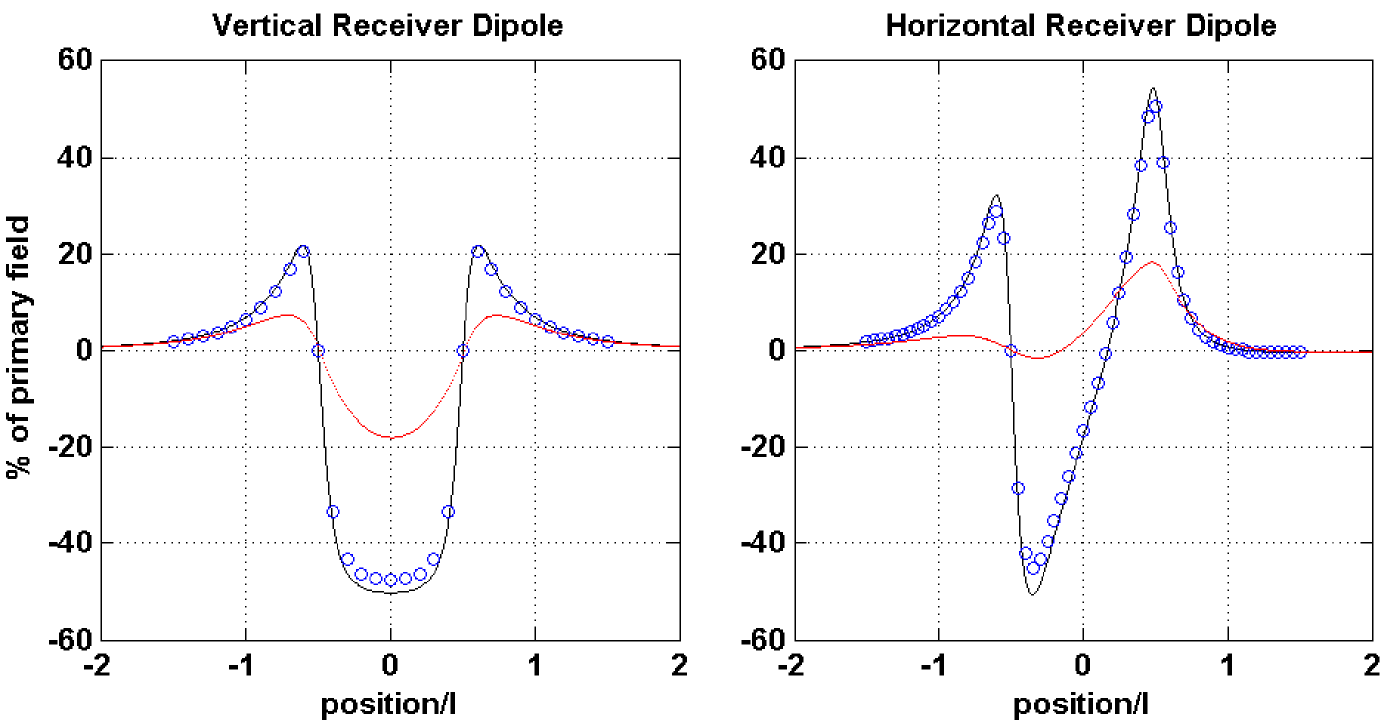
The Problem with "Ribbon Models"

The diagram below illustrates the problem of modeling thin sheets by using a "ribbon" representation for the current density on the sheet. In the example below, contributed by Dr. Jim Macnae of the Royal Melbourne Institute of Technology, MultiLoop II (which uses a ribbon representation) was compared with the Martin's analytical solution for a strip. The model represents a slingram max-min response over a vertical sheet. Approximately one week of trial and error modeling was required to try to fit both x and z components, and the result shown below illustrates a typical compromise. While the z component fit could be improved, the x component was always worse than that shown.

The MultiLoop III model, which agrees well with theory, was computed from scratch in a single modeling session using a mesh with approximately 600 points. Agreement with theory is very good, and would be improved if a mesh with more points were used.

The problem with representing scattering with ribbon models is that location of the centre of the current vortex must be guessed, and input into the model to "skew" the ribbons to fit the current. The accuracy of any modeling thus depends on the how well the skew can be guessed. Additionally, if any significant current migration is present, or if a moving transmitter system is being modeled, the "skew" may vary with time and transmitter position. The accuracy of any such models will be accordingly compromised.



Slingram Max-min coupled

Target depth = 0.1 coil separation

Red: MultiLoop2 biggish ribbon, after considerable skew/ribbon optimisation expended (just possible to fit "z", but never "x")
Blue: MultiLoop3 ribbon
Black: Analytic ribbon (Martin solution)