

Workshop on Beampipes for GWT



LIGO-P1900072-v1

Workshop Proceedings

1 March 2019

NSF Workshop on Large Ultrahigh-Vacuum Systems for
Frontier Scientific Research Instrumentation

LIGO Livingston Observatory

January 29-31, 2019

H.F. Dylla, R. Weiss and M. E. Zucker, eds.



Distribution of this document: public release pending. This is a working note of the LIGO
Laboratory. <http://www.ligo.caltech.edu/>

California Institute of Technology
LIGO Project

Massachusetts Institute of Technology
LIGO Project

This event follows the objectives of the **Livingston workshop** (January, 2019).

‘The workshop primarily focused on the need to **identify cost-effective technologies** for the design, construction and operation of the **large vacuum systems** that would be required for **gravitational wave observatories** (GWO) that are a **factor of ten larger than the current generation systems** in the US (LIGO), Europe (Virgo) and Japan (KAGRA). ‘

Workshop on Beampipes for GWT at CERN

Institutes:

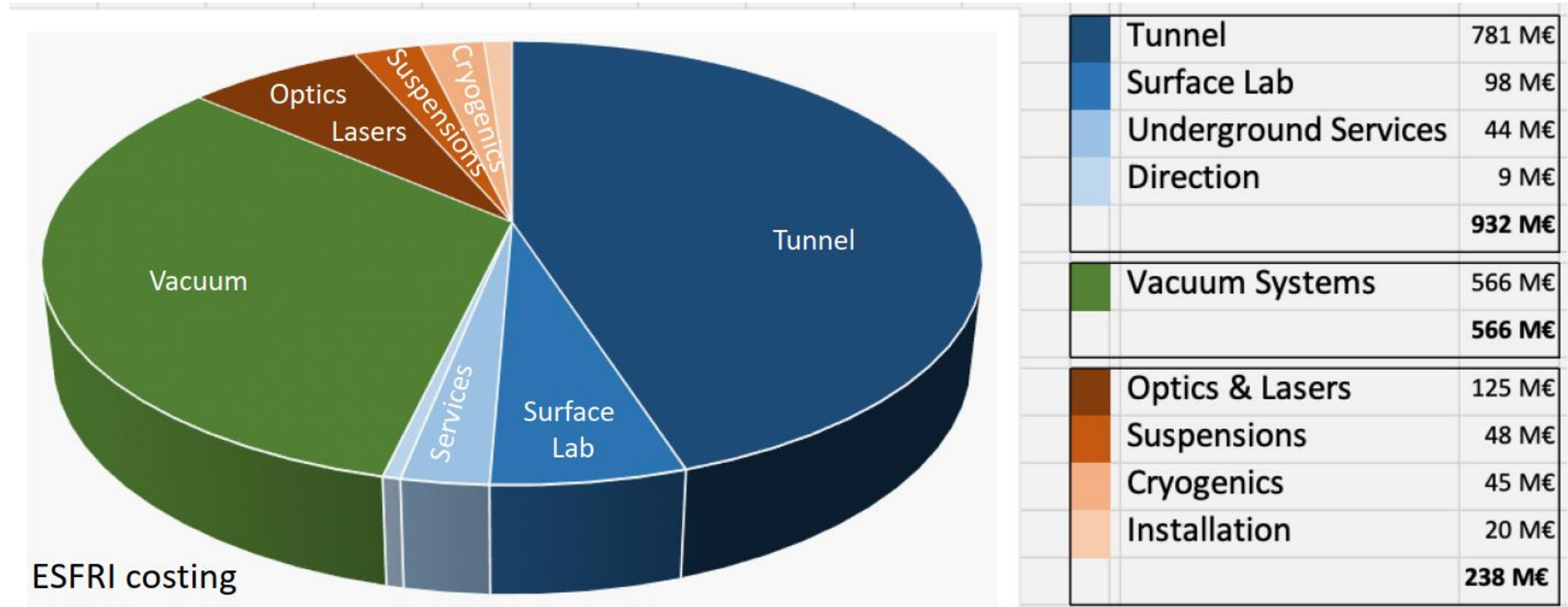
Caltech-LIGO
MIT-LIGO
CERN
CNRS-LAPP
CNRS-IJCLab
Cornell University
DESY
EGO-Virgo
FermiLab
Forschungszentrum Jülich GmbH
Ghent University
IFAE
INFN (INAF, Roma, LNF, Perugia)
KIT
KEK
Material Forensics LLC
NIST
Nikhef
Rheinisch Westfaelische Tech. Hoch.
Syracuse University / Cosmic Explorer
The Barcelona Institute of Science and Technology
Universiteit Antwerpen
University of Padua

Industry:

Agilent Vacuum Product Division
APERAM
Atlas Copco
C3DM Germany
Ecoclean GmbH
FEF Aachen
Leybold
SAES Getters S.p.A
VDL ETG
Voestalpine

- 84 participants (20 from CERN)
- 26 talks
- 3 topical discussions with final reporting
- Visits to surface treatments and mechanical workshops
- CERN visit.

ET vacuum system: cost estimation



It includes the vacuum of the towers in the corner stations.

Slide copied from: *Andreas Freise, The current status of the Einstein Telescope 10.05.2020*

Agreement among CERN, Nikhef and INFN

ADDENDUM NO. 1
KR5427/TE
TO
FRAMEWORK COLLABORATION AGREEMENT
KN 4657/DG

Done in the English language and signed by the authorized representatives of the Parties.

BETWEEN: THE EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH (“CERN”), an Intergovernmental Organization having its seat at Geneva, Switzerland,

AND: THE ITALIAN NATIONAL INSTITUTE FOR NUCLEAR PHYSICS (“INFN”), established in Rome, Italy,

AND THE DUTCH NATIONAL INSTITUTE FOR SUBATOMIC PHYSICS (“Nikhef”), established in Amsterdam, The Netherlands,

Hereinafter each individually referred to as a “Party” and collectively as the “Parties”,

CONSIDERING THAT:

Framework Collaboration Agreement KN4657/DG (the “Agreement”) concluded between the Parties defines the framework applicable to collaboration between them in domains of mutual interest.

Article 2.1 of the Agreement provides that the scope, each Party’s contributions, and all other details of each specific project shall be set out in Addendum to the Agreement.

The Parties have identified the collaborative project set out below, which shall be covered by the provisions of this Addendum No. 1 (the “Addendum”),

AGREE AS FOLLOWS:

Article 1
Purpose

- 1.1 Under the terms of this Addendum, the Parties shall collaborate in the development of the vacuum systems of the arms of the Einstein Telescope (“ET”) (the “Project”). The Project is outlined in Annex 1.
- 1.2 The Parties shall use the results and resources of their collaboration for non-military purposes only. INFN and Nikhef shall ensure compliance with this obligation by the ET Consortium members.
- 1.3 This Addendum shall be subject to the provisions of the Agreement, it being understood that in case of divergence the provisions of this Addendum shall prevail.

Article 2
Duration of the Project

Subject to the continued validity of the Agreement, the Project shall begin upon signature by the last Party to sign and shall be completed after 36 months.

The European Organization
for Nuclear Research (CERN)

Mike Lamont

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Mike Lamont
Director for Accelerators and Technology

Signed on 7/7/2022.....2022

The European Organization
for Nuclear Research (CERN)

Jose Miguel Jimenez

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Cristina Lara

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Cristina Lara
Deputy Head of Procurement Service

Signed on 9/7/2022.....2022

The Dutch National Institute for Subatomic
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Stan Bentvelsen

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Nikhef Director

Signed on 19/7/2022.....2022

The Italian National Institute for Nuclear
Physics (“INFN”)

Dr. Antonio Zoccoli

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Antonio Zoccoli
INFN President

Signed on 26/7/2022.....2022

CERN objectives

Main technical objectives

1. Re-evaluate **the baseline solution** (Virgo/LIGO and CDR) with minor modifications imposed by the new requirements.
2. Design and test **technical solutions** that fulfil the ET requirements and are **less expensive** than the baseline. The required **technical infrastructure** will be evaluated and optimized as well.
3. Manufacture, assembly and test a **pilot sector**.
4. Write the **technical design report**, including **cost estimations**.

Main coordination objectives

1. **Coordinate the effort of ET collaborators** interested in the same technical objectives.
2. Coordinate the contact and sharing of information with **Cosmic Explorer in the field of vacuum technology**.

**WP1:
engineering**

Design and engineering of the vacuum chamber

**WP2:
production**

Choice of materials and manufacturing technology

**WP3:
treatments**

Choice of post-manufacturing treatments

**WP4:
transport**

Handling and logistics

**WP5:
installation**

Installation procedure and interface with other systems

**WP6:
vacuum**

Choice of vacuum pumps and valves

**WP7:
prototyping**

Installation and test of a pilot sector

**WP8:
coordination**

Coordination of the different work packages and contribution of collaborators

Work-Breakdown Structure

