The mission of the Washington State University High-Resolution X-Ray Computed Tomography Laboratory (WAX-CT) is to promote the advanced microstructure characterization, simulation, and design of solids, including metals, ceramics, geological, and biomaterials. WAX-CT actively collaborates on research and teaching with local as well as international academic institutions and industries to support its mission.

FACILITY

Computed tomography provides non invasive, three-dimensional characterization and visualization of microstructural features within the interior of opaque solid objects. The FlashCT™ (Flat-Panel Amorphous Silicon High-Resolution Computed Tomography) scanner at Washington State University is based on a system developed by HYTEC Sensors and Imaging Group, Inc. as part of a cooperative research and development agreement with Los Alamos National Laboratory in the mid-1990s. The scanner facility was established with grant support from the Geomechanical and Geotechnical Systems division of the National Science Foundation and the Murdock Trust Foundation with matching funds from the University.

FlashCT is an advanced, high-speed, industrial, X-ray-based, 3-D scanning system for nondestructive testing and evaluation. Developed as an area detector scanner employing flat-panel amorphous silicon arrays, FlashCT is suitable for use within a wide spectrum of X-ray energies and geometric magnifications. Washington State University's FCT-4200 is a novel design that incorporates both an X-tek 225 kV microfocus X-ray source for material characterization at high magnification and a Pantak/Seifert 420 kV X-ray source for larger component analysis housed in a single radiation cabinet enclosure. The detector is a Varian PaxScan 2520 with CsI scintillator. With the wide energy spectrum and high magnification available, the FCT-4200 can image a large variety of sample shapes, sizes, and densities. The operator can switch between X-ray tubes in a matter of minutes by simply moving the 225 kV microfocus tube in (or out) of the beam path and selecting the corresponding system on the selector switch located on the electronics panel. The FlashCT data acquisition software is independent of X-ray source, hence it requires no setup to change between sources.

SCANNER SPECIFICATIONS

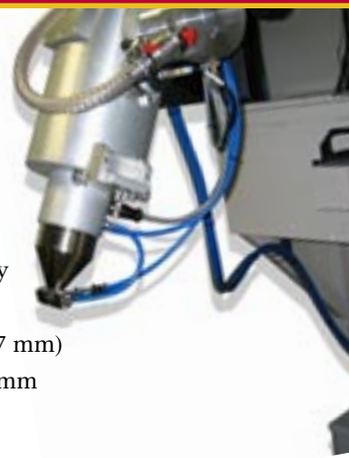
PANTAK/SEIFERT 420 KV X-RAY SOURCE

Model: ISOVOLT HS-420/5
Maximum Operating Energy: 420 kV
Focal Spot Size EN12543 (IEC336):
3.00 mm (1.5 mm)/1.60 mm (0.8 mm)
Maximum Power: 2240 W / 960 W
Tube Current at Max kV:
5.3 mA / 2.3 mA

X-TEK 225 KV MICROFOCUS X-RAY SOURCE

Model: MF-225
Maximum Operating Energy: 225 kV
Minimum Focal Spot Size: 5 µm at 60 watts
Maximum Power: 225 watts
Tube Current: 0.1 to 2 mA (non continuous)

VARIAN PAXSCAN X-RAY DETECTOR



Model: PaxScan 2520
High-kV Format
Detection Medium:
Amorphous Silicon (a-Si)
Scintillator: CsI grown directly on a-Si array
Pixel Spacing: 0.005 inch (127 mm)
Limiting Resolution: 3.94 lp/mm
A/D Converter: 12 bits

HYSIG MANIPULATOR SUBSYSTEM

The system enables the object to be rotated for scanning by high-accuracy stages and computer-controlled micro-stepping motors. The system has six axes of motion. The three axes in the horizontal plane are used to change the source-to-object and detector distances and manually operated. In addition, there are three computer-controlled axes available; one that positions the object left and right, one that moves up and down in front of the detector, and the third that rotates the object, respectively. The third axis is the only one in motion during acquisition of a CT data set in this third-generation (rotate only) CT scanner.

SOURCE-TO-DETECTOR DISTANCE:

Variable from 12 to 76 inches (30 to 193 cm)
Maximum Object Diameter: 8 inches (20 cm)
Maximum Object Height: 18 inches (46 cm)
Minimum Rotational Movement: 0.001 degrees

RESEARCH ACTIVITIES

The major thrust of research activities at WAX-CT is the characterization and modeling of microstructure and defects in solids and structures. The three-dimensional topology of defects (such as cracks and voids) and microstructure (such as grains and particles) in crystalline and geological materials can be constructed via computed tomography and understood in terms of material fundamentals and characteristics. Current studies include the development of advanced theoretical

models for the prediction of deformation, fatigue, strain localization, liquefaction, and fracture processes in materials. The following is a list of current research activities:

- Damage detection and life analysis of composites
- Damage detection in rapidly solidified materials
- Bifurcation and instabilities in geomaterials
- Powder metallurgy and hard materials fabrication for petroleum industry
- Modeling grain-shape anisotropy in multi phase alloys
- Evaluation of remodeling of cancellous bone and design of blended polymer
- Granular dilatancy
- Modeling of grain boundaries in crystalline materials
- Deformation and damage in irradiated materials
- Localization and damages in metals under cyclic fatigue
- Anisotropic hydraulic behavior of soils

EDUCATIONAL ACTIVITIES

WAX-CT activities promote distance learning and research through the Internet for meetings and for conducting "long-distance," real-time experiments where researchers conduct the experiments, collect, and process data from their own computer terminals. The laboratory also offers workshops on the principles and uses of computed tomography. WAX-CT welcomes opportunities for exchange of scientists, faculty, and students.

SCANNING SERVICES

The primary purpose of this facility is to provide accessible, quality, high-resolution scanning services for the scientific and industrial community. Many local and international institutions collaborate with WAX-CT researchers through faculty and student exchanges. The list includes:

- Conservatoire National des Arts et Métiers (France)
- Chungnam National University (Korea)
- Ecole Polytechnique Federal de Lausanne (Switzerland)
- Georgia Institute of Technology (United States)
- Instituto Universitario de Tecnología (Venezuela)
- Kitami Institute of Technology (Japan)
- Kobe University (Japan)
- Lousiana State University (United States)
- Michigan Technological University (United States)
- Pacific Northwest National Laboratories (United States)
- Riso National Laboratory (Denmark)
- Texas A&M University (United States)
- Universidad Autonoma de Nuevo Leon (Mexico)
- Universidad Nacional de Rosario (Argentina)
- University of Cape Town (South Africa)
- University of Idaho (United States)
- University of Minnesota (United States)

The cost of scanning services has been established by Washington State University. The charge per hour depends on the project type. Charges for projects funded by federal grants and those a Washington State University collaborator are significantly lower and receive preferred scheduling. WAX-CT can provide a limited number of free test scans to justify its use or help obtain funding for detailed study. Please contact us for additional details.

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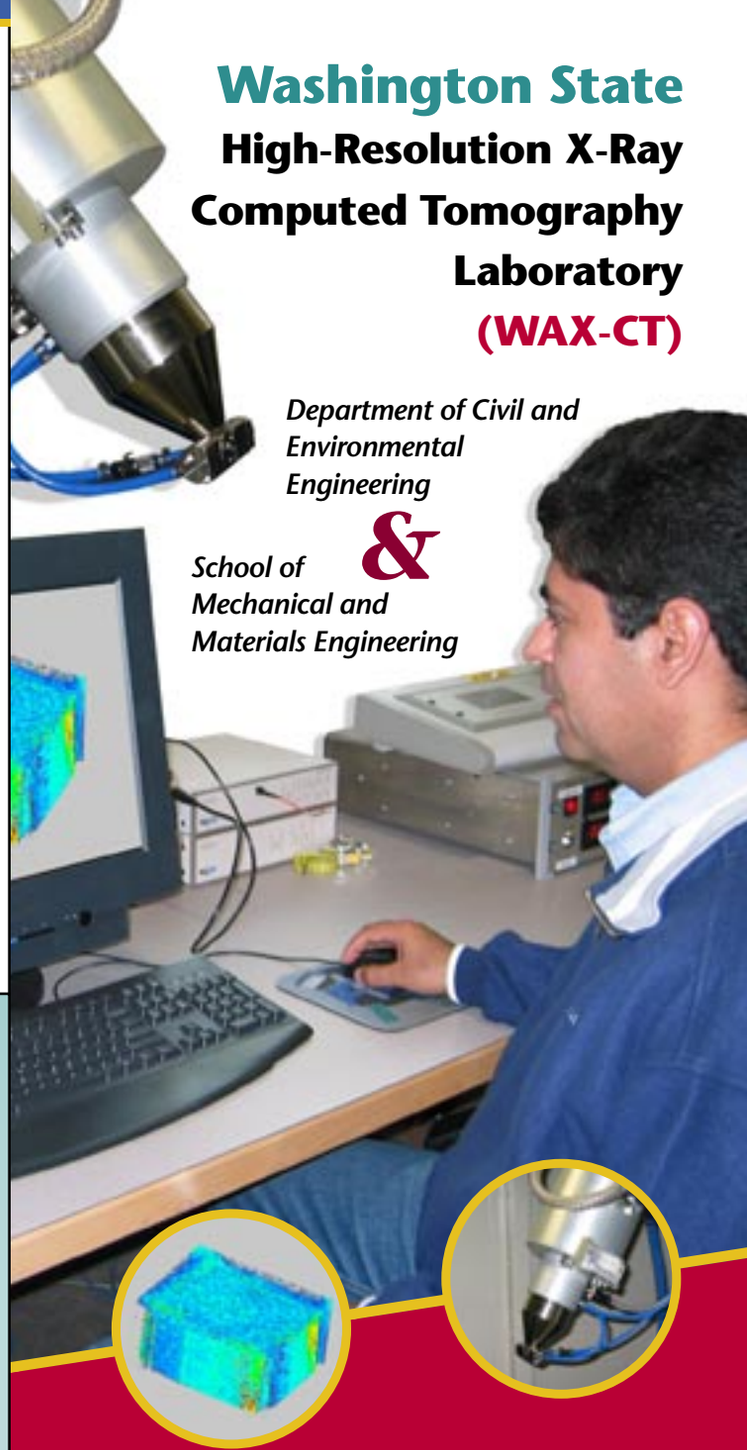
Washington State High-Resolution X-Ray Computed Tomography Laboratory (WAX-CT)



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