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SUBSURFACE VIEWS

GPR INNOVATIONS
HARDWARE AND SOFTWARE

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EKKO_Project V4 Released

EKKO_Project is the all-inclusive software solution for managing, displaying, processing and interpreting GPR data. Many users have commented that the power and simplicity of EKKO_Project makes them far more productive than ever before. Some of the new features in EKKO_Project V4 were a result of customer feedback from earlier releases of the software. We always want to hear your ideas to make our software (and hardware) better. Our focus is always to make the complex challenges faced by our customers simpler and easier to tackle by using the most advanced instrumentation and integrated software. EKKO_Project V4 has now been released and one of the new features is the ability to quickly generate a GPR report. A professional report is a powerful deliverable, reinforcing to your client the quality of the insights and expertise you bring to their assignment. The latest version of EKKO_Project software includes the GPR Summary Report; an auto generated PDF that includes data images, photographs and tables, taking only seconds to produce.

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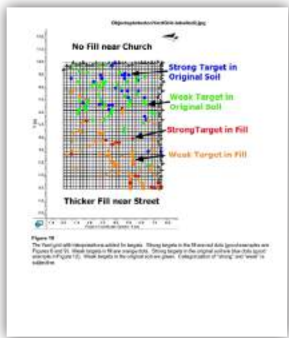
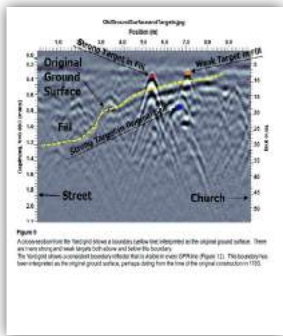
EKKO_Project V4 has now been released and includes the following features





Your Company's logo

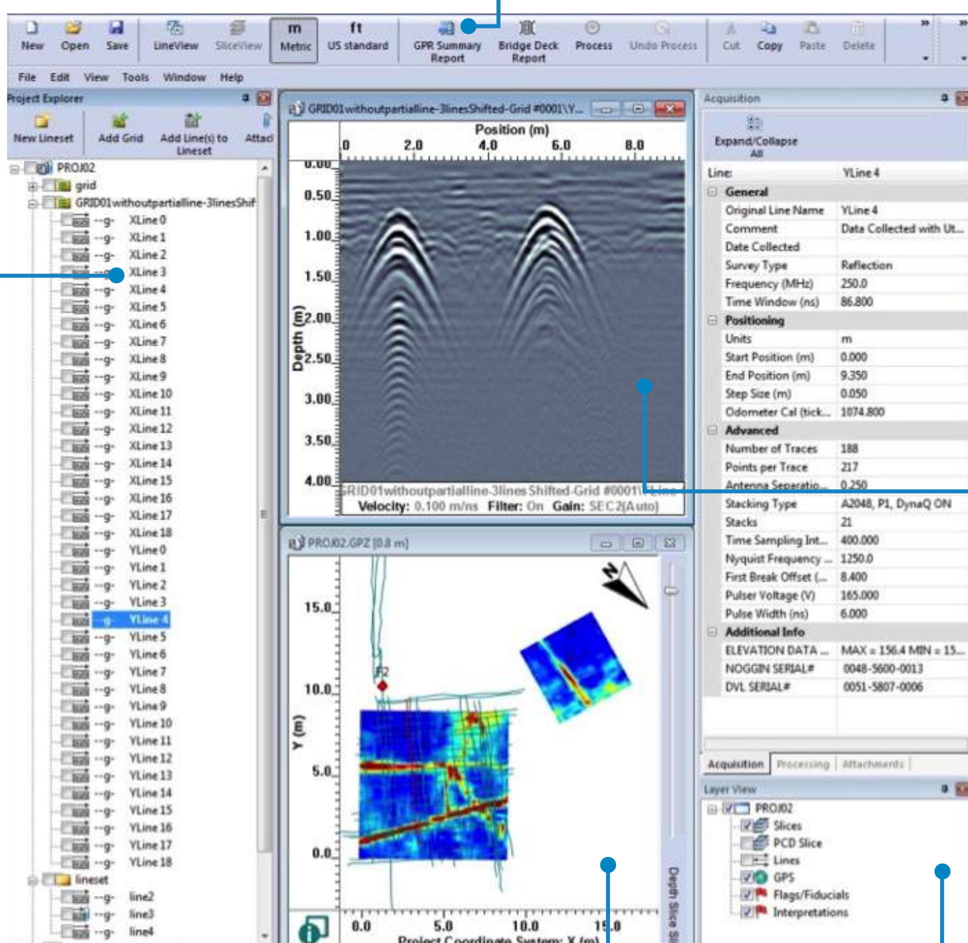
Report includes your Company's logo

GPR Summary Report - NEW

Generate a PDF report by adding captions to: screen captures from the field, data images generated with EKKO_Project and/or your own photographs. Data images include GPR lines, depth slices, map views of grids, and GPS survey paths.

Merging Projects

Merge any number of project (.gpz) files together to make one large project.



Line Preview - NEW

Automatically displays GPR lines in EKKO_Project without the need to open the LineView module.

Provides fast switching between lines to quickly review all the GPR lines in a project.

Layer View - NEW

Select layers to display in MapView and Line Preview:

- Depth slices
- Conquest PCD
- Lines
- GPS path
- Flags/Fiducials
- Field/Point Interpretations

MapView Window:

- Now displays depth slices generated by data acquisition hardware or processed with SliceView.
- Uses the slider bar to slice through all grids simultaneously, regardless of orientation – **Very powerful!**
- Now works with Conquest PCD data.

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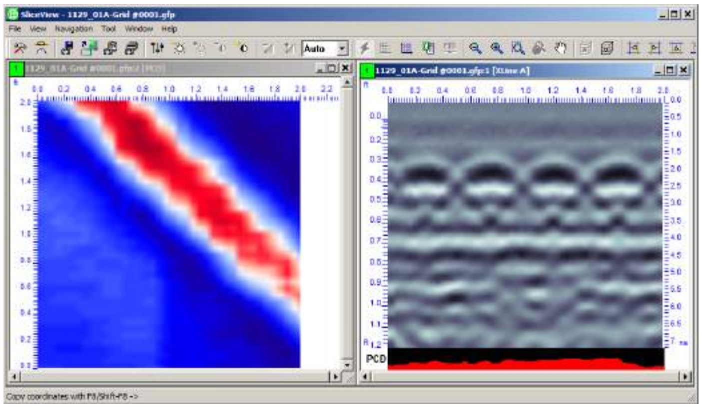
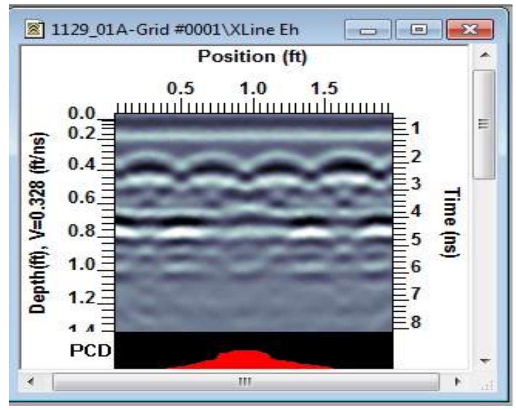


SliceView module:

- Displays Conquest depth slices and the PCD slice
- Is now available in 64-bit to process larger grids



LineView module:

Now plots Conquest PCD (Power Cable Detector) data under the GPR line image

Whether you're a novice or a long time GPR professional, EKKO_Project allows you to quickly and easily extract key information, add your valuable insights and provide impressive reports to your client.

Contact us to get more information about EKKO_Project V4, a trial version or upgrade pricing from earlier versions of EKKO_Project.

EAGE 2015 Boot Camp

The European Association of Geoscientists and Engineers (EAGE) annual Geophysics Boot Camp provides students and early career professionals with valuable field experience using geophysical instruments. Sensors & Software provides a pulseEKKO PRO GPR system with 250 and 500 MHz transducers for the field camp.

Under the guidance of Dr. Adam Booth, 60 participants from various universities and companies performed GPR surveys to map near-surface infrastructure around Germany's Emlichheim oilfield (operated by the company Wintershall). The data were also used in support of archaeological initiatives in the local area.

Delineating buried infrastructure plays a critical role in de-risking the seismic operations. Wintershall had specified that no seismic sources could be placed within 10 meters of any of their subsurface pipes. GPR surveys (Figure A) confirmed that exclusion zones had been correctly marked on the road surface. Participants were therefore undertaking a relevant and real-time civil engineering survey as part of the camp!

Figure A: : Infrastructure survey with a pulseEKKO PRO 500 MHz system

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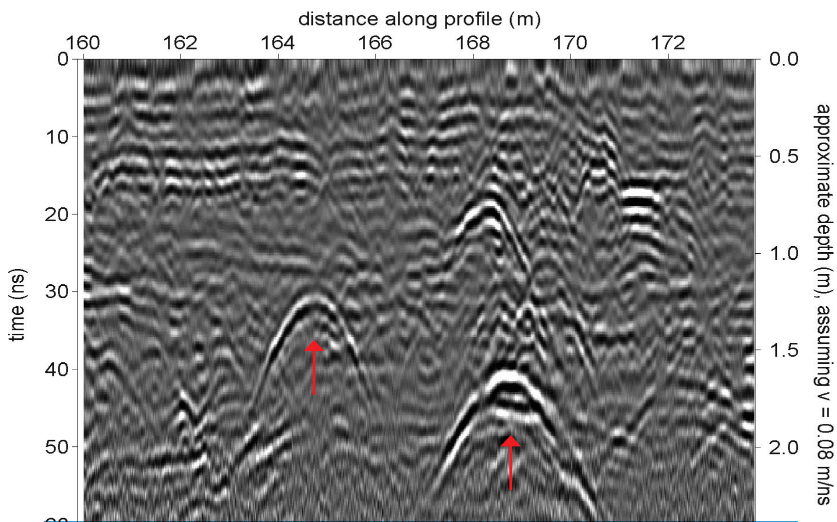

Figure B: GPR line showing utilities to stay 10 meters away from during the seismic survey

The GPR line in Figure B shows the classic hyperbolic response from a pipe, specifically two steel gas pipes, imaged with a 500 MHz system. We were fortunate to have very "GPR friendly" ground conditions, and imaging was possible to depths of 2.5 meters.

Archaeological surveys (Figure C) were conducted in the grounds of Stiftung Kloster Frenswegen, originally a 13th Century monastery close to the town of Nordhorn. GPR surveys using 250 MHz and 500 MHz transducers revealed evidence of earlier archaeology, and the circular features cut into the soil at the site are potentially Saxon storage pits termed 'grubenhäuser' (Figure D).

Figure C: Archaeological survey using 250 MHz transducers

These are typically present between depths of 0.5-1.4 m, and are up to 4 m in diameter.

Sensors & Software is a strong supporter of educational activities like the boot camp and collaborate with many groups to help people to expand their knowledge of GPR, ensuring that the technology is used appropriately and effectively.

Learn more at http://lg.eage.org/?evp=6195

Story courtesy of Adam Booth and the EAGE

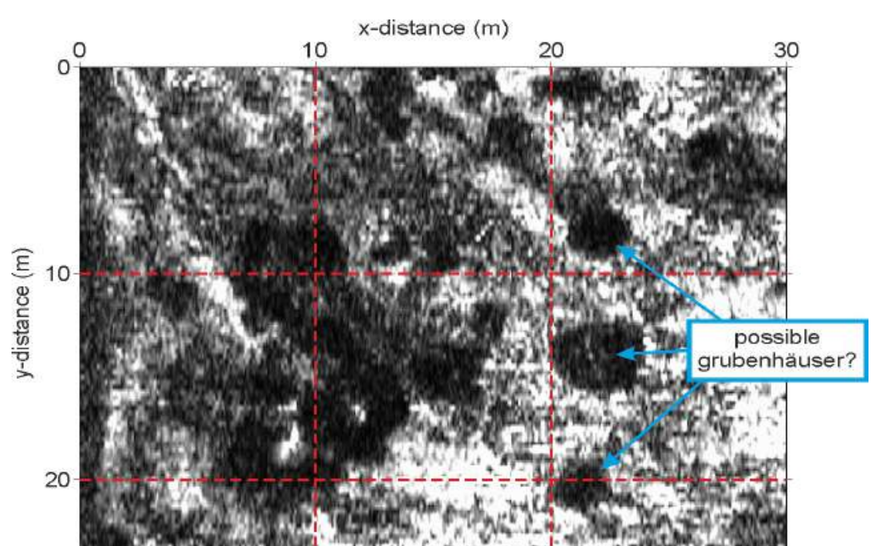

Figure D: GPR depth slice shows circular features, potentially of archaeological interest

TIPS Using the Water Table Reflection to Add Topography

The interface from drier to wetter soils represents a very large change in electrical properties. The reflection from this interface can be one of the strongest interfaces seen with GPR. Water and air represent the most extreme relative dielectric constant (K) values for commonly occurring materials: $K_{water} = 80$ and $K_{air} = 1$.

Dry sediments with air in the pore space has a low bulk dielectric permittivity of about 5. Below the water table, the air is replaced by water in the pore space so the bulk dielectric permittivity is much higher; typically around 20 to 30. Reflection strength depends on the difference between material permittivities, so the strong water table reflection amplitude often dominates the GPR reflection section as shown in Figure 1.

Given that the water table provides a strong, easily interpretable reflector and if we assume the water table is a flat, horizontal boundary (which it usually is) the depth of the water table on the GPR section mimics the elevation change along the GPR profile line. Extracting the depth of the water table along a GPR line provides a means to compensate the GPR section for the topography.

The EKKO_Project Interpretation module is ideally suited for this task. Adding a 'polyline' interpretation along the water table reflector (Figure 2) provides depth to the water table reflector which are extracted to a spreadsheet (Figure 3). The "Position" and "Depth" columns (shown in green) are extracted and saved as a topography (.top) file and attached to the GPR line. Topography files are special "positioning" files that EKKO_Project recognizes and are used to automatically interpolate an elevation value for every GPR trace in the GPR line.

Elevation information allows the GPR line to be plotted with an elevation axis in the LineView module (Figure 4). Correcting a GPR line for the topography provides a more representative image for further interpretations about the structures imaged by the GPR.

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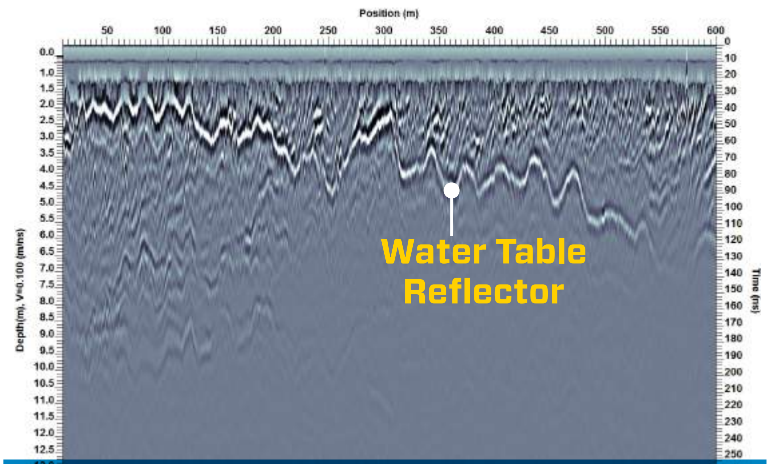

Figure 1

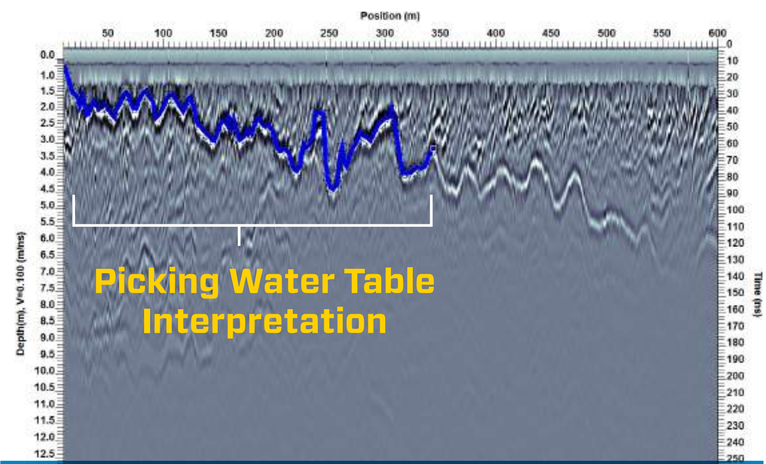

Figure 2

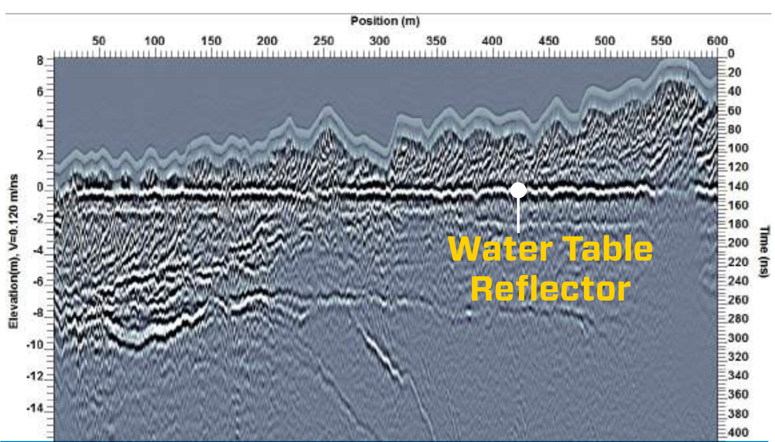

Figure 4: GPR line corrected for topography by flattening the water table reflection. The benefit is that topographic variations are removed from the other strigraphic features making the section more readily interpretable.

	A	B	D	E	F	G	H	J	K
1	Name	Description	Count						
2	WaterTable2								
3									
4	Tool	Interpretati	Position(r	X(m)	Y(m)	Depth(m)	Time(ns)	Amplitude	Velocity(m/ns)
5	Polyline	WaterTable	11	11	0	1.739	26.82	40.68	0.12
6	Polyline	WaterTable	12	12	0	1.714	26.43	-49.164	0.12
7	Polyline	WaterTable	13	13	0	1.678	25.84	5.499	0.12
8	Polyline	WaterTable	14	14	0	1.641	25.26	24.023	0.12
9	Polyline	WaterTable	15	15	0	1.628	25.05	50	0.12
10	Polyline	WaterTable	16	16	0	1.705	26.28	50	0.12
11	Polyline	WaterTable	17	17	0	1.791	27.66	50	0.12
12	Polyline	WaterTable	18	18	0	1.877	29.03	50	0.12
13	Polyline	WaterTable	19	19	0	1.962	30.41	50	0.12
14	Polyline	WaterTable	20	20	0	2.04	31.68	50	0.12
15	Polyline	WaterTable	21	21	0	2.107	32.75	39.792	0.12
16	Polyline	WaterTable	22	22	0	2.173	33.82	49.405	0.12
17	Polyline	WaterTable	23	23	0	2.238	34.89	50	0.12
18	Polyline	WaterTable	24	24	0	2.304	35.96	34.68	0.12
19	Polyline	WaterTable	25	25	0	2.37	37.03	50	0.12
20	Polyline	WaterTable	26	26	0	2.435	38.1	-49.373	0.12
21	Polyline	WaterTable	27	27	0	2.501	39.17	-50	0.12
22	Polyline	WaterTable	28	28	0	2.567	40.24	-41.261	0.12

Figure 3: Extract the Position and Depth columns from the interpretation report to create a topography file to attach to the GPR line

A strong GPR reflector is not always the water table and ground truth should be sought to confirm it. In addition, the water table is usually gradational and is not always visible when the GPR pulse length is similar or shorter than the gradation width (in other words, if the GPR frequency is high, the water table may not be visible in the GPR cross section). Since it does not take long to flatten a selected reflector using EKKO_Project, experimenting to see if reflector topography makes the subsurface structures and stratigraphy more understable can be done on a trial and error basis.

In this example, the GPR line started on the beach at the shoreline, essentially right on top of the water table, and ran perpendicular to the Lake Superior shoreline. A strong reflector gets deeper as the GPR line moves higher in elevation up the beach; it is pretty easy to confidently interpret this reflector as the water table. Flattening the GPR line on the water table reflector corrects the orientation of other reflectors; these show lakeward-inclined strand-plain structures with progradational and stillstand sequences. Interpreting these structures helps to better understand how Lake Superior shorelines have developed during a period of lake level drop.

Data courtesy of Dr. Harry Jol, University of Wisconsin, Eau Claire

FREE GPR workshops

Successful Concrete Scanning with GPR

Anaheim, CA - January 20, 2016
Ayers Hotel Anaheim

Utility Locating with GPR

Anaheim, CA - January 20, 2016
Ayers Hotel Anaheim

Upcoming Tradeshows

World of Concrete - Las Vegas, NV - February 2-5, 2016
ORCGA - Blue Mountain, ON - February 9-11, 2016
CGA - Las Vegas, NV - March 8-10, 2016
CSDA Tech Fair - Palm Desert, CA - March 10-12, 2016
NASTT's No Dig Show - Dallas, TX, March 20-24, 2016
SAGEEP - Denver, CO - March 20-24, 2016

GPR courses

Subsurface Imaging with GPR

Sensors & Software - head office - March 7, 2016

Concrete Scanning with GPR

Sensors & Software - head office - March 8, 2016

GPR Principles, Practice & Processing

SAGEEP - Denver, CO - March 20, 2016

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subsurface imaging solutions