DUNE-PRISM Engineering Updates

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DUNE-PRISM Engineering Meeting
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Hilman Roller Control System

- On Wednesday, we had a conference call with Hilman control system experts
  - On DUNE side, we included slow control experts: Xavier Pons (CERN), Aflons Weber (Oxford), Asher Kaboth (RHUL)
- Hilman delivers the skates and control boards, and programs the boards to perform detailed movement patterns
  - They can make any necessary variables available to us
  - Standard “trapezoidal” velocity pattern is possible
    - Can also specify the jerk (time derivative of acceleration), or “s-curve” variables, to round the edges of the trapezoid
  - “Arbitrary precision” is possible acceleration, velocity, jerk values
  - All costs captured in current cost estimates?
- We just need to connect with an ethernet cable and use modbus-tcp protocol
  - Alfons found libraries online, and said this should be easy to integrate with any slow control system
- The rollers can keep track of distance traveled internally, and an additional absolute position measurement system can be included
  - The additional position measurement system can provide dynamic feedback to the rollers

Prototype System

- We need to decide on what is needed for a prototype system
  - Most items used in the prototype can, in principle, be reused in the main system
- Need to test smoothness of acceleration, deceleration, constant velocity phases
  - Probably ~10 m of total travel distance required
  - Instrument with accelerometers (motion & vibration measurements)
  - Test different stopping scenarios: gradual, “soft” quick stop, & emergency stop (partly depends on safety requirements)
    - Could also prototype automatic stop sensors (e.g. laser curtain)
  - We would plan to iterate with Hilman on control system programming
- Main question: how many skates are needed for the prototype?
  - With 4 skates, we can add a platform and test transporting large volumes of liquid (e.g. water)
  - With 1 skate, we could study some motion parameters, but probably without a significant load

Requirements Next Steps

- We have added a requirement that we must be able to change directions 60 times per year
  - Puts constraints on flexible cryogenic hoses; can they last full project lifetime, or will they need to be periodically serviced?
- For requirements, need to consider:
  - What can be easily defended in a review (i.e. what is really needed) vs what we would really like the system to achieve (goals)
  - Different requirements for years 1-3 vs longer term?
  - Once we are satisfied with our list, pass to NDDG to propose in the DUNE executive board
- Timescale is the end of May