

From tissues to molecules: Application insights with plasma-FIB technologies

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Focused ion beam (FIB) technologies have become essential tools in the life sciences, enabling the thinning of vitrified specimens (lamellas) for cryo-electron tomography (cryo-ET). Recent advancements in plasma-focused ion beam (pFIB) technology have introduced faster and more versatile milling options, broadening the range of potential applications.

The Hydra Bio pFIB system exemplifies this versatility, offering not only lamella milling but also supporting a variety of volume EM techniques. These include volume imaging under cryogenic and room temperature conditions with Slice & View, as well as the novel Spin Mill technique for larger room temperature samples. These techniques provide unprecedented structural research opportunities for larger specimens. Additionally, the presence of multiple ion sources in the system makes it possible to tailor milling conditions to the type of sample, be it cryo-preserved or polymer-embedded.

The system's adaptability can be further enhanced by optional features like a cryo-micromanipulator and an integrated fluorescence light microscope (iFLM), which allow researchers to tackle a wide array of experimental workflows. Combined with higher milling speeds, these add-ons facilitate work with thick high-pressure frozen samples, and targeted lamella preparation with fluorescence-guided milling.

Plasma technologies are also at the forefront of high-throughput lamella automation and integration with cryo-ET workflows through the use of specialized software like MAPS and AutoTEM Cryo. This is taken even further by the Arctis Cryo-pFIB, which makes use of an autoloader and advanced milling automation software WebUI to maximize lamella output and connectivity with the Krios 5 Cryo-TEM.

Here we will showcase the capabilities of plasma-FIB systems, highlighting their impact on advancing cryo-ET and structural biology.