Analysis Modules

Learn yt workshop 2016

Nathan Goldbaum

(some slides from Britton Smith's
2012 clump finding tutorial)

Outline

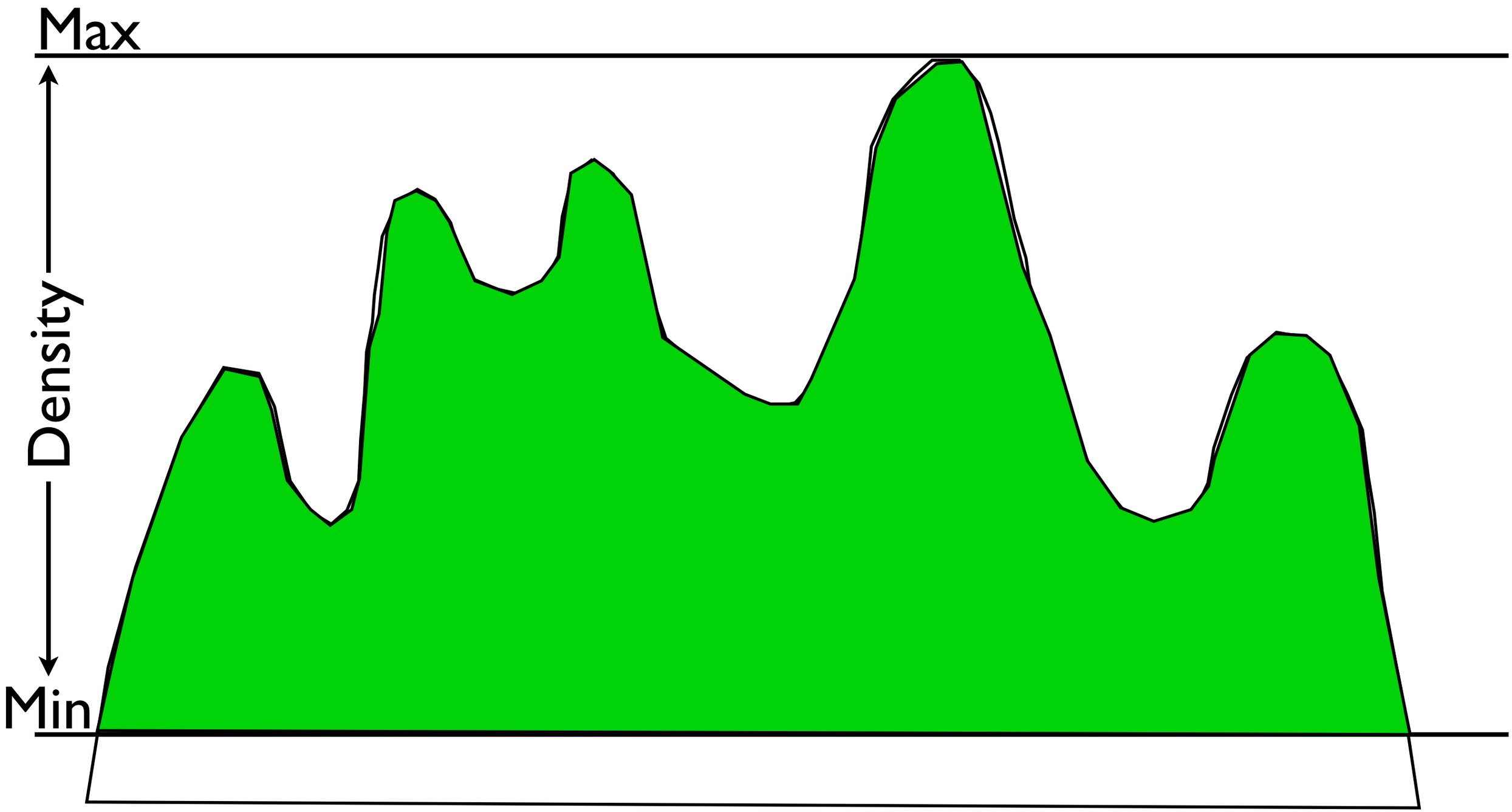
- Clump finding
- Halo finding
  - rockstar
- Synthetic Observations
  - Trident, pyXSIM

Clump Finding

“clump”:

The largest disconnected isocontour satisfying some criteria, such as being gravitationally bound.

Finding Clumps



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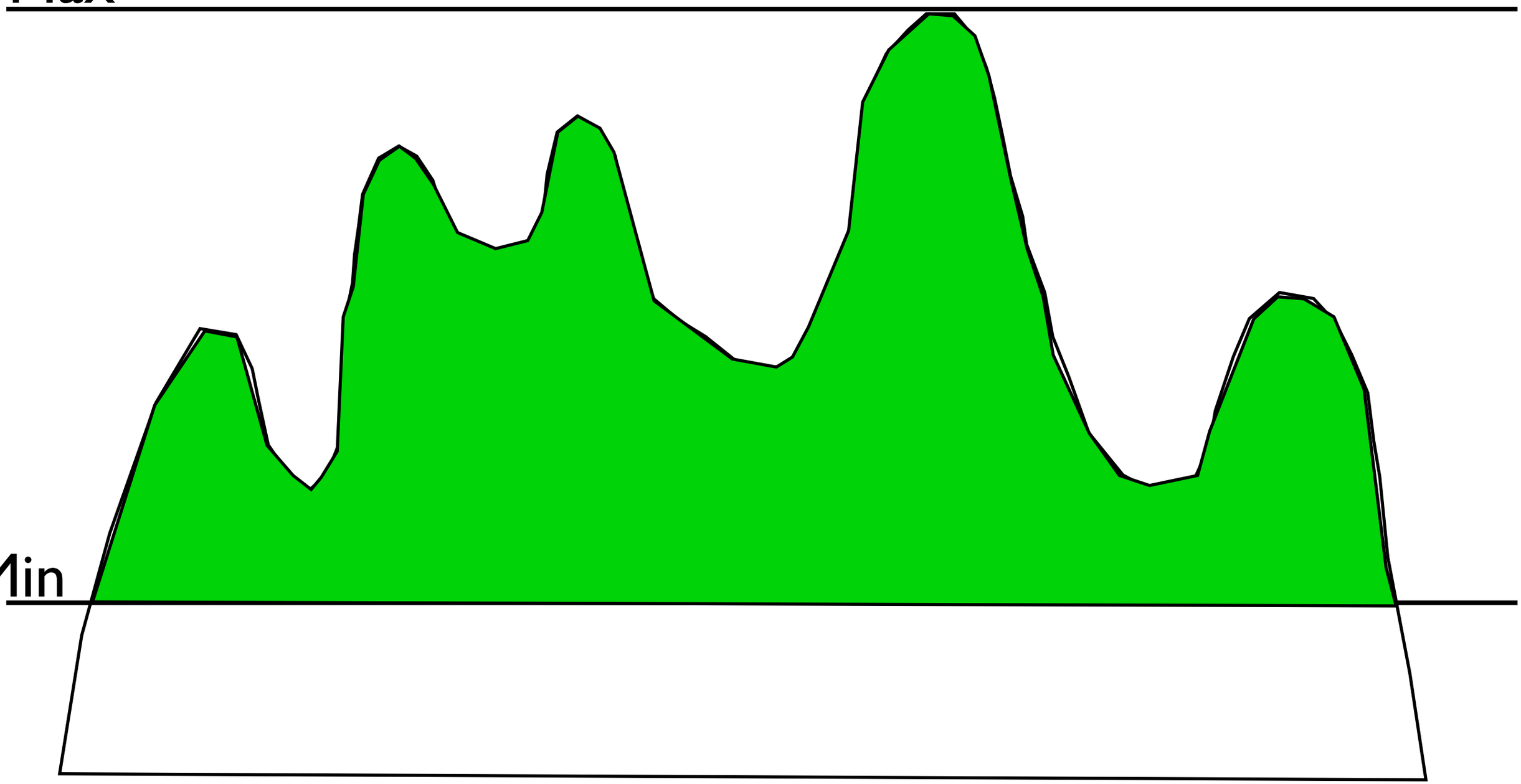

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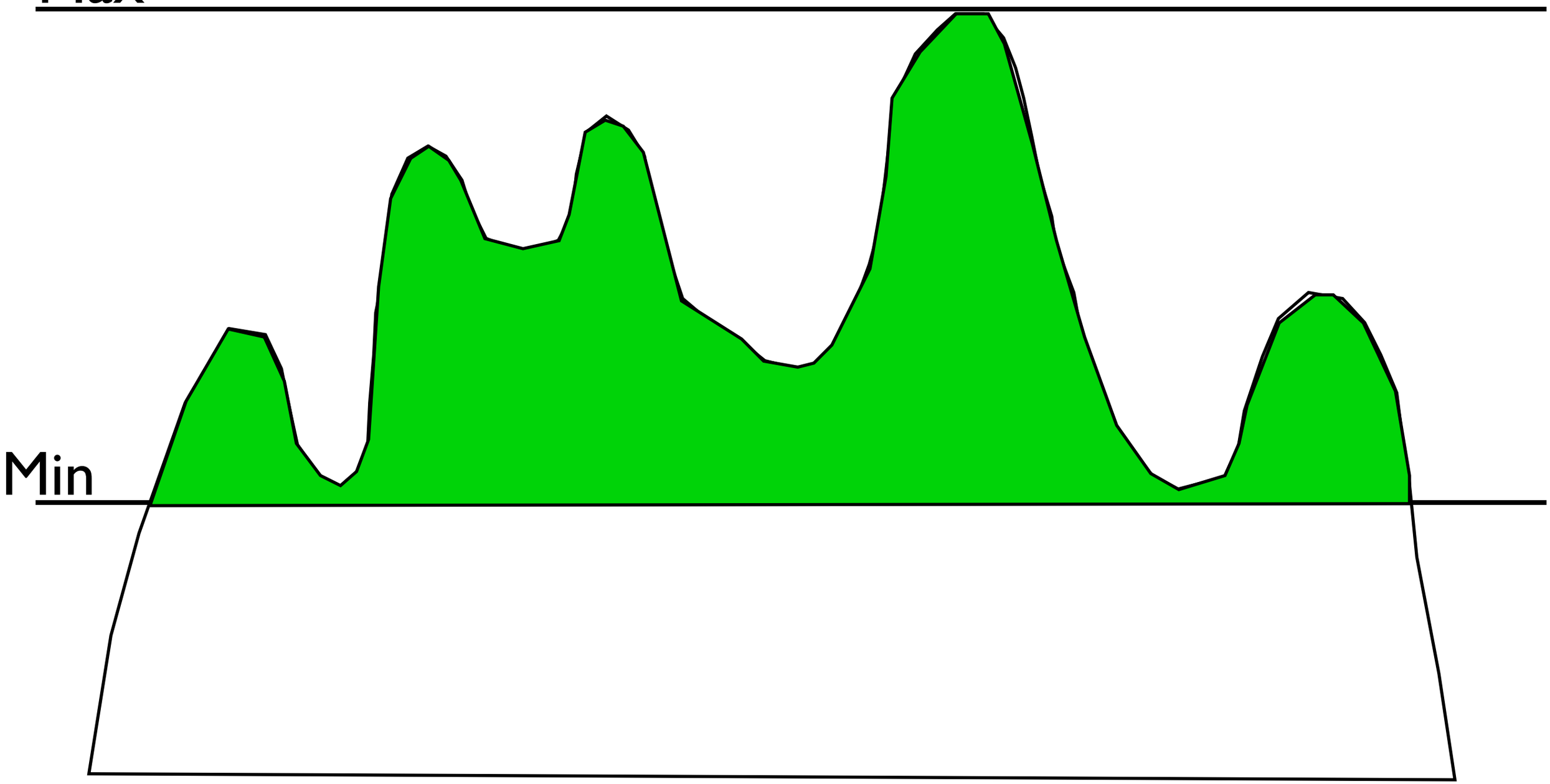

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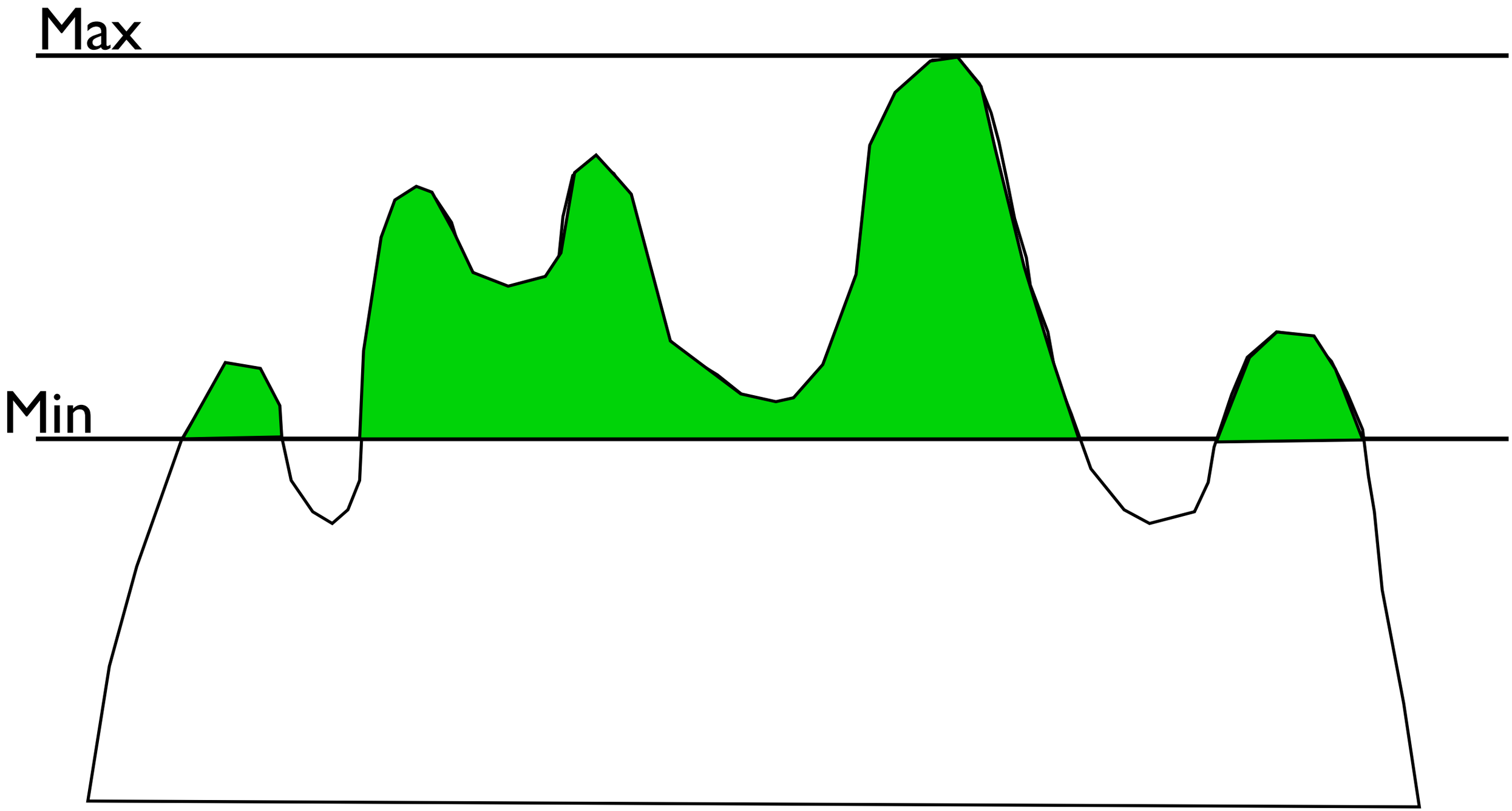

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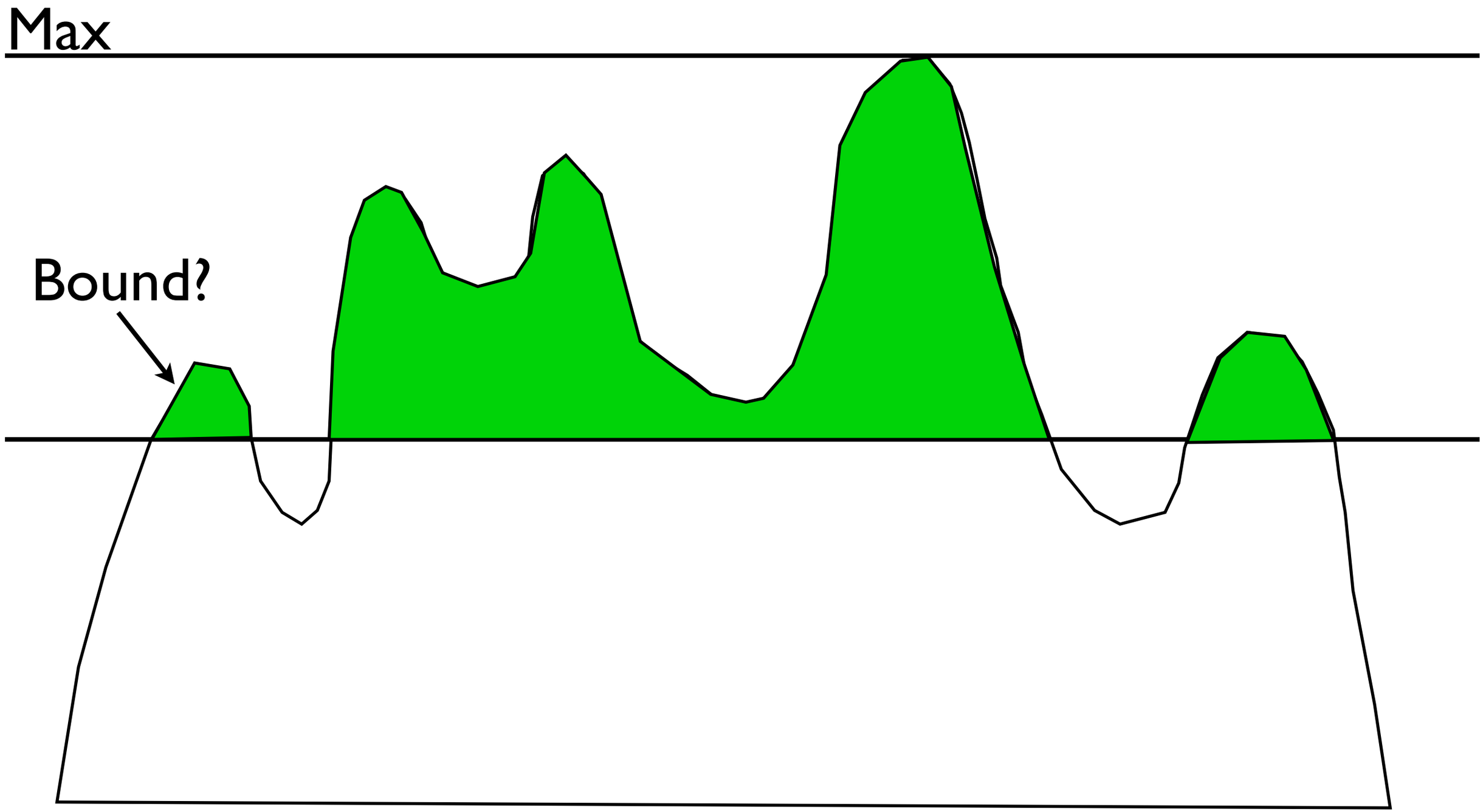

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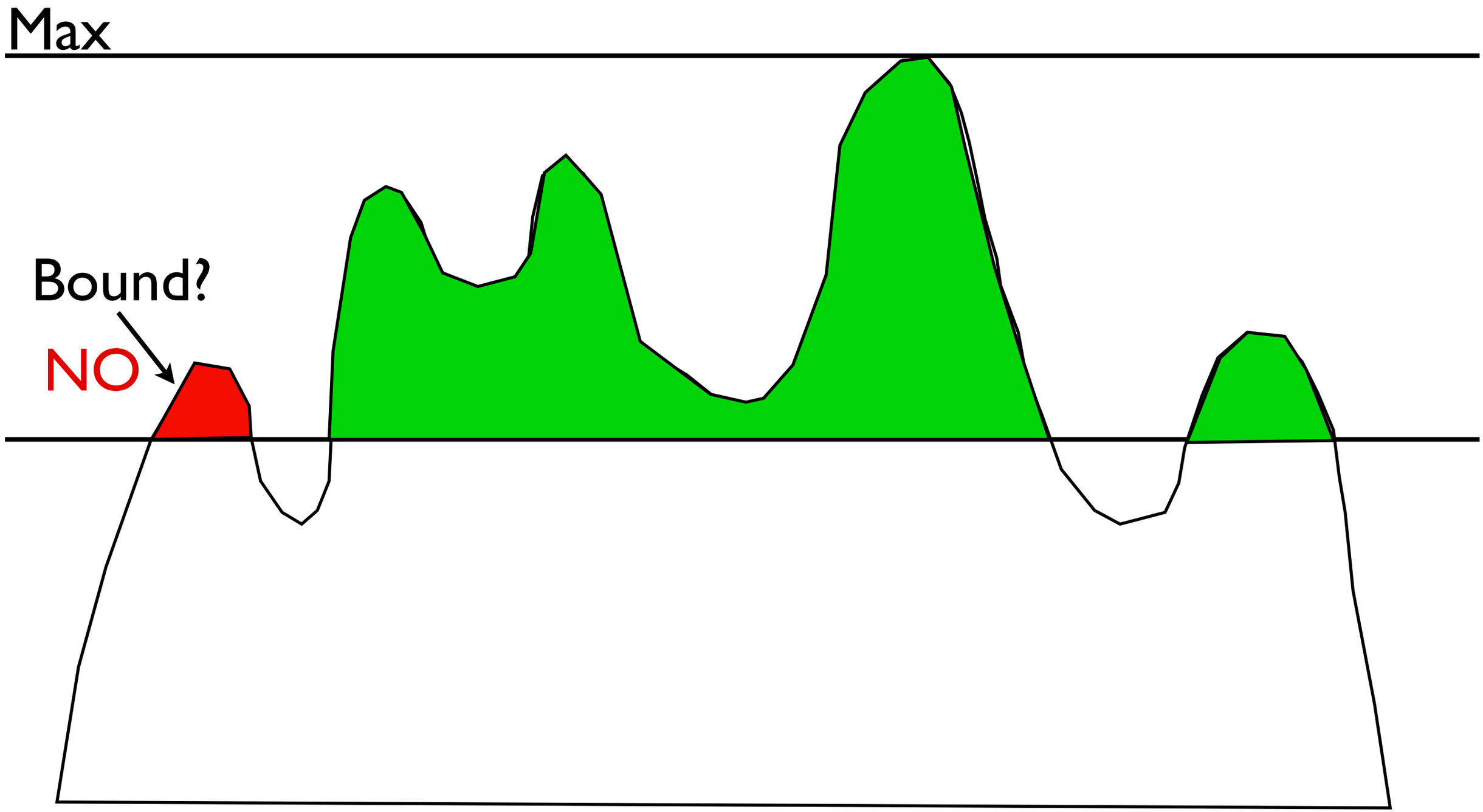

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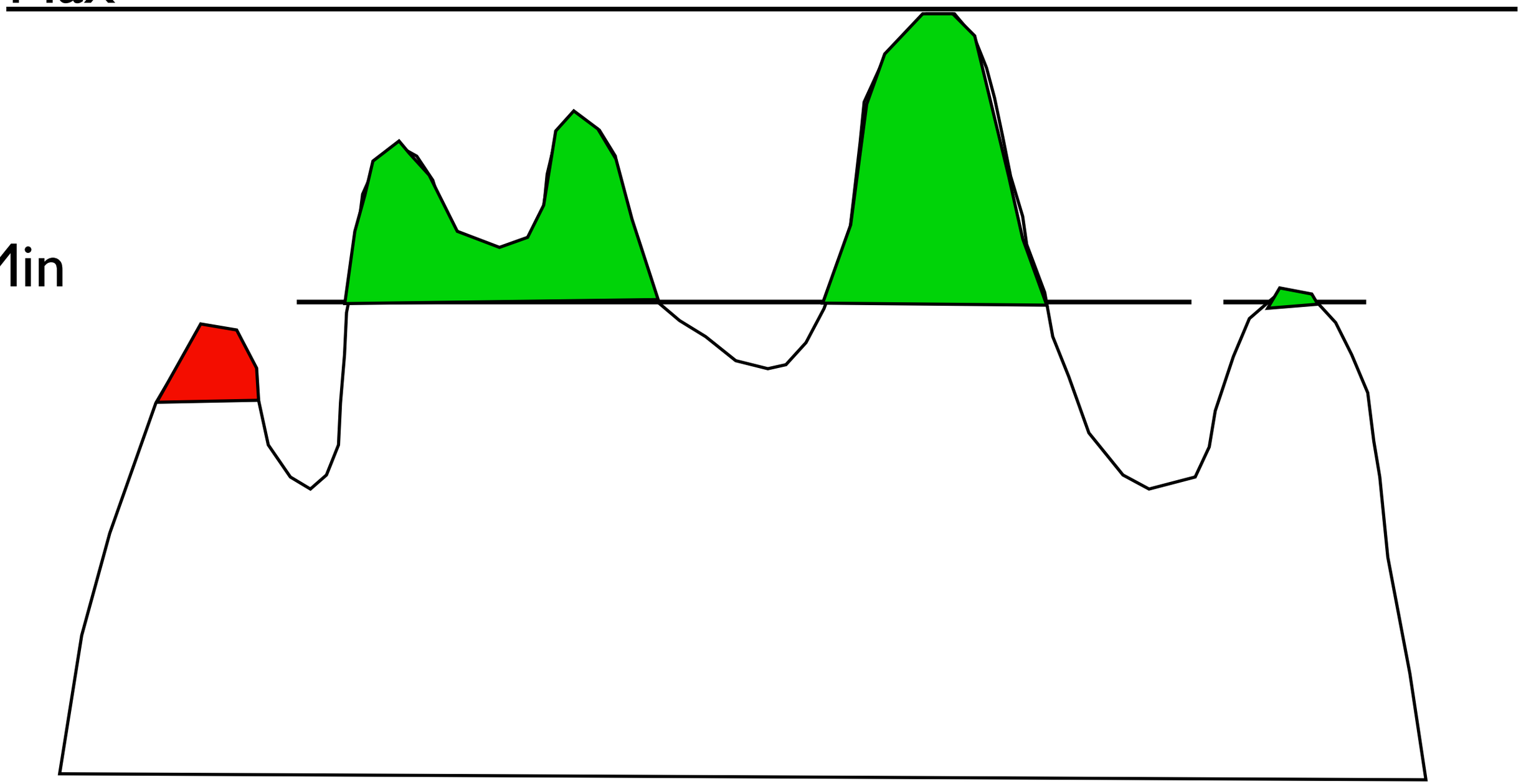

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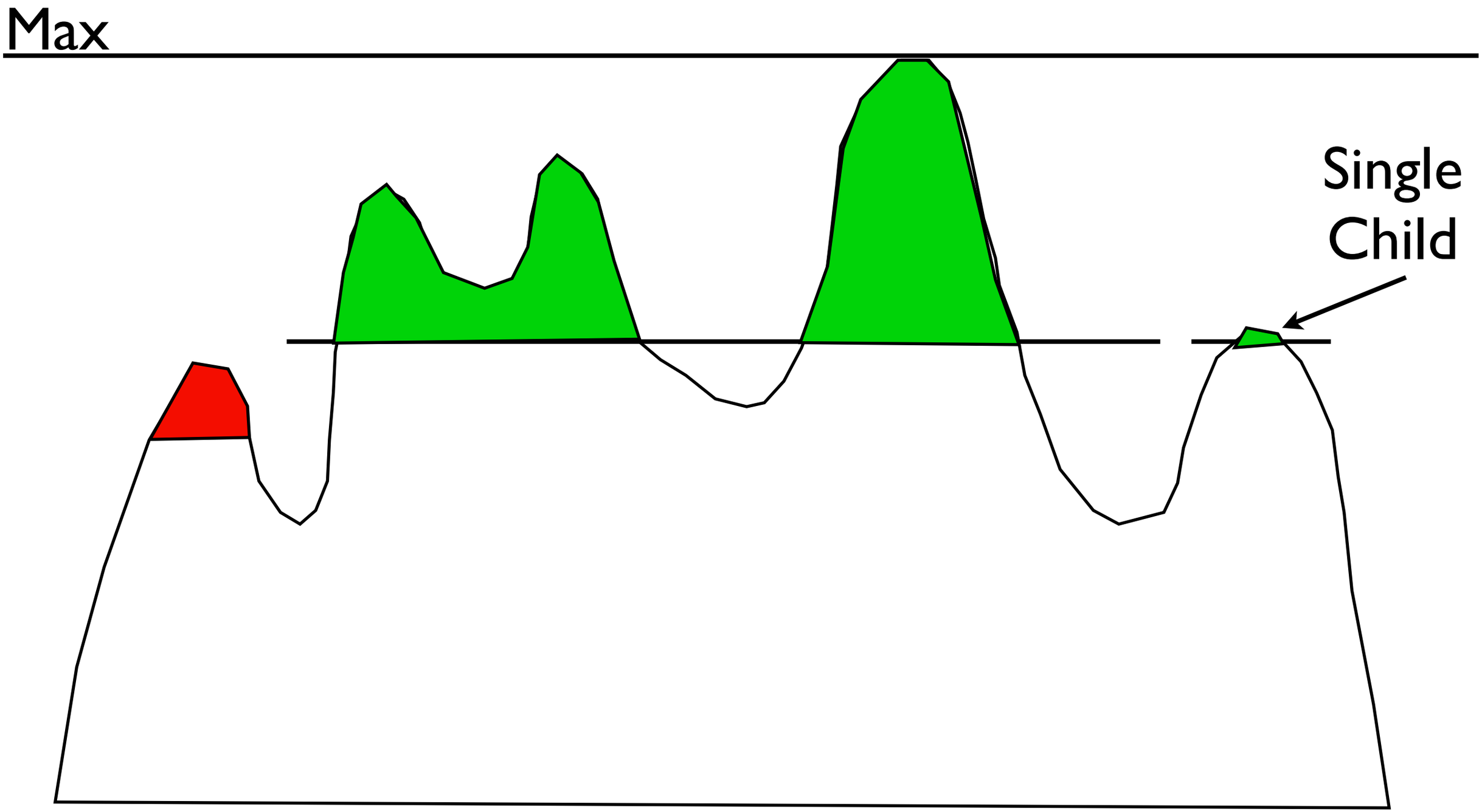

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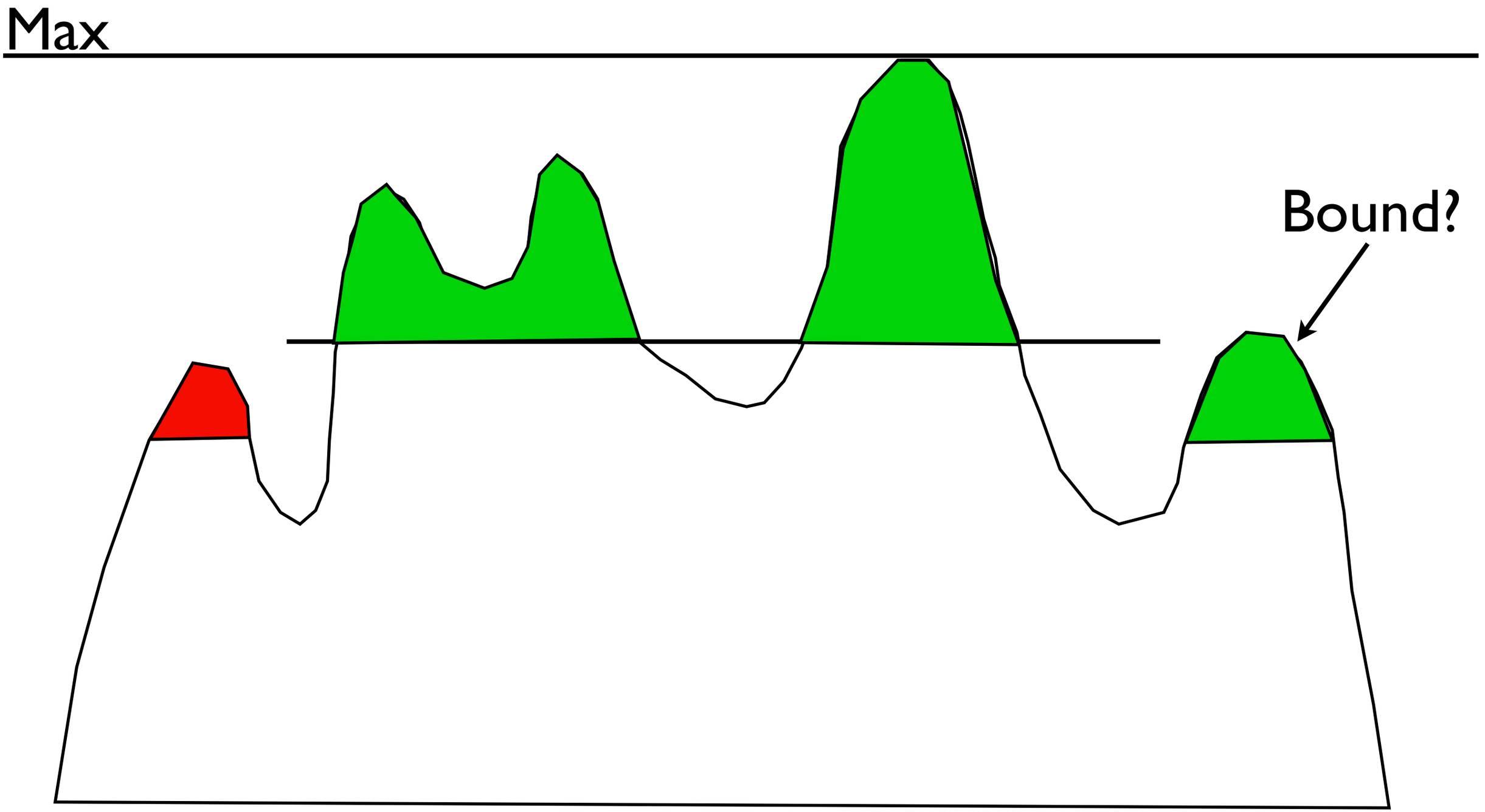

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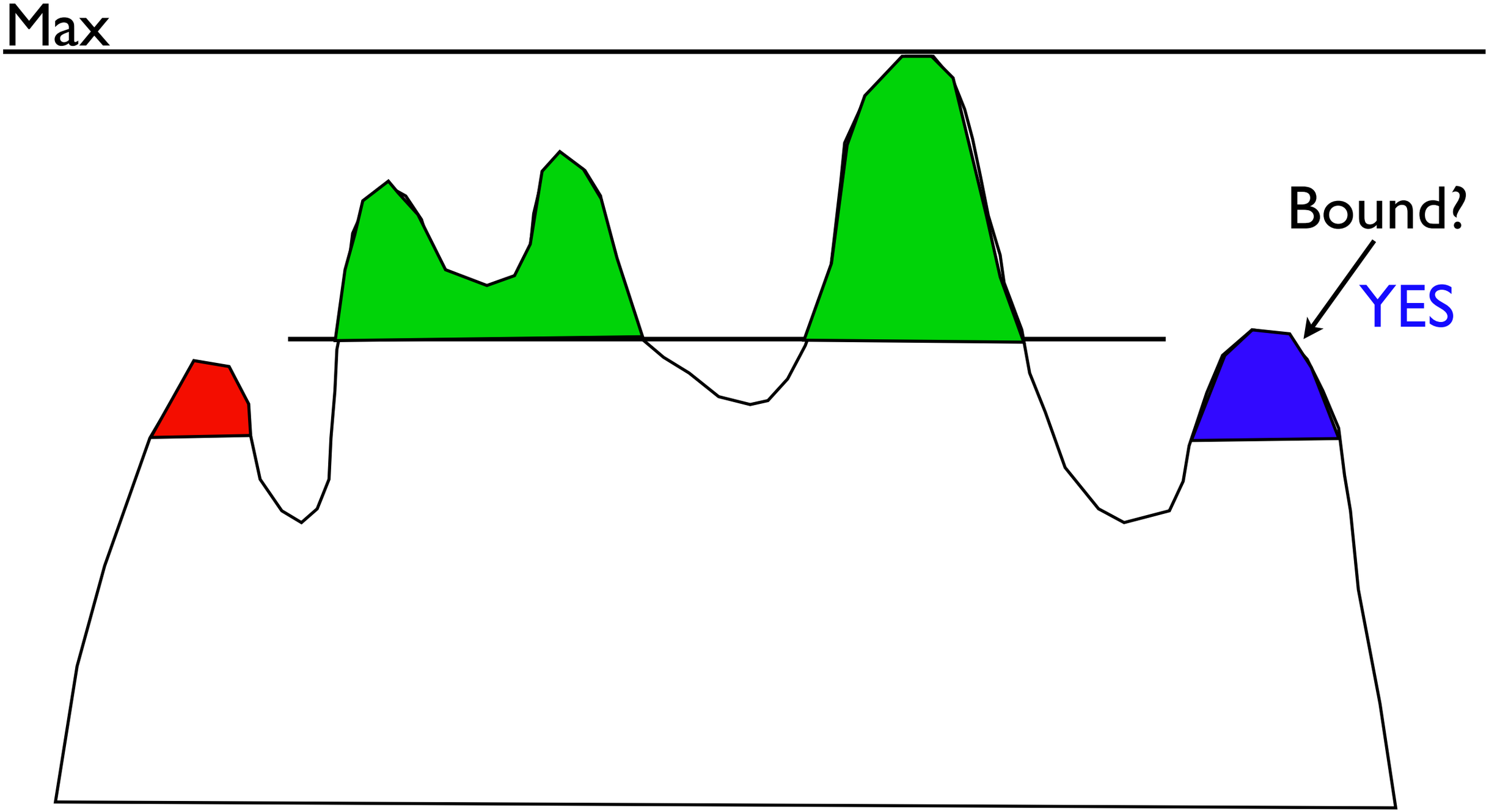

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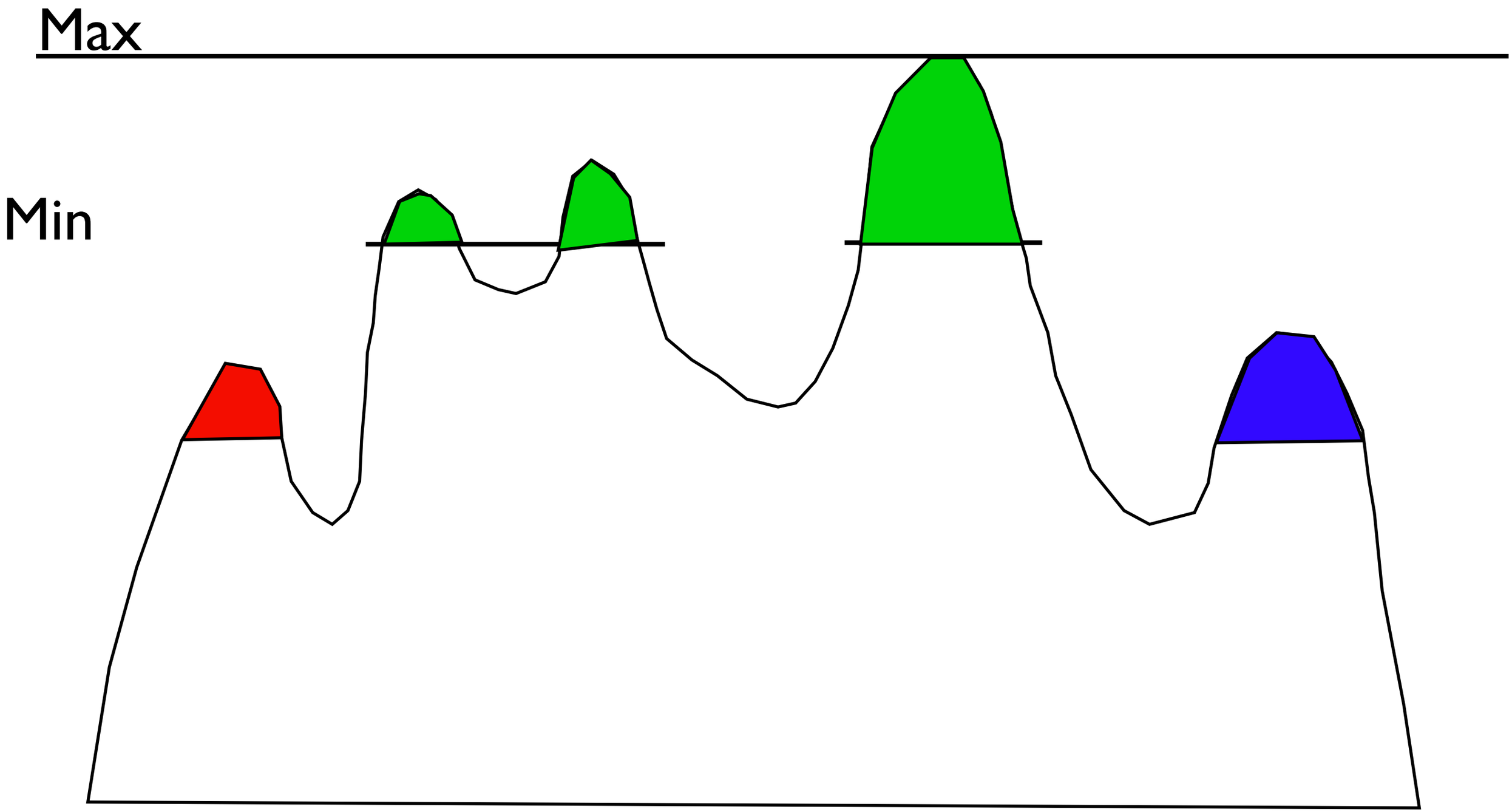

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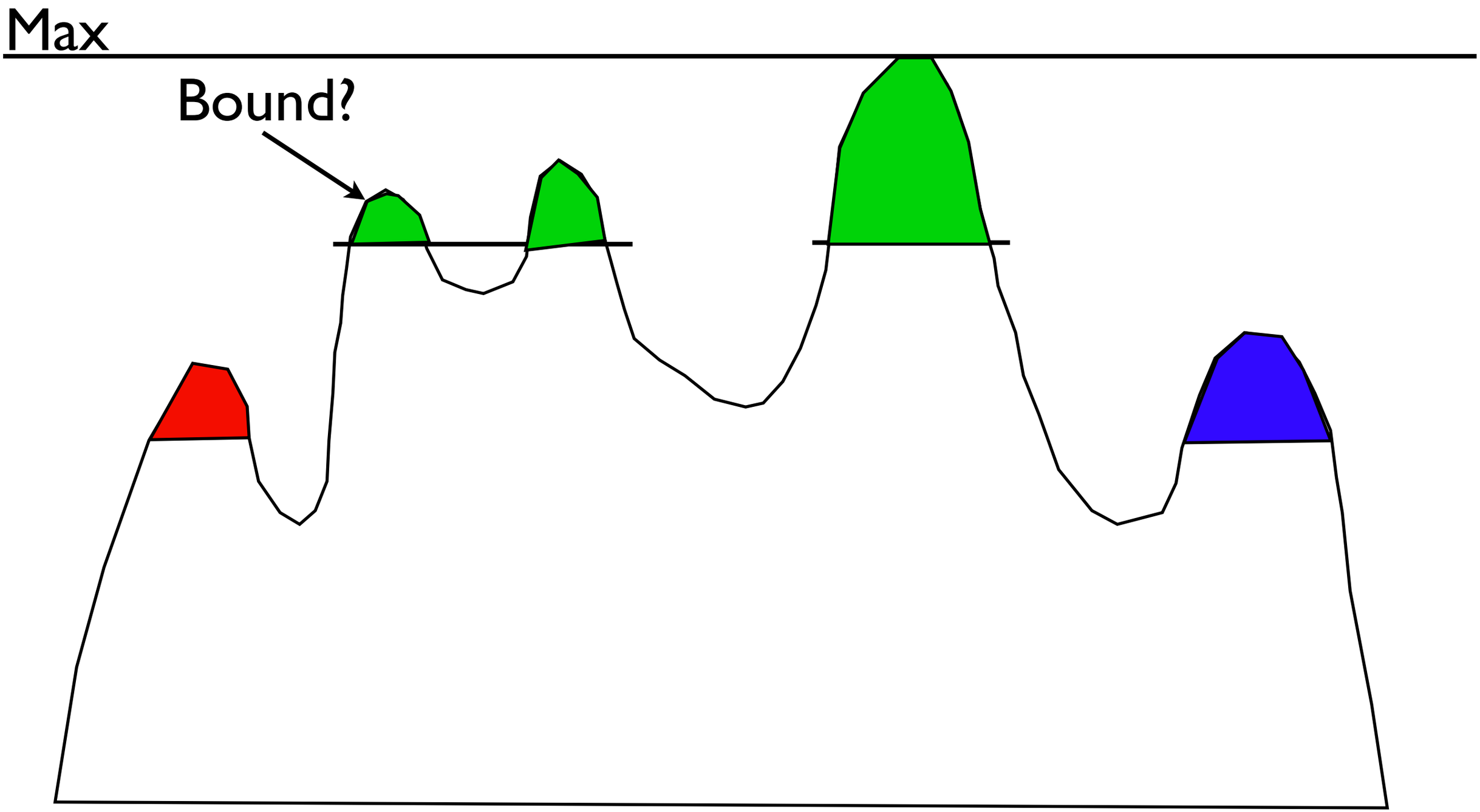

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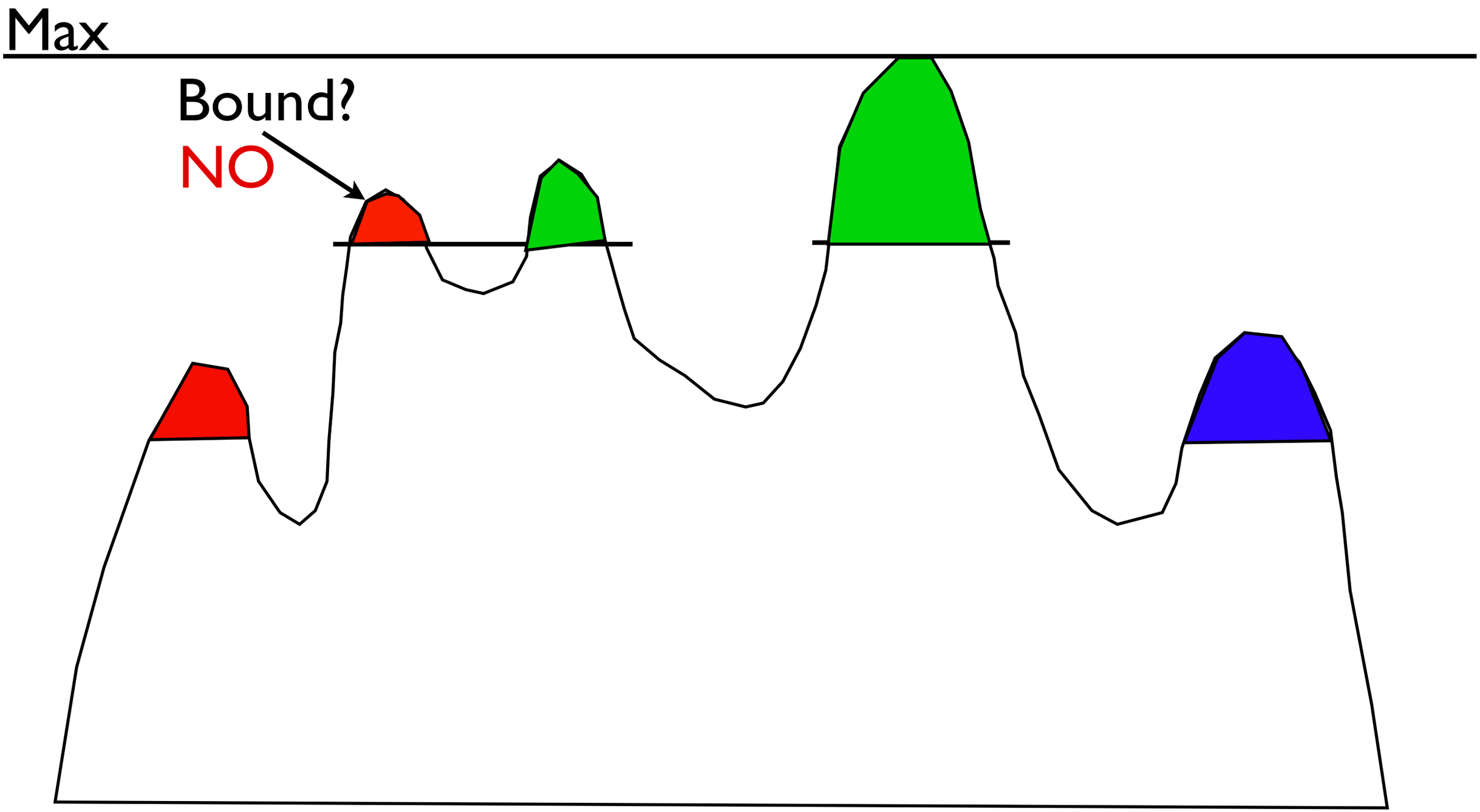

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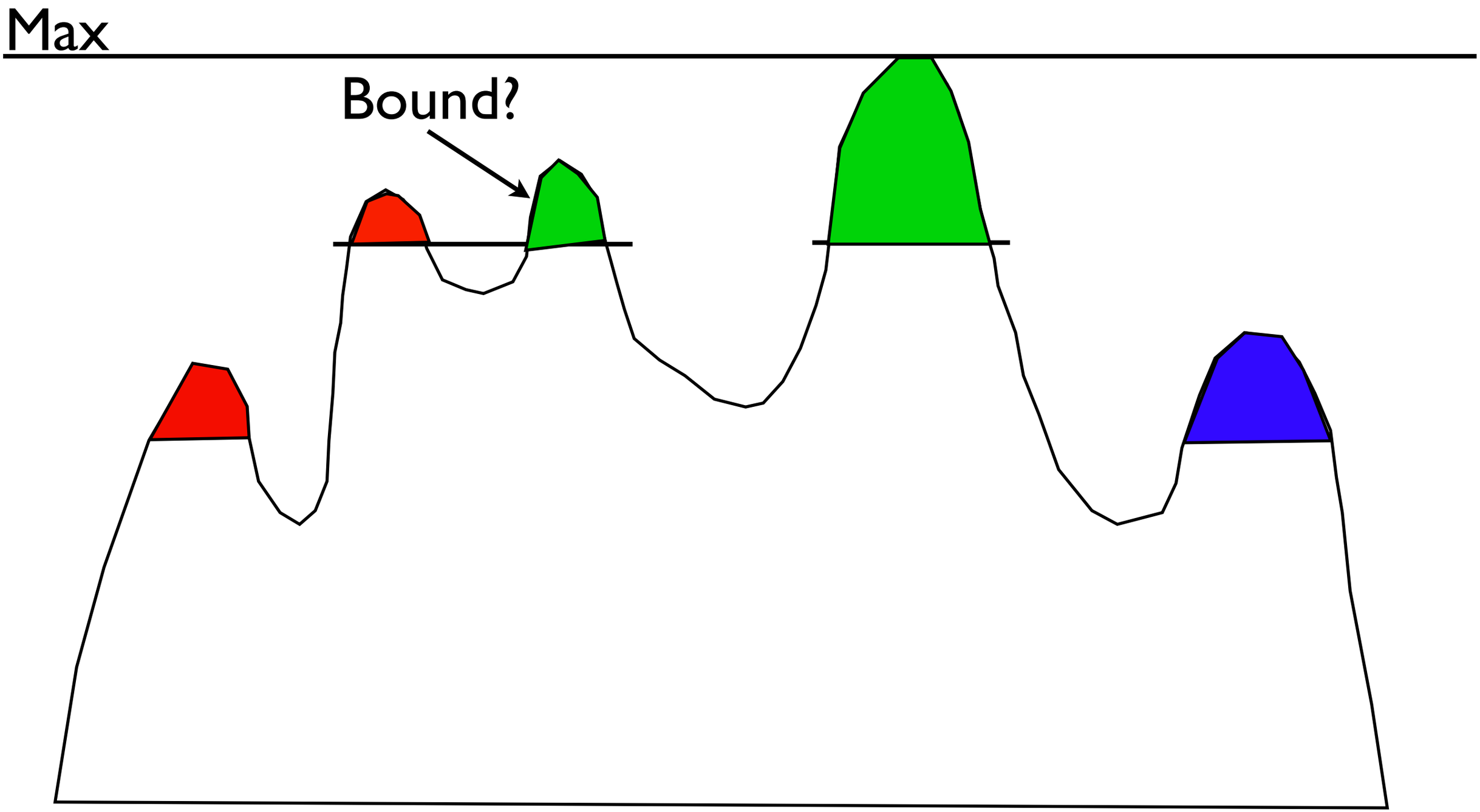

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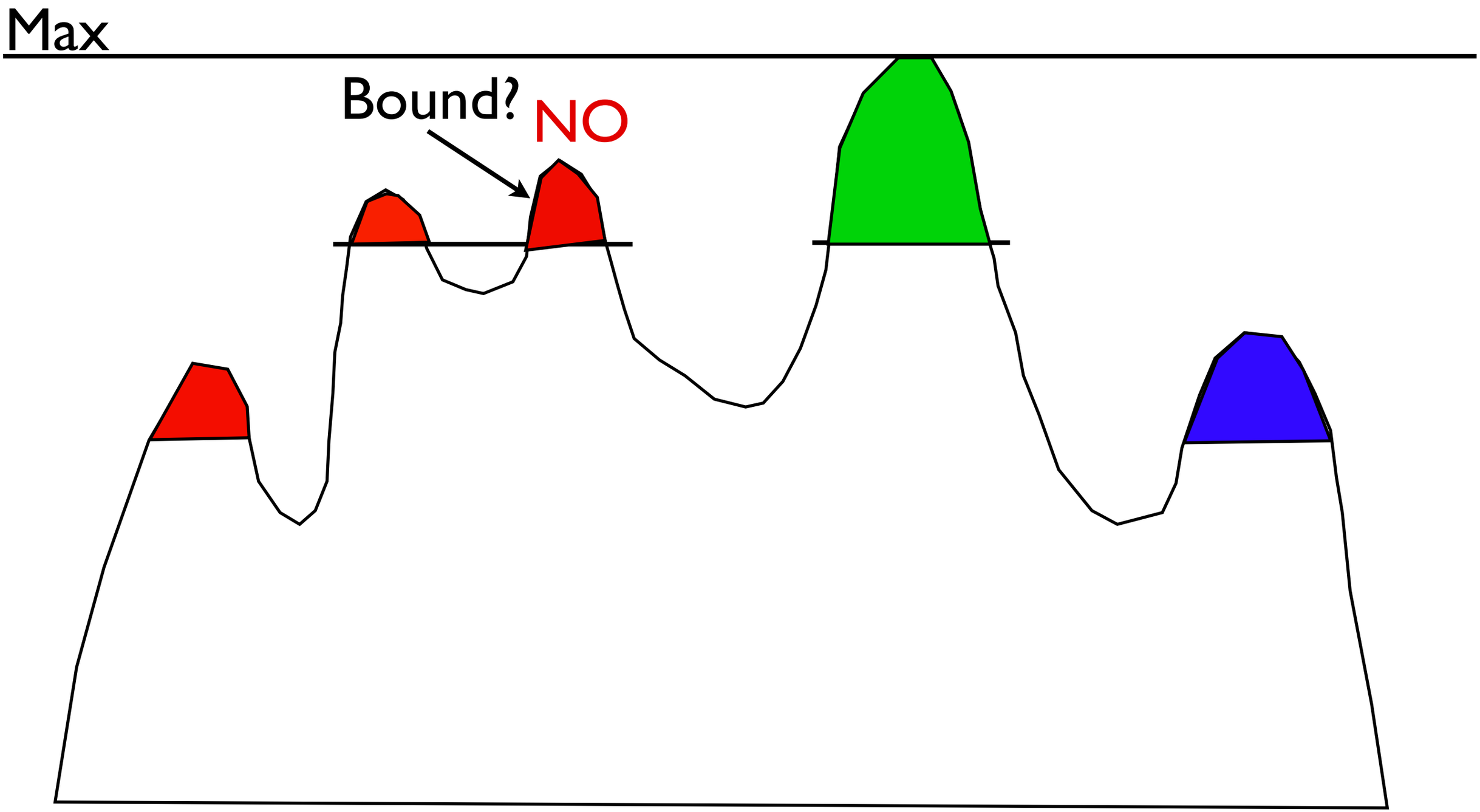

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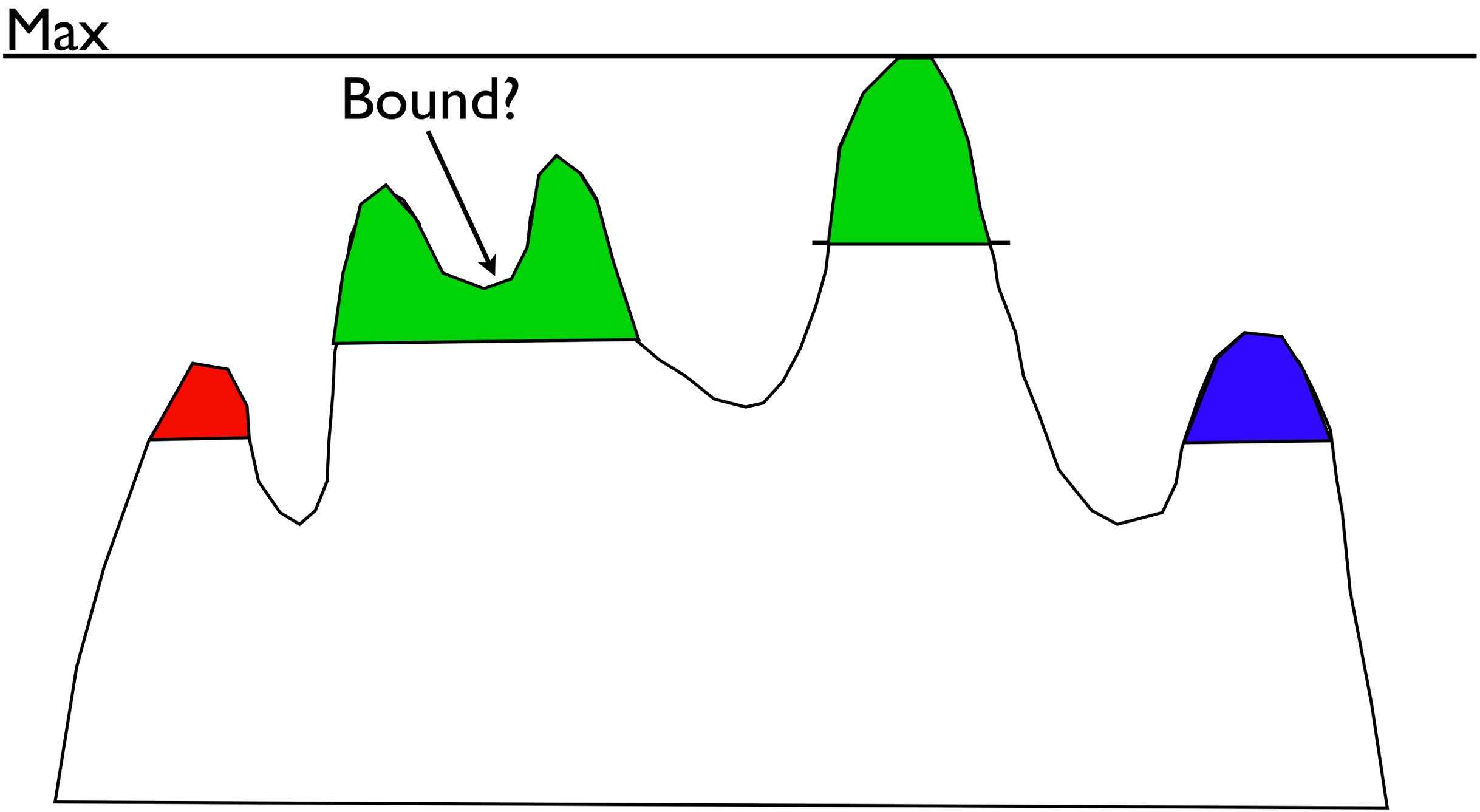

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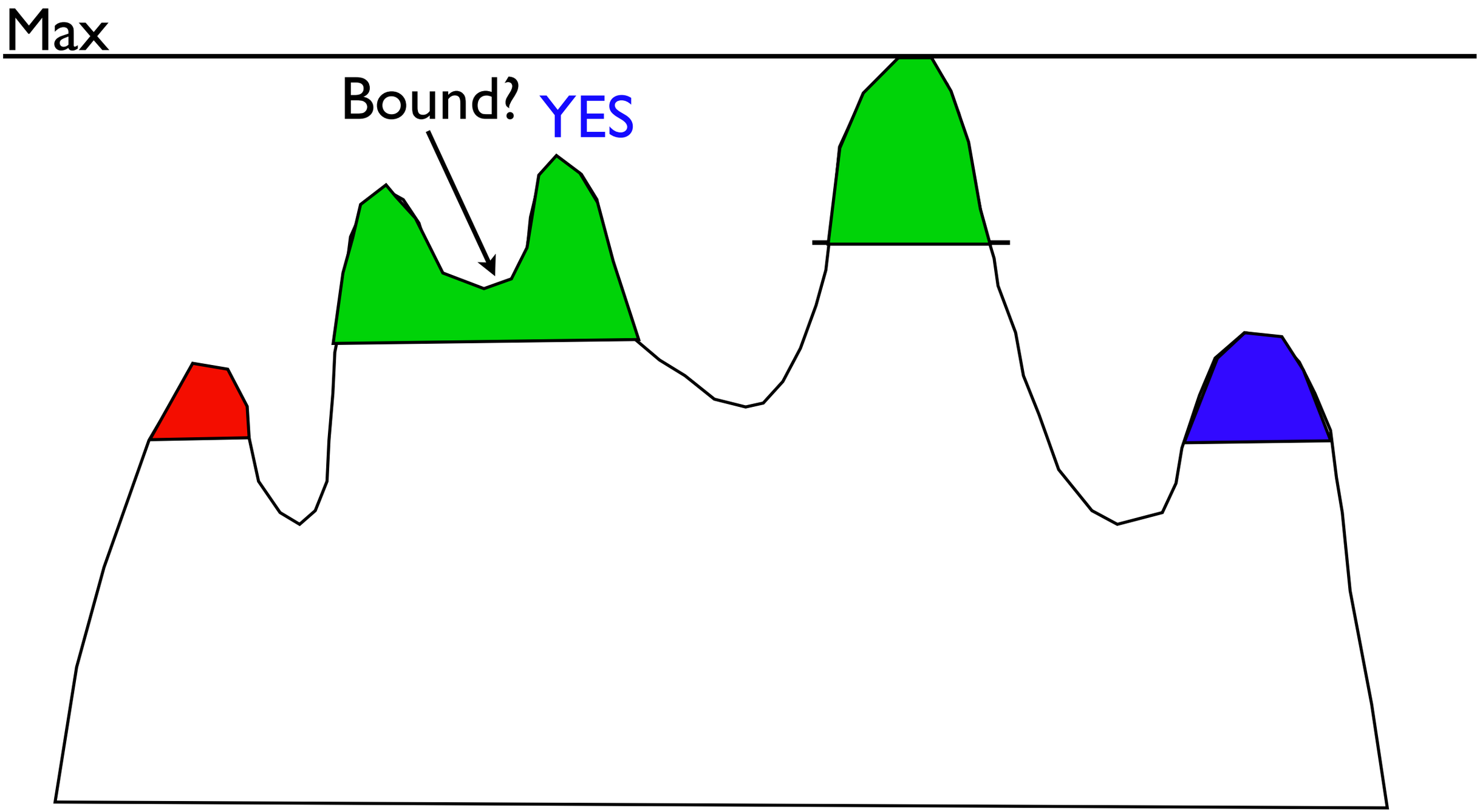

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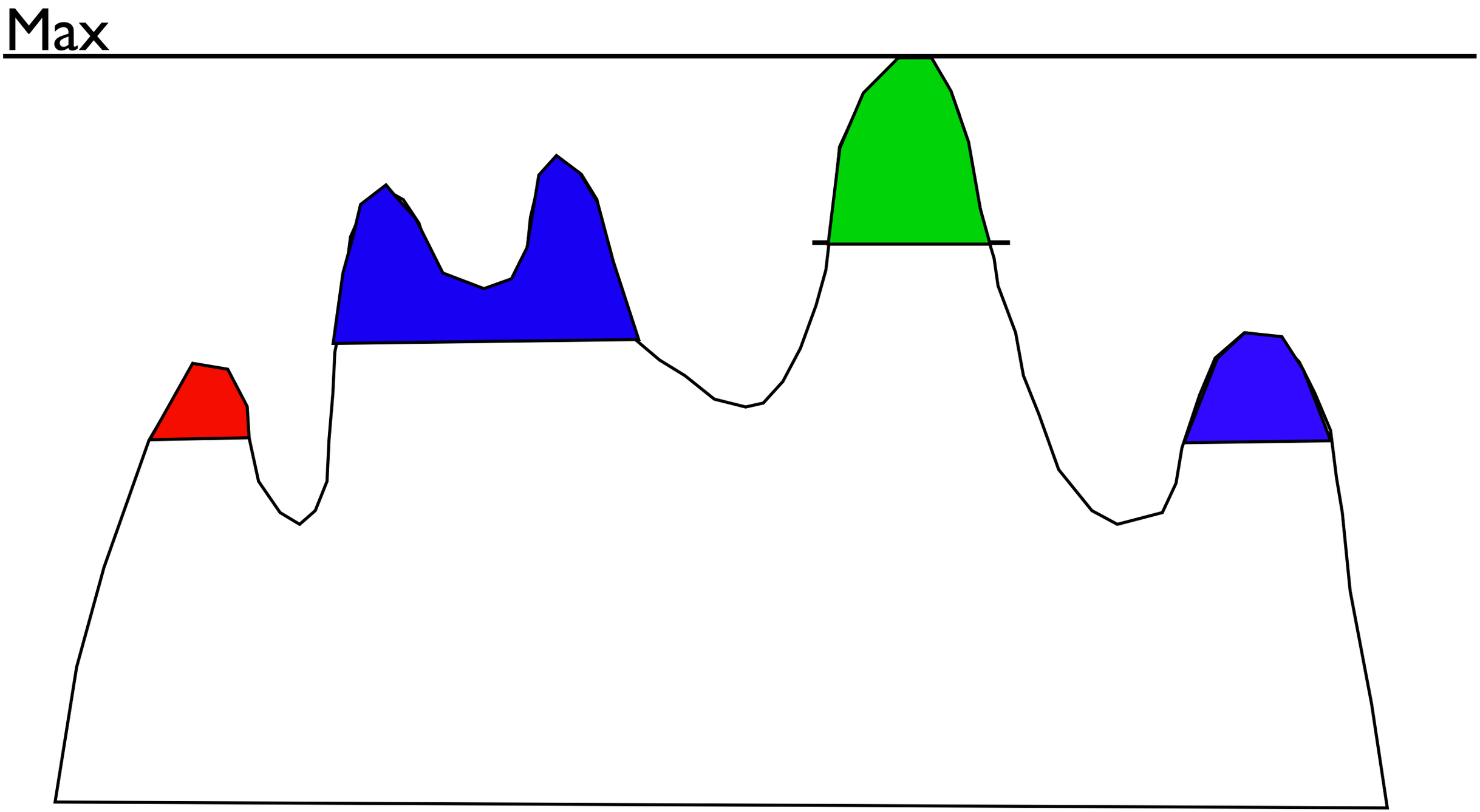

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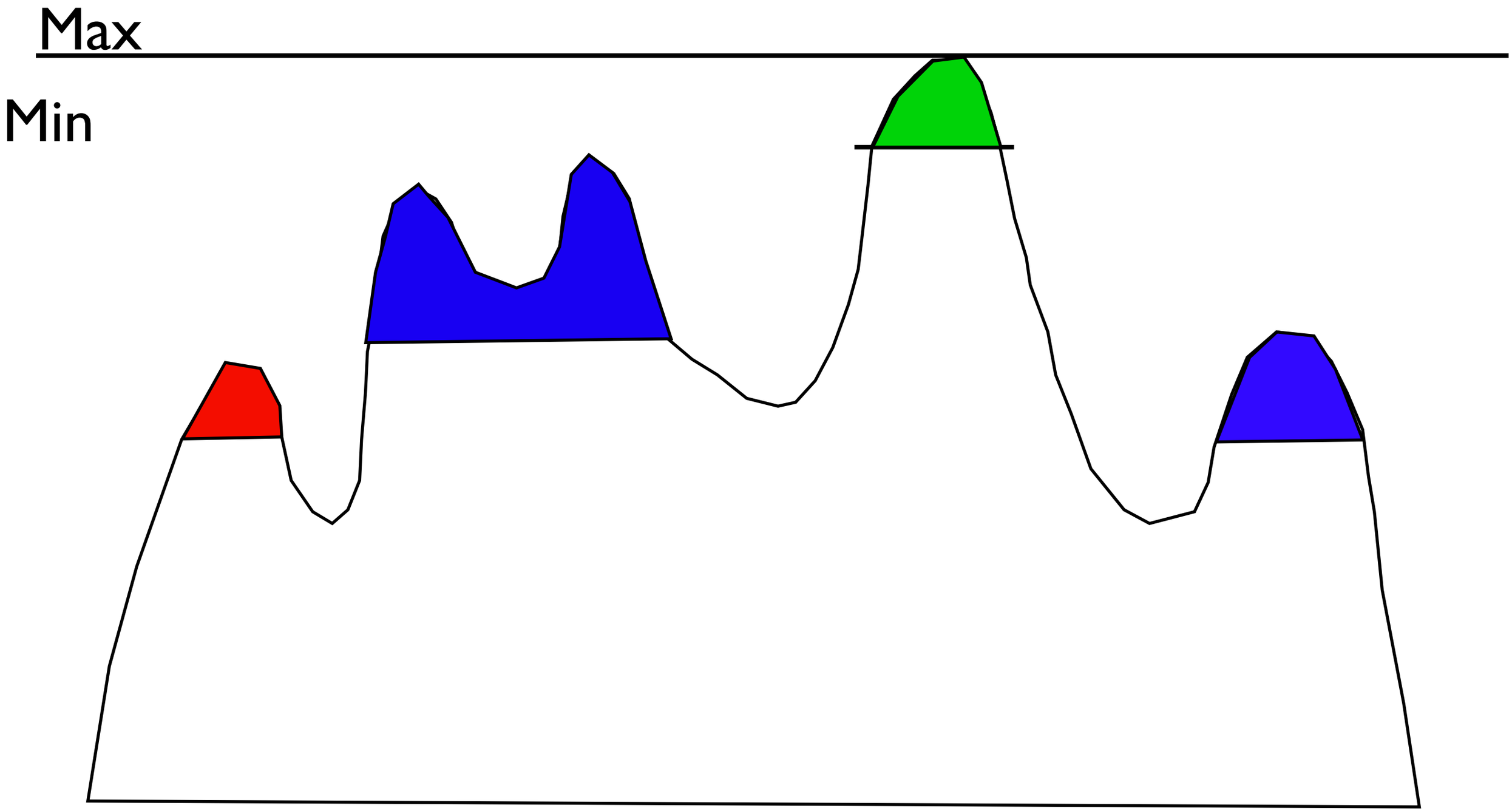

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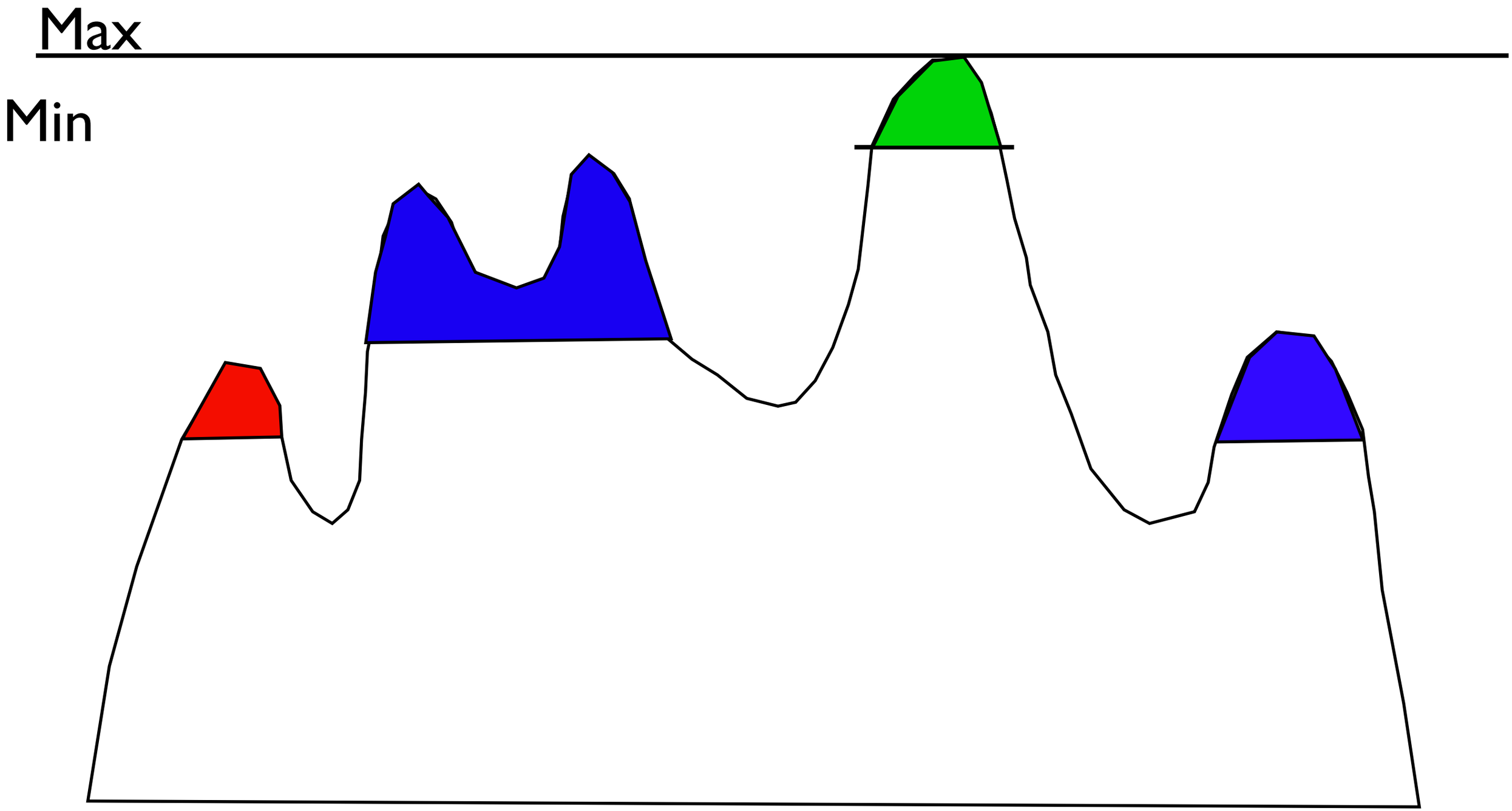

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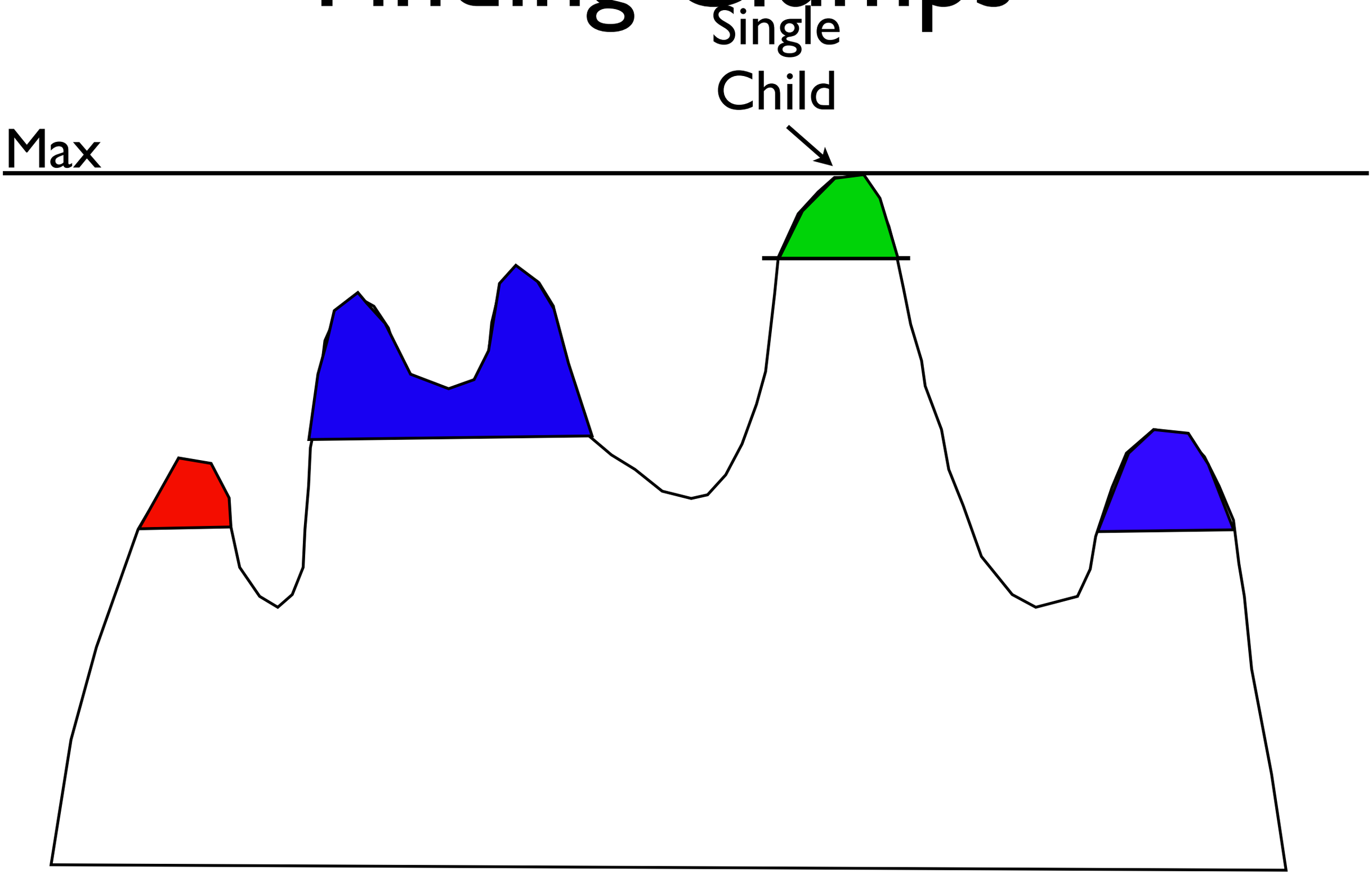

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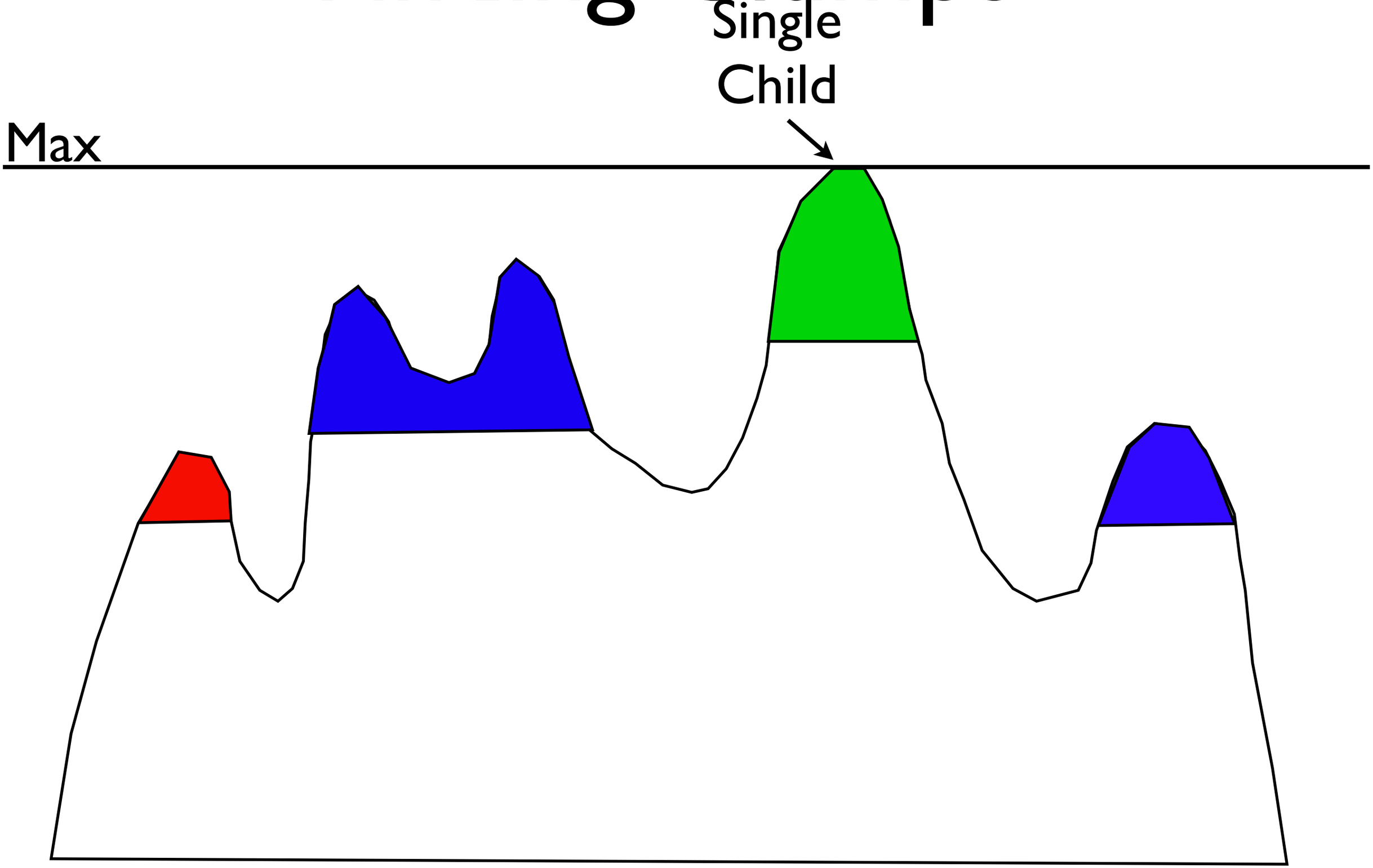

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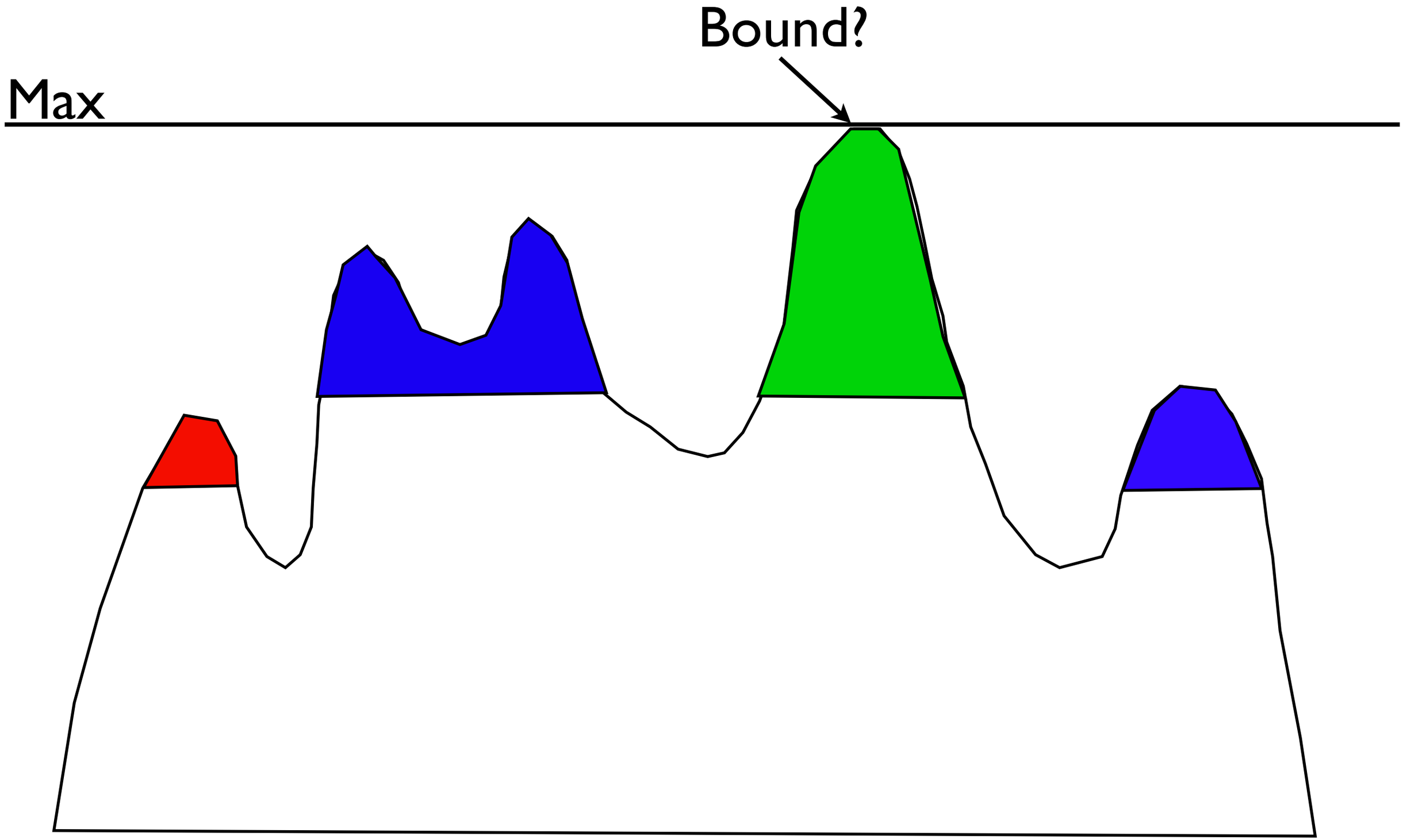

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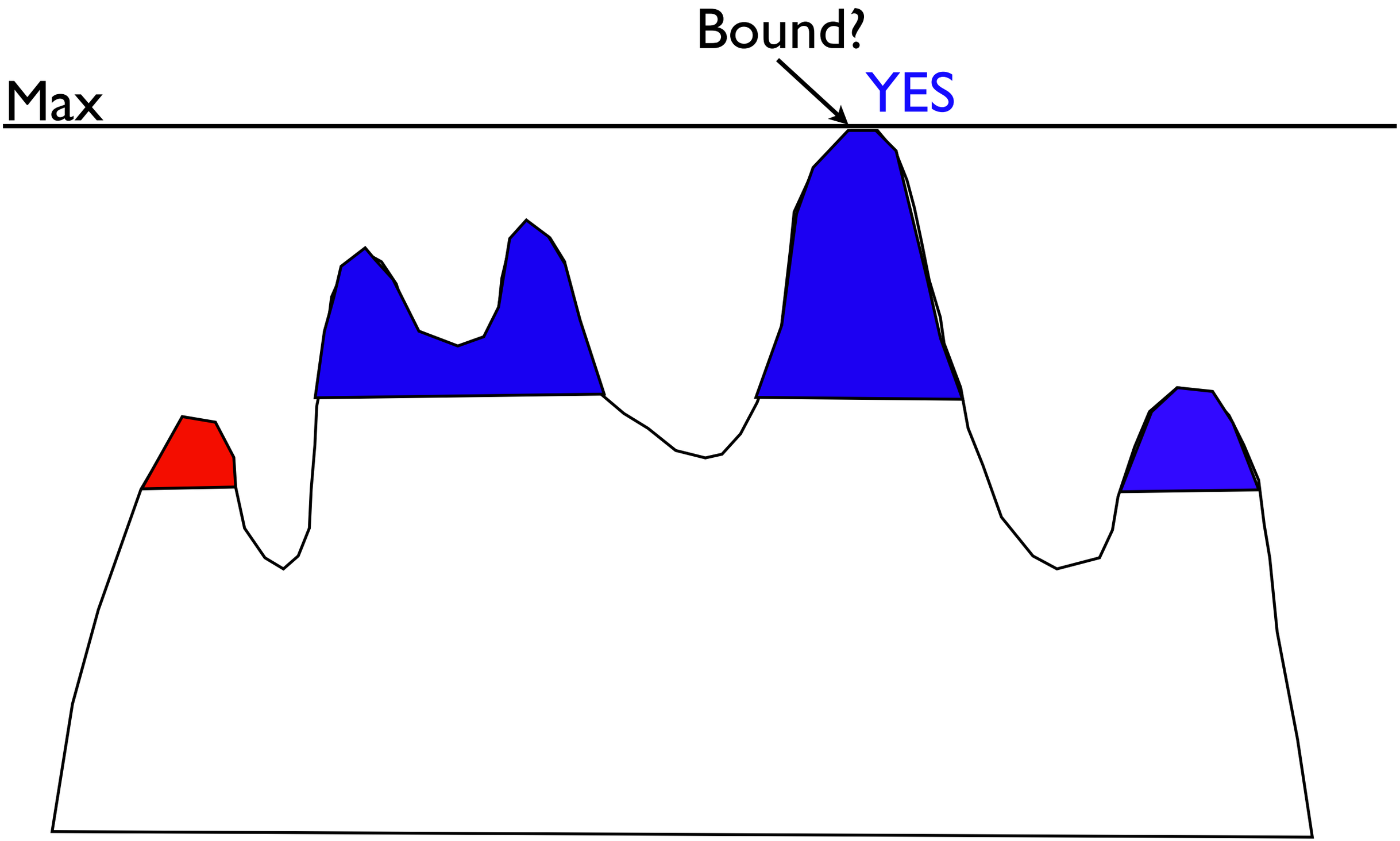

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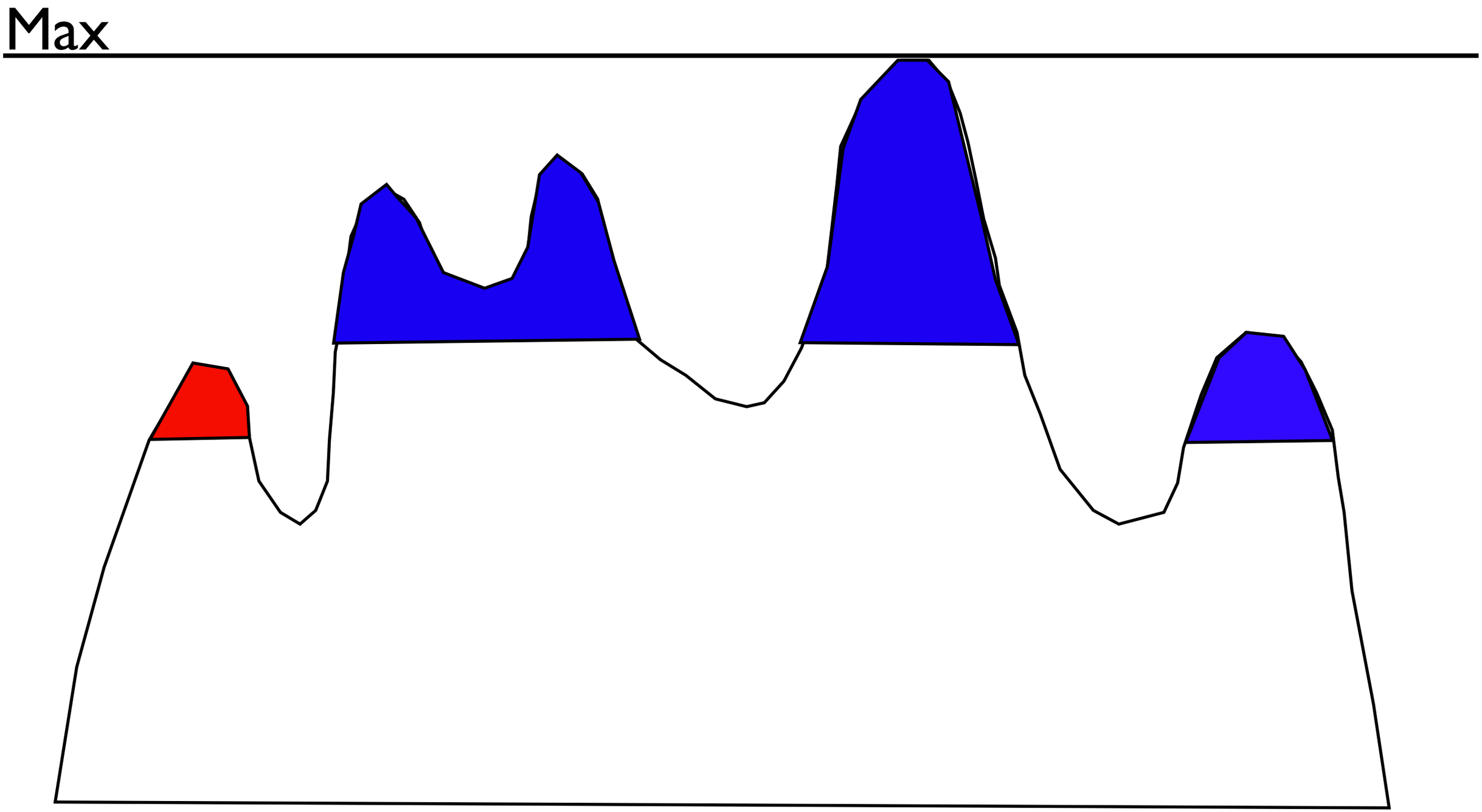
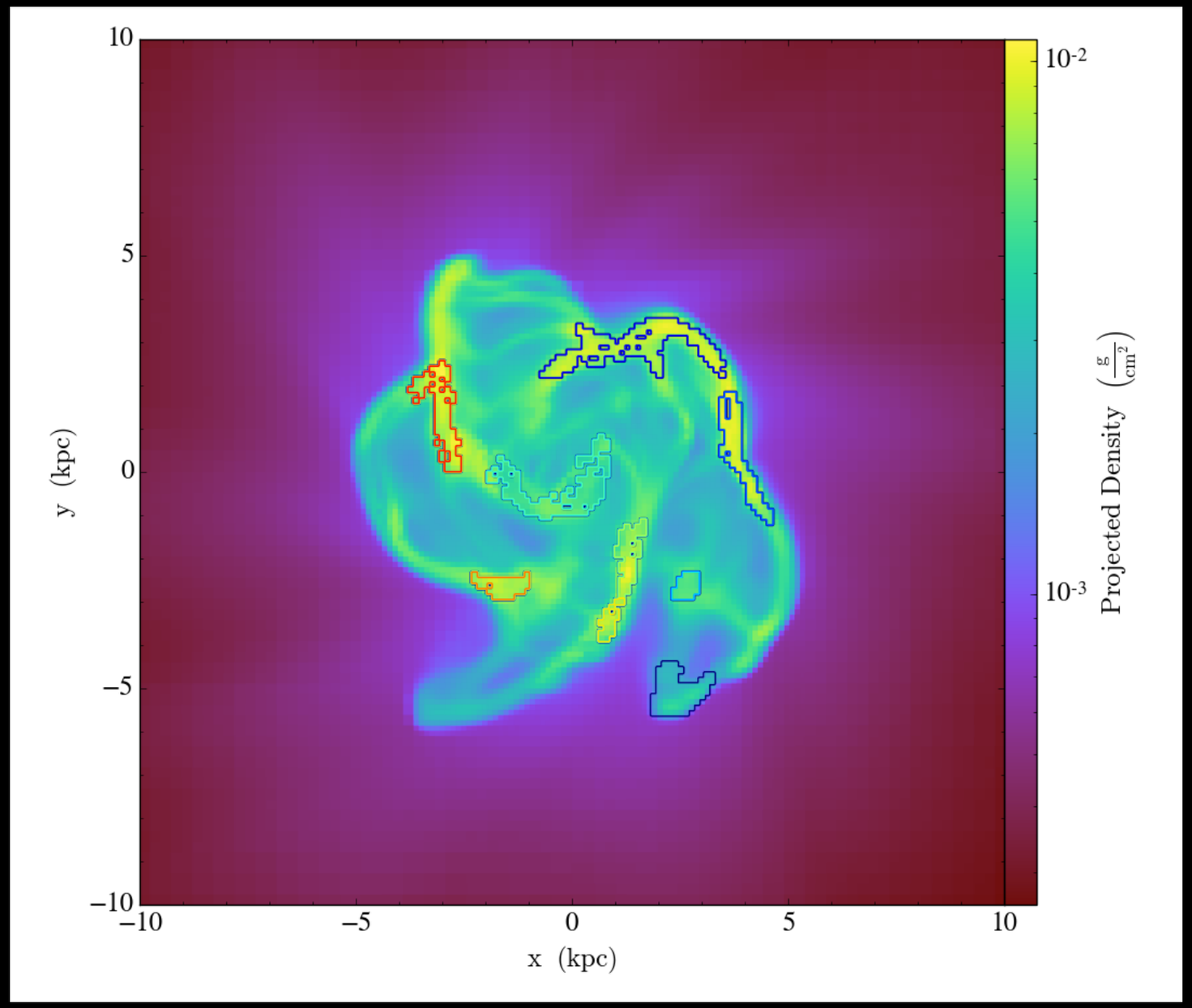


Using the clump finder

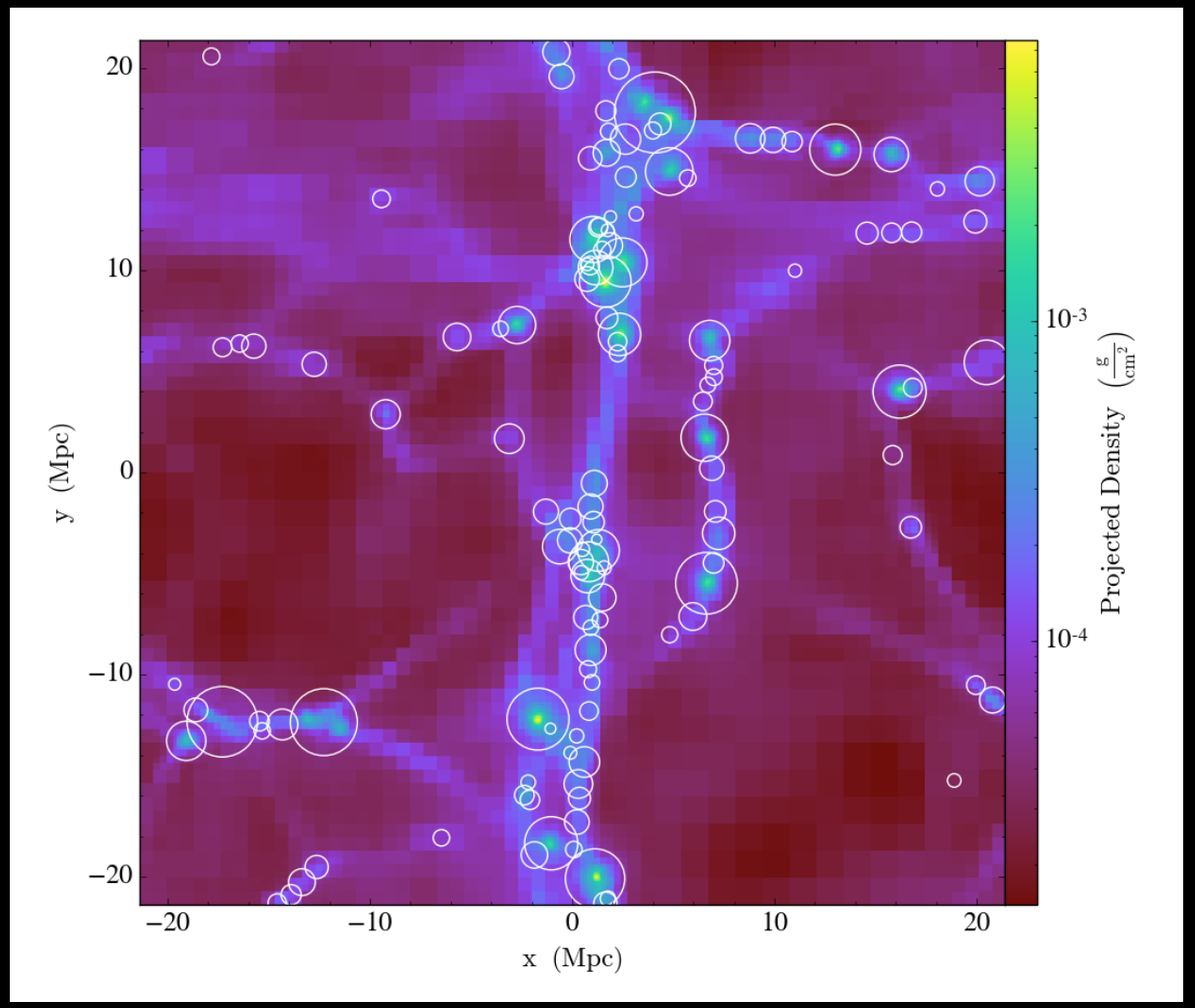
- Create “master” clump
- Add validators
  - Gravitationally bound?
- Find clumps
- Analyze, write to disk, and plot

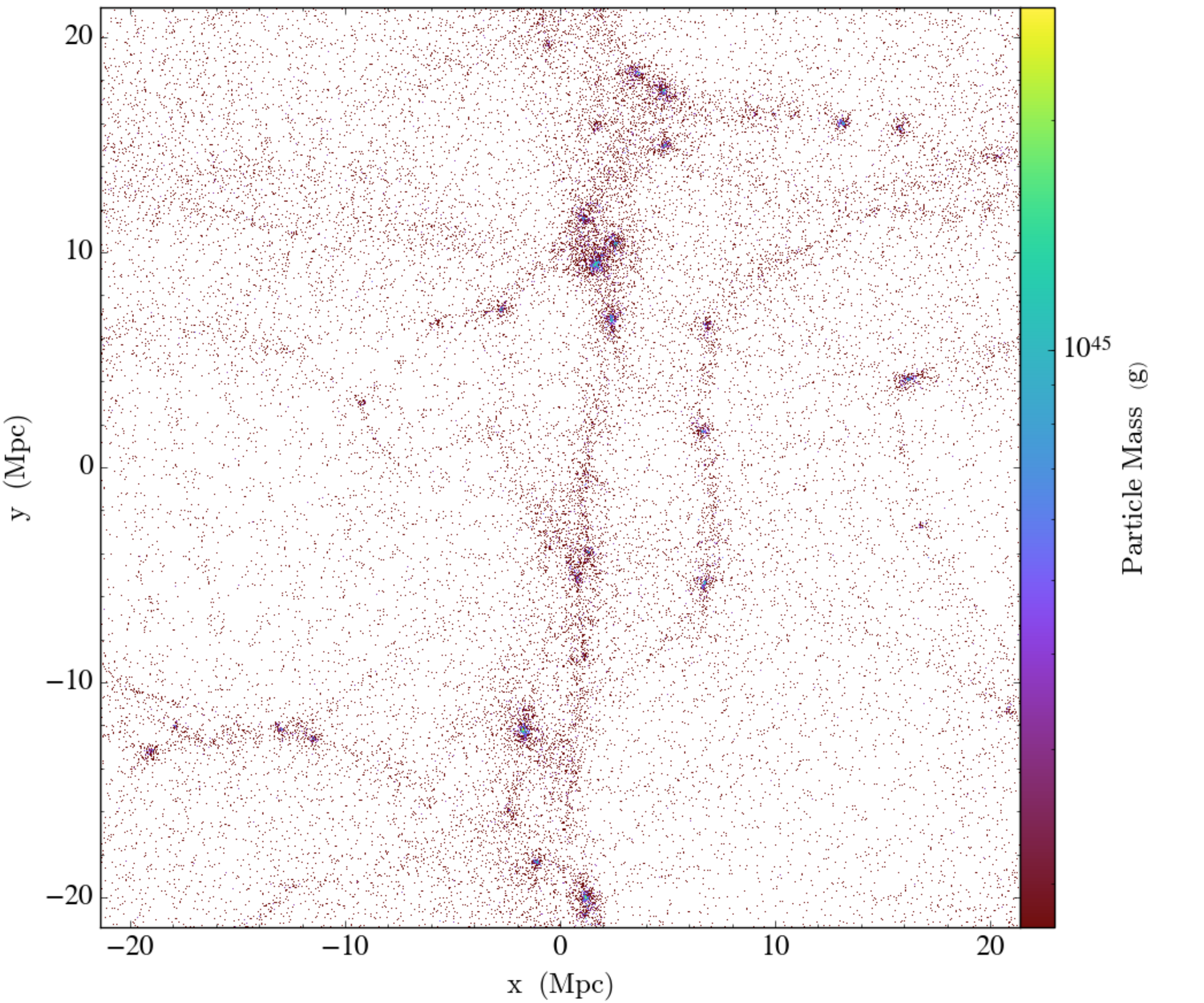


$ yt pastebin_grab 6867 > find_clumps.py

Halo finding and analysis

- Halo Finders
  - FOF, Hop, Rockstar
- Halo analysis
  - Halo catalog
  - Saving and reloading




20
10
0
−10
−20
y (Mpc)
−20
−10
0
10
20
x (Mpc)
10^{45}
Particle Mass (g)

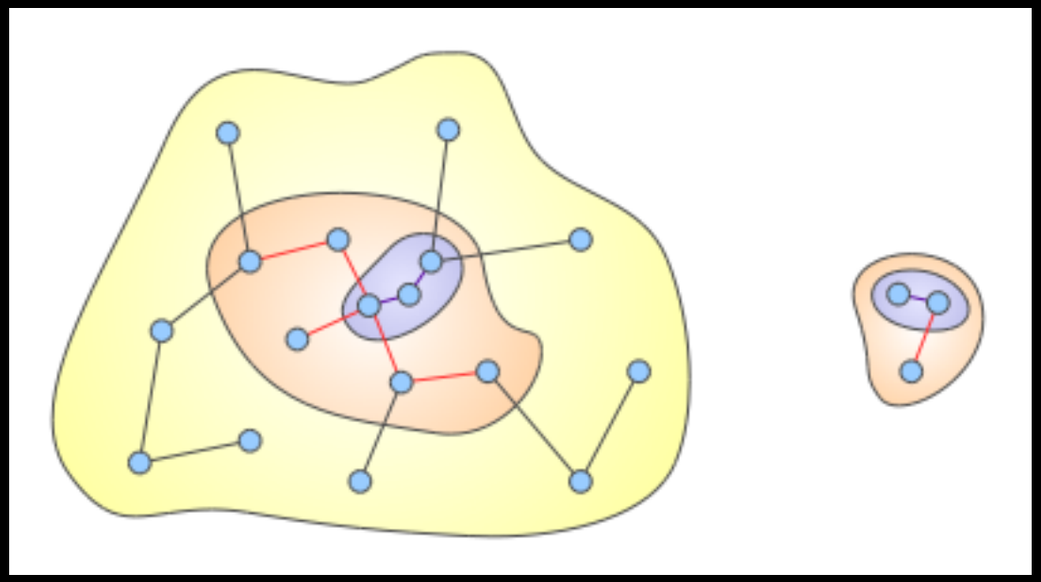
Halo Finders

Identify particle clusters based on linking length (FOF)

Calculate R_vir, mass, position

HOP, Rockstar, similar but add refinements like smoothing and taking into account velocity information

Halo Finders



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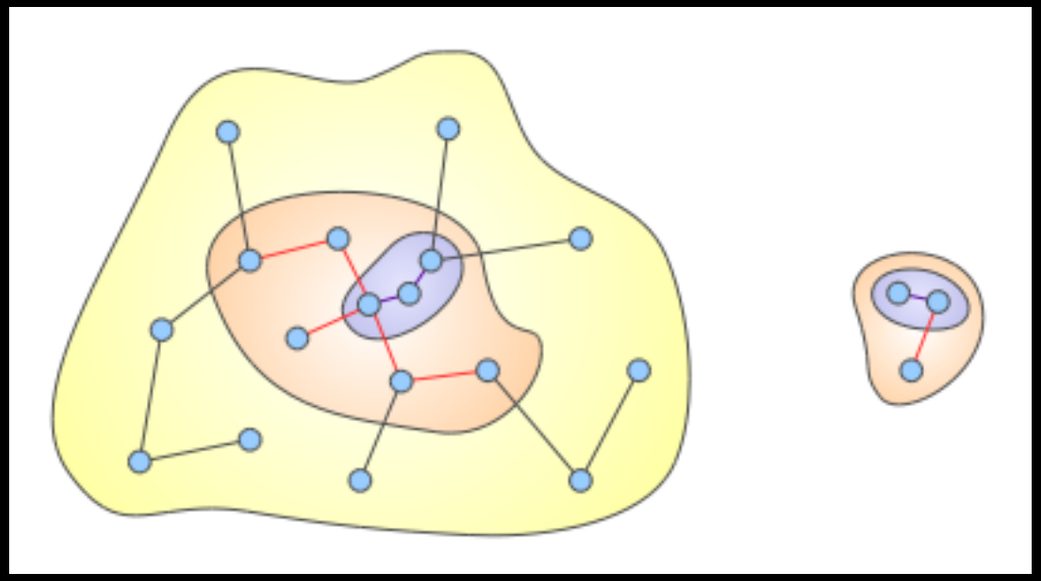

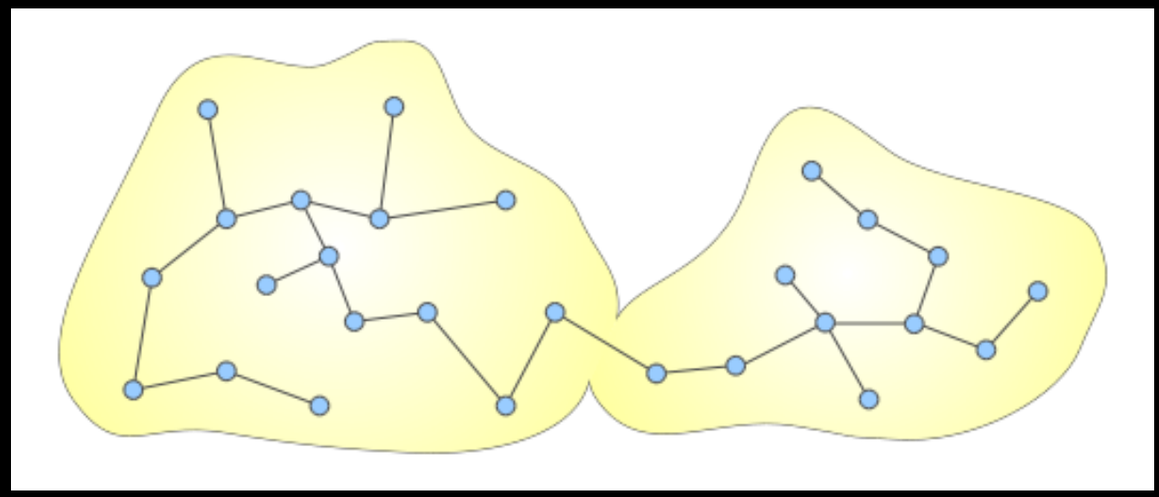

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Installing Rockstar

- Install script: easiest method
- Build Matt's fork of rockstar: http://bitbucket.org/MatthewTurk/rockstar
- Build yt from source, pointing it at the rockstar build directory by adding a rockstar.cfg file
    - Seems to be an issue on MacOS Sierra?

Running Rockstar

```
import yt
yt.enable_parallelism()
from yt.analysis_modules.halo_finding.rockstar.api import RockstarHaloFinder


# create a particle filter to remove star particles
@yt.particle_filter("dark_matter", requires=["creation_time"])
def _dm_filter(pfilter, data):
    return data["creation_time"] <= 0.0


def setup_ds(ds):
    ds.add_particle_filter("dark_matter")


es = yt.simulation("enzo_cosmology_plus/AMRCosmology.enzo", "Enzo")
es.get_time_series(setup_function=setup_ds, redshift_data=False)
rh = RockstarHaloFinder(es, num_readers=1, num_writers=2,
                        particle_type="dark_matter")
rh.run()
```

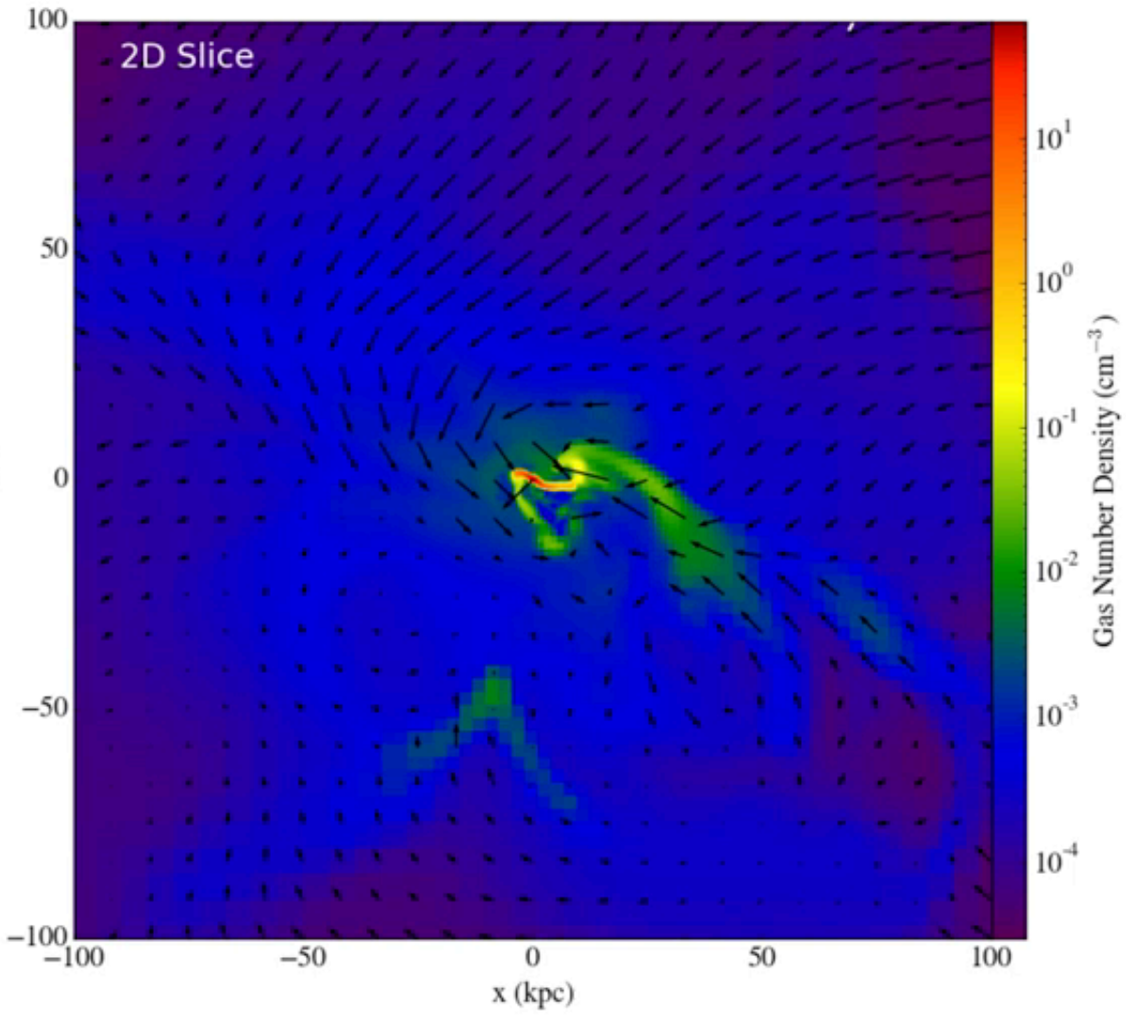
Needs at least 3 MPI tasks

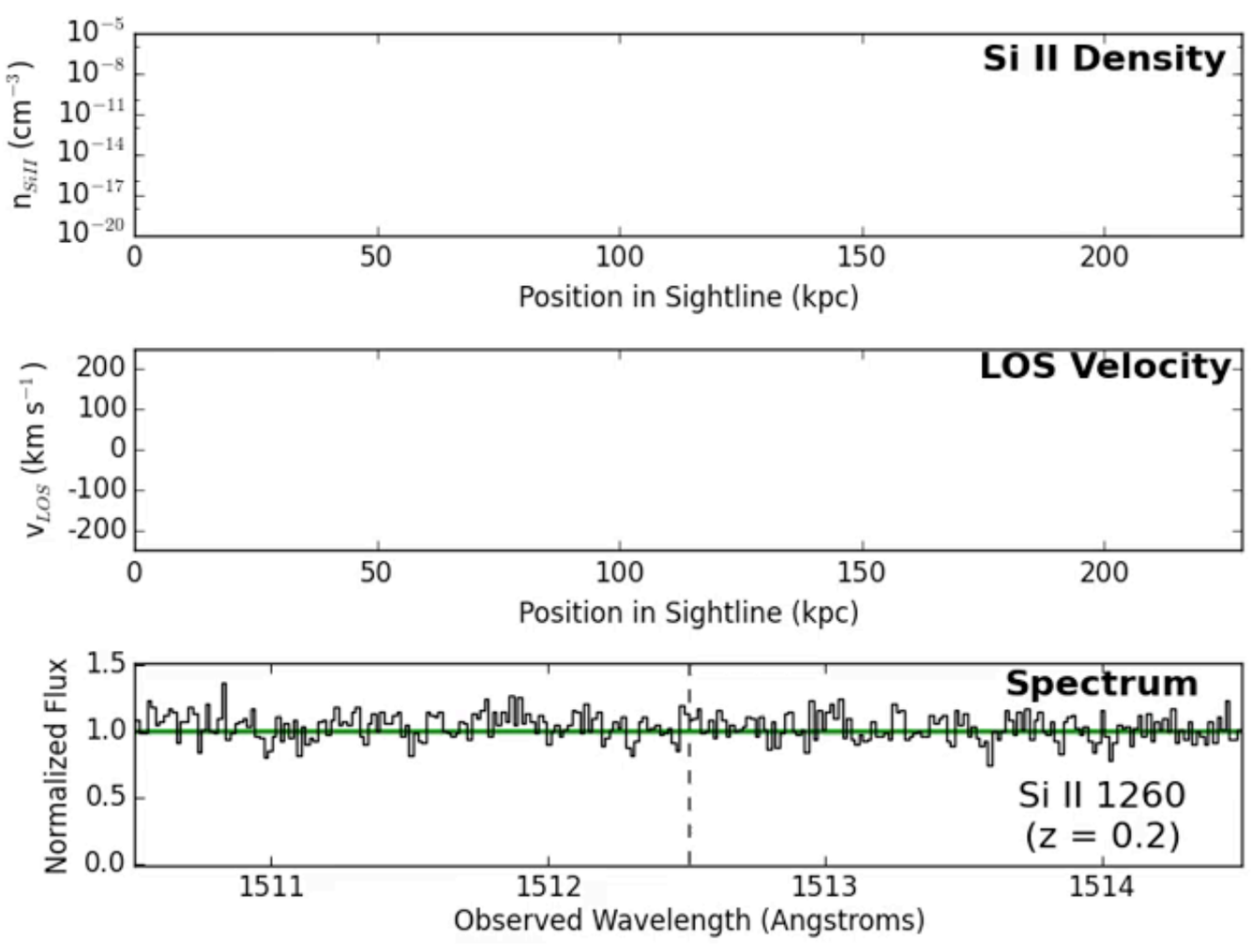
Halo analysis example

http://yt-project.org/docs/dev/cookbook/halo_analysis_example.html

Let’s modify this example in the yt docs to use this dataset we’ve been working with

Trident

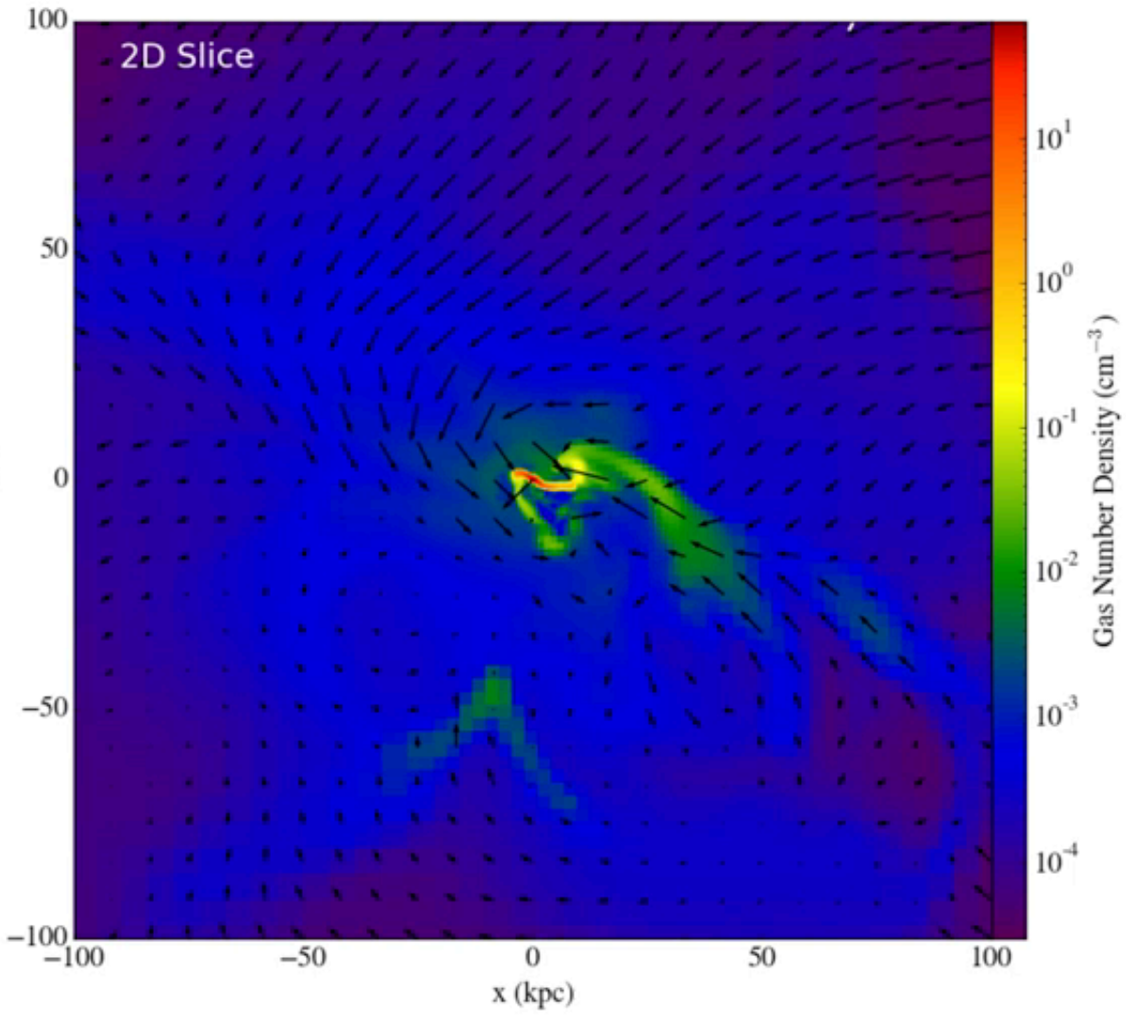


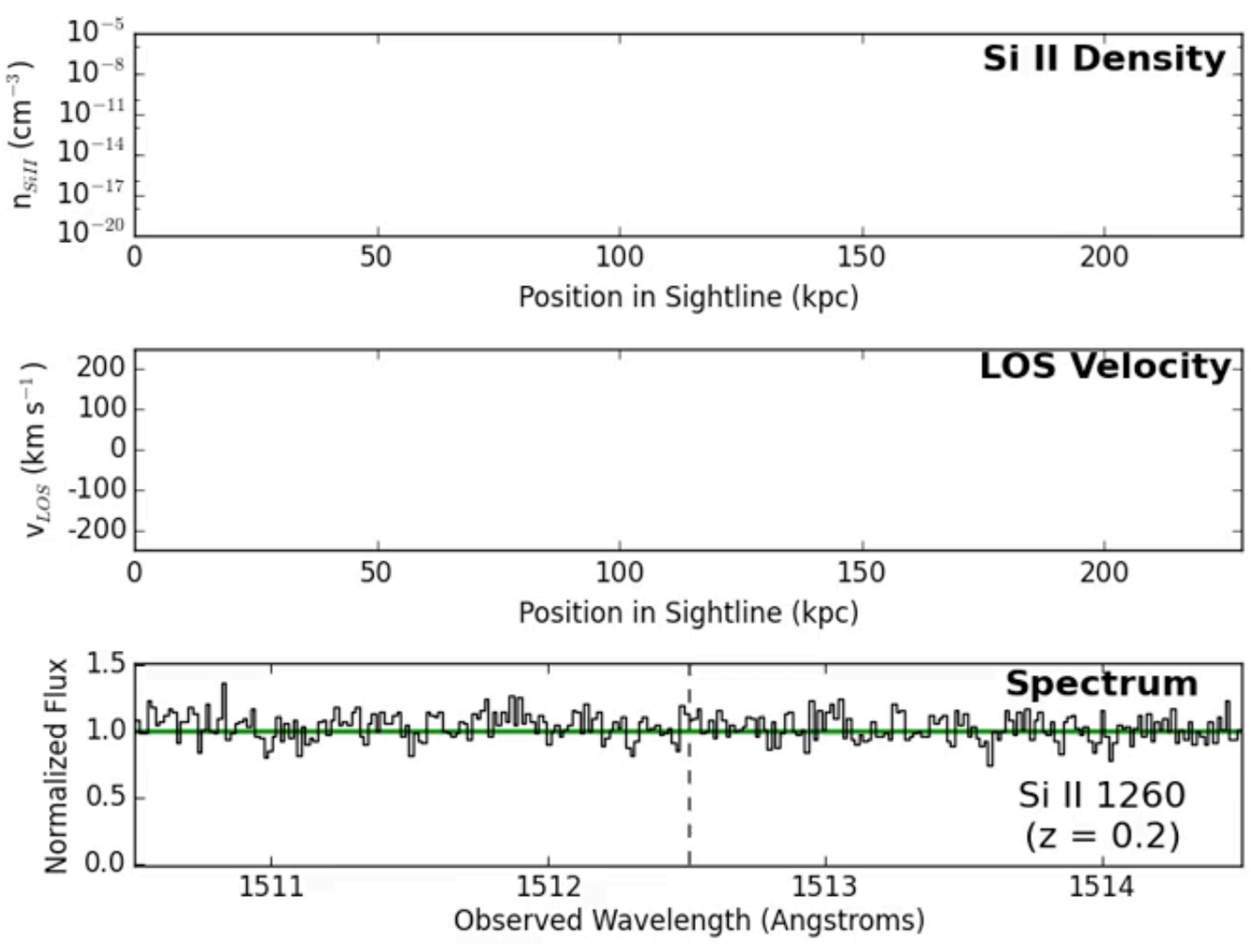


http://trident.readthedocs.io/en/latest

http://trident-project.org

Trident





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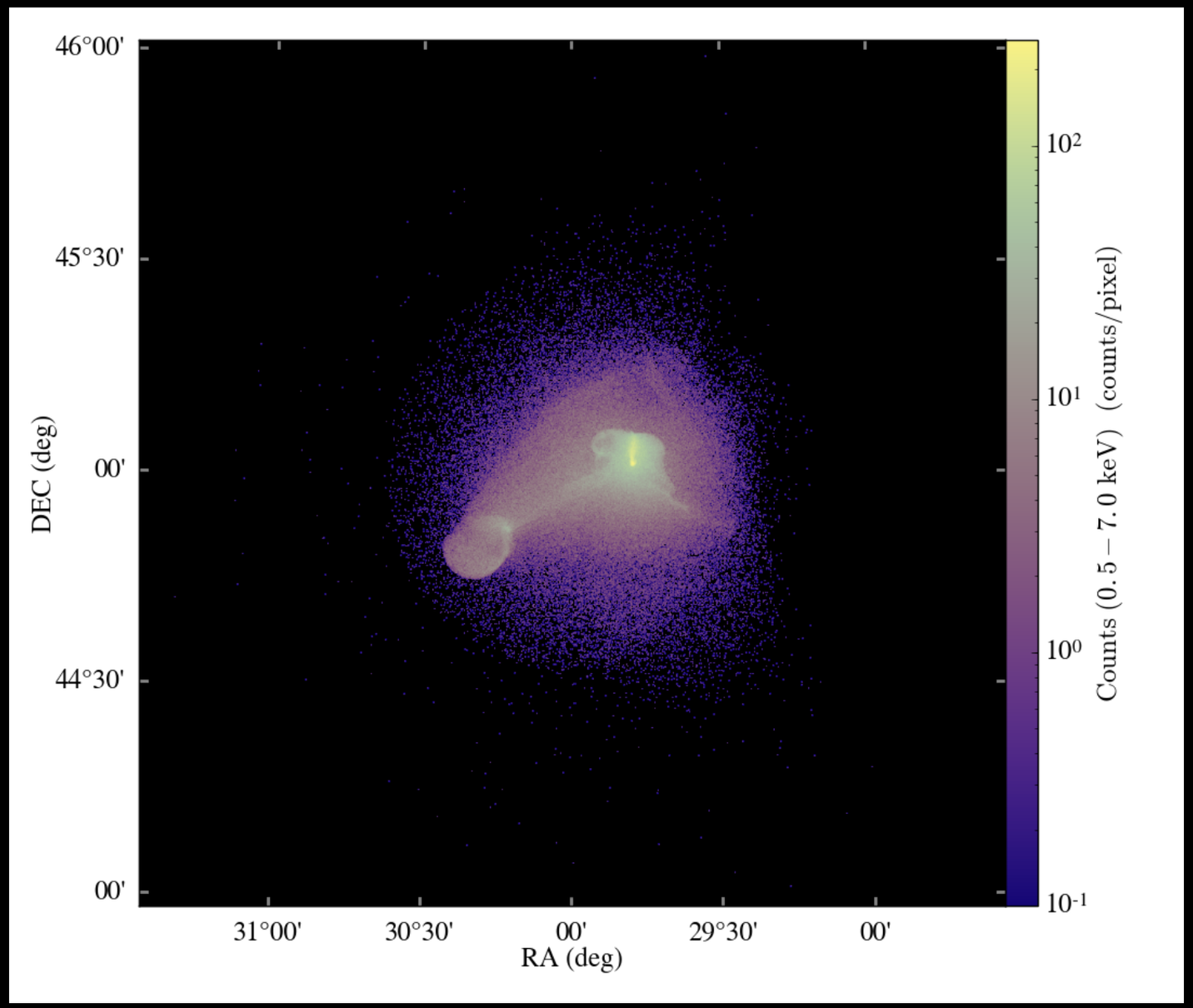
pyXSIM



Simulating xray observations

http://hea-www.cfa.harvard.edu/~jzuhone/pyxsim/index.html