OMERO in yeast high throughput microscopy: from images to networks

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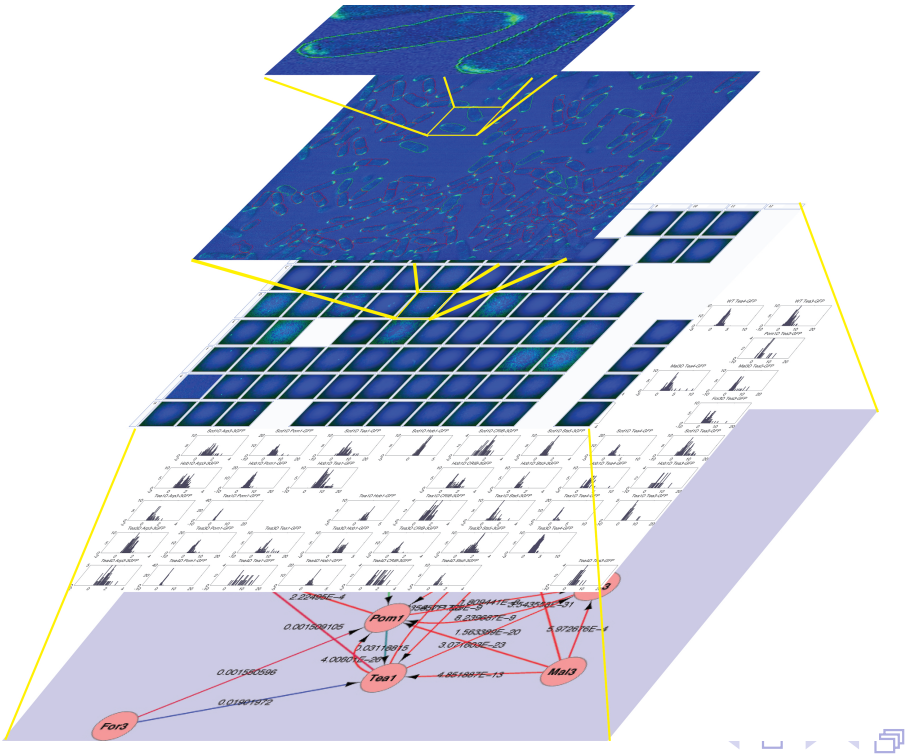
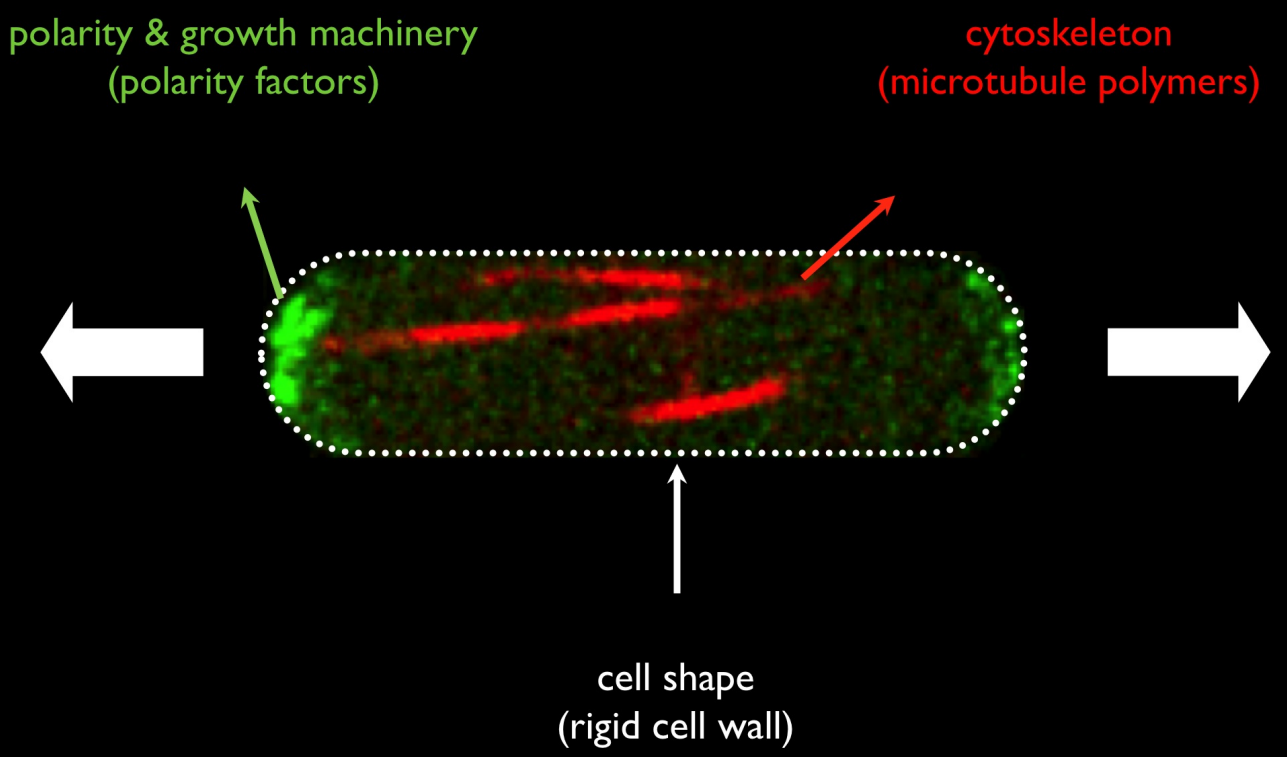


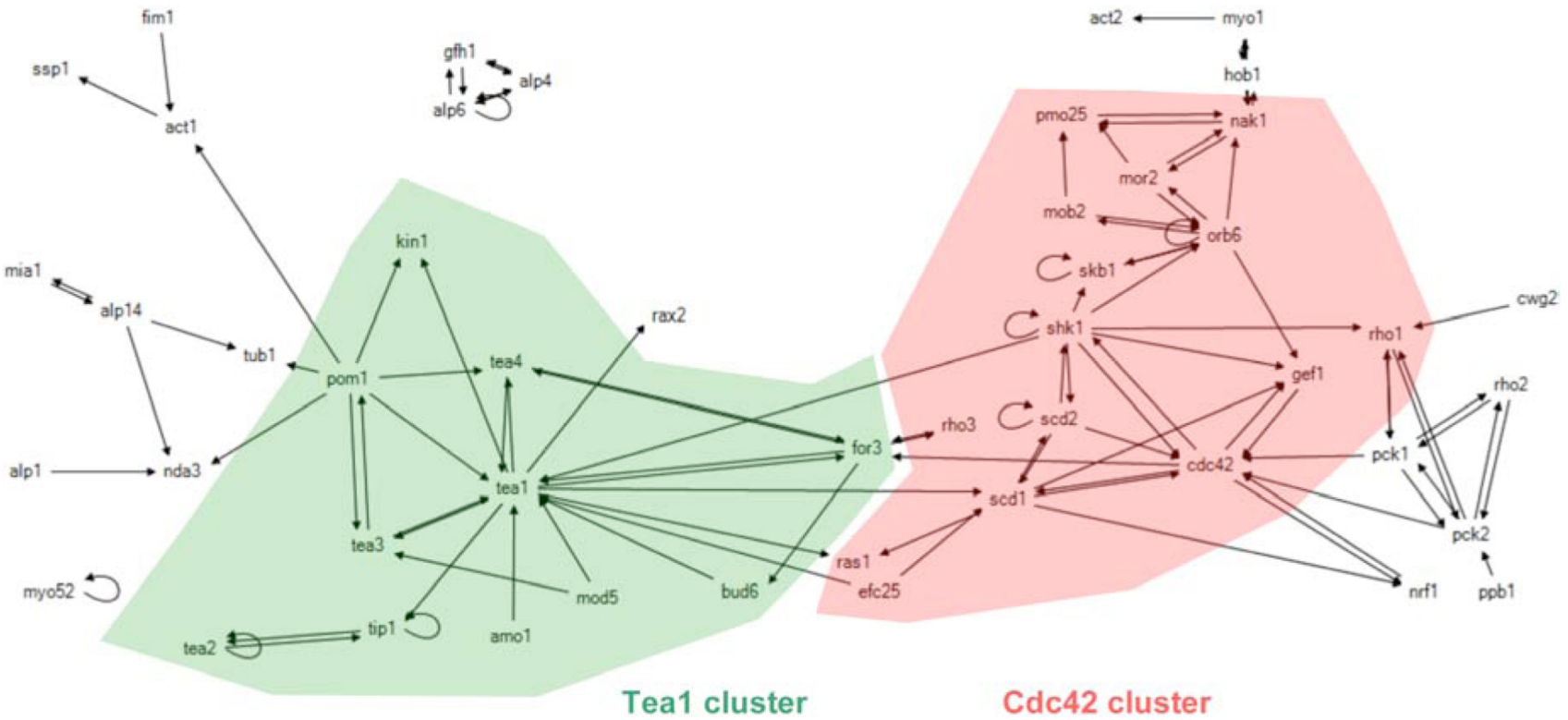
S. pombe as a model for cell morphogenesis

Studying the interplay between cytoskeleton, polarity, growth and shape



polarity factors (GFP-Tea3) microtubules (mCh-Atb2)

A network view of *S. pombe* polarity

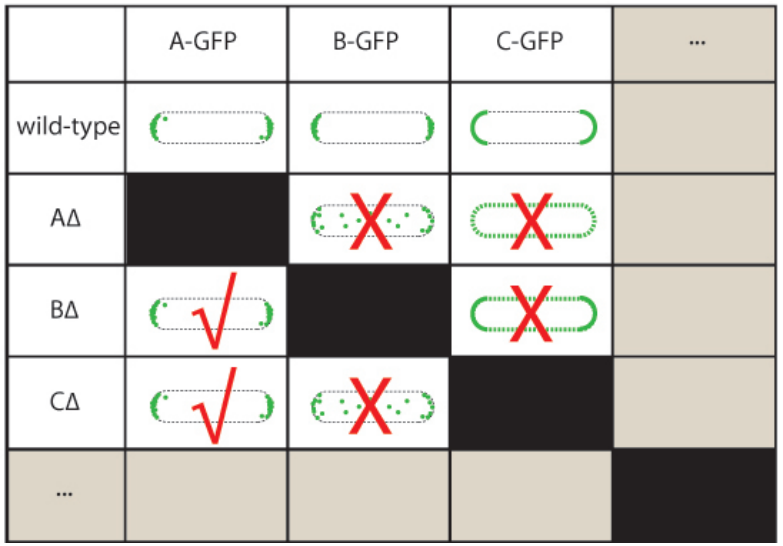


Aims:

- To obtain an **unbiased and exhaustive** network topology of the 50 polarity factors
- To clarify polarity **establishment, maintenance and inactivation** using network inference approaches

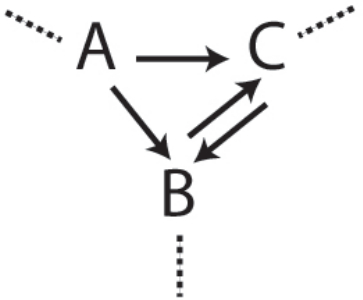
Proposed process

Construct a 50×50 matrix of polarity factor interdependencies



0. Filming 2500+ strains (JD)
1. Segmenting and selecting cells from images
2. Extrating single cells phenotypes
3. Inferring a network

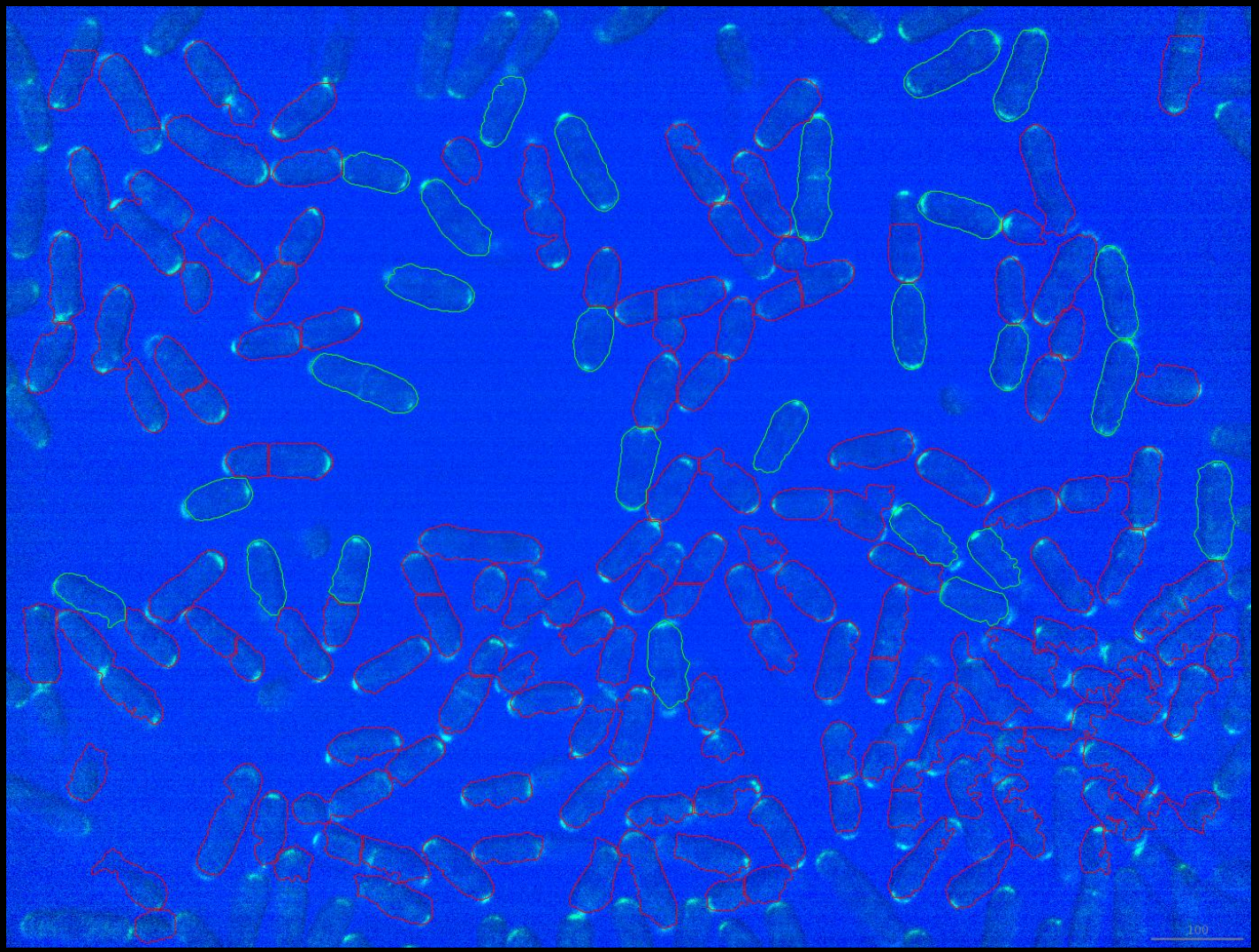
Reconstruct hierarchical relationship among polarity factors



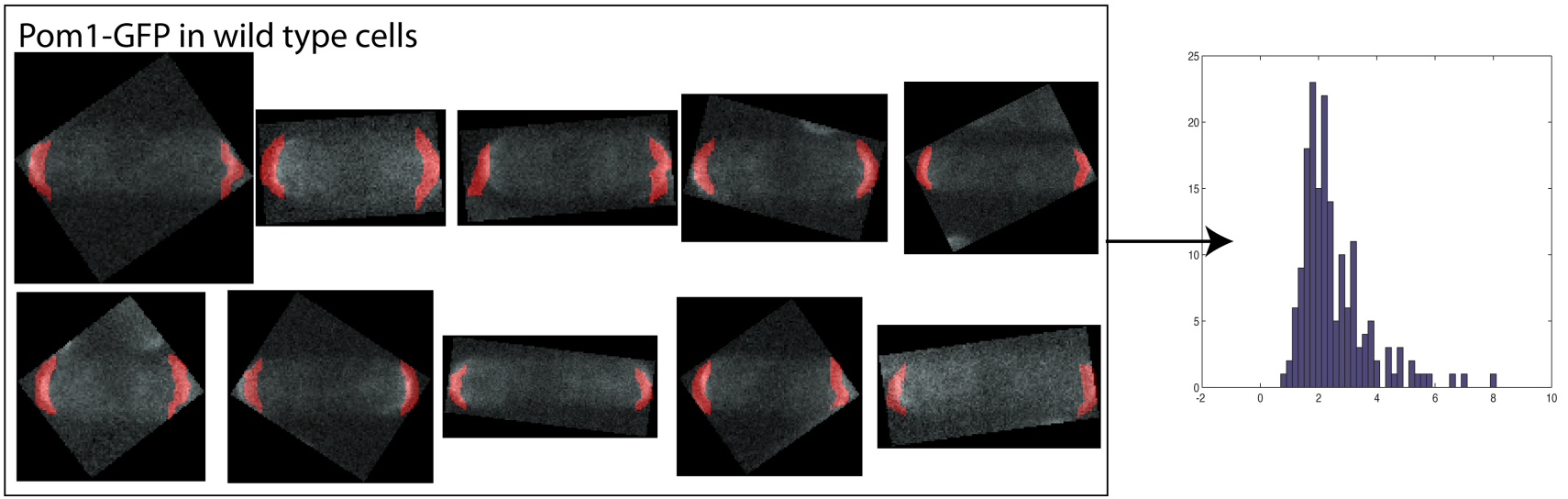
From a Perkin-Elmer OperaLX

to a server with an OMERO database

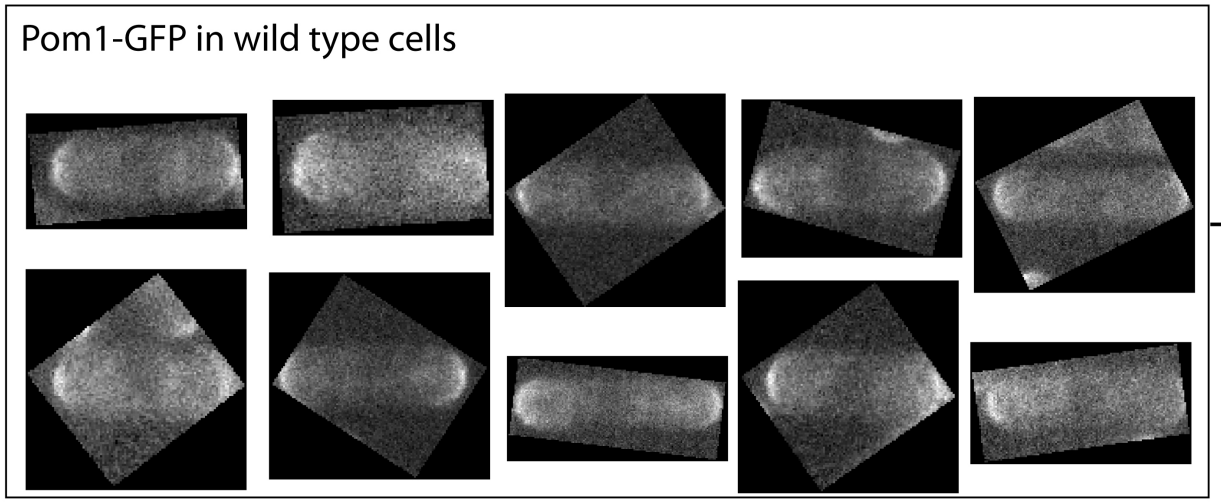
Segmenting cells: object segmentation & cell selection by machine learning

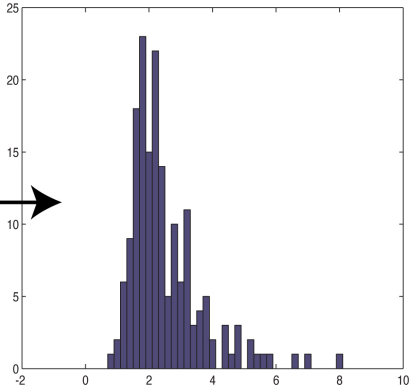


Tip enrichment phenotype

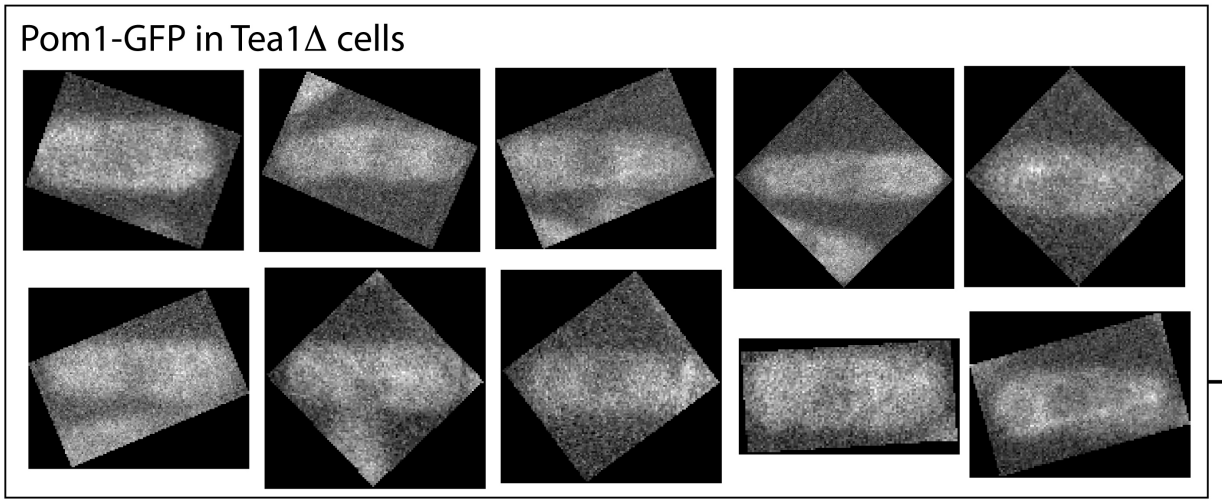


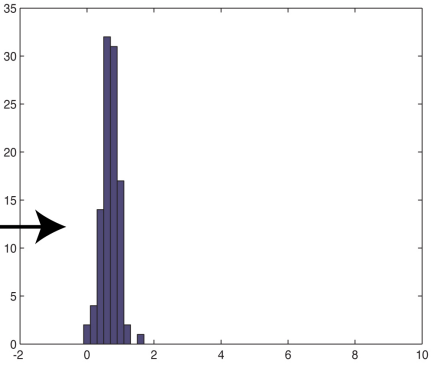
Inferring one network "arrow"





Kolmogorov-Smirnov test
p-value=1.2e-54
(very different distributions)

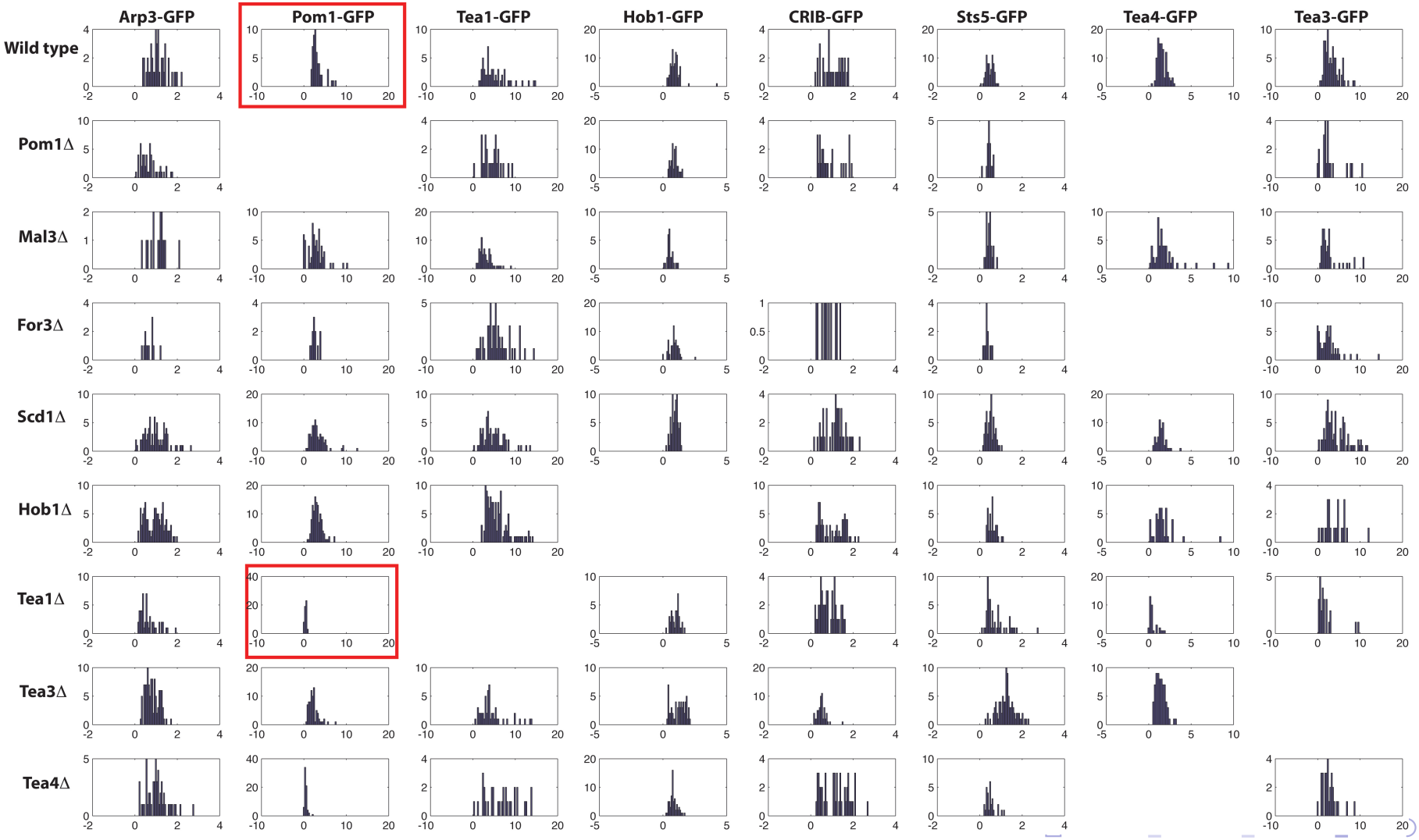




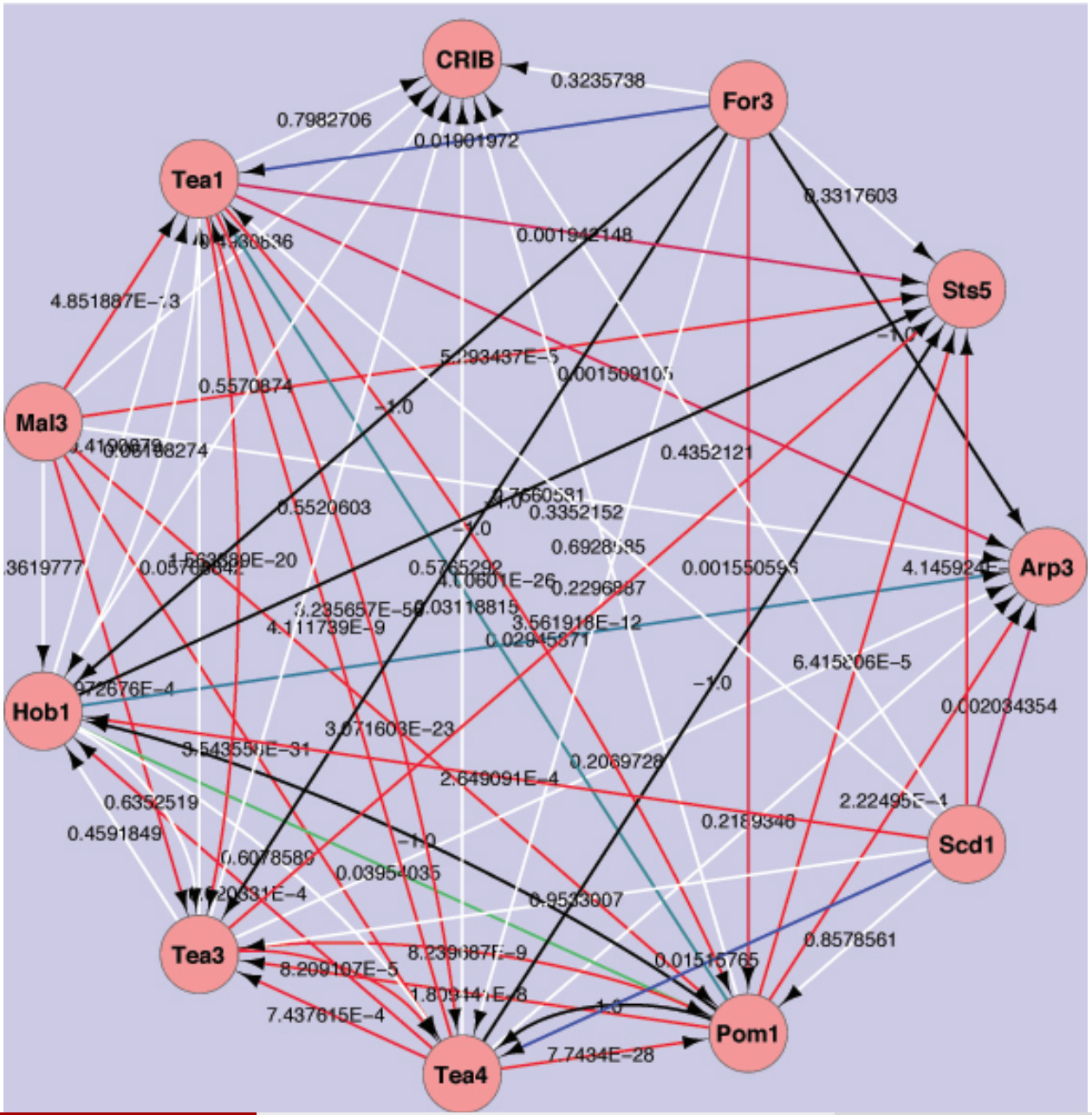
Thus: Tea1 ⟶ Pom1 (Bähler & Pringle, 1998)

Tip enrichment phenotype

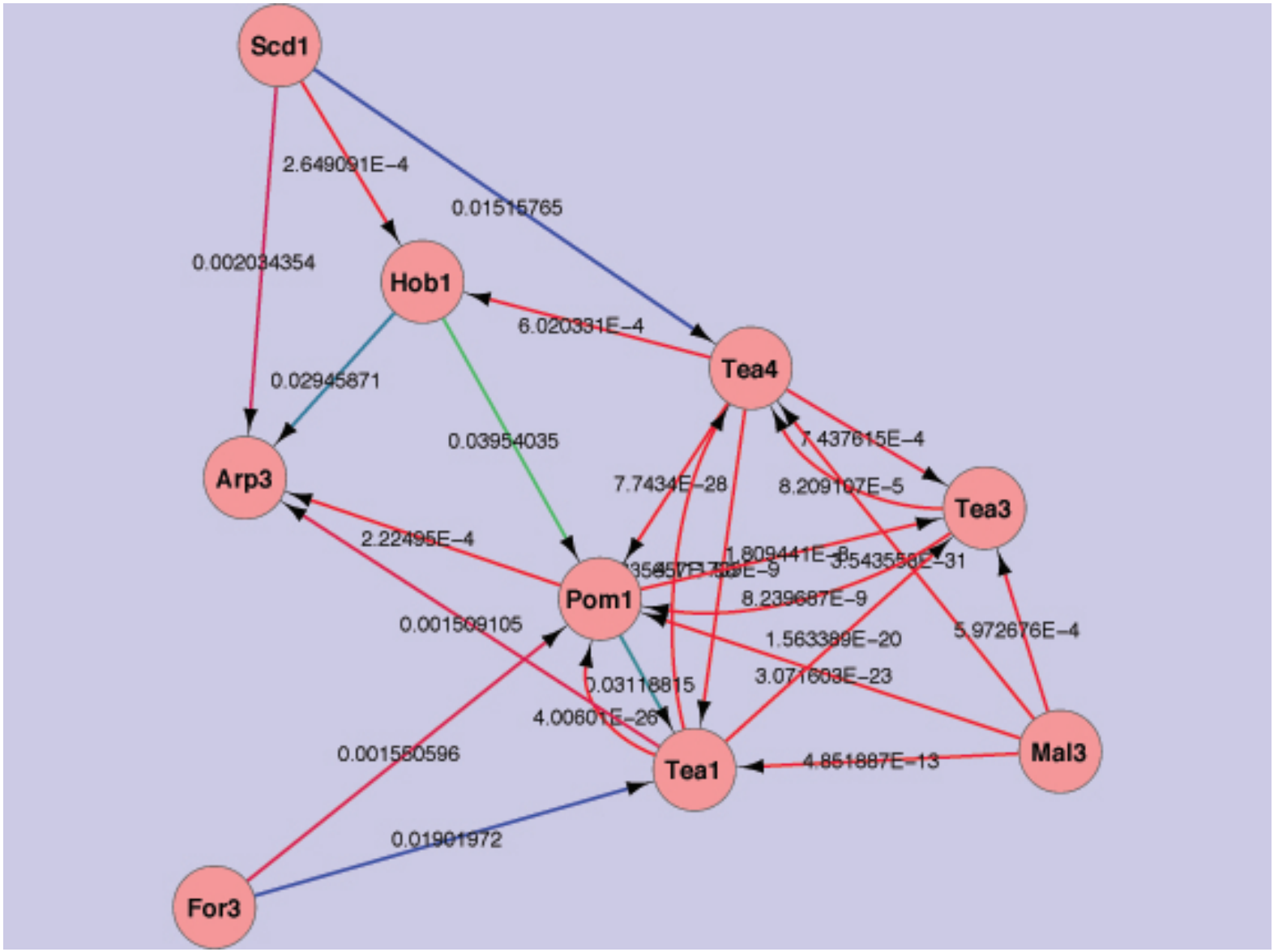
Polarity factor tip enrichement histogram



Pilot matrix network



Pilot matrix network: significant edges



Conclusion & future work

- Systematic investigation of a polarised growth network
- Pipeline going from matrix of genotype to a network
- Acquire the data!
- Statistical network inference

Pieces of an image informatics pipeline

Problem statement: A large quantity of raw data have to be stored, analysed, and the analysis results themselves stored and analysed with the whole thing needing to be visualised in various ways.

- Store/serve images (OMERO)
- Analyse them (Matlab)
- Store the results (SQL/Matlab)
- Re-analyse them (matlab/R/python)
- visualize the above (anything...)

An object oriented data analysis

PombeCell

Properties

- croped image data
- intracellular localisation
- Metadata & measruments

Methods

- compute subcellular fluo intensities
- compute growth stage (...)
- single cell display & export to OMERO ROI

PombeCells

Properties

- An list of PombeCell

Methods

- compute/export various population wide measurements, distance matrix...
- various (interactive) displays

PombePlate

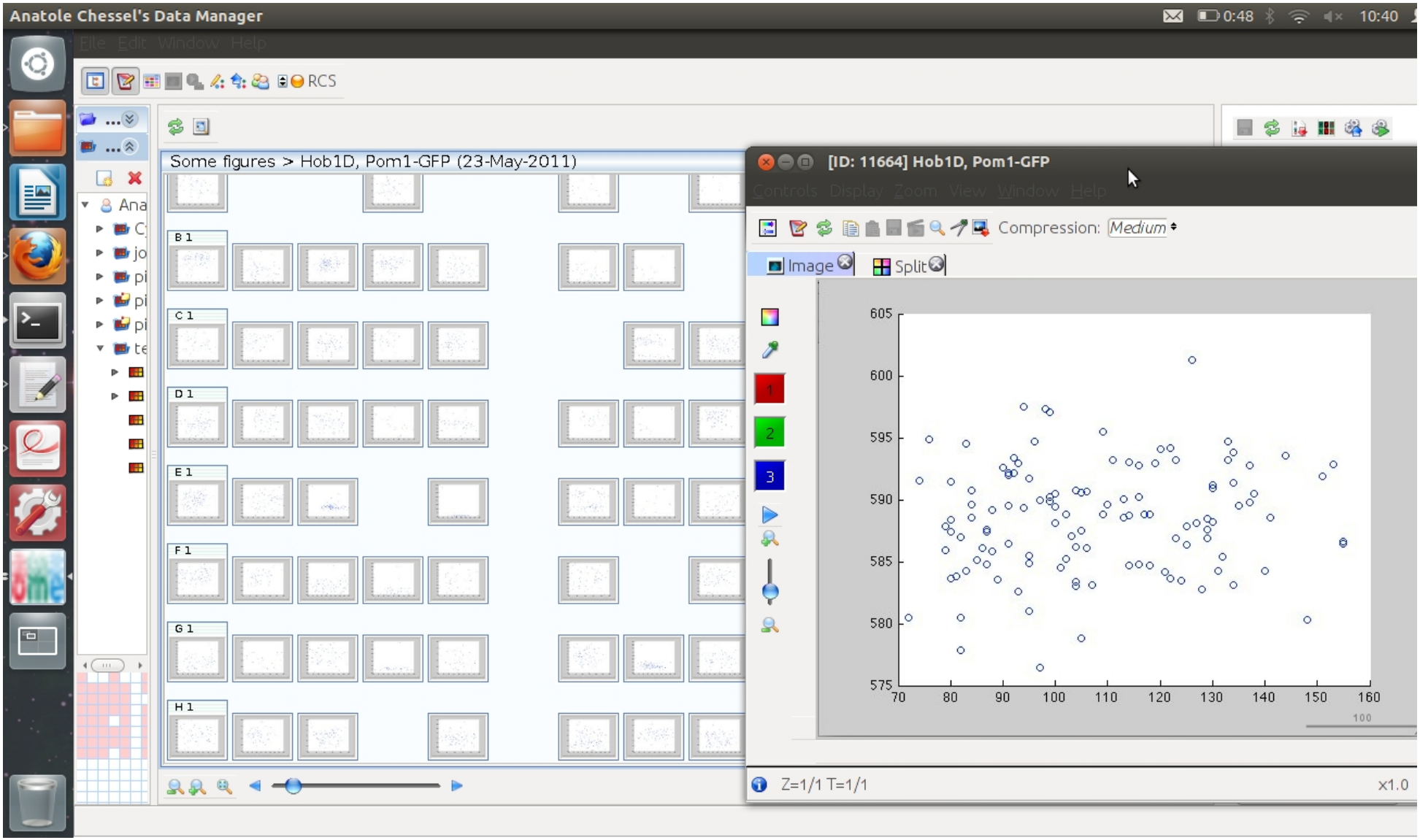
Properties

- An array of PombeCells, according to plate or any other scheme

Methods

- compute/export network
- export array of visualisation to OMERO

Twisting OMERO a bit



Pieces of an image informatics pipeline

Approach taken: An object oriented framework to store and manipulate data and interface it with various software

- Input: any set of segmented images, SQL database
- Processing: anything in Matlab
- Output: visu in Matlab, OMERO at various points, updating SQL
- will it scale up one order of magnitude?
- interface with R, python
- ... OMERO model extension?

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