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Sandia High Temperature Split Hopkinson Pressure Bar

Megan Boston
8246 Mechanics of Materials

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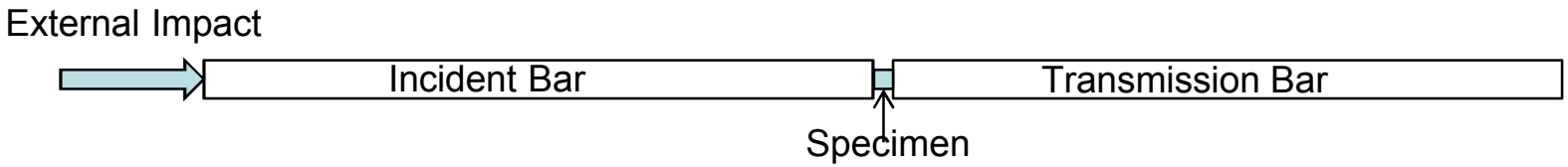
Introduction

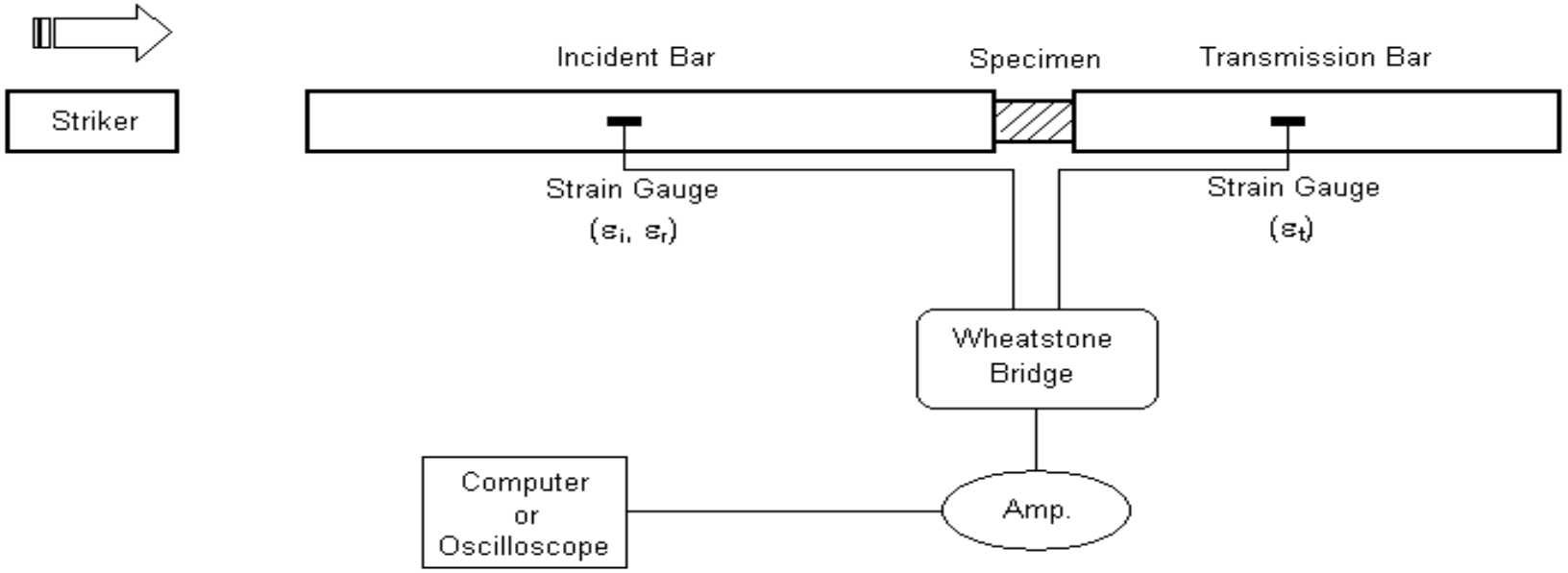
- Split Hopkinson Pressure Bar



- Uses and Benefits
  - Stress and strain in material under dynamic loading
  - Performance of materials under impact loads
  - Can get data from Hammer like impact loads

Conventional Split Hopkinson Pressure Bar (SHPB)

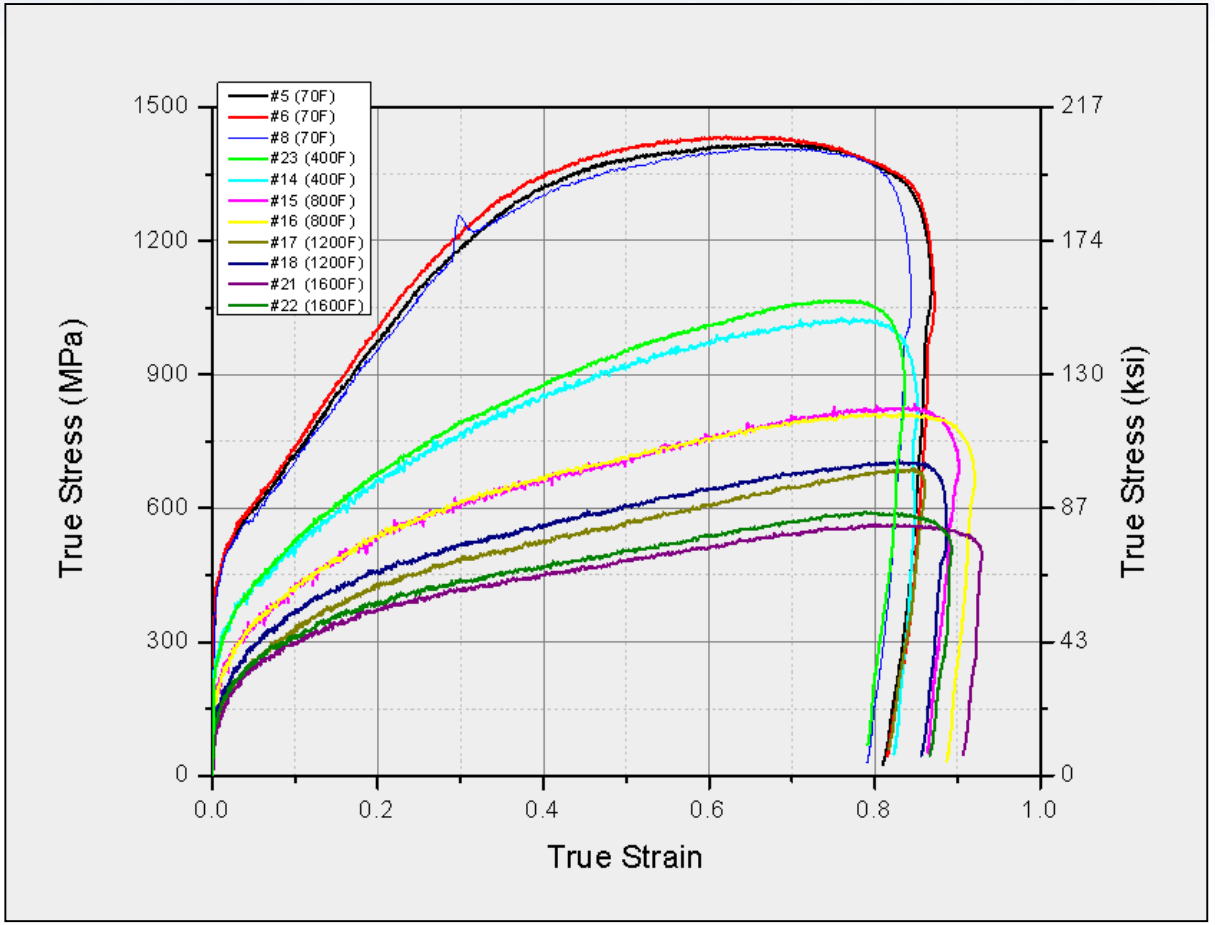
Strain rate range from 10^2 to 10^4 s^{-1}.



High Temperature Testing

- Why High Temperature Testing
  - See how materials perform under high strain rates at elevated temperatures
    - Welding
    - Machining
    - Forging
    - Gas Transfer
- Can examine how the substructure of a material changes when subjected to dynamic loads at high temperatures

High Temperature Testing



Heating Methods

- Heat the specimen and the bars
  - Temperature gradients in the bars
  - Properties of the bars change
- Heat the specimen separately and then bring the bars into contact with the bars
  - Furnace, radiant heating system, electric pulse heating
  - Cold Contact Time

Kuokkola HT-SHPB

- Computer controlled testing
  - Automated control of removing the specimen from the furnace
  - Controls when the bars are moved into contact with the specimen
  - Controls when the Fire Valve is opened
- Eliminates the amount of time the specimen is in contact with the cooler bars

Video of existing setup

Specimen Preservation and Quenching

- Specimen Preservation
  - Single loading of the specimen
  - Momentum Trap

- Quenching
  - Preserve the microstructure of the loaded specimen
  - Way to observe the recrystallization of the specimen after high temperature high strain loading conditions

Sandia HT SHPB

- Modifications to the Kuokkola setup
  - Added controls that provide ways to preserve the sample for help in modeling and simulation
  - Momentum Trap
    - In typical Kolsky bar experiments, specimen is loaded by multiple incident waves.
    - Momentum trap should stop the incident bar from hitting the sample again.
    - Able to have a force history
    - Stress Strain rate

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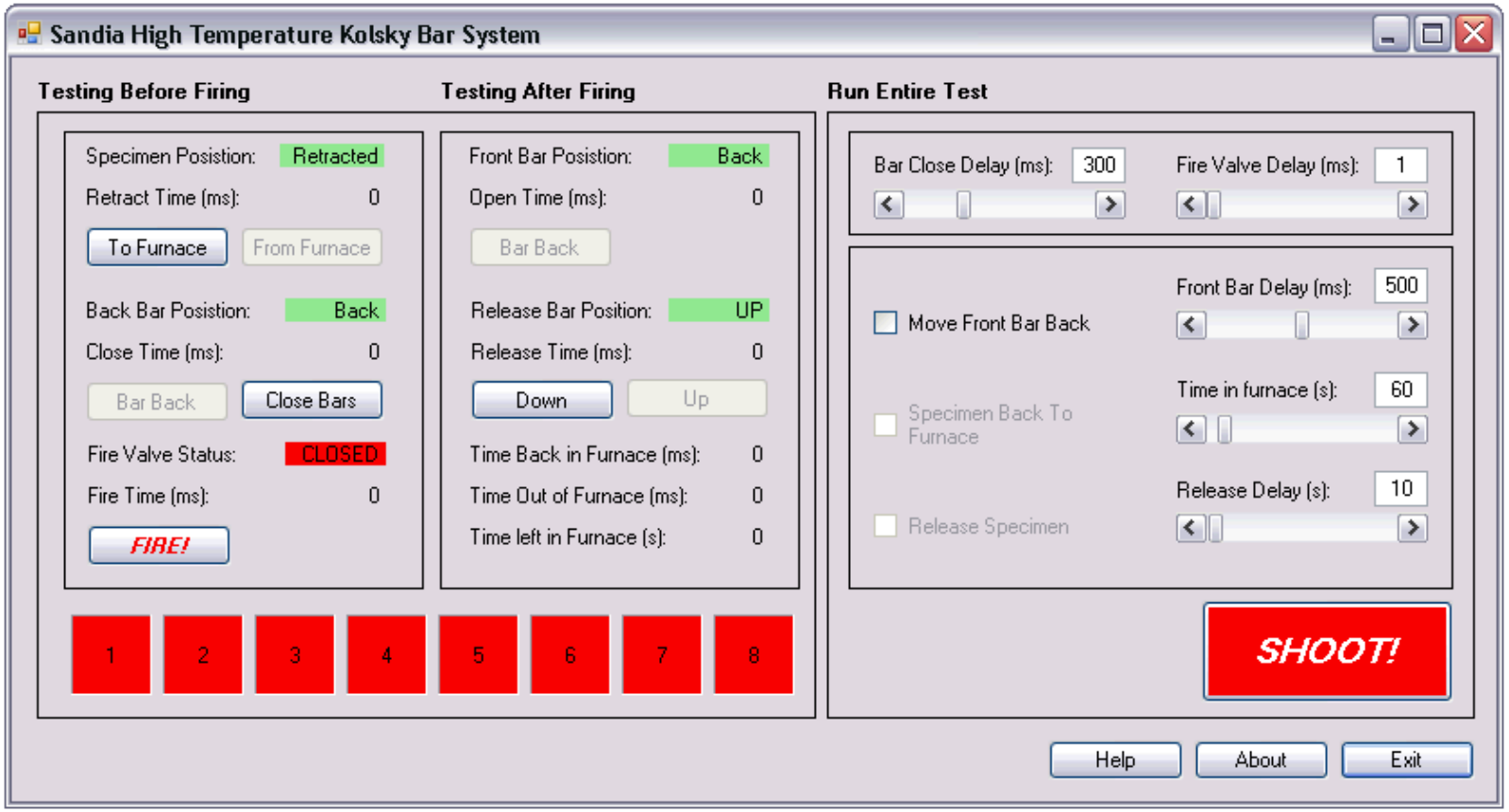
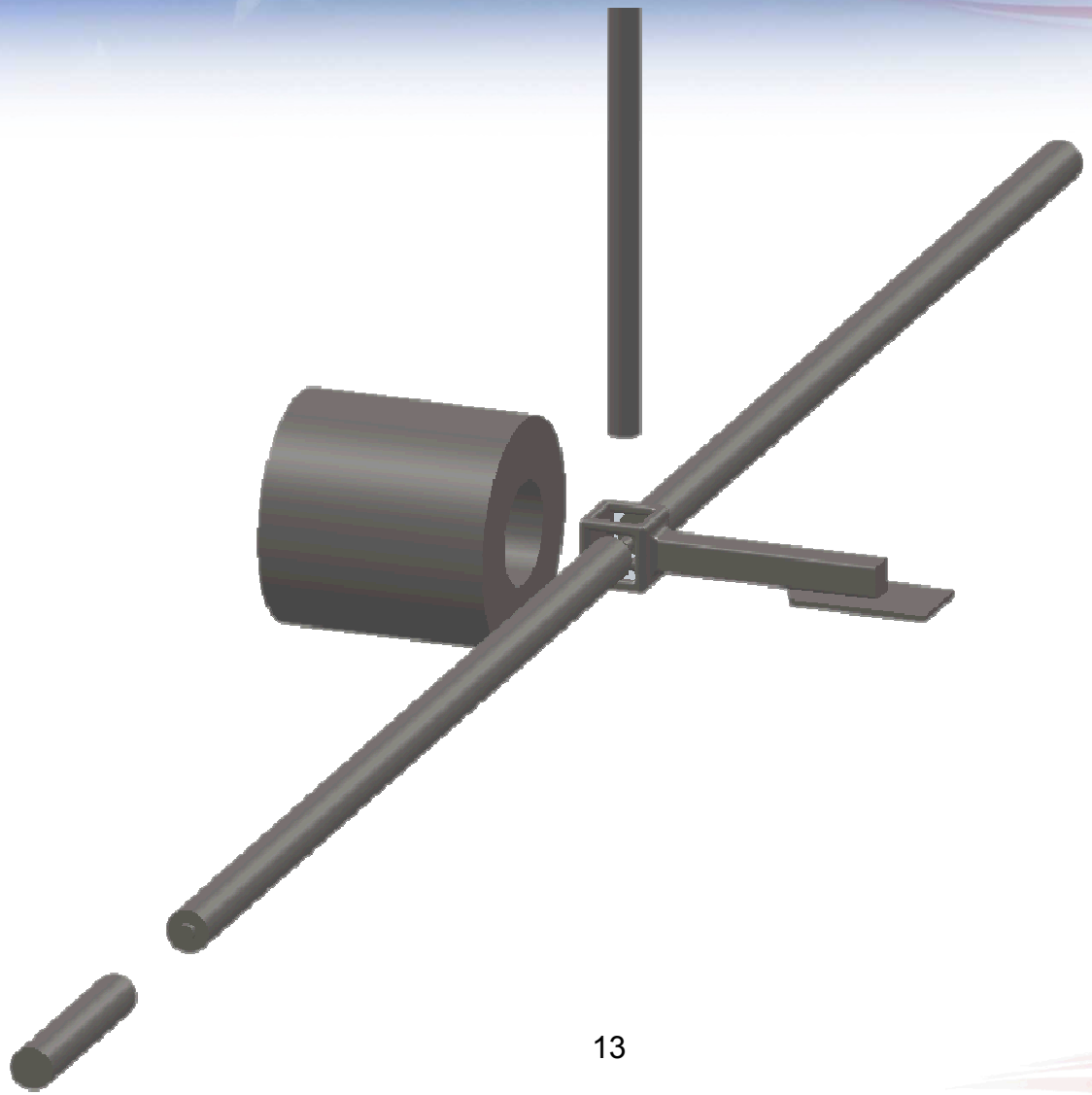
- Reheating the specimen
  - Can control how long specimen is reheated
  - Reheating helps with controlling the quenching conditions
  - Reheat sample to previous temperature
  - Helps with modeling and simulations

- Specimen Quenching
  - User can adjust the time for quenching the specimen
  - Quenching to lockup microstructure to help with modeling

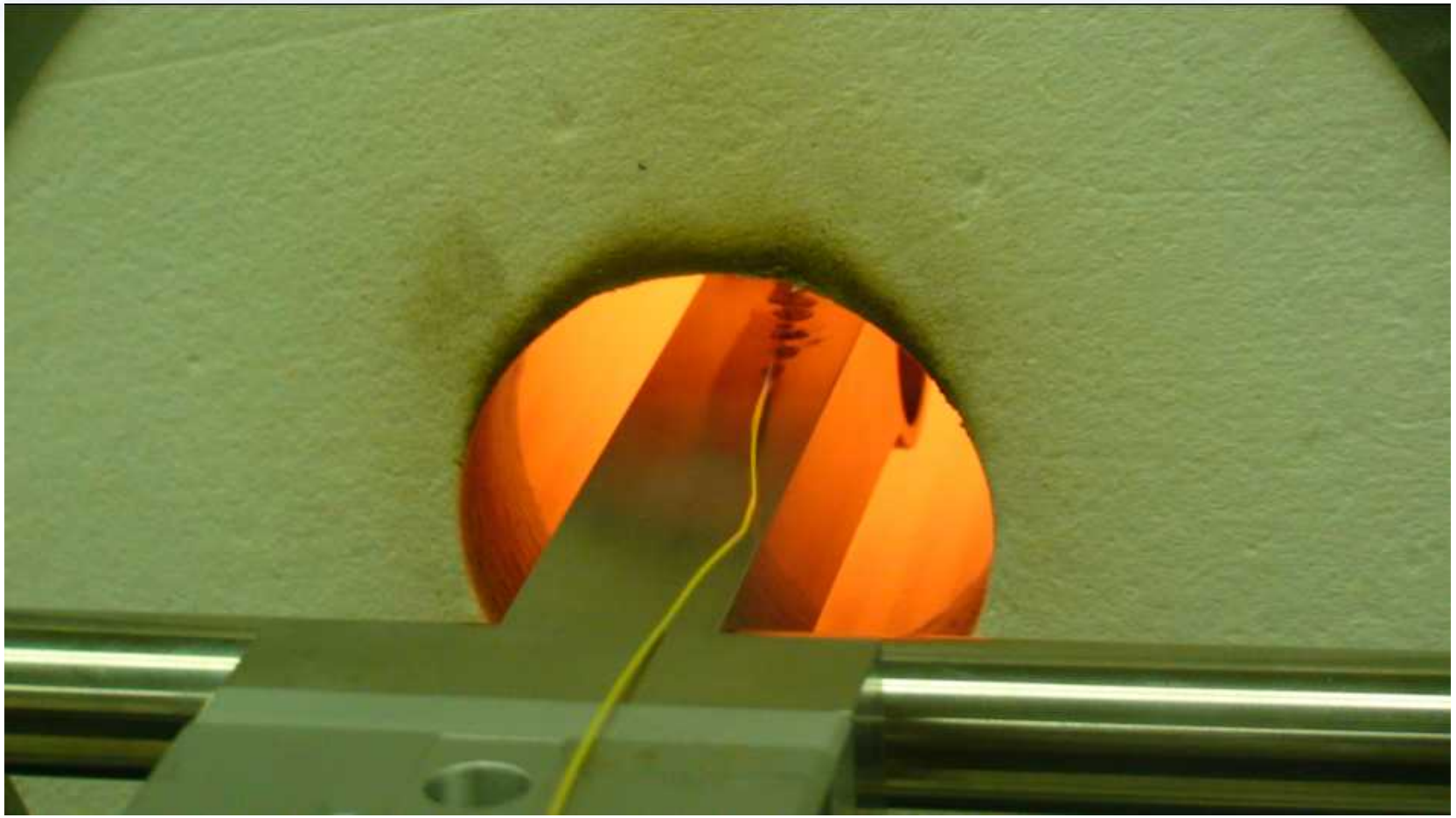
Control Panel

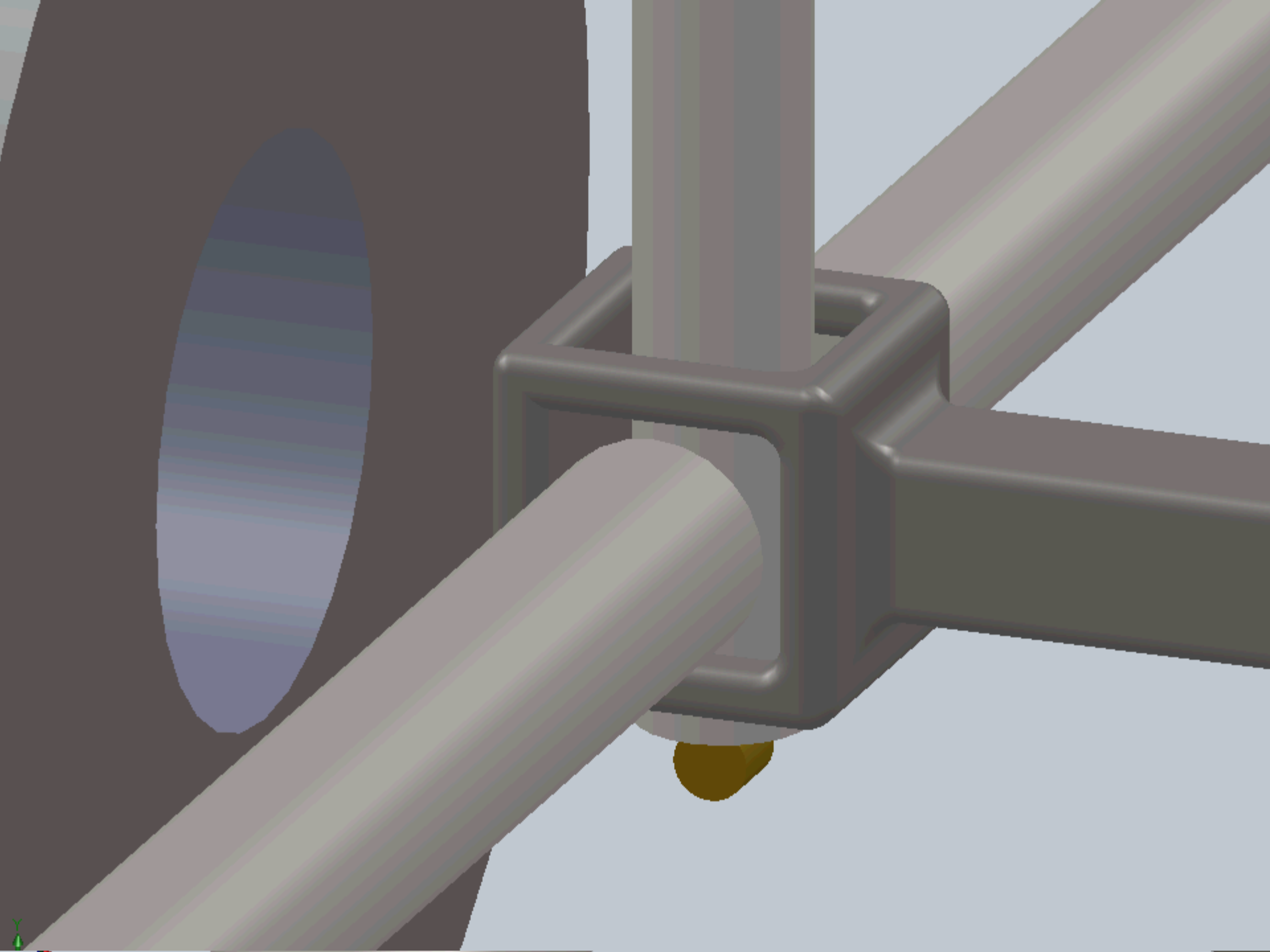


System Set Up



Pictures





Acknowledgments

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