

# Physically-Based Simulation Final Presentation (Jelly) Jenga

Group 2

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# Overview

- Features
  - Gyroscopic Forces
  - Collision Detection
  - Collision Resolution
- Known Issues

# Gyroscopic Force

**No gyro**



**With gyro**



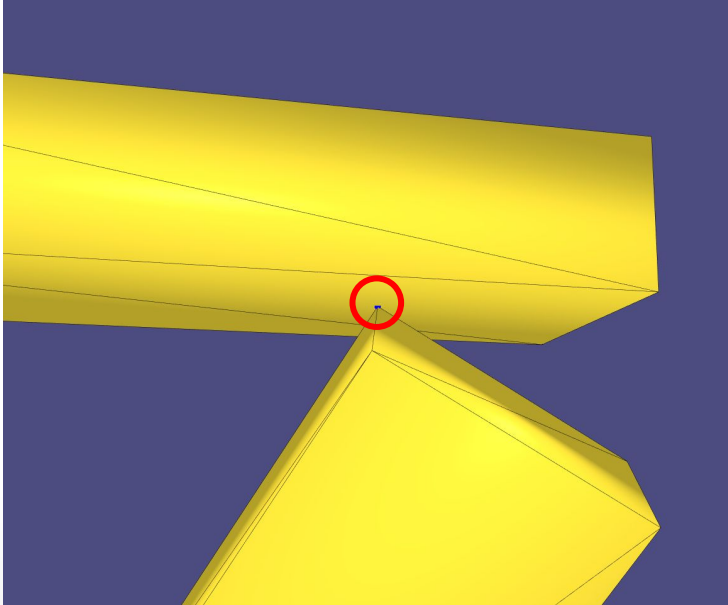
# Collision Detection

## Implemented Features

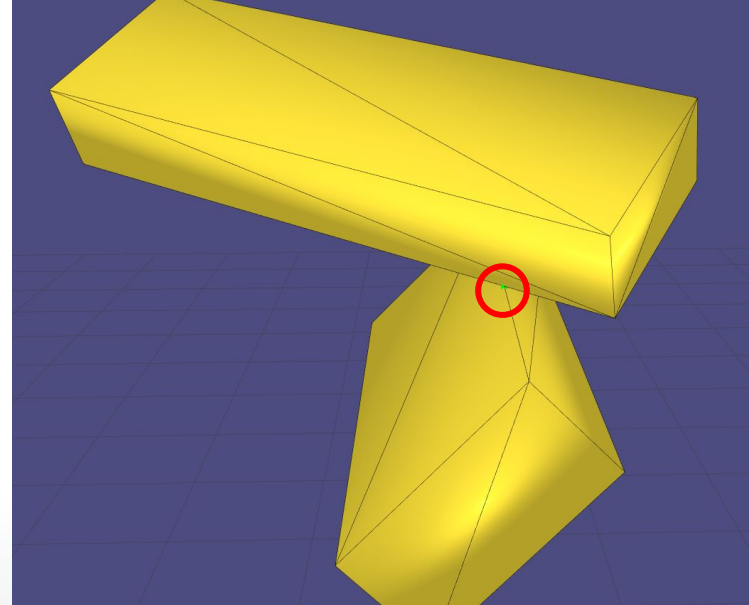
- SAP broad phase
- GJK + EPA narrow phase
  - + extension to EPA for multiple contact points

# Collision Detection

## Vertex-Face

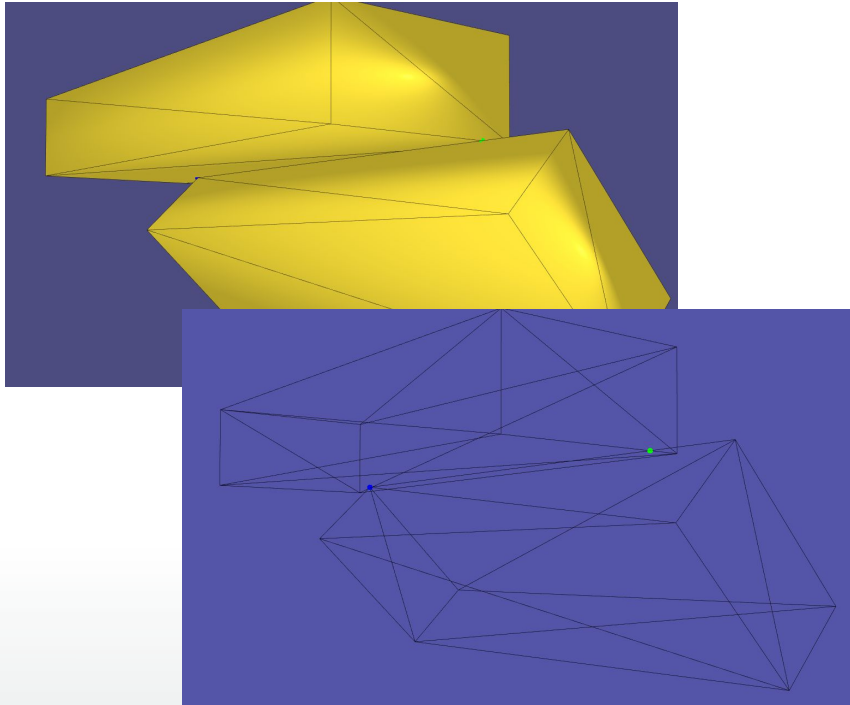


## Edge-Edge

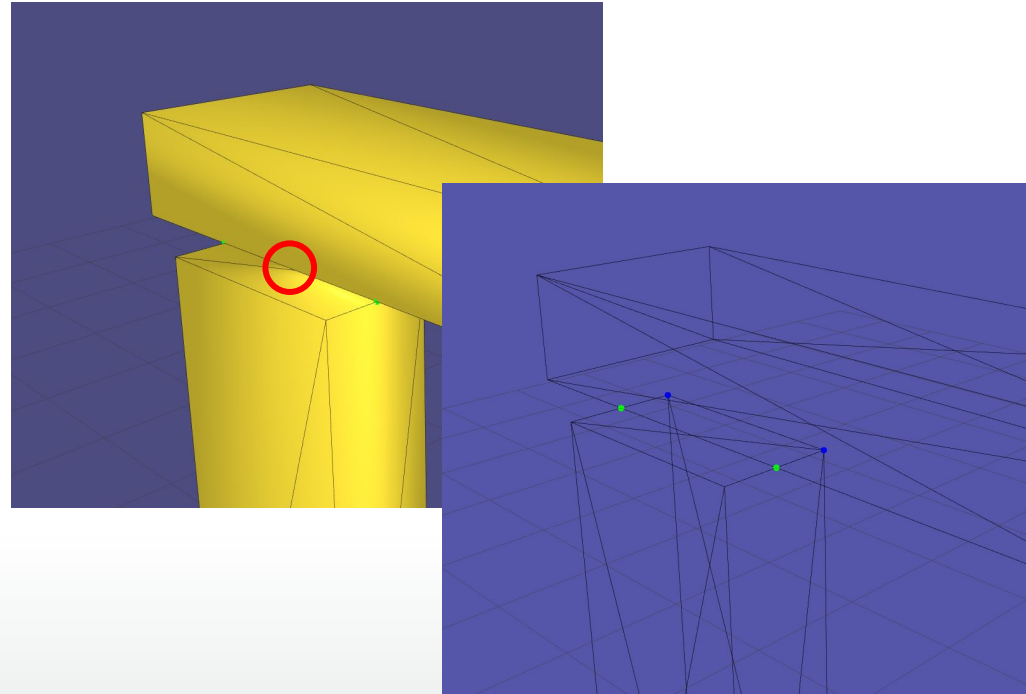


# Collision Detection

## Edge-Face

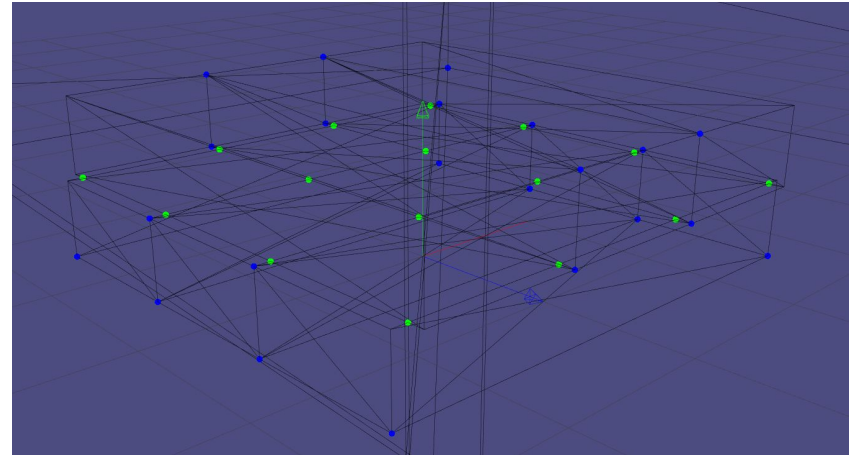
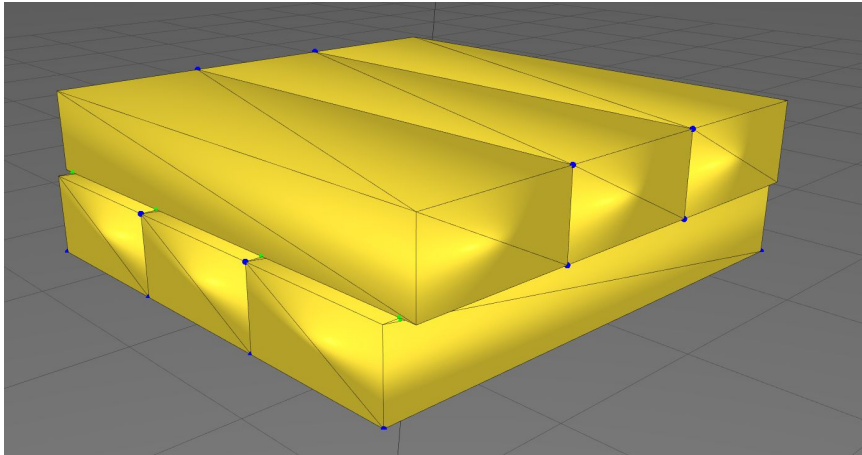


## Face-Face



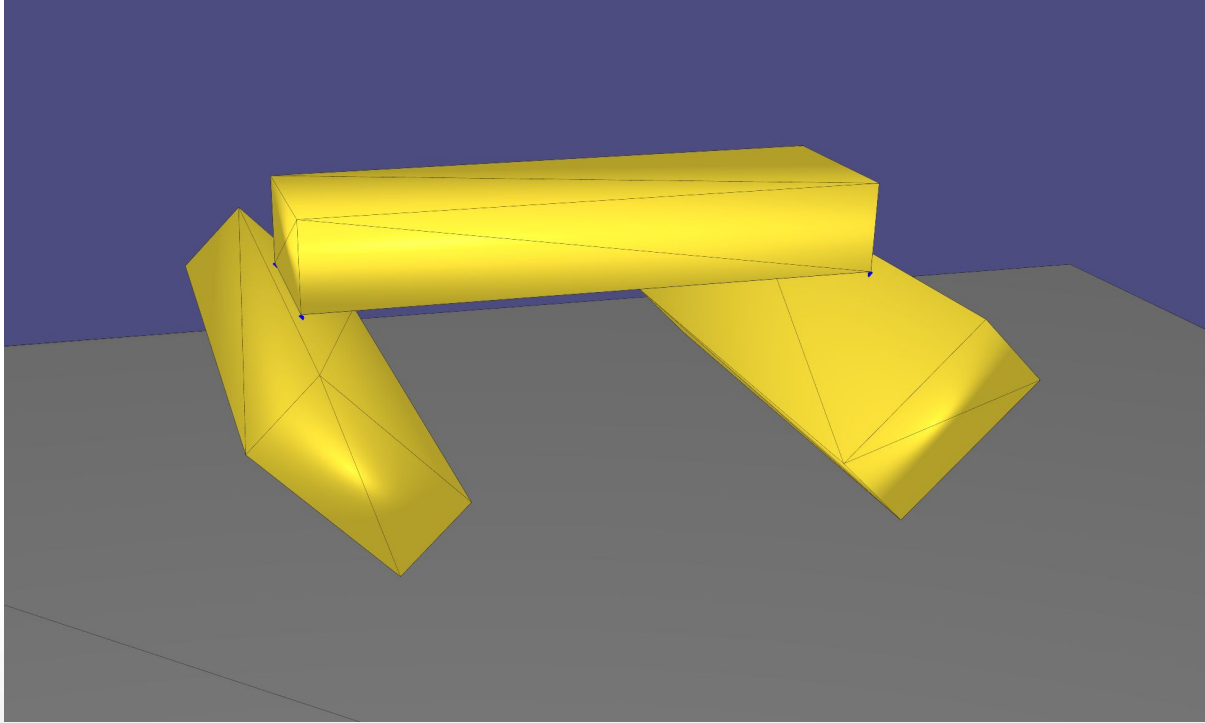
# Collision Detection

All together





# Collision Resolution



# Collision Resolution

## Contact Forces

$$\begin{bmatrix} f_1 \\ \dots \\ \dots \\ f_n \end{bmatrix}$$

# Collision Resolution

**Contact  
Forces**

$$\begin{bmatrix} f_1 \\ \dots \\ \dots \\ f_n \end{bmatrix}$$

**Constant  
Constraints**

$$\begin{bmatrix} b_1 \\ \dots \\ \dots \\ b_n \end{bmatrix}$$

# Collision Resolution

**Constraint Matrix**

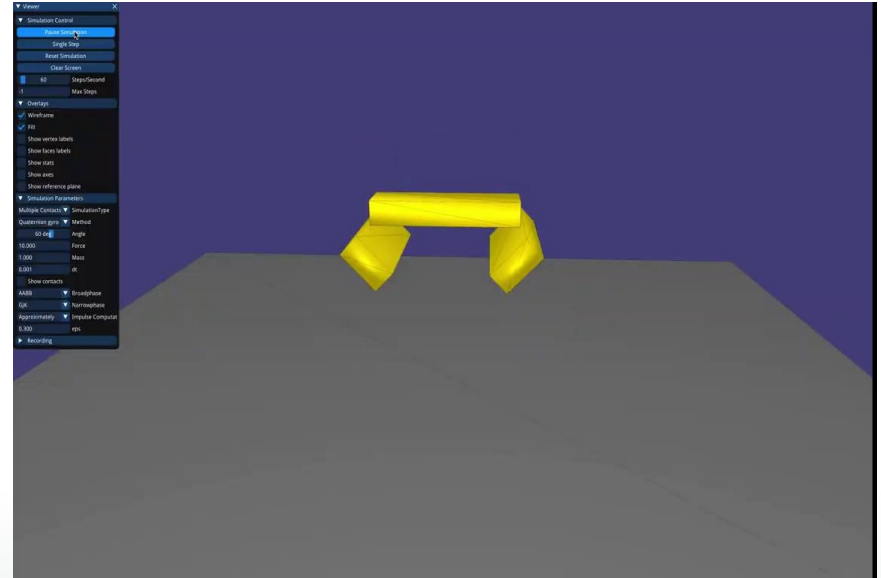
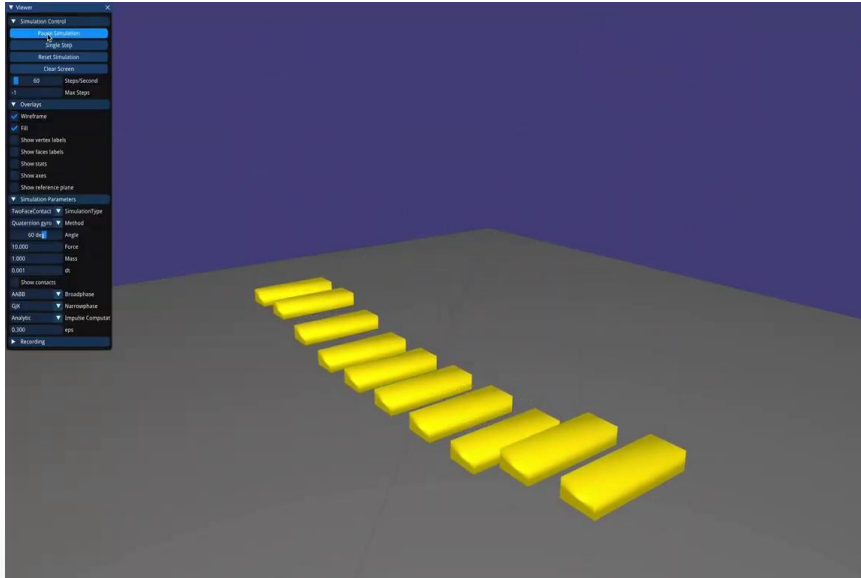
**Contact  
Forces**

**Constant  
Constraints**

$$\begin{bmatrix} a_{11} & \dots & \dots & a_{1n} \\ \dots & \dots & \dots & \dots \\ \dots & \dots & \dots & \dots \\ a_{n1} & \dots & \dots & a_{nn} \end{bmatrix} \begin{bmatrix} f_1 \\ \dots \\ \dots \\ f_n \end{bmatrix} \geq \begin{bmatrix} b_1 \\ \dots \\ \dots \\ b_n \end{bmatrix}$$

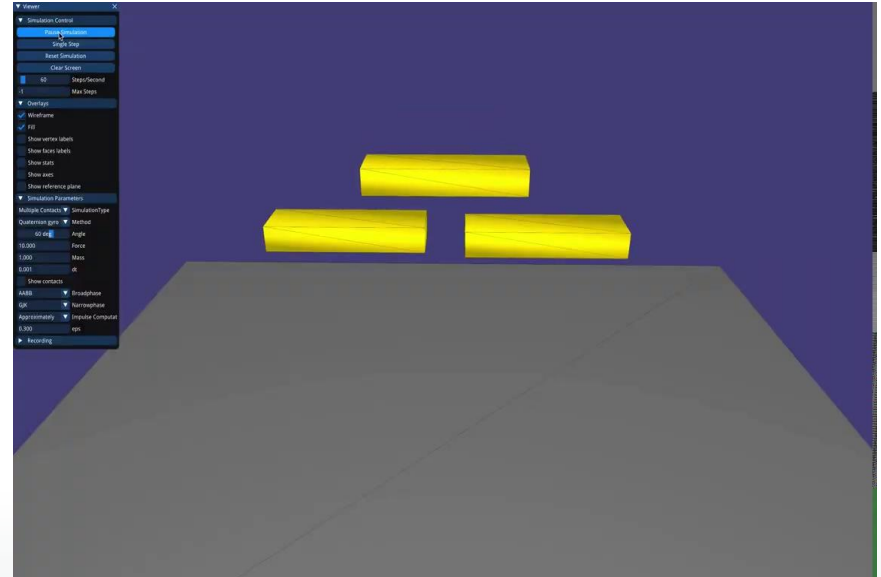
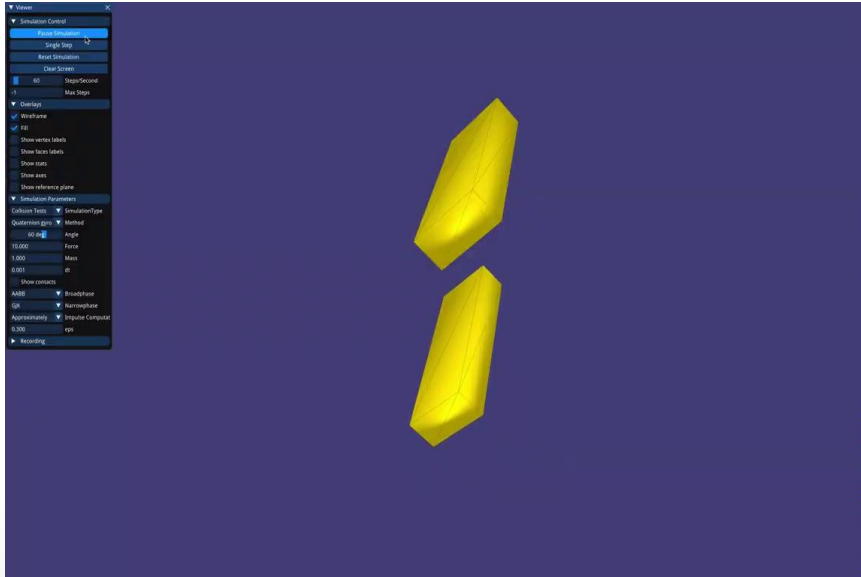
# Collision Resolution

## Resting Contact

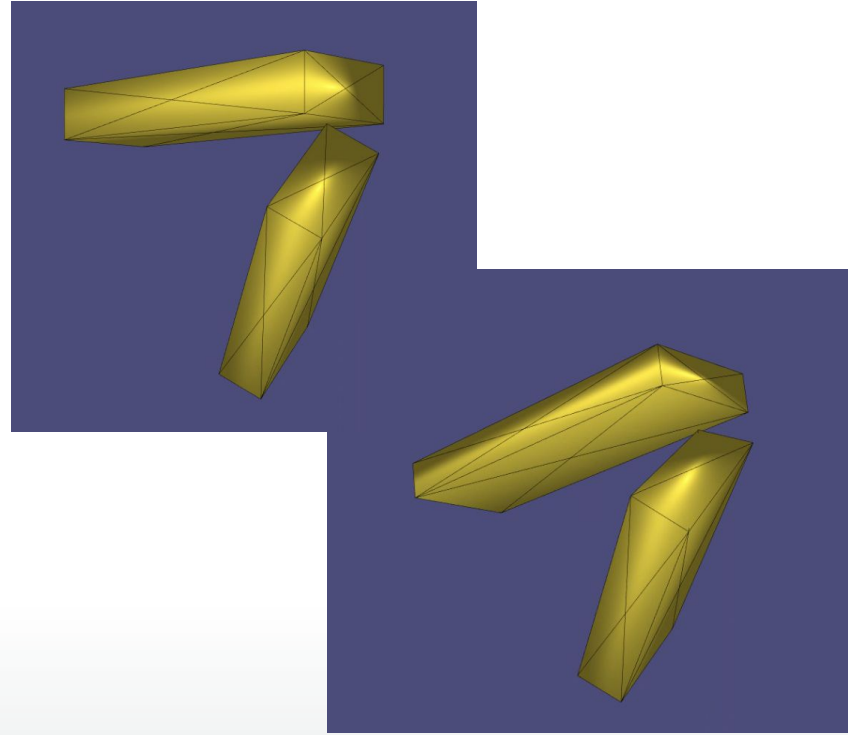
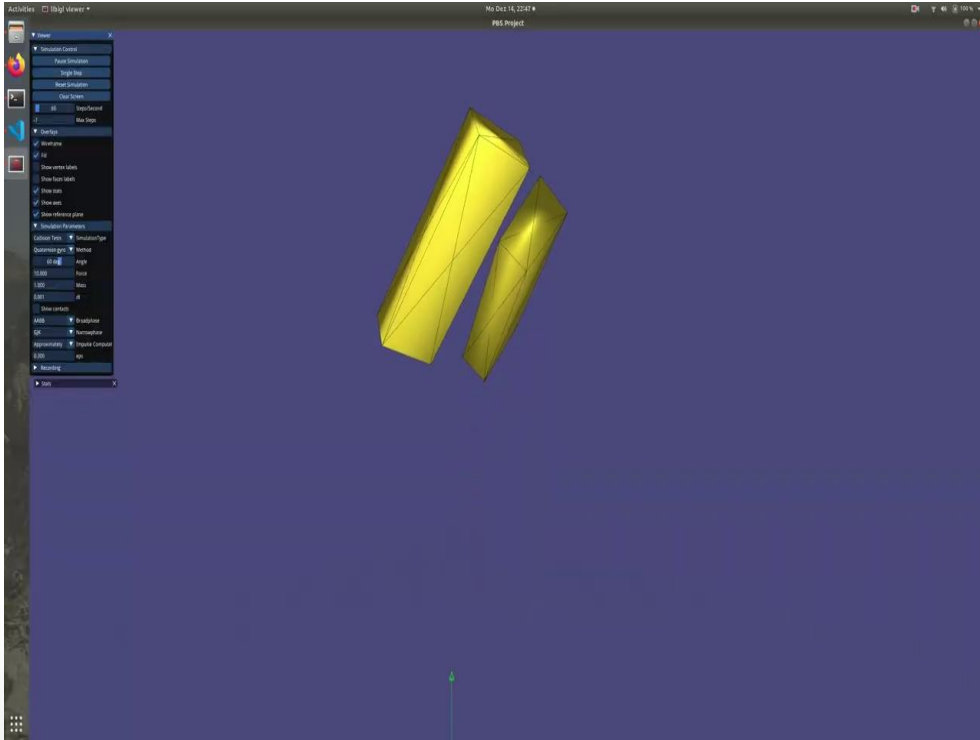


# Collision Resolution

## Multiple Collision



# Jelly - Proof of Concept



# Known Issues

- Perfect alignment collision detection
- Stacked resting contact
- EPA not working well with (deep) penetrations
- Soft bodies only proof-of-concept



# Q&A

# Appendix

