DUNE installation plan and CALCI

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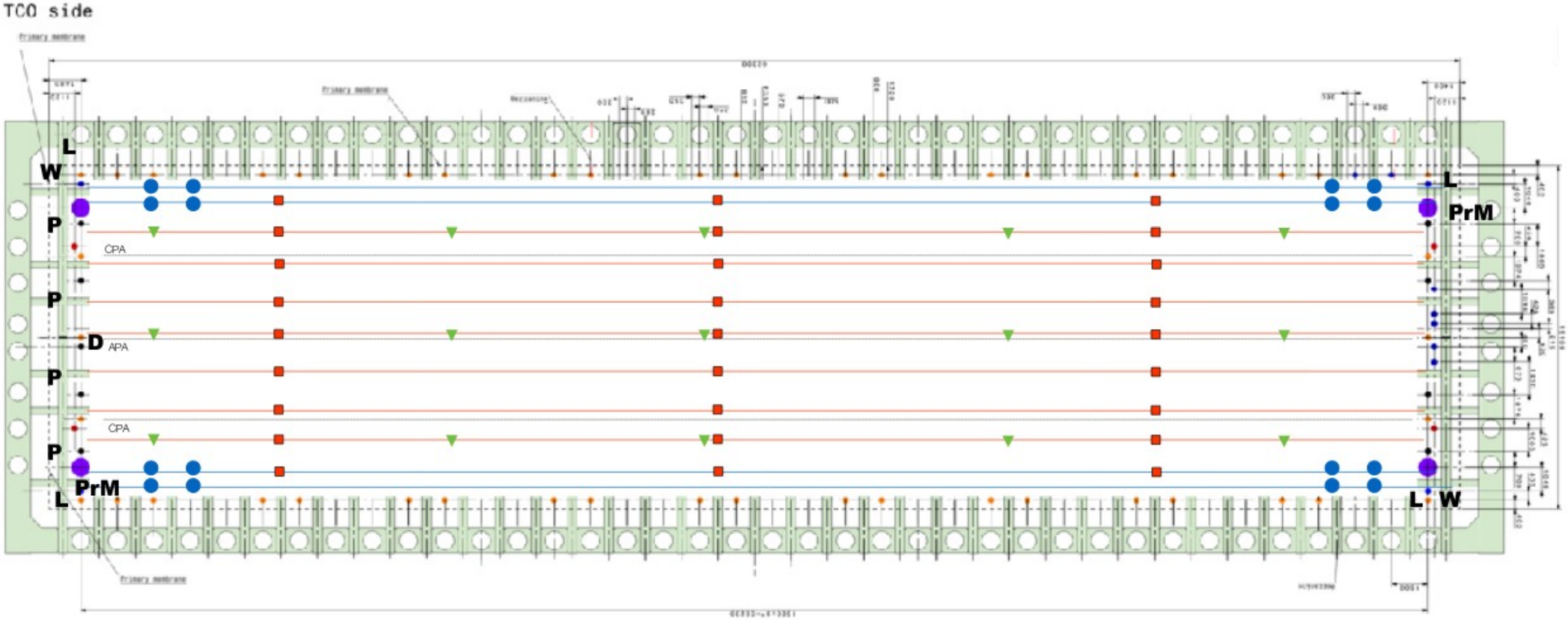
DUNE Installation Coordination meeting, 2020/02/19

All CI devices together (except cameras)



- Top/bottom (?) individual temperature sensors
- Floor individual temperature sensor (15 sensors in total)
- **W** Wall sensor array with 13 sensors, one every three corrugations (26 sensors in total)
- **D** Dynamic T-Gradient monitor
- **P** Sensors near LAr pumps (4 sensors)
- Sensors in LAr inlets (LAr return pipes, 16 sensors)
- **PrM** Vertical array of three purity monitors
- **L** Capacitive level meters
- Gas purge pipes
- Liquid argon return pipes

Anselmo

Tentative overview of the time-line for CI installation

				Start Det installation				
	Time Frame	**T0-12**	**T0-1**	**T0**	**T0+1**	**T0+10**	**TO+12**	**TO+15**
Consor		**DAQ instal lation**	**Installatio n setup**	**E-EW installation**	**APA+FC installation**	**FC Deployment and W-EW installation**	**TCO closing**	**Commissio ning**
CISC								
	Collaborators stationed onsite	2 (Slow Contr ols)	3 (**Gas analyzers**)	3 (**Gas analyzers**)	4 (**static T** and **T-sensors**) + 4 (**dynamic T**) + 1 (**cold cameras**)	4 (**static T** and **T-sensors**) + 2 (**PurMon**) + 1 (**dynamic T**)	0	3 (**warm cameras**) + 1 (**pressure level meters**)
	Collaborators working full time on the Surface	0	0	0	0	0	0	0
	Total Underground Workers per shift	2	3	3	9	7	0	4
	Underground workers needing a desk	2	3	3	4	3	0	2

CI installation

Gas analyzers:

- Installed before the piston purge and gas recirculation phases of the cryostat commissioning
- Installed near the tubing switchyard to minimize tubing run length and for convenience when switching the sampling points and gas analyzers. Because each is a standalone module, a single rack with shelves
- is adequate to house the modules
- Must be brought online and calibrated before beginning the gas phase of the cryostat commissioning

Static T-gradients → APA T-sensors:

- Instead of an array of T-sensors outside the APAs, the design has changed so the T-sensors are mounted on the APA frames (with numerous advantages, in the sense of the installation this means less installation time in the cryostat)
- Supports are mounted on the APAs previous to installation of these
- Cabling routing strategy needs to be further studied
- Sensors can be easily mounted on their supports at the APAs

Individual T-sensors:

- This item can follow pretty much the installation procedure done in PD-SP
- Cables and supports for the floor and wall T-sensors can be installed installed once the pipes are installed
- Sensors will be plugged in right before the final APA installation (wall) and right before the FC deployment (floor/pipes) to avoid damage
- For convenience, the sensors at the top wall of the cryostat can follow the same time-line as those in the bottom

CI installation

Dynamic T-gradients:

- Cables and supports installed close to the TCO in parallel with the APA installation
- Plug in sensors right before the TCO closing
- Installation by segments, each of them is fed into the flange one at a time until the entire sensor carrier rod is in place
- Given the position and installation time of this device, it will have a very low impact on the whole detector installation

Cold cameras:

- Due to space constraints in DUNE as compared to PD-SP cold cameras and light systems need to be installed in parallel to the APA installation
- To be mounted on the cryostat wall, cryogenic piping and/or DSS

Purity Monitors:

- 2 purity monitor strings, each of them with at least 3 purity monitors
- The strings are close to west and east end-walls and outside of the TPC field cage
- Assembled outside to reduce work inside the cryostat
- Inserted within a month before the closure of cryostat, from instrumentation ports or manholes
- Inside the cryostat,
  - the top and bottom support tubes will be mounted to the brackets inside the cryostat, and the brackets attached to the cables trays and/or the detector support structure
  - at the same time electronics will be installed

CI installation

Warm cameras:

- Designed to be inserted and removed from any instrumentation feedthrough after the TCO closing

(Capacitive) Level meters:

- At least four at the four corners of the cryostat
- Attached to the M10 bolts in the cryostat corners after the detector is installed

The related spreadsheets are being updated accordingly to the latest developments,
https://docs.google.com/spreadsheets/d/1AOtT4WW_dP0yh9w-Nw72C_4mbk7ZzevJoZuTJssZQQg/edit#gid=139713008
https://docs.google.com/spreadsheets/d/16MA3lR631aV3vOHXJPHOOG2f7QZyarH7ItURwQXMgjM/edit#gid=0
and converge in the CALCI installation plan

In addition...

Summary of office space needs as in https://docs.google.com/spreadsheets/d/16MA3lR631aV3vOHXJPHOOG2f7QZyarH7ItURwQXMgjM/edit#gid=0

	Office Space	Long term visitors (how many? how long?)	Short term visitors (how many? how long?)
Purity Monitors	At least one desk and some chairs (4)	None	Up to four people for up to 2 months
Static Thermometers and ind. T-sensors	At least two desks and some chairs (4)	None	3-4 people for several weeks during integration and commissioning.
Dynamic Thermometers	Office space for 2-3 people	1, for several months	3-4 people for several weeks during integration and commissioning.
Cold Cameras and light system	Office space for 2-3 people	1, throughout entire TPC installation period (alternating surface and UG)	None
Warm Cameras	Office space for 2-3 people	None	2-3 people for several weeks during integration and commissioning.

	Office Space	Long term visitors (how many? how long?)	Short term visitors (how many? how long?)
Level Meters	None	None	None
Slow Controls	None	None	None
Gas Analyzers	Some space might be useful. I believe installation could be done by a 2 or 3 person crew.	None	2-3 people during 2-3 weeks for the preparation.