

**MUSical Instrument-Computed tomography Examination-Standard**

Newsletter 2015/01, March 2015

The research project MUSICES, funded by Deutsche Forschungsgemeinschaft has kicked off on 1<sup>st</sup> of November 2014. Researchers and conservation scientists of Germanisches Nationalmuseum, Nuremberg (GNM) and of Fraunhofer Gesellschaft Institute for Integrated Circuits, Development Center for X-ray Technology (EZRT) in Fürth will develop a standard for the device-independent 3D computed tomography of musical

machinery containing different computed tomographs and peripherals.

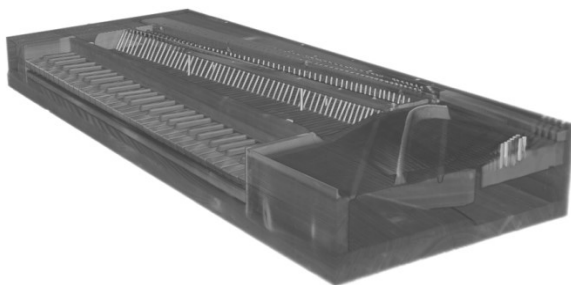
The high energy CT using a linear accelerator (LINAC) in a custom built ample hall serves for the non-destructive examination of large and thick-



*Square piano, Christian Gottlob Hubert, Ansbach, 1787*

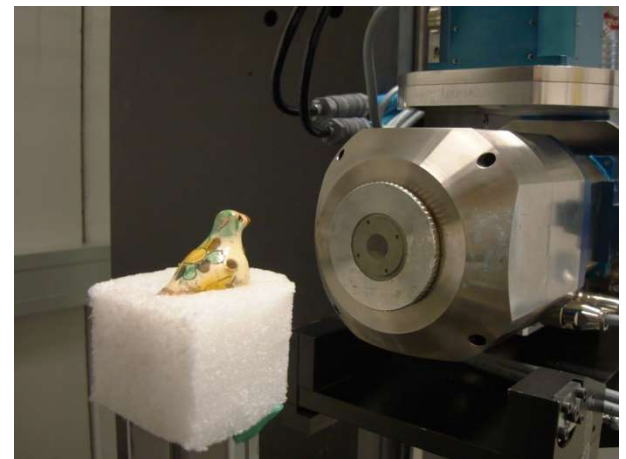
instruments. A best practice guide will contain recommendations for the handling of objects.

The working groups at GNM and EZRT are made up of researchers of different disciplines. Consequently, the starting phase of the project



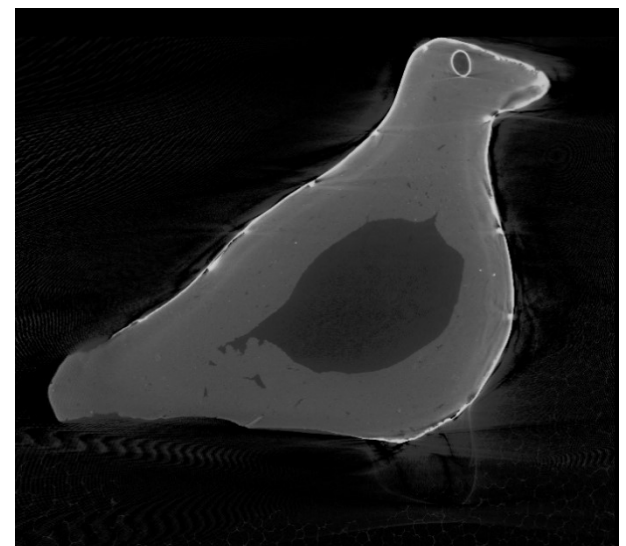
*Square piano Hubert, 3D-CT-view out of XXL-CT*

focused on becoming acquainted with the respective working areas and methods. Colleagues of EZRT visited the considerable musical instrument collection housed in GNM whereas GNM staff learned more about the sophisticated



*Bird-shaped vessel flute, majolica, Italy, prob. 16<sup>th</sup> century, in plastic foam mold; to the right: micro focus X-ray tube*

walled objects such as sea freight containers and cars. This kind of XXL-CT allows for the examination of pianofortes or small portable



*Bird-shaped vessel flute, cross-section out of micro CT*

organs. The examination of a square piano by Christian Gottlob Hubert, Ansbach 1787 (Inv.no. MIR 1145) in February 2015 with a spatial resolution of 600 Mikrometers in all three dimensions was the first of its kind.

During regular project meetings the working program for the first twelve months of the project runtime was refined, and terminological as well as methodological issues were resolved. Musical instrument researchers commonly categorize e.g. recorders and violins according to their mode of sound generation whereas material scientists might consider them as wooden objects with a low mass density and a cavity which should be examined on a Micro CT facility using a defined local resolution. Everyday working language's terms such as "resolution" and "measuring precision" had to be reconsidered, and established ways of thinking had to be readjusted.



*Four 18<sup>th</sup> century recorders in a scalable stand and climate-protective wrapping; to the left the X-ray detector, to the right the X-ray source*

During the preliminary stages of the first measurements, standards concerning conservation practice and documentation were subject of intense discussions, as they will be part of the best practice guide aiming at ensuring optimized workflows everywhere the standard is applied, one main issue being the protection of objects against climatic changes. The turntable of the CT-facility requires a vibration-free mounting that should neither influence the measurement nor violate conservational rules.

The fixing of small objects as a vessel flute made of majolica (Inv.no. MIR 240) with lead glaze was executed as a custom-shaped plastic foam mold.

For medium sized woodwind instruments up to a length of ca. 50 cm, the conservators developed a scalable stand that has been successfully tested with a cluster of four recorders (Jacob Denner, Inv. nos. MI 139 and MI 140; Nicolaus Staub, Inv. no.



*3D-CT view of the cluster of recorders and cross-section of a single instrument*

MI 211; school of Johann Christian Oberlender, Inv. No. MI 138).

The next examinations will be dedicated to stringed bowed instruments with a body width of max. 50 cm in order to conduct tests on the expansion of the measurement field.