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Evaluation of the Proposal for Theme 1119 Extension during 2017-2019

Proposal details

Title: "Methods, Algorithms and Software for Modeling Physical Systems, Mathematical Processing and Analysis of Experimental Data"

Proposed by: Laboratory of Information Technology

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Status: Suggested for extension till the end of 2019

Introduction

The proposal combines the unique infrastructure at the Laboratory of Information Technology (LIT) – the HybrLIT computation cluster with the cumulated experience and know-how for solving applied and fundamental scientific problems. The subject of the proposal is very general and it has an impact over a large number of scientific units like instrumental groups, large scale facilities, institutes and even international communities overcoming the borders of a local institutional project.

Nowadays the role of the applied mathematics and computational simulations combined with sophisticated data treatment is a key factor for successful fundamental science and applied research. The continuous improvement of the computation power of the available hardware and the optimization of the existing algorithms allow for processing of data volumes unimaginable few years ago. The proposal emphasizes the problematic of

- The outstanding participation in the development of computer software for large scale experiments (BM@N and MPD at NICA, CMS and ATLAS at LHC, CBM at FAIR, the general Geant4 package) is documented by inclusion of the LIT-developed modules into the dedicated software packages of these experiments.
- Of special concern within the theme 1119 will be the creation of efficient computing tools for solving the ever increasing number of computing intensive tasks in the JINR research, with the aim of overcoming the notorious inefficiency of the existing computer codes on the multi-core, manycore, and GPU accelerator processors which constitute the today exclusive deliveries on the hardware market. To this aim, the information-computing environment of the heterogeneous computing cluster will be improved, new efficient parallel algorithms and codes will be derived for the solution of the new tasks arising in the JINR research.
- Another timely subject of research is the derivation of symbolic-numerical or numerical algorithms and codes for hardly solvable mathematical topics by creating new mathematical methods and algorithms characterized by decreased computational complexity and efficient information flow inside the hardware.

Criteria 2: *Expertise of the group and technical feasibility of the project within the proposed timescale*

- The existence of adequate expertise of the basic staff of theme 1119 is probed by the existing high level of qualification (24 DSc, 47 PhD – figures in continuous evolution), the developed new discretization approaches to the algorithm derivation involving, among them, inheritance of the basic algebraic properties of the initial mathematical models, new principles of approximation, multiscaling, new search methods of extrema of discontinuous functions, new canonic basis expansions in computer algebra.
- To alleviate the abrupt learning curve of arid computer mathematics topics and programming by young scientists, a variety of instruction and educational methods and forms are used: regular scientific seminars, intensive courses, lectures, tutorials, consultations with leading specialists, etc. Online modern methods (like the pm, the Gitlab, both for HybriLIT) are used.

Criteria 3: *Compliance of the requested financial resources with the objectives of the project/theme*

- The requested financial resources fully comply with the objectives of theme 1119.

Criteria 4: *Availability of human resources at JINR and in the collaborating institutions*

- The existing human resources are of good quality, the LIT is an attractor for young talents, both from Russian institutions and from JINR Member State institutions.

Conclusions

- In conclusion, I estimate that the proposed tasks are well formulated, are ambitious, they are directed to the solution of top difficult topics of the JINR research, they are feasible.
- I propose the CMP-PAC to approve the support of the theme 1119 extension on 2017-2019 with the first priority.



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