STEAMVR™
Tracking Training

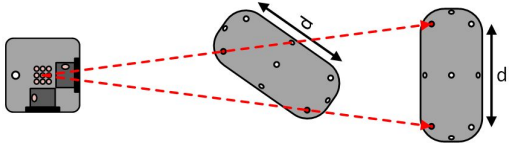
STEAM® VR

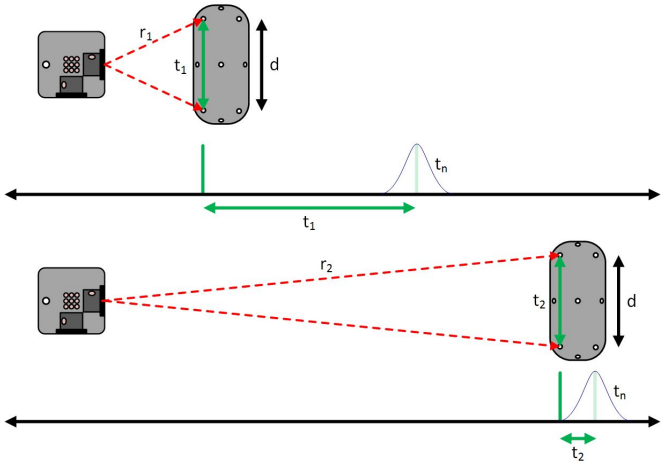
Tracking Training

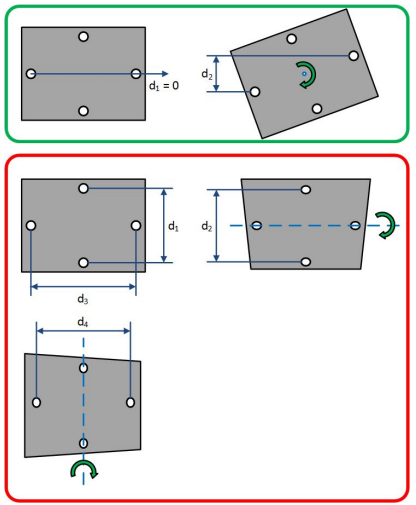
Object Design

Tracking Performance Drivers

- Number of visible sensors required to constrain the object's pose
- Sufficient baseline to overcome translation error
- Baseline in three axes to overcome rotation error





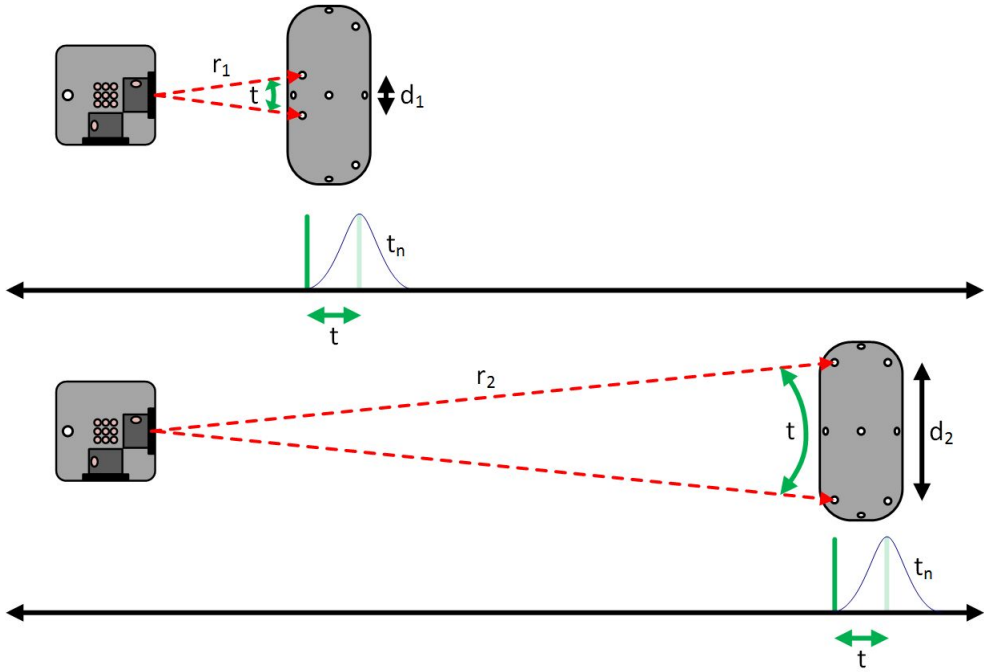


Number of Visible Sensors

- One sensor defines an object with no dimensions
- Two sensors define a 1 dimensional object
- Three sensors define a 2 dimensional object
  - As long as one is out of the line defined by the other two
- Four sensors define a 3 dimensional object
  - As long as one is out of the plane defined by the other three
- **Four sensors are required for an object to begin tracking**
  - Initiating tracking is called “booting” or “bootstrapping”
  - Once tracking the IMU in the object can assist during occlusion

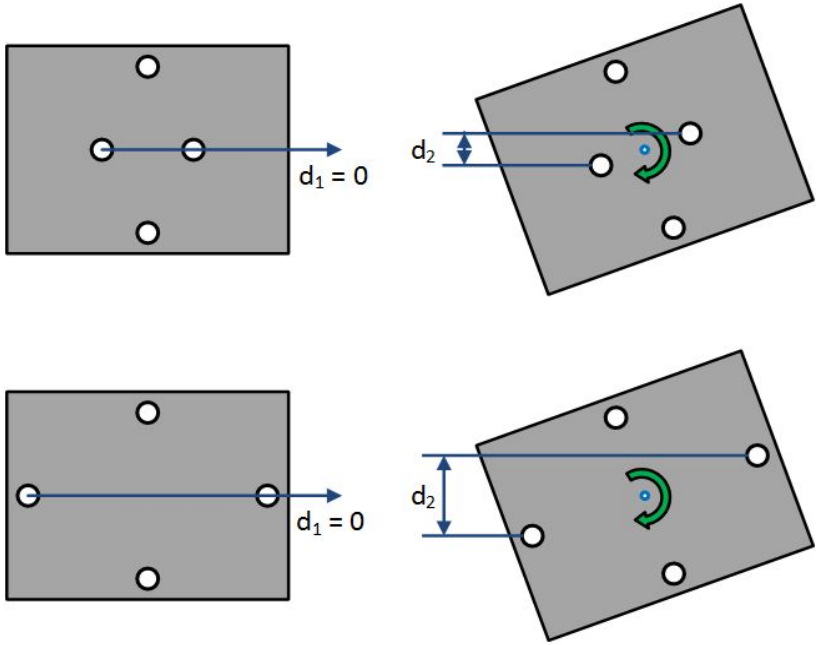
Sufficient Baseline

- Baseline increases the time between laser hits
- Sources of error are angular
- The limit of the system is a minimum detectable angle
- More baseline accommodates the same angle at a greater distance
- Need baseline to overcome translation error



Baseline in Three Axes

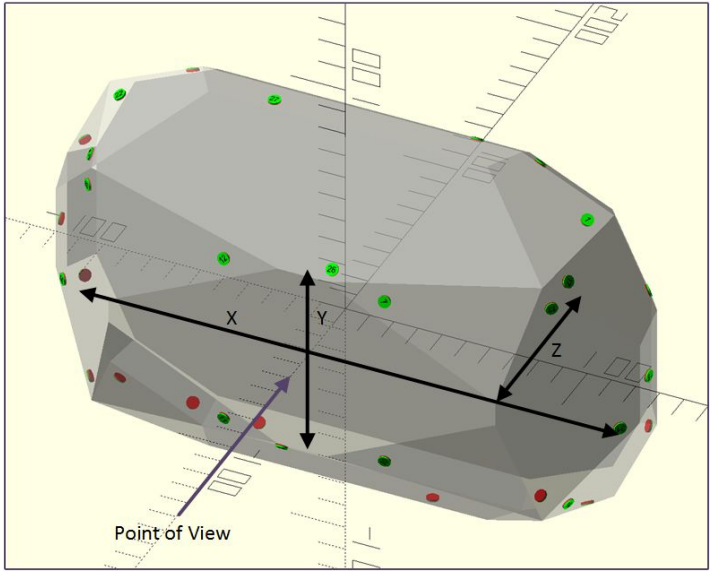
- Baseline amplifies the effect of rotation
- Pose tracking detects
  - Roll
  - Pitch
  - Yaw
- Detecting all three means amplifying all three
- Need baseline in X, Y and Z axes to overcome rotation error



Sensor Placement Criteria

1. Four visible sensors (minimum)
   - One must be 8mm out of the plane
   - Sensors have a ±60° viewing angle
2. Maximize the distance between sensors
3. Create baseline in three axes

- **Objects that track well have geometries designed for optimal sensor placement!**



Industrial Design Challenges

- Consumer products need to look and feel great
- Products also need to perform, especially VR products
- Appealing design features:
  - Miniaturization: What about translation error?
  - Flat surfaces: What about rotation error?
  - Right angles: What about sensor viewing angle?
  - Low profile: What about translation and rotation error?
  - Curved surfaces: What about sensor covering?

Mechanical Design Challenges

- Facets on shapes improve performance
  - How many slides in the mold?
- Sensors facing in all directions
  - Multiple parts to facilitate ejection
- Sensor covering
  - IR transmissive materials
  - IR diffusive materials
  - Optical crosstalk

Electrical Design Challenges

- Sensor interconnect
  - 20 - 32 sensors
  - Distributed over the surface of an object
  - Four wires to each sensor
  - All sensors at different angles
- FPC design challenge
  - Circuit size
  - Panel efficiency
  - Interconnect density

Recommendations

- Collaborate between engineering and industrial design early in the process
- Teach industrial designers and product visionaries about sensor placement
- Use the constraints of sensor placement as a seed for creating unique, compelling designs
- Reduce risk early
  - Use the simulation tools in the HDK to validate design choices
  - Prototype shapes using rapid prototyping techniques and evaluation hardware
  - See your object track in SteamVR before investing in tooling