CIS Group 9 Update 03-30-2022

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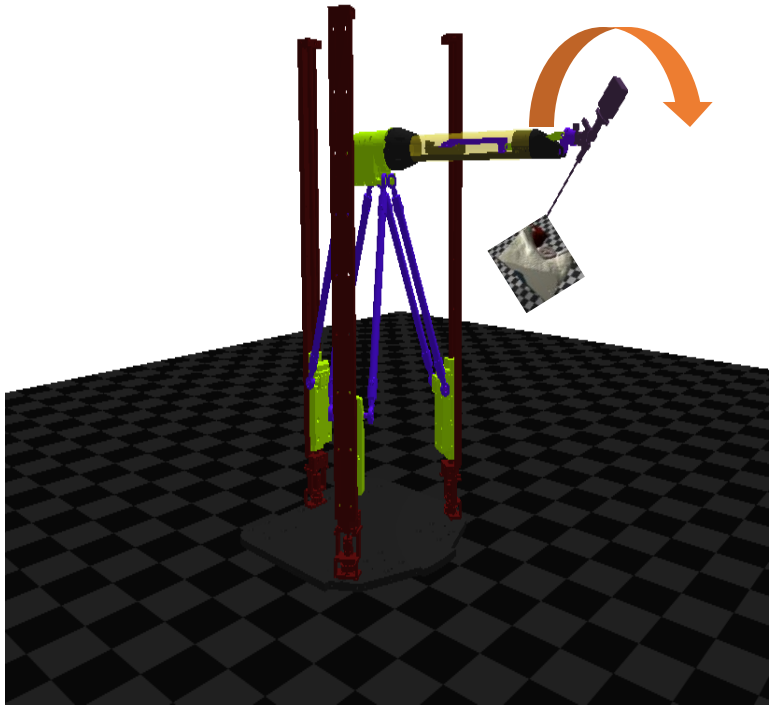
Technical Overview



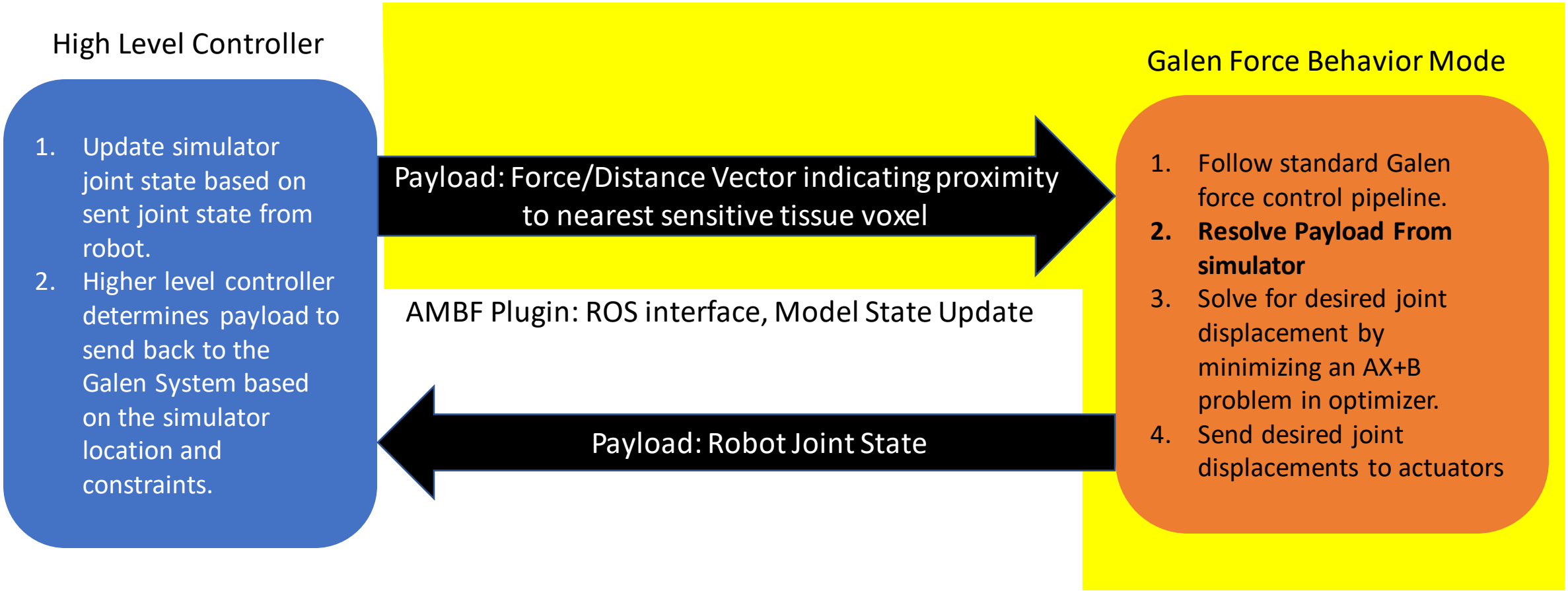
Constraints

Robot State

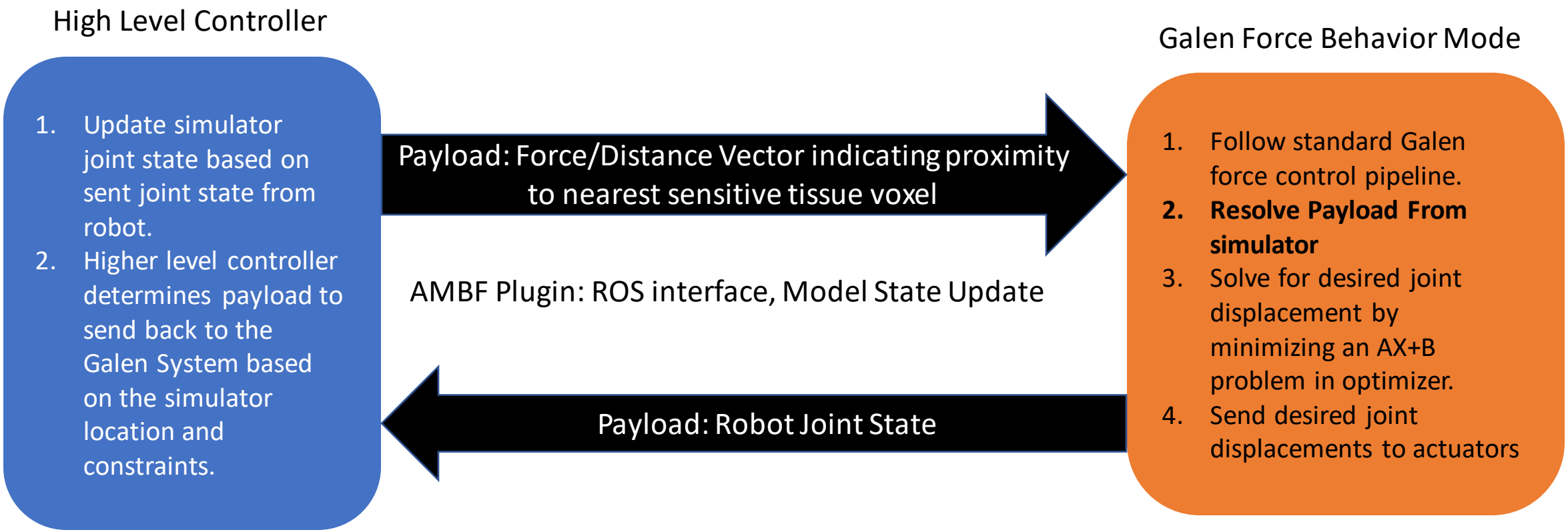
[3]

[3]: Cohn, M. (2019, November 6). *This tech company is the first to get a boost from moving to a Baltimore Opportunity Zone. are more coming?* baltimoresun.com. Retrieved February 15, 2022, from https://www.baltimoresun.com/business/bs-bz-opportunity-zone-business-20191106-n7fxg3wpuvah5fyuoulf47kes4-story.html

Pipeline


High Level Controller
1. Update simulator joint state based on sent joint state from robot.
2. Higher level controller determines payload to send back to the Galen System based on the simulator location and constraints.
Payload: Force/Distance Vector indicating proximity to nearest sensitive tissue voxel
AMBF Plugin: ROS interface, Model State Update
Payload: Robot Joint State
Galen Force Behavior Mode
1. Follow standard Galen force control pipeline.
2. Resolve Payload From simulator
3. Solve for desired joint displacement by minimizing an AX+B problem in optimizer.
4. Send desired joint displacements to actuators

Pipeline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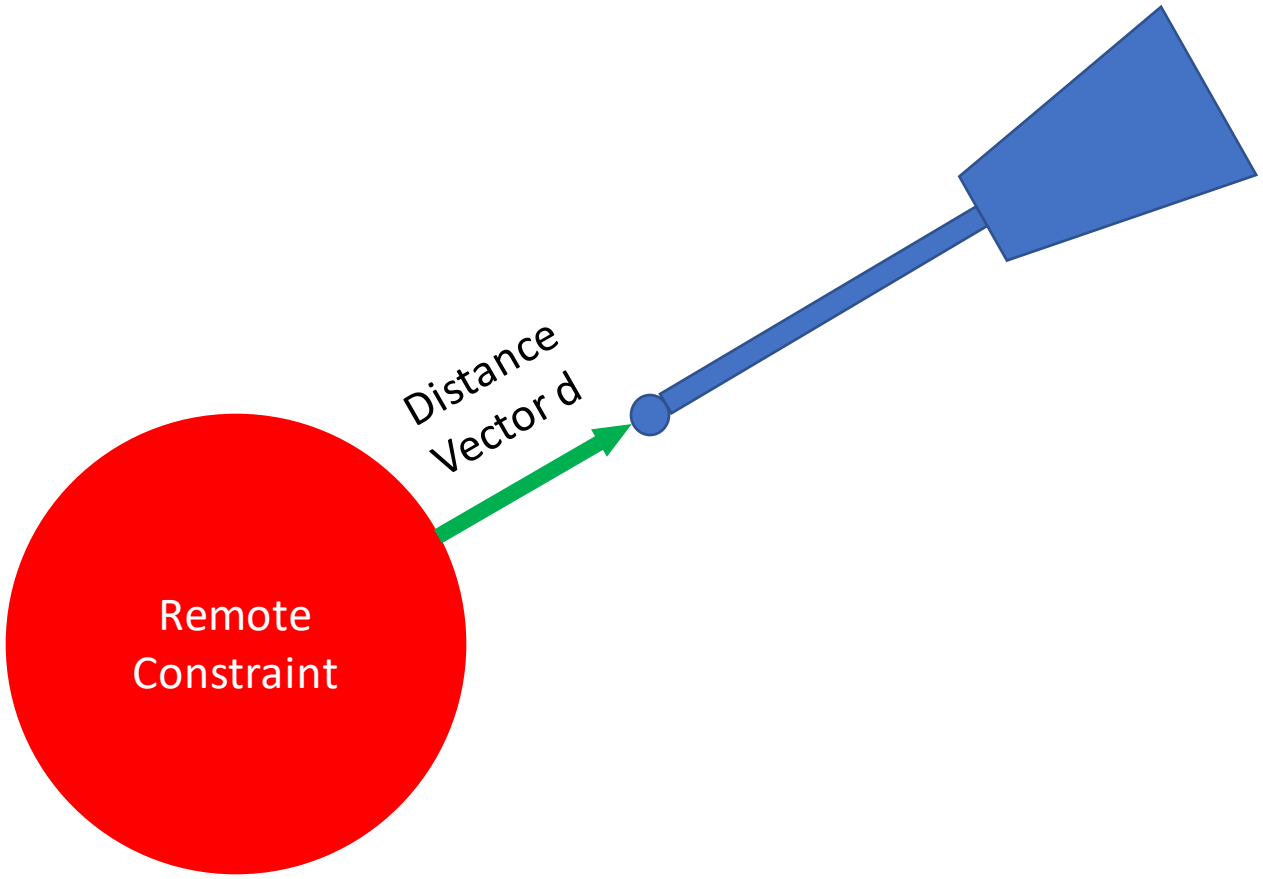

Distance
Vector d
Remote
Constraint

Payload: Distance vector from TOOL TIP to closest voxel on virtual surface d

1. Force applied to tool tip

$d = (x, y, z, 0\ 0\ 0)$

If $||d|| > \alpha$, $d = (0, 0, 0, 0, 0, 0)$ where α is a maximum distance threshold

$F_{s\_tip} = (1/||d||)*kp*(\text{normalized}(d)) +$ [possible kd term] <- this is in robot frame

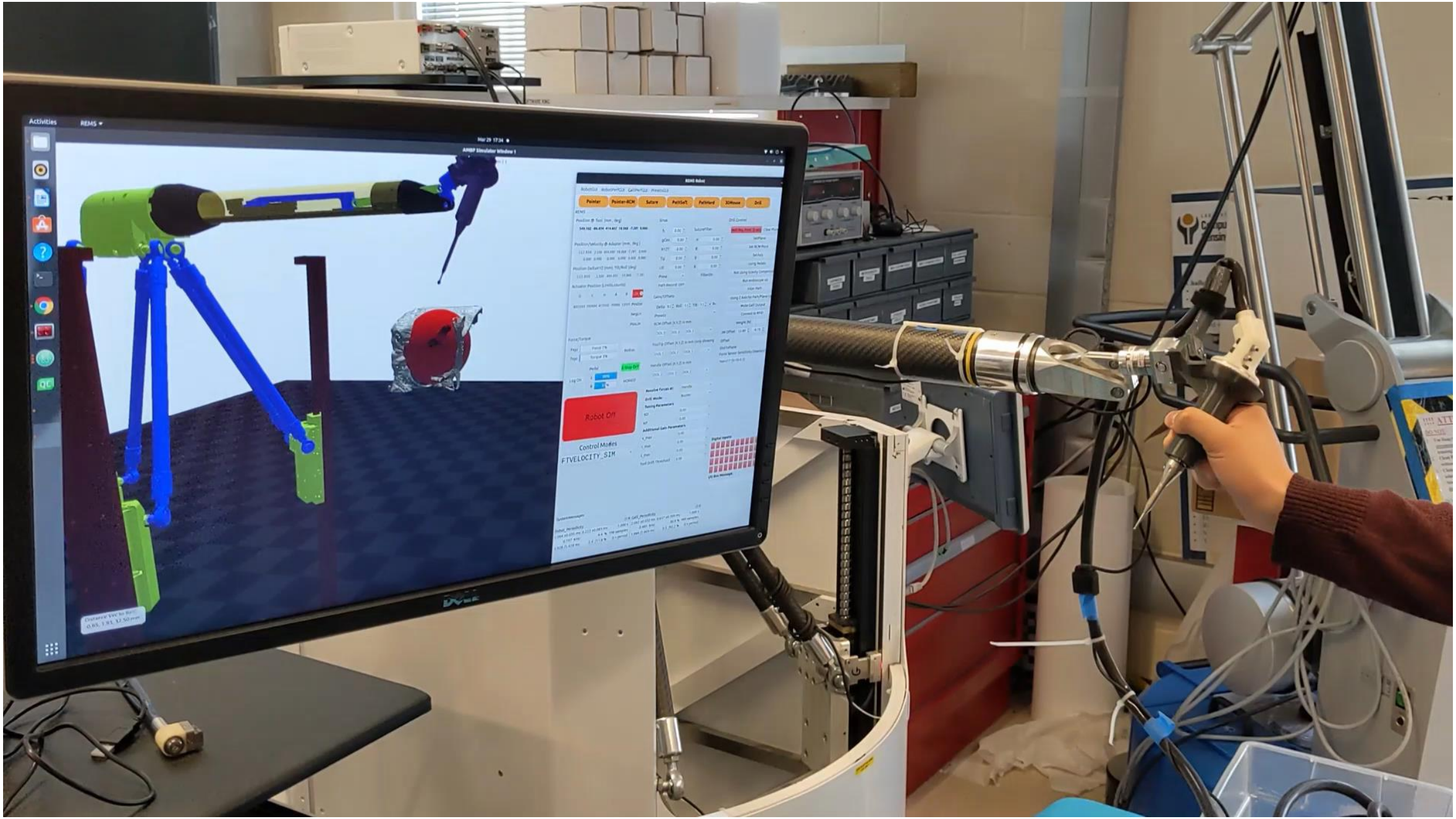
$F_{s\_ee} = Ad^{T}_{tip\_ee} * F_{s\_tip}$

2. Resolve Force Vector at End Effector and Sum

$F_{total} = w_1*F_{s\_ee} + w_2*F_{handle}$

W1 and w2 are adjustable weights

3. F_{total} get shipped to the optimizer


Activities
REMS
Pointer
Pointer-RCM
Suture
PalmSoft
PalmHard
3DMouse
Drill
Robot Off
Control Modes
FTVELOCITY_SIM

Next Steps

- Resolve Stability Issues, start with adjusting gains.
- Galen should have it’s tilt error resolved soon
- Resolve forces from volumetric drilling plugin
- Scale size of robot instead of scaling volume down (scale in blender)
- Communicate with SDF team