

The Piezo stage extension

Precision imaging on the atomic scale

The new Piezo stage extension enables ultra-precise movement in all directions (X, Y, and Z).

Precision imaging

Accurate stage movement in all directions facilitates easy navigation on the atomic scale with 20 pm finest step, which is mandatory to find the right area and center it precisely in the field of view - especially working at high magnifications. The continuous jogging mode enables both linear drift compensation, beneficial for dynamic experiments, or fastest time to data acquisition after specimen loading. The unique Piezo focusing capability enables precise high quality imaging in STEM and TEM at any given high tension.

Ultra-precise navigation

The Piezo extension of the stage allows for movement in X, Y, and Z direction with 20 pm finest step. The Piezo elements are integrated in the software and can be controlled with the joystick and multifunction knobs for precise navigation. Other specifications of the regular CompuStage such as the optical resolution down to 70 pm and the maximum specimen drift (for optimized holder) of 0.5 nm/minute (for Titan™ G1 and G2 series) are not affected.

Stability in dynamic experiments

Ultimate imaging performance and robustness in dynamic experiment applications is assured with the Piezo extension. The continuous mode (Jog) compensates linear drift, which can be caused by holders being used for dynamic experiments such as heating, resulting in stable conditions of the specimen required for applications aiming for atomic resolution. The continuous movement of the Jog mode can be combined with shifts in X, Y, and Z direction to be able to navigate while compensating the drift. The upgrade of the Piezo extension causes no change in the compatibility of the Thermo Fisher approved holders in comparison to the classical CompuStage.

Highest throughput in sample loading

The time to reach atomic resolution after loading the specimen can be reduced to 10–15 minutes using the active drift compensation. The Piezo elements are embedded in the TEM operating software enabling the speed control movement by the multi-function knobs and joystick. The included indicator of the range sensing the shift of the specimen positions is unique for this Piezo extension. The maximum range of the Piezo elements in X and Y is 1.25 µm and can be extended with a “smart reset” keeping the feature of interest in the field of view during reset.

Key benefits

Fast navigation on the atomic scale. 20 pm finest step allows for the most precise movement of the specimen to enable fastest navigation on the atomic scale

Highest performance in dynamic experiments.

The stimulus of dynamic holder experiments can cause linear drift limiting the resolution. The continuous Jog mode compensates this drift and enables highest resolution while keeping the navigation capability optimal at the same time.

Faster time to data by faster specimen loading.

Full compensation of thermal linear drift after loading the specimen to reduce the time to reach atomic resolution to 10-15 minutes.

High quality S/TEM imaging at any high tension.

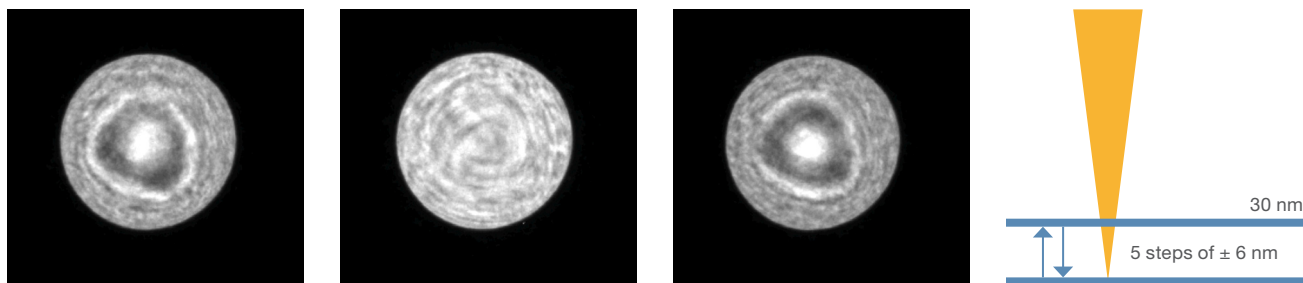
Focusing by Piezo movement of the specimen heights eliminates changes of optical lens settings. This is beneficial for all users with different experience levels preventing unwanted alignment changes, for instance aberrations of the Cs corrector optics.

Available for upgrades on existing Titan tools. The retrofit downtime is minimized, because the vacuum of the column stays active during the Piezo extension upgrade.

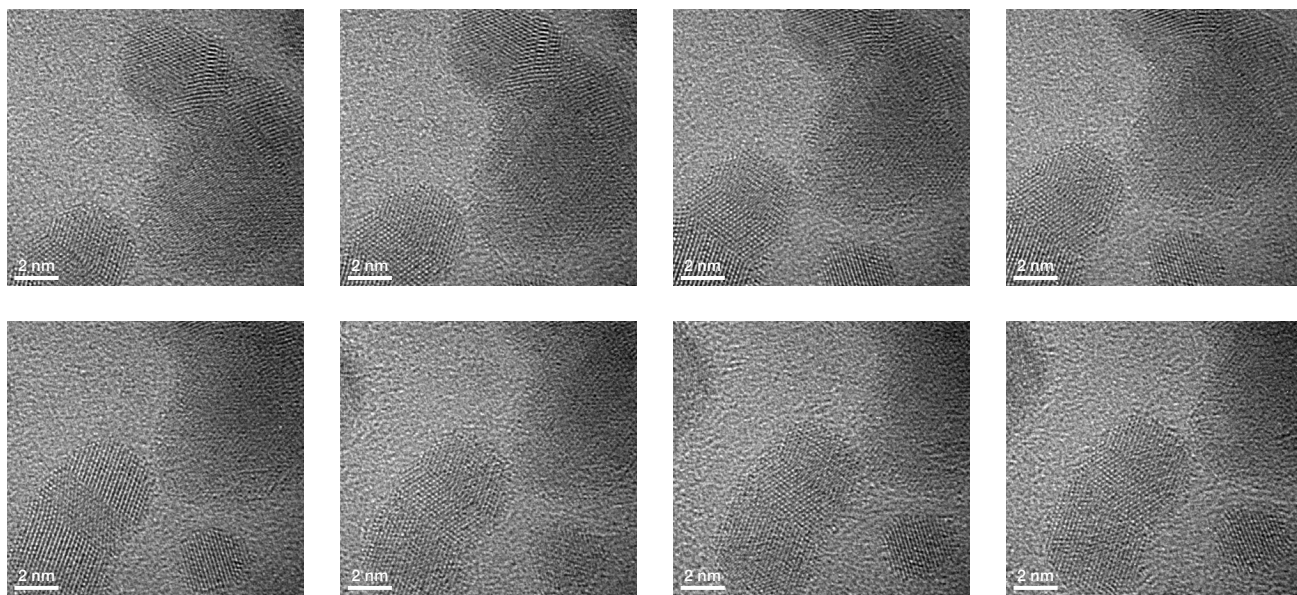
The regular stepper motors of the CompuStage are used for bigger movements up to ± 1 mm

Piezo focus with Z- movement

Focusing in STEM mode with the objective lens can cause a degradation of image quality and a misaligned Cs corrector due to the change of aberrations in the correctors (mainly lower order aberrations). The Z-Piezo movement enables independently focusing from optical changes and prevents related alignment adjustments. The finest step with the Piezo element of 20 pm allows for finer focusing than currently possible with optical lenses resulting in very precise imaging in STEM and TEM at any given high tension.



↑ Ronchigram changes with Piezo focus in STEM: (a) in focus, (b) 30 nm overfocus (c) refocused back to 30 nm.



↑ Precise navigation in HRTEM using the X and Y Piezo movement. The twinned gold particle on carbon was moved at 1.1 Mio times magnification to the center of the image using the Piezo elements. The series of images shows from left to right and top to bottom in 8 images the movement of the particle during the event.

| Specifications | |
|----------------------------|---|
| Operation voltage | 20–300kV |
| Minimum step size in X,Y,Z | 20 pm |
| Drift compensation | Jog mode with joystick or multifunction control |
| Piezo range X,Y | 1.25 µm |
| User interface | Integrated interface with range indicator; Reset of X, Y, Z, and all directions; “Jog (continuous) mode” for drift compensation and “move mode” for navigation; Piezo focusing using focus knob |
| Smart Reset | During reset of Piezo elements, the feature of interest remains in the field of view (“Auto center”) |
| Embedment | Embedded in the existing CompuStage hardware and software |
| Holder requirements | No special requirements compared to classical CompuStage. The same Thermo Fisher Scientific holder policy applies. |
| Retrofitable | Titan G1/G2 series |

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