



National Institute of Nuclear Physics

and



Alma Mater Studiorum - Physics Department

13 June 2008

Workshop

*Advanced Computed Tomography Systems
for applications in
Industry and Cultural Heritage*

*Physics Department -
INFN (Sezione di Bologna)
Hall 1 (floor -1)
Viale Berti Pichat 6/2
40127- BOLOGNA*

www.xraytomography.com

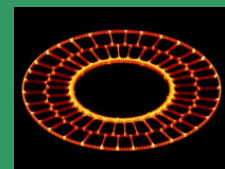
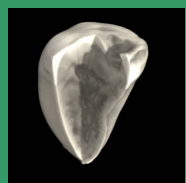
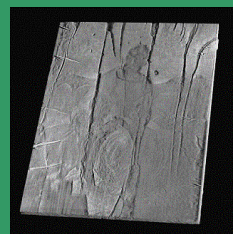
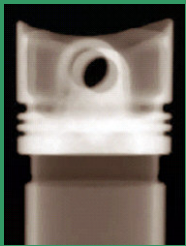
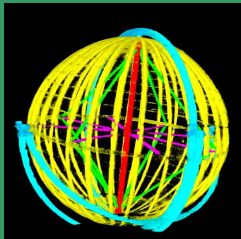
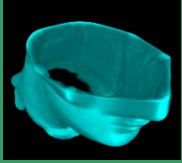
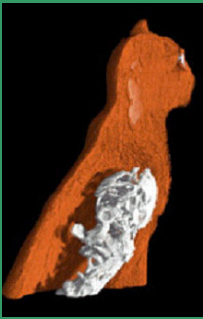
Date: Friday 13 June 2008

Location: Physics Department - Viale Berti Pichat 6/2 - Hall 1 (floor -1)

Contact: Prof. Franco Casali, Tel. +39 051 209 5132 - franco.casali@yahoo.it

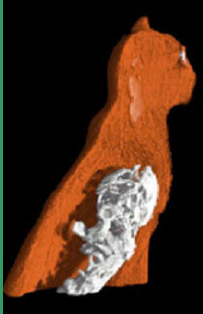
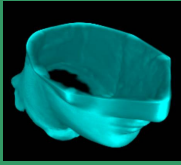
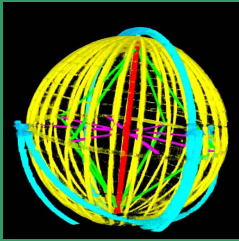
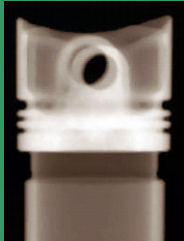
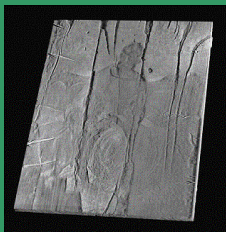
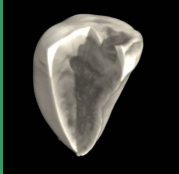
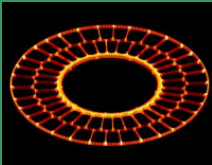

Topic: State of the art technology and devices used in non conventional X-ray Computed Tomography

Invited guests: **Dan Schneberk**, Lawrence Livermore National Laboratory, USA
Alexander Flisch, EMPA, CH





Program

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- 10:00 Welcome and introduction by Franco Casali (UNIBO)
- 10:15 “Evolution and potential of X-ray Computed Tomography for applications in industry and science”, Alexander Flisch, EMPA.
- 11:00 Coffee break
- 11:15 “A review of Medium to High-Energy CT Scanning at LLNL”, Dan Schneberk, Lawrence Livermore National Laboratory (USA).
- 12:00 “Application of computed tomography in cultural heritage conservation: a summary of case studies and experiences”, Matteo Bettuzzi, Department of Physics, UNIBO.
- 12:30 “Industrial development of a medical CT dedicated to teeth”, Alessandro Pasini, Nectar Imaging, CEFLA.
- 13:00 Lunch
- 15:00 Visit to the X-ray Laboratory at the Department of Physics



Abstracts

Evolution and potential of X-ray Computed Tomography for applications in industry and science

Alexander Flisch1, Peter Wyss1, Thomas Lüthi1, Raphaël Thierry1, Alice Miceli1,2, Jürgen Hofmann1

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2 Università di Bologna, Department of Physics, C. Bertini Pichat 6/2, I-40127 Bologna, Italy

Abstract

The demand for industrial computed tomography has increased strongly in recent years. Before, CT was applied rarely as a method for non-destructive testing. In most cases section images were analyzed to define the exact location of a defect in material. With today's advanced computers and the possibilities of 3D imaging of CT data, a wide field of interesting opportunities has opened. Nowadays, industrial computed tomography is not only used for non-destructive testing but also and even more important for metrology. Different kind of industrial computer tomographs are available on the market. To be able to penetrate large parts or samples of high X-ray absorbing materials, in general 450 kV X-ray tubes or in some cases linear accelerators are used. State-of-the-art CT scanners using high X-ray energy are equipped with line detectors and collimators to avoid scattering as much as possible. These so-called 2D-CT systems can obtain only one single slice at a time. For a fully 3D data acquisition multiple contiguous slices have to be scanned. This process is time consuming and expensive. During a recently finished European research project, in collaboration with the University of Bologna, a prototype of a new generation of CT scanners has been installed at Empa. The new tomograph uses a large area detector. A volume can be scanned with only one rotation of the sample. The contribution gives an overview of the evolution of industrial X-ray CT and its potential for applications in industry and science. It describes problems of data acquisition, especially when using high X-ray energies and presents also first results with the new research prototype.

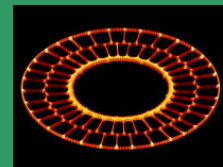
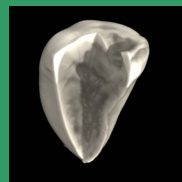
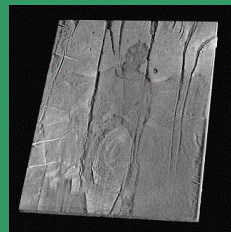
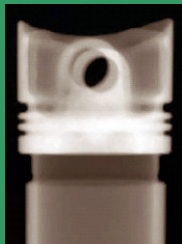
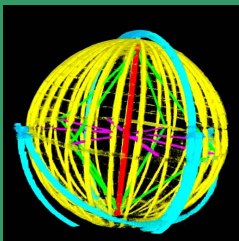
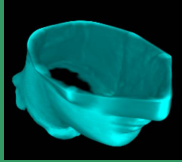
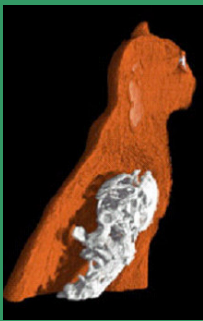
A review of Medium to High-Energy CT Scanning at Lawrence Livermore National Laboratory

Dan Schneberk1, A.J. Koshti2, Harry Martz1, Jim Trebes1, Gary Stone1, Roger Perry1

1 Lawrence Livermore National Laboratory e-mail: schneberk1@llnl.gov
2 NASA Johnson Space Center, Houston, TX

Abstract

At LLNL we have employed our in-house configured DR/CT systems for inspecting a variety of objects and assemblies for NASA, UC Davis Geology Dept., objects of interest to LLNL, and marble samples related to the scanning of Michelangelo's David. Two different types of area detectors have been used to scan these objects; systems which include Amorphous Silicon or CMOS panels, and systems which include camera-scintillator detectors. These two different types of scanners have been fielded at three different energy regimes: low-energy micro-focal scanning (30-225 kVp), medium-energy scanning (60-450 kVp), and high-energy scanning (2-15 MeV). Data from all systems are processed and reconstructed with Feldkamp cone-beam techniques, implemented on single processors, or distributed over clusters of computers. In this talk we describe salient details of scan technique and analysis of the data to support inspection of the objects.





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Application of computed tomography in cultural heritage conservation: a summary of case studies and experiences

M.Bettuzzi, F.Casali, M.P.Morigi, R.Brancaccio, A.Berdondini, V.D'Errico

Department of Physics of the University of Bologna

Abstract

X-ray Computed Tomography (CT) is a complex technology. It is well known in medicine, but it hasn't yet shown its full potential in cultural heritage conservation. The researchers at the Department of Physics, University of Bologna, have developed, over a couple of decades, expertise in non-standard systems for X-ray CT and they worked to use this know-how in the investigation of valuable works of art. Two main goals have been reached in recent years: to allow conservators to investigate, by means of this powerful methodology, a class of objects previously excluded, and to bring the CT instrumentation inside museums and restoration centers. Our experience in development of CT systems for diagnostics of cultural heritage will be reported and a number of case studies will be presented.

Industrial development of a medical CT dedicated to teeth

Alessandro Pasini

Nectar Imaging, CEFLA

Abstract

