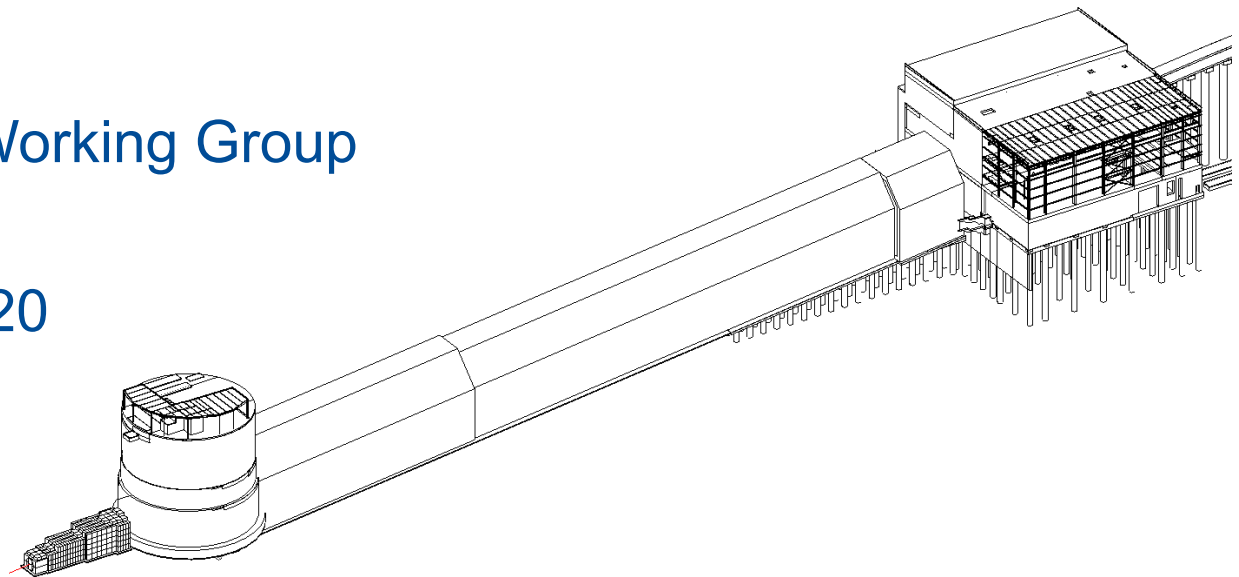


Decay Region Construction and Operation Geometry

Beam Interface Working Group

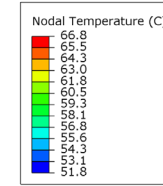
Jonathan Lewis

19 November 2020

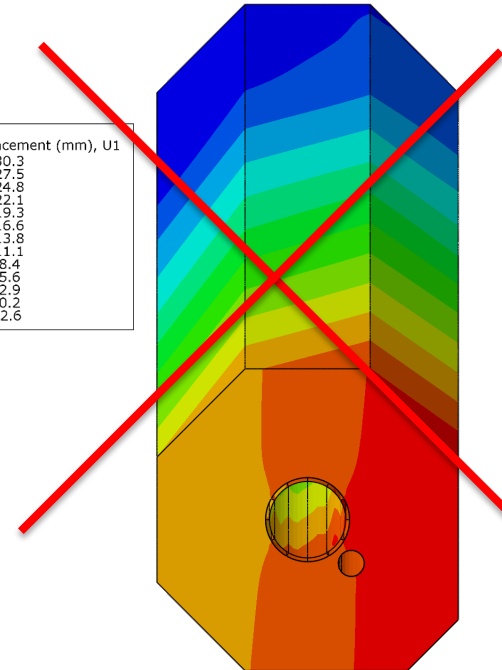
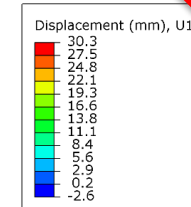
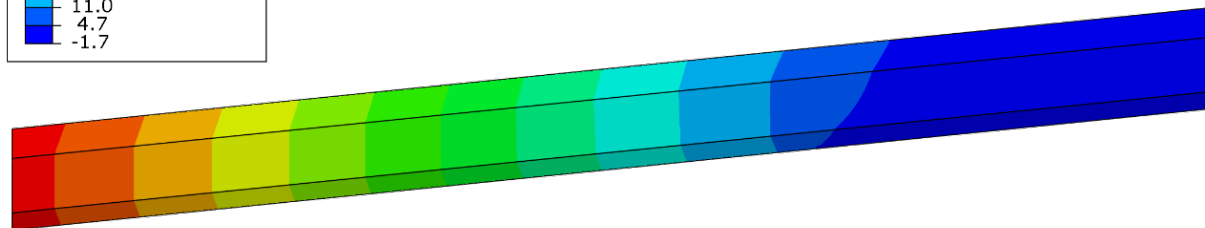
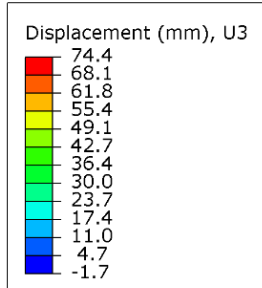
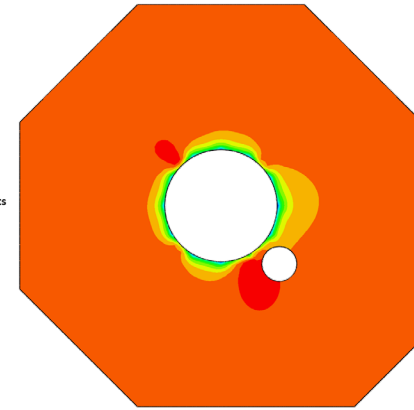


Thermal Expansion

- Energy Deposition results used in thermal FEA
 - Temperature 60C for 2.4MW operation
 - Shows expansion of 5-8cm along 200m length
 - Single cooling return pipe causes lateral distortion
 - Will revert to design left-right symmetry

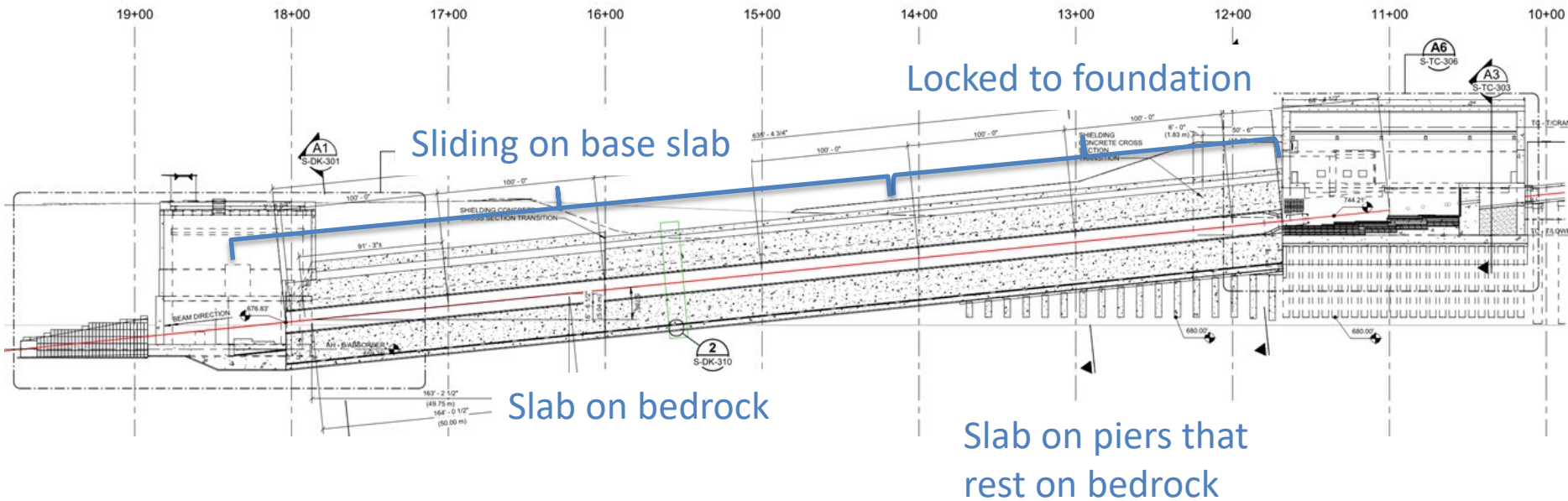


Thermal Analysis Temperature Results
Concrete Only - 1/2 Along Length
Convection Inflow: 13.38 W/m²K
Convection Outflow: 12.82 W/m²K
Nitrogen Inflow: 288.9 K
Nitrogen Outflow: 318.2 K



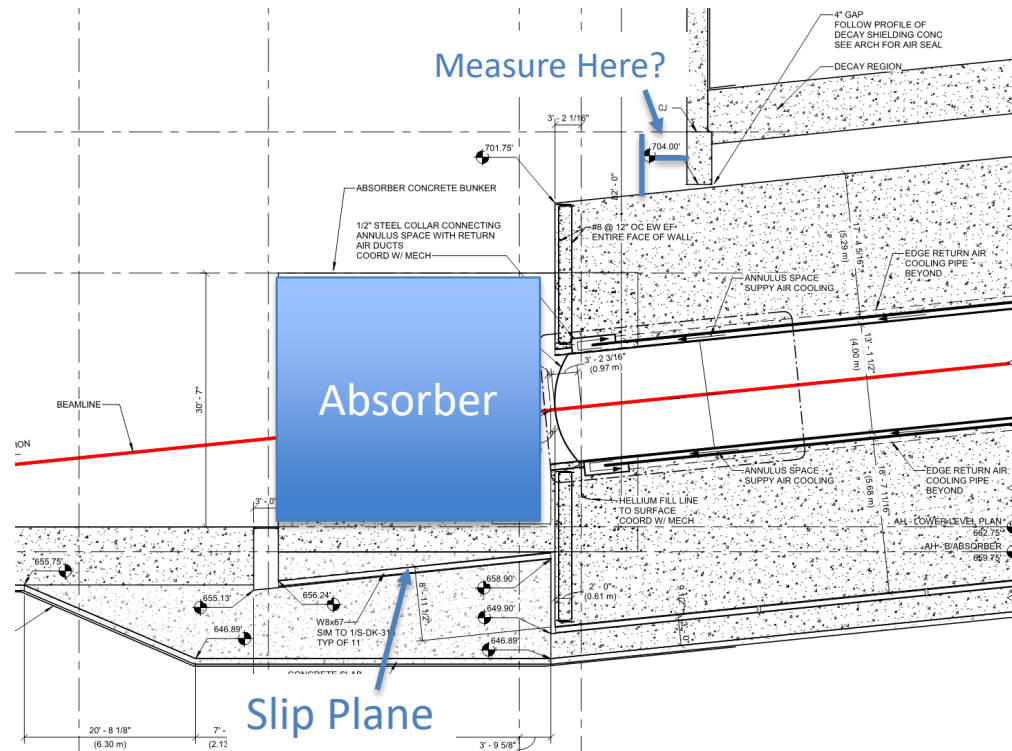
Construction Features

- Structure is locked to base slab at top
 - Expansion is toward absorber hall
 - Avoids displacement of target



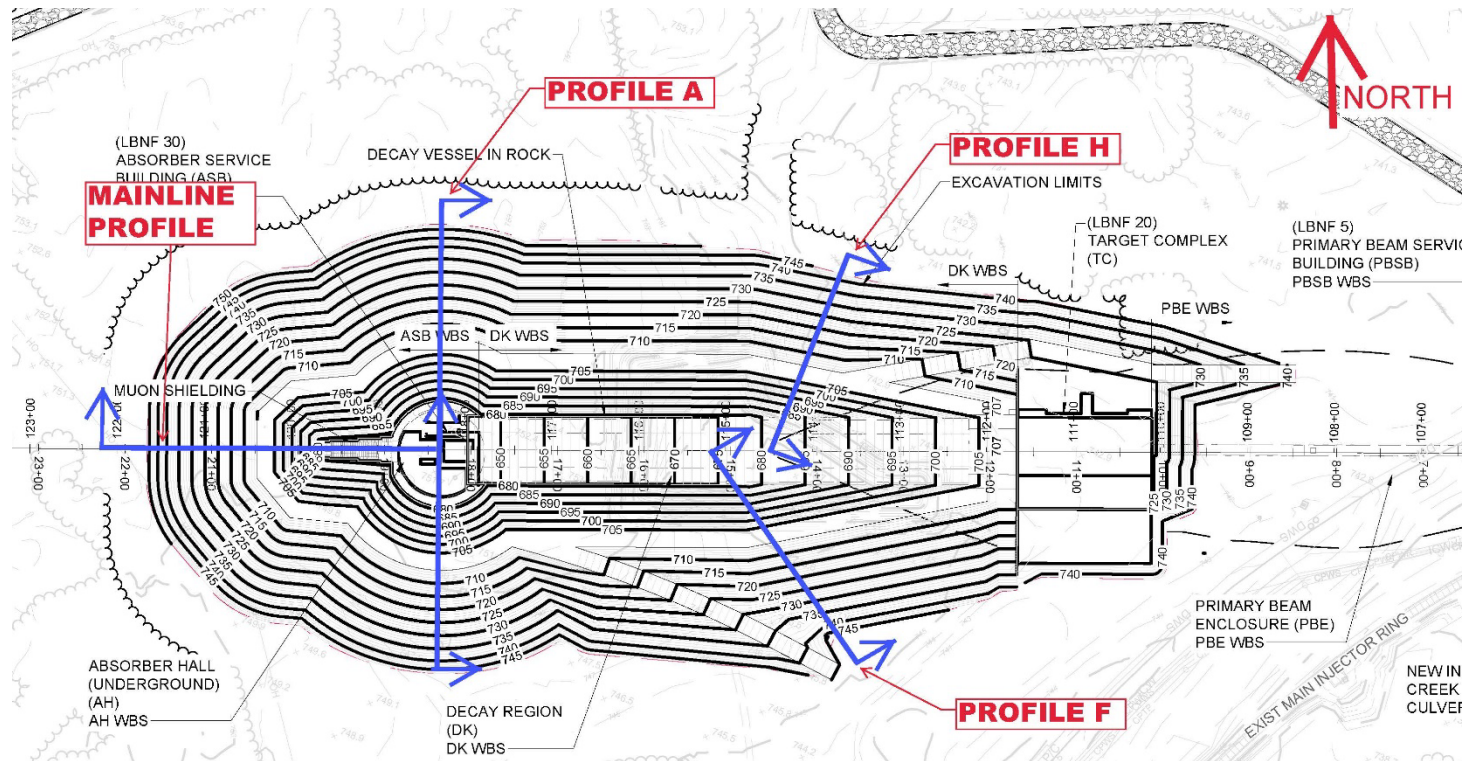
Absorber Moves with Decay Pipe

- The arrangement solves many structural and cooling problems
- Decay region length will change depending on decay pipe heating
 - Should reach a steady state after a few weeks of operation
 - Have access to top of decay structure, so this can be measured



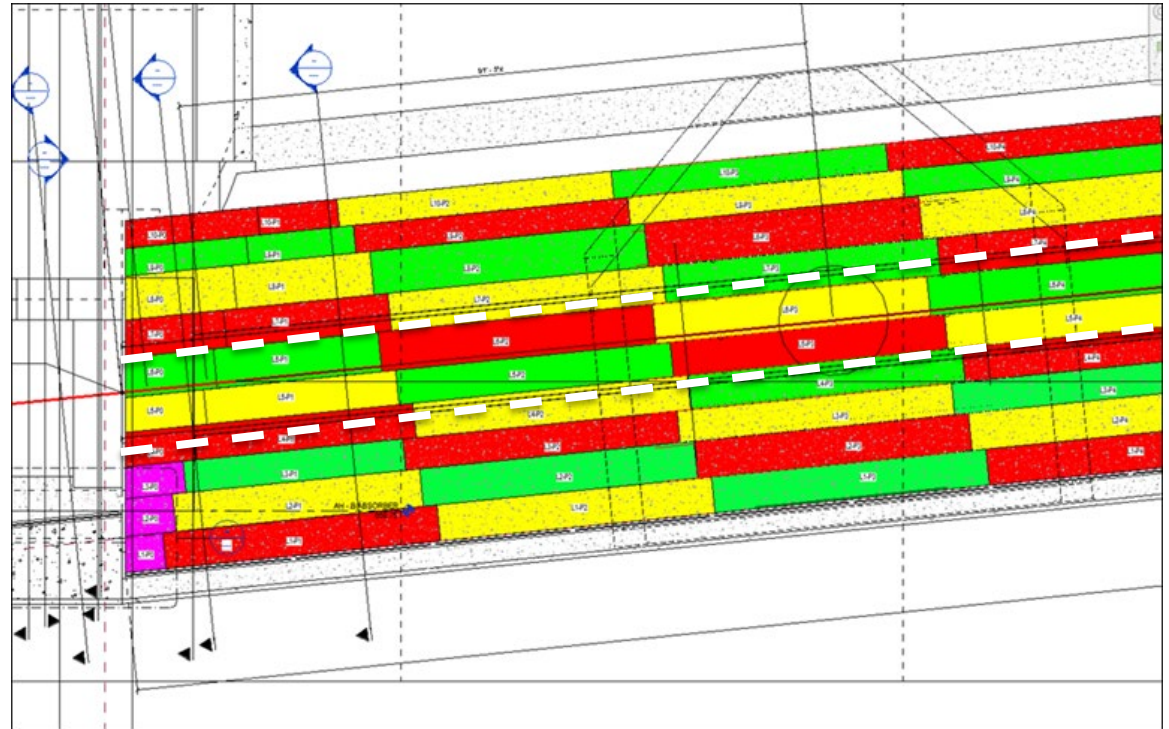
Construction Process

- Start with a massive excavation



- Then build the base slab

Construction of Decay Structure



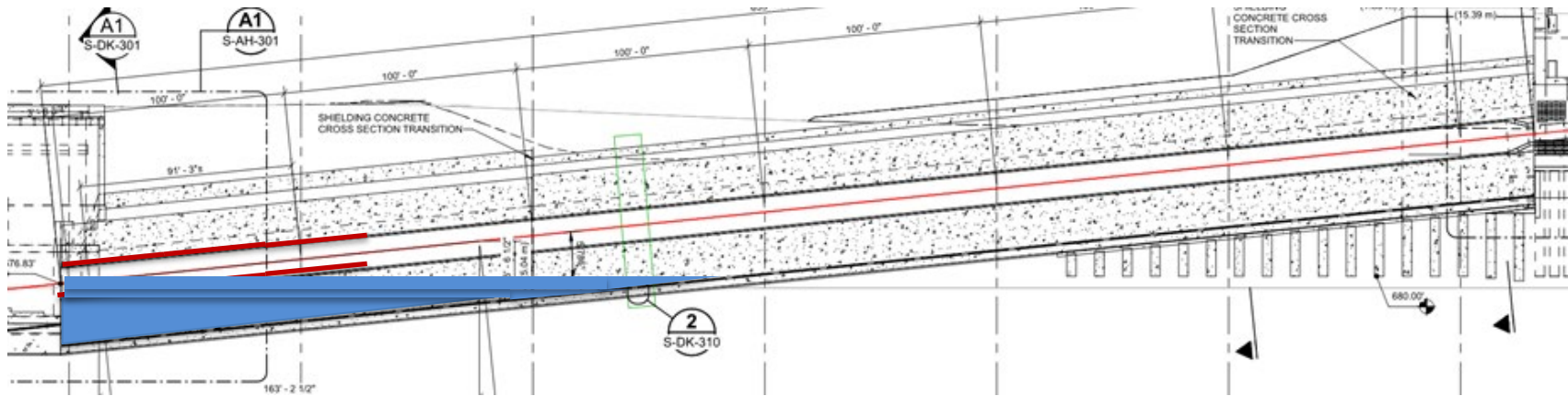
- Build in sections
 - Concrete set in a series of 5-foot lifts
 - Add sections of pipe as you go along
 - Pipe set with typical construction tolerances: $\sim 1/4$ inch
- Add outer structure
- Fill in excavation

Concerns and Questions

- Pipe position will be set by survey crew as it is built
 - Will check for residual magnetic fields after welding
 - Will sink ~1 inch after structure is complete and excavation is filled
 - Awaiting calculations for current design
- Not a perfect cylinder
 - Some amount of wiggle expected
 - 1-2 cm out of round with axis varying over length of pipe
- How concentric does the pipe need to be with beamline?
 - Do we need to compensate for expected movement when it is placed?
- How well does position need to be measured?
 - In principle can get mm accuracy from Alignment staff
 - Is measurement required after settlement is expected to be complete?
 - Could we measure the outside of the structure to before and after to look for settlement?
- How well do we need to measure elongation?

Backup

Construction of Decay Structure



- Build in sections
 - Concrete set in a series of 5-foot lifts
 - Add sections of pipe as you go along
 - Pipe set with typical construction tolerances: $\sim 1/4$ inch
- Add outer structure
- Fill in excavation