INTEGRATION READINESS REVIEW

SuperNEMO: Light Injection and Monitoring System Installation

Issue 1 - Revision 1

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CHANGE RECORDS

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1.- Introduction

This document describes the process of installing the Light Injection and Monitoring System (LIM System).

2.- Principle

The LIM System implements 20 LEDs which distribute reference pulses of light to all optical modules (OMs) in the demonstrator (main calorimeter walls, X-walls, gamma veto).

Each LED is able to send light through a unique bundle of about 70 optical fibers. The termination of each fiber must be connected to a scintillator block of an OM in the main calorimeter walls, the X-walls or the gamma veto setup.

Each scintillator block has two connectors in order to plug in the optical fibers which transport light from the LEDs to the detector. One of these connectors is named the primary connector, while the other is the secondary connector. The purpose of the primary connector is to transmit light pulses from an LED for routine calibration operations. The secondary connector is used as a spare in case of failure of the primary line.

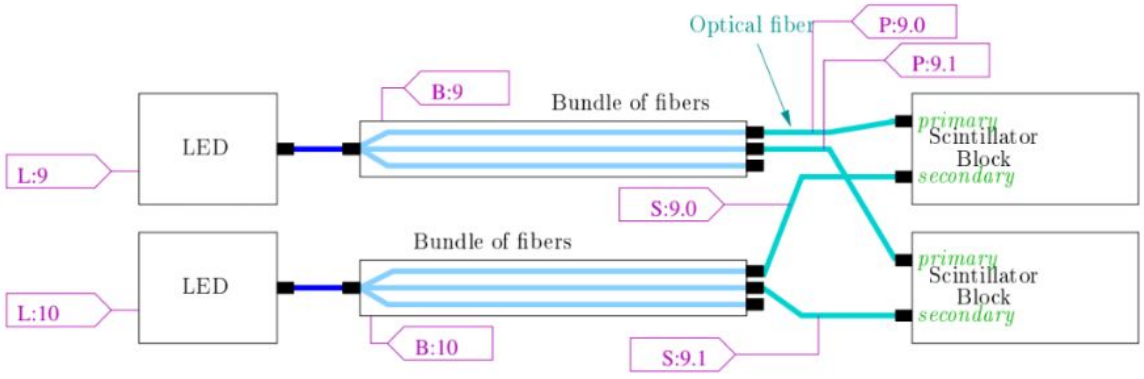

Fig. 1 .- Schematic of LIM System connections and labels.

3.- Pre-installation Tasks

Before the installation of the LIM System can begin, the vertical copper bars behind each calorimeter need to be mounted, all other calorimeter and tracker cables must be connected, the LIM rack and the fibers need to be shipped from Texas to Modane, a mapping must be in place that shows which fibers go to which OM, and an accurate measurement of the length of each fiber needs to be determined.

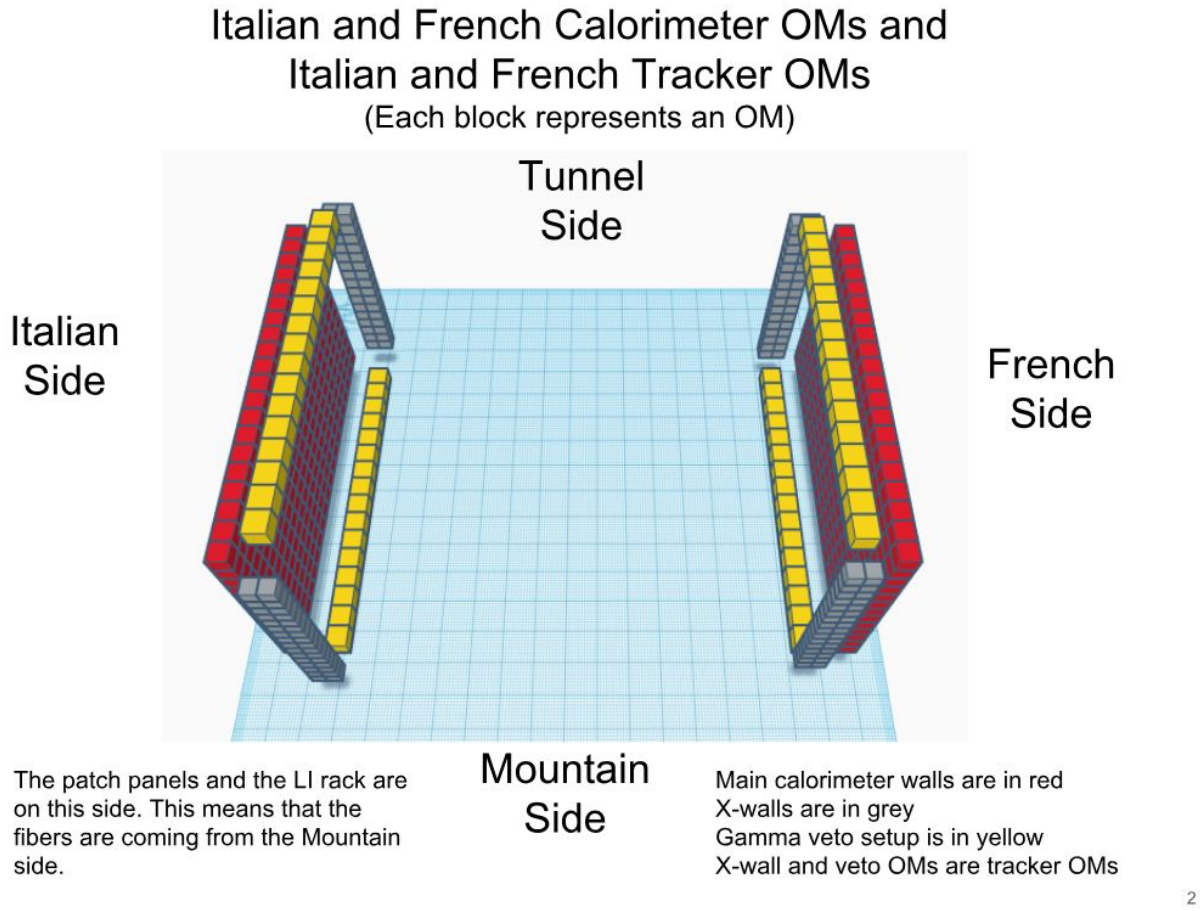

Fig.2 .- Three-dimensional drawing of the calorimeters and trackers exploded for clarity.

3.1.- Mapping

There are 3 categories of optical modules and thus of scintillator blocks, depending on their location in the experimental setup:

- Main wall block OMs are addressed through their side number from 0 (Italy) to 1 (France), column number from 0 (Mountain) to 19 (Tunnel) and row number from 0 (bottom) to 12 (top). Such blocks are labelled with the following scheme:

  M:side.column.row

  Examples: M:0.0.0 , M:0.19.12 , M:1.0.0 , M:1.19.12

- X-wall block OMs are addressed through their side number from 0 (Italy) to 1 (France), wall number from 0 (Mountain) to 1 (Tunnel), column number from 0 (source frame) to 1 (calorimeter) and row number from 0 (bottom) to 15

(top). Such blocks are labelled with the following scheme:

X:side.wall.column.row

Examples: X:0.1.1.15 , X:1.0.0.8

- Gamma veto block OMs are addressed through their side number from 0 (Italy) to 1 (France), wall number from 0 (bottom) to 1 (top) and column number from 0 (Mountain) to 15 (Tunnel). Such a blocks are labelled with the following scheme:

  G:side.wall.column

  Examples: G:0.1.0 , G:1.0.8

A fiber is labeled starting with the letters “P”, “S”, or “Sp” representing “Primary”, “Secondary”, or “Spare”. There will be a colon after the letter followed by the bundle number where the fiber is found. There will be a period after the bundle number followed by the fiber number within that bundle. Different bundles have different amounts of fibers, so some bundles will have fibers from 1-75, others from 1-72, others from 1-77, etc. Bundle numbers run from 1-20. Notice that the labeling convention for the fibers and bundles differs from the labeling convention of the OMs in that we start counting from one rather than from zero. We propose to label fibers using the following schemes:

P:bundle.fiber
S:bundle.fiber
Sp:bundle.fiber

Examples: P:1.30 (this is a primary fiber, and it is the 30th fiber in bundle one)
S:11.04 (this is a secondary fiber, and it is the fourth fiber in bundle eleven)

*Not all OMs will receive a secondary fiber. There are 80 blocks which will only receive one fiber (the primary fiber). These blocks are located at the top and bottom rows of the main calorimeter walls.

The following pages show the mapping between fibers and OMs:

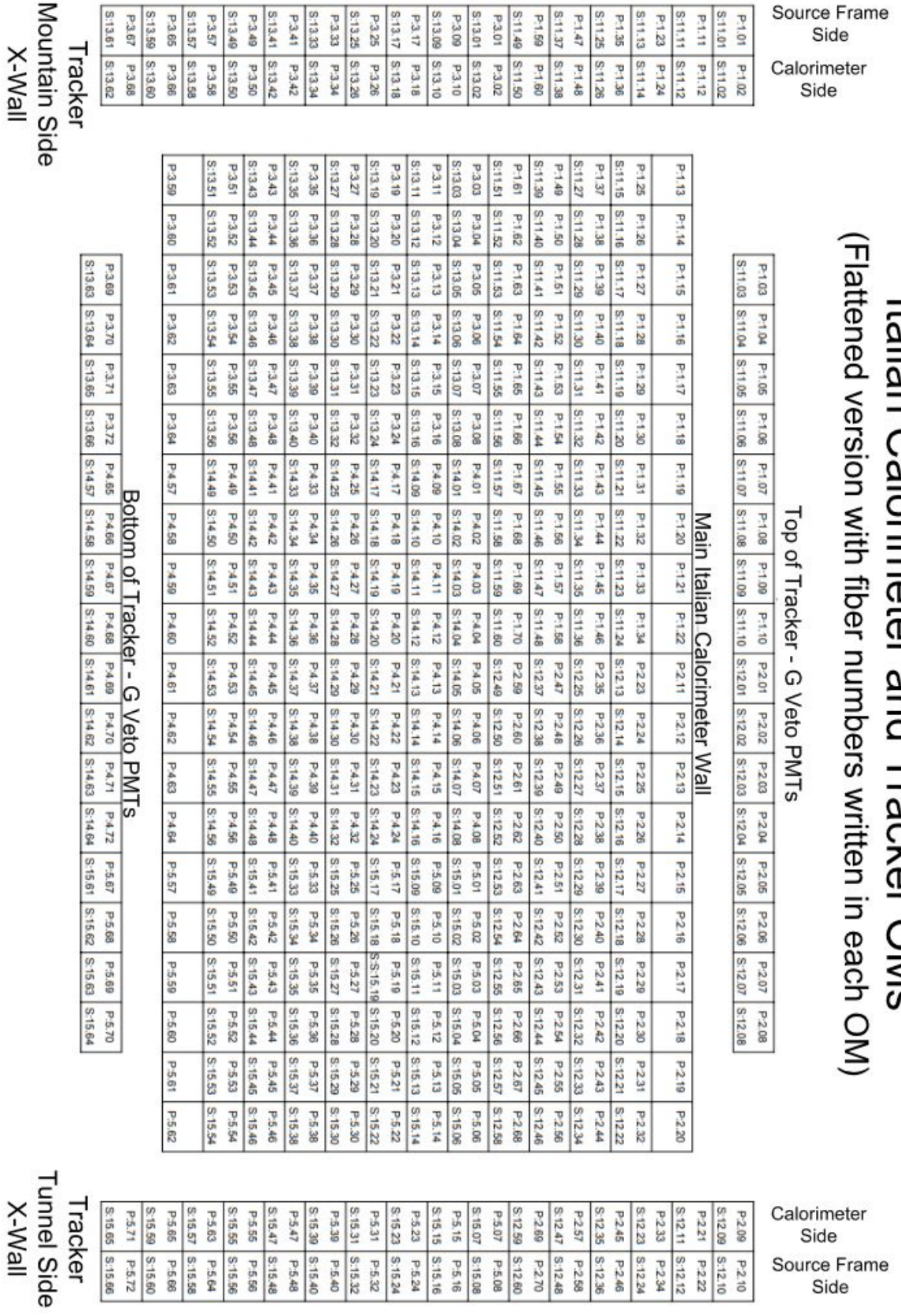

Fig.3 .- Graphical representation of how the fibers map onto the Italian half of the detector.

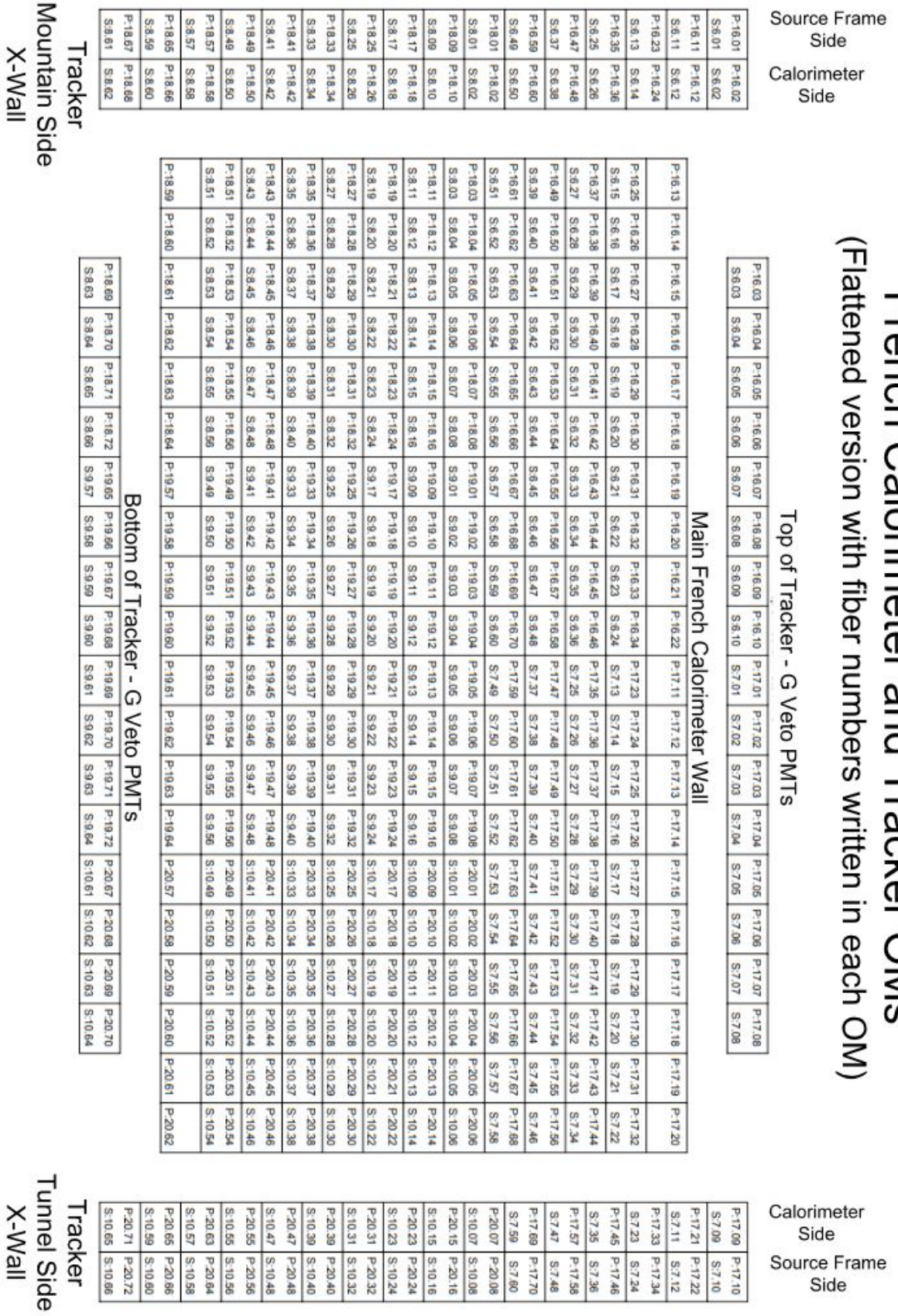

Fig. 4 .- Graphical representation of how the fibers map onto the French half of the detector.

3.2.- Lengths

Detailed length information about the fibers as well as further mapping formats can be found in DocDB#4796 (name “Fiber Mapping and Lengths.pdf”).

4.- Installation Scheme

To install the fibers, it is necessary to attach seven horizontal nylon rods onto the copper bars on the back of each of the calorimeters. The fibers will travel vertically up the copper bars closest to the mountain side. From there the fibers will travel horizontally on the nylon rods. The scheme of the French side calorimeter is shown next:

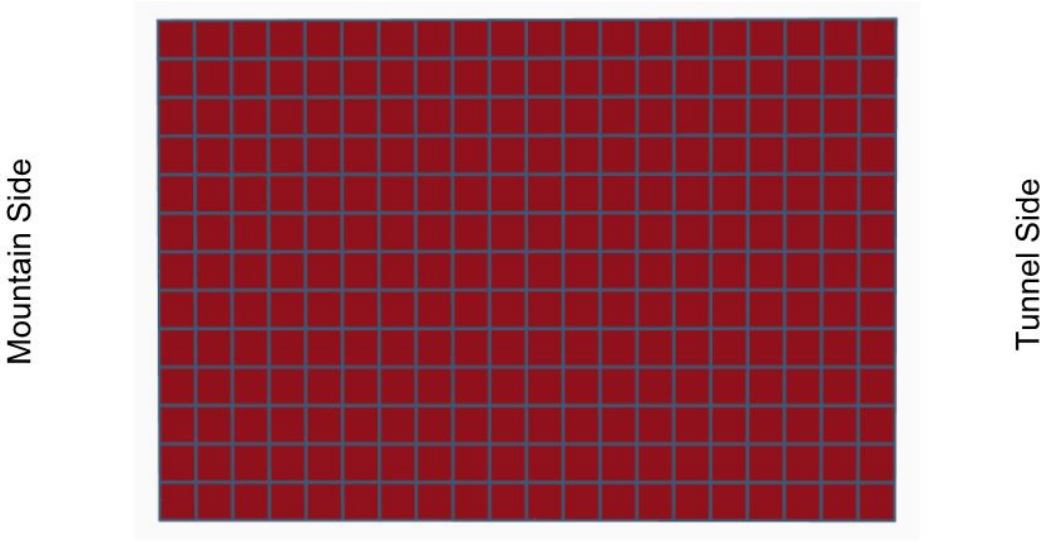

Fig. 5 .- Flattened drawing of the back of the French calorimeter.

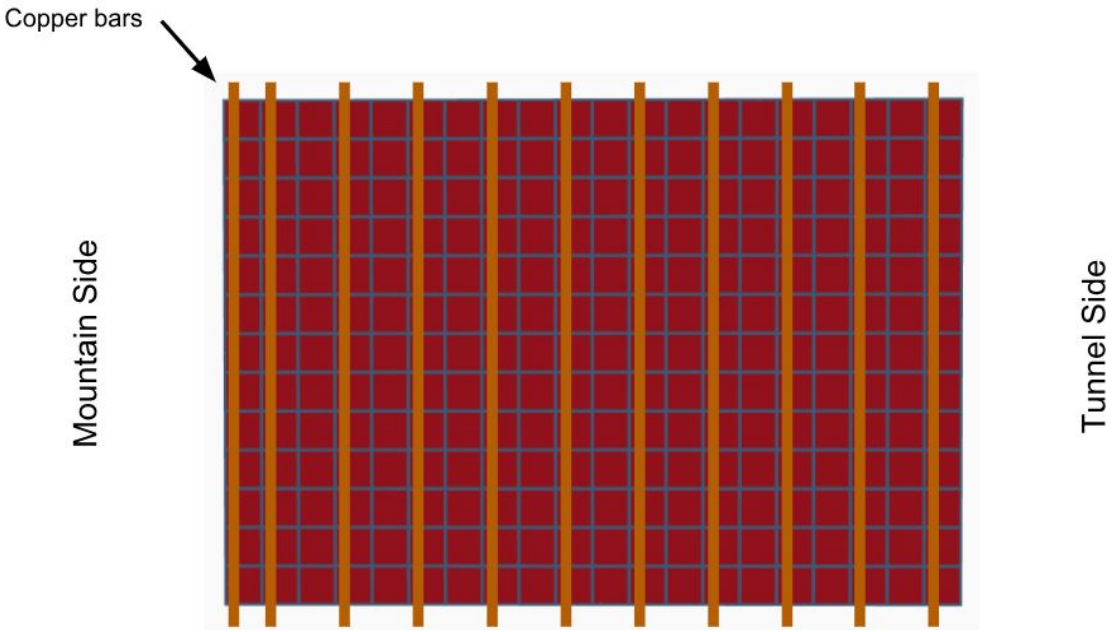

Fig. 6 .- Flattened drawing of the back of the French calorimeter with the copper bars included.

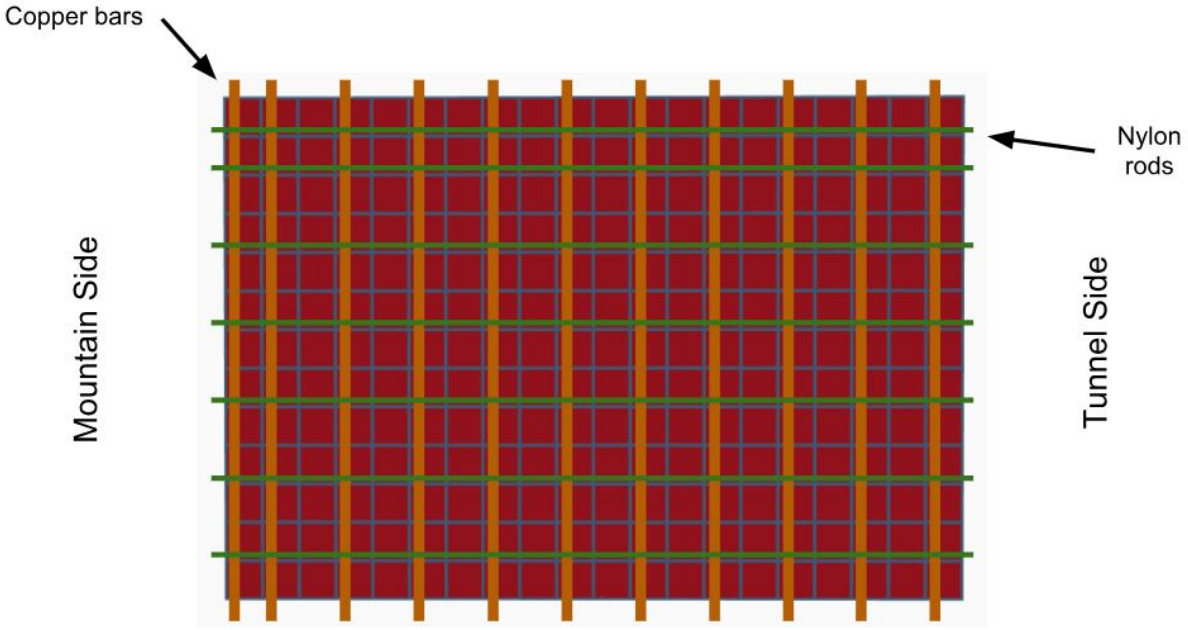

Fig. 7 .- Flattened drawing of the back of the French calorimeter with the copper bars and the nylon rods included.

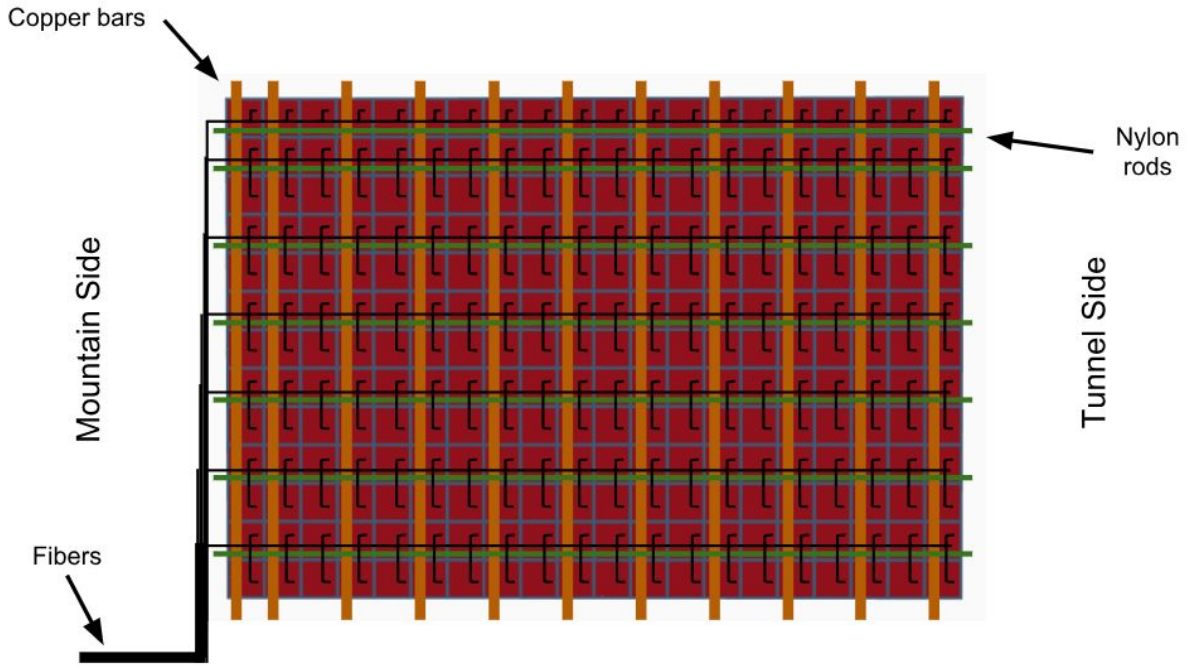

Fig. 8 .- Flattened drawing of the back of the French calorimeter with the copper bars, the nylon rods, and the fibers included.

As for the fibers destined for the trackers, they will travel through the inside of the dog bones of these structures and they will be attached to them with zip ties.

5.- Organization of the Work

John Cesar, Marek Proga, and Ramon Salazar will be in Modane from January 21st until the end of February for the installation of the LIM System. Karol Lang will also be present for some of the weeks within that time frame.

6.- Materials Needed

For the installation of the LIM System we will need:

Inside the radon tent:

- White nylon rods
- Fibers (with cotton sleeves)
- Teflon tape
- White nylon zip ties

At the radon tent panels (mountain side):

- Fibers (with cotton sleeves)
- Fiber feedthrough sub-patch panel
- RTV
- Miscellaneous screws
- Allen wrenches

At the LIM rack:

- Black corrugated pipe
- Fibers (with cotton sleeves)
- Miscellaneous screws
- Allen wrenches
- Crescent wrenches