## General principles of working with software package.

- First, you need to create a description of the controlled object in the object editor software.
- If there is a description of the object, register AE data for analyzing the object's state, and get a partial analysis of the state of the controlled object in the data registration software.
- Perform a complete analysis of the state of the controlled object in the post-processing software.
- If necessary, check the state of the database, perform database maintenance, and edit rarely changed variables in the database editor software.
- If you have problems loading hardware, get the full hardware loading protocol and the values of service variables associated with loading in the hardware loading test software.

Object editor software
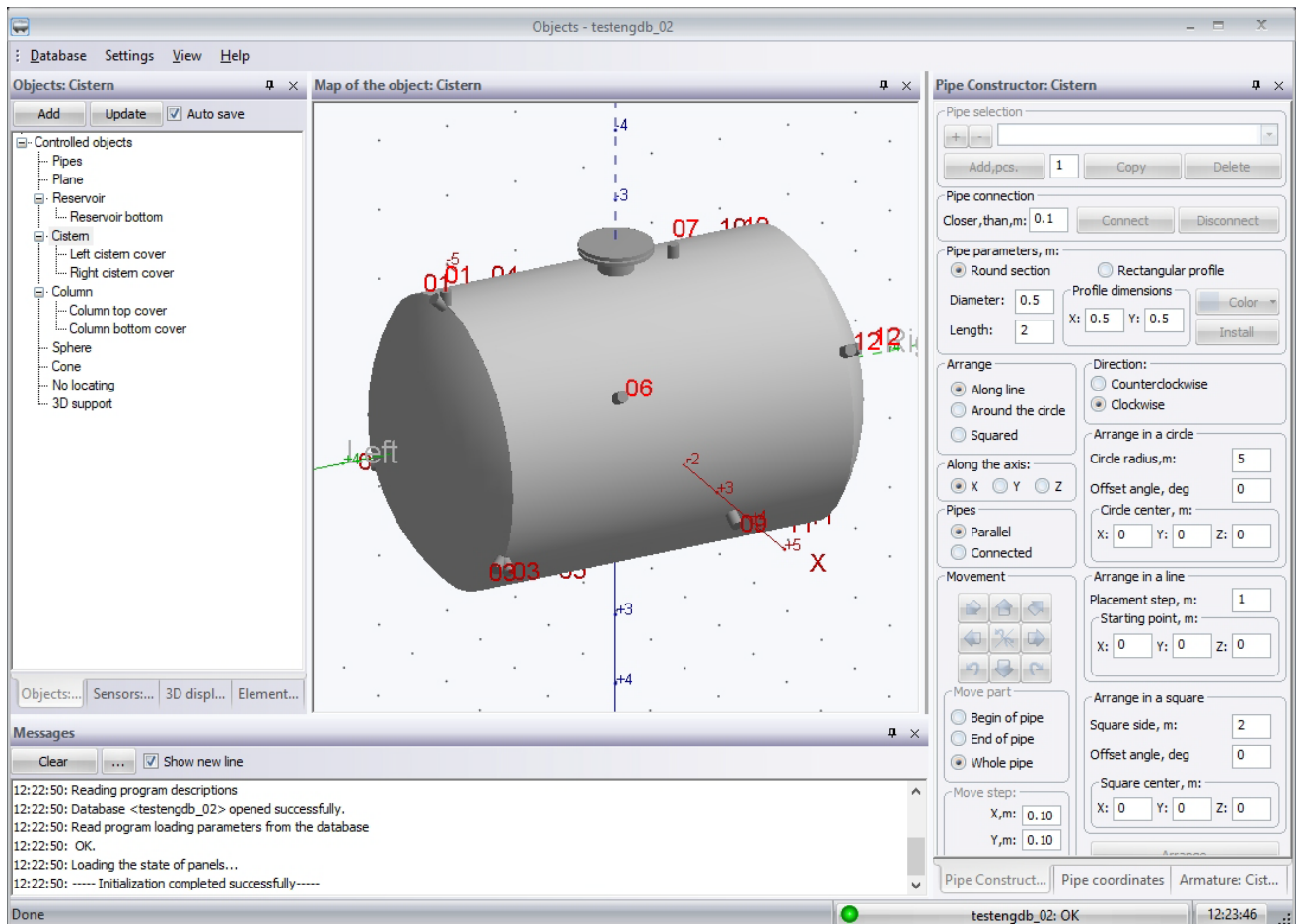
The software is designed for creating, editing, and deleting descriptions of controlled objects in various MySQL databases in the RANIS format. The software creates, edits, and deletes MySQL databases required for storing descriptions of controlled objects, registered data, and data generated during processing of registered data. Databases can be stored both on the management computer and remotely. Unlimited number of object descriptions can be stored in a single database.
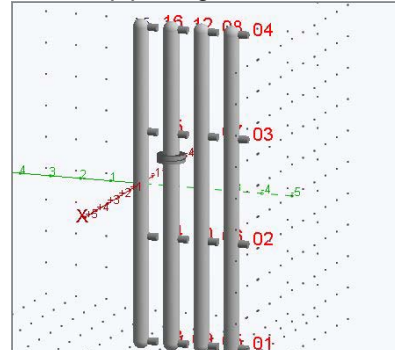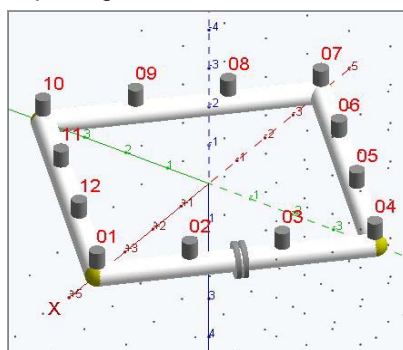
The software allows you to create the following types of grids from sensors (antennas):

The linear antenna type involves placing sensors in a linear manner along sections of pipes or profiles. Sections of pipes(profiles) can be positioned in any way in space, for example:
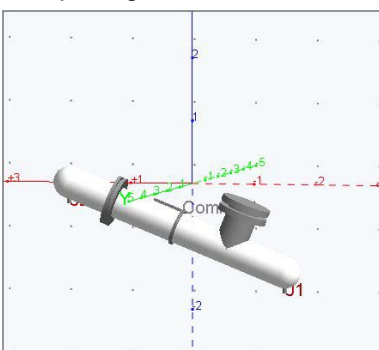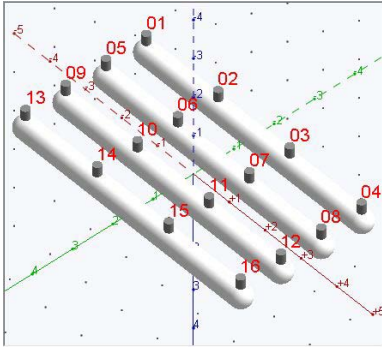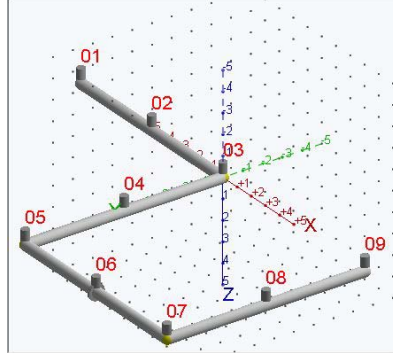
Pipe segment: Pipe segments enclosed in a circle: Vertical pipe segments:
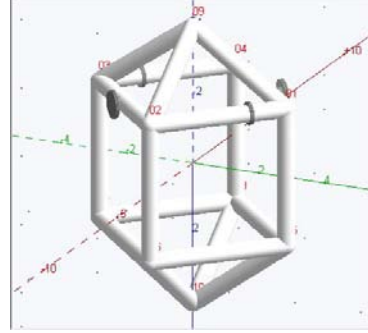
Horizontal pipe segments:
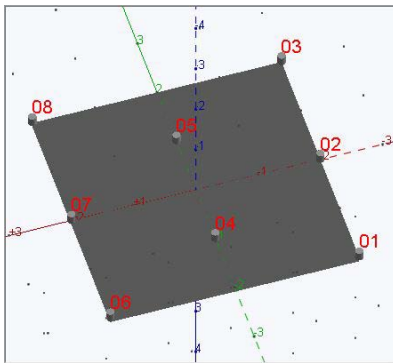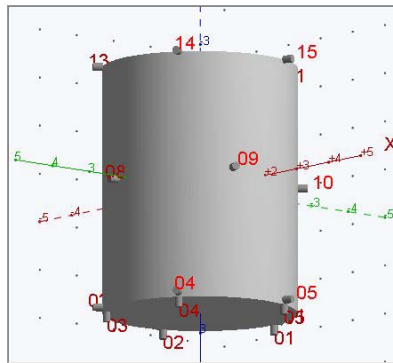
Pipe chain:

Three-dimensional pipe structure:
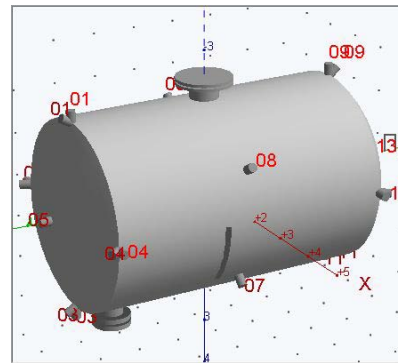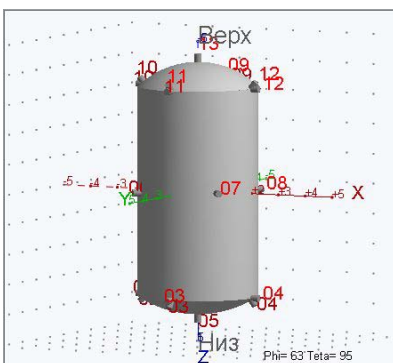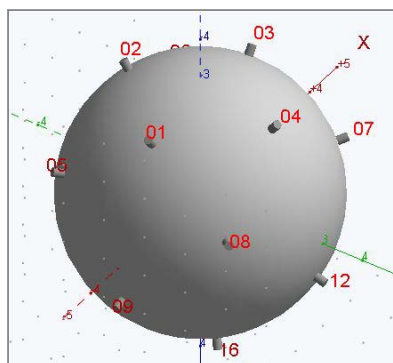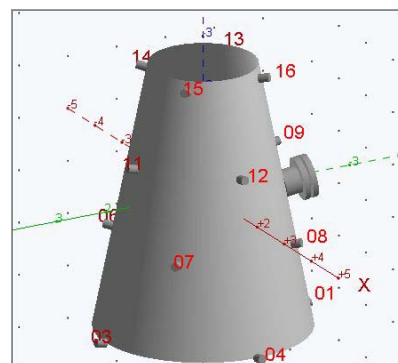
Rectangular object:
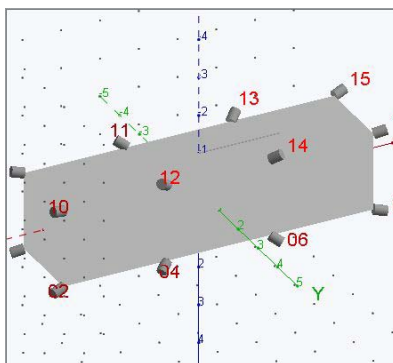
Round tank:

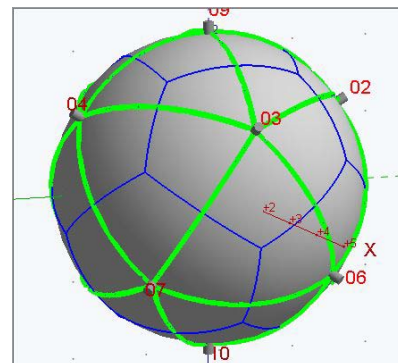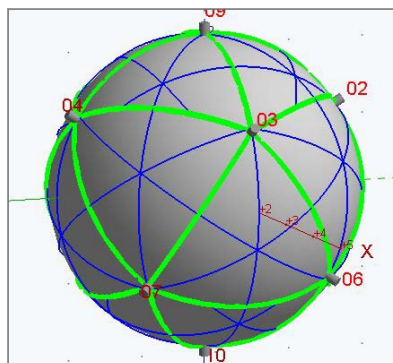**Cistern:**

Column:

Sphere:
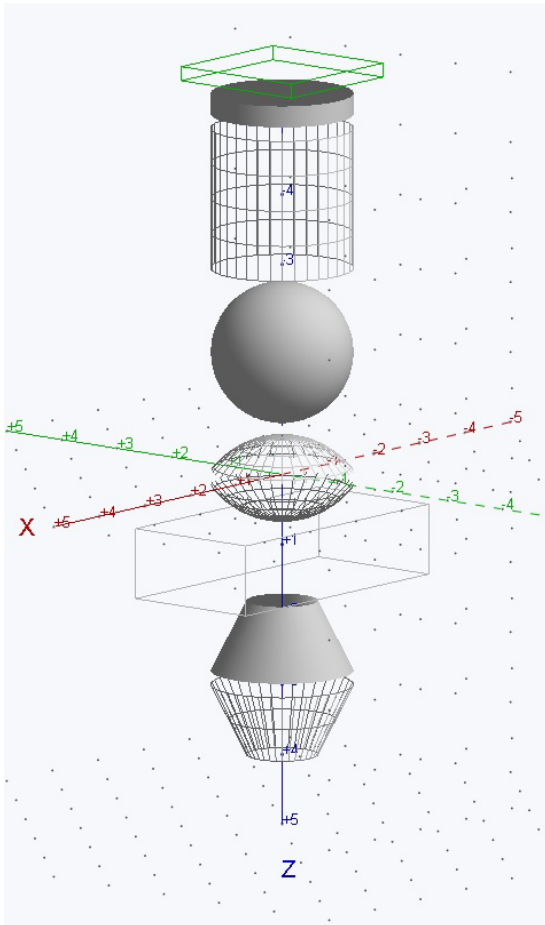
Cone:

3D support:

Zonal positioning for each grid type, for example, for a sphere:

You can log data without searching for sound sources.

The user has the opportunity to create their own types of controlled objects – composite types. Composite object types can include geometric primitives in any Z-order, shown in the picture below:

Each geometric primitive has its own dimensions and individual display settings on the screen. The user can adjust the offsets of the primitives relative to each other, i.e. the primitives can both be combined in space and have gaps between each other. A composite object can be moved relative to the origin of the coordinate axes.

The image of each element of the object can be configured individually.

Controlled objects are displayed in three-dimensional form in all programs of the package, but the construction of two-dimensional forms of objects is also possible.

You can add the following to an item of any type:

- Arbitrary number of pipe segments where you can search for ultrasound sources (locate them).
- Arbitrary number of non-relocatable reinforcement elements, such as:
  o Linear seam
  o Ring seam
  o Text
  o Text on the callout shelf
  o 3D - round base
  o 3D – rectangular base
  o Flange
  o Hatch

The added armature elements allow the user to reflect significant standard and non-standard structural elements on the object. The picture on the left shows a composite type of objects with elements of an unlocated reinforcement.
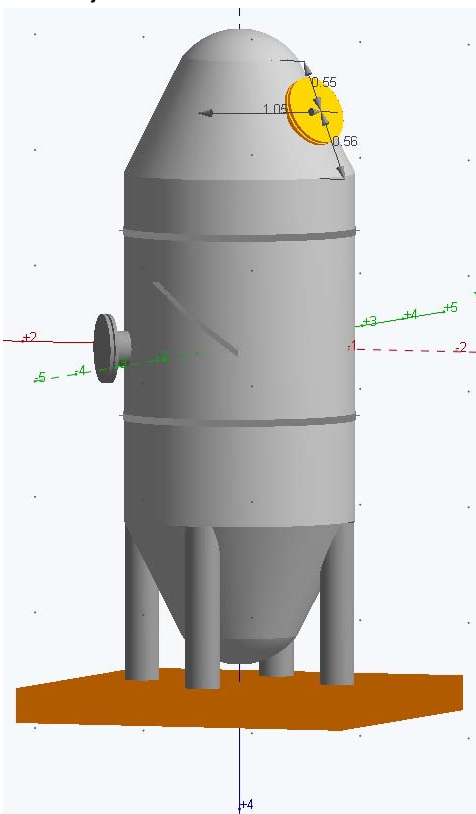
The geometric dimensions of all object types, as well as armature elements, are set by the user.

The sensor layout is created based on the list of logical channels created by the user. Logical channels are bound to hardware channels in the data logging software. Based on the geometry of the sensor placement, the software creates locating elements (LE) - fixed sets of sensors that are used when event calculation.

The software allows placing sensors on the surface of controlled objects in two modes:

- Automatic, when the software distributes sensors so that the entire surface of the monitored objects is covered with LE.
- Manually, when the user uses the arrow keys to move the sensors on the object's surface.

The software uses 3 types of locating elements:

- Linear LE that include two sensors and calculate the position of sound sources by linear positioning.
- Triangular LE that include three sensors and calculate the position of sound sources by locating in sensor triangle.
- Tetrahedral LE that include four sensors and calculate the position of sound sources by locating in sensor tetrahedron.

LE sets can be created in both automatic and manual modes. Dynamic (during calculations) LE generation is possible. You can set individual settings for each LE. The software also adjusts the parameters of the event search algorithm.

Data logging software
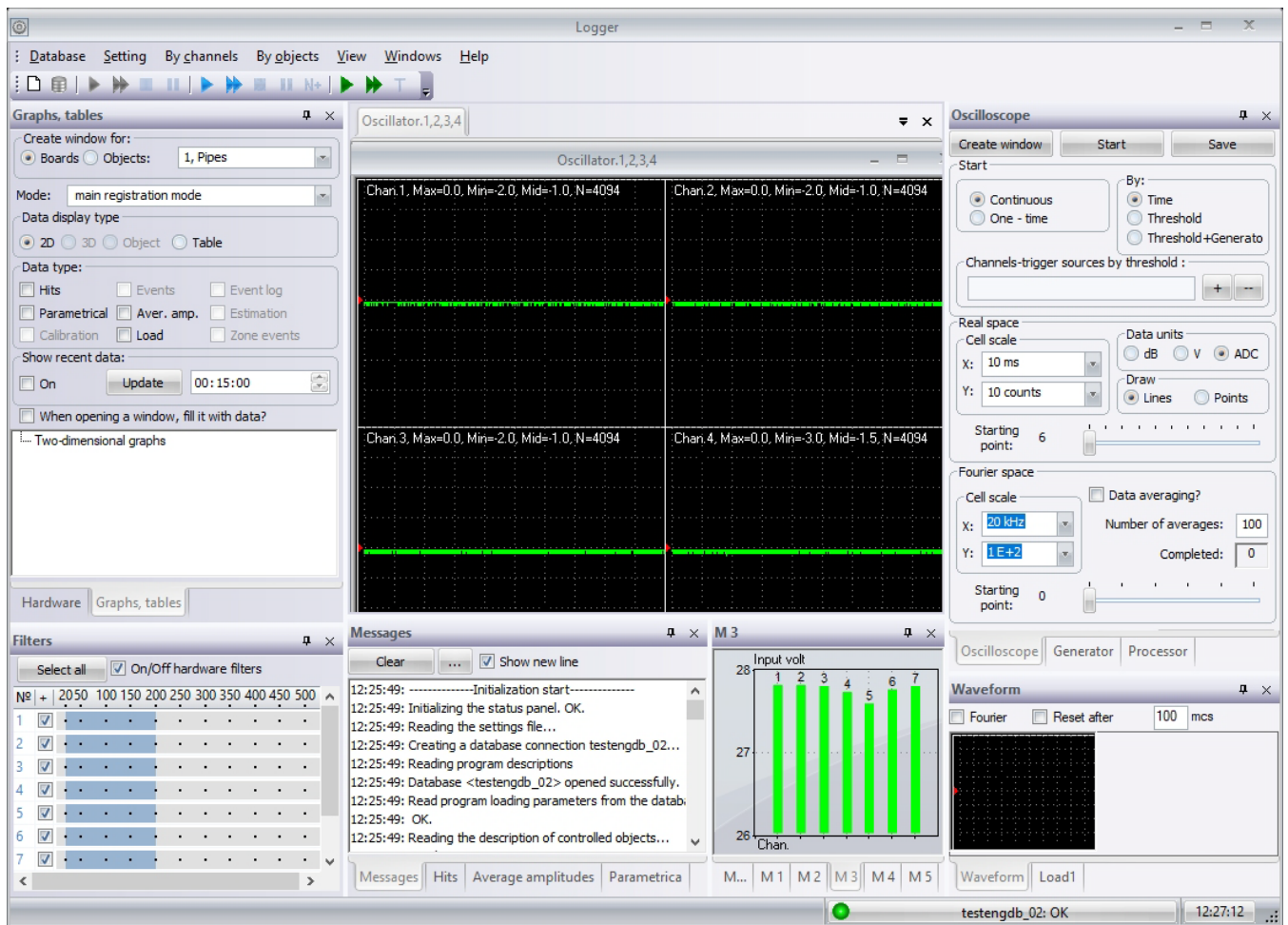
The software is designed for recording various types of data required for performing acoustic emission diagnostics and studying various materials by acoustic emission methods, for conducting partial analysis of the object's state. If you want to execute AE test of object, then the description of such an object must be generated in the "Object editor" software before launching the "Data logger" software. To configure AE channels and record test data in the channel registration mode, the object description is not required.

RANIS hardware management software features:

- Initial equipment loading.
- Configure the parameters of each of the hardware channels.
- Configuring hardware frequency filters of the equipment.
- Data logging in the "hit only" mode.
- Data acquisition in the "hits + waveforms" mode.
- Registration of waveforms in the "real space" mode.
- Registration of waveforms in the "Fourier space" mode.
- Generation of sound pulses on each hardware AE channel.
- Recording data on average amplitudes.
- Data logging from hardware parametric channels.
- Registration of data on the state of equipment and channels.
- Calculation of simulated hit data, calculation of simulated events.

The software performs in real time:

- Calculation of event positions and event parameters.
- Work with loading cycle templates.
- Calculation of user-defined criteria ratings for data.
- Recording the log of registration events.
- Operation of the data processing processor, filtering by simple and composite filters of recorded and calculated data.
- Automatic sensor calibration.
- Stream evaluation of products based on the specified criteria.
- Measurement of changes in the object's material.
- Text, 2D, and 3D representation of data, and 3D object diagrams with calculated data.
- Building graphs and tables based on user templates, building preset graphs.
- Plotting graphs based on user formulas with a built-in parser for mathematical expressions. About 40 types of standard mathematical functions and operators. All parameters of hits, events, and geometric dimensions of controlled objects can be used as variables in mathematical formulas - more than 30 types of special variables.

Data post-processing software
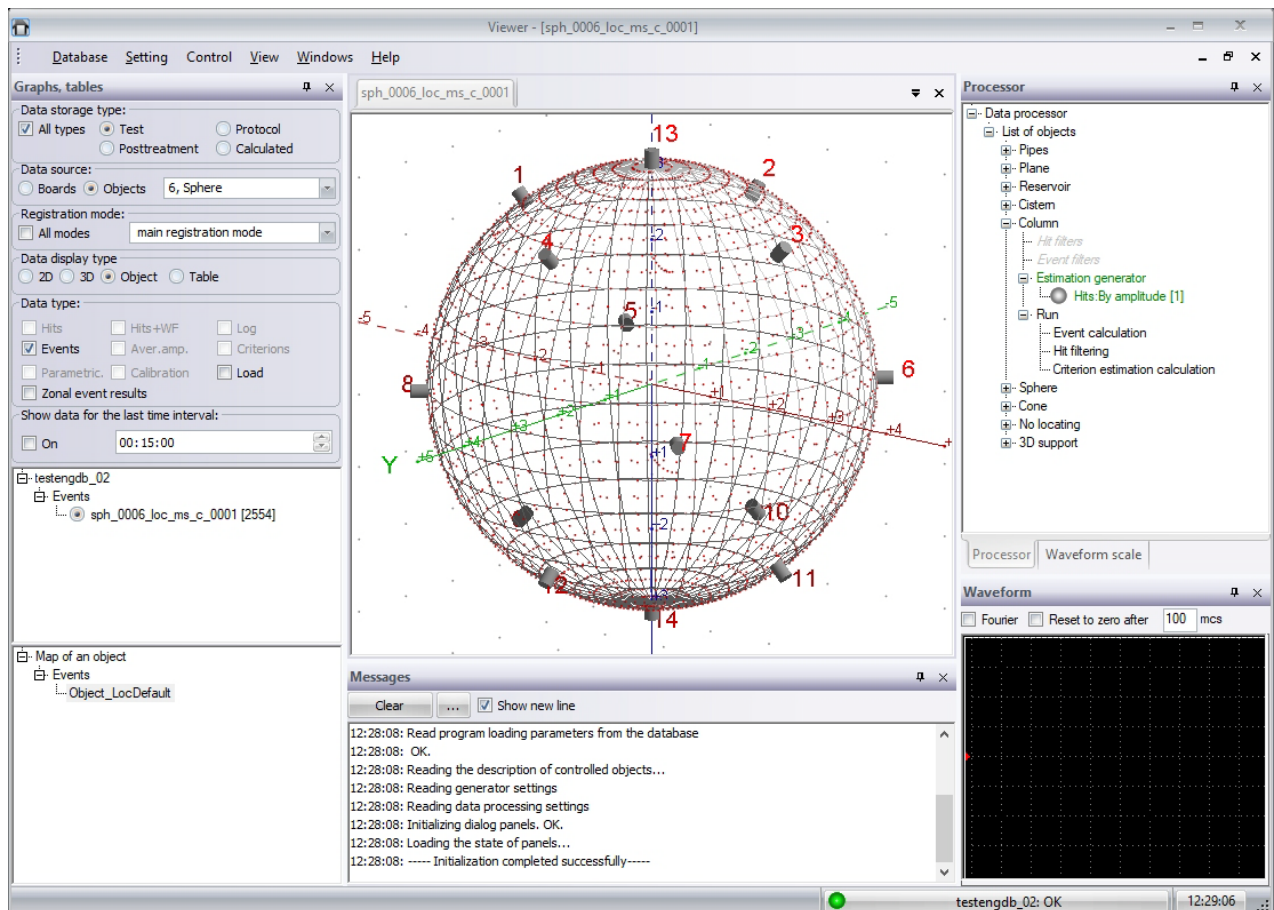
The software is designed to perform a complete analysis of the state of the controlled object based on data recorded using the Data logger software.
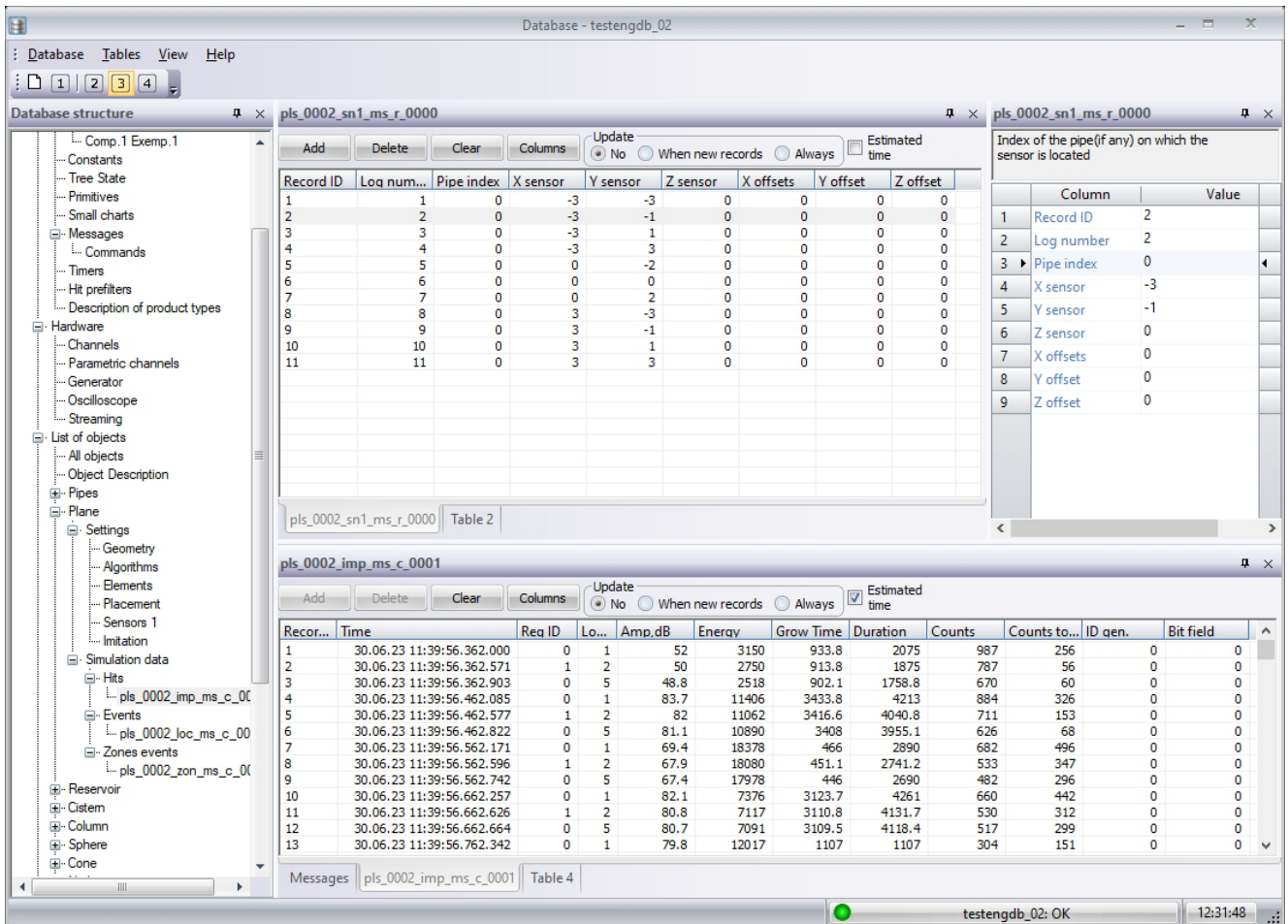
The software performs:

- Calculation of event positions.
- Calculation of user-defined criteria ratings for data.
- Operation of the data processing processor, filtering by simple and composite filters of recorded and calculated data.
- Text, 2D, and 3D representation of data, and 3D object diagrams with calculated data.
- Create and edit chart template files.
- Monitoring of measurements performed on a remote computer using the Data Logger software
- Building graphs and tables based on user templates, a set of preset graphs.

- Plotting graphs based on user formulas with a built-in parser for mathematical expressions. About 40 types of standard mathematical functions and operators. All parameters of hits, events, and geometric dimensions of controlled objects can be used as variables in mathematical formulas - more than 30 types of special variables.
  - Clustering of event data.
  - Analysis of clustering data.

Database editor software

The software is designed to visualize the structure of MySQL databases in the "RANIS" format, to check the state of the database, perform database maintenance, and edit rarely changed variables.

The software performs:
- Creating, editing, copying, and deleting MySQL databases
- Visualization of the active database structure.
- Visualization of the contents of database tables.
- Populate database tables from files, copy database tables to files.
- Create, edit, and delete database tables in the RANIS format.