



# EurValve Project Newsletter

December 2017

## Project Update

### First Period Review

EurValve's first period review took place at the end of September 2017 in Brussels. Twenty members of the consortium and project attended the meeting before the Project Officer and three Commission appointed reviewers. The reviewers were impressed with the progress of the project.



### Progress Report:

EurValve has completed its first 18-month period (Feb 2016 – July 2017) submitting all 14 planned deliverables and achieving all three planned milestones during the period.

A dedicated portal and file store service has been implemented and is used as a central exchange for file based data. The Model Execution Environment has been developed and is used for simulation investigations of different models of the heart. Simulated data from 3000 records have been used to develop a random method to estimate six parameters.

Segmentation tools have been provided for nearly all relevant tasks and modalities. The OD circulation model of the heart has been implemented and tested. A 2D model of the aortic valve has been used to build an initial reduced order model and an initial 3D aortic valve model has also been developed.

The specification for the internal data systems of the Decision Support System has developed and the basis for the infrastructure-based clinical processing pipeline has been built.

A Clinical and Ethical Board and an Exploitation and IPR Board have been established.

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**www— For further information check out the EurValve website at [eurvalve.eu](http://eurvalve.eu)**

## Beneficiary Profiles

Each edition of the EurValve newsletter will contain profiles on selected beneficiaries. In this edition, we feature Sheffield Teaching Hospitals NHS Foundation Trust, Cyfronet AGH, University of Rennes 1 and the University of Bristol.

### Beneficiary Profile – Sheffield Teaching Hospitals NHS Foundation Trust



Sheffield Teaching Hospitals NHS Foundation Trust (STHFT) is a teaching hospital in Sheffield UK. It manages the five NHS adult hospitals in Sheffield and provides a full range of local hospital and community services for people in Sheffield, as well as specialist care for patients from further afield, including cancer, spinal cord injuries, renal and cardiothoracic services. The hospital works very closely with the University of Sheffield and Sheffield Hallam University to ensure that it is at the cutting edge of medical research and development. This helps to develop new and specialist services for the benefit of patients from Sheffield and all over the country. STHFT has two core roles in the EurValve project, first to develop the data management platform for the project, and second as a clinical partner collecting data for analysis.

Norman Briffa is EurValve's PI for STHFT. Norman is a Consultant Cardiac Surgeon at the South Yorkshire Cardiothoracic Centre. He has an interest in heart valve disease and is a mitral valve specialist. He has set up the postoperative heart valve clinic in Sheffield and sits on the executive of the British Heart Valve Society.

<http://www.sth.nhs.uk/>



Steven Wood is a registered Clinical Scientist and head of the Scientific Computing section of Medical Physics at Sheffield Teaching Hospitals NHS Foundation Trust. Dr Wood has over 11 years' experience since leaving academia, in the development of clinical software systems across the hospital and is the research informatics lead for the trust. Steven is developing the data management platform for EurValve.



Sheffield Teaching Hospitals **NHS**  
NHS Foundation Trust



Gareth Archer is the EurValve Clinical Fellow. Gareth's role in the project is to collect retrospective clinical data for patients who have had mitral and aortic valve surgery in Sheffield. He is also collecting all the clinical and activity data for 20 Aortic and 20 mitral patients undergoing interventional surgery in Sheffield.

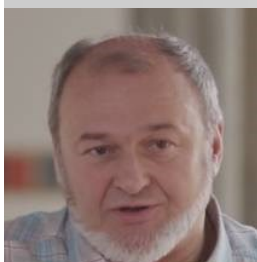


## Beneficiary Profile – Cyfronet AGH



The Academic Computing Centre, Cyfronet AGH is an autonomous unit, both organisationally and financially, of the AGH University of Science and Technology in Krakow. Cyfronet is one of the largest Polish supercomputing and networking centres and the leader of the Polish PL-Grid Infrastructure for e-Science. In cooperation with the top Polish and European universities, Cyfronet designs, develops and deploys large-scale computing infrastructure solutions dedicated to scientific research. Thousands of computational analyses are run every day on HPC equipment managed by Cyfronet and connected with a high-throughput network backbone to key laboratories in Poland and Europe. Cyfronet research teams have extensive experience in European collaboration, dating back to FP5 research projects – including direct involvement in development and deployment of custom research tools in the life science and medicine domains. Cyfronet's fastest computer, Prometheus, is now 77th in the world, and is the fastest machine in CE EU region.

The Cyfronet AGH team (Marian Bubak, Tomasz Bartynski, Tomasz Gubala, Daniel Harezlak, Marek Kasztelnik, Maciej Malawski - <http://dice.cyfronet.pl/>) leads the Infrastructure Work Package 2, where it is responsible for delivering efficient, scalable, secure and robust model execution environment (MEE) which, in turn, will enable the development of a valve DSS. The team also participates in integration related tasks of Work Package 5.



Marian Bubak is an assistant professor at the Department of Computer Science AGH, and the Professor of Distributed System Engineering at the University of Amsterdam. He is also Manager of the Laboratory of Informatics Methods for Medicine and the Scientific Leader in a Teaming for Excellence Phase 1 project CECM. Marian has authored about 230 papers in this area, and he served key roles in series of EU-funded projects, including CrossGrid (the Architecture Team leader), K-WfGrid (the Scientific Coordinator), CoreGRID (member of the Monitoring Committee), and ViroLab, GREDIA, UrbanFlood, MAPPER and VPH-Share (WP leader). Prof Bubak leads WP2.

<http://cyfronet.pl/>; <http://dice.cyfronet.pl/>



There is an increasing recognition that ‘patient-specific modelling’ means much more than personalisation of the anatomy from medical image data, although of course this is an essential element”.

## Beneficiary Profile – University of Rennes 1

**S**ignal and Image Processing Laboratory (LTSI – INSERM U1099) is a joint Research Unit of the INSERM and the University of Rennes 1. The research is conducted in cooperation with physicians, some of them being affiliated both to LTSI and to clinical organisations. Research activities of LTSI lie at the interface of Information Technology and Health sciences. Their objectives are methodological, technological and clinical with two main aims: data interpretation and decision-making. They are based on the kernel 'signal-model-image', these three components bringing an essential added-value. The team organisation of LTSI is backed by transversal projects of methodological research exploiting



synergies between signal and image processing, sensors and modelling. Each team is focused on a limited target and was built around a multidisciplinary group able to integrate the latest physiological knowledge in the field, and to identify the underlying methodological issues. Among these, the activities of IMPACT team, which will be more specifically involved in the project, focus on decision support through images and modelling to plan and guide surgical and therapeutic procedures. The works aim particularly at addressing main issues in terms of public health. The challenge is to build the future personalised therapeutic strategies in the fields of cardiovascular and cancer diseases where organs and lesions are soft and deformable within the course of treatment and observed through multimodal and multi-scale N-dimensional data.

**I**n EurValve LTSI will focus on cases representation and similarity to provide the decision support system with case based reasoning facilities.



**P**ascal Haigron is Professor at the University of Rennes 1, Rennes, France. He is responsible of the research team IMPACT (Images and Models for Planning and AssistanCe to Therapy and surgery) at LTSI. He currently coordinates the work on case based reasoning to be integrated in the decision support system.

**H**élène Feuillâtre is employed by University of Rennes 1 to work on the EurValve project.

See page 7 for more information on Hélène.



[www.univ-rennes1.fr/](http://www.univ-rennes1.fr/)



“

The focus of the system model is on the characterisation of the cardiac physiology, and the quantification of the influence of the valve disease on this characterisation.”



## Beneficiary Profile – University of Bristol



The University of Bristol (UBRIS) is a member of the UK's prestigious "Russell Group" of research-intensive institutions. In the UK's recent nationwide audit of research it was ranked fourth in the UK for the combination of quality and volume of its research activity. Bristol is the lead partner in SPHERE, a UK flagship Healthcare Technology research grant, developing an integrated platform of sensors and the requisite data analysis capability for long term pervasive health applications. Prof Craddock is the Director of SPHERE and Dr Piechocki leads the wearable sensor development, targeting ultra-low power operation in harvested power and seamless connectivity for greater usability in long term clinical and research scenarios.

Bristol's Intelligent Systems Laboratory (ISL) is known for world-leading research contributions in machine learning and data mining theory (including kernel methods, various approaches to data fusion, exploratory data mining) as well as for the successful application of this theoretical expertise in collaboration with scientists in other data-driven projects (including SPHERE but also projects in bioinformatics, social media analysis, music informatics, and finance).

UBRIS is providing the sensor systems used in the project (Work Package 4) and provide algorithms to make sense of this data.

<http://www.bristol.ac.uk/>



Ian Craddock is Director of the SPHERE project, co-ordinating a programme of research spanning wearable activity recognition, video analytics, low power communications, energy harvesting and machine learning. He also undertaking pioneering interdisciplinary research in medical imaging; he founded a company that has attracted investment of £4M to undertake clinical trials and commercialise a cancer imaging device. He serves on the Steering Board of the University's flagship Elizabeth Blackwell Health Research Institute.



James Pope is a Research Associate with the Department of Electrical and Electronic Engineering at the University of Bristol. He has researched Internet of Things technologies for the past decade including wireless sensor networks and radio frequency identification. James is currently researching pervasive monitoring for health applications and has been involved in creating the Bristol Activity Monitor.



EurValve aims to bring Reduced Order Models (ROM) closer to clinical utility by integrating them with a clinically-oriented Decision Support System”.

**Validation:** Two clinical trials are being conducted, a retrospective study and a prospective study.

The *Retrospective Study* is complete, and has acquired data from large patient groups, across EurValve's three clinical centres (Sheffield, Eindhoven and Berlin), to facilitate the development of the mechanism to infer missing data, and to provide evidence for the generation of the rule sets that will drive the detailed decision support process. This study is therefore gathering data to inform a 'machine learning' process.

The *Prospective Study* will compare computer predictions of the outcomes of heart valve replacement surgery with the actual results obtained in normal clinical practice. A total of 120 patients across the project's three clinical centres will be recruited to the study. The enrolled patients will be investigated before valve intervention by ECG, laboratory tests and anthropometrics, including blood pressure, body weight and clinical status. They will also be imaged, and in the case of MR the scan will employ a slightly modified protocol to suit project analysis. These data will collectively be used for modelling. In the Sheffield cohort

there will be an extra observation of the patients' level of locational activity and physiology before and after the intervention, yielding additional information relevant to CV disease: lifestyle, behaviour, risk and recovery. Subjects will be monitored, using wrist-worn devices, once prior to intervention, and twice after intervention - immediately on return home, and at 12 weeks. After treatment, patients will be followed-up, repeating the relevant components of the study assessment protocol, including an MR scan, allowing comparison of the modelled/predicted outcome against measured data. After this validation step, a randomised controlled assessment of the DSS process itself will be conducted on the data, comparing the virtual decision-support from the DSS with the actual clinical decision-making process that took place. The prospective study is underway.

In an extra feature of the project, introduced during its execution, patients at all three centres are being equipped with the *Philips Health Watch*, to monitor heart rate and (non-locational) activity. The Berlin cohort are also having myocardial biopsies performed during their surgical procedure.

**S**ummary:

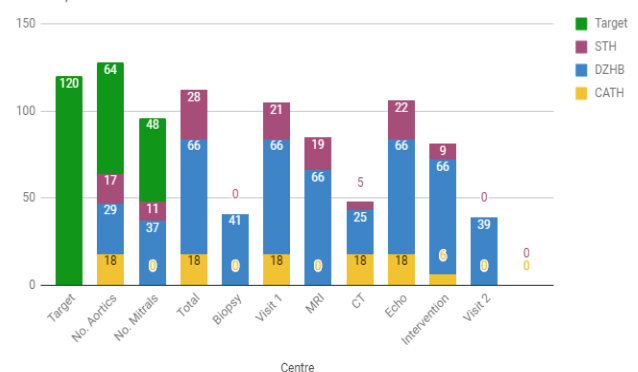
## Retrospective Data

Retrospective non-identifiable data for testing the ICT environment (DHZB, CATH and STHT) has been obtained in significant quantities across all clinical centres.

## Prospective Data

- Ethical approval has been obtained in all three centres
- All centres have begun patient recruitment and prospective pseudonymised data collection
- Pervasive and physiological activity monitoring has begun in Sheffield as planned, and extra physiological data is being acquired in all three centres.
- Myocardial biopsies are being obtained from DHZB patients.
- Acquired data is being employed as intended, in the planned simulations

CATH, DZHB and STH



Current Status of recruitment Nov 2017

## Researcher Profile

**M**y name is Hélène Feuillâtre and I currently live in Rennes, France. After obtaining a Master's degree in Computer Science from an engineering school (UTBM - Belfort-Montbéliard University of Technology) and a PhD at the University of Rennes 1, I began to work on the EurValve project in June 2016.

### *What is your role with EurValve?*

My main role is to develop the Case-Based Reasoning module. In this module, the past experience of physicians is used to solve similar problems. Thanks to similarity measures, we retrieve a set of previous cases similar to the current candidate patient from a database. The information provided by these retrieved cases aims to help the practitioner to take the most suitable decision about current case. This relevant information is displayed in a graphical user interface. Currently, we are developing the Case-Based Reasoning module to plan the Transcatheter Aortic Valve Implantation (vascular access and prosthesis choice).



### *What are you working on at the moment?*

The beta version of Case-Based Reasoning module has been integrated into the current version of the Decision Support System. The design of software architecture and graphical user interface has been consolidated. We are currently working to improve the similarity measure used to retrieve the set of most similar patients.

### *What do you do in your free time?*

I practice modern-jazz dance at university and I am just starting to learn Swing. I am lucky to live in Brittany where there are many beautiful landscapes: I enjoy hiking near the coast and appreciate the seaside and the nature. Last but not least, it's always a pleasure to be surrounded by friends and enjoy their company.

## Dissemination/News

### **A**rchitecture meeting—Krakow—October 2017

A EurValve architecture meeting took place in Cyfronet AGH following the CGW 2017 Workshop. The CGW Workshops, which were initiated in 2001, support the community of researchers, developers, and practitioners who work in the fascinating field of e-Science and distributed computing infrastructures, including grids and clouds.

Members of EurValve presented a number of papers including a keynote lecture at the CGW (available on the EurValve website) and also discussed updates to the service system (MEE) and migration from Infrastructure to Standalone DSS.



### The Solution

Computational  
Medicine

• Unlimited Capacity





# EurValve Information

**Project title** EurValve—Personalised Decision Support for Heart Valve Disease

**Project Number** 689617

**Total cost:** €4 998 012,51

**Start date** 01/02/2016

**End Date:** 31/01/2019

**Coordinator** The University of Sheffield

## Partners



Find out more about EurValve

On our website:

[www.eurvalve.eu](http://www.eurvalve.eu)

WWW

Or follow us on:

Twitter

and

LinkedIn



## Contact

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