure, expertise and know-how have been crucial in finalizing in due time the ambitious commitment of assembling and testing 50% of the outer readout chambers (OROCs) based on GEM technology. The results in terms of energy resolution, 2D gain distribution and its reproducibility, the results of the long term tests in high flux of X-ray were reported weekly in the ALICE-TPCU vidyo meetings. 15 OROCs were already transported to CERN, 4 more assembled from which 3 were successfully tested and the remaining one will be finalized until the end of the year.

- ***Participation to detector operation:***

In parallel with the above mentioned activities which are keeping rather busy all members of our group, we are trying to fulfill also the duties related to the shifts necessary to run the ALICE experiment. This year we have done 59.5 shifts as Detector Control System, Data Acquisition Control System operators and Run Manager.

Papers:

- On similarities as a function of system size in heavy ion collisions – invited lecture
  M.Petrovici, A.Lindner and A.Pop
  Carpathian Summer School of Physics, July 1-14, 2018, in print at AIP Proceeding
- Geometrical scaling for energies available at the BNL Relativistic Heavy Ion Collider to those at the CERN Large Hadron Collider
  M. Petrovici, A. Lindner, A. Pop, M. Târzila and I. Berceanu
  Phys. Rev. C98(2018)024904
- Multiplicity dependent pT distributions of identified particles in pp collisions at 7 TeV within HIJING/$B\bar{B}$ v2.0 model
  V. Topor Pop and M. Petrovici
  arXiv:1806.00359v2 [hep-ph]; accepted at Phys.Rev. - in print
- PC members - Multiplicity dependence of light-flavor hadron production in pp

collisions at $\sqrt{s}$ = 7 TeV

ALICE Collaboration

arXiv:1807.11321v1 [nucl-ex]; provisionally accepted at Phys.Rev.C

GRID (computation and storage) and detector operation support:

– Neutral pion and η meson production at midrapidity in Pb-Pb collisions at $\sqrt{s_{NN}}$ =2.76 TeV
– Phys. Rev. C 98(2018)044901

- Azimuthally-differential pion femtoscopy relative to the third harmonic event plane in Pb–Pb collisions at $\sqrt{s_{NN}}$ =2.76 TeV
Phys.Lett. B785(2018)320

- Inclusive J/ψψ production in Xe-Xe collisions at $\sqrt{s_{NN}}$ = 5.44 TeV
Phys.Lett. B785(2018)419

- Neutral pion and $η$ meson production in p-Pb collisions at $\sqrt{s_{NN}}$ = 5.02$ TeV,
Eur.Phys.J. C78(2018)624

- Anisotropic flow in Xe-Xe collisions at $\sqrt{s}$ =5.44 TeV ,
Physics Letters B, 784 (2018) 82-95

- Constraints on jet quenching in p-Pb collisions at $\sqrt{s}$ =5.02 TeV measured by the event-activity dependence of semi-inclusive hadron-jet distributions,
Phys. Lett. B 783 (2018) 95-113

- First measurement of Ξ_c^0 production in pp collisions at $\sqrt{s}$ = 7 TeV, Phys. Lett. B 781 (2018) 8-19

- Longitudinal asymmetry and its effect on pseudorapidity distributions in Pb-Pb collisions at $\sqrt{s}$ = 2.76 TeV, Phys. Lett. B 781 (2018) 20-32

- Measurement of Z^0-boson production at large rapidities in Pb-Pb collisions at $\sqrt{s}$ =5.02$ TeV, Phys. Lett. B 780 (2018) 372–383

- D-meson azimuthal anisotropy in mid-central Pb-Pb collisions at $\sqrt{s}$ =5.02 TeV , Phys. Rev. Lett. 120 (2018) 102301

- Search for collectivity with azimuthal J/$ψ$-hadron correlations in high multiplicity p-Pb collisions at $\sqrt{s}$ = 5.02 and 8.16 TeV,
Phys. Lett. B 780 (2018) 7-20

- Systematic studies of correlations between different order flow harmonics in Pb-Pb collisions at $\sqrt{s}$ = 2.76 TeV, Phys. Rev. C 97 (2018) 024906

- Constraining the magnitude of the Chiral Magnetic Effect with Event Shape Engineering in Pb-Pb collisions at $\sqrt{s}$ = 2.76$ TeV, Phys. Lett. B 777 (2018) 151-162
- The ALICE Transition Radiation Detector: construction, operation, and performance , Nucl. Instr. Meth. A881 (2018) 88
- First measurement of jet mass in Pb-Pb and p-Pb collisions at the LHC, Phys. Lett. B 776 (2018) 249
- J/$ψ$ production as a function of charged-particle pseudorapidity density in p-Pb collisions at $\sqrt{s}$ = 5.02$ TeV, Phys. Lett. B 776 (2018) 91
- Energy dependence and fluctuations of anisotropic flow in Pb-Pb collisions at $\sqrt{s}$ = 5.02 and 2.76 TeV, JHEP 07 (2018) 103

Conferences:

- Core-Corona and Geometrical scaling from RHIC to LHC energies, pp - (A-A) similarities
  M. Petrovici, Light-Up Workshop, CERN, June 14-16, 2018
- IFIN-HH/HPD within ALICE and CBM
  M. Petrovici, NuPECC Meeting - Bucharest, October 12, 2018
- Geometrical scaling from RHIC to LHC energies
  A. Lindner, Anual Scientific Meeting, University of Bucharest, June 21st, 2018
- Systematics of $\langle p_T \rangle$ and their mass dependence as a function of a CGC inspired variable in ultra-relativistic heavy ion collisions
  A. Lindner, IFIN-days, Bucharest, December 19, 2017

- 7th International Conference on High Energy Physics in the LHC Era (Universidad Técnica Federico Santa María, Valparaiso, Chile, 08/01/2018)
- The ALICE detector upgrade program
- Studying the bulk properties of matter under extreme conditions with ALICE
- Constraining QCD Phase Boundary with data from Heavy Ion Collisions – In memory of Helmut Oeschler (GSI Darmstadt, 12/02/2018)

Production of pions, kaons, protons, and (multi-)strange particles with ALICE at the LHC (Presenter: Kalweit, Alexander Philipp)

Rencontres de Moriond QCD and High Energy Interactions (Moriond (France), 17/03/2018)：

- Understanding particle production in high multiplicity pp collisions using event shape studies in ALICE

QM2018 The 27th Int. Con. on Ultrarelativistic Nucleus-Nucleus Collisions (Venezia (Italy), 13/05/2018):

- Multiplicity and energy dependence of inclusive charged and identified particle production in pp collisions with ALICE at the LHC
- Upgrade of the ALICE central barrel tracking detectors: ITS and TPC
- Highlights from ALICE
- POSTER - Energy dependence of transverse momentum spectra of primary charged particles in proton proton collisions measured by ALICE at the LHC
- POSTER - Production of pions, kaons and protons as a function of charged particle multiplicity in pp collisions at $\sqrt{s}$ = 13 TeV with ALICE at the LHC (Prese

Sixth Annual Conference on Large Hadron Collider Physics (Bologna, 04/06/2018):

- From small to large colliding systems: lessons learned and future perspectives
- The upgrade program of ALICE at the LHC

MESON2018-15th International Workshop on Meson Physics (Krakow (Poland), 07/06/2018):

- Energy and system dependence of light- and heavy-flavor hadron production in p-p, p-Pb, Xe-Xe and Pb-Pb collisions at the LHC

EuNPC - European Nuclear Physics Conference 2018 (Bologna, 02/09/2018):

- Light-Flavor Hadron Production from Small to Large Collision Systems at ALICE

Hard Probes 2018 (Aix-Les-Bains, 01/10/2018):

TPC Upgrade:

~ 46 presentations in ALICE TPCU meetings
- 15 OROCs finalized and already transported to CERN
- other 4 OROCs are assembled and tested and 1 will be finalized in the next month

Further group activities:

R&D activities for a new generation of high counting rate RPC and TRD detectors, associated frontend electronics and free running mode data processing
- 2 new RPC prototypes with the final architecture for CBM-ToF inner zone
- High rate free running mode tests of the 2D position sensitive TRD operated with FEE and DAQ designed and realized in our Department

- International Conferences and Meetings:
    - 10 presentations at CBM Collaboration meetings
    - 5 contributions to the CBM Annual Report
    - 1 oral presentation at ICHEP 2018-10-2018

- Papers:
    - Romanian Journal of Physics 63, 901 (2018);
    - Journal of Physics: Conference Series, Vol. 1023(2018), 012007
    - Nucl. Instr. and Meth. A – provisionally accepted

Summer Student Program:
Quite successful, i.e. 5 participants: 3 students from Birmingham University, 1 from Bucharest Technical University and 1 from Sherbone High School, England.

Outreach:

- Numerous visits of Romanian and foreign delegations, Romanian pupils winners of International Competitions in Physics
- "My experience within the ALICE experiment at LHC", A. Herghelegiu, Summer School for pupils, prepared for International Competitions in Physics, Busteni, 18-26 July, 2018
- Interview for Romanian Radio Broadcast
- Visit of Paulo Giubellino – Scientific Managing Director of FAIR/GSI
- Visit of some SMEs of Magurele Tech. Park
- More details could be seen in: https://niham.nipne.ro

https://www.youtube.com/watch?v=OJd4fA0xUh0
https://www.facebook.com/Hadron-Physics-Department-211078852968333/
https://www.youtube.com/watch?v=ZHBgGKamUc8&feature=youtu.be

2019

Physics:

- Studies for obtaining p_T spectra simultaneously conditioned on multiplicity, directivity and within same-side, away-side and in between relative to the leading particle for identified charged hadrons in pp collisions at $\sqrt{s}$ = 7 TeV.
  Implementation of unfolding based on a multi-dimensional detector response matrix.

- Studies of two charged particles correlations as a function of multiplicity and directivity in pp collisions at $\sqrt{s}$ = 7 TeV.
  Cross-checks and similar studies for pp collisions at 13 TeV are in progress.

- Studies on the core-corona interplay at LHC and RHIC energies based on experimental data and Glauber MC estimates.
  The existing experimental data were carefully analyzed, extrapolations and interpolations of p_T spectra were performed in a consistent way, final results are expected soon.

- 15 presentations in ALICE meetings (TPCU)

- Contribution to 17 conference presentations

- Co-authors to 30 ALICE published papers

- Color Glass Condensate inspired scaling variable and system size dependence
  A. Lindner, Annual Scientific Meeting, University of Bucharest, 21-22 June, 2019

- Towards Color Glass Condensate at LHC energies
  D. Avramescu, IFIN – Young scientist days, Bucharest, 17 December, 2018

- Dependence of different observables on the CGC inspired variable for light flavor hadrons in pp and A-A collisions at RHIC and LHC energies
  A. Lindner, IFIN – Young scientist days, Bucharest, 17 December, 2018

- Geometrical scaling for pions, kaons, protons and strange particles in pp collisions at $\sqrt{}$ s=7 and $\sqrt{}$ s=13 TeV and Pb-Pb; Xe-Xe at 5.02 and 5.44 TeV, respectively
  - preliminary results

- Multiplicity dependence of light-flavor hadron production in pp

collisions at $\sqrt{s}$ = 7 TeV; PC members
Phys.Rev.C99(2019)024906

- Why pp collisions at 14 TeV ?
C. Andrei, D. Avramescu, I. Berceanu, A. Bercuci, A. Herghelegiu, A. Lindner
M. Petrovici, A. Pop, C. Schiaua, M. Tarzila
ALICE-ANA-2019-26.08 - Internal Note

- Charged particle multiplicity and event shape dependence of two charged particle correlations in pp collisions at $\sqrt{s}$ =7 TeV
M.Tarzila, C.Andrei, M.Petrovici, A.Pop
ALICE Week, PWG-MM mini workshop, March 28, 2019

– What's really new at LHC energies ?
C. Andrei, D. Avramescu, I. Berceanu, A. Bercuci, A. Herghelegiu, A. Lindner, M.Petrovici, A. Pop, C. Schiaua, M. Tarzila
Spectra PAG , September 16, 2019

- R_{AA}, R_{CP} and normalized ratios, with and without Core-Corona corrections – scaling as a function of N_{part} – in progress

- A consistent treatment of pp and A-A collisions at LHC energies was started. First results within CGC framework for pp and Pb-Pb collisions at LHC energies were obtained – work in progress

- NIHAM Status and Performance
C. Schiaua
9th Annual ALICE Tier-1/Tier-2 Wokshop, 14-16 May, Bucharest, 2019

ALICE upgrade:

- 20 OROCs were successfully assembled and tested, all being transported at CERN, passing the upon arrival tests, installed in the TPC and preliminary tests are in progress

Computing:

- NIHAM maintained the leading position among Tier2s ALICE GRID centers.
A new data storage capacity of 4.6 PB Raw and 3.82 PB Effective was installed and is currently in operation.
An upgrade with 50% more data storage will be done in the next months.
Two new cooling units were purchased and their installation is in progress.
NAF is efficiently managed.

- ***Experimental data analysis and interpretation****:*

- Cross-checks of the two-particle correlation studies as a function of charged particle multiplicity and event shape selection based on directivity and sphericity for pp collisions at $\sqrt{s}$=7 TeV and comparison with PYTHIA, PHOJET and EPOS predictions were accomplished. Similar studies for pp collisions at $\sqrt{s}$=13 TeV are in progress.

- We continued the investigations of core-corona interplay and presently we are extracting different observables attributed to the core in Pb-Pb at LHC and Au-Au at RHIC.

- Preliminary results of R_{AA}, R_{CP} and normalized ratios as a function of N_{part}.
- A consistent treatment of pp and A-A collisions at LHC energies was started.

- Unfolding procedure using multi-dimensional detector response matrix is under control. Obtaining p_T spectra simultaneously conditioned on multiplicity, directivity and within same-side, away side and in between relative to the leading particle for identified charged hadrons in pp collisions at $\sqrt{s}$ = 7 TeV is close to be finalized.

- ***GRID activities:***

NIHAM Data Centre continues to be one of the most efficient Tier2 centre of ALICE GRID. This is a result of a continuous effort to improve the monitoring tools, in due time interventions, replacement of failing hardware components, efficient interaction with offline ALICE experts. The new storage capacity was installed and is presently in use. Two cooling units were purchased and their installation is in progress.

- ***TPC upgrade contribution:***

The assembling and test activities in our Department were very successful in many respects. The local infrastructure, expertise and know-how have been crucial in finalizing in due time the ambitious commitment of assembling and testing 50% of the outer readout chambers (OROCs) based on GEM technology. The results in terms of energy resolution, 2D gain distribution and its reproducibility, the results of the long term tests in high flux of X-ray were reported weekly in the ALICE-TPCU vidyo meetings. The 20 OROCs were transported to CERN and installed in the TPC.

Papers:

- Multiplicity dependence of light-flavor hadron production in pp collisions at $\sqrt{s}$ = 7 TeV; PC members
  Phys.Rev.C99(2019)024906

- Why pp collisions at 14 TeV ?
  C. Andrei, D. Avramescu, I. Berceanu, A. Bercuci, A. Herghelegiu, A. Lindner
  M. Petrovici, A. Pop, C. Schiaua, M. Tarzila

GRID (computation and storage) support:

- Co-authors to 30 ALICE published papers

Conferences and ALICE PWG presentations:

- Color Glass Condensate inspired scaling variable and system size dependence
  A. Lindner, Annual Scientific Meeting, University of Bucharest, 21-22 June, 2019

- Towards Color Glass Condensate at LHC energies
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  Spectra PAG , September 16, 2019

- NIHAM Status and Performance
  C. Schiaua
  9th Annual ALICE Tier-1/Tier-2 Workshop, 14-16 May, Bucharest, 2019

- Contribution to 17 conference presentations on behalf of ALICE Collaboration

TPC Upgrade:

- 15 presentations in ALICE TPCU meetings
- 20 OROCs finalized and already transported to CERN

Further group activities:

R&D activities for a new generation of high counting rate RPC and TRD detectors, associated front-end electronics and free running mode data processing

- 2 new RPC prototypes with the final architecture for CBM-ToF inner zone tested at mCBM at SIS18 - GSI Darmstadt
- 2D position sensitive TRD operated with FEE and DAQ, designed by our Department, were implemented in CBMRoot and the results based on UrQMD event generator and GEANT show the high performance of the architecture proposed and developed by us in terms of tracks reconstruction

- International Conferences and Meetings:
    - 15 presentations at CBM Collaboration meetings
    - 5 contributions to the CBM Annual Report
    - 1 oral presentation at ICHEP-10-2019
    - M.Petris et al., EPS-HEP2019, 10 - 17 July 2019, Ghent, Belgium
    - M.Petris et al., XXIII International School on Nuclear Physics, Neutron Physics and Application, 23-27 September 2019, Varna

- Papers:

    - M.Petris et al., Nucl.Instr. And Meth., A920(2019)100

Summer Student Program:

Quite successful, i.e. 3 participants: 2 from Faculty of Physics, University of Bucharest and 1 from Universidad Complutense de Madrid, Spain.
Lectures were presented by HPD members (http://niham.nipne.ro/lectures.html)

Outreach:

- Numerous visits of Romanian and foreign delegations, Romanian pupils winners of International Competitions in Physics

- The first number of the HPD Courier was issued
  http://niham.nipne.ro/HPD-Courier_electronic-version.pdf
  The second one will be dedicated to the 70th anniversary of the Institute for Physics of Romanian Academy, founded by Horia Hulubei, the precursor of IHIN-HH and will be issued in December 2019

- visit of the participants to the 9th Annual ALICE Tier-1/Tier-2 Workshop, 14-16 May, Bucharest, 2019

- CERN Courier January 24, 2019, ALICE revitalised

- FOPI Photo selected on the occasion of GSI 50th Anniversary

- More details could be seen in:
  https://niham.nipne.ro
  https://www.youtube.com/watch?v=OJd4fA0xUh0
  https://www.facebook.com/Hadron-Physics-Department-211078852968333/