

Technical Coordination, and Towards a CDR

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PIONEER Collaboration Meeting

CENPA/UW

Next Collaboration Meeting

January 7-9, 2025

TRIUMF

Vancouver, BC, Canada

Host: Chloe Malbrunot

What Does PIONEER Need to Do

In the broadest possible terms

- Convince agencies to provide seed funding
- Do R&D with this funding to develop and optimize these approaches
- Identify critical sector tests to establish performance
- Convince agencies to provide construction funding
- Fabricate, assemble and deploy the detector and beamline

Assume that operation/analysis funding will accompany construction funding

➔ CDR/TDR process



CDR/TDR Timeline

Conceptual Design Report (soon? Q1 2025?)

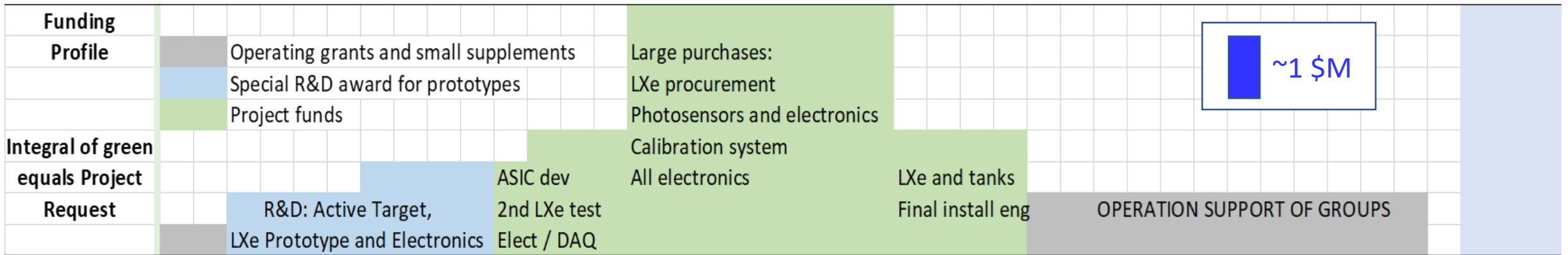
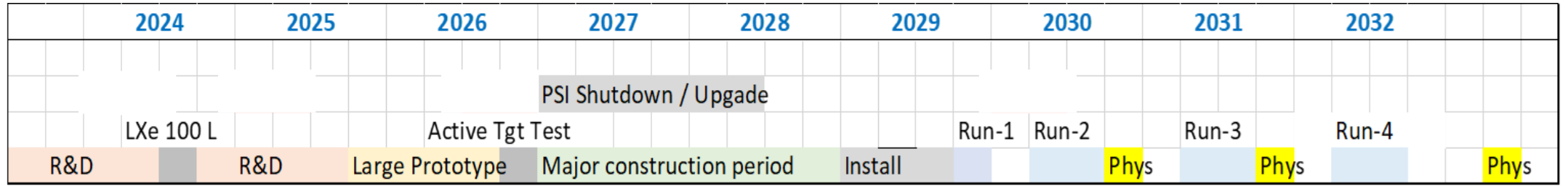
- Physics case and experimental strategy
- R&D roadmap, including sector tests
- To inspire seed funding from regions

**~1 year of
R&D after
CDR!**

Technical Design Report (T minus 2-3 years? Q3-Q1 2026-27)

- Engineering design
- No or limited alternatives
- To justify full funding of PIONEER 1.0

Timeline and budget: 2023 version; coarse view



Important dates impacting timeline

- July 2024: Will learn about UBC prelim; will learn about UCSC/Cornell R&D grant; will learn about Cornell base grant (encouraging)
- Early fall 2024: CENPA base grant submission. This is significant because g-2 will not “drive” the support of the Muon Group within the grant. The KY group will submit to NSF.
- Dec 2024: CFI grant goes in as a full document if step 1 is successful.
- Jan 2025: PSI report must be clear, with CDR level descriptions of how the experiment will perform and hardware choices made
- July 2025: UCSC base grant submission

What is CDR all about?

- Establish compelling Physics case
 - $e\nu_e$
 - $\pi^0 e\nu_e$
 - $a e\nu_e$
 - $l\nu_l\gamma$
 - ... ?
- Lay out detection strategy, including alternatives
- Establish plausibility, with clearly identified risks
- Establish R&D path to address risks
- Lay out performance demonstration milestones and timelines
- Provide cost estimates

What is the Purpose of the CDR

- No one has asked us for this document
- PSI has asked for a Progress Report in January, but this would be much deeper and more comprehensive
- The reasons for this are to
 - Provide a document we can use to inspire funding and draw in new collaborators
 - The exercise will force us to step back and identify risks, to focus our R&D, and identify and mend gaps in our thinking

Given the timeline and status of our effort, I believe this is a very important exercise for us

Straw CDR Outline

Introduction

- Statement of Physics opportunities
 - Rare pion spectrometer
 - Universal technology (5D tracking)
- Status of prior experimentation
- Summary of main needs and outline of strategies
 - PSI / beam
 - Detector
- Timelines
- Content and structure of the collaboration

Basic Design Concept

- Beam
- ATAR
- Calo
 - LYSO
 - LXe
- DTAR/Tracker
- Trigger strategies
- DAQ

Physics Reach

- Sensitivity studies
 - $e\nu_e$
 - $\pi^0 e\nu_e$
 - $a e\nu_e$
 - $l\nu_l \gamma$

Identified Risks

- Summary of identified risks
- Associated R&D plan
- Plans and goals for PIONEER 0.5

Costs

- R&D towards TDR
- Envelope for full experiment (?)
 - Engineering studies
 - Construction
 - Collaboration costs (travel etc.)
 - Operation costs
 - Personnel costs (students etc.)

Summary and Outlook

Personal Slide: Technical Coordinator Role

Can be significantly more active now. Possibilities include

- Detector/Analysis “Whip”
 - Push collaboration towards consensus paths when possible
 - Oversee their implementation
- Village Skeptic
 - Step back and anticipate questions from agencies looking for an excuse not to fund us
 - Invite and curate others’ skepticism
 - “Show me” gadfly (e.g. have we thought hard enough about reducing the tail fraction?)
- Regular meetings of Technical Board (how often?)
 - Tentatively: Hertzog, Schumm, Mihara, Mazza, Gibbons, Buat, Kammel, Bryman, Soter
- Individual meetings with sub-area leaders (depending on need)
 - Help identify and strategize about risks
 - Identify areas where support is needed
 - Oversee work towards CDR

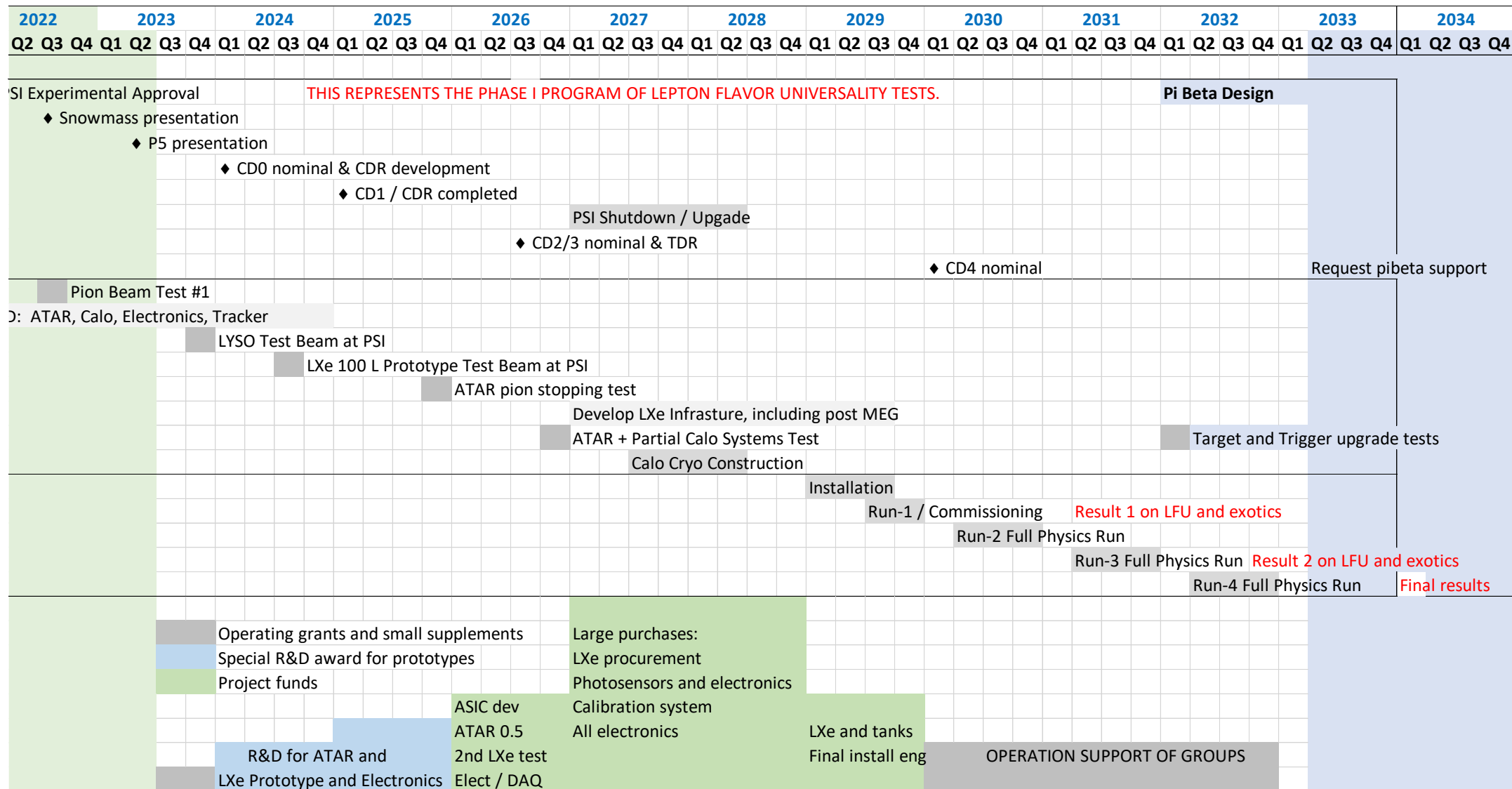
Other Thoughts

- What can we work towards consensus on now?
 - DAQ protocols (Apollo, PCE vs. Ethernet, ...)
 - Simulation baseline (maybe with alternatives for Calo, beam)
 - ???
- ATAR region getting very busy
 - Could use engineering drawing of 2-3 alternatives
 - Will almost certainly be needed for CDR
- Need to discuss well-defined simulation goals for the CDR
 - Feedback to detector groups best if by end of summer

Backup



Detailed Notional timeline & funding profile: 2023 version



U.S. and International approximate Scope division

- Active Target development and readout electronics (US)
- Calorimeter digital electronics (US)
- Trigger and DAQ (UK groups?)
- Calibration system for calorimeter (Italy?)
- Tracker system (US + TBD)
- Custom beamline elements (Switzerland)
- Calorimeter procurement (Canada, Japan, Switzerland, China?)
- Calorimeter photosensors, cabling, and power supplies (TBD)
- Beamline detectors and LH₂ charge-exchange calibration infrastructure (PSI, Italy)
- Local installation support at PSI
- Data storage at PSI