Digitisers for SAGE and LISA

Digital Electronics Requirements:

- 14bits, 100MHz for pulse shape analysis & energy is normal
- But, don't need PSA because detectors aren't segmented and preamps are too slow.
- So 14 bits 50MHz would be fast enough.
- Real time processing up to 30kHz count rate (energy only)
- Data rate: 30k x (energy (2) + timestamp (6) + ID (2))

= 300kBytes/second per channel: 1.2Mbytes/sec/4 chan card.

- 100 channels = 30Mbytes/sec.

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Digitisers for SAGE and LISA
Alternatives to the TNT2 (CAEN N1728).

SMARTPET will use commercial electronics: why?

- Nicely packaged for our application
- Volume users (Radar, software radio)= sensible price
- Powerful FPGA built in- DSPs too.
- Can process 50kHz singles rate on 48 channels
- 160/320Mbytes/sec (diagnostic). Normally 20Mbytes/sec output.

- Needs interface card for TDR port and analogue matching

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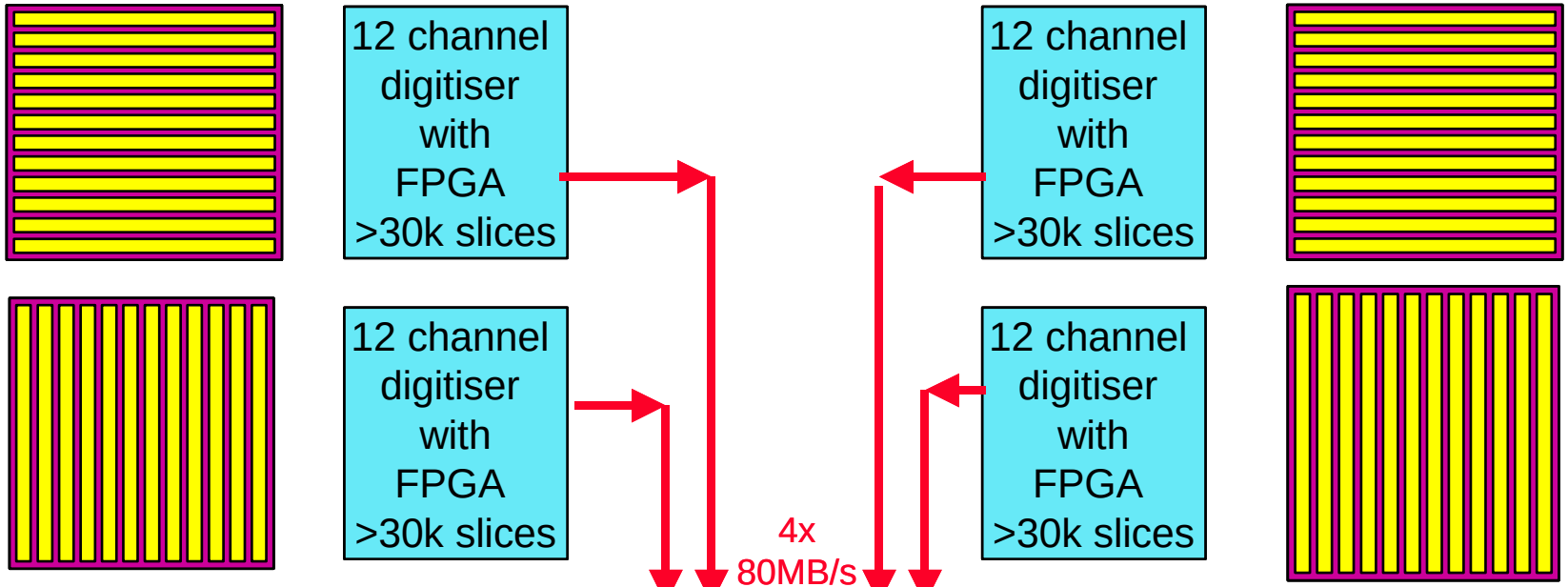
Digitisers for SAGE and LISA: Smartpet

Ge strip detector (12 x 12)

Ge strip detector (12 x 12)



Necessary, but not shown:

1) Timestamp system to stamp all data when CFD fires.
2) Common ADC clock
3) Sync for timestamps
4) Reset and Error timestamp
5) Control/setup bus/net

Tender includes all blue parts

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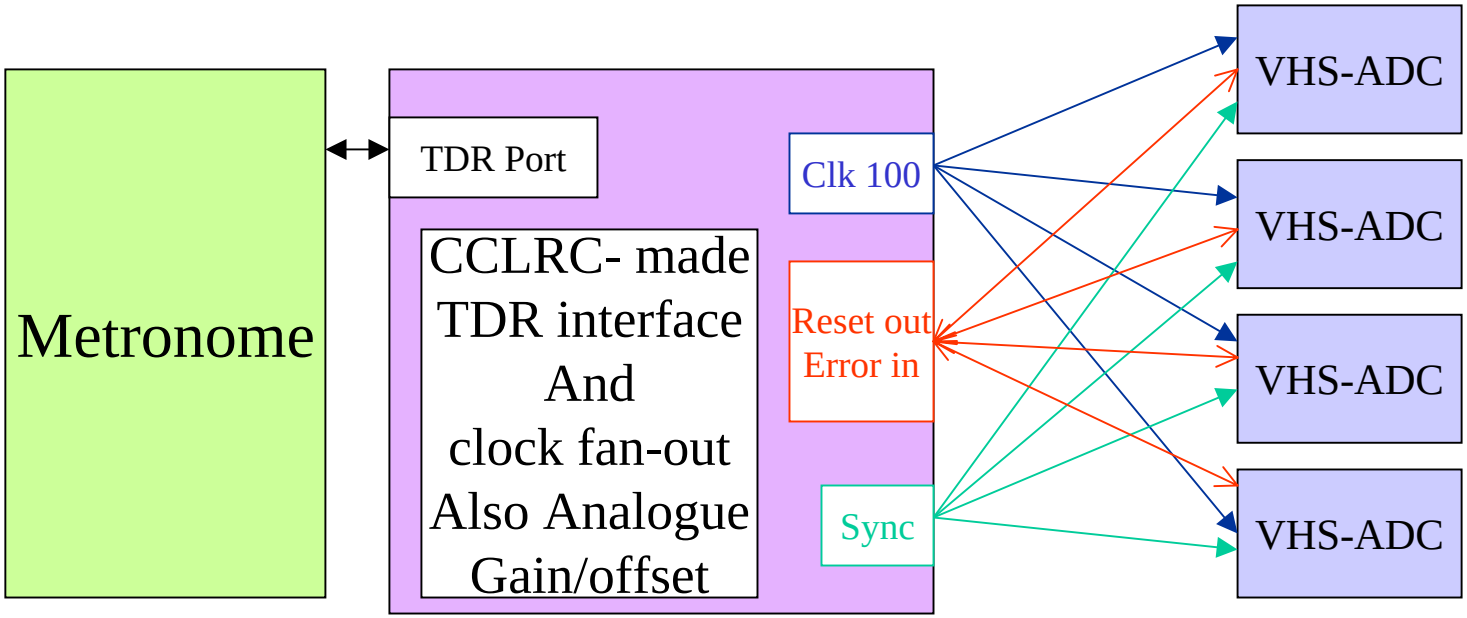
Digitisers for SAGE and LISA: TDR port



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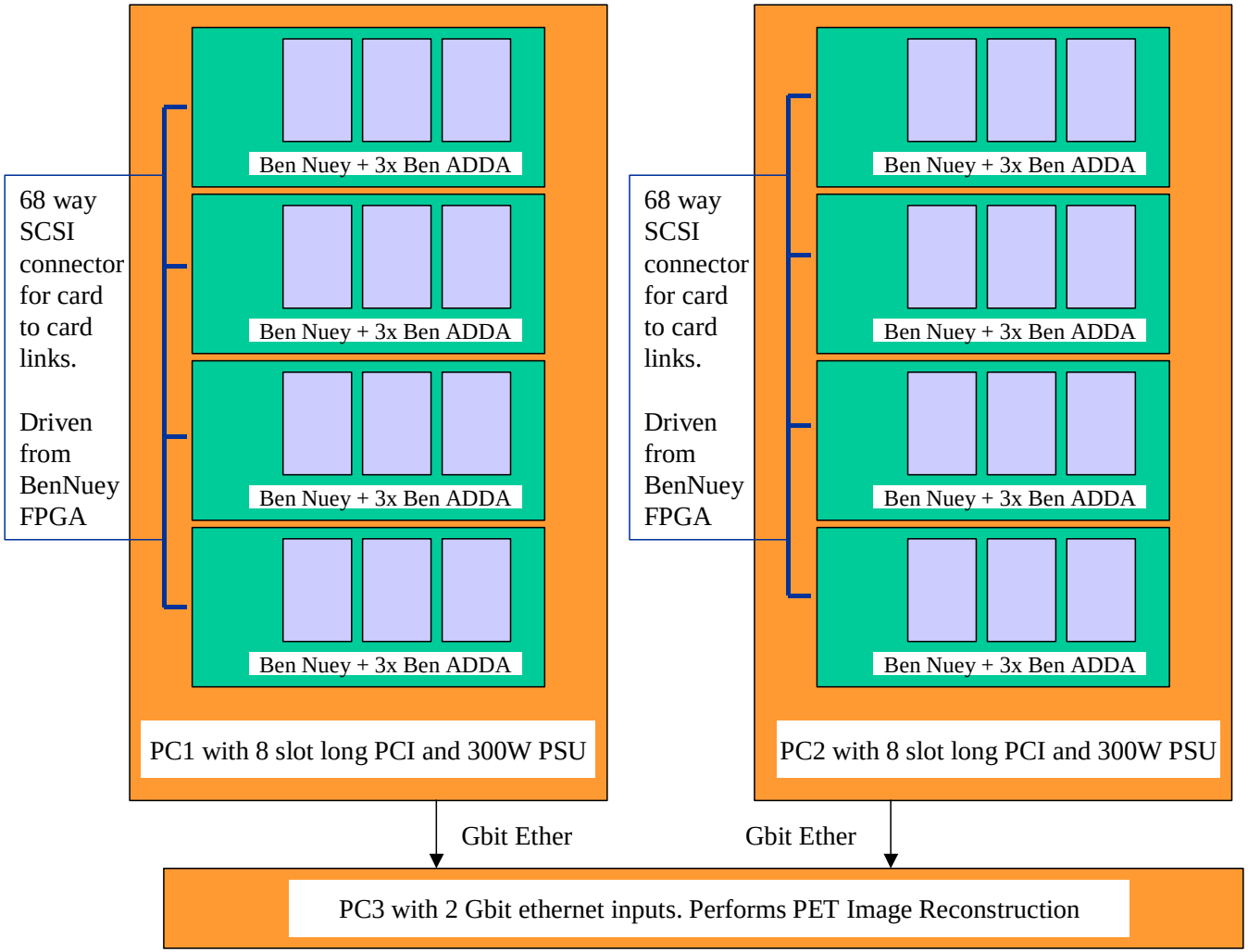
Digitisers for SAGE and LISA: Commercial

Commercial digitisers with powerful built-in FPGAs

- Nallatech: 2 channel DIME cards: 8 channels/carrier
- Lyrtech VHS-ADC CPCI card (16 channels, 100MHz, 14bits)
- ICS: 4 channel PMC cards: 8 channels/carrier
- Sundance: 4 channel TIM cards: 16 channels/carrier
- XIA: PIXIE: 4 channel CPCI/PXI cards (75MHz, 14 bits)

Digitisers for SAGE and LISA: Nallatech



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Digitisers for SAGE and LISA: Nallatech

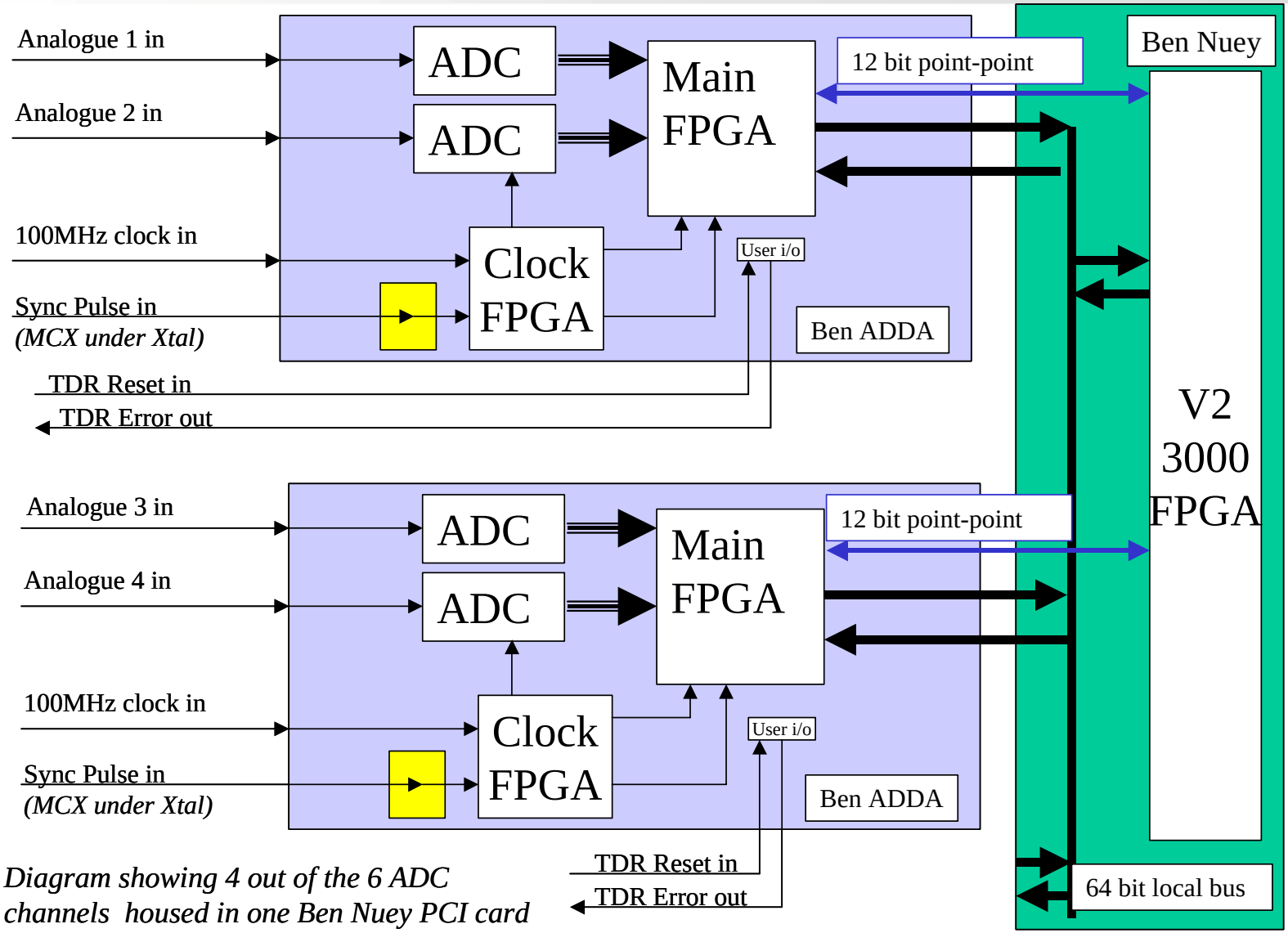

Diagram showing 4 out of the 6 ADC channels housed in one Ben Nuey PCI card

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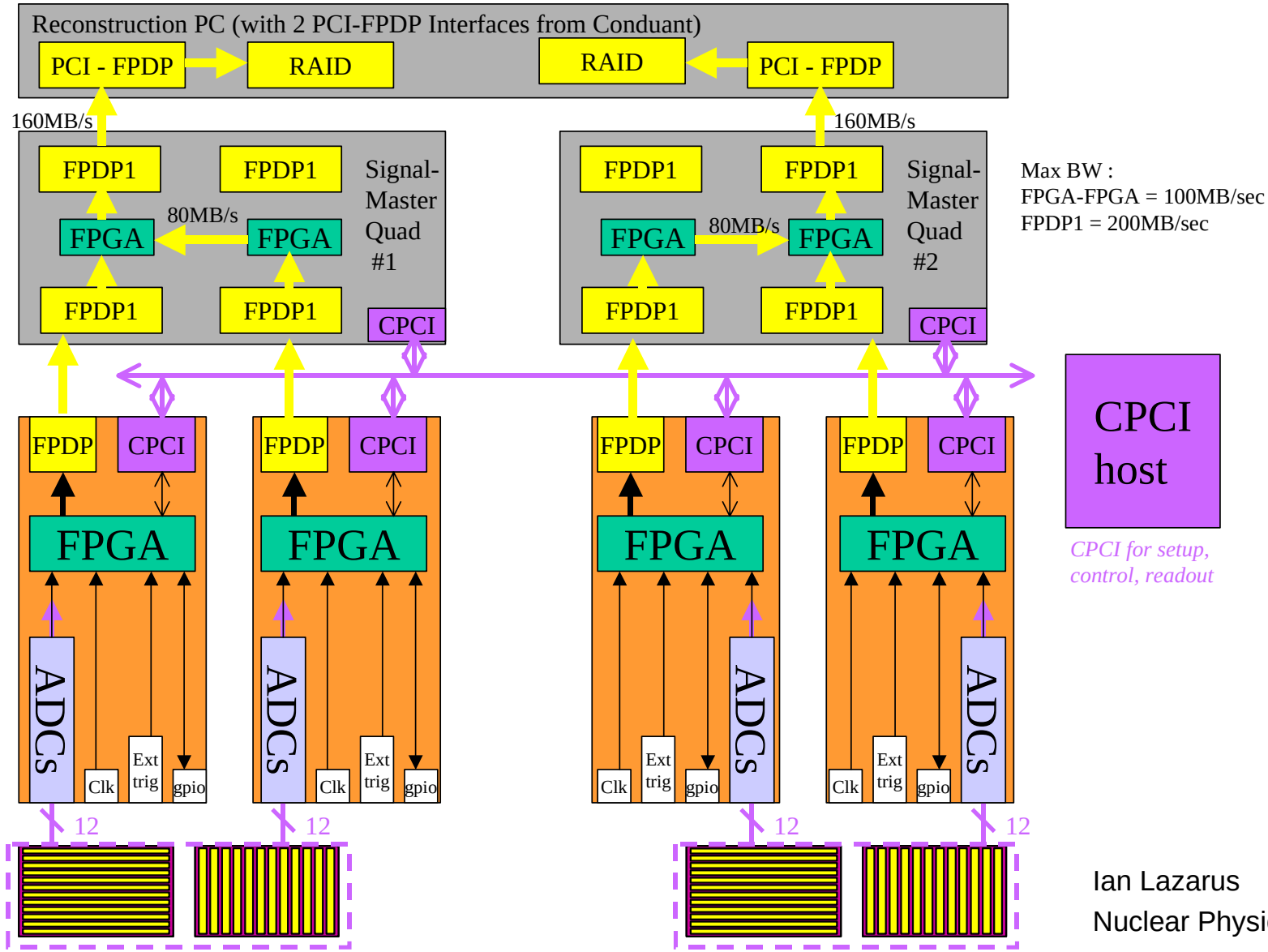
Digitisers for SAGE and LISA: Lyrtech

First Configuration : Diagnostic Mode (Multi-Channel, Phase-Synchronous Data Recording)



Max BW :
FPGA-FPGA = 100MB/sec
FPDP1 = 200MB/sec

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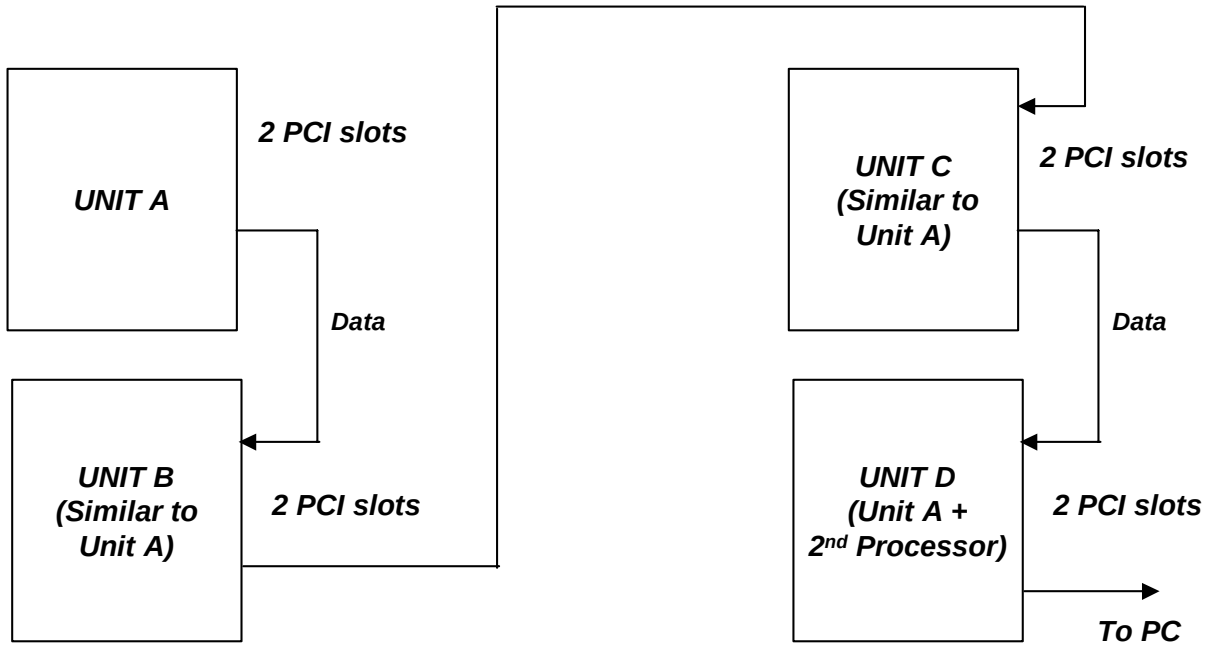
Digitisers for SAGE and LISA: ICS

ICS SENSOR PROCESSING

System connectivity



A 3rd PCI slot may be required for Unit D if additional FPGA is required for the 2nd stage processor

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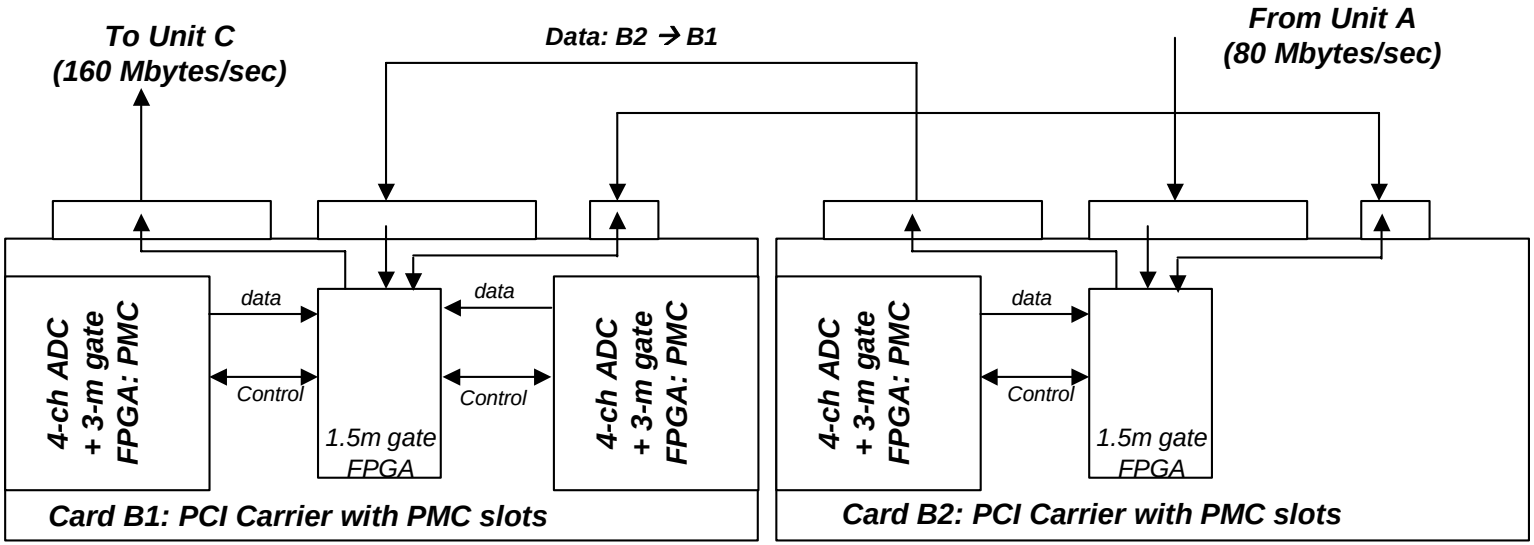
Digitisers for SAGE and LISA: ICS

Unit B (12 ADC Group)



- **Unit B is very similar to Unit A**
- **Card B2 accepts the output of Unit A merges the data with the data from the PMC in Card B2 & sends it to card B1**

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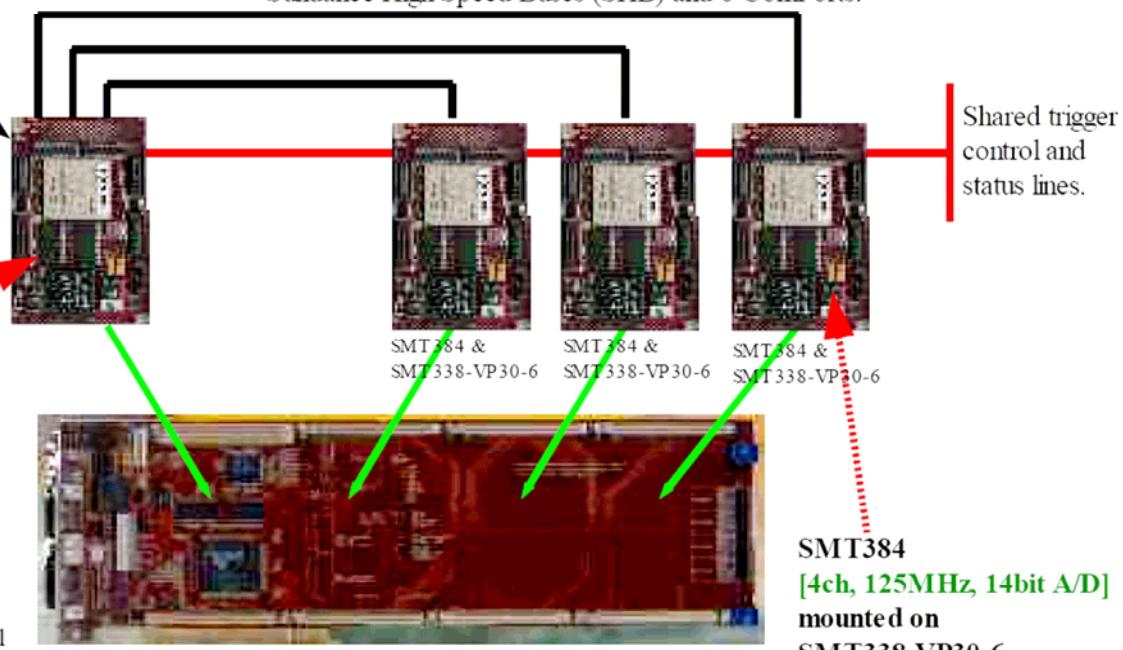
Digitisers for SAGE and LISA: Sundance

3 A/D boards connected to processing card using a Datapipe:
Flexible arrangement selected from 8 channels of RocketSerialLink (RSL), 2 Sundance High Speed Buses (SHB) and 6 ComPorts.

Uplink:
Selected from same connectivity options as datapipe. Multiple protocols can be accommodated. E.G. 1G & 10G Enet.

Shared trigger control and status lines.



SMT395-VP30-6
[1GHz 'C6416T, Virtex-II Pro XC2VP30-6, 2 x SHB, 8 x RSL, 6x ComPorts]

Many other processing options available eg: quad 1GHz 'C6416T or all Virtex-4.....

4 slot PCI host as example.
Could be VME, CompactPCI or VxS

SMT384
[4ch, 125MHz, 14bit A/D]
mounted on
SMT338-VP30-6
[Virtex-II Pro XC2VP30-6, 8 x RSL, 2 x SHB, 1 x SLB, 6 x CompPorts...]

4 PCI Host boards, loaded as above, each handle 12 channels from strip detector.
A flexible data connection architecture can be optimised for load balancing.
(Even after system is in situ.)
Rated maximums for each element of the datapipe are:

- 8ch RSL @ 250MBytes/sec
- 2ch SHB @ 400MBytes/sec
- 6 ComPorts @ 20MBytes/sec.

(Note: if intermediate fast streaming is required, 4 of the RSLs can be combined to provide a 10Gbit/sec link.)

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Digitisers for SAGE and LISA: XIA

XIA PIXIE CPCI/PXI card

75MHz, 14-bit digitizing of input signal

Module-to-host transfer rates up to 109MB/s

Simultaneous amplitude measurement and PSA

Pulse heights measured with up to 15 bits accuracy on each of the four channels

Waveform acquisition up to 13.7us for each channel, in 13.3ns intervals

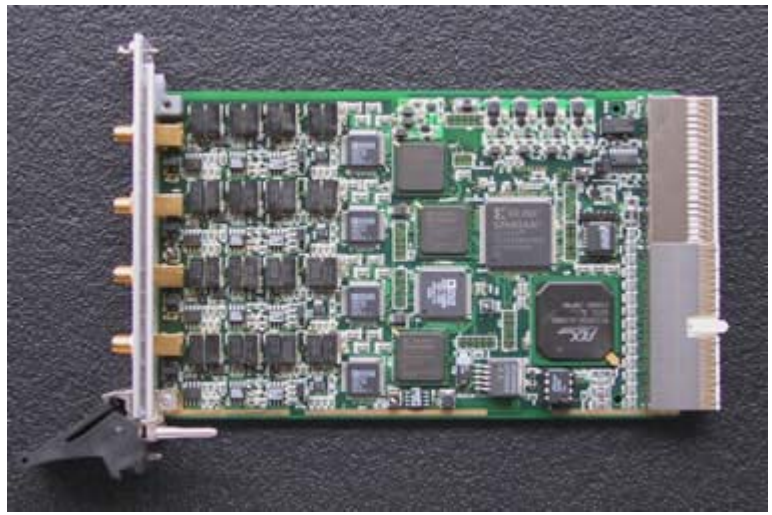
Programmable gain, input offset, trigger and energy filter parameters

Coincident data acquisition across channels and modules

Triggers, run synchronization and clocks distributed over PXI backplane

Compared to DGF-4C: A quarter of the size, almost double the ADC sampling rate, and more than ten times the data transfer rate!

Up to 13 slots per crate (using 12 = 48 channels).



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