Long, JA (Judy)

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Sent: 25 January 1999 14:34
To: J.A.long@rl.ac.uk
Subject: Fw: SPIRE electronics (fwd)

Date: Thu, 10 Dec 1998 21:42:40 -0800 (PST)
From: James Bock <jjb@astro.caltech.edu>
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Subject: SPIRE electronics

Hi Matt,

I am faxing you a candidate circuit for the warm electronics. I think you will see that low-power designs are possible, but require some complexity. The preamp, built from discrete components, dissipates 53 mW/channel. Two possible 16-bit A/D converters are the ADS7807 (planned for the HFI) at 35mW max dissipation, and the 7809LPRP (rad hard, latchup protected) at 132 mW max dissipation. In the latter case especially we could multiplex several channels onto a single A/D with an analog MUX before the A/D converter. An 18-bit A/D would reduce the sampling rate (see below), but may have further qualification issues with ESA?

Total power, with a single ADS7807 per channel, is 88 mW/channel, or 53 W for 600 channels. Of course this does not include the other electronics we will need (voltage regulators, AC bias supply, possibly a few channels for temperature control). The expected noise performance of the preamp is quite good - 3nV/rtHz - including a 10 kOhm output impedance from the JFETs.

I think it is fair to say that there was general concern about the total power budget available for the warm electronics, and the components that would be allowed to fly, at the last bolometer meeting. So naturally we are very interested in the reaction the component and power issues.

The SPU will be required to perform demodulation of the signals. The sampling rate of the A/D converters is determined by the total voltage across the bolometers, the detector noise, and the noise on the A/D converter:

2.8*Vrms/[Vn*sqrt(B)] < (1/2)*2^N,

where N is the number of bits to the noise level. Assuming N = 15, Vn = 20 nV/rtHz, Vrms = 7 mV implies B = 3.5 kHz and a sampling rate of 7 kHz. The resulting data rate into the SPU is then 2*7k*600 = 8 MB/s. This is probably a bit of an overestimate - I'll have to calculate for each waveband separately. Using an 18 bit converter, for example, would slow the data rate into the SPU by a factor of 16. Naturally the demodulated data rate post SPU is much slower.

Finally, we are also concerned about the interface to the shell of the dewar for the cables going to the warm electronics. At a minimum we would like to have the RF-tight connection we mentioned earlier with rigid attachment of the cables to the inside of the fixture. Depending on the RF shielding architecture, we may wish to put passive RF filters here, or at the 15K shield. Do you have any

numbers for parasitic power dissipation onto the dewar shell?

On other issues, we are making good progress on the focal plane design. When do you think a mechanical envelope will be available? It would definitely help guide our work. Also it would be very valuable to have the 350um feedhorn array measured at QMW. What are the prospects for doing that in the next month or so? I am worried that the prototype may have some problems at the waveguide section on 2 of the 7 horns. Marty is working to fix these problems, incurred during machining of the mandrels, but it would be a bit scary to order the test feedhorn arrays without measurements.

Best Regards,

Jamie

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