530
doi:10.1017/S1431927619003386
Microsc. Microanal. 25 (Suppl 2), 2019

ZEISS Orion NanoFab New Features: "Shuttle and Find" and Automation

Anthony Morin[1], John Notte[1*] and Doug Runt[1]

[1.] Carl Zeiss SMT, Inc. PCS Integration Center, One Corporation Way, Peabody, MA, USA.
* Corresponding author: John.Notte@Zeiss.com

The ZEISS ORION NanoFab is well-established as a multi-ion beam (He, Ne, Ga) platform with many diverse applications including imaging, nanofabrication, and analysis. The latest software release for the NanoFab, "Ebetsu", makes available useful features including "Shuttle and Find", and automation capabilities with both a visual scripting editor and an API.

Shuttle and Find helps to solve the difficulty for the microscopist who seeks to examine progressively smaller features using an increasingly large collection of imaging and analytical instruments. The difficultly is most keenly felt when the feature of interest is not recognizable without resorting to very high magnification, which of course necessitates searching though many images to relocate the same feature in a second instrument. The problem originates because different instruments' coordinate systems are not universal, and because sample mounting cannot be perfectly repeated.

The Shuttle and Find solution consists of a special sample holder, together with software which enables the workflow. The NanoFab's special correlative microscopy ("corrmic") sample holder (Fig. 1) has provisions to accommodate several standard SEM stubs, as well as clips to hold larger substrates, such as silicon or glass microscope slides. The sample holder incorporates the standard Zeiss dovetail and attachment points, so it can work across many Zeiss products. And importantly, on this sample holder are reference fiducials which are designed for easy recognition at large fields of view, and precise location at small fields of view (Fig. 1). At the start of the workflow, the operator finds the three fiducials and clicks on the corner of the centermost L-shaped feature. Once this registration is complete, the user can navigate freely to any sample mounted to that sample holder and conduct their work, and save images or features of interest. The sample holder can then be extracted from the original instrument and loaded to another instrument, either across the lab or across the globe. Once the fiducials are located in the second instrument the previously saved image files can be called up in the second instrument to automatically navigate to the original locations. The three fiducial markers serve as coordinate references, allowing the software to transform coordinates to account for rotation, skew, and scaling discrepancies from one instrument to the other. This coordinate mapping allows accurate feature redetection, saving the time previously needed to manually relocate the feature visually.

The NanoFab's latest software also provides two methods for instrument automation: the integrated scripting editor and the NanoFab Automation API. The scripting editor uses the Microsoft Workflow Foundation platform to provide a visual, flowchart-based programming interface in the Zen software. Users can quickly develop powerful scripts to do repetitive tasks, optimizations, dose arrays, and image analysis without having to learn a rigid, text-based programming language. Looping and branching operations are easily programmed, an example of which is shown in Fig 2. More advanced users can leverage additional functionality and the convenience of familiar software development platforms by using the NanoFab Automation API. The NanoFab Automation API is a .NET library distribution which provides the full suite of automation functionality supported by the NanoFab. Users can use the

API with any .NET programming language or any programming language which provides interoperation with .NET.

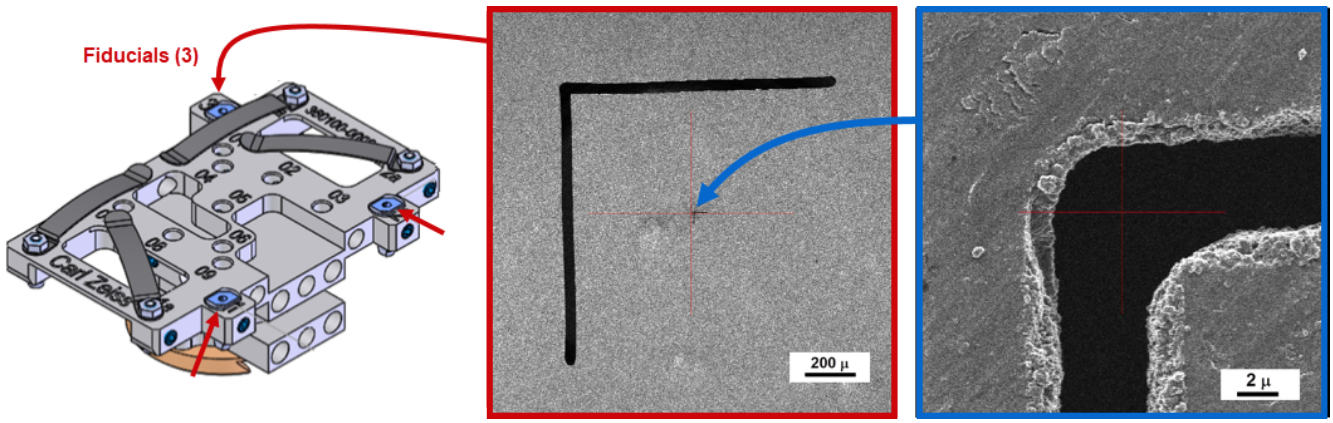

Figure 1. (left) The Correlative Microscopy sample holder for the "Shuttle and Find" capability. This design can accommodate several stubs as well as optical microscpe slides. (center, right) The fiducials have markers that are easily found by optical, electron, or ion beams, at both low magnification and high magnification.

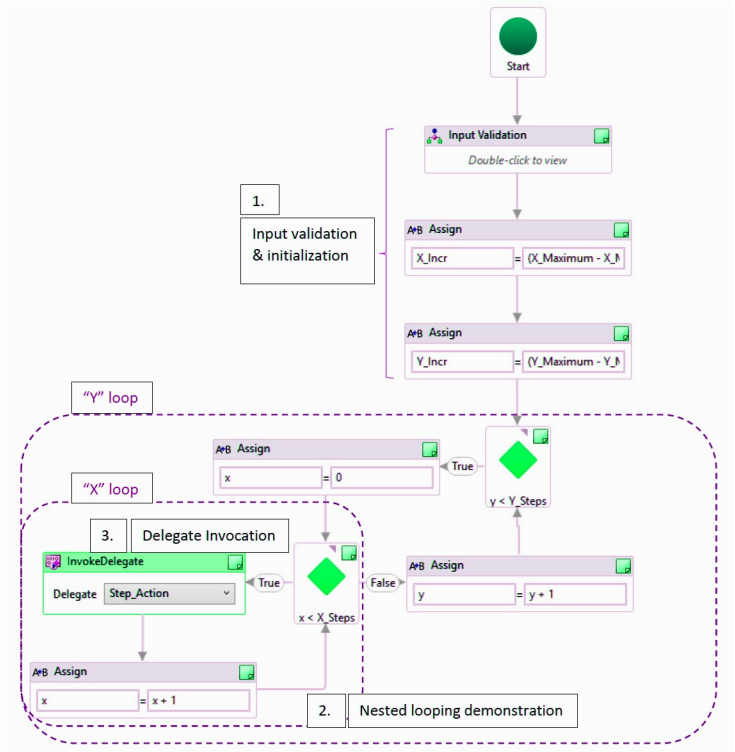

Figure 2. A simple example of the visual flowchart-based scripting language.

https://doi.org/10.1017/S1431927619003386 Published online by Cambridge University Press