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Anthony Denault <anthonydenault@gmail.com>

Comments re: internal review of the ARC (Leach) array controller

1 message

Don Hall <hall@ifa.hawaii.edu>   **Thu, Jan 26, 2012 at 7:19 AM**
To: Tony Denault <denault@ifa.hawaii.edu>, Charles Lockhart <lockhart@ifa.hawaii.edu>, Eric Warmbier
<warmbier@ifa.hawaii.edu>, John Rayner <rayner@ifa.hawaii.edu>
Cc: Tim Bond <bond@ifa.hawaii.edu>, Morgan Bonnet <mbonnet@ifa.hawaii.edu>, Don Hall <hall@ifa.hawaii.edu>,
Klaus Hodapp <hodapp@ifa.hawaii.edu>, Shane Jacobson <jacobson@ifa.hawaii.edu>, Lars Bergknut
<bergknut@ifa.hawaii.edu>, George Koenig <koenig@ifa.hawaii.edu>, Peter Onaka <onaka@ifa.hawaii.edu>,
Michael Connelley <msc@ifa.hawaii.edu>, Darryl Watanabe <watanabe@ifa.hawaii.edu>, Greg Ching
<gching@ifa.hawaii.edu>, Alan Tokunaga <tokunaga@ifa.hawaii.edu>

Tony, Charles, Eric and John,

The noise figures are very encouraging and should meet the IRTF requirements. The Low Gain
shorted/10K input noise of around 14.5uV and Low Gain grounded input noise of 17 uV over
most of the range (except near full scale) are acceptable and the High Gain values of 6 and 10
uV are excellent (although I don't understand why the noise goes up when you short out the 10K
resistor - a disturbing indication of possible ground loop problems). The end to end noise test
in section 4.4.1 is far more stringent and gives impressive values of 50 - 60 uV for the
reference pixels and ~60 uV for a 20 x 20 pixel sub-array - the absolute floor for the H2RG is
around 40 uV and the values you measure are probably fine for all of the IRTF instruments
(although see Peter ONaka's comments and the SNAP detector paper by Roger Smith re
power supply noise). My only other caution would be to check that the bandwidth limiting filter in
the ARC analog chain was set correctly for 300 KHz pixel rate during these measurements
(rather than at the standard 100 KHz value). This filter needs to be set to allow proper settling of
the signal to the required number-of-bits (usually 14 or 16) precision before the sample-and-
hold or ADC conversion - for the JWST Leach-2 we used 220 KHz at 100 KHz pixel rate
derived as follows:

If the requirement is to settle to 16 bits in an 8usec interval before ADC conversion then:

1) 16 bit settling requires **ln [1:2E16] = ln [1:65,536] = 11.1 time constants.**

2) For 8 usec settling time the time constant is therefore **0.72 usec**.

3) The 3dB filter frequency is $f = 1 / \{2 * Pi * 0.72 \text{ usec}\} = 1 / 4.53 \text{ MHz} = 220 \text{ KHz}$

scaling to 660 KHz for 300 KHz pixel rate. You will need to figure the equivalent bandwidth limit
if an integrator is used to limit bandwidth.

The throughput limitations (5.2.1) and the software system crashes (5.3.1) are more difficult to

evaluate and the MKIR experience with only 4 outputs (the baseline JWST configuration) does not stress this at all. Can you simulate 32 channel operation at 10 Mpkl/sec on the MKIR system or check with some other user who runs at these rates? These are appropriately reflected in Peter Onaka's first two "Negative aspects"

Where the ultimate noise performance is not required (certainly the initial IRTF H2RG controllers) it is fine to run in buffered output mode and so the cable lengths of 1 - 2 meters referenced in 5.3 should not be a problem.

Cheers

    Don

At 07:12 AM 1/25/2012, you wrote:

> We would like to have an internal review of the ARC (Leach) array
> controller for the IRTF facility instruments. Our engineering staff
> has prepared a report with a technical assessment and recommendation
> to go forward with the ARC controller. This report can be downloaded
> at:
>
> http://dl.dropbox.com/u/12111886/ARC%20controller%20reports.zip
>
> This folder also includes an assessment by Peter regarding the ARC controller.
>
> We would like to have the review as soon as possible.   Peter is away
> this week. Don and Klaus may be away next week. Don is available
> only on Friday afternoon this week.   With these constraints, I have
> made a doodle poll to pick a date. Please go to:
>
> http://www.doodle.com/tc52ergnszvd9g3a
>
> and select the times you are available. I will set a date and time
> for the meeting as soon as possible.
>
> Thanks, Alan