Cavity feeding calculations

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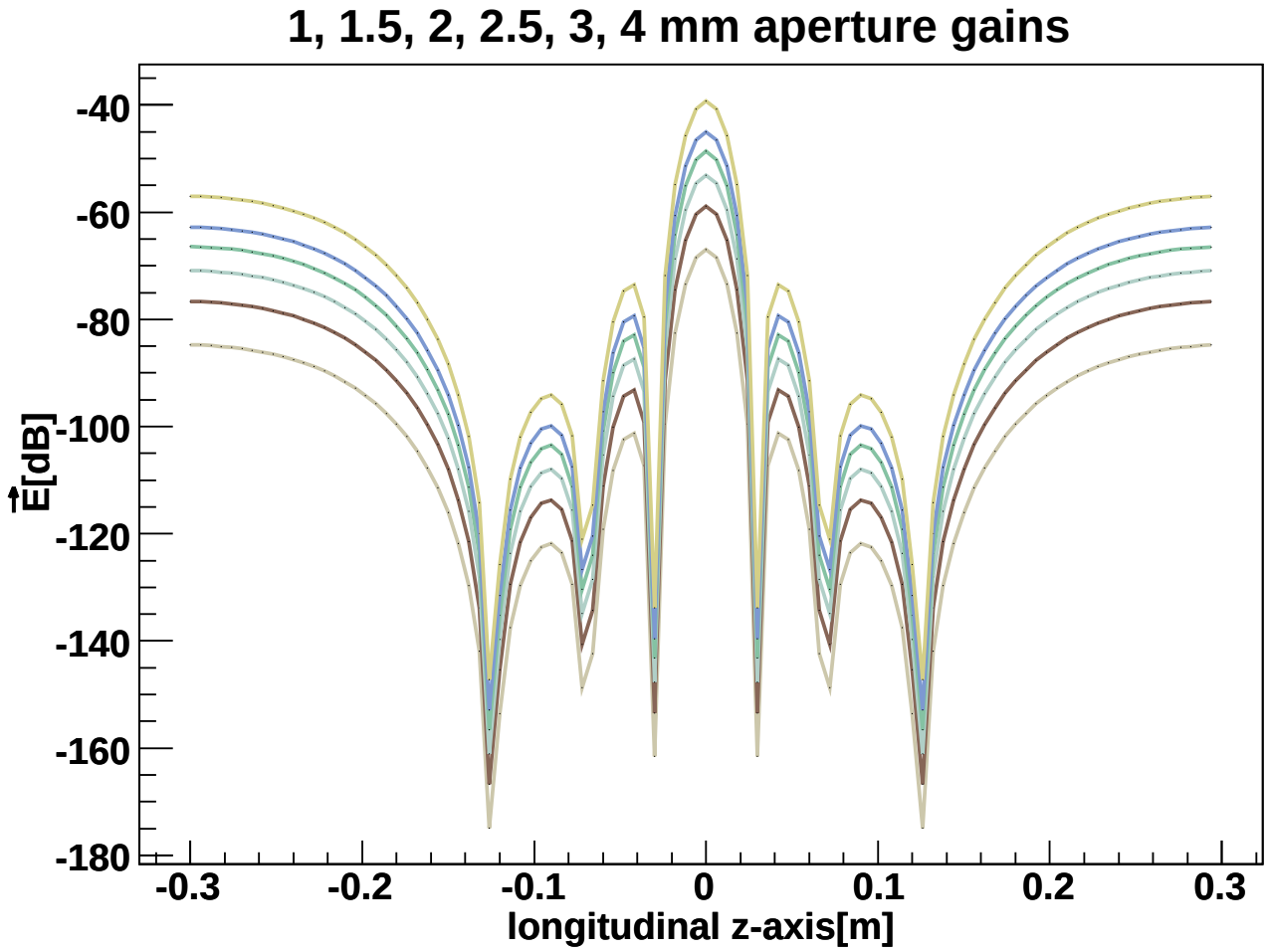
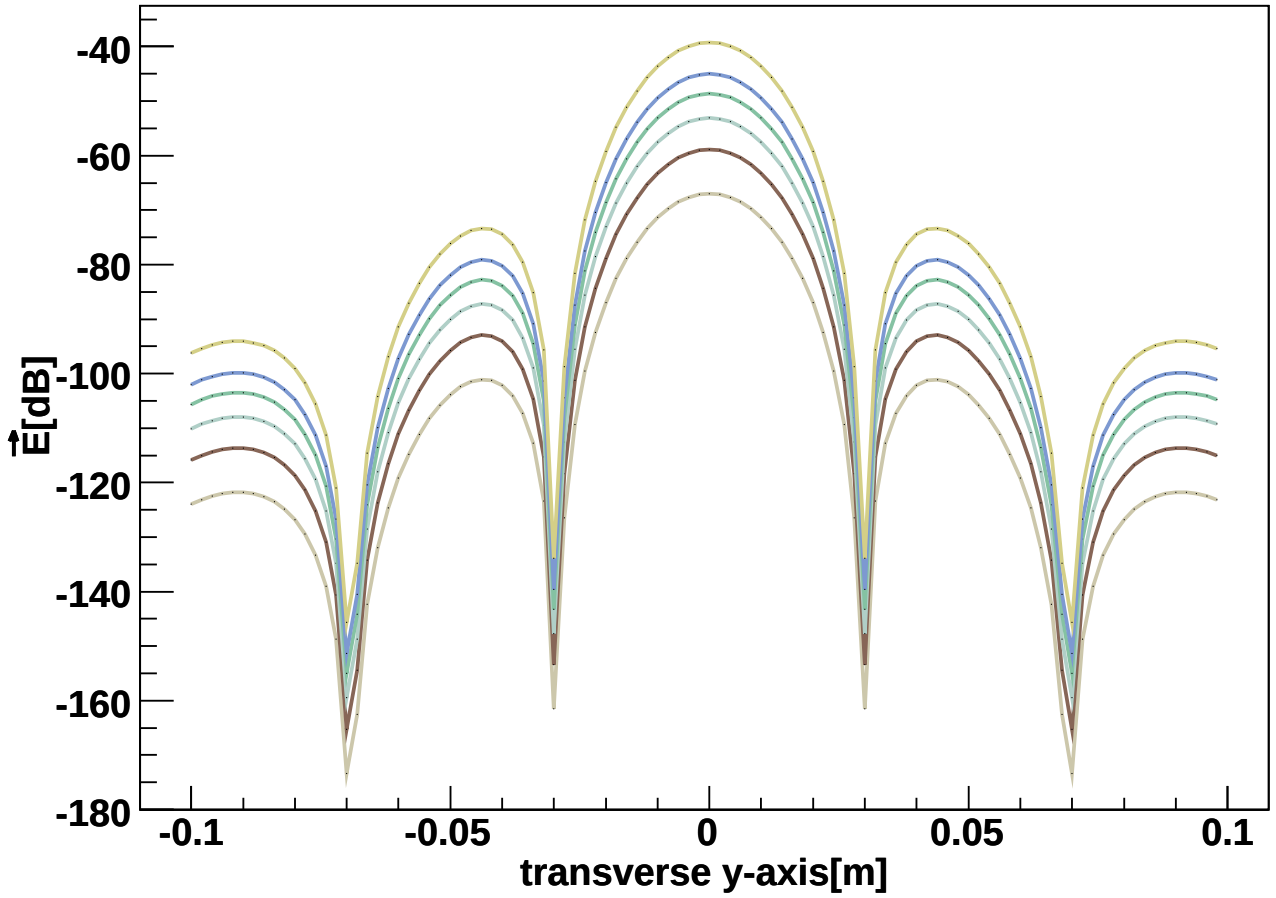
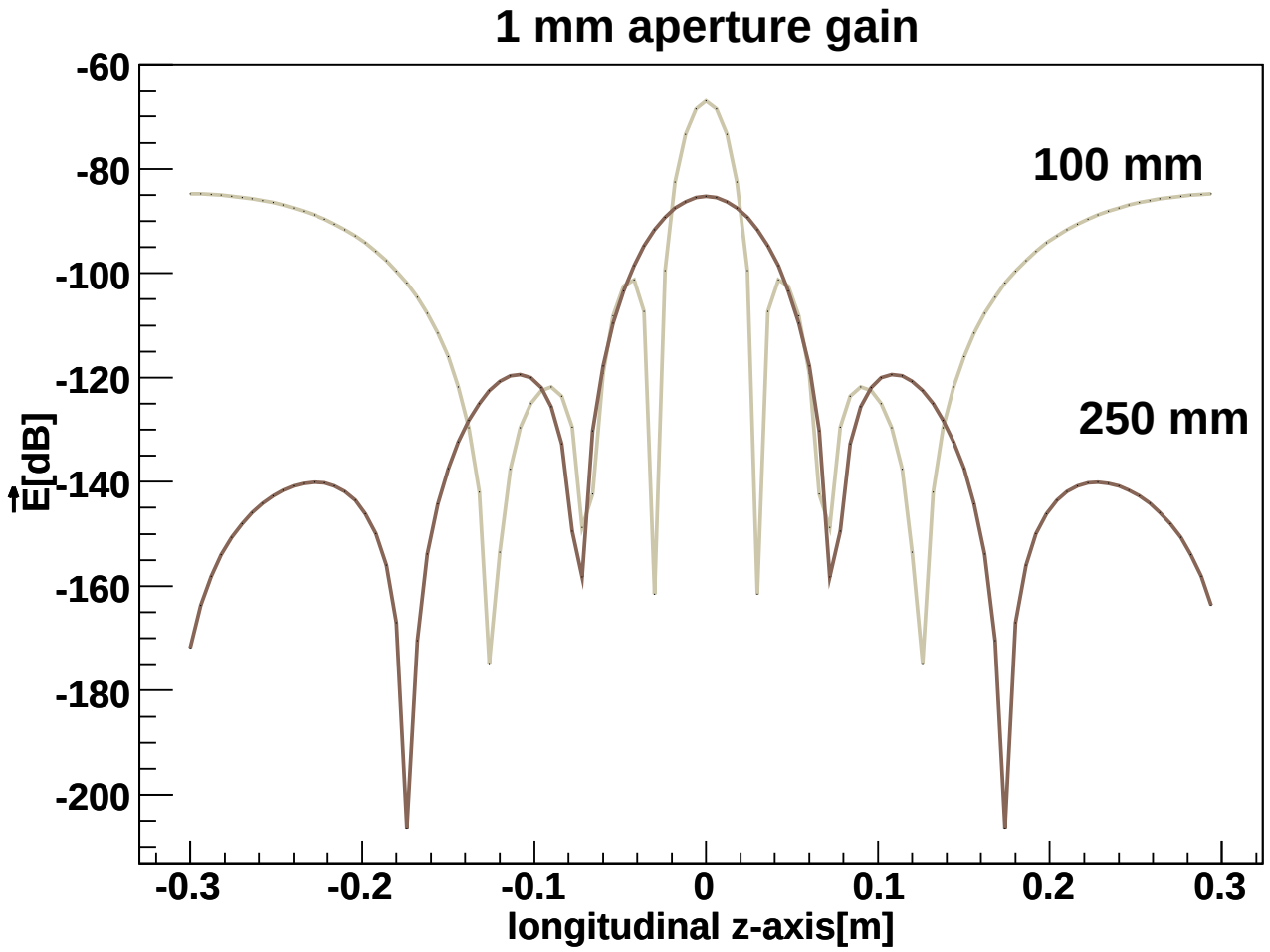
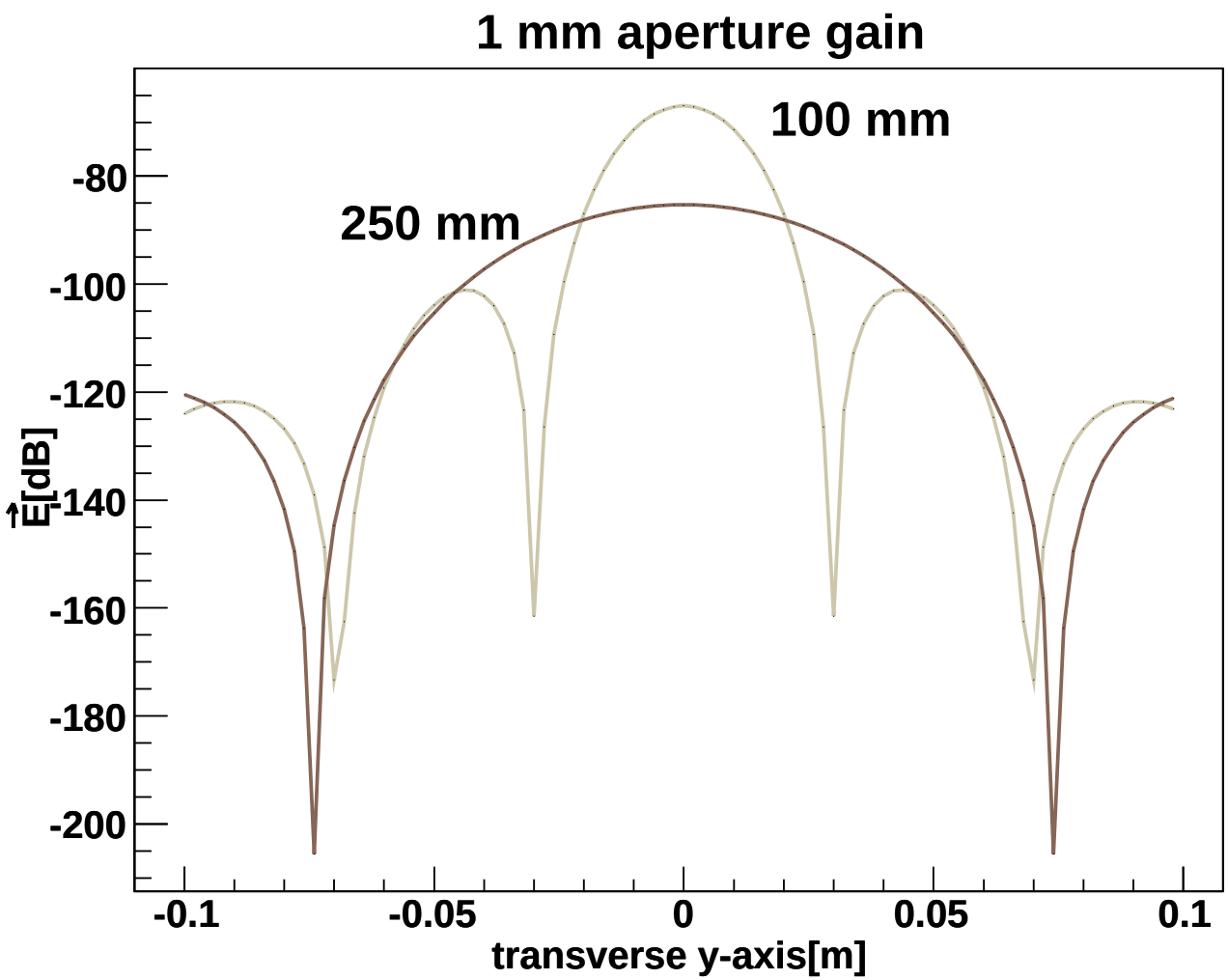
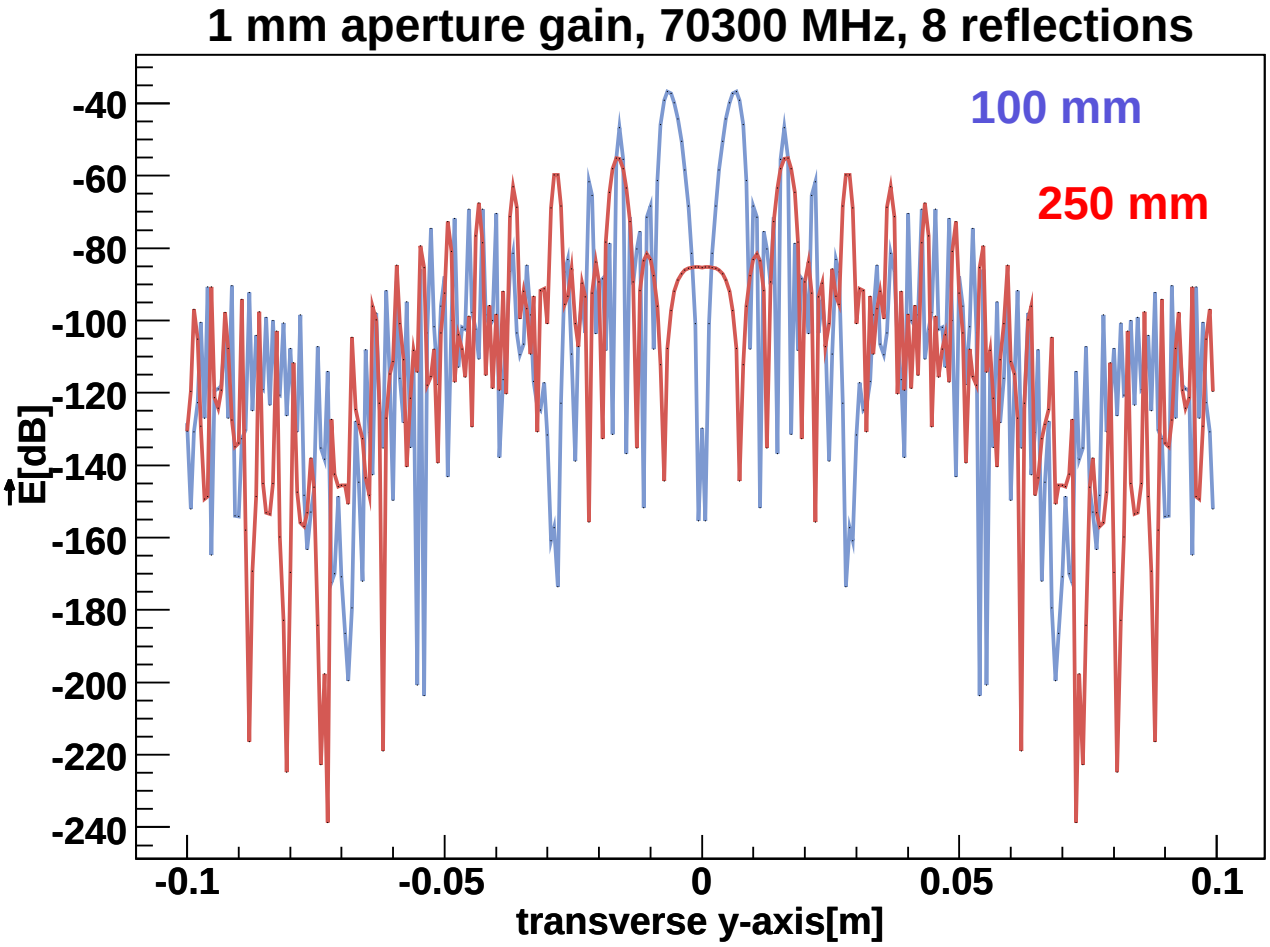
- calculate radiation pattern from one 15 mm long aperture on cavity wall for widths 1, 1.5, 2, 2.5, 3 and 4 mm
- aperture in the center of target cell at 100 mm or 250 mm distance from the central axis
- simple homogeneous electric field $\vec{E}$ across the narrow aperture assumed, the aperture gains are relative to this field
- calculate first target cell and microwave guide system only - add reflections from cavity wall later

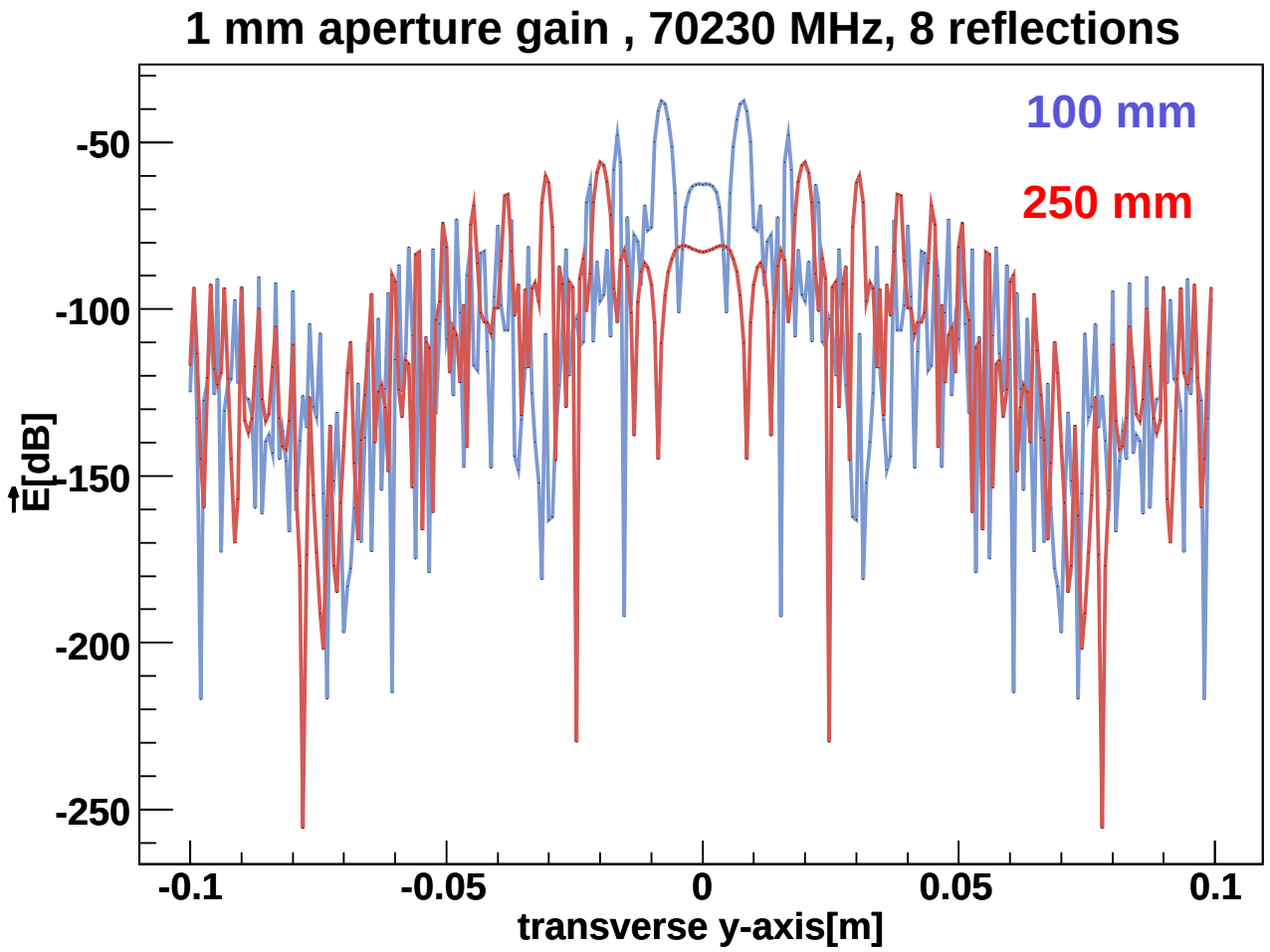

1, 1.5, 2, 2.5, 3, 4 mm aperture gains
-40
-60
-80
-100
-120
-140
-160
-180
$\vec{E}$[dB]
-0.3
-0.2
-0.1
0
0.1
0.2
0.3
longitudinal z-axis[m]

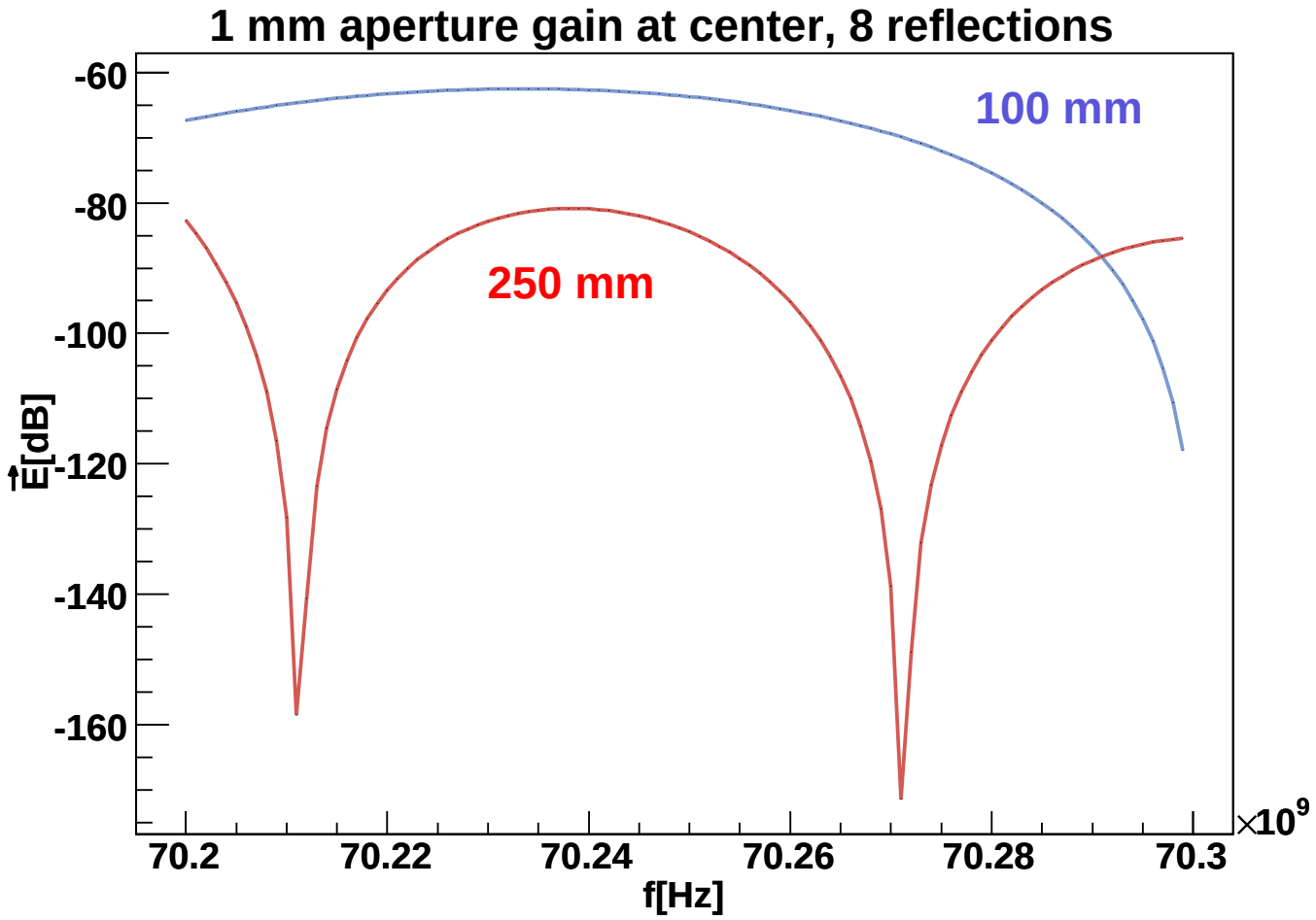

-40
-60
-80
-100
-120
-140
-160
-180
$\vec{E}$[dB]
-0.1
-0.05
0
0.05
0.1
transverse y-axis[m]


1 mm aperture gain
100 mm
250 mm
-60
-80
-100
-120
-140
-160
-180
-200
$\vec{E}$[dB]
-0.3
-0.2
-0.1
0
0.1
0.2
0.3
longitudinal z-axis[m]


1 mm aperture gain
100 mm
250 mm
-80
-100
-120
-140
-160
-180
-200
$\vec{E}$[dB]
-0.1
-0.05
0
0.05
0.1
transverse y-axis[m]


1 mm aperture gain, 70300 MHz, 8 reflections
100 mm
250 mm
-40
-60
-80
-100
-120
-140
-160
-180
-200
-220
-240
$\vec{E}$[dB]
-0.1
-0.05
0
0.05
0.1
transverse y-axis[m]


1 mm aperture gain , 70230 MHz, 8 reflections
100 mm
250 mm
-50
-100
-150
-200
-250
$\vec{E}$[dB]
-0.1
-0.05
0
0.05
0.1
transverse y-axis[m]


1 mm aperture gain at center, 8 reflections
100 mm
250 mm
-60
-80
-100
-120
-140
-160
$\vec{E}$[dB]
70.2
70.22
70.24
70.26
70.28
70.3
×10^9
f[Hz]

Conclusions

- aperture gains from -40 to -67 dB
- multiple reflections in cavity produce "random" radiation pattern outside main lobe
- there is a main lobe in the central axis of the aperture: the radiation is not symmetric in transverse plane
- larger cavity diameter decreases aperture gain at center by 20 dB and produces 2 nulls in frequency sweep 70200 - 70300 MHz - the energy is spread more into the cavity volume
- multiple apertures operating at same time make the system even more complex - more random radiation pattern can be expected