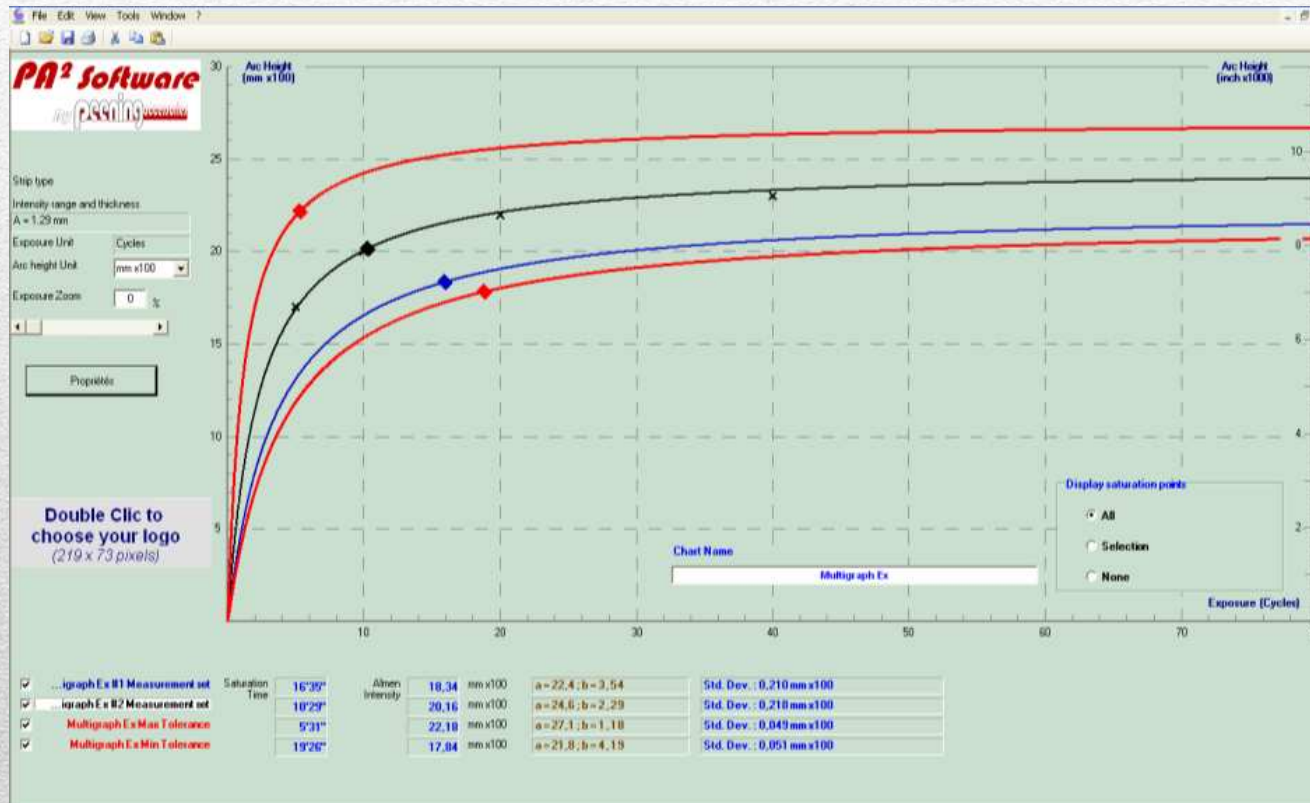




Computer Generated Saturation Curve for Shot Peening Process

Software Introduction
11th MFN Asian Workshop Singapore, November 2011



- Establish and select the optimal curve,
- Sketch single or multi diagrams,
- Define the saturation point
- Give directions for interpretation and corrections.

PA² Overview

- In the 80's, computer popularization helped using it for industrial process assistance with mathematical models,
- Soon after, Some mathematical models were adopted in the French Aeronautical Standard **NFL 06-832**,
- Recently issued, **SAE-J2597** fully describes the algorithms and requirements for this type of software, which allows further practical developments in a safe frame.

Almen Softwares History

- PA² Software has been designed and tested by experienced users, making it very accurate and powerful.
- Advanced functionalities have been integrated to make it user friendly and to avoid any possible mistake, in particular for fresh operators in production and control phases of the shot peening process.
- PA² Software fully meets SAE-J2597 requirements.

PA² User Friendly

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- Based on a very simple equation

$$h = a \cdot t / (t + b)$$

h: Arc height

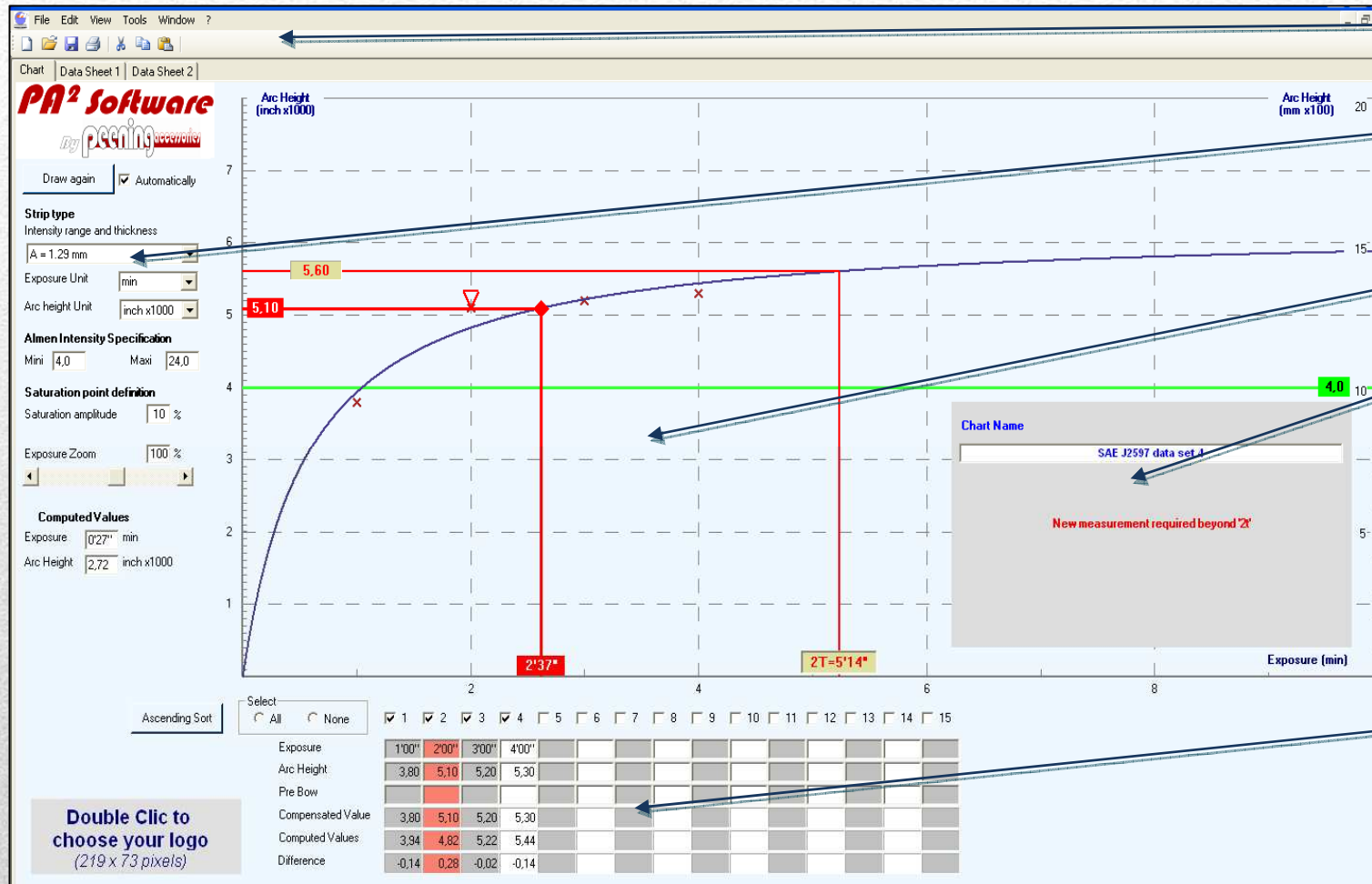
t: Peening time or equivalent

a: Parameter (arc height units)

b: Parameter (time units)

- By minimizing the sum of all square distances from each measurement point to a theoretical curve of this equation, PA² will define the best fitting set of parameters a and b.
- By scanning a and b parameters PA² will define the best a and b values.

PA² Basic Theory



Main menu

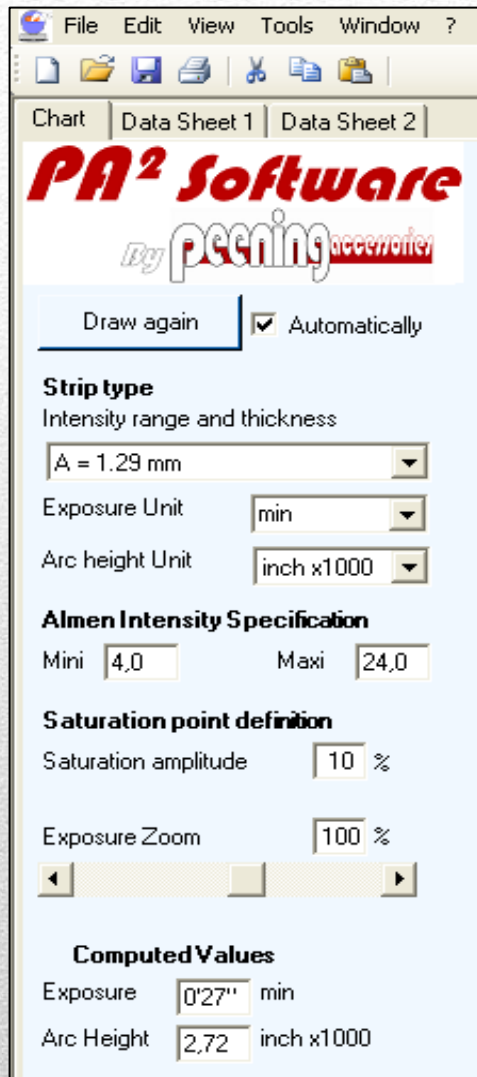
Measurements data format

Graphic chart

Chart title and message box for results and automatic comments display

Table for measurements data input

Chart description



- **Almen strip type**

Almen strip type; N, A or C,

- **Arc height units**

Select “inch/1000” (Imperial units) or “mm/100” (metric system)

- **Exposure units**

Select “cycles” or “s” or “min” or “kg/m²” or “Passes” or “min/m”,

- **Almen intensity specification range**

Maximum & minimum required limits of Almen intensities,

- **Saturation point definition**

Maximum arc height increase, in %, for double exposure; generally 10%,

- **Exposure zoom**

Percentage of the maximum exposure input which will be added to it and used as the maximum abscisse value for graphic display (from 0% to 200%). The cursor can also be used,

- **Computed values**

The Almen saturation curve displayed as soon as 2 measurement points acquired.

When pointing anywhere at the curve, the exposure and corresponding computed arc height will be displayed in this frame,

Measurements Data Format

Ascending Sort

Select
 All None

Double Clic to choose your logo (219 x 73 pixels)

	<input checked="" type="checkbox"/> 1	<input checked="" type="checkbox"/> 2	<input checked="" type="checkbox"/> 3	<input checked="" type="checkbox"/> 4	<input checked="" type="checkbox"/> 5	<input checked="" type="checkbox"/> 6	<input type="checkbox"/> 7	<input type="checkbox"/> 8	<input type="checkbox"/> 9	<input type="checkbox"/> 10	<input type="checkbox"/> 11	<input type="checkbox"/> 12	<input type="checkbox"/> 13	<input type="checkbox"/> 14	<input type="checkbox"/> 15
Exposure	0'15"	0'30"	0'45"	1'00"	2'00"	4'00"									
Arc Height	10,8	12,9	13,7	14,4	15,7	16,4									
Pre Bow															
Compensated Value	10,8	12,9	13,7	14,4	15,7	16,4									
Computed Values	10,5	12,9	14,0	14,6	15,6	16,2									
Difference	0,3	0,0	-0,3	-0,2	0,1	0,2									

- Each column refers to one measurement point,
- Orange highlighted columns contain measurement points out of maximum the allowed distance from the curve.
- The maximum allowed distance is defined inside the <Options> menu
- These points are marked with a red triangle in the chart. If the triangle is pointing downside < >, the point is too high above the computed curve; positive distance. If the triangle is pointing upside < >, the point is too low underneath the computed curve; negative distance.

Measurements Data Input Table

Chart Name

Almen1

Switch Almen strip from type A to finer type N

New measurement required beyond '2t'

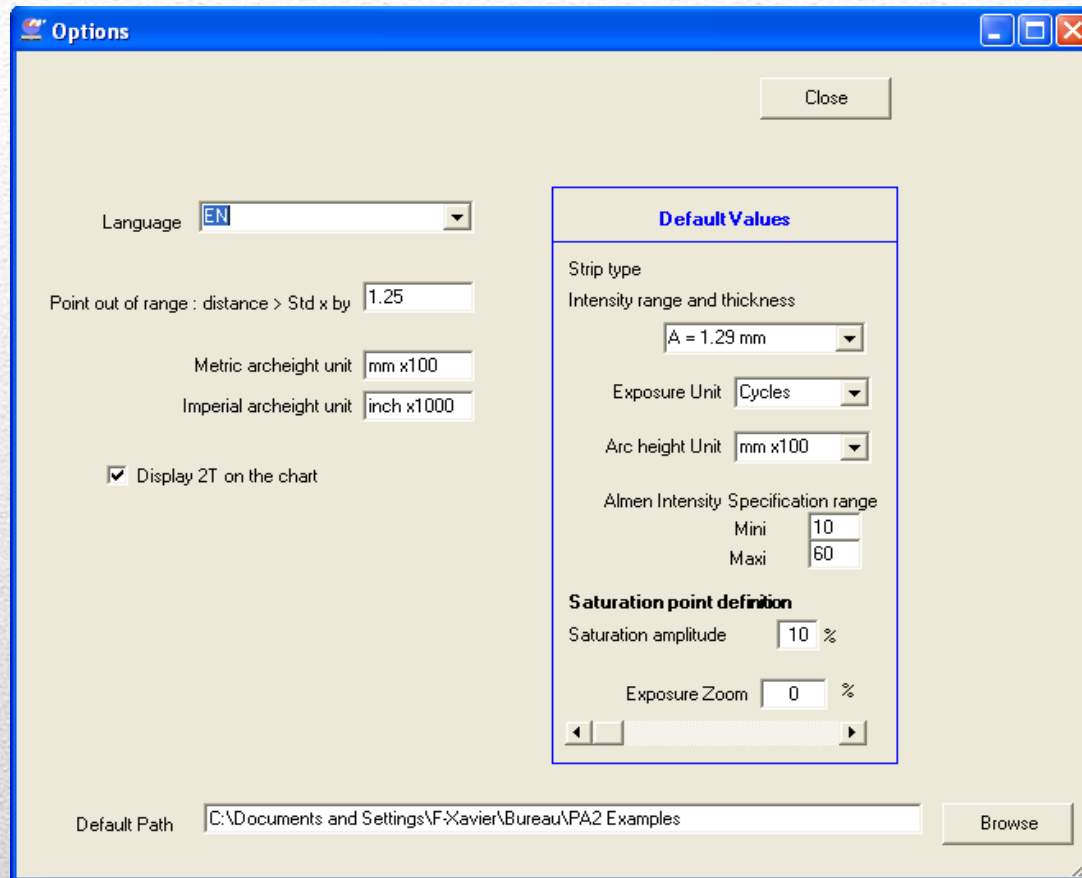
Saturation point out of tolerance span

Std. Dev. : 0,054 inch/1000

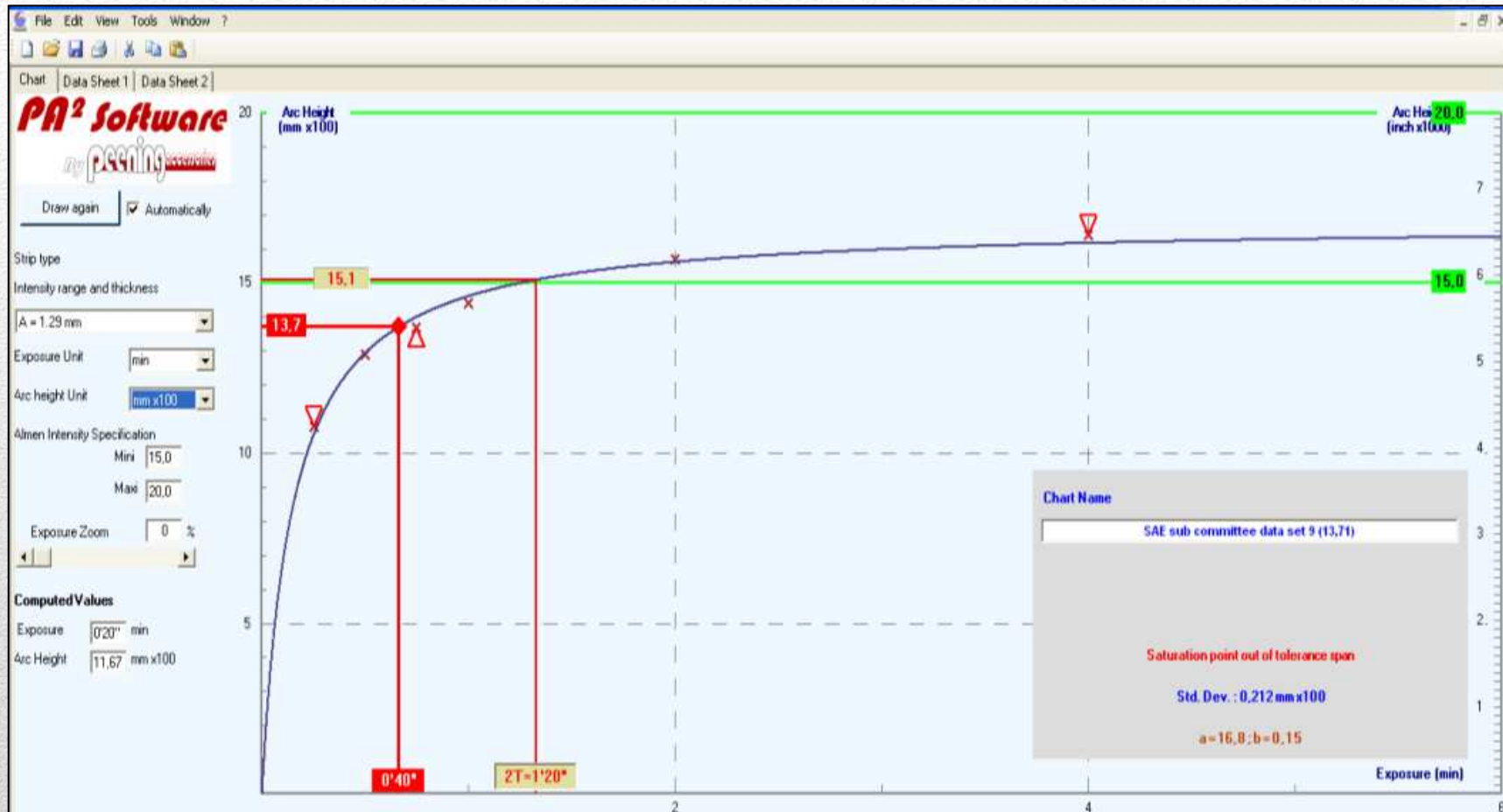
a = 3,4666, b = 14,0650

- The messages are just advises and will not bring any automatic reaction from the software. It is the choice of the user to follow or not follow the advice.
- The blue line displays standard deviation. This will be used to define whether measurement points are close enough from the computed curve.

Automatic comments



Options & Default Values



Graphic Chart Layout

File Edit View Tools Window ?

Chart Data Sheet 1 Data Sheet 2

Chart name *

Customer Data

Company	<input type="text" value="MY COMPANY"/>	Location	<input type="text" value="THERE"/>
Contractor (end customer)	<input type="text" value="MY CONTRACTOR"/>	Country	<input type="text" value="WORKLAND"/>
Free	<input type="text"/>	Free	<input type="text"/>

Work Part

Assembly Name	<input type="text" value="F2222R ENGINE"/>	Material	<input type="text" value="THE MATERIAL"/>
Part Name	<input type="text" value="MAIN SHAFT"/>	Heat Treatment	<input type="text" value="CASE HARDENING"/>
Reference	<input type="text" value="XQR-VPT-126-44"/>	Hardness	<input type="text" value="HV 1000"/>
Peening Zone	<input type="text" value="ALL AREA AS REQUIRED 10N MM IN THE DRAWINGS"/>	Free	<input type="text"/>

Specification List	AMS	SAE	Others
	<input type="text" value="NA"/>	<input type="text" value="NA"/>	<input type="text" value="XK-2264 (PROCESS)"/>
			<input type="text" value="PLGR-B2 (SHOT)"/>
			<input type="text"/>

Main Requirements

Almen Strip Type *	<input type="text" value="A = 1.29 mm"/>	Coverage Rate	<input type="text" value="100%"/>
Almen Strip Quality	<input type="text" value="THE BEST FROM PA"/>	Maximum Roughness	<input type="text" value="µmRa 0.6; µmRz 3"/>
Minimum Almen Intensity *	<input type="text" value="10"/>	Residual Stress Profile	
Maximum Almen Intensity *	<input type="text" value="60"/>	Compression Depth	<input type="text" value="0.15 mm"/>
		Depth of Compression Peak	<input type="text" value="0.075 mm"/>
		Compression Peak	<input type="text" value="1300 MPa"/>
		Surface Compressive Stress	<input type="text" value="1 100 MPa"/>

*These labels can't be changed **

Data Sheet-1

File Edit View Tools Window ?

Chart | Data Sheet 1 | Data Sheet 2

Chart name *

Process Parameters

Equipment Type *	<input type="text" value="Wet peening"/>	Shot Type	<input type="text" value="SCW"/>
Machine Type *	<input type="text" value="Direct pressure"/>	Shot Size	<input type="text" value="MM 0.8"/>
Equipment	<input type="text" value="Wheel turbine"/>	Shot Hardness	<input type="text" value="HV 640"/>
Number of nozzles *	<input type="text" value="16"/>	Shot Flow Rate	<input type="text" value="KGMIN 10"/>
Nozzle Type *	<input type="text" value="STRAIGHT"/>	ShotConcentration Water (%)	<input type="text" value="40"/>
Nozzle Diametre *	<input type="text" value="8"/>	Throwing Distance to Target	<input type="text" value="MM 125"/>
Air pressure *	<input type="text" value="2 BARS"/>	Impingement Angle *	<input type="text" value=""/>
		Shot Velocity	<input type="text" value="M/S 75"/>

Movements

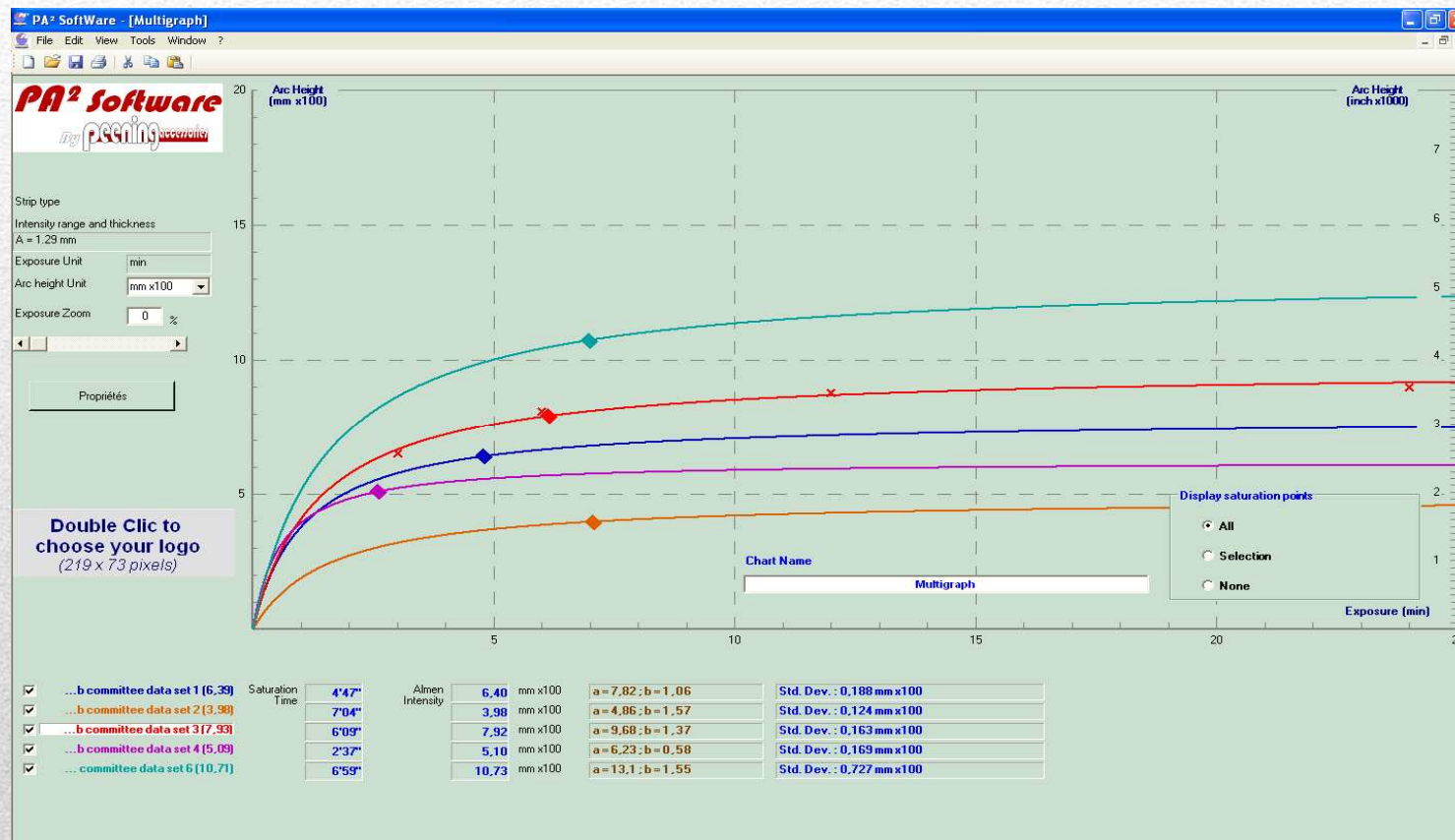
Table Rpm	<input type="text" value=""/>	Nozzle Speed	<input type="text" value="MMIN 0.25"/>
Spinner Rpm	<input type="text" value="65"/>	Scan Pitch	<input type="text" value="MM 25"/>

Specific Data

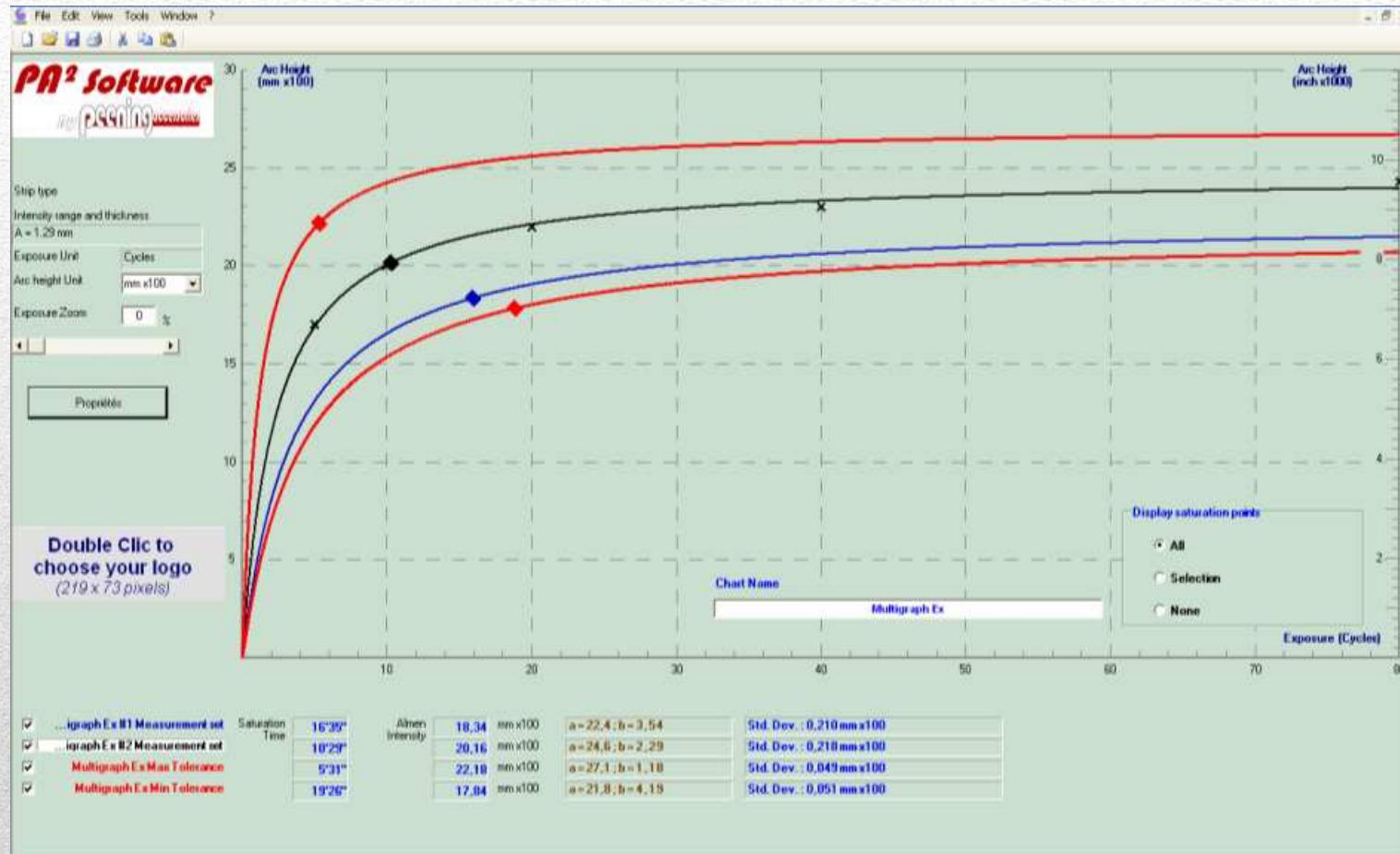
(Free)	<input type="text" value=""/>	(Free)	<input type="text" value=""/>
(Free)	<input type="text" value=""/>	(Free)	<input type="text" value=""/>
(Free)	<input type="text" value=""/>	(Free)	<input type="text" value=""/>
(Free)	<input type="text" value=""/>	(Free)	<input type="text" value=""/>

*These labels can't be changed **

Data Sheet-2



MultiGraph Chart, Ex. 1



MultiGraph Chart, Ex. 2

The screenshot shows the PA2 Software website. At the top left is the logo for PA² Software by PEENING ACCESSORIES. Below the logo is a navigation menu with two items: 'Home' and 'Administrator access'. The main content area is titled 'Pa2 Software' and contains the following text:

You can free download the full version of PA2 Software.

- EXE Version or
- ZIP Version.

This version contains all features but you can use it during a limited amount of use.
If you enjoy this software and if you want to receive the unlimited version, please contact us at:

PEENING ACCESSORIES GmbH
Frohbergstr. 38
8620 Wetzikon
Switzerland
Tel. +41.44.811 26 44 - Fax +41.44.831 26 45 - e-mail : info@peening.ch

to determinate the payment method.

Then, from PA2 Software, menu " ? About", click on the link "Apply for a serial number", input your company name, your name and address mail in the appropriate fields and we will send your personal serial number.
This number can only be used on the station which you perform this request from.

Requirements:

- Microsoft Windows XP SP 2 or later.
- Screen and graphic card with a resolution of 1024 x 768 pixels or more.
- Microsoft .NET Framework 4, if it is necessary, you can free download it from the Microsoft website by clicking one of the links below:
 - English Version
 - Version Française
 - Deutsche Version
 - Spanish Version
- You must have administrator rights, you may need to contact your network administrator.

Downloading Procedure

The screenshot shows the registration form for PA2 Software. At the top left is the logo 'PA² Software By peening accelerator'. Below it is a 'Menu principal' with 'Home' and 'Administrator access'. The main heading is 'Pa2 Software'. A warning message reads: 'To receive your serial number, please fill the following fields: WARNING! The code that will be sent to you can only be used on the station from which you perform this request.' The form contains the following fields: 'Company' (MY COMPANY), 'Firstname' (MY FIRST NAME), 'Lastname' (MY LAST NAME), 'E-mail' (myemail@myprovider.com), and 'Confirm your e-mail' (myemail@myprovider.com). A 'Submit' button is at the bottom.

The screenshot shows the confirmation page after registration. It features the same logo and menu as the registration form. The main heading is 'Pa2 Software'. A confirmation message reads: 'Your request has been registered. You will receive your serial number by e-mail after your order will be acknowledged'. At the bottom right, it says 'Powered by Joomla!, valid XHTML and CSS.'

Hello,

Hereafter the serial number of your PA2 Software, which allows unlimited use:

35fc-99ab-ee36-2dc3

To input your serial number, use the PA2 software menu "? / About". You can select and copy it (CTRL-C) out of this mail and then you can paste it. You can also enter it manually.

Thank you for your confidence

Downloading Procedure

- The Almen gage can be connected with the USB port and simply used as a key board data input.
- After configuration of the gage software, it is then possible to allow the number of digits and the measurement sign, positive or negative.
- To enter data with the Almen gage, place the Almen strip in the gage and press the on/off button.
- To input the next measurement, press again the on/off button.



Almen Gage Connexion

- Intelligent data input,
- Automatic saturation point and standard deviation calculation & display,
- On purpose advices,
- Clear data display,
- Multi graphic handling,
- Simple direct connection and input from the Almen Gage,
- And much more...

*PA² Delivers Much more
than a Simple Solver...*