Project development status. Engineering team and configuration discussion

Sep 5, 2023 Milind Diwan

Current priority at CERN is to make a decision on the experimental program for the ECN3 (north area).

And any project funds for CE for FPF can only be available after LS3.

Reminder from FPF6

- We -the steering committee- have started some higher level discussions
- PBC can/will sign off after:
  - We conclude on some some outstanding issues on isses on the facility update the document CERN-PBC-Notes-2023-002
  - “Demonstrate the experiments can well mutually fit in the available space”
- This would open the door to sent a LOI to the LHCC for review(*) by end 2023/or beginning 2024
- The LHCC wil then determine the next steps

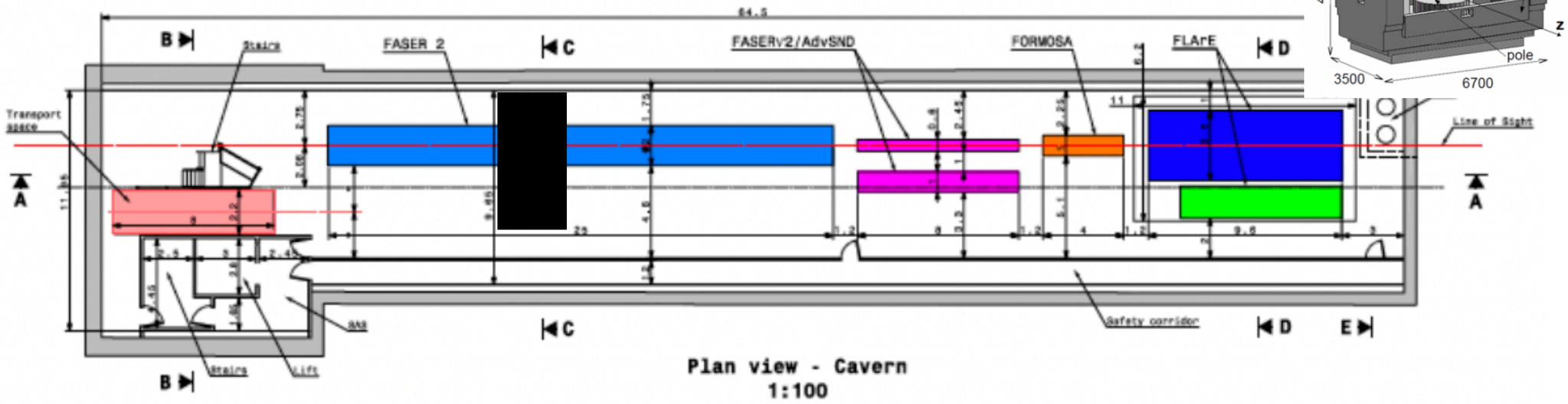
(*) …if no veto from CERN top management…

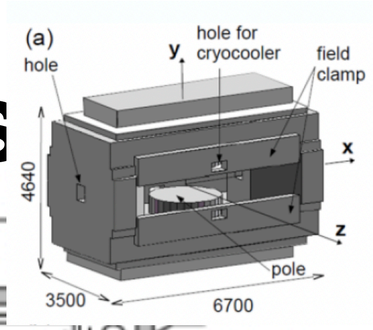
Technical team for FLARE and coordination

Very preliminary discussion have been held.
Engineers will contact each other and start on some figuration con discussions.

- Connor Miraval - BNL Project Engineer
- Larry Bartoszek - Bartoszek engineering inc.
- Jan Boissevain - Bartoszek engineering inc.
- Franck Cadoux - U. Geneva (contact for muon tagger Baby-mind)
- Jean-Piere Corso - CERN (and associate engineer)
- Scientific contacts
  - Jamie Boyd (CERN), Gianluigi Arduini (CERN) (physics beyond colliders group), Yichen Li (BNL), Steven Linden (BNL), A. Bolotnikov (BNL), M. Diwan (BNL), Sergio Rescia (BNL), Bo Yu(BNL), Jianming Bian (UCI)
  - Alan Barr (Oxford), Hidetoshi Otono (Kyushu), Yasuhiro Makida (KEK), Naoyuki Sumi (KEK), — (coordination w.r.t FASER2 magnet)
  - Physics Simulations: Matteo Vicenzi (BNL postdoc), Wenjie Wu (UCI postdoc) , Student from Oxford U.?

Discussion of Configuration choices





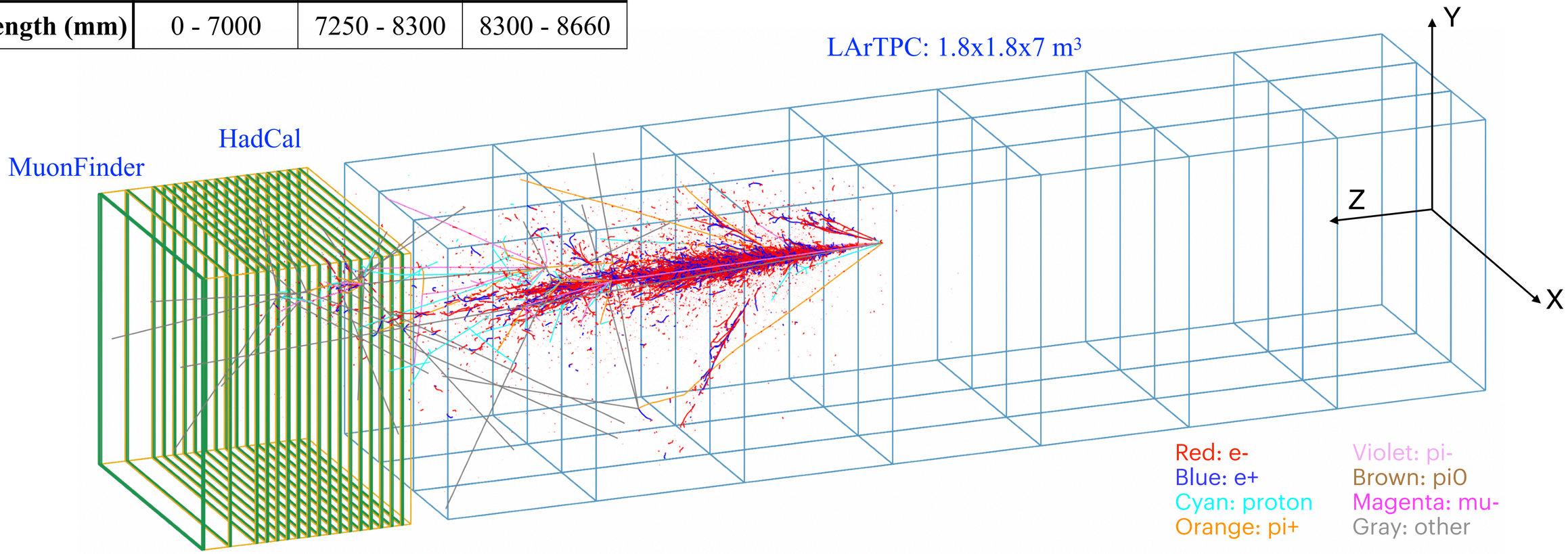
- Reference choice: Need to add a hadronic calorimeter and muon tagger to FLARE. Place a large (Samurai) dipole in FASER2.
- Option 1: Place FORMOSA at the end of FASER2. Use the space for a magnetized muon tagger for FLARE.
- Option 2: Move FLARE behind FASER2nu and eliminate FLARE magnetized muon tagger. Use FLARE as a tracker/tagger FASER2nu.
- Option 3: Use existing crystal pulling magnets as spectrometer magnets for FASER2.

- Two items need further examination by simulation: Spectrometer configuration with respect to FLARE, and confirmation of optimization of the geometry.

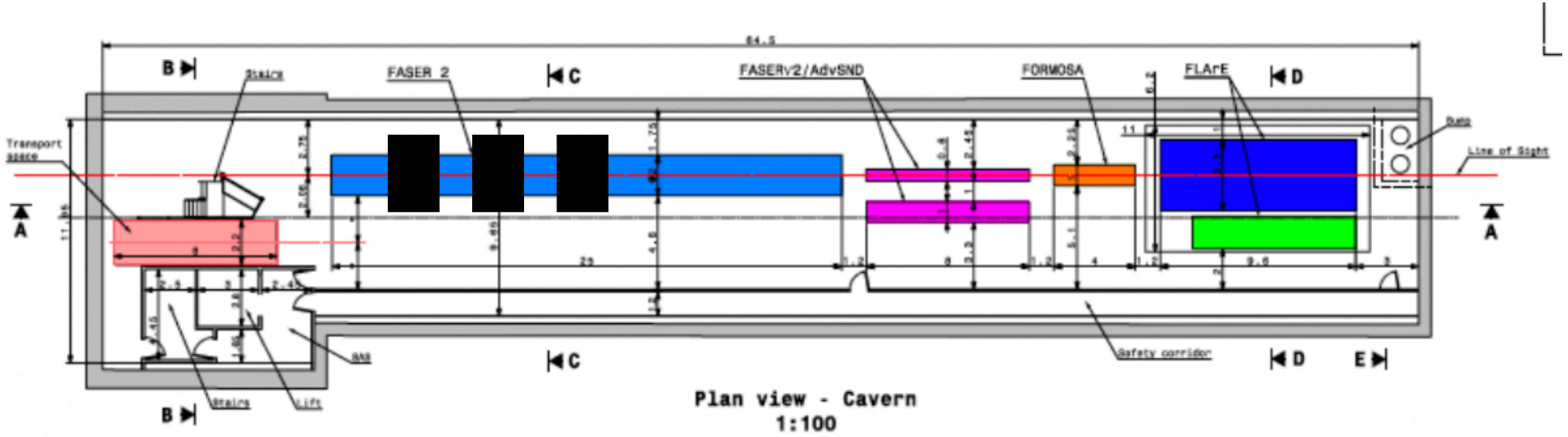
Detector configuration in simulation

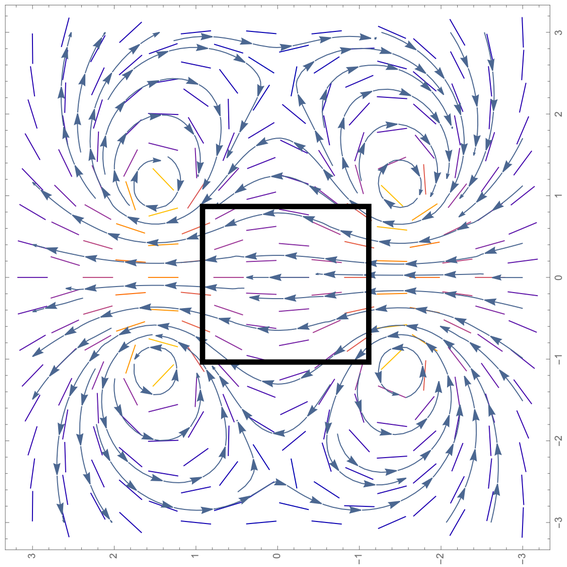
- Fiducial mass of 10 tons (1x1x7 m^3) is needed for good statistics and sensitivity to dark matter.
- Detector needs to have good energy containment and resolution for neutrino physics.
- Muon and electron ID. Very good spatial resolution (~1 mm) for tau neutrino detection.

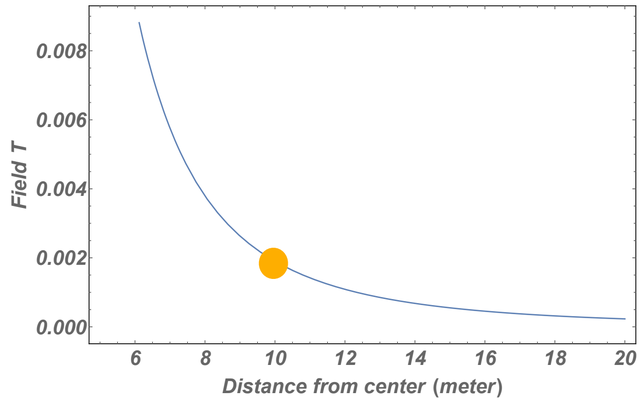
	LArTPC	HadCal	MuonFinder
Length (mm)	0 - 7000	7250 - 8300	8300 - 8660



Just use crystal puller magnets rotated by 90 deg.







2X2 m fiducial. Center field ~ 0.6 T

The bend plane may have to be vertical to support the coils.

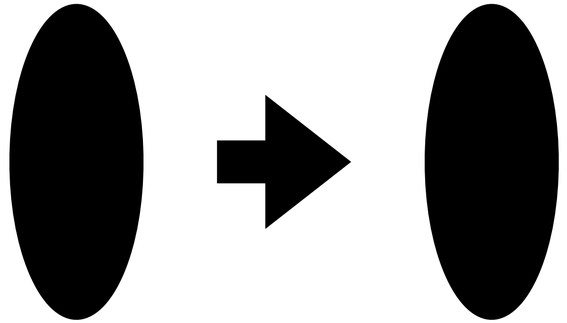
Field can be improved with addition of steel
Without shielding field at the LHC will be ~ 20 gauss.

Toshinobu Ito, Shohei Takami, Tomofumi Orisaka (senior scientist), Kiyokaku Sato (Senior Engineer), MVD, Yasuhiro Makida (KEK), Naoyuki Sumi (KEK)

Some more specs.

>1000 of such devices have been delivered

First at the center is ~ 0.5 T but field near the coils is 4 T.



- The magnets use saddle coils that are encased in extremely pure Al sheets. And they use Giffords/Mcmahon 2 stages coolers.
- The largest magnet was with 2.5 meters inside diameter. There is a water jacket inside to keep the heat of the ingot away from the cryostat.
- They also have magnets that are open on one side with flat coils. It is not trivial to design the magnets to be 90 deg oriented.