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The Open_Cut Project - An Interest Group Concerned With Older Ultramicrotomes That No Longer Have Original Vendor Support.

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Nearly every modern ultramicrotome ever built was a mechanical marvel—a high-quality piece of hardware capable of providing decades of excellent service with nothing more than routine maintenance. Some of those decades have now passed and it is becoming increasingly difficult to find parts and service vendors for these older instruments. Some of the original vendors no longer exist, and others have changed ownership or focus. It is understandable that some vendors have dropped support for the older microtomes in favor of supporting their more recent models. Nevertheless, the older microtomes that have been properly treated still have a great deal of potential life remaining, typically needing only regular cleaning, lubrication, adjustment, new belts, and shock-mounts to allow them to continue their work.

There is another issue for the mid-evolution ultramicrotomes: electronics. The early microtomes such as the Sorvall MT-1 were entirely mechanical: hand cranked and with a gear-driven specimen thickness control. The next phase incorporated a motorized drive for cutting (Sorvall MT-2, Reichert OM-U2) with only the simplest electronic controls; specimen advance remained either the simple clockwork or a thermal advance. The A-O Ultracut represented a next step, still a clockwork advance, but with an electronic servo-motor drive system to provide very smooth independent control of the cutting and return strokes and the cutting window. Model features evolved to yield units like the Ultracut-E, adding stepper motor specimen advance accuracy to the servo-motor cutting drive systems, and these had considerably more complex electronics - sophisticated for their day.

There were regular postings to the Microscopy List on issues of support for the older microtomes - people seeking service vendors, or with dead or missing electronic control units. I was the recipient of a tip from the list for an excellent aftermarket service vendor in my area for the A-O Ultracut and Reichert Ultracut-E, both "abandonware". I became aware that there are many others in a similar situation, although some have not yet realized it. Sometimes a new person is hired into a facility and finds that they have an older model ultramicrotome, no budget for a new one, and no idea where to get it serviced. Even if someone replaces an older unit with a new ultramicrotome, I wanted to get the word out that some of these older models are very desirable, have value, and should not be scrapped.

To the end of organizing a forum dedicated to these older ultramicrotomes, I initially posted to the Microscopy Listserver the creation of a Google Group, the "Open_Cut Project" for people concerned with older Ultracut units to share information. Due to a number of requests we have expanded it to include older ultramicrotomes of all types. We will maintain a list of vendors known to work on the older ultramicrotome units, have discussions of support issues, share knowledge of maintenance and sources of supplies. Other topics of interest to ultramicrotomists are also welcome. I am working on documenting the electronics and functional "states" of the Ultracut and Ultracut-E in a way that would assist repair or replacement of the electronic control box should that be necessary. I am working on developing a retrofit lighting design for the Ultracuts using high-brightness white LEDs so we can get away from the mercury-containing fluorescence lighting units. I have found antistatic units essential for routine ultramicrotomy and have uploaded some information on antistatic devices and technology. Any things of this sort that can be freely shared are welcome.

For those not familiar with it, Google Groups supports discussion threads, "pages" (essentially like webpages), and upload/download of files. Members can manage their profile to allow email notices of messages or just check on things by logging in. The Open_Cut Group is set as a "private" group—does not show up in a search of Google Groups and requires an invitation (invitation can be requested—it is open to anyone) to provide some safety to the Group operations. There is a public web page with information about the Open_Cut Project at: http://people.umass.edu/dac/projects/Open_Cut/

Or send an email to the group: mailto:open_cut_project@googlegroups.com and you should receive an invitation to join. ■

Determining the Relationship Between the Diameter of an Objective Aperture and Its Subtended Angle

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We generally concern ourselves with the semi-angle of an aperture -- that is, the angle between the optic axis and the edge of the aperture (noted as 2Θ in the figure) rather than the full angle subtended by the aperture diameter.

The subtended semi-angle (in radians) of the objective aperture is the radius divided by the focal length of the lens (*f*). Actually it is the tangent of the angle, but we're talking about small angles here where approximately tan (a) = sin (a) = a.

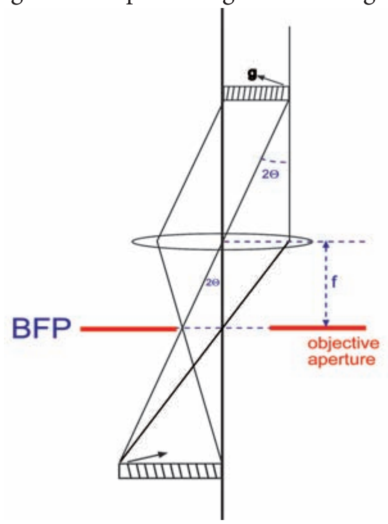
To determine the subtended angle of an aperture, you need to use a sample with a known crystal structure and lattice parameter. Two common materials are aluminum and gold. For polycrystalline samples, the first diffraction rings will have d-spacings of

	Al	Au
(111)	2.338	2.355
(200)	2.035	2.039
(220)	1.432	1.442
(311)	1.221	1.230

Just use Braggs law ($\lambda = 2d \sin(\Theta)$) to calculate the diffraction angles for your electron energy. In our case, we can use the small angle approximation and replace sin(Θ) with Θ. So, if we know λ and we know d, we can solve for the diffraction angle.

Accelerating voltage	Wavelength
100kV	0.037Å
120kV	0.0335 Å
200kV	0.0251 Å
300kV	0.0197 Å

To measure the subtended angle of an objective aperture, record the diffraction pattern both with and without the aperture. You can calibrate the angle of the aperture against the ring radii.



With a known aperture and a standard diffraction pattern, you can also calculate the focal length of the lens. You use the aperture size to calibrate the physical radius (in µm) of the diffraction ring at the BFP (back focal plane). Knowing the ring radius, and the diffraction angle, you can calculate the value of *f*, the lens focal length.

A quick way to make a calibration sample is to take a formvar coated TEM grid and put it into an SEM Au sputter coater. Put down a fairly heavy coating and you should have a good polycrystalline Au calibration sample. Be sure you use a pure Au target rather than a Au/Pd target, your d-spacings will be different with the Au/Pd. ■

Post-Doctoral Research Fellow Soft Materials EELS Imaging

Stevens Institute of Technology

Hoboken, New Jersey

Stevens Institute of Technology seeks to fill a post-doctoral position to lead research in the area of spectroscopic imaging of soft materials in the scanning transmission electron microscope (STEM). The principal project centers on the development and application of advanced electron-optical methods for mapping at high resolution the spatial distribution of solvents in both synthetic multiphase polymers and physiological materials. Of particular interest is the high resolution mapping of water in biological tissue and the role that differences in nanoscale water distribution play on transport processes such as drug delivery. The project will be centered at the Stevens Laboratory for Multiscale Imaging (LMSI) but will involve extensive collaboration with partnering laboratories in the greater New York Metropolitan area. The LMSI is a 3000 sq. ft. multiuser and multidisciplinary laboratory housing an analytical FEG TEM/STEM, a FEG SEM, a confocal microscope, and an AFM, among other instruments. More information can be found at: www.stevens.edu/hydrogel/libera/research/LMSI/LMSI.html.

Qualified candidates will hold a PhD in either a physical or a life-science discipline. Applicants must have extensive experience with transmission electron microscopy and will preferably have additional experience with electron energy-loss spectroscopy (EELS) and cryo-TEM techniques. Applicants must further have sufficient computer-programming skills, in for example MatLab or C, to independently develop and apply data-analysis algorithms as needed. Depending upon the availability of funds, this position is anticipated to begin on 1 January, 2009 and run for two years. Interested candidates should submit by email, with the subject heading of EELS POST DOC, a detailed resume that includes a clear description of the candidate's experience with transmission electron microscopy as well as the contact details of at least three references to Ms. Nancy Webb at Nancy.Webb@stevens.edu.