ETH zürich

Coalescence kinetics of oil-in-water emulsions using a microfluidic ship *in situ*

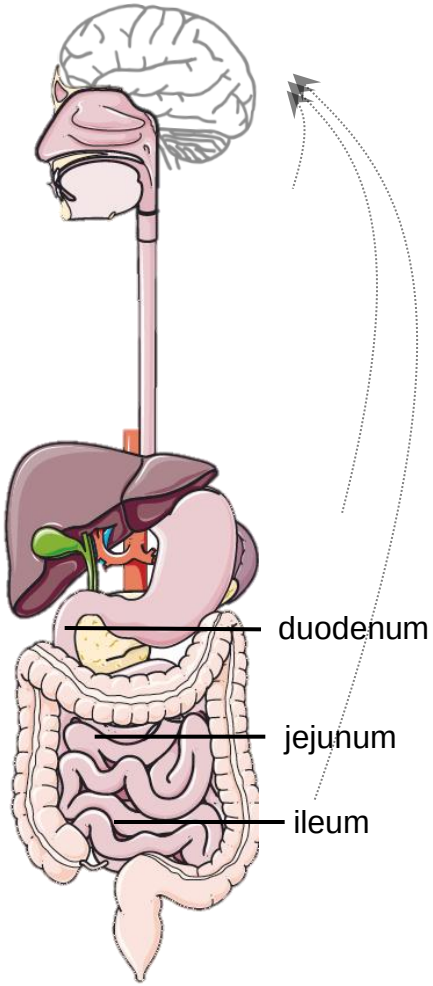
Nathalie Scheuble

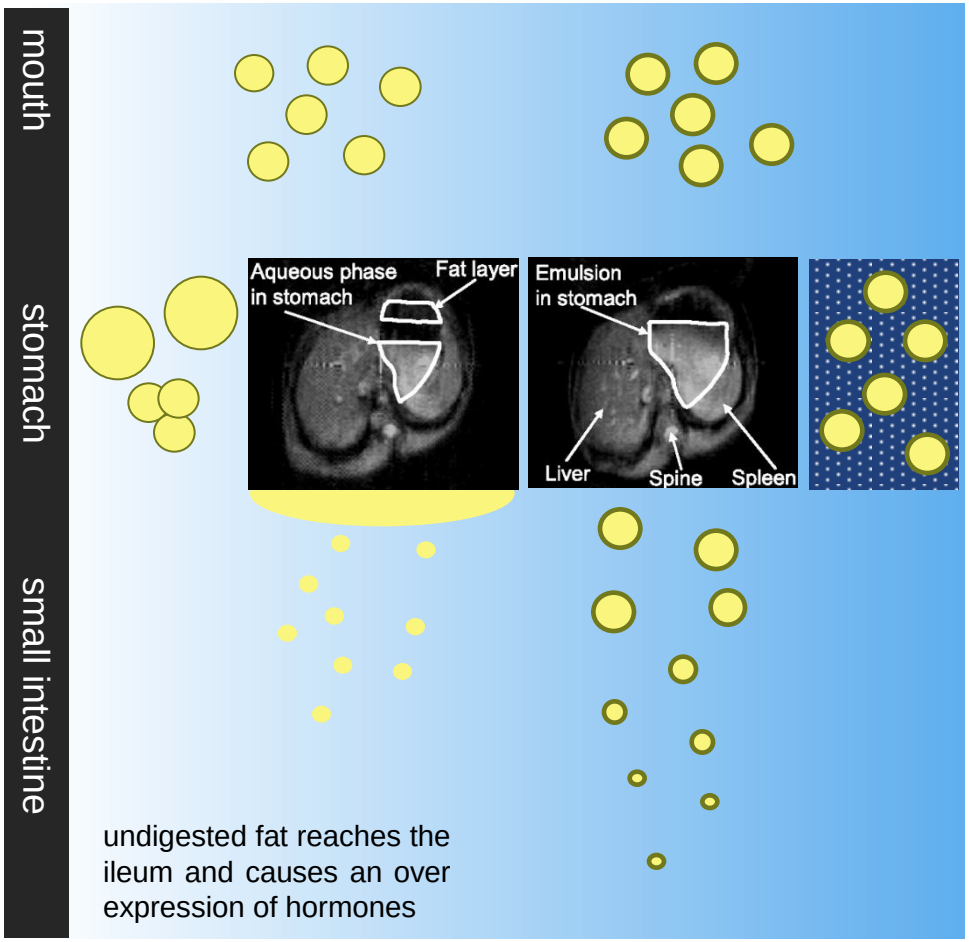
QBI lecture by Kevin Mader

Laboratory of
Food Process
Engineering

Aim: control and quantify emulsion structure during digestion

Emulsion structures define, when and how the nutrients/drugs are sensed in the body.



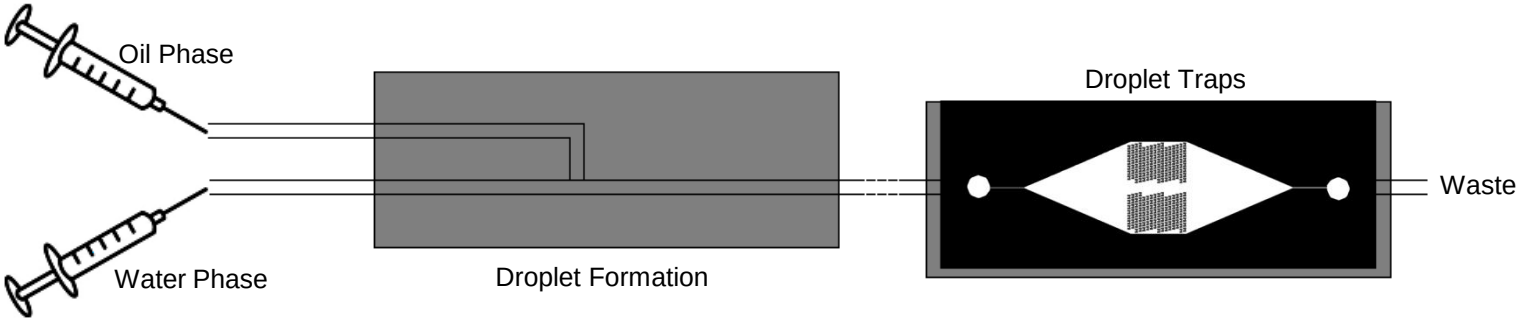


Motivation

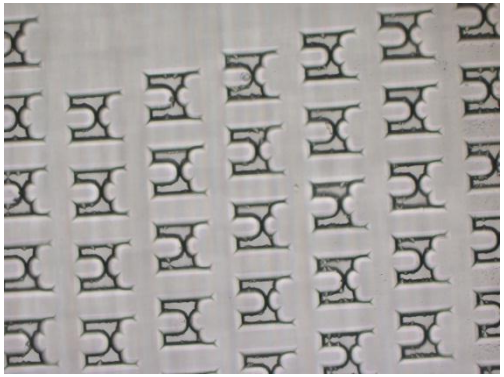
- **Main structural changes** of emulsions during digestion is due to **lipase activity** (superposition: droplets coalesce, shrink (oil is digested) and emulsion flocculates).
- **Drawbacks of backscattering** techniques: lag time (not in situ), do not differentiate between flocculated and coalesced droplets.

=> microfluidic chip, which allows differentiate and quantify droplet coalescence and digestion over time!

Microfluidic chip



Droplet Formation

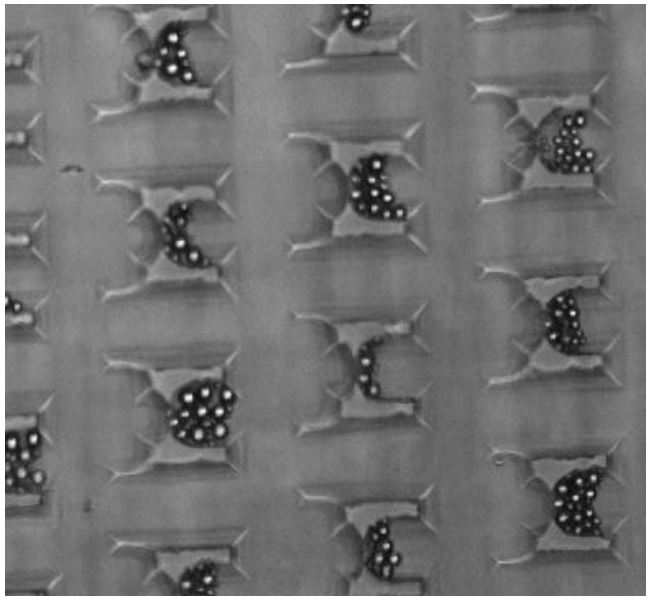


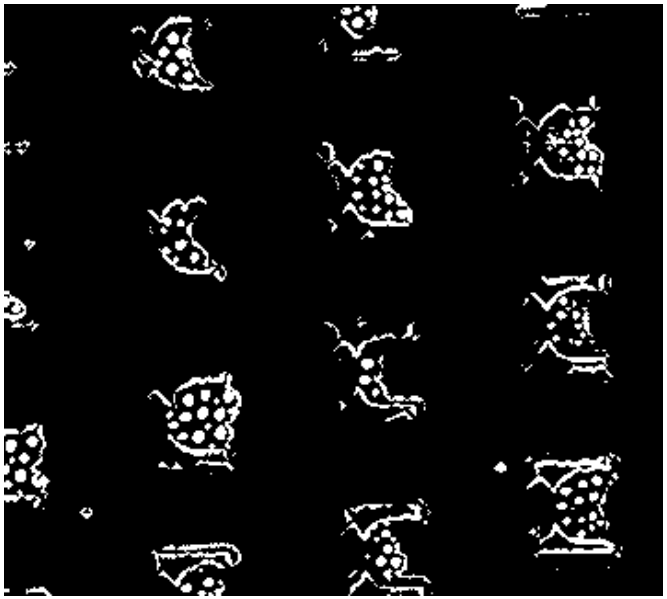
traps

Dynamic Experiments – experimental design important

- Define area of analysis, resolution vs statistics
- How big should the droplets be (experiment (small) vs analysis (big))?
- What influences droplet detection in traps?

Fail of segmenting droplets without mask of traps



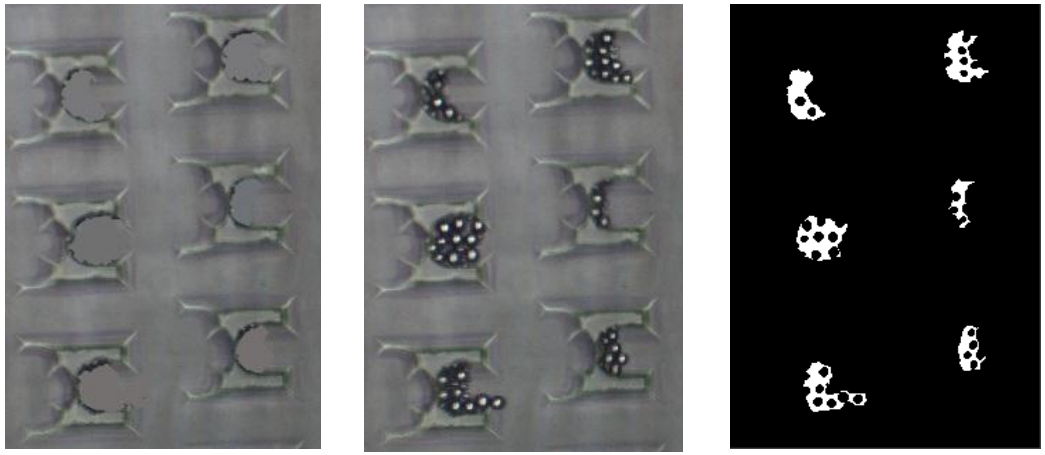


Result of overlaying an enroded inverted thresholded image with a dilated thresholded image

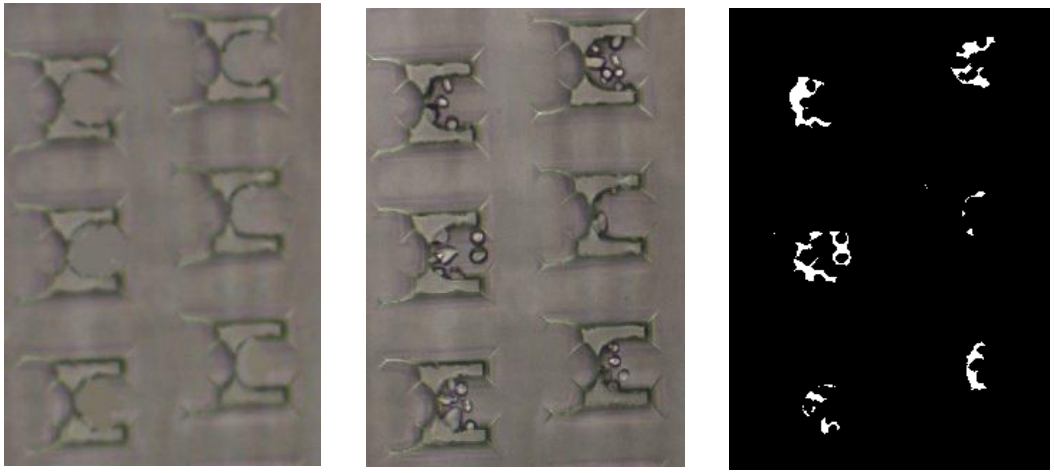
Mask is needed for getting rid of traps!

Applying a mask

before

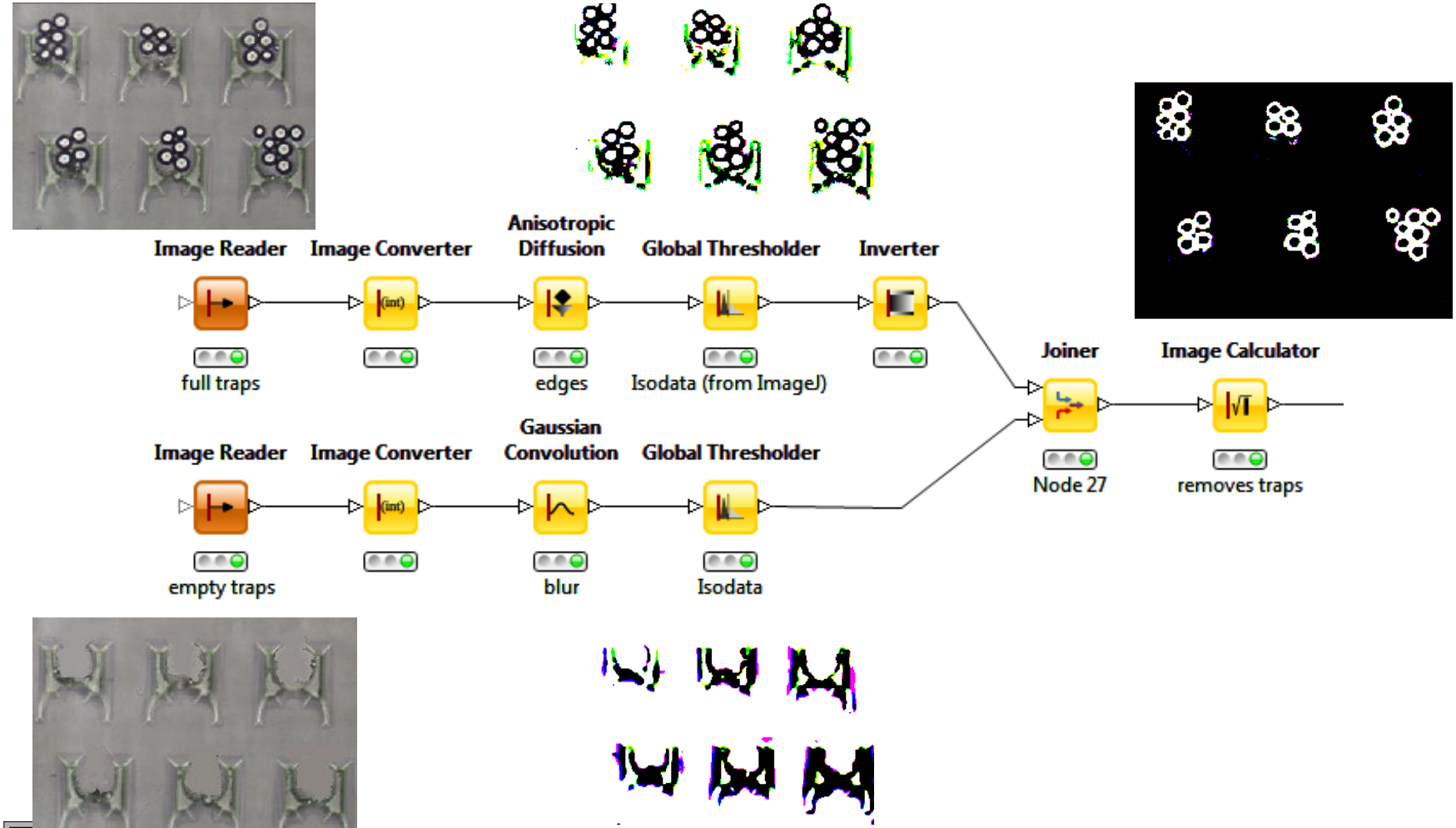


After 60 min of digestion

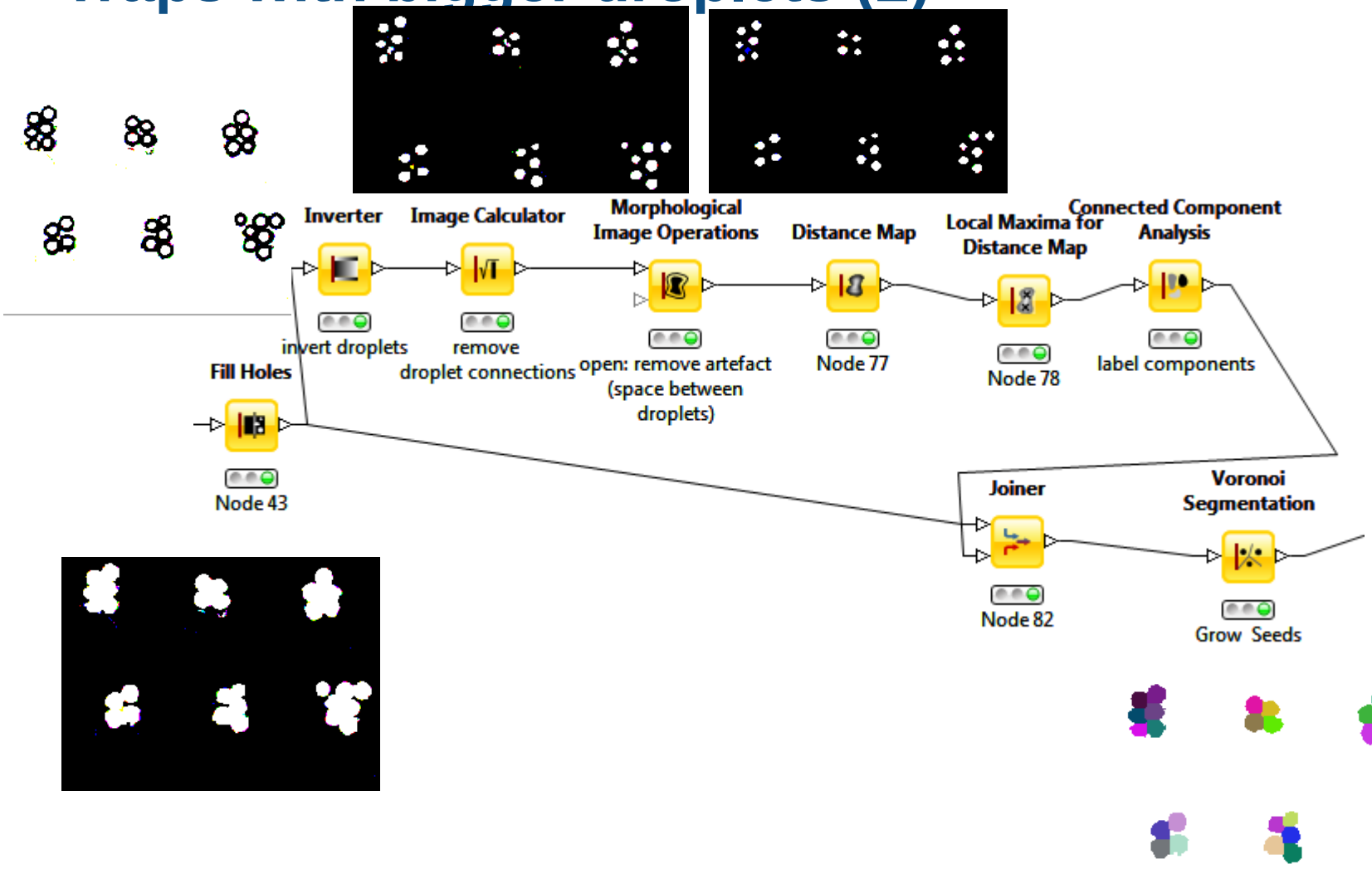


Droplets too small (attach too much to traps), bad contrast

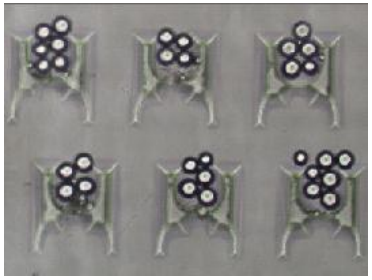
Traps with bigger droplets (1)
(no digestion experiments performed yet)

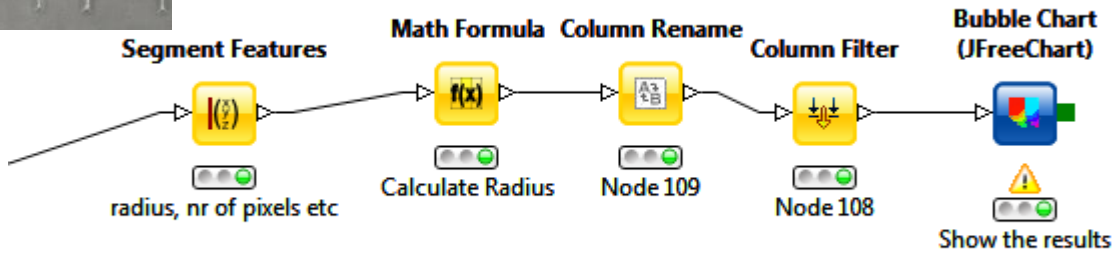


Traps with bigger droplets (2)

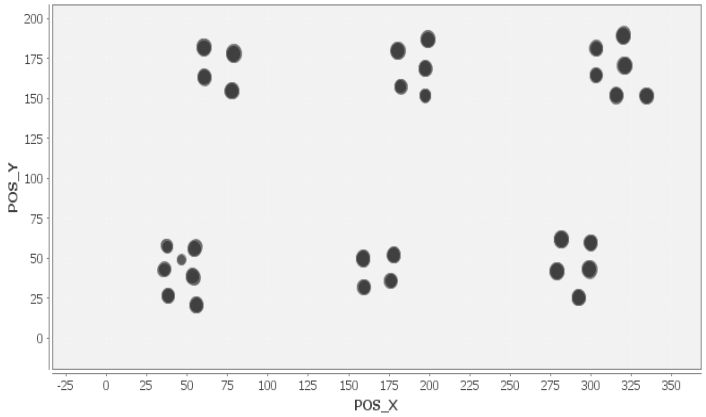


Traps with bigger droplets (3)





Going in the right direction…



Summary and Conclusions

- Good to start planning image analysis before performing all experiments
- For experimental design
  - Use mask or dye droplets
  - Use big droplets