

# Updates on physics research with ATLAS detector at the LHC (JINR participation)

E. Khramov

3 February 2020

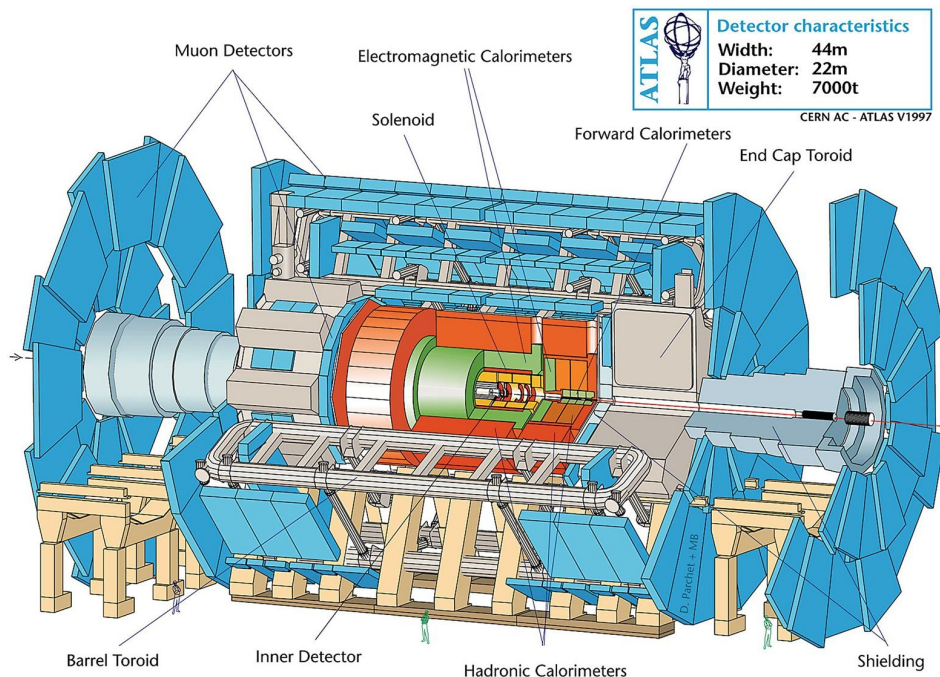
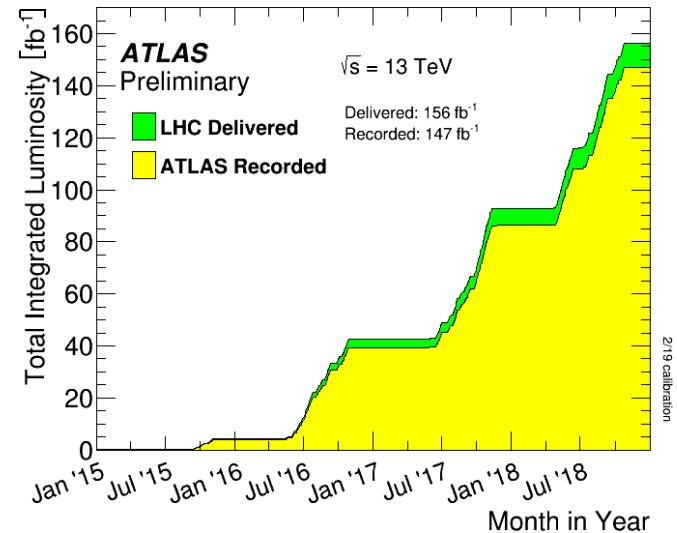
# The ATLAS Collaboration

NUMBER OF INSTITUTES: 261

NUMBER OF AUTHORS: 1874

NUMBER OF PARTICIPANTS: 8408

NUMBER OF COUNTRIES: 44



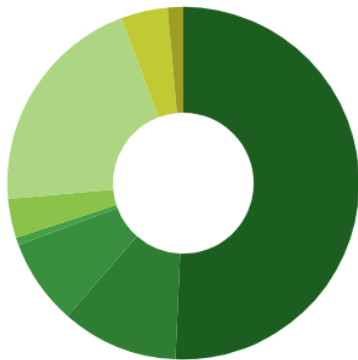
JINR-ATLAS team was deeply involved in designing, construction, tests and assembly of the major systems of ATLAS:

- Inner Detector
- Tile Calorimeter
- Liquid Argon Endcap Calorimeter
- Muon detector
- Common Items:
  - Magnet system
  - Warm Structure, etc.

# JINR in the ATLAS Collaboration

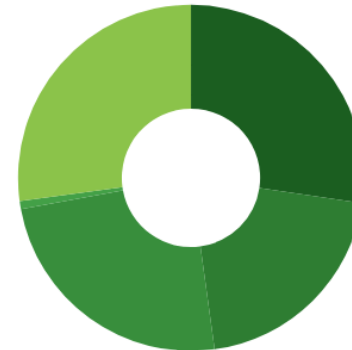
► Institutes Active Members - total: 140

► Professional Status



- 71 Physicist
- 15 Physics PhD student
- 11 Physics masters/diploma student
- 1 Undergraduate/summer student
- 5 Engineer with PhD
- 29 Engineer without PhD
- 0 Engineering student
- 6 Technician or equivalent
- 2 Administrator/other

► Lists



- 36 on Authorlist (A)
- 27 Signing-Only (a)
- 32 counted for M&O (M)
- 1 qualifying members (q)
- 35.75 for Operation Tasks (O, o)

DLNP: Batusov V., Bednyakov V., Boyko I., Budagov Y., Chelkov G., **Cherepanova E.**, Chizhov M., Chubinidze Z., Dedovich D., Demichev M., Elkin V., Ershova A., Gladilin L., Glagolev V., Gongadze A., Gongadze L., Gostkin M., Huseinov N., Ivanov Y., Kalinovskaja L., Karpov S., Karpova Z., Kharchenko D., Khramov E., Kostyukhina I., Koval O., Kruchonak U., Kultchitsky Y., Lyabline M., Lykasov G., Lyubushkin V., Lyubushkina T., Malyukov S., Minashvili I., Minashvili I.(jr.), Nefedov Y., Plontikova E., Potrap I., Prokoshin F., Rusakovich N., Sadykov R., Sapronov A., Shiyakova M., Tsiareshka P., Turchikhin S., Yeletsikh I., Zhemchugov A., Shalyugin A., Stepenenka Y., **Shilin V.**, Usov Y., Usubov Z., Vasyukov A.

LIT: Alexandrov E., Aleksandrov I., Gromova N., Iakovlev A., Kazymov A., Mineev M., Oleinik D., Petrosyan A., Shigaev V., Zrelov P.

VBLHEP: Ahmadov F., Cheplakov A., Javadov N., Kukhtin V., Ladygin E., Manashova M., Soloshenko A., Zimin N., Fillipov Y., Shaykhatdenov B., Turtuvshin T.

# JINR in the ATLAS Human resources

A total number of personnel in the JINR group participating in the ATLAS Physics program is 33+2 including 6 professors, 12+1 postdocs and 15+1 young scientists, students and engineers. The whole Team provides 29 FTE.

Besides the participation in the analysis itself members of the ATLAS-JINR Team are also playing managerial roles in the Collaboration. In the recent period we were taking responsibilities of conveners and sub-conveners of the ATLAS Working Groups (WG) as well as technical contacts persons with others Working Groups, such as Standard Model WG, B-Physics sub-group, Trigger Performance etc.

Major part of them is engaged in the project for many years. They have well recognized reputation within the Collaboration and beyond, solid background and necessary skills to fulfill all our obligations.

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VBLHEP: Ahmadv F., Cheplakov A., Javadov N., Kukhtin V., Ladygin E., Manashova M., Soloshenko A., Zimin N., Fillipov Y., Shaykhatdenov B., Turtuvshin T.

# JINR in the ATLAS M&O

During the 2019 period JINR has successfully secured all requested OTs of Class 1 and 2 providing:

0.55 FTEs out of 0.48 FTEs requested in 2019

The main task is participation in the ATLAS SLIMOS/TI - Safety shifter and we would like to continue to cover this kind of shifts in that way.

At the beginning of the 2019 period the Class 3 shifts were covered at the level of ~90%.

~ 7 FTEs out of 8.05 FTEs requested in 2019

This coverage was mainly due to “Grid Data Processing & Analysis” and “DAQ/HLT Control & Configuration” and authorship qualification tasks. There are several minor tasks usually provided by JINR Team members in the detector sub-systems

# JINR in the ATLAS Physics during the 2<sup>nd</sup> part of 2019

**1. Study of the applicability of the Standard Model and verification of SM predictions (including interactions of heavy ions), defining the structure of the proton at ultra-high energies (PDFs), tuning and improvement of relevant computer codes and events generators etc.**

**– 1 prof., 2 postdocs (2.5 FTE), 1 journal publication, work in progress**

**2. Search for (and study the characteristics of) additional exotic (including chiral  $Z^*$ ,  $W^*$ ) bosons in Drell-Yan and two-jet processes.**

**– 1 prof., +1 postdoc (1.5 FTE) work in progress**

**3. Search for manifestations of Long Lived Supersymmetry (or Beyond-SM physics) mainly in inclusive events with many (more than 4) hadron jets accompanied by the large missing energy and DV.**

**– 1 student (1 FTE) work in progress**

**4. Search for (supersymmetric) charged Higgs bosons via their specific decay modes (3 leptons, etc).**

**– 1 postdoc, 1 master student (2 FTE) work in progress**

# JINR in the ATLAS Physics during the 2<sup>nd</sup> part of 2019

**5. Search for a valence-like nonperturbative component of heavy quarks in the proton (intrinsic heavy quarks) via specific final state topology in the pp-interactions**

**+**

**6. A new comprehensive study of the gluon structure of the proton, etc.**

**– 1 prof., 1 postdoc, 1 PhD student (2.5 FTE) work in progress**

**7. Search for new hadrons and baryons containing heavy c- and b-quarks, study the properties.**

**– 1 prof., 2 postdocs, 1 engineer (3.5 FTE) work in progress**

**8.  $VH(\rightarrow b\bar{b})$**

**– 1 postdoc, 1 master student (2 FTE) work in progress (the publication this year)**

**9.  $BSM \rightarrow V/H(\rightarrow J)+\gamma$**

**– 1 postdoc work in progress (the publication this year)**

**10. Quantum Black Holes**

**– 2 postdocs (2 FTE) work in progress (the publication this year)**

**11. SM precision measurements ( $W/Z + b$ -jet x-section)**

**– 1 postdoc (1 FTE) work in progress (the publication this year)**

# JINR in the ATLAS Physics during the 2<sup>nd</sup> part of 2019

## 12. $B_c$ excited states

– 1 prof., 2 postdocs, 1 engineer (3.5 FTE) work in progress (1-2 publications this year)

## 13. Pentaquark

– 1 prof., 1 postdoc, 1 master student (2 FTE), 1 conf note, work in progress

## 14. $t\bar{t}H/W$

– 1 postdoc (0.8 FTE), 1 conf note, work in progress

## 15. $tH$

– 2 postdocs, 1 engineer (1.2 FTE) work in progress

## 16. BEC

– 1 prof., 2 engineers (3 FTE) work in progress (the publication this year)

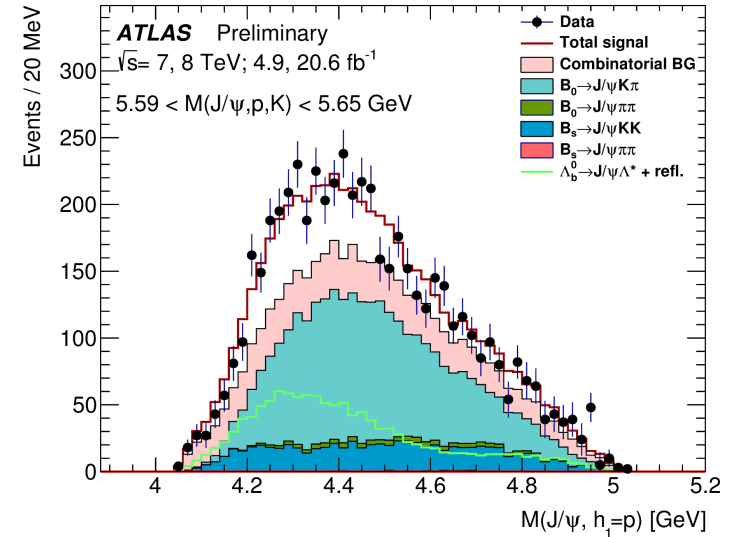
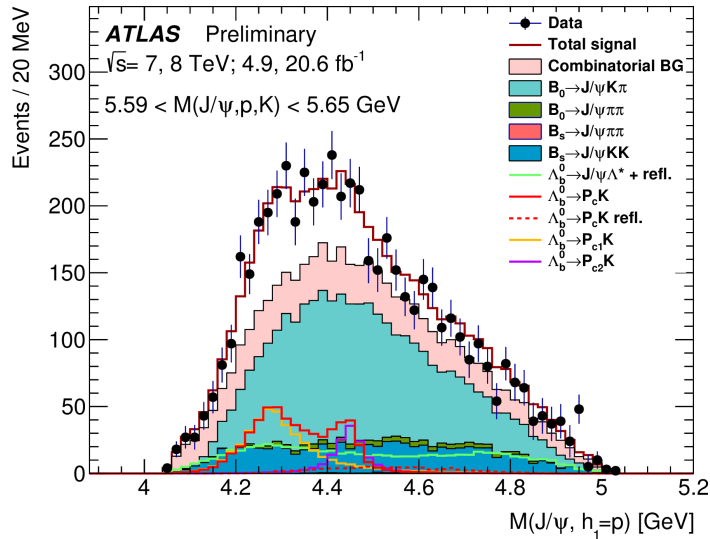
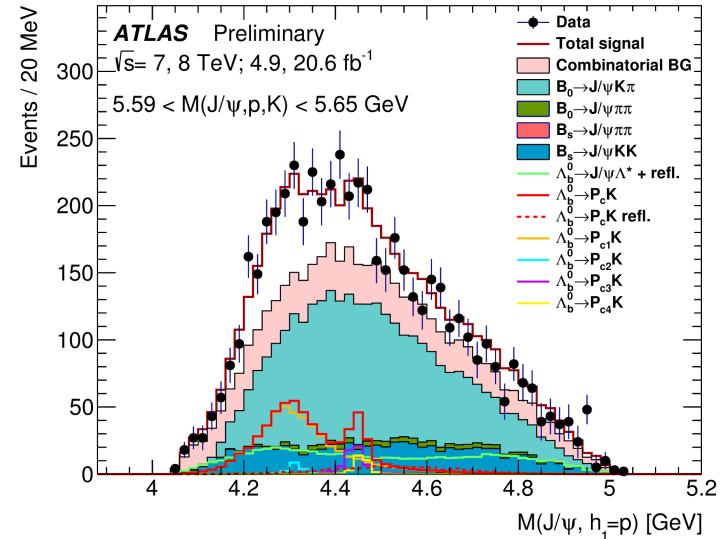
During the second half of 2019 it was published 1 paper and 3 other publications with significant participation of the JINR staff, 6-7 publications more this year, more than 5 talks at 5 different conferences

Organization and participation in the Physics&Computing Russian Institutes meeting



## Pentaquarks

Beauty2019

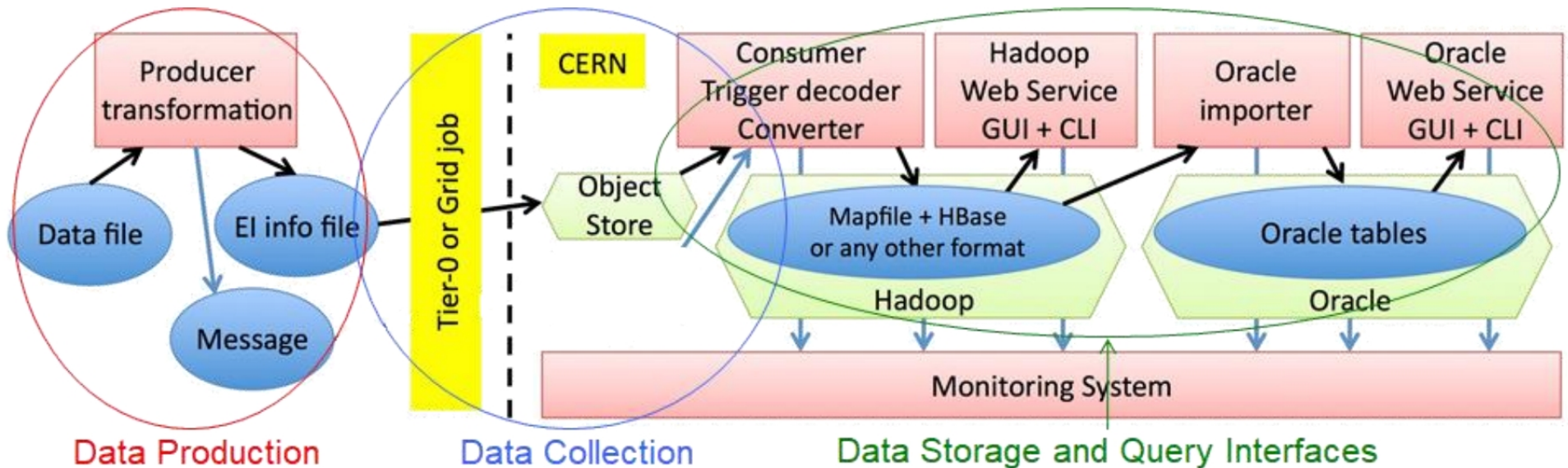

 $P_c(4380)^+$ 
 $P_c(4450)^+$ 
 $P_c(4312)^+$ 
 $P_c(4440)^+$ 
 $P_c(4457)^+$ 
**No  $P_c$ :**  $\chi^2/N_{\text{dof}} = 42.0/23$  **p-value =  $9.1 \times 10^{-3}$** 

**2  $P_c$ :**  $\chi^2/N_{\text{dof}} = 37.1/39$  **p-value = 55.7%**

**4  $P_c$ :**  $\chi^2/N_{\text{dof}} = 37.1/42$ 


The  $P_c$  masses and widths obtained using the model with two  $P_c$  are consistent with those from the LHCb experiment. The data are also compatible with the recent LHCb observations of three narrow  $P_c$ .

Although the data prefer the model with two or more  $P_c$  states, the model without  $P_c$  is not excluded.

# Events Indexing

**EventIndex** is a system to index the data or Monte Carlo events in the ATLAS experiment



Application:

- Event picking
- Event selection or counting based on trigger decisions
- Checking data consistency
- Producing trigger chain overlapping matrices
- Producing data stream overlapping matrices
- Quick assessment of datasets content

**Organizing test server at JINR**

**NEC 2019**

CEUR Workshop Proceedings pp 30-35

2.44 FTE for 2019

# Conclusion and plans

- During 2<sup>nd</sup> half of 2019 we continued our successful participation in the ATLAS Physics program and realize attractive ideas in the ATLAS research program proposed by ATLAS at JINR
- ATLAS-JINR team participate in almost all ATLAS Physics WG
- We significantly participate in the Detector upgrade
- We contribute to detector maintenance: Class 1, 2 (115%) and 3 (~90%) shifts
- We plan to increase participation in Class 3 shifts by 1-2 FTEs this year
- We will keep going to strengthen our analysis activity
- We expect 6-7 publications this year