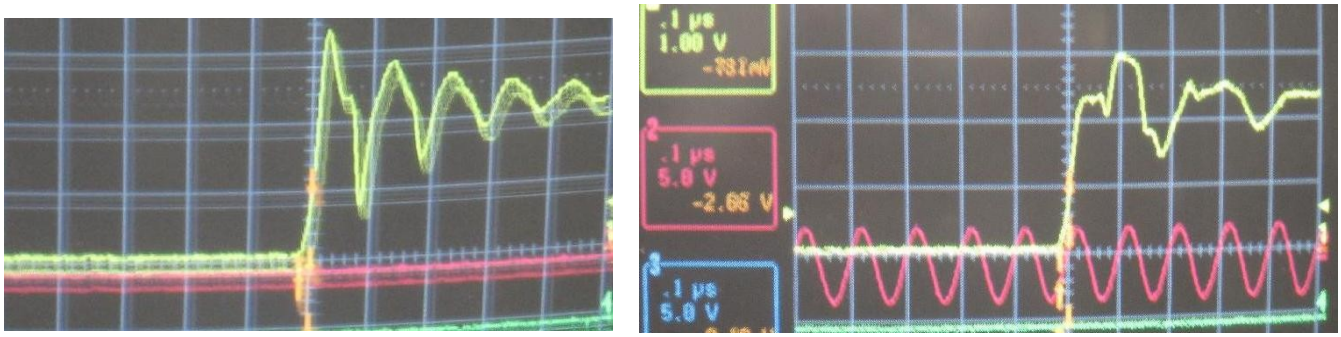
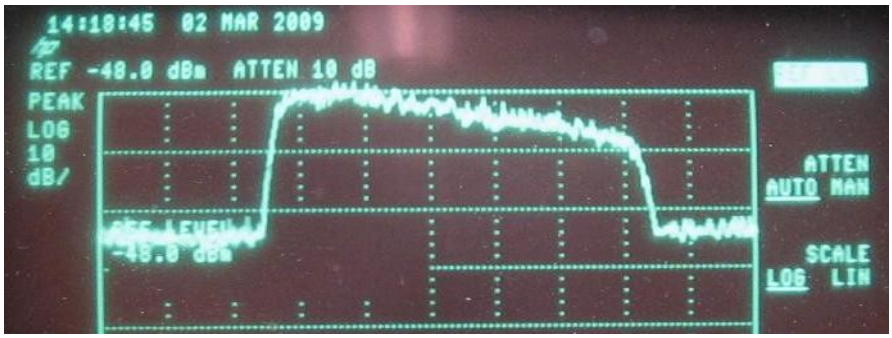
Performance of dBBC and interfacing to existing equipment

The dBBC needs 10MHz and 1PPS, as 2V signals into 50 Ohms. The IF signals can have octave bandwidths, for instance 0-500MHz, 500-1000 MHz at about -30dBm. A dBBC was installed at Effelsberg in the Faraday cage. The 1PPS is a dangerously large 10V pulse with terrible ringing provided by a defective 40-year-old unit. We did some simple 'pulse shaping' with an open-ended cable. The pulse before and after shaping is shown below.



The red trace is the 10MHz, a sinewave about 3 Volt PP.

The dBBC has an 8-bit ADC, also the out-of-band rejection is only about -35dB: this means for 8MHz dBBC setting and 500MHz input bandwidth, SNR in the BBC is only 35-18=17dB. For this reason careful attention is needed to have flat bandpasses at the input of the unit. Also the amplifiers inside the unit may affect the bandpass. At Effelsberg the bandpass is flat in the receiver room, but differential losses in cables lead to a difference of 6dB in level between 500 and 1000MHz in the Faraday room after 30m of cable.



The maximum level of -48dBm is also not enough for the dBBC: here an extra 20dB of gain is needed, and probably some extra passband flattening. Other receivers may have different bandpass slopes.

Requirements for an interface unit :

- 10MHz: square incoming sinewave using comparator and distribute to other units.
- 1PPS: Limit to TTL level, clip off ringing. Use this signal to synchronize a 1PPS signal made by counting incoming 10MHz. Synchronization by pressing button, like VLBA 1PPS generator. (“grey box”). A clean, correctly synchronized 1PPS is necessary for all systems using Mark5B (or 5C).
- 4-channel 20-30dB amplifier for IF. Cable compensation needed for 6dB loss between 500 and 1000MHz. Commercial cable compensation units are unfortunately 75 Ohm. May need band-defining filters (0-500, 500-1000MHz) to remove out-of-band signals. When dBBC channels use narrow bandwidths (2MHz, 4MHz) it may be useful to add filters to further limit analog bandwidth, for instance to 250-500MHz or 750-1000MHz.
- For high-bandwidth experiments at 4Gbps, wider IF bandwidths will be needed, for instance 0-1000MHz. This should be done with analog optical transmission.