



# ITA Facility Infrastructure Upgrades

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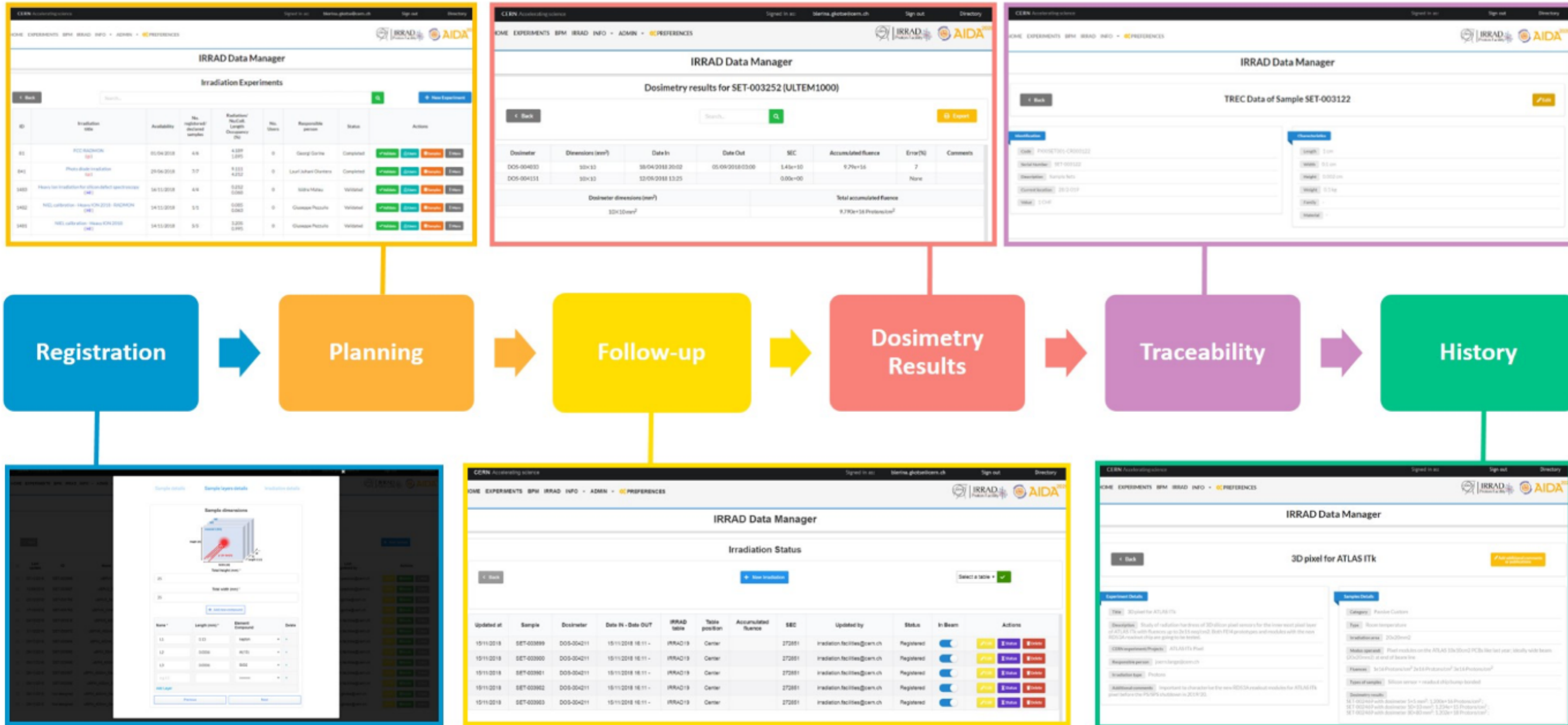
# Overview

- There are many areas in which ITA facility infrastructure can be updated.
- This talk covers some of the possibilities that are in various stages of reality.
- Looking for input to prioritize work. Some projects would require new equipment and/or FTEs to support.

# Data Management

- We have an increasing amount of data associated with ITA experiments. Management is cumbersome and through several different systems and groups
  - Significant manual interfacing between users/ITA/RSO/RAF/shipping
- As we look to increase the number of experiments and samples passing through ITA, we need an efficient central data management tool
  - Register each sample coming to ITA with ID, catalogue sample composition
  - Perform radiation length and materials calculations on sample
  - Track dose received
  - Track sample location
  - Associate dosimetry and RAF reports with each sample
  - manage shipping
- CERN has spent years developing the IRRAD Data Manager (IDM) to cover all these features in a web portal as has been highlighted in Federico's talk.

# Data Management



<http://icalepcs2019.vrws.de/papers/mopha048.pdf>

# Data Management

- In 2020 CERN provided us with the IDM repository. Summer intern spent time making some adaptations, we have a database setup and web hosting machine.
- IDM is a Django-based website which Core Computing does not (at least at the time) support.
  - Cyber security hurdles tying site into SSO, keeping compliant, etc to difficult for myself to maintain
- There is significant advantage to using the IDM tool
  - Years of development time and debugging based on the expertise of a long running facility
  - Easy interface for ITA facility to make small changes, database differences
  - Assistance from CERN IDM team
  - Common tool for users of both facilities
- We probably need 3-6 months of some computing support or ITA needs to hire a web expert to push this over the finish line (more depending on what we want this to be)
- This is high on my personal list of upgrades. A proper tool would save considerable ITA and RPO staff time and improve the safety and operations of the facility. Current methods cannot scale.

## Be7 contamination

- In 2021 we installed an air blower unit with HEPA filter (100 cfm) to pull air through sample box.
- Initial unit discovered to have improper HEPA filter seal leading to leaks.
- Got through beam year using Rad vacuums which are not designed for continuous operations (used three of them).
  - Vary grateful to HCT/RPO for the loans and MSD for quick adapter fabrication
- We have now purchased a proper HEPA filter to use with original blower
  - Need to fabricate hose adapters.
  - Working with FESS engineering (Lee Hammond) to test new system before use.



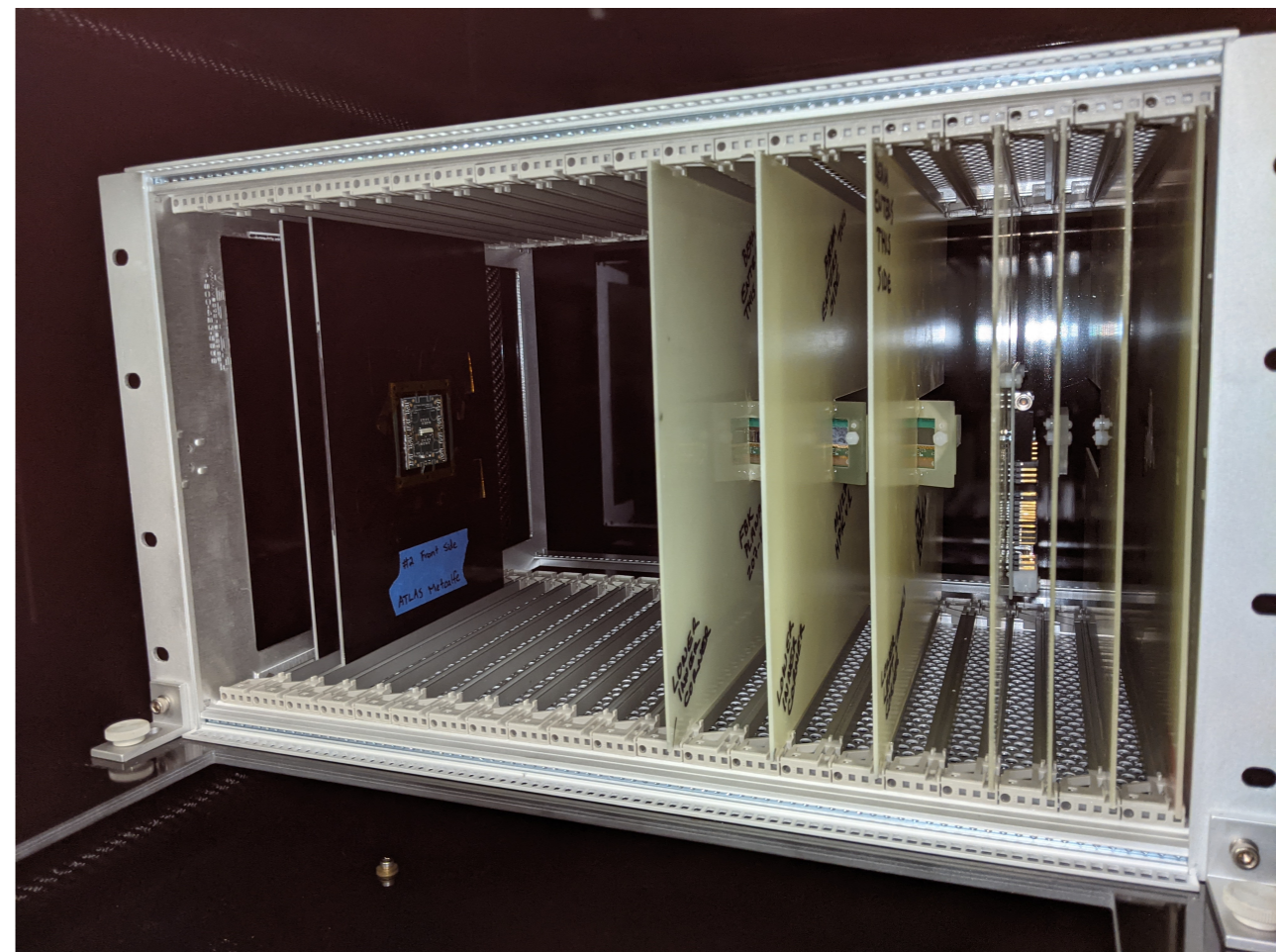
# Be7 contamination

- HEPA filter has improved Be7 contamination seen on samples but NOT eliminated it, particularly in very high fluence runs.
- Some strategies going forward
  - Work with RP/RPO to better understand how much Be7 we think is being produced in the beam
  - Modeling of air flow with FESS, how efficiently are we removing it.
  - Should we make optional ports in sample box to change hose location depending on sample geometry (Corrinne's sub-frame has walls on the sides maybe trapping air)?
  - Do we need additional units and/or increased air capacity.
  - Would situation improve if we ran a purge gas through box, or would we just make something else?



# Beam Alignment/monitoring

- We have an identical spare VME crate at FTBF (need to add backstop to spare)
- Alignment fiducialize sample box (after decon) with PWC
- Motion table controls are accurate and reliable, need to understand stability/jitter in box mount, screw samples in place
- We need a profile monitor in the sample box to compliment PWC
- Paul R has been working on a diode option
  - Can we improve rad hardness of diodes
  - Optimum diode pattern, improve DAQ
  - online monitoring system
  - collaborate with SMU



- We need to understand relationship between dosimetry readings and the toroids and and improve our realtime prediction of the delivered dose.



# Active cooling of samples

- Many experiments would benefit from active sample cooling during irradiation
  - additional benefit reducing pressure to remove samples after irradiation for cold storage to stop annealing
- In 2020 we began pursuing a vortex chiller option
  - Located air compressor in “pump room” next to counting house, ran hose down to experiment hall. We’ve been stalled ~1 year on getting electrical rec fulfilled to wire compressor.
- Some questions for experiment input:
  - What amount of cooling is workable? What is ideal?
  - Do we need a new sample box designed and insulated for that level of cooling?
  - How difficult to swap boxes?
  - Does air filtration system removing air from box effect

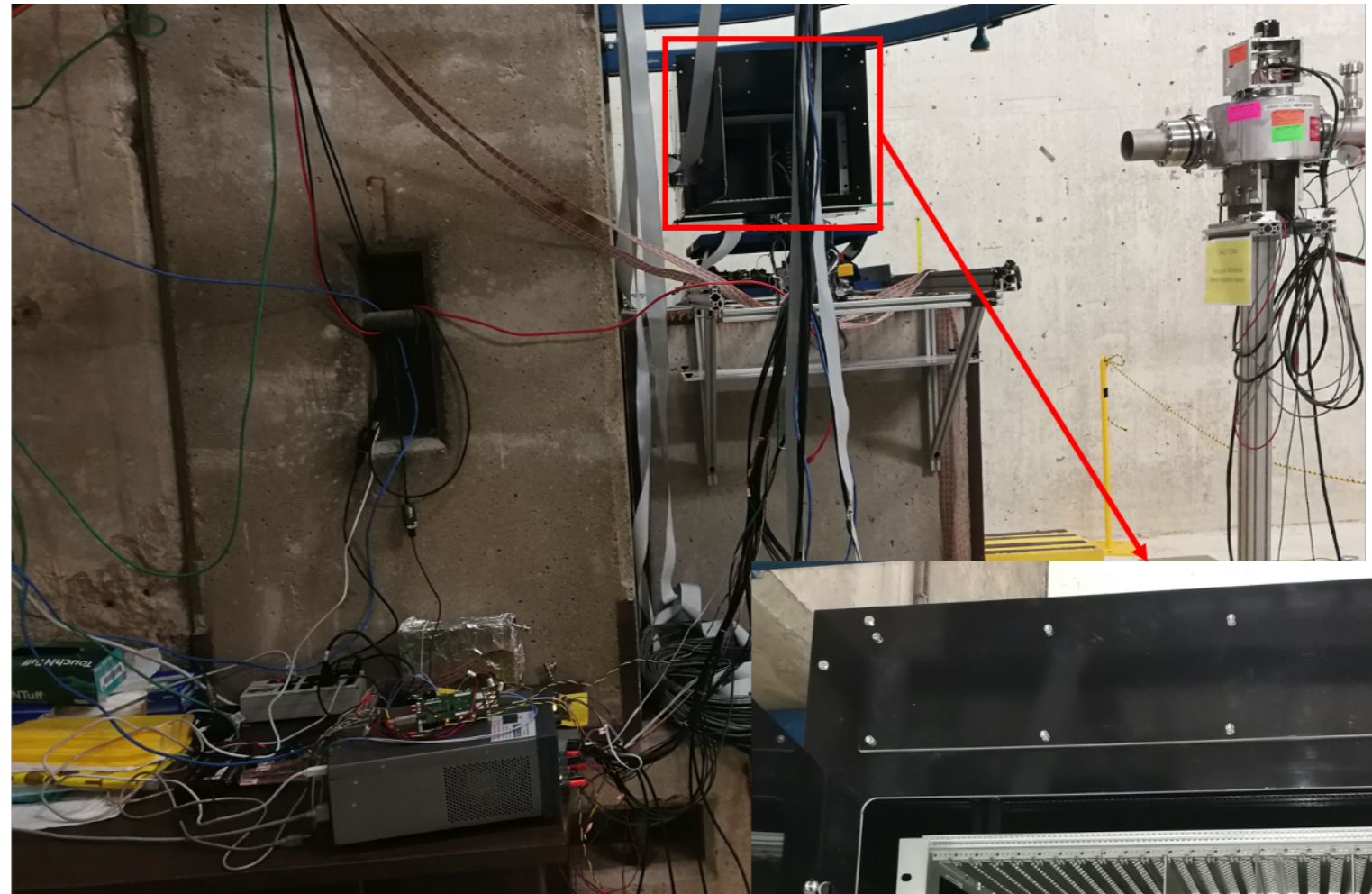
# Motion Table

- Two stage motion table for vertical and horizontal positioning of sample box.
- Controllable remotely from box in counting house.
  - Prone to getting stuck in a position that requires system reboot or expert intervention.
  - Remote control outside counting house (such as acnet) has proven challenging for expert and is still a work in progress.
  - We need to improve robustness of controls.
- “Beam center” is close to the far end of horizontal motion. Would like to recenter system to a coordinate useful to the users.
  - Require mechanical adjustments in contamination space.



# Electronics in the beam enclosure

- Experiment input on cable length
- What are we trying to shield against?
  - Experiments interface with Anna on MARS models
- Work with RPO to identify possible shielding options onsite “movable” in enclosure
- We do have an electronics rack in enclosure or could setup table/stand pending distance requirements
- Ideal to move electrical outlet from wall to cave, needs an electrician.



# Timeline

- My first guess based on input so far. Adjustable based on feedback
- During shutdown:
  - Get sample box decontaminated (RPO) and fiducialized (Carol coordinate alignment joint with PWC)
  - Replace enclosure camera (have ready spare at FTBF)
  - Install phosphor screen on box (have screen, might need to modify box mount)
  - Get new air filtration hose adapters made (MSD), tested (FESS), and approved (ORC)
  - Identify location for electronics equipment and shielding options
  - Explore options for diode system in sample box (Paul R, Joe P coordinating)
  - Improve motion controls remote operation and reliability (Jerry)
- Over the course of the next year
  - Central data management solution (Evan + requested computing support + RPO stakeholder)
  - Deploy beam monitoring system (diode array or other) in sample box (Paul, Joe)
  - Expand air filtration system (if necessary) based on FESS and RPO recommendations
  - Develop active sample cooling capability

# Ask

- ITA infrastructure upgrades will require additional resources beyond current operations
- 0.5 FTE over ~6 months of a computing expert with experience Django and FNAL cyber-security standards to bring IDM to mature and operational state, then low level maintenance support
  - As we expand features beyond a straight copy from CERN this requirement grows. Making this a lab wide tool would require some design support beyond the hosting/security need.
- 0.5 FTE instrumentation specialist to develop and coordinate beam position monitoring/motion table/sample cooling projects. Supplemental engineering and electrical support also needed for various aspects.
  - Paul R says engineering is available. Joe P has some time from ITA instrument side.
- RSO/RCT/RAF resources already captured elsewhere also make this possible. Its very difficult to evaluate improvements when we can barely maintain status quo.
- Material investment
  - Beam profile monitor instrumentation and readout
  - Sample box modifications/new box for Be7 contamination and active cooling
  - Possibly additional HEPA filters and/or chiller

# Other changes to consider