

# **Target Schedule**

**SpinQuest Collaboration**

**D. Keller**

# Target Schedule Overview

- Critical Target Construction
- Major Accomplishments
- Major Hurdles

## Cost

- Additional Expenses
- Remaining Costs to SpinQuest (UVA)

## Risks

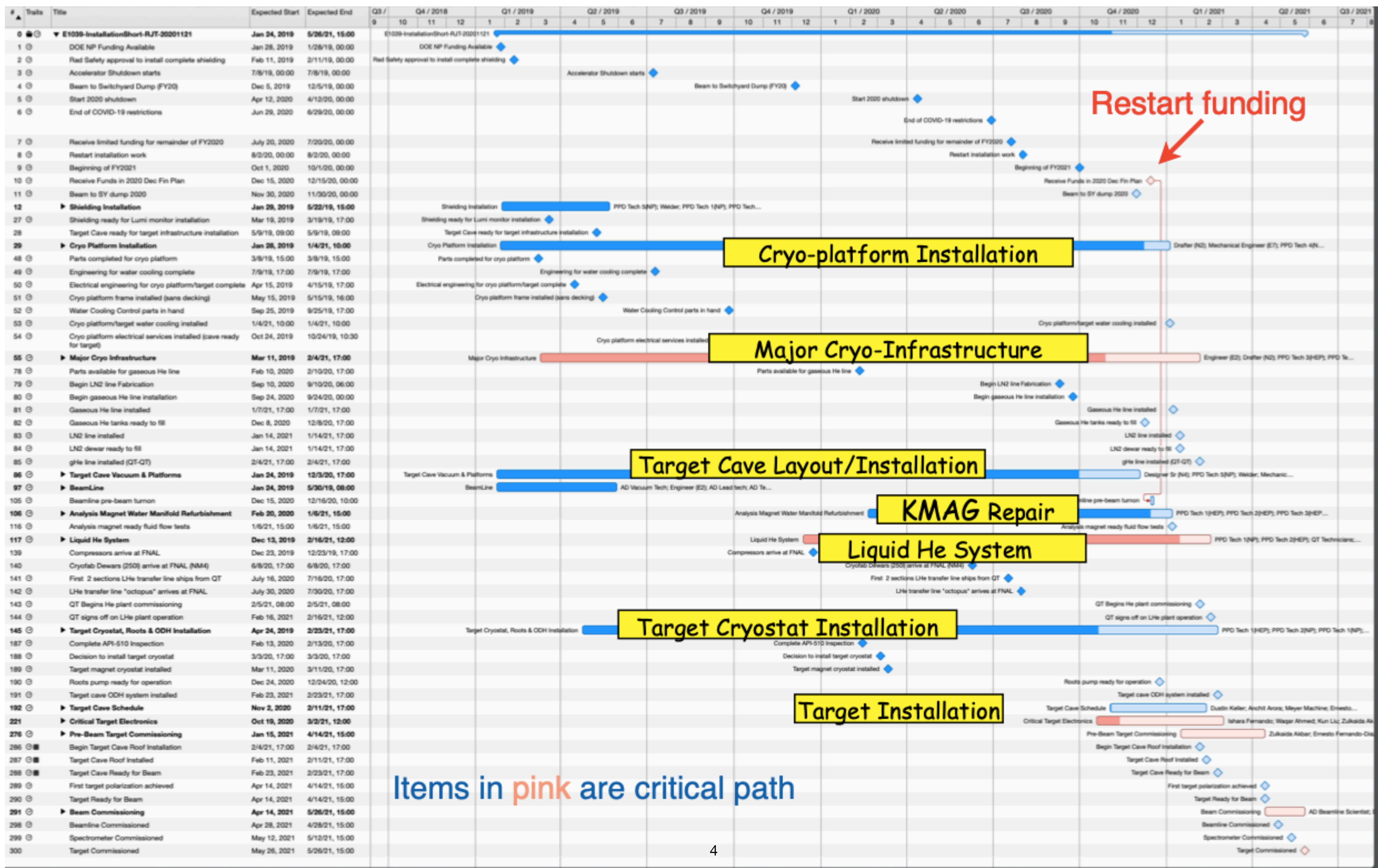
- Additional Modification
- Additional Engineering
- Expense of Documentation

## A Look Around

# Polarized Target Schedule

## SpinQuest Polarized Target System

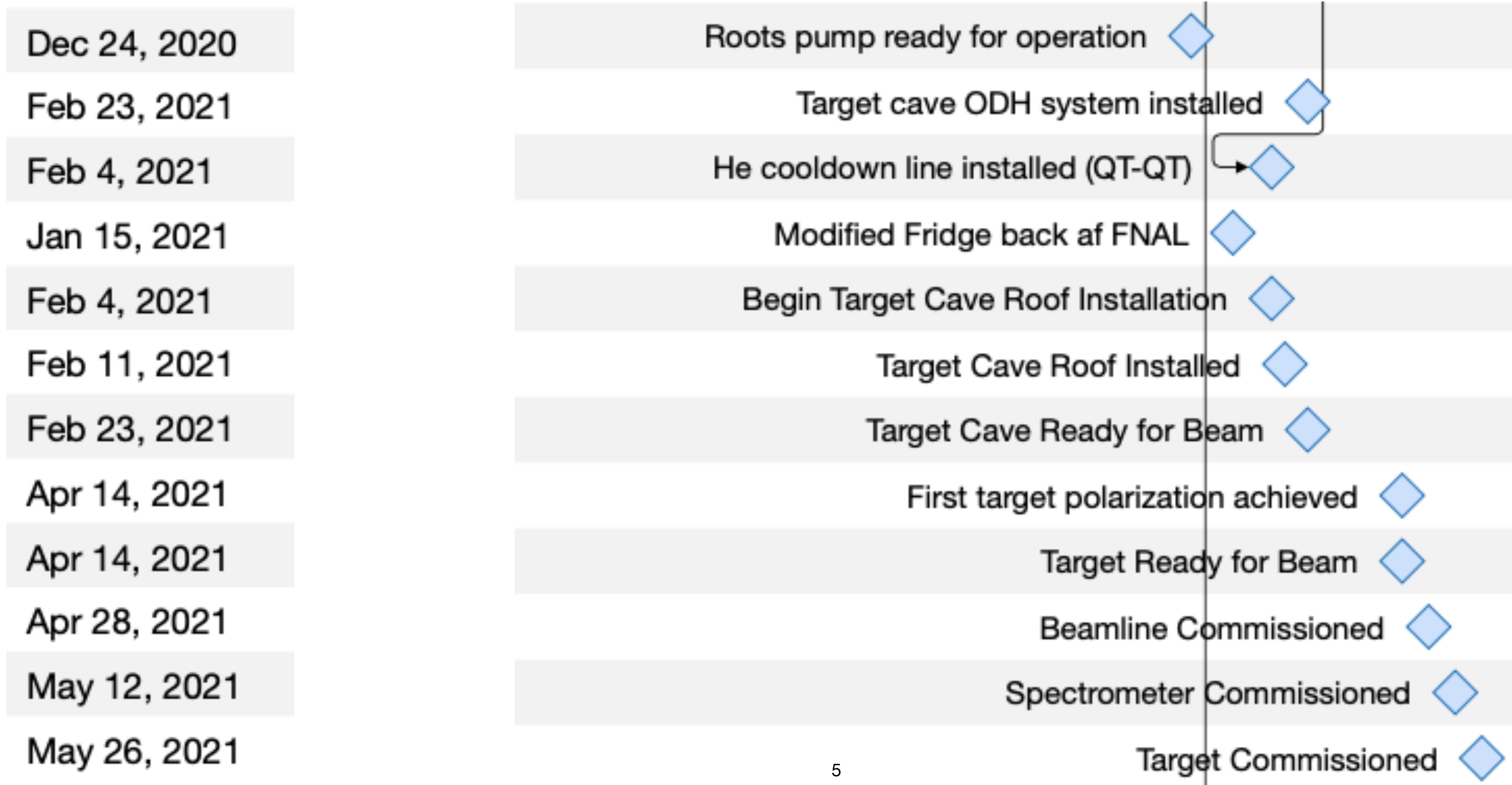
- Magnet and Evaporation Refrigerator
- Supporting cryogenic infrastructure + QT
- Electronics for controls and monitoring
- Commissioning cryogenic systems



Items in pink are critical path

# Final Milestones

Assume no additional delays

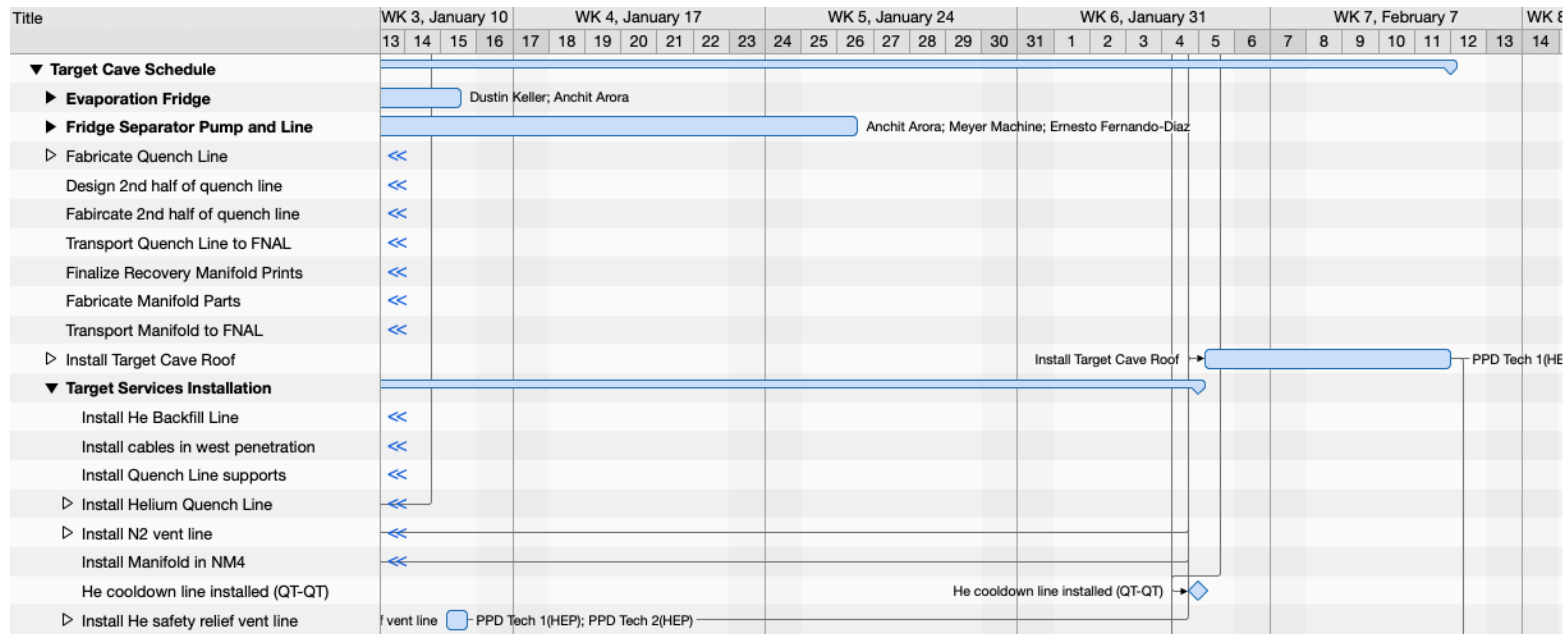


# Target Schedule (Milestones)

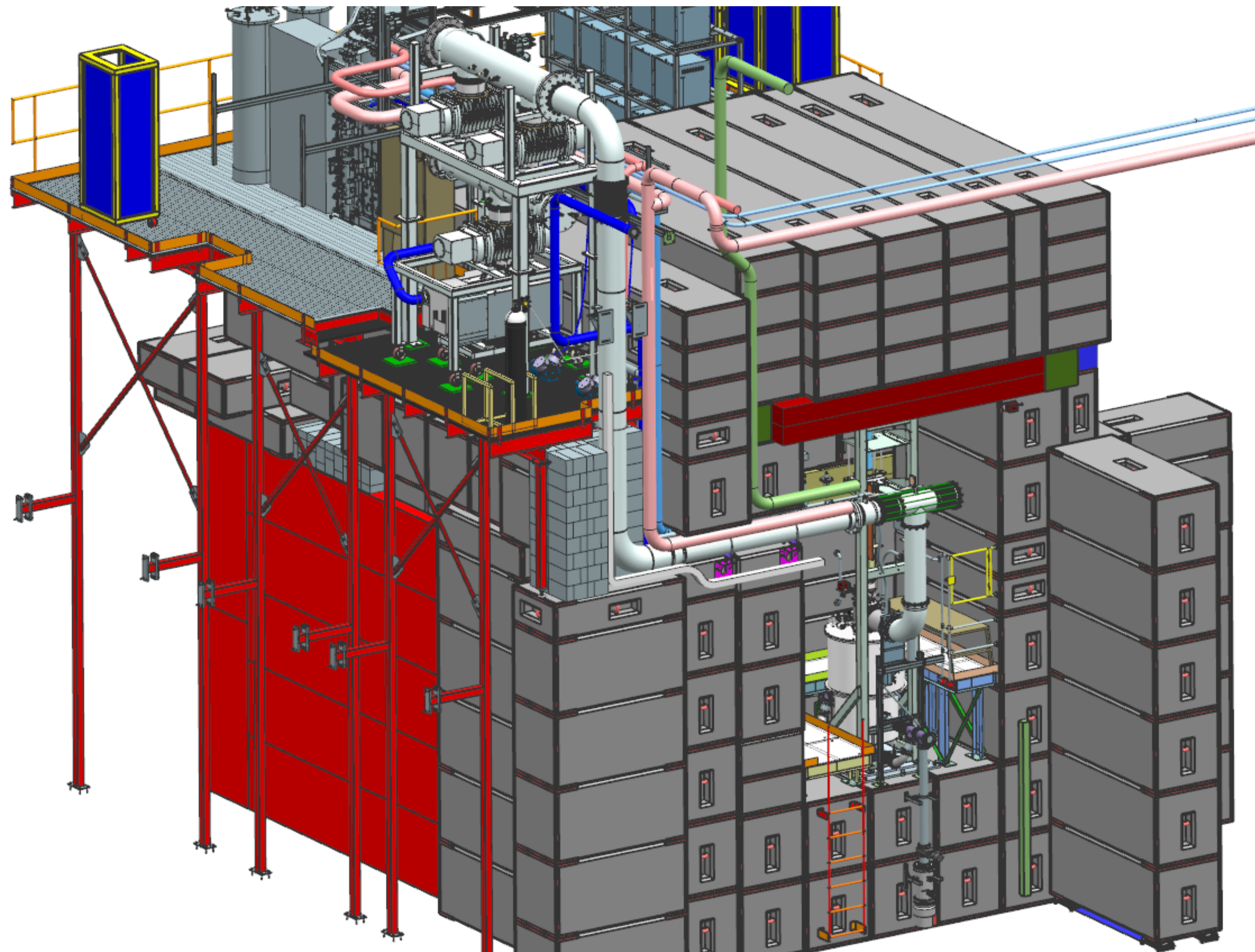
Title	March 28	WK 15, April 4								WK 16, April 11							WK 17, April 18							WK 18, April 25								
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30			
▶ <b>Target Cave Schedule</b>	<<																															
▶ <b>Critical Target Electronics</b>	<<																															
▶ <b>Pre-Beam Target Commissioning</b>	Zulkaida Akbar; Ernesto Fernando-Diaz; Anchit Arora;...																															
Begin Target Cave Roof Installation	<<																															
Target Cave Roof Installed	<<																															
Target Cave Ready for Beam	<<																															
First target polarization achieved																																
Target Ready for Beam																																
▶ <b>Beam Commissioning</b>																																
Beamline Commissioned																																
Spectrometer Commissioned																													>>			
Target Commissioned																													>>			

- Schedule designates work-load and personnel
- Critical Milestones
- Contingency of several weeks
- Technically driven (difficult to advance)

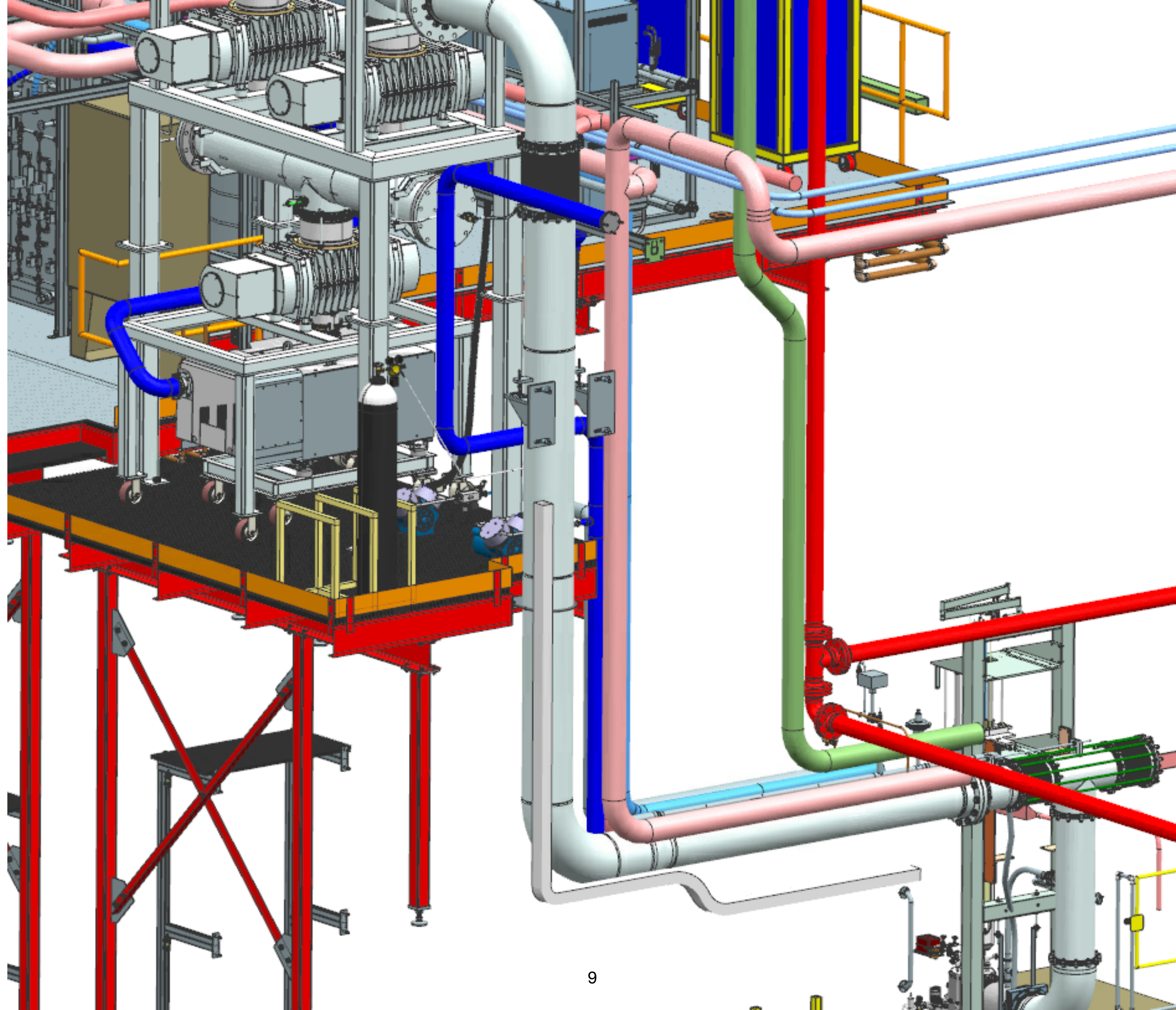
# Target Schedule (Primary Infrastructure)

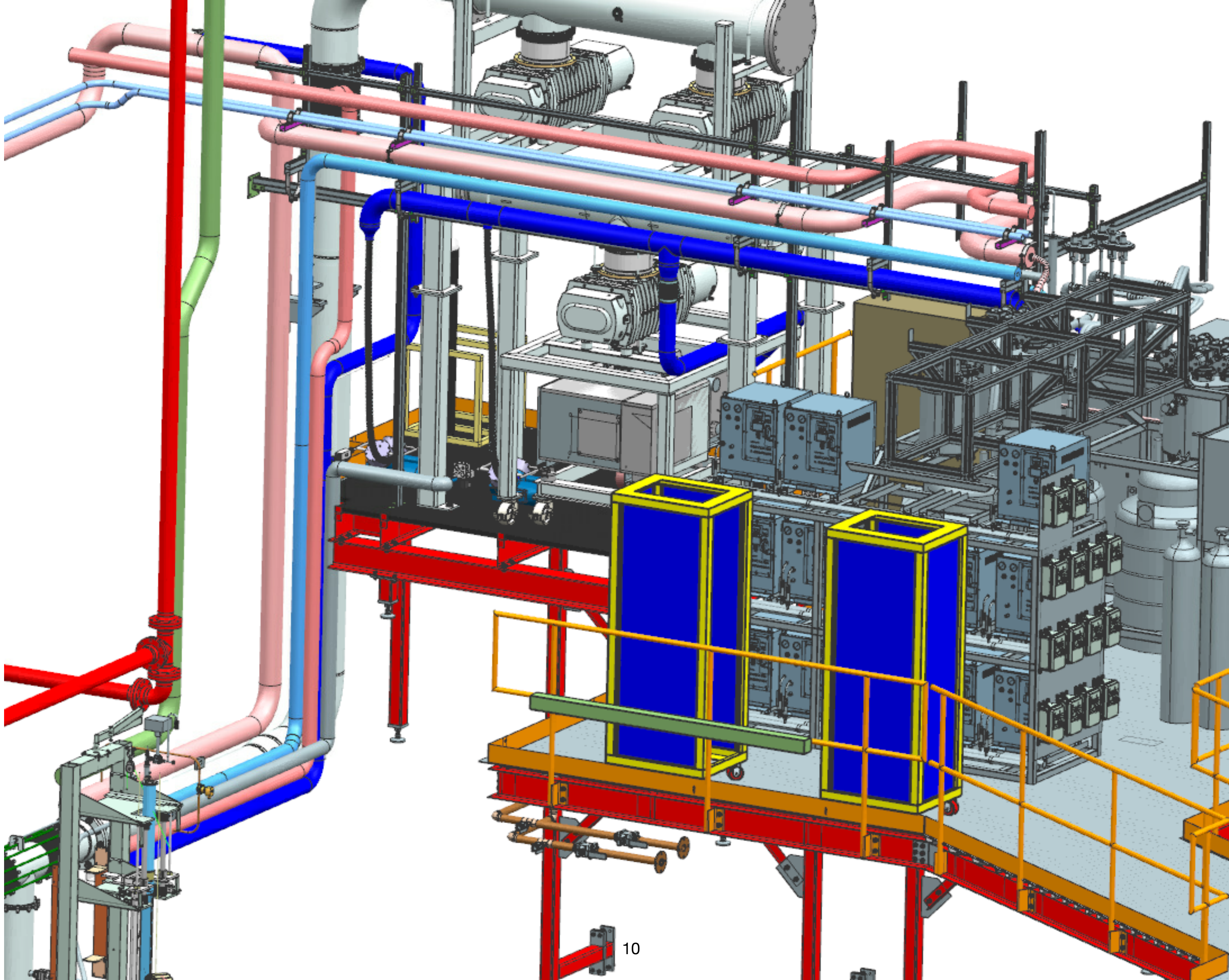


# Full Cave View



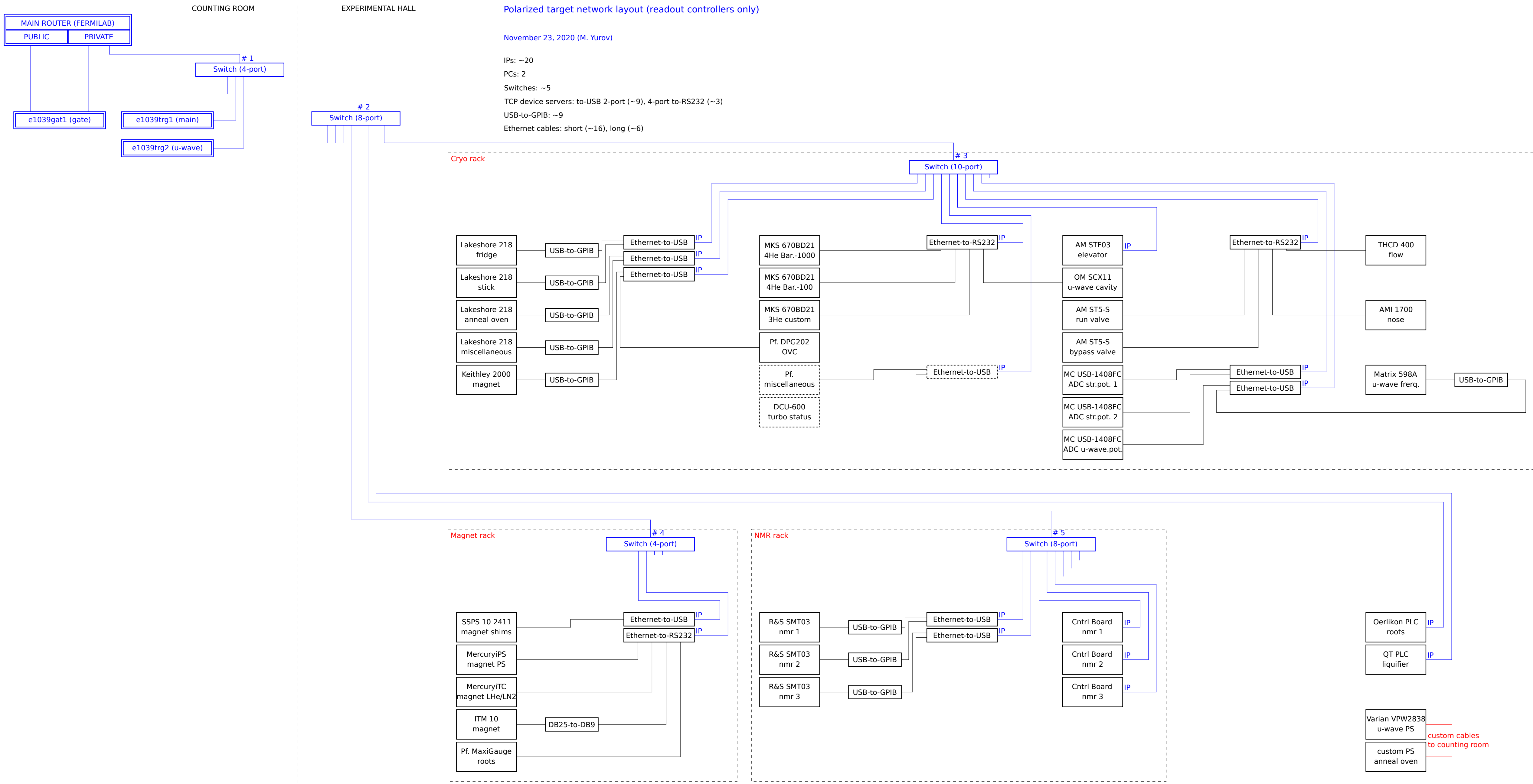




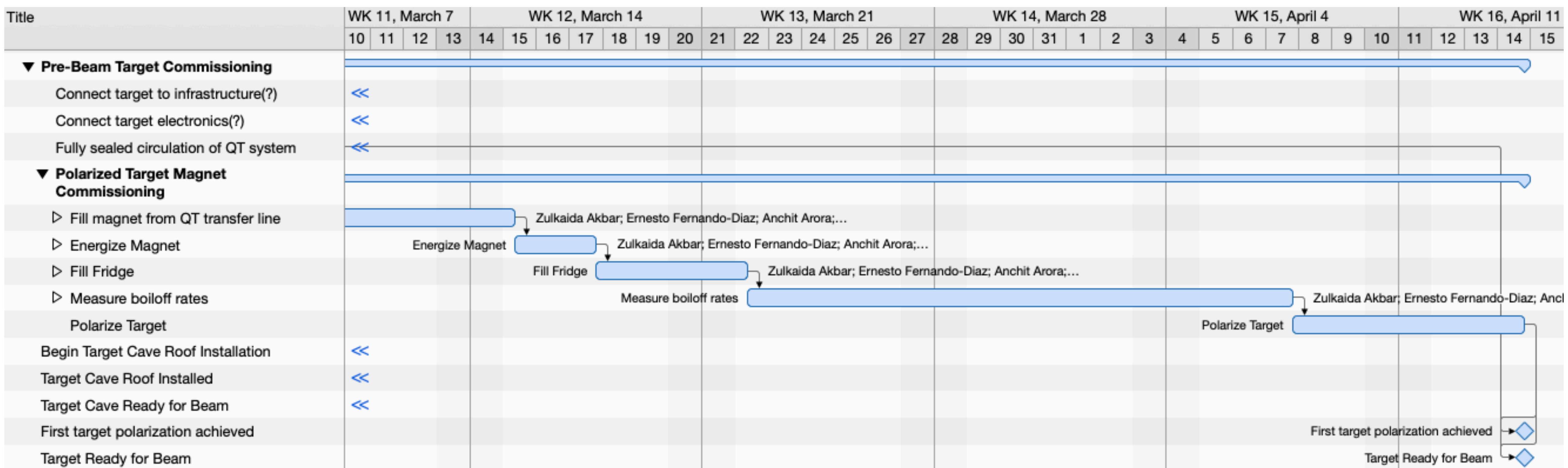


# Target Schedule (Critical Electronics)

Title	WK 7, February 7							WK 8, February 14							WK 9, February 21							WK 10, February 28						WK 11, March 7					
	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	1	2	3	4	5	6	7	8	9	10	11
▶ Target Cave Schedule	Dustin Keller; Anchit Arora; Meyer Machine; Ernesto...																																
▼ Critical Target Electronics	[Bar spanning from Feb 7 to Feb 27]																																
▶ NMR	<<																																
▶ Microwave	<<																																
▶ Magnet Power Supply Rack	<<																																
▶ Helium Vapor Pressure	<<																																
▶ Separator Flow Control	<<																																
▶ Pfeiffer Vacuum Sensors	<<																																
▶ Main Flow Monitor	<<																																
▶ Fridge Sensors	Ernesto Fernando-Diaz; Waqar Ahmed																																
▶ Control Room Integration	<<																																
Modified Fridge back at FNAL	<<																																
▶ Pre-Beam Target Commissioning	[Bar spanning from Feb 7 to Mar 7]																																
Begin Target Cave Roof Installation	<<																																
Target Cave Roof Installed	Target Cave Roof Installed ◆																																
Target Cave Ready for Beam																									Target Cave Ready for Beam ◆								



# Target Schedule (Pre-beam Commissioning)



# Pre-beam Commissioning

## Major cryogenic commissioning

### **Sealed QT Commissioning:**

QT has its own commissioning procedure for the liquefier which will take a dedicated two weeks. This can be done with everything closed/sealed from the QT system except the main helium gas intake manifold for the first part as needed. The second part should include a full circulation test over the entire system also allowing efficiency studies of the QT transfer line for another two weeks.

### **PT Magnet Commissioning:**

The first step here is to do a cooldown of the magnet and ramp it up to make sure all is well and to measure the boil-off rate we are getting with the recent safety modifications and vacuum setup. This would normally take about two weeks of dedicated time and can be coupled to the refrigerator and/or fully sealed QT commissioning. This assumes no un-intended quenches or vacuum issues which can add much more time for this commissioning.

### **Beam-target Commissioning:**

The next step is to see at what intensity we can actually run without quenching. The focus is on finding the intensity threshold and would require completion of the critical path electronics for monitoring purposes. There would be a set of intended quenches done to understand and reproduce thresholds and study optimization of the magnet pumping cycle and present coil temperature regulation system. Geometry and materials of the target insert may need to be modified to get the lowest background rates. This may end up being different for NH<sub>3</sub> and ND<sub>3</sub>. This part of the commissioning is expected to take about three weeks.

# Pre-beam Commissioning

## Major cryogenic commissioning

- Sealed QT Commissioning: 4 weeks
- Polarized Target Commissioning: 2 weeks
- Beam-target Commissioning: 4 weeks

# Point of No Return

## SpinQuest Ramp before Summer Shutdown

- Push towards full target assembly as soon as we can
- Cave will be closed up no later than 1st week of May
- FNAL AD needs 2 weeks dedicated to beam tuning
- We can then initiate non-target beam commissioning before 2021 Summer Shutdown (July 5)
- *Must* request beam on or before May 24
- Complete target/cryo-connections and safety review over Summer Shutdown (Sep 20)
- Target-beam commissioning after Summer Shutdown
- Production data taking 2 months after Summer Shutdown



# Major Accomplishments

## Target System Status

- Cryo-engineer details for magnet vessel complete and considered safe
- Magnet in place and roots piping connected and able to run
- Roots piping leak checked
- LCW source installation nearly complete (cooling QT + roots)
- Actuator (target position device) ready (need install/ORC)
- Microwaves (safety + interlocks) ready (need install/ORC)
- LANL NMR system complete final boards being setup, UVA backup system ready (need install/ORC)
- Full in cave magnet survey complete
- Beam-line piping and magnet/fridge vacuum assembled
- All major QT infrastructure is in place

# Next Major Steps (before target com)

## Target System Status

- Fridge modifications (Assume no *further* modification)
- Complete cave piping/venting system
- Fabrication of ASME certified piping + documentation
- Seal up full system and leak check all
- Put shielding roof on
- Critical path electronics
- Beam window fabrication
- **Cryogenic Safety Review**

# Cost to SpinQuest (UVA)

## No Further Modifications?

- Further analysis and engineering (CFD) time (~5 K)
- Fabrication of piping System (~25 K)
- Fabrication of the in cave connection and manifold (~15 K)
- Refrigerator Modification (~25 K)
- Second modification to the target magnet piping (~5 K)

# Running Costs

## Commissioning and first year of operations

- Chamber gas (based on E906) \$27K per year
- LHe for first cooldown at least 2000 LHe to prime system (\$30K)
- LHe for quench commissioning (\$45K)
- Target LHe cost about 500 LHe/month (\$10K)

**Have secured funding for running costs for the first year**

# Risks

## No Further Modifications?

- Remaining Modification (paid by collaboration)
- Remaining Engineering (integration/safety-review)
- Remaining Documentation and Analysis (that SpinQuest can't do)
- FNAL resource availability
- Priority level of project (especially with no FNAL funding)
- Cryogenic Safety Review (no guarantees)

# Risks

## **FNAL is not (yet) a polarized target facility**

- Very little background, help or knowledge of setup/application
- This is a tight-budget project (and low priority for FNAL resources)
- FNAL-FESHM cryo-sections updated 2014 (but not for PT)
- Still figuring out how to apply the code for this system (need funds to finish)
- No full time cryogenic engineer on this project
- Piece wise safety/code protocol approach

# Where are we now

## How much left to do

- Construction and major equipment ~85% complete
- Supporting infrastructure ~65% complete
- Documentation and prep work (safety) ~50% complete

# **Where are we now**

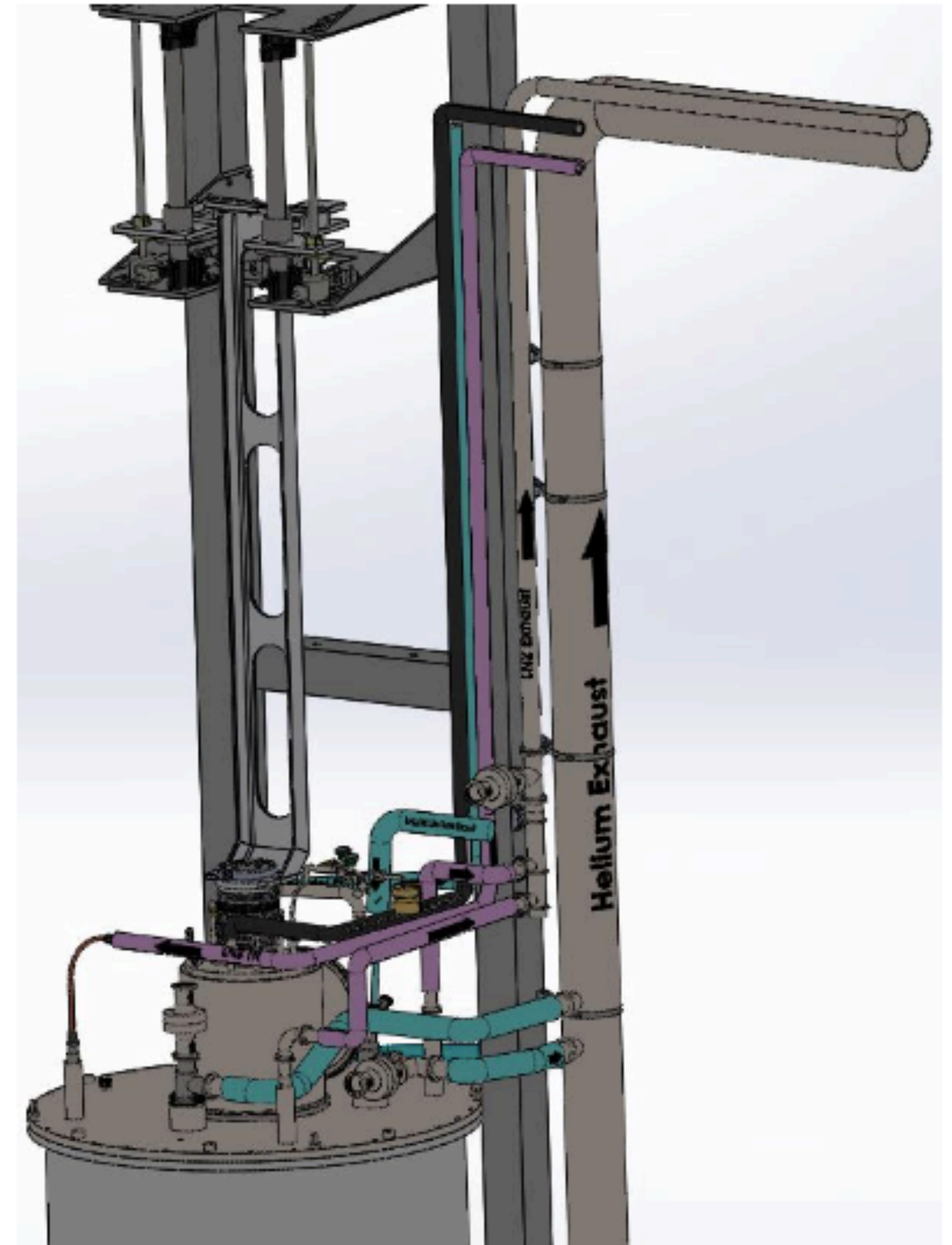
## **How much left to do**

### **A Look Around**



# Target Venting System

- All evaporation/boil-off helium vapor captured
- All relief ported out of the building
- All piping to code + docs (still need FNAL)



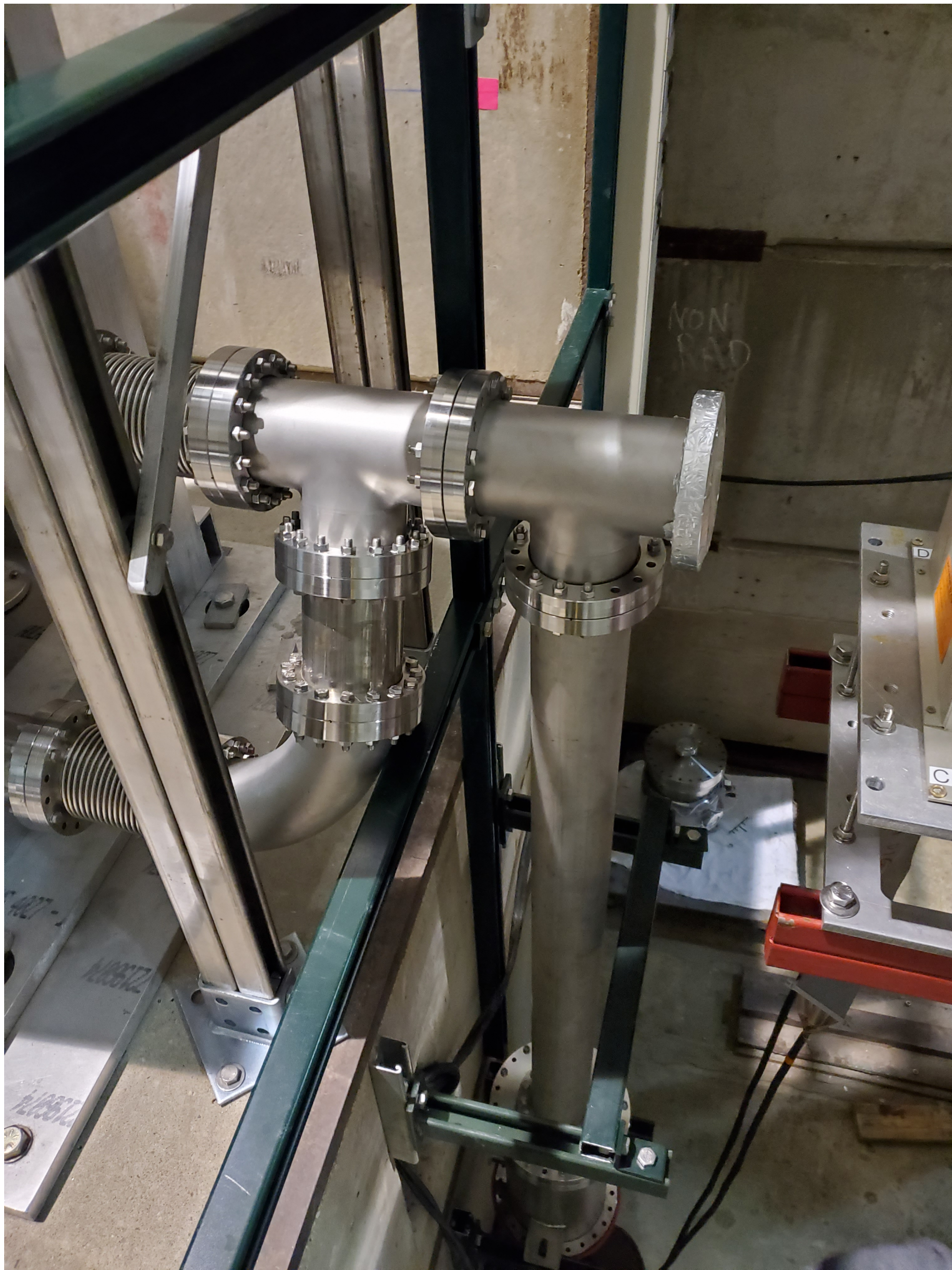












**Thank You**



# Backup

# Modification of fridge separator and relief

