

High Energy Physics in Armenia and collaboration with CERN

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History of HEP in Armenia (important landmarks) 1

1942 – Soviet authorities decide to establish a cosmic ray station on the mount Aragats. Brothers *Abraham and Artem Alikhanian* are appointed responsible for the expedition to Aragats. The Yerevan Physics Institute (YerPhi) is founded and intensive studies of the high energy physics begin.

1960-1967 – Design, construction and commissioning in YerPhi of an electron synchrotron accelerator at 6 GeV, one of the largest in the world at that time.

1962-1991 – Increase of the YerPhi status: direct subordination to the USSR Atomic Energy Committee.

1967-1993 – Years of the accelerator continuous operation.

History of HEP in Armenia (important landmarks) 2

Number of HEP scientists in Armenia at the “prosperity” time: some 700 specialists in experimental, theoretical and accelerator physics. The main “supplier” of the scientific staff is the Physics Department of the Yerevan State University

1993 – Energy crisis in Armenia. Stopping of the accelerator operation. However, its maintenance continues till now and short- time experiments are periodically performed.

Despite the “brain leakage” in the beginning of 90’s, the core of the scientific staff of YerPhi is conserved. Over the last five years, one observes a stabilisation of the number of specialists at a level of 300 persons.

HEP in Armenia (YerPhI main investigation fields)

Experimental Physics: Studies of electro- and photo-production (using secondary beams of polarized photons) processes. Investigation of the nature and properties of transition and channelling radiations. Applied physics experiments. YerPhI was officially nominated as the leading Soviet Institution in the high energy electromagnetic interactions.

Theoretical Physics: Phenomenology of particle and nucleus interactions in perturbative and non-perturbative QCD, weak interactions and physics beyond the standard model. Quantum field theory, dual models, statistical physics, superconductivity.

Cosmic ray Physics – Detection and study of the galactic and solar cosmic rays at two large and well-equipped stations situated at the altitude of 3200 and 2000m on the slope of Mt. Aragats,

Accelerator Physics: Study of the traditional and advanced methods of acceleration. Prof. *A.Ts. Amatuni (former director of YerPhI)* – member of ICFA in 1992-1995

HEP in Armenia (International Collaborations)

Traditionally - very intensive and lasting collaborations with the experimental physics laboratories in Europe, USA and Soviet Union

CERN, DESY, TJNAF, JINR, IHEP, ITEP

+ collaborations in cosmic ray physics, accelerator physics

**Main participant – YerPhl + Physics Department of the Yerevan State University (graduate and PhD students).
Experiment hardware and software development, data taking and analysis.**

HEP in Armenia (Collaboration with CERN)

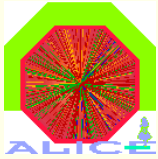
Since the late seventies of the last century. Numerous experiments: **WA69, WA56, NA22, NA43, NA50, etc.**

Actually

Direct participation in **LHC** experiments: **ALICE** and **ATLAS**. In **CMS** – through JINR. Also **NA60**.

Participation in the detectors design, engineering and construction, software development, test beam data taking and analysis, performance studies.

HEP in Armenia (CERN ALICE experiment) 1



ALICE (12 members, including 5 students).

Contribution to the detector development and construction:

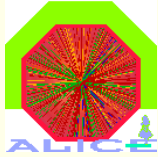
Work on the optical Geometry Monitoring System for Dimuon Forward Spectrometer.

Manufacturing in YerPhi (together with the Armenian ArAl aluminium factory) of a 4.7 tons Aluminium Ring serving as a supplementary absorber of the background radiation in the ALICE detector.

Development of optical sensors for high - precision monitoring of the relative position of the tracking detectors, including the monitoring in the heated air environment using simultaneously the infrared and ultraviolet light beams.

Development of a fast preamplifier for Time Projection Chamber.

HEP in Armenia (CERN ALICE experiment) 2



ALICE (12 members, including 5 students).

Contribution to the ALICE software and performance analysis

Development of the methods for the muon alignment of the initial relative positions of the Tracking Chambers of Dimuon Forward Spectrometer.

Development of the software for the reconstruction of the Muon Tracking Chamber movements using the optical Geometry Monitoring System data.

Monte Carlo studies of the feasibility of the optical Geometry Monitoring System of Dimuon Forward Spectrometer.

Analysis of the performance of the ALICE detector for low, intermediary and high mass dilepton production in pp and heavy ion collisions.

HEP in Armenia (CERN ATLAS experiment) 1



ATLAS (6 members, including 2 students).

Main involvement (since 1993) – the work within the Tile Hadron Calorimeter (TileCal) Project activity:

Design and construction of a robot for high-precision in situ polishing of the cut wave length shifting fiber bundles inside of 3 and 6m long girder tubes. The robot was used in 4 TileCal optical instrumentation workshops in ANL, MSU (USA), Barcelona (Spain) and CERN allowing to process, with an acceptable optical quality, some 10100 bundles for 128 modules of the Barrel and Extended Barrel.

Coordination of the ATLAS Projects' radiation shielding components construction in Armenia.

Development and construction of 10100 two-level individual magnetic shields (soft iron and mu-metal) for photo-multiplier tubes.

HEP in Armenia (CERN ATLAS experiment) 2



ATLAS (6 members, including 2 students).

Contribution to the ATLAS performance analysis

Analysis of the performance of the optical components and optical instrumentation of the TileCal using muon and electron test beam data .

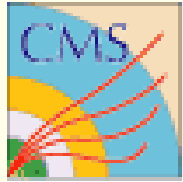
Study of the photoelectron statistics and calibration issues of the TileCal modules

Studies of the hadron shower weighting technique and leakage for TileCal

Study of the test data on the combined performance of the ATLAS detector components.

Test beam study of the shower difference for different hadron beams.

HEP in Armenia (CERN CMS experiment) 1



CMS (6 members, including 2 students).

Contribution to the detector construction:

Development of the Endcap Preshower Silicon detector.

Development of the technology of thick film printing on a ceramic PCBs with various metallic pastes and laser cutting technique.

Large-scale production (4500 units) of the ceramic PCBs for Preshower detector (together with MARS factory and Rubin L.Tech.JSC in Yerevan)

HEP in Armenia (CERN CMS experiment) 2



CMS (6 members, including 2 students).

Contribution to the CMS performance analysis:

Study of magnetic field influence on CMS hadron calorimeter response

Test beam study of Preshower prototype.

Monte Carlo simulation of Preshower taking into account real geometry of CMS detector.

Study of the structure of hard double Pomeron exchange processes in pp collisions at the LHC

HEP in Armenia (coming LHC data analysis)



Extrapolating actual situation: the estimation for the potential brain power, which could be available in Armenia for the LHC data handling, is:

Some 20 high-skilled physicists

+

Some 5 students

A considerable contribution to the community of experts needed for the LHC data effective analysis!