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A new, and improved, MOSTAB (monochromator stabilizer)

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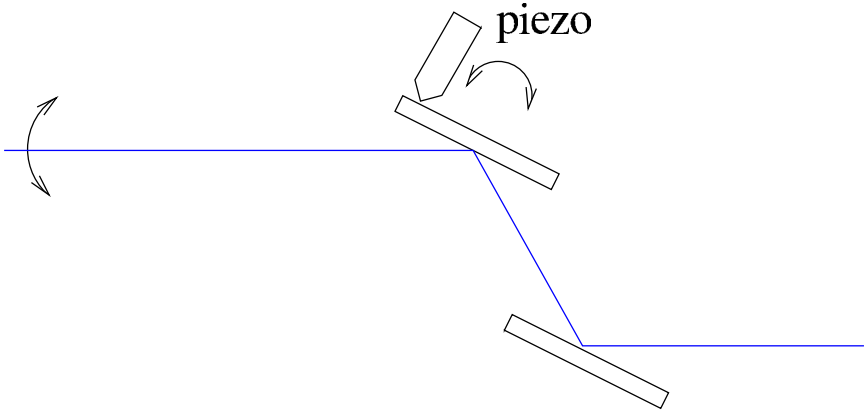
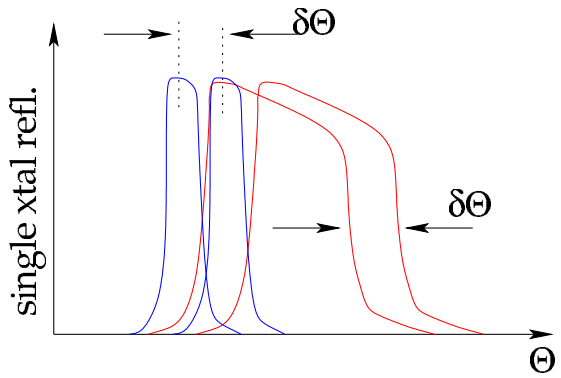
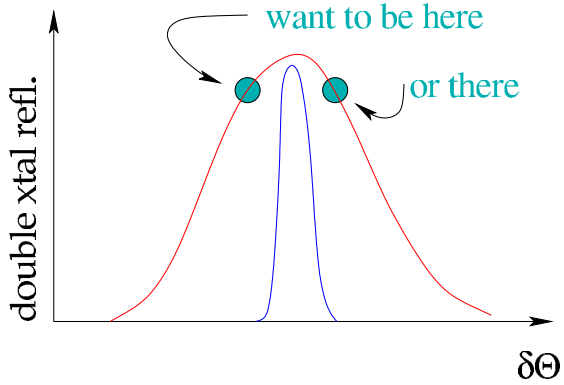
Monochromator

Double-crystal monochromators typically have a piezo
on the 2nd crystal to adjust parallelity
motion of the piezo affects throughput and beam position







Often want to detune a bit
to suppress harmonics

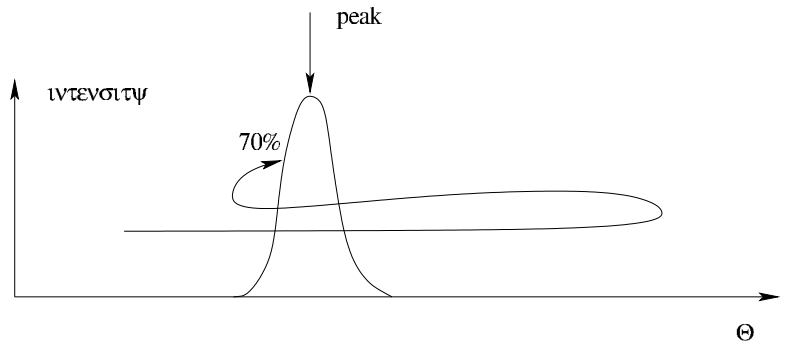
what is a MOSTAB

Monochromator Stabilizer

Feedback loop to maintain constant detuning or beam position

Scans monochromator piezo, then returns to:

- left shoulder of peak at typ. 70 %
- right shoulder of peak at typ. 70 %
- constant position



or, with more advanced programming . . .

- top of peak
- more complex criteria – this talk

MOSTAB

history

MOSTAB (Monochromator Stabilizer) originally developed at DESY

1. generation: all analog Materlik et al., NIM **219**, 430 (1984)

2. generation: digital, no longer available

`http://www.struck.de/dmostab.htm`

new MOSTAB (this talk)

up to 8 analog inputs (12 bit res.)

up to 4 analog outputs (12 bit res.)

up to 4 digital inputs, 4 outputs (counters, veto, gate, etc.)

based on Propeller microcontroller and a few extra components

prototype cost ca. $ 150

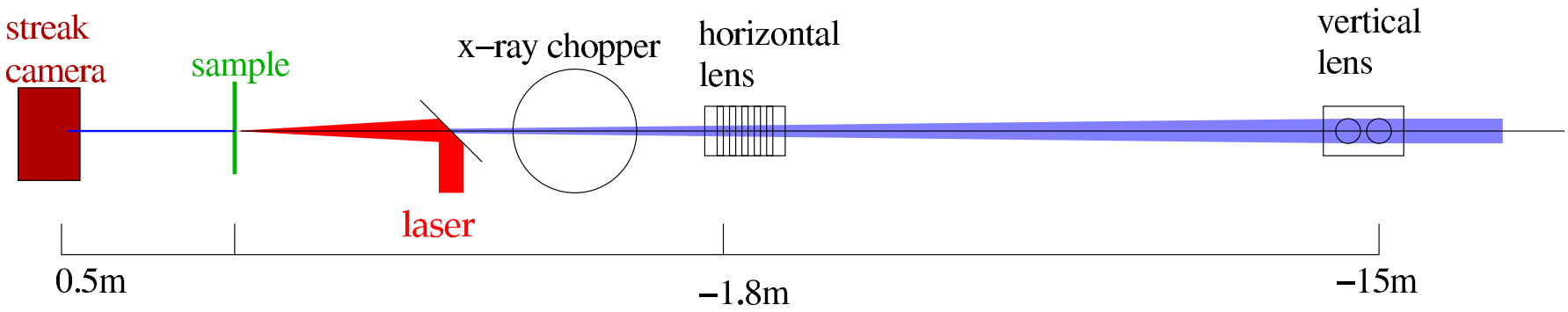
program easy to modify

The Current Problem

needed micron-level beam-position stabilizer for focused x-ray

to overlap with laser focus in streak-camera operation

16-meter focal length for 50-cm-long focus (Rayleigh length)

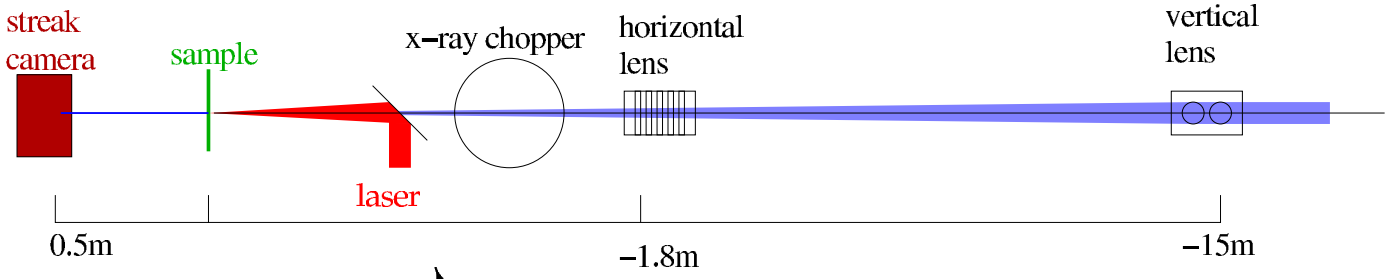


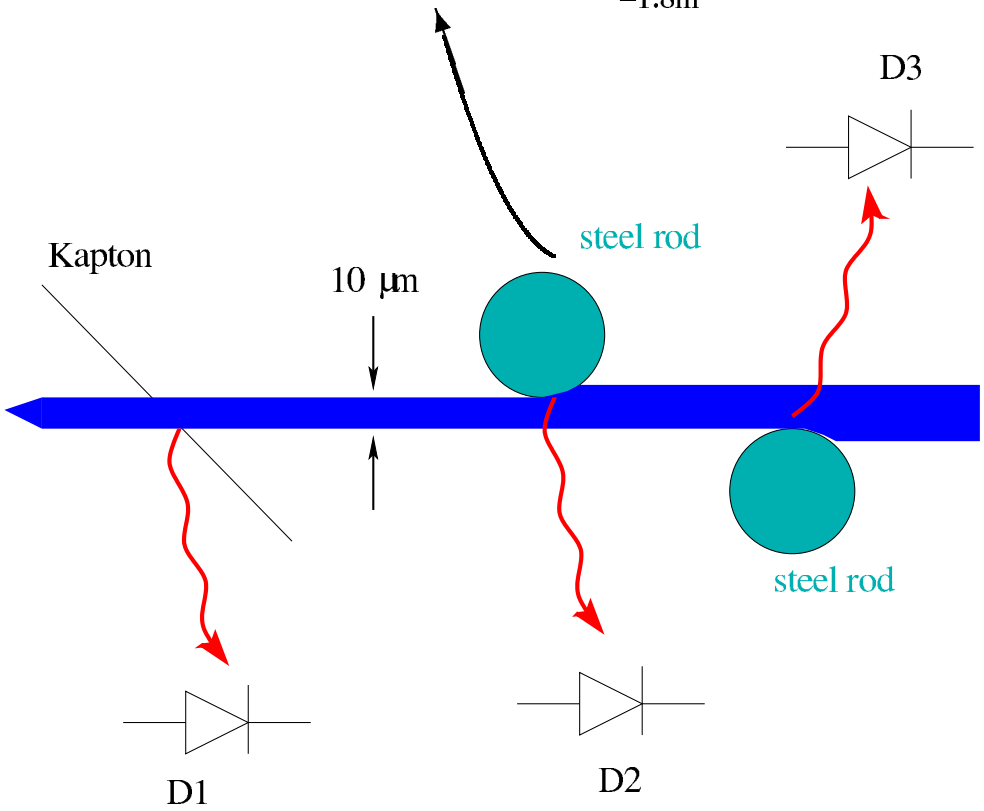
with this long focal length

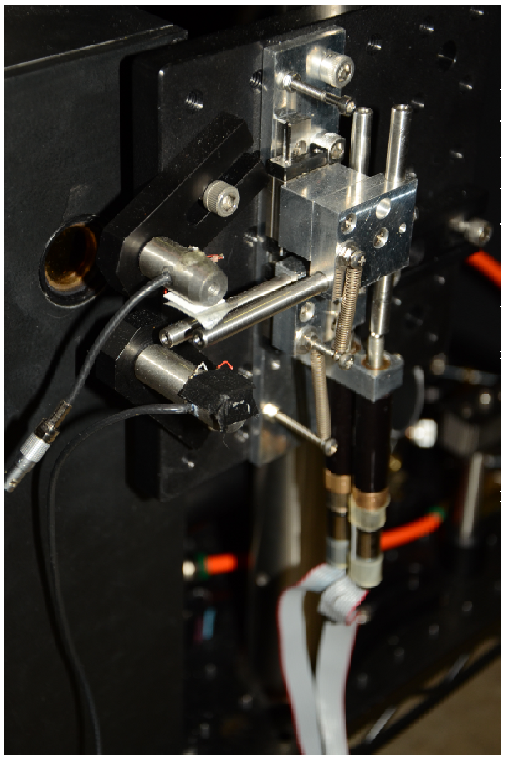
piezo motion has large effect on beam position

The Current Problem

Solution: High-resolution slit/BPM - good to $< \mu$m

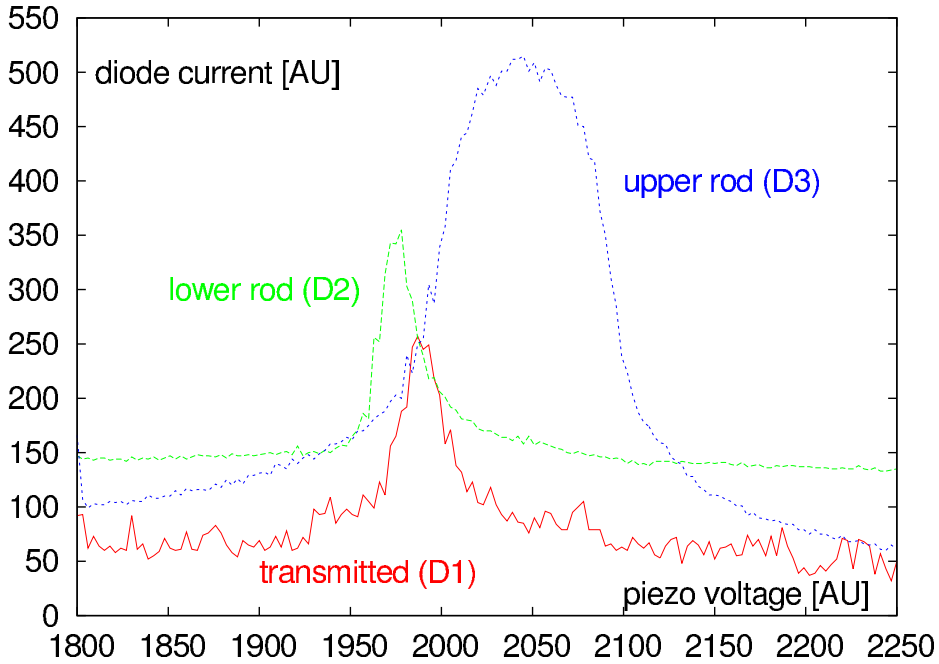






Solution

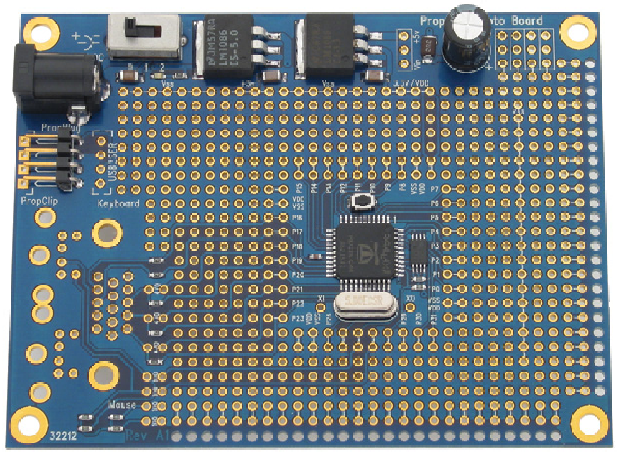
need a MOSTAB that scans for peak in 1 signal (transmitted, D1), then stabilizes on on other signals (normalized rod signals, D3-D2)



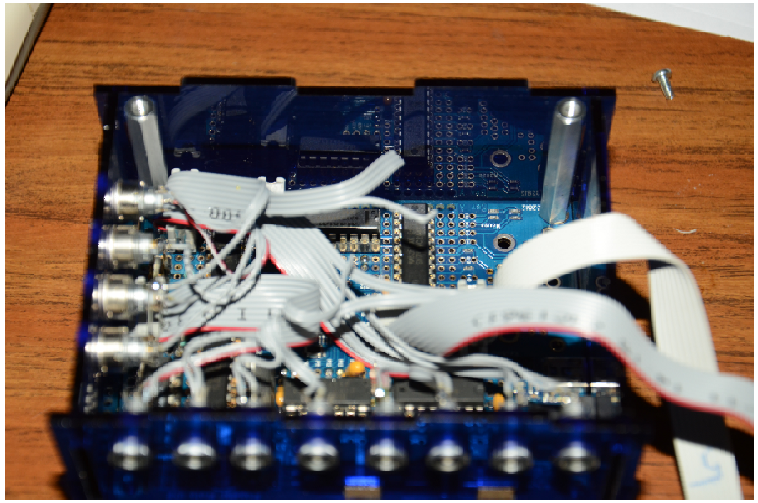
scan piezo (DAC output), acquire 3 signals on ADC inputs (D1 .. D3)
find peak in transm. signal, rod signals at peak (d2, d3) to normalize
stabilize on D3/d3-D2/d2

Solution

Prototype has: 4 analog 12-bit DAC outputs
4 analog 12-bit ADC inputs
4 digital outputs
4 digital inputs (gate, veto, counter, etc.)

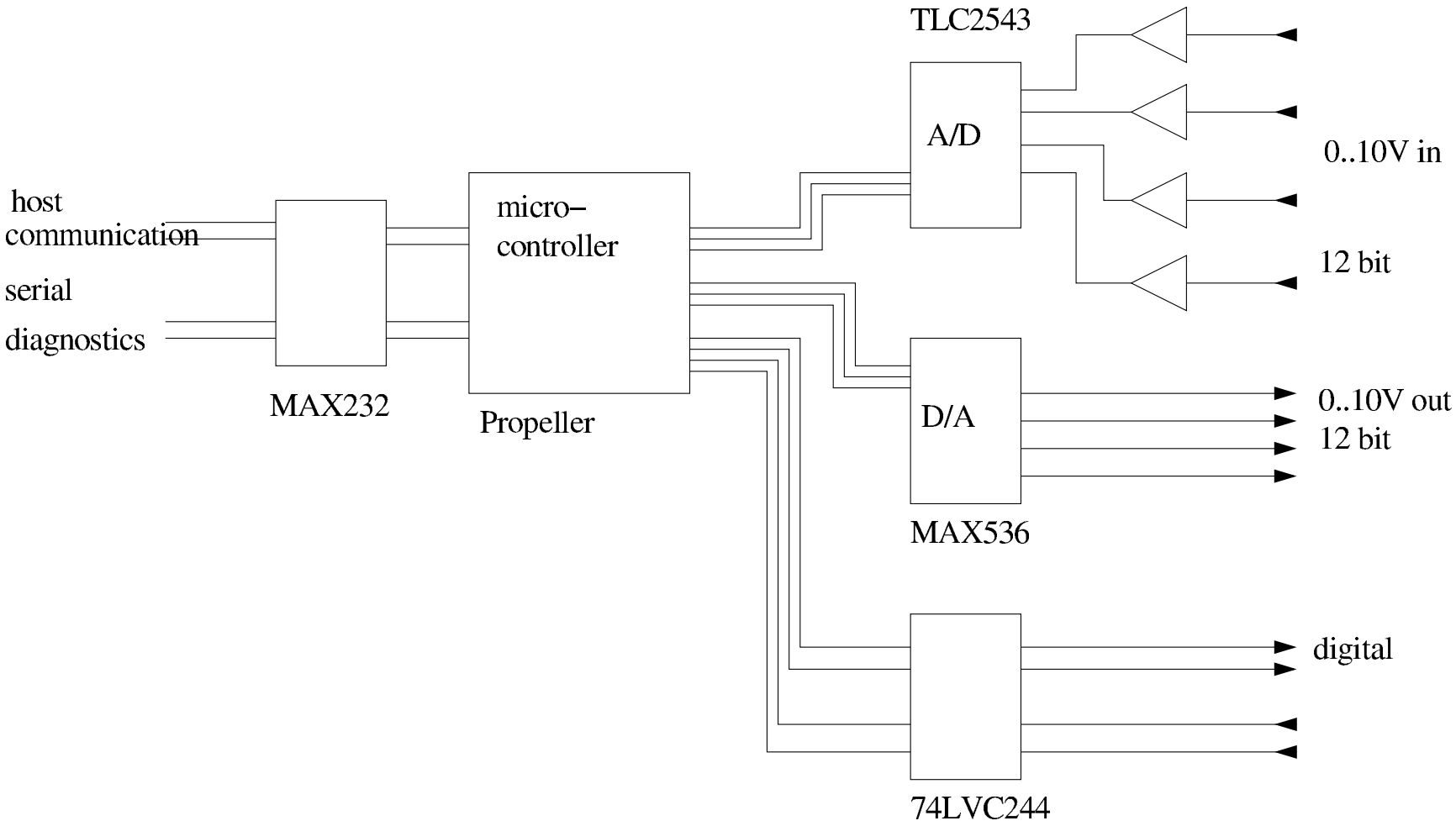


www.parallax.com



Solution

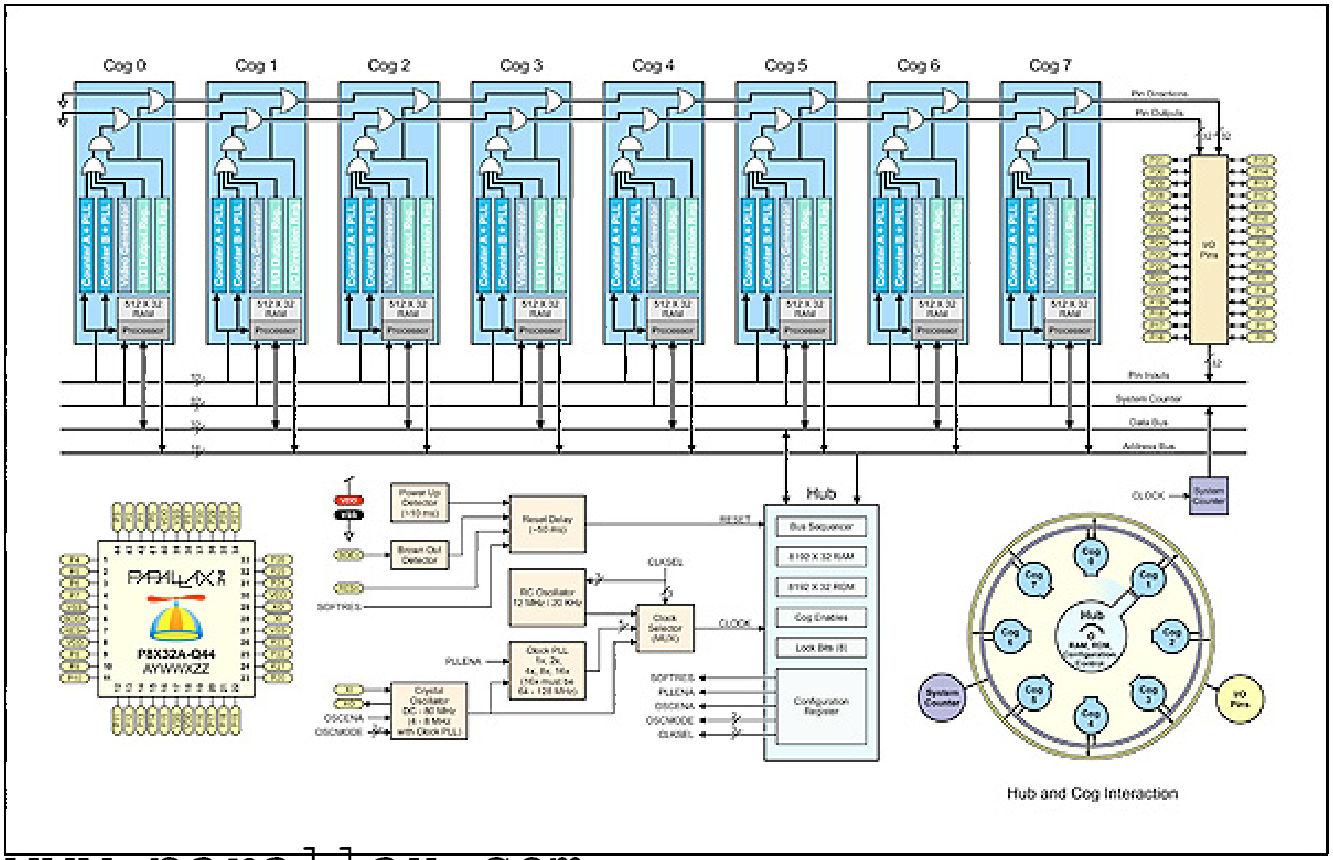
schematic



Solution the Propeller

Eight 32-bit cores in one chip

cores handle tasks concurrently (ADC, DAC, UART, counter, ..)



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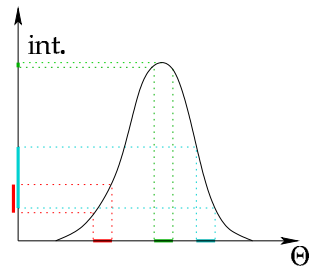
Solution

the multicore architecture allows a different programming style
the main program does the high-level stuff:
command interpretation, scan, find peaks, etc.
peripherals (UART, ADC, DAC, counter, ..) appear as variables
to write to or read from
each is handled by a core that does the low-level interfacing

another application may require scanning several actuators
(trajectory or higher-dimensional scan)
or stabilizing on some combination of analog/digital signals
can easily adapt the program in the MOSTAB to do that
or stabilize on peak, not slope: can program that, too



Solution

Status:

Mostab works, keeps focused beam in slit during energy scan

enters seek mode when beam is lost, returns to slit

Next steps: design circuit board, put into NIM module, tie into EPICS