

Structure and Research Activities of the Institute of Information and Communication Technologies, Bulgarian Academy of Sciences (IICT-BAS)



Assoc. Prof. Todor Gurov
Deputy Director
Acad. G. Bonchev str., Bl. 25-A 1113 Sofia, Bulgaria
gurov@bas.bg



Background & Organisation

Founded

- The Institute of Information and Communication Technologies at the Bulgarian Academy of Sciences - (IICT) is founded on 1-st of July 2010 as a successor of Institute for Parallel Processing (IPP), Institute of Information Technologies (IIT) and Institute of Computer and Communication Systems (ICCS).

Strategic targets:

- Sustainable development of the institute as a national leader in the information and communication technologies, with internationally visible and recognized results.

Mission:

- To perform basic and applied research in the fields of computer science and information and communication technologies, as well as to develop interdisciplinary innovations.



1. Information and Communication Sciences and Technologies

- Institute of Mathematics and Informatics
- Institute of Mechanics
- Institute of Robotics
- Institute of Information and Communication Technologies (IICT)
- National Laboratory of Computer Virology
- Laboratory of Telematics

2. Energy Resources and Energy Efficiency

3. Nanosciences, New Materials and Technologies

4. Biomedicine and Quality of Life

5. Biodiversity, Bioresources and Ecology

6. Climate Change, Risks and Natural Resources

7. Astronomy, Space Research and Technologies

8. Cultural-Historical Heritage and National Identity

9. Man and Society

Specialized and Supporting Units

1. **Parallel Algorithms**
2. **Scientific Computations**
3. **Mathematical Methods for Sensor Data Processing**
4. **Linguistic Modelling and Knowledge Processing**
5. **Information Technologies for Security**
6. **Grid Technologies and Applications**
7. **Modelling and Optimization**
8. **Information Processes and Decision Support Systems**
9. **Intelligent systems**
10. **Embedded Intelligent Technologies**
11. **Communication Systems and Services**
12. **Hierarchical Systems**

Chairman of the IICT Scientific Council: [Professor D.Sc. Ivan Dimov](#)
 Scientific Council Secretary: [Diana Georgieva](#) (tel. +3592 9793218; e-mail: diana@iccs.bas.bg)



Corr. Mem. D.Sc. Svetozar Margenov



Professor D.Sc. Ivan Dimov



Professor D.Sc. Galia Angelova



Professor D.Sc. Krasimira Stoilova



Professor D.Sc. Todor Stoilov



Professor Aneta Karaivanova



Professor Dimitar Karastoyanov



Professor Ivan Mustakerov



Professor Todor Tagarev



Assoc. Prof. Vladimir Monov



Assoc. Prof. Gennady Agre



Assoc. Prof. Dimitar Todorov

Assoc. Prof. Vladimir Monov



Assoc. Prof. Dimo Dimov



Assoc. Prof. Kiril Alexiev



Assoc. Prof. D.Sc. Lyubka Doukovska



Assoc. Prof. Todor Gurov



Academician Kiril Boyanov

Assoc. Prof. Gennady Agre



Assoc. Prof. Emanouil Atanassov



Assoc. Prof. Kiril Simov



Assoc. Prof. Rumen Andreev



Academician Vasil Sgurev



Assoc. Prof. Stanislav Stoykov

Assoc. Prof. Dimitar Todorov



Assoc. Prof. Zlatoliliya Ilcheva



Assoc. Prof. Krasimir Georgiev



Professor Stefka Fidanova



Academician Ivan Popchev

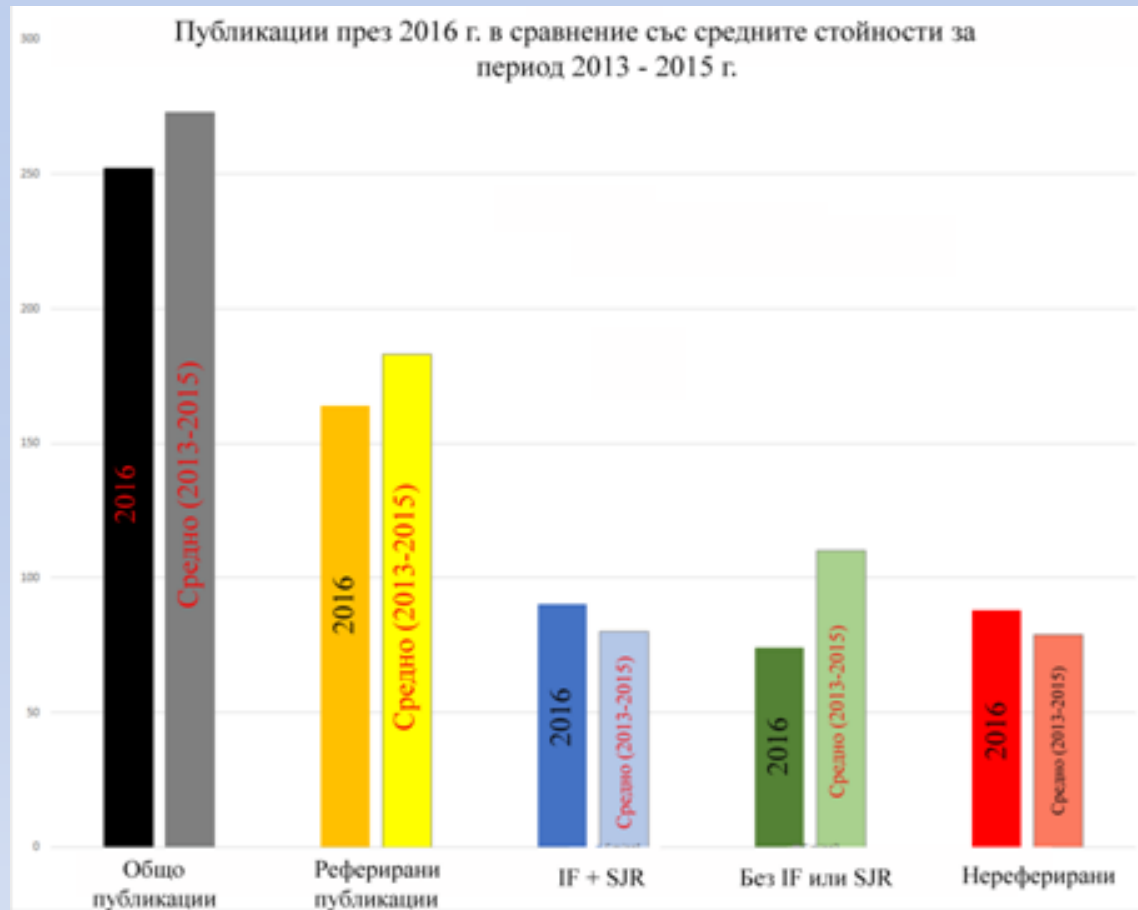
Scientific staff

- 4 - Academicians
- 1 - Corr. Member
- 9 - Professors
- 35 - Associate Professors
- 35 - Assistant Professors
- 40 - PhD students

Non-scientific staff

- 45 - specialists with higher education (programmers, engineers, accountant specialists)
- 30 – specialist with secondary education

More than 250
publications per year



Comparison of the publications in 2016 with the mean value of the last 3 years' period (2013-2015)

The institute has a leading position among the scientific institutions in Bulgaria in the fields of Information and Communication Technologies.

Main Scientific Trends

- HPC, Distributed and Cloud computing;
- Large-Scale scientific computations and supercomputer applications;
- Linguistic and semantic technologies;
- Intelligent systems;
- Signal and image processing;
- Security and information.



Mathematica Balkanica
(English and French)



Information Technologies and Control (English)
ISSN 1312-2622



Cybernetics and Information Technologies
Print ISSN: 1311-9702; e-ISSN: ISSN: 1314-4081



Problems of Engineering Cybernetics and Robotics
Print ISSN: 0204-9848, e-ISSN: ISSN: 1314-409X



Abstracts of Dissertations
e-ISSN: ISSN: 1314-6351



Lectures Notes in Computer Science and Technologies of the IICT-BAS
e-ISSN: 2367-8666

2018

28-31 May 2018 [Numerical Methods for Scientific Computations and Advanced Applications" \(NMSCAA'18\)](#)

2017

20-22 December 2017 [12th Annual Meeting of the Bulgarian Section of SIAM](#), Sofia, Bulgaria

18-22 September 2017 [132th European Study Group with Industry ESGI'132](#), Sofia, Bulgaria

4-7 September 2017 [International Conference on Engineering Vibration](#), Sofia, Bulgaria

2-8 September 2017 [Recent Advances in Natural Language Processing \(RANLP 2017\)](#), Varna, Bulgaria.

5-9 June 2017 11-th International Conference on [Large-Scale Scientific Computations, LSSC'17](#), Sozopol, Bulgaria.

3-7 April, 2017 NATO Advanced Training Course on SPS Program: [Countering ISIS Radicalisation Activities through the Cyberspace in the Region of SE Europe - CIRACRESEE](#), Ohrid, Macedonia

2016

20-22 December 2016, [11th Annual Meeting of the Bulgarian Section of SIAM](#), Sofia, Bulgaria

7-9 September 2016, 17th International Conference on "[Artificial Intelligence: Methodology, Systems, Application](#)" AIMSA 2016, Golden Sands Resort, Varna, Bulgaria.

3, 7 September 2016, Joint Meeting on "[Computational Intelligence](#)" with Prof. James Bezdek, IEEE Fellow (preliminary [REGISTRATION](#))

23-24 June 2016, [17-th International Conference on Computer Systems and Technologies CompSysTech'16](#), Palermo, Italy ([program](#)).

25-29 July, 2016, [120th European Study Group with Industry ESGI'120](#), Sofia, Bulgaria.

29 May - 02 June, 2016, [International Conference on "Numerical Methods for Scientific Computations and Advanced Applications"](#), Hisar, Bulgaria.

25-28 April 2016, Intel together with the National Center for Supercomputing Applications (NCSA) is organizing a training school on "[Code Modernisation for Intel Multi Core and Xeon Phi Architectures](#)", Sofia, Bulgaria.

2015

21-22 December, 2015, [10th Annual Meeting of the Bulgarian Section of SIAM](#)



Projects for last 10 years

38 total projects during the FP7 program of the EC (2008-2013)

- **Infrastructure projects:** EGEE-III, EGI-InSPIRE, SEE-GRID-SCI, HP-SEE, SEERA-EI, CLARIN, etc.
- **ICT projects:** REMICS, IDEALIST 2014, EYE, QTLeap, SysSec, IMPACT, EuroMatrixPlus, etc.
- **Regional Potation projects:** AComIn : “Advanced Computing for Innovation”.

More than 20 projects funded by the Bulgarian NSF (2010-2017)

- **SuperCA++:** “Centre of Excellence on Supercomputing Applications”, (Coordinator: Corr. Mem. S. Margenov), (2010-2014);
- “Efficient Parallel Algorithms for Large-Scale Computational Problems”, DFNI-I02/20, (Coordinator: Prof. I. Dimov), 2015-2017;
- “Development and Investigation of quasi-Monte Carlo Algorithms for Extreme Parallel Computer Systems”, DFNI-I02/8, (Coordinator: Assoc. Prof. T. Gurov), 2015-2017;

More 25 R&D contracts directly with SMEs;

More than 20 bilateral projects with international universities and academia.

6 project during the 1st period of the EC program Horizon2020 (2014-2016):

- **SESAME-NET**, “Supercomputing Expertise for Small and Medium Enterprise Network”, Consortium – 15 partners; funded by EC, H2020, 2015-2017, (<http://sesametwork.eu/>).
- **EGE-Engage**, “Engaging the EGI Community towards an Open Science Commons”; Consortium - 41 partners; funded by EC, H2020, 2015-2017, <http://www.egi.eu/>.
- **VI-SEEM**, “VRE for regional Interdisciplinary communities in Southeast Europe and the Eastern Mediterranean”, Consortium – 16, funded by EC H2020, 2015-2018, <https://vi-seem.eu/>.
- **e-IRGSP5**: “e-Infrastructure Reflection Group Support Programme 5”, funded by EC H2020, 2016 – 2018, <http://e-irgsp5.e-irg.eu/> .
- **CRoNoS**, “Computationally-intensive methods for the robust analysis of non-standard data”, COST Action: IC1408, 2015 – 2019, http://www.cost.eu/COST_Actions/ict/IC1408



National activities

- According the National Roadmap for Research Infrastructure (approved 2014, updated in 2017 by the Council of Ministers for the period until 2023), IICT-BAS is a coordinator of two research infrastructure entitled:
 - "National Center for HPC and Distributed Computing" (BG-NC4HPC&DC) and
 - "National interdisciplinary research e-infrastructure resources and technologies for Bulgarian language and cultural heritage" (BG-CLADA).
- IICT is responsible for the operations of the Bulgarian Academic Certification Authority (<http://ca.acad.bg/>) which is authorized to issue digital Grid certificates free of charge for all Bulgarian Grid users or hosts.
- IICT is responsible for the management, monitoring and maintenance of the Bulgarian Research and Educational Network (BREN). The main node of BREN is located in the Institute and is connected to GEANT via high speed fiber optic cable.

International activities

- **EGI.eu** (membership through IICT)
- **CLARIN ERIC** (membership through IICT), **DARIAH ERIC** (Observer only)
- **e-IRG** (One of BG delegates is from IICT)



HPC Infrastructure in Bulgaria and TOP500 list of the fastest supercomputers

| Top500 List, Year | Rank | Site | System | Vendor | Cores | Rmax (TFlop/s) | Rpeak (TFlop/s) |
|-------------------|------|---|--|--------|----------|------------------|-----------------|
| June 2007 | 1 | DOE/NNSA/LLNL, United States | BlueGene/L Solution | IBM | 131,072 | 280.6 | 367.0 |
| Nov 2009 | 379 | SAITC, Bulgaria | Blue Gene/P Solution | IBM | 8,192 | 23.9 | 27.9 |
| June 2015 | 332 | IICT-BAS, Bulgaria | Avitohol - Cluster Platform SL230s Gen8 | HPE | 20,700 | 264.2 | 412.3 |
| Nov 2015 | 388 | IICT-BAS Bulgaria | Avitohol - Cluster Platform SL230s Gen8 | HPE | 20,700 | 264.2 | 412.3 |
| June 2017 | 1 | Na. SuperComp. Center in Guangzhou, China | Sunway TaihuLight | | 3120,000 | <u>33862,700</u> | 54902,400 |
| June 2017 | 500 | Bull, Atos Group France | Manny- bullx DLC 720, Xeon E5-2690v3 12C 2.6GHz | Bull | 12,960 | 430.5 | 539.1 |

(2007) The journal CIO published: "The 7 wonders of the IT world "

The 5th wonder of the IT world is the fastest supercomputer: IBM BlueGene/L (Lawrence Livermore National Lab)

<http://www.cio.com/article/2438083/infrastructure/seven-wonders-of-the-it-world.html?page=5>



HPC infrastructure at IICT-BAS

150 HP Cluster Platform SL250S GEN8 servers with 2 Intel Xeon E 2650 v2 CPUs and 2 Intel Xeon Phi 7120P coprocessors

| | |
|------------------------------|----------------------------------|
| Name | Avitohol |
| Manufacturer | Hewlett-Packard |
| Cores | 20700 |
| Interconnection | FDR InfiniBand |
| Theoretical Peak Performance | 412.3 Tflop/s |
| RMAX Performance | 264.2 Tflop/s |
| Memory | 9600 GB |
| Operation System | Red Hat Enterprise Linux for HPC |
| Compiler | Intel Composer XE 2015 |
| Lustre Storage systems | 96 TB storage |

Top500 List on 332nd place (June 2015)
<http://www.top500.org/system/178609>



Advanced Computing and Data Centre



Home News Projects Services Systems Events and Training Contacts Language:



Advanced Computing and Data Centre at IICT-BAS

The Advanced Computing and Data Centre is managed by [Department Grid Technologies and Applications](#) from the [Institute of Information and Communication Technologies - BAS](#). According to the renewed National Roadmap for RI (in July 2014), IICT-BAS is a scientific coordinator of two research infrastructures: (i) "National Centre for high performance and distributed computing"; (ii) "CLaDA-BG: EInfrastructure for Bulgarian Language and Cultural Heritage Resources and Technologies". In 2015 the Advanced Computing and Data Centre was expanded with new multifunctional high performance computing complex "AVITOHOL", which is **388th** place in the TOP 500 list (November 2015).

Latest News

- [Workshop "Two Years Avitohol: Advanced HPC applications", 29-31 October, Panagyurishte](#)
- [First call for visitors in HPC-Europa](#)
- [2nd Call for Proposals for Projects Accessing VI-SEEM Services](#)
- [SESAME-Net Workshop "Benefits of using HPC in the Industry", organized by IICT-BAS, 3 April 2017](#)
- [VI-SEEM Presentation for Students from Department of Informatics at University of Food Technologies, Plovdiv, 4 April 2017, Sofia, Bulgaria](#)

Upcoming Events

- [e-IRG Workshop](#)
October 3 - October 4
- [Workshop "Two Years Avitohol: Advanced HPC applications", 29-31 October, Panagyurishte](#)
October 29 - October 31

[View All Events](#)

webpage: www.hpc.acad.bg

HP Cluster Platform Express 7000 enclosures, 36 blades BL 280c with dual Intel X5560 @ 2.8 GHz (Total 576 CPU cores), 24 GB RAM per blade;

CPU peak performance 3.2 Tflops;

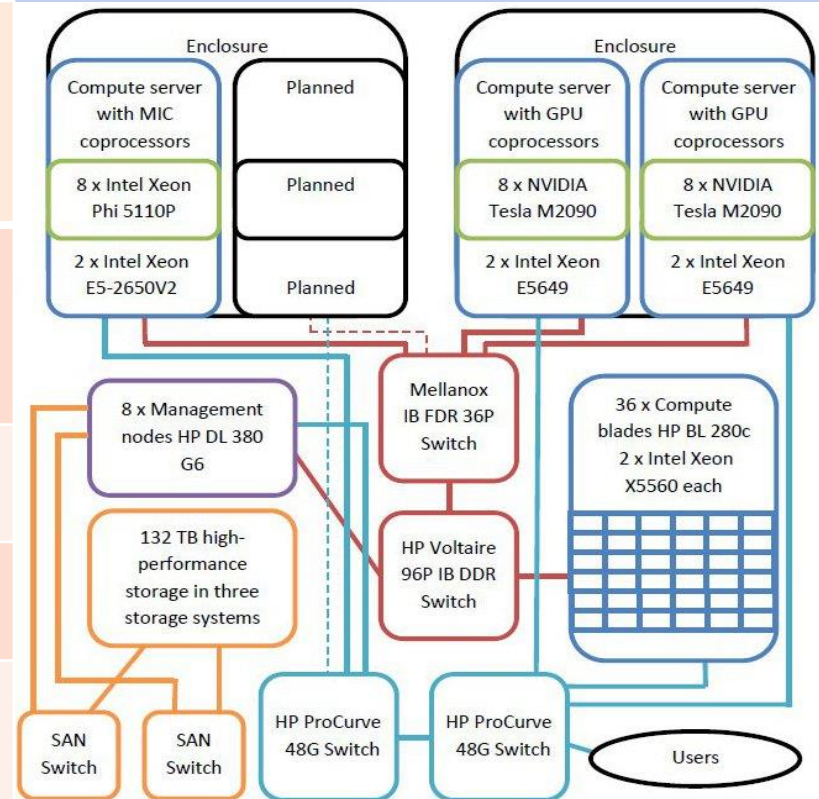
8 controlling nodes HP DL 380 G6 with dual Intel X5560 @ 2.8 GHz, 32 GB RAM (total 128 CPU cores);

3 storage systems with total 132 TB storage;

2 InfiniBand Switch Systems.

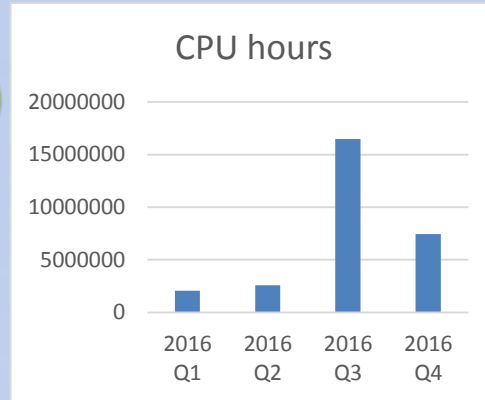
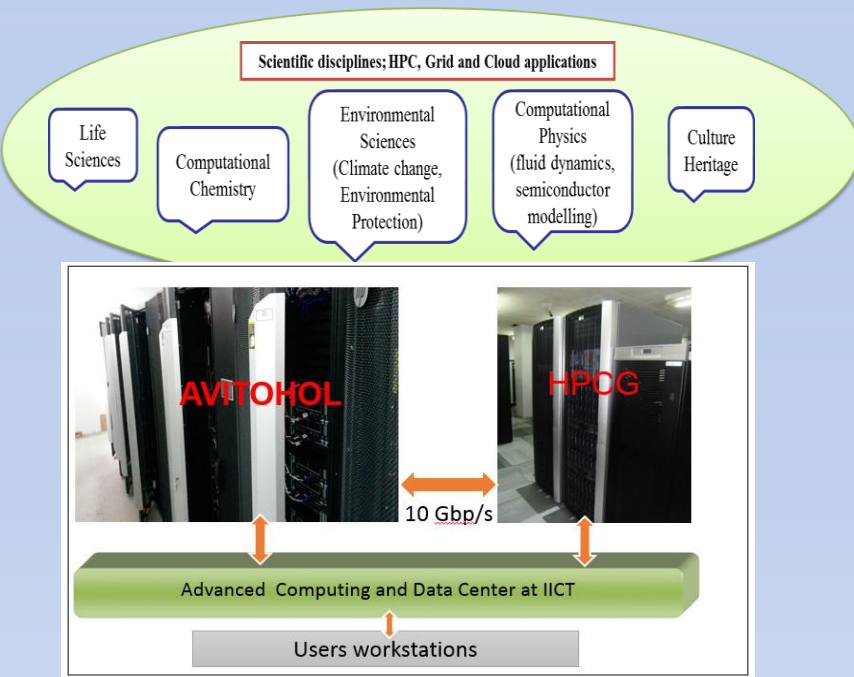
2 HP ProLiant SL390s G7 4U servers with 16 NVIDIA Tesla M2090 graphic cards (total 8192 GPU cores) with **10.64 Tflops**

HP SL270s Gen8 4U server with 8 Intel Xeon Phi 5110P Coprocessors (total 480 cores, 1920 threads, with **8.088 Tflops.**

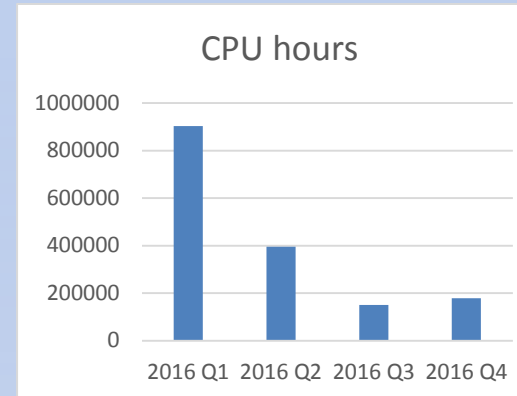


The scheme of **HPCG** system

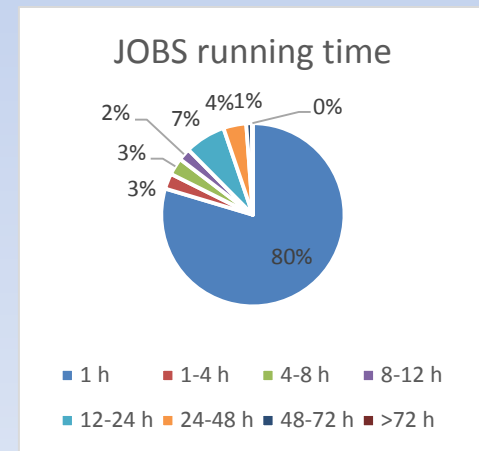
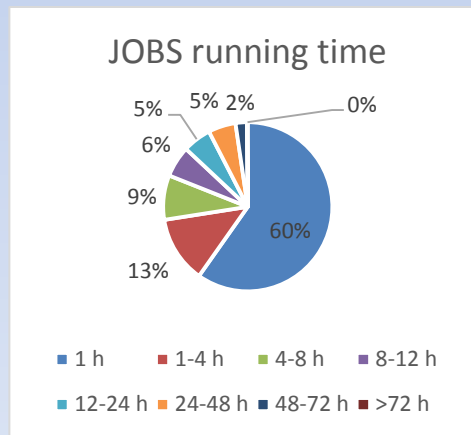




Avitohol usage

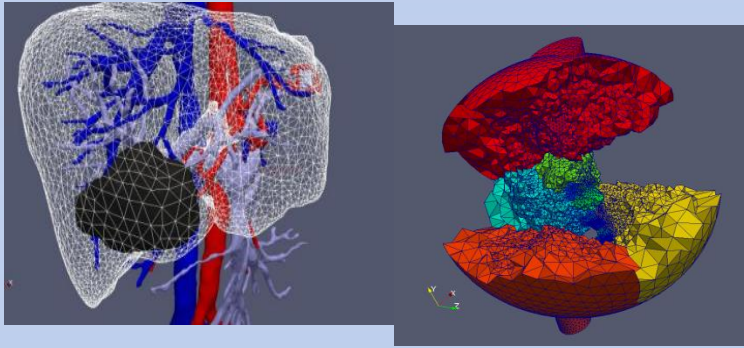


HPCG usage



- Avitohol users > 120
- HPCG users > 100





3D simulations for the study of liver tumor ablation

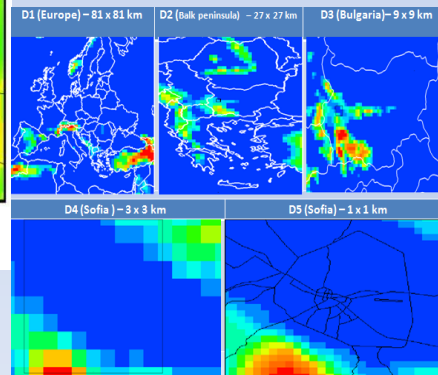
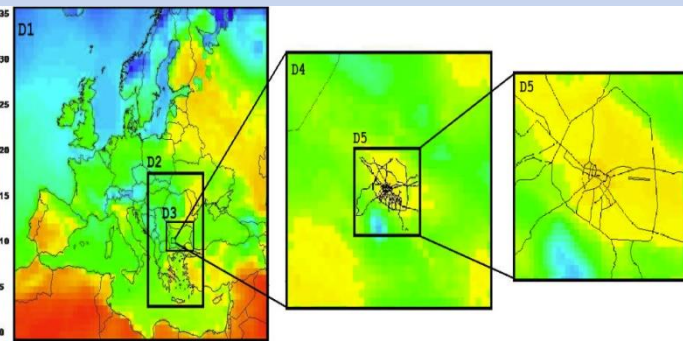
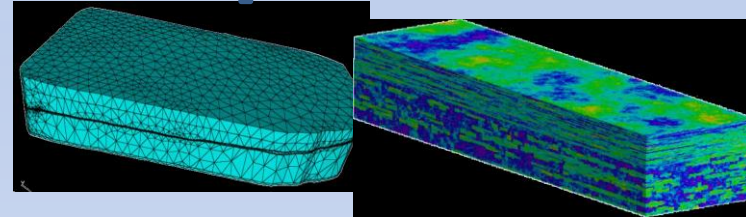
- Adequate representation of the problem was achieved by FEM discretization for a time-dependent partial differential equations, generated based on 3D high resolution medical imaging.
- Radio frequency exposure parameters are evaluated to maximize the reliability of the ablation.

Joint work of IICT-BAS and AMET Ltd

Modeling flows in underground reservoirs, oil and gas fields

- Develop new faster algorithms and software solutions for computer simulation of industrial flows.

Development of IICT-BAS



Study Atmospheric Composition Impact on Quality of Life and Human Health in Sofia

- WRF and CMAQ nesting capabilities are applied for downscaling the simulations to a 1 km step for the innermost domain.
- The simulations is performed day by day for a period of 7 years (2008-2014). The surface concentrations are calculated for the four seasons and annually by averaging the typical fields

Development of NIGGG-BAS and support of IICT



Challenges in operation of the HPC infrastructure at IICT

- Creating a converged infrastructure for HPC, Big Data, and Cloud
- Sustainable development and maintenance of the HPC infrastructure
- The financial support is expected to come from:
 - National Roadmap for research infrastructure (2018-2023)
 - Operational Program “ Science and Education for Smart Growth 2014-2020”, in the Call: “Development of Centers of Excellence and Competence”. (CoE in the ICT)