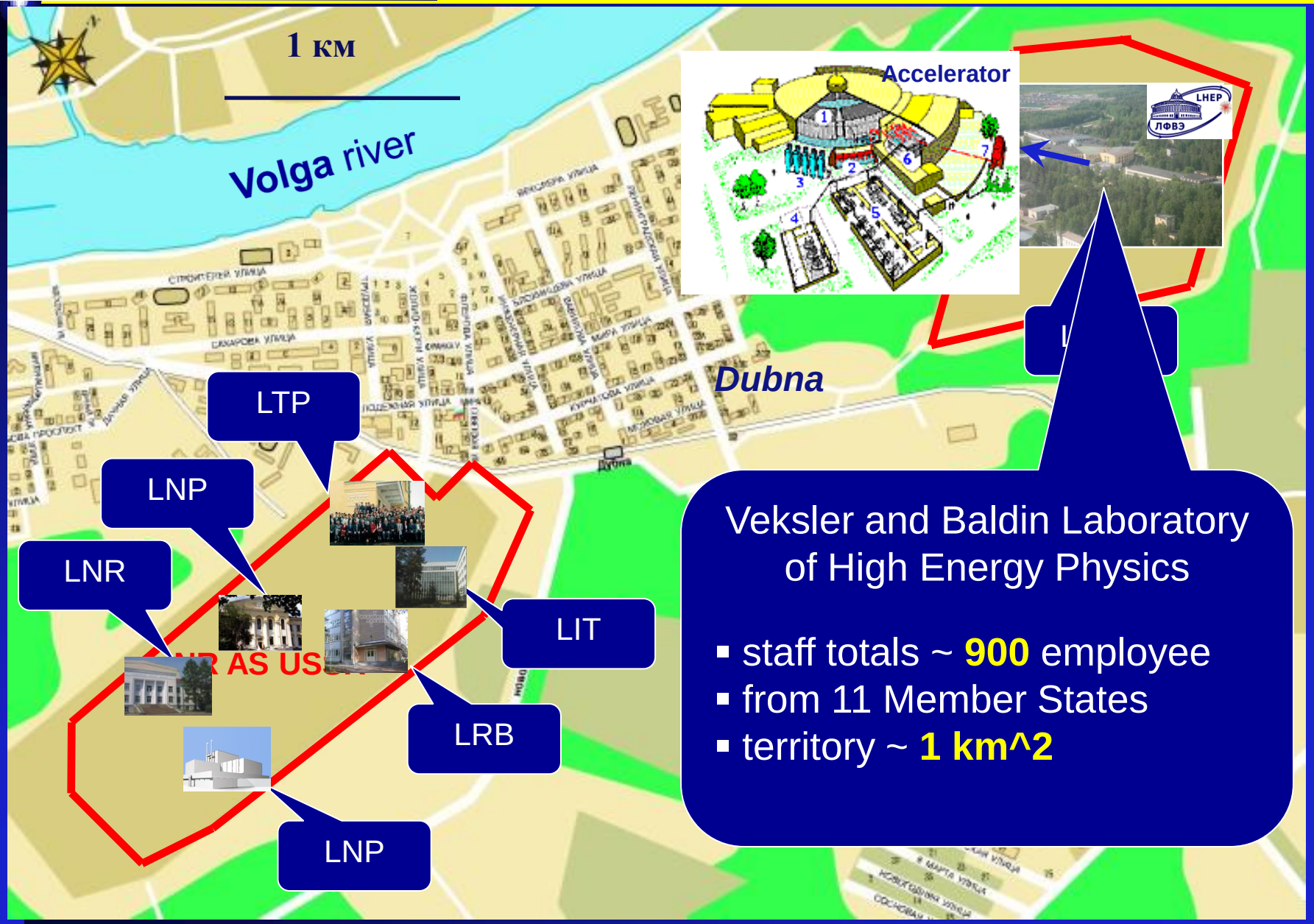
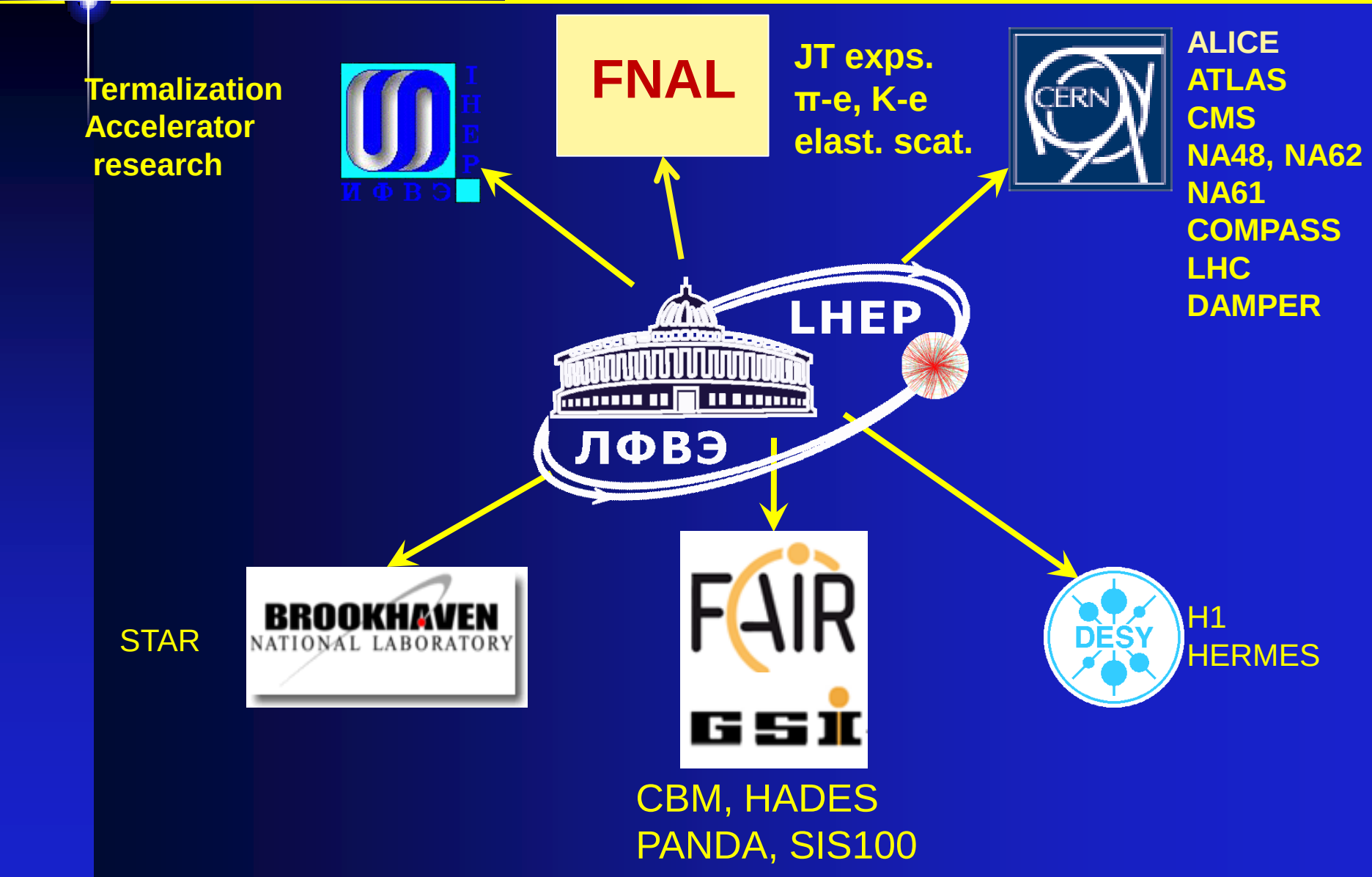
LHEP JINR

Structure of JINR

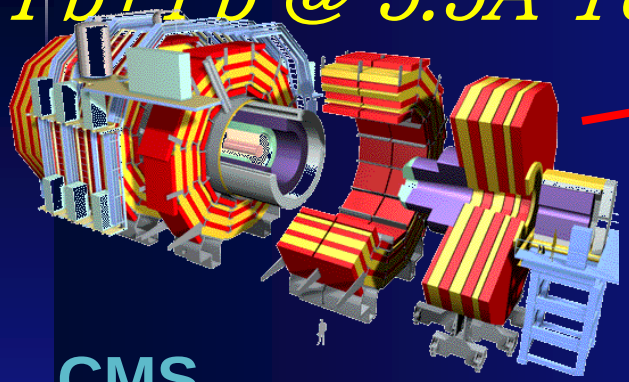


JINR LHEP Scientific Links

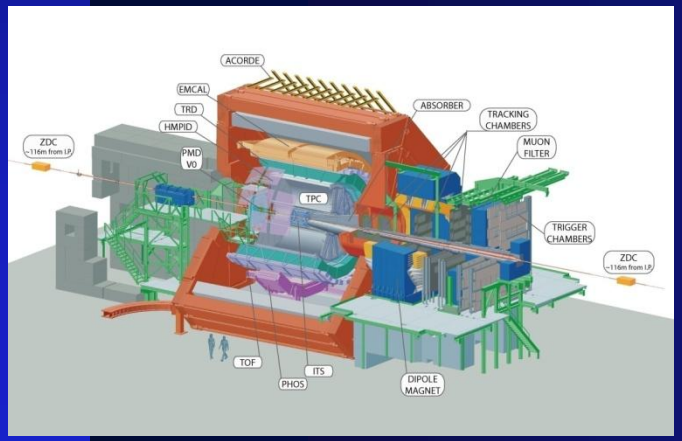


p+p @ 14 TeV

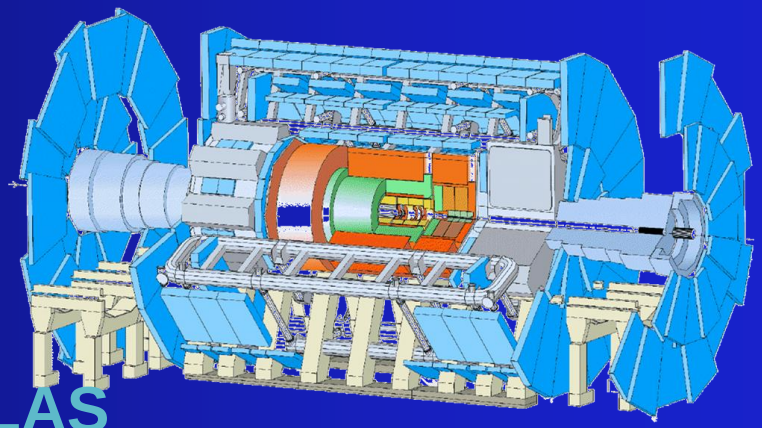
Pb+Pb @ 5.5A TeV



CMS



ALICE



ATLAS

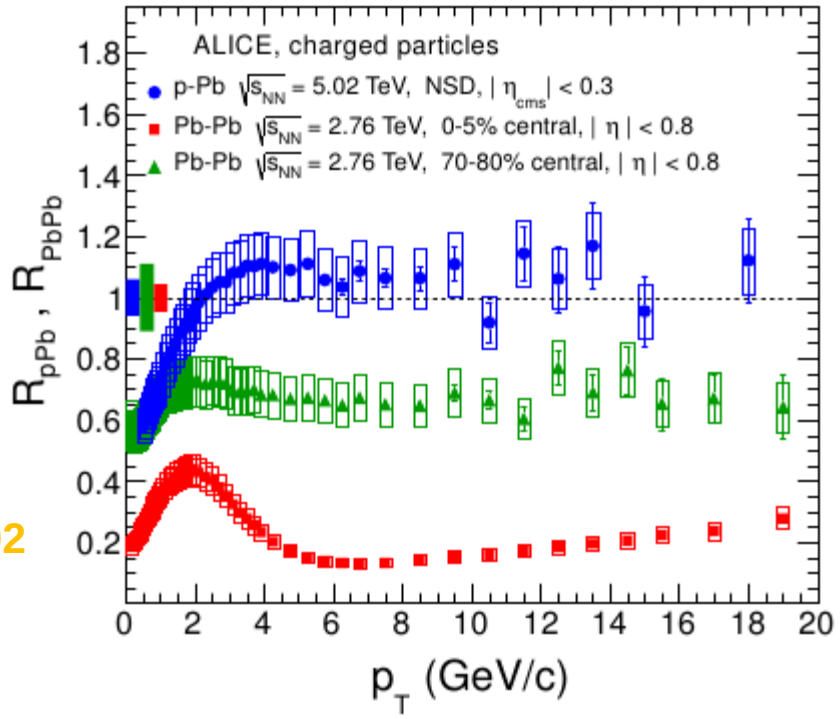

размер: 16 x 26 метров
вес: 10,000 тонн
TOF
TRD
HMPID
ITS
PMD
Muon Arm
PHOS
TPC
ALICE Set-up

ALICE
Study of interaction of heavy ion and proton beams at LHC

Contribution:
- Very large dipole magnet
- Drift chambers for Transition Radiation Detector;
- PWO crystals for Photon Spectrometer;

Physics tasks:
- Vector mesons;
- Heavy quarkonia;
- Particle correlations;

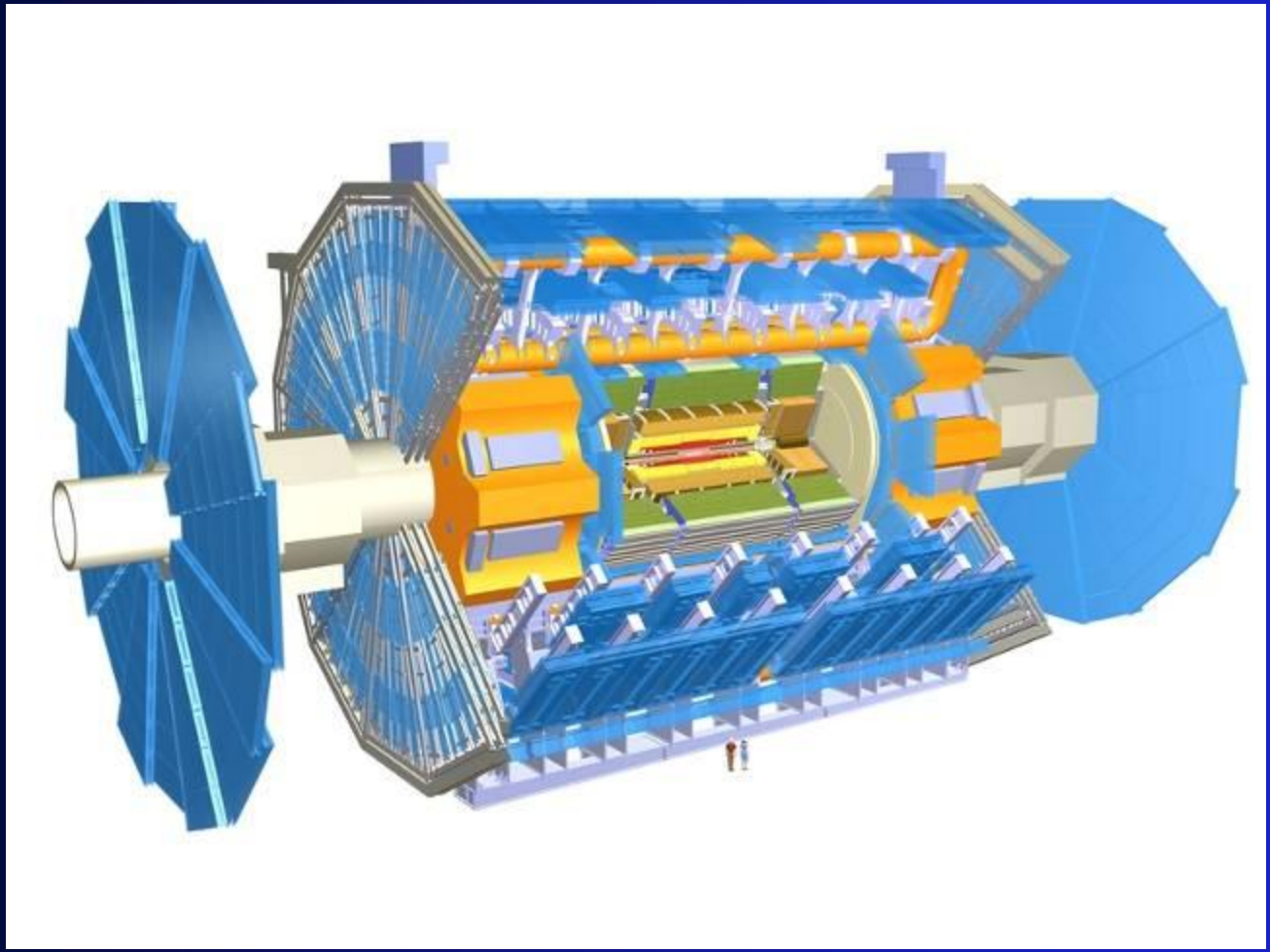
Computing:
ALICE-Russia GRID development.



Nuclear- modification factors in Pb-Pb (R_{PbPb}) at $(s_{NN})^{1/2}$ = 2.76 TeV and in p-Pb (R_{pPb}) at $(s_{NN})^{1/2}$ = 5.02 TeV (one of the first ALICE p-Pb results) (B.Abelev et al., arXiv:1210.4520, 2012)

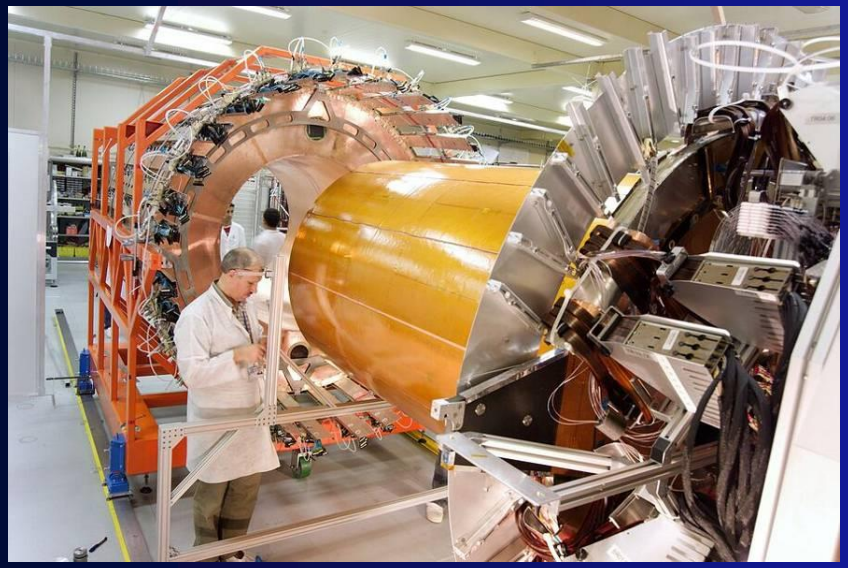
Largest dipole magnet (850 ton, 9×7×4.5 м) and particle detectors

ATLAS detector



Diameter	*25 m*
Barrel toroid length	*26 m*
End-cap end-wall chamber span	*46 m*
Overall weight	*7000 Tons*

JINR contribution to ATLAS

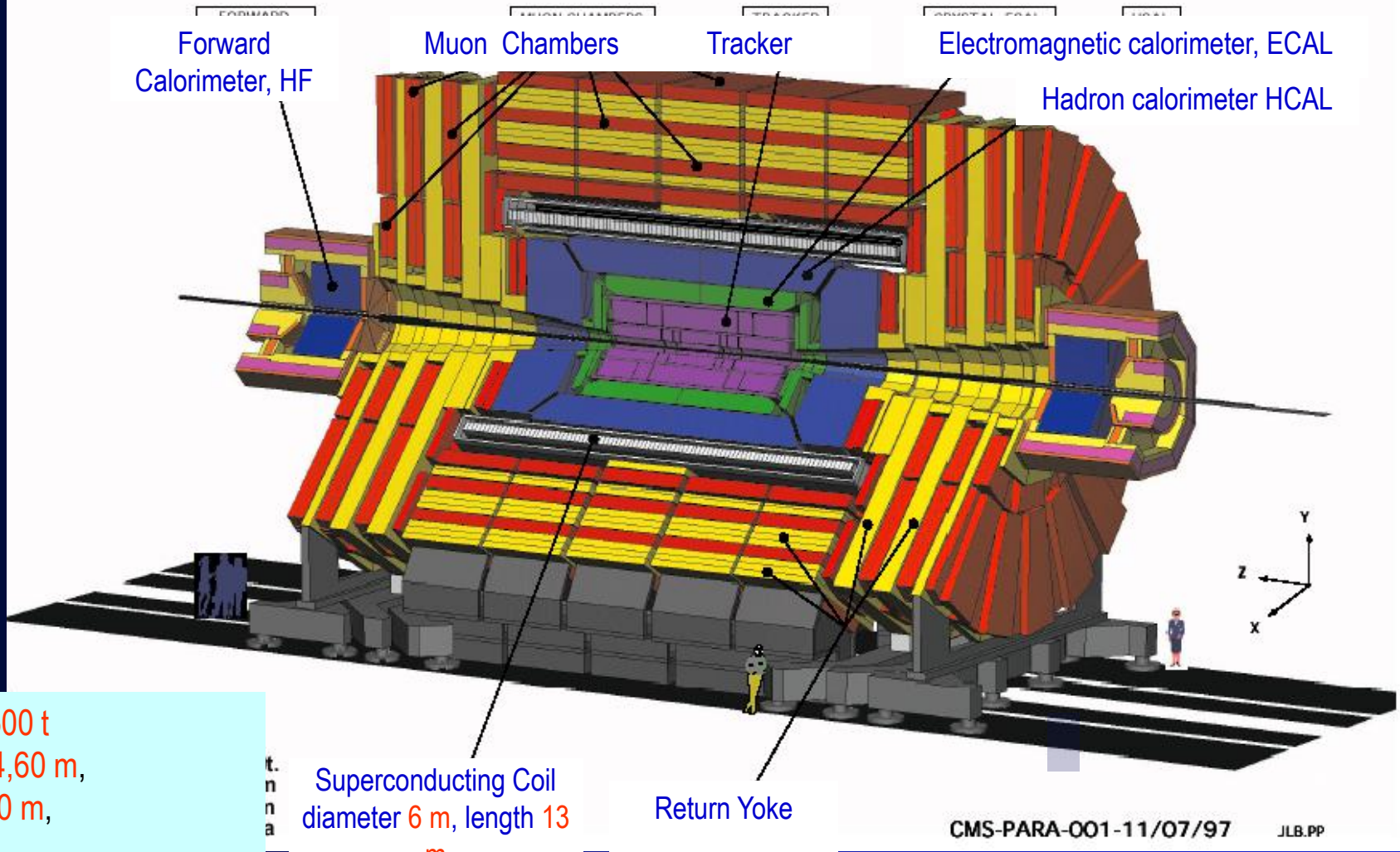


Transition Radiation Tracker based on straw tubes assembly

Barrel Tile Calorimeter;
LqAr Hadronic End-Cap Cal.
Muon Chambers

Compact Muon Solenoid- CMS

Detector subsystems are designed to measure: the energy and momentum of photons, electrons, muons, jets, missing E_T up to a few TeV



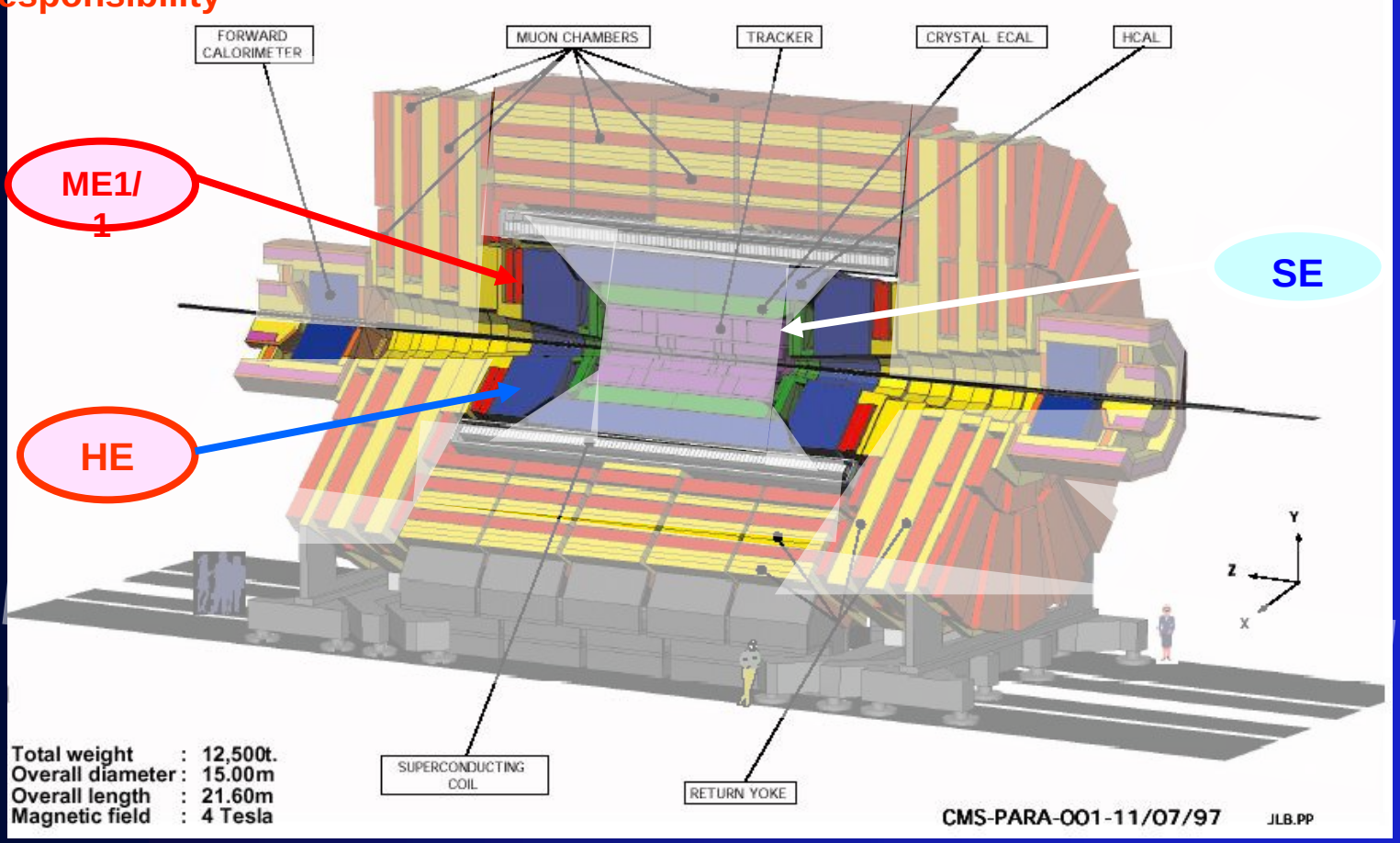
weight - 14500 t
diameter - 14,60 m,
length - 21,60 m,
B-field - 4 T

JINR Participation in CMS Construction

JINR participates in the CMS in a framework of the RDMS CMS Collaboration

RDMS bears Full Responsibility

JINR Participates



CMS
Compact Muon Solenoid at LHC

Contribution: muon station ME1/1, endcap hadron calorimeter

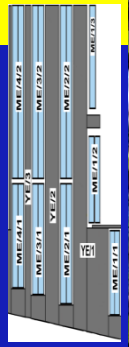
Computing:

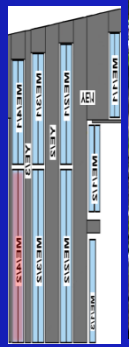
Tier-2, and Remote Operation Centre in JINR

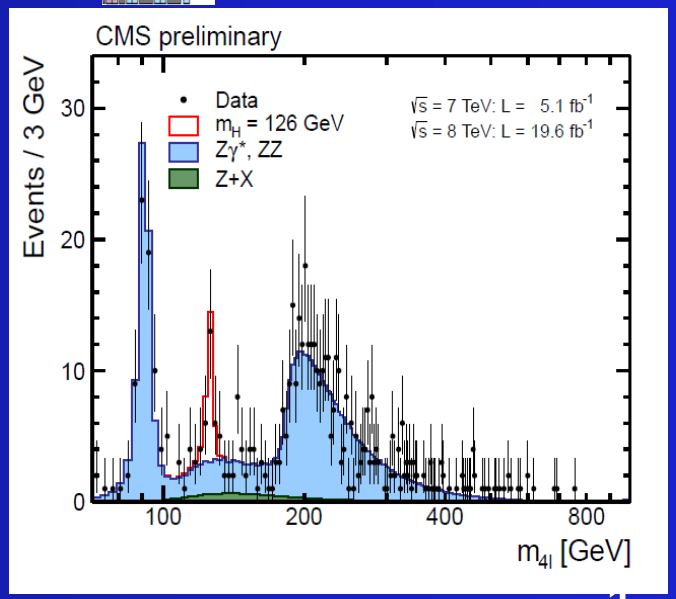
Participation in the physics analysis:

- Study of Drell-Yan processes in the large invariant dimuons mass region;
- Search for Higgs boson (4-leptons channel, and *2l-2*ν channel)
- Search for new physics beyond the Standard Model (Extended Gauge models, Extra dimensions, Black Holes, etc.)

  - Z' with standard-model-like couplings can be excluded below 2960 GeV and the superstring-inspired Z' below 2600 GeV
  - Set limits on the minimum Black Holes mass of 4.1-6.1 TeV







PARTICIPATION IN THE LHC and DETECTORS UPGRADE

ALICE: Photon Spectrometer (PHOS) upgrade

The purpose of PHOS modernization is increasing the Time of Flight resolution for Improvement of photon identification. It is necessary for measurement of direct photons production.

CMS: muon detector ME1/1 and endcup hadron calorimeter upgrade

The purpose of ME1/1 modernization:

- **to recover trigger up to eta=2.4;**
- **to minimize dead time, to remove rate worries, to guarantee readout robustness.**

The purpose of hadron calorimeter modernization:

- **to increase dynamic range, rate capability, to provide better timing information – resolution of ~2ns instead of 25 ns , improve muon ID;**
- to update longitudinal segmentation to increase Particle Flow capability and optimize ECAL/HCAL interface.

ATLAS: participation in upgrade of the superconducting magnet system, Muon spectrometer, Scintillating TILE calorimeter, Liquid argon hadron calorimeter, and in Irradiation tests at the IBR-2m pulsed fast neutron reactor.

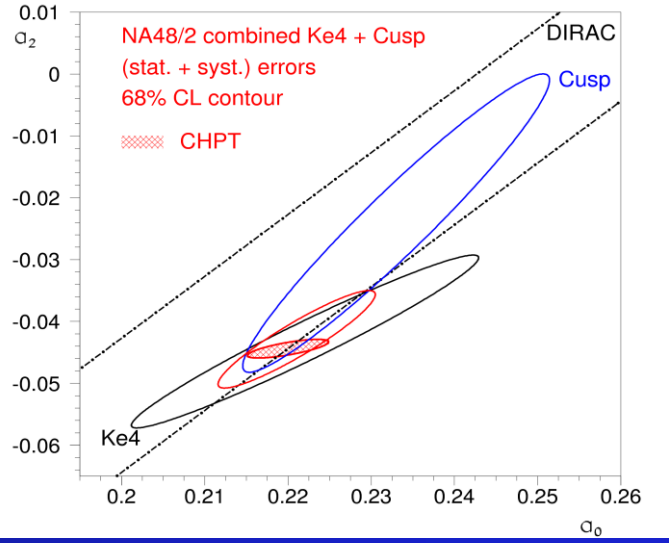
NA48/2 and NA62
Study of the rare charged kaon decays at SPS

Contribution to NA48/2:

Participation in Liquid Krypton calorimeter production (used also for NA62), on-line monitoring system elaboration. Data taking, processing, simulation, final analysis for $K^{\pm} \rightarrow \pi^{\pm}\pi^0\pi^0$, $\pi^{\pm}\pi^+\pi^-$, $\pi^{\pm}l^+l^-$, $l^{\pm}\nu$ decays.

Main results:

- set of the limits on CP violation in 3π decays,
- Cusp effect 1st observation in $m(\pi^0\pi^0)$ spectrum of 3π decay,
- Precise ππ scattering lengths (a^0 and a^2) measurement,
- Precise $\pi^{\pm}l^+l^-$ Br and Form Factors measurement,
- Precise $(e^{\pm}\nu)/(\mu^{\pm}\nu)$ ratio measurement.



Contribution & Responsibility at NA62:

Desing, R&D and production of the Straw tracker able to work in vacuum.

Status of the work:

- Design of the module (R&D are completed).
- Straws production: 4000 tubes are made and tested,
- Module 1: assembled in CERN and tested on beam,
- Module 3: assembled in JINR, tests are in progress,
- Elaboration of the straw database to trace each straw quality & position.

Straws under pressure test

Electronics assembled on module

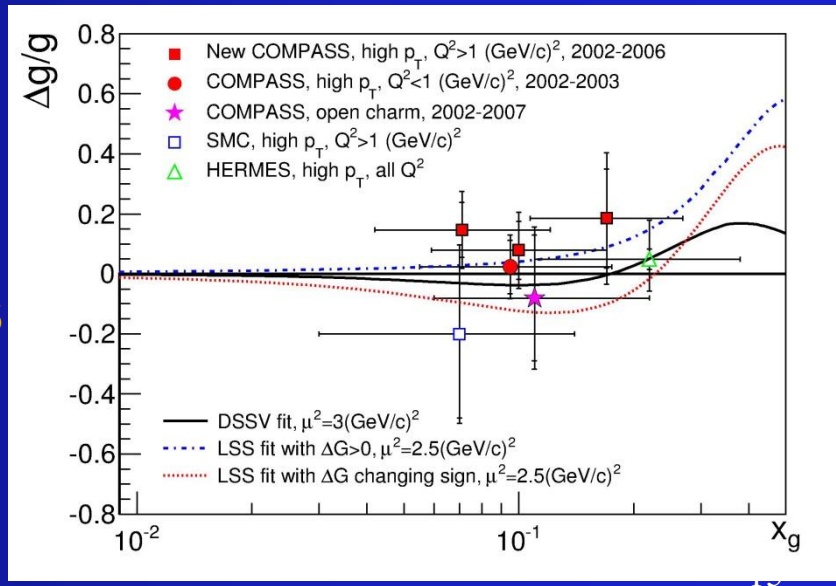
Tracker module assembled in JINR

COMPASS:
studies of the nucleon and hadron structure at SPS CERN

Contribution: Hadron calorimeter HCAL1, Straw tube detector (production), Drift tube detector "Muon wall 1", support of the polarized target, engineering support of the experiment

Main achieved results:

1. The most precise measurement of the gluon polarization;
2. Extraction of the quark Δu, Δd, Δs and antiquark helicity distributions;
3. Test and confirmation of the Bjorken sum rule;
4. Study of the transverse spin effect in the nucleon (Collins & Sivers asymmetries);
5. Study of the Primakoff effects.

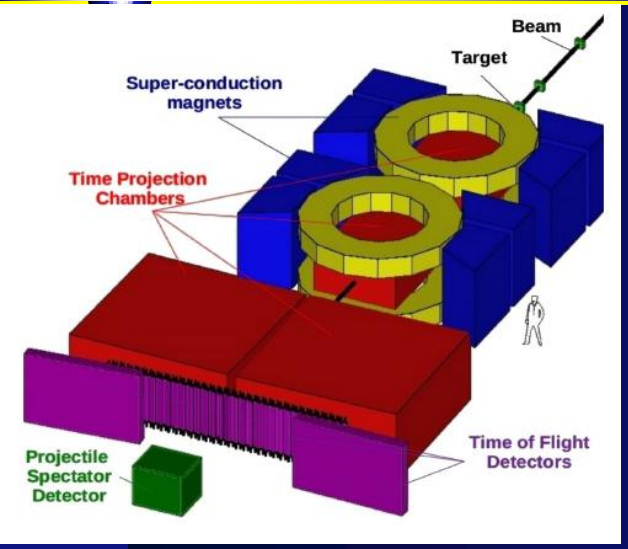


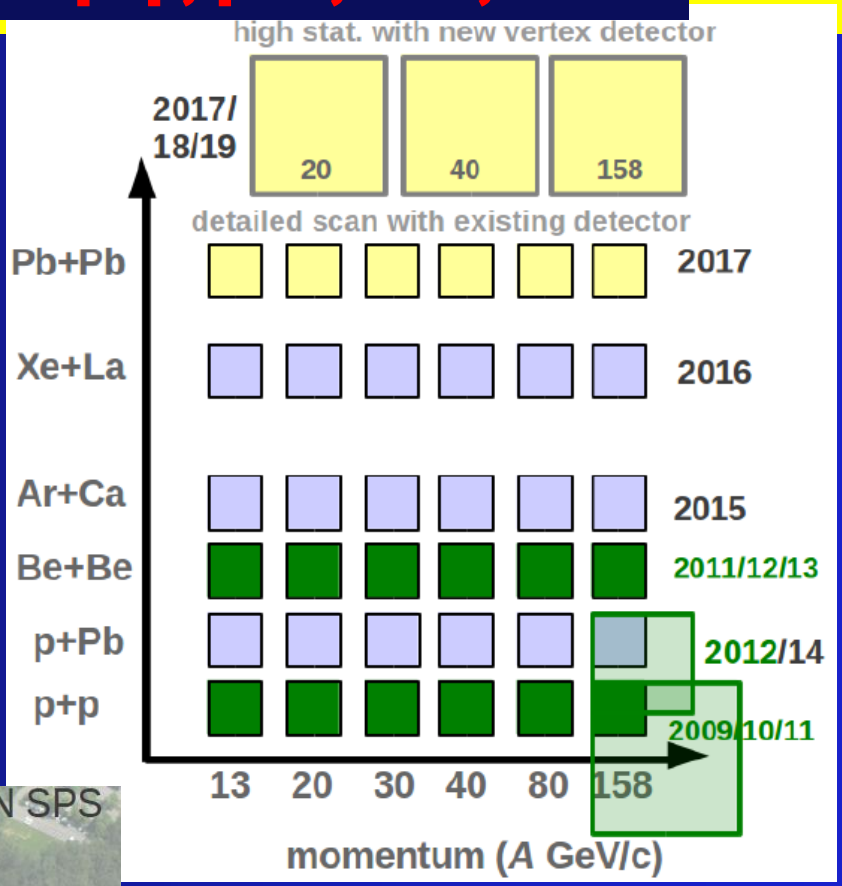
COMPASS current programme:

1. Measurement of Drell-Yann with π beam and polarized proton target
2. Measurement of GPD with help of the DVCS process

JINR responsibility in COMPASS upgrade:
Electromagnetic calorimeter ECAL0

NA61/SHINE
Hadron production in p+p, p+A, h+A, A+A





Contribution: TOF, data analysis

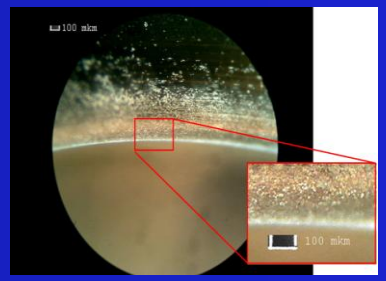
- Fixed target experiment in the north area of the CERN SPS
- Based on the upgraded NA49 detector
- Started in 2007
- Beams:
  - ions (Be - fragmentation, Ar and Xe - primary) at 13*A* - 158*A* GeV/c
  - Hadrons: p at 13 - 158 GeV, π at 158 and 350 GeV/c, K at 158 GeV/c

recorded data
pilot (test) data

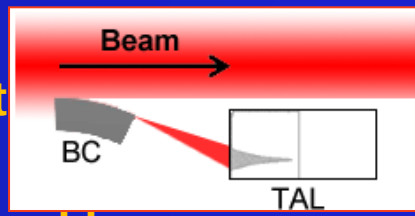
planned data (approved)
beyond the approved program

Collaboration of JINR-CERN for CLIC and next e+e- colliders.

1. Conventional Facility and siting (CF&S): construction and engineering problems, site investigations, tunnel design .
2. Test of RF cavities for CLIC accelerating structures in Dubna. Development of dedicated facility at JINRf or serial tests.
3. Stabilization of the laser source at 10^{-8} rad for precision laser metrology and high-precision laser metrology to control the position of accelerating sections at complexes of future lepton linear colliders.



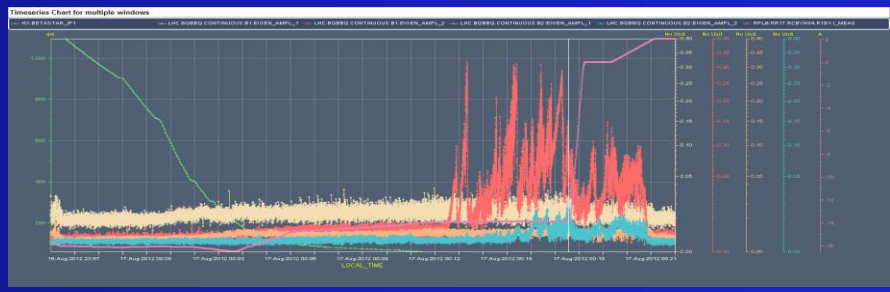
Collaboration in the project UA-9 Crystals for High Energy Accelerators



- The experiments performed at JINR, CERN and BNL showed that multicharged ions are successfully deflected by bent crystal.
- Collimation efficiency of 90% have been demonstrated at SPS lead beam
- Electromagnetic dissociation (ED) for well channeled Pb-ions in Si crystal at 7 TeV is estimated to about 0.01%

LHC Damper (CERN – JINR)

Stabilization of high intensity beams agains transverse instabilities.
LHC Transverse Feedback System was done with strong participation of JINR team



Hadron - and Heavy Ion Physics Projects related to FAIR within the BMBF-JINR Cooperation

The fruitfull cooperation in the fields:

- **Magnet development for SIS100;**
- **Detector development for FAIR experiments;**

Experiments:

- **CBM (experiment w/ proton & heavy ion beams);**
- **PANDA (experiments w/ antiproton beam)**

Contribution under discussion (to be funded by Rusia:

- **CBM – superconducting dipole magnet;**
- **PANDA – superconducting split coil solenoid + muon system;**

THANK YOU FOR YOUR ATTENTION