

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

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Project CRYVISIL *

- To resolve glass dynamics

pitch=0.25nm

Freq=2e⁵Hz

Time=286ms

Points=57210

pitch=125pm

Freq=2e⁶Hz

Time=75ms

Points=11424

pitch=25pm

Freq=2e⁴Hz

Time=375ms

Points=7512

- 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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Interpolated images



Scan range: 5 nm x 5 nm Recording Time: 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 nmx 6.6 nm Recording Time > 10 min

asy

Traditional Scanning (triangular for x/y)

Traditional scan signals Example for 50 x 50 points (forward/backward)	X-Piezo Y-Piezo	
		1



up to 3000 f/s



home made

"fast STM"

ei6





CRYVISIL-LAN

EPICS Wiener Crate 6U VME cubic linear

Video-LEED

Waveform generator Highland V375

4 independent direct digital synthesizer (DDS) frequencysources allow smooth variation of waveform scan rates

nearest

neighoubour

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



- User authentication, data cache - Apache, php, perl, mysql

Check Status	Archive Archiv	ve (specify sampl	ling period) Loc	Pause	Resume			
PV Name	Status +	Appliance 🔶	Connected?	Monitored?	Sampling period 🔶	Last event	Details	Quick chart
/P01A:M_Press	Being archived	archappl1	true	true	1.0	Oct/08/2015 10:48:00 +02:00		
/P01B:M_Press	Being archived	archappl1	true	true	1.0	Oct/08/2015 10:33:30 +02:00		
/P02A:M_Press	Being archived	archappl1	true	true	1.0	Oct/08/2015 11:56:50 +02:00		
/P02B:M_Press	Being archived	archappl1	true	true	1.0	Oct/08/2015 10:57:20 +02:00		
/P03A:M_Press	Being archived	archappl1	true	true	1.0	Oct/08/2015 11:56:50 +02:00		
/P03B:M_Press	Being archived	archappl1	true	true	1.0	Oct/08/2015 11:56:25 +02:00		
/P04A:M_Press	Being archived	archappl1	true	true	1.0	Oct/08/2015 11:56:18 +02:00		
/P04B:M_Press	Being archived	archappl1	true	true	1.0	Oct/08/2015 11:46:52 +02:00		
/P05A:M_Press	Being archived	archappl1	true	true	1.0	Oct/08/2015 11:56:48 +02:00		
/P05B:M_Press	Being archived	archappl1	true	true	1.0	Oct/08/2015 10:43:00 +02:00		
/P06A:M_Press	Being archived	archappl1	true	true	1.0	Oct/05/2015 19:15:49 +02:00		
/P07A:M_Press	Being archived	archappl1	true	true	1.0	Oct/08/2015 11:52:12 +02:00		
PM11:M_Press	Being archived	archappl1	true	true	1.0	Oct/08/2015 11:02:25 +02:00		
PM12:M_Press	Being archived		Archivo Vi		(0)			(7788)

GeniCam

- Ability to cluster appliances
- Scalable by adding appliances to the cluster
- Focus on data retrieval performance



iPad - App

- On line data monitor

iGw

- Uses http
- Can be used everywhere
- distributed in-house



- 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/