CRACO Update

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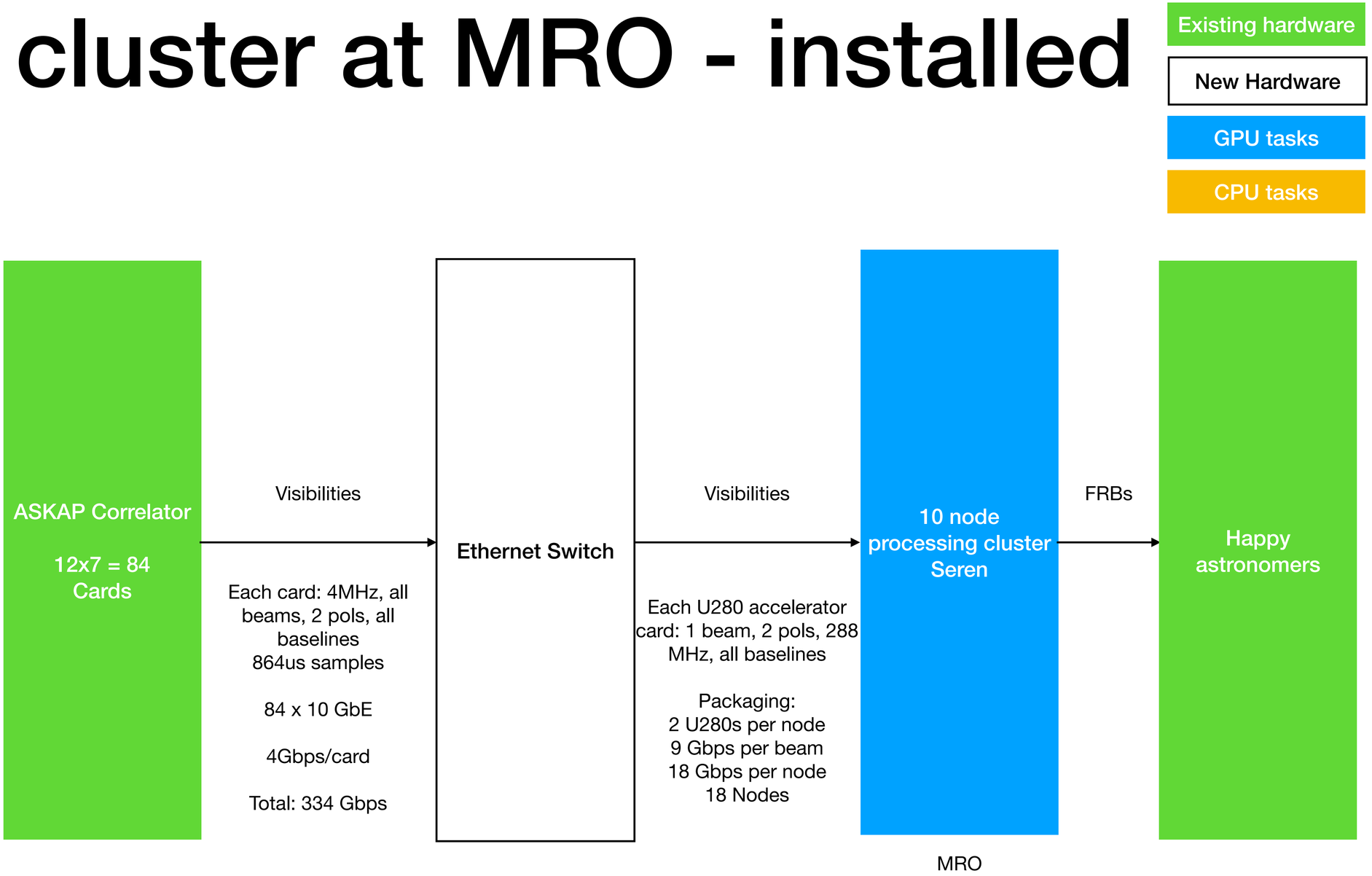
CRACO Aim

- Antenna-coherent FRB search - 5x improvement in detection sensitivity
- Similar time/frequency resolution to existing ICS system: ~1ms/1MHz
- 0.5-2 FRBs / day each with ~arcsecond localisation
- Re-use existing voltage dump infrastructure
- Just build an awesome detection machine

Scientific Uses

- Large numbers of FRBs: Large statistical sample, cosmology, weird guys
- Higher redshift FRBs: - strongest constraints on cosmology and the early universe
- Interplanetary scintillation (IPS) of AGN- space weather
- Timescales 1ms - 10s transients
- Dual-use as VLBI recording (online channel stitching)
- Pulsar searching
- SETI?

Pilot cluster at MRO - installed



GPU vs FPGA Smackdowr

More power hungry
Easy to program
Less control
Faster processing?

Lower power
Hard to program
More control
Faster processing?

	NVIDIA V100 GPU	Xilinx Alveo U280	Xilinx Alveo U50
Cost	~$15k AUD	~$10k AUD	$3k AUD
Memory	16/32 GB	8GB HBM + 32GB DDR	8GB HBM
“Memory Bandwidth”	900 GB/sec	460 GB/Sec	316 GB/sec
“Computing”	“100 TFlops”	24.5 Tops (int8)	(less than U280)
L1 Cache	96KB x 84 = 8MB	41 MB(!)	28 MB
L1 cache rate	24 TB/sec	30 TB/sec	24 TB/sec
Power	300W	225 W	75W
Programming	CUDA :-)	HLS :-(	HLS :-(

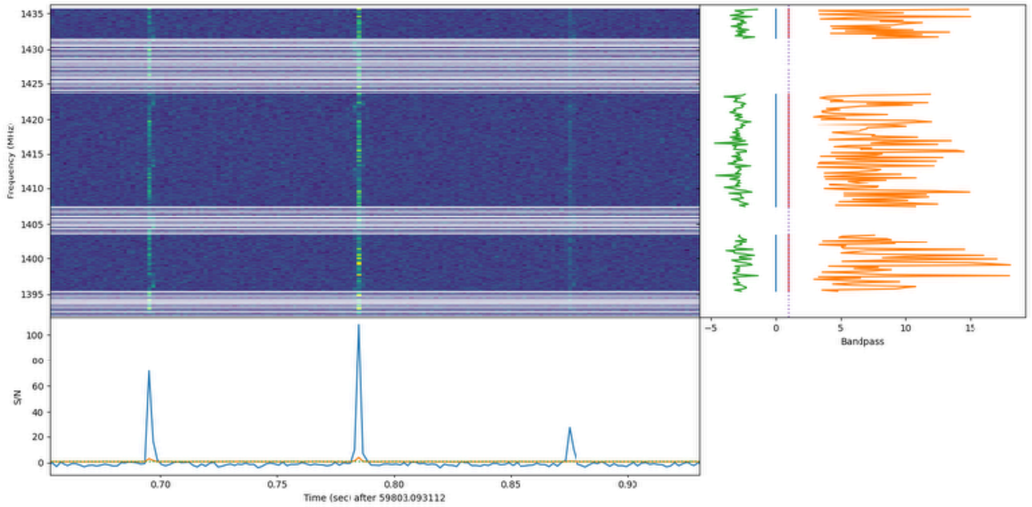
Alveo learnings

- Very steep learning curve! - But we've climbed it now
- Network connector may be a saviour
- Lower power wasn't a requirement but it's very nice - and well placed for the future projects?
- Off the shelf hardware - similar to buying GPUs
- Much smaller / lower power than equivalent GPUs

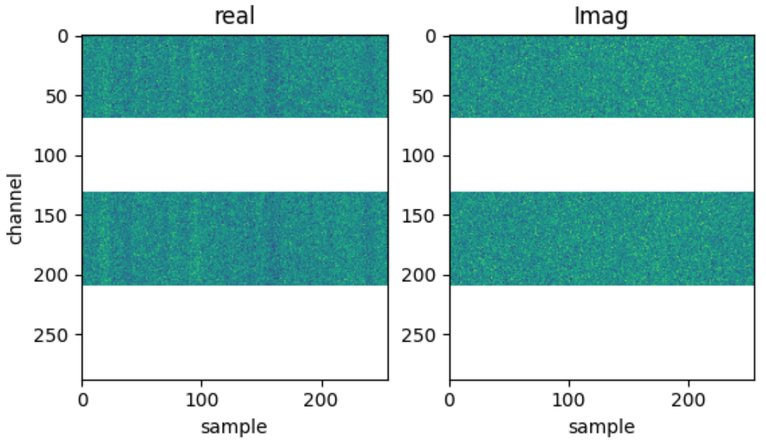
Challenges

- Alveo programming learning curve
- Finding and fixing lots of problems in ASKAP correlation firmware:
  - Corrector dropouts
  - Link reliability
  - Memory reliability
- Many thanks to John Tuthill and Mike Pilawa - absolutely

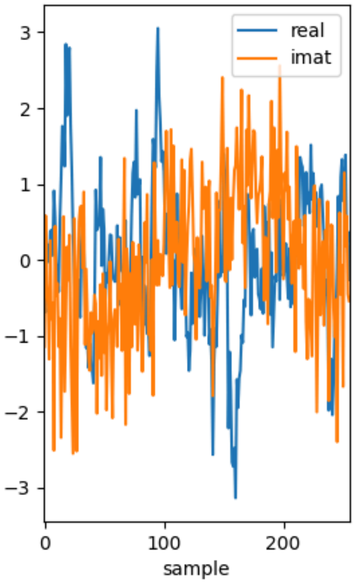
Incoherent sum pulses from the Vela pulsar



IPS of 1934-638



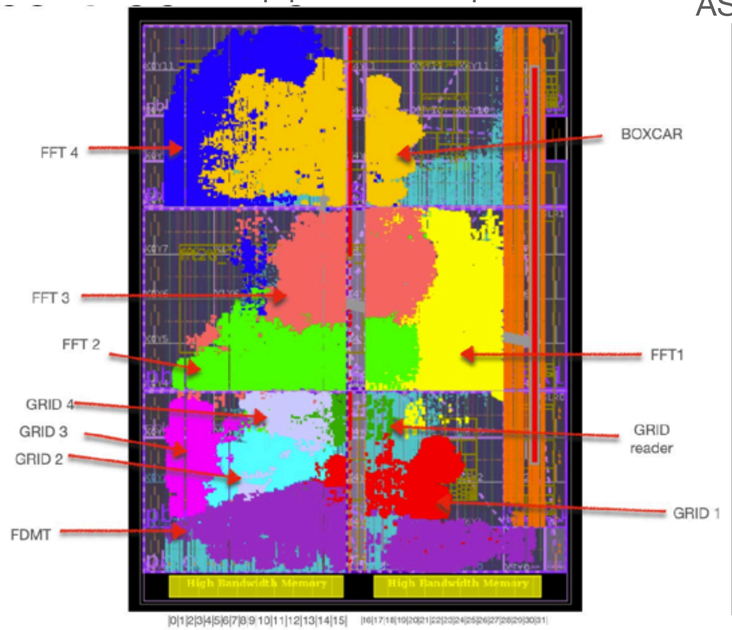
time series



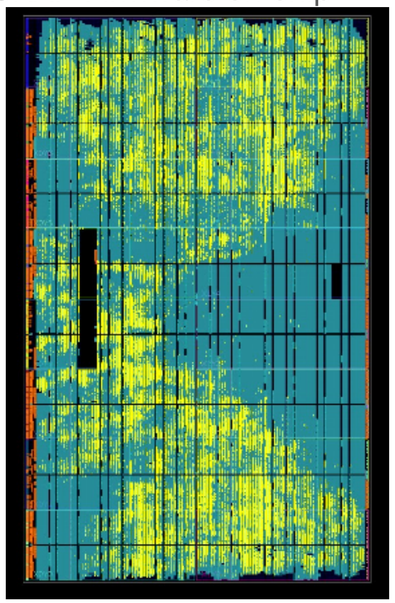
In commissioning…

- first light May 2202

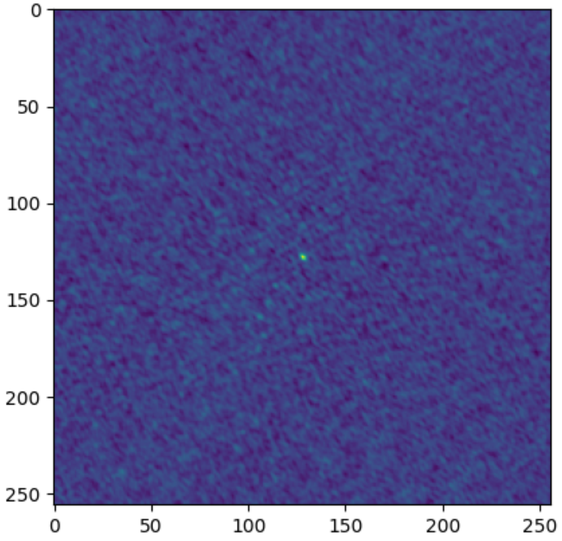
CRACO pipeline on chip



ASKAP Firmware on chip



ASKAP Firmware



Baseline S/N vs baseline