



Technical Specification
Design, supply and installation of four cryogenic systems for the
Neutrino Platform proximity cryogenics

Introduction to spec meeting on

**“Technical Specification
Design, supply and installation of four cryogenic systems for the Neutrino
Platform proximity cryogenics”**

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Introduction to CERN Neutrino Platform (CENF)

Work on the proximity cryogenics systems for the neutrino detectors is falling under the CENF project.

Mandate of the CENF project:

- Assist the various groups in their R&D phase (detectors and components) in the short and medium term
- Provide to the neutrino community a test beam infrastructure (charged particles)
- Bring R&D at the level of technology demonstrators in view of major technical decisions
- Continue R&D on neutrino beam, as a possible base for further collaborations
- Support the short baseline activities (infrastructure & detectors)
- Support the long baseline activities (infrastructure & detectors)

Proximity cryogenics collaboration

The proximity cryogenics for neutrino detectors project is falling under the responsibility of the CENF project. The technical specifications have been written in collaboration with:

- CENF
- CERN infrastructure groups
- CERN cryogenics group
- Fermilab infrastructure groups
- Fermilab cryogenics group
- NP.01 (Short Base Line Far Detector) collaboration
- NP.02 (ProtoDune Dual Phase) collaboration
- NP.03 (Short Base Line Near Detector) collaboration
- NP.04 (ProtoDune Single Phase) collaboration

Proximity Cryogenics System

The actual tender covers the proximity cryogenics system for four installations

The cryogenic system of a detector can be divided in three sub-systems:

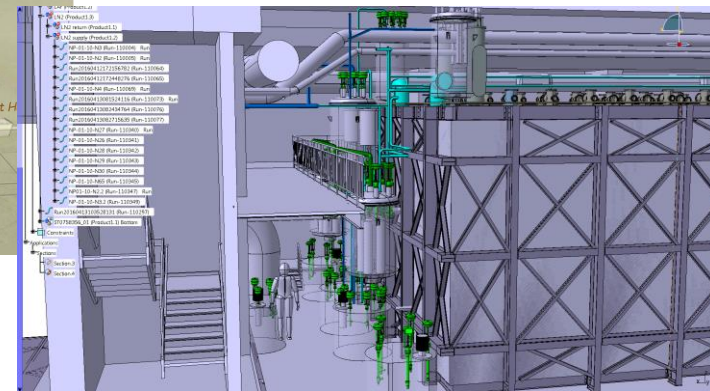
1. Internal cryogenics system: all the cryogenic equipment housed inside the detector volume;
2. External cryogenics system: the systems used for the storage and eventual production of the cryogenic liquids needed for the operation of the cryogenic system (cooling and detector liquids);
3. Proximity cryogenics system: takes the cryogenic liquids from the external cryogenics system and delivers it to the internal cryogenic system, under the correct pressure, temperature, purity and mass flow.

This tender is mostly concerning the proximity cryogenics installations, but also the external cryogenics system for the CERN based installations is included

Four cryogenic systems

The actual tender covers the proximity cryogenics system for four installations

- NP.01 (Short Baseline Far Detector):
 - The former ICARUS detector (about 600 m³ of liquid argon) is being completely refurbished (thermal insulation, cooling shields, argon container, cryogenic system) at CERN, and will be installed as the Far Detector in the Fermilab based Short Baseline neutrino beam line



Four cryogenic systems

The actual tender covers the proximity cryogenics system for four installations

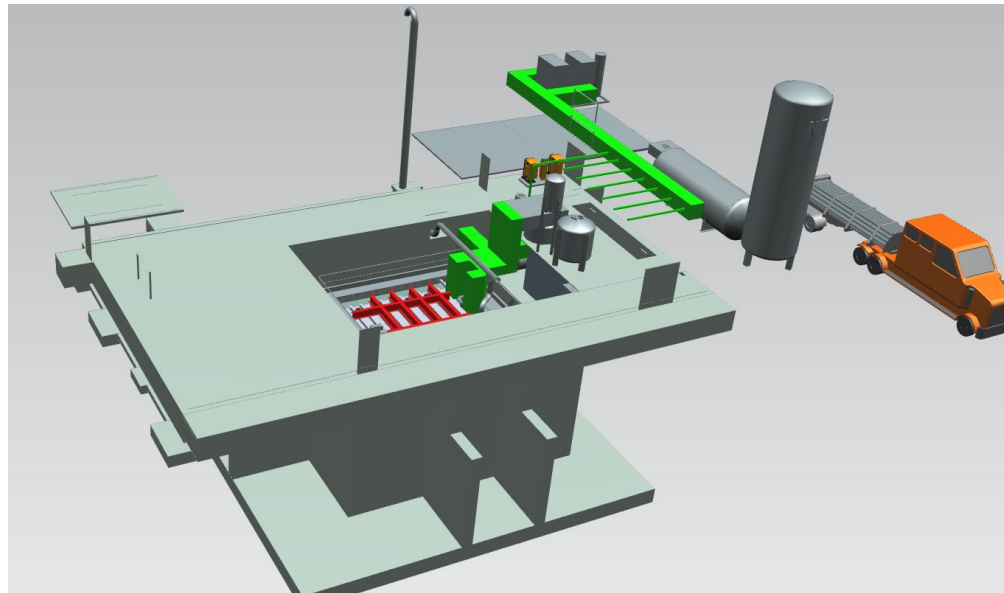
- NP.02 (ProtoDune Dual Phase):
 - Prototype detector for the DUNE experiment: 600 m³ liquid argon based neutrino detector installed in a membrane cryostat in the CERN EHN1 building. Will receive the EHN1 charged particle beam (about 600 m³ of liquid argon).



Four cryogenic systems

The actual tender covers the proximity cryogenics system for four installations

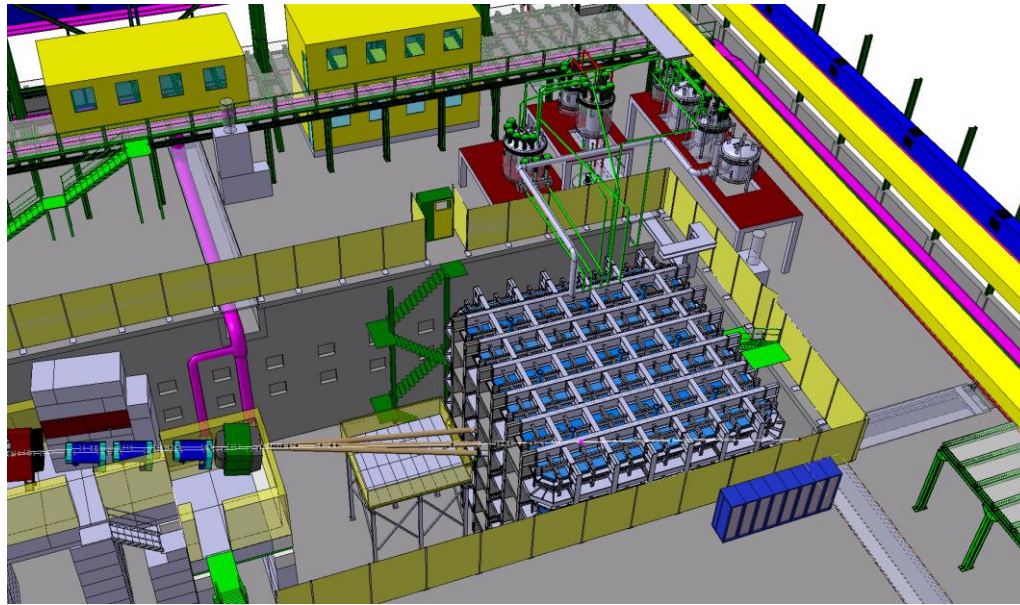
- NP.03 (Short Baseline Near Detector):
 - 200 m³ liquid argon based neutrino detector, housed in membrane cryostat. The detector will be installed as near detector in the Fermilab based Short Baseline Neutrino beamline.



Four cryogenic systems

The actual tender covers the proximity cryogenics system for four installations

- NP.04 (ProtoDune Single Phase):
 - Prototype detector for the DUNE experiment: 600 m³ liquid argon based neutrino detector installed in a membrane cryostat in the CERN EHN1 building. Will receive the EHN1 charged particle beam (about 600 m³ of liquid argon)



Proximity Cryogenics System

Proximity cryogenics applied to the liquid argon based neutrino detector installations:

- Low pressure cryostats → low argon bath pressure (safety relief opens at < 1.35 bara)
- Large volume cryostats (between 200 m^3 and 600 m^3) placed in “low” areas (ODH) and cannot be rapidly emptied: safe system needed (safety integrated from beginning of design, good quality material and workmanship, back-up systems,...)
- Systems operational 365/365 over several years period
- Heat loads to be extracted by cryogenic systems (including valve boxes and lines): between 3 kW and 8 kW

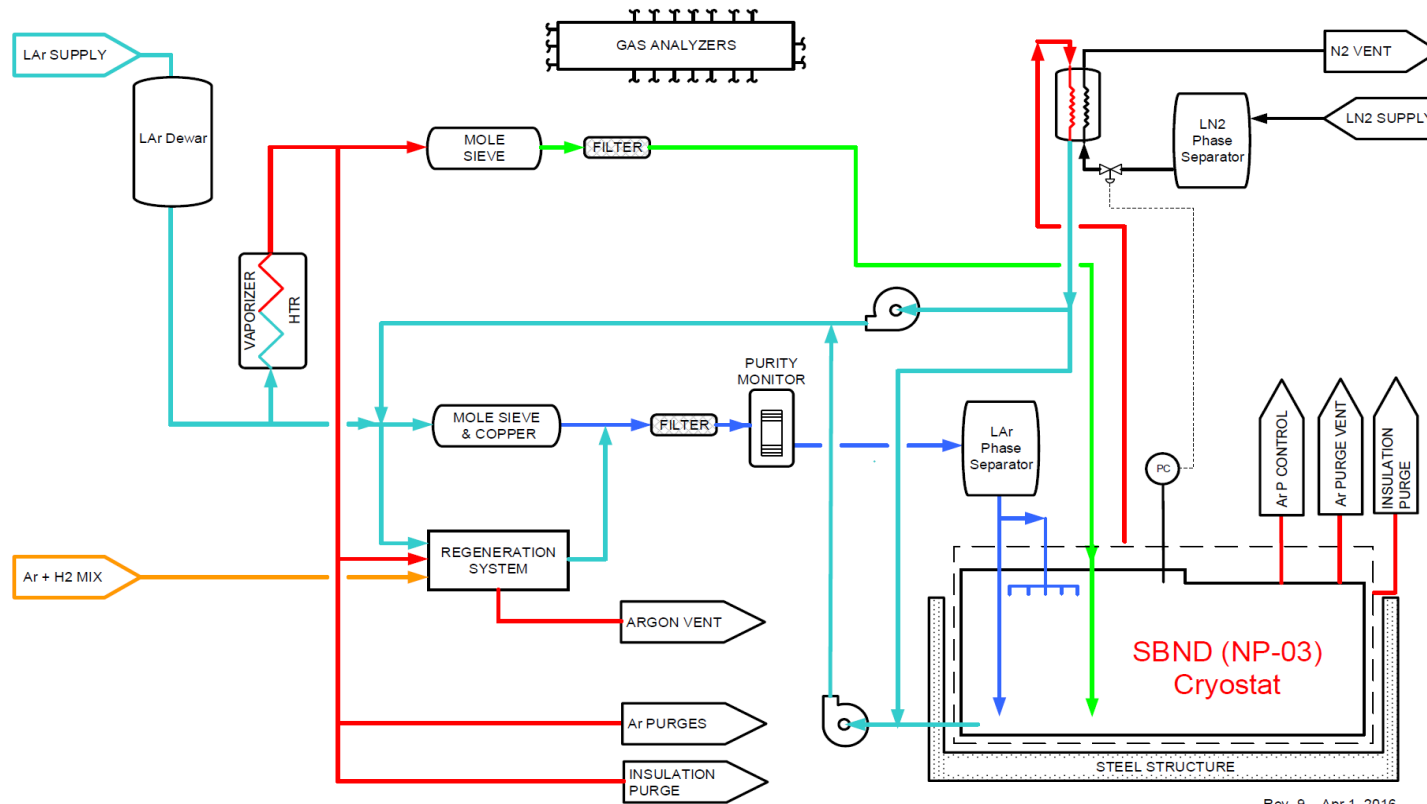
Proximity Cryogenics System

Proximity cryogenics applied to the liquid argon based neutrino detector installations:

- Cooling source: evaporating liquid nitrogen, not re-liquefied
- Detector demand: ultra pure liquid argon (ppt O₂ equivalent) → active purification
- Equipment to be installed at CERN and at Fermilab
- International Collaboration

Proximity Cryogenics System

Example of the cryogenic system for a neutrino detector



Rev. 9 – Apr 1, 2016

Contract deliverables

What are we asking from the contractor:

- Specifications have been written in a functional form, contractor has to calculate the system (line dimensions, valve dimensions,...) based on these functional specifications;
- Supplier has to design the systems based on his calculations, the interface sheets and the integration drawings;
- Supplier has to fabricate/order the hardware based on his designs;
- Supplier has to test the hardware at fabrication premises;
- Supplier has to install the hardware at CERN, at the SBNFD and at the SBNND (option in contract);
- Supplier has to test the installed equipment;

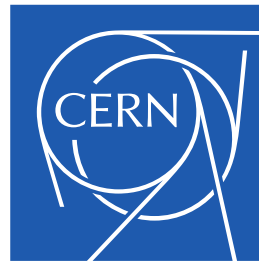
Not included in the contract

- Cryogenic pumps will be delivered to the supplier by
 - Fermilab
 - NP.01 collaboration
 - CERN
- Knowledge on chemical filter (seizing of cartidges, filter material, regeneration) to be supplied by:
 - Fermilab
 - NP.01 collaboration
 - CERN
- Chemical filter material will be delivered by
 - CERN

Review Remarks

During this review documents concerning the “ Design, supply and installation of four cryogenic systems for the Neutrino Platform Proximity Cryogenics” will be presented, and especially the Technical Specification will be discussed

- Not all documents are available in their final status yet
- All final documents shall be available within a two week period



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