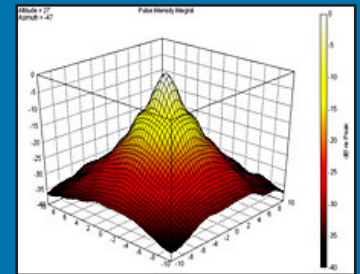


AIMS Software Version 4.2 Features

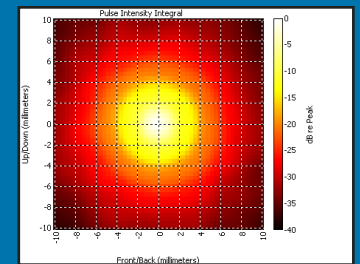
The AIMS software is designed to be used to measure ultrasound output from diagnostic and therapeutic ultrasound devices. It is the result of many years' work at NTR Systems in developing scanning tank systems. Its features include:

Control:

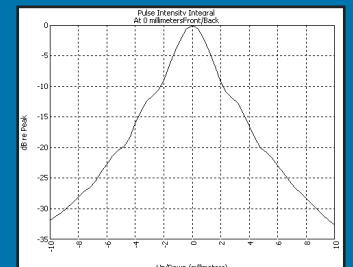
- Control of function generators. Current models supported are Agilent 33120, 33220, and 33250 (customer to supply GPIB-USB adapter).
- Control of NTR EMDS 3- or 6-Axis stepper drive electronics. This includes limit switches as well as software limits on motion to protect valuable hydrophones and transducers.
- Scripting: Automated tests may be carried out using the built-in scripting capability.
- Enhanced external control of AIMS software: The AIMS software can now be controlled by an external program. This allows the controlling program to carry out automated test procedures where it changes the settings of the system under test, then uses the data acquisition capabilities of the AIMS software. Communication with the AIMS software is through a TCP connection (may be on the same PC as AIMS.exe, or on another networked PC). A Win32 DLL is provided which contains over 600 functions to set and get AIMS settings, acquire data, and retrieve measurement data and calculation results.
- Control of waveform averaging in the oscilloscope hardware (Tektronix and Agilent models).
- Support for Agilent 5000 and 6000 Series Oscilloscopes. These oscilloscopes have better throughput than other models, resulting in faster scanning speeds.



2D XY Intensity Plot



Contour XY Plot



1D Intensity Line Profile

Alignment:

- Automated search for peak on an axis or in the x-y plane.
- Beam alignment (using the NTR angular positioner) with selectable number of iterations and completion criteria.
- Automatic determination of z-axis position.
- Automatic determination of suitable x or y axis scan dimensions.
- Determination of x axis of a scanhead, then subsequent use of an alternate coordinate system to stay aligned with the x axis.

Acquisition:

- Acquisition of waveforms. Waveforms can be averaged using cross-correlation to remove jitter caused by vibration. This can be a problem when acquiring a waveform right after moving on the z-axis, causing the membrane hydrophone to vibrate like a drum head.
- Acquisition of one-dimensional and two-dimensional scans. Scans can be on any axis or combination of axes, either translation or rotation.
- ZX scans: A special-purpose two-dimensional scan to provide data for calculation of SII (scan intensity integral) for scanning beams.
- Acquisition of three-dimensional scan data as a series of two-dimensional x-y scans.
- Acquisition of frequency scans (requires a function generator).

Calculations:

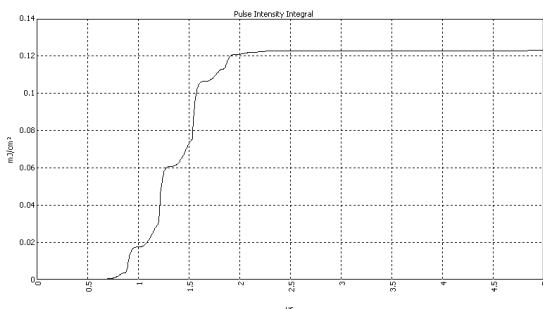
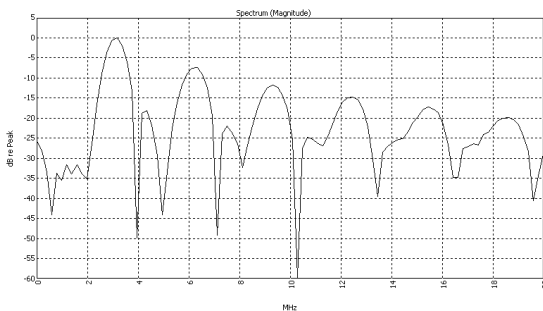
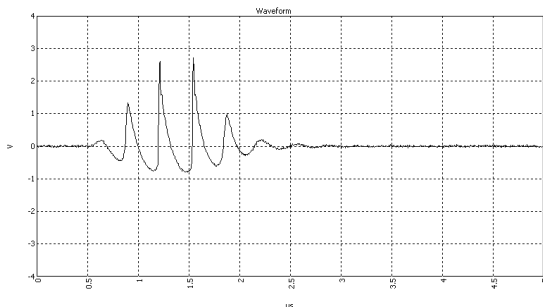
- Calculation of intensities (pulse average I_{ppa} , temporal average I_{pta}) and pressure (peak rarefactional P_r), both in water and derated.
- Calculation of mechanical index (MI) and thermal indices (TIS, TIB, TIC).
- Calculation of associated acoustic parameters such as pulse duration, beam widths, center frequency, etc.
- Calculation of acoustic power from x-y scan data.
- Calculation of Effective Radiating Area (ERA) and Beam Non-uniformity Ratio (BNR) according to FDA and IEC procedures. This includes automatic execution of the various scans required.
- Multiple-frequency hydrophone calibration data: Interpolation of hydrophone sensitivity to measured center frequency (F_c).
- Hydrophone calibration via planar scanning of calibrated source

Output:

- Files: The AIMS files are tab-delimited text with extensive labeling. They can be viewed with any text editor or can be opened with Microsoft Excel or other programs that support tab-delimited files. The format is self-explanatory.
- Printer: The various plots and text data can be printed. The user selects which items are to be printed.
- Clipboard: Plots and text data can be copied to the clipboard, and then pasted into documents to prepare reports. Examples of this are below.
- Output to Excel Workbooks: Waveform, z-axis scan, and x-y scan data can be output to a Microsoft Excel workbook. A template file is opened by the AIMS program, measurement data are copied into it, and then it is written out to a new Excel file. The output worksheet in the template file can be modified to suit users' needs. Examples are below.

Software Output Examples

Sample Waveform Analysis



Voltages:

Positive Peak Voltage	2.72	V
Negative Peak Voltage	-0.8	V
Largest Peak Voltage	2.72	V
Peak to Peak Voltage	3.52	V
VRMS	0.0262	VRMS
Average Voltage	0.00604	V

Intensity:

Pulse Average	114	In Water:	40.5	Derated:	W/cm ²
Temporal Average	123		43.6		mW/cm ²
Pulse Duration	1.08	µs			

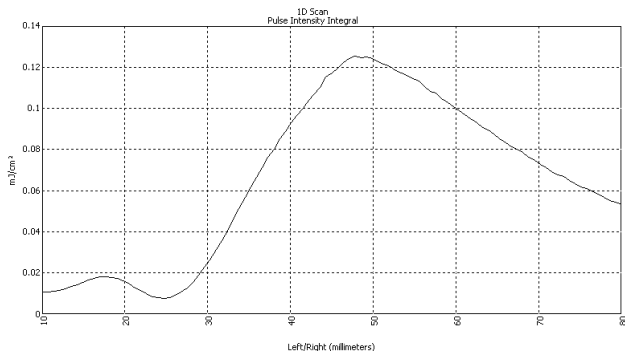
Pressure:

Peak Negative Pressure	1.31	In Water:	0.781	Derated:	MPa
Peak Positive Pressure	4.46		2.66		MPa
Mechanical Index	0.445				

Frequency:

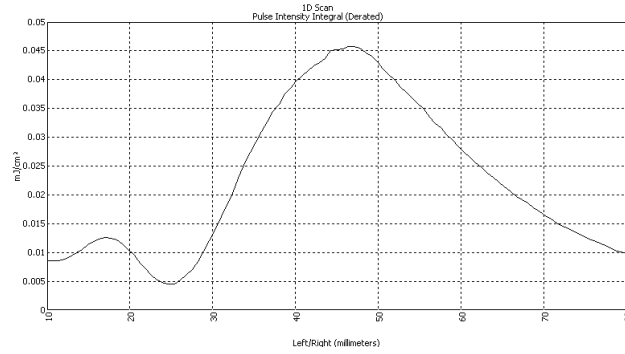
Max. Freq.	3.13	MHz
Center. Freq.	3.08	MHz
Lower -3 dB Freq.	2.78	MHz
Upper -3 dB Freq.	3.38	MHz
Bandwidth	0.603	MHz
	19.6	%

Sample Z-axis Scans

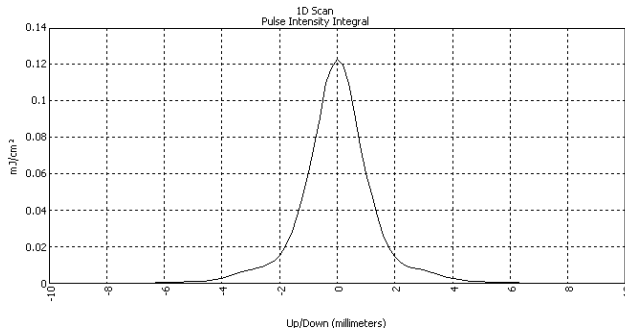


1D Scan Peak - Pulse Intensity Integral

Water:	0.125 mJ/cm ² at	47.8	millimeters
Derated:	0.0458 mJ/cm ² at	47.1	millimeters
Center Frequency: 3.07 MHz			

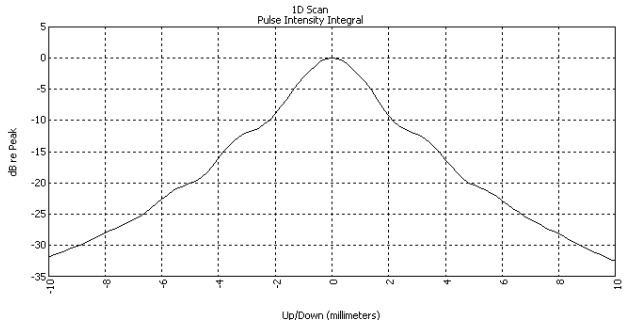


Sample X-axis Scans



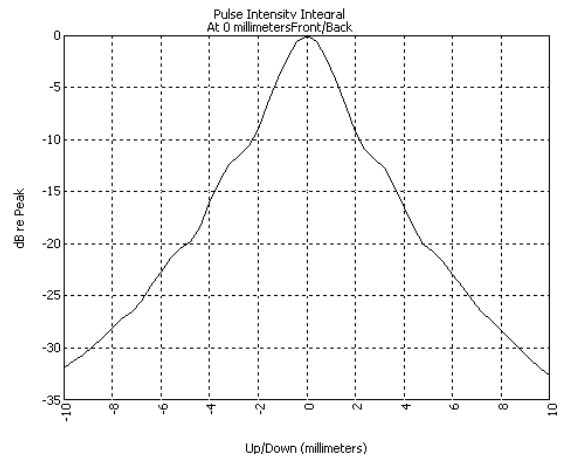
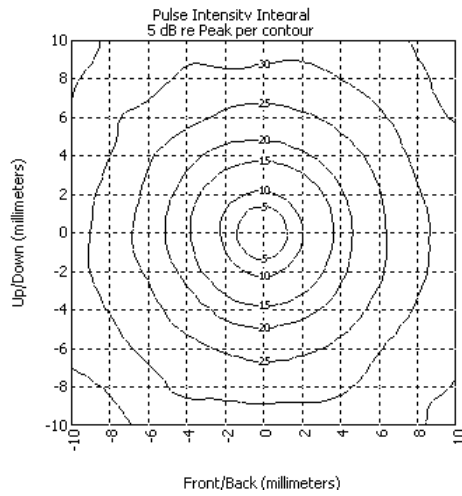
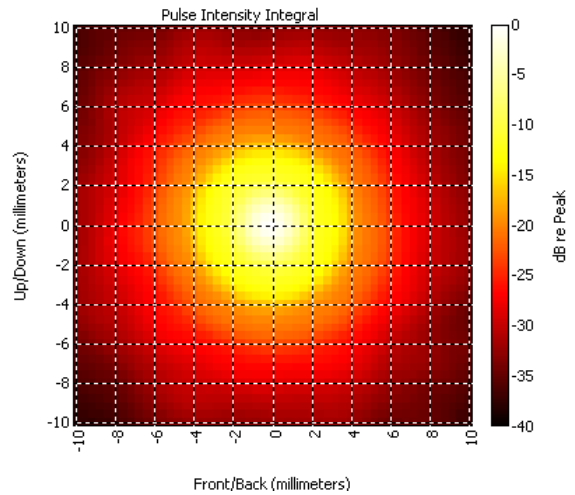
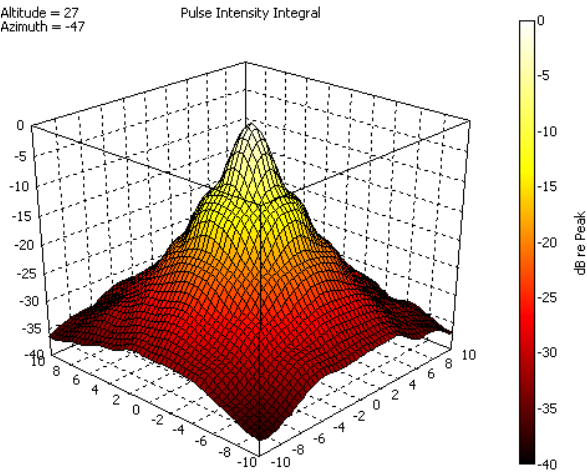
1D Scan Width - Pulse Intensity Integral

-3 dB:	1.83	millimeters
-6 dB:	3.01	millimeters
-10 dB:	4.4	millimeters
-12 dB:	5.98	millimeters
-13 dB:	6.61	millimeters



Sample XY Scans

Altitude = 27
Azimuth = -47

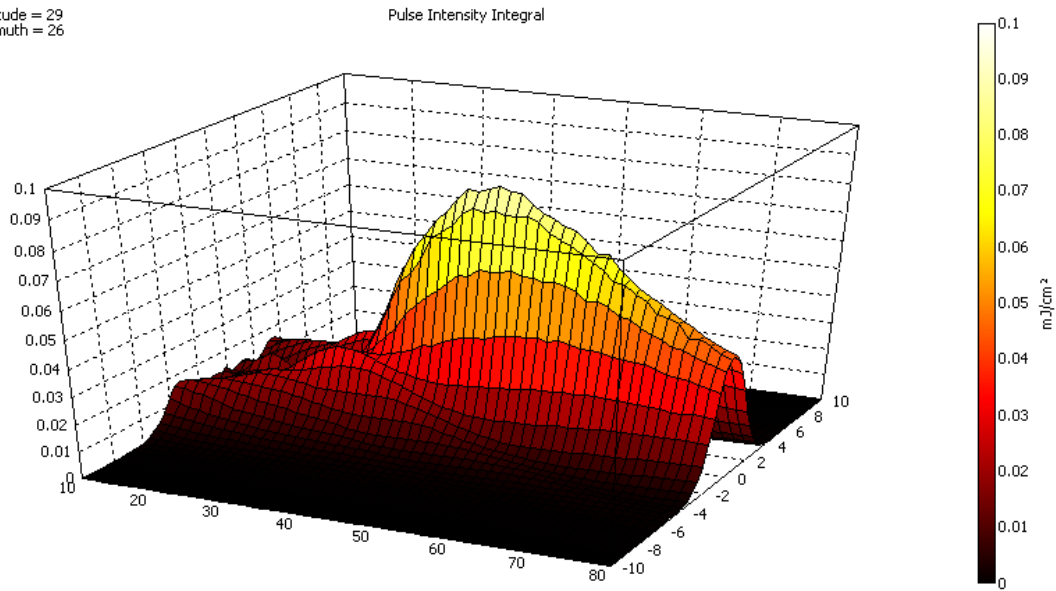


2D Scan Beam Dimensions - Pulse Intensity Integral

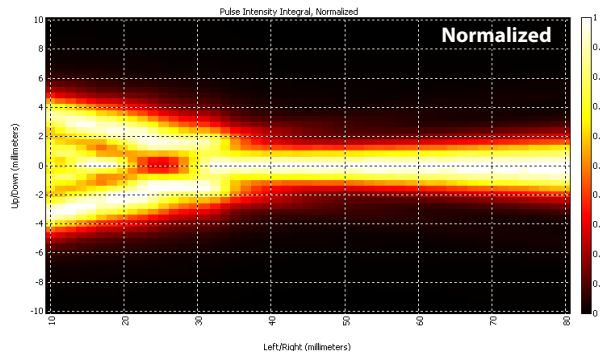
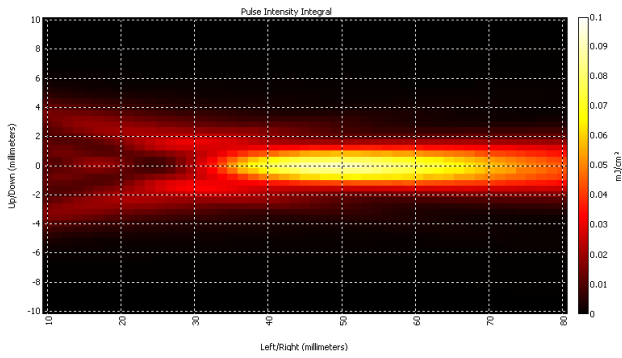
-3	dB Width:	1.98	x	1.99	millimeters	Area:	3.2	millimeters ²
-6	dB Width:	2.86	x	2.89	millimeters	Area:	6.72	millimeters ²
-10	dB Width:	4.36	x	4.42	millimeters	Area:	14.9	millimeters ²
-12	dB Width:	5.54	x	5.92	millimeters	Area:	25.3	millimeters ²
-13	dB Width:	6.4	x	6.73	millimeters	Area:	34.2	millimeters ²
-20	dB Width:	9.66	x	9.65	millimeters	Area:	74.2	millimeters ²
-26	dB Width:	14	x	14	millimeters	Area:	155	millimeters ²

Sample XZ Scans

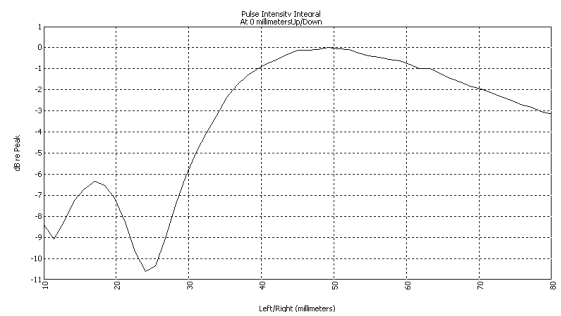
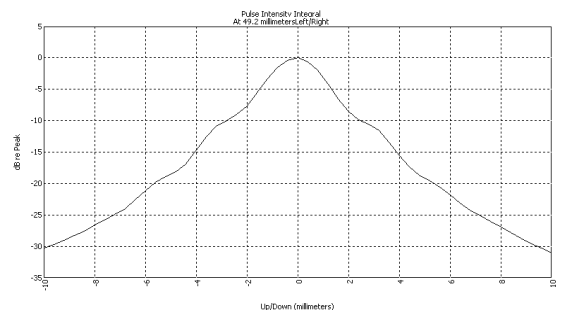
Altitude = 29
Azimuth = 26



Top-Down XZ Contour Plots

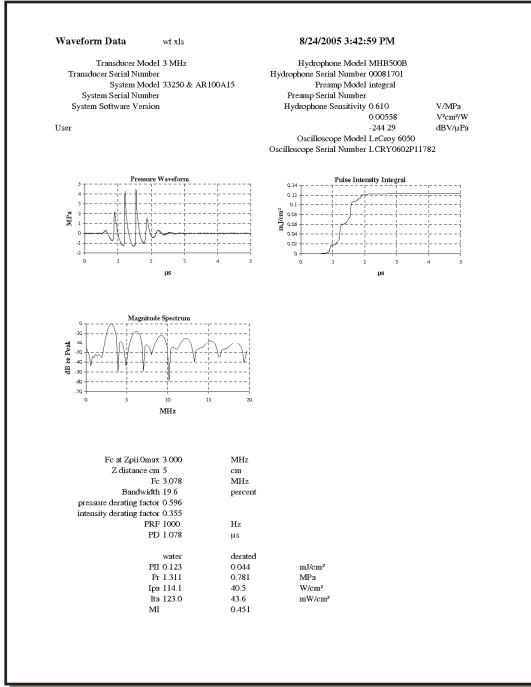


1D Slices from XZ Plot

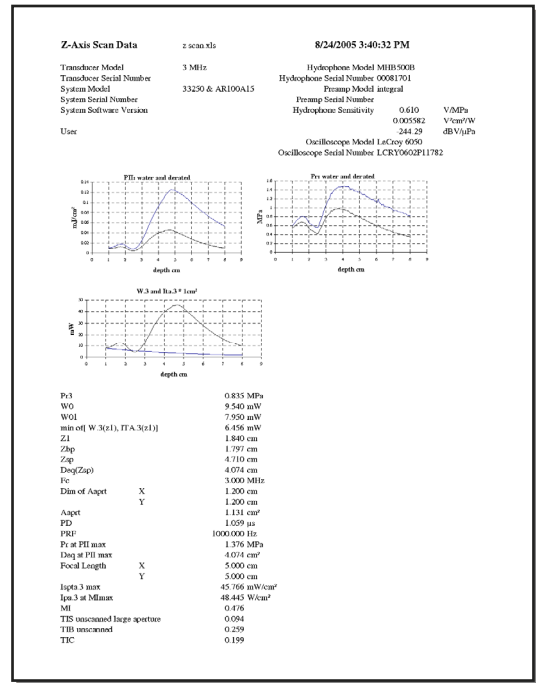


Sample MS Excel Worksheet Reports

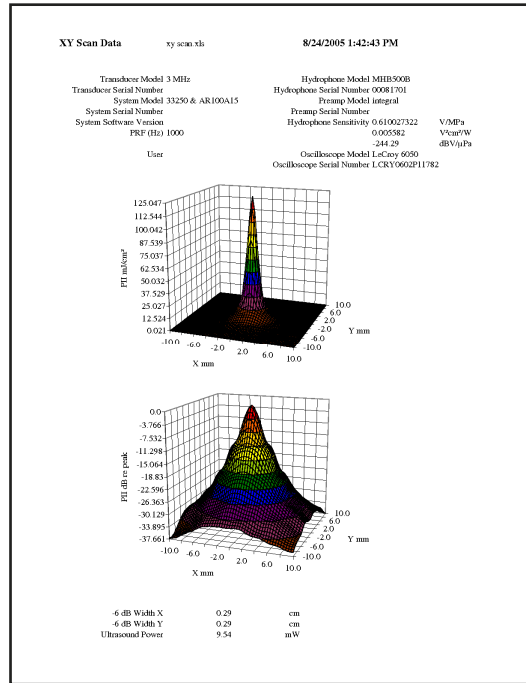
Waveform Data



Z-Axis Scan Data



XY Scan Data



Oscilloscopes supported by AIMS 4.2

Agilent

DSO5012A
DSO5014A
DSO5032A
DSO5034A
DSO5052A
DSO5054A

DSO6012A
DSO6014A
DSO6032A
DSO6034A
DSO6052A
DSO6054A
DSO6102A
DSO6104A