ProtoDUNE – DSS Envelope
DSS Review

Dan Wenman

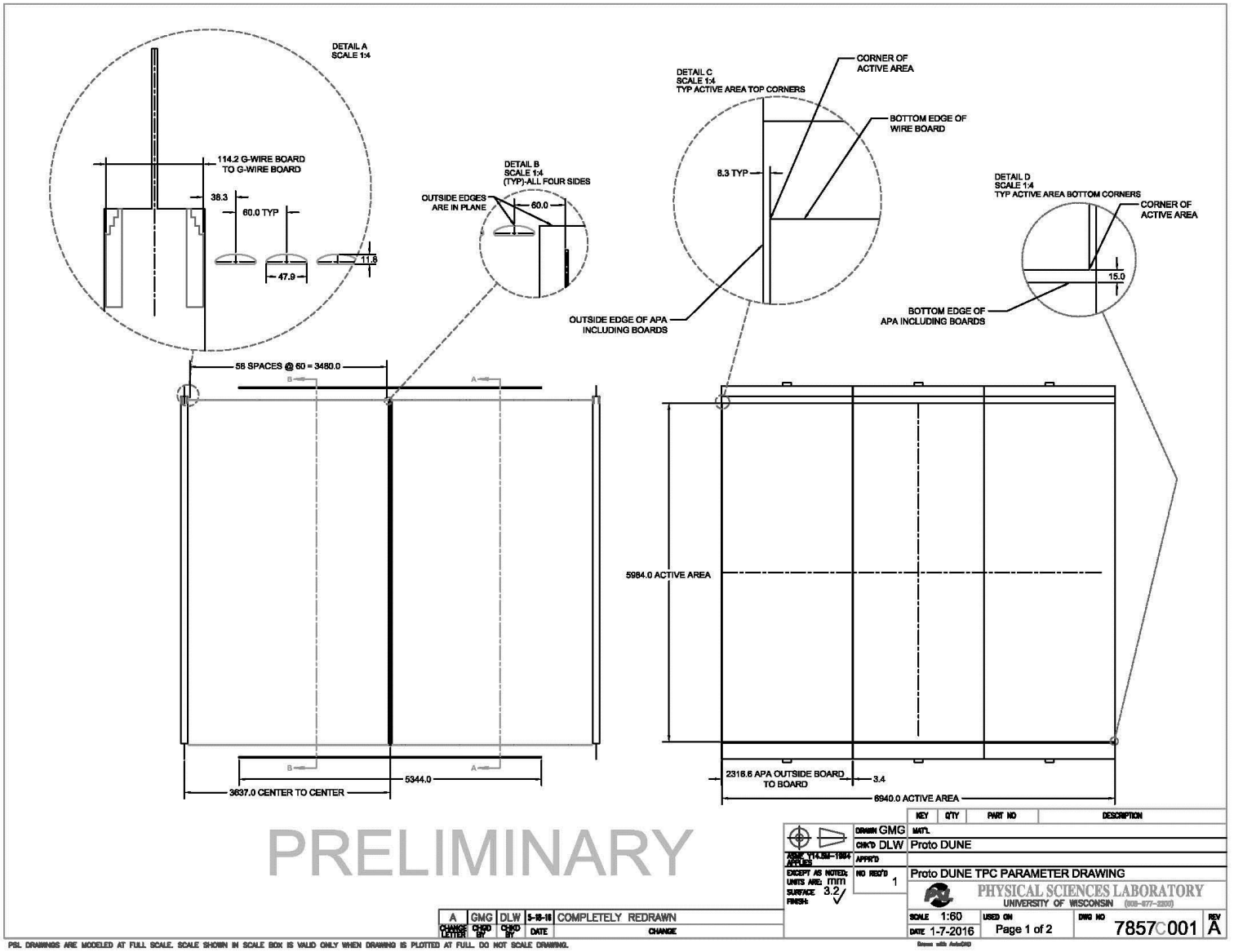
DSS Review

November 9, 2016

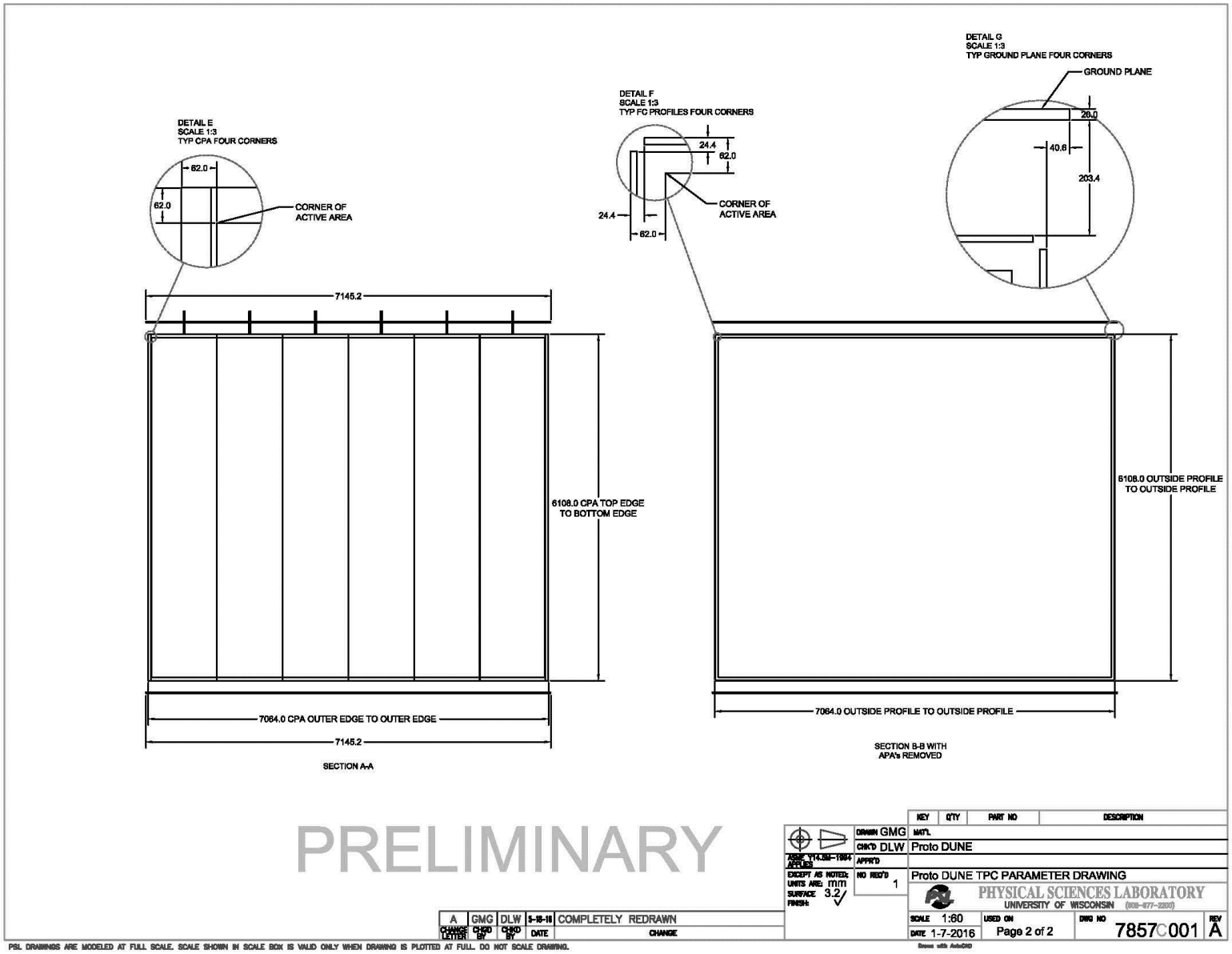
Outline

- Basic TPC dimensions/parameter drawings
- Integrated model
- TPC “dynamics”
  - The roof motion
  - Coefficient of thermal expansion (CTE) compliance

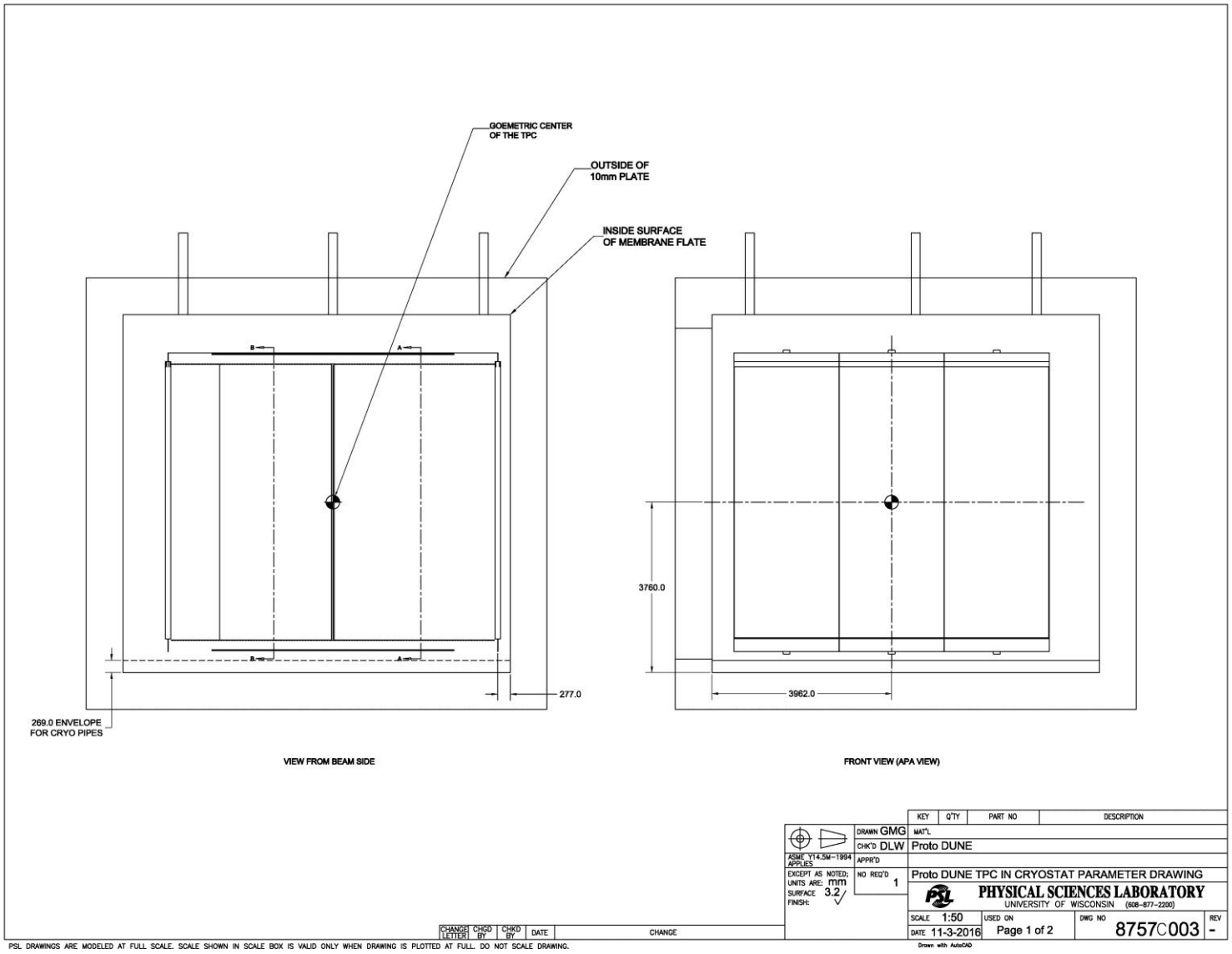
Basic TPC Dimensions



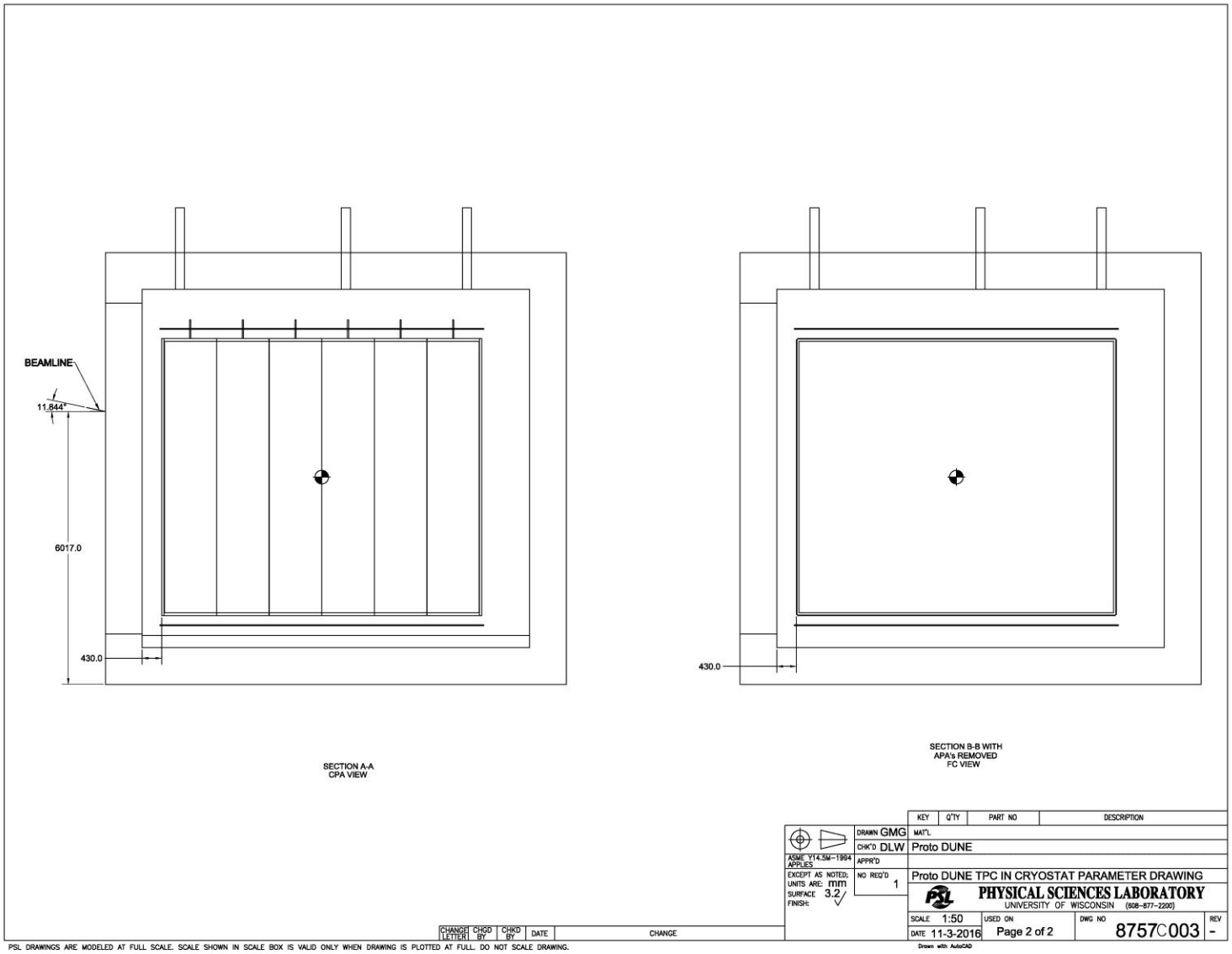
Basic TPC Dimensions



TPC Location

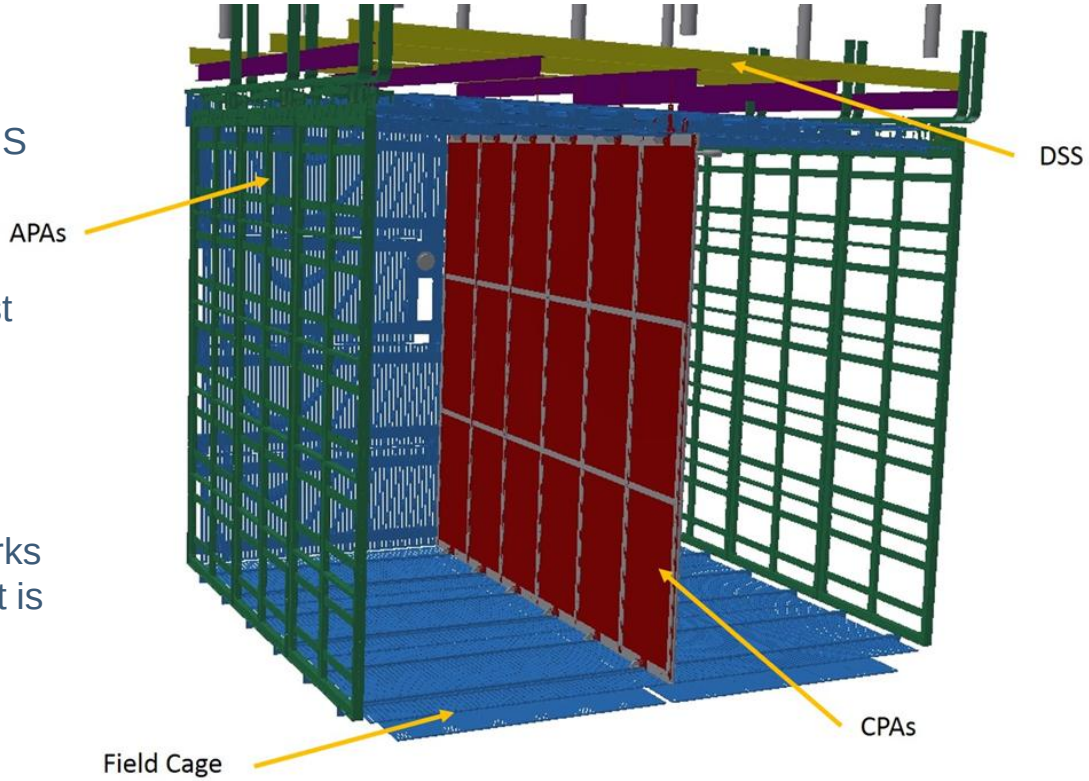


TPC Location



Integrated Model

- The integrated model is posted on EDMS in step and SolidWorks formats. Vic Guarino possesses an Inventor model.
- The model reflects the design in its most current state and is periodically revised.
- The step version of this model file is 320MB and slow to work with.
- A dummy model of the APA is in the works that will be stripped of minutia detail that is not important for integration. Other simplifications may be needed as well.
- A simplified model will be useful for generating TPC installation documentation
- The integrated model will be archived in both the “lightweight” and heavy weight versions

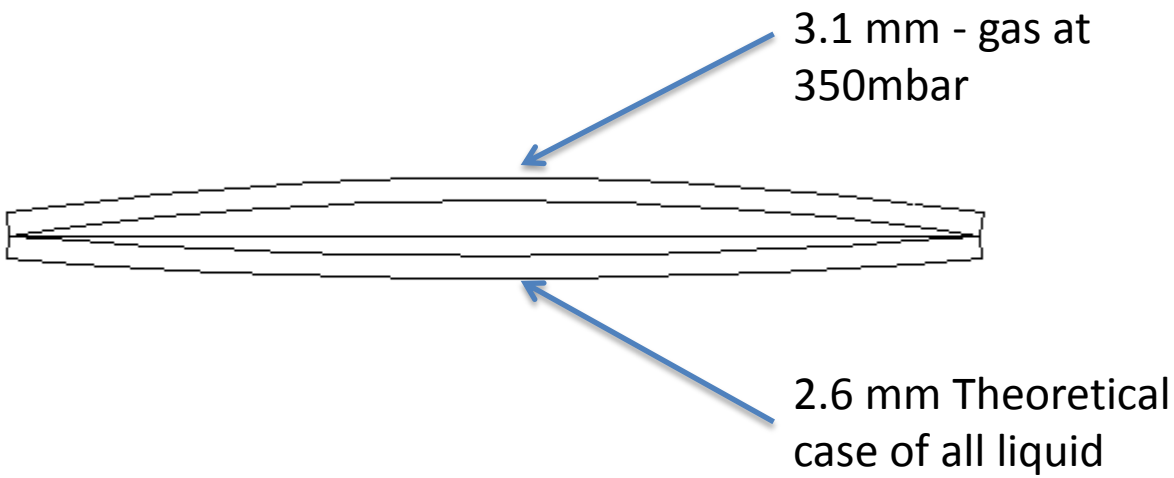


TPC “dynamics”

- The DSS supports and positions the TPC in the cryostat.
- The DSS is mounted to the cryostat roof which will deflect under the load cases that it I subjected to.
- The mounting points of the DSS are on the warm structure and the TPC will change size with temperature. ~20mm in length and width and 16 mm in height.
- In addition, materials within the TPC/DSS assembly have different CTE’s and will not all change size at the same rate.
- The DSS and TPC assembly must be able to accommodate all these relative movements without over stressing any of the connections that hold the assembly together.
- Where necessary, joints have been designed to allow relative motion or to rotate as needed to avoid over stress.

Roof motion

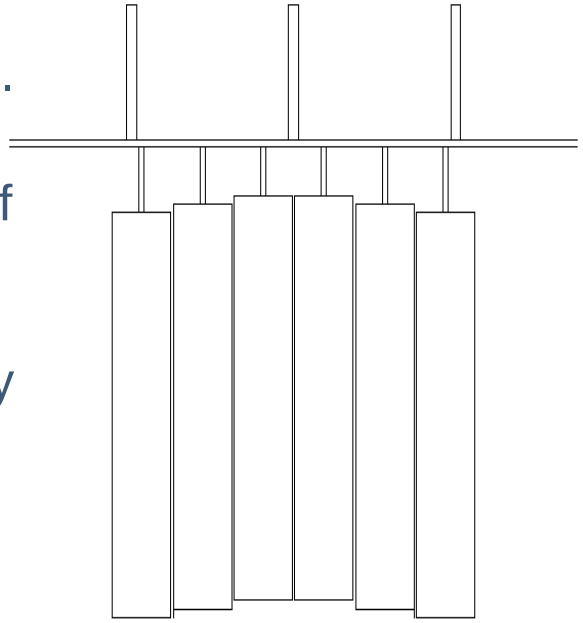
Maximum extents of deflection per EDMS doc #1531441



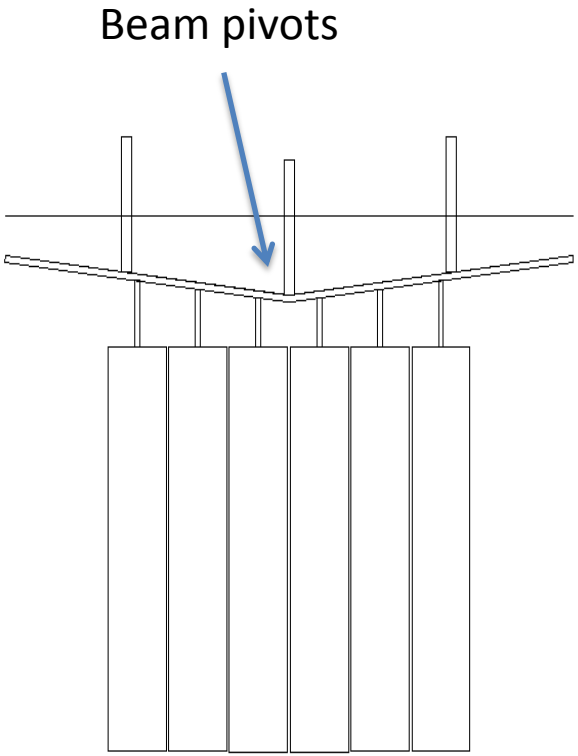
- Maximum calculated deflection that must be accommodated is 5.7mm.
- From installation state to normal operating state the calculated deflection is -1.75mm.

Roof motion

- CPAs and APAs have single support points to accommodate roof motion.
- A pivot in the beam allows the beam to follow the roof without stressing the support rod.
- This pivot also significantly reduces beam distortion due to differential temperature gradients in the ullage
- Detector will be mounted in anticipation of movement to the operating condition
- The DSS allows for adjustment if movement is not as anticipated.



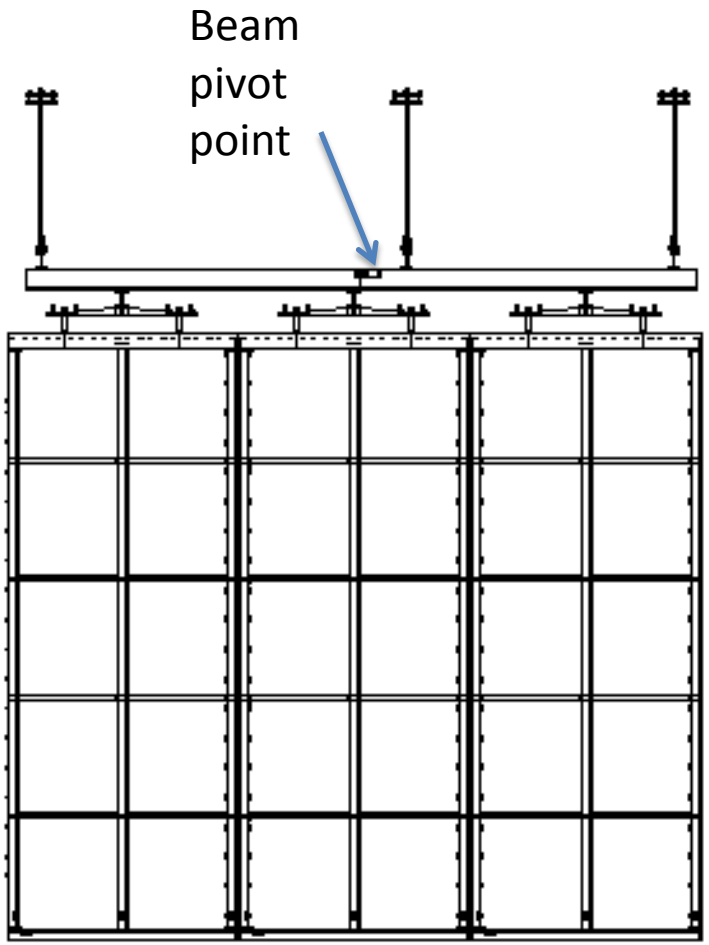
CPA mounted to "anticipate" operating condition



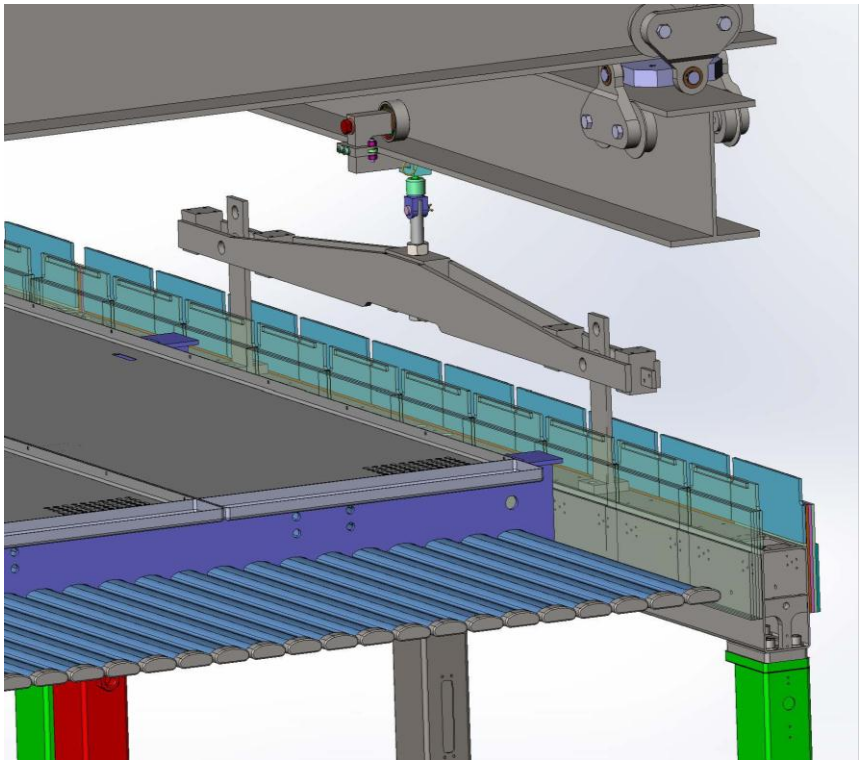
CPA in operating condition

Schematic of movement of CPAs in the x-z plane from initial installation to operating condition.

APA compliance



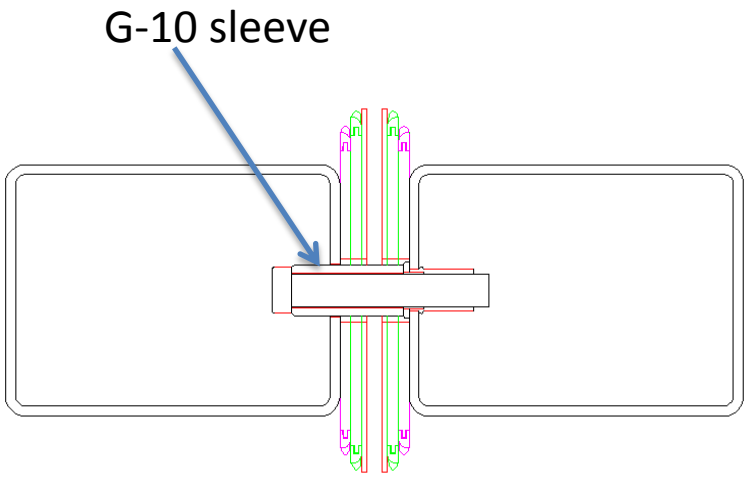
Elevation view - APA plane with single supports



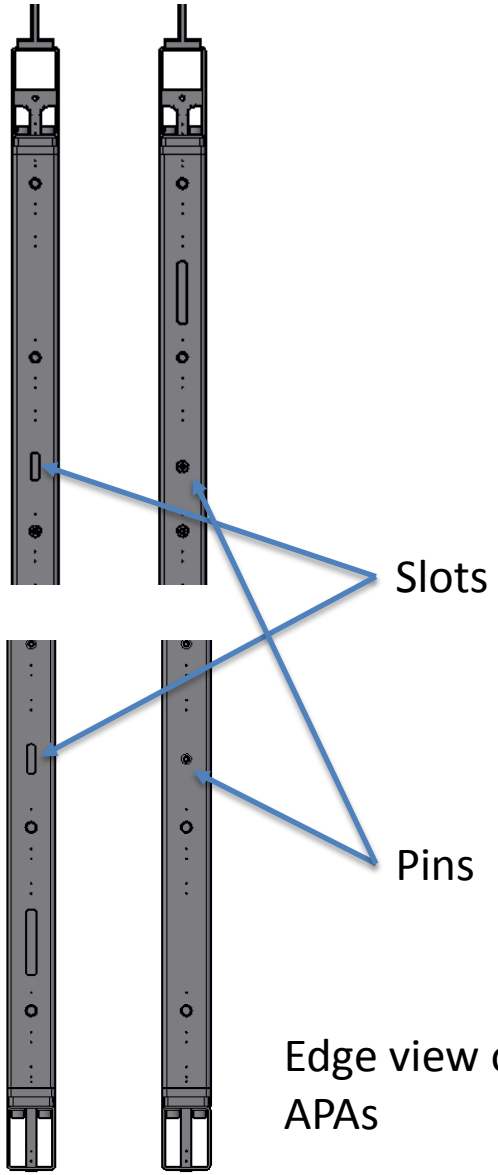
ISO view of single support

APA compliance

Pins in one edge of the APA engage with slots in its neighbor to allow for vertical motion. CPA are similar.



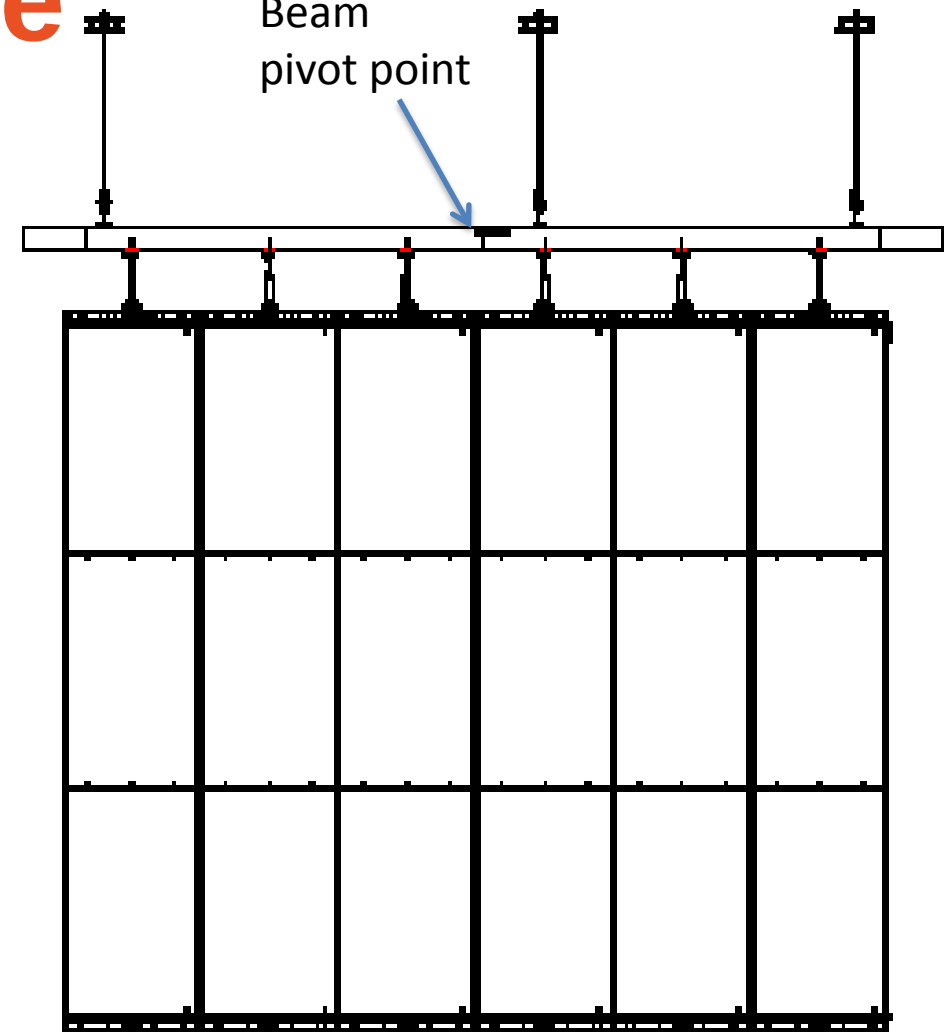
2D top view of the APA



Edge view of APAs

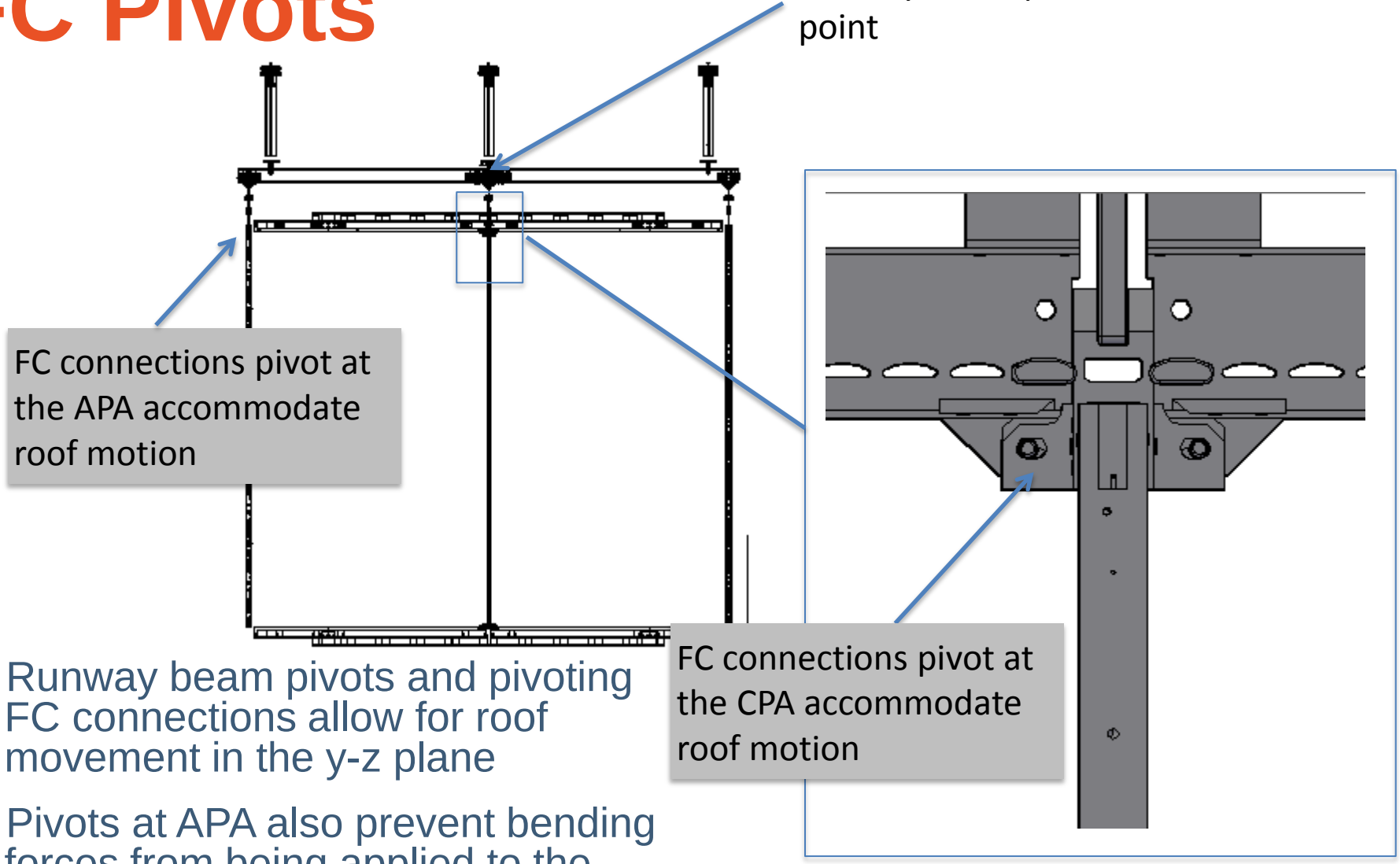
CPA compliance

- CPAs are also supported at a single point to prevent plane-to-plane conflict
- Planes can slide vertically



Elevation view - APA plane with single supports

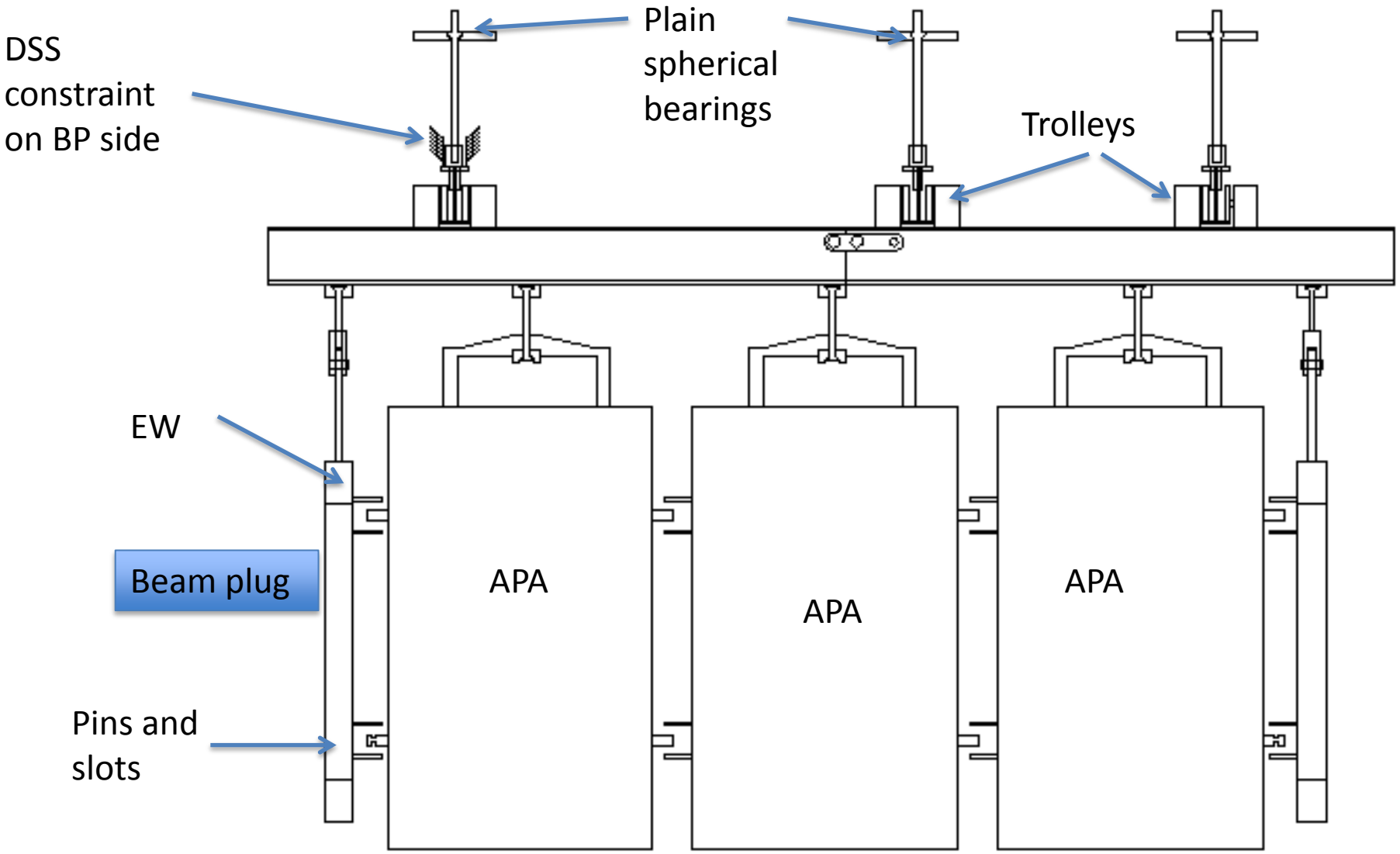
FC Pivots



- Runway beam pivots and pivoting FC connections allow for roof movement in the y-z plane
- Pivots at APA also prevent bending forces from being applied to the APA

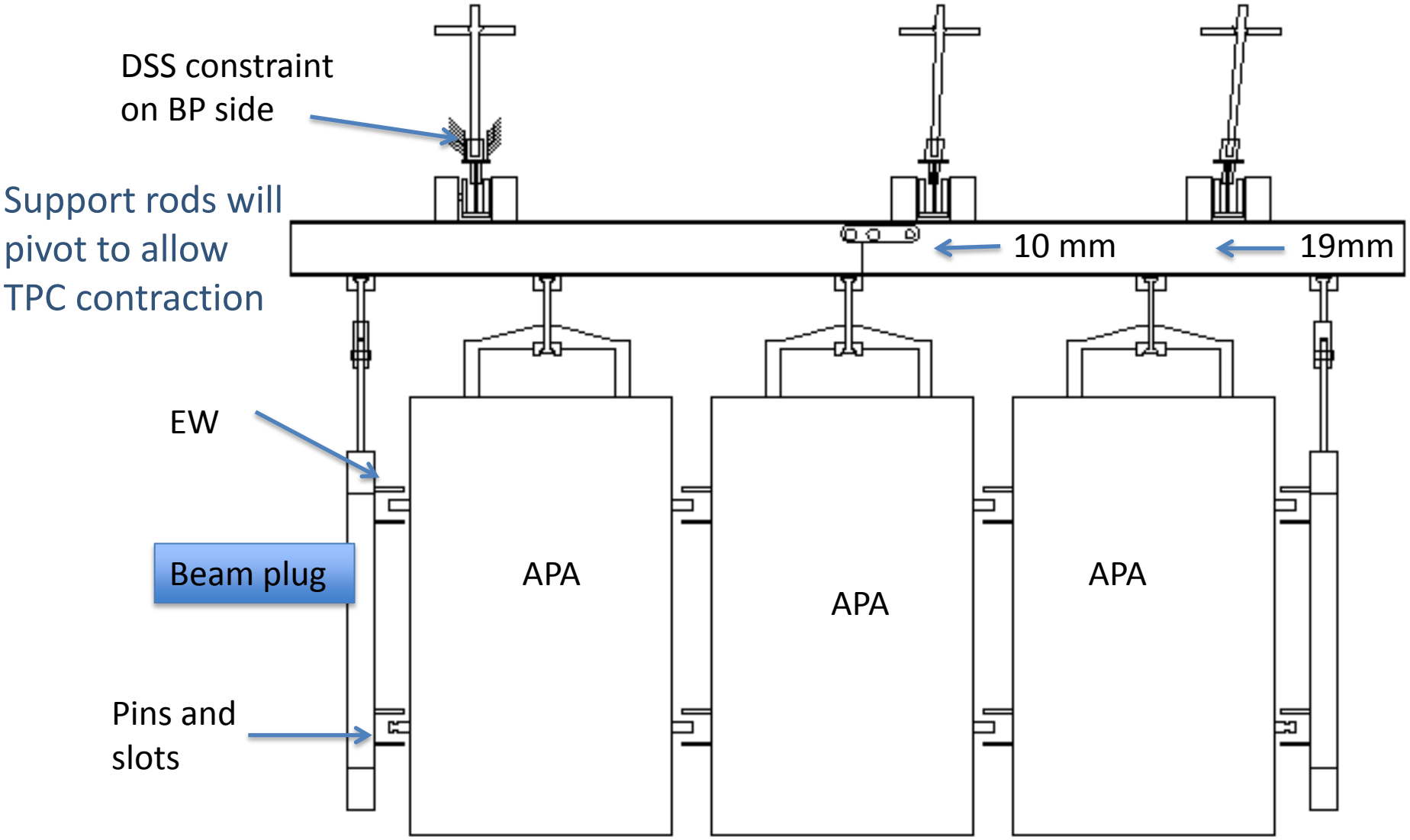
CTE - Compliance

View of APA Plane



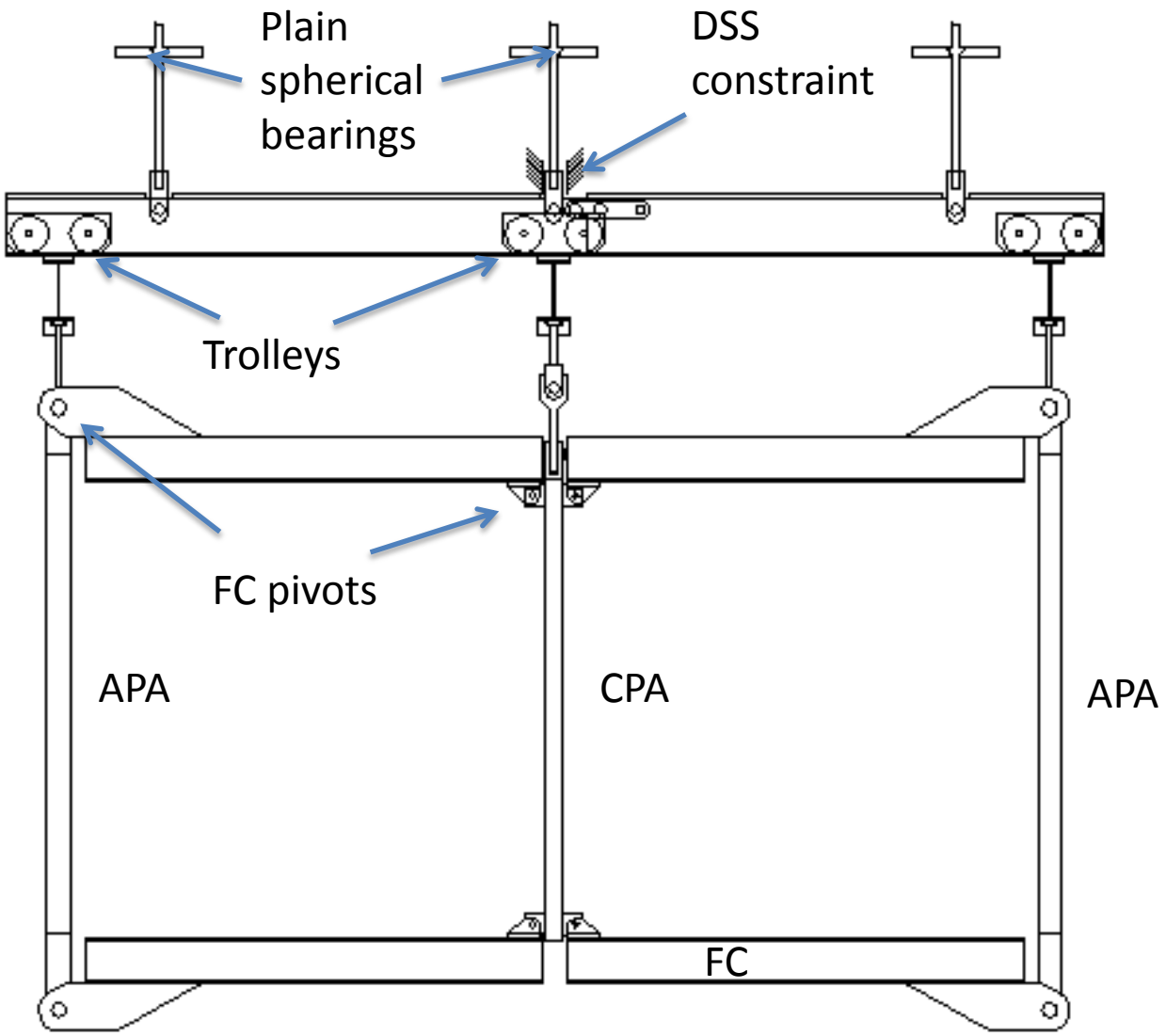
CTE - Compliance

View of APA Plane



CTE - Compliance

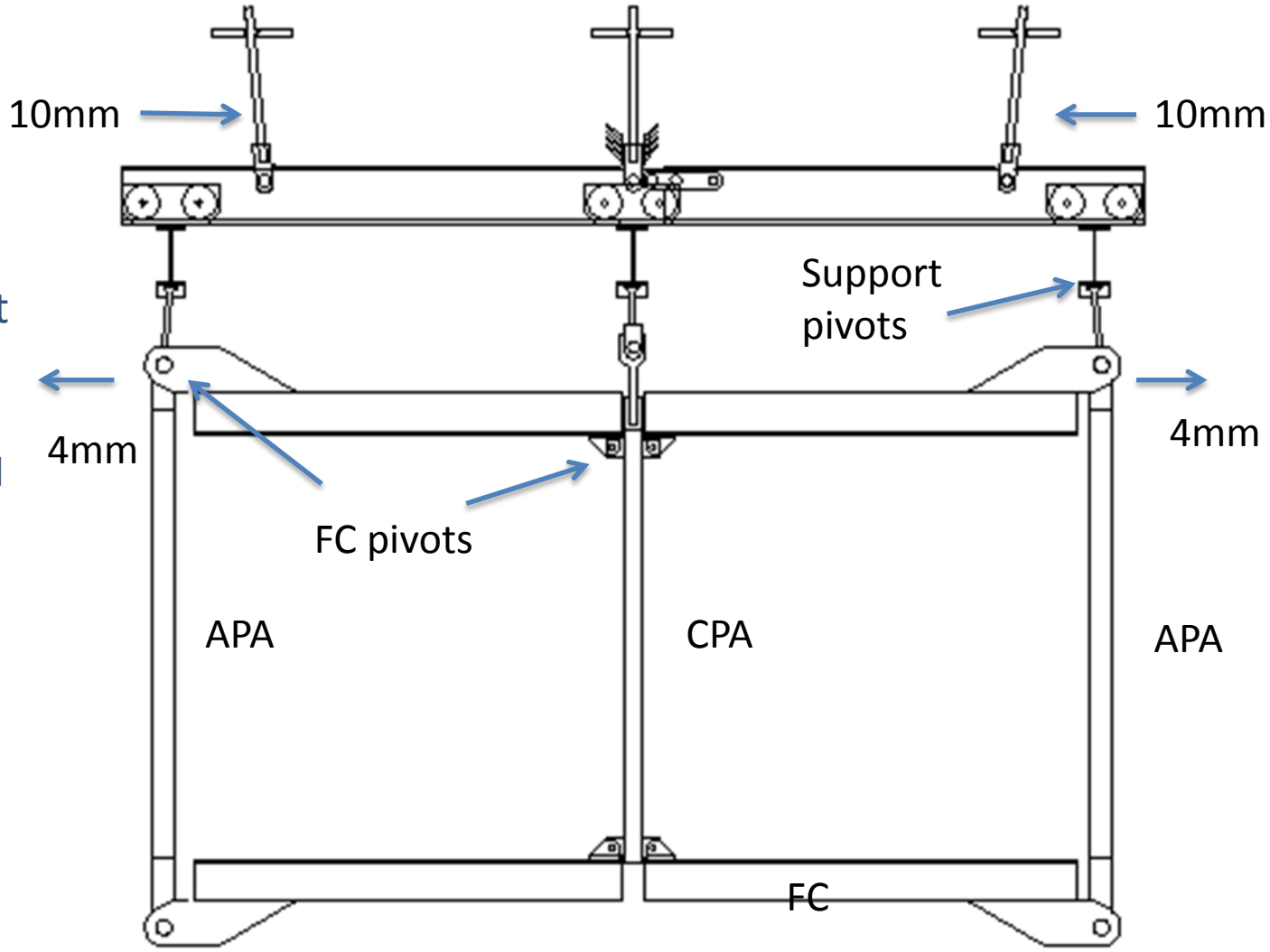
View from Beam
Plug side



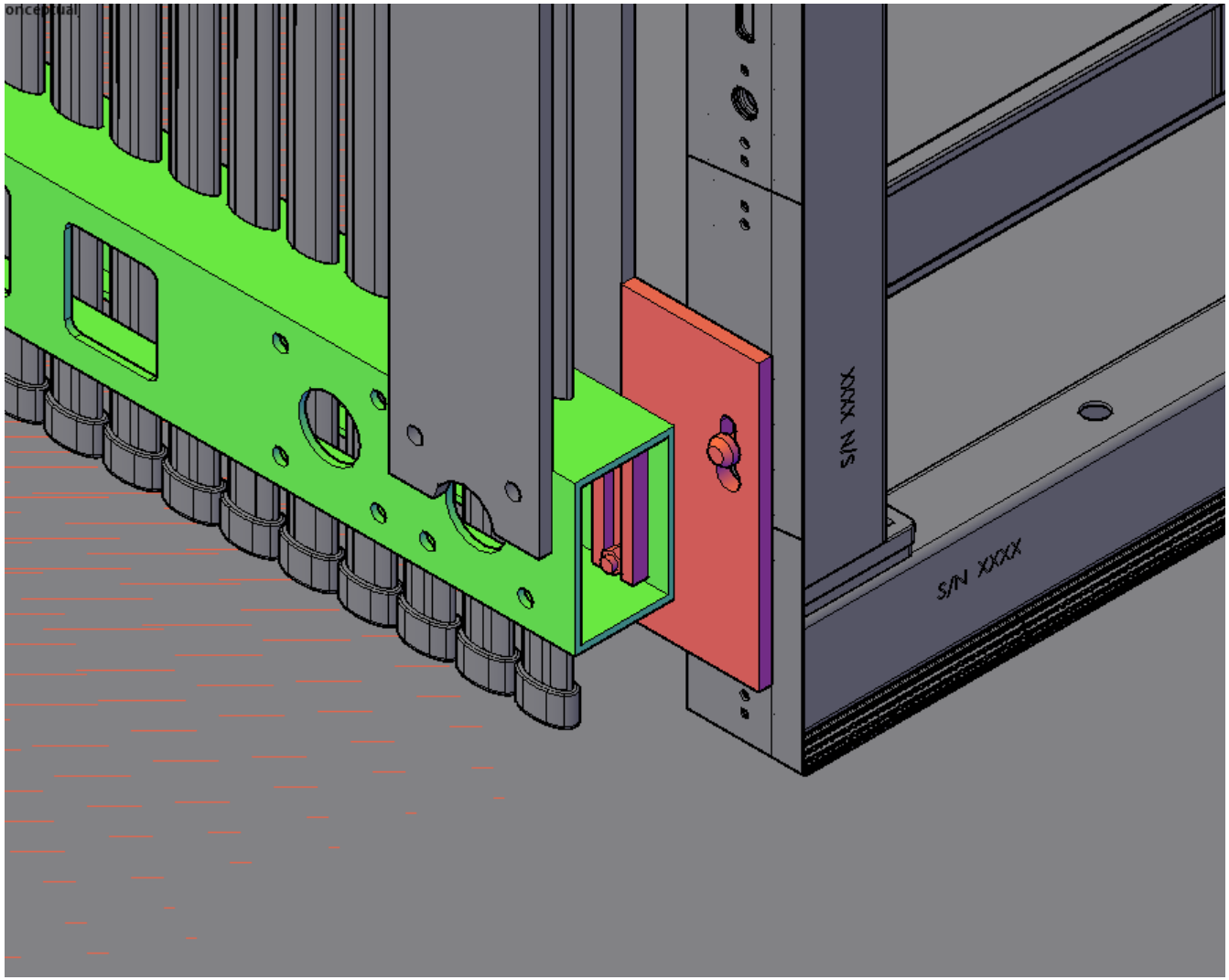
CTE - Compliance

Support rods will pivot to allow the rails to contract

The support links between the DSS and the TPC will accommodate the differential CTE between SS and fiberglass



Back up slides


S/N XXXX
S/N XXXX