Protocols

Graphical programming for Icy

a.k.a. programming, for the rest of us

Foreword: Reproducible Research

- Quote: "Results aren't much if they can’t be reproduced!"
  (your boss, your reviewers, your colleagues, you!)

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  *[...] Image quantification was **carefully** conducted using Photoshop. [...]*

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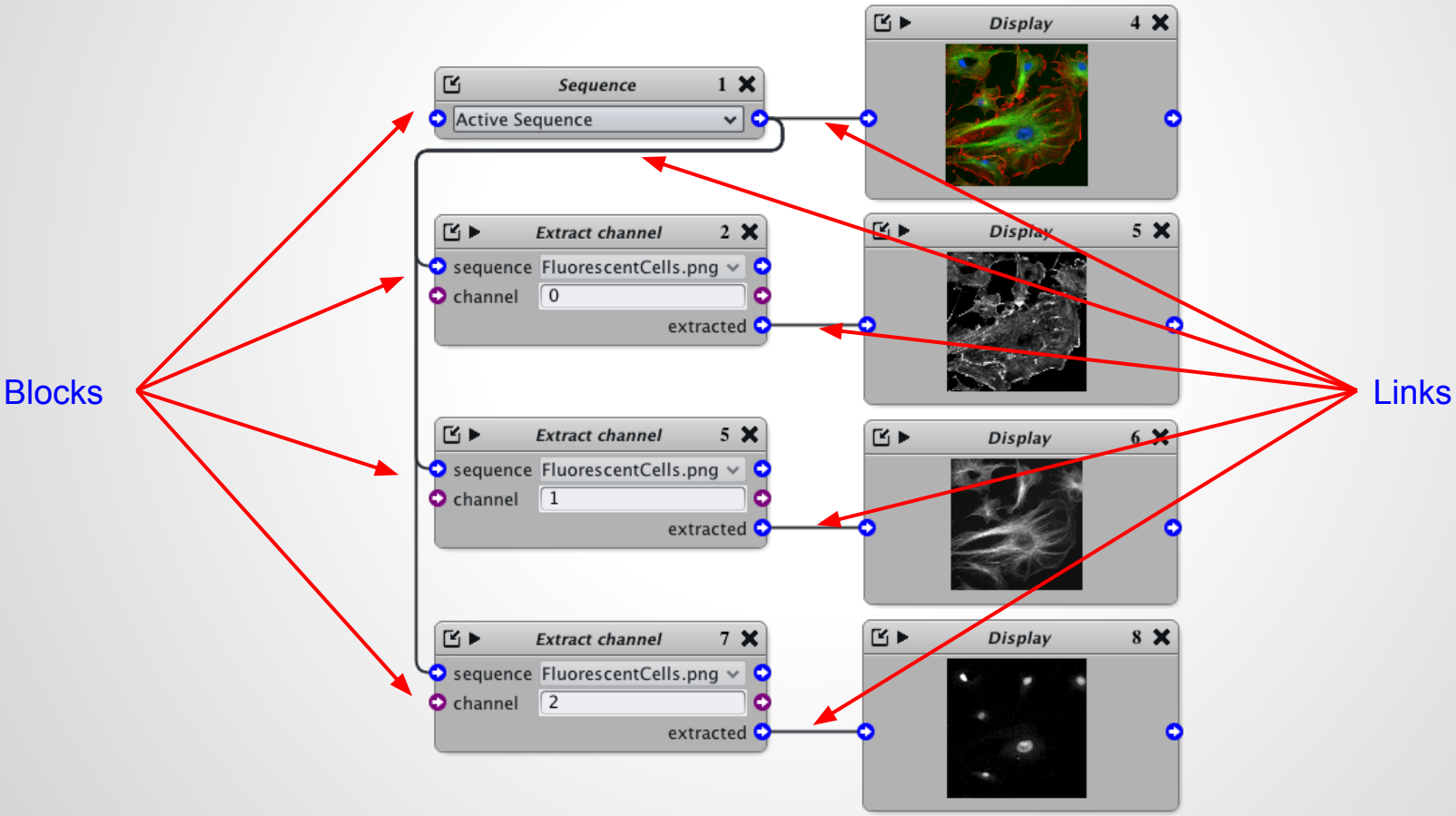
- Icy makes these protocols easy to read / write / use / adapt
  - **Design** a protocol once, run on thousands of images
  - **Upload** your protocol and share with the world (within publications)
  - **Download** other protocols, run them out-of-the-box
  - **Extend** any protocol to meet your needs and share/publish again

  all in just a few clicks, no programming knowledge required.

Protocols in Icy

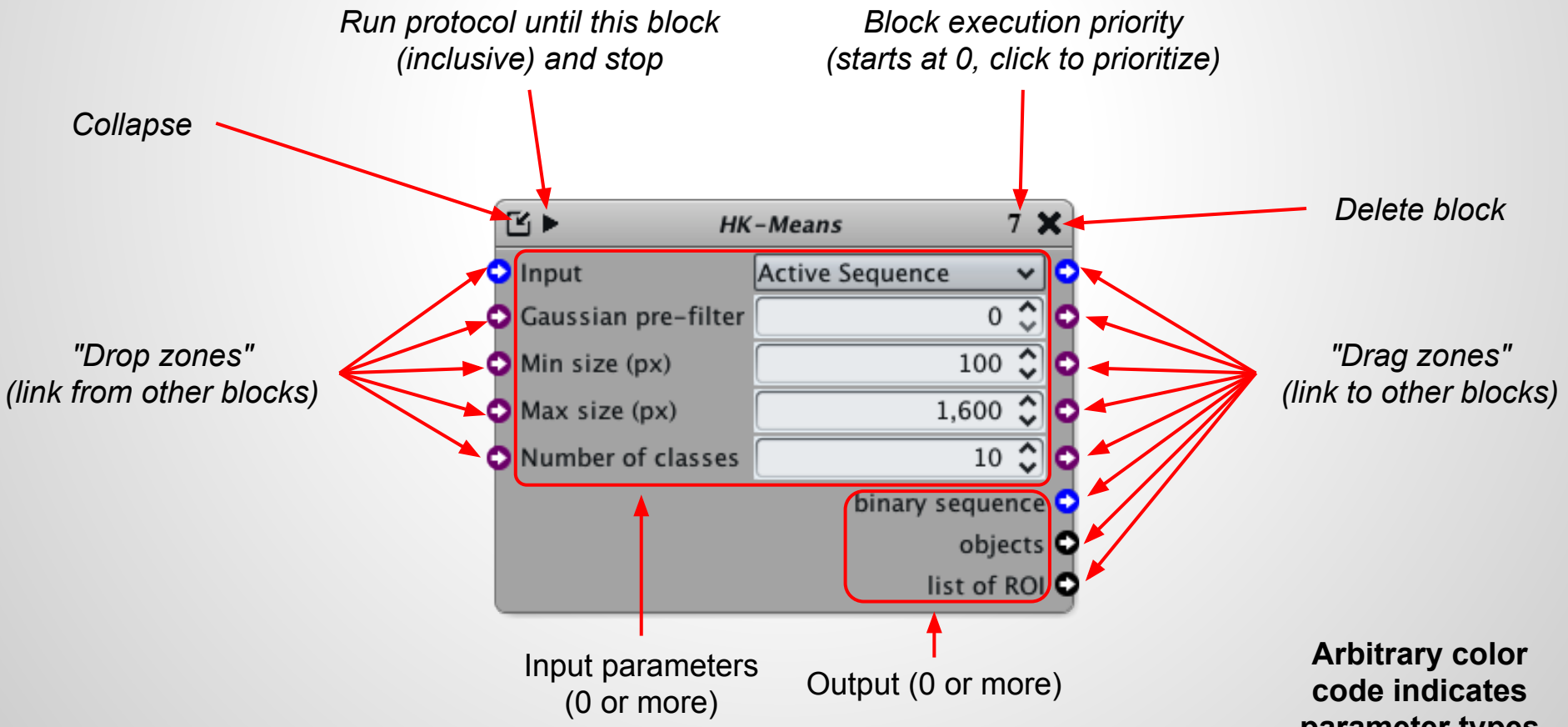
- A protocol is a ***workflow*** linking processing ***blocks*** together



http://icy.bioimageanalysis.org/protocol/Extract_channels

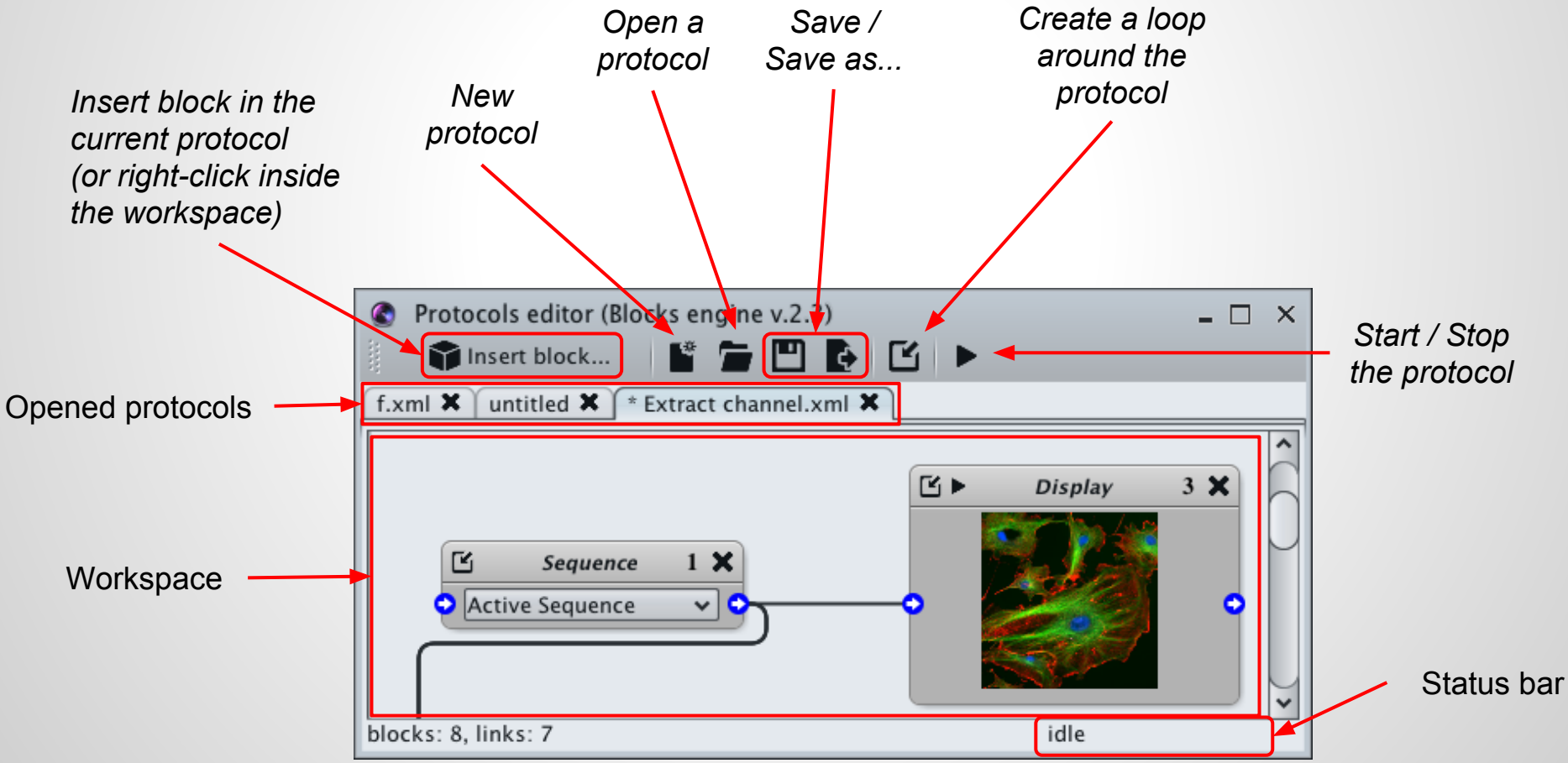
Protocols in Icy

- Standardised design: all blocks look the same
- Strong modularity: one block = one task



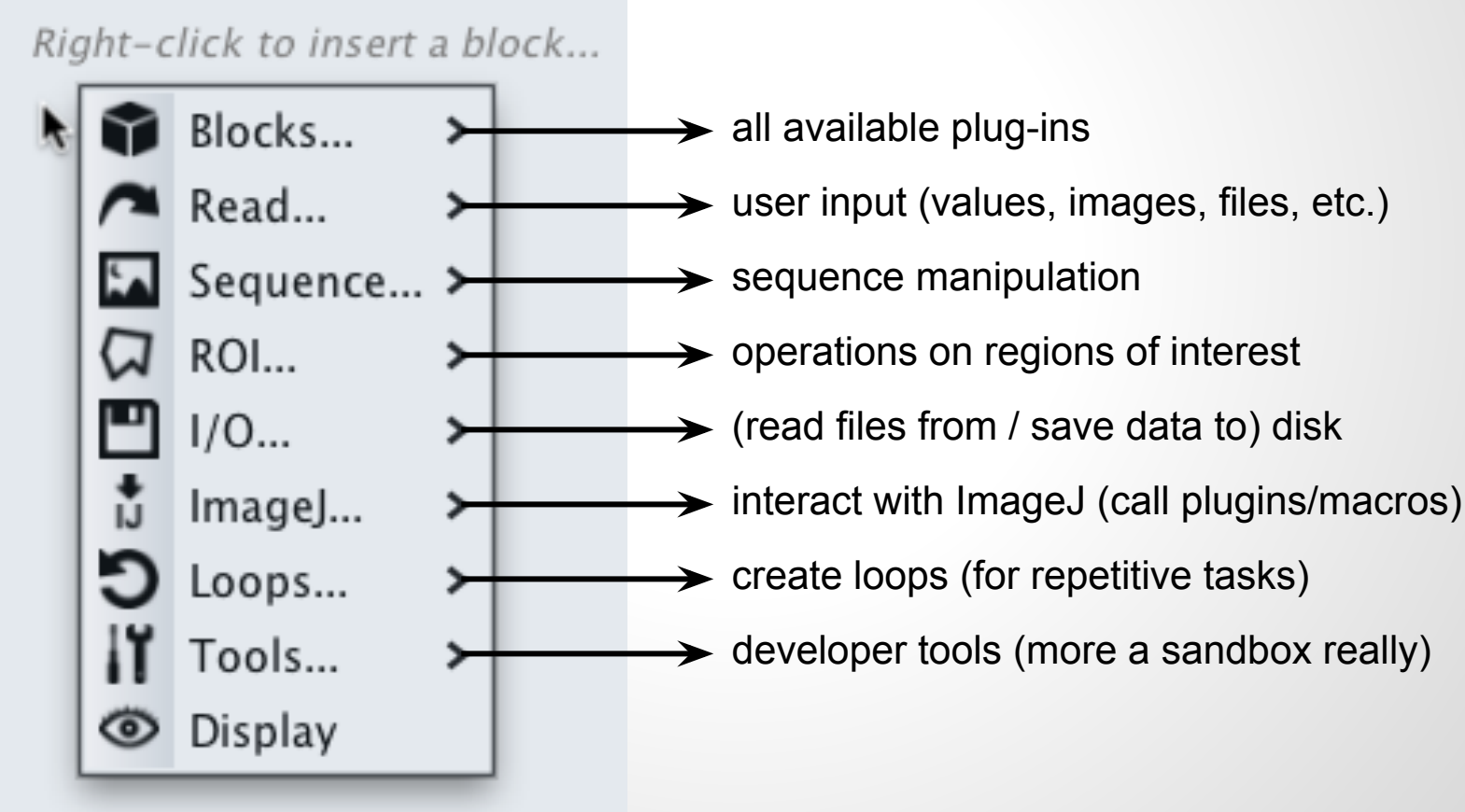
Protocols in Icy

- The protocols editor: *http://icy.bioimageanalysis.org/plugin/Protocols*



Protocols in Icy

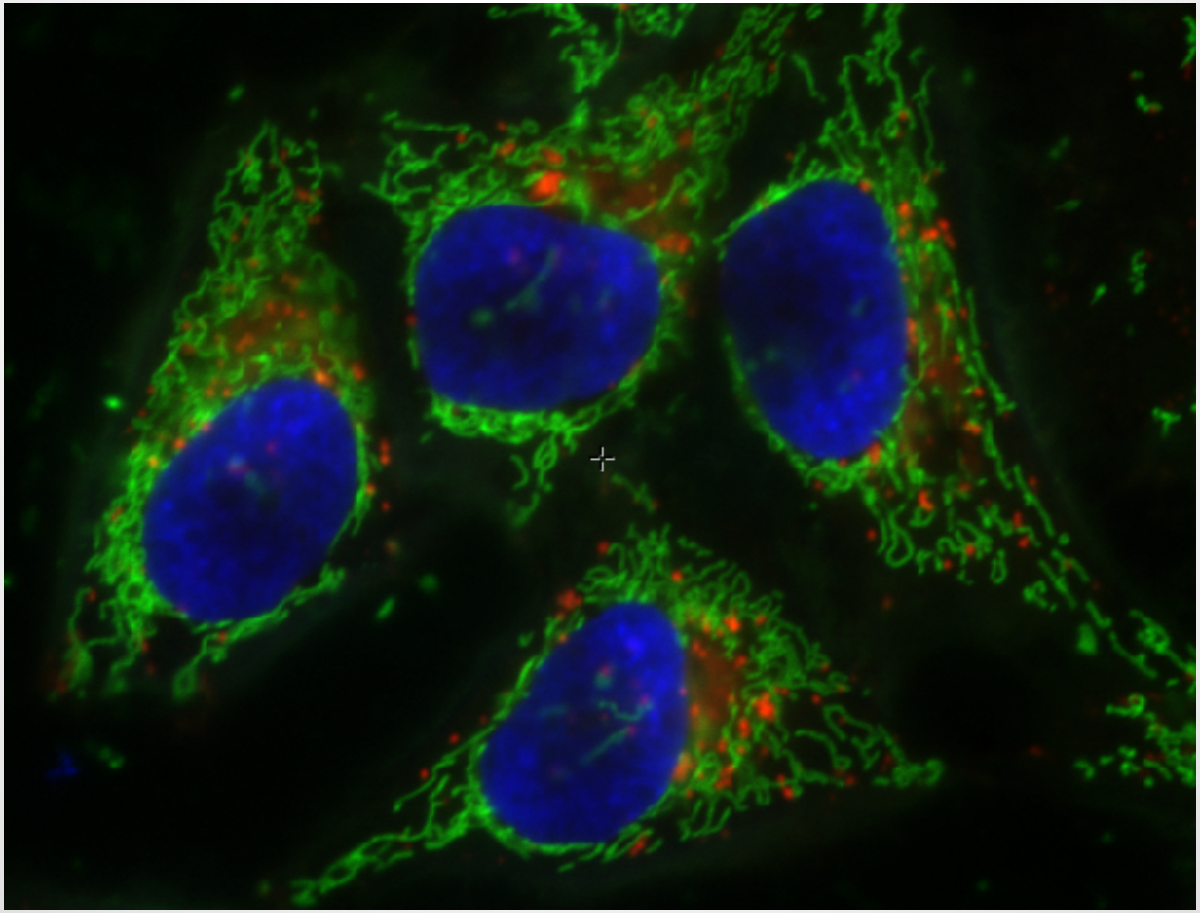
- Blocks are organised by groups



More ideas on how to tidy things up? Let us know!

Protocols in Icy

- Question: how would you find the nuclei in this image?



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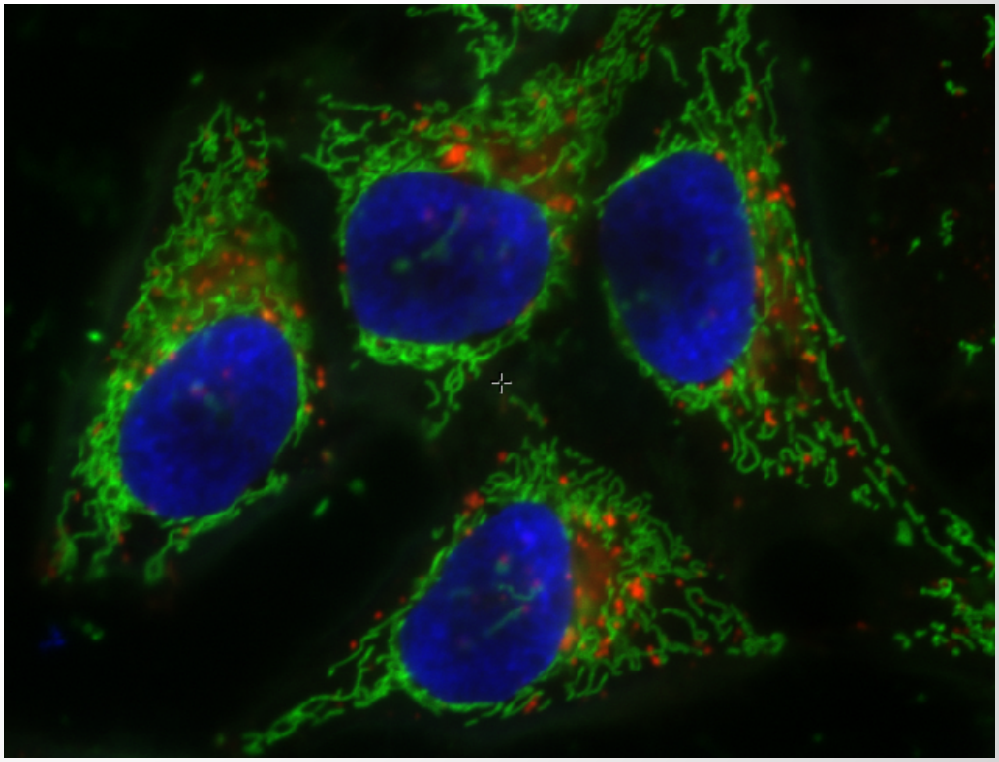

Outline:

1. Extract the channel of interest
2. Clean the data
3. Find an intensity threshold
4. Threshold the image
5. Extract the regions of interest
6. Quantify

(notice how generic this outline is…)

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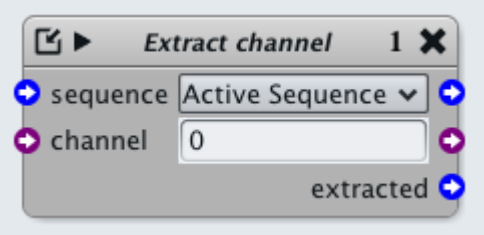
Menu: Sequence > Extract Channel



NOTE: channel index starts at 0...

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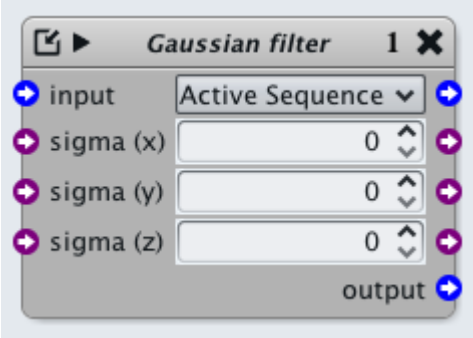
Menu: Blocks > Gaussian Filter



Diffuses the intensity contained in each pixel (i.e. makes the image look blurry)

Adapt the diffusion to the image noise
Too much diffusion: edges fade away!

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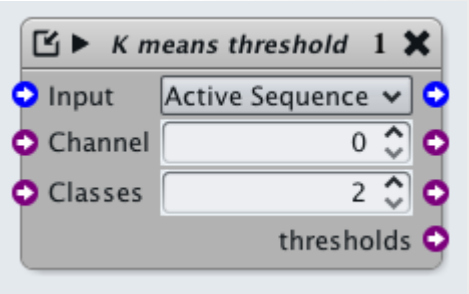
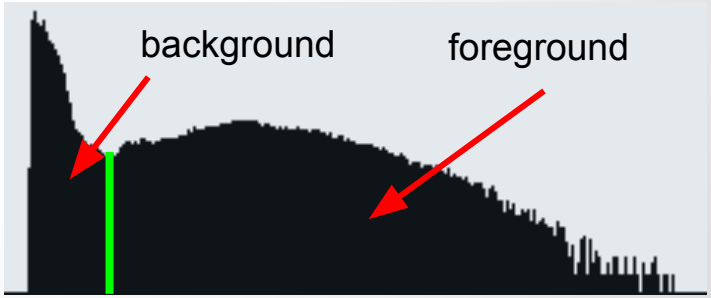
Menu: Blocks > KMeans Threshold





Finds the optimal separation(s) between the histogram modes (i.e. intensity classes)

2 modes => 1 threshold (3 => 2, etc.)

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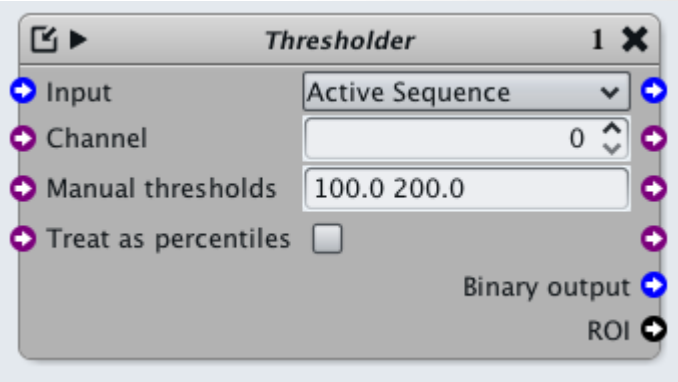
Menu: Blocks > Thresholder



Creates a labeled image by classifying pixel intensities according to the threshold(s)

1 threshold => [0;1] (binary) image
2 thresholds => [0;1;2] (labeled) image
etc.

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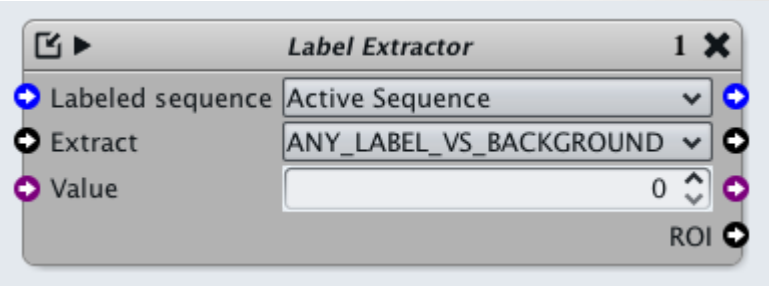
Menu: Blocks > Label Extractor



Extracts objects from a labeled image using connected component analysis

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Menu: ROI > ROI Statistics

Calculates size, dimensions, intensity statistics, etc.

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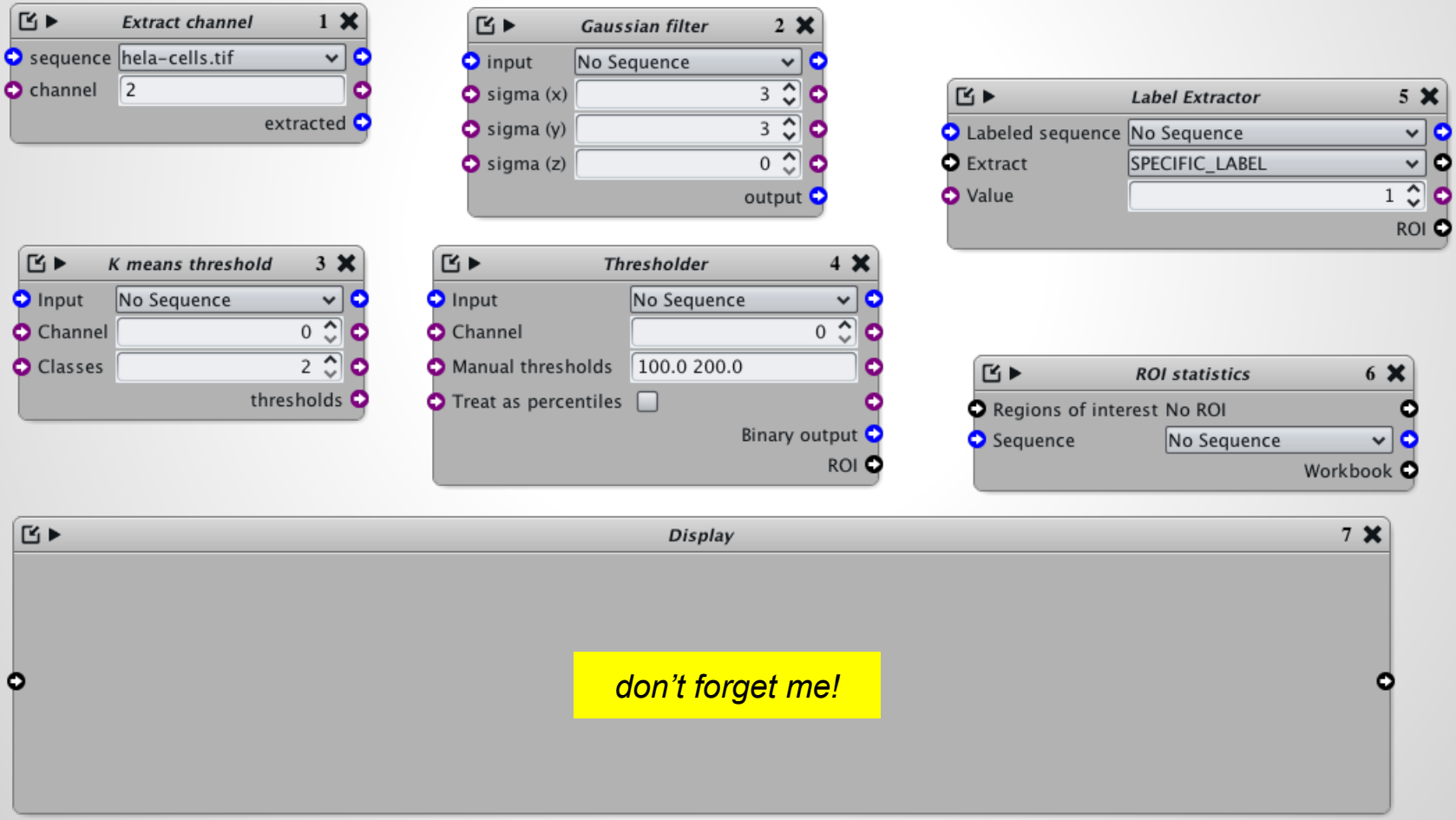

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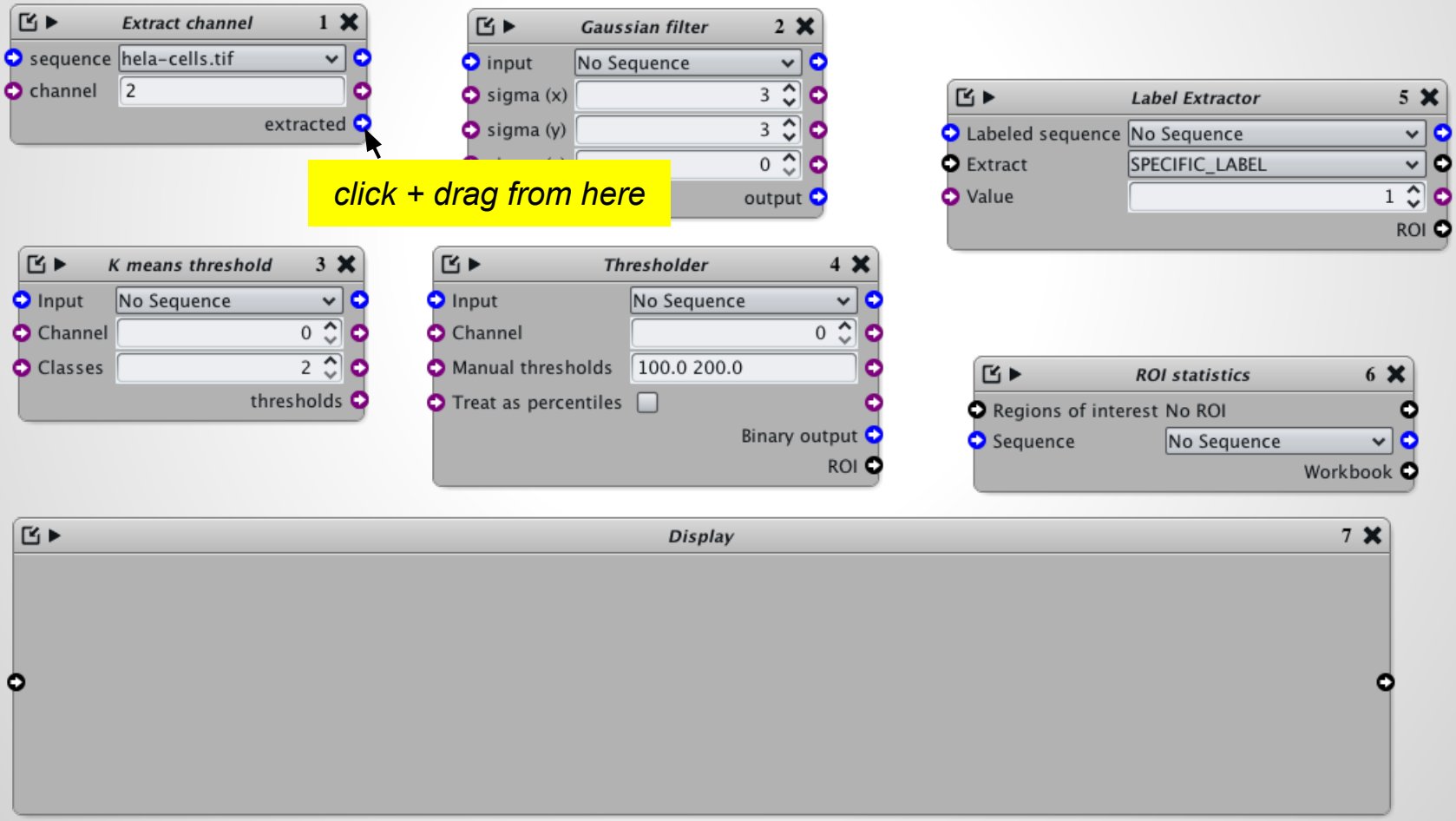

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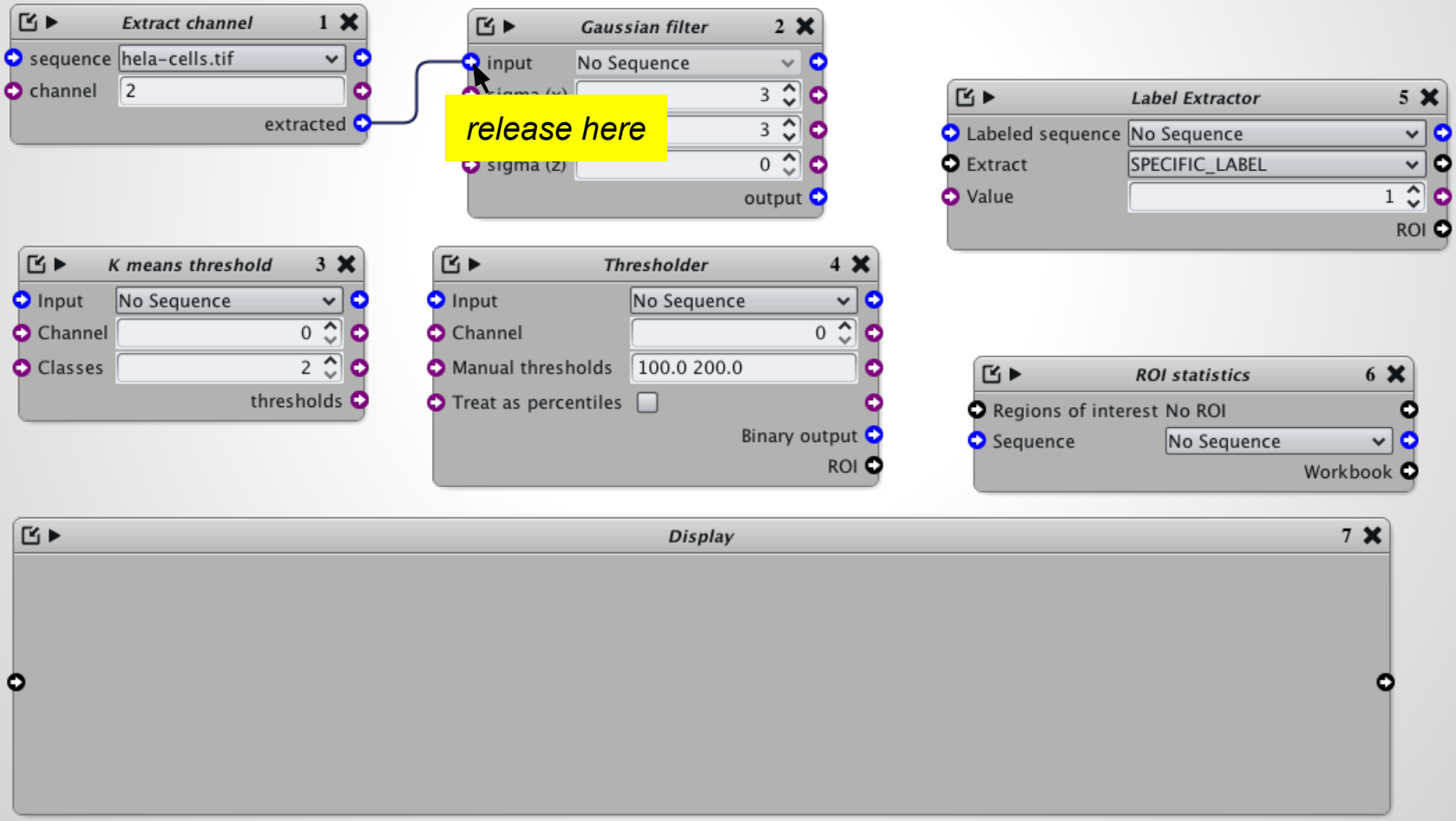

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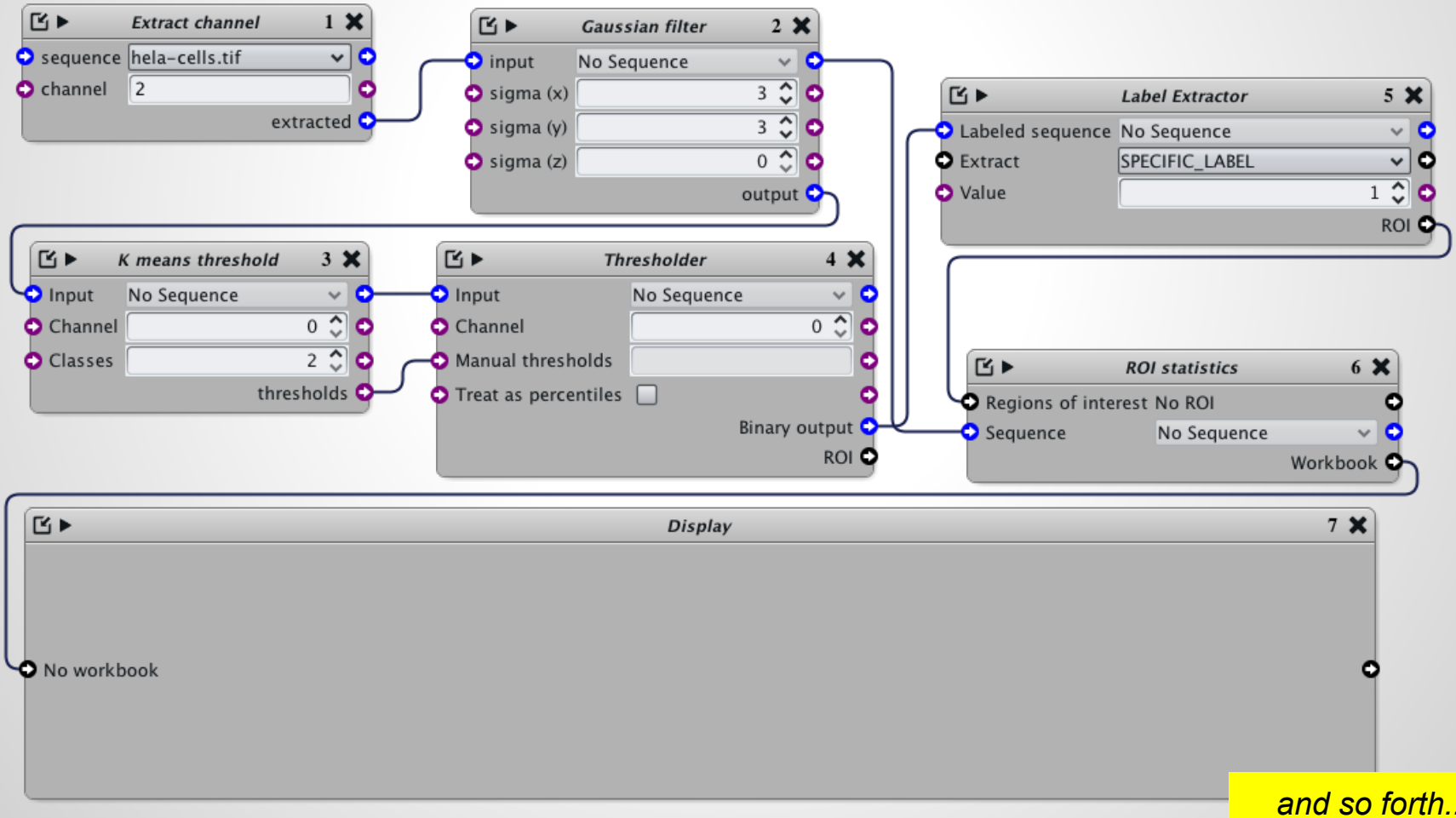

and so forth...

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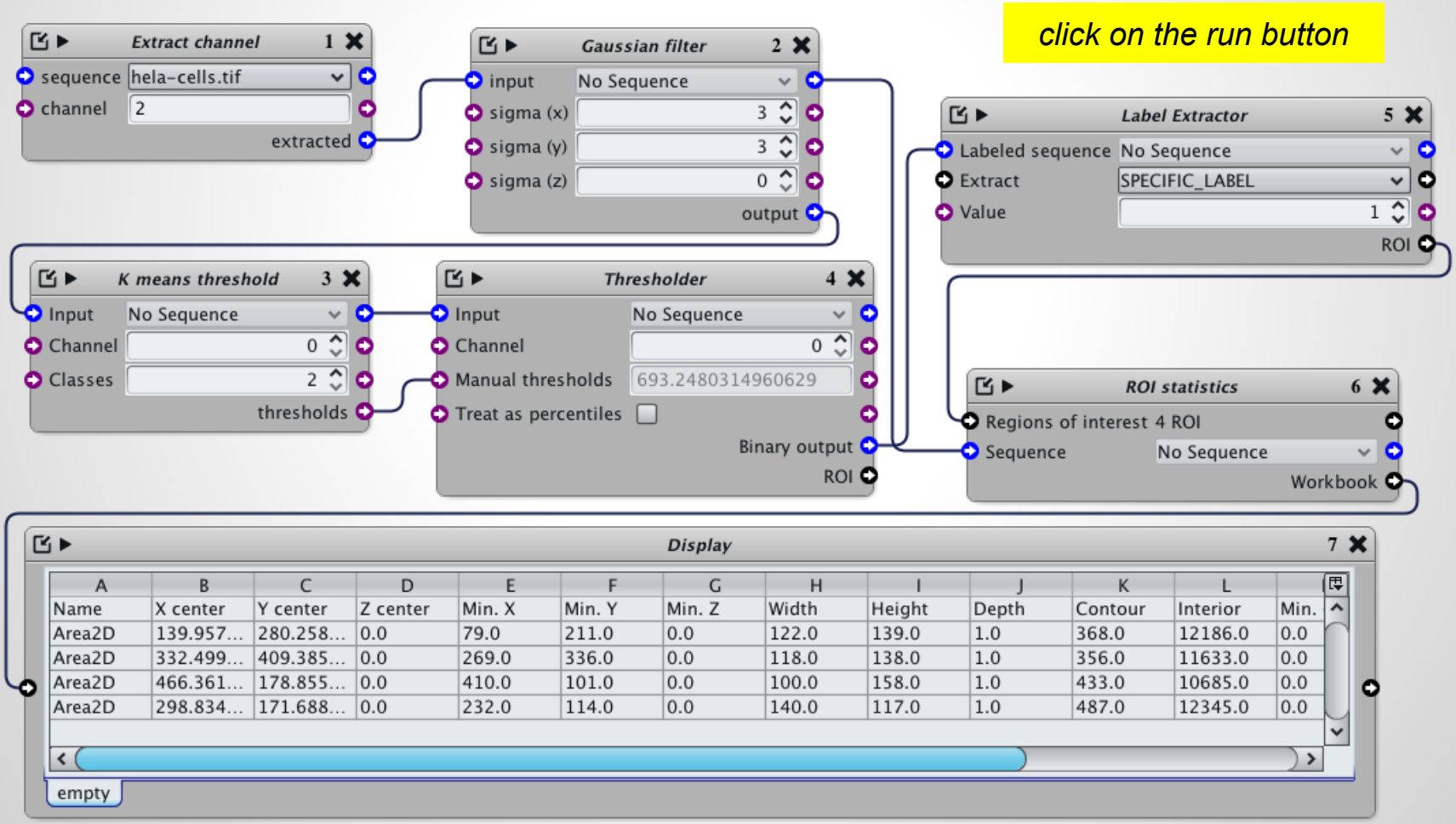

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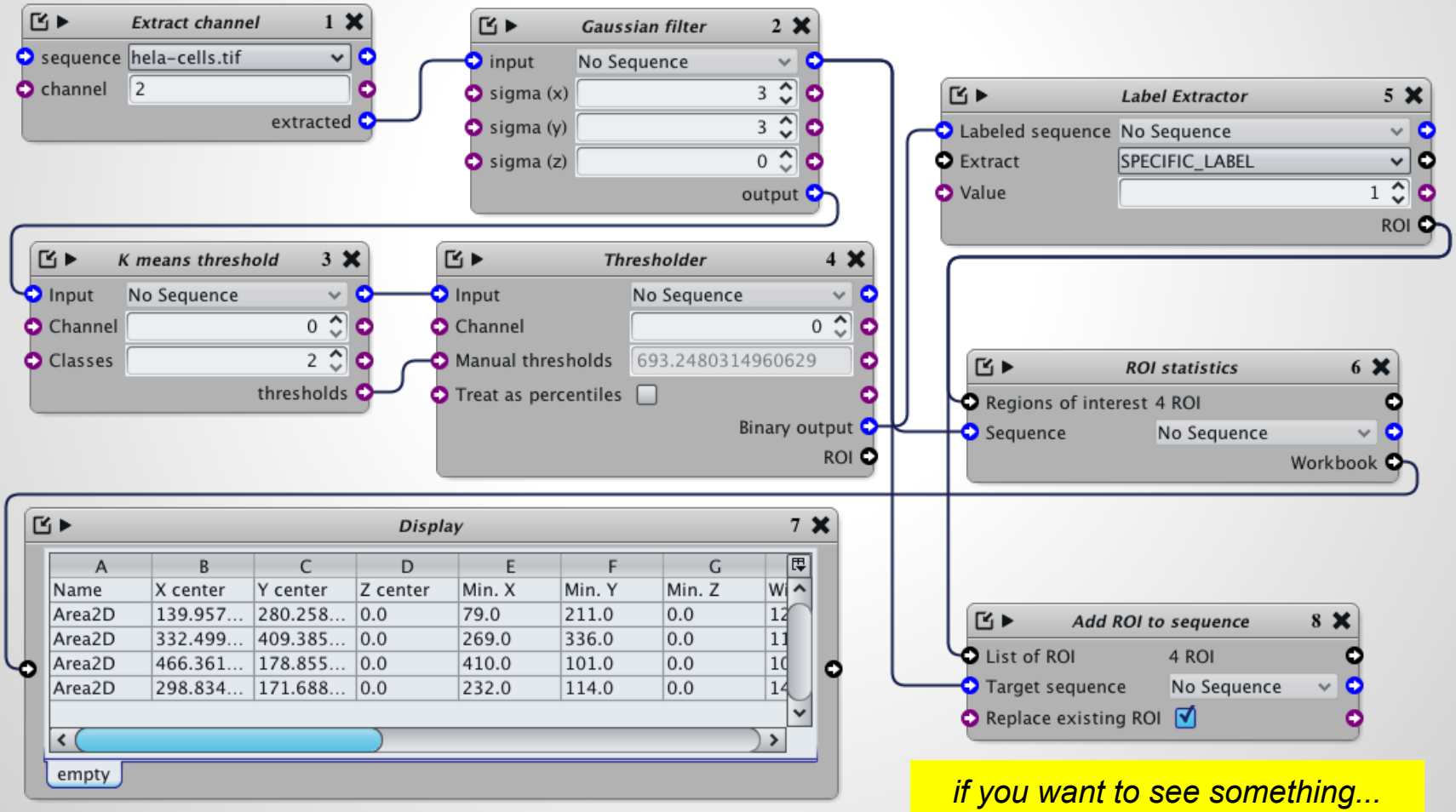
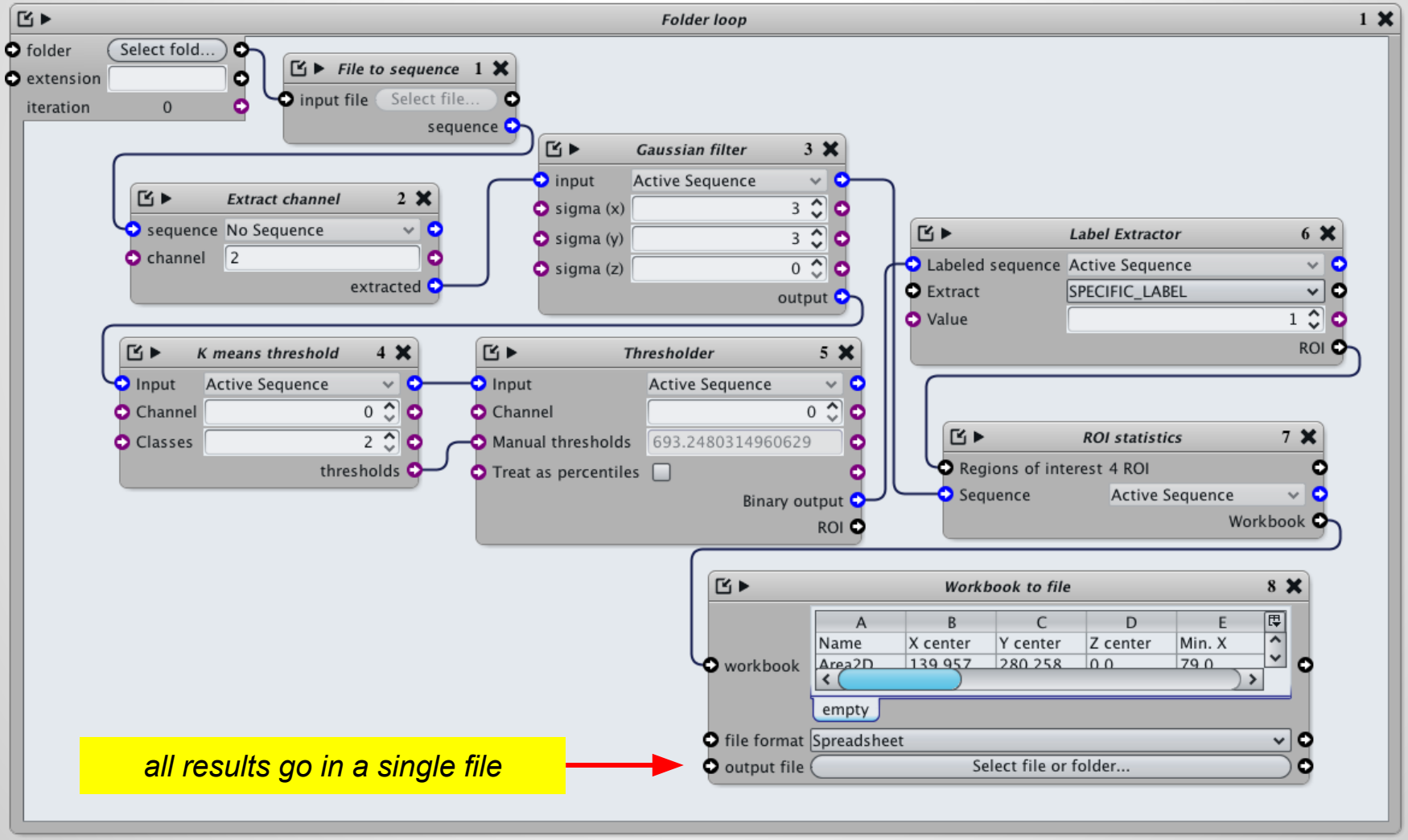


if you want to see something...

Protocols in Icy

- How about batch processing?



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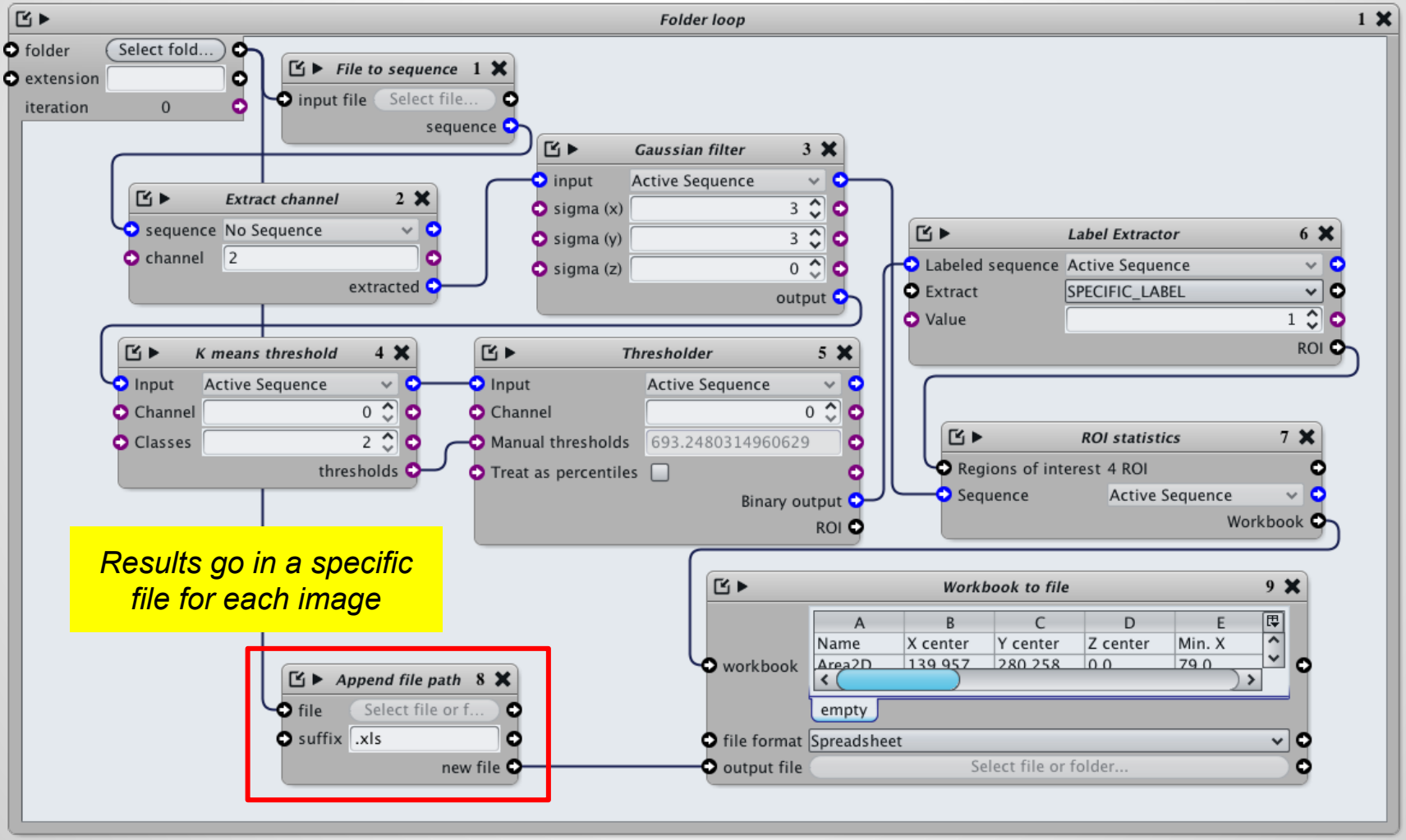
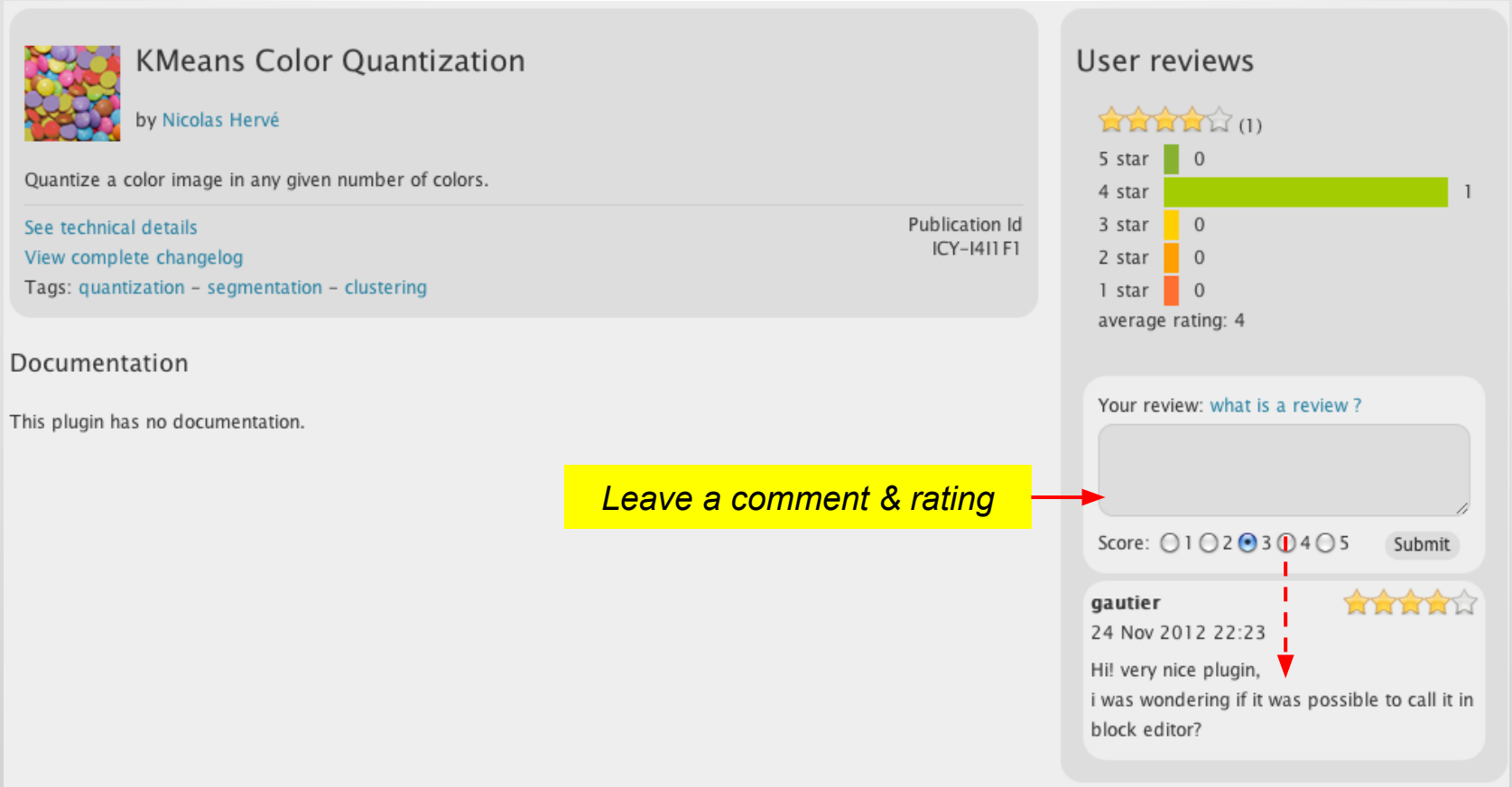


Protocols in Icy

- Most plugins have their corresponding Block
- What if the one you need isn't there (yet)?
  - #1: Leave a comment on the plug-in's page online



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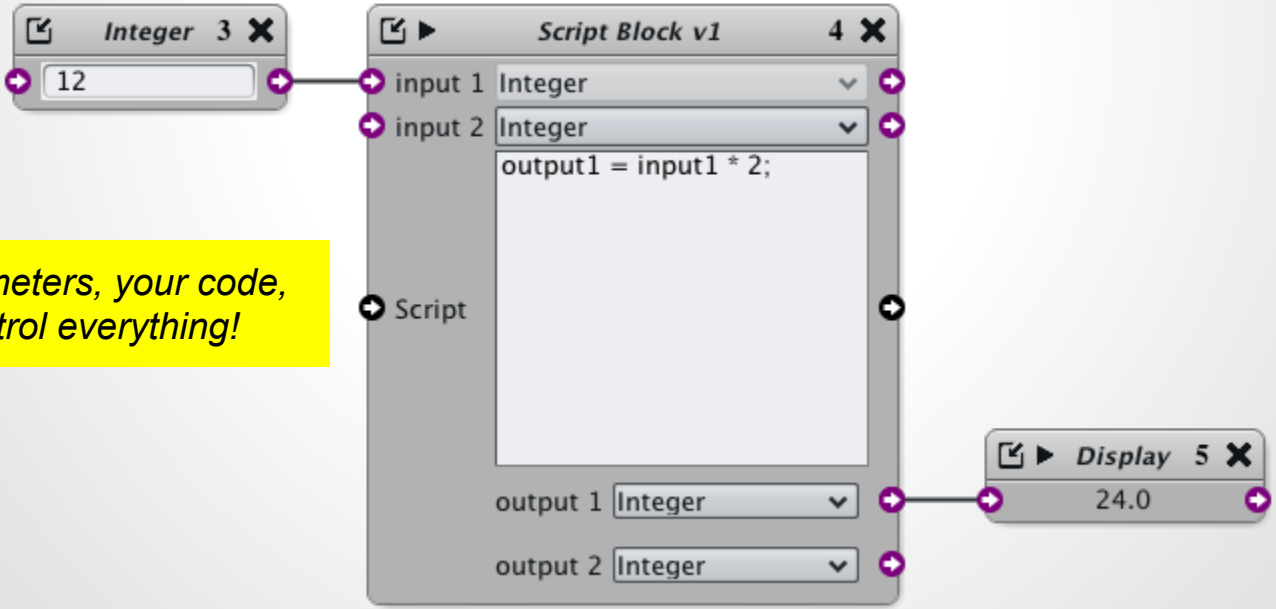
  - #2: The "DIY" (Do It Yourself) approach



Your parameters, your code, you control everything!

Interested? We'll be back, after the break!