

Digital Continuum Backend for the Green Bank Telescope 1 cm and 3 mm Receivers

Preliminary Design Review
Sep 6, 2002

Purpose of PDR

- Present preliminary design for approval
- Confirm and finalize specifications
- Identify all interfaces to be defined in detailed design phase
- Review schedule and budget

Scientific Requirements

- General-purpose continuum radiometer for use with GBT 1 cm and 3 mm receivers
- Difference of two beams to suppress atmosphere
- Deliver total power in each beam, allowing differenced power to be derived
- Dual polarization for sensitivity

Receiver Block Diagram

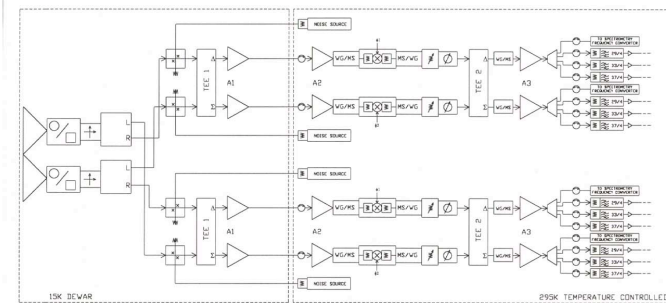


Figure 1, Receiver Block Diagram

Specifications

- Digitize up to 16 detectors (4 bands, 2 polarizations, 2 feeds)
- Channel bandwidth up to 8 GHz
- Minimum integration time 1 ms
- Fully sample noise (30 K at 1 cm, 80 K at 3 mm)
- Dynamic range sufficient for > 100 Jy
- Phase-switch period < 1 ms
- Demodulate phase-switch to deliver (nominal) total power in each polarization in each feed
- Control noise-diode sequencing during scan
- Interface to GBT control system via Ygor

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Design Overview

- Analog/digitization section, in front-end package close to detectors
- Digital integration and phase-switch demodulation package
- Real-time computer for control and monitoring with ethernet interface to GBT control and monitor system
- Two complete systems (1 cm and 3mm), plus spares

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Personnel

- Project Scientist: Tony Readhead
- Project Engineer: Martin Shepherd (15 months at 60%)
- Engineer/Technician: John Yamasaki (6 months at 100%)
- Project Manager: Tim Pearson (12 months at 20%)
- Consultant: Steve Padin

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Project Budget

	Year 1		Year 2		Total	
	1/1-12/31/2002	months	1/1-6/31/2003	months		
Salaries						
Readhead	0		0		0	
Shepherd	5.4		3.6		9	
Pearson	1.2		1.2		2.4	
Yamasaki	4		2		6	
Padin	0		0		0	
Total salaries	10.6	\$67,206	6.8	\$44,698	17.4	\$111,904
Staff benefits @ 25%		\$16,801		\$11,175		\$27,976
Total salaries and benefits		\$84,007		\$55,873		\$139,880
Parts						
A/D converters	Count	\$1,000		\$0		\$1,000
Real-time CPU+PSU, memory, flash disk, enclosure	2	\$6,000		\$0		\$6,000
Altera FPGA	2	\$900		\$0		\$900
Backend enclosure	2	\$6,000		\$0		\$6,000
PCB fabrication	2	\$8,000		\$0		\$8,000
Miscellaneous parts		\$2,000		\$0		\$2,000
Spares				\$11,900		\$11,900
10% contingency		\$3,570		\$0		\$3,570
Development workstation (PC)	1	\$2,000		\$0		\$2,000
Total parts		\$29,370		\$11,900		\$41,270
Travel						
Trips to Green Bank	5	\$5,000	8	\$8,000		\$13,000
Total travel		\$5,000		\$8,000		\$13,000
Total request		\$118,377		\$75,773		\$194,150

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Project Timeline

Preliminary Design Phase

Jan – Sep 2002

Preliminary Design Review (PDR)

Detailed Design Phase

Sep – Dec 2002

Critical Design Review (CDR)

Construction and Lab Testing

Jan – May 2003

Pre-Delivery Review

Green Bank Integration and On-Telescope Tests

May – Jun 2003

Acceptance Review

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Principal Interfaces

- Packaging: mechanical, RFI shielding, cooling
- Front end control: phase switches, noise diodes
- Radiometer/detector outputs
- Time (1 PPS from GBT)
- Power
- Control interfaces (ethernet)
- Software interface with Ygor: control protocol, data return

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Some Design Issues

- Dynamic range; switchable range?
- Phase switching master/slave
- Phase switch cycle time (200 μ s)
- Differencing in hardware or software; return data from two arms separately?
- Support for two receivers
- Software interface with Ygor
- Packaging and RFI
- Spares

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