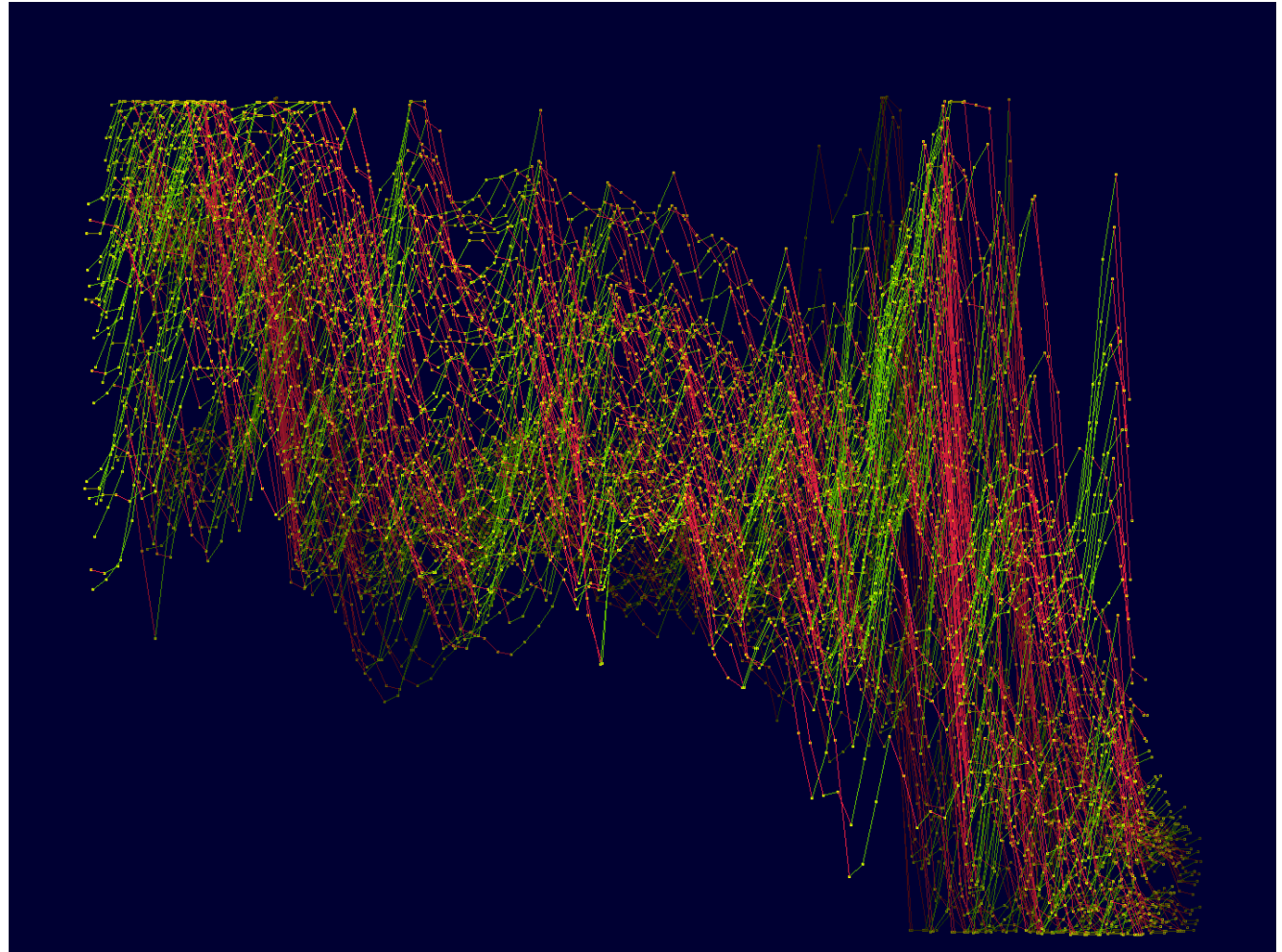


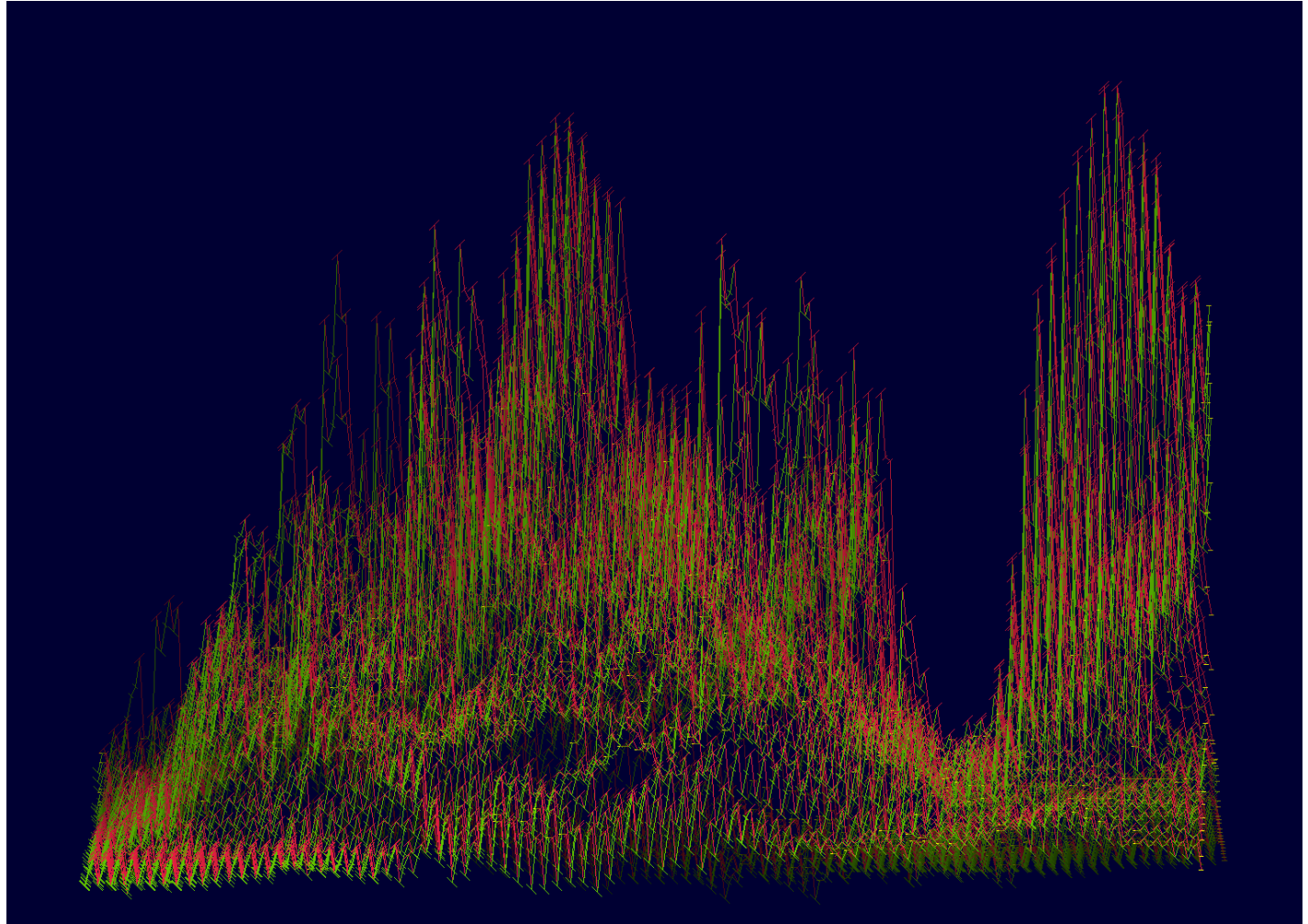


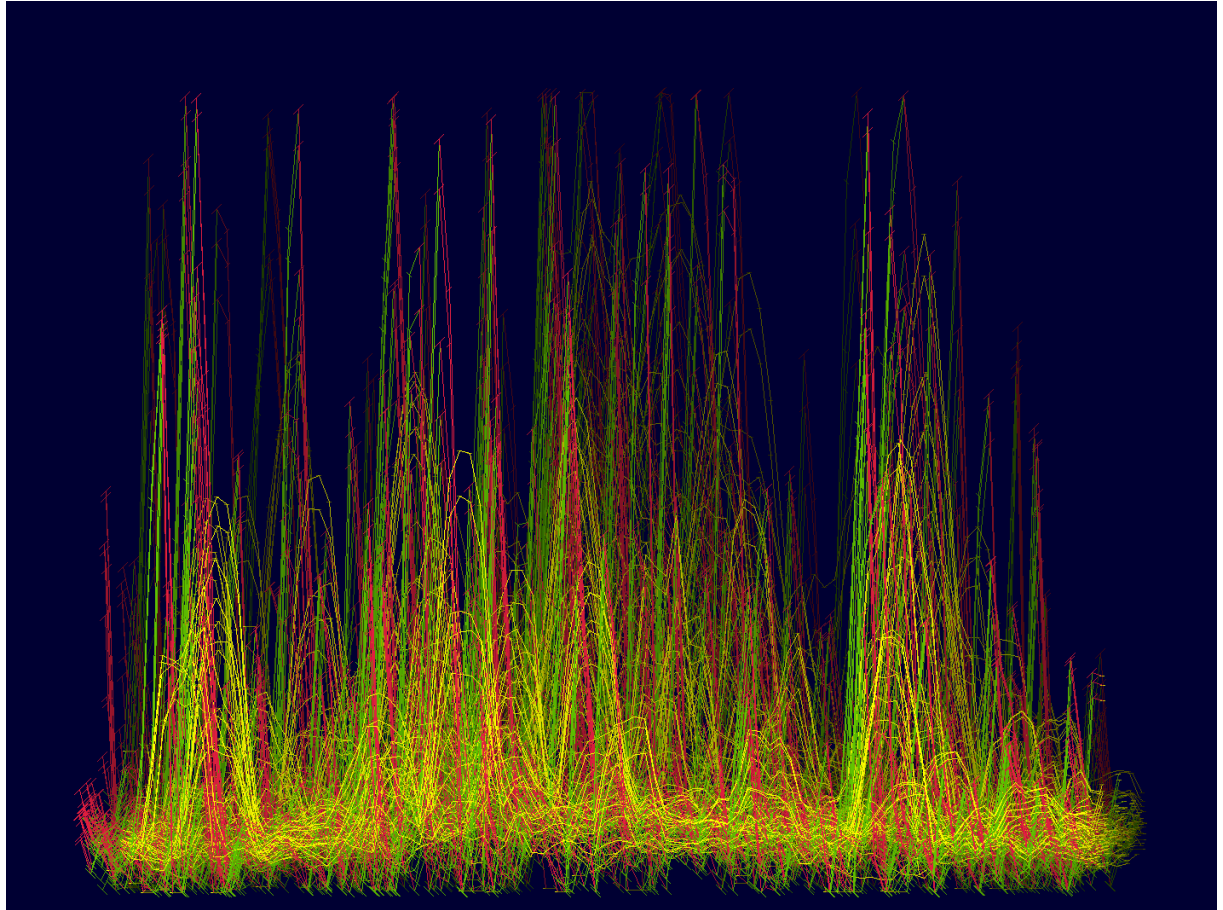
# New Measures for Science through Quantifying Images

“Visual Data Intelligence”  
as Proof of Concept  
for Innovative Core Processes

Sabine K McNeill

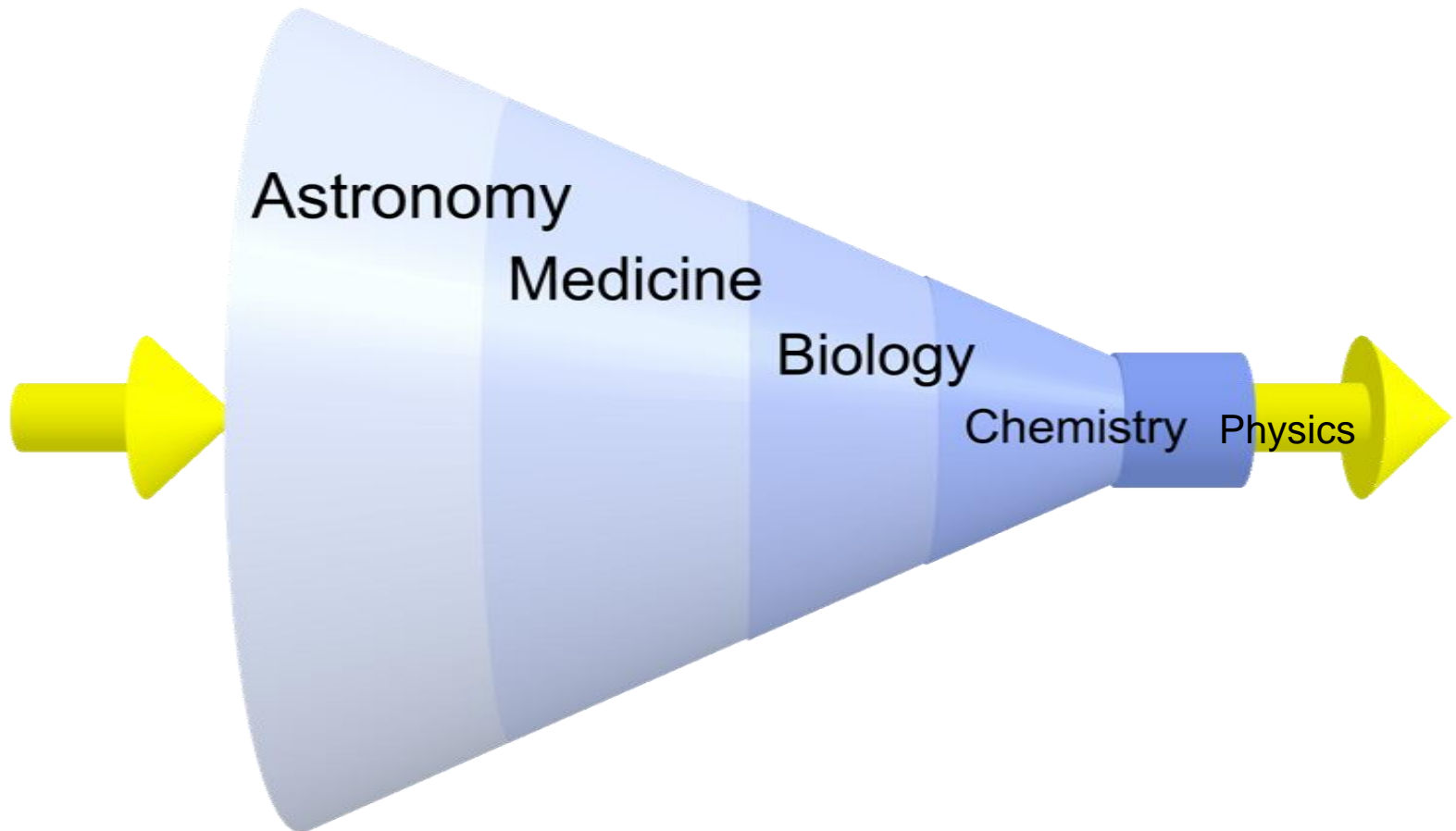




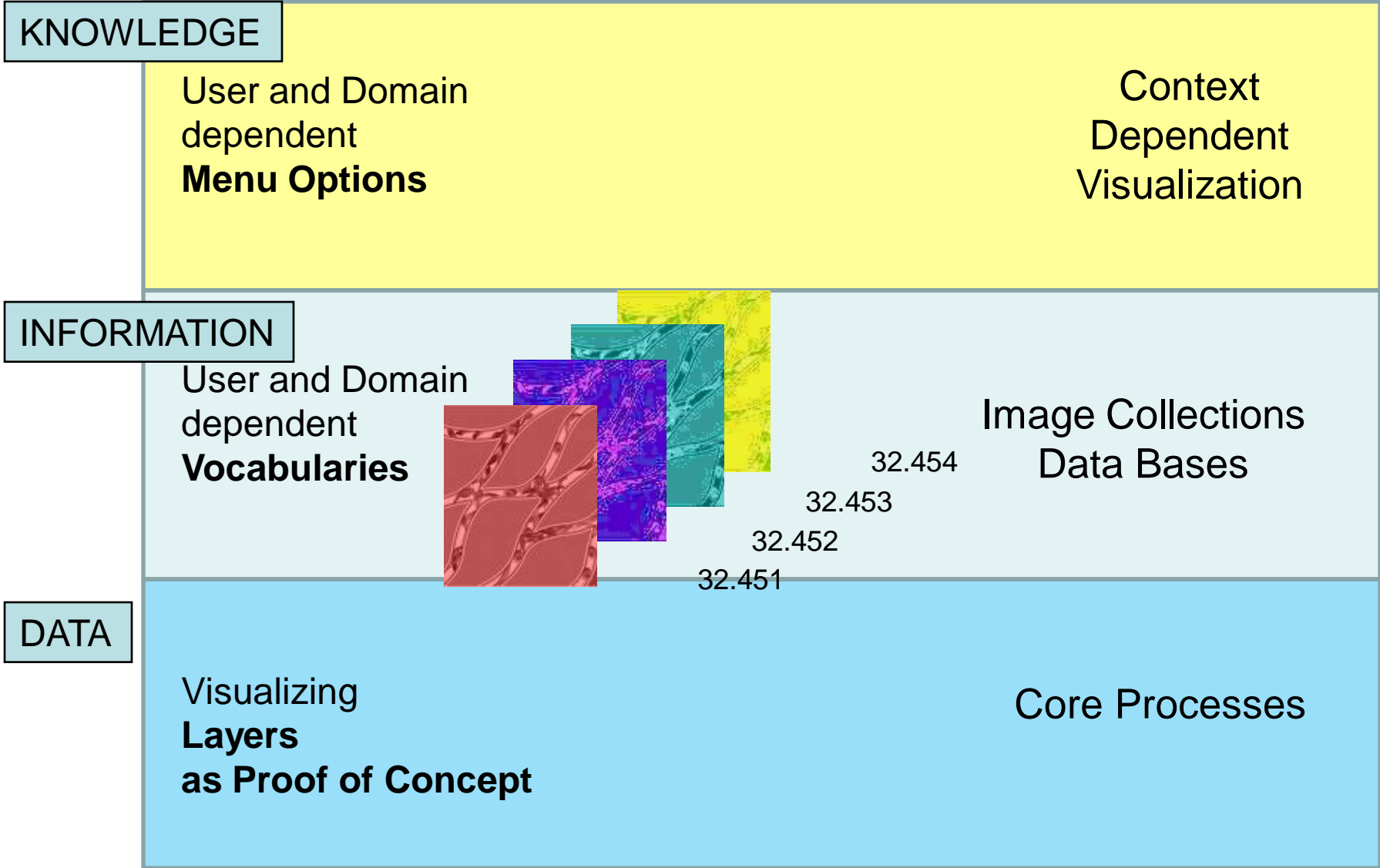


# Domains of Scale

- The right needle for the right haystack

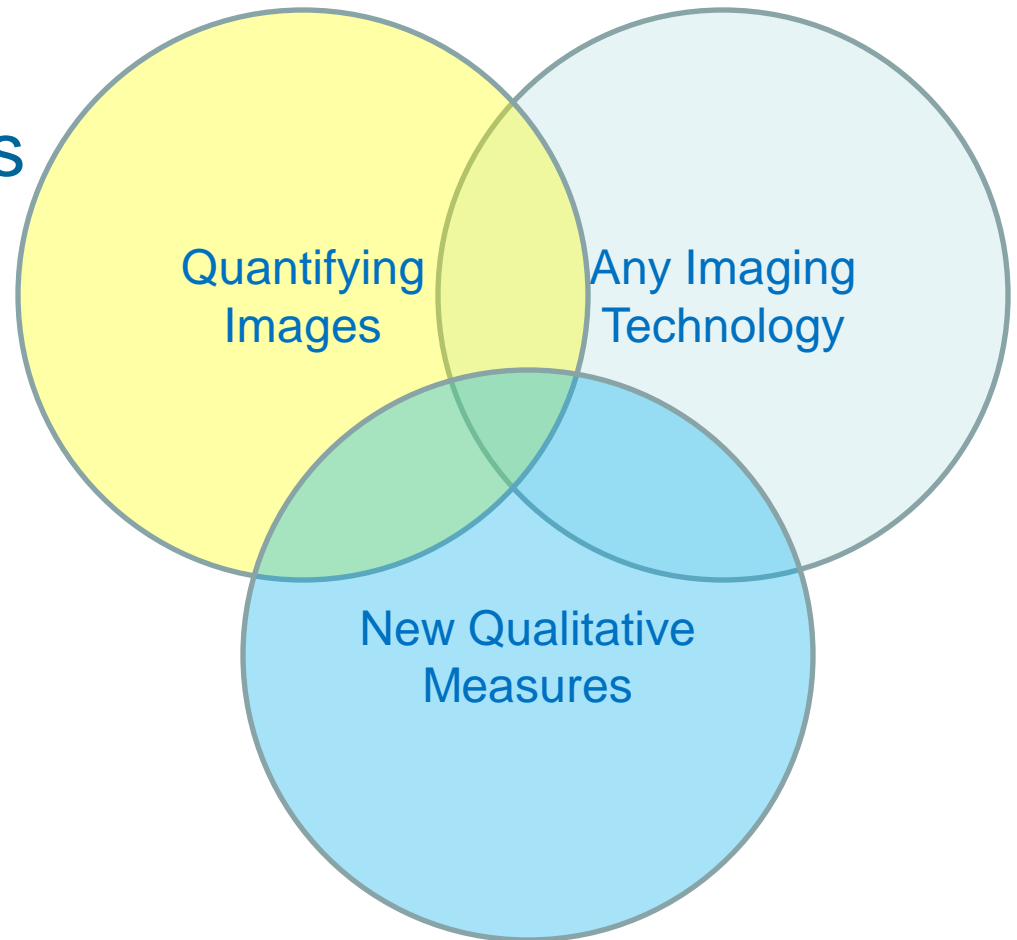


# Layers of Software



# New Measures of Quality

- Homogeneoususness
- Granularity
- Porosity
- ...





# Quantification of Images

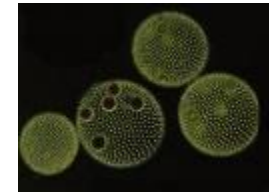
- Our core processes consist of methods that give unique numbers to images produced by any imaging technology



32.45



54.12

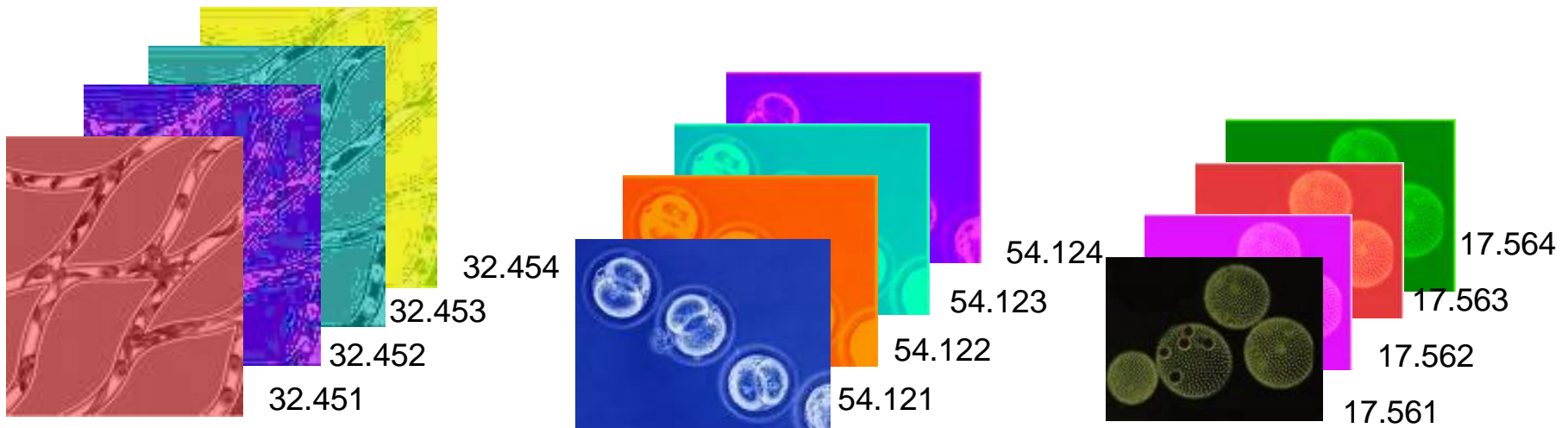


17.56



# Using Quantified Images

- Benefits
  - sorting
  - selecting
  - comparing
  - determining minima, maxima and standards

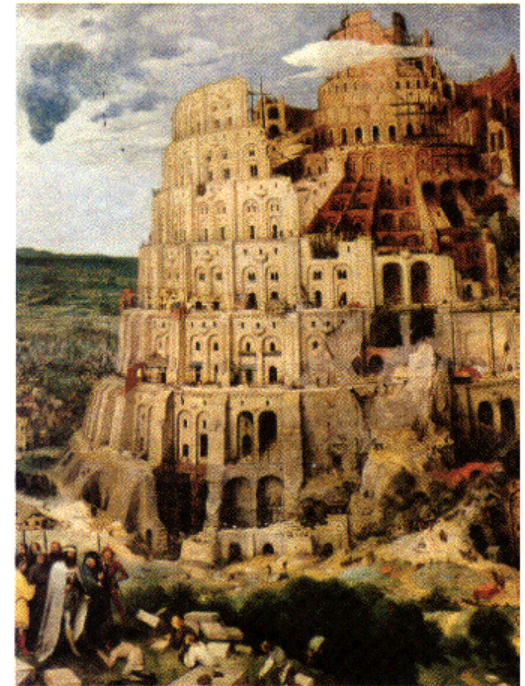


# Naming Patterns

- Further black box methods distinguish colours, contrasts, shapes and patterns
- Zooming in on small image parts means that
  - individual grains, cells, molecules and atoms can be distinguished and compared over time
- Pattern names can be associated with new qualitative measures
  - granularity, porosity, homogeneousness,...

# Structured Vocabularies

- By naming picture contents, experts can put together ‘vocabularies of meaning’ for
  - Qualitative measures
  - Comparative parameters
  - Experimental variables
    - Microscopic resolution
    - Calibration images
    - Standard samples
    - Time intervals





# New Instrument of Observation

- “Humboldt had 'a horror of the single fact', believing that ' in order to explore any one thing, one needs to approach it from all sides'... Every discovery opens up the imagination further, stimulating more discovery: it 'enlarges the sphere of ideas', excites a taste for investigation, while the creation of new instruments of observation increases the intelligence.

Theodore Zeldin, *An Intimate History of Humanity*, London 1994

- Measuring ‘on screen’
  - Time series at different intervals
  - Measurements from any application
  - Digital images from any technology.

## Domain

- Biology
- Chemistry
- Nanomedicine

## Image Collection

- Cells
- Molecules
- Tissues

## Imaging Technology

- NanoVideo
- Optical Microscope
- Electronic Microscope

## Quality Measures

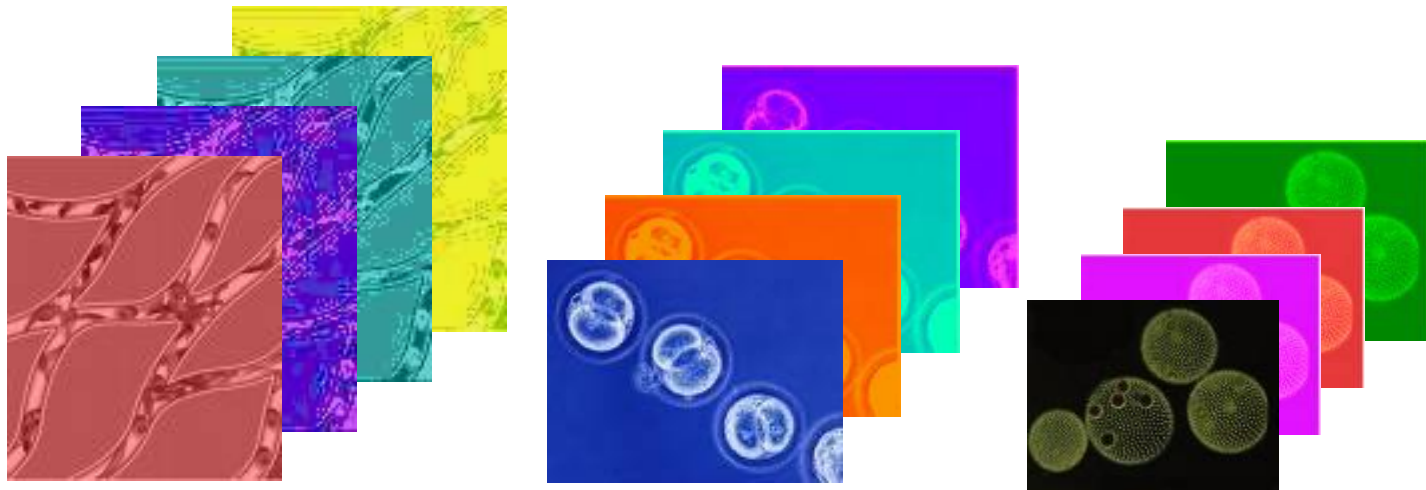
- Granularity
- Porosity
- Homogeneoususness

## Software Statistics

- Minima
- Maxima
- Averages

## Human Statistics

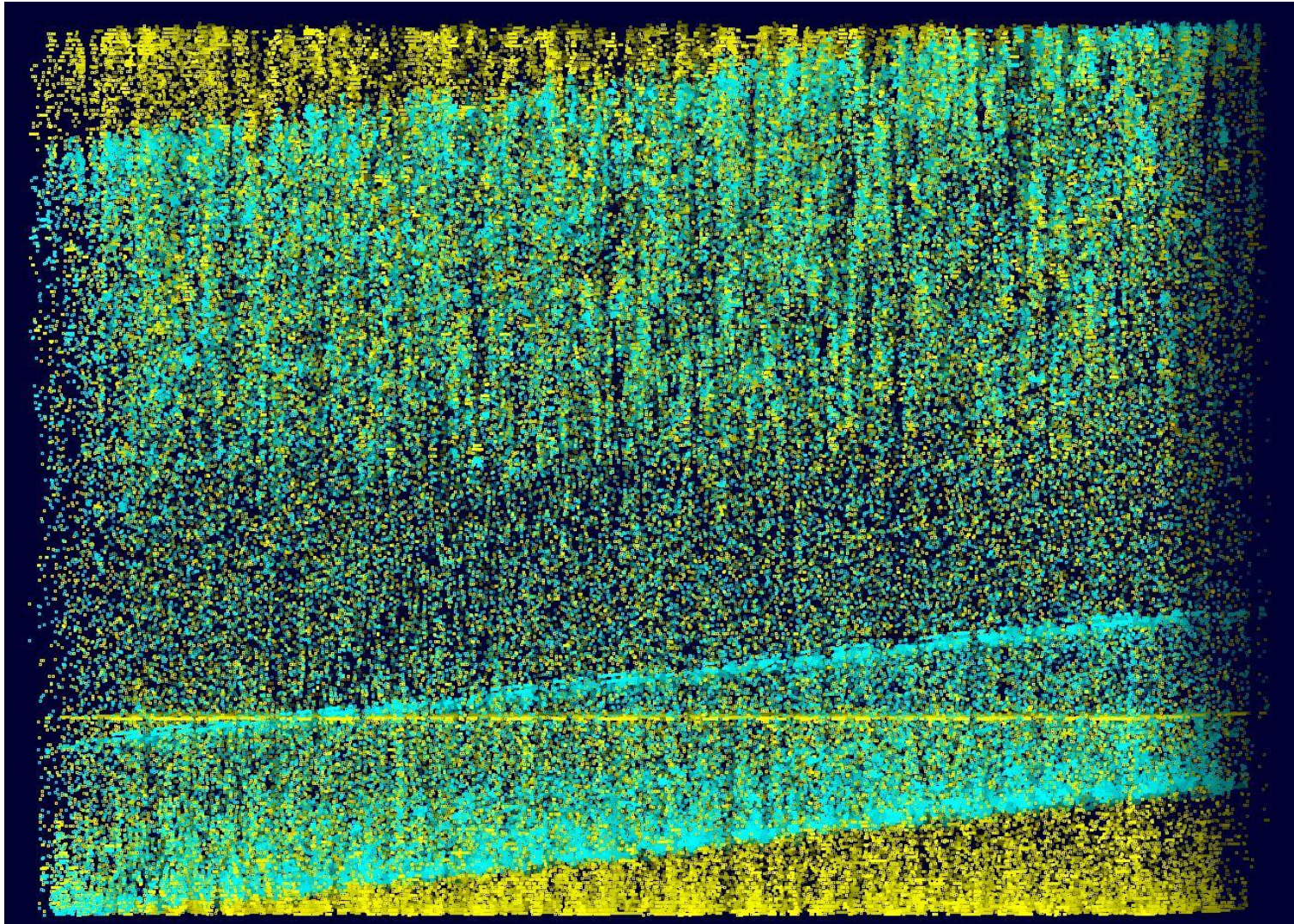
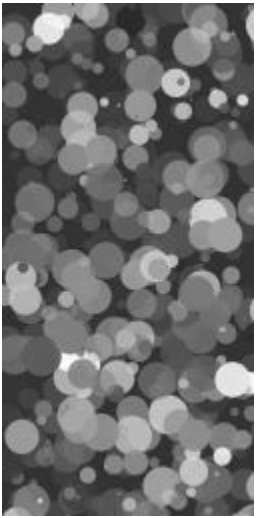
- Observations
- Recommendations
- ⇒ Standards
- Metric Samples
- => Calibration

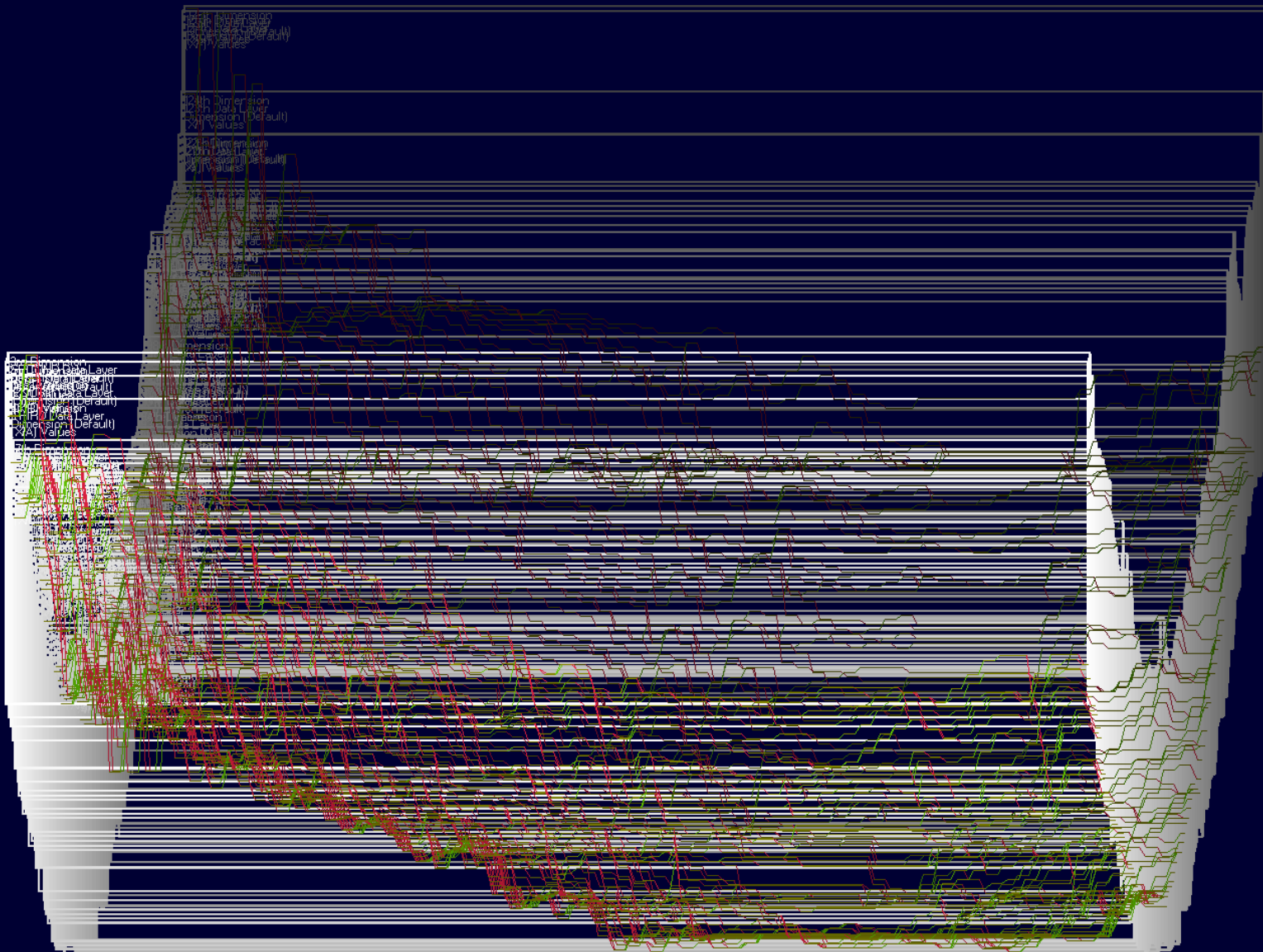




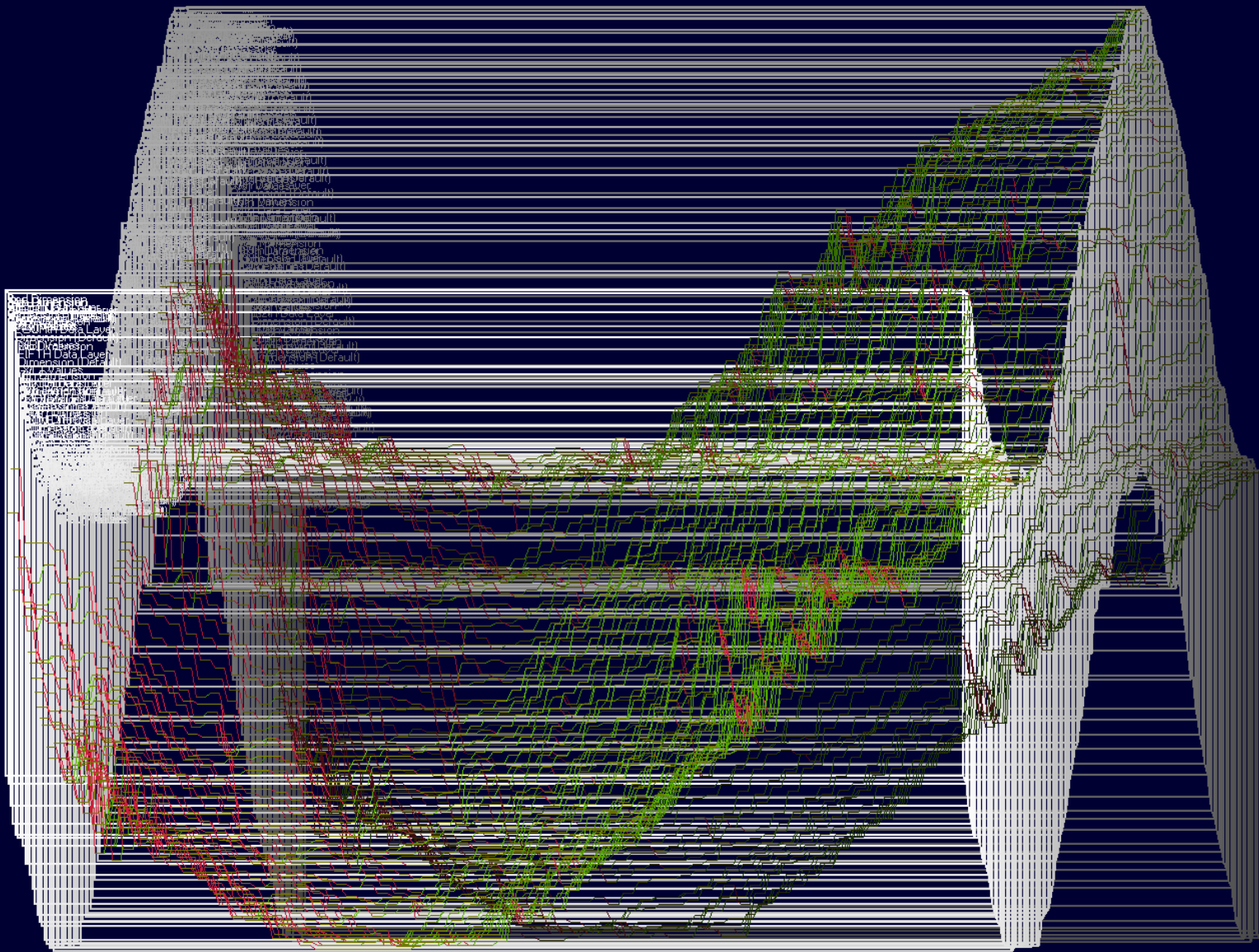
# Samples from:

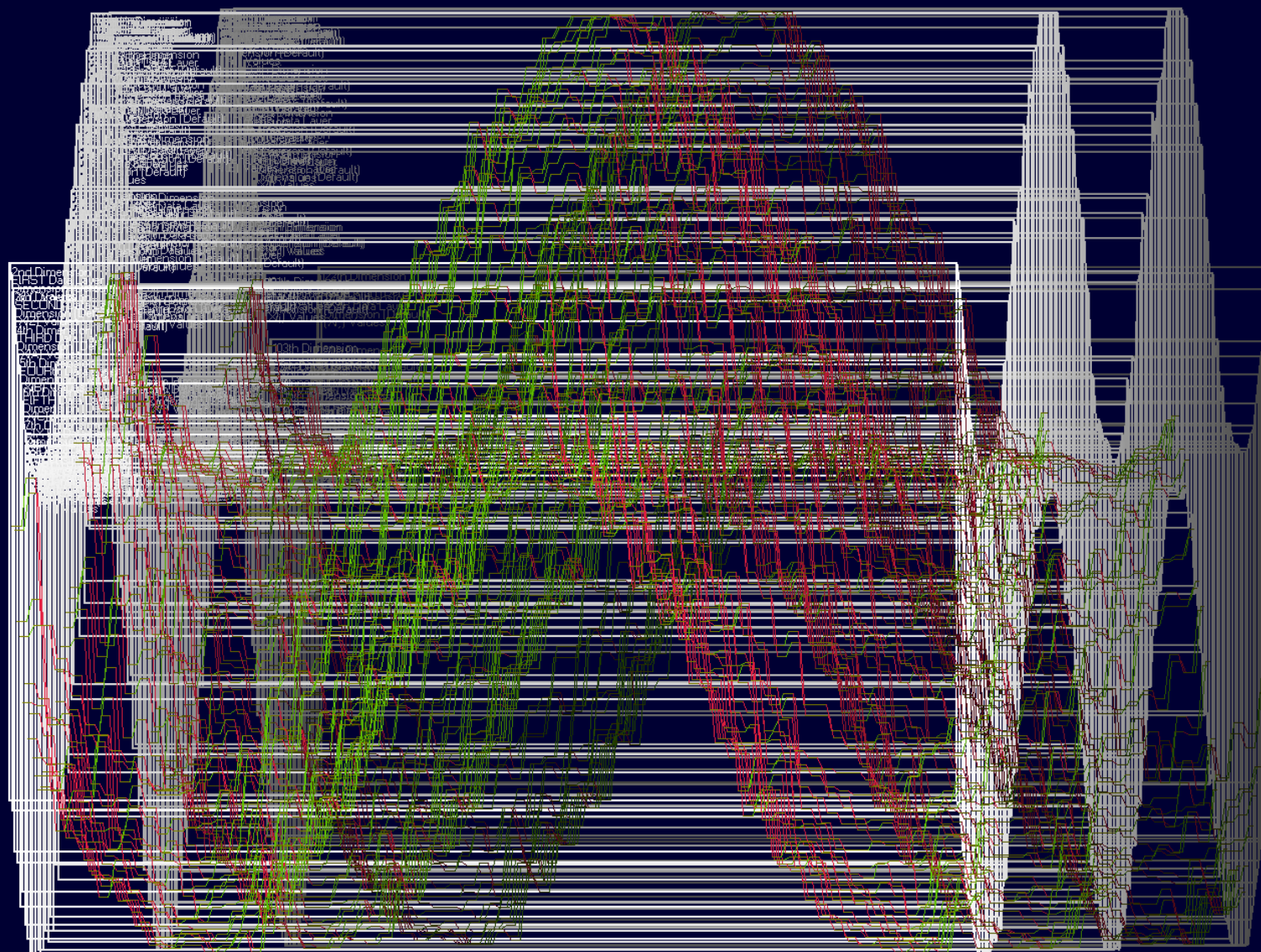
- National Physical Laboratory (NPL)
- Uwe Braun GmbH / Askania
- Thomas Swan
- GlaxoSmithKline
- Nanosight
- Johnson Matthey
- Agilent
- Zeiss

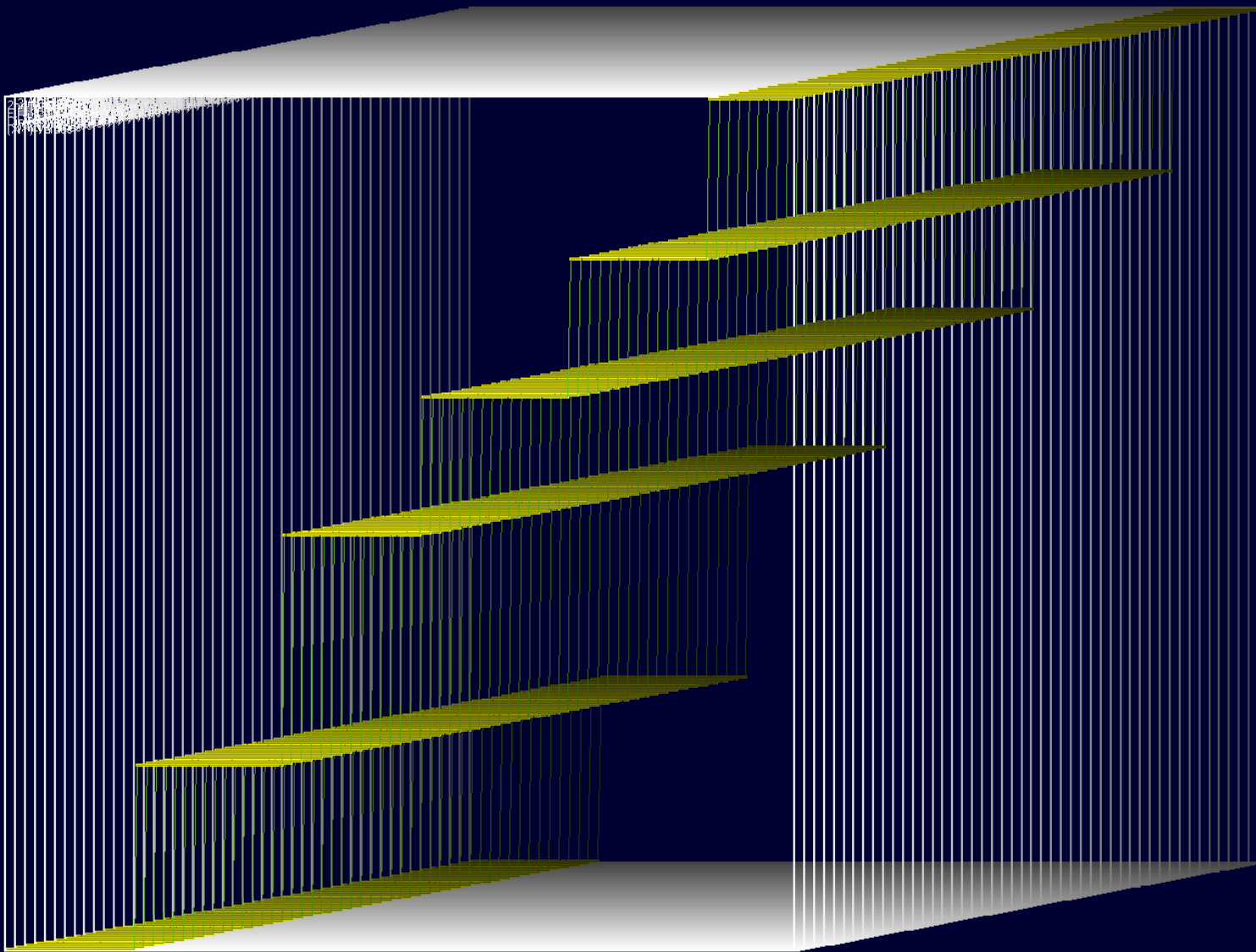


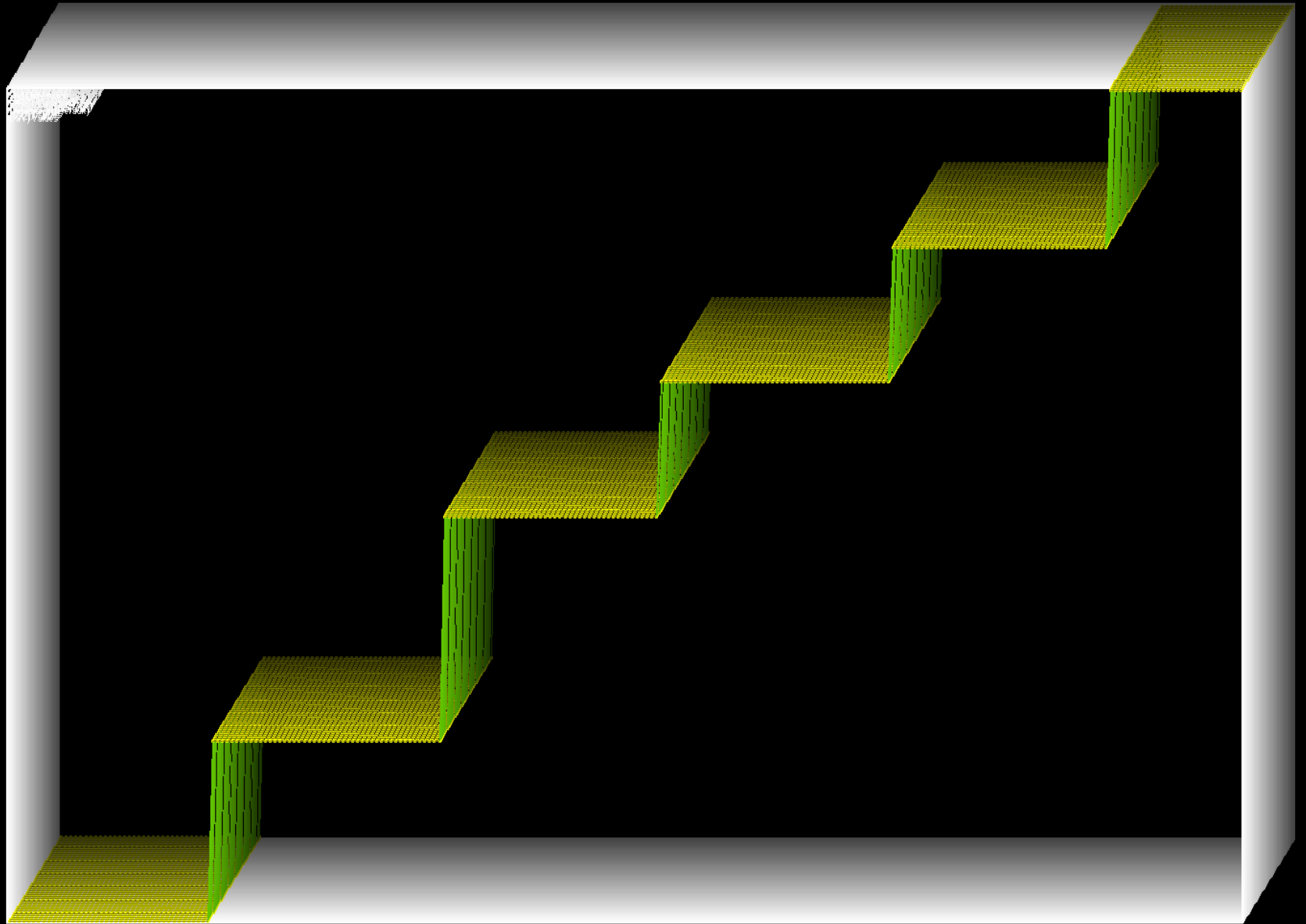






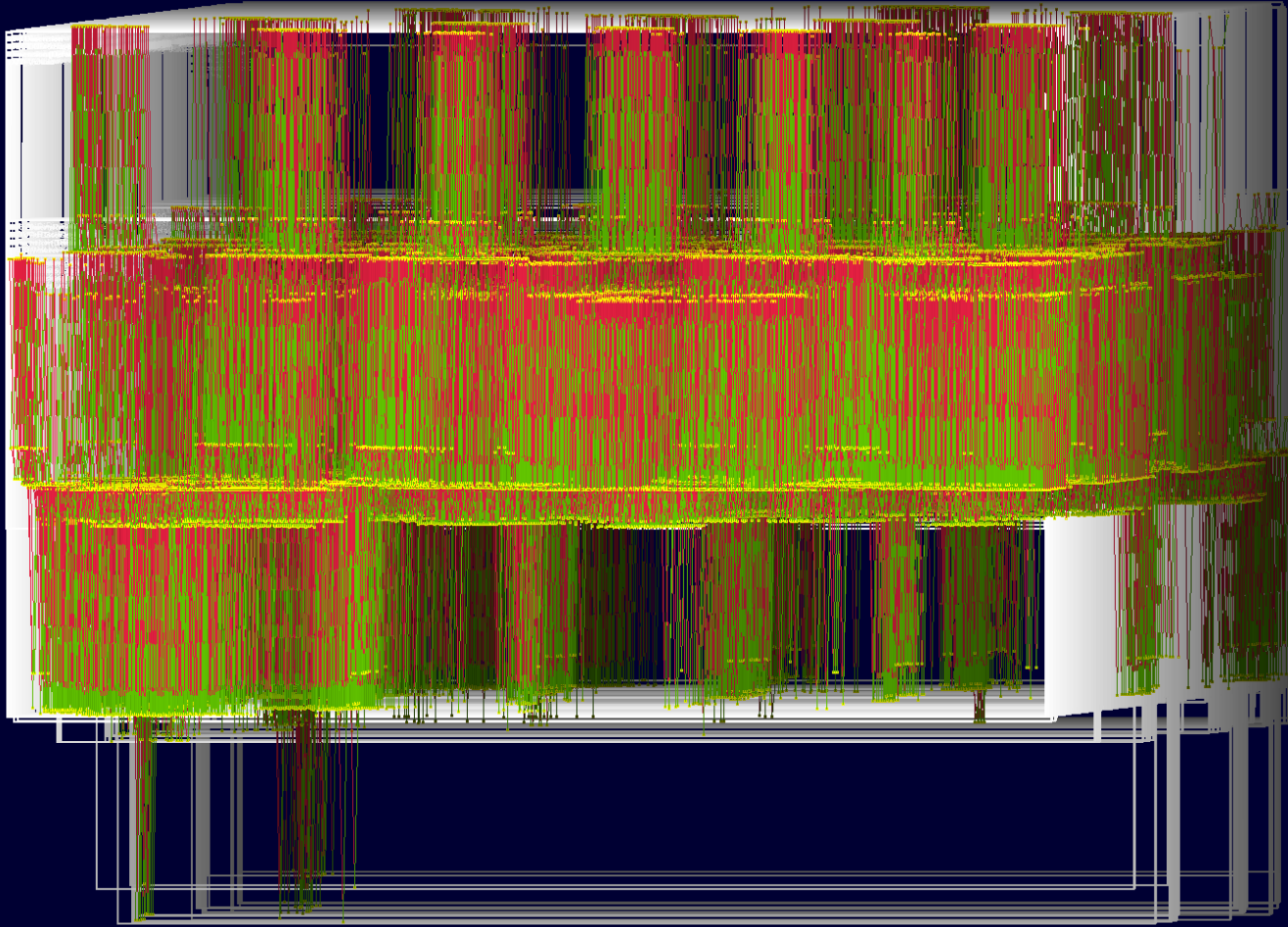




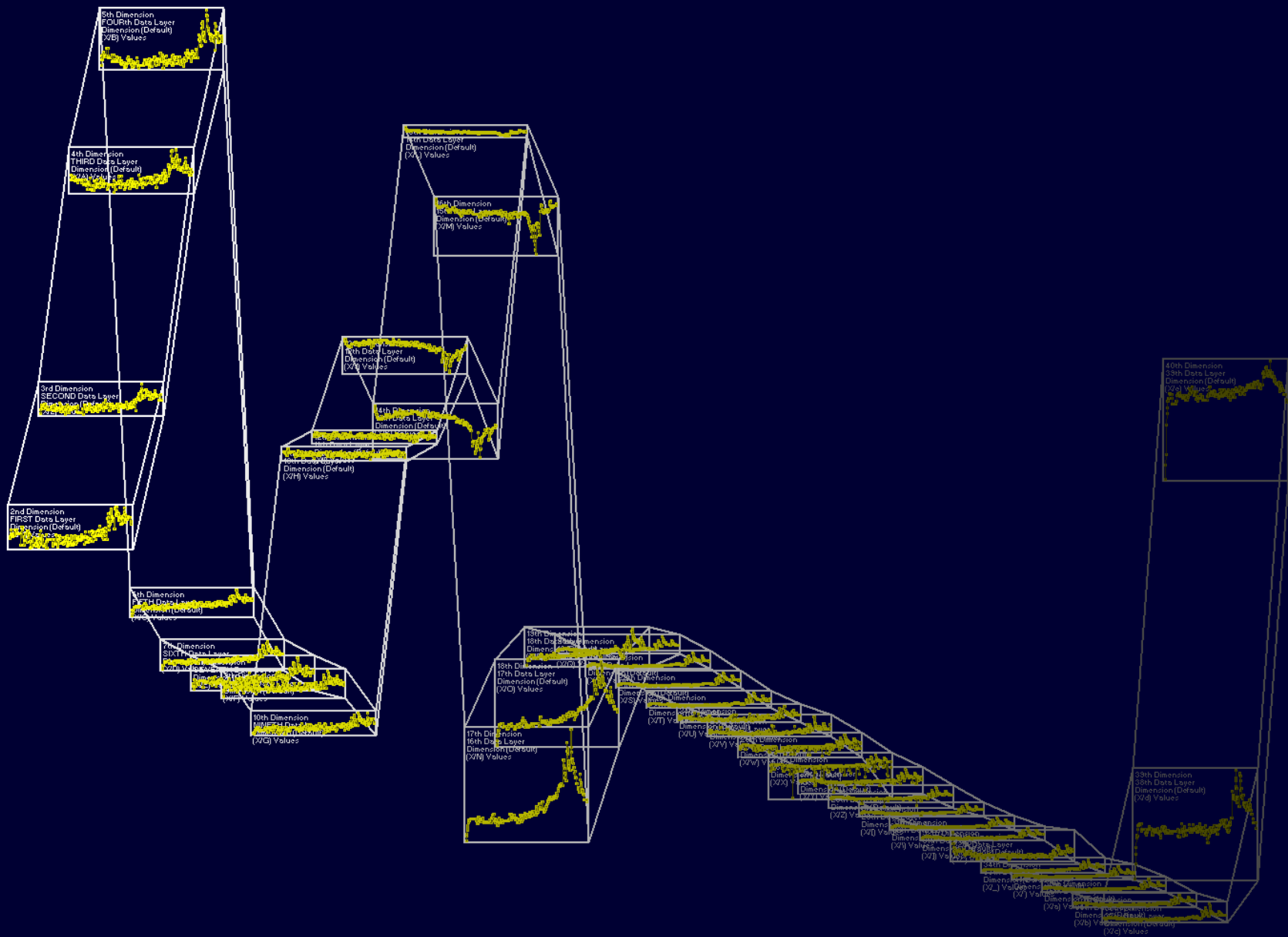




# Zeiss











# The Message

- Quantifying Images = Basis for ‘on-screen measuring’
- ‘On-screen measuring’ => defining ‘image-dependent measures’
- ‘Image-dependent measures’ => vocabularies of new metric qualities
  - Wellcome Trust
  - Quantifying toxicity.

# Hermann Hesse

***Siddhartha***<sup>-1</sup> PICADOR, London, 1991

‘When someone is seeking,’ said Siddhartha, ‘it happens quite easily that he only sees the thing that he is seeking; that he is unable to find anything, unable to absorb anything, because he is only thinking of the thing he is seeking, because he has a goal, because he is obsessed with his goal. Seeking means: to have a goal; but finding means: to be free, to be receptive, to have no goal. You, O worthy one, are perhaps indeed a seeker, for in striving towards your goal, you do not see many things that are under your nose.’

1\* **Siddhartha** was the personal name of the man known as **Buddha**, meaning "enlightened one". He was the founder of the religion that came to be known as Buddhism.