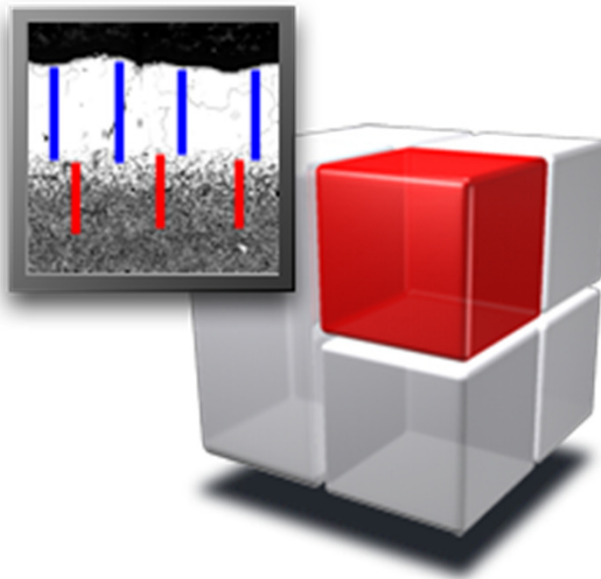
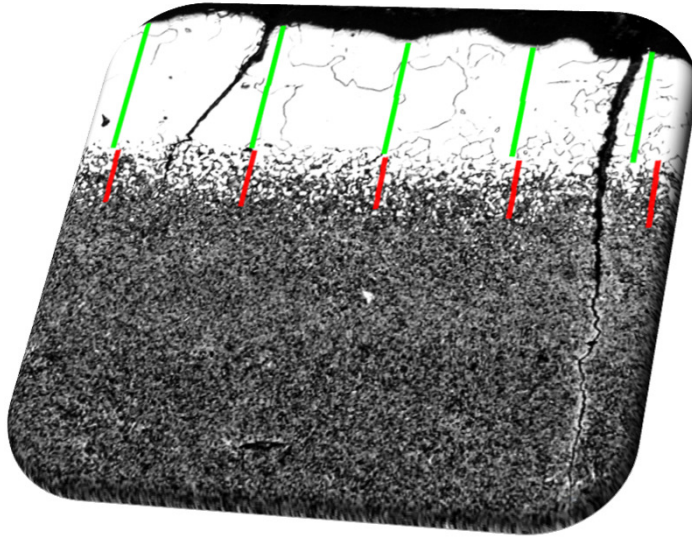


Living up to Life



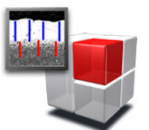
Leica Decarburisation Expert – Briefing

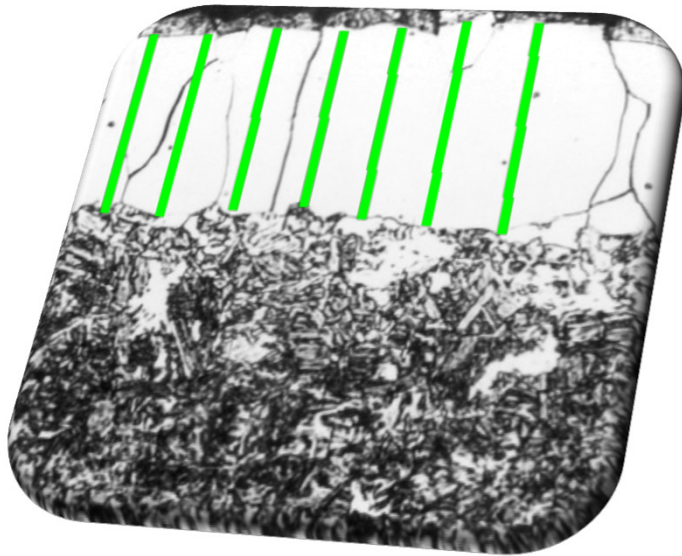
Leica Decarburisation Briefing - Contents



- Application
- Technique
- Images
- Measure
- Results
- Advantages

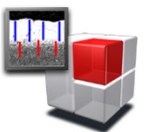
Article No. 12730476
LAS Image Analysis, 12 730 218, is pre-requisite





Application

- To measure the depth of decarburisation



What is Decarburisation?

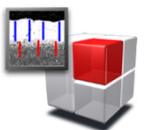
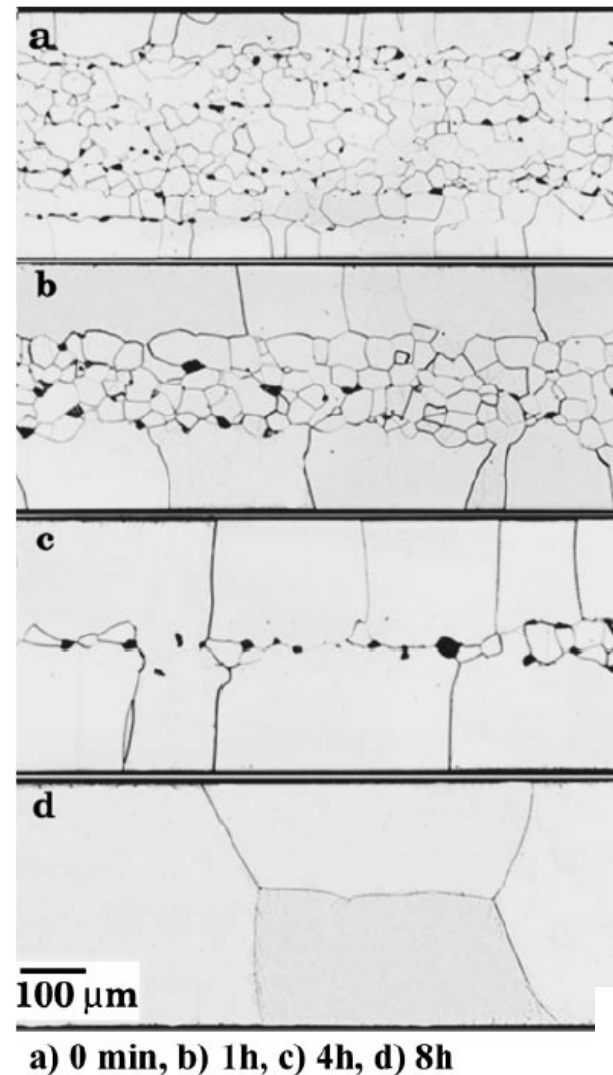
- Due to a prolonged exposure to high temperature of a steel, some changes may occur in the microstructure:

Phase transformations

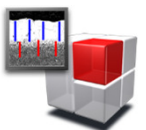
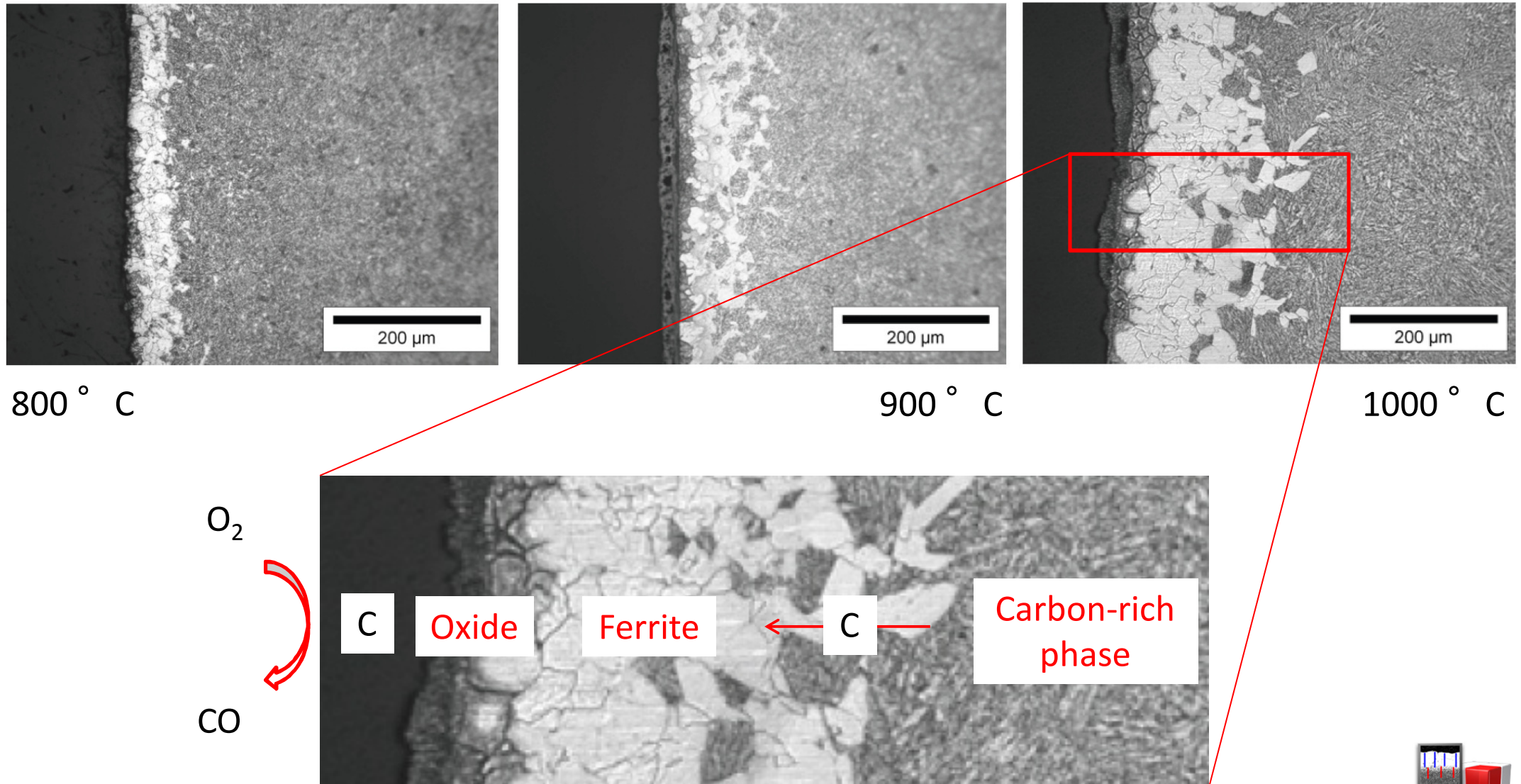
Grain growth

Surface modification

Decarburisation is the loss of carbon of a steel as a result of heating in an oxidizing atmosphere.

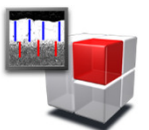
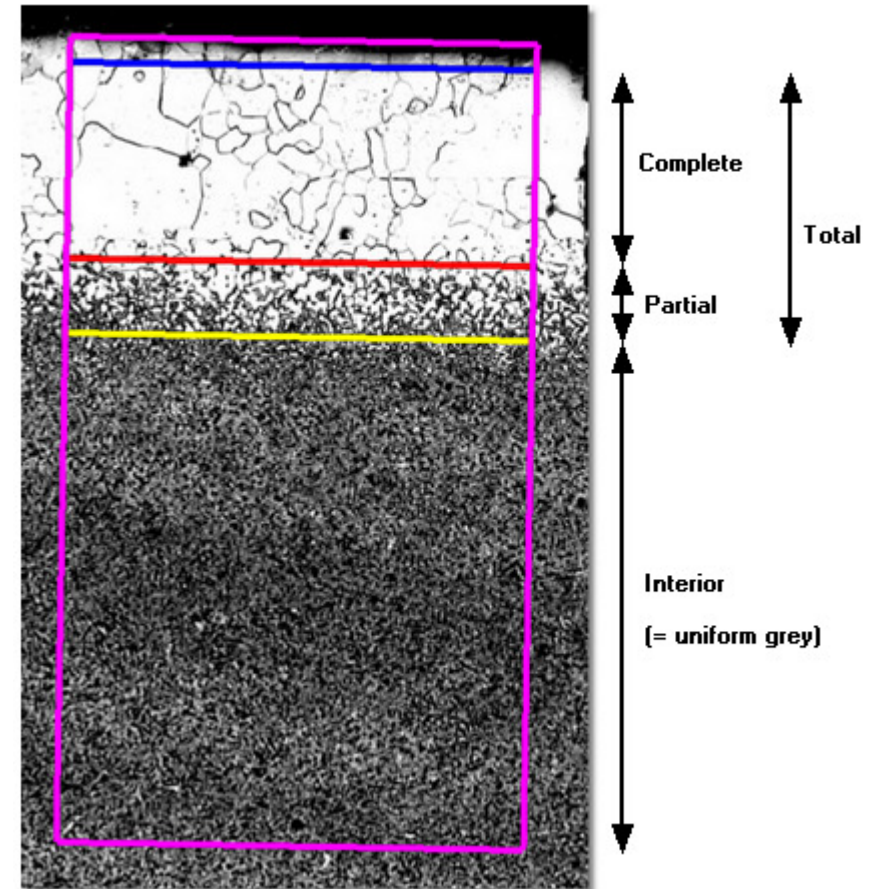


Decarburisation Mechanism



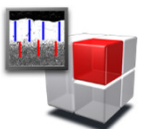
Definitions of Decarburisation Regions

- Complete
 - Loss of carbon content to a level below the solubility of carbon in Ferrite, so that only Ferrite is present. This is the brightest region.
- Partial
 - Loss of carbon is less than the surface and gradually increasing as shown by the gradually decreasing brightness
- Total
 - This is the region furthest from the surface, where the grey level has become uniform



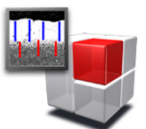
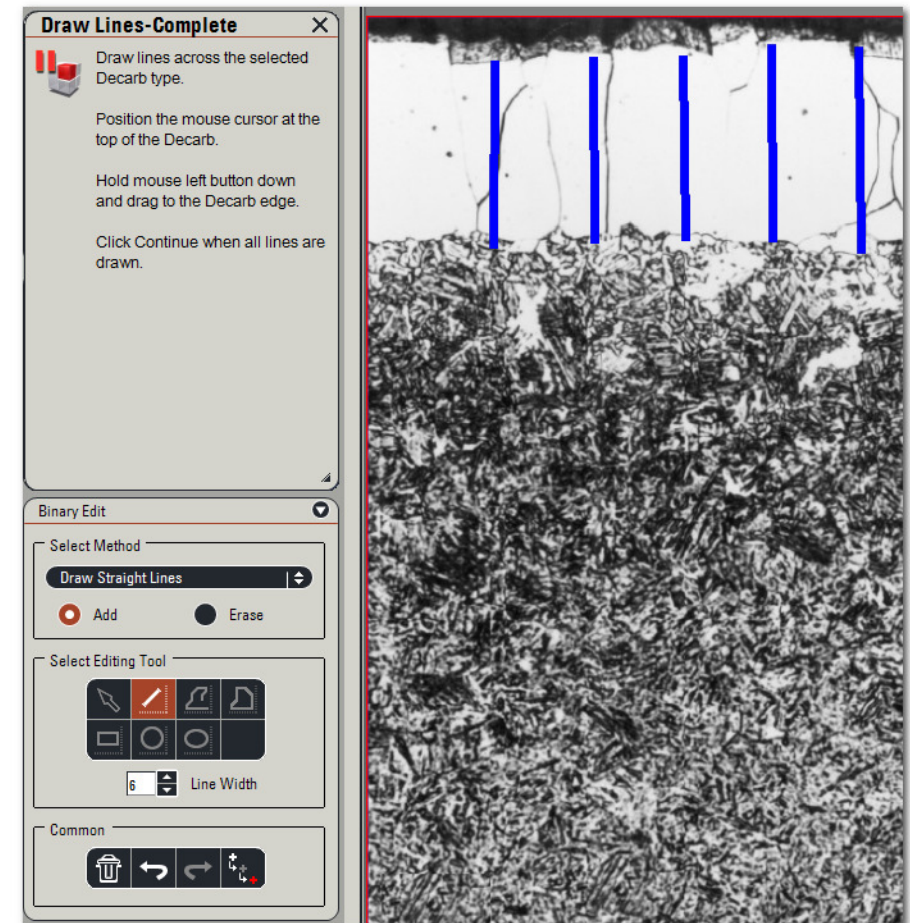
Measurement Methods

- In Manual mode
 - user indicatea the decarburisation regions by drawing lines on a digital image; the lines are measured and averaged to give the decarburisation results.
- In Automatic mode
 - the depth of decarburisation is averaged over a defined region by interpreting the difference in the etching contrast shown as image brightness variation.



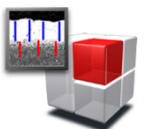
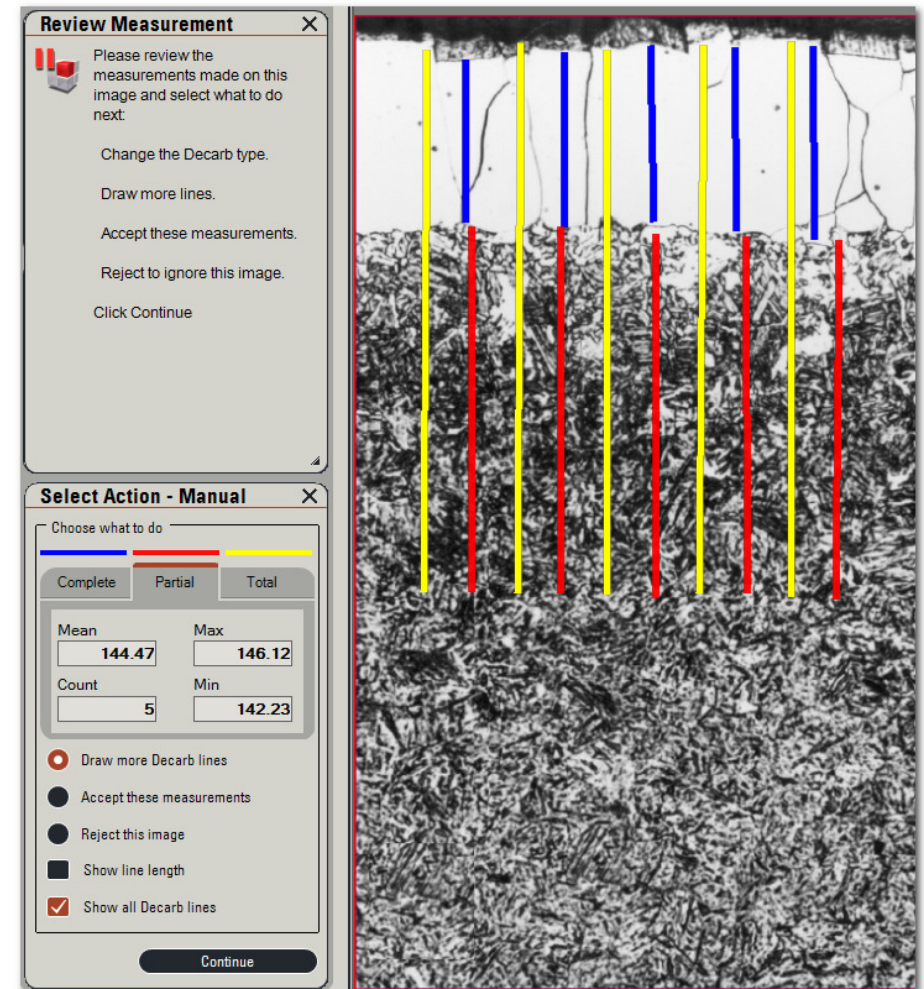
Manually Drawn Regions

- User selects a type of region
- User draws lines across the region and perpendicular to it, using the mouse
- The lengths of these lines are measured and the mean values are the Depth of Decarburisation for each region



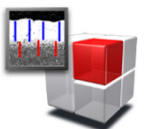
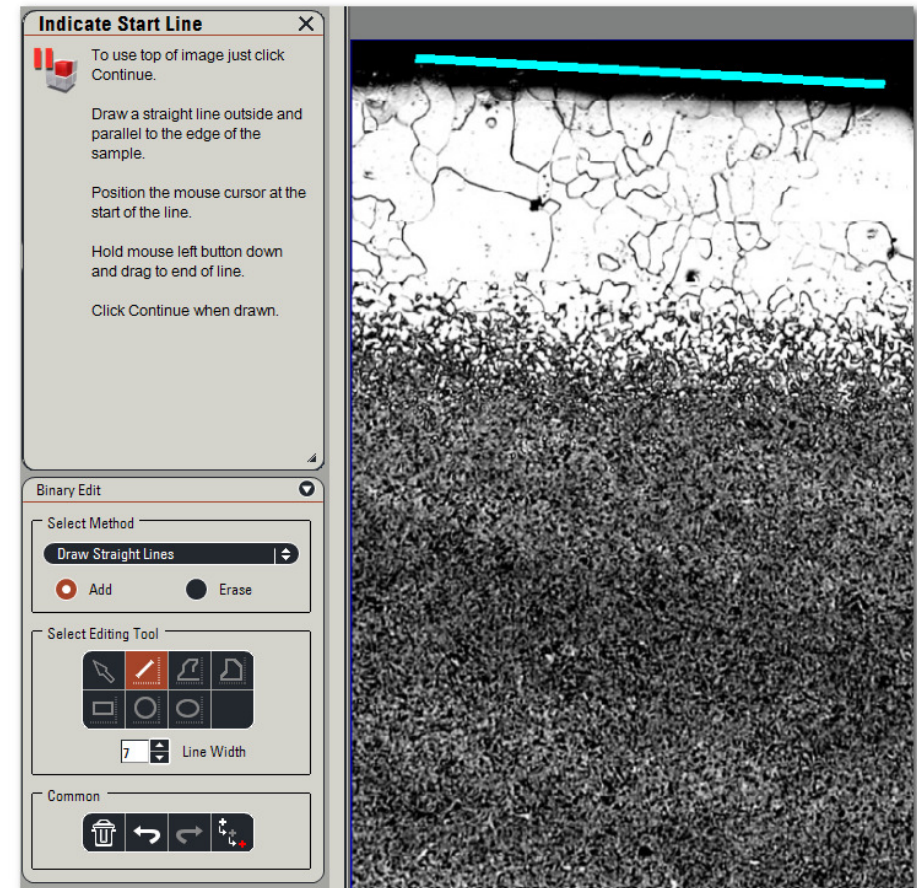
Manually Drawn Regions - Result

- User can add more lines for the 3 types of region
- All types of region can be shown on the image
- Line length can also be displayed



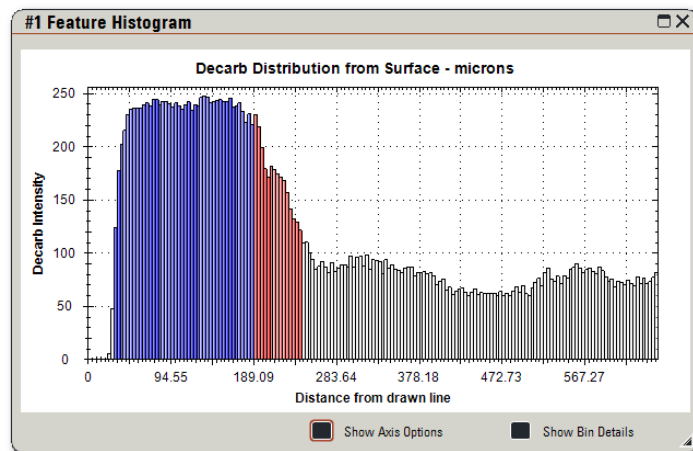
Automatic Region Detection

- Check alignment
 - If image is aligned horizontally, simply continues
 - If image is tilted, user draws a line parallel to the specimen surface
- Regions calculated
 - Software measures the grey profile perpendicular to the surface
 - From the profile the regions are estimated
- User can edit positions of lines for fine tuning

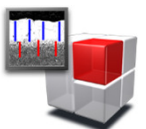
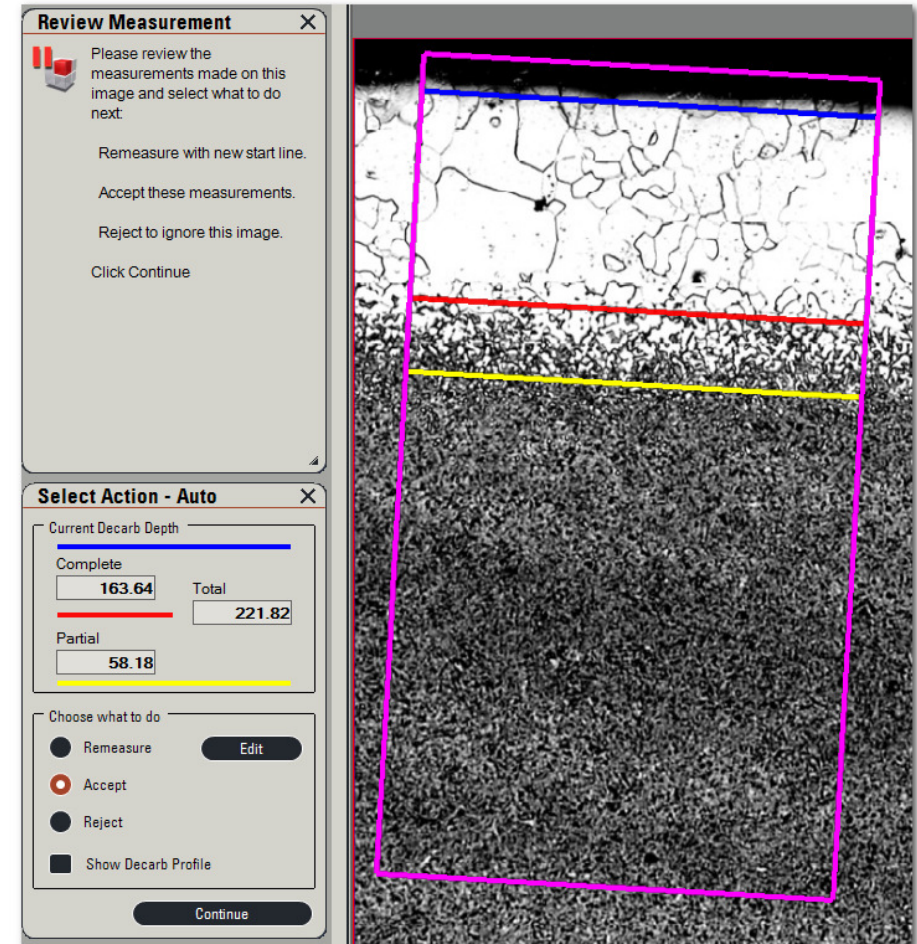


Automatic Regions

- The region measured is shown
- The decarb regions are indicated
- User can Remeasure, Accept or Reject the result

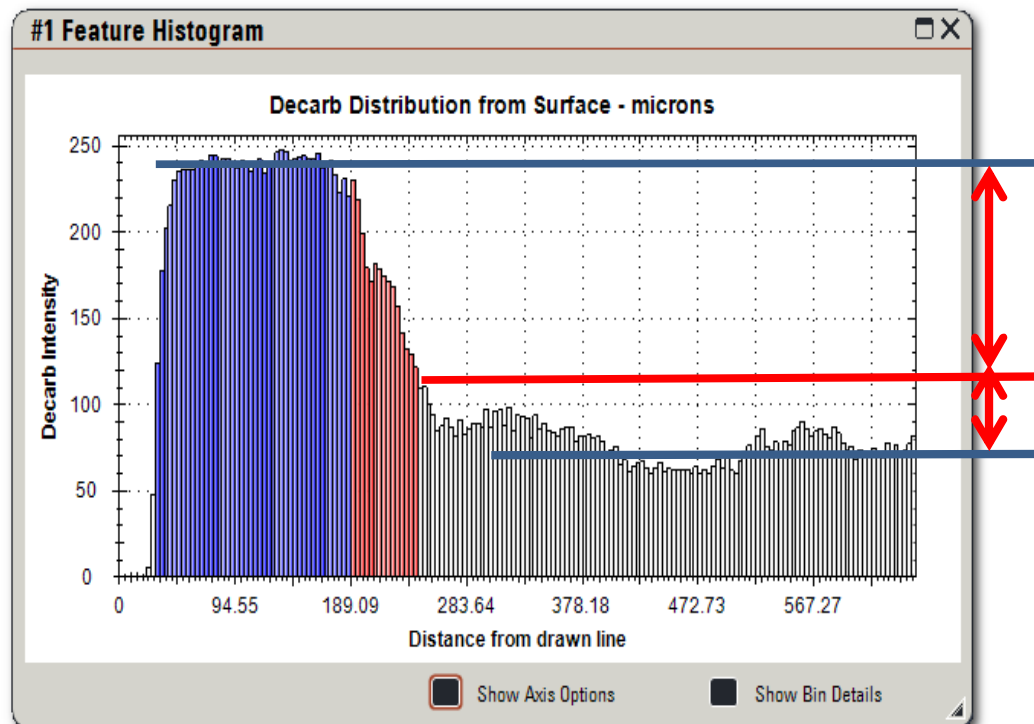


Typical Profile showing Decarb regions



Partial Value%

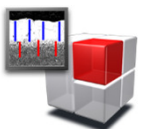
- How do we know that the Partial region has ended and the Interior or Total region starts? Particularly as the Interior may vary considerably. A cut-off is calculated as follows where the Partial Limit is a user entered value:
- Partial cut-off =
Average grey level in the interior Total region +
Partial Limit *
(Average grey level Complete region - Average grey level Total region)/100

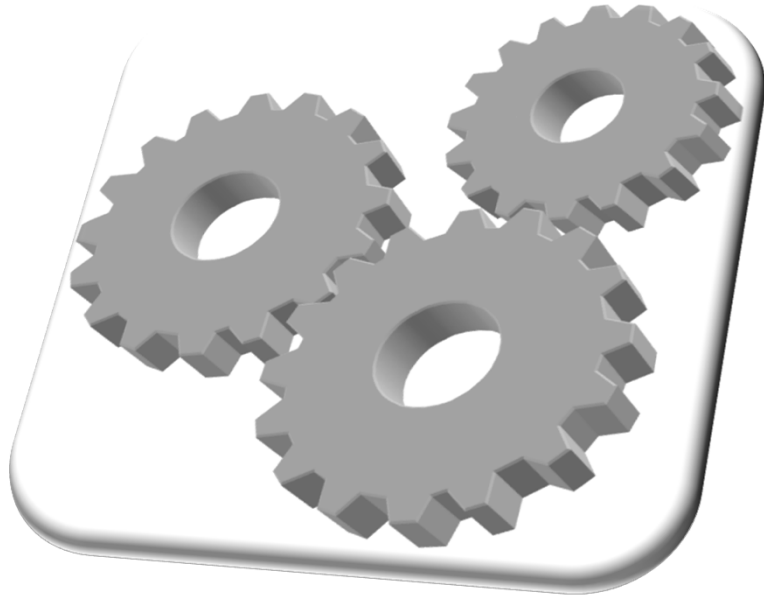


Average Complete Region

Partial cut-off

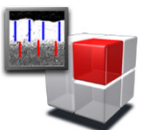
Average Interior Region





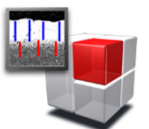
Technique

- Digital images acquired from a Leica microscope are analysed by application software based on the Leica Application Suite



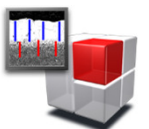
Instrumentation

- Specimen is imaged by a Leica microscope
 - E.g. Incident light with x10 objective
- Leica Digital Camera views and acquires images
 - Resolution 1280 x 960 is sufficient
 - Normally Monochrome image is used (Colour also OK)
- Leica Application Suite with Windows PC
 - Micro-imaging software integrates microscope and camera
 - You will be impress by how easy it is to use
- LAS Decarburisation Expert
 - The Leica App for Decarburisation analysis
 - Excel for report generation is additionally required



Leica Application Suite - Core

- Integrates microscopes, digital cameras and application software
 - Optimises the imaging experience
- Uses the computerised features of Leica microscopes
 - to automate the digital-microphotography environment
- Friendly appearance with convenient operation
 - Reduces complexity and improving efficiency
- Produce excellent images
 - with a high-level of reproducibility and versatility



Decarburisation Analysis Procedure

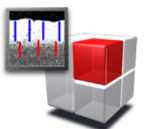
1. Acquire Decarb images

- Prepare specimen so the Decarb regions are clear
- Acquire representative number of digital images, this will depend on specimen but is probably 1 to 5.

2. Perform Analysis

- Use manual or automatic method

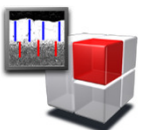
3. Create Report





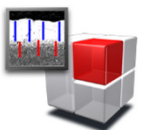
Acquire Images

- Uses LAS to take images
- Microscope conditions
- Grab images in known folder



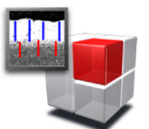
Acquire images - Preparation

- Check microscope
 - Correct filters, objective, uniform illumination
- Select objective or zoom
 - Example - x10 brightfield, reflective
- Check system calibration
 - Normally taken from selected objective
- Load specimen and ensure it is flat
 - Bring into focus and check preparation is good



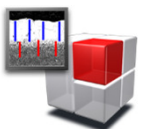
Acquire Image - Camera

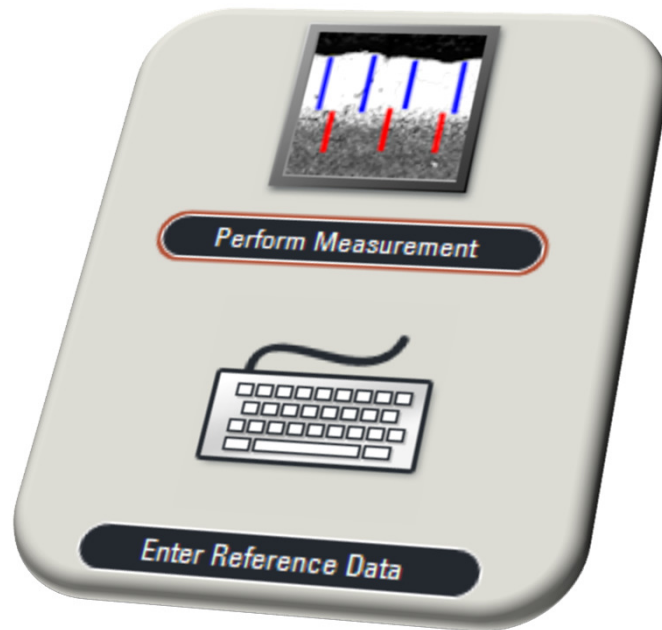
- Image type
 - Monochrome is often appropriate
 - A colour camera can be used
- File type
 - Save images as .tif to preserve detail
- Ensure no image saturation
 - Use under/over exposure indicator
- Check shading correction is set
 - Use a blank, clean slightly out-of-focus field



Acquire Images – Grab Images

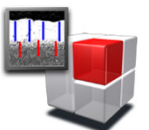
- Create folder to store images for this application
 - Use LAS navigator to do this from live image
 - Give the folder a name appropriate to the sample
 - Set this folder as the capture folder
- Decide image selection strategy
 - Number of images required and where they are selected from
- Move to first position
 - Check focus, do not change exposure or illumination
 - Do not use auto-exposure
 - Capture images as required





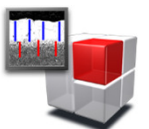
Measure Images

- Using LAS Decarburisation
- Settings – choose method
- Measure



Before you start - Use of the Gallery

- Before starting LAS Decarburisation, make sure you can access your images by selecting the folder where they are stored so they are seen in the Gallery
- If you want to select a folder while LAS Decarburisation is running make sure that you have a FLOATING Navigator before starting
 - Float the Navigator from Browse by dragging it away from its 'parked' position.

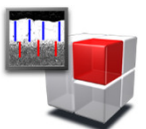
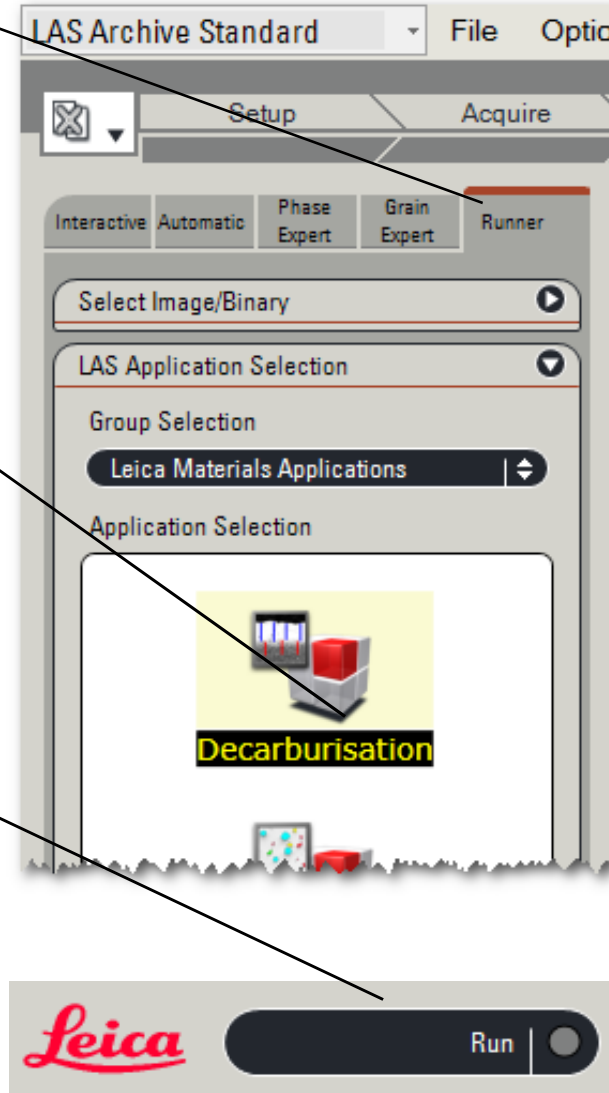


Measure Images - Prepare

Select Analysis ->
Runner

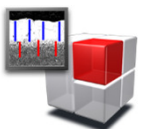
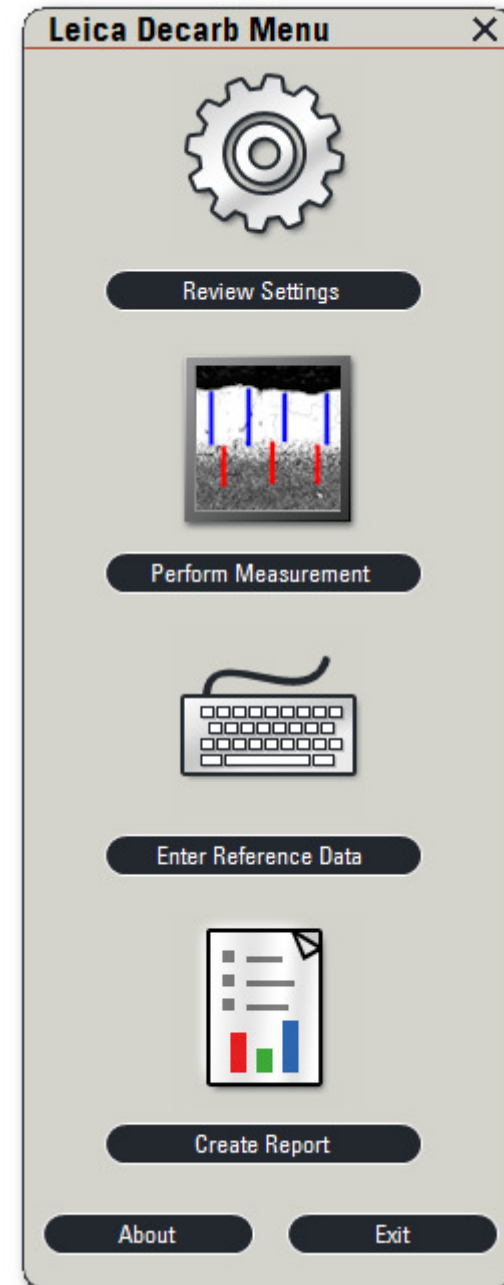
Select Decarburisation
App

Click Run

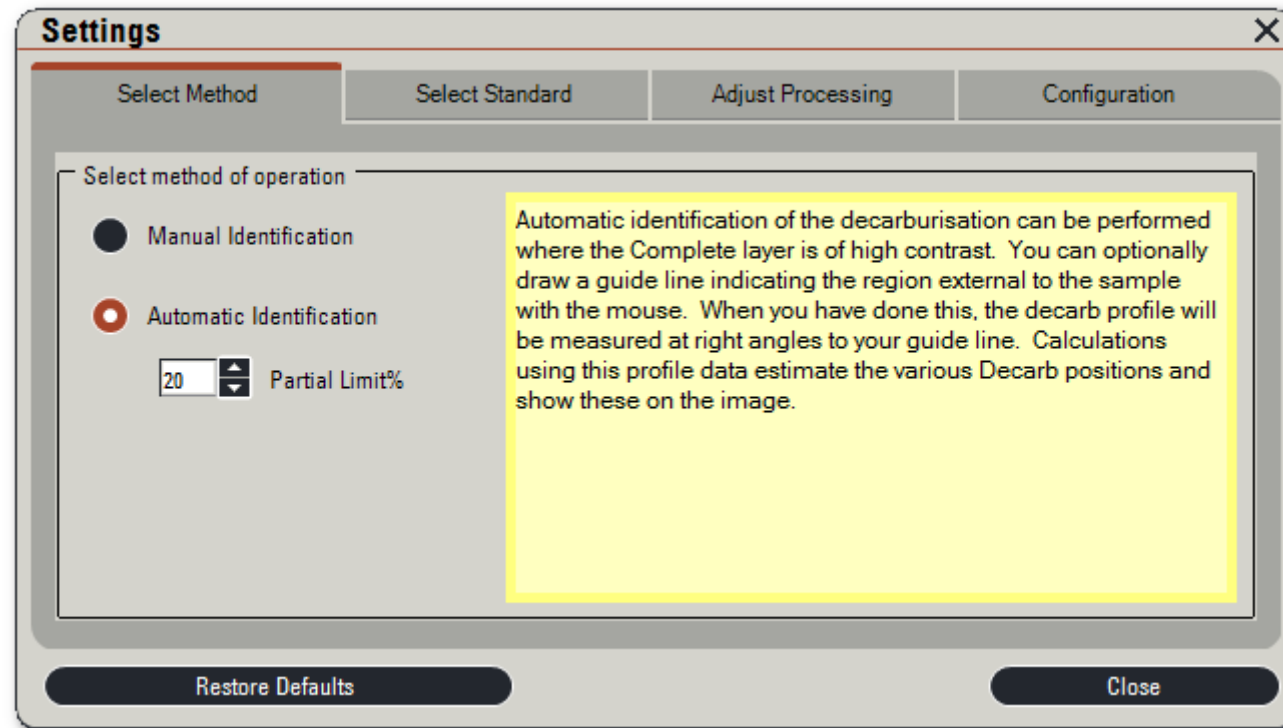


Leica Decarb Main Menu

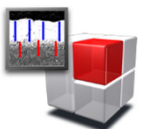
- The App Menu appears and shows the 4 main tasks
 - Review Settings
 - Perform Measurements
 - Enter Reference Data
 - Create Report



Review Settings



Select Method – Select Standard – Adjust Processing - Configuration



Measure

- This panel is used to
 - Start the measurement
 - Display a summary of results
- No measurements have been made so far
- Click the Select and Measure button to be guided through the measurement sequence

Measure - Auto ✕

Select and Measure Images

Method - Automatic Identification

Standard - None

Select and Measure

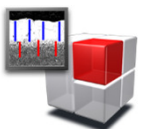
Decarb Depth Summary

	Current	Mean
Complete		
Partial		
Total		

Units - microns

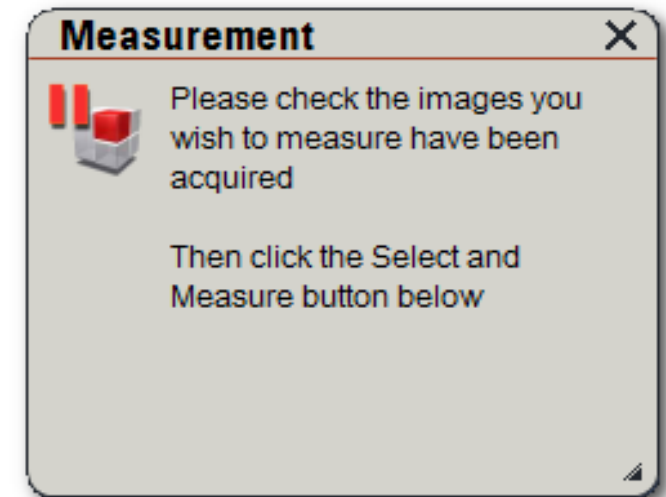
☐ Show Details

Back to Menu

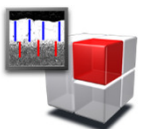


Measure Steps

- Select 1 or several images from gallery
- Measure decarb regions
- Accept / Edit / Reject measurements
- Repeat for all images
- The following slides illustrate the procedure



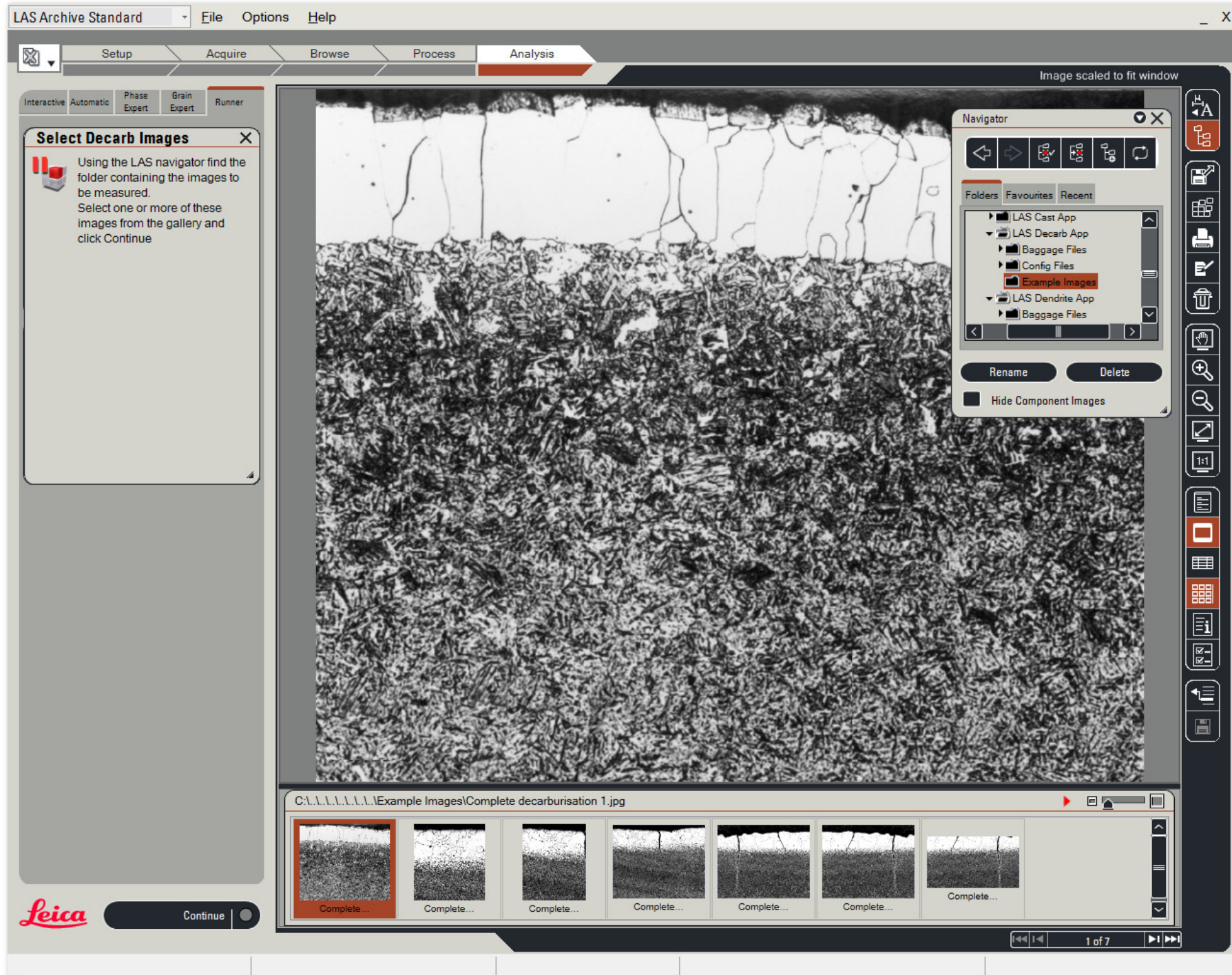
- At each step of the analysis a short message is shown in a panel as illustrated



Select Images

Leica

STEMS



Automatic Method Result with Edit

LAS Archive Standard File Options Help

Setup Acquire Browse Process Analysis

Image scaled to fit window

Interactive Automatic Phase Expert Grain Expert Runner

Review Measurement

Please review the measurements made on this image and select what to do next:

- Remeasure with new start line.
- Accept these measurements.
- Reject to ignore this image.
- Click Continue

Auto Method - Edit

Adjust Decarb Boundaries

	Sample Edge
Complete	6.80
End Complete	82.52
End Partial	113.59

Continue Cancel

Current Decarb: Complete 6.80, Partial 82.52

Choose what to do:

- ☐ Remeasure
- ☒ Accept
- ☐ Reject
- ☐ Show Decarb Profile

Continue

Leica

1 of 7

Summary Results

Measure - Auto ✕

Select and Measure Images

Method - Automatic Identification

Standard - None

Select and Measure

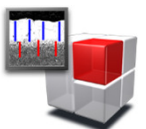
Decarb Depth Summary

	Current	Mean
Complete	75.73	75.73
Partial	31.07	31.07
Total	106.80	106.80

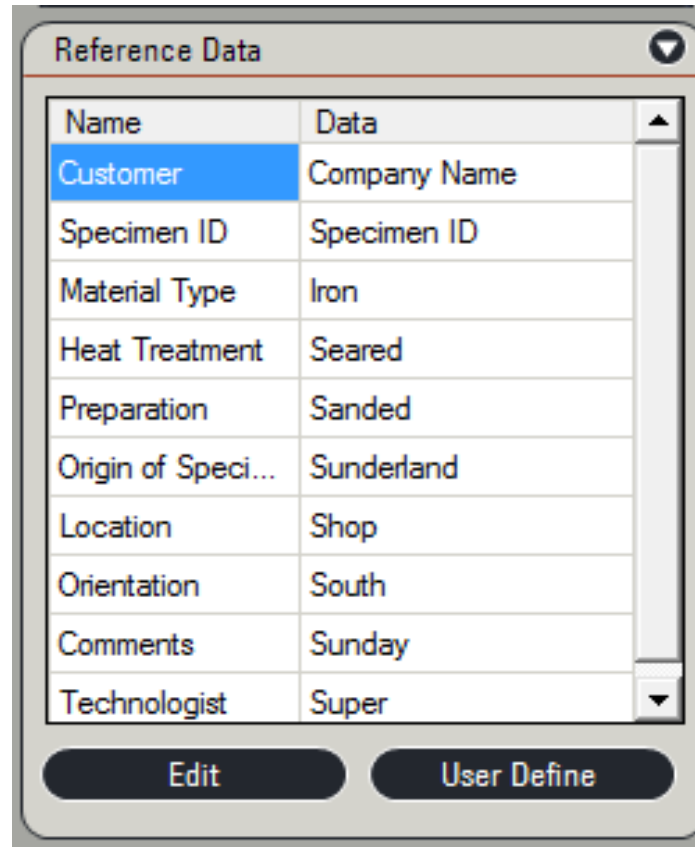
Units - microns

☐ Show Details

Back to Menu



Reference Data

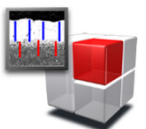


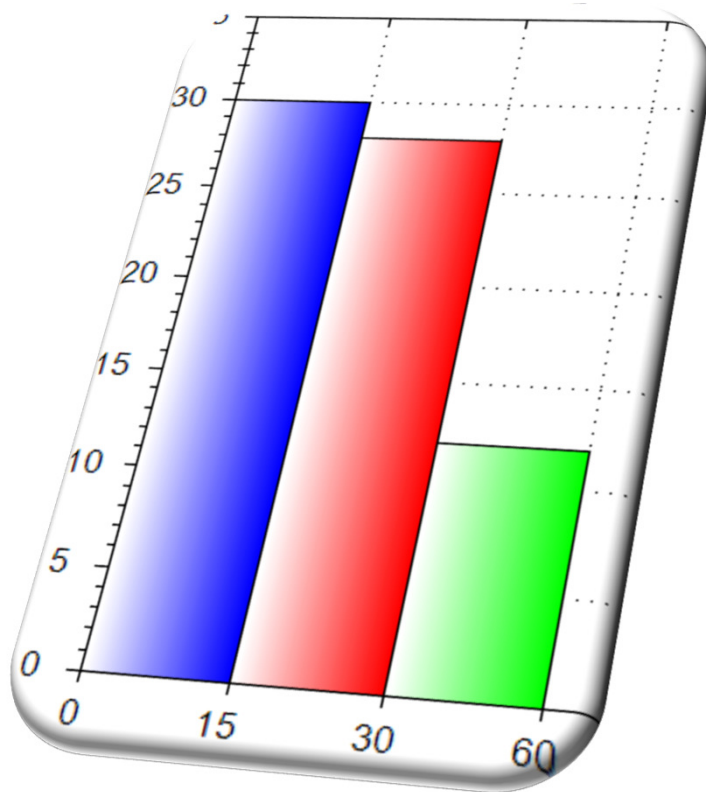
A screenshot of a software dialog box titled "Reference Data". It contains a table with two columns: "Name" and "Data". The "Customer" row is highlighted in blue. Below the table are two buttons: "Edit" and "User Define".

Name	Data
Customer	Company Name
Specimen ID	Specimen ID
Material Type	Iron
Heat Treatment	Seared
Preparation	Sanded
Origin of Speci...	Sunderland
Location	Shop
Orientation	South
Comments	Sunday
Technologist	Super

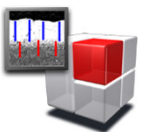
Edit User Define

The reference data fields
can be customised as
required

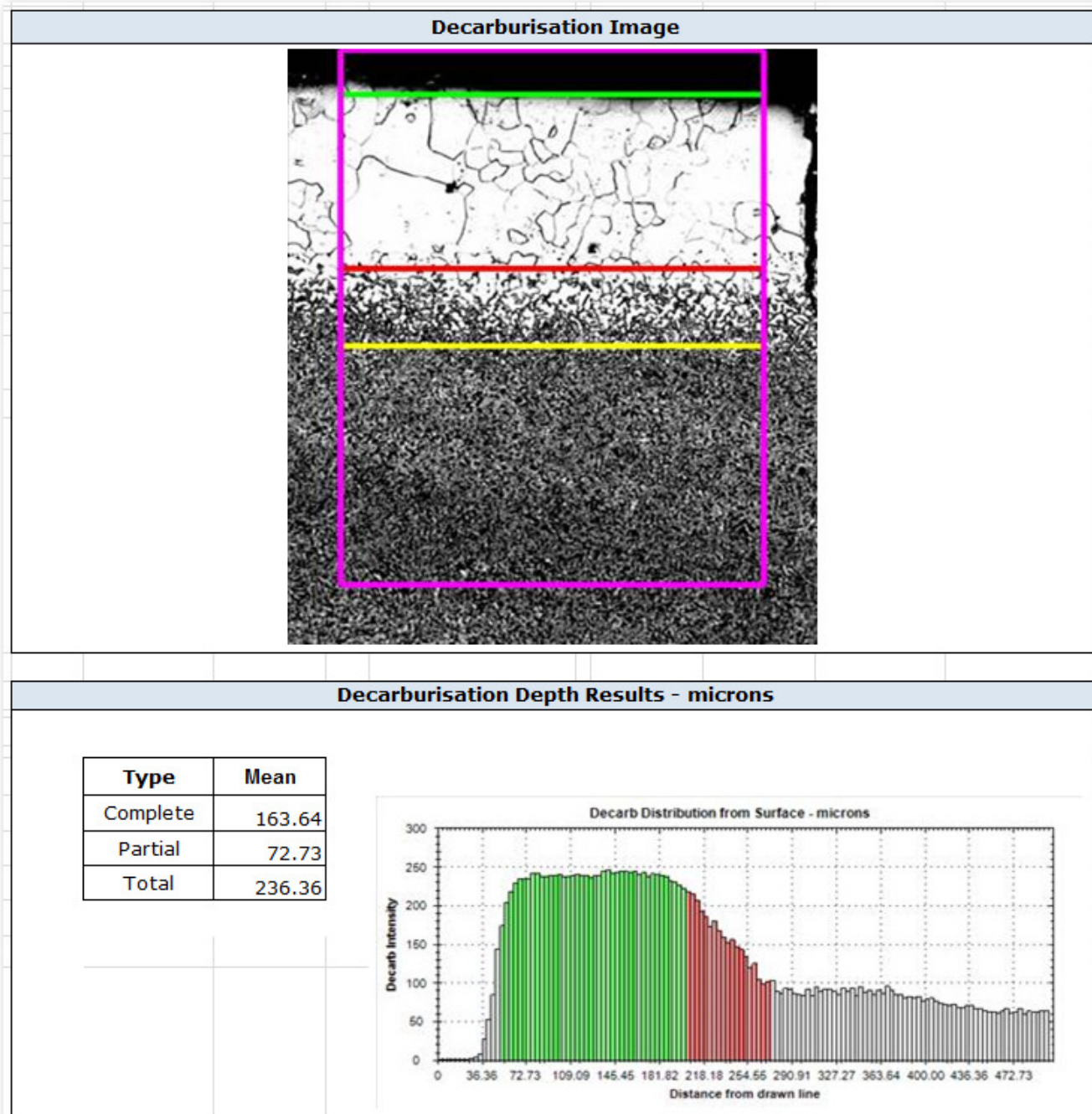




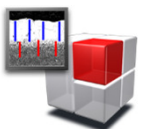
Results



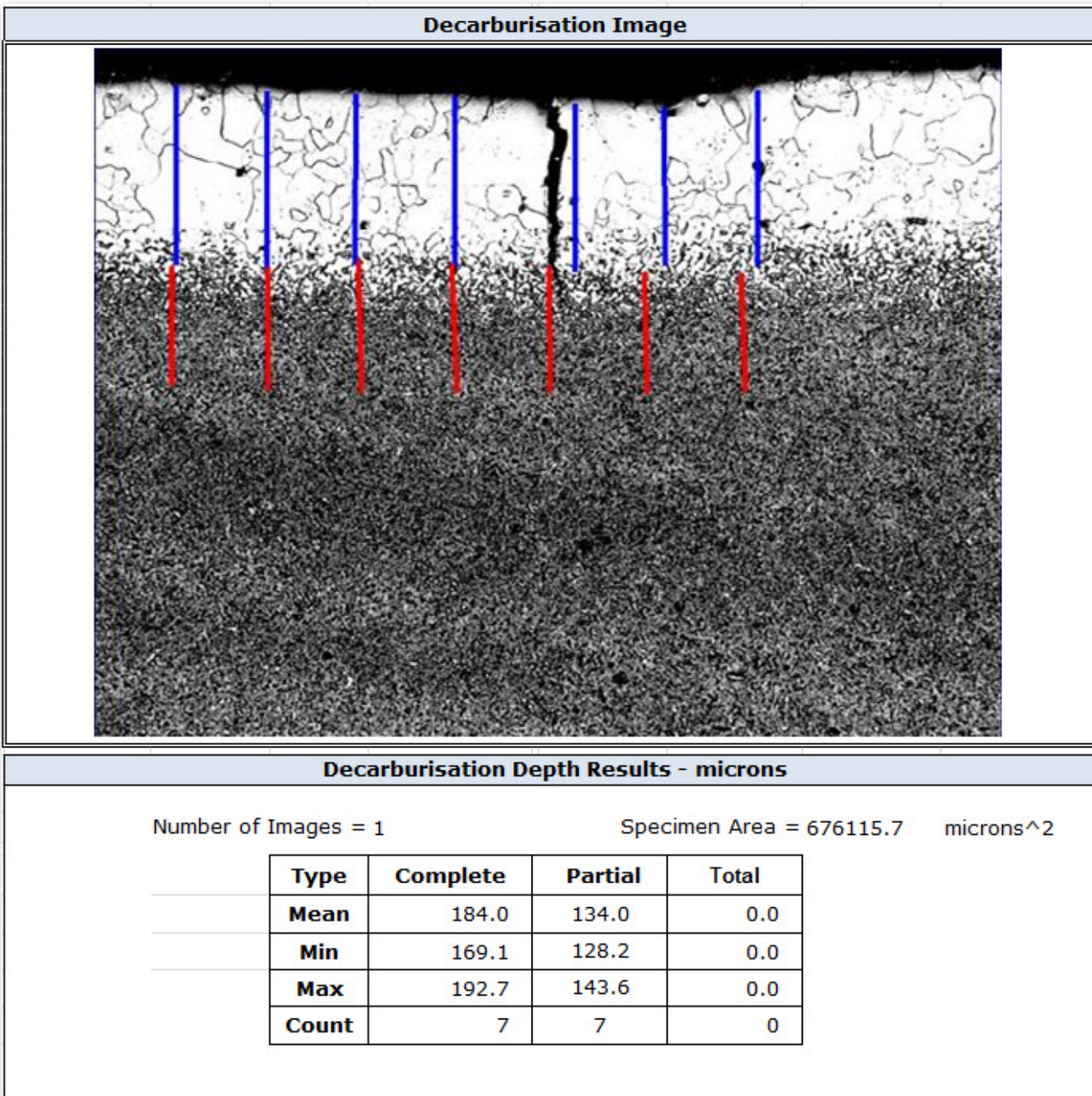
Report in Excel - Automatic Method



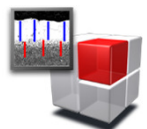
All data is saved to Excel so further calculations can be performed as required

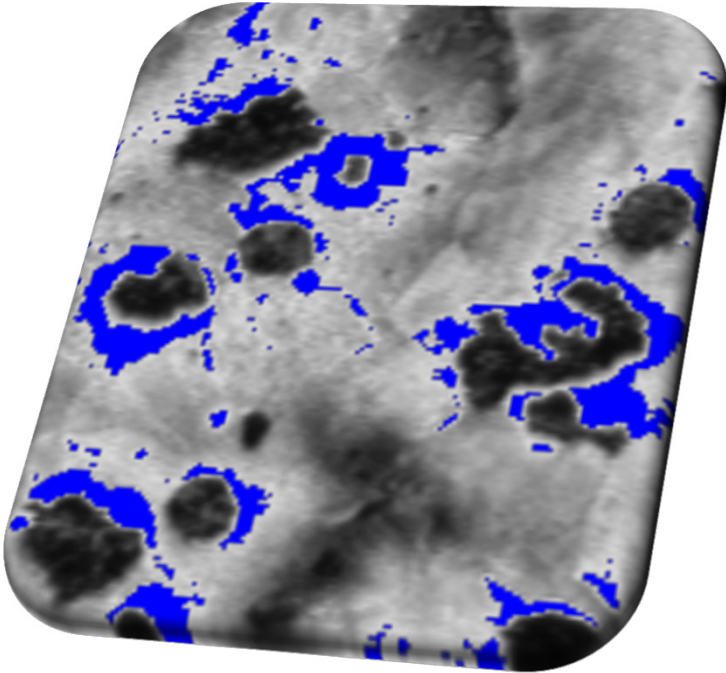


Report in Excel - Manual Method

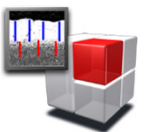


All data is saved to Excel so further calculations can be performed as required



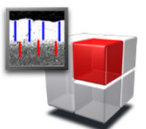


Advantages



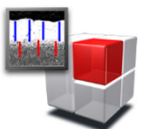
Feature List

- Step-by-step guided operation
- Interactive settings
- Settings stored in named configurations for easy recall
- Include specimen details and reference information with results
- Simulation of standards including:
 - ASTM E1077 - Standard Test Method for Estimating the Depth of Decarburisation of Steel Specimens
 - ISO 3887 - Steel Non Alloy and Low Alloy Determination of Decarburisation Depth
 - JIS G0558 - Methods form Measuring Decarburised Depth of Steel
 - DIN 50192 - Determination of the Depth of Decarburisation
- Manual and Automatic methods
- Display of decarburisation regions on screen
- Display of profile showing the variation of decarburisation with position into the sample
- Accumulation of results over multiple images
- Display of individual results for each image
- Customisable Excel results template

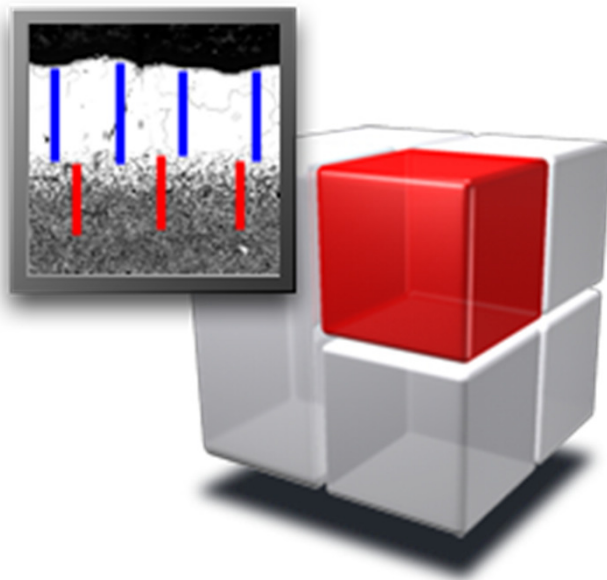


Leica for Materials Analysis

- Enables many samples to be analyzed quickly and consistently
 - Without taxing operator endurance or objectivity
- The application is ready to use
 - To get you up and running immediately
- Measurement software gives high sample throughput
 - User remains in control to confirm results
- Images are saved before analysis
 - You can always review your results even if specimen no longer available



Leica Application Suite



Leica
Decarburisation
Expert
Thank You

