RTV diagnostic

Layout and Current status

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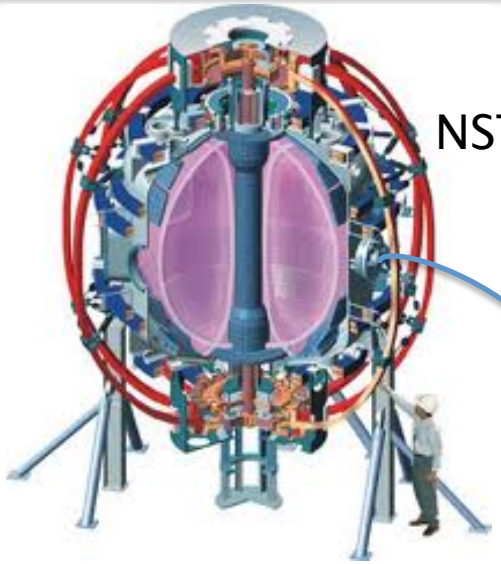
RTV systems: stand-alone diagnostic or *input* for PCS



NSTX

fibers from test-cell to darm

Goal: *fast* measurements of toroidal rotation

- Up to 5kHz (limited by SNR)
- 2 systems, 4 channels
  - Active + background pairs

Control & acquisition

spectrometers & cameras

link to PCS (e.g. reflective memory)

Plasma Control Software (PCS)

Basic parameters

parameter	value, min/max
Spectrometer	KOSI with HD grating
Camera	2x Cascade 128+
	max 5kHz sampling
	4 views/camera
	8 fibers/view
	16bit resolution
Target ops	1kHz sampling
	real-time analysis: v_{tor}
	<5% error on v_{tor}

Control & Acquisition PCs

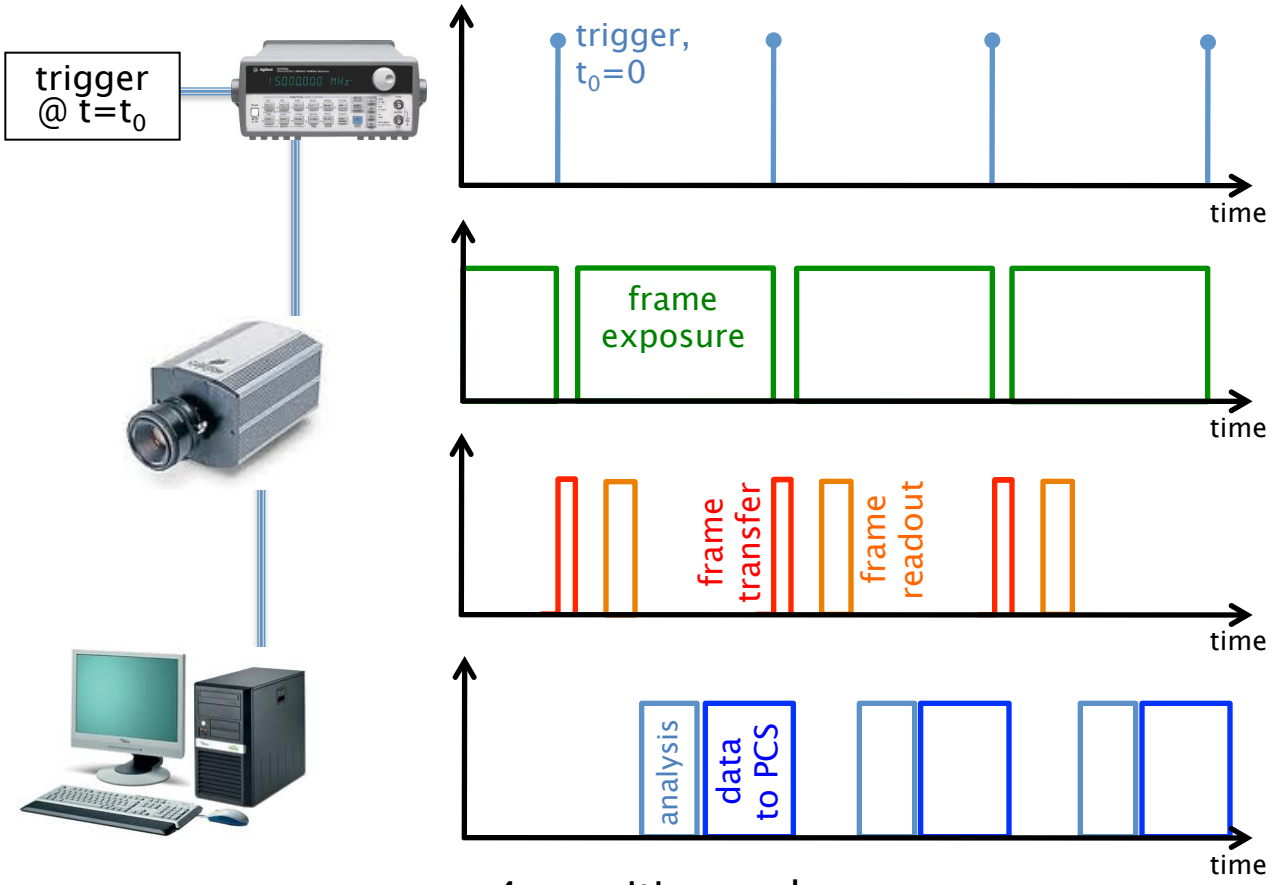
4U; QuadCore-XEON 3400
2xPCI-E x16
4xPCI 32bit/33MHZ
150GB/1TB drives
4:USB3.0

Description	Mfgr	Model	Qty
Processor	Intel	X3440 Lynnfield 2.53GHz 8MB L3	1
Motherboard	Asus	ASUS P7F-C/4L LGA 1156 Intel 3420 ATX	1
Memory	Kingston	2GB 1333MHZ DDR3 ECC CL9DIMM KIT3 TS Intel	2
Power Supply	Seasonic	SS-560KM Active PFC, 560W, 80Plus	1
DVD Burner	LG	DVD SATA Burner	1
CPU Heatsink	Dynatron	K985	1
1TB RE3 Drive	Western Dig	WD1002FBYS 1TB 7200 RPM SATA 3.0	1
150GB VelociRaptor Drive	Western Dig	VelociRaptor 150GB 10K SATA 3.0	1
92mm PWM Fan	Arctic Cooling	AF9 PWM 92mm Case Fan	3
4U Rackmount Case	AIC	EJ-RMC4S	1
4U Rack Rails	AIC	20" Rack Mount Rails	1
LCD Monitor	Samsung	EX2220X Glossy Black 21.5" 5ms LED	1
Keyboard w/GlidePoint	Adesso	ACK-730PB PS/2 Keyboard with Touchpad	1

Current status of control/ acquisition software

- Developed C++ prototype control software
  - Use standard libraries, open source only
    - PVCAM from camera manufacturer, LEVMAR for curve fitting
  - MDS events supported
  - Acquisition up to 5kHz achieved
    - 4 bins, 2 spectra/bin
    - Frame acquired and analyzed in <200μs
  - Real-time fitting w/ gaussian+linear background demonstrated in <100μs, multiple bins
    - Most time-consuming step in v_{tor} analysis
    - Excellent comparison w/ off-line fit (IDL)
- Used Windows XP so far, plan to move to Unix soon

Expected timing and data format



exposure	~1/fsamp
frame shift	<15μs
readout	~50μs, 100μs fixed delay wrt t_0
analysis	<100μs
data to PCS	<10μs (reflective memory*), or t.b.d.

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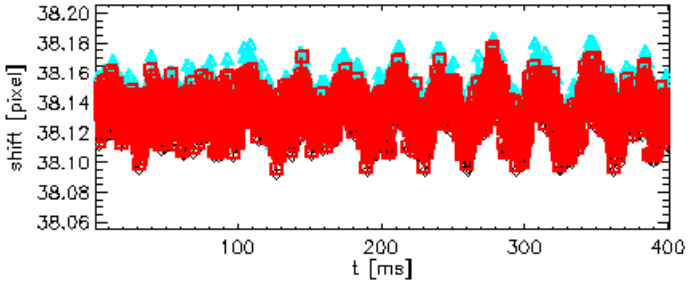
Data to PCS, 16bit resolution:

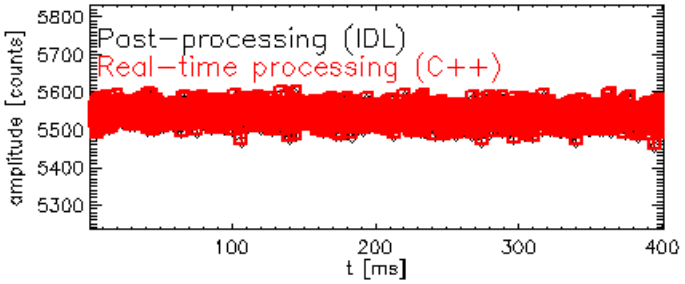
- 4x positions values
- 4x velocity values
- 4x velocity uncertainty values
- 4x "error flags"
- 1 time-stamp

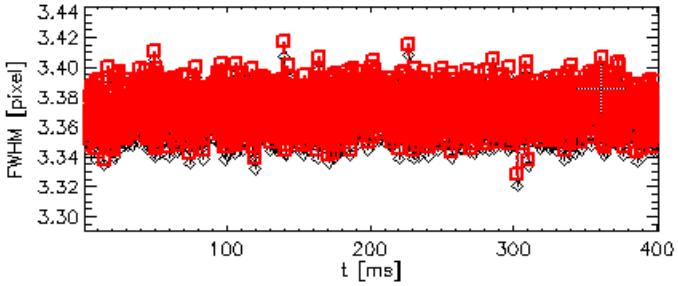
Example of 'real-time' acquisition and analysis; typical performance

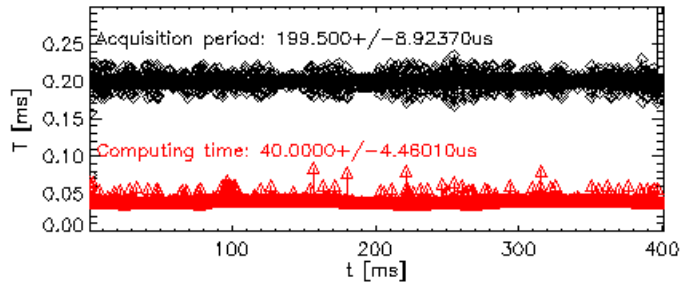
- Use waveform generator as external trigger
- Compare real-time vs. off-line (IDL) fits

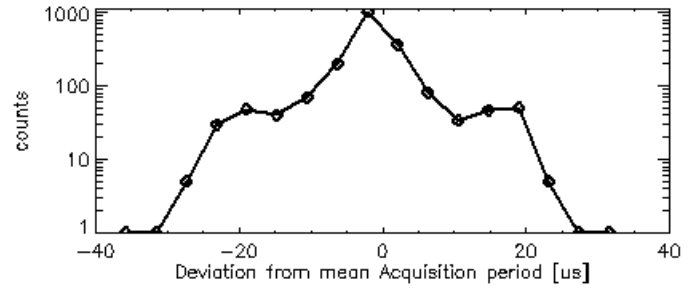
- Time-stamps from C++ software timer
- Compare w/ scope
  - Artifacts (spikes) introduced by Windows timer

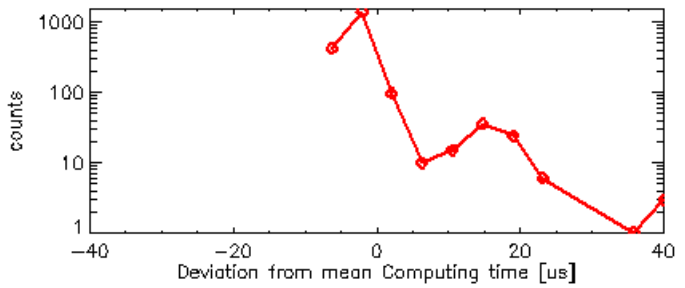




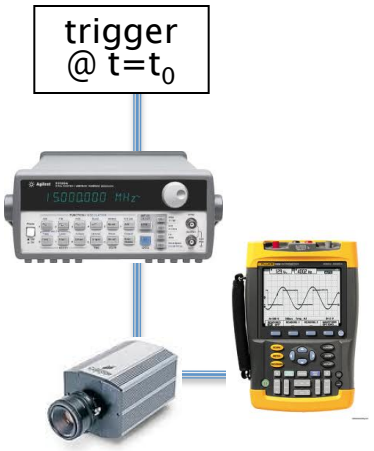






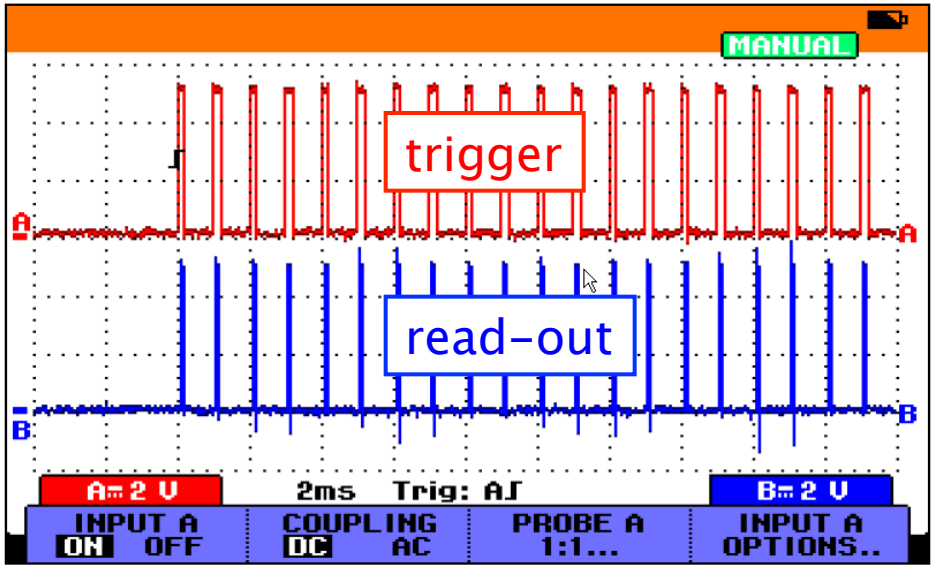


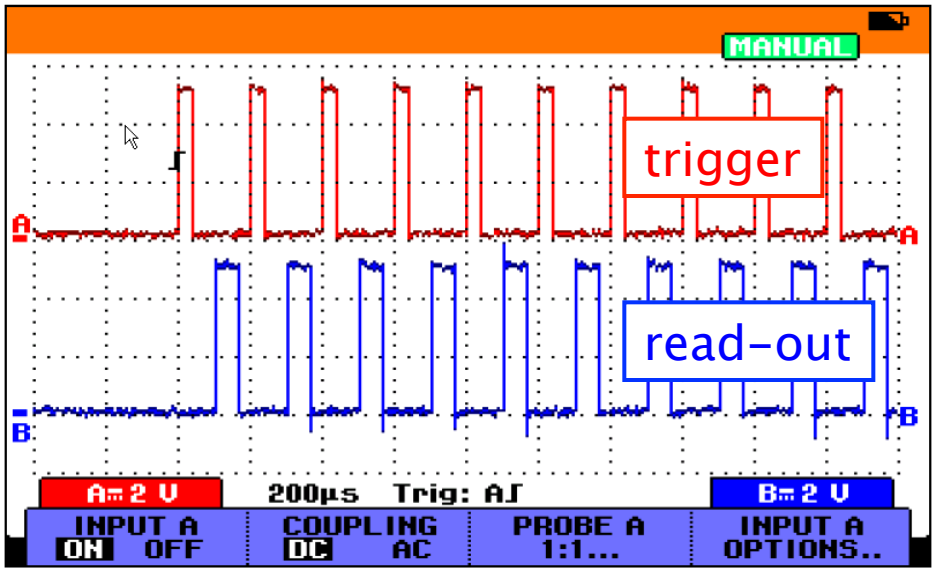
No delay observed between initial trigger & start-of-acquisition



- Waveform generator provides precise, controllable trigger/timing
- Reproducible sequence, no 'set-up' delay observed, no missing frames, …

Acquisition @ 1kHz





Acquisition @ 5kHz