Experiment Control With Epics7 and Symmetric Multiprocessing on RTEMS (THPHA154)

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Project CRYVISIL *

- To resolve glass dynamics
- Build up of a very high speed scanning tunneling microscope (STM)
- Integration of a commercial normal speed STM
- High sustained data rate (~ 3 Gbit/s for 5 hrs)

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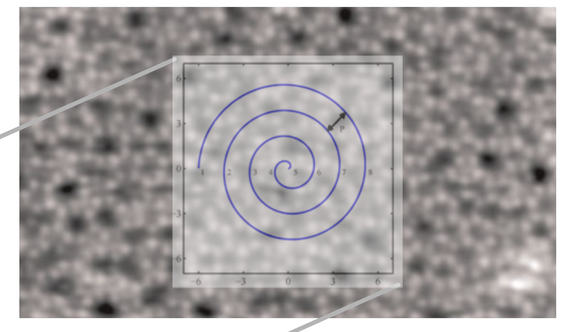
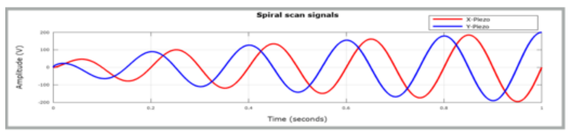
Large atomically resolved STM image of the vitreous silica film revealing the Si positions

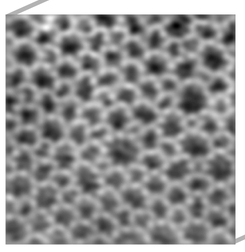


V_S = 2 V, I_T = 50 pA,
Scan range = 12.2 nm
x 6.6 nm
Recording Time > 10 min

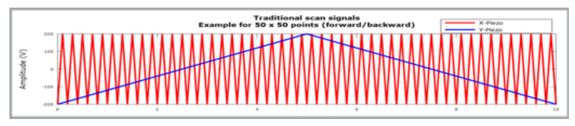
New Scanning with spirals



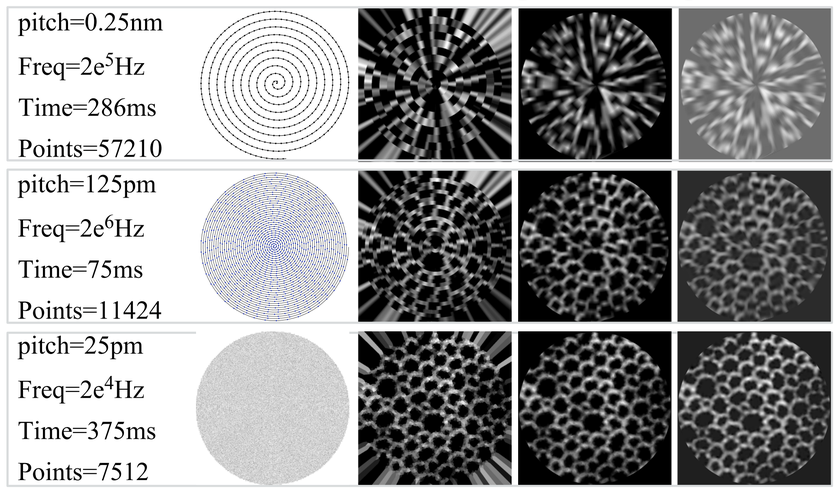
Scan range:
5 nm x 5 nm
Recording Time:
up to 3000 f/s

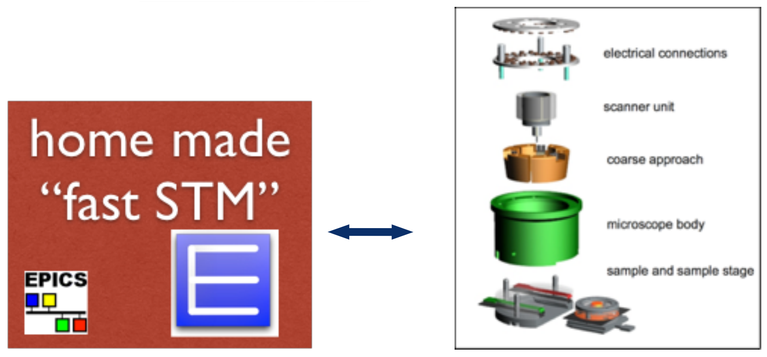


Traditional Scanning (triangular for x/y)

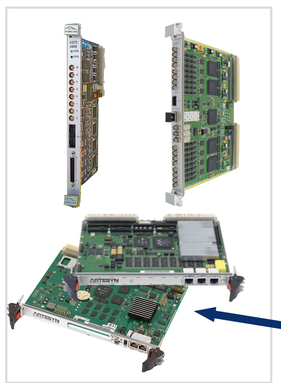


Interpolated images



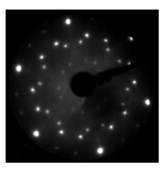


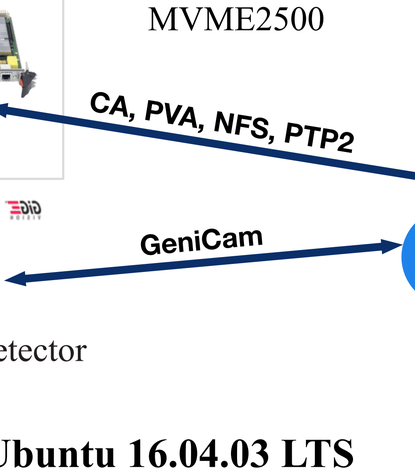
Wiener Crate 6U VME



RTEMS 4.12
EPICS 3.16
PVA/QSrv
MVME6100
+
MVME2500

Video-LEED





Waveform generator Highland V375

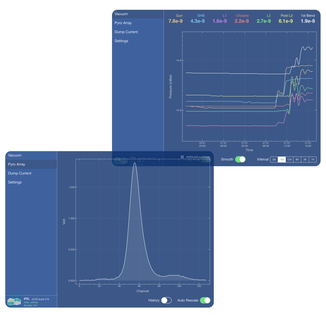
4 independent direct digital synthesizer (DDS) frequencysources allow smooth variation of waveform scan rates
Output frequency, amplitude, phase, and DC offset are smoothly variable in real time
EPICS/RTEMS 4.12 device support

Digitizer Struck SIS3316

16 channels, 250 MS/s per channel, 14-bit resolution, 64 MSamples memory/channel
Two programmable input ranges, 50 Ω or high impedance programmable, Offset DACs
125 MHz analog bandwidth, Internal/External clock
EPICS/RTEMS 4.12 device support

VMEbus CPUs

MVME6100 (beatnik) for control and compute runs CAS
MVME2500 for communication runs CAS and PSrv/QSrv
full EPICS and RTEMS 4.12 support



iPad - App

- On line data monitor
- Uses http
- Can be used everywhere
- distributed in-house

EPICS Archiver Appliance

- Ability to cluster appliances
- Scalable by adding appliances to the cluster
- Focus on data retrieval performance
- Able to archive millions of PVs
- Can archive waveforms, arrays (CA and PVA)
- Uses JSON for retrieval, easy to use with perl and python
- Developed at SLAC by Murali Shankar

References

- Markus Heyde, Georg H. Simon, and Leonid Lichtenstein , "Resolving oxide surfaces – From point and line defects to complex network structures" Phys. Status Solidi B 250, No. 5, 895–921 (2013) / DOI 10.1002/pssb.201248597
- epics-base, pvDataCPP, pvAccessCPP, …: https://github.com/epics-base (Restruction during ICALEPCS 2017)
- RTEMS source builder: https://github.com/RTEMS/rtems-source-builder
- EPICS Areadetector: https://github.com/epics-modules; Control System Studio: https://github.com/ControlSystemStudio
- EPICS archiver appliance: https://slacmshankar.github.io/epicsarchiver_docs/