VAT/Co. No. 511729618

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This document is shared by Dr. Uri Basson / GeoSense Ltd. with Mr. Dror Meirovich (research engineer) under the Mutual NDA dated 09.11.2025.
It describes early-stage concepts of the POC, structures and implementation ideas for Program 1 (and related future programs).

All such ideas and materials are proprietary to Dr. Uri Basson / GeoSense Ltd. and are provided solely to explore and, if agreed, develop this project together.

LEAN POC

Automatic-Large-Scale AI Imaging, Mapping and Computations of Subsurface Physical Characteristics and Target Detection

The main aspects of the AI GPR & Seismic Imaging Software/Program Suite for this LEAN POC:

a. Flexible structure allows additional filters, procedures and integration.
b. Open-sources.
c. Common formats.
d. Independent and synergistic interaction of the parts/programs.
e. Option for a different division and or combination of the parts/programs.

The main programs are:

Program 1 – Processing-Visualization GPR and Seismic data-profiles as a preparation for advance geophysical-AI identification of the environment and the targets" in large scale. Program 1 also prepare the "baseline" for the Geophysical-AI (Program 2).
Program 2 - Geophysical-AI identification of environment and targets in large scale.
Program 3 - Enlargement of Program 1 and Program 2 for advanced modelling and visualization of the results of **Program-2** and extracting the physical properties and correct XYZ.
Program 4 – Advanced Processing and Visualization of GPR and Seismic based on Program 2 and Program 3 for advanced subsurface regional and targets mapping.

POB 921 Even Yehuda, ISRAEL
Tel: +972 9 8995531 Fax: +972 9 8995608 Mobile: +972 54 4899123
info@geo-sense.com www.geo-sense.com

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Program 1: Processing & Visualization Program (Windows)

Development of processing-visualization of GPR and Seismic data-profiles, a Windows based Software/Program. The program will also be the "baseline" for the later on geophysical-AI (Program 2) and other programs according to the following:

1) GPR and Seismic data representation = different unit scales:
   1.1 GPR scales: time = ns (nano-second); horizontal distance = m; depth = m
   1.2 Seismic scales:
   1.2.1 near-surface/shallow imaging:
   time = ms (milli-second), horizontal distance = m ; depth = m.
   1.2.2 oil & gas imaging:
   time = s (second); horizontal distance = km; depth = km.

2) Loading GPR data formats:
   1.1 MALA format:
   header = .RAD, data = .RD3, .RD7, .RD8, GNSS files = .COR & .SRD, mark/note .MKR)
   1.2 Seismic data format: SEG-Y.

3) Using the MALA header file (.RAD) for automatic computations and default parameters. Later on, the same for the SEG-Y header and written info.

4) Creating 3D site-map representation – formats: Google Earth/Map ; open source GeoJSON; GIS Shapefile (.shp). For MALA GPR - use also the GNSS files (.COR, .SRD) and the note/marker file .MKR.

5) Show markers/notes (.MRK) on the profile (option Y/N) and on the 3D map (Y/N).

6) Presentation of 2D GPR and Seismic Reflection profiles:
   6.1 Sample=Pixel; Trace=Column of pixels
   6.2 Several pallete scales = 1 B&W, 3 colors, 32 - 64 - 128 shades in milli-Volts. Later on, allow the creation and save / load the new pallets by the user)
   6.3 When the Cursor is moving on the profile, the following should be presented: Trace GNSS coordinate; Trace no.; Sample no.; Sample time (ns/ms/s); Sample avg. depth (m/km), sample amp. (mV). Allow multi-windows - the details should appear in the active window.

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6.4 Grid options: Distance (vertical) and time or depth (horizontal) main units grid only (not for the sub-divisions)
6.5 Profile presentation
6.5.1 The 2D profile itself = Point mode: 1 color per 1 pixel (color pallete depending)
6.5.2 Wiggle Trace window = current trace/selected, all traces/selection of traces plot one on top the other, average trace from all traces/selection of traces in a different color).
6.6 Dynamic window size - scroll vertical & horizontal.
6.7 Zoom, all the profile at different aspect ratio, a "click" and bottom for native = pixel per trace.
6.8 Open recent files (presented list).
6.9 Add Contrast bottom (written levels mV)

7) Applying list of signal-processing filters for visualization improvements and save into a renamed data-file. The filters will have a complete control on their parameters (filling numbers) and their implementation order (changing their order).
The initial filters/procedures:
7.1 DC removal
7.2 Dewow ("wow" removal)
7.3 Time-zero (TZ) setting (basically a first-break finding algorithm): Global/ave. T0 with median first-break on the trace/envelope (e.g., the samples before Zero (negative) and leave the pre-T0 data on the profile). Static Correction – adjusted of "bad traces jumps" is a part of the TZ correction.
7.4 Topographic correction (Elevation Static following the topography, for now) - (Y/N).
7.5 Gain (AGC, SEC, TVG, Trace/Profile Normalizations…) – floating datum.
7.6 Running Average = 3X3 samples; 5X5 samples; 7X7 samples; 9 & 11, (later on "running median"…).
7.7 BP filters: FIR and IRR filters, Ormsby ($\cos^2$) (f1, f2, f3, f4) MHz/Hz, Zero padding ON
7.8 Background removal (removing an Average-Trace computed from number or all traces).
Option 1: Removing an average using "number of traces";
Option 2: Removing an average computed from the complete traces/profile).

8) Data journal – Jason, GeoJason and Shapefile.

9) Saving the processed files in addition to the raw data file, with a name with additional character/s. (for example Dat_0801 → Dat_0801_PXXX). Also - export to JPG.

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