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To: SRT Group

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Subject: SRT VLBI data format

The new SRT electronics is capable of operating in "VLBI" mode. Currently this mode is limited in the firmware to the following:

Bits per sample	1
Bandwidth	4 MHz
Sample rate	8 Ms/s

The firmware running in the DSP converts the 16 bit real output from the GrayChip GC4016 (in wideband downconvert mode) to one bit and packs the 1 bit samples into 512 byte USB transfers. 1600 USB transfers are made starting on each 1 second "tick". This burst of $512 \times 8 \times 1600 = 6553600$ continuous bits lasts for 0.8192 seconds. No data is available between 0.8192 seconds and the beginning of the next second. This "dead" time is used by the controlling PC to provide services like writing to disk and graphics output etc. The 1 bit data is output in a file in blocks of $512 \times 8 = 4096$ 1-bit data. Each block has the following format:

$$\text{yyyy:ddd:hh:mm:ss.xxxxxx typ block vlbi datablock cr}$$

Where   typ = fixed number 6
            Block = 0 thru 1599
            vlbi = fixed ascii characters
            Datablock = encoded 1-bit data
            cr = carriage return line feed ("\n")

The data block encoding uses the standard e-mail attachment code:

Binary	Code
0-25	'A' → 'Z'
26-51	'a' → 'z'
52-61	'0' → '9'
62	'+'
63	'/'

While this block contains only non white ascii characters can be written and read using binary write and read operations. The 1-bit samples are in order with the first bit on the second mark (to within the fixed delay of the GC4016). Other ancillary information like the station name, the latitude, longitude and height from the GPS receiving is written on ascii lines which start with '#'. Each value is preceded by a keyword that identifies the quantity. A few sample lines (truncated to the first 50 characters) from the VLBI data file 2005_049_17_10.haystack is given below:

> #2005:049:17:10:00 Station Haystack Lat 42.622317
> 2005:049:17:10:00.000000 6 vlbi   0   AAjuvgAAAAD//
> 2005:049:17:10:00.000512 6 vlbi   1   AAnuvgHpADWcC
> 2005:049:17:10:00.001024 6 vlbi   2   AAruvvy0/bac1

VLBI data files can be written by clicking on the record button on the controlling GUI. Alternately VLBI files can be written automatically using the keyword VLBIAUTO followed by the start time, duration and source. A start time of 10 is interpreted as any start time module 10 minutes. The duration is in seconds. The plot shown in Figure 1 is the correlation amplitude, phase and delay on an observation of the Sun taken between the 2 new SRT prototypes on a baseline of about 15 feet.