CT Scanner
CAF Central Analytical Facilities
STELLENBOSCH UNIVERSITY

CT News Issue 6

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Recent interesting scans (clickable links)

CT inspection of casting
http://blogs.sun.ac.za/ctscanner/2013/11/25/casting-ct-inspection/

Nondestructive analysis of microchip
http://blogs.sun.ac.za/ctscanner/2013/11/25/electronic-microchip/

3D microscopy of a vine leaf
http://blogs.sun.ac.za/ctscanner/2013/11/25/vine-leaf/

Characterizing sweet potato powders
http://blogs.sun.ac.za/ctscanner/2013/11/25/characterizing-sweet-potato-powders/

Contact Us

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Find us on "Science Exchange" (satisfied customers, please endorse us!):
https://www.scienceexchange.com/facilities/ct-scanner-at-central-analytical-facilities

Welcome

CT Scanning, Computed Tomography, X-ray microscopy, X-ray tomography, MicroCT, Industrial CT, 3D scanning … all terms to describe the limitless capabilities of this amazing technology we offer to you as a service. This newsletter is the last of 2013, we hope you enjoy it and send it on to your colleagues. Have a blessed Christmas and we look forward to working together in 2014 !

More info such as previous newsletters and many more examples can be found at **www.sun.ac.za/ctscanner**.

People & News

An informal farewell was held recently for Olwethu Majodina, NRF intern at the CT scanner unit. Olwethu made a large contribution to the unit and will be missed. We wish him the best in his career moving forward!

Olwethu Majodina (right) receiving a token of appreciation from Dr Anton du Plessis for his contribution as NRF intern at the CT scanner Facility

The CT Scanner Unit shared the prize for best CAF unit in 2013 with the SEM unit. Finally, Anton made an invited presentation at the annual Additive manufacturing of Titanium Parts seminar held in Golden Gate Highlands. The presentation can be viewed here:

http://www.rapdasa.org/docs/Ti%20Seminar%20Oct%202013%20A%20du%20Plessis.pdf

Application of the month:
Nondestructive testing of metal or plastic parts

Nondestructive testing of any component or part is simple. Step 1: CT scan the object. Step 2: Make slice images. Step 3: Analyze slice images (jpg, tiff, etc).

Figure 1 shows a locally produced vehicle Cam Cover (Al alloy). The 3D view is shown with a surface view as well as a transparent view, with some large defects coloured in blue (in the middle). These are voids due to an imperfect casting process. For client self-analysis slice images are produced (eg. 1000 images at a spacing of 50 micrometers). One such slice image is shown with red circles indicating defects.

Normal X-ray inspections can identify some of these voids but the power of CT is the high contrast and ability to see detail such as much smaller defects and the connectivity of defects, as well as the exact location, which can indicate if certain voids could be problematic or not.

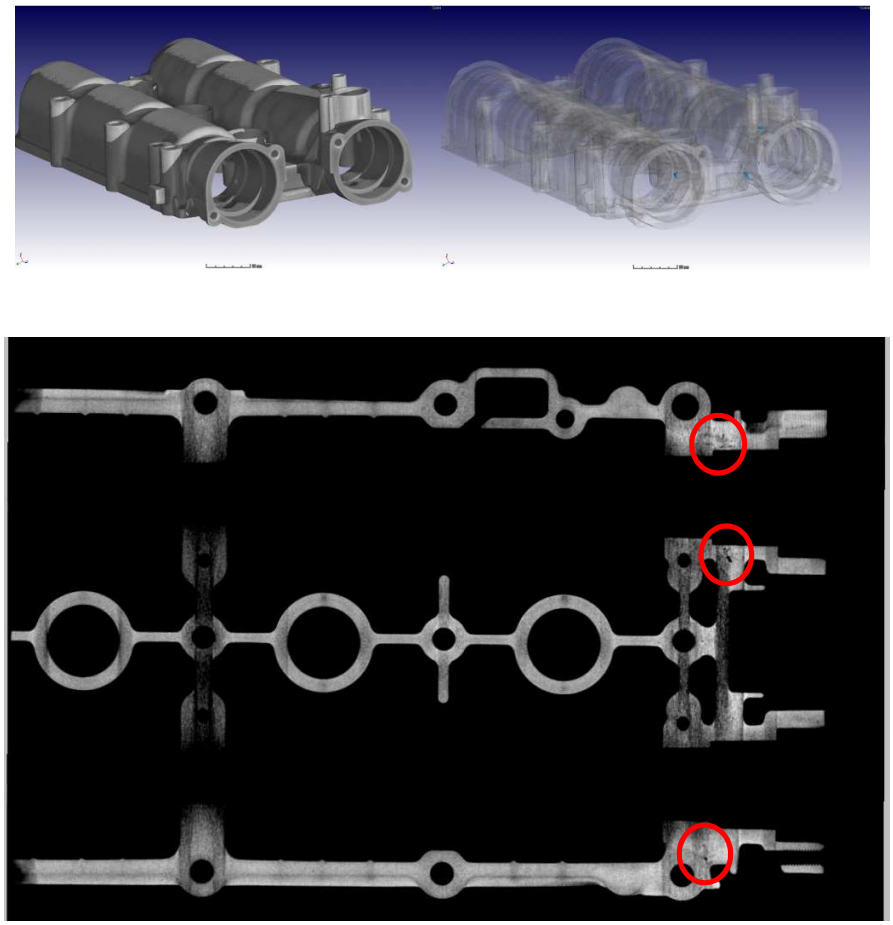


Figure 1: (top left) Cam Cover 3D surface view (top right) Transparent 3D view with selected defects in blue, and a slice image with some defects indicated (bottom).

Collaboration project: Sweet potato powders

In a proof of concept study with the University of Venda's Prof Henry Silungwe, some interesting possibilities of 3D analysis in Food Science research is demonstrated. In this project, 4 varieties of sweet potatoes from two growing sites were compared to see what differences might be attributed to the site conditions. The figures show Prof Henry and the comparison of sweet potato powders of the Bophelo cultivar: the Univen site has smaller average particle sizes. We hope this is just the start of a good research collaboration

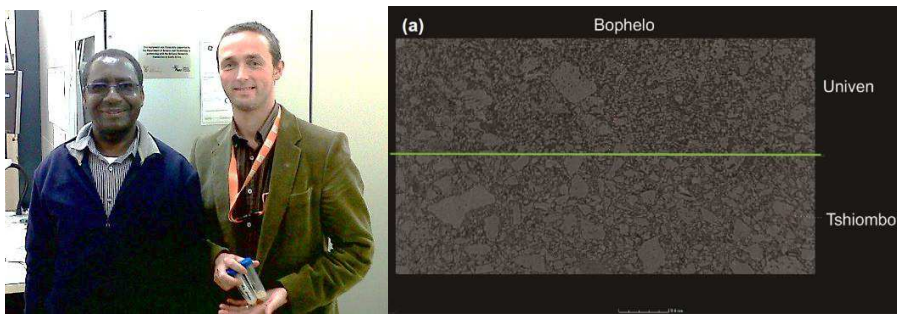


Figure 2: Prof Henry Silungwe (University of Venda) at the CT Scanner (left) and some preliminary results from sweet potato powders (right).

Special offers

We welcome commercial clients at academic rates from today until the 15th of December 2013. That means all customers pay R500 an hour.

Please support our advertiser – see advertisement in the next pages – more information at
http://www.zeiss.com/xrm
Local contact / representative:
Veno.naidoo@zeiss.com

X-ray microscopy workshop to be held early in February at Zeiss Johannesburg Office, watch this space for more info soon!

Services

We offer fast-turnaround routine non-destructive testing services as well as interactive scan and analysis sessions. Our pricelist and service offering will be updated for 2014 to include many detailed options for all the different types of clients we serve, these will include:

Outlook calendar CT bookings for local academics

Outlook calendar Analysis and Assisted analysis bookings

All-inclusive per-scan flat rate for routine scans

Month and Year Pass for post-grad students (including scans and analysis)

1-day Training

VIP service agreement – up to 10 scans per month any time, 24 hr turnaround guaranteed (top priority)

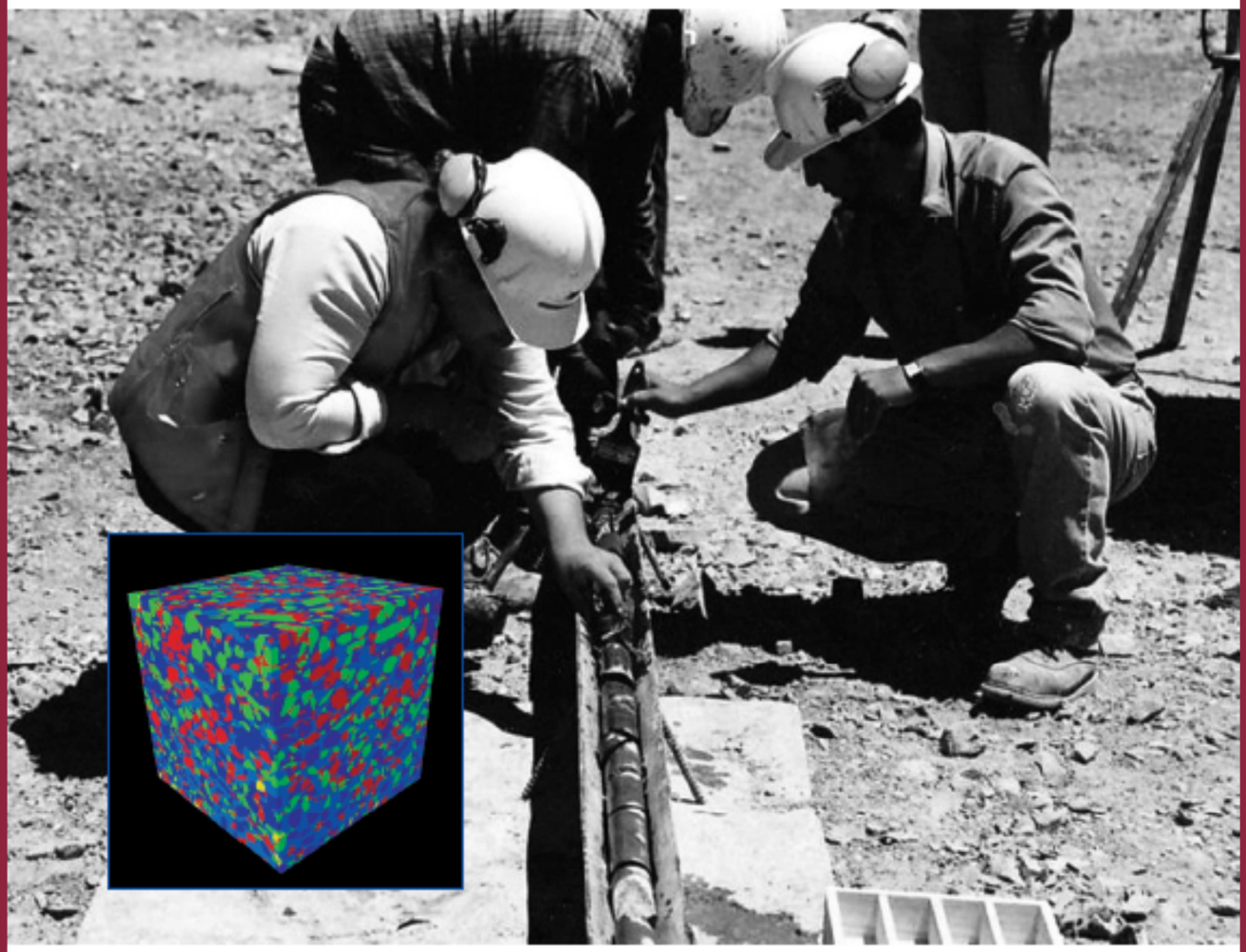
Normal X-ray Images – immediate results (less than 5 minutes)

Watch the website for detailed pricing information soon.

Acknowledgements

The CT scanner equipment acquisition was made possible with grants from the National Research Foundation and Stellenbosch University. The Department of Science and Technology Internship program is also acknowledged for its support of this facility. We encourage and welcome any form of sponsorship or support in order to keep delivering the best quality.

Natural Resources Solution



Mineral Processing with 3D X-ray Microscopy

Precious Metals, Base Metals, Industrial Metals and Coal

ZEISS

We make it visible.

Mineral Processing with 3D X-ray Microscopy

Precious Metals, Base Metals, Industrial Metals and Coal

Author: *Carl Zeiss Microscopy GmbH, Germany*

Date: August 2013

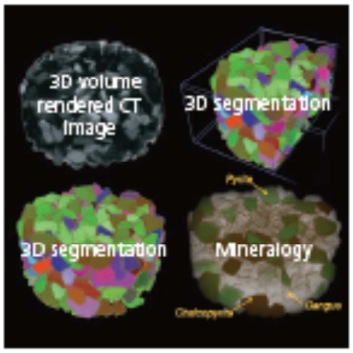
3D X-ray microscopy (XRM) is an emerging complementary method to 2D SEM-EDS techniques for volumetric analysis at submicron resolution of mining ores. This tomographic technique achieves rich statistics on exposure and particle damage, providing basic mineralogical discrimination that opens up a wide range of application possibilities.

The possibilities for providing improved analytical information cross much of a mining site's lifetime. The opportunity exists for rapid 3D characterization of ores for geometallurgical composition during exploration, inspection of plant feeds in comminution and flotation circuits, and ore characterizaton for exploration in addition to liberation analysis of precious metals in tailing and heap leaching operations. This non-destructive X-ray tomographic technique does not require complex preparation of polished sections typical of SEM-EDS techniques. XRM complements existing techniques by providing 3D information of multi-phase particles—texture, size, distribution and mineralogy—using significantly larger volume statistics within a much shorter turn-around time.

Unique advantages of XRM in mineral processing

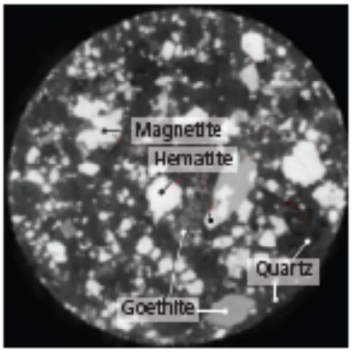
- Rapid 3D mineralogy and liberation analysis
- Minimal sample preparation
- Large volume statistics for high resolution characterization of tailings (PGMs, Au, Ag, Cu)
- Dual energy for mineralogical distinction between common mineral pairs such as chalcopyrite and magnetite or galena and platinum
- Particle damage assessment during comminution for assessment of high pressure grinding rollers (HPGR)
- Non-destructive measurements of grain dissolution over time during heap leaching
- Coal washability analysis
- Correlate to SEM-based mineral analysis

Mineralogy

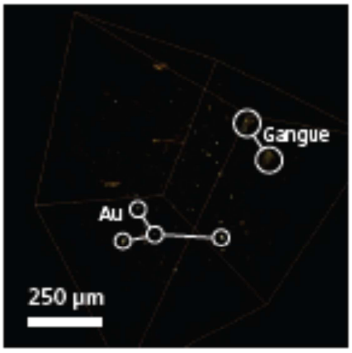


3D segmentation and characterization of Cu ore. Samples scanned in a packed particle bed, 5 mm in diameter. > 30,000 multiphase particles can be analyzed rapidly.

Chalcopyrite	*0.49%*
Pyrite	*12.75%*
Gangue	*86.76%*



Low grade iron ore. CT slice showing discrimination of valuable metal ore (Fe_2O_3/Fe_3O_4) versus Goethite (FeO(OH)) and Quartz (SiO_2) (Particle size range ~ 0.3mm + 0.1 mm, Image Field of View: 5 mm)



Rapid detection of Gold, Silver, or Platinum Group Metals (PGMs). Feed, Concentrates or Tailings. Large number of particles can be scanned in 3D to detect valuable phases. Image: Scanning for Au particles (bright particles) in 3D at 1 µm voxel within a 3 mm packed bed tube

ZEISS Xradia Versa 3D X-ray Microscopes for Mineralogy

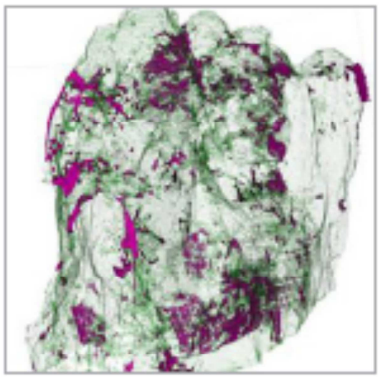
Xradia Versa 3D X-ray microscopes operate on the principle of computed tomography, similar to those used in medicine for human body scanning, by taking X-ray radiographs of a sample at a number of rotational angles. However, unlike conventional medical CT, industrial CT or desktop microCT, which use a simple geometric magnification principle to achieve resolution, Xradia Versa solutions rely on an architecture that is derived from technology originally developed for synchrotron radiation facilities. They feature a unique two-stage magnification imaging technique based on proprietary detector and optics that enable <0.7 µm spatial resolution (<150 nm voxel) on relatively large samples.

In addition, ZEISS Xradia Versa optics employ advanced contrast mechanisms that uniquely allow for the discrimination of valuable mineral phases from the gangue materials.

The DSCoVer module on ZEISS Xradia 520 Versa uses dual energy information to distinguish between minerals with similar X-ray attenuation such as platinum and galena (in PGMs) and chalcopyrite and magnetite (in certain Cu ores). Enhanced contrast capabilities on the XRM also enable difficult-to-image internal fracture networks, optimizing comminution processes.

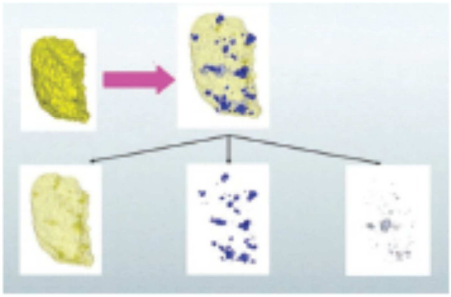
X-ray microscopy volumetric datasets enable a large number of particles in 3D to be rapidly characterized. XRM studies provide 3D liberation and exposure analysis, volumetric particle shape analysis for minerals that are virtually identical in X-ray absorption such as hematite and magnetite, and grouped mineral classification.

Comminution



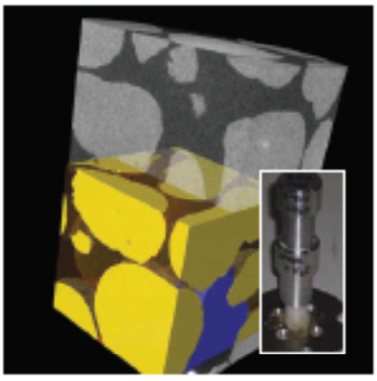
Comminution & Particle Damage Assessment. The understanding of fracture networks within particles can determine the energy required for comminution and predict the efficacy of liberation techniques, as fracture networks provide pathways for leachants and flotation chemicals to reach interior locked particles. With high resolution X-ray microscopy, detailed 3D analysis of fracture networks can be performed before and after comminution to establish fracture mechanisms: transgranular random breakage or preferential breakage (Garcia 2009).

Flotation



Exposure Analysis in 3D for Mineral Liberation. With XRM and software, 3D analysis enables the determination of Size Fraction vs Locking Class over a large number of particles (Miller et al; SME 2009).

Leaching



In situ Observation of Particle Dissolution. Due to the non-destructive nature of X-rays, particles within a mini leaching cell can be repeatedly monitored over time and under environmental conditions as to their dissolution behaviors during leaching (Kodali 2011).