Next generation digitiser for MeerKAT

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The South African Radio Astronomy Observatory (SARAO) is a National Facility managed by the National Research Foundation and incorporates all national radio astronomy telescopes and programmes.

Talk outline

- About SARAO
- MeerKAT legacy
- MeerKAT extension project
- Next generation digitiser
- Measurement results

About SARAO

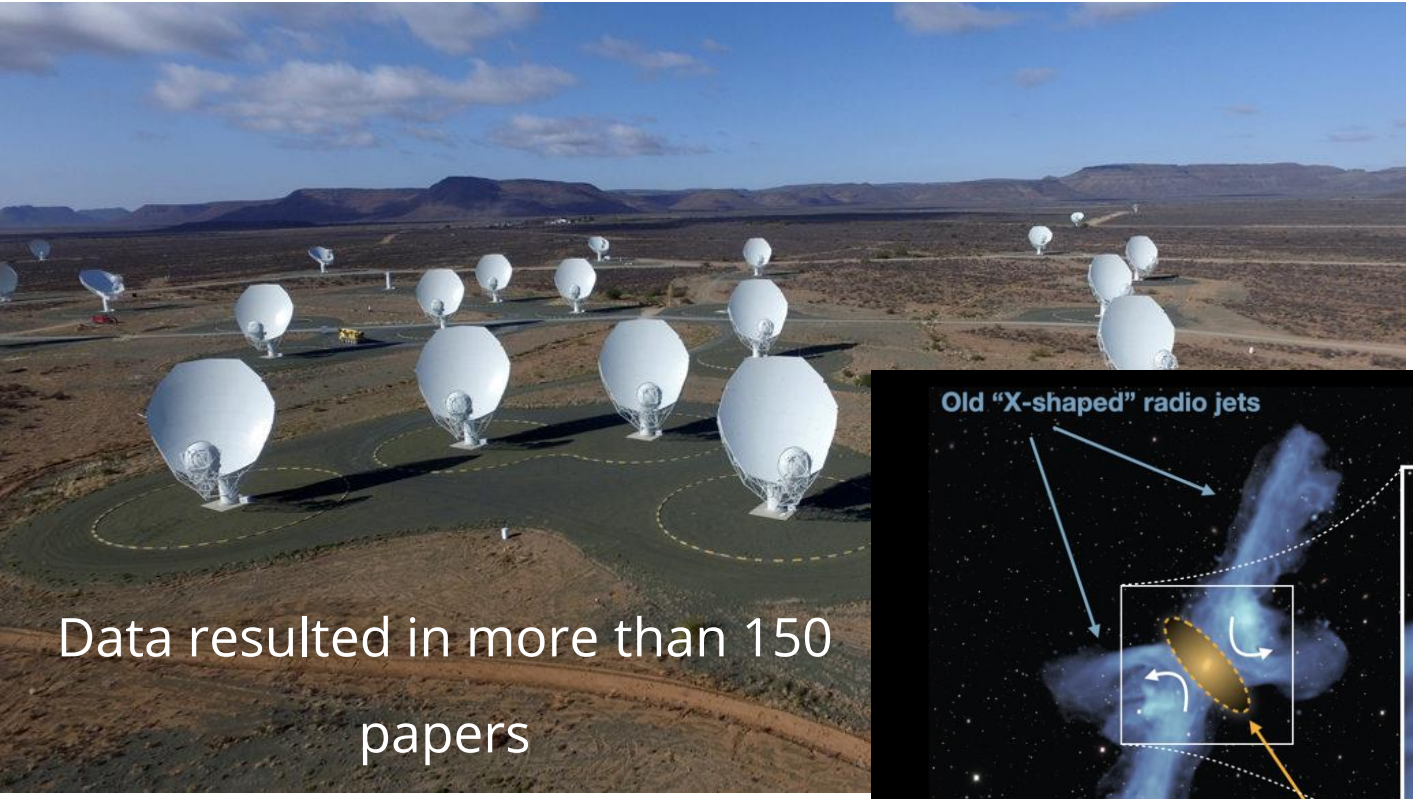

MeerKAT


Head office
Cape Town


Limpopo
Mpumalanga
Gauteng
Swazi-
land
South Africa
KwaZulu-
Natal
Free State
Lesotho
Eastern Cape
Western Cape
Africa


HartRAO

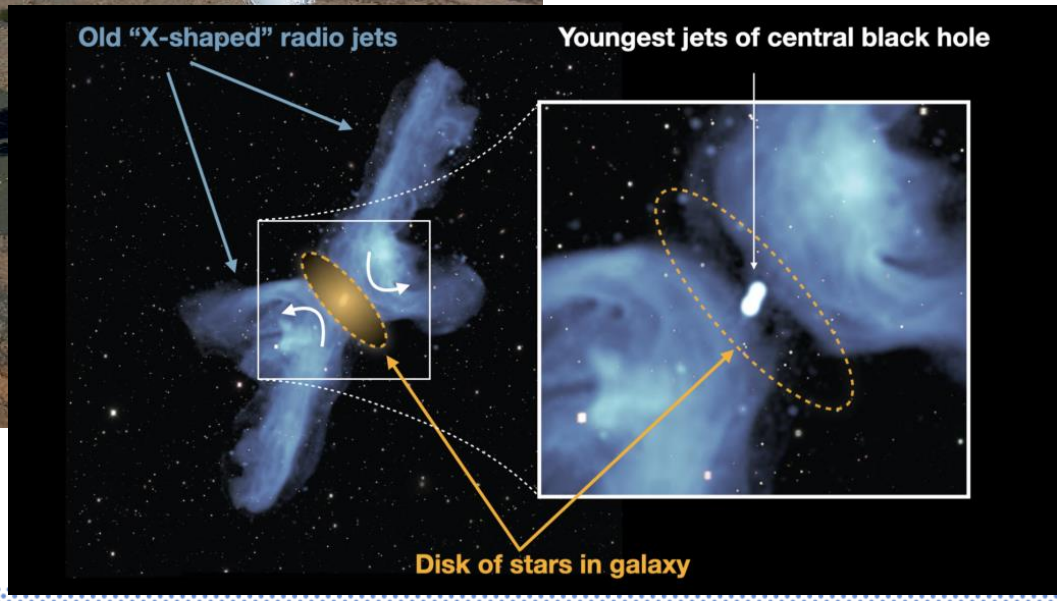
MeerKAT legacy



Data resulted in more than 150 papers

published (ADS public library)

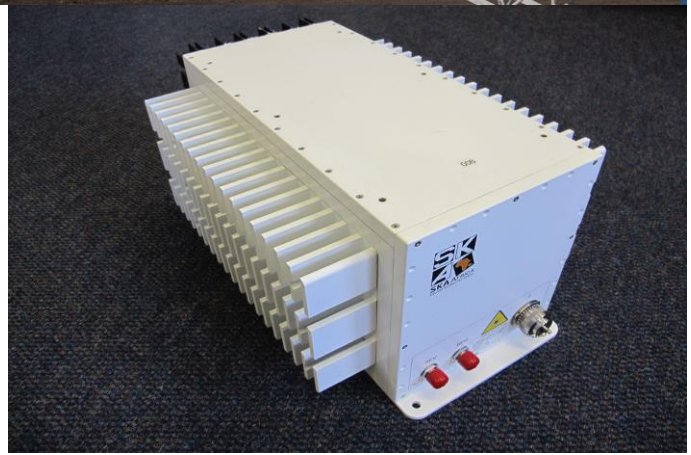
Images credit: SARAO



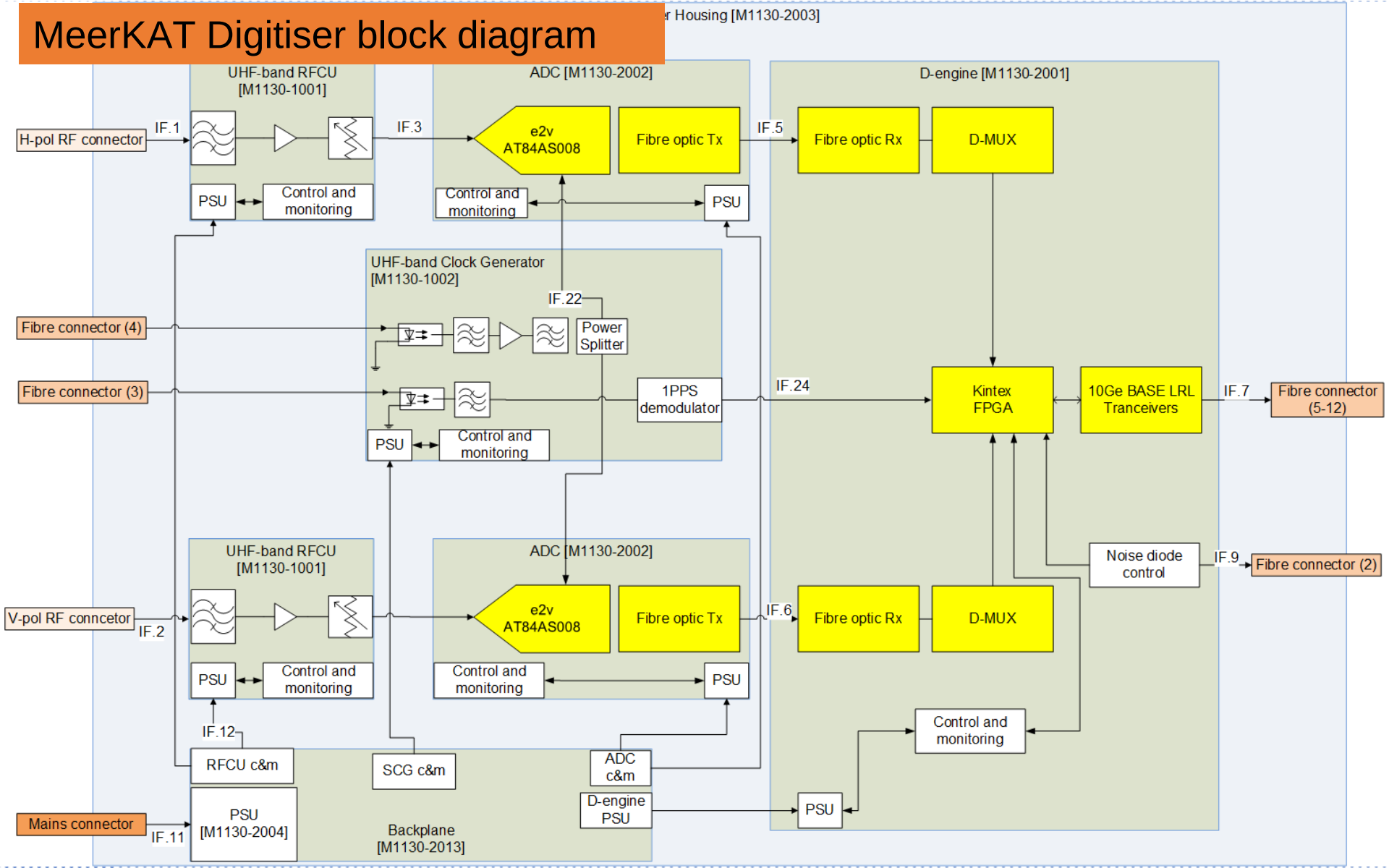
MeerKAT legacy

MeerKAT Digitisers

- System comprising RF conditioning, clock synchronization, Analog to Digital Conversion and DSP
- Two channels, 10 bit , 2.2 Gsps max
- Harsh environments
- Extreme RFI requirements
- 140 units produced
- First unit installed September 2014



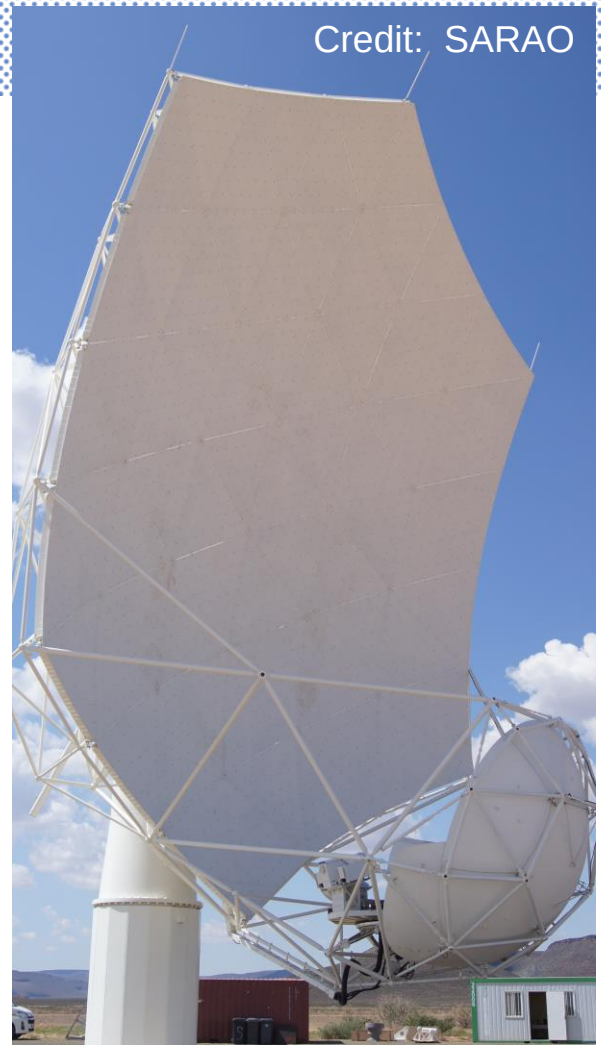
MeerKAT Digitiser block diagram



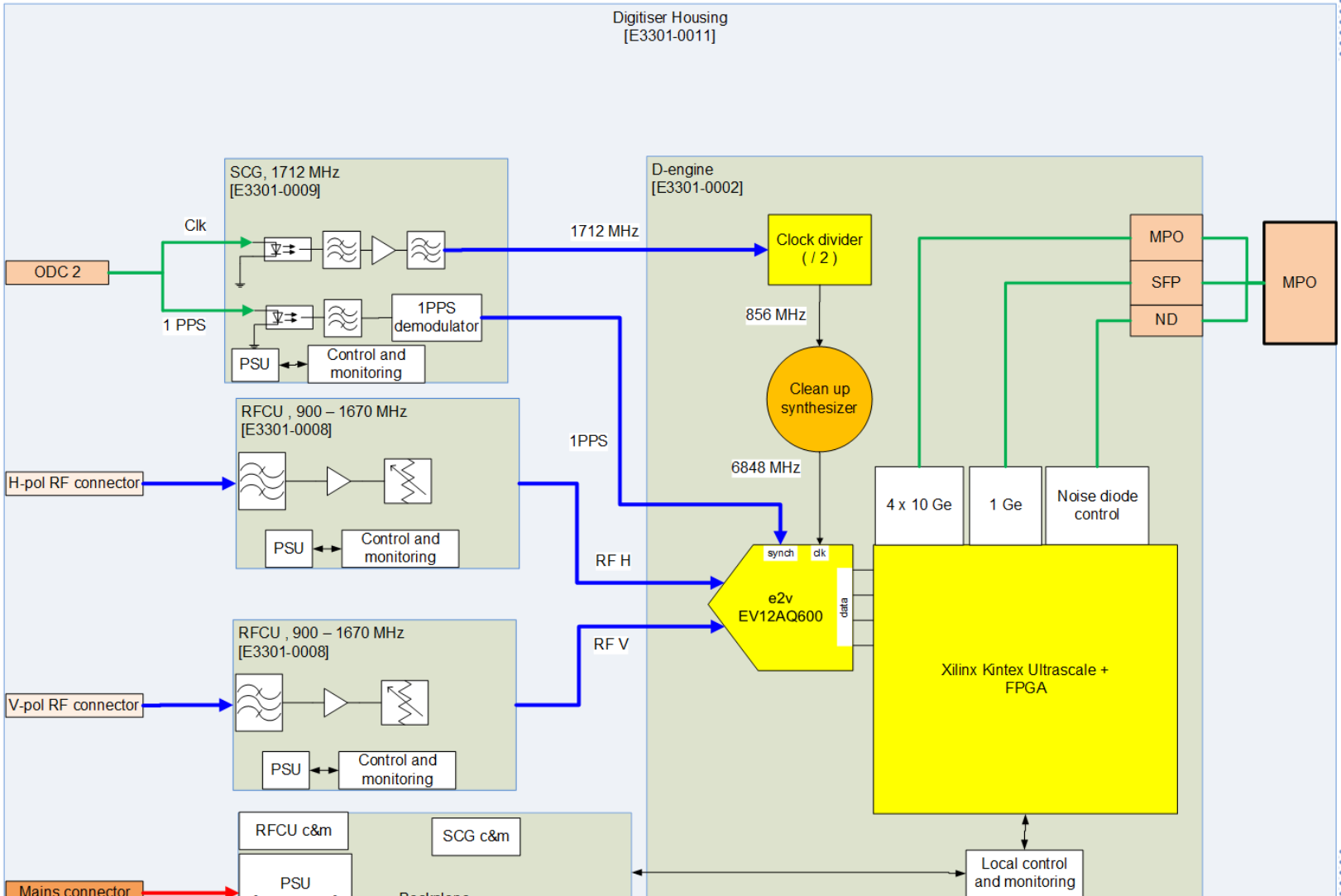
MeerKAT legacy

MeerKAT extension

- Funding to extend MeerKAT by 16 antennas
- Requires a technology refresh on the digitisers
- New digitiser design suitable for broader applications



Next generation digitiser block diagram



6.4 Gsps digitiser module

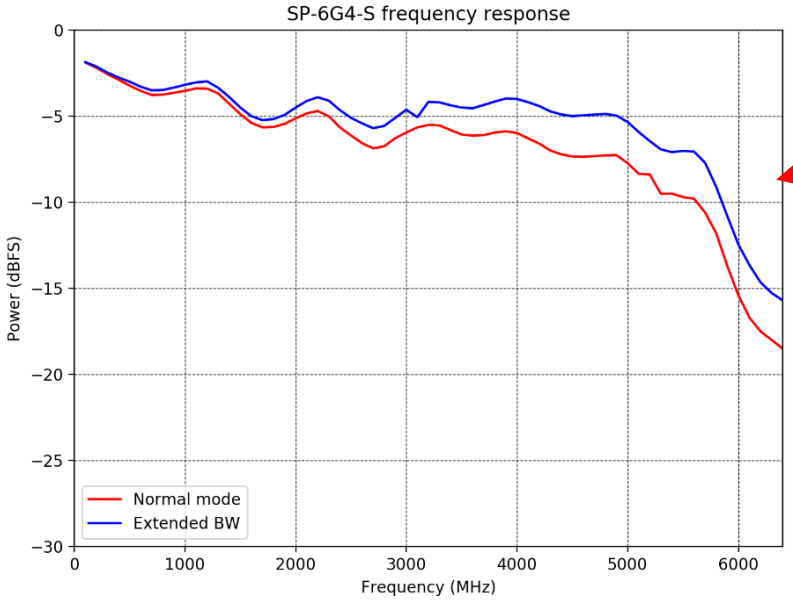
- Wideband sampling and processing module
- Designed for harsh environments
- Interface to standard computer and network infrastructure
- Two RF channels
- Operational temperature range of 0 – 50 ℃

6.4 Gsps digitiser module

Key features

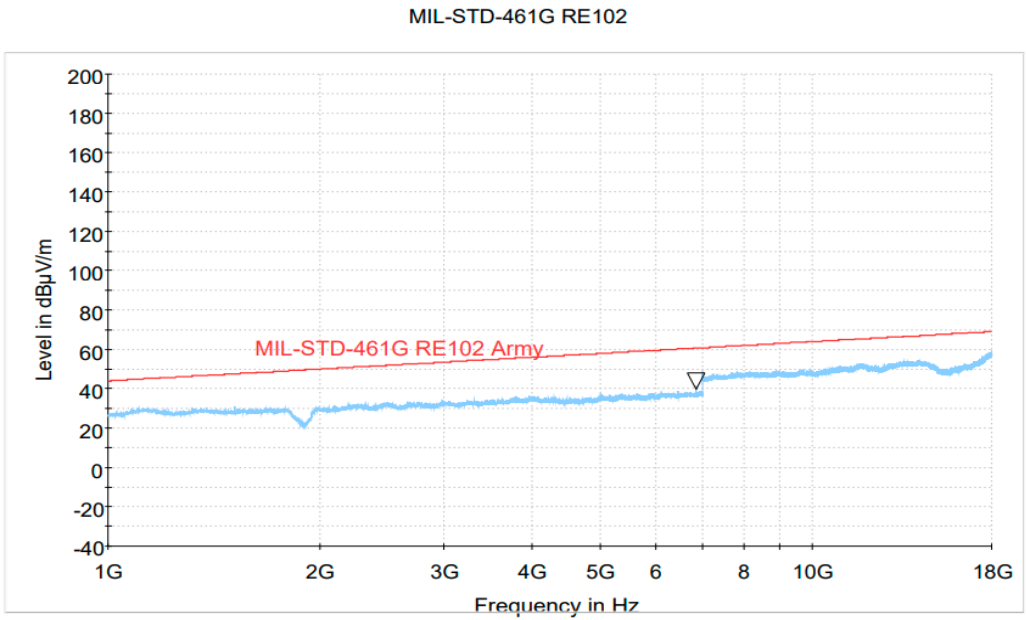
- Xilinx Kintex UltraScale+ FPGA
- Single or dual input RF digitization: 12 Bit, 6.4 GSps, 5GHz RF BW
- Up to 3GHz instantaneous bandwidth
- Supports IQ sampling
- Onboard synthesizer
- 40 or 100 GbE and 1 or 10 GbE via SFP/SFP+
- 12 Vdc (24 W)
- Form Factor: 245 x 185 x 33 mm
- Firmware development using CASPER tool flow

Measured results



Measured frequency response

Radiated RFI



Preliminary results

ADC performance

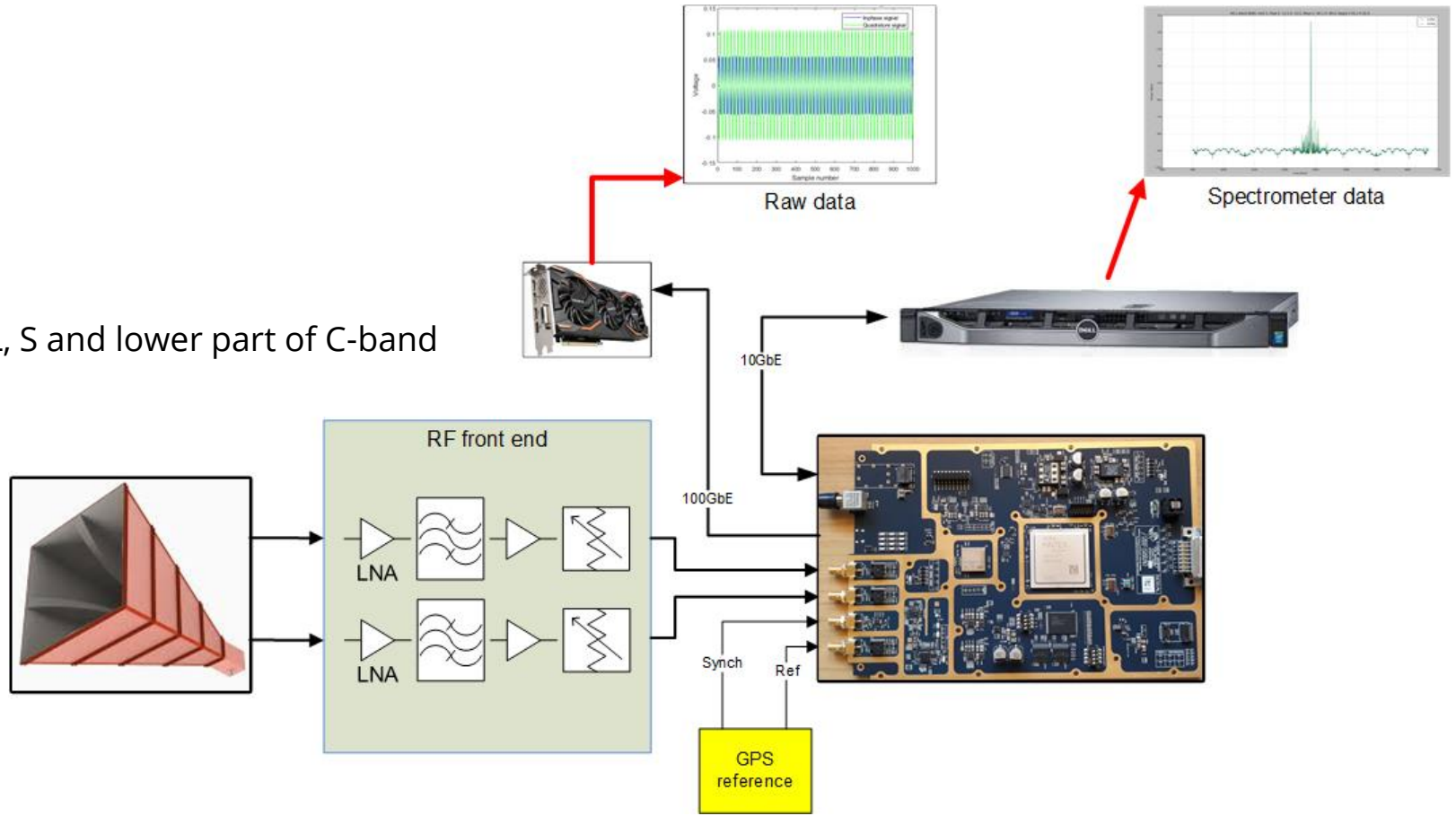
Freq (MHz)	SINAD (dB)	ENOB
900	52	8.4
1578	52.2	8.3

Stability

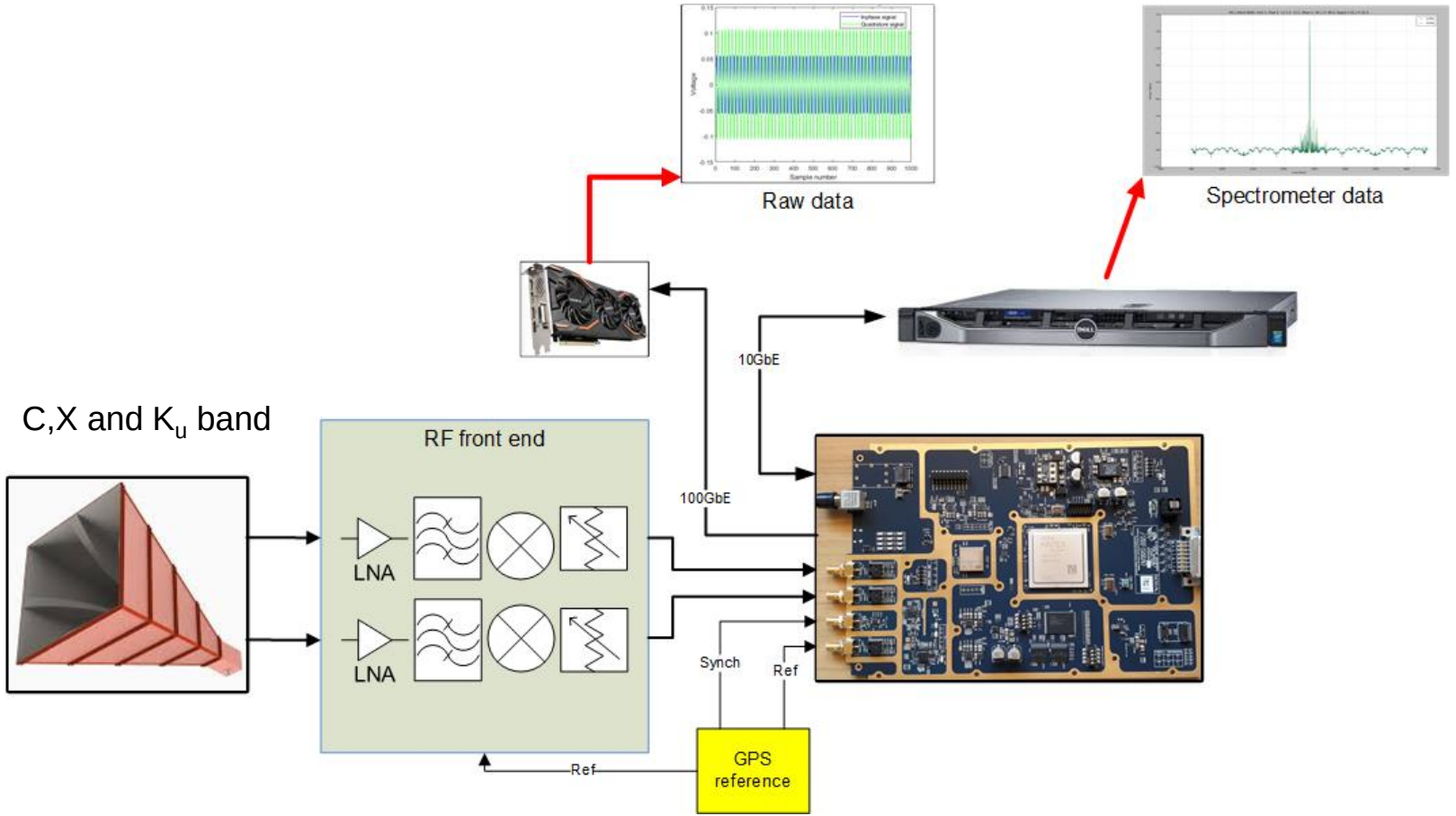
Gain stability	0.096	rms
Phase stability	1.532	° rms

Typical applications

UHF, L, S and lower part of C-band



Typical applications



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NRF National Research Foundation | SARAO South African Radio Astronomy Observatory

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