QUICOM Newsletter Issue #03, 02/2015

# QUICOM

## Quantitative Inspection of Complex Composite Aeronautic Parts Using Advanced X-ray Techniques

## Focus on Phase 2

Phase 1 is now completed, during which the detailed specifications were defined including industrial needs, samples and conventional NDT data as well as the required techniques and software modules. QUICOM is now fully focused on Phase 2, the development of individual methods and techniques for different application areas, as well as their evaluation and validation.

A major achievement within this period is the intermediate evaluation, in which the QUICOM consortium successfully presented the degree of fulfilment of the project objectives, the current state of the project's work plan and deliverables, the scientific quality and strategic decisions with regard to the project objectives, the continued relevance of the objectives and breakthrough potential with respect to the scientific and industrial state of the art, the achieved impact (and the potential impact after the lifetime of the project) in scientific, technological, economic, competitive and social terms (where relevant) and the plan for using and disseminating the knowledge.

## Get Involved

There is still the chance to join the industrial interest group of the QUICOM project. Feel free to apply for joining the QUICOM Industrial Interest Group and get access to more detailed information on the QUICOM project and its results. Get in contact with: c.heinzl@fh-wels.at

## Research and Development Achievements M1-M24

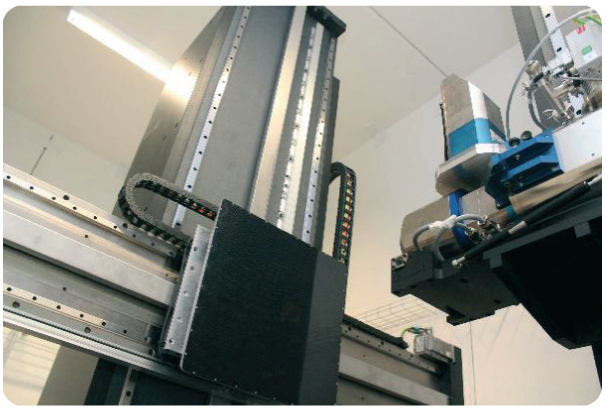
Currently all RTD work packages are pushing hard to achieve the targeted QUICOM technology platform which will contain novel, non-destructive, fully 3D, highly detailed, fast and economic techniques based on cutting edge X-ray computed tomography methods for non-destructive structural and material characterization of aeronautic CFRP components. and tested on the samples of the industrial end users.

Especially the extraction and quantification of porosity, delamination, inclusions, cracks and other voids in CFRP materials has been focus of research.

Regarding Phase 2 of the QUICOM project plan, WP3 was the first work package to be finished. In WP3 optimized micro-scale and meso-scale material characterizations have been developed, evaluated and tested on the samples of the industrial end users. Especially the extraction and quantification of porosity, delamination, inclusions, cracks and other voids in CFRP materials has been focus of research.

In WP4 X-ray based imaging techniques for the production integrated inspection of defects in small high volume parts were investigated and first activities on the simulation of specified test scenarios were carried out. 2D and 3D X-ray imaging techniques have been applied, advanced and evaluated on the end user's samples. On-going studies focus on the investigation of dual and multi-energy techniques as well as artifact removal.

WP5 addresses the development of reliable methods for the inspection of composite metallic parts. Supported by XCT simulation, optimal scanning parameters for dual energy CT (DECT) scans are determined and the generated DECT scans proved to be suitable for the identification of pores in the metal core of the CFRC specimen. Current and future work focuses on dual energy CT experiments for the decomposition of the Carbon and Aluminum component. WP6 examines the application of X-ray CT techniques to scan complex and large components. First activities focused on the simulation of specified test scenarios. Using a RobotCT setup further simulations and corrections have been carried out in order to generate the first data on the end user's samples. The setup is continuously refined and applied on the enduser's samples.



*View at the vertical and horizontal detector movement axis of the recent CT setup*

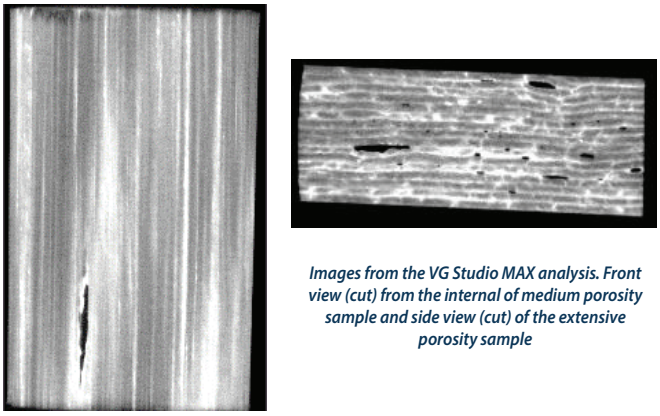


This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement n° 314562

QUICOM Newsletter Issue #03, 02/2015

# QUICOM

## Quantitative Inspection of Complex Composite Aeronautic Parts Using Advanced X-ray Techniques

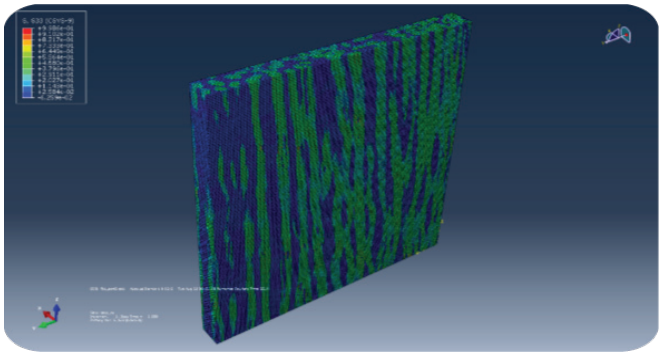


*Images from the VG Studio MAX analysis. Front view (cut) from the internal of medium porosity sample and side view (cut) of the extensive porosity sample*

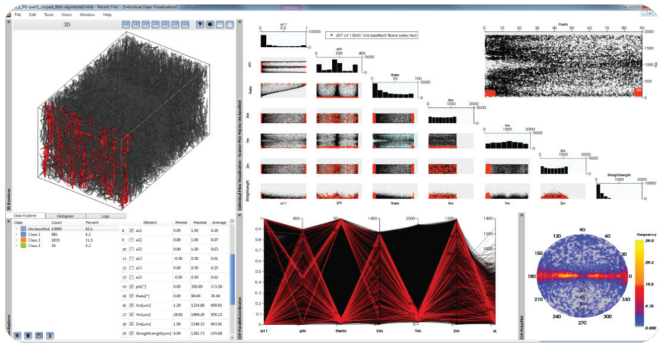
WP7 focuses on the development of algorithms for the quantitative characterization of the inner structure of composite materials, operating on the basis of the XCT data. It aims at the development of reliable and robust methods that will be used for the determination, extraction and characterization of the geometry, orientation and shape of the inner structure in CFRP, towards determining geometrical as well as material properties. Applied techniques examine the determination of surface, detection of pores, orientation of fibers, and more. For example the FiberScout tool allows investigating and exploring 3D XCT datasets of fiber reinforced composites in a simple and fast way.

WP8 focuses on the development and/or optimization of validated CFRP models based on quantitative data analysis of the real inner structures of composite components, taking into account production flaws.

Scanned 3D images were further processed and defects were quantified in order to enable CFRP modelling based on CT input data. In addition a focus lies on the creation of a progressive damage model for the simulation of CFRPs as well as on the evaluation of the developed models.



*Longitudinal stresses in the finite element model of a part of the UD flax/epoxy sample*



*Overview of the FiberScout interface. Top left: 3D Renderer with a GFRP specimen, top right:scatter plot matrix, bottom right: polar plot, bottom middle: parallel coordinates, bottom left: class explorer*

The next big achievement in the project will be to complete the development and evaluation of the different methods and techniques as well as to disseminate and exploit the results generated. Furthermore results will be made available to the Industrial Interest Group. Entering the final year of development, Phase 3 of the project is about to begin.

This final stage includes the demonstration of the QUICOM technology platform on a typical aeronautic component.

For more information on the QUICOM project please visit www.QUICOM.eu

QUICOM Project Website
www.QUICOM.eu

Coordinated by
University of Applied Sciences

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement n° 314562