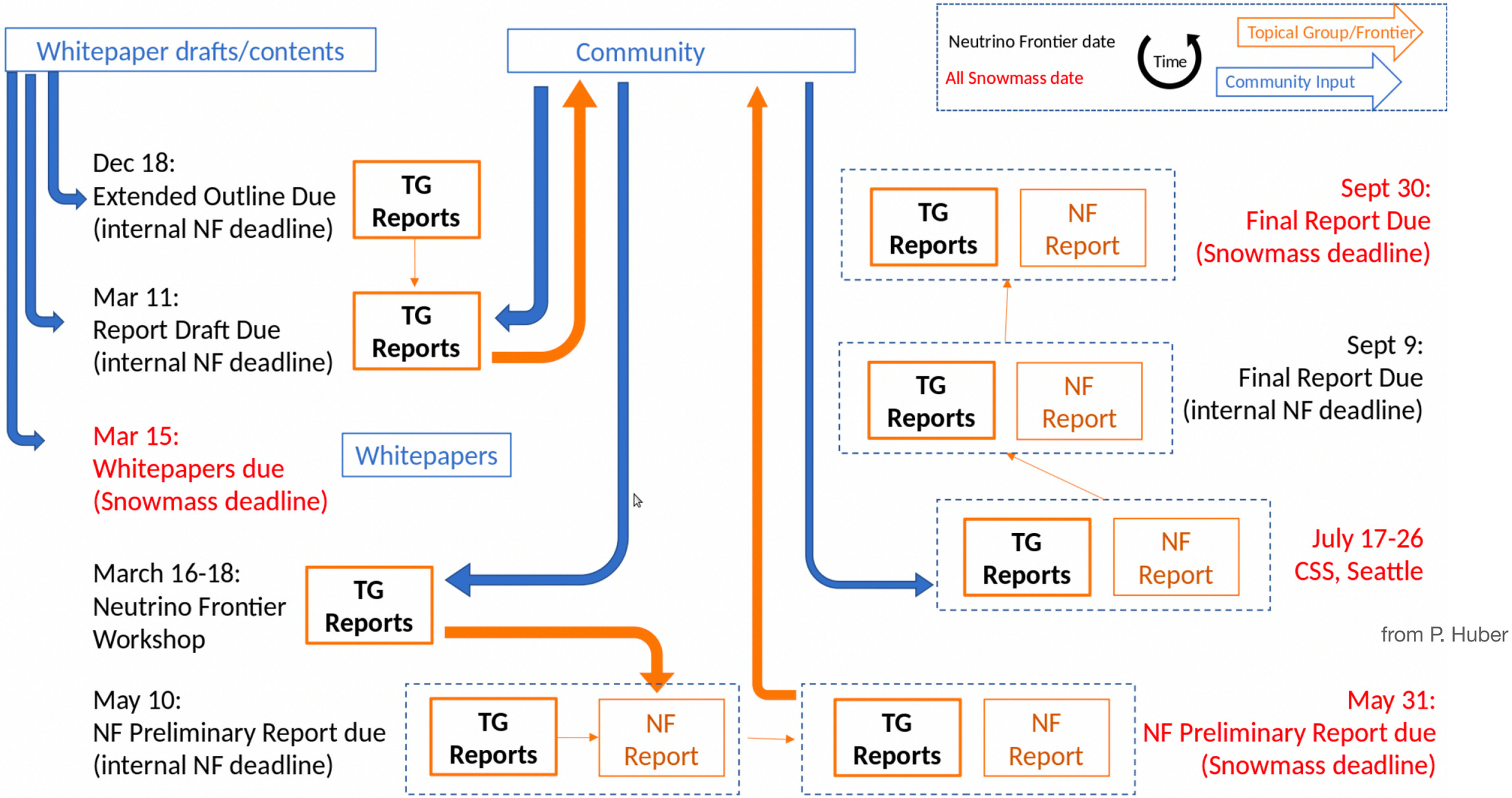
Updates on R&D
Snowmass documents
and comments on FLARE configuration

Milind Diwan 2/17/2022

Meetings

- https://indico.cern.ch/category/14011/ our notes
- Last meeting notes: Feb 3, 2022
- 4th FPF workshop
  - https://indico.cern.ch/event/1076733/ (FPF workshop)
- Feb 17 - today.
- March 3, Next meeting .
- March 15 - Snowmass documents to be finalized. March 16-18 NF workshop ?
  - Also look at NF2, NF10, NF8 meeting notes. https://indico.fnal.gov/event/52455/
  - NF2 - Neutrino anomalies - Needed input before Feb 11.
  - NF8 - Neutrino theory - “expect to include some discussion of FPF-related topics the “high-energy colliders” subsection”
    - NF10 - neutrino detectors - “happy to have something we could include.” Currently do not have anything much on FPF detectors.



from P. Huber

Notice: Neutrino Frontier workshop March 16-18. There should be a talk at this workshop on FPF and FLARE.

Various documents and status

Organizations: Snowmass, CERN, FPF

Document	Editors	Date due	Status
FPF Short paper.	Felix Kling, Jonathan Feng, Maria V. Garzelli	Sep 22, 2021	2109.10905
FPF Long paper	Jonathan Feng, Felix Kling, Rojo, Reno, Soldin	300 pages/200 authors	8 pages provided on FLARE. Editing in progress
Tau neutrino paper for Snowmass	Denton, Aurisano, Bishai, et al.	Draft on Feb 21	Have provided input on FLARE to Albert
Snowmass NF9	Fields, Marino, Ochoa, Spitz	Don;t know	Artificial Neutrino Sources
Snowmass NF10	Klein, Machado, Schmitz, Strauss	Provide input now	Neutrino Detectors (also IF6)
NF2 (BSM neutrinos)	Sousa, Machado ?	Feb 21, 28	Provide input ?
CERN: CDR	Need to assign someone soon	November 2022	Need to get organized
Other papers	We need to create a bibliography that is out of this effort.		

Funding proposals

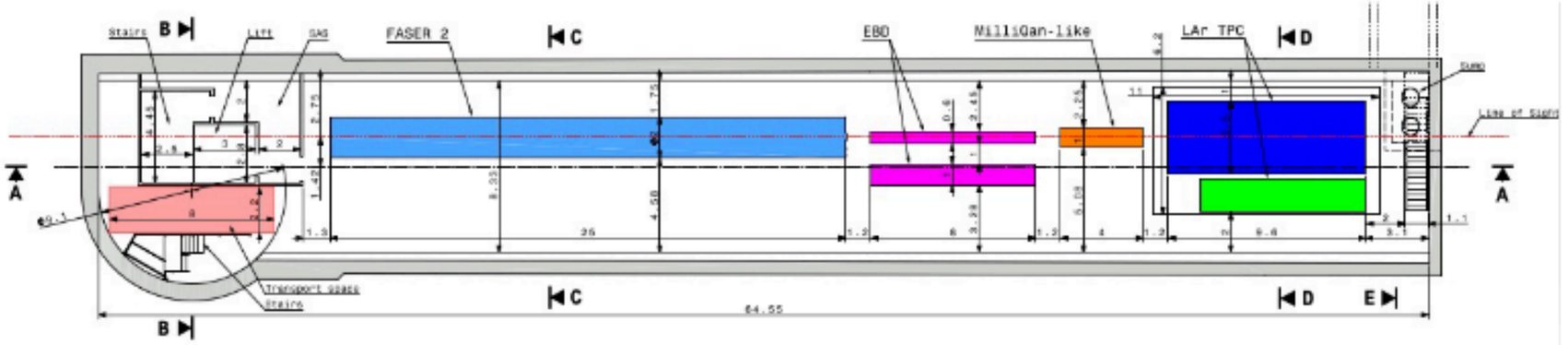
- Laboratory Directed Research and Development proposal at BNL to be put together by Feb 28 for nuclear and particle physics. Presentation on March 1. - MVD will need to focus on this. https://www.bnl.gov/ldrd/
    - “the primary purposes of Type B LDRD funding are to seed new research areas and competencies at the Lab, both of these will be important considerations during the selection process.” High risk is preferred.
    - Proposal will be focused on scientific development. Limited to <$200k/yr for 2 years. Starts Oct 1. 22.
- Joint BNL-Stony Brook seed grant proposal is due April 15. MVD will put attention on this after LDRD.
- If you can identify other opportunities please let me know if we can help.

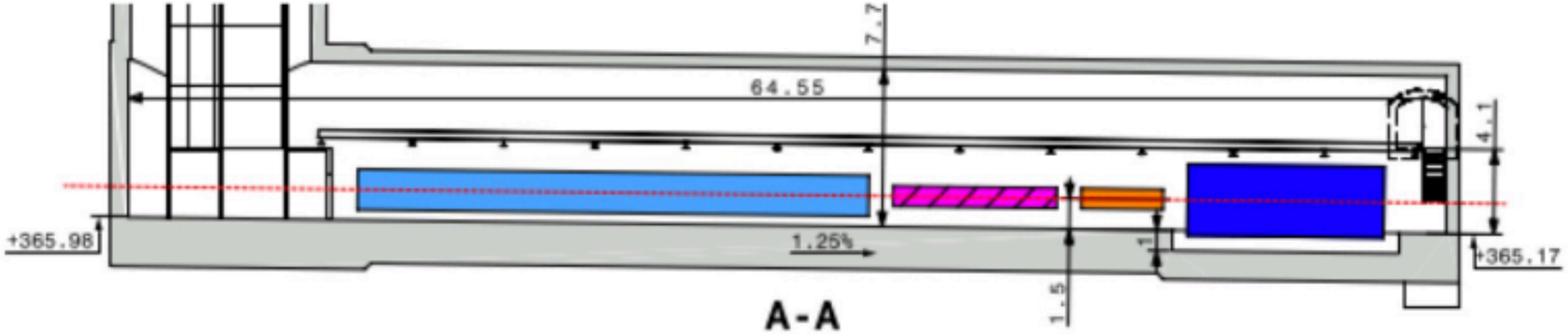
Important Technical issues before CDR.

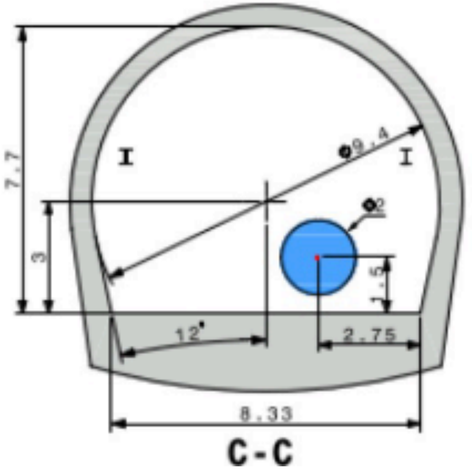
- *Need to have a confident Monte Carlo simulation of underlying events for neutrinos beyond 1 TeV.*
- *Need to have detailed muon rates at the FPF after sweeping magnet.*
- *For a Flare fiducial volume of 10 tons, a detector of much larger size is needed.*
  - *Allocated space appears to be 3.5m x 3.5 m x 9.6 m with includes the cryostat.*
  - *Need to understand space requirements and event containment.*
- *Need hadron and muon measurement behind detector.*
- *Space charge. Both LAr and LKr subject to beam muons, And large radioactivity in LKr. Need to evaluate space charge effect.*
- *Need to understand photon readout and trigger by simulation*
- *TPC readout with pixels or hybrid. With high resolution in the core of the detector ?*

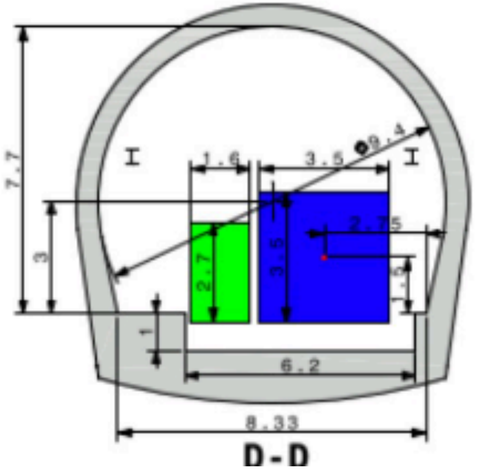
New Facility:

65m long, 8m wide/high cavern
Connected to surface through
88m high shaft (9.1m diameter):
612m from IP1.

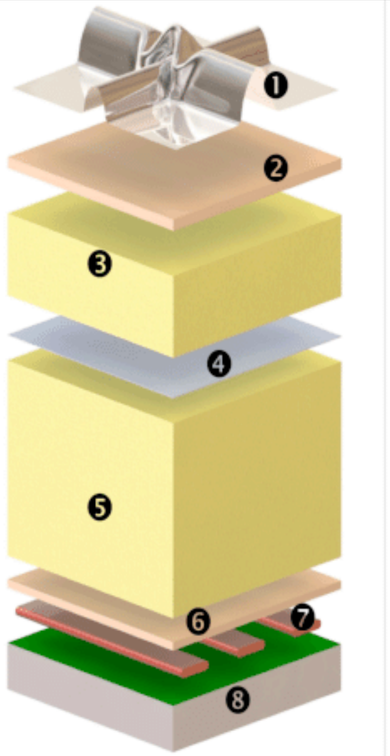








K. Balazs, J. Osborn
CERN SCE



1. Stainless steel primary membrane
2. Plywood board
3. Reinforced polyurethane foam
4. Secondary barrier
5. Reinforced polyurethane foam
6. Plywood board
7. Bearing mastic
8. Steel structure with moisture barrier

ProtoDUNE parameters are

- The inner dimensions are 7900 mm high × 8548 mm length × 8548 mm wide. This corresponds to a total volume of ∼580 m^3.
- Tank liquid capacity (assuming a ∼4% ullage): ∼ 557 m^3
- Residual Heat Input (RHI): 5-6 W/m^2
- Insulation weight: 90 kg/m^3
- Insulation thickness (all included): 0.8 m
- Design pressure: Max 1350 mBar / Min 950 mBar. The 1350 mBar is for an accident condition during the cryogenics operation.
- Operating temperature: 86K-89 K

We are assuming we can go down to 0,5 m thickness

We would lose 1.6 meters in the width and height of the detector with this technology. Vacuum cryostat would lose much less. If space is at a premium need to think about how to install a vacuum cryostat underground.

Charge deposition

With help from Sandro Palestini.

	LAr	LKr	Units
Radioactivity charge	$2*10^{-6}$	0.7	pC/cm3/sec
Muon charge	~0.011	~0.02	pC/cm^3/sec
ICARUS/ cosmics	10^{-4}	—	pC/cm^3/sec

Assume 500 bq/cm3 for LKr
0.001 bg/cm3 for LAr

1 muon/cm^2/sec
Assume detector of 1 m^2X 7 meter
Muon sweeper is essential

This already causes small effects with drift distance of 1.5 m

Questions: low activity krypton ? Smaller gap ? Higher voltage ?