

3D Visualization for SIMS Analysis

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• Goal: An efficient, intuitive, and powerful SIMS data visualization suite

- Primary ion sources based on molecular clusters open the door to molecular depth analysis using SIMS
- A three dimensional (3D) chemical description of a solid sample is intriguing

• Challenge: High demand on computing resources and visual presentations

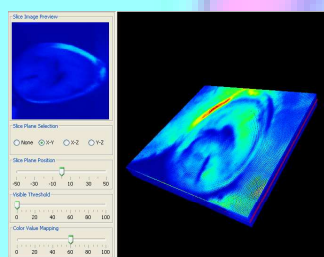
- A large number of analysis layers
- A large number of pixels at each layer
- High resolution mass spectrum at each pixel

• Approach:

- A data compression scheme for rapid loading of the entire 3D data space
- Interactive views of 3D perspectives and 2D layers
- Interactive color maps and visibility controls to reveal detailed structures

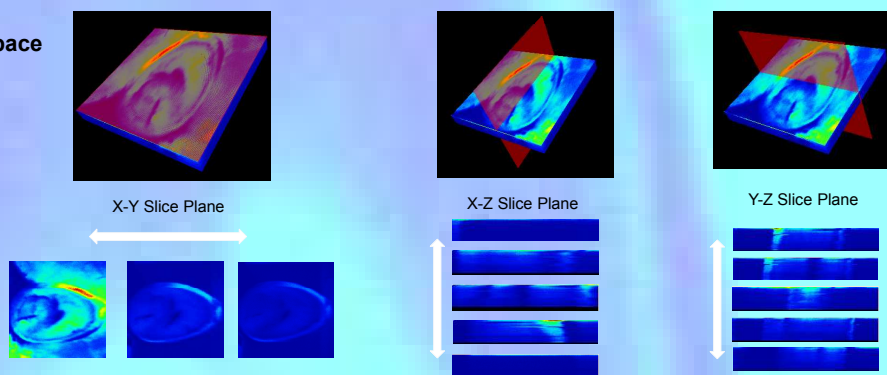
• A 3D perspective view

• Three 2D orthogonal slices through the 3D space



Interactive 3D GUI

Interactive views: 3D and 2D

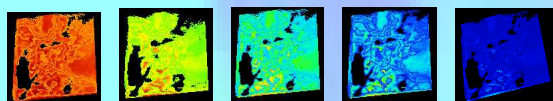


• Color Map

- A customized color space
- A controllable log-exponential value-to-color mapping function
- Supports real-time interactive adjustment allowing the human eye to distinguish many more distinct gradations in 3D data space



Cold-Hot Color Space



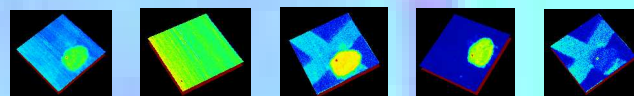
Log Extreme Log Linear Exponential Exponential Extreme

Interactive Color Map

Selected Ion Color Map

• Selected Ion Intensity Space:

- Computes selected ion count on user-specified ion ranges
- Supports the combination of multiple ranges for various purposes
 - Remove interferences
 - Reveal regions of interest
 - Classify the data points

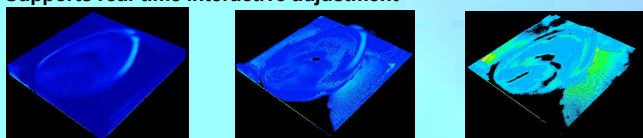


TIC Noise TIC - Noise Organic Material Grid

Interactive Visibility Control

• Data Point Visibility

- Filter data points based on their intensities to reveal detailed 3D structures
- An intensity space is defined by the maximum and minimum intensities
- A user-specified threshold controls the percentage of the visible intensity space
- Supports real-time interactive adjustment



100% intensity space

90% intensity space

80% intensity space

Future Work

• Multiple Visual Maps

- **TIC map:** *total intensity count* (TIC) at each data point (i.e., the sum of intensities in the entire spectrum of each point)
- **SIC map:** *selected ion count* (SIC) at each data point (i.e., the intensity at a specific ion range of interest)
- **ROI map:** *region of interest* (ROI) in the entire data space such as a “Cell Map” that indicates the points inside a cell
- **Multiple 3D Visuals:** show multiple scalar maps simultaneously such as TIC and SIC control various 3D visuals including different shapes, sizes and colors