



# BIGCAT

## Broadband Integrated-GPU Correlator for ATca

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ASTRONOMY AND SPACE SCIENCE

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# CABB

- CABB has been a great upgrade for the ATCA
  - 4 GHz bandwidth (2x 2 GHz, dual pol)
  - 0.49 kHz spectral resolution over 8 MHz (1 MHz zoom)
    - 0.1 km/s over 1700 km/s at 1.4 GHz
  - 31.25 kHz spectral resolution over 512 MHz (64 MHz zoom)
    - 6.7 km/s at 1.4 GHz
    - 0.09 km/s over 1500 km/s at 100 GHz

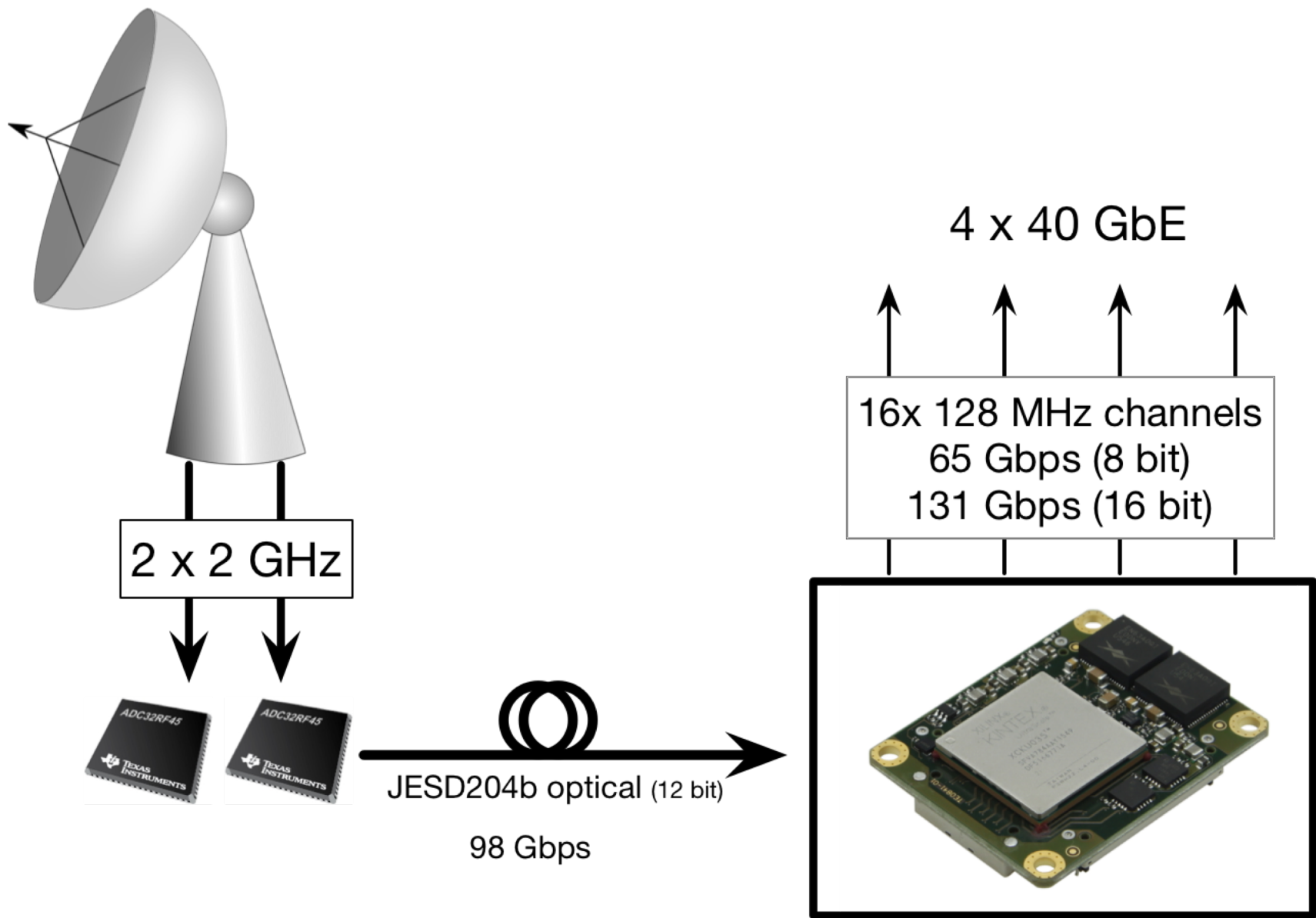
# CABB - But

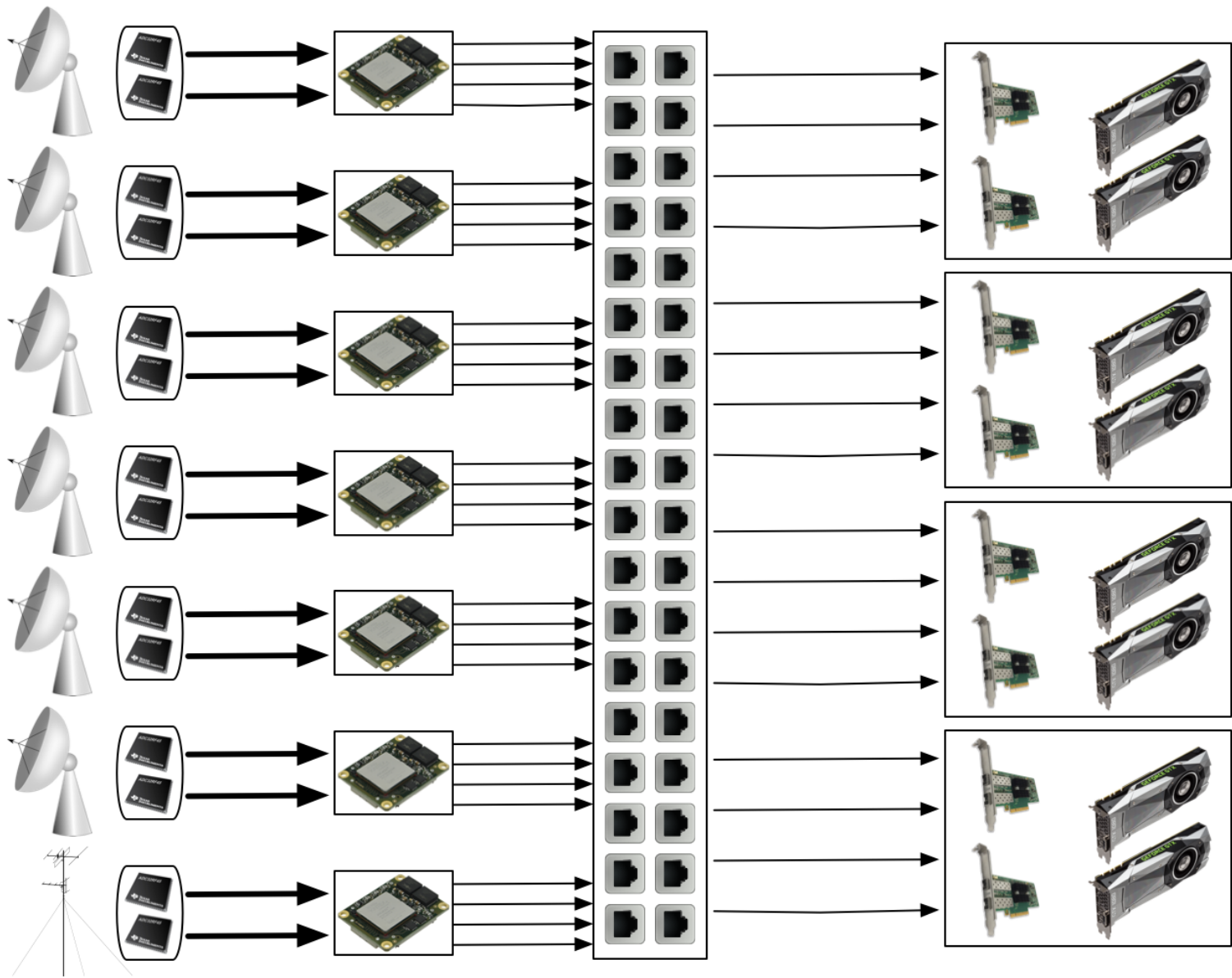
- Reliability
  - Lost observing time
  - Expert staff needed to reconfigure
- Support difficult
  - Dependent on retired fellows
- No “automatic” mode changes
- “16 MHz” zoom band never delivered
- Limited tied array bandwidth (2 x 64 MHz)
- Difficult to add advanced modes
  - Fast dump visibilities, RFI mitigation, pulsar binned modes

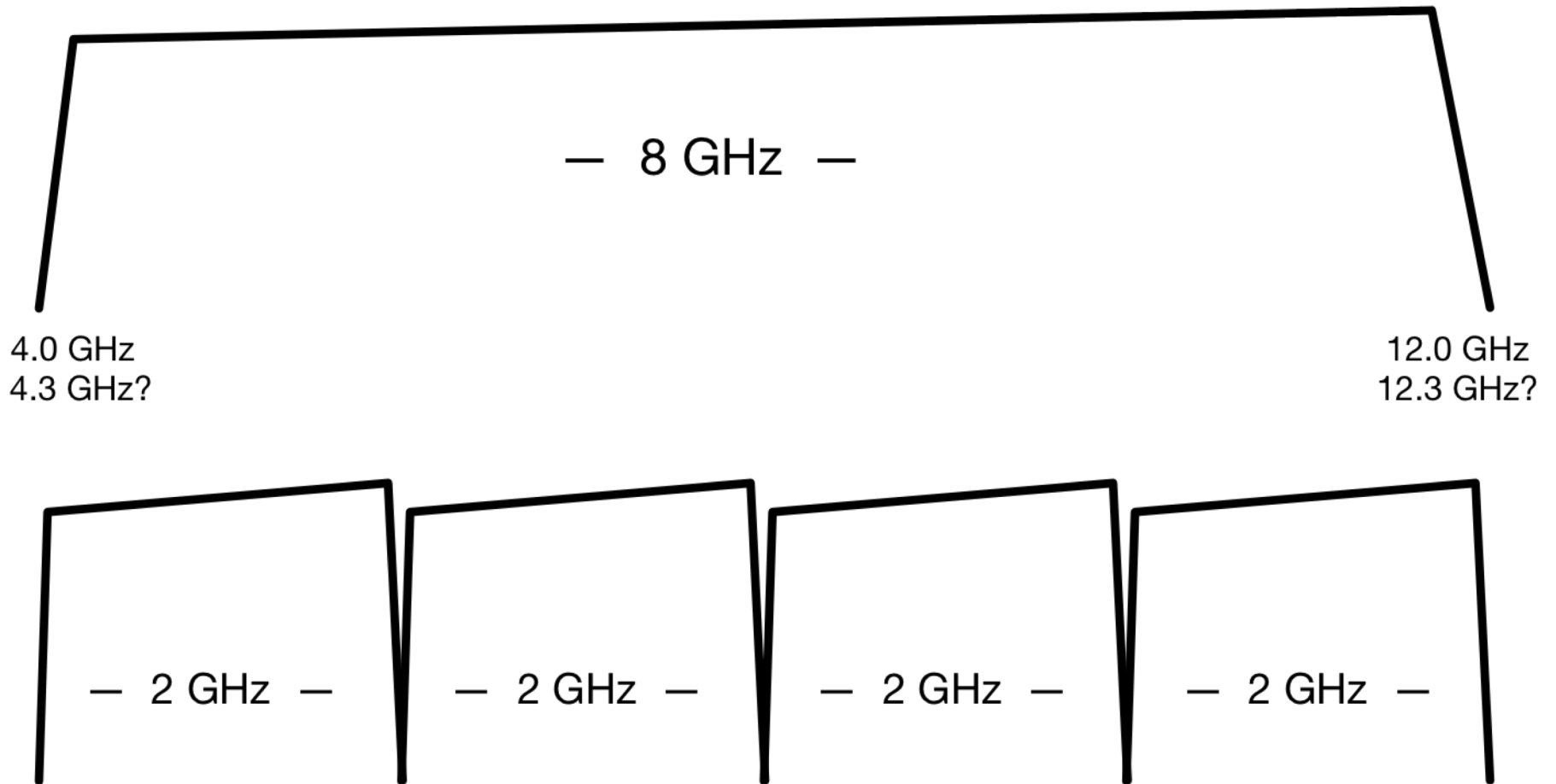
# BIGCAT:

## Broadband Integrated-GPU Correlator for ATca

- Based on Parkes UWB hardware and design
  - 2 GHz bandwidth sampler, FPGA coarse filter, GPU based processing
  - 128 MHz initial filtering
- 4-8 GHz total bandwidth (“update” or “upgrade”)
- Flexible processing, lots of possible options...
- 12 bit initial sampling, 8 bit after coarse filterband (16 bit for 1-3 GHz band).







# Design Priorities

- Reliability
- Simplify control (hands off reconfiguration)
- “Unlimited” spectral resolution (0.1 kHz over 8 GHz?)
- Double bandwidth (8 GHz)
- RFI mitigation (Blanking, adaptive filtering)
- Advanced modes
  - 8 GHz tied array – Recombine to single channel?
  - Multiple tied array beams
  - Short integration visibilities (piggyback FRB searches?)
  - Sub array (CA06 single dish – 12/7mm?)

# Status

- 2017 SEIF proposal unsuccessful
- 2018 LEIF proposal not submitted
- Still investigating funding opportunities
- Proof of concept “toy” correlator works

<https://github.com/XhrisPhillips/gcorr>

# Request to ATUC & Community

- What is the priority of BIGCAT?
  - Compared to transparent feed legs, UWB-High etc
- What are the “killer” science goals?
- What new modes do you want to see?
  - Ultra high spectral resolution?
  - Fast dump?
  - User contributed processing?
  - ...?

# Thank you

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# Fast Dump Visibilities

- Assuming full stokes and autocorrelations
  - 2 GHz bandwidth
  - 0.2 MHz channels
  - 1msec integration times
- 55 Gbps sustained data rate
  - Could be ingested onto another GPU for realtime transient detection
  - Dump voltages on detection
- Expect 1 FRB every 25 days of L-band observing
  - 8+ GHz transient searches