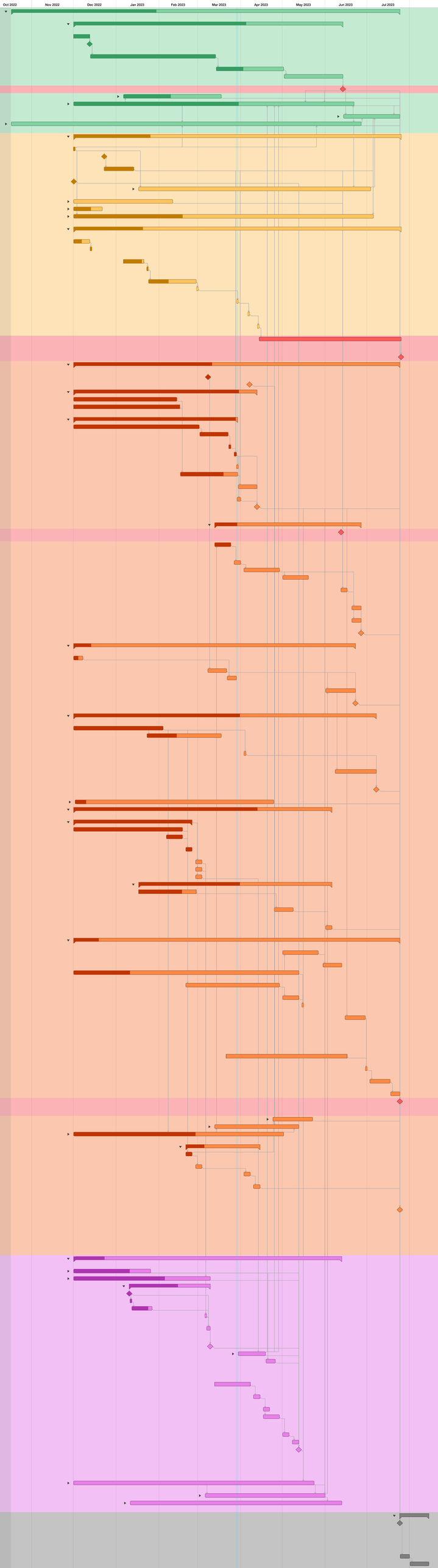Title	Prerequisites	Start	Duration	End
1) Electrical Infrastructure		10/17/22	191 d	7/24/23
1.1) AC Distribution Upgrade Work		12/1/22	131 d	6/13/23
1.1.1) Develop Description of Work		12/1/22	8d	12/12/22
1.1.2) Submit AC distribution upgrade work Description of Work	1.1.1	12/12/22		12/12/22
1.1.3) Iteration on DOW to SOW	1.1.2	12/13/22	58d	3/13/23
1.1.4) Bidding process & award contract	1.1.3	3/14/23	35d	5/1/23
1.1.5) AC distribution installation work by contractor with oversight by FNAL	1.1.4	5/2/23	30d	6/13/23
1.1.6) AC distribution upgrade work completed	1.1.5	6/13/23		6/13/23
1.2) DC Distribution		1/6/23	50d	3/17/23
1.3) Rack builds		12/1/22	136 d	6/21/23
1.4) Underground installation of racks		6/14/23	27d	7/24/23
1.5) Network upgrade work		10/17/22	172 d	6/26/23
2) Mechanical Infrastructure		12/1/22	159 d	7/25/23
2.1) Finalize rack locations		12/1/22	1d	12/1/22
2.2) Complete installation of MINERvA module sets		12/23/22		12/23/22
2.3) Installation of cryostat access platform (incl. gates & steps)	2.2	12/23/22	10d	1/13/23
2.4) Four-module lifting fixture ready for use		12/1/22		12/1/22
2.5) Cable trays		1/17/23	118 d	7/3/23
2.6) Condenser support structure		12/1/22	45d	2/10/23
2.7) Oil containment for HV filter box		12/1/22	15d	12/21/22
2.8) Purity Monitor		12/1/22	145 d	7/5/23
2.9) ODH fan upgrade work		12/1/22	159 d	7/25/23
2.9.1) Start ODH design work		12/1/22	8d	12/12/22
2.9.2) FESS coordination site visit	2.9.1	12/13/22	1d	12/13/22
2.9.3) 90% review set to sponsor		1/6/23	10d	1/20/23
2.9.4) Submit 100% code and comment review (CCR)	2.9.3	1/23/23	1d	1/23/23
2.9.5) CCR comments and updates	2.9.4	1/24/23	25d	2/27/23
2.9.6) Submit construction document to Procurement	2.9.5	2/28/23	1d	2/28/23
2.9.7) Pre-bid site visit with contractors	2.9.6+20d	3/29/23	1d	3/29/23
2.9.8) ODH fan upgrade bids due	2.9.7+5d	4/6/23	1d	4/6/23
2.9.9) ODH fan upgrade contract awarded	2.9.8+4d	4/13/23	1d	4/13/23
2.9.10) ODH fan upgrade work by contractors (negotiating w/FESS to get this finished in less than 70d)	2.9.9	4/14/23	70d	7/25/23
2.9.11) ODH fan upgrade complete	2.9.10	7/25/23		7/25/23
3) Cryogenic Systems		12/1/22	158 d	7/24/23
3.1) Receive Demaco system (except spool 23)		3/8/23		3/8/23
3.2) Receive Demaco spool 23		4/7/23		4/7/23
3.3) Internal cryogenics		12/1/22	88d	4/12/23
3.3.1) Procure piping & flex hoses		12/1/22	46d	2/13/23
3.3.2) Complete engineering design and prints for piping and stand		12/1/22	48d	2/15/23
3.3.3) Purity Monitor/Combined Feedthroughs		12/1/22	78d	3/29/23
3.3.3.1) Finalize design & create BOM, prints		12/1/22	58d	3/1/23
3.3.3.2) Procure combined feedthrough & PrM components	3.3.3.1	3/2/23	15d	3/22/23
3.3.3.3) Fabricate FTs in FNAL machine shop	3.3.3.2	3/23/23	2d	3/24/23
3.3.3.4) Pressure/leak testing of PrM/Combined FTs	2.3, 3.3.3.3	3/27/23	2d	3/28/23
3.3.3.5) Install PrM/Combined FTs	3.3.3.4	3/29/23	1d	3/29/23
3.3.4) Fabricate internal piping (1 bushing missing, Mike will give to them next week)	3.3.1, 3.3.2	2/16/23	30d	3/29/23
3.3.5) Bench test and install internal piping and pump in cryostat (1 mech tech + 1 welder)	2.3, 3.3.4	3/30/23	10d	4/12/23
3.3.6) Install conduit and wiring for combined FT	3.3.3.4	3/29/23	3d	3/31/23
3.3.7) Pump and internal piping installation completed	3.3.5, 3.3.3.4, 3.3.6	4/12/23		4/12/23
3.4) Condenser and VJ Transfer Lines		3/13/23	74d	6/26/23
3.4.1) Receive Cryomech reworked system and documentation		6/12/23		6/12/23
3.4.2) Design VJ transfer lines and generate BOM and machine shop prints (Gary will work on this after vent layout)	3.10.2	3/13/23	10d	3/24/23
3.4.3) Procure piping/tubing components	3.4.2	3/27/23	5d	3/31/23
3.4.4) Fabricate VJ transfer lines (drain & boil-off)	3.4.3	4/3/23	20d	4/28/23
3.4.5) Field fit transfer lines, construct pipe stands, etc.	3.4.4	5/1/23	15d	5/19/23
3.4.6) Install condenser on cryostat access platform	2.3, 2.6.4, 3.4.1	6/12/23	5d	6/16/23
3.4.7) Install & pressure/leak test of LAr drain transfer line	3.4.4, 3.4.6	6/20/23	5d	6/26/23
3.4.8) Install & pressure/leak test of boil-off line	3.4.4, 3.4.6	6/20/23	5d	6/26/23
3.4.9) Condenser system installation complete	3.4.7, 3.4.8	6/26/23		6/26/23
3.5) Install/interface with Demaco system		12/1/22	137 d	6/22/23
3.5.1) Purchase components for regen system at LArTF		12/1/22	5d	12/7/22
3.5.2) Install Demaco filter & lower transfer lines	3.1	3/8/23	10d	3/21/23
3.5.3) Regenerate Demaco filter	3.5.2, 3.5.1	3/22/23	5d	3/28/23
3.5.4) Install Demaco upper transfer lines	3.5.2, 4.14.9	6/1/23	15d	6/22/23
3.5.5) Demaco system installation complete	3.5.2, 3.5.4	6/22/23		6/22/23
3.6) Gas Analyzer System		12/1/22	147 d	7/7/23
3.6.1) Design distribution/sampling system		12/1/22	40d	2/3/23
3.6.2) Acquire valves (ordered but not delivered yet), hoses (have), tubing (PO exists...), fittings (need new Swagelok order), etc.	3.6.1-10d	1/23/23	40d	3/17/23
3.6.3) Move MicroBooNE gas analyzer rack and panel (need permission, and afternoon of Mike and helper's time (can be Jen))	3.6.1+40d	4/3/23	2d	4/4/23
3.6.4) Install analyzer system tubing, instruments, panel, etc. (2 techs + welder)	3.5.4SS +5d, 3.6.3	6/8/23	20d	7/7/23
3.6.5) Gas analyzer system complete	3.6.4, 3.6.3	7/7/23		7/7/23
3.7) Cryostat vacuum system		12/2/22	95d	4/24/23
3.8) Other feedthrough work		12/1/22	125 d	6/5/23
3.8.1) Design, build, install module purge valves		12/1/22	55d	2/24/23
3.8.1.1) Procure components for purge valves		12/1/22	50d	2/17/23
3.8.1.2) Design & review of purge valve drawings	3.8.1.1-10d	2/6/23	10d	2/17/23
3.8.1.3) Fabricate flanges w/purge valves	3.8.1.1, 3.8.1.2	2/20/23	5d	2/24/23
3.8.2) Add purge valves to Mod-1 FT	3.8.1	2/27/23	5d	3/3/23
3.8.3) Add purge valves to Mod-2 FT	3.8.1	2/27/23	5d	3/3/23
3.8.4) Add purge valves to Mod-3 FT	3.8.1	2/27/23	5d	3/3/23
3.8.5) Design/fabricate relief valves		1/17/23	99d	6/5/23
3.8.5.1) Procure parts for relief valves (missing a few valves) and flanges (level probe, etc) and fittings		1/17/23	30d	2/27/23
3.8.5.2) Fabricate module & condenser relief valves and flanges (FNAL machine shop + ND techs)	3.8.5.1+40d	4/25/23	10d	5/8/23
3.8.5.3) Install flange w/relief valves (ND techs)	4.14.9, 3.8.5.2	6/1/23	3d	6/5/23
3.9) Controls		12/1/22	158 d	7/24/23
3.9.1) Complete ODH design documentation	3.9.3SS +100d	5/1/23	20d	5/26/23
3.9.2) Design review of ODH controls	3.9.1	5/30/23	10d	6/12/23
3.9.3) Modify/expand existing controls rack		12/1/22	110 d	5/12/23
3.9.4) Complete cryo controls documentation	3.9.3SS +50d	2/20/23	50d	4/28/23
3.9.5) Design review of cryo controls system	3.9.4	5/1/23	10d	5/12/23
3.9.6) Move cryo controls rack underground	3.9.3, 3.9.5	5/15/23	1d	5/15/23
3.9.7) Field wiring to instruments (can start doing parts as each subsystem is completed, then one last thing at end)	3.3.7, 3.4.6SS +2d, 3.5.4SS +10d, 3.6.4SS, 3.7.5	6/15/23	10d	6/29/23
3.9.8) Procure & receive cryocooler power supplies		3/21/23	63d	6/16/23
3.9.9) Cryo controls ORC	3.9.7, 3.9.8	6/30/23	1d	6/30/23
3.9.10) Test PLC programming and HMI development	3.9.9	7/3/23	10d	7/17/23
3.9.11) Cryo controls checkout	3.9.10	7/18/23	5d	7/24/23
3.9.12) Controls system installation complete (this probably needs extra prereqs from cryo side — gas purge? etc? Ask MZ)	3.9.11	7/24/23		7/24/23
3.9.13) Instrument Air system		4/24/23	21d	5/22/23
3.9.14) LAr Fill Manifold		3/13/23	45d	5/12/23
3.10) Cryostat & misc venting and ODH (non-FESS)		12/1/22	101 d	5/1/23
3.11) Water cooling system		2/20/23	40d	4/14/23
3.11.1) Process design engineering	3.6.1+10d	2/20/23	5d	2/24/23
3.11.2) Walkthrough with Andy Scherf	3.11.1	2/27/23	5d	3/3/23
3.11.3) Procure OTS parts	3.11.2+20d	4/3/23	5d	4/7/23
3.11.4) Assemble chilled water system (ask MZ about this — can use existing water system underground? what is this for? cryocoolers?)	3.11.3	4/10/23	5d	4/14/23
3.12) Cryo system ready to fill	3.3.7, 3.4.9, 3.5.5, 3.6.5, 3.7.5, 3.8.5.3, 3.9.12, 3.9.13.4, 3.11.4	7/24/23		7/24/23
4) Modules		12/1/22	130 d	6/12/23
4.1) Module-0		12/1/22	33d	1/25/23
4.2) Module-1		12/1/22	64d	3/9/23
4.3) Module-2		1/10/23	42d	3/9/23
4.3.1) Receive Mod-2 at FNAL		1/10/23		1/10/23
4.3.2) pORC for Mod-2 power supplies and fans	4.3.1	1/11/23	1d	1/11/23
4.3.3) Mod-2 QC tests, including pulser, at LArTF	4.3.2	1/12/23	10d	1/26/23
4.3.4) Test RTDs and LEDs after purge valve installed	4.3.3, 3.8.3	3/6/23	1d	3/6/23
4.3.5) Mod-2 checklist sign-offs	4.3.3, 4.3.1, 4.3.4	3/7/23	3d	3/9/23
4.3.6) Mod-2 ready for installation	4.3.5	3/9/23		3/9/23
4.4) Module-3		3/30/23	14d	4/18/23
4.5) Install ponchos for water protection during transport	4.1.6, 4.2.7, 4.3.6, 4.4.3	4/19/23	5d	4/25/23
4.6) Design 4-module alignment & support structure (external designer: LBNL)		3/13/23	20d	4/7/23
4.7) FNAL engineer reviews design of 4-module alignment and support structure	4.6	4/10/23	5d	4/14/23
4.8) Build alignment and support structure (80/20)	4.7	4/17/23	5d	4/21/23
4.9) Design 4-module top plate support for seal surface preparation (potentially external designer?)	4.7	4/17/23	10d	4/28/23
4.10) Review alignment and support structure	4.9	5/1/23	5d	5/5/23
4.11) Build 80/20 alignment and support structure	4.10	5/8/23	5d	5/12/23
4.12) Four 2x2 modules ready for transfer underground	4.1.6, 2.4, 4.2.7, 4.3.6, 4.4.5, 4.5, 4.11	5/12/23		5/12/23
4.13) Module transfer to underground		12/1/22	117 d	5/23/23
4.14) Module installation in cryostat		3/6/23	62d	5/31/23
4.15) Underground 4-module testing in cryostat		1/11/23	107 d	6/12/23
5) Final Steps		7/24/23	15d	8/14/23
5.1) All pORCs completed, ready to fill with LAr	1.1.6, 1.2.6, 1.3.12, 1.4.4, 1.5.5, 3.12	7/24/23		7/24/23
5.2) Pump/purge (?) cryostat volume	5.1	7/25/23	5d	7/31/23
5.3) Fill cryostat with LAr	5.2	8/1/23	10d	8/14/23