



JINR-ALICE annual report

V. Pozdnyakov for the analysis team:

*B.Batyunya, S.Grigoryan, **A.Kondratiev**, L.Malinina*, K.Mikhaylov**, V.P., E.Rogochaya, **G.Romanenko**, **B.Roumyantsev**, G.Stiforov, Yu.Vertogradova, A.Vodopianov*

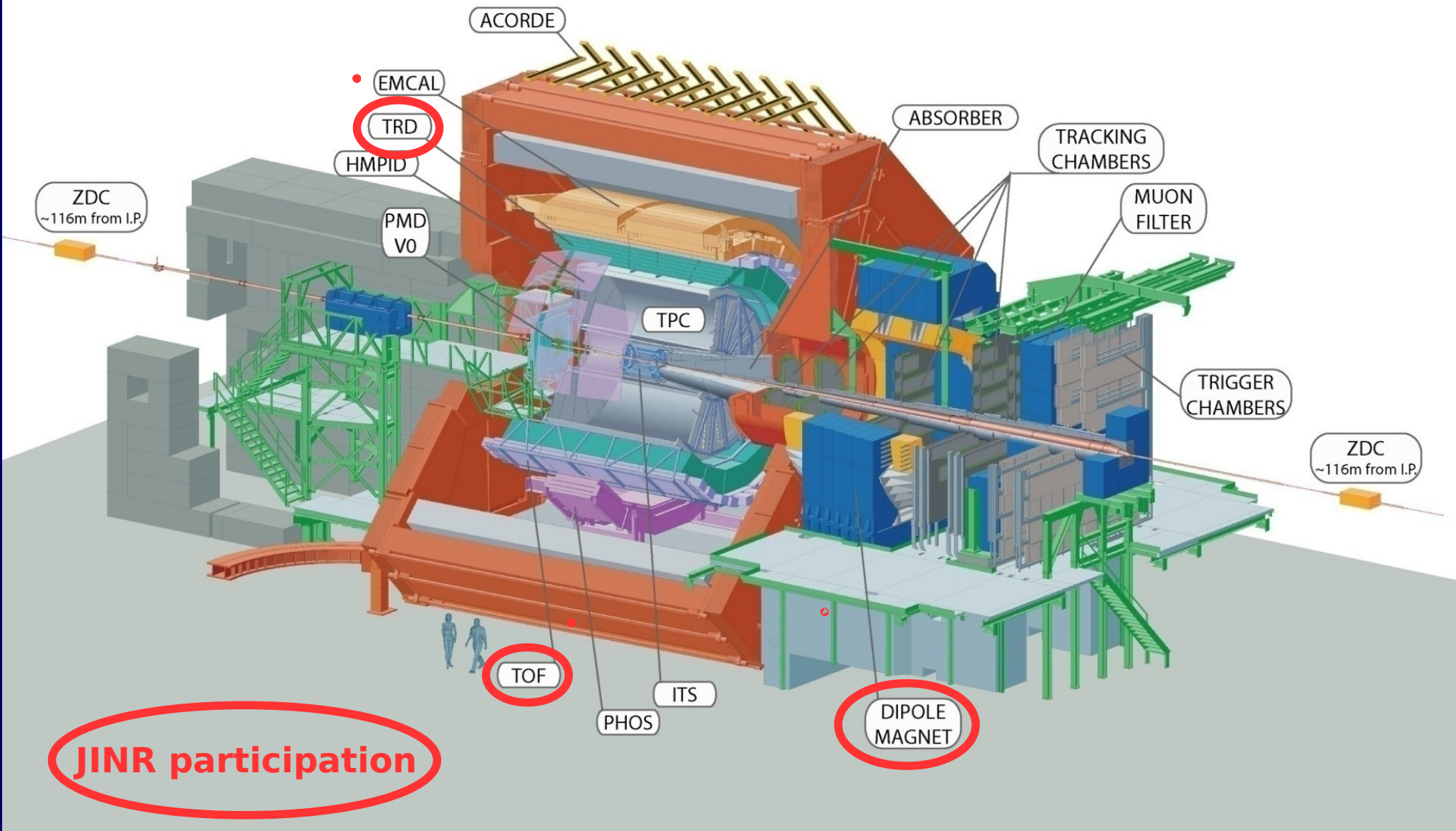
** also SINP MSU*

*** also ITEP*

PhD student

MSU student

ALICE collaboration: 42 countries, 174 institutes, >1800 members



The activities of the JINR group in the ALICE experiment in 2020

Femtoscopic correlations :

B.Batyunya, L.Malinina, K.Mikhaylov, E.Rogochaya, G.Romanenko and R.Lednický (theory)

- analysis of charged kaons and pions in p-p, p-Pb and Pb-Pb collisions proposed by group;
- software development for the analysis.

Quarkonia:

S.Grigoryan

- development of Monte Carlo generator for J/ψ and Υ in p-p, p-Pb and Pb-Pb collisions to calculate detection efficiency and for understanding of J/ψ and Υ production mechanisms.

Ultra-peripheral processes:

V.Pozdnyakov, B.Rumyantsev and Yu.Vertogradova

- measurement of J/ψ and ρ^0 photoproduction cross sections in Pb-Pb and p-Pb interactions;
- study of a resonance produced at mass ~ 1.5 GeV.

GRID-ALICE at JINR (together with LIT)

G.Stiforov

Participation in Inner Tracking System (ITS) commissioning run

all, 63 shifts per year

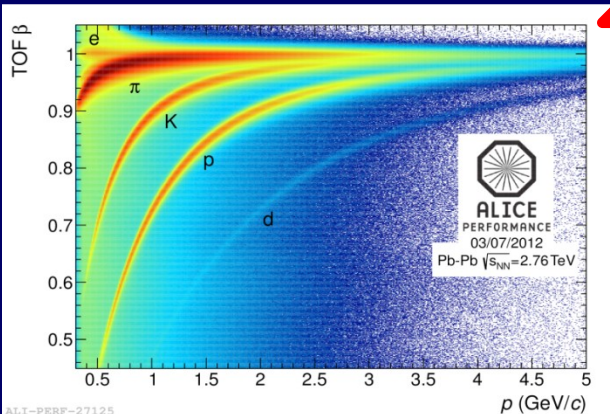
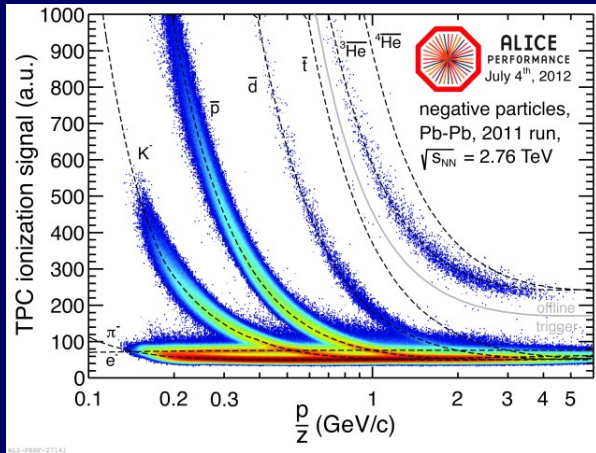
Others

- E.Rogochaya replaced L.Malinina as the convener of the Femtoscopy Analysis Team;
- participation in Internal Referee Committee (IRC) or Analysis Review Committee (ARC) for 7 ALICE papers (E.Rogochaya and K.Mikhaylov);
- joint RFFI and CNRS grant for femtoscopy study was approved.

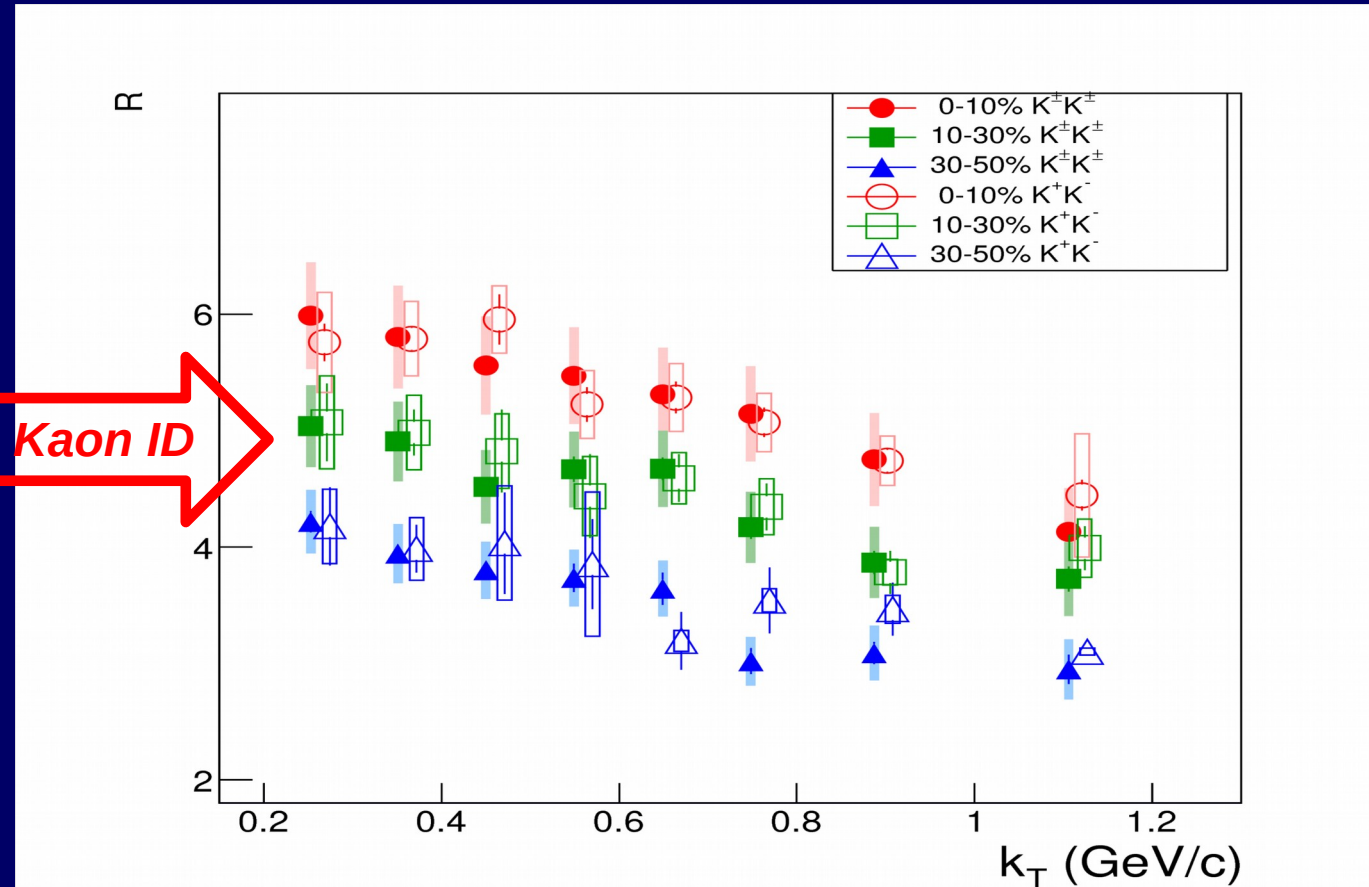
K^+K^- correlations in Pb-Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV

K.Mikhaylov

Radii of source of kaon emission (R) as a function of the average transverse momentum (k_T) of a non-identical (K^+K^-) or identical (K^+K^+ / K^-K^-) pair for different event centralities.



Kaon ID



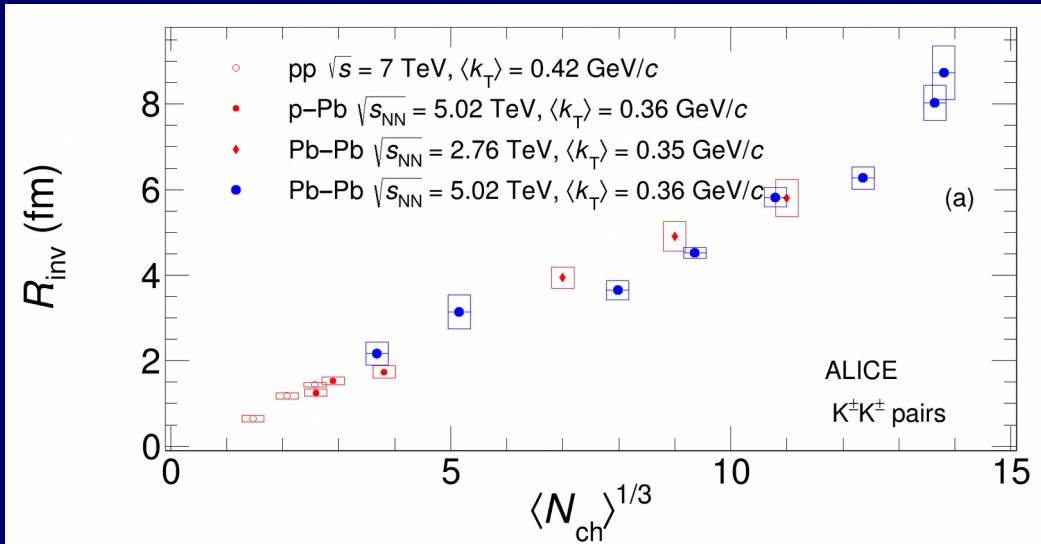
New preliminary $f_0(980)$ parameters were obtained from a fit of correlation function under condition that the K^+K^- radii close to $K^\pm K^\pm$ ones.

Presented at 5th ICPPA (Moscow, 2020) <https://indico.particle.mephi.ru/event/35/contributions/2323>

Charged kaons femtoscopic of PbPb collisions at $\sqrt{s_{NN}} = 5.02$ TeV

G.Romanenko and L.Malinina

Radii of source of kaon emission as a function of event charged multiplicity for different k_T of identical kaon pairs.

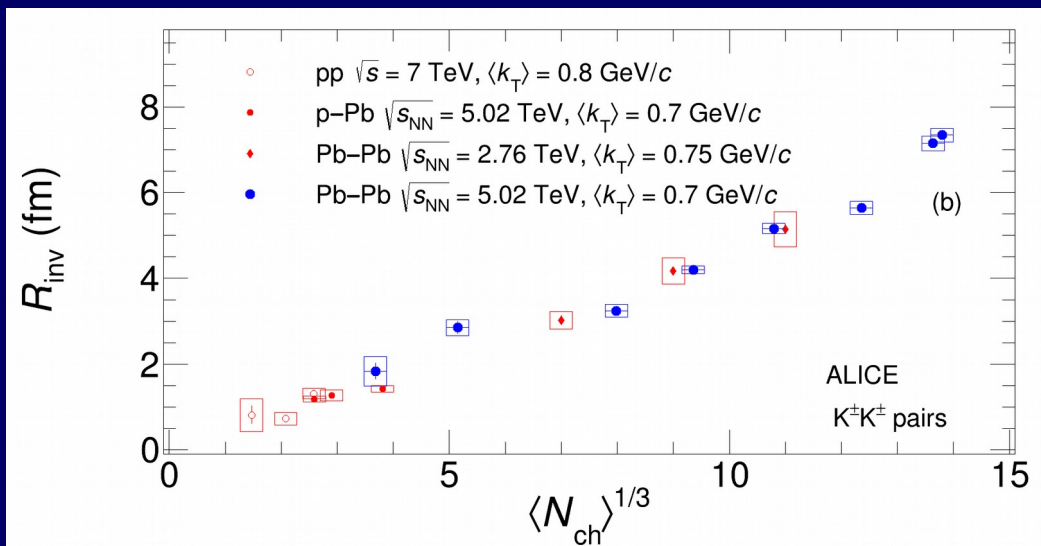


The event charged multiplicity may be even more significant for describing behavior of radii than the type of colliding system.

More precise studies are needed to analyze the same k_T -bins as done for p-Pb at $\sqrt{s_{NN}} = 5.02$ TeV and Pb-Pb at $\sqrt{s_{NN}} = 2.76$ TeV

since

the Pb-Pb data at $\sqrt{s_{NN}} = 5.02$ TeV were $\langle k_T \rangle$ -corrected for the results of the fit of early p-Pb and Pb-Pb data.

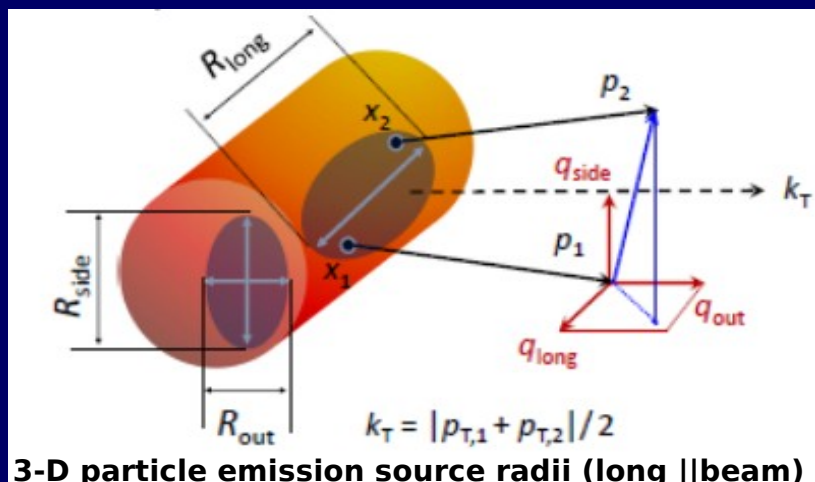


Presented at "Lomonosov Readings" (Moscow, October 2020)

<http://www.sinp.msu.ru/en/node/26342>

Pion and kaon femtoscopy in Pb–Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV in comparison with the EPOS 3 model prediction

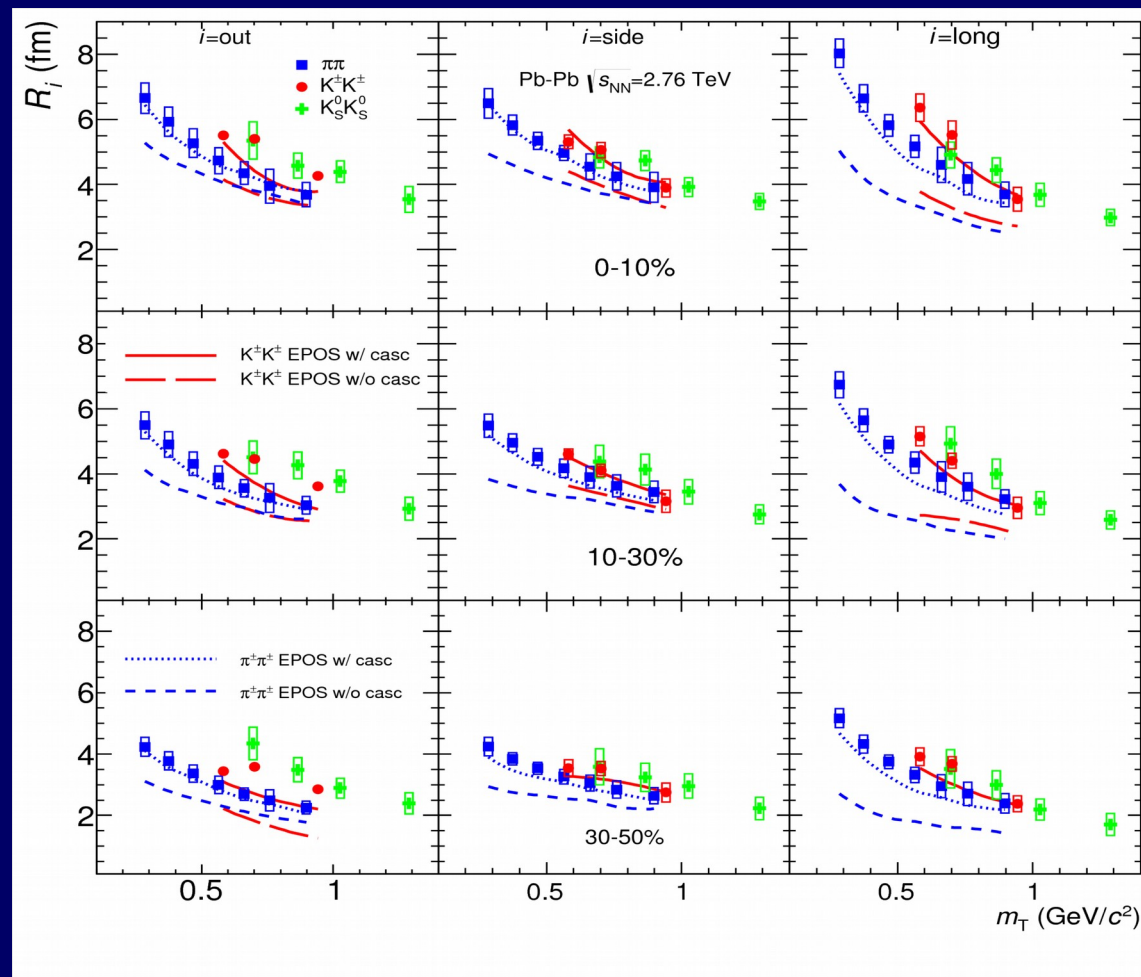
E.Rogochaya



EPOS 3 with UrQMD describes fairly well the experimental data except for “out” projection for kaons, “long” projection is underestimated for pions.

Hadron cascade is very important both for pions and for kaons.

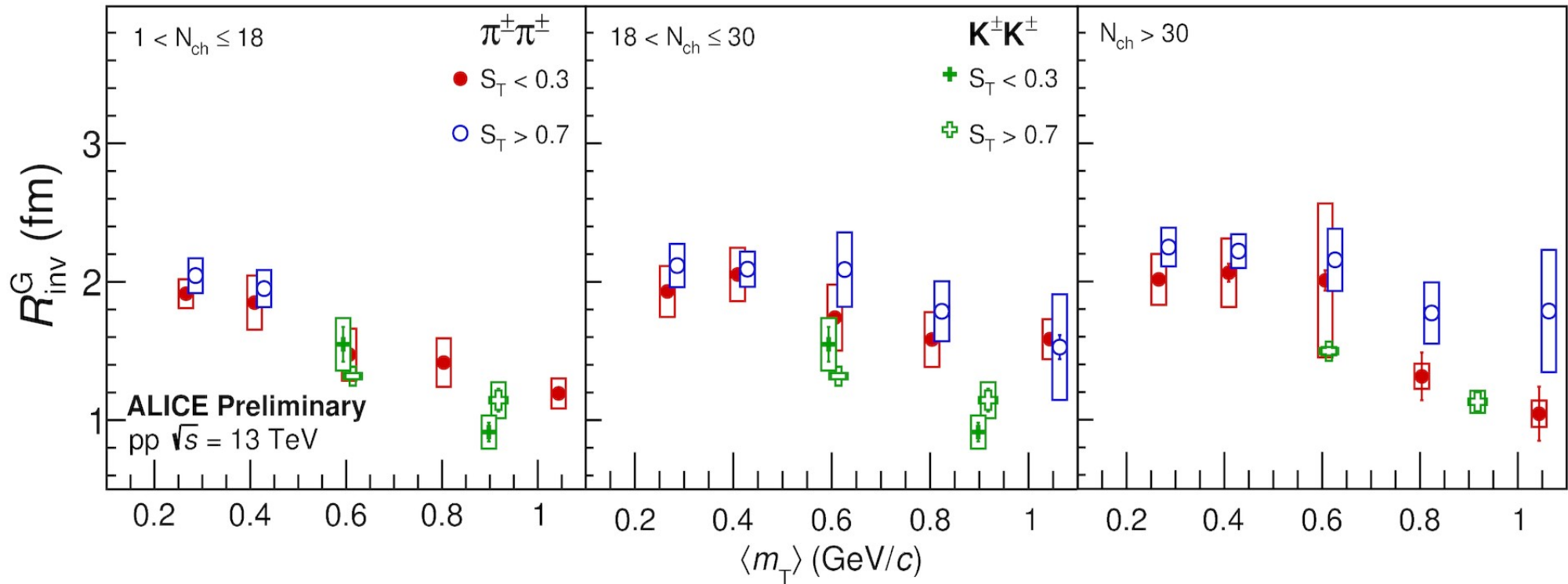
EPOS 3 w/o UrQMD radii show noticeably flatter m_T dependence.



Presented at 5th ICPPA (Moscow, October 2020)
<https://indico.particle.mephi.ru/event/35/contributions/2341>

Femtoscopic correlations of identical charged particles in pp collisions under event-shape selection

L.Malinina



- the pion femtoscopic parameters of spherical events are larger than those for jet-like events;
- spherical radii have flatter behavior compare with jet-like ones;
- no mass scaling is observed. Kaon radii are always smaller than pion ones.

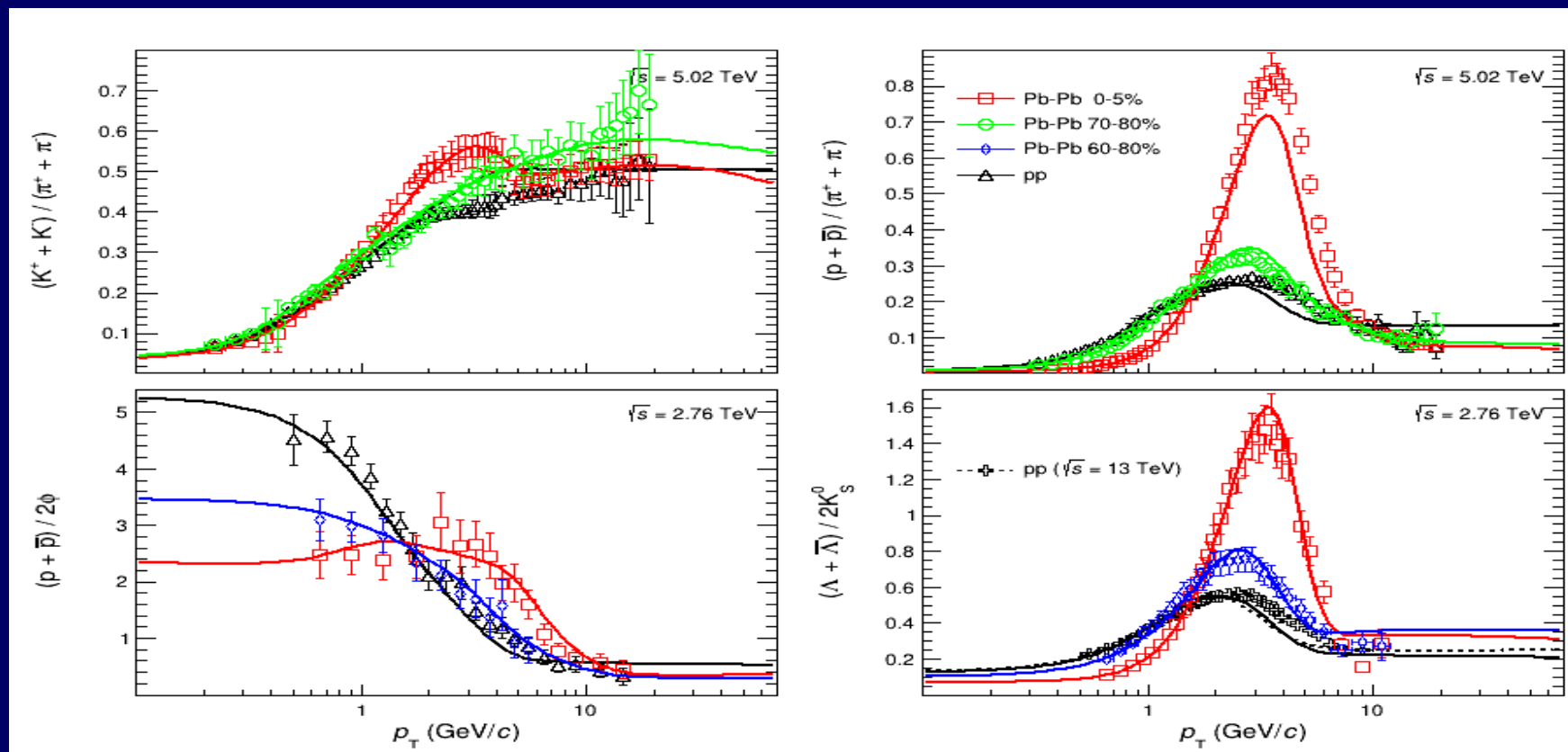
Presented at 5th ICPPA (Moscow, October 2020)

<https://indico.particle.mephi.ru/event/35/contributions/2319>

Phenomenological model for particle production in pp and A-A collisions at the LHC

S.Grigoryan

A three componen model: Boltzmann-Gibbs thermal and Tsallis distributions both to describe low and intermediate values of p_T and power-law form for hard processes at high p_T .

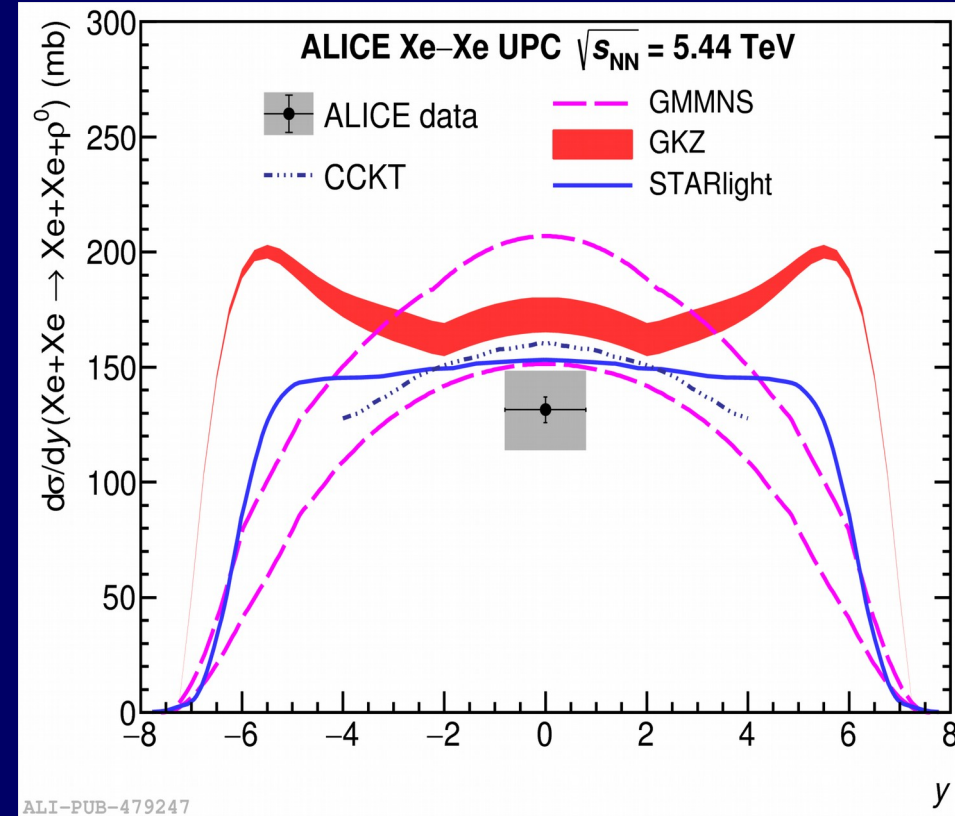
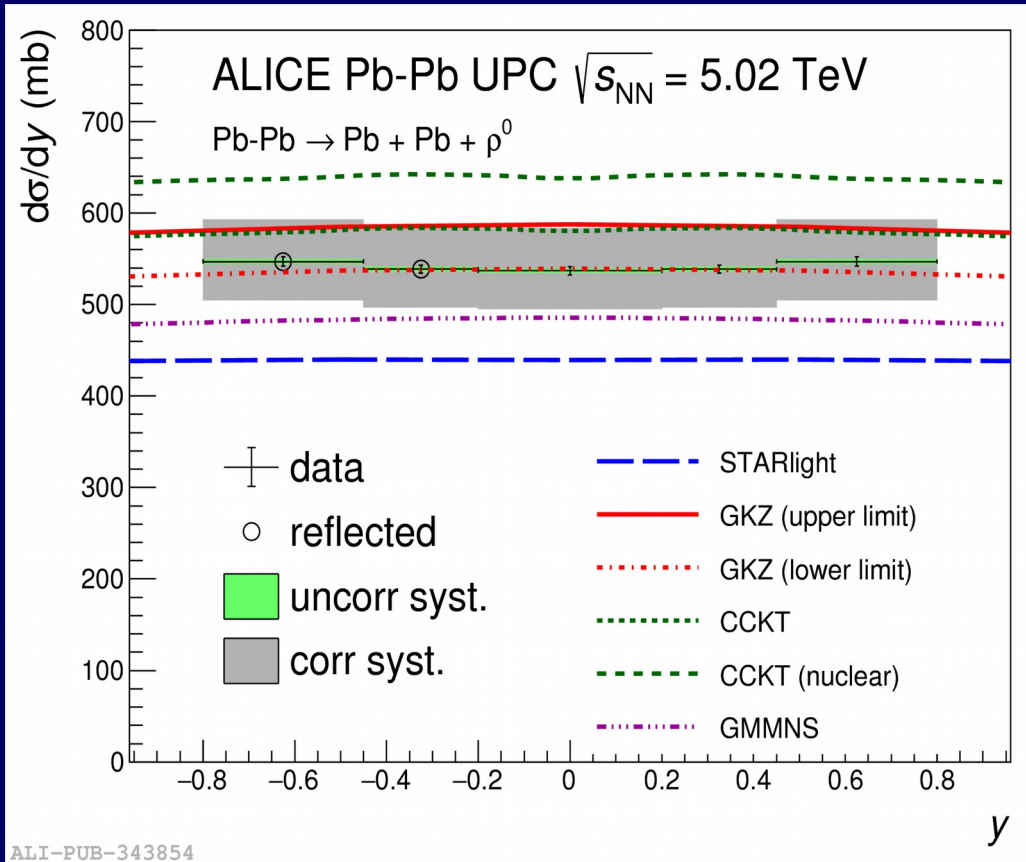


model predictions are in agreement with the available ALICE data for ratios of different particle spectra. Right panel effect at p_T of (2-6) GeV is related to transverse flow and important for most central collisions and heavier particles.

Coherent photoproduction of ρ^0 in Pb-Pb UPC at $\sqrt{s_{NN}} = 5.02$ TeV

Xe-Xe UPC at $\sqrt{s_{NN}} = 5.44$ TeV

V.Pozdnyakov



Presented at 40th Int. Conference on
High Energy Physics (Prague, 2020)

<https://indico.cern.ch/event/868940/contributions/3814462/>

and published

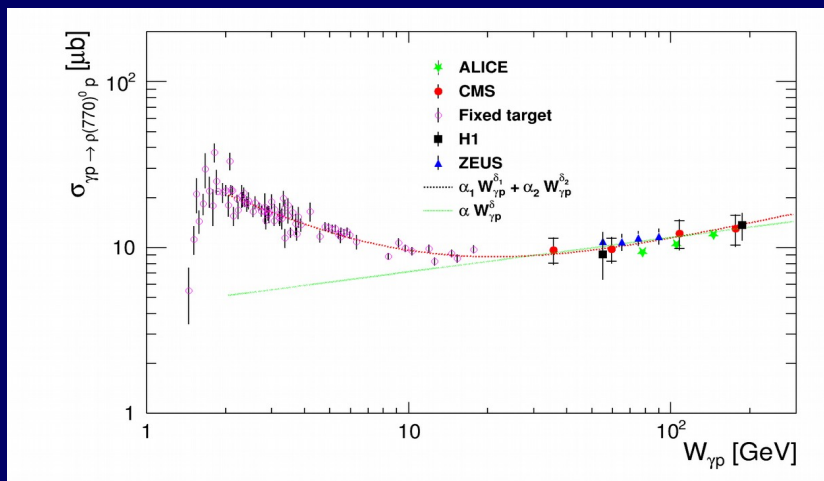
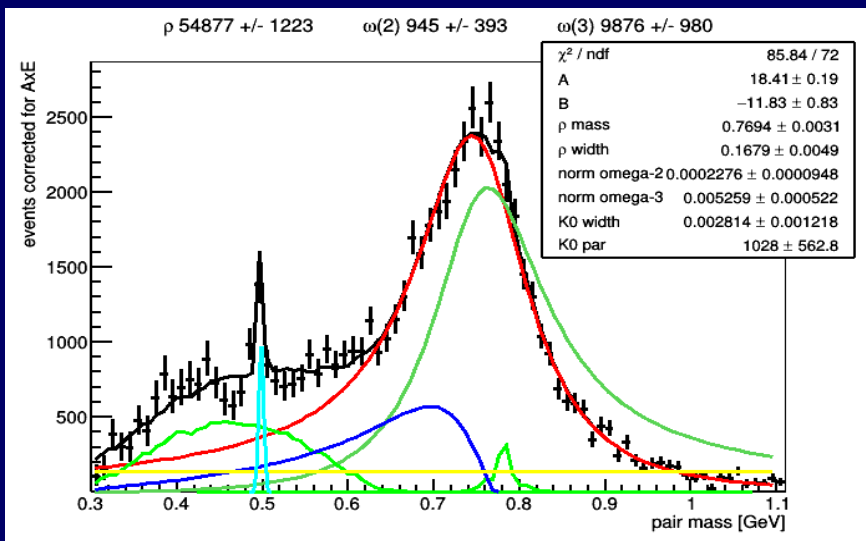
JHEP 06 (2020) 035, <https://arxiv.org/abs/2002.10897>

54th meeting of PAC for PP

Pozdnyakov V.

Draft of a paper to be sent to PLB,
circulates within Collaboration

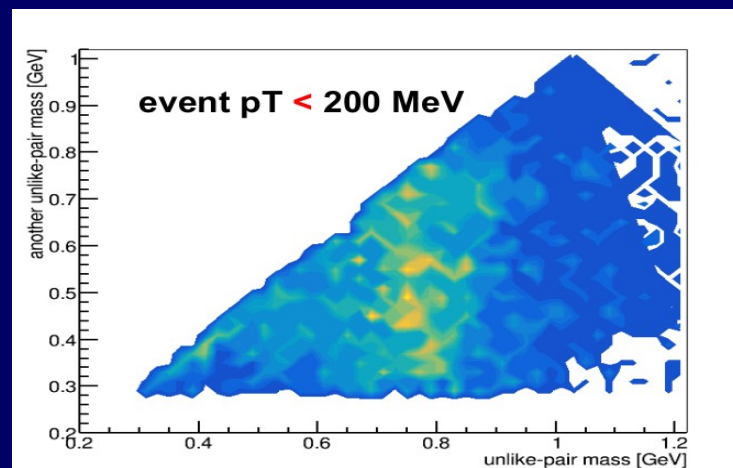
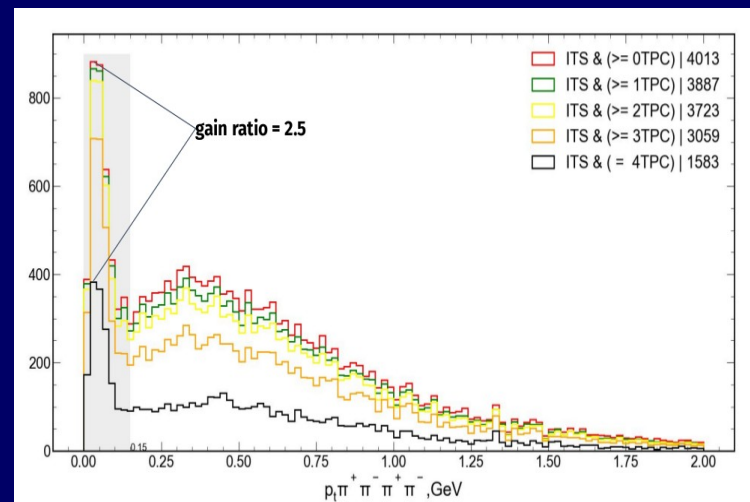
ρ^0 photoproduction in p-Pb UPC at $\sqrt{s_{NN}} = 5.02$ TeV V.Pozdnyakov



*A work on methodical and
systematics is in progress*

Study of four-prong events in Pb-Pb UPC

B.Rumyantsev



*A work on methodical is in progress,
a way to reach a great gain of the event
statistics was developed.*

The results achieved in 2020 with an activity of JINR-ALICE group

published

“Coherent photoproduction of ρ^0 vector mesons in ultra-peripheral Pb-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV”, ALICE Collab. (S.Acharya et al.), JHEP 06 (2020) 035, <https://arxiv.org/abs/2002.10897>

talks

1. K.Mikhaylov (on behalf of the ALICE) “ K^+K^- correlations in Pb-Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV”, 5th International Conference on Particle Physics and Astrophysics ICPPA (Moscow, October 2020); <https://indico.particle.mephi.ru/event/35/contributions/2323>
2. L.Malinina (on behalf of the ALICE) “Femtoscopic correlations of identical charged particles in pp collisions at LHC energies with event-shape selection”, ICPPA (Moscow, October 2020); <https://indico.particle.mephi.ru/event/35/contributions/2319>
3. E.Rogochaya “Pion and kaon femtoscopy in Pb-Pb collisions at 2.76 TeV in comparison with the EPOS 3 model prediction”, ICPPA (Moscow, October 2020); <https://indico.particle.mephi.ru/event/35/contributions/2341/>
4. V.Pozdnyakov (on behalf of the ALICE) “Recent ALICE results on photon-induced J/ψ production”, 10th Int. Conf. on Hard and Electromag. Probes of High-Energy Nuclear Coll., (Texas, May 2020); <https://indico.cern.ch/event/751767/contributions/3770991/>
5. G.Romanenko “Charged kaons femtoscopy analysis in Pb-Pb collisions at 5.02 TeV”, “Lomonosov readings”, (Moscow, November 2020); <http://www.sinp.msu.ru/en/node/26342>
6. V.Pozdnyakov (on behalf of the ALICE) “Vector meson photoproduction in ultra-peripheral Pb-Pb collisions at the LHC with ALICE”. 40th Int. Conference on High Energy Physics (Prague, July). <https://indico.cern.ch/event/868940/contributions/3814462/>

The results achieved in 2020 with an activity of JINR-ALICE group

paper with participation in ALICE Analysis Review Committee

“AK femtoscopy in Pb-Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV”, ALICE Collaboration (S.Acharya et al),
<https://arxiv.org/abs/2005.11124>

conference papers

1. K.Mikhaylov (on behalf of the ALICE Collab.), “ Non-identical charged kaon femtoscopy in Pb-Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV”, J. Phys.: Conf. Ser. **1690** 012099;
<https://iopscience.iop.org/article/10.1088/1742-6596/1690/1/012099>
2. B.Batyunya et al., “Identical pion and kaon femtoscopy in EPOS3 with and without the hadronic afterburner UrQMD”, J. Phys.: Conf. Ser. **1690** 012102;
<https://iopscience.iop.org/article/10.1088/1742-6596/1690/1/012102>
3. V.Pozdnyakov (for the ALICE Collab.), “Recent ALICE results on photon-induced J/ψ production ”, PoS (HardProbes2020) 110.
https://pos.sissa.it/cgi-bin/author/gest_conf.cgi?confid=387

JINR-ALICE group plans for 2021

continue femtoscopy analysis of:

- K^+K^- pair production in Pb-Pb at $\sqrt{s_{NN}} = 2.76$ TeV and prepare a publication on (K.Mikhaylov);
- 1-D correlations of identical kaon pairs in pp interactions at $\sqrt{s_{NN}} = 13$ TeV for spherical and jet events (L.Malinina);
- identical charged kaon pairs in Pb-Pb at $\sqrt{s_{NN}} = 5.02$ TeV (G.Romanenko(student) and L.Malinina);
- $K^{ch}K^{ch}$ in p-Pb collisions at 5.02 TeV in 3-D (E.Rogochaya).

quarkonia:

- prepare next version of phenomenological thermal model for p-Pb and Pb-Pb collisions (S.Grigoryan).

continue study of ultra-peripheral processes for:

- ρ^0 coherent photoproduction in Xe-Xe UPC (all steps repeat Pb-Pb analysis);
- ρ^0 photoproduction in p-Pb UPC, comparison with HERA results (V.Pozdnyakov and Yu.Vertogradova);
- four-pion final states in Pb-Pb where an indication on $\rho(1450)$ resonance is observed (B.Rumyantsev (PhD student) and V.Pozdnyakov).

service tasks:

- support ALICE-GRID system in LIT (G.Stiforov);
- take part in the Inner Detector commissioning runs (all).



Summary



The status of analysis carried out with activity of JINR group in the ALICE experiment was presented.

Past year the group members represented several talks on physics conferences and made corresponding publications.

The analysis of the ALICE data is performed for two lines – the study of the femtoscopy effects and a measurement of vector meson cross sections in ultra-peripheral heavy ion collisions.

The working plan for 2021 supports the continuation of these analysis with an intention to present results on conferences.

The service tasks hold by the group include the support of the GRID system in JINR and the participation in the Inner Tracking System commissioning runs this year.

Thanks



Backup

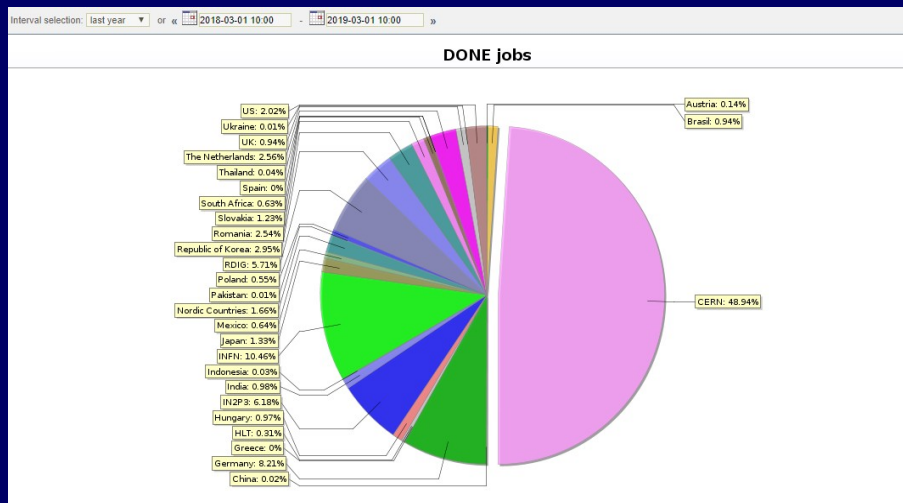


Предлагаемый план-график и необходимые ресурсы для осуществления проекта
«ALICE: A Large Ion Collider Experiment at CERN LHC (JINR participation)»
 «ALICE: Исследование взаимодействий пучков тяжелых ионов и протонов на LHC
 (участие ОИЯИ)»
 (продление проекта)

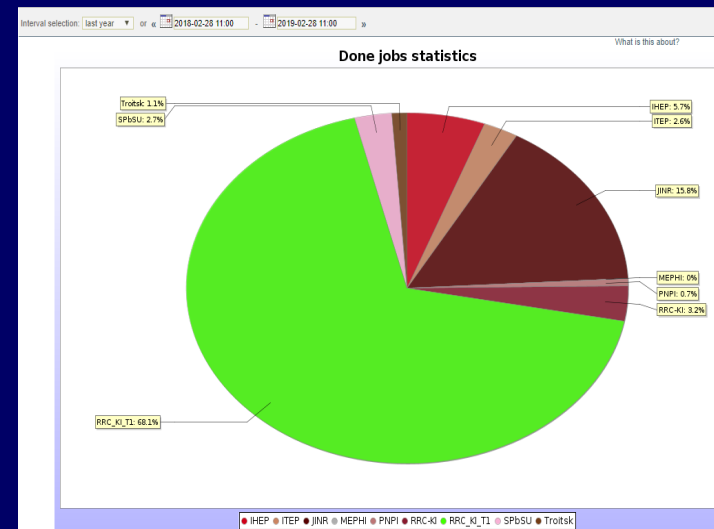
Наименование узлов и систем установки, ресурсов, источников финансирования			Стоимость узлов установки (тыс. дол. США) Потребности в ресурсах	1 год	2 год	3 год
Основные узлы и оборудование	1. Платежи в ЦЕРН		360.0	120.0	120.0	120.0
	2. Компьютерное оборудование.		120.0	40.0	40.0	40.0
	3. Командировочные расходы		400.0	120.0	140.0	140.0
	ИТОГО		880.0	280.0	300.0	300.0
Необходимые ресурсы	Нормо-часы	ООЭП ЛФВЭ				
Источники финансирования	Бюджет	Затраты из бюджета	880.0	280.0	300.0	300.0
	Внебюджетные средства	Целевое финансирование				

FTE = 14.5

GRID-ALICE in JINR



ALICE Institutions in GRID, Russian ~5.7%



JINR / Russian Institutions ~15.8%
Highest among Tier-2 of Russia

Other activities of JINR group in ALICE

- L. Malinina became so-convener of a femtoscopy subgroup
- take part in internal revision committees for ALICE publications
- take part in institutional revision committees for ALICE publications

- for the reviewed period the ALICE experiment continued to take the data (2017-2018) and return back to the physics data taking in 2021 for another three years.
- the data taking was very successful and the experiment collected huge amount of the data. It allows us to make finer measurements (3-D instead of 1-D) and searching jobs
- next period of the data taking will be first one with NO trigger and continued recording of the data
- several presentations on main physics conferences and publications per year
- technical issues (GRID) in good shape