Methods for Pre-screening Samples in High-Throughput Experiments at MFX

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High Throughput

MFX is working to leverage automation to increase sample throughput and develop a "mail-in" program

- Increase the accessibility of small crystal protein screening through a "blue box" program similar to SSRL.
- Automate operation of the MFX beamline to reduce operator fatigue.

smSFX Using the DoD

250 µl of suspension loaded in well, next well contains delivery solvent for washing

Glass nozzle pulls 60 µl of sample from 96-well plate and delivers 60 µl droplets to the beam, synchronized to the 120 Hz repetition rate of LCLS-I. Can achieve kHz synchronization.

Pre-Screening

During the last high throughput experiment at MFX only 15 out of the 86 samples had a viable number of hits to solve

- I am using Optical Microscopy and Environmental Scanning Electron Microscopy (SEM) to verify crystals are present and undamaged

Drop On Demand

One of the systems we aim to use to develop high throughput at MFX is Drop On Demand (DoD)

- Uses piezoelectric dropper to reduce sample consumption to low as 2 µL/min

Scienion Droplet-on-Demand (DoD)

- Screened 86 samples (MOFs, inorganic materials, metal-organic materials, organic materials) using 120 Hz LCLS-I
- Solved 6 structures in 15, 21, 24, 27, 30, and 66 minutes of diffraction data collection
- 3 full datasets, 7 partial datasets that are still being worked up.

OTHER PROJECTS

- Experimenting with PPS, a chemical resistant and vacuum safe polymer. I hope to test a sample for virtual leaks in the future.
- Training of other interns on Computer Aided Design and Slicing.
- Maintenance of Printers in ASC and Makerspace

RESULTS

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USER INSTITUTIONS

- MIT
- TU-Wein
- UC Berkeley
- Stanford
- UConn
- University of Washington
- College of William and Mary
- McGill University
- University of Windsor
- Center for Nano and Soft Matter Sciences, Bengaluru
- Georgetown University
- Purdue University
- Iowa State University
- SUNY Buffalo
- University of Virginia

References
