

Project Management

Jonathan Paley

Cost and Schedule Review

January 22, 2021



Institutions















































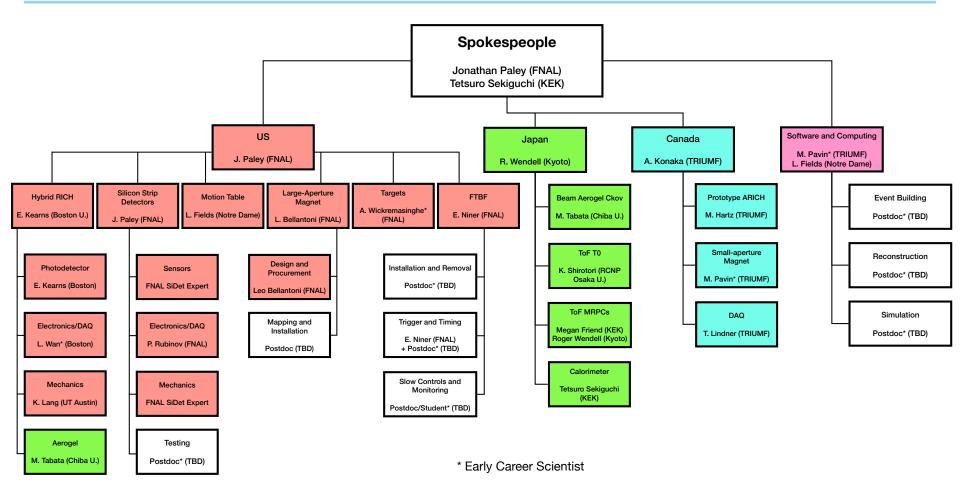




- 9 postdocs (6 from US institutions), 5 students so far.
- Cincinnati, Notre Dame, Boston and UT Austin all joined within the past 18 months.
- We continue to grow: Houston and IIT Hyderabad (India) have expressed interest in joining.



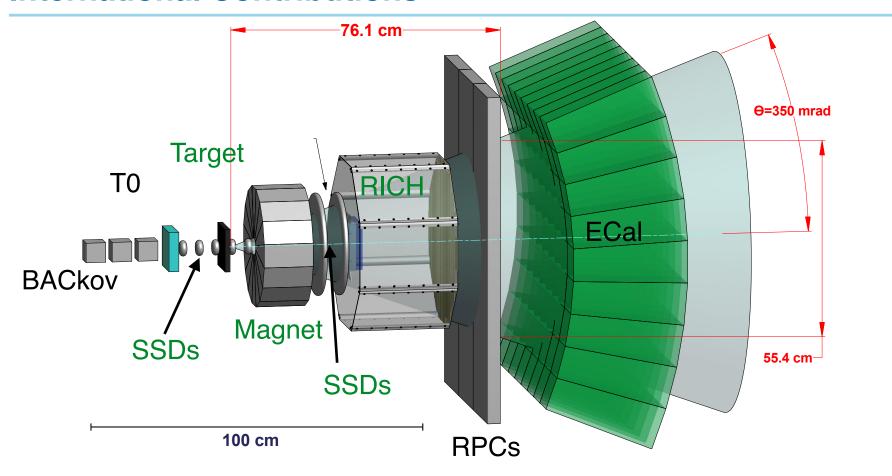
Collaboration and Project Structure



- Postdocs playing many important roles for the Project; will continue playing a critical part in the data collection and analysis.
- Many opportunities for students to work closely with scientists and engineers.



International Contributions



- International partners already committed to funding critical contributions:
 - Canadian contributions (small acceptance magnet and RICH) are already available.
 - Japanese contributions for Phases 1 and 2 will be available by August.
- US contributions are needed to execute Phases 2-4.

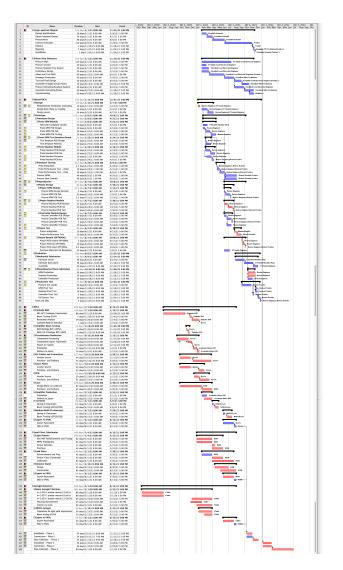


International Contributions - Impact on Schedule

- Canadian and Japanese institutions have funding to actively participate in EMPHATIC through 2022.
- Japanese funding could get extended through 2023.
- Canadian funding for hardware contributions for EMPHATIC Phase 1 has already been spent
 - Canadian institutions are particularly eager to see Phase 1 happen this year, which will have been a 1.5 year delay.
 - The groups will begin to move on to other experiments and tasks in 2022 and may lose key personnel by the end of 2021.
- The Project schedule is designed to achieve our physics goals for Phases 1 and 2 before summer of 2023.
 - Flexibility: Phase 1 can be done with either the FTBF SSDs or new SSDs from this Project.
 - FTBF SSDs: experiment is constrained to MT6.1a with tight schedule constraints for the run.
 - New SSDs: experiment can move to MT6.2d with open schedule
 - Schedule float: We have built in several extra months for Phase 2 detector commissioning.
- Nevertheless, funding is needed ASAP in order to achieve the goals above.



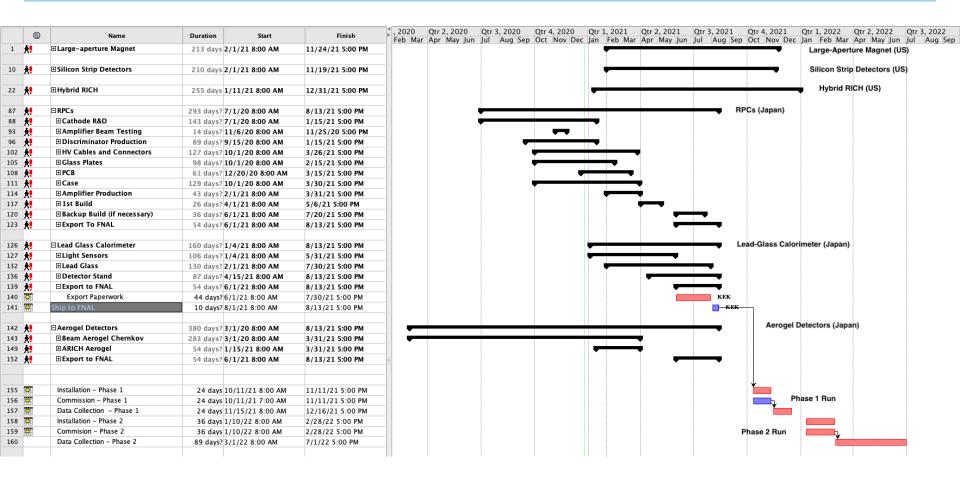
Resource-loaded Schedule



- A resource-loaded schedule is maintained by Paley using ProjectLibre.
- To the left is an exploded view of a snapshot of the current schedule —don't try to read this!
- The schedule is a living document, and will be modified when necessary.
- Costs are not yet full associated with all tasks this will be done soon.



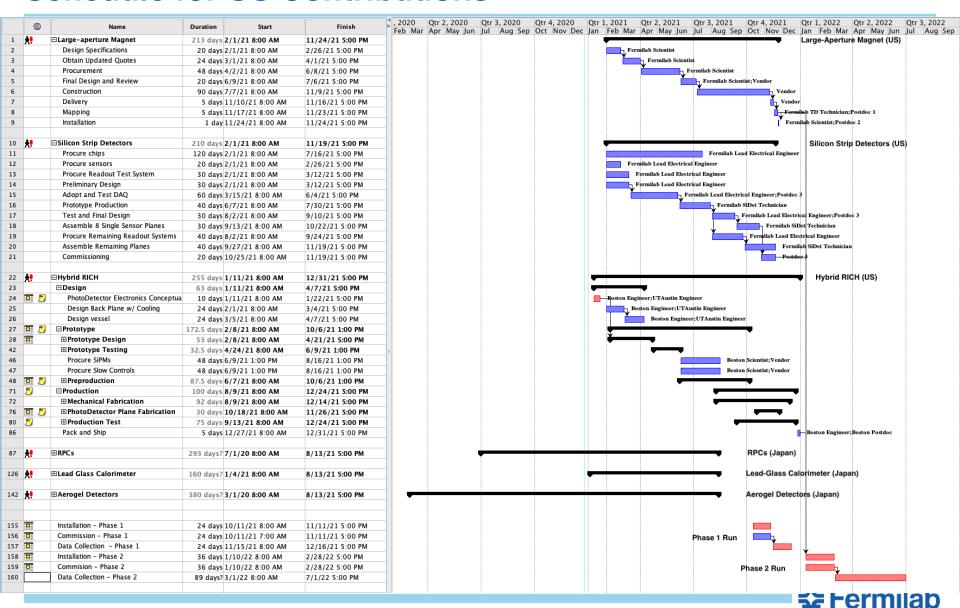
Schedule for Japanese Contributions



- Small-acceptance detectors were already available in March 2020 for original Phase 1.
- Detectors arriving later in summer 2021 are large-acceptance and some have improvements.



Schedule for US Contributions



Schedule for US Contributions

	(A)	Name	Duration	Start	Finish		Qtr 2, 20						Qtr 3, 2021			Qtr 2, 2022	
	•	rvame	Duration	Start	riidsn	Feb Mar	Apr May	Jun Jul	l Aug Sep	Oct Nov Dec	Jan Feb Mar	Apr May Jun	Jul Aug Sep	Oct Nov Dec	Jan Feb Mar	Apr May Jun	Jul Aug Sep
155	•	Installation - Phase 1	24 days	10/11/21 8:00 AM	11/11/21 5:00 PM												
156	o i	Commission - Phase 1	24 days	10/11/21 7:00 AM	11/11/21 5:00 PM								Phase 1 Run	t			
157	o	Data Collection - Phase 1	24 days	11/15/21 8:00 AM	12/16/21 5:00 PM										1		
158	Ö	Installation - Phase 2	36 days	1/10/22 8:00 AM	2/28/22 5:00 PM												
159	o i	Commision - Phase 2	36 days	1/10/22 8:00 AM	2/28/22 5:00 PM									Phase 2 Run			
160		Data Collection - Phase 2	89 days?	3/1/22 8:00 AM	7/1/22 5:00 PM												

- Ideally we want complete data collection for Phase 1 before the end of CY 2021.
- Beam typically returns to FTBF around early- to mid-November.
- · A few weeks of running should be ample time for Phase 1
 - In 2018 we collected ~20M triggers in ~7 days, running at a max. trigger rate of approximately 2.5kHz. Statistical uncertainty of the measurement was ~10%.
 - The rate was limited due to the CAMAC readout electronics provided by the FTBF.
 - A significant fraction of data was unanalyzable because of synchronization issues between the SSD DAQ and CAMAC readout used for all other detectors
 - We expect to be able to operate at ~30kHz, and there should be no synchronization issues since all data will be timestamped.
- Desire is to complete data collection for Phase 2 before the 2022 summer accelerator shutdown.
 - Want to collect data while international collaborators can participate
 - Schedule contingency: we believe we can collect all data for Phase 2 in a month of running. If schedule for any of the US contributions slips, we have several months of float.



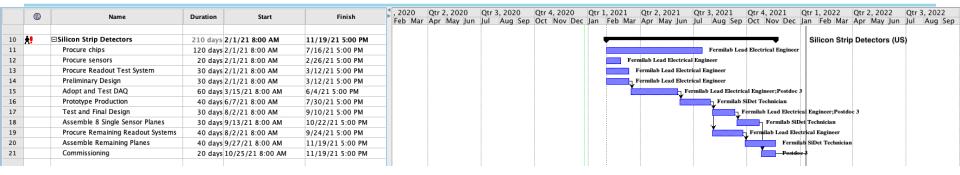
Cost and Schedule for Magnet



- Cost of magnet (\$106k) is driven by engineering and assembly on the vendor's side.
- Milestones:
 - Quotes are now out-of-date, will need to obtain new ones. Vendors did not indicate any significant changes are expected.
 - This is large expense for a single item; procurement process at Fermilab could take up to 2 months, resulting in a contract with a vendor.
 - Once a contract is in place, will work with vendor to **finalize design**.
 - Allowing 4.5 months for construction and shipping of the magnet.
 - Mapping of the magnetic field by Fermilab TD and installation at FTBF should take less than 1 week.
- Hazard analysis and safety protocols are currently not in the schedule; much of this can be done during construction and should have a limited impact on the installation schedule.



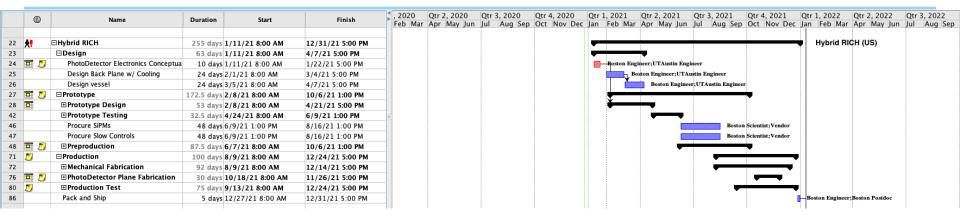
Cost and Schedule for SSDs



- Cost (\$375k) is driven by M&S, however engineering and assembly labor are significant.
- Milestones:
 - Procurement of all components.
 - Preliminary design by Fermilab electrical and mechanical engineers.
 - Adopt AliVATA software and Test DAQ.
 - Produce and test prototype.
 - Final design based on feedback from prototype tests.
 - Assemble single-sensor planes for Phase 1.
 - Assemble remaining large-area planes.
 - Commissioning.
- Relies on significant scientific effort, in particular for testing and DAQ development.



Cost and Schedule for RICH

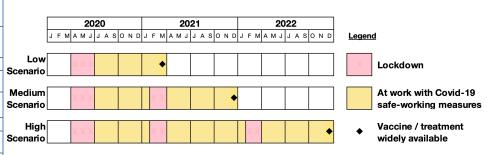


- Cost (\$381k) is driven by M&S, however engineering labor are significant.
- Major milestones:
 - Design of the photodetector and electronics plane, integrated with mechanical support and vessel.
 - Prototype: design, testing and feedback to preproduction design.
 - Procurement of all components
 - Final production.
- Minor milestones defined within each major milestone.
- · Relies on significant scientific effort, in particular for testing and DAQ development.



COVID Risks

Low impact scenario (optimistic, best case)	Medium impact scenario (realistic, best guess)	High impact scenario (pessimistic, worst case)
Authorities respond effectively, build up medical capabilities, and support the economy.	Authorities responses are only somewhat effective.	Authorities are ineffective, fail to build up medical capabilities, and fail to support the economy.
Preventative measures (e.g. physical distancing) effectively prevent major resurgences.	Preventative measures are moderately effective, but one resurgence occurs.	Preventative measures are not effective, and two resurgences occur.
One lockdown is sufficient.	Two lockdowns are needed.	Three lockdowns are needed.
Virus does not mutate (much).	Virus mutations are moderate.	Virus mutates to be significantly more contagious or deadly.
A treatment or vaccine is available in early 2021.	A treatment or vaccine is available at the end of 2021.	A treatment or vaccine is not available before the end of 2022.
Low number of deaths.	Moderate number of deaths.	High number of deaths.
Jobs losses are moderate, and economy recovers quickly.	Significant job losses and economic recession.	Numerous job losses and economic depression.
No major secondary risks occur.	Secondary risks are moderate.	Major secondary risks, e.g. social unrest or international disputes.



- Fermilab has produced a document "Covid-19 Scenarios for Fermilab Projects" (PPP-doc-2104).
- This Project follows the "Medium impact scenario" (best-guess at this time).
- We therefore assume that critical experts will be able to work at Fermilab under Covid-19 safeworking measures.
- We follow the Lab's medium risk scenario. If high-risk scenario occurs, we will have a schedule delay, but no standing army costs to the *Project*. Collaboration has concerns how this will impact early-career scientists.



Summary

- EMPHATIC is widely recognized as a very useful experiment within the Neutrino community evidenced by the active participation of a large number of people within the community and the growth of the collaboration over the past 18 months.
- Many opportunities for early-career scientists for hardware and leadership experience.
- EMPHATIC is an international collaboration with significant in-kind contributions already or soon-to-be in-hand.
- Funding is needed ASAP in order to begin the critical design and testing work for the SSDs and RICH.
- Project schedule is aggressive, and there is risk that durations of testing components will take longer than anticipated, or that Covid will cause further delays.
 - We have built in several months of float in the schedule through Phase 2 to compensate for this possibility.
 - Funding for additional single-sensor detectors will significantly reduce schedule concerns, since we will be able to move into an unoccupied space at MTest.
- Project costs have been reviewed, and we feel confident in our budget.

