GenISys Newsletter

GenISys GmbH

Keep up-to-date on GenISys Software Products | **1/2019**

Editorial

Customer care is an essential aspect of GenISys' corporate culture. Pre-sales highly technical advice, and after-sales support are priority issues for GenISys.

With every new license GenISys provides a one year Software Update & Support Service after delivery and installation. The service offers:

- Update of GenISys software to the latest version including all bug fixes, new features and enhancements released in the service period. Major software updates are generally biannually with minor patches between as required. Feature development and improvement is supplemented by User input. Most of the major features in todays GenISys products are based on User requests, keeping the software always at the "leading edge" of technology. All Users under contract have access to the latest technology for best lithography.
- Technical support over e-mail, phone and Internet (e.g. screen-sharing), not only in the use of software, but also application support including information and suggestions on specific processes. The global GenISys application support team is actively working with the most advanced nanofabrication centers worldwide, consolidating best practice and having access to a wide range of applications.
- On-site and/or on-line training adapted to the customer needs and applications.
- Access to the Support area of the GenISys server with access to technical documentation, presentation and information on applications.
- Attendance at technical workshops (BEAMeetings) and trainings at major conferences or regional meetings.

Our BEAMeetings are focused on E -Beam and Laser lithography, data-preparation, PEC, process correction, and lithography simulation and are technical exchange platforms for BEAMER, TRACER, LAB and ProSEM Users and those who are interested. Major meetings are held during or before the important lithography conferences such as MNE, EIBPN, SPIE, MNC and the China Lithography Conference (see listing on last page). In addition BEAMeetings are held locally in areas with one or more User sites (Berlin, Paris, Israel and England). Meetings can be requested and hosted by Users.

GenISys is also represented at technical exhibitions at the major lithography conferences; another opportunity for GenISys - User interactions.

The extension of the Support service after the fist year is optional, but generally advisable for all Users; in fact most Users, even after more than 10 years, avail of this service.

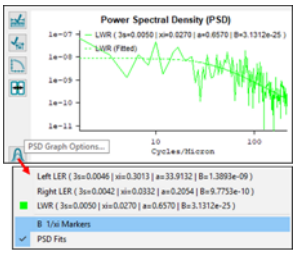
We are always working on improving the quality and value not only of our software, but also our service. Please give us your feedback, what we can do better for you…

Your GenISys Team.

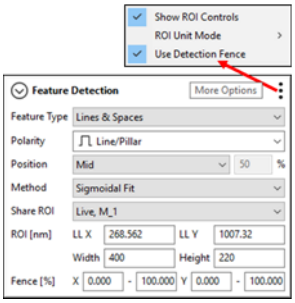
BEAMER for better e-beam lithography

ProSEM Update

- Improved edge detection
- Better triangle results possible
- Faster image loading
- Zoom behavior enhanced
- Improved noise correction and contrast adjustment in recipe mode



LWR (line width roughness) information is now computed together with LER (line edge roughness) information for lines, spaces and gratings. When the metrology result panel displays the PSD graphs, a new "PSD graph options..." button is shown in the lower left corner of the panel.



Enhanced ROI (region of interest) controls: When "Show ROI Ctrls" is enabled, four new text fields are shown for ROI: LL X, LL Y, Width and Height. The unit can be changed (through the 3-dots menu) to either the currently selected user unit or pixels. When enabled, Share ROI includes a dropbox where the user can select from existing measurements.

- ProSEM project files are now saved using a binary file format by default. The new format files have file extension of .iab, and this format is both smaller and faster to save and load, typical projects are 8 to 10 times smaller and faster. The older, text-based project files, with file extension .iap, are still supported, and can be selected during project file saving using the Save As Type selection.
- In addition to properties like `CDMean` and `CDStdDev`, the JavaScript objects representing lines & spaces measurements now offer `CDSampleCount`, the number of single-scan-line measurements that were the basis for the former properties.
- User-defined formulas now support functions computing distances between two metrology objects: `Metrology.distanceFittedFeature` computes the distance between the geometrical shapes fitted for its two arguments of type `Metrology`, if possible. `Metrology.distanceNearestPoints` returns the distance between the two closest edge points detected for its two arguments of type `Metrology`. If no simple geometrical shapes were fitted for the metrology objects, `distanceFittedFeature` falls back to the behavior of `distanceNearestPoints`. The functions are guaranteed to return zero in case both arguments refer to the same measurement.
- A new "Single Edge" feature type allows single-edge position to be measured. This is useful for measuring spacing between features with different edge types, or different shape types.

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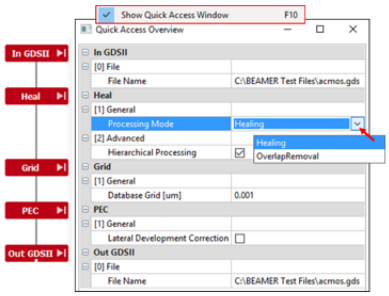
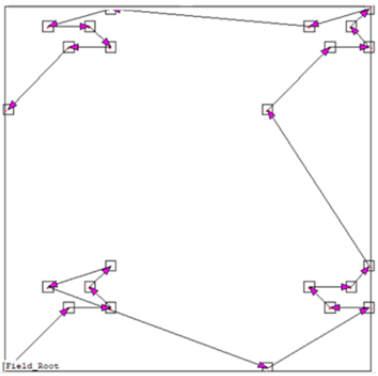
BEAMER 5.7.0

Some of the new features in the latest **BEAMER** version are described below. Please read the Release Notes and **BEAMER** manual for a full description of **BEAMER** 5.7.0

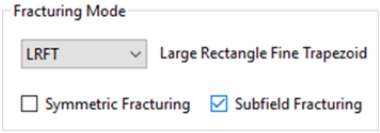
- Quick Access
- Floating Fields
- Subfield Fracturing
- Region Definition



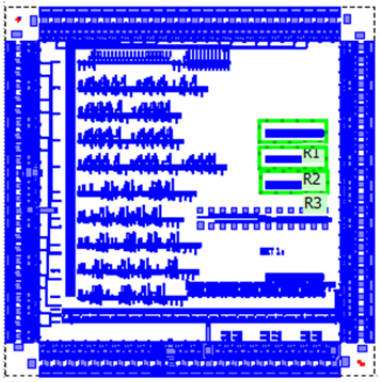
The Quick Access Overview provides direct access to previously defined module values without having to open the individual modules. Parameters can be file names, drop-down menu settings, on/off settings or units.



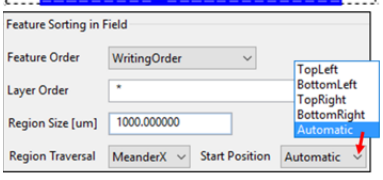
The Floating Field feature has been optimized to find the shortest path with the most efficient field placement.



In the Fracture module Subfield fracturing with Subfield Size defined in the Fields tab has been implemented.



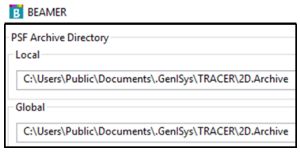
In addition, Region definition using shift + double mouse click centered around the pointer location with Fields tab defined Field Size is now possible.



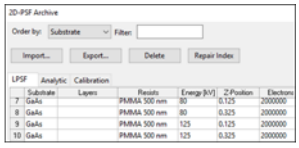
Finally for the Feature Sorting in Field options WritingOrder and FollowGeometry a Start Position can now be defined.

Managing PSF Archives

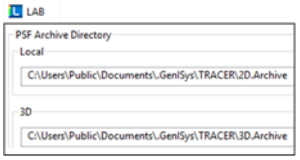
The proximity effect is characterized phenomenologically by a Point Spread Function (PSF), which specifies the relative energy deposited at the distance r from a point exposure. PSFs are calculated using Monte Carlo (MC) simulation software (e.g. TRACER) or measured using experiments (exposure and measurement of a test pattern). In BEAMER, both PEC and E-Beam modules require this energy distribution represented by a PSF. PSF archive provides the capability to store PSFs, enabling simple calling of the PSF. In LAB the E-Beam 3D simulation requires 3D or 2D Representation. Directories are defined in the File/Properties/Directories settings.



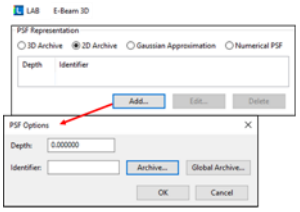
In BEAMER local and global archives are available for 2D PSF storage. The local archive is intended for individual usage while the global archive is designed for sharing with other BEAMER users. TRACER users can use the TRACER archive at the location: C:\Users\Public\Documents\TRACER\2D.Archive.



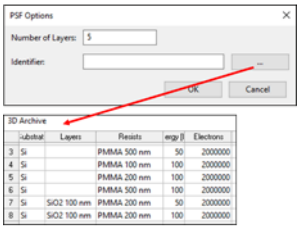
In BEAMER in the PEC and E-Beam modules the PSF representation can be selected from the archives. Choose an entry that closely matches the required material stack and tool settings.



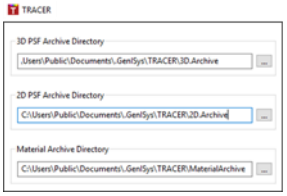
LAB users may also store the 2D and 3D directories using the File/Properties/Directories settings.



In the LAB E-Beam 3D module the PSF representation can be selected from either the 2D or 3D archive. The 2D archive settings require Depth settings since the PSF is depth dependent. Note Archive and Global archives are here both the same.



Access the 3D archive as shown on the left.



Finally TRACER users should set the 2D and 3D directory settings to match BEAMER and LAB settings.

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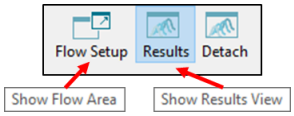
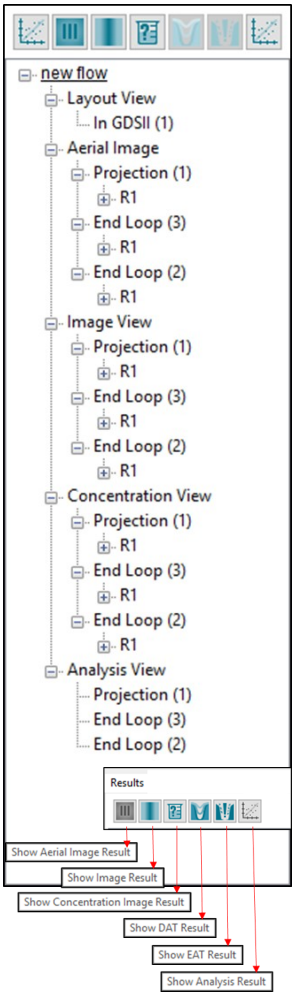
- Material database from tool bar
- Elliptical process window
- Projection NA—Sigma analysis
- New Linux installers available
- Multiple Resist Stacks definable
- 1D and 2D Arrays definable in the optical simulation modules



Flow Setup and **Results** buttons are used to switch between LAB Modules and working area, and results display. Increases the Viewing areas. **Detach** detaches the *Results* display to a separate window.



Results Tree
The left image shows the contracted *Results Tree* a part of which (aerial image) is expanded.

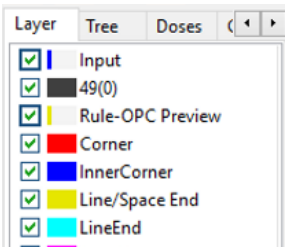
There are 5 sub folders corresponding to the *Projection Exposure Analysis* settings (see LAB application right opposite).

Layout View opens the VIEWER to display the layout.

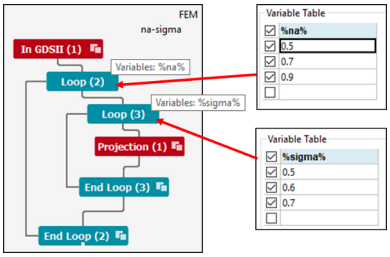
The Folder R1 displays results for the region R1. For each of the 3 na values there is a sigma folder which in turn includes Defocus folders, each having the Dose values of the FEM.

Each of the 4 sub folders corresponding to the *Projection Exposure Analysis* settings contains the above described tree structure.

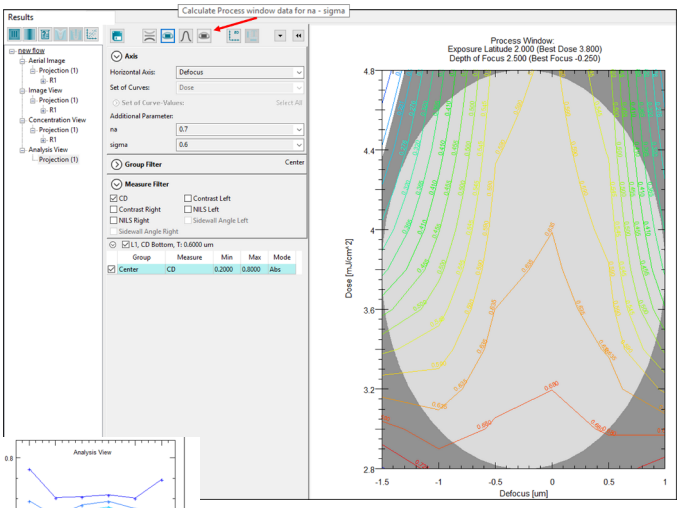
Results Buttons (left) are used to toggle the relevant folder in the tree structure on and off. Refer to the LAB manual for more in-depth information.

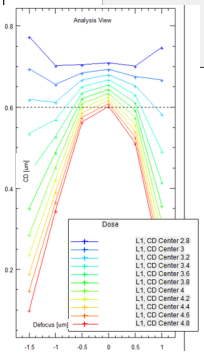


Segment Assignment Preview (Rule –OPC)
Displays settings for layout segmentation are taken into account and a preview in the form of a new layout generated, where each of the layers represent one of the types of *Segment Assignment* (such as Corner, Long Segment, Outer Corner, Inner Corner etc.).



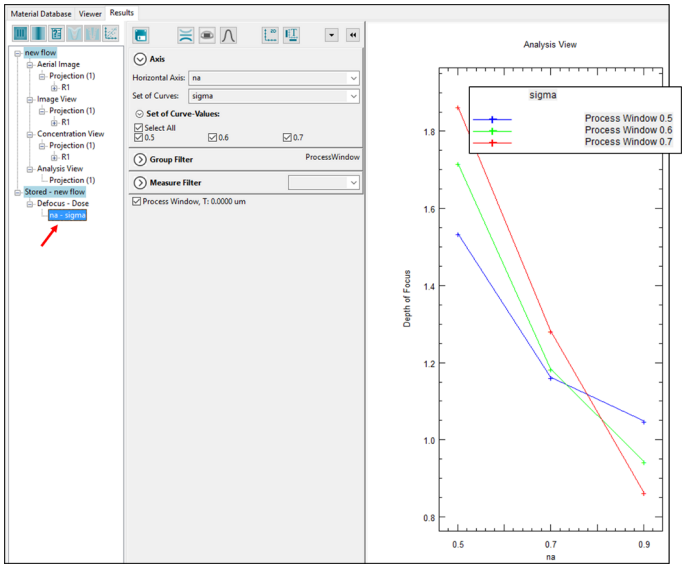
An interesting application of the Projection module is to simulate the effects of numerical aperture (na) and partial coherence (sigma) on the depth of focus values. Numerical aperture is varied in the top loop and sigma in the second loop. We use the flow shown above resulting in the *Tree Structure* pictured below.





The Analysis View displays a set of curves of *CD* values against *Defocus* for various *Dose* values (pictured left).

The *Process Window* (above) displays the *Exposure Latitude* and *Depth of Focus* for the *Projection simulation*. Below is the *Analysis View* of *Depth of Focus* versus *NA* values for the various *sigma* values.



LAB Update | **LAB Application**

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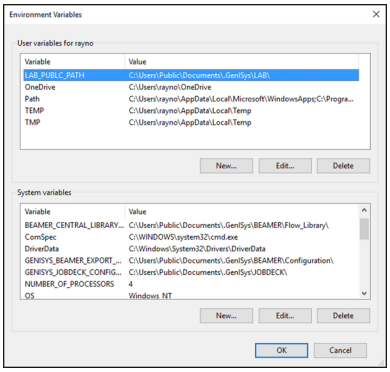
Environmental Variables, Configurations and Settings

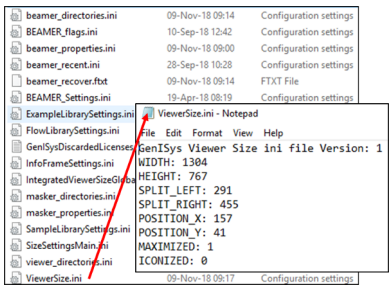
Environmental variables govern behavior of programs in your operating system. For GenISys products we are using these variables to control lookup positions for used databases and settings.



For Windows we are using the global documents folders to store these centrals. The Linux systems are more heterogeneous and we are offering the environmental variables to have a unified setup possibility working cross system and cross version.

For all our products we are delivering the key settings and databases in the installation folder and create copies to the global documents folders for Windows. Under Linux it is up to the user to create a structure as central reference and in which case the environmental variables are intended as support.

With these variables one can also easily manage a multi user environment by overwriting the default references in the installation folders or in the Windows public documents. When found the environmental variables are used first. Both Linux and Windows admins can create scripts that append these variables to the user environment.



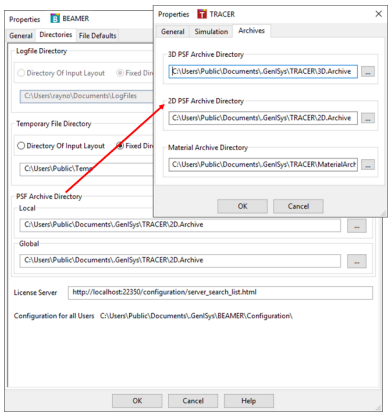
Configuration (INI) files are used to configure the parameters and initial settings for some computer programs and for user applications across various versions. Listed on the left are some of the BEAMER configuration files. For the VIEWER file where settings (width, height etc.) are stored after each session so that on reopening the VIEWER the most recent settings are used. These INI files are automatically updated on closing the program.

These settings are found in the user documents folder in the .GenISys folder for Windows or in the users home folder, also .GenISys.

The Windows 10 Example (below) points to where BEAMER Flows are saved. (See BEAMER Manual: Environmental Variable Handling).

BEAMER_CENTRAL_LIBRARY_PATH

C\Users\Public\Documents\BEAMER\Flow_Library\

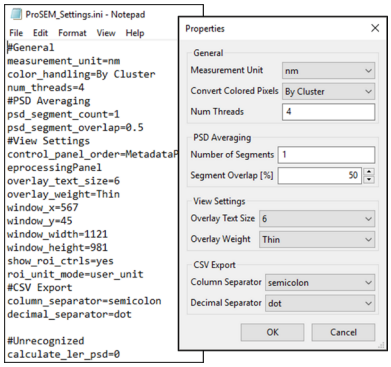


It is important to match the BEAMER and TRACER PSF archive directories as shown on the left. These settings are in the relevant Properties/ Directories settings and the values are storied in the relevant INI files.

Similarly LAB has its own Configuration and INI files for the relevant settings.

Export modules: Exposure tool settings with specific individual customized settings (resolution, exposure direction, field size etc.) are stored in machine INI files. Note that some of these files are encrypted (confidential settings only set directly in the exposure tool) while others can be read using a standard editor.

INI and Configuration files are usually delivered with the GenISys software. Contact GenISys for further information.



ProSEM: INI files for ProSEM are normally stored in the \Documents\.GenISys\proSEM folder. Settings from the Properties tab in ProSEM are stored in the ProSEM_Settings.ini file. On opening ProSEM these settings are then restored.

Configuration for all Users:

File\Properties\Directories

C:\Users\public\Documents\.GenISys\BEAMER \Configuration

Additional information can be found in the GenISys Software Installation Guide, available from GenISys.

After 50 years of service Mike Butler left his position as Product Manager EBPG Systems for Raith and joined GenISys GmbH as Director of Technical Marketing. He Started with Cambridge Instruments in 1968 at the age of 16 and undertook a 5 year block release course (University/Industry) to gained a HND in Electrical and electronic engineering.
Mike still lives in Cambridge, UK and has a wide range of different interests most of which circle around family activities.
He is very pleased to be given the opportunity to join GenISys, a group of people he has known for many years with a reputation in the field of excellent customer support.

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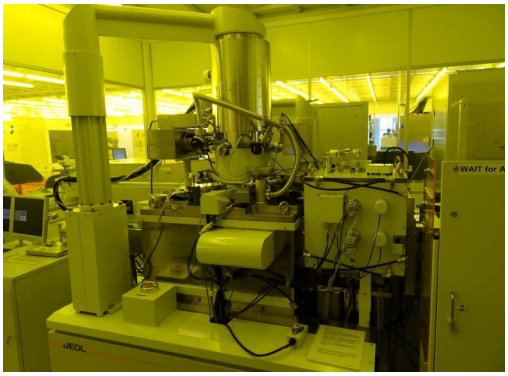
GenISys Customer Profile

The Department of Microtechnology and Nanoscience at Chalmers – MC2 – is a unique environment where successful research and education is conducted within photonics, high-frequency electronics, medical electronics, microsystems, electronic systems construction and quantum components. Semiconductors, superconductors, liquid crystals, graphene and carbon-nanotubes are examples of materials that are used to produce unique nanostructures for the research. Different types of superconducting quantum components for sensor technology and quantum informatics, high-frequency components in compound semiconductors for microwave and terahertz applications, optoelectronic components and micro/nano electromagnetic systems are built from these materials. Fiber optic systems and system integration constitute additional significant aspects of activities.

Strong and successful cooperation initiatives between theoreticians and experimentalists have been developed in the department. The multi-disciplinary environment provides an excellent breeding ground for research and innovation, which will benefit society by new inventions and ultimately new business opportunities.

Cooperation with the Swedish and international business communities is well developed. Research creates a base in this arena for the Swedish telecom and space industry, for example, and provides technical platforms for bio applications and medical electronics.

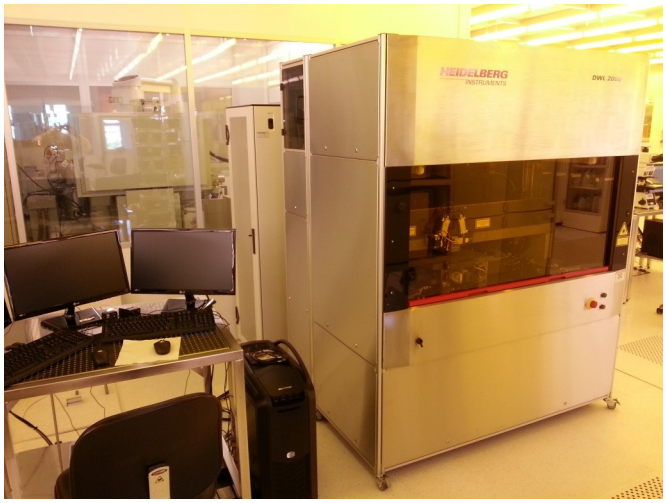


MC2 hosts the Chalmers Nanofabrication Laboratory, which is an open national infrastructure for nanotechnology in a 1250 m^2 clean room environment with 191 different tools. The Nanofabrication Laboratory currently has more than 200 active users, and in 2018 the number of booked tool hours was 65137. The laboratory is a part of the Swedish national research infrastructure for micro and nano fabrication, Myfab.

To structure the devices at a nano level at the Nanofabrication Laboratory, advanced patterning techniques such as electron beam and optical lithography, are required. Since the Nanofabrication Laboratory is a user facility, the users are trained to handle most of the equipment hands-on, including the ebeam and laser lithography tools. MC2 Nanofabrication Laboratory has invested heavily in the GenISys software suite, including the Beamer, Tracer, Lab, and ProSEM tools. The Beamer installation has multiple licenses to enable the users hands-on access to PEC and pattern conversion.

Photos:

1. Inside the Nanofabrication Laboratory (bottom).
2. The JEOL JBX9300 ebeam lithography system (left).
3. The Heidelberg DWL2000 laser lithography system (below).
4. The Raith EBPG5200 ebeam lithography system (right).



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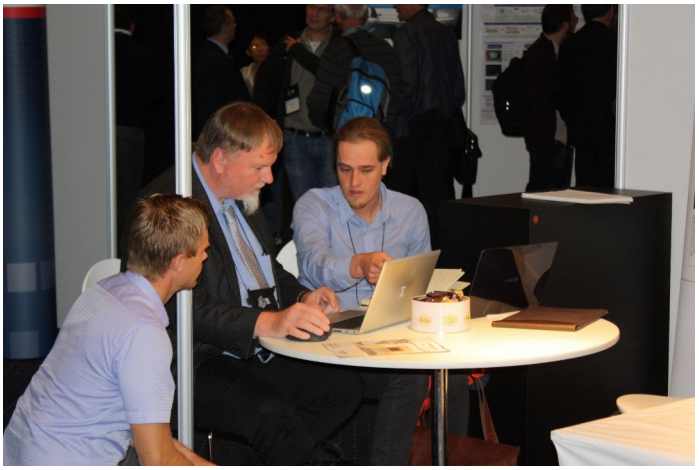
Nezih Unal (GenISys) and Bengt Nilsson (Chalmers University)



Niclas Lindvall (Chalmers University), Daniel Ritter (GenISys) and Marcus Rommel

Christian Giese (FhG), Olga Lohse (MPG) and Bert Lägel (TU Kaiserslautern)

Martin Charlton and Kian Chen Kiang (University of Southampton)

Silvia Diewald (KIT), Irina Harding (MPG) and Lothar Hahn (KIT)

Daniel Ritter (GenISys), Thomas Weimann (PTB), Stefan Rehbein (HZB)

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China Lithography Conference, Shanghai, October 2018.

GenISys MNE Booth, Copenhagen 2018.

Upcoming Events in 2019

- BEAMeeting at KIT, Karlsruhe, Germany, March 25th - 26th.
- Photomask Japan, April 16th-18th.
- EIPBN 2019 Minneapolis May 28th-31st.
- BEAMeeting at the MNE, Rhodes, Greece, September
- SSDM (Solid State Devices and Materials), Japan, Sept.
- MNC Japan November
- China Lithography Conference, October

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BEAMER LAB TRACER Pro SEM MASKER