

The World's Leading Electromagnetic Interpretation Platform

EMIGMA V6.2 at a Glance

EMIGMA has been evolving rapidly since its conception, progressing from a prompt based modelling program without data plotting tools to a full EM interpretation platform with advanced 3D Data representation.

If you haven't seen EMIGMA recently, you haven't seen EMIGMA!

Completely redesigned for the Windows 95/NT environment in 1996, EMIGMA now contains not only the worlds leading EM simulation algorithms, but some of the most useful EM plotting and Visualization software. 3D Visualization offers viewing and manipulation of your model as well as representation of your data as lines, surfaces or contours in 3D space. Not only can you view simulated data in this manner, but you can directly compare simulated data to measured field data by importing your measured data into EMIGMA through our easy to use PEImport tool. Importation of data from multiple profiles and transmitters into a single *PetRos EiKon* file simplifies both modelling and data investigation.

EMIGMA is not just a tool for the experienced geophysicist. EMIGMA is useful to the exploration and mine geologist, environmental technicians as well as the junior geophysicists. EMIGMA is now an excellent way to show data characteristics to your exploration geologists. EMIGMA is a tool that can be used to help anyone more fully understand the relationship between the geology and their geophysical responses.

EMIGMA is also the perfect academic tool. It is ideally suited for undergraduate and graduate lab courses as well as thesis work.

Increased User Friendliness

Batch Mode is now available for both the forward Simulations and for the frequency to time domain transform. Simulating a suite of models has never been easier. Build your models and run overnight or throughout the weekend.

Faster Simulations and Transformations EMIGMA V6.2 runs forward models significantly faster and transformations at lightening speed with excellent accuracy.

Look forward to our databasing which will further increase computation speeds and allow for more rapid retrieval and storing of both your data and your models.

On Line Help has been implemented into each page of our Simulation, Import and Transform software. More help on the way for the Visualizer and EiKPlot.

Tutorials Available Tutorials walk users through the building, simulating and plotting of Crone, Max-Min, Questem, Geonics EM58 and UTEM systems. Please request the tutorials of your choice from *PetRos EiKon*.

Examples Directory Updated

The examples directory for V6.2 has now been significantly updated. Use these examples as starting models to make setting up your models easier. Simply open the file of your choice into

Simulations and adjust the parameters to match the survey that you wish to model.

investigating your data 3-dimensionally. Look for the release of pseudo-depth sections for FEM, TEM and IP early in 1999.

Interface Improvements

Ease of Modelling Import model constructions (anomalies and layered earths) between files to enhance the fluid building of models and suites of models. To detail variations in the geology of your target, convert prisms to polyhedra and modify.

Flexible Profile Generation and Modification For ease of building and modifying profiles a number of improvements have been made to the Profiles page. These include, among others, the ability to unify and split profiles and the ability to define a profile by the sample spacing instead of the sample density.

MT and CSAMT frequency selection Automated logarithmic sampling is now available for MT and CSAMT frequency selections.

Reversal of Current direction in the Loop Intuitive building of loops, a current reversal button and a loop elevation shift all make modelling with loops easier.

Enhanced Data Representation

Enhanced Surface Representation

2 interpolation styles are now offered for creating data surfaces from multiple line data: linear and cubic. Both techniques are true to your data! Use linear for a simplified look at each time channel or frequency. Switch to cubic for a more detailed look at a specific channel.

EM Contouring Introducing our new contour application for quickly and accurately contouring EM, Magnetic or IP data over your survey grid. Multiple frequencies or time windows can be stacked proportional to depth for



EiKPlot A number of changes have been made to increase 2D plotting flexibility. Look for the changes you may have requested. Contact us if they have not yet been implemented.



Improved Data Imports

Importing of field data allows for the immediate viewing and investigation of data. Imports allow automatic selection of data locations, transmitters, receivers and data channels. The user is only required to define the 3D geological and electrical model before the survey can be simulated. EMIGMA is then relatively automatic for direct comparison of the modelled data to the measured data.

Improvements have been made to a number of the data imports.

Large Loop TEM Imports: Added to the CRONE, UTEM3 and GEONICS imports is the ability to import multiple profiles and multiple transmitter loops. Wherever possible the ability to browse for multiple data files and import them together into a single *PetRos EiKon* file has been implemented. In addition, loops are now easier to modify and currents can be reversed with the click of a button.

Comprehensive imports have been built for Max-Min, EM34 and Dighem systems. An import is also available for the importation of generic frequency domain data in ASCII column format for systems with dipole transmitter and receiver configurations.

Magnetic data in XYZ format can now **EMIGMA**.

be formatted, viewed and modelled in

Look forward to the release in January, 1999 of new data imports: UTEM4, Geotem, RIM, IP6 and a generic Geosoft import for TEM data.

Once imported, you are ready to view and analyse your field data in our 2D Plotter, our 3D Visualizer or our new Contouring tool. All of these are designed to help in the careful analyses of your data for insight into your geophysical anomalies and your geological targets.



Based on a hypothesis of your geological environment, build a layered earth and add a target to your imported survey. Simulate the response in Forward Simulations and directly compare to your measured data.

Transforming imported .spt files to time domain is trivial, essentially automated as the base frequency, waveform configuration, ramp times, data channel times and normalization are all automatically selected. There is no need for you to know the system specification of your data, we have done the work for you!

Increased Simulation Capabilities

A host of improvements have been made to the simulation capabilities of V6.2. See the "Focus on Increased Simulation Capabilities" insert for more details.

- ✓ *Addition of AC Magnetic Effects*
- ✓ *Modelling of Multiple Transmitters in a single run.*
- ✓ *User defined electric and magnetic interactions:*
- ✓ *Advanced sampling for prisms*
- ✓ *Increased speed in layered earth and Normalization Calculations.*
- ✓ *Improved splitting of prisms and polyhedra at layer boundaries.*
- ✓ *Improved EM Field calculations inside anomalies*
- ✓ *Improved error checking and messaging*
- ✓ *Reduced Virtual memory requirements*
- ✓ *Improved time domain transformations*
- ✓ *Enhancements to polyhedral gridding*
- ✓ Enhancements to ILN algorithms



Xbhole A new tool which allows you to build and simulate 3 component X-hole surveys for both electric and magnetic dipole transmitters and receivers. Targets include prisms (LN and ILN), plates, and spheres. This capability is offered as an add-on to EMIGMA. Xbhole data representation is available for all our data viewers including contouring. Look forward to new ray tracing techniques for studying your Xbhole data.

Advanced Target and Topography Definition

Poly Generate For more realistic representation of your targets and topography, easy to use polyhedra generators are offered.

Especially in areas of high relief, topography can impact on the results of a survey.  The topography generator is designed to allow users, who do not have stored topography information, to build a synthetic topography to represent dominate features in the terrain. Users can then overlay receiver positions on the topography and simulate the response.

Restricting geologic targets to prisms, plates and spheres is a simplification. More accurate results would be achieved if we could more accurately represent the target's actual shape. *PetRos EiKon* now allows for advanced target definition in several ways:

Polyhedral Generation: The development of polyhedra generators allows users to build polyhedral targets of prismatic, cylindrical, hemi-cylindrical, spherical or 2 dimensional polygonal shape to more accurately simulate the geology.

Geological Imports V6.2 allows the first direct importation of your geological model into EMIGMA from your CAD tools using Gemcom formats.

Polyhedral Manipulation: Prisms may be converted to polyhedra at the click of a button. A polyhedra corner manipulation dialogue box has been added to the Visualizer. This allows enhanced accuracy and ease of manipulation. A flexible splitting routine is also available for cutting polyhedras thus allowing the user to displace portions of anomalies, down faults for example.

Note: it is always a good idea to model first with simpler prismatic primitives to ensure understanding of the physics occurring in your model. Then graduate to more complex bodies.

Visit Us On Line

<http://ourworld.compuser.com/homepages/PetRosEiKon>

PetRos EiKon has a new web page. Although still under construction, it is worth a visit to our site.

Toronto - March 8-12, 1999

Booth #1024

We welcome the opportunity to arrange for demonstrations or training during either conference. Please call to schedule a time.

See You on the Circuit ...

...Visit our Booth

Cordilleran Roundup

Vancouver January 28-29, 1999

Booth #B39

PDAC

Focus on Increased Simulation Capabilities

1. AC Magnetic Effects: Our new Magnetic LN algorithm is now available in EmigmaV6.2 MLN is an extension to the current gathering LN algorithm for prisms to include magnetic field gathering due to induced magnetization. MLN fully simulates the combined effects of resistivity, susceptibility, permittivity and IP variations. Polyhedra versions of these algorithms are being developed. See insert 'Focus on Magnetics' for benchmarked examples

2. Multiple Transmitters: V6.2 allows the modelling of multiple transmitters or multiple receivers (several boreholes and/or profiles) in a single model run to allow for comparison and interpretation of different TX-RX pairs.

3. Advanced sampling in prisms. Defaults for directional sampling of prismatic anomalies are based on the most uniform distribution of the total number of sample points (as in V6.1) but can now be modified by the user in V6.2.

4. Separate dynamic-linked library (DLL) for layered earth. Optimization of Layered earth and freespace normalizing calculations result in an increase of speed from 10-20 times over V6.1. Layered earth studies can now be completed in a fraction of the previously required times.

5. Improved splitting of prisms and polyhedra at layer boundaries. The automatic splitting of prisms and/or polyhedra which cross layer interfaces and the application of nearfield (electrical) interactions on the bodies was introduced in V6.1. Further in V6.2, the user has the option to save the split construction before simulating as the original construction is restored after simulation. This enables editing and manipulation of the original structure which may then be re-split (if necessary) and re-run.

6. Field calculations inside anomalies. Generally unavailable in other software, EMIGMA can accurately calculate electric (and magnetic) fields inside scatterers. This situation is encountered, for example, in modelling MT and IP over

topography and in borehole surveys when the hole intersects the target. In V6.1, the first such internal field calculations, for electric dipolar fields inside LN anomalies (both prisms and polyhedra) were implemented. In V6.2 this functionality has been extended in to include electric (and magnetic) dipolar fields inside ILN scatterers as well as to extended electric receivers inside all prisms and polyhedra.

7. Improved error checking. Due to the implementation of enhanced error checking the code rarely fails without informing the user of a specific problem encountered.

8. Dynamic allocation of layered earth. Dynamically allocation of memory for layered earth calculations enables users to run V6.2 with, on average, 40-50 MB less virtual memory than V6.1, despite the enhanced functionalities in V6.2.

9. Improved time domain simulation. Automatic attachment of the model construction from the time domain survey enables models to be run immediately, or the spectral survey to be edited through the survey selection box. Automatic generation of a three-component free-space survey when a spectral survey is run enables users to normalize to all three components without running all three components in the simulation, representing a three-fold increase in speed from V6.1.

10. Enhancements to polyhedral gridding. A number of enhancements have been made to the polyhedral scattering routines.

11. Enhancements to ILN algorithms. The addition of an iterative refinement technique has increased the accuracy of the matrix solution for the scattering tensors for ILN prisms and polyhedra.

Focus on Magnetics

MLN Example AC Magnetics benchmark (sphere vs. LN vs. ILN)

The figures are of a massive conductor model of a sphere and equivalent volume cube at 1 S/m and 20 S/m embedded in a 500 Ohm/m background. Both forward and backward scattering situations are considered.

For the weaker conductor, both the LN and ILN prism algorithms match the benchmark EMSphere result on the order of a MHz (the backscattering case is shown).

For the stronger conductor, the ILN result has much the same character as the EMSphere throughout the spectrum and in particular, the amplitude at low frequency match well (the forward scattering case is shown) while the LN result is much damped as it ignores induction modes which are now significant.

When permeability effects are added ($k=1$) to the weak conductor case, the LN algorithm exhibits the correct flatness in the inphase component of the response as we approach DC. The response character is consistent with the EMSphere result for higher frequencies in the backscattering case, but not as well-matched in the forward scattering case which is evidently a more inductive target-receiver coupling; this is a persuasive argument as the forward scattering case was well reproduced by the ILN algorithm for the stronger conductor.

