

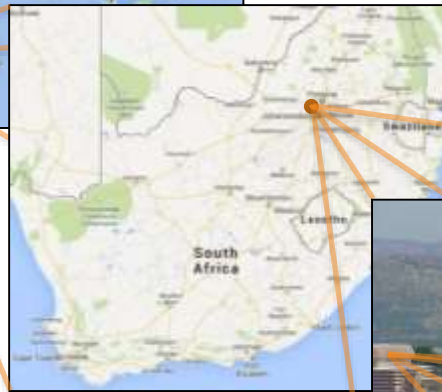
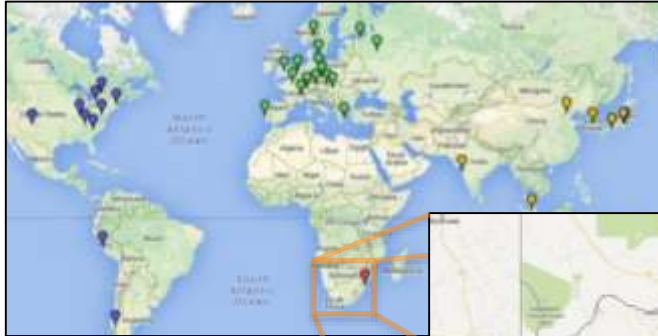
Towards near real-time data analysis and instrument calibration at the Necsa Neutron Strain Scanner



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*Radiation Science, Research and Development
Division, The South African Nuclear Energy
Corporation (Necsa) SOC Limited*

Who we are and what we do



- South African Fundamental Atomic Research Installation
 - A.k.a. SAFARI-1 Research Reactor



- 20MW Tank-in-pool
- Commissioned in 1965
- Flux $4 \times 10^{14} \text{ n.cm}^{-2} \cdot \text{s}^{-1}$
- Medical isotopes
- Irradiation services
- Neutron activation analysis
- Neutron beam line facilities



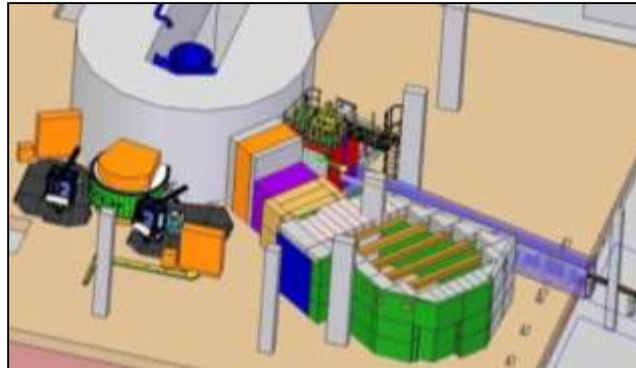
Neutron Diffraction Facility (NDIFF)

MPISI

*Materials Probe for Internal
Strain Investigations*

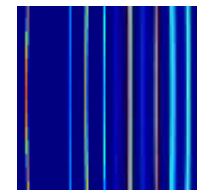


Spotted hyena in Zulu



PITSI

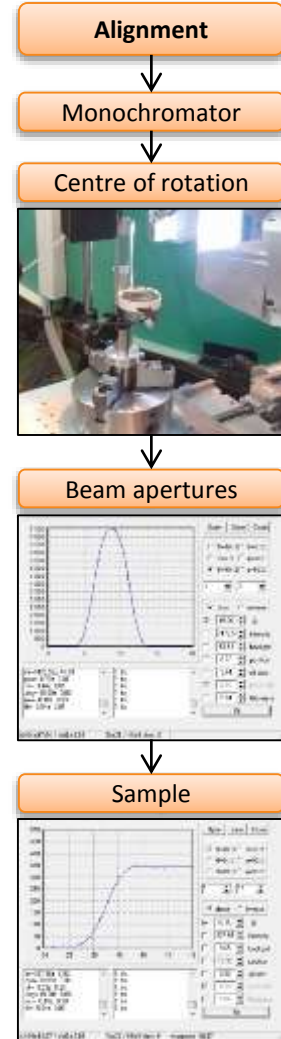
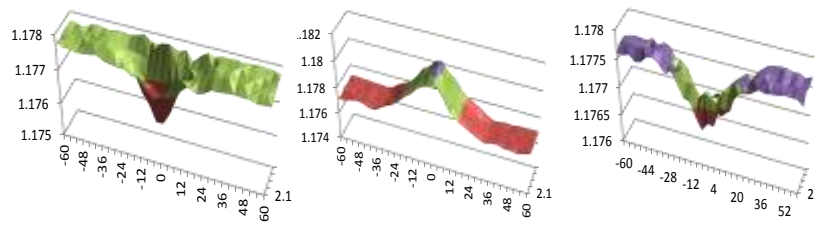
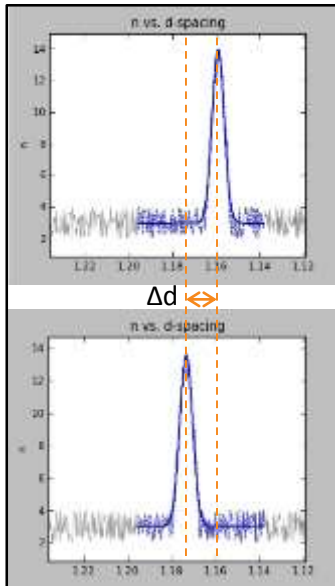
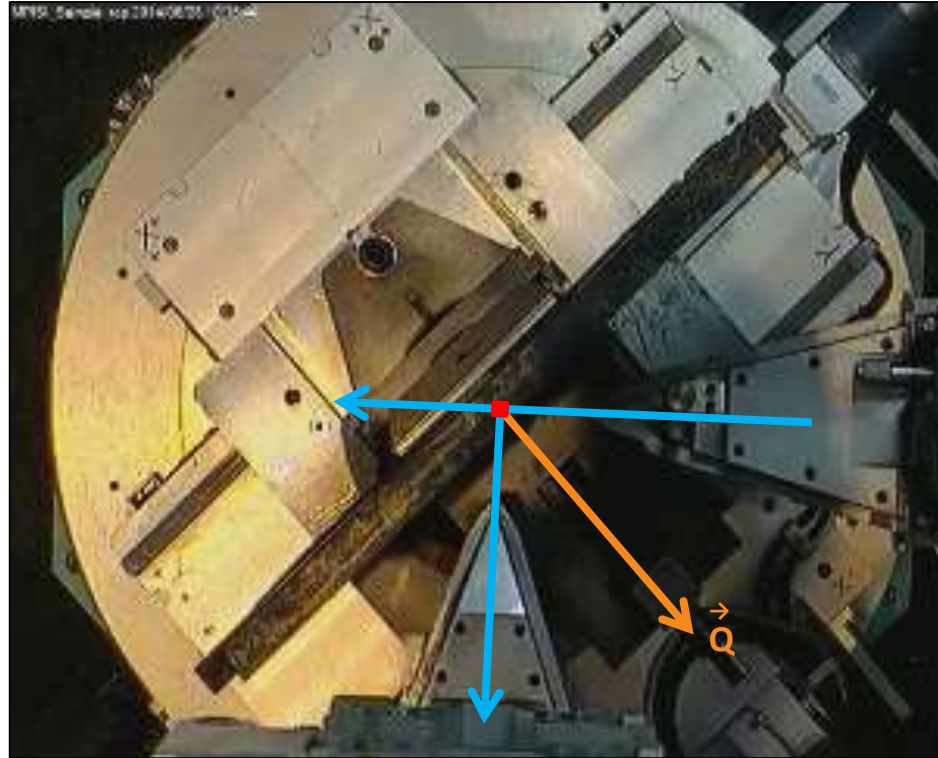
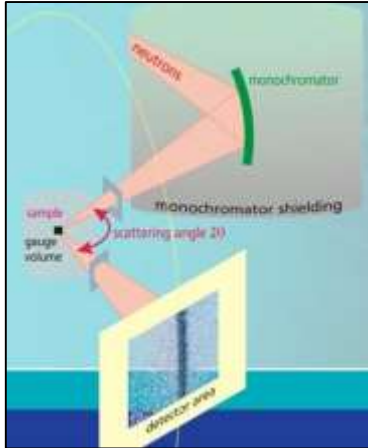
*Powder Instrument for Transition
in Structure Investigations*



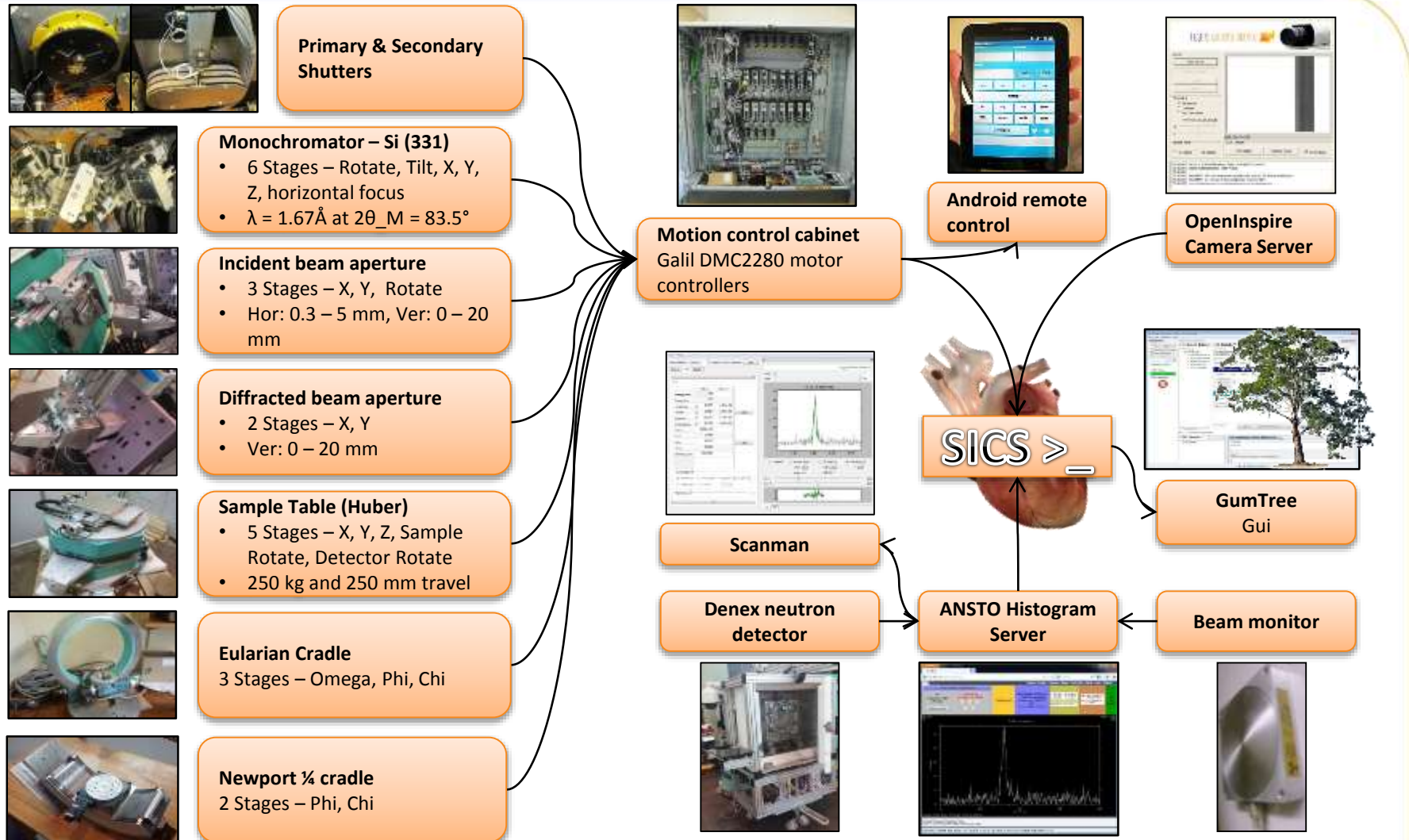
Zebra in Sotho



Neutron strain scanning



MPISI DAC

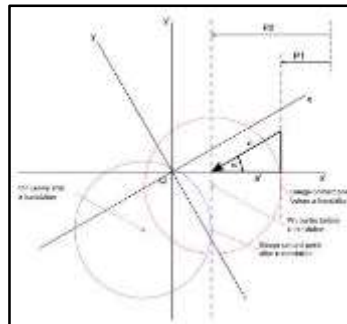


Sample table Centre of Rotation

- High definition camera
 - 1392(h) x 1040(v)
 - 6.45 μ m square pixels
 - Telecentric lens with distortion < 3 μ m

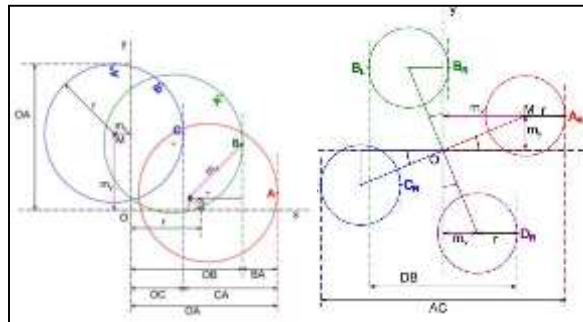


- Align camera axes with sample table axes
 - Adjust focus for scaling factor



	Focused	sy translated	som softzero set	sy returned
OI Cam graphic				
sy	-1.499756	3.50	3.50	-1.499512
som	0.0	0.0	2.044	2.044
Edge positions	589.95, 871.28	647.82, 863.66	626.74, 842.16	596.55, 877.61
Centre	730.61	755.74	734.45	737.08

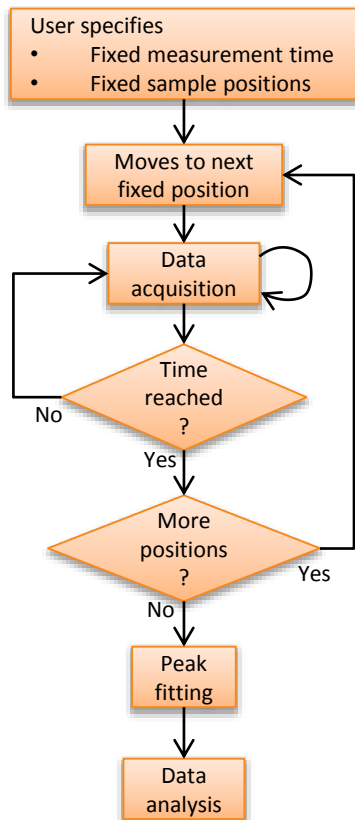
- COR offset calculation methods
 - 3 Positions
 - 4 Positions



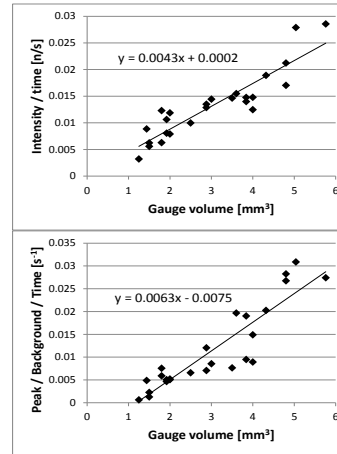
Rotation	0	45	90	All (aligned)
OI Cam graphic				
Edge positions	922.37, 1171.96	655.57, 880.58	272.92, 501.25	463.03, 729.16
Pin width (px)	249.59	225.01	228.33	266.13
Centre	1047.165	768.075	387.085	596.095
Corrected edges	891.48, 1202.85	612.39, 923.76	231.40, 542.77	440.41, 751.78

Data acquisition strategies

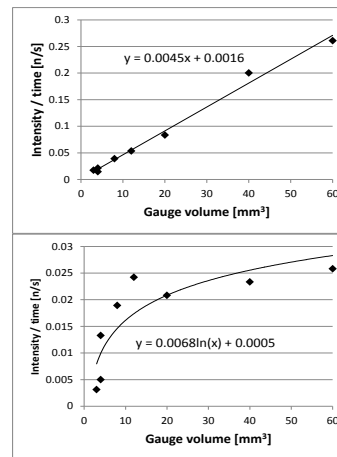
Time based



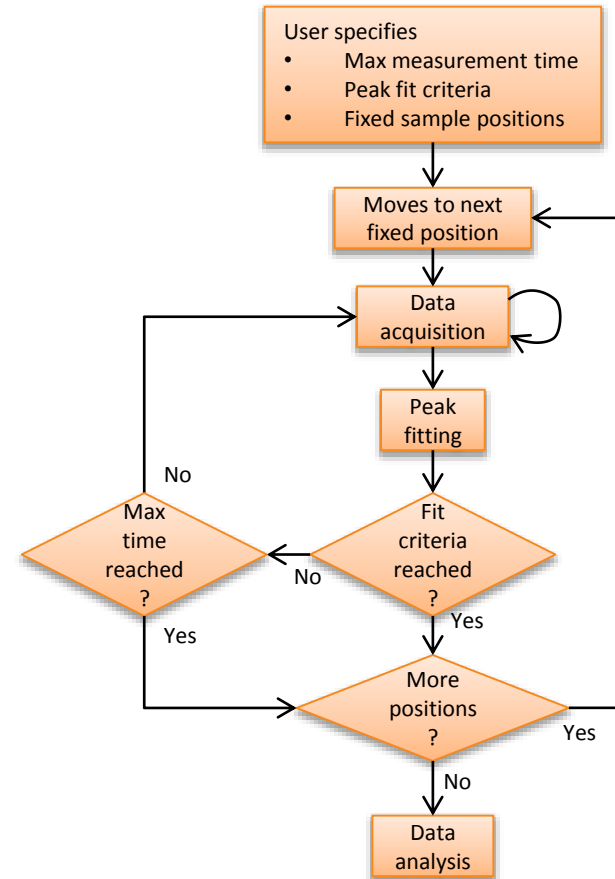
Aluminium



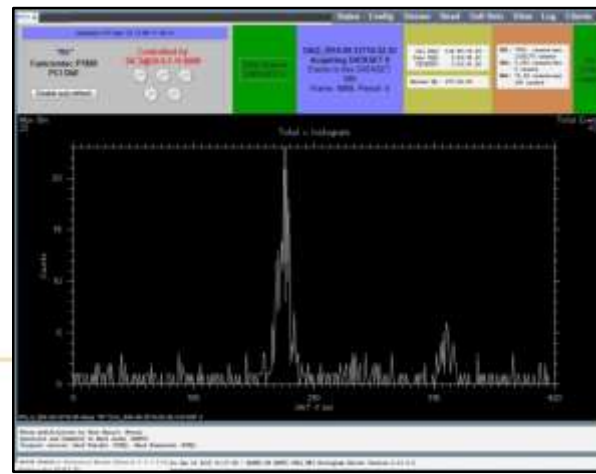
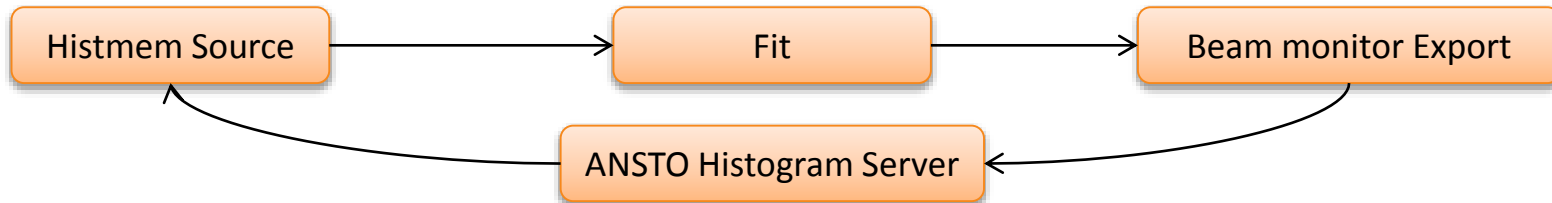
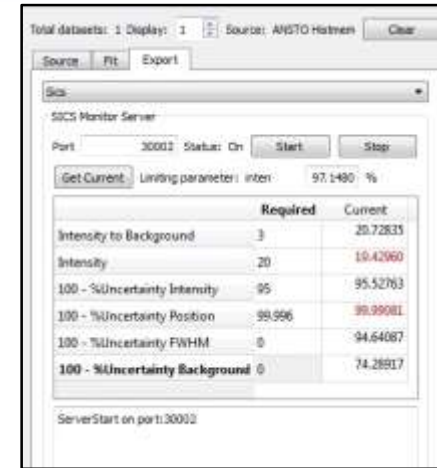
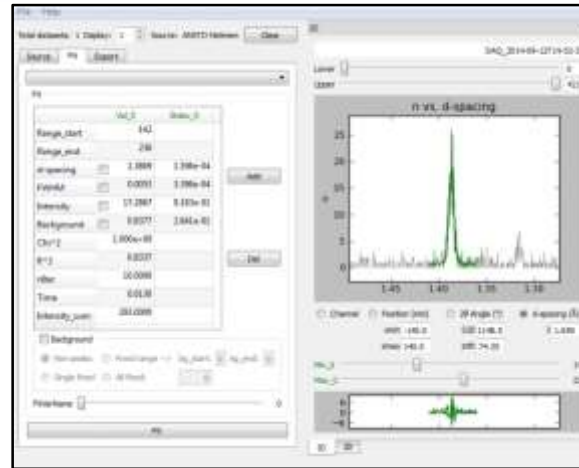
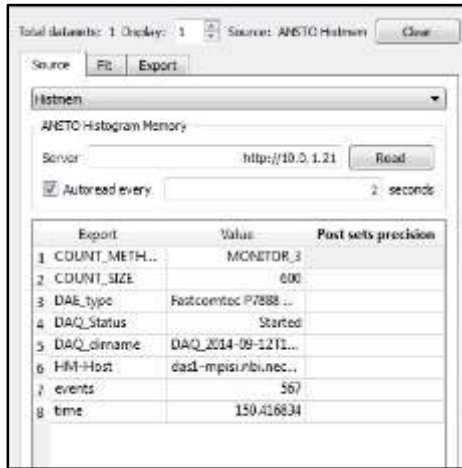
Titanium



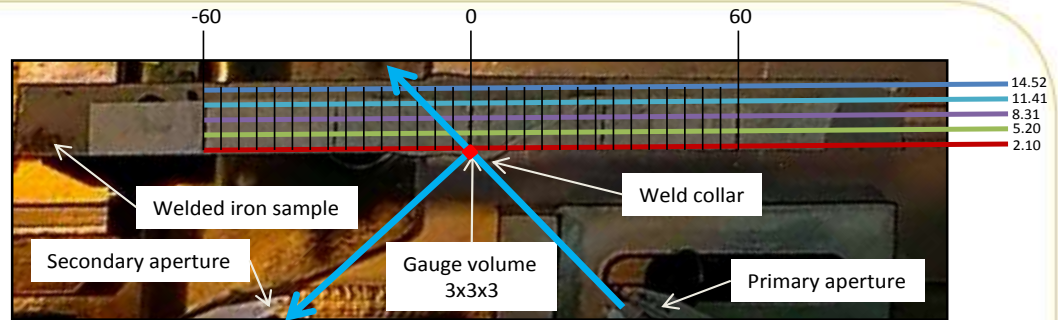
Statistics based



Statistics based DAQ implementation



Test case – Welded Iron sample



	Const time	Min intensity	Stdev: 4e-5	Stdev: 1.5e-5
Max time	600	600	1200	1800
Min intensity to background	N/A	3	3	3
Min intensity	N/A	100	10	10
Min % certainty intensity	N/A	95	95	95
Min % certainty position	N/A	99.993	99.993	99.9987
Corresponding stdev d-value	N/A	4.00E-05	4.00E-05	1.50E-05

Results

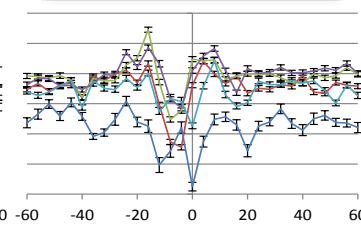
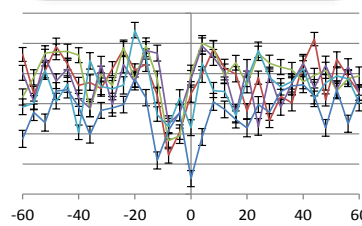
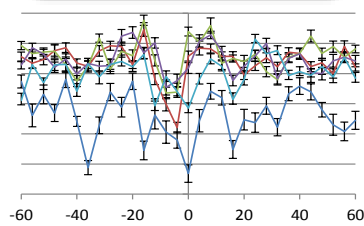
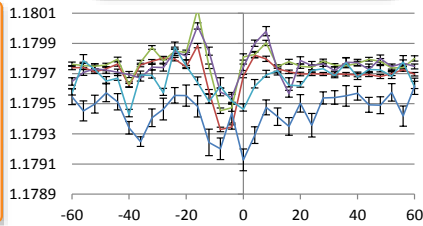
Const time

Min intensity

Stdev 4e-5

Stdev 1.5e-5

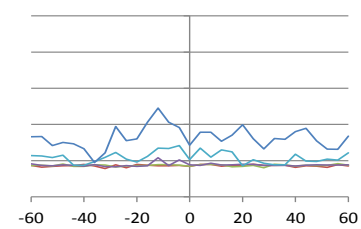
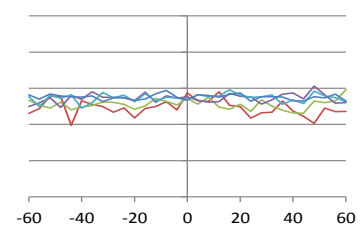
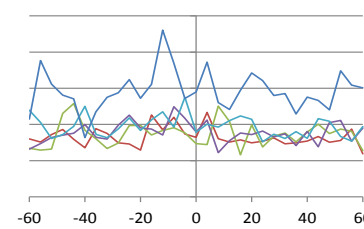
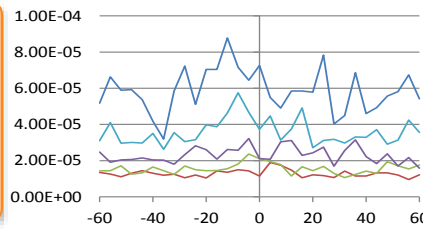
d-val



2.10
 5.20
 8.31
 11.41
 14.52

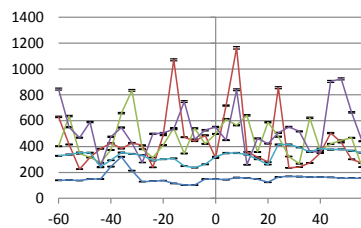
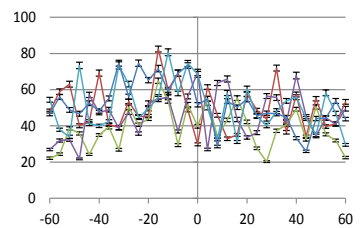
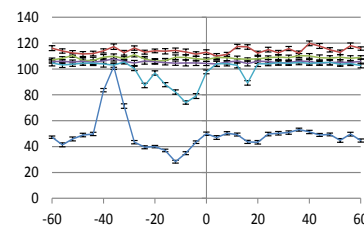
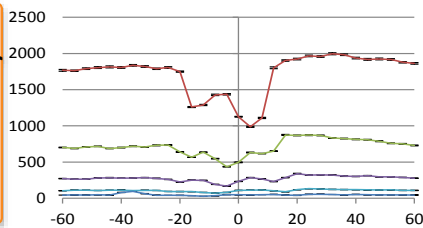
Stdev

d-val



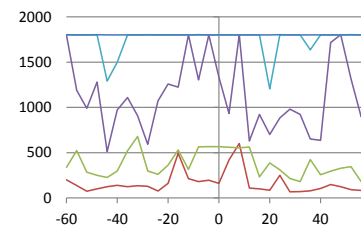
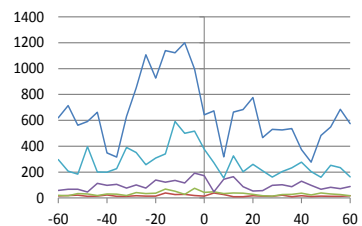
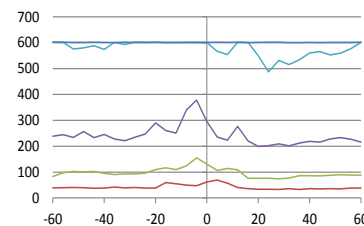
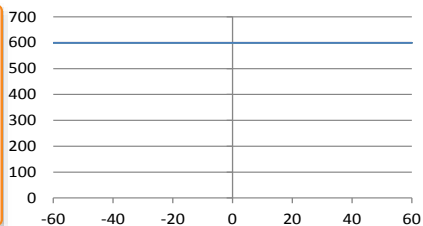
2.10
 5.20
 8.31
 11.41
 14.52

Intensity



2.10
 5.20
 8.31
 11.41
 14.52

Time



2.10
 5.20
 8.31
 11.41
 14.52

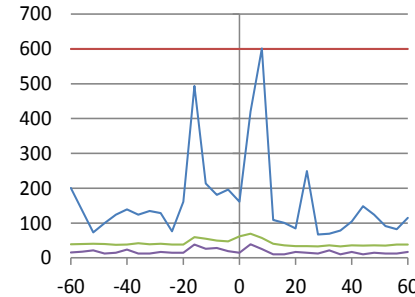
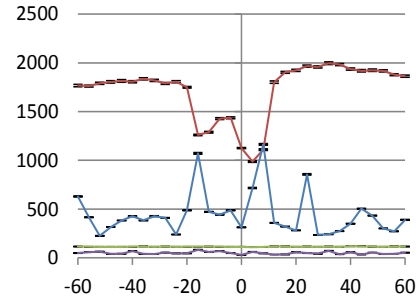
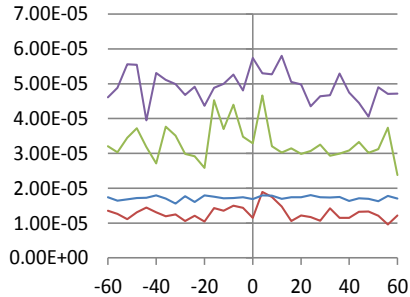
Comparison

Stdev d-val

Intensity

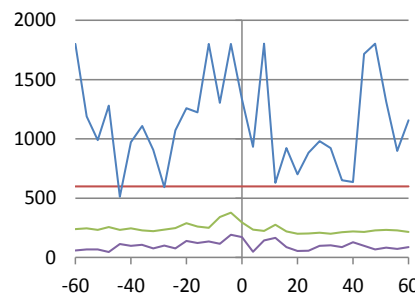
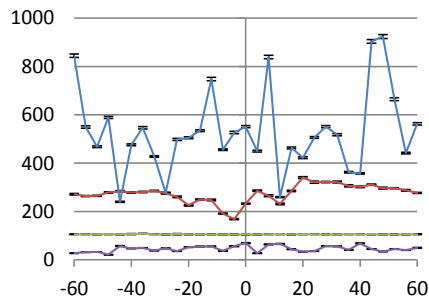
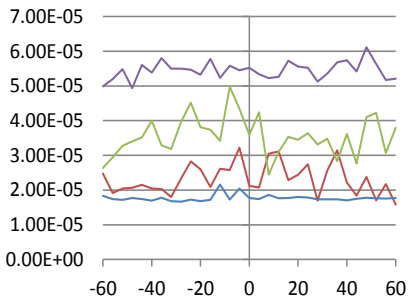
Time

2.10



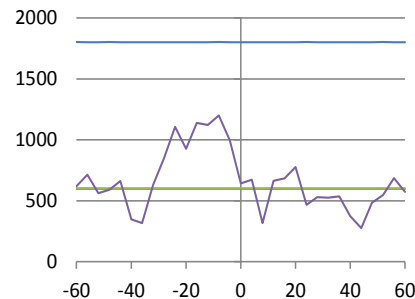
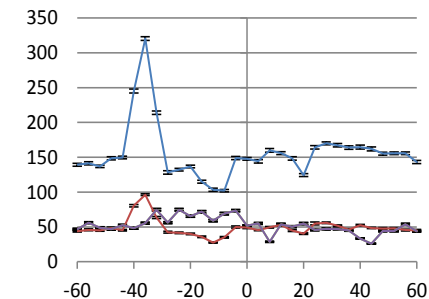
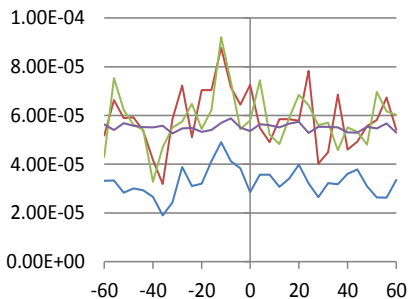
	Time (h)
Const time	5.17
Min intensity	0.36
stdev 4e-5	0.15
stdev 1.5e-5	1.41

8.31



	Time (h)
Const time	5.17
Min intensity	2.09
stdev 4e-5	0.85
stdev 1.5e-5	9.75

14.52



	Time (h)
Const time	5.17
Min intensity	5.18
stdev 4e-5	5.71
stdev 1.5e-5	15.51

Conclusions and future projects

- Automated, 'loggable' COR alignment achieved
- Statistics based DAQ can save time, but is not a black box solution
- Intelligent DAQ protocol
 - Initial measurement on course mesh
 - Identify regions with high stress gradients
 - Re-measure these areas with finer mesh
 - Automate the process



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- Vladimir Luzin for the entry curve software 'Alihn'
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- Nobugs for bringing the people together!

Questions

