

Physically-Based Simulation for Computer Graphics

# Project Results: Meteorite strike

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# Inspiration



[https://www.google.com/search?biw=1280&bih=561&tbm=isch&sa=1&ei=RRAZXLLyCoywrgSIhbuYCQ&q=meteorite+in+ocean&oq=meteorite+in+ocean&gs\\_l=img.3...21824.22466..22628...0.0.0.97.448.5.....0....1.gws-wiz-img.GVEnOnzLP1M#imgrc=YrRoqH8ERfMx6M:](https://www.google.com/search?biw=1280&bih=561&tbm=isch&sa=1&ei=RRAZXLLyCoywrgSIhbuYCQ&q=meteorite+in+ocean&oq=meteorite+in+ocean&gs_l=img.3...21824.22466..22628...0.0.0.97.448.5.....0....1.gws-wiz-img.GVEnOnzLP1M#imgrc=YrRoqH8ERfMx6M:)

# Last time...

Problems with 2D simulation:

- Symmetry
- Stability
- Incompressibility

Don't you remember?

# Last time...

Activities libig viewer

17:17:21 | Wednesday 28. November 2018

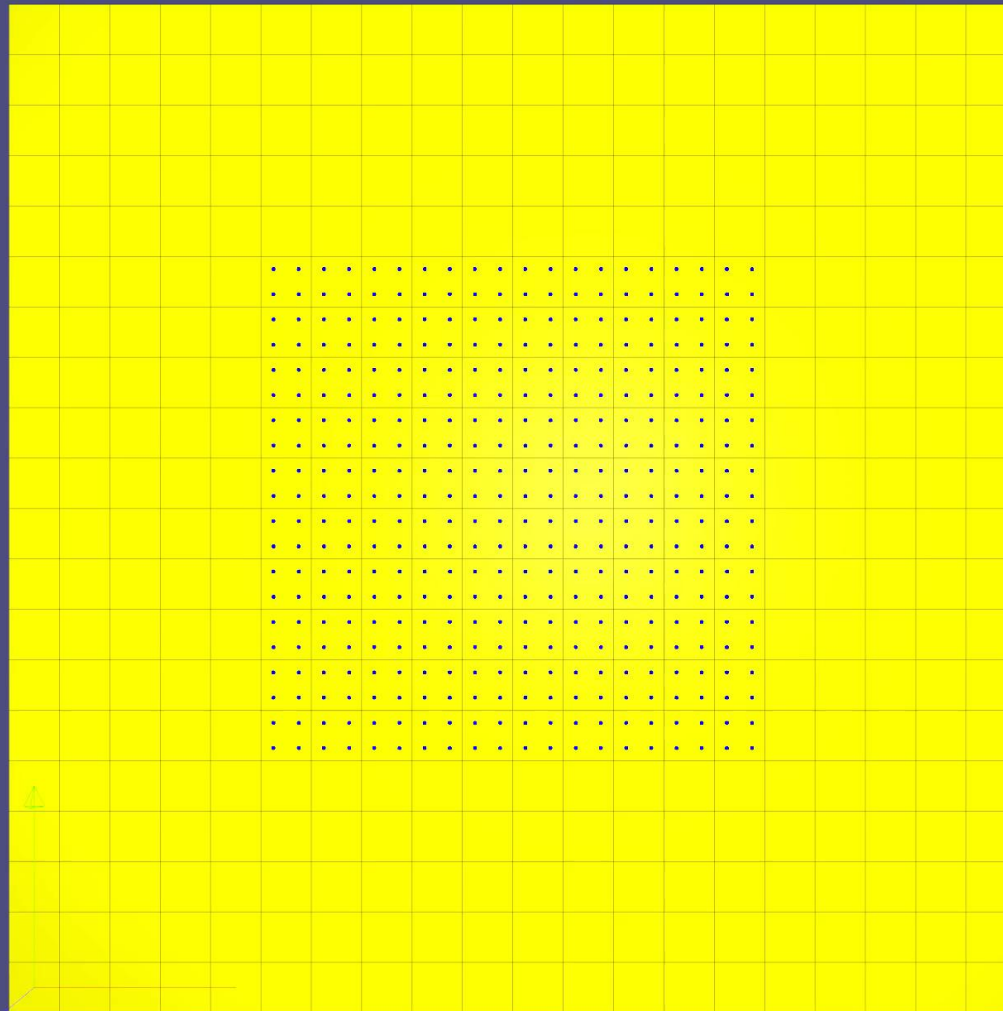
1.76GHz

99 %

PBS Exercises

Viewer

- Simulation Control
  - Run Simulation
  - Single Step
  - Reset Simulation
  - Clear Screen
- 60 Steps/Second
- 1 Max Steps
- Overlays
  - Wireframe
  - Fill
  - Show vertex labels
  - Show faces labels
  - Show stats
  - Show axes
- Simulation Parameters
  - Export meshes
  - Show pressure field
- 0.050000 Alpha
- 0.022361 Timestep [s]
- 1000.000000 Density [kg/m<sup>3</sup>]
- 9.810000 Gravity [m/s<sup>2</sup>]
- 5.000000 X Size [m]
- 5.000000 Y Size [m]
- 20 Grid resolution X
- 20 Grid resolution Y
- Display grid
- Display velocity arrows
- Recording



Stats

- Iteration: 0
- Average time per iteration: 0.00ms
- Current time: 0.00000
- Maximal pressure: 0.00000
- Minimal pressure: 0.00000

# Debugging



<https://d20eq91zdmkqd.cloudfront.net/assets/images/book/large/9781/4053/9781405306508.jpg>

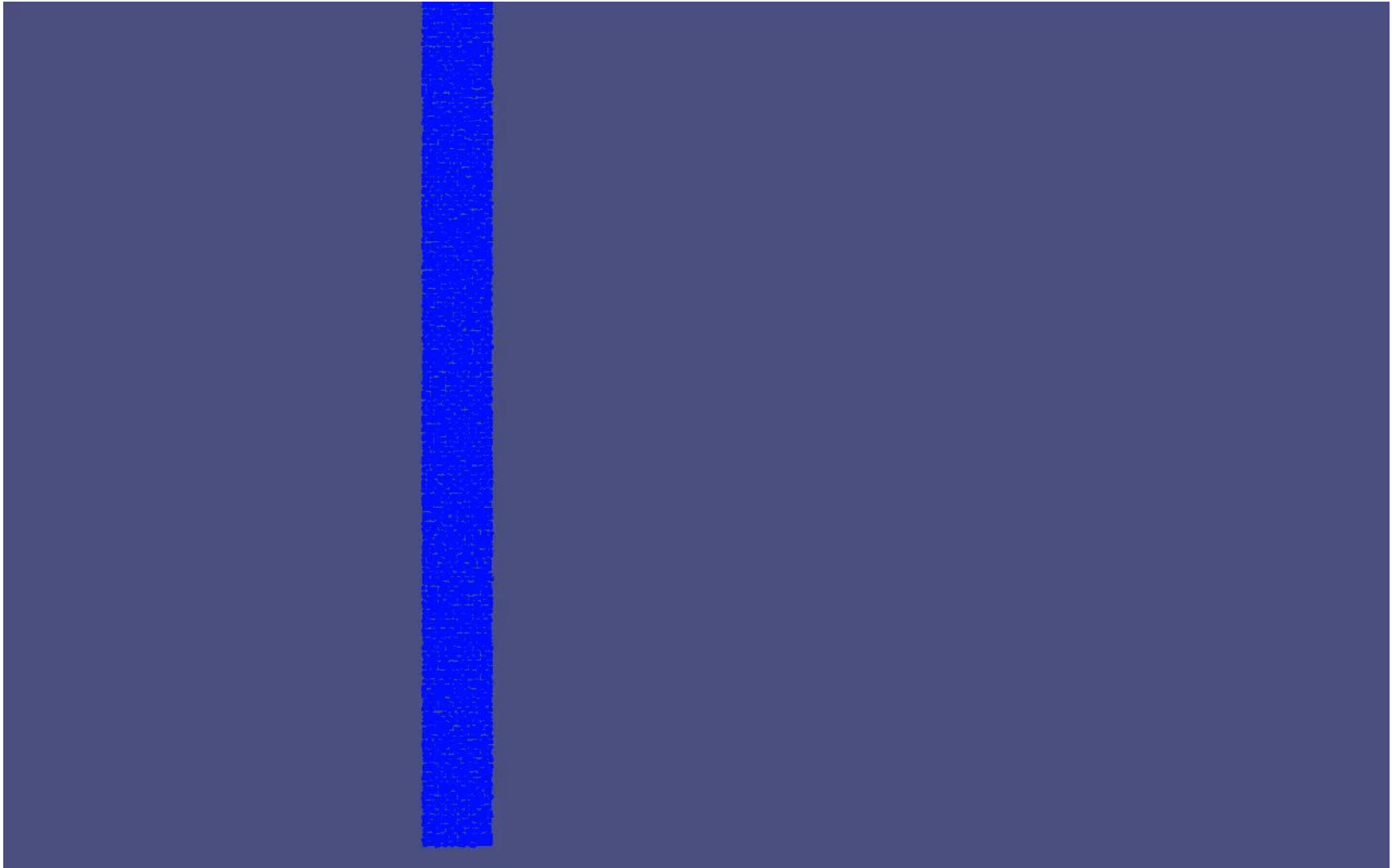
# 2D Problems

The problems were:

- Symmetry → wrong indices
- Stability → more PIC on boundary
- Incompressibility → error in pressure matrix

The main problem were **indices** and **typos**!

# 2D final result



# 3D

From the 2D to the 3D we had to do:

- Expand our grid in the z-dimension
- Adapt the algorithm to the z-dimension

In order to get a rendered image we had to do:

- Level set function



# More bugs



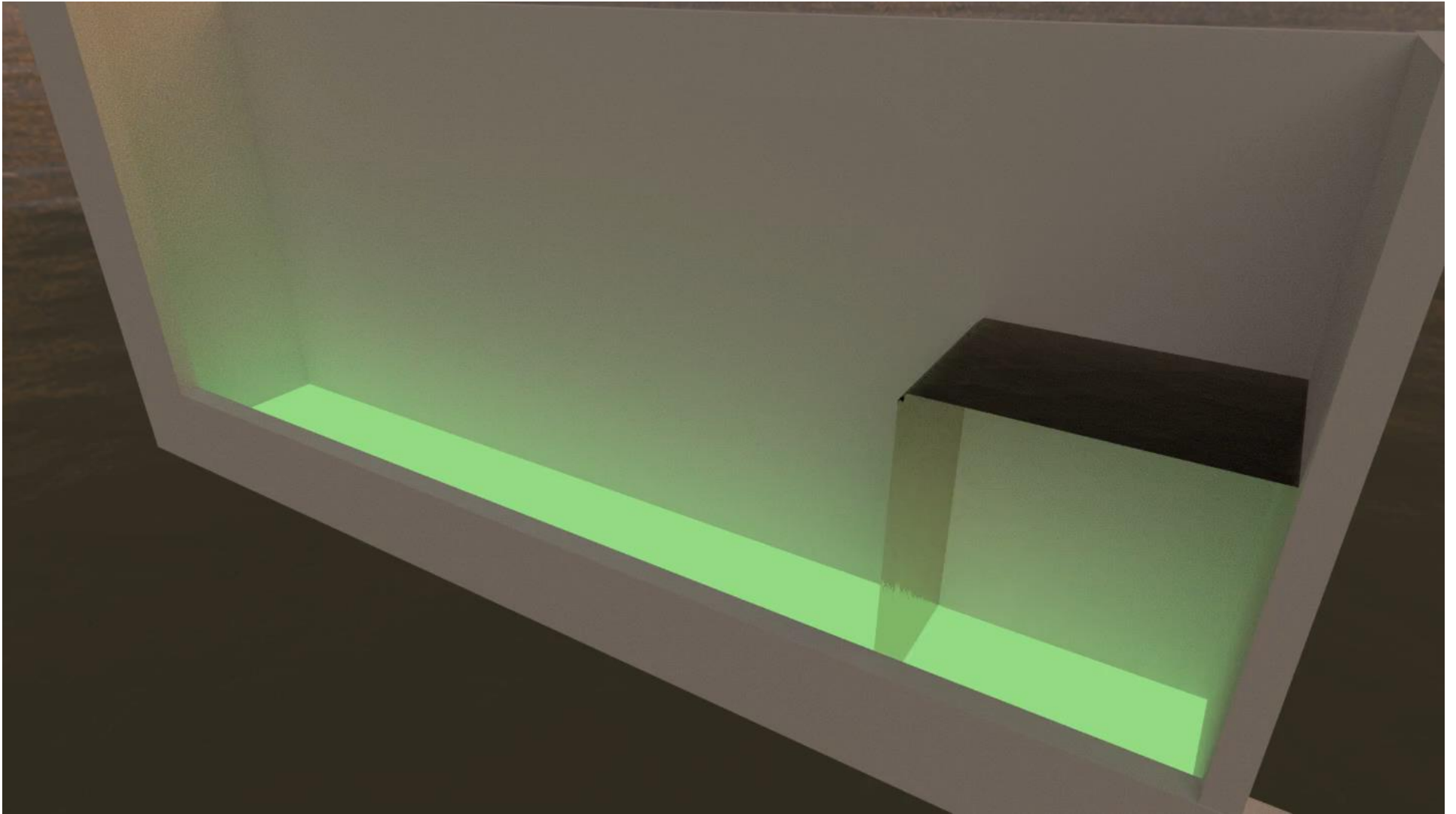
[https://www.wired.com/wp-content/uploads/blogs/magazine/wp-content/images/19-11/ff\\_betterlivingb\\_f.jpg](https://www.wired.com/wp-content/uploads/blogs/magazine/wp-content/images/19-11/ff_betterlivingb_f.jpg)

# 3D Problems

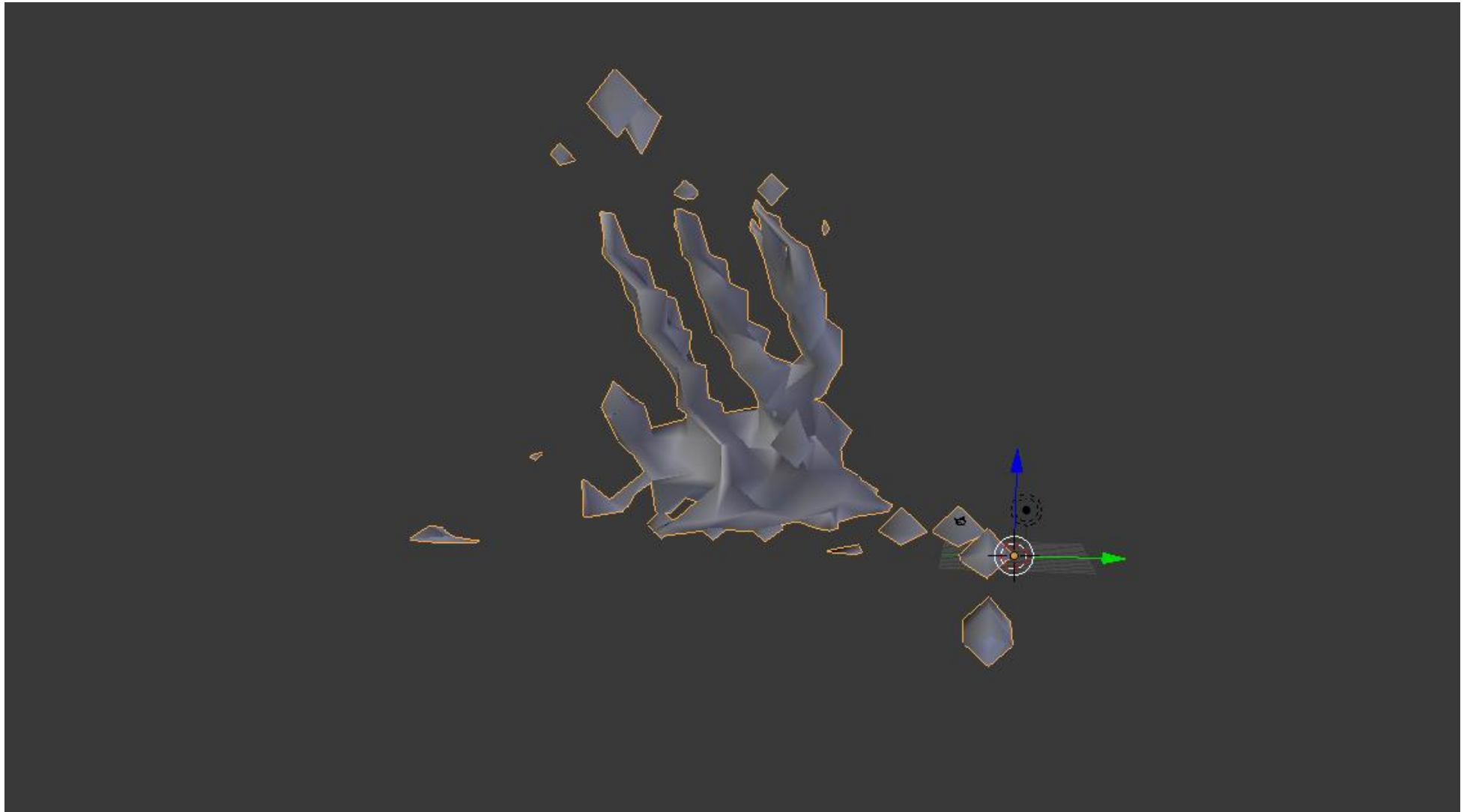
The problems were:

- Symmetry  $\rightarrow$  wrong indices
- Level set function  $\rightarrow$  wrong implementation!

# 3D Problems



# 3D Problems

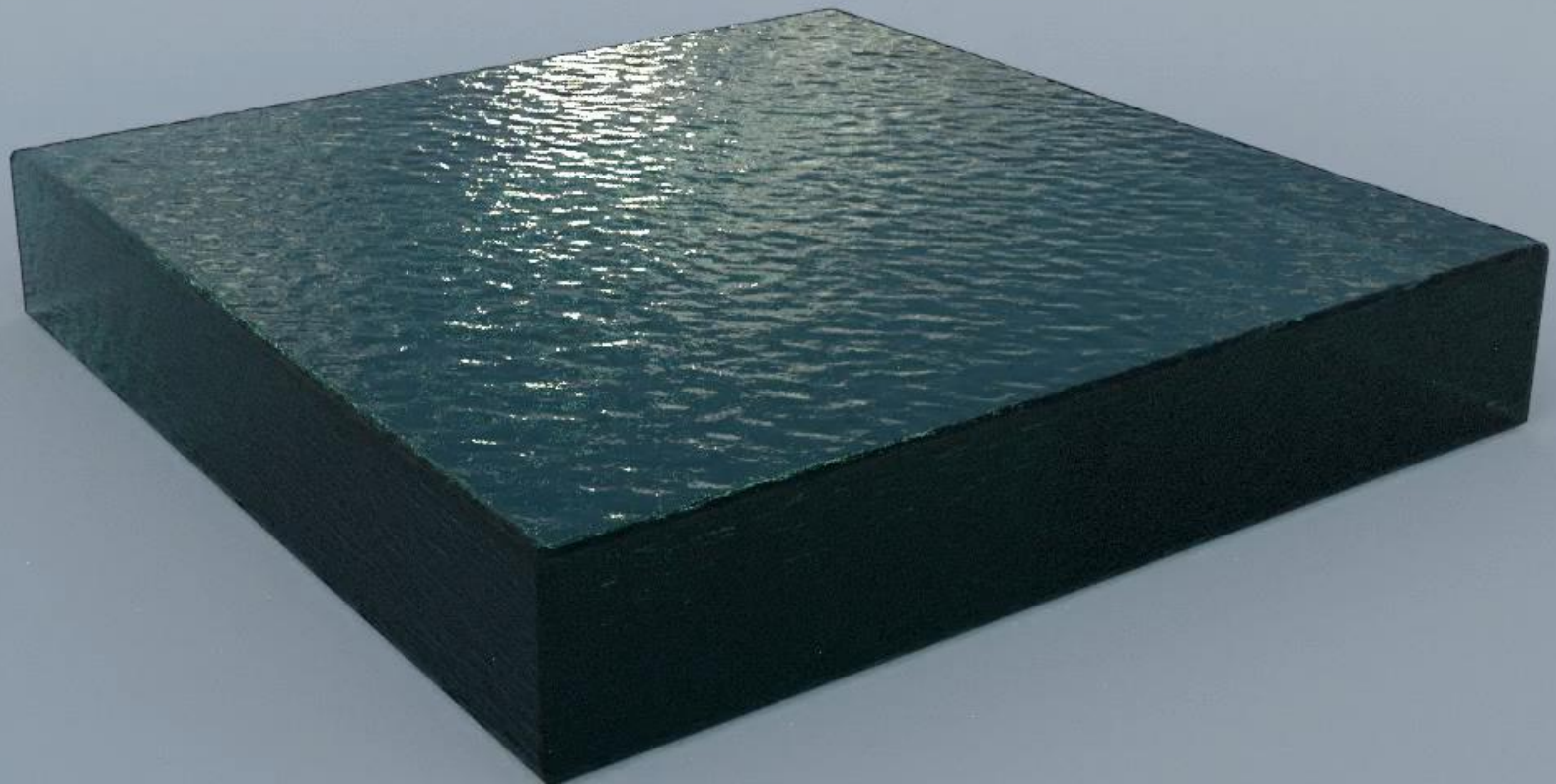


# Final Work



<https://r-loops.com/web/uploads/images/entries/600/Music-Rendering-Do-you-know-this-feelin--6675063.jpg>

# Final video



# Improvements

- Better level set function
- Improve the runtime of our simulation
- Implement smoke and lather
- Implement fluid-solid interactions

Thank you for the  
attention, any questions?