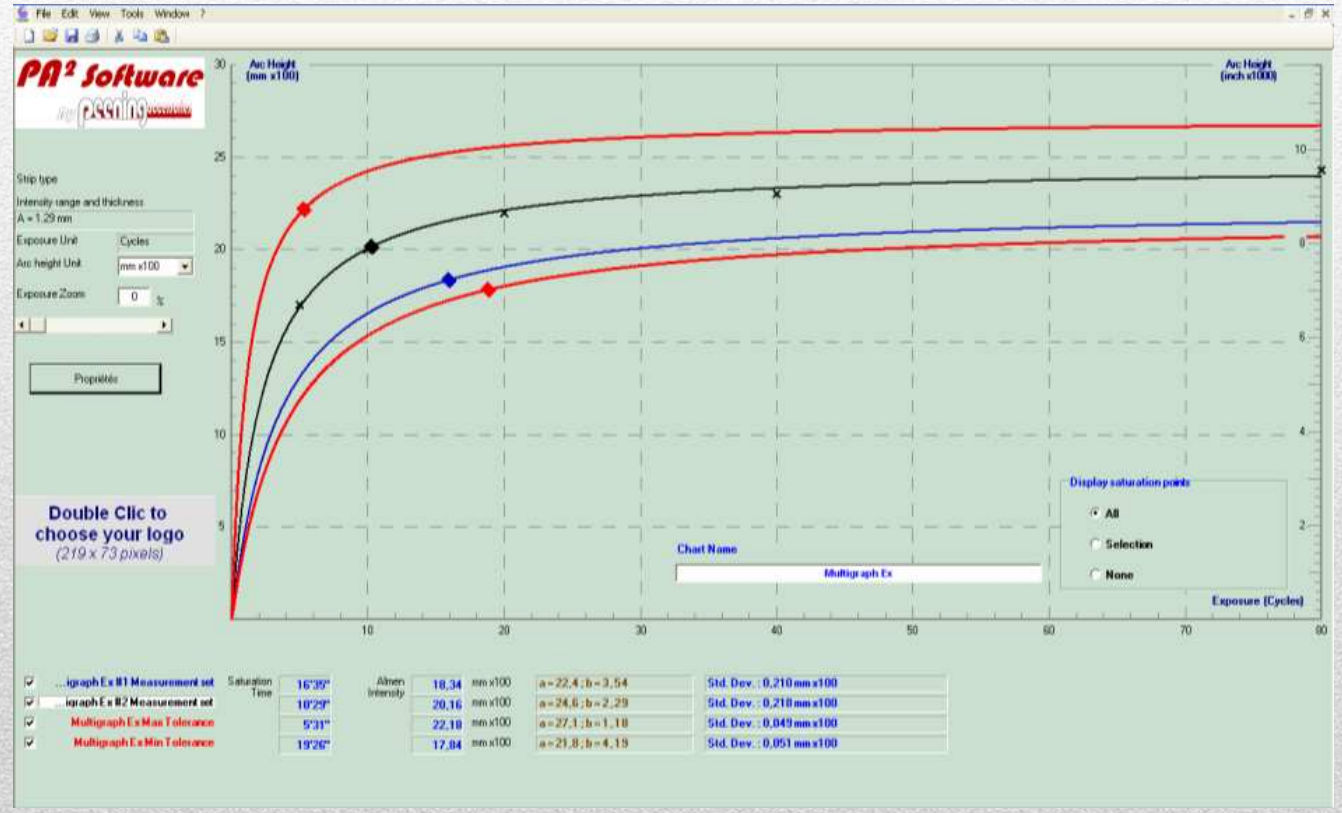
PA² Software

by peening accuracy

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

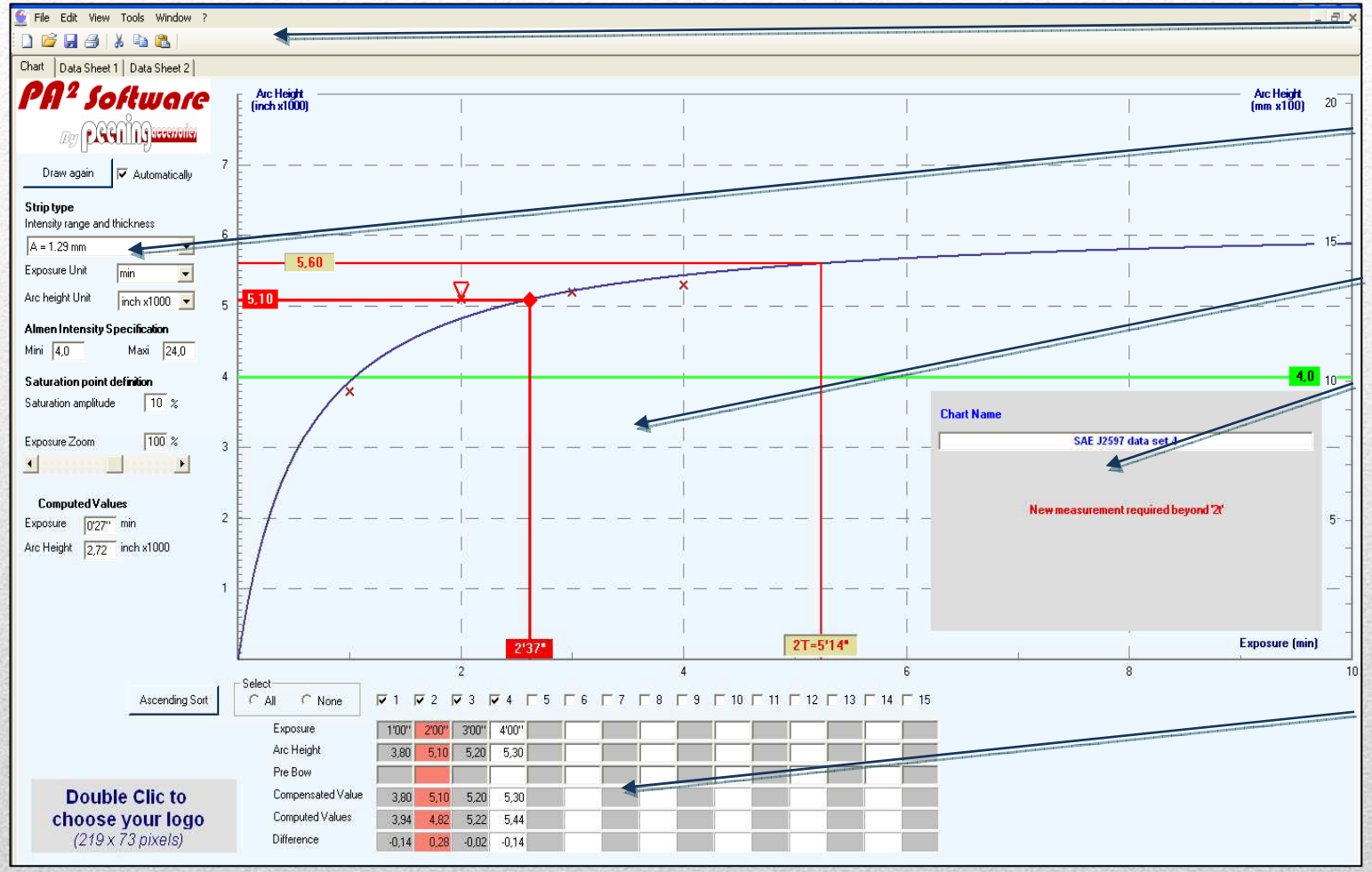
- Based on a very simple equation

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

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 form 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

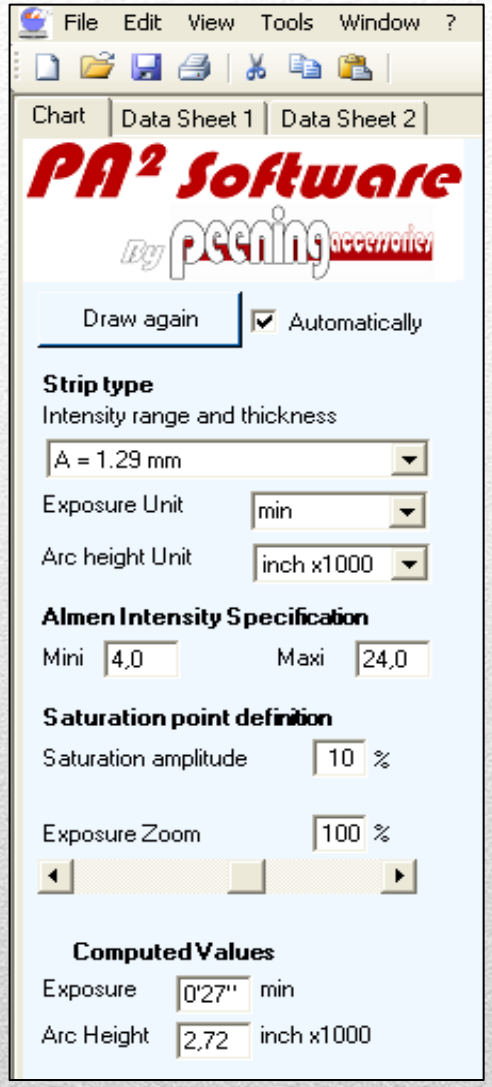
Measurements data format

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%,

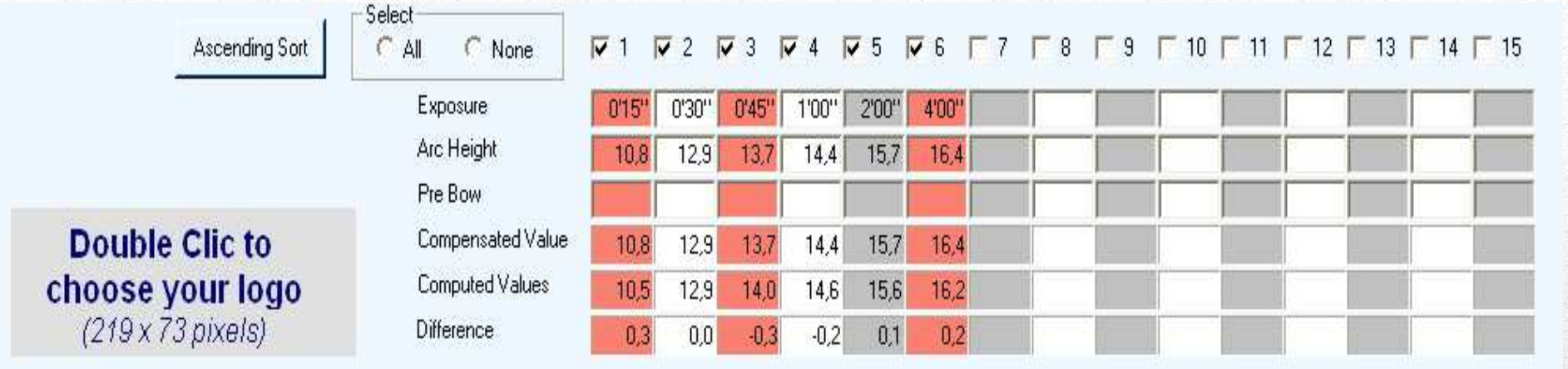
- **Exposure zoom**

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 used,

- **Computed values**

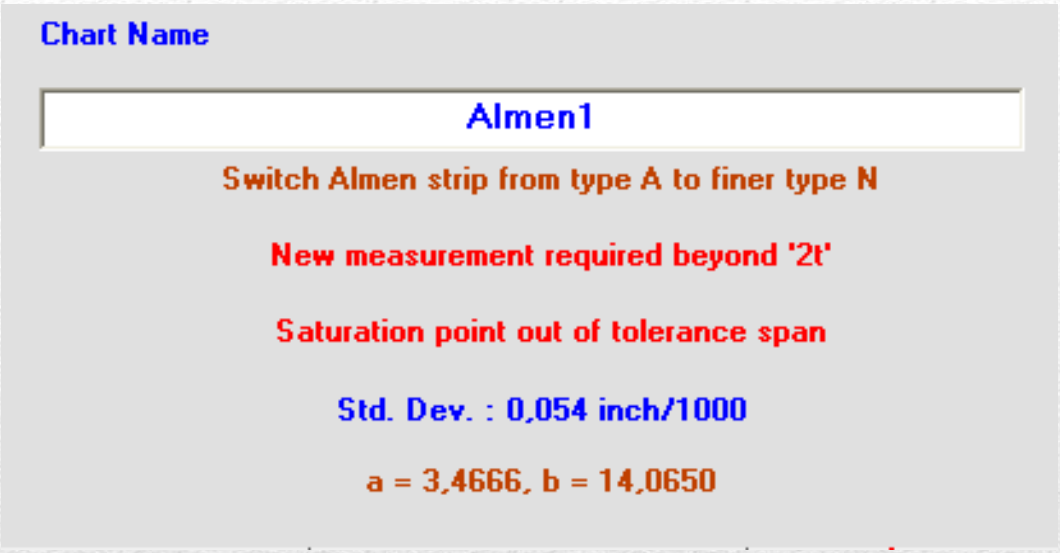
The Almen saturation curve displayed as soon as 2 measurement points acquired. When pointing anywhere at the curve, the exposure and corresponding computed arc height will be displayed in this frame,

Measurements Data Format



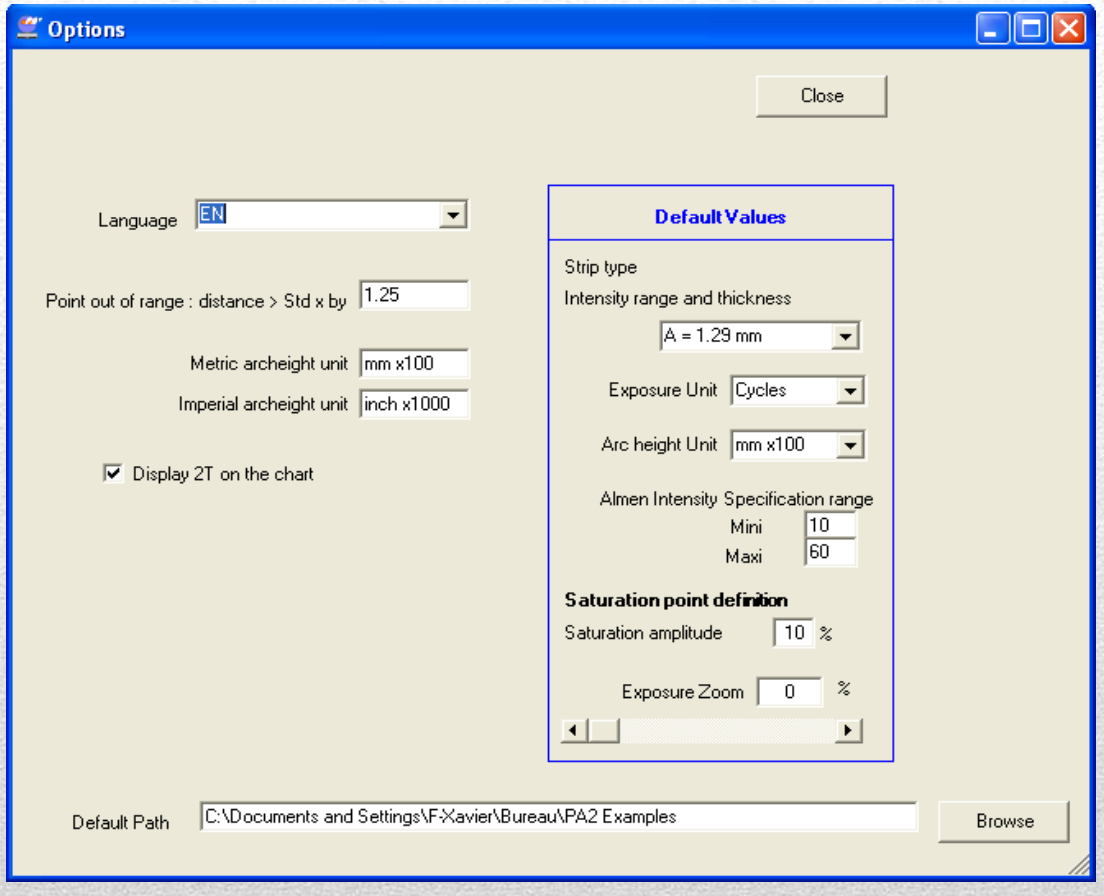
- Each column refers to one measurement point,
- Orange highlighted columns contain measurement points out of maximum the allowed distance from the curve.
- The maximum allowed distance is defined inside the <Options> menu
- These points are marked with a red triangle in the chart. If the triangle is 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

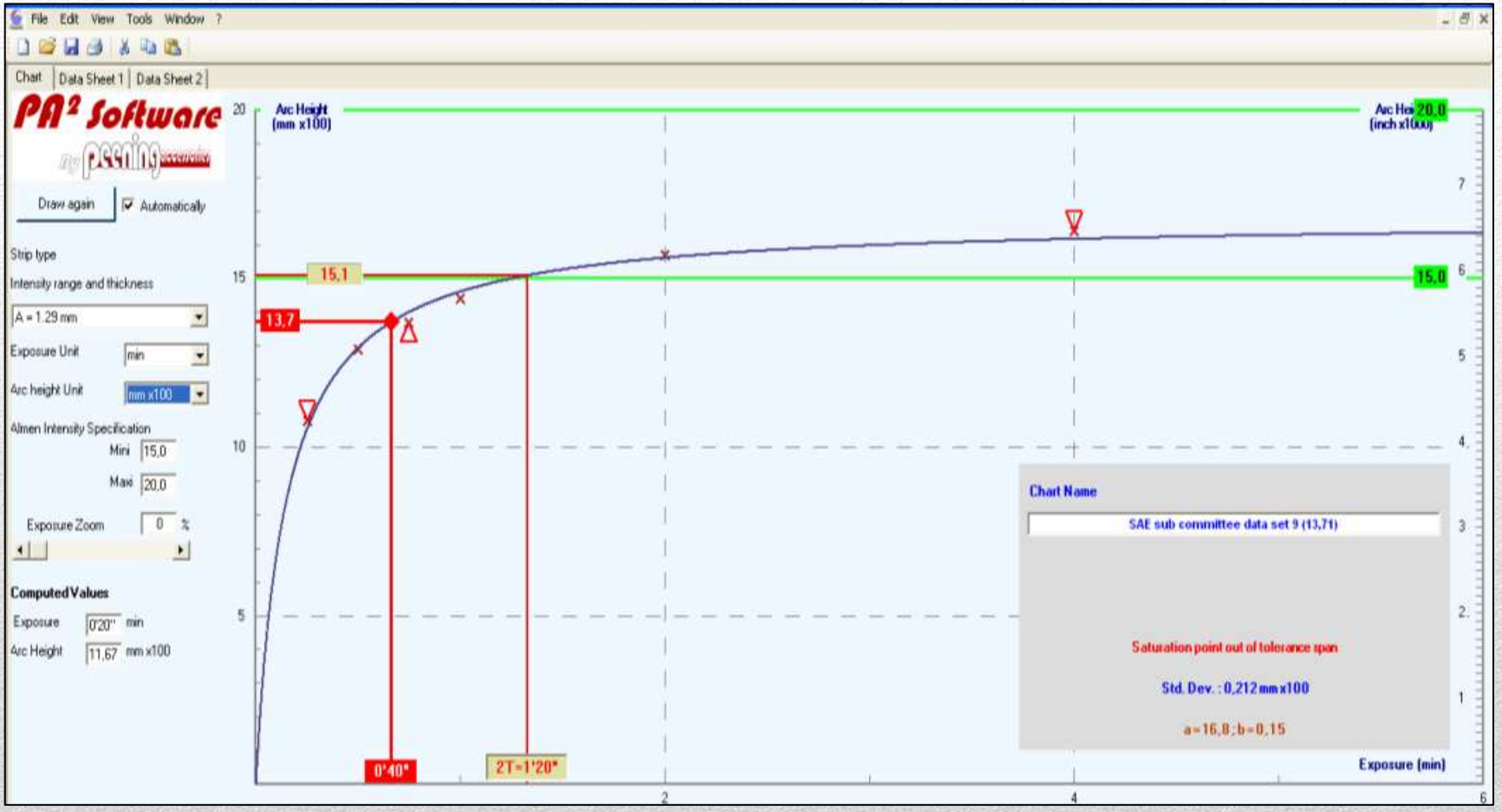


- The messages are just advises and will not bring any automatic reaction from the software. It is the choice of the user to follow or not follow the advice.
- The blue line displays standard deviation. This will be used to define whether measurement points are close enough from the computed curve.

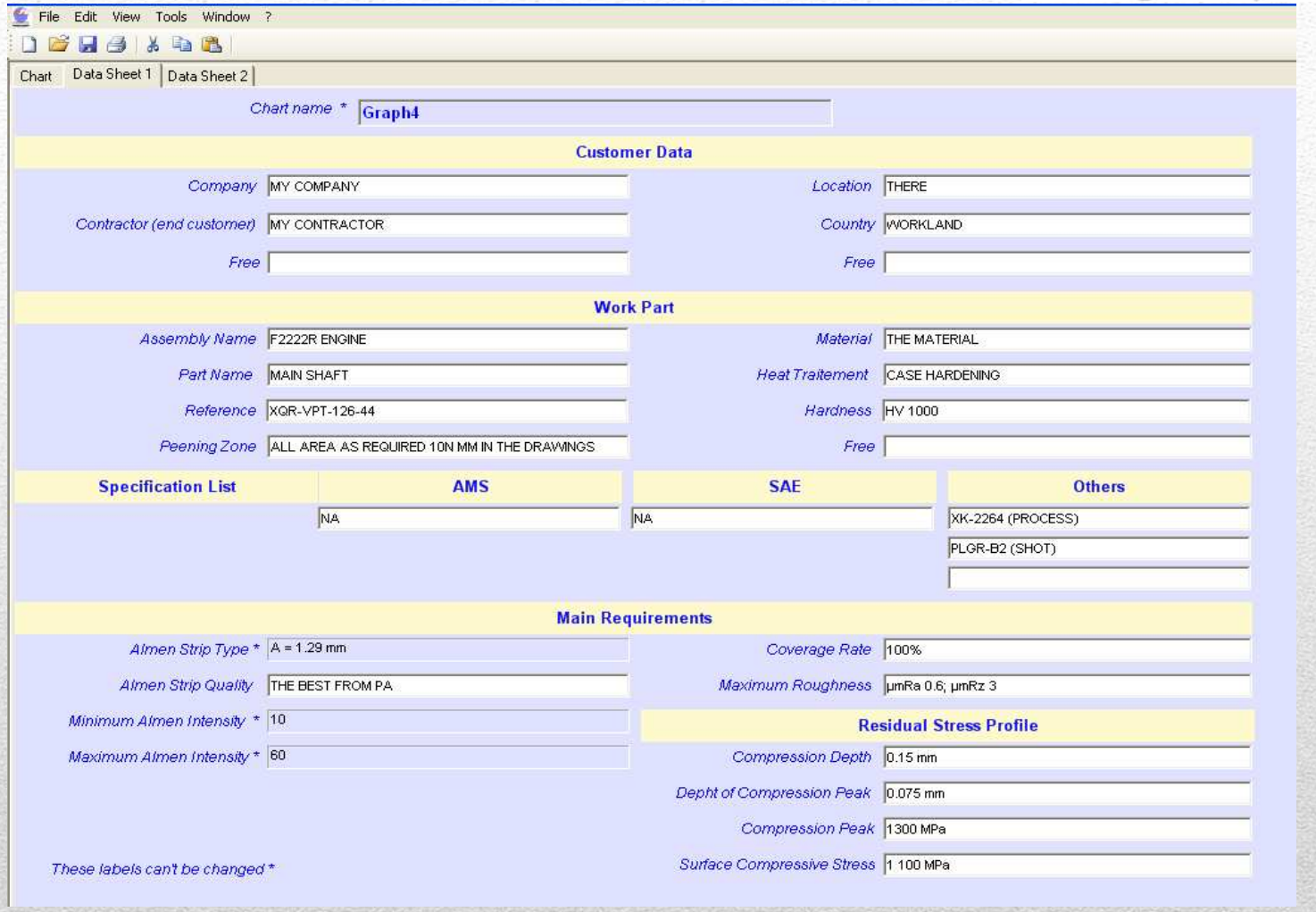
Automatic comments



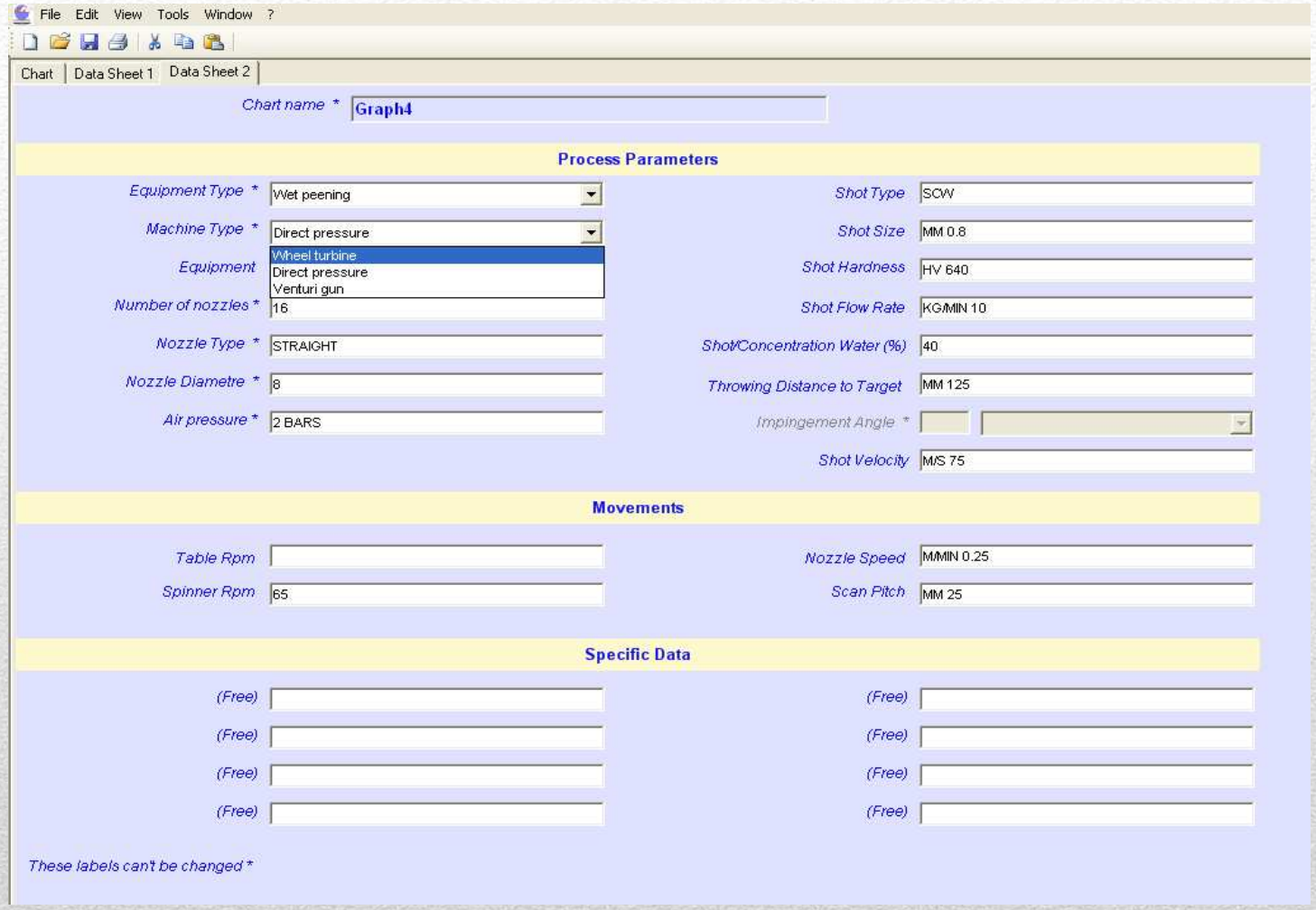
Options & Default Values



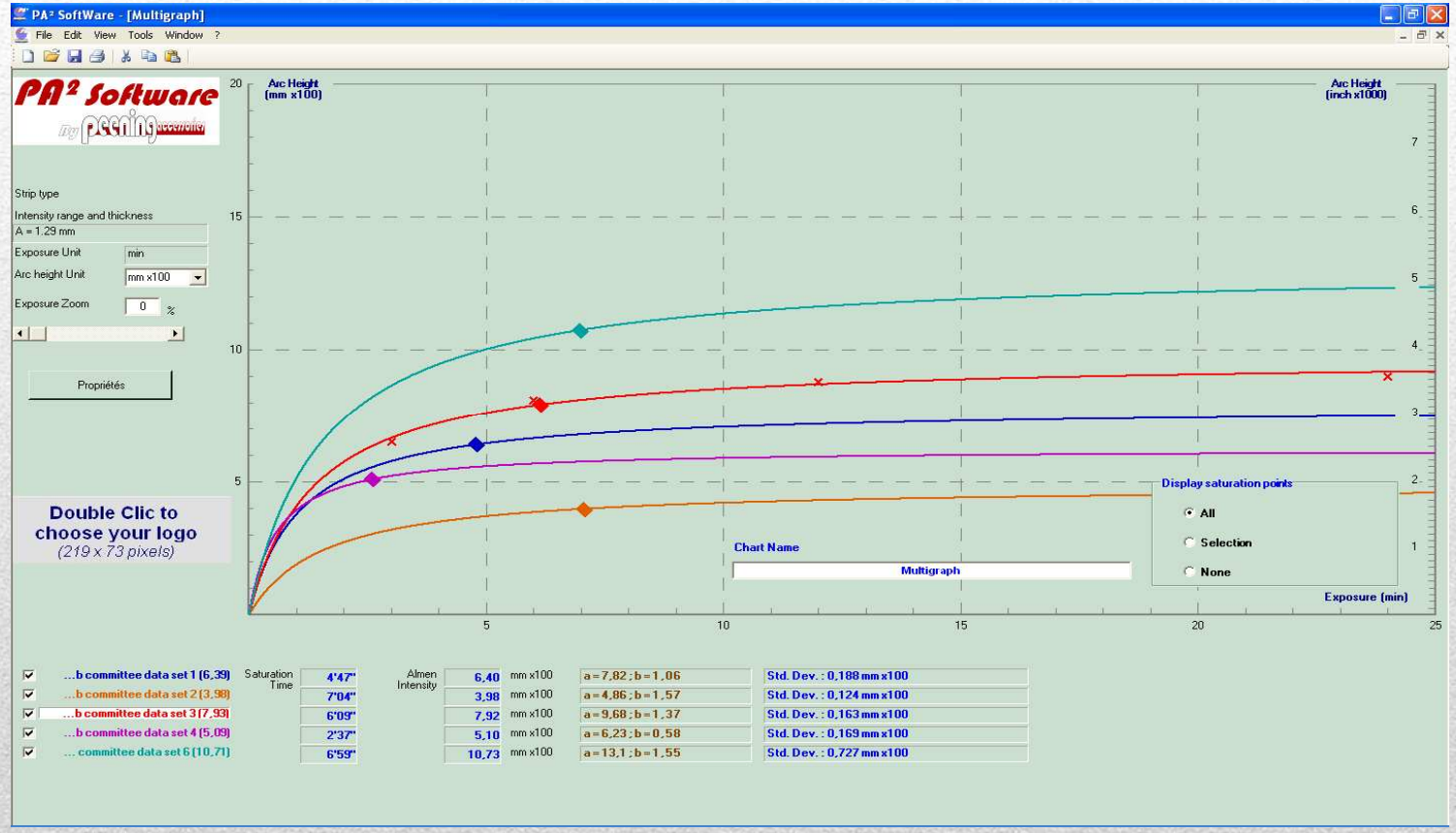
Graphic Chart Layout


File Edit View Tools Window ?
Chart
Data Sheet 1
Data Sheet 2
Chart name * Graph4
Customer Data
Company MY COMPANY
Location THERE
Contractor (end customer) MY CONTRACTOR
Country WORKLAND
Free
Free
Work Part
Assembly Name F2222R ENGINE
Material THE MATERIAL
Part Name MAIN SHAFT
Heat Traitement CASE HARDENING
Reference XQR-VPT-126-44
Hardness HV 1000
Peening Zone ALL AREA AS REQUIRED 10N MM IN THE DRAWINGS
Free
Specification List
AMS
SAE
Others
NA
NA
XK-2264 (PROCESS)
PLGR-B2 (SHOT)
Main Requirements
Almen Strip Type * A = 1.29 mm
Coverage Rate 100%
Almen Strip Quality THE BEST FROM PA
Maximum Roughness µmRa 0.6; µmRz 3
Minimum Almen Intensity * 10
Residual Stress Profile
Maximum Almen Intensity * 60
Compression Depth 0.15 mm
Depht of Compression Peak 0.075 mm
Compression Peak 1300 MPa
These labels can't be changed *
Surface Compressive Stress 1 100 MPa

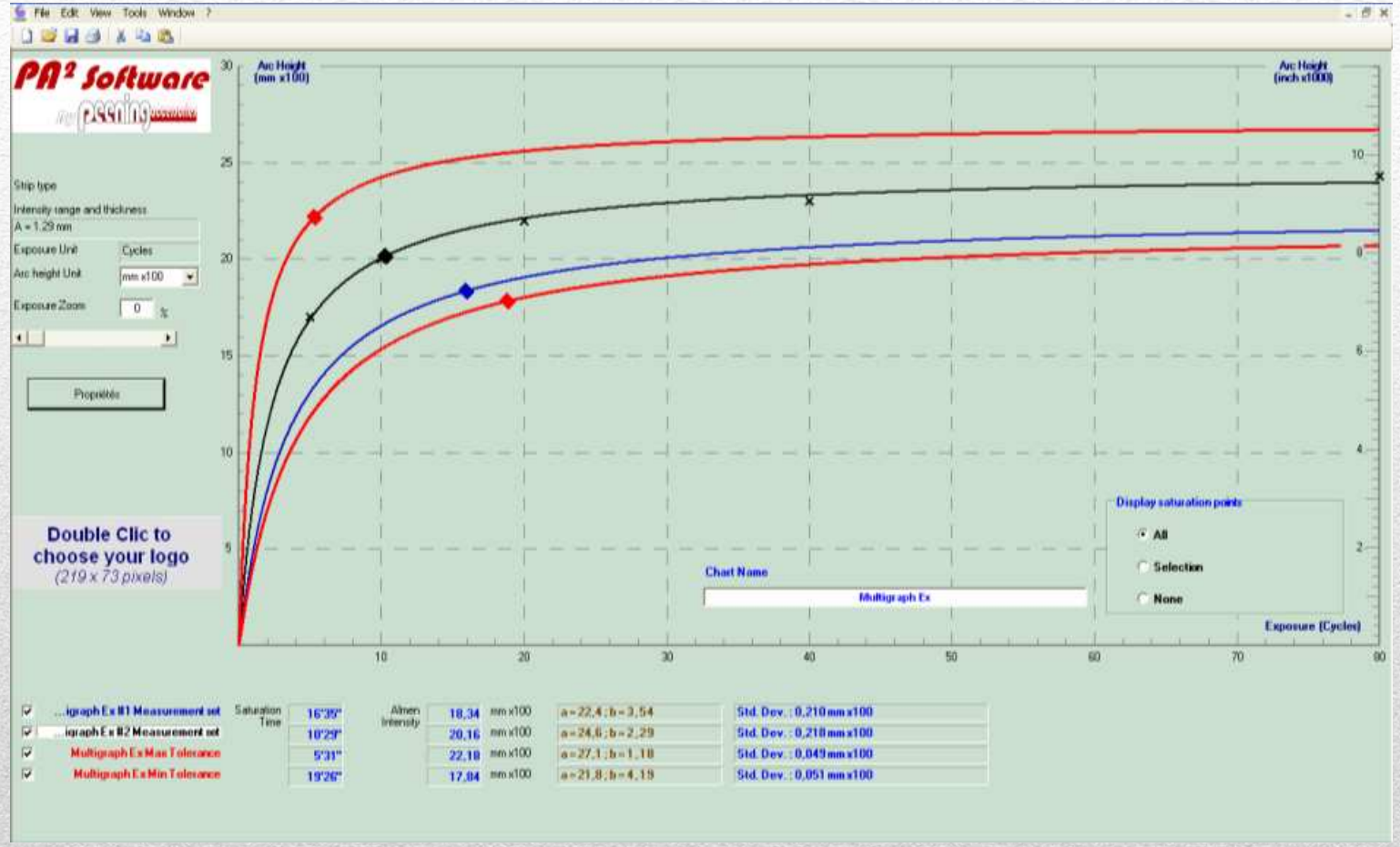
Data Sheet-1


File Edit View Tools Window ?
Chart
Data Sheet 1
Data Sheet 2
Chart name * Graph4
Process Parameters
Equipment Type * Wet peening
Machine Type * Direct pressure
Equipment
Wheel turbine
Direct pressure
Venturi gun
Number of nozzles * 16
Nozzle Type * STRAIGHT
Nozzle Diametre * 8
Air pressure * 2 BARS
Shot Type SCW
Shot Size MM 0.8
Shot Hardness HV 640
Shot Flow Rate KG/MIN 10
Shot/Concentration Water (%) 40
Throwing Distance to Target MM 125
Impingement Angle *
Shot Velocity M/S 75
Movements
Table Rpm
Spinner Rpm 65
Nozzle Speed M/MIN 0.25
Scan Pitch MM 25
Specific Data
(Free)
These labels can't be changed *

Data Sheet-2

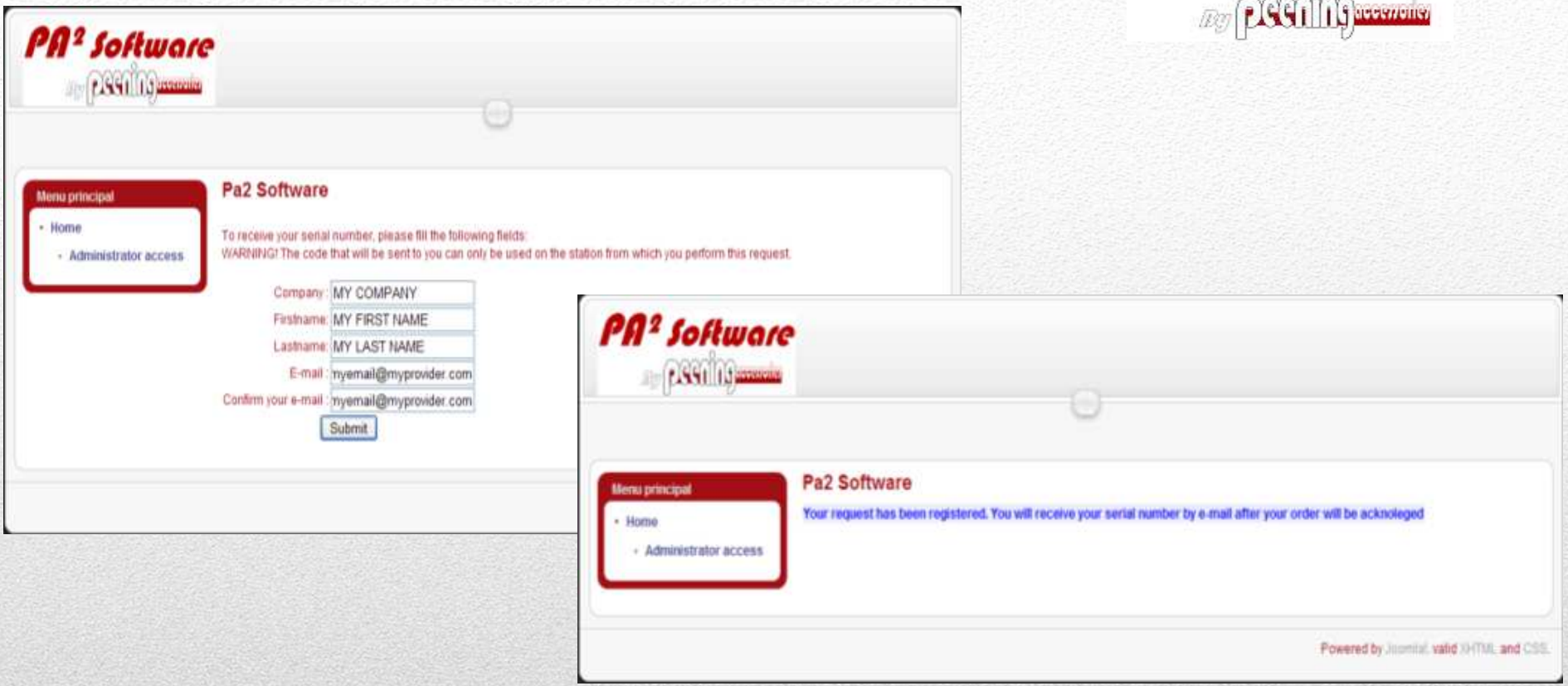


MultiGraph Chart, Ex. 1



MultiGraph Chart, Ex. 2

Downloading Procedure



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…