



## Project Title: CPS: Medium: Real-Time Learning and Control of Stochastic Nanostructure Growth Processes Through in situ Dynamic Imaging

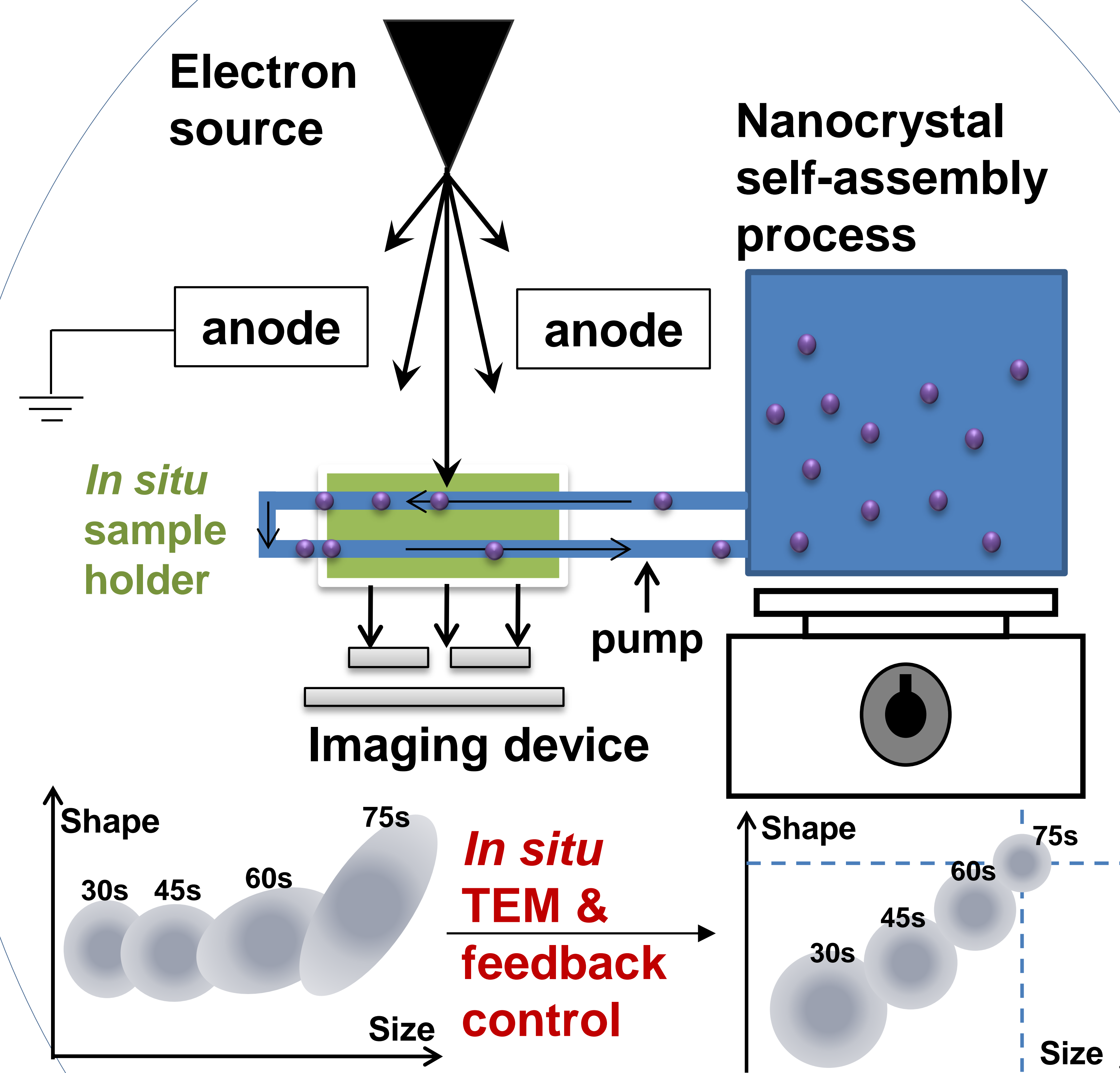
Award #2038625; Texas A&M; PI/Co-PIs: Yu Ding, PR. Kumar, Jiang Hu, Sarbajit Banerjee; Shahin Shahrampour (Northeastern)

### Challenge:

- A CPS automatically and reliably converts dynamic imaging data to machine intelligible information for process monitoring and control
- Modeling stochasticity, real-time tracking and adjustment.

### Solution:

- An adaptive kernel density estimator for real-time learning;
- Structured-shallow-networks enabled process control, one of the early applications of neural networks in real-time, dynamic settings;
- Hardware acceleration tailored to attain the real-time goals.



Project info (#2038625, 01/2021-12/2023; Texas A&M University, Email: yuding@tamu.edu)

### Scientific Impact:

- This project addresses the foundational problem of real-time learning and control of a multivariate, nonparametric model of probability density functions that reflect the collective stochastic behavior of evolving objects.

### Broader Impact:

- Aim at a roadblock in novel material design identified by the National Nanotechnology Initiative.
- Enable scalable production control of certain nanomaterials.
- Prepare next-generation CPS workforce blending data science and domain sciences.