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AComIn:
Advanced Computing for Innovation

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Research Potential of Convergence Regions

D 2.3

Building User Communities - Month 18

Prof. Dimitar Karastoyanov, WP4 Leader

Prof. Galia Angelova, AComIn Coordinator

Prof. Ivan Dimov, WP2 Leader

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Authors	**Prof. Dimitar Karastoyanov**, IICT – BAS (WP4 Leader) **Prof. Galia Angelova**, IICT – BAS (AComIn Coordinator) **Prof. Ivan Dimov**, IICT – BAS (WP2 Leader)		
Responsible author	Prof. Dimitar Karastoyanov	**Email**	dkarast@iinf.bas.bg
		Phone	+3592 979 2723

Summary	Deliverable D2.3 reports about the activities in Task 2.3 “Building User Communities” in Work Package 2 (WP2) “Purchasing Smart Lab and building User Communities”. In months 6-18, several lectures were organised for emerging User Communities. Five Technology Transfer Workshops were held. Nine joint RTD tasks with Users were performed in January-March 2014.
Keywords	User Communities, technology transfer, innovation, joint research, strengthening the IICT innovation potential

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Executive Summary

Deliveralbe D2.3 reports about the AComIn activities in Task 2.3 “Building User Communities” in Work Package 2 (WP2) “Purchasing Smart Lab and building User Communities”. Task 2.3 started in month 6 and will continue to the project end.

D2.3 presents:

- the AComIn concept of Users and what is the role of the User Communities;
- the channels and approaches to identify and collect Users;
- the three main instruments for know-how transfer to Users: *(i)* lecturing to emerging User Communities and participation in Information events; *(ii)* Workshops for know how transfer with usual duration of 1-4 days as well as *(iii)* joint research activities with Users who have clearly formulated requests and tasks.

In months 6-18, several lectures were organised for emerging User Communities. Five Technology Transfer Workshops were held. Nine joint RTD tasks with Users were performed in January-March 2014.

A challenge for Period 2 is to extend the User Communities to supporters from the neighboring countries.

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1. INTRODUCTION: WP2 OBJECTIVES, PLANNED TASKS AND ACTIVITIES

The Objectives of Work Package 2 (WP2) "Purchasing Smart Lab and building User Communities" are, in general, to ensure the delivery of the Smart Lab equipment, its installation and maintenance, and to organise its exploitation by building User Communities. In particular, the WP2 Tasks:

- *Task 2.1 Equipment purchase and*
- *Task 2.2 Smart Lab Integration*

deal with the equipment specification, announcements of public procurement procedures, execution of the tenders, selecting the providers, delivery and installation of the devices, as well as integration of the equipment in the IICT network. These Tasks close in AComIn Period 1.

According to the AComIn Technical Annex, the WP2 activities continue to month 36 via the *Task 2.3: "Building User Communities"*.

Task 2.3 starts at month 6 and organises at least four User Communities in the following ares:

- 3D input/output,
- speech processing,
- microstructure dynamics and
- advanced transportation systems.

The User Communities will have mailing lists and their members will be included in intensive industrial training seminars, hands-on experiments with the Smart Lab devices and exchange of best industrial practices. Leaded by IICT seniors, these Communities are viewed as dynamically-growing expert groups that disseminate the AComIn results to the innovation-absorbing Bulgarian companies. Each User Community will have dedicated pages in the project Web-site which will be constantly updated.

In Period 1 an active Community in "3D input/output" is already operational with two clearly seen sub-communities of Users who are interested correspondingly

- primarily in the object shapes (i.e. *3D scanning and priniting*) and
- in the 3D microstructure (i.e. *the tomography*).

The User Community of "Microstructure dynamics" brings to IICT real-world tasks for studying changes in the microstructures of various materials and objects when different processes affect them. Section 6 presents these Tasks performed in a broad variety of environments.

The User Communities in "Speech processing" and "Advanced transportation systems" will be active in AComIn Period 2, when the corresponding equipment is fully operational.

Meanwhile, several new groups of AComIn supporters ("fans") in various areas were formed: in

- Termography,
- Medical imaging and biometrics,
- Industrial mathematics and
- Intelligent management of digital and electronic content.

Deliverable D2.3 reports about all the activities, performed in WP2 in months 6-18 in order to identify potential Users and organise them into thematic groups.

2. THE ACOMIN CONCEPT OF "USER"

The User in AComIn is an expert or organisation who needs novel knowledge in areas covered by the IICT competences. The User can be, for example:

- representative of industrial organisation who wants to get up-to-date information regarding the recent developments in his/her area of activity;
- representative of industrial organisation that is ready to absorb innovation and needs joint RTD developments;
- representative of industrial organsation who wants to use the advanced AComIn equipment and the relevantly skilled IICT staff in order to receive expert opinion including diagnostics (i.e. identification of internal defects of machine components);
- representative of the Public sector who needs joint RTD developments – e.g. hospitals, medical authorities or doctors interested in advanced medical data processing;
- representative of the Public sector who needs expert opinion or consultancy;
- representative of the Public sector who are interested to learn about the recent developments in their field – e.g. Educational experts interested in most advanced eLearning technologies;
- representative of Policy Making Bodies who wants up-to-date information regarding the recent developments in his/her area of activity;
- researcher who needs access to the SmartLab equipment, to use it for research tasks;
- lecturer (professor) in High Education who teaches subjects, related to the AComIn topics, and needs update of his/her knowledge and skills and so on.

Because of the variety of User interests and needs, the AComIn Executive Board tried to form a (dynamic) vision regarding the types of instruments that should address the heterogeneous community of potential users.

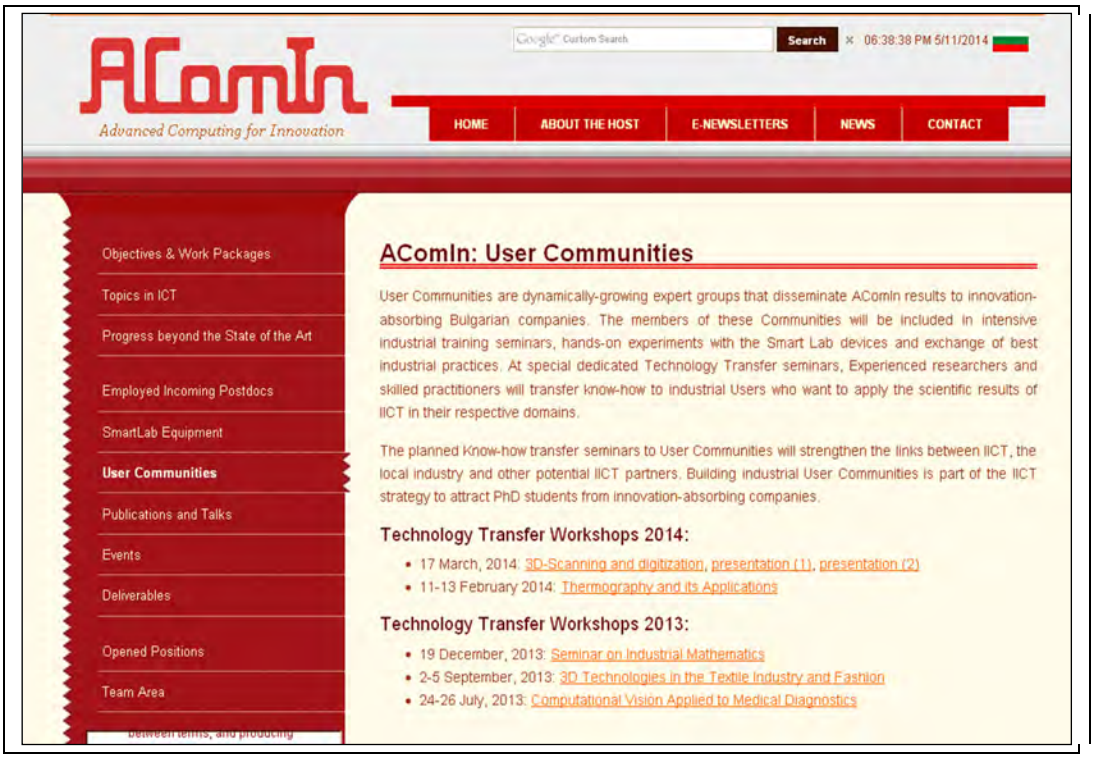


Figure 1. User Community page in the public area of AComIn site: Reports about Technology Transfer Workshops organised within the project

Three types of instruments have been developed so far:

- Technology Transfer (TT) Workshops with focus on specific topics and deeper considerations of the subject. In general these Workshops are oriented to professionalists who want to apply the acquired know how in their activities. Five TT Workshops have been organised in Period 1 with duration of up to 4 days;
- (Cycles of) Lectures that aim at raising the awareness about hot topics, with orientation to a broader audience and duration of 60-90 minutes, organised with the intention to collect supporters, open a mailing list of fans and keep the contacts in order to form a User Community ready to absorb innovation via a Technology Transfer Workshop;
- Joint work with Users who have specific well-formulated Tasks, to be solved by the Smart Lab equipment and the expertise of the IICT Researchers.

These instruments have been applied since July 2013 (when the first TT Workshop was held, see Fig. 1) and seem to suit the project needs and objectives. In fact the User Communities help IICT to develop contacts that might lead to further joint projects for contracted research. The Communities allow IICT seniors to assess whether certain task is feasible and whether the investments in its elaboration to the necessary level of maturity are reasonable. This is the “mission” of the User Communities in the innovation environment of the institute. The fact that the AComIn project supports the development of these Communities, in synergy with the infrastructure upgrade, is an excellent opportunity for IICT.

The AComIn DoW often refers to “Users from industry” as the most representative type of supporters. Now the notion is extended as it is clear that there are many experts coming from the Public sector, High Education and Academia among the Users of AComIn.

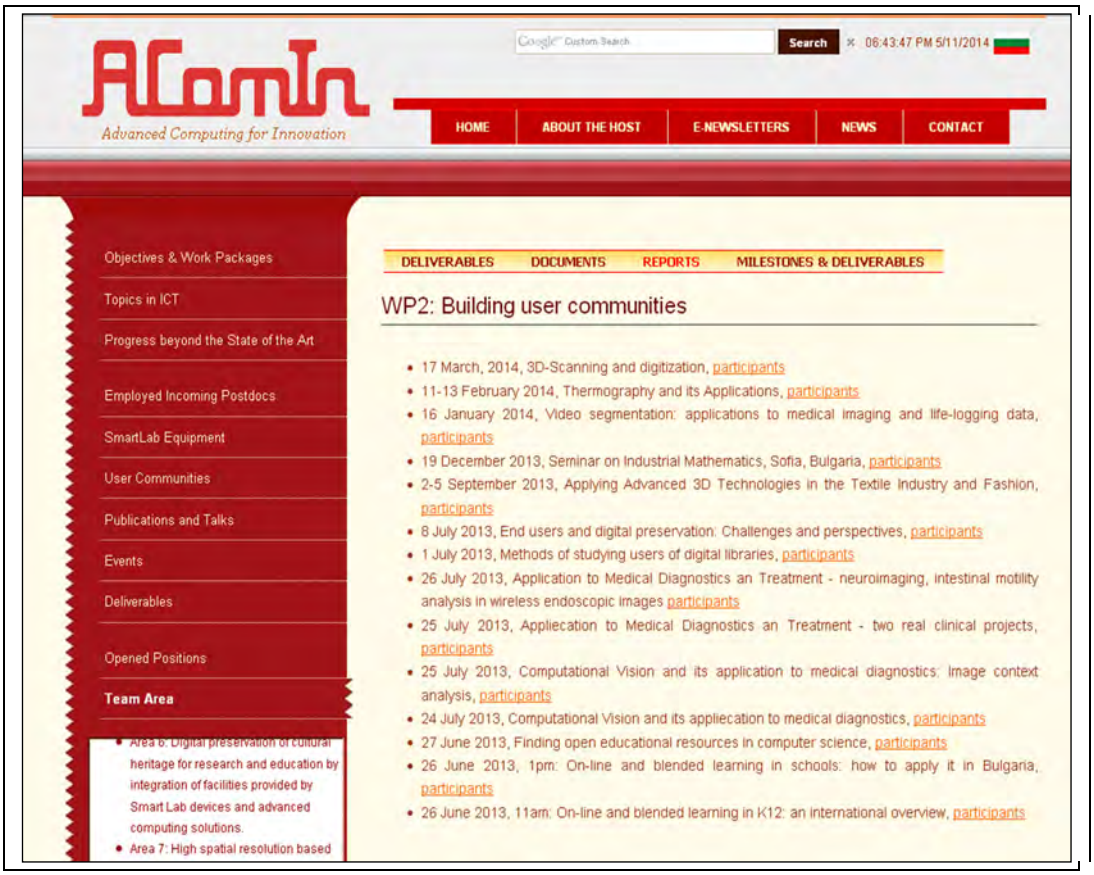


Figure 2. The Team Area with lists of participants in various Task 2.3 events

Information about the Technology Transfer Workshops is stored in the Public Area of the AComIn site, in "*User Communities*" (after the Workshops, Fig. 1) or in "*News*" (as announcement before the events). The lists of participants in all events are kept in the Team Area (see Fig. 2).

3. IDENTIFYING AND COLLECTING USERS

The initial plan for identification of Users was to organise a Stakeholders' committee that met in January 2013 (project month 4), to inform the members about AComIn and to ask them to help in disseminating the information about the new research capabilities of IICT. It turns out that this plan was a good one. The majority of the industrial Users, who approached IICT with proposals for joint research tasks, where informed about Smart Lab by the Bulgarian Chamber of Machine Building, the Cluster of Mechatronics, the Bulgarian Association of Electrical Engineering and Electronics etc.

Other dissemination channels are the link to Universities especially the Technical ones as well as to Faculties in Natural Sciences. Most IICT seniors teach at various Universities so the dissemination to academic circles is relatively easy. Especially for the colleagues from the Bulgarian Academy of Sciences, invitations to AComIn Information events are sent to public academic forums. In some cases, whenever possible, even the training sessions of some devices are open to external experts (this was the case with the Acoustic Holography, when colleagues from the neighboring institutes attended freely the training on how to use the device).

The IICT seniors participate in various scientific events, exhibitions and fairs and disseminate there promotional materials of AComIn. Information about the project has been disseminated to the International Fair in Plovdiv, September 2013, via the IICT Technology Transfer Office. Project leaflets were given to the participants of the 95th European Study Group with Industry, 23-27 September 2013, Sofia. At 20 February 2014 the AComIn coordinator Prof. Angelova and the SmartLab manager Prof. Karastoyanov were invited to give talks at the FabLab - Sofia in order to present the project and the Smart Lab equipment.

The groups of AComIn Users are naturally formed "around" the new devices that attract attention and candidates who wish to apply them in academic or industrial developments. The Smart Lab devices are almost unique for Bulgaria and sometimes the supplying companies themselves bring to IICT potential Users who need to work with such equipment. This is the case with the Thermocamera – the company provider sends to IICT potential Users that want to do research in related topics.

Last but not least IICT regularly updates its industrial partners on recent developments in the institute. With 13 running projects in the Competitiveness Operational Programme and a plenty of contacts, including the mailing lists of the Technology Transfer Office, the institute supports a broad network of contacts to industrial entities and public bodies. They are all informed about AComIn and might read the project bulletins at the site.

Finally, on 28-29 March 2014 AComIn organised its first Doors Open Days for international guests. Visitors were invited from: three Romanian Universities, the National Aviation Academy (Kiev) and the Institute for Radiophysics and Electronics, National Academy of Sciences of Ukraine (Kharkov), two Universities in Skopje (FYROM), University of Patras (Greece), Nis University (Serbia) as well as Mersin University (Turkey). Mobilising various dissemination channels, the AComIn seniors plan to continue the promotional and dissemination activities in order to identify further potential Users.

4. TECHNOLOGY TRANSFER WORKSHOPS

When a group of supporters is formed around a hot topic and an experienced lecturer with high reputation is ready to deliver a course, the Executive Board of AComIn considers the option to organise a Technology Transfer Workshop. Perhaps the first example in this respect was the course "3D Technology in the Textile Industry and Fashion" that had been planned before the AComIn start. Having in mind the lack of 3D scanners in the Public domain and even in University training, the AComIn seniors took care to include a 3D scanner and 3D printer in the Smart Lab. Thus AComIn intends to support the faster dissemination of 3D technologies in Bulgaria.

Another scenario for planning a Technology Transfer Workshop is the case with the event dedicated to Industrial Mathematics, ogranised on 19 December 2013. This Workshop was co-located with the 8th Annual Meeting of the Bulgarian Section of SIAM[1] (BGSIAM, 18-19 December 2013, Sofia). Some renowned researchers arrived to the Meeting and the AComIn Executive Board decided to invite them as lecturers at a Technology Transfer Workshop.

Five Technology Transfer Workshops were organised between July 2013 and March 2014 (see http://www.iict.bas.bg/acomin/user_communities.html):

With lecturer **Prof. Petia Radeva (University of Barcelona)**: *Computational Vision Applied to Medical Diagnostics*, 24-26 July 2013.

The Workshop was held as a Course with 14 lectures in 4 days. It considered recent advances in image segmentation techniques; in image context analysis (shape context, active shape models and active appearance models, Bayesian context modelling); real clinical projects for applications of computational vision to medical diagnosis and treatment (arteriosclerotic plaque analysis in intravascular ultrasound images of coronary vessels and stent detection); neuroimaging as well as intestinal motility analysis in wireless endoscopic images. The workshop was open to all interested experts: from public and/or private companies, researchers from academic institutions and others. It was attended by 33 participants from private companies and academia. The presentations are public at the AComIn site. The course continued at 16 January 2014 with 3 hours lectures in "*Video segmentation: applications to medical imaging and life-logging data*", for the same User Community.

With lecturer **Dr. Petar Goulev (School of Fashion, University of the Arts, London)**: *3D Technology in the Textile Industry and Fashion*, 2-5 September 2013.

The course was organised for Bulgarian textile and fashion specialists with the aim to increase the competitiveness of the Bulgarian industry. The lectures covered topics related to user opinion studies, scanning and creating 3D models of the human body, 3D design of cloths and accessories, as well as using 3D models in electronic trade in the fashion industry. The list of participants included 24 company owners and managers from the textile industry, fashion designers, university professors and teachers from specialised secondary schools. The 3D scanner and printer of AComIn were not available in early September 2013 so two companies (3d Print – Bulgaria) and Team Ltd. demonstrated the creation of 3D objects in real time using MakerBotReplicator2 and provided software for a manual 3D scanner ZScanner 800 for scanning textile objects and human shapes in real time. Figure 3 shows some photos taken at the Workshop.

With lecturer **Prof. Oleg Iliev** (**Fraunhofer Institute in Industrial Mathematics, Kaiserslautern**): *Technology Transfer Workshop in Industrial Mathematics*, 19 December 2013.

The first part of this event included presentation of the new SmartLab equipment with demonstrations and hands-on experience. Six high-tech devices were demonstrated within 3 hours.

[1] SIAM is the Society for Industrial and Applied Mathematics, www.siam.org

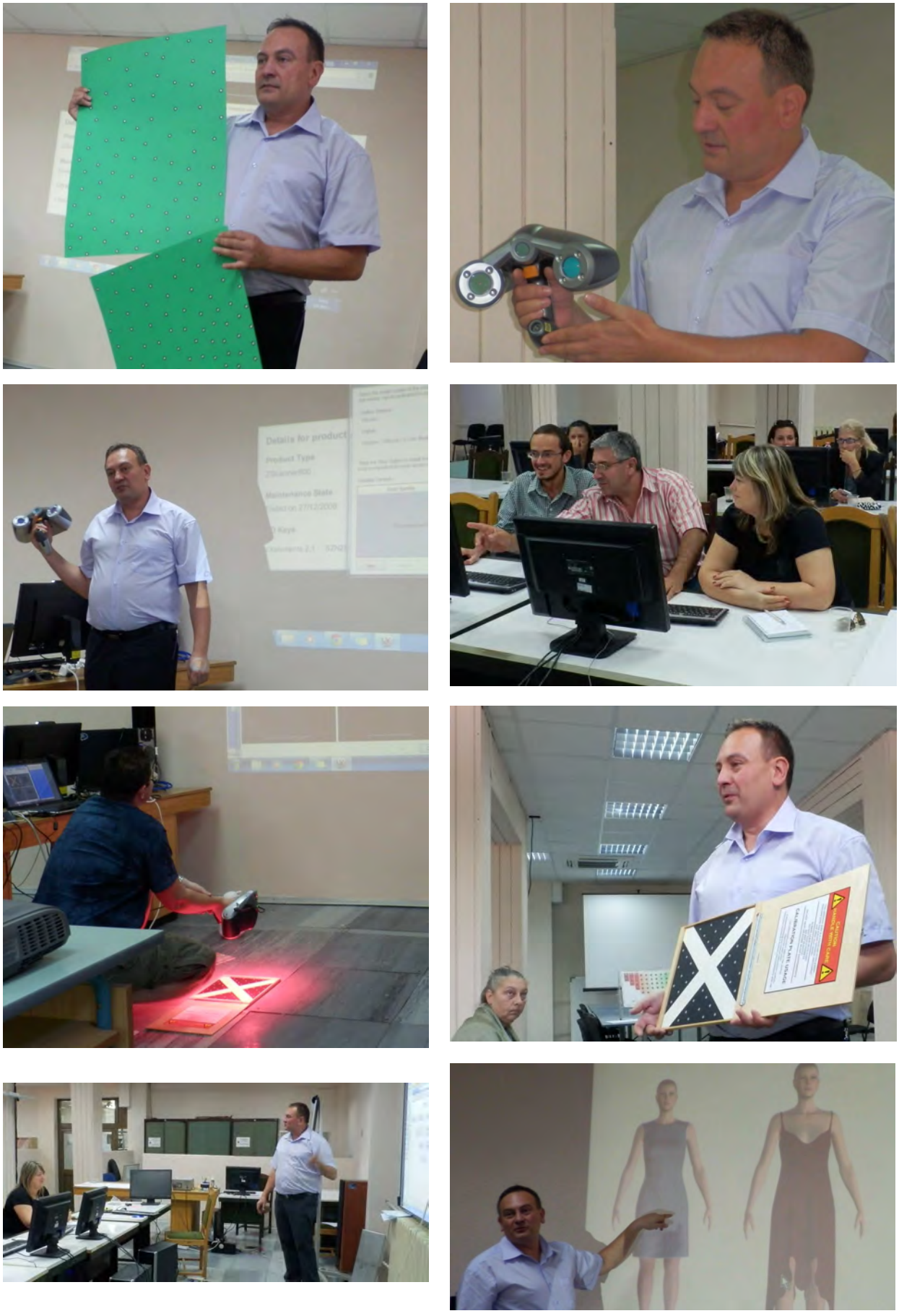


Figure 3. The Technology Transfer Workshop “3D Technology in the Textile Industry and Fashion”

Prof. Oleg Iliev delivered the lecture "*Mathematics as technology: good practices in various industrial applications",* followed by presentations of particular industrial applications developed in the IICT. Three young researchers from IICT (N. Kosturski, Y. Vutov and I. Georgiev) presented their projects in Computer *simulation of radio frequency ablation*, *Supercomputer simulation of the cooling process in a porous inert media gas burner* and *Computer simulation of wood polymer composite matherials*. Representatives of 12 industrial organisations attended the Workshop, including two Clusters.

With lecturer **Dr. Todor Bagarov** (**STEDOR Ltd, Bulgarian Representative of FLIR**): *Technology Transfer Workshop in Thermography*, 11-13 February 2014.

The course included the following topics: Infrared thermography applications overview; Basic camera setup and operation in different conditions; Theories behind infrared thermography and heat transfer; Discuss the effects of emission, reflection, and transmission on IR camera measurements; Learn how to correct measurements when imaging through IR windows or unknown emissivity of material; Thermal and infrared science fundamentals; Heat transfer; Thermal measurement; Electrical, mechanical and building applications and Thermography safety. More than 20 participants attended the course; the learnt the basics of infrared images, how to operate with the thermocamera FLIR and store the images.

With lecturers **Yori Radkov** (**Ada 3D Ltd**) and **Milush Blagoev** (**GeoKad-93 Ltd**): *3D-Scanning and digitalisation*, 17 March 2014.

The lectures presented the 3D digitalisation principles by using, respectively, a 3D hand-held scanner and Laser Geodesic Scanner for modelling of architectural objects. Ada 3D also presented a robot for automatic movement of the 3D scanner around the modelled object. Geokad-93 presented videos of virtual reality documenting famous buildings in Bulgaria. More than 40 participants took part in the Workshop which ended with demonstrations and hands-on experiments.

5. FORMING USER COMMUNITIES IN ADVANCED TOPICS

There are topics in ICT where Bulgaria is lagging behind the state-of-the-art since years but no Strategies and Policies are developed to cope with this delay. Such areas are *eLearning* and *digitalisation of cultural heritage*; both of them are foci of Europe 2020. In the area of *eLearning* only the Bulgarian Universities develop and apply the technology but there are almost no attempts to introduce it in K-12 (i.e. in high schools). In *digitalisation of cultural heritage* only few cultural institutions are aware about the issue; less than 15 Bulgarian organisations digitalise content and deliver it to Europeana. The semantic and language technologies, which enable the organisation of and access to large repositories of digital content, are somehow unknown beyond the circles of ICT researchers and advanced software companies.

In order to contribute to the acceleration of raising awareness in these fields and penetration of the research ideas behind them, the Executive Board invited renowned experts to perform research studies and deliver lectures to interested experts. The visiting scientists are Prof. Darina Dicheva and Prof. Hristo Dichev (Department of Computer Science, Winston-Salem State University, NC, USA) and Prof. Milena Dobreva (Faculty of Media and Knowledge Sciences, University of Malta, Malta). Prof. Dicheva spent one month in IICT doing research on IT challenges in developing and using educational digital repositories as well as semantic techniques for supporting educational systems. Prof. Dichev spent one month in IICT, assessing and analysing the local needs and readiness for online K-12 education. They made a Review of the state of the art in K12 e-learning developments and practices, including dozens of countries. Prof. Milena Dobreva visited IICT for one month as well and did research on application approaches for digitalisation of, access to and preservation of cultural heritage; application of 3D models in this domain, and finally, synergies between access methods to

digitalised cultural content and educational resources. The activities of Prof. Dicheva, Prof. Dichev and Prof. Dobreva are presented in more details in Deliverable D1.1, sections 3.2 - 3.4.

During their stay in Bulgaria, they delivered five lectures, considering various aspects of ***Intelligent management of digital content***. The lectures were focused on eLearning, access to educational resources, user satisfaction and assessment of user needs, digital libraries and digital preservation. More than 40 participants attended the talks and now continue to support contacts with the AComIn seniors regarding future activities in this area. Due to the active interest in the topic we view this group of supporters as an emerging User Community. However, on the other hand, AComIn needs to find suitable formats for know how transfer to these supporters. Therefore, a Technology Transfer Workshop can be organised in the next project period, given the proper focus and instruments for know how transfer are found.

Another emerging User Community is linked to the topic of Big Data. AComIn is naturally related to big data at least because it deals with language and semantic technologies that are the foundational approaches for structuring the human knowledge encoded in free text. Since many years, IICT scientists do applied research in structuring and processing of big data in the medical domain.

Recently the AComIn seniors initiated a new task: to accelerate the construction of a Register of diabetic patients in Bulgaria by integration of language technologies and business intelligence tools. Together with experts from Medical University - Sofia they established a team that tries to extract automatically from texts some of the most important indicators in the Diabetic Register – data about patient status, family risk factors, drugs taken by the patient, values of clinical tests and lab data, as well as information about the hospitalisation status. The data repository for this experiment currently contains more than 37.9 million pseudonymised reimbursement requests (Outpatient records) submitted to the National Health Insurance Fund in 2013 for more than 5 million patients, including 436 000 diabetic ones. This data is available in the premises of the Medical University – Sofia and can be used for research purposes including information extraction from clinical narratives in Bulgaria.

The Outpatient records are semi-structured files with predefined XML-format. Despite their primary accounting purpose they contain sufficient text explanations to summarise the case and to motivate the requested reimbursement. Software components, called extractors, have been developed to capture patient-related information from free texts. Integrating the extractors within a unified platform, together with Business intelligence tools, the AComIn seniors propose to use this environment for knowledge discovery. It has been demonstrated how to find diabetic patients, that are not formally diagnosed, inside the repository of Outpation records. The demonstration was presented at the Exhibition of the European Data Forum (EDF) in Athens in March 2014, where it was the only exhibit from the new member states. It attracted the attention of the participants with the size of the repository and the large-scale approach to language technologies (a topic addressed by AComIn).

Prof. Nicoletta Calzolari, President of ELRA and Prof. Galia Angelova, AComIn coordinator at the Exhibition of EDF-2014

Totka Chernaeva (Bugarian Representative, ICTC H2020), Prof. Galia Angelova and Prof. Dimitar Tcharaktchiev Medical University, Sofia) at the EDF-2014 Exhibition

6. PERFORMING RTD TASKS POSED BY USERS

After the installation and integration of the Smart Lab equipment, IICT performed various tasks for **3D modelling** (investigating the presence of defects in the internal structure of different industrial details and solid bodies via scanning with 3D tomography) and studying the **microstructure dynamics**.

3D modelling

Cast aluminum details

Using the computer 3D tomography, IICT experts have studied aluminum details (cast in metal mould shape, gravity way; Figure 4) with the following parameters: weight up to 4kg and sizes up to 300/200/100mm. The analysis included:

- Identifying casting defects – pores, drawing, shrinkage porosity, nonmetallic inclusions;
- Detecting the size and position of the defects in the contour of the casting;
- Preparation of a series of images obtained when scanning the detail at intervals of 0,3 mm;
- Preserving and sending the images as files for further analysis.

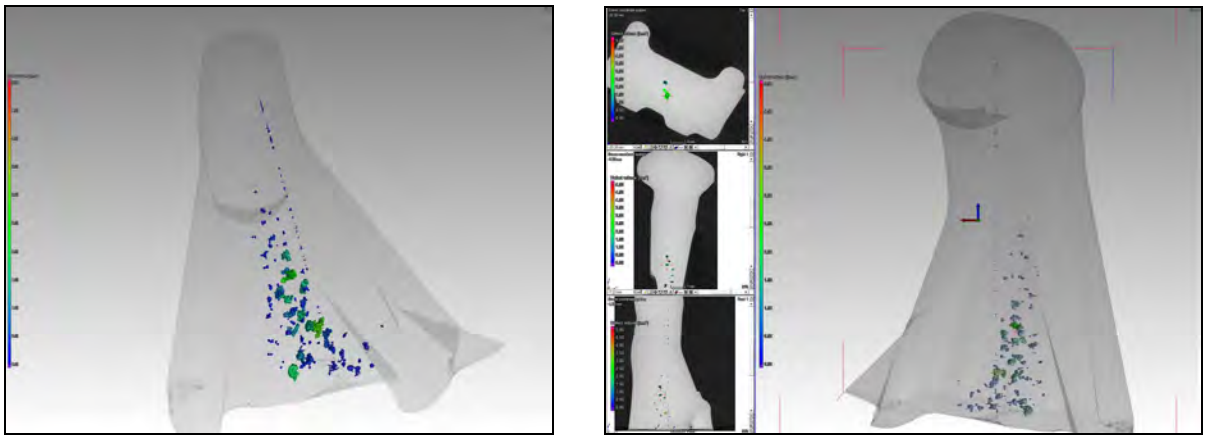


Figure 4. Aluminum part of an automatic gear box pump for Japanese cars

Detail for industrial rotators and breaks

JSC details of ductile iron EN GJS 500-7 mark according to ISO EN 1563:2012, produced by the method “TUNDISH-COVER” (Figure 5), were subject to investigation with the CT tomography:

- *Detail 1* – stator bottom plate 2522M – main detail for completion of industrial rotators. The detail works at a pressure of 250 bars and has high requirements as regards the mechanical properties. The requirement for hydraulic density requires absence of defects / including micro porosity/ in the whole casting volume. Sample weight – 7,1kg; Dimensions: 180x180x60mm,
- *Detail 2* – Upper stator plate 46-2523M – main detail for completion of industrial rotators. The detail works at a pressure of 250 bars and has high requirements as regards the mechanical properties. The requirement for hydraulic density requires complete absence of defects / incl. micro porosity / in the whole casting volume. Sample weight – 10,46kg; Dimensions: 180x180x140mm,
- *Detail 3* – case detail 2098M – intended for use in the break system of high-speed trains subject to high load, hydraulic density and wear resistance. Sample weight – 7,9kg; Dimensions: 220x240x110mm.

The analysis included:

- Checking for internal defects in the volume of castings using the 3D computer tomography,
- Thermography of the process of liquid metal freezing in the casting molds, using the thermo camera,
- Evaluation of the possibility of grading (sizing) and building a 3D model of ductile iron castings with a 3D scanner.

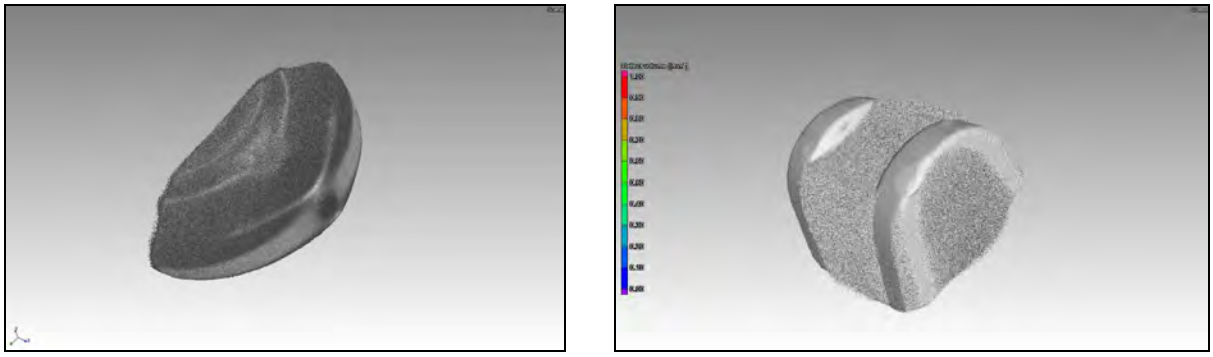


Figure 5. Break system details for high speed trains

3D tomography of polymer composite samples

In relation to a research experiment conducted for a project of the Laboratory of Experimental Mechanics of Micro and Nano materials (OLEM) at the Institute of Mechanics (Bulgarian Academy of Sciences), we used the 3D computer tomography for 3D scanning and analysis of a polymer composite sample (Fig. 6).

The sample represents a Nano composite epoxy resin with gold Nano particles (grouped into agglomerates with a size of a few microns), which are deposited on the surface of the layer of clay (also in micron size). We investigated the volume common distribution and size of agglomerates of gold Nano particles and also the same for the clay layers.

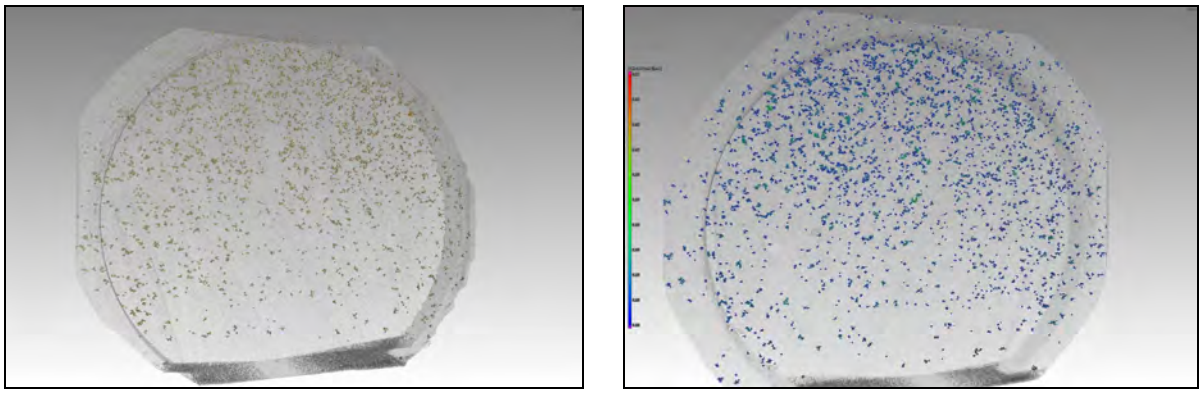


Figure 6. Tomography of composite polymer samples

Ear canal experimental cast model

In relation to a prototypical experiment aimed at scanning castings of an Ear canal, performed for the Research Centre of Technical University — Sofia, Laboratory „Modern Control Systems", IICT used the 3D tomography for scanning the experimental cast model and 3D reconstruction (Fig. 7). The result can be used for modelling and producing devices for people with hearing disabilities.

Figure 7. Ear channel experimental models

3D scanning in cultural heritage

For the research projects of the Institute of Archeology - Bulgarian Academy of Sciences, the IICT experts scanned also archeological objects – small figures (Fig. 8), using the 3D computerised tomography.

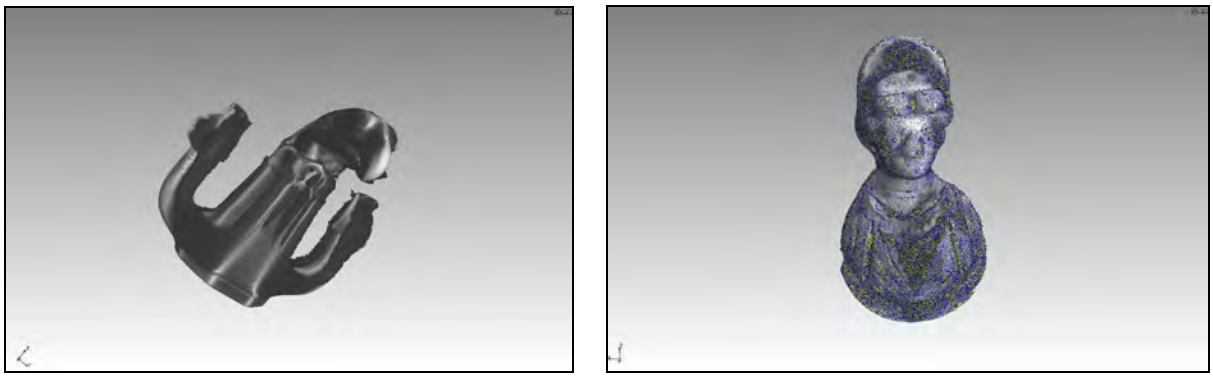


Figure 8. Archeological artifacts

Microstructure dynamics

Dynamics is always related to change, when solid bodies and materials are exposed to processes taking place in various environments. The Smart Lab equipment enables one to study the processes and their effects with great precision. Some of the companies and research institutes work with liquid metal and it is important for them to know how even the process of metal freezing is. Also in other cases (welding with Nano particles included in the welding wire) it is important to observe the freezing process of the welding seam. For these cases we use the thermo camera.

Examining welding processes

As part of a research task performed together with colleagues from the Institute of Metal Sciences, Bulgarian Academy of Sciences, IICT experts examined the structure of castings and aluminum alloy samples both with and without added Nano sized dusts using 3D Computer Tomography. They also studied the layer temperature field during the welding process using Thermo Camera (Fig. 9).

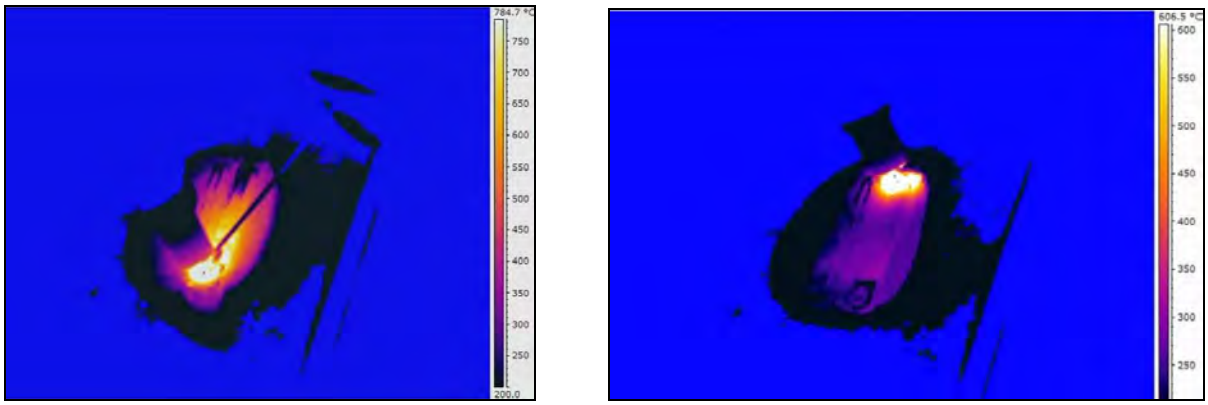


Figure 9. Welding with nano particles in the welding wire

Dynamic tests of pedestrian railings

Together with colleagues from the Institute of Mechanics, Bulgarian Academy of Sciences, IICT researchers have developed a test stand for pedestrian railings by applying the impact load. The test parameters are specified in the standard SD CEN/TR 1317-6:2012 *Road restrictive systems, Part 6: Restrictive systems for pedestrians, Railings for pedestrians*. The test has been performed in two settings:

- Strike with a soft elastic body (simulating stroke of a human body) with certain size and speed, providing energy 600J on certain parts of the railing;
- Strike with a solid body, with certain size and speed, providing energy 30J on certain parts of the railing.

Strikes have been made on 25% and 50% of the height of the railing. The goal of the experiment was to determine the resistance of the structure against dynamic loads, characterized by the deformation under mechanical criteria. For a better understanding of the structural behavior under dynamic load the strikes have been recorded with the Smart Lab High Speed Camera. The record (shown in Fig. 10) allowed one to determine the size of the subsequent elastic and/or plastic deformations of the panel and the support pegs, the presence of detached parts as well as the degree of penetration of the body in the parts of the structure.

Figure 10. Strike between soft elastic body and pedestrian railing

Conducting micro-CT (Computed Tomography) tests

Research experiments were carried out in IICT in collaboration with experts from Ruhr-University of Bochum (Germany) on 10-14 March 2014. The task was to investigate interactions via micro structural analysis of geo materials.

Several test experiments have been performed:

- *Test 1*: Infiltration into the environment of glass spheres and plastic granules of bentonite suspension. Using the 3D scanning and reconstruction, one can observe the movement of the water and the particles in the crystals. The purpose of the experiment is to visualize the distribution (proliferation) of the water and the bentonite particles in the relevant granular environment;
- *Test 2*: Hydration of rock salt by a single application of water in the radial limited sample (in the shape of a tube with a small radius). The scanning is done in parallel to the process of hydration. The purpose of the experiment is to visualize the structure of the pore system, the mechanism of water penetration in rock salt and structural changes due to hydration;
- *Test 3*: Scanning the internal structure of sedimentary rock (hard clay). The purpose of the experiment is to determine the size distribution of the pores (PSD);
- *Test 4*: Micro-CT of a sample of sand containing small size fractions. The purpose of the experiment is to determine the size distribution of the pores (PSD) in the fine fraction and to obtain information about the orientation of the contact surfaces between the silica grains

with the aim to study the following subjects:

- ***Microstructure of sandstone***: A cube of about 8mm side length was investigated in the micro-CT to show the pore size distribution, density and the grain size distribution (Fig. 11). Two samples have been investigated in the micro-CT;
- ***Microstructure of salt*****:** A cylindrical sample with a diameter of about 25mm was investigated in the micro-CT to show the 3D structure of cracks and pore size distribution (Fig. 12). Three samples were investigated in the micro-CT. One sample was dry and unloaded. One sample was wet and unloaded. One sample was dry and loaded;

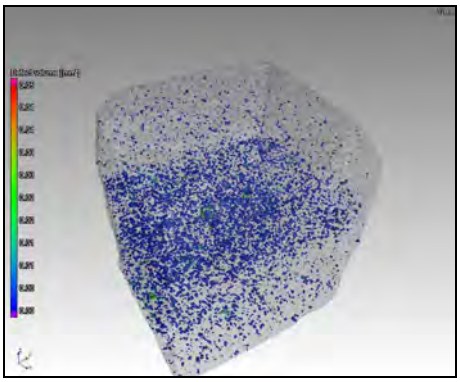


Figure 11. 3D-view of the sandstone

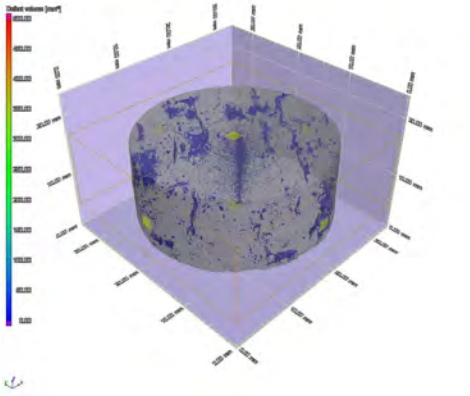
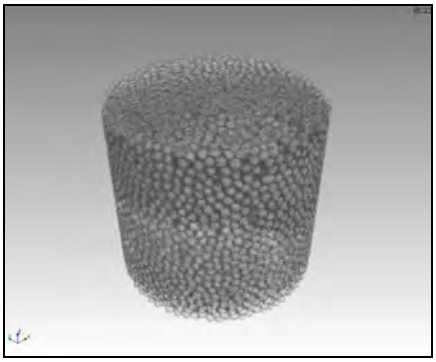
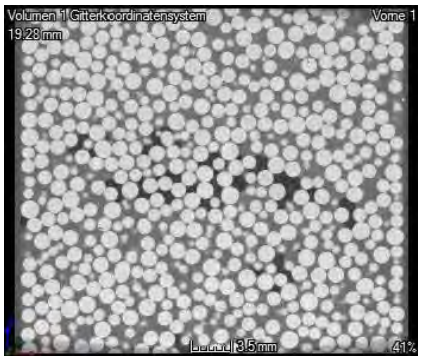


Figure 12. 3D-view of the salt

- ***Infiltration of bentonite***: A cylindrical cell was filled with glass beads with the bentonite on top. After infiltration into the glass beads the sample was investigated in the micro-CT. The objective is to analyze the propagation of water and bentonite. Two samples with different mixtures of bentonite were investigated in the micro-CT (Fig. 13). One sample was prepared with a bentonite-suspension with a density of 1,1g/cm^3. One sample was prepared with a bentonite-suspension with a density of 1,1g/cm^3 and 1% polymer;



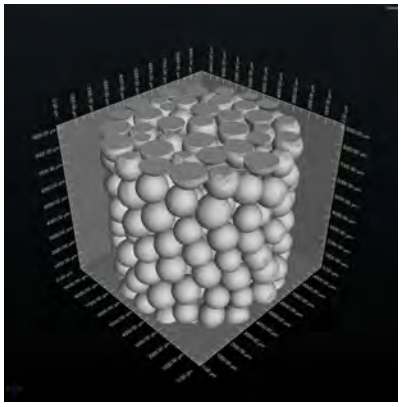
3D-view of the sample



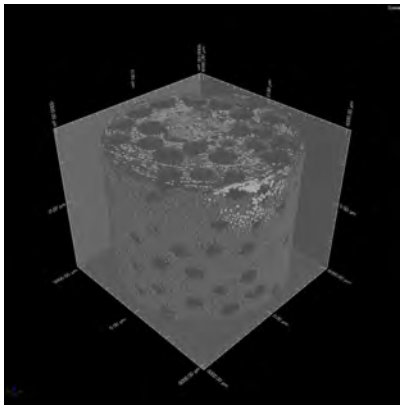
Section of the sample

Figure 13. Infiltration of bentonite

- ***Anisotropy in sand with different fine content***: A cylindrical cell was filled with different mixtures of glass beads. The objective is to get information on pore size distribution within the fines alone, within the sand and of the mixture independently. Another objective is to derive the distribution of contact plane orientation among the sand. Five samples with different mixtures of glass beads have been investigated in the micro-CT (Fig. 14, Fig.15). Two different kinds of glass beads were used for the mixtures. The first glass bead had a diameter of 1, 25-1,5mm and the second one had a diameter of 0,125-0,2mm. The different mixtures were: *(i)* 100% of first glass beads, *(ii)* 90% of first glass beads and 10% of second glass beads, *(iii)* 80% of first glass beads and 20% of second glass beads, *(iv)* 70% of first glass beads and 30% of second glass beads, and *(v)* 50% of first glass beads and 50% of second glass beads.

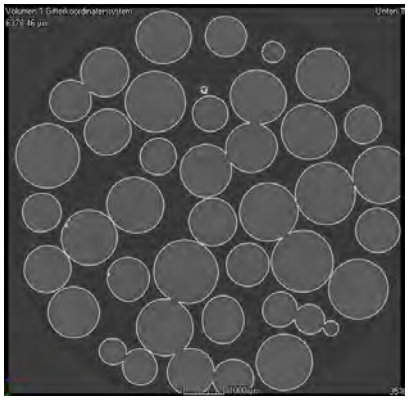


3D-view of sample 1

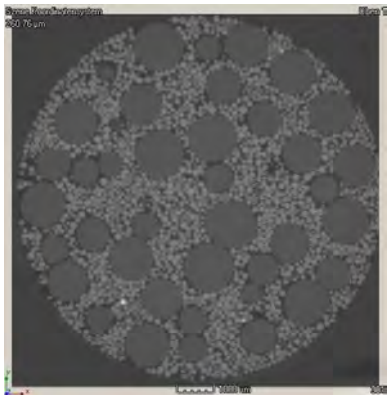


3D-view of sample 5

Figure 14. Anisotropy in sand with different fine content – 3D view



Section of sample 1



Section of sample 5

Figure 15. Anisotropy in sand with different fine content –sections

Thermography

Apparently the thermography is a topic where AComIn needs to build another User Community. In addition to the nano welding thermograms shown at Fig. 9, we present here thermograms of a high power transformer – temperature deviations and temperature distribution in case of different current in the coils (Fig. 15). These experiments have been carried out together with colleagues from the Technical University of Sofia.

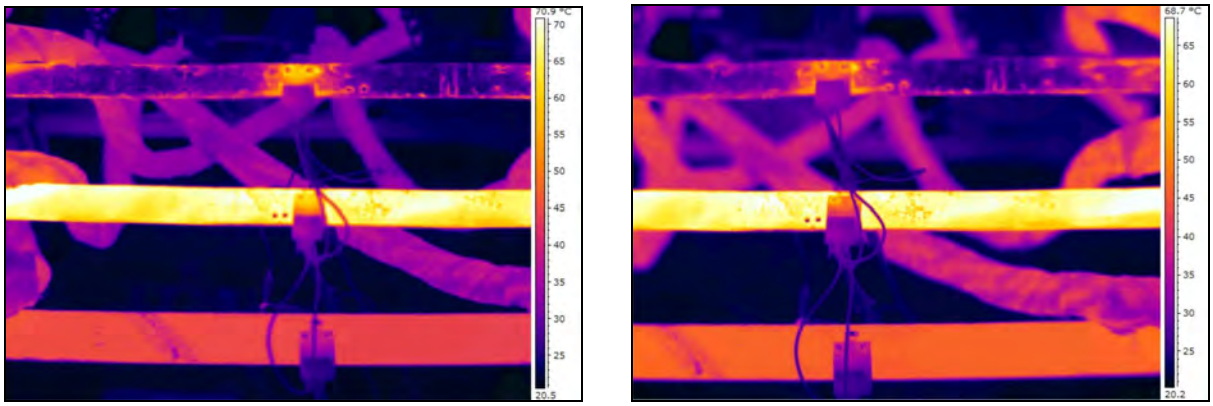


Figure 15. Thermograms of the temperature distribution in high power transformer

7. ASSESSMENT OF THE ADDED VALUE OF TASK 2.3 ACTIVITIES TO THE STRENGTHENING OF IICT RESEARCH AND INNOVATION POTENTIAL

Task 2.3 started in period 1 but its activities and importance will grow in project period 2. Despite the fact that the Smart Lab devices were switched on only 3 months ago, there is considerable interest to apply them for various purposes. In this way, AComIn enabled a whole new world of tasks and potential research projects in the institute, and this extended research capacity implies that IICT will accomplish its mission to become the Bulgarian research leader in ICT.

Obviously the role of the User Communities will increase in AComIn months 19-36 because contracted research will be one of the basic elements in the IICT Sustainability strategy.

8. DEVIATIONS FROM SCHEDULE

There are no deviations from the DoW schedule in the formation of User Communities.

9. CONCLUSION

In Period 1, a somewhat bottom-up approach to the construction of User Communities has been applied. These Community depend on the availability of supporters, therefore IICT organised a relatively active dissemination and promotion Agenda in order to advertise the availability of the Smart Lab equipment and its potential. In Period 2 the approach will be also top down since the AComIn team is already informed about some of the major channels for information dissemination to relevant supporters.

A challenge for Period 2 is to extend the User Communities to supporters from the neighboring countries.