

DEUTERIUM ARRAY MEMO #015
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
HAYSTACK OBSERVATORY
WESTFORD, MASSACHUSETTS 01886

June 7, 2002

Telephone: 978-692-4764
Fax: 781-981-0590

To: Deuterium Array Group

From: Alan E.E. Rogers

Subject: Data rates in the station electronics

A/D sample rate 40 MHz

GC4016 output rate 500 K complex samples from each of 4 channels

GC4016 data output rate

At 2×16 bits per complex sample 64 Mb/s

USB transfer rates:

Data representation (quantization) bits/complex sample	Rate per USB device Mb/s	Rate per polarization (25 receivers) Mb/s
2×16	64	400
2×12	48	300
2×8	32	200
2×5	20	125
2×4	16	100

Notes: 1] current choices is 2×16 bits/sample

2] representations of less than 2×8 bits/sample would require block normalization encoding or pseudo floating point.

Comments

Restricting the FFT output to less than 2×16 bits per complex sample would have the advantage of reducing the USB transfer in the event that we have difficulty achieving high enough USB rates. For random data the growth in the FFT is $1024^{1/2}$ or 5 bits in addition to 15 bits if the twiddle factors are normalized to 32768 so that a down shift of 20 would be needed to put the data output in the same range as the input. If we use a floating point FFT a division by 32 in the conversion back to fixed point will place the output numbers in the same range as the input.