

Major news

New "Movie & Time Series Analysis" Module Now, you can create movie and slide shows by SPIP(tm)

- Combine different views:
Top View image, Difference image, 3D view.
 - Export window views or screen to AVI or MPEG: Single View or Screen dump.
 - Include Zoom, Cross section profiles, Histograms, Cross Section Fourier.
- Drift correct images to keep fixed surface objects steady.
- New function for aligning all images to the Main Image and correct for drift.

File Input / Output

- Implemented force curve for PSIA *.txt files
- Implemented Reading of SPIP ASCII files *.asc
- Implemented Aarhus CAMP movie format, *.bio
- Corrected reading of older Zygo formats

Miscellaneous

- Optimized image drawing performance
- Automated color scaling by Quantiles
- Gradient images, X, Y and Gradient Normal images are now quantified in degrees.
- Abs function implemented.
- Roughness now also include Fourier based parameters without selecting Fourier transform first.
- Roughness calculation faster for large images.
- Align All Image function for drift compensation of images series.
- Plug-in programs can now force new images to be shown in the Main Image Window
- Printouts will contain basic roughness parameters when they have been calculated.

Corrections

- Corrected Average PSD curves which was equal to Average Fourier amplitude curve.
- Roughness parameters associated with the Fourier image are now independent of view mode (e.g. Amplitude, Power).
- Roughness Sdr calculated without taking void pixels into calculation.
- Corrected Save 1:1 bitmaps of images containing no color bar.
- Solved Rotation XRange/YRange errors for rectangular images.
- Repaired amplification in filter menu.
- Repaired Save 3D settings.
- Solved GDI resource leaks in Windows 98, ME, occurring in SPIP version 3.0.1.4-3.0.1.6.
- Corrected writing of Void and Material Volume in histogram.

- Corrected occasional wrong direction of semi circle indication in Tip Characterization and Radius of Curvature measurements.
- Corrected Misbehavior of interactive Fourier Filtering by threshold markers.
- Corrected wrong z-range when changing z-range in image properties dialog twice
- "Apply when Loading" in Plane Correction now also includes Line wise correction when surface fitting is

Version 3.0.1.0 Major new implementations, Version 3.0.0. - 3.0.1 (Released Sep 30, 2003)

Major news

The Sniffer

The Sniffer enables you to monitor and process data files automatically when new files are put into a defined Sniffer Folder. This way SPIP can automatically process data from your instrument whenever they are generated. The Sniffer is part of the Basic module, but you will experience its full automation power when combined with the Batch Processor and the ActiveReporter.

Batch Processing

It is now optional to reset statistical results between individual batch processes.

File Input / Output

- You can now from the menu bar select how you want to open files:
 - By the ImageMet Explorer
 - By the Heuristic File Importer, which now also have a browse functionality added
 - By a plain file open dialog.
- When saving image windows to .bmp, .tiff and .jpg it is now optional to save the images with the same resolution as the original image or with the actual resolution of the window.

New File Formats

- ATOS .mmd
- ATOS .Plu
- NanoMagnetics .sif
- Nanonics .img

Corrections

Due to change of development environment there has been a number of unforeseen problems in version 3.0.0.0, which are now corrected, see below:

- Failure to start on some Windows 2000 systems
- GDI Resource leaks causing program to stop after a while on Windows 98 and Windows Me
- Problems when saving Filter and 3D settings on Windows 98, Windows Me and NT
- Copy & Paste failure on Windows 98 and Windows Me
- Potential crash when closing Grain Analysis and Batch Processing dialogs

- Potential crash when Saving curves into ASCII or BCR format.
- Failure when exporting 3D animation with empty file name string and file names with spaces.
- Potential failure when saving 3D settings
- Wrong reading of some Molecular Imaging files
- Unable to read Omicron CITS files
- Potential failure when loading NanoScope files with long path name
- Wrong reading of Seiko current and voltage images
- Wrong reading of SIS multi image files
- Wrong reading older Asylum multi image files
- Heuristic file importer dialog closing on Enter key
- Heuristic file importer: incorrect reading of unsigned data files with extreme values
- Undesired tiling of image windows containing images with differing x and y units
- Undesired color bar selection when having multiple images with different color bars
- Failure to recall Filter settings from files
- Incorrect behavior of "New Folder" function in ImageMet Explorer
- Inactive short cut keys in ImageMet explorer
- Failure when plane correcting with line-wise polynomial order set to nine
- Potential crash when opening Fourier Dialog after Unit Cell detection and with no color bar defined.
- Incorrect title captions of windows after changing input file
- White lines at borders when exporting images to tiff, bmp and jpg formats
- Wrong x-range in profile windows when x- and y-units of the associated image differs.
- Wrong x-offset value in zoom images when x- and y-units differs
- Potential crash when initiating the Batch Processor from a Plug-in without having the Batch Processor open

Version 3.0 Major new implementations, Version 2.32-3.00 (Released July 16, 2003)

Batch Processing & ActiveReporter

- New ActiveReporter for customized reporting to Microsoft Word documents. Define the contents and layout of the by templates. Together with the Batch Processor, you can generate detailed reports for each image and curve file, and include statistical summaries.
- New Batch processing dialog for easier control of HTML and MS Word reports

File Formats

- Asylum Research (.ibw), new implementation
- PSIA (.tiff)), new implementation
- Anfatec (.int), new implementation
- Omicron, updated
- Seiko, now supporting current images
- Molecular Imaging, Corrected reading of multi image files
- SIS, Corrected Z-scaling of multiple image files
- KLA-Tencor, updated reading of .3dd formats
- Toray, Y-mirroring corrected
- DI NanoScope, Updated to file version 0x05120000

1D Graphs

- Automated radius of curvature measurement
- Measurement markers enabled in log-log graphs
- Corrected Z-scale of 1D Fourier, 1D Average FFT, and 1D PSD curves

Void Pixels

- Possible to defining void regions by zoom box and mouse clicks
- Improved interpolation for void regions.
- Possible to define "outliers" as void pixels in Outlier Filter

Grain/Pore Analysis

Possible to report grain height parameters by their absolute values and defining the zero level.

New Development Platform

We have not finished porting the SPIP from a Borland development environment to Microsoft Visual Studio .Net. This mean than a large part of the code has been reprogrammed and retested. The result is a more efficient and robust program for which it will be faster to implement future features.

**Version 2.32 Major new implementations,
Version 2.31-2.32 (Released November 15, 2002)**

3D Animation

- New tool for creating impressive 3D movie presentations of your images
- Control all 3D scene parameters (position, angle, colors, light etc.) by a few anchor points and let SPIP fill in frames that creates smooth transition between the defined scenes
- Output to .avi or .mpeg files
- This is part of the 3D Visualization Studio; if this module is included in your current maintenance license you will receive this extra utility for **free!!**

Filter Module

- Faster Gaussian ISO filtering, improved by a factor of 5, including ISO iterative filtering
- Enabled Auto Gaussian parameters for kernel size and cutoff when running saved filters from a batch process.
- All output settings and the unsharp mask value is now a part of the filter file definitions. So these output settings can be saved with a corresponding filter for use in batch processing.
- File Menu for easier navigation of the dialog and settings.
- Layout of ISO Gaussian filter improved.
- Included a check box to show the rms deviation image in median filter dialog.

File Formats

- JPK Instruments AFM (.jpk)
- Oxford STM (.top)

- NT-MDT SPM (.mdt) corrected missing last image in some multiple image files
- KLA Tencor Profiler (.3d, .3dd, .dat), Repaired reading of Tencor version 400/300 files

Void Pixels

- Possible to define individual pixels as void (and make them invisible)
- Ignoring void pixels in most numerical image analysis
- Saving void pixels in .BCR format
- Possible to define void pixels from Plug In programs

Misc.

- Possible to run batch processes from the Plug In Programming Interface
- Implemented Average Power Spectral Density functions for X and Y directions and with 8 times normal resolution
- Log Log scaling of 1D Fourier graphs
- Repaired undesired change of zoom box size when moving it
- ImageMet Explorer, added Arrange option on the top menu bar for easy arrangement of images.

Version 2.31 Major new implementations, Version 2.30-2.31 (Released August 22, 2002)

3D Visualization

New user interface for easy and effective adjustment of 3D scene parameters. Most parameters can now be set interactively by sliders and arrow buttons. The menu is expandable so that you can concentrate on selected parameters.

Grain/Pore Analysis

Interactive tools for splitting, merging and rejecting grains and pores.

File Formats

- Implemented NT-MDT SPM format (.mdt)
- Toray Engineering (.sp)
- Hitachi Kenki FineTech (.afm)
- KLA-Tencor KLA-Tencor P15, (.dat) profiles
- JEOL CITS (topographic formats implemented earlier)
- SDF ASCII (binary implemented earlier)

Misc.

- Handling of **Void Pixels**. Some instruments may contain non-measurable pixels, *void-pixels*, - now you can choose whether you want to have these pixels shown by calculated interpolation values or shown as invisible and ignored in Roughness / Histogram and Plane Correction algorithms.
- Handling of 2D window resizing. 2D images will now redraw automatically while changing their window sizes, with proper respect to the physical aspect ratio.
- Large ISO Gaussian filters much faster, - a filter of 101x101 on a 256x256 image takes less than a second on a Pentium 1.7 Ghz.

- Polynomial Fit area and subtraction of curve profiles can be defined interactively by the zoom box.
- Implemented CITS Zoom and Profile utilities.
- Profiling in Fourier Image changed so that the starting point is always set at DC, this assures proper scaling and the ability to perform measurements on the Fourier profiles.
- Fourier Filtering, "Include Only" implemented.

Version 2.30 Major new implementations, Version 2.21-2.30 (Released March 12, 2002)

Fourier Analysis and Filtering

New extended Fourier Menu with sections for:

- Preprocessing, selection of optional Data Window
- Filtering; Low Pass, High Pass, Band Pass, Band Reject, Interactive Filtering
- Measurement; for example Unit Cell, Line Structures, Noise Frequencies
- Output Options, for example automated display of inverse filter results when manipulating filters.

Grain/Pore Analysis

New extended Grain/Pore Analysis menu with advanced algorithms:

- Multi Scale Watershed segmentation
- Threshold based segmentation up-to 10 times faster
- Interactive definition of acceptance level for various grain parameters, for rejection or separation of joined segments.
- Optional histograms for most grain parameters
- Optional selection of grain parameters for file report
- Dedicated window for display of result files

File Formats

- Implemented reading of Pacific Nanotechnology SPM files (*.sur)
- Reading of KLA-Tencor .3dd files updated to handle version 300.

Roughness

- New dedicated window for display of result files

Misc.

- Possible to define default colors scaling for Fourier Images differing from the default colors of normal images
- Solved missing text in 3D occurring for some 3D graphic cards

Version 2.21, Major new implementations, Version 2.20-2.21 (Released January 10, 2002)

Fourier Analysis and Filtering

- New High Performance FFT, up-to 15 times faster, **click here to see performance test**

- The high-speed implementation of the FFT algorithm has made it possible to calculate the inverse Fourier transform while modifying the Fourier image in almost real-time. We have therefore taken advantage of this and implemented three new optional functions:
 - Auto Erase Markings: which will erase the marked areas when they are drawn; for example Fourier peaks marked by the circle marker.
 - Auto Inverse: Perform an Inverse Fourier transform (filter result) whenever the Fourier image is modified; for example when a peak is erased.
 - Auto Subtract: Automatically subtract the filtered result from the source image. When erasing a Fourier peak pair you will, for example, see the waves corresponding to that peak pair.

Z-Calibration

- Implemented ISO 5436 based step height measurement that works on single profiles as well as images. Provides very accurate results and enables calculation of uncertainties.

Force Curves

- Implemented reading of Park Scientific Instrument (Now, Veeco Metrology Group) Autoprobe CP ASCII (*.txt) and binary (*.sdf) formatted force Curves.

Profiling and Histograms.

- Histogram can now measure both material and void volumes between cursor pairs
- ISO 5436 based step height measurement on profiles.

Tip Characterization:

- It is now possible to ignore peaks in the lower parts of an image and thereby lower the processing time and limit the unwanted influence from small noise peaks. Is especially useful when applying dedicated tip-characterizing samples where the vital information is found in the upper part of the structure.
- More effective Reduce Spikes algorithm.
- More robust estimation of tip radii from x- and y- tip profiles.

File Formats

- Implemented reading of Omicron CITS data
- Implemented Seiko older ".inh" topographic format.
- Implemented VTS-CreaTec, LT-STM Low Temperature STM format
- Implemented reading of Park Scientific Instrument (Now, Veeco Metrology Group) Autoprobe CP ASCII (*.txt) and binary (*.sdf) formatted force Curves.

Roughness

- To limit the number of parameters that will show up in the reports you can now limit the number of parameters to those, which you find most relevant.

Misc.

- Each image can now have its own independent color scaling. Especially useful when you want the Fourier Image to use a different color scale.
- Extra set of color bar cursors for setting threshold values without changing the contrast. Especially useful for grain analysis.
- Faster handling of images larger than the output windows.
- Corrected GDI object leak when using Window->Close, which could cause program fault after analyzing larger number of images.

Version 2.2, Major new implementations Version 2.10-2.20 (Released October 18, 2001)

Plug In Interface for Programmers, Now with Visual Basic Wizard for creation of Visual Basic projects that allows you to:

- Retrieve Images or curves from SPIP windows and perform specialized analysis.
- Manipulate data and send them back to SPIP.
- Integrate your own control and acquisition software with SPIP

The package includes also an improved Microsoft Visual C++ 6.0 Plug In Wizard and a Borland C++Builder 5.0 project example enabling you to create and run a Plug In within a few minutes.

Force Curves

- Force Curve Averaging.
- Force curve Hysteresis correction that will align the extending and retracting curves implemented.
- Detection of cantilever sensitivity made more robust for early saturation of deflection signal.

Plane Correction

- A new method for subtracting a polynomial fit estimated from pixels within a certain z-range. This enables improved correction of scanner artifacts and more accurate step height measurements.
- Slope correction of profiles based on a limited x, y range defined by the curve zoom box.
- Leveling of an image so that its bearing plan is set to zero, for easy comparison of images.

Profiling and Histograms

- Fourier with 16 times resolution on curves and automated detection of Fourier harmonics enabling accurate pitch measurements (requires Calibration module)
- Histogram distribution on curves including automated step height measurement (requires Calibration module).
- Possible to limit the histogram distribution to a certain z-range and define a fixed number of bins.
- Automated update of histogram and Fourier transform on profile changes including detection of step height and pitch.
- Possible to define the zero level of the parent image by cursors in its profile window or histogram window.

- Improved Poly Line management, useful for creating topographic profiles from SEM images.

Tip Characterization

- Possible to import and use tip image with resolution differently from the image to be deconvoluted.
- Tutorial demonstrating tip characterization and deconvolution integrated in the help file.

File I/O

- Implemented reading of Molecular Imaging Force Curve files
- RHK .sm2 file format with CITS spectroscopy implemented
- SNU Precision SPM file format (Korea) implemented
- Reading Special File Formats:
 - Unsigned/ Signed checkbox for integer types
 - Scatter checkbox for interpretation of data as x,y coordinates rather than a matrix of height values.
 - Guess X and Guess Y buttons for guessing number of x and y pixels individually
 - Accepting commas as delimiters in ASCII files
- Reading of older JEOL file formats
- Reading of Digital Instrument files updated to version 5.12
- Corrected reading of Quesant Zscale
- Corrected possible Z-scale reading error of Molecular Imaging files.

Misc.

- Possible to define the color scale limits for 3D images enabling direct comparison of images with different z magnitude
- Implemented arrow heads for arrows showing the directions of lateral linearity errors

Version 2.1, Major new implementations, Version 2.00-2.10 (Released July 04, 2001)

Plug In Interface for Programmers, Now you can write your own code for analyzing, modifying and exchanging data with SPIP:

- Retrieve Images or curves from SPIP windows and perform specialized analysis.
- Manipulate data and send them back to the SPIP.
- Create new data, from, e.g., your own on-line scanner, and view them in the SPIP windows as curves, 2D or 3D images.

Get all the advantages of the SPIP processing features including file handling and visualization while you concentrate on your own specialized data processing and data creation functions.

Easy access to your plug ins by definitions of associated buttons that will appear on the SPIP Menu Bar. The package comes with a Microsoft Visual C++ 6.0 Plug In Wizard and a Borland C++Builder 5.0 project example, which enables you to create and run a Plug In within a few minutes.

Profiling, Histograms and Force curves:

Average Profiling in any angle is made easy, just press 'A' while moving the mouse to define the average area.

Straight horizontal or vertical profiling lines is created by the 'X' and 'Y' keys.

Appearance options allows you to personalize the graphical look.

Poly Line Profiling that allows profiling along an irregular path.

"SEM Profiling" Use Poly Lines to define X,Y positions and create a curve, - useful for transferring side view SEM images into profiles. SPIP can automatically find the best path between the Poly Line points by following the highest intensities.

Quadrangle Fit for finding the repeat periodic length, height, duty-cycle and quality. Useful for measuring the quality of structures where quadrangle forms are desired.

Number of bins in histograms can be altered.

Force curves incorrect reading of cursor 3 and 4 corrected.

Calibration and unit cell detection:

Complete lattice grid can be indicated for visual inspection of perfectness.

Position error vectors are indicated as part of the linearity analysis. Problem when correcting the lateral dimension with extreme correction parameters handled.

Roughness:

Optional result units, for example nm or μm

New roughness parameters related to the Bearing Curve describing the height differences between different bearing ratios

Repaired error when writing roughness of 1D profiles to database

File I/O

JEOL SPM file format implemented

Unisoku SPM file format implemented

DI NanoScope file reading upgraded to Version: 0x04460101

Corrected reading of SDF files

Wyko 16 bit and Wyko WFD formats implemented.

Corrected Reading of SIS Z-Scale

Reading of Dektak comment fields.

Misc.

Robust Filtering an iterative filter good for separating images into waviness and roughness images by minimum influence of outliers.

Partial Plane Correction perform plane correction only in sub-areas of the image, useful for correction of contaminated or noisy or other irregular images.

Color Equalization for quick contrast enhancement implemented (just press 'Q')

Tip characterization menu has new "Trust" area fields that allows you

to ignore the periphery of the tip when calculating the certainty area, this has also influence of the tip estimation when using more than one iteration.

Grain and Pore Analysis: Perimeter implemented.

Color Bar in Image Window: Color boundary Markers and height value indication made optional.

3D Visualization: New Block Style. Selected Color options are indicated by the color of the associated buttons

Major new implementations

Version 1.92-2.00 (Released March 07 2001)

ImageMet Explorer™, a productivity tool adding a new dimension to image and data handling. It contains an integrated database that allows you to browse quickly through your data files and view them as thumbnails.

Image characteristics are automatically entered to the database from where they can be retrieved on the fly while browsing your files. Furthermore, important analytical results from SPIP can automatically be stored in the database so that you never lose important results. You have the flexibility to enter descriptions, assign categories or create hyperlinks to individual files.

ImageMet Explorer integrate three sub-programs sharing the database:

The ImageMet Browser, by which you can browse through your files with thumbnail view and send images to the SPIP main program

The ImageMet Finder, which allows you to search the database for files with certain characteristics or e.g. numerical results within defined ranges.

The ImageMet Reporter, which can create image lists in HTML format containing optional characteristics stored in the data base.

Filtering

- New "**Outlier Objects Filter**", which makes it possible to recover areas covered by contamination and remove spikes exceeding a slope criteria (for example set from the knowledge about the probe). [Click here to see a how powerful it is.](#)

Image Colors

- Possible to adjust the color bar directly inside the image window.
- Possible to define color boundary defaults for direct comparison of images.

Plane Correction

- Possible to view the applied correction (difference) image.
- User control of the absolute Z-height after correction s

3D Visualization

- Number of x,y lines in wire frame mode can now be set independently. and the colors can be set differently from the color bar.

New supported File Formats:

- Veeco WFD and OPD Interference microscope files

- Veeco: Detak AFM (the one with the hammer tip)
- SEIKO SPM
- Saving Park files into their native format now possible

Profiling

- Optional double cursors in curve window, with direct length and height indications.
- Optional to view profile cursors simultaneously in the parent image.
- Possible to define the x-y aspect ratio

Zooming

- Possible to define a default zoom box size
- Fourier sub-pixel Zoom,- investigate Fourier peak positions and width at sub-pixel level.

Force Curve Analysis and Batch Processing

- Now contains a table with numerical results for the analyzed files

Result storage

- It is now possible to define which results should be stored automatically to text files and/or the database of ImageMet Explorer.

Tip Characterization

- Tip profiles are now show in 1:1 aspect ratio for easier interpretation.

Major new implementations Version 1.91-1.92 (Released October 30 2000)

- **Rotation:** Images can now be rotated automatically into positions where the lattice or line structure is parallel to the axes. True averaging of the x-profile after rotation excluding void areas provides the best estimate of the average profile, from which periodicity, duty-cycle etc. can be calculated. Do not spend tedious time on accurate rotation of samples before recording; - let SPIP do the job off-line. Interactive rotation is of course also possible.
- **Angle Measurement:** New tool for interactive angle measurement implemented.
- **Force Curve Analysis:** Batch processing possible, analyze groups of force curves and put screen dumps to HTML. Possible to import force curve data from ASCII files.
- **Grain Analysis:** Has now also a mode for **pore / pit detection**. New result window shows the data for individual mouse selected objects. Possible to ignore all border elements to achieve better statistics and to reject individual objects. Use of high-contrast colors makes it easy to distinguish close-by objects. Histogram for length distribution implemented.

Automated Rotation based on unit cell detection, which alligns the dominating structure to be parrallel to the y-axis. The average x-profile is automatically calculated excluding the void areas at the corners.

Major new implementations

Version 1.90-1.91 (Released September 20 2000)

- **Force Curve Analysis** now includes automated fit to Worm Like Chain (WLC) models, detections of "Pull off" force base-line correction by approach curve. Filters in the Filter Module can now be applied.
- **Batch Processing** contains now functions for chaining different filters of the Filter Module. Can also write individual images to different formats: BCR, ASCII, NanoScope, JPEG, BMP and TIFF.
- **Filter Module** faster and easier to use.
- Reading of **TopoMetrix** file format updated with new file version 5.

Major new implementations

Version 1.81-1.90 (Released August 28 2000)

New Filtering Module

- The SPIP Filter Module provides a powerful set of predefined spatial filters and tools for designing dedicated filters. Use the filters for getting nice presentations and robust measurements. Apply the ISO standard filters and calculate Roughness parameters as described in the standards.
- Includes tools for design of a comprehensive set of filters: Low-Pass (smoothing), High-Pass, Sharpening, Laplacian of Gaussian, ISO 11562 Gaussian and ISO 13565 Filtering of Deep Valleys, Median, Statistical Difference, Edge Enhancement (Roberts, Prewitt, Sobel), Unsharp Masking.
- Easy-to-use Filter Kernel Editor
- Watch the filter kernel in 3D and the filtered result together with the difference image while modifying the filter parameters in almost real-time.
- Combination of filters can be defined
- Works on images as well as profiles
- Save, retrieve and apply filters in Batch Processes

Misc.

- **Undo / Redo** image processes.
- **Synchronized Multi Zoom**; display Zooms of the different images at the exact same positions. This is useful when dealing with images from the same physical area but showing different properties, for example height, friction, cantilever amplitude, phase, capacitance, magnetic force or to compare the source image with a filtered output image.
- **Fourier Sub-pixel Zoom**, Detect and view a Fourier Peak with 1/100 pixel resolution.
- **Image Masking**: Let a second image determine which pixels in the main window should be minimized and thereby ignored in, e.g., grain analysis.

Major new implementations

Version 1.80-1.81 (Released July 05 2000)

Tip Characterization

- The characterization is made less sensitive to noise by automated reduction of single peaks found to be unreasonable sharp.

- The tip radii calculation is now only based on the 5x5 center pixels of the tip and thereby independent on tip pixel size.
- **Profiling** (part of Basic Module)
 - **Synchronized Multi Profiling;** display profiles of the different images at the exact same cross-sections. This is useful when dealing with images from the same physical area but showing different properties, for example height, friction, cantilever amplitude, phase, capacitance, magnetic force or to compare the source image with a filtered output image.
- **Fourier Auto Apply;** while changing a profile by moving the cross section marker the effect on the 1D Fourier can be visualized simultaneously.
- **Profile Zoom;** Profile zoom windows are now also updated along with their parent windows
- **Default Settings** defining the appearance of the 1D graphs (show fitted curve, show markers, subtract fitted curve, Fourier Auto Apply) can now be defined for the different types of 1D graphs (Profile, Histogram, Fourier, Scatter, Force curves).

Misc.

- Optional **Auto Tiling** of graphical windows when creating new so that all windows are visible and not overlapping.
- **Roughness** calculation of profiles (part of Roughness module)
- **Image Masking;** Use another image to define which pixels should be set to a minimum value in the Main Image. This can be useful for having a height image determining the area of interest in e.g. the phase image.
- **Reading of Unknown file formats** is made easier and settings can be stored as default.
- **Batch Processing:** Possible to bring the most recent created image to the Main Image Window for further processing.
- **Grain Analysis:** The result files now also contains statistical mean and standard deviation values.
- **3D Studio:** When recalling settings it is now optional to include the 3D window size.

Major new implementations Version 1.73-1.80 (Released May 18 2000)

Tip Characterization

It is well known that the tip is the most critical part of scanning probe instruments and knowledge about its form is essential for any evaluation of surface images.

- The SPIP tip characterization module allows you now to characterize the tip or stylus used for scanning an image and to compensate for the tip shape by "Tip Deconvolution".
- SPIP can automatically generate a number of graphs and quantitative results for example: Tip top view, 3D view, Profiles of tip, Certainty Map and Confidence graphs.
- The integration in the SPIP program gives several advantages for example: The SPIP Correlation Averaging can lower the influence from noise, the SPIP Batch Processing facility makes it possible to perform Tip Characterization or Tip "Deconvolution" on a large number of files and report the results to HTML.
- The function is easy-to-use and has a one-mouse-click interface.

CITS Spectroscopy Analysis

- The new Continuous Imaging Tunneling Spectroscopy (CITS) module allows you to visualize and handle I/V spectroscopy data. From the topographic or CITS Volume Image it is possible to extract the individual I/V curves.
- In The CITS Volume Image, the current is shown for a selectable voltage.
- The Spectroscopy images can be transformed into conductivity (dI/dV) data, or the Density of States ($dI/dV * V/I$) data

3D Visualization:

- 30% faster
- Possible to combine wire frame with rendered image.
- Indication of light position, when changing with mouse.

Misc.

- Reading of Molecular Imaging partly implemented (missing the absolute scaling)
- Possible to define the color z-range larger than the z-range in the data (to avoid dark colors)

Major new implementations Version 1.72-1.73 (Released March 07 2000)

Force Curve Analysis:

Force curve analysis has now become easier. From deflection data SPIP can automatically calculate Force(Separation) and other graphs and the new zoom and cursor facilities makes it easy to perform detailed measurements.

The availability depends on the force data file format, (currently NanoScope versions 4.2 and newer are supported); we will implement new formats on demand at no extra costs.

New Histogram and Curve functions:

- Optional display of Integration curve in histogram,
- Possible to calculate area and volume for the region between histogram cursors.
- Easy-to-use zoom box.
- Smooth filtering with optional kernel size
- Default subtraction of fitted polynomial while moving the cross section line
- Use the histogram to define and filter extreme values.

New implementation Version 1.70-1.72 (Released February 01 2000)

New implementation, Version 1.70-1.72 (Released February 01 2000)

- **Batch Processing**

Now more than 40 functions available. Function description displayed on selection.

Possible to perform predefined corrections and calibration self test.

Screen dumps to JPEG Files

- **Reporting to HTML:** SPIP is delivered with predefined batch sequences for XY-calibration, Z-Calibration, Roughness that will automatically create HTML reports with screen dumps, numerical results and statistics. You can include your own logo and operator description and publish the result directly on the Web.

New implementations

Version 1.60-1.70 (Released December 13 1999)

- **Batch Processing**, increase your productivity, design processing sequences easily by mouse clicks and apply them on hundreds of images. No programming skills required.
This release was approved after batch-processing more than 700 files using different processing combinations.
- Reading of **Nanosurf EasyScan** files
- **3D Studio:** Possible to combine topographic information from one image with colors from another image, e.g. phase image.
- **Plane Correction:** Optional Sphere fit algorithm.
- **Correlation Averaging:** Possible to auto process with a single mouse click.
- **Linearity Analysis:** Possible to auto process with a single mouse click.
- **Median Filter**
- **"Copy All"** SPIP windows to clipboard
- **"Print All"** SPIP Windows to printer

New implementation

Version 1.51-1.60 (Released November 17 1999)

File I/O:

- **Drag Drop** function; Drop a group of files or folders from File Explorer to SPIP
- Writing to **Digital Instrument NanoScope** File Format
- Reading of **ADE Phase Shift** Images
- Reading of **KLA-Tencor 3DD** Images.
- Reading of 32 Bit integer "Unknown" file formats

Misc.:

- **Fractal dimension** based on Fourier. The dimension is calculated for all directions and shown in a polar plot.
- **Log Log functions** for 2D Fourier spectra to evaluate fractal dimension
- **3D:** Works faster, time-consuming calculations are now only performed at scene changes. Z Scaling in Animation function stays within view range
- **Angular Spectrum** shown in Polar plot
- Optional default **Plane Correction parameters**
- **Calibration** can now be based on oblique unit cells, - quadratic form no longer required
- **Save / Recall of correction parameters.** Images can be corrected directly based on previous saved parameters.

- **Save / Recall of reference parameters** for calibration standards
- **Filtering** of extreme values defined by color bar limits
- Possible to change colors for all image windows simultaneously from Color Editor
- Optional **polynomial fits to curves** and scatter diagrams
- Curve Markers are active by default.
- "Hidden" right mouse key menu items now also available in the main menu

New implementation Version 1.500-1.510 (Released September 16 1999)

Grain Analysis:

- New algorithms for automated separation of overlapping particles.
- Color bar threshold automatically synchronized with grain threshold level

Misc.:

- Possible to define scaling and labeling in curve windows by new Curve Property Menu
- Possible to display coordinates of mouse position in pixel coordinates or physical coordinates
- In the correlation averaging function the default average count set to 100, and an initialization error fixed.
- Double floating point precision is applied for calculations where bit truncation is considered a problem.

New implementation, Version 1.4 -1.5 (Released June 22)

3D rendering, it has now become easier to create impressive 3D images by these new features:

- Define, Store and Recall 3D scene settings together with window size and position.
- More controls in 3D for easy positioning of surface.
- Combination of height dependent surface colors with light colors.
- Exact color matching when light-mode is turned off.
- Animation: let the surface rotate, move and scale by itself.

Grain Analysis:

- Coverage factor written in result file.
- Analysis of image with a single grain enabled.
- No histogram shown when less grains than requested elements in the histogram.
- Store and Recall of Color Scales.
- Slope correction disabled during inverse Fourier transformation.
- Reading of EC data and Force Curves partly implemented (missing exact physical scaling).
- Automatic resizing of curve windows when cursors are activated or deactivated.
- New Windows Menu item for closing all dialog windows.

Symptoms of Corrected Errors, Version 1.4-1.5

- Application errors when closing program with 3D-dialog open.
- Possible read error after linearity correction and roughness calculation with Fourier On.
- Possible error when clicking on alternative unit cell with no unit cell defined.
- Rectangular images scaled wrong in 3D.

New implementation, Version 1.1 -1.4 (Released May 21)

1. 3D view by OpenGL, rotate, position, scale the surface and define light source parameters dynamically in (almost) realtime.
2. Improved Unit Cell detection for images having higher harmonic Fourier peaks larger than the fundamental.

Symptoms of Corrected Errors, Version 1.0-1.4

1. Possible floating point errors when loading *.bcr files causing very slow calculations.

New implementation, Version 1.0 -1.1 (Released April 28)

1. SPIP is now structured so that it is possible to purchase only the modules of interest.
2. Writing of images in tiff format.
3. Grain Analysis menu extended with contrast enhancement functions, - Local mean value equalization and local SD equalization (also known as Statistical Differencing).
Possible to separate close together grains at local minimum pixels.
4. Cross-correlation between any image and the Main Image by the right mouse button menu.
When applied on a zoom window it is possible to quantify the coordinates of similar features.
5. Property menu of 3D image windows, change of Z-scaling is now possible.
6. Duplicated curve windows now inherits the visualization settings of their origin, - useful for comparisons.
7. Display of the physical image coordinates associated with profile markers.

Symptoms of Corrected Errors, Version 1.0-1.1

1. Segmentation error when performing Fourier analysis on average profiles.
2. Not possible to read newer NanoScope files containing phase images.
3. Not possible to read Tiff files with missing "Samples Per Pixel Tag".

New implementation, Version 0.93 -1.00 (Released April 8)

1. 1D Fourier, optional increase of Fourier resolution by a factor eight, optional dB scaling ,direct reading of wavelength at marker positions, calculation of harmonic number.
2. Profiles: Triangular markers reflecting slope and summit positions. Fine position control by arrow keys.
3. Average Fourier of X and Y profiles.
4. Possible to define an Area of Interest for Average Profiling or Average Fourier.
5. Reading of NanoScope MFM (frequency) images with correct Z-unit (Hz).
6. Reading of Tiff files (use this for SEM and other images).

7. Reading of 32 and 64 bits Non-Intel floating point data. All files having less than 3 rows or columns are treated as curves.
8. Accuracy of lateral linearity analysis improved.
9. Smoother update of images especially zoom window.

Symptoms of Corrected Errors, Version 0.93-1.00

1. Possible segmentation error when trying to perform linearity analysis after closing main image.
2. Possible segmentation error when performing Fourier on images having uneven number of x and y pixels
3. Possible segmentation error when closing all windows.
4. Sqrt error after Fourier Marking and Sqrt scaling.
5. Possible display error for some *.bmp files.

New implementations, Version 0.92 - 0.93 (Released March 8)

1. Identification of file, date and SPIP version number on printouts
2. More convenient placement of client windows. Windows are put on top when updated.
3. Better handling of drawings when using 256 colors palette mode.
4. Z-calibration results in Histogram window are written with transparent background and text strings are put on more suitable positions.
5. Handling of threshold limits in Grain Menu improved.

Symptoms of Corrected Errors, Version 0.92- 0.93

1. Possible segmentation error when running 256 colors palette mode
2. Possible segmentation error after performing multiple Fourier transforms and closing Fourier windows.
3. Possible division by zero when unit cell detection fails
4. Possible division by zero when the lower threshold limit in the Grain Menu exceeds the height associated with the upper color limit of the colorbar.

New implementations, Version 0.91 - 0.92 (Released March 02 1999)

1. Grain Size analysis menu, Detect, count and quantify grains/ particles by area, height and volume.
2. Numbers of colors in color scale increased to 4000 for 16 bit color modes and higher. Easier manipulation of color bar, keep the color limits fixed when changing the color table.
3. NanoScope images will be identified with extra letters in their name. 'z' for height based on Z-piezo voltage, 'h' for height based on sensors, 'd' for deflection, 'a' for amplitude, 'p' for phase.
A rotation will be indicated by the rotation angle in degrees.
4. The directory path is now excluded from the image windows caption.

Symptoms of Corrected Errors, Version 0.91- 0.92

1. Exiting error messages when closing by use of "X" in the program title bar
2. Averaging problem when only 1 feature exists in the image, - Z-calibration now requires user to define a template
3. File could not be Reloaded by the mouse menu
4. Division by zero when profiling constant data images.

New implementations, Version 0.90 -0.91 (Released February 24 1999)

1. Now also supporting Burleigh, Omicron and Zygo file formats
2. Max Flatness put behind Line leveling in processing chain (gives better results). Max Flatness algorithm improved. Plane correction menu remembers state of the checkboxes.
3. Memory status written at bottom of image, warning for low memory situations.
4. Arrow keys interface for moving profile line, zoom box, and unit cell in image windows.
5. Better handling of rulers in curve window.
6. Result files include date, time and SPIP version number for traceability.

Symptoms of Corrected Errors, Version 0.90-0.91

1. Max Flatness improves only the image the first few times used.
2. Possible crash on some systems when processing tasks with high memory usage.

New implementations, Version 0.611-0.9 (Released February 15 1999)

1. Context sensitive help implemented for all menus. Complete online Users and Reference Guide
2. Z calibration menu extended/improved. Possible to apply correction factor,. Adaptive Z-creep filter
3. Z-calibration & correlation averaging: Max no of valid averages detected automatically and prompted when lower than the requested number.
4. Plane correction menu extended and improved. Possible to combine more techniques
5. Linewise leveling by histogram match works now also on images with positiv skeewness.
6. Edit Image Info change name to Properties. Possible to enter and save comments in BCR format
7. Rulers in curve window put behind the curve
8. New license coding, if you have an arrangement with Image Metrology, contact us.

Symptoms of Corrected Errors, Version 0.611-0.9

1. Possible crash after performing linearity analysis, closing Fourier window, and repeating linearity analysis
2. Possible crash during LMS plane correction while concurrently performing other analysis

New implementation, Version 0.61-0.611 (Released January 28 1999)

1. Number of Most recent files in file menu increased from 10 to 20
2. Format of calibration files (*.cal) improved for easier copy & paste or export to spreadsheets
3. Check marks implemented for state buttons in Main menu and the right key menu
4. Possible to enter other X_c , Y_c or dx/dy correction parameters in "Unit Cell and Calibration Results" Menu

Symptoms of Corrected Errors, Version 0.61-0.611:

1. Possible square root domain when calculating unit cells of very uniform structures
2. Possible GDI error in Slope Menu
3. Possible crash after performing linearity analysis, closing Fourier window, and repeating linearity analysis

New implementations, Version 0.60-0.61 (Released January 18 1999)

1. Plane Correction: Immediate correction of image when selecting one of the line wise leveling methods
2. Plane Correction: Implemented Reload function
3. Handling of markers in histogram and bearing curves improved
4. Averaging for Z-calibration now requires a minimum template of 50 pixels
5. Implemented WinHelp 2000, with user friendly split windows navigation

Symptoms of Corrected Errors, Version 0.60-0.61:

1. Potential overflow problems when performing the Square or Exponential function in Fourier menu
2. Absolute values of Z-calibration markers in histogram not in agreement with manual marker settings (although the found step height was correct)
3. Possible division by zero when repeated features is not found
4. Possible floating point overflow when performing Z-calibration by averaging

New implementations Version 0.59 - 0.60 (released January 08 1999)

1. Read out of wave length and amplitude while moving mouse cursor over Fourier image, - useful for setting filter cutoff limits.
2. Reading of RasterScope Images larger than 512 x 512
3. Max Image size increased to 2048 x 2048.
4. Y-Range of Curve windows now default higher than the z range of the curve data, (preparing interactive zoom)
5. Reads now bitmap (*.bmp) files
6. Linearity analysis can now handle modulus errors (i.e. linearity error larger than the unit cell vector)
7. Instant feedback when toggling the 16 Bit Color Mode
8. Time consuming slope correction running in threads which can be interrupted
9. Fourier Menu updated with unit cell results calculated outside the menu
10. Fourier Menu: Change of layout
11. Zoom of images smaller than 2x2 disabled
12. Remembering the 10 Most Recent opened files in the file menu
13. Context sensitive help for Fourier Menu and Slope Menu
14. More tool-keys on tool-bar
15. Tuning of LMS error unit cell in linearity improved

Symptoms of Corrected Errors, Version 0.59 - 0.60:

1. Crash after roughness analysis in combination with Fourier analysis
2. Scan range in Quesant images incorrect
3. Possible Division by zero when detecting unit cells in certain images
4. Possible Division by zero when updating roughness statistics
5. Slope correction fails for 2nd order LMS method
6. Possible Crash after closing an opening multiple windows