Beamforming Software HOWTO

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This document is located in
/geoclutter5/scratch/sunwoong/Calibration/Beamform_Test_Export/Beamform_Howto.ps

1 Command

full_beamformer can be executed from command line prompt by typing
full_beamformer *input_file input_arr output_arr*

- *input_file:* Text file containing information such as source and receiver position, array length, etc., as explained in Sec. 2.
- *input_arr:* Arr file that contains transmission loss to be beamformed. Transmission loss should be in magnitude squared, not in dB. It also needs either an .m file with the same name that has grid information in it, or it should have arr footer field.
- *output_arr:* Beamformed field of *input_arr* in arr format. The output is also in magnitude squared.

The source code of this command is in
/geoclutter5/home/sunwoong/LinkDir/Geoclutter/util/full_beamformer.C

2 Input_file format

Below is an example of *input_file*:

```
# source
150689.50 4330784.29 84
# receiver
146764.66 4333585.40 58
# array length
94.5
# array heading
354.96
# range_resolution
30
# beamform_freq
415
# range
```

```
1 60000
# angle
0 360
```

In *input_file*, lines starting with # are comments, and are ignored.

1. *source:* Position of source in utm. The last field is the source depth, and it can be given an arbitrary value, since it is not used for beamforming.
2. *receiver:* Position of receiver in utm. The last field is the receiver depth, and it can be given an arbitrary value, since it is not used for beamforming.
3. *array length:* The length of an array in meters.
4. *array heading:* The array heading in degrees, measured from East (x-axis) in the CCW direction.
5. *range resolution:* Range resolution in meters.
6. *beamform_freq:* Frequency for beamforming. This field and the array length determine the cross-range resolution.
7. *range:* Minimum and maximum two-way ranges to be beamformed. For a 40-second reverberation measurement time, the maximum two-way range is $40 \times 1500 = 60000$ meters.
8. *angle:* This field should always be 0 360.

3 Benchmark

Figure 1 is an example of the beamformed field using full_beamformer. The input file, input arr, and output arr of this example are in
/geoclutter5/scratch/sunwoong/Calibration/Beamform_Test_Export/beamform.in
/geoclutter5/scratch/sunwoong/Calibration/Beamform_Test_Export/biconvolve_in_alog10.arr
/geoclutter5/scratch/sunwoong/Calibration/Beamform_Test_Export/beamform_out_alog10.arr

Figure 2 is the same beamformed field calcuated using biconvolve. Figure 3 is the difference between Fig. 1 and Fig. 2.

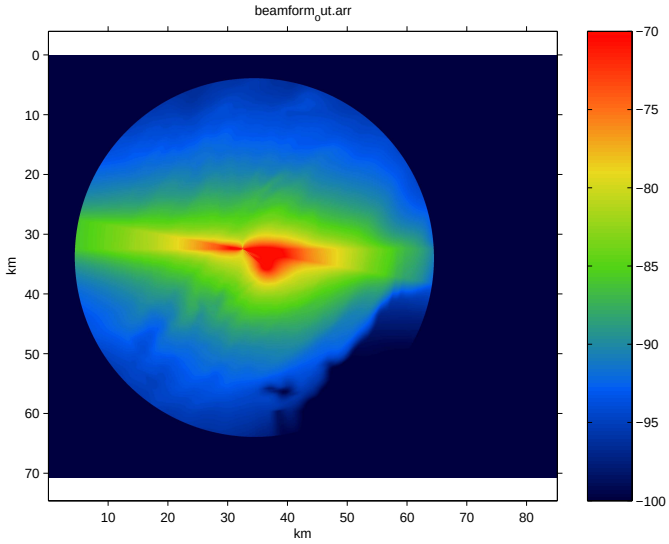

Figure 1: Beamformed field using full_beamformer. Computation time: 40 s.

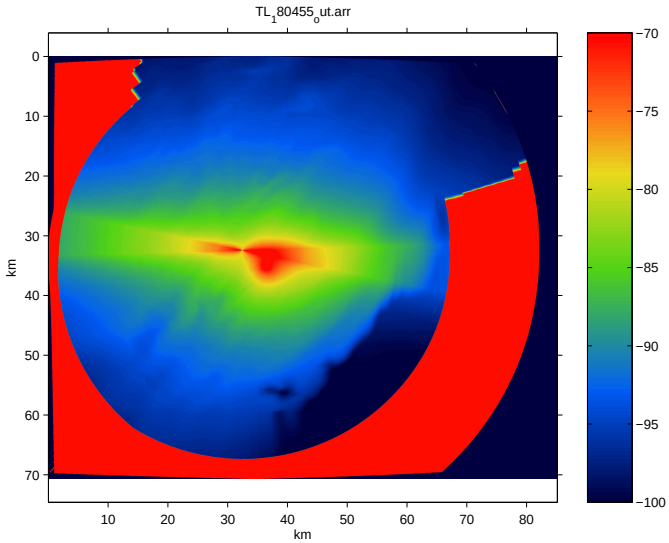

Figure 2: Beamformed field using biconvolve. Computation time: 3 h.

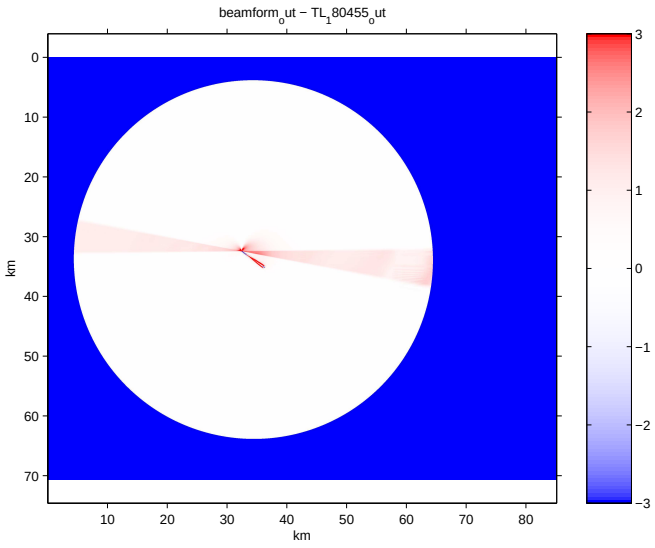

Figure 3: Difference between Fig. 1 and Fig. 2 in dB.