





HADRON PHYSICS DEPARTME

http://niham.nipne.ro







Activities and achievements in this year (01.11.2020-15.11.2021) Impact on other activities

ISAB Meeting, November 15, 2021

Motivation



M.Dittmar et al., Proceedings HERA-LHC Workshop arXiv:[hep-ph]0511119



Following A.H. Mueller approximations NP A715(2003)20



	Au-Au	Pb-	рр		
	0.2	2.76	5.02	7	
¹)	$\simeq 4.7$	$\simeq 11.8$	$\simeq 15.9$	$\simeq 18.7$	
	$\simeq 0.9$	$\simeq 2.3$	$\simeq 3.1$	$\simeq 3.6$	



Highlights of accomplishments in the last year **Physics**

- Charged particles p_T spectra as a function of charged particle multiplicity and sphericity in pp collisions at $\sqrt{s} = 7$ TeV
 - Implementation of unfolding based on a multi-dimensional detector response matrix
 - 2 presentation in ALICE spectra PAG
 - Internal Note
 - systematic errors estimate in progress
- Studies of two-particle correlations as a function of multiplicity and sphericity in pp collisions at $\sqrt{s} = 7$ TeV
 - PhD Thesis
 - Internal Note ready
 - systematic errors estimate in progress
- Considerations on charged particles and π^0 suppression at RHIC and LHC energies
 - published in Phys.Rev.C103(2021)034903
- Strange and multi-strange geometrical scaling
 - 1 poster at EPS-HEP 2021
 - 1 oral presentation PANIC 2021
- Studies on the core-corona interplay at LHC and RHIC energies
 - Preliminary manuscript
- Contribution to 7 conference presentations
- Co-authors to 23 ALICE published papers
- 2 institutional reviews
- PhD service task started within the Data Preparation Group
- 18 EPN/PDP and QC remote ALICE shifts at the Romanian ROS



Highlights of accomplishments in the last year Computing

- NIHAM maintained the leading position among Tier2 ALICE GRID centers
 - done jobs: $5.4 \cdot 10^6$, i.e. 6.1 % of total Tier2 ALICE contribution
 - CPU: 8.7 Mhours, i.e. 3.3 % of total Tier2 ALICE contribution
 - a data storage unit of 2.3 PB to be implemented during Run3
 - new UPS stations of ~120 KVA installed
 - NAF is efficiently managed
 - new cooling unit in progress

Teaching and Outreach

- 1 PhD thesis
- 1 diploma thesis
- 1 master student
- visit of the Prime Minister adviser
- visit of Research and Education Commission of the Romanian Senate
- visit of the Charge d'Affaires ad-interim of American Embassy in Romania
- visit of the vice Prime Minister
- German bachelor students visit
- visit of EUROGAMs consortium members and the Director of ERIC-ELI
- a movie related to the ALICE-TPC upgrade finalized
- a movie for "Researchers Night" event finalized
- more details can be seen in:
 - https://niham.nipne.ro
 - https://www.facebook.com/Hadron-Physics-Department-211078852968333/
- contribution to the new web page of IFIN-HH
 - https://www.nipne.ro/mission.php



Charged particle p_T distributions Multi-differential analysis in pp collisions at 7 TeV



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Sphericity

































Charged particle pr distributions

Ratio away peak to near peak

Peak Near **Q** Batio 0.4 0.2

to Near Peak o

Peak Near 8.0 to 0.4

Full line = PYTHIA 6.4 Perugia0

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Two-particle correlations



 $1 \text{ GeV/c} < p_T^{\text{trig}} = p_T^{\text{leading}} < 2 \text{ GeV/c}, 1 \text{ GeV/c} < p_T^{\text{ass}} < 2 \text{ GeV/c}, p_T^{\text{trig}} > p_T^{\text{ass}}$

Two-particle correlations Fit parameters

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Two-particle correlations Further crosschecks and systematic errors

|η|<0.6 vs |η|<0.8

Event mixing pool size: 15 events vs no limit

10

Considerations on charged particles and π^0 suppression at RHIC and LHC energies

M.Petrovici, A. Lindner, A. Pop, Phys. Rev. C 103, 034903 (2021)

Considerations on the suppression of charged particles and π^0 in high energy heavy ion collisions

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Geometrical scaling

Geometrical scaling for light flavor hadrons

Geometrical scaling for strange and multi-strange hadrons Pb-Pb vs. pp @ LHC

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pp: \sqrt{s} - Multiplicity selector $\alpha = 1$ 7 TeV: Combined **13 TeV: SPD tracklets**

$$\frac{1}{2\pi p_T} \frac{d^2 N}{dy dp_T} \propto \int_0^R r dr m_T I_0 \left(\frac{p_T \sinh \rho}{T_{kin}}\right) K_1 \left(\frac{m_T \cosh \rho}{T_{kin}}\right) K_1 \left(\frac{m_T \cosh \rho}{T_{kin}}\right)$$

with $\rho = \tanh^{-1} \beta_T = \tanh^{-1} \left[\left(\frac{r}{R}\right)^n \beta_s\right]$

_____ 39 GeV (Au-Au) **— 2.76 TeV (Pb-Pb)** pp: √s - Multiplicity selector $\begin{array}{c} \alpha = 10 \\ 7 \text{ TeV: V0M} \\ 7 \text{ TeV: Combined} \end{array}$ 7 TeV: V0M 7 TeV: Combined 13 TeV: V0M 13 TeV: SPD tracklets 13 TeV: SPD tracklets 13 TeV: V0M

Worth to be mentioned HPD contribution to the ALICE Experiment

ID	Task Name		2013				2014			_
		Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	
1	LS1		-							_
2										
3	Read out chambers									
4	R&D	- '								
5	Design and prototyping									
6	Signal cables choice								♦ 01/	07
7	Detector configuration defined									
8	Pad plane design defined									
9	Chamber body design defined									
10	Chamber bodies production									
11	Pad planes production									
12	GEM foil production									
13	GEM foil QA									
14	ROC assembly									
15	ROC testing									
16	End of ROC production									
17										
18	FEE	1			~					
19	Design and prototyping	1								_
20	SAMPA verification	1					C			_
21	SAMPA final layout	1								
22	SAMPA production and testing									
23	Num. of channels per FEC defined								♦ 01/	07
24	FEE partition layout defined									
25	FEC preseries									
26	FEC production and testing									
27	CRU prototype								-	_
28	CBU production									
29	Fully equipped IROC prototype									
30	End of EEE production									
31										
32	Service support wheel									_
33	FEC frame design									_
34	FEC frame production									
35										
36	HV system									
37	HV system design									
38	HV system production									
39										
40	Contingency									
40	contingency									
41	162									
42	132									
45	Installation and commissioning									
44										
45	IPC on surface									
40	Domounting FEE and services									
47	All replacement									
48	Alignment and sealing									
49	FEE Installation									
50	Pre-commissioning on surface									
51	Reinstallation in cavern									
52	Service connection									

Worth to be mentioned

Computing Contribution to ALICE GRID

Done jobs - NIHAM:

- 5.4 · 10⁶
- 6.1 % of total Tier2 ALICE contribution

CPU:

- 8.7 Mhours
- 3.3 % of total Tier2 ALICE contribution
- New UPS stations installed
- A new cooling station in progress

Training & teaching

UNIVERSITY OF BUCHAREST Physics Faculty Doctoral School of Physics

Mădălina - Gabriela TÂRZILĂ

Study of collective type phenomena in p+p collisions at the highest energy accessible at LHC using the ALICE experimental set-up

Thesis submitted for the degree of Doctor of Philosophy

> Scientific advisor: Prof. dr. Mihai PETROVICI

This work was carried out in the "ALICE" group of Hadron Physics Department of the National Institute for Physics and Nuclear Engineering-Horia Hulubei

Bucharest, 2021

PhD Thesis

Diploma Thesis

Outreach

ALICE-TPC upgrade movie

https://www.facebook.com/211078852968333/videos/582740123099895

Outreach

ALICE-TPC upgrade movie

https://www.facebook.com/211078852968333/videos/582740123099895

Impact on other activities RPC & TRD-2D in mCBM FAIR Phase0 @ SIS18

Counting rate (Hz/cm²)

Addendum of the CBM-TRD TDR was finalized and sent for EEC of FAIR

Counting rate (Hz/cm²)

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Impact on other activities **MSMGRPC** - aging investigations

No change of the resistivity of the Chinese glass after exposure

https://arxiv.org/abs/2105.12214

