

User Manual (v7.X)



TOOL FOR VISUALIZATION AND ANALYSIS OF TWO AND
THREE - DIMENSIONAL DATA SETS

Overview

The purpose of this manual is to provide the complete features and the usage of IntroView Concrete Visualization and Analysis software tool.

Introduction

This short chapter presents some basic information about the IntroView Concrete software, which is a tool for visualization and analysis of two and three-dimensional datasets. The viewer can be applied in different areas such as non-destructive testing, medical applications, homeland security, seismology and many others. Not only researchers, but also scholars can benefit from the usage of this software tool. It suits a great number of industrial applications where detailed analysis of three-dimensional data sets is an important issue. Among others, IntroView offers you the following in-built features:

- 3D volume view
 - Cut planes
 - Texture mapping
 - Ray casting
 - Maximum intensity projection
 - BDC projections
 - Amplification and threshold.
-

Supported Datasets

IntroView Concrete supports datasets, measured by the following instruments of Acoustic Control Systems – ACS Group:

- A1040 MIRA
 - A1220 MONOLITH
 - A1020 MIRA Lite
 - A1040 MIRA 3D.
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License

The software can be used under license, which is provided by ASC-Solutions GmbH on behalf of ACS Group. Such a license is valid only for a concrete computer. Thus, IntroView installed on another computer will not properly work with the same license.

System Requirements:

CPU: Dual Core 2 GHz and higher; RAM 8 GB and more; Operation System: Windows8 64bit, Windows10 64bit; Graphical processing unit GPU: supporting OpenGL version 4.3 or higher.

About the software

This section describes the software, and how to get started with the Installation of IntroView. With a double click on the file “setup.exe” from the delivered installation cd or from the folder on your computer you received by electronic delivery, see Figure 1. to run the software successfully.


Name	Änderungsdatum	Typ	Größe
 setup.exe	01.02.2017 13:44	Anwendung	76,239 KB

Figure 1: Installation folder

In the welcome window 2(a), the installation is started by pressing the button “next”.

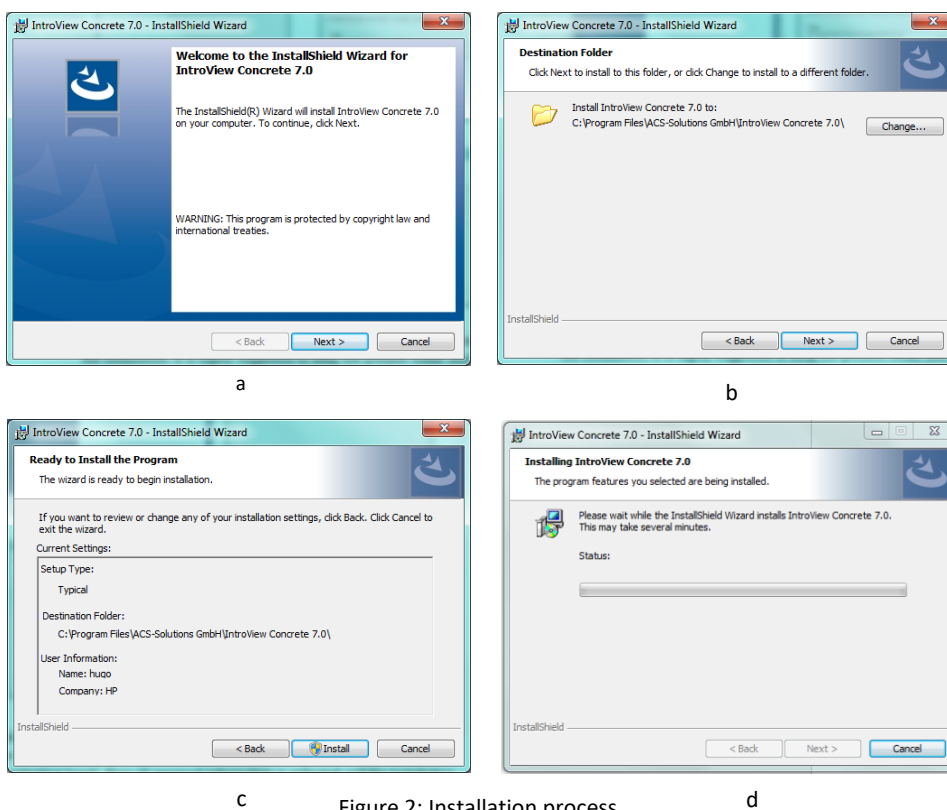


Figure 2: Installation process

Installation window 2(b) offers the possibility to select the destination folder for the installation. It is highly suggested to keep the present folder and just proceed by selecting “next”. Now all required information is collected and the installation process is confirmed by selecting “install”, and can be seen in Figure 2(c). The progress bar in Figure 2(d) shows the status of the installation and informs about the successfully installation of IntroView. If there is an error occurs during the installation, please contact our local reseller.

About license

To receive an IntroView license a user is required to start the license request utility, which is delivered with the installation package of IntroView. The license request utility is needed for creating of a special system file.

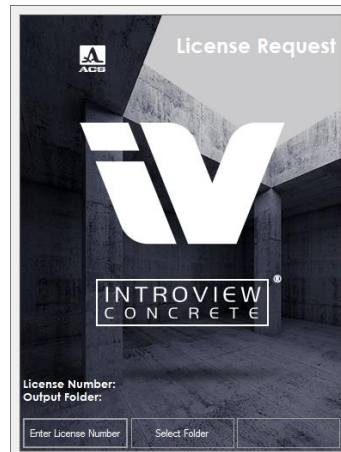



Figure 3: License Request utility

To generate this file, enter license number from invoice (see instruction for license generation), select output folder and click 'start', see Figure 3. The system file is in earlier defined folder. It should be send to ACS-Solutions GmbH. User receives a license file generated for a given computer as a response. The license key should be copied into IntroView Concrete installation folder. This allows the software to access the license file.

Application

By continuing, the main window of IntroView is displayed with activated main menu, see Figure 4.

The main menu consists of IntroView button , which is located at the top left corner of the window, and some quick launch buttons around it. The menu consists of the following functionalities:








- open dataset from IntroView button  or quick launch button 
- save dataset in internal format 
- close dataset 
- get brief information about the software product from IntroView button  or quick launch button  and
- close application 



Figure 4: IntroView main window form

It also has a list of recently used files, for simplified access previously used datasets. All other controls and menus will be activated after dataset is successfully loaded.

The open file dialog helps to select proper file type, see Figure 5.

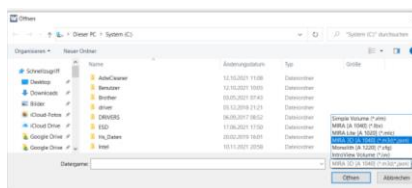


Figure 5: IntroView open file dialog


In order to load A1040 MIRA dataset (set of files with '.lbv' extension), user can select any file within corresponding folder. The files will be automatically read, sorted and projected into the inspected volume. A progress bar informs about the status of the loading procedure as shown in the Figure 6. After loading procedure is finished the user interface of IntroView is enabled. The reload button  is also activated, which allows reloading the opened dataset within initial settings.



Figure 6: Loading progress

For loading a A1220 Monolith dataset, user should select a file with '.cfg' extension. The software performs SAFT reconstruction on loaded data and constructs corresponding volume.

For loading a A1020 MIRA Lite dataset, user should select a file with '.mlc' extension in the corresponding folder.

For loading a A1040 MIRA 3D or A1040 MIRA 3D PRO dataset, user should select a file with '.m3d' extension in the corresponding folder.



Volume moving

With the help of a mouse, the user can adjust the volume: when the left button is pressed the volume is rotated in all directions, moving mouse up and down with a right button is pressed the volume can be zoomed in and out correspondingly, the middle button pans volume in one plane. The rotation/zoom control offers the possibility to rotate or zoom in small steps. The control appears in the lower right corner of volume window, see Figure 7. To rotate the volume in a specific direction, press or press and hold the arrow so that it directs in that direction. To zoom in click the "+" button and to zoom out click the "-" button.

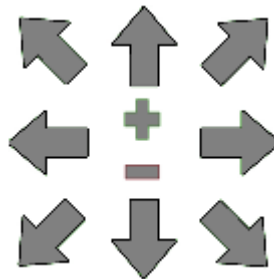


Figure 7: Rotation/Zoom control

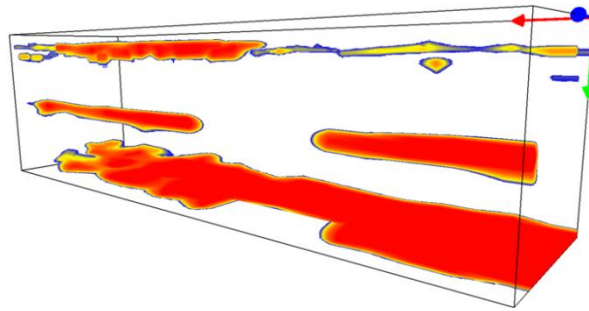


Rendering mode

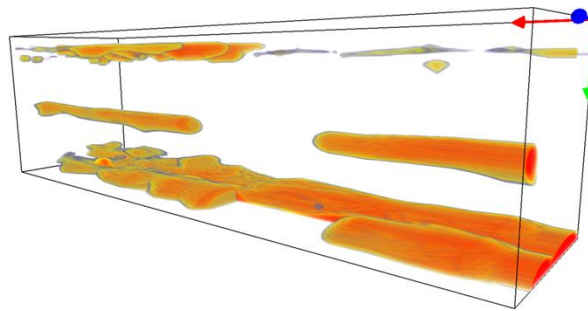
It has three different modes to visualize the 3D dataset:

1. Maximum intensity projection (MIP) using ray casting technique, see Figure 8a,
2. Texture based technique, see Figure 8b, and
3. Isosurface rendering (Marching Cubes), see Figure 8c.

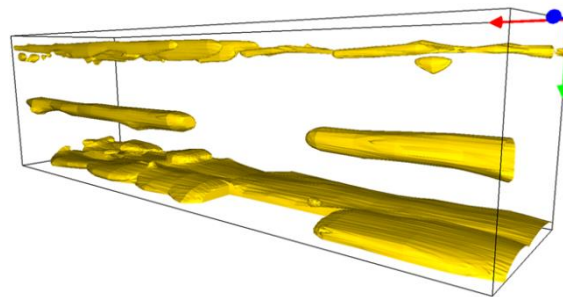
The ray casting technique is extremely used for seeking maxima in the inspected dataset and applying it to big datasets can slow down the performance. In such a case, it is better to use texture mapping, which is extremely fast even for big datasets. By generating isosurface from volume helps in better detection of small inclusions.



a



b



c

Figure 8: Available rendering modes



Axis origin

It has a possibility to show or hide the axis origin on the volume.

Color table, Threshold, Opacity, and Software gain

In this section the control at the right side of the application consists of three slider areas, see Figure 9. The left most slider offers possibility to hide some voxels in the

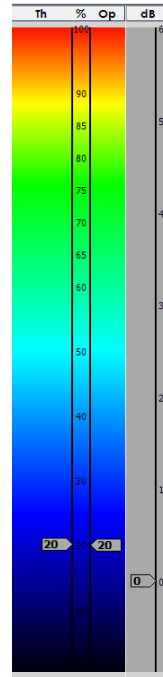


Figure 9: Control for threshold, opacity, and software gain.

volume. The value of the threshold is a certain percent of maximum amplitude. Voxels with lower amplitude in the given threshold will not be shown. The next slider (opacity) sets the transparency of remaining voxels. This option will be

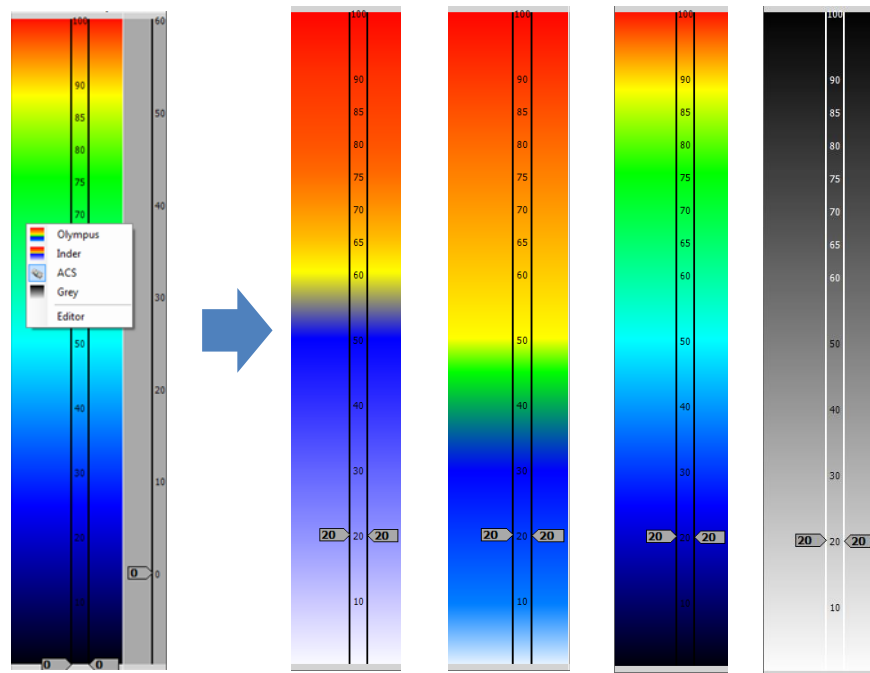


Figure 10: Color table.

enabled only in texture-based rendering; otherwise, it does not have any sense. The right most slider controls the amplification of amplitude in range from -10 dB to 60 dB. For better visualization, voxels with different amplitude are represented with different colors. The tool offers four different color tables, see Figure 10. User can change the color table, on the fly, by right clicking on the color table area. The color table can be selected in the pop up menu. There are three multicolor tables, one of which corresponds to A1040 MIRA device, and another is one grey scale table.

The pop up menu also offers editor, which allows creation user specified color table, see Figure 11. The table consists of colors corresponding to certain percent

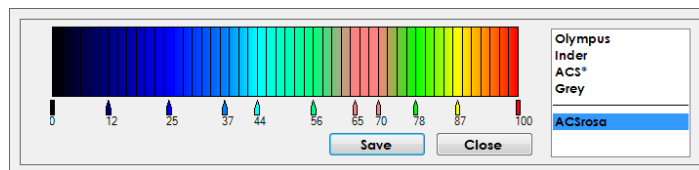


Figure 11: Color table editor

values. The color for other values is interpolated. One can change the number of defined colors, or re-specify the color for particular percent value. Created color table could be saved under specified name. From now on, it will be shown in the pop up menu and available for selection.

Cut plane control

This allows user to choose between “plane” and “gated” modes. Depending on the selected mode user can adjust either exact cross section position or its start and

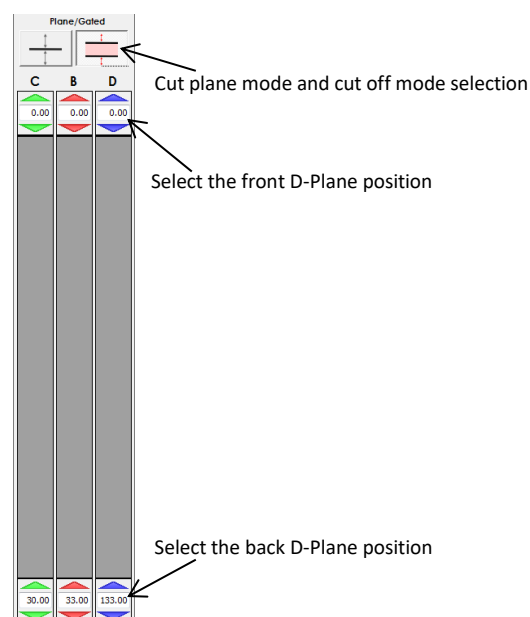






Figure 12: Cut plane control

end to cut off in significant part of volume, see Figure 12. The plane position can be adjusted in one of the following ways:

- using the correspondent slider
- the  respectively the  buttons on the top and the bottom of the slider
- by entering a valid position in the edit field
- the arrows up respectively down next to the edit field

By activating plane mode , only one slice (cross-section) of the volume is shown, see Figure 13a. In gated mode  the front and back planes are enabled and the volume is shown in between these two planes only, see Figure 13b.

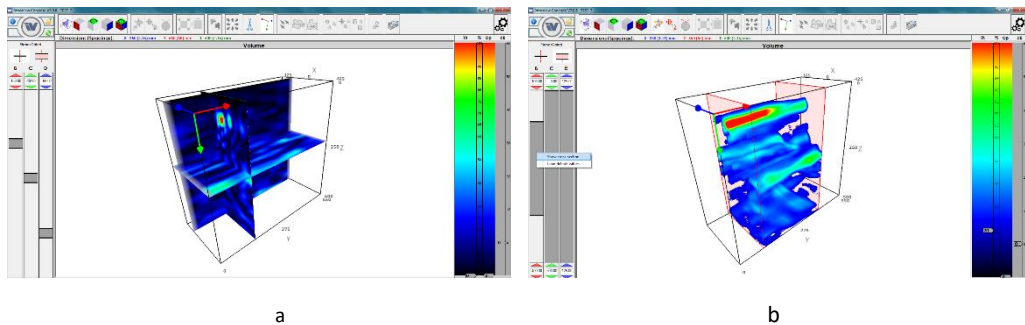
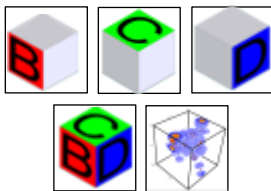


Figure 13: Cut planes in different modes

By default, the planes are not visible in the “3D” volume window. To show the planes in “3D” volume window, go to the correspondent group box (click right cursor of mouse) of the plane you want to see and then click “Planes visibility” in coming pop up menu. In the same menu, there is an option to reset positions of planes. In plane mode the positions are reset to zero (cross-section is in origin), in gated mode the front and back planes are set to start and end of volume correspondingly, to show the whole volume. Note, that in gated mode one can move the front and back planes separately, but by holding the middle slider and by dragging those moves complete gate in both directions.



Scan projections

Choosing one of the corresponding scan projections, the user has possibility to inspect the volume in orthogonal projections. The dataset projections are shown according to the following two options:

1. currently rendering technique
2. actual values of threshold, opacity, and gain.

In case of plane mode, only one slice of data is shown; in gated mode, the selected gate is parallel projected to 2D plane. The user can also view all scan projections in one screen (together with volume) or switch back to only 3D view of the dataset.



Volume overview

It is also possible to see the volume in only one scan projection, which is selected. In this case, a small volume window will appear in lower right corner of the projection, see Figure 14, and has all properties of a big volume window.

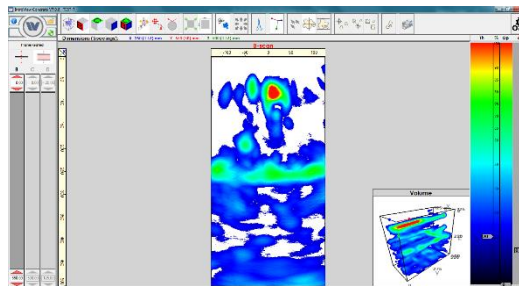
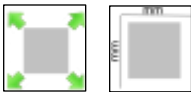


Figure 14: Volume overview



Zoom mode

There are two kinds of scan representation:

1. Fit to screen mode, where the proportions of particular scan projection are not kept
2. The projection picture is stretched to fit the window or mode with kept proportions where the picture does not fit to whole window



Projections truncation

Even if in the 3D view the cut planes are moved away from the bounds of the dataset, the 2D view ignores the orthogonal planes and shows the whole projection. This option allows to see only part of projection, as it see in the volume representation.



Cursors (with synchronization)

To analyze the 3D dataset it is very important to use cursors, which helps to determine the position of defects on the scan projection or their size. There are two kinds of cursors.

1. The first one is represented by two perpendicular lines, where the position of the intersection is calculated with respects to the object size, see Figure 15a. By double clicking, the left button of the mouse switches the cursors on and off. Single mouse click determines whether the intersection follows the mouse or stays at the chosen position.
2. The second one is represented by four lines, which form rectangular area to measure, see Figure 15b.

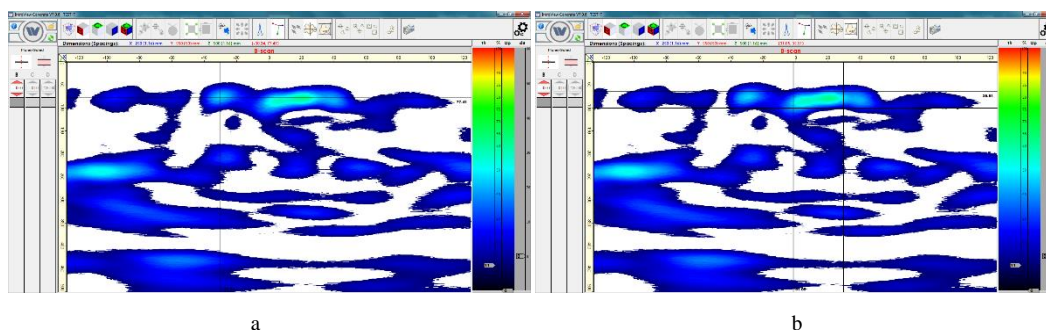
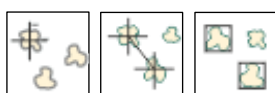


Figure 15: Cursors

When all scan views are shown, the cursors could be synchronized in all projections. By switching on the corresponding control, moving the cursor on one projection is reflected on other two projections.



Defects analysis

Each of these three controls switches application to defect analysis mode. In this mode, defects are found with black. The boundaries depend on user-selected threshold for defects. It is reflected on threshold control by black rectangle from

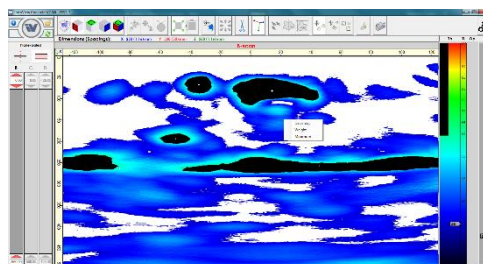


Figure 16: Defects analysis

top of the scale till desired value, see Figure 16. The center of each defect is marked with white cross.

There are three algorithms to determine the center:

1. geometry center of arbitrary area
2. weight center, uses amplitude as a weight for each point
3. maximal center – the point with maximal amplitude

One can switch between them by selected algorithm in the context menu, appearing by right click of the mouse in the scan image.

These three controls perform following analysis for automatic defect detection:

1. Point cursor: finds the position of the defect center, see Figure 17a.
2. Point-Point cursor: measures the distance between centers of two selected defects, see Figure 17b.
3. Flow size detection: shows rectangles in which form of defects fits, see Figure 17c.

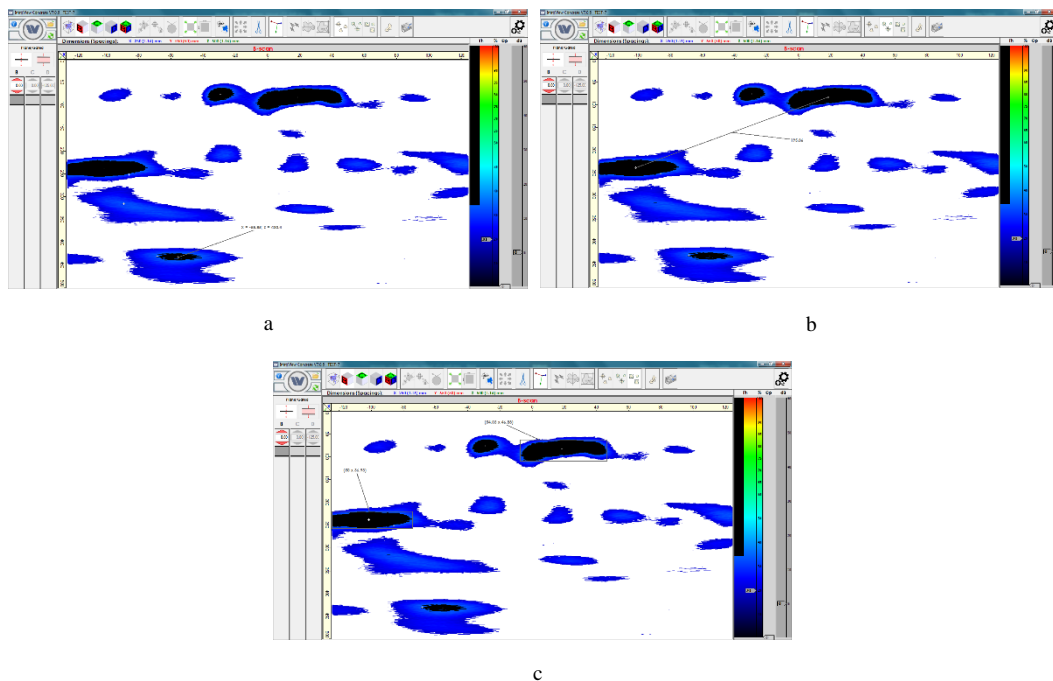


Figure 17: Tools for defect analysis



Curve

This control switches application to defect analysis mode. The defects are shown with black colored areas with marked center. The algorithm for center search

could be selected in the pop up menu as usual. Besides that, pop up menu offers some operation to work with curves, see Figure 18.

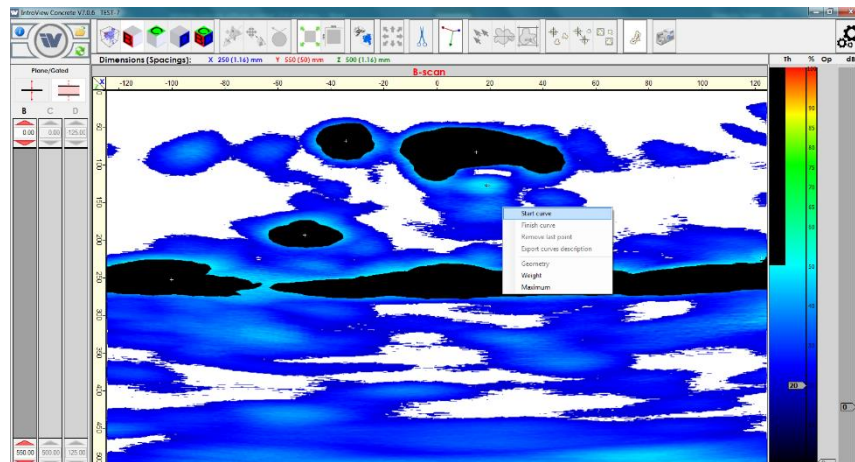


Figure 18: Menu for curve construction

Each curve is constructed on the set of points that are connected using Catmull-Rom spline. To start selecting points one should use menu item “Start curve”. Mouse double click on particular places sets point by point. Option “Remove last point” removes last created point, using this option again removes last but one point and so on. Menu item “Finish curve” creates the curve from given points and calculates its length, see Figure 19. One can set additional label to the

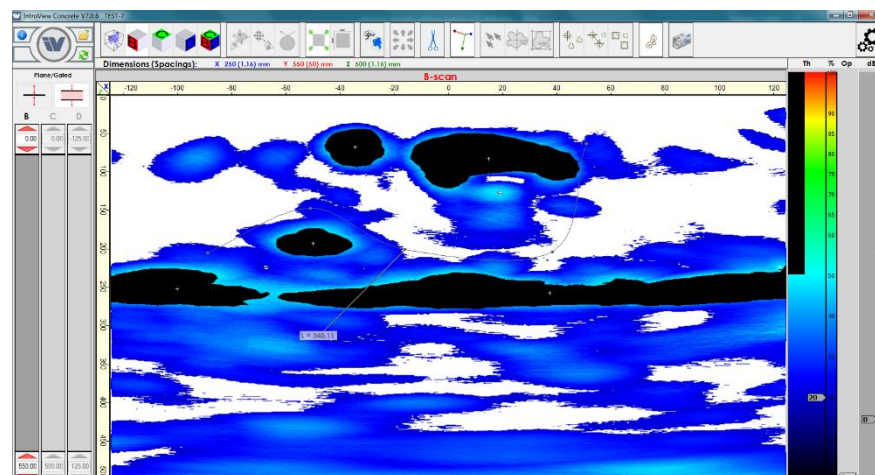


Figure 19: Created curve

curve or remove it by double click on label region. Last menu item “Export curves description” creates the XML file with mathematical description of all curves.

```

<Curves>
  <FileName>TEST-7</FileName>
  <View>B-Scan</View>
  <PlaneGate>0 - 550</PlaneGate>
  <Curve>
    <Length>L = 340.11</Length>
    <ControlPoints>
      <P1>X = -89.113, Y = 203.835</P1>
      <P2>X = -51.21, Y = 146.307</P2>
      <P3>X = -16.331, Y = 199.574</P3>
      <P4>X = 38.105, Y = 202.415</P4>
      <P5>X = 50.605, Y = 61.79</P5>
    </ControlPoints>
    <Polynoms>
      <P1-P2>
        <X>A = -1.613, B = 1.613, C = 37.904, D = 35.887</X>
        <Y>A = 55.398, B = -55.398, C = -57.528, D = 203.835</Y>
      </P1-P2>
      <P2-P3>
        <X>A = 11.089, B = -12.5, C = 36.291, D = 73.791</X>
        <Y>A = -80.966, B = 136.364, C = -2.131, D = 146.307</Y>
      </P2-P3>
      <P3-P4>
        <X>A = -30.847, B = 40.726, C = 44.557, D = 108.67</X>
        <Y>A = -46.875, B = 22.017, C = 27.699, D = 199.574</Y>
      </P3-P4>
      <P4-P5>
        <X>A = 20.968, B = -41.936, C = 33.468, D = 163.106</X>
        <Y>A = 71.733, B = -143.466, C = -68.892, D = 202.415</Y>
      </P4-P5>
    </Polynoms>
  </Curve>
</Curves>

```

The “control points” section lists coordinates of all points used in curves. The “polynoms” section describes the polynomial coefficients to construct the splines that connect the points. The parametric formula looks as follows:

$$\begin{cases} x(t) = A_X * t^3 + B_X * t^2 + C_X * t + D_X \\ y(t) = A_Y * t^3 + B_Y * t^2 + C_Y * t + D_Y \end{cases}, \quad 0 \leq t \leq 1$$

Rotation and flipping the projection scans

In case of single projection scan is selected, by right click of the mouse on the top (line with scan name, see Figure 20) offers menu with four manipulations on

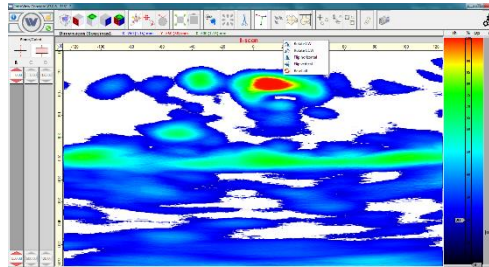


Figure 20: Rotation and flipping

project scan:

- clockwise rotation
- anticlockwise rotation
- horizontal flipping
- vertical flipping



Report

This tool offers a short report. After selecting the needed projection scan, volume window or all of them with required settings, users can save the picture (screenshot) to the hard disk drive. Clicking the corresponding button shows the screenshot window, see Figure 21. Here user can choose in between JPG and PDF file formats. The PDF file format has the advantage that additional information like

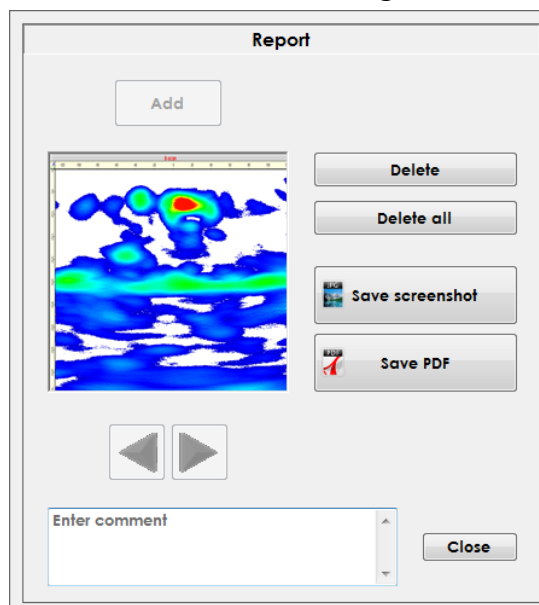


Figure 21: Screenshot form

threshold, opacity, and optional comments are added to the document. Several pictures could be collected for creating one report. Each of them has own custom comment.

Information bar

A bar is present directly under the functional bar with buttons, which informs user about dimensions and resolution details of the loaded dataset, see Figure 22.



Figure 22: Information bar

The values of different dimensions are colored with different colors. These color dimensions correspond to colors of axis in volume picture, colors on planes sliders control, and colors of corresponding scan projections.

Application settings

The settings menu, see Figure 23, is available even when no dataset is opened. First group allows selecting the language for the software. Selected language will be



Figure 23: Application settings

saved and used during the next application launch. The following groups define how the dataset will be load/reload:

- compression: in case the dataset is very big, the program will compress the data to save the rendering speed; in case the dataset is not too big, it will be always loaded without compression;
- zero alignment: one has a possibility to define the zero in the dataset – either on the data start, or in the middle of the first aperture, or on the edge of the first aperture. This setting is only applicable to the data sets of A1040 MIRA and A1020 MIRA Lite, while for the data sets of A1220 MONOLITH and A1040 MIRA 3D the zero-alignment in the middle of the aperture is applicable.

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