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Helios 5 – New Generation DualBeam Technology for Materials Science

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Over the last decade, Thermo Fisher Scientific has introduced several generations of DualBeam™ FIB-SEM instruments and this technology has rapidly evolved from a method that was initially used only in specialized laboratories, to a very common technique, which is nowadays applied in a large number of disciplines in materials science [1,2]. The successful evolution of focused ion beam (FIB) technology was driven by increasing application needs in the areas of ultra-high resolution electron imaging, sample preparation (cross-sections and S/TEM specimens), and direct-write patterning of materials for nanoprototyping.

While column and source technology has advanced significantly to achieve sub-nanometer imaging by SEM or preparation extremely thin specimens for HR-STEM and EELS, the ability to achieve these results often required peak system performance where system alignments were required. Today's state-of-the-art DualBeams and SEMs offer fully automated column alignments with no advanced knowledge or know-how required by the operator. Additional complexities with sample and system interaction such as working with non-conductive, beam sensitive materials may often still require further beam parameter optimization to achieve the best result. To address these challenges, Thermo Fisher Scientific is introducing FLASH - a new fine image tuning capability on the 5th generation Helios™ DualBeam platform. FLASH technology is replacing the traditional way to optimize an image, which is typically done by the alignment sequence of focus, lens centering and stigmation. With FLASH, the user need only perform a simple mouse-gesture in the graphical user interface (GUI), a procedure similar to focusing the image, and the instrument will introduce any necessary corrections "on-the-fly" to the stigmators and lens centering, as well as bring the image to focus. Tests have shown that on average FLASH can result in up to a 10X improvement in the time required to obtain an optimized image.

Helios 5 also introduces the concept of "system presets" to the GUI. System presets allow the user to set up specific beam conditions and patterns to develop a manual workflow for common use cases or very specific applications with many different processes and/or beam conditions. These presets are stored for future use or as an instructional tool for novice users.

These features are invaluable for multi-user shared facilities, where users operate DualBeams occasionally and have a limited amount of time to run an experiment. Here, we present the newest 5th generation of Helios DualBeam technology where fastest time to results and ease of use are at the core of its capability. Helios 5 features the innovative Elstar™ electron column with high-current UC$^+$ technology for extreme high-resolution (XHR) imaging and the highest materials contrast. Depending on the configuration, Helios 5 includes a next generation Tomahawk HT™ or Phoenix™ ion column for the fastest, easiest, and most precise high-quality sample preparation. In addition to the most advanced electron and ion optics, the Helios 5 incorporates a suite of state-of-the-art technologies that enable simple and consistent high-resolution S/TEM and Atom Probe Tomography (APT) sample preparation, as well as the highest-quality subsurface and 3D characterization, even on the most challenging samples.

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References:

[1] CA Volkert and AM Minor, MRS Bulletin **32** (2007), p.389.
[2] J Mayer et al., MRS Bulletin **32** (2007), p. 400.

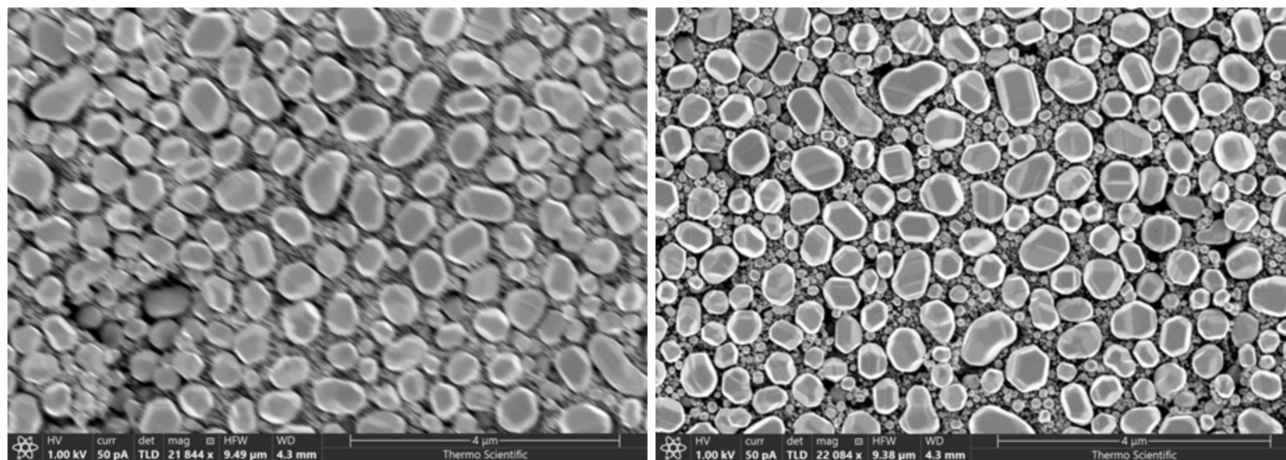

Figure 1. An example showing images before (image is misaligned manually) and after tuning by using FLASH. The time needed to optimize the image is typically <10 seconds. Final image quality and the time do not depend on the user experience.

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