



# Development of an automated, multi-specimen, cartridge-based loading system for transmission electron microscopy

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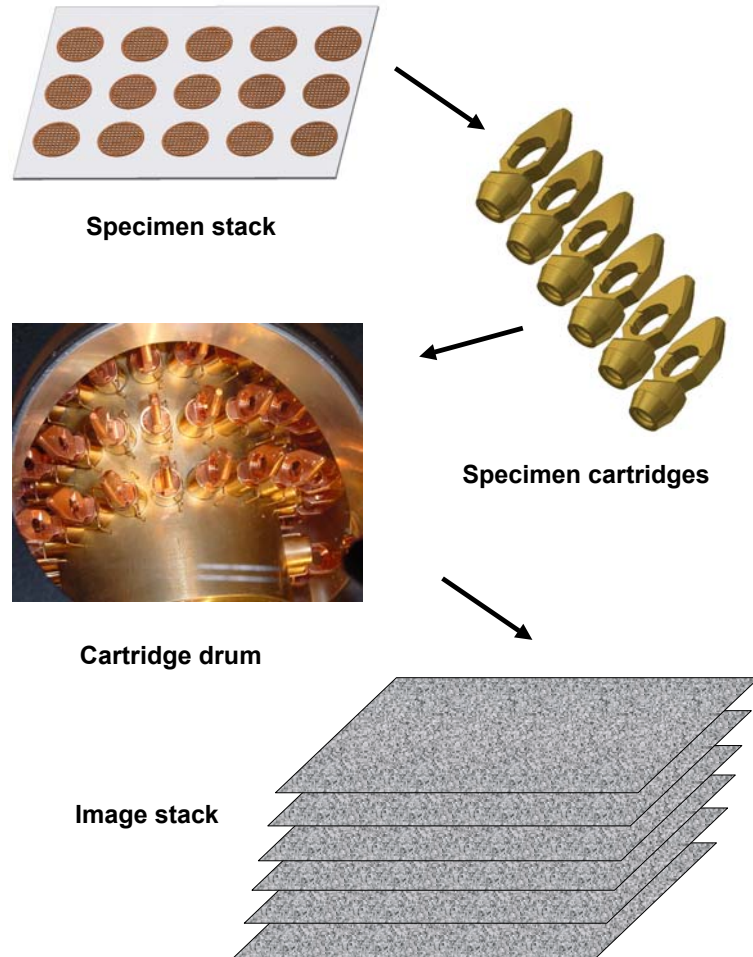
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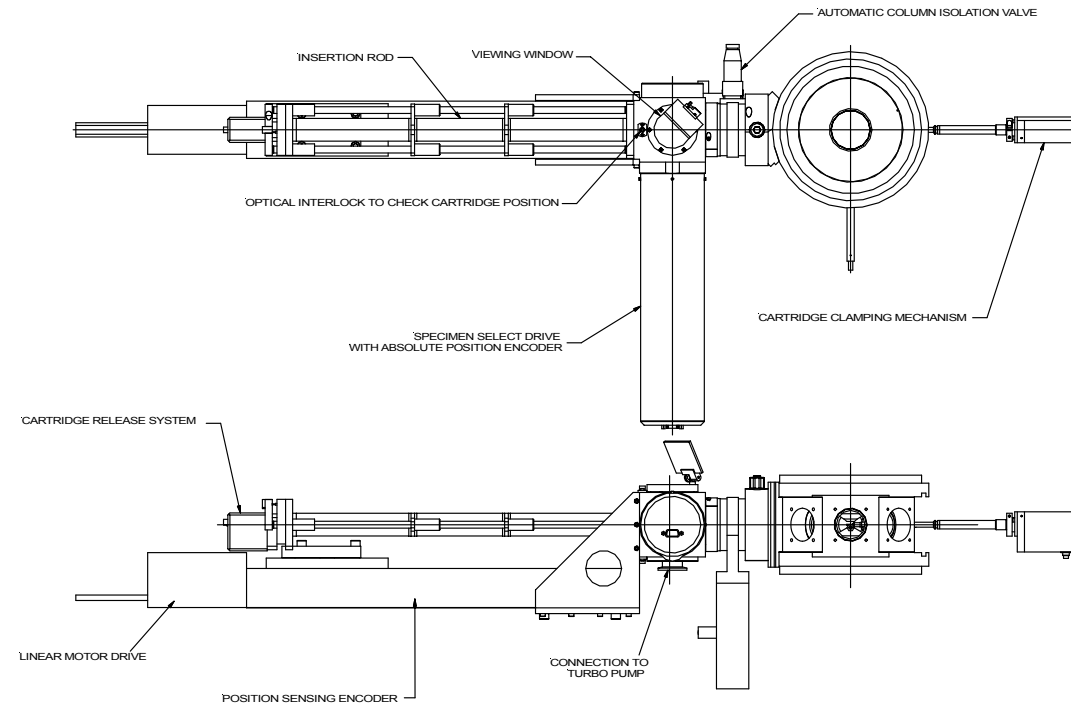
## Abstract

We report here on the development and construction of a novel cartridge-based, multi-specimen holder assembly for room temperature transmission electron microscopy. Pre-loaded specimen-containing cartridges are loaded into indexed locations on a transfer cylinder, which, in turn, is connected to a motor-driven advance mechanism and vacuum chamber. The device allows pre-loading and sequential delivery of as many as 100 specimens into the microscope with mechanisms for rapid and automated specimen exchange. An absolute encoder indexes each specimen position and a computer controls specimen advance. The design allows for the transfer of each cartridge into and out of the microscope column, where it is clamped onto a specimen rod. The multi-specimen holder can be used for all applications requiring high throughput screening for both biological and non-biological specimens.

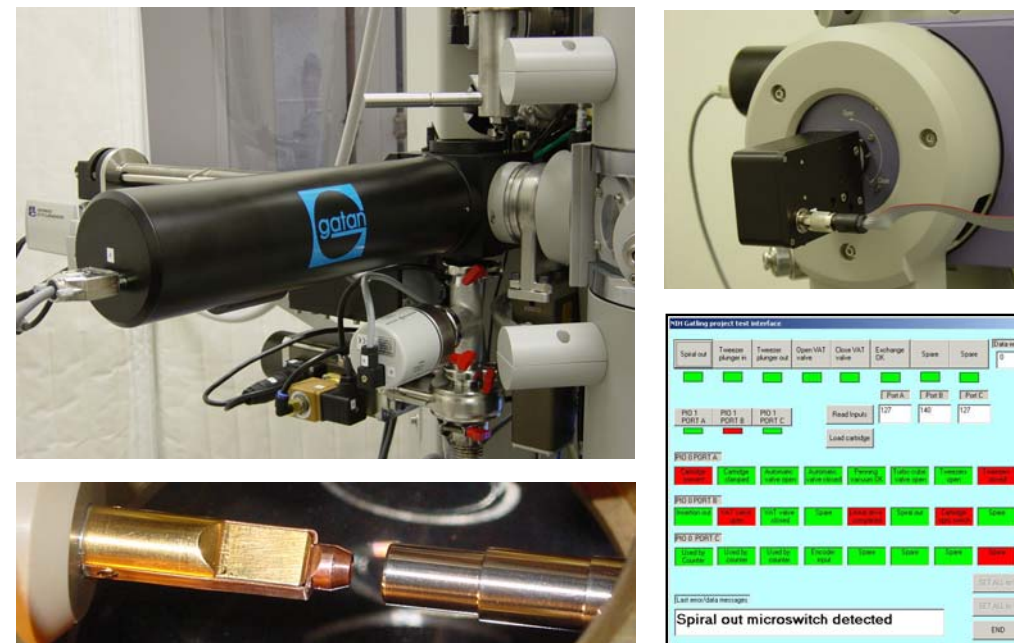
## Strategy for “high-throughput” microscopy



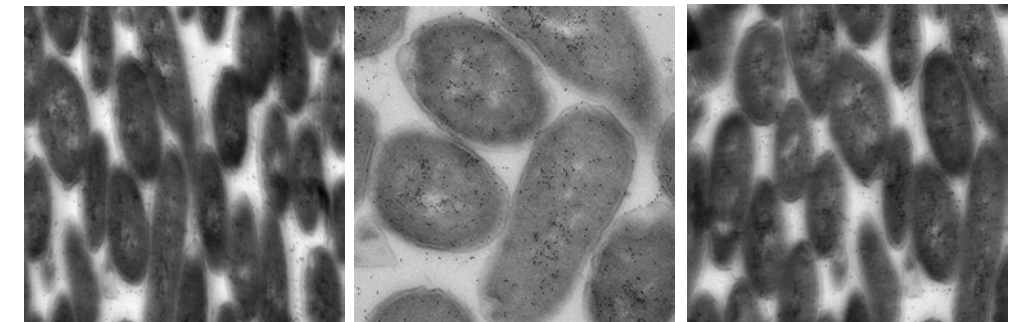
## Design of spiral drive and specimen transfer mechanism



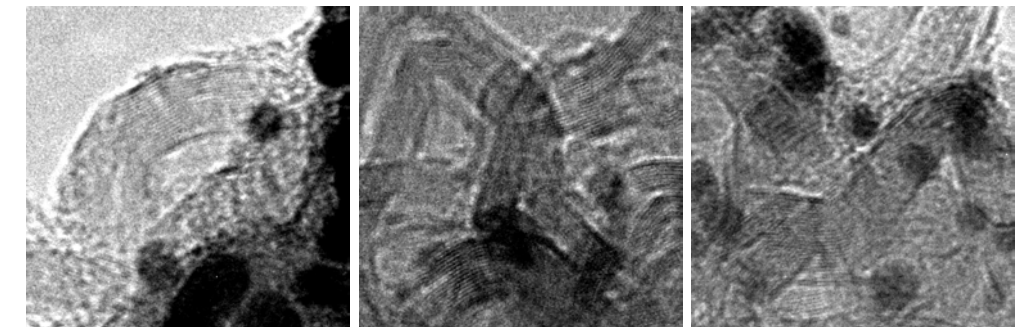
## Transfer system mounted on Tecnai 12 microscope



## Stage performance and image quality



Images recorded from E.coli sections at nominal tilts of -76°, 0° and +65°



Images recorded from graphite at 220,000x at nominal tilts of -69°, 0° and +70°

## Summary and future prospects

- We have developed and implemented a specimen holder and transfer device capable of handling one hundred EM grids into a transmission electron microscope. The device is likely to be useful for applications requiring high throughput screening and image analysis in material science and biological applications such as proteomics.
- Areas for future development will include integration of microscope operation with specimen exchange as well as automated loading of cartridges into the spiral drive.

