

## Organization of protoDUNE-DP running phase

### **A) Goals :**

- 1) Run efficiently ProtoDUNE-DP while optimizing at the same time the human resources and the presence of personnel at CERN
- 2) Allow for broad remote active participation of the institutions involved, information and transparency. There should be an effective way for remote participation/information of everybody including people who cannot spend all their time at CERN
- 3) Improve the integration within DUNE, increase the general involvement of the collaboration and the understanding of the DP results by non-DP experts

### **B) ProtoDUNE-DP running organization:**

ProtoDUNE-DP is under the responsibility of **DUNE** since the closure of the TCO and the run follow-up and discussion of the analysis results is organized within DUNE.

The running of the detector is ensured by a **Run Coordination Organization**. This organization is composed by the Run Coordinator (RC), the shifters and the daily support by the experts. This support is guaranteed by a certain number of experts from the groups which built the sub-systems and will guarantee their smooth operation. These groups are committed to provide continuous expert support and monitoring of the performance of their related sub-systems and ensure that these sub-systems will be continuously operational during the run.

The **key sub-systems of protoDUNE-DP** are:

- 1) Cryogenics: supervised by remote shifts by the CERN cryogenic group (Reference persons J. Bremer, M. Chalifour)
- 2) Electronics, DAQ, DAQ back-end and event building, online computing and raw data flow: supervised by remote shifts and ensured by the Lyon group and with interventions on site if needed. This support was already provided for the 3x1x1 run, given the distance of Lyon from CERN on site interventions can be guaranteed within a few hours (Reference person D. Autiero)
- 3) LEMs (supervised by the Saclay group by remote shifts, Reference person E. Mazzucato)
- 4) CRP positioning, motorization, level control and extraction grid: supervised by the LAPP group by remote shifts and interventions on place if needed (Reference person D. Duchesneau)
- 5) High Voltage System: supervised by CERN, guaranteeing also on site interventions, and UTA Reference persons F. Pietropaolo + J. Yu)
- 6) Photon detection system: supervised by remote shifts by the Spanish groups and on site interventions if needed (Reference person I. Gil-Botella)
- 7) Slow control: supervised by CERN (Reference persons G. Lehman-Miotto + ...)
- 8) Cryogenic instrumentation (Reference person S. Pordes)
- 9) Cosmic trigger counters Grenoble and CERN (Reference persons J.S. Real and Paola Sala)

The reference persons indicated above are the leaders of the sub-systems and not necessarily the people who will be on call all the time. Each reference person will organize the on-call service within his group and make public the list of on-call experts for the week to the run coordinator and on the elog section.

The ProtoDUNE-DP coordination of **major hardware maintenances** (not of daily small interventions happening during the run) is ensured by the **TCn group**, which meets to coordinate large maintenance interventions when needed, as it happened during the construction and the installation of ProtoDUNE-DP.

The TCn will also provide the first allocation of Run Coordination tasks in order to cover the needs until the end of the year. Then the routine extension of this list will be continued by the Run coordinators themselves.

**Filippo Resnati, as neutrino Platform Coordinator**, is responsible of the general on site logistics and running of the infrastructure (ancillary systems, safety, access control to people etc ...)

Given the limited availability of human resources and funding **it is crucial to optimize the presence of people at CERN and maximize remote involvement and active participation**. A fundamental role in that respect is the one played by the Run Coordinator (RC). This organization scheme relies on a Run Coordinator 100% committed on a limited period and rotating among various groups. This model has been very successful in past experiments and it allowed maximizing the commitment of the groups and their involvement in the experiments.

### **C) The Run Coordinator (RC):**

The RC is committed to a quite heavy task. He ensures:

- 1) the smooth execution of the run plan
- 2) daily supervision of the detector status
- 3) communication of problems and executions of related actions and the involvement of external people and experts
- 4) general communication with all people involved in protoDUNE-DP and coordination of prompt analysis feedback efforts

The Run Coordinator must be resident at CERN during his term. The Run Coordinator task is a rotating duty among experienced people in the collaboration who have an overview of the detector (we can think already about 10 DP people who could immediately cover this rotating duty and additional people who could do it in a second phase once getting more familiar with the experiment during the run). Given the fact that this task is very demanding it is limited to a period of two weeks. Two weeks is the recommended period for this duty however there is the flexibility to shorten it to one week in particular cases of availability of the person. This period may be covered again by the same person in a future slot, after a even rotation with other groups. This scheme will allow covering the entire run for long-term operation.

#### **Tasks of the Run Coordinator:**

- The Run Coordinator is **resident at CERN during his period of two weeks and fully committed to his task**.
- The Run Coordinator is **the first responsible of the smooth operation of the detector and of the execution of the run plan**.
- The Run Coordinator is responsible of supervising the shifters and the detector conditions.
- The Run Coordinator is responsible of contacting within a short delay the experts of the key-subsystems 1)-6) in case of problems. He/she is responsible of providing, a first on site intervention in collaboration with remote experts (cycling power to devices, cabling, local

measurements not accessible remotely). Of course, this is a first intervention performed in collaboration with remote experts and it does not replace a major intervention, if needed with the presence of the experts on site. However, it will provide a first quick response and limit the travel of people to the cases where this is really needed (for instance avoiding keeping permanently people at CERN just to reboot a device once per week). The Electronics/DAQ/data flow for instance can be handled very smoothly by using this model plus the remote and on-site commitment of the Lyon group. All the systems have been designed to be controlled and debugged remotely and local intervention is only needed in the extreme case of cycling power to a non-responsive device.

- The Run Coordinator will write **at the end of each day a summary of the run conditions and of the encountered problems** on the dedicated **E-LOG section (Run Planning)**.
- Still in that Run Planning section of the E-LOG, the Run Coordinator will post, at the beginning of each week, a program of the run plan of the week based on the interactions with the experts and discussion at the Run Coordination weekly meeting. This plan will also contain the list of shifts experts on-call.
- The Run Coordinator will ensure an **overlap of at least one day with the term of the next Run Coordinator** in order to define together the run plan and communicate efficiently to the new person the situation and the issues encountered during his term
- In order to guarantee remote participation the **Run Coordinator will keep daily contacts with the experts and remote shifters**
- The Run Coordinator will organize every day a short meeting of 30 minutes (**Daily follow-up meeting**) by videoconference. This meeting will take place at the beginning of the afternoon and will be open to everybody. Daily issues should not be debugged at this Daily meeting but its time slot should be exploited for general communication with remote shifters or remote people involved in the analysis and monitoring of run conditions
- The Run Coordinator will as well organize a longer meeting of two hours (**ProtoDUNE-DP Run Coordination meeting**) by videoconference **once per week** for a more extensive discussion of the run-plan with open external participation. That day the Daily follow-up meeting will not be held but the Run Coordination meeting will start at the same hour foreseen for the Daily Follow-up meeting
- **The Run Coordinator should as well ensure that all issues and findings are quickly documented** on the E-LOG
- The **Run Coordinator will carry a CERN portable phone**, which will turn among people covering this duty, in order to be quickly reachable from outside.
- The Run Coordinator will also draft a **written summary of the activity of the week** posted on the E-LOG and addressed as well to the DUNE spokespersons

#### **D) Integration in DUNE:**

In order to enhance the integration in DUNE and the critical discussion of the results and their appropriation by the entire collaboration it is suggested that DUNE appoints a few **reference liason persons** who can follow the run activity (and meetings), provide information from the previous running experience of **protoDUNE-SP** on critical point and promote the **critical review of the protoDUNE-DP** running experience within DUNE and peer reviewing

There should be **reference persons** covering:

- a) HV issues and experience from HV streamers

- b) Purity assessment
- c) Space charge effects
- d) Grounding and noise
- e) Larsoft reconstruction, this person will be quite important as constant contact to integrate the two analysis (SP/DP) and promote the exploitation and development of existing tools

This list is not exhaustive and the more people will ensure a DP follow-up the better. It would be important that these reference persons and a number of SP people have a regular follow-up of the activity and ensure exchange of information and critical review **by attending at least the weekly Run Coordination meeting**. In order that they feel committed it would be better that the spokesperson **officially appoint these persons as liaisons to the DP running**. In general, the transmission of information will be enhanced as much as possible via the E-LOG/run plan documentation under the responsibility of the Run Coordinator.

#### **Maximization of involvement:**

The run will have **an initial period of detector commissioning of a few weeks after the completion of LAr filling**, where, even with the Run Coordination structure already active, most of people from the groups of experts will be at CERN. In that period there will be no problems in finding shifters among people who are supposed to be in any case at CERN. A possible Run Coordination structure will include the Run Coordinator + 1 shifter (this shifter will be rotating every 8 hours). After the commissioning it will follow a smoother, **long-term operation period**, where we can think to have remote shifters (two shifters per day) with just the Run Coordinator present on site at CERN. Not being a beam data taking, apart for the commissioning period, it will not be needed to have night shifts.

In general, we should limit for economic reasons the number of shifters on site and reserve funding to on-site interventions when needed. A model, used also in other experiments, is based on the Run Coordinator at CERN and remote shifters elsewhere. Remote shifts may also be assigned, as in other experiments, at the level of institutions and covered by more than one person alternating during a single shift. The commissioning period will offer the possibility of testing the remote shifters functions in a safe environment with many expert people present on site.

DAQ running is perfectly doable by remote shifters. All the other information on the detector status should be also of easy access to remote people. The Run Coordinator should also distribute to remote people a number of assessment tasks of quick data analysis needed for immediate actions affecting the run plan of the following day(s). For all these reasons, the transmission of information of what is happening on site at CERN to external people and the global sharing of information are essential and so the role of the Run Coordinator to promote this communication.

#### **Presentation of analysis results:**

More detailed discussion of analysis results should happen at the **joint SP-DP DRA meetings** in order to guarantee diffusion in DUNE and understanding of the results. The Larsoft reference contact should be regularly attending these meetings and be in contact with people involved in the run and analysis who may need quick response. There is already a good coordination on computing via E. Pennacchio and H. Schellman and this will continue in order to ensure optimal support.

**E) Run-Plan:**

The **run plan for the commissioning phase** is under work. It will have to address in the initial phase of commissioning a step-by step approach in order to understand possible issues by disentangling the critical effects:

- a) PMTs commissioning
- b) Adjustment of the CRP planes at the required level and automatic control
- c) Integrity of CRPs grid
- d) Gradual LEM HV setting and stability
- e) Cathode and field cage HV stability, presence of streamers
- f) Space charge effects and accumulation of positive ions on surface (this requires a special tuning and planning of the aspects a)-c) after their first basic stand-alone functional assessment). This task may require playing with on/off switching of the LEM gain and drift field in a particular sequence. Space charge effects and problems related to the positive ions on the LAr surface are correlated and have different time scales, which have to be exploited for disentangling them in a clear way.