

ISTITUTO NAZIONALE DI FISICA NUCLEARE

CONSIGLIO DIRETTIVO

DELIBERAZIONE N. 13550

Il Consiglio Direttivo dell'Istituto Nazionale di Fisica Nucleare, riunito a Roma in data 26 febbraio 2015 alla presenza di n. 31 dei suoi componenti su un totale di n. 34;

- premesso che l'INFN, attraverso la partecipazione di diverse sue Sezioni e Laboratori, è coinvolto da anni all'esperimento "Mu2e" in corso presso il FERMILAB per attività di sviluppo sui cavi superconduttori per i solenoidi di detto esperimento;
- tenuto conto che il FERMILAB negli anni ha considerato molto positivamente questo contributo e che, pertanto, intende ora utilizzare le competenze e l'*expertise* dei gruppi INFN per effettuare test di corrente sui cavi che saranno impiegati nella costruzione dei solenoidi;
- ravvisata la volontà delle Parti di formalizzare la partecipazione dell'INFN all'esperimento "Mu2e" attraverso la sottoscrizione di un Accordo per le specifiche attività da svolgere;
- **considerato che per le attività svolte dai gruppi INFN, il FERMILAB corrisponderà la somma di Euro 159.000,00 che sarà accertata nelle entrate del Bilancio dell'Istituto con successiva deliberazione di questo Consiglio Direttivo;**
- visto lo schema di "Memorandum of Agreement for Collaboration on the electrical characterization of the superconducting cables for the solenoids of the Mu2e experiment at Fermilab", allegato alla presente deliberazione e di essa facente parte integrante;
- vista la nota del Direttore della Sezione di Genova, Prof. S. Squarcia, del 20 gennaio u.s., prot. n. 62;
- su proposta della Giunta Esecutiva;
- con n. 31 voti favorevoli;

DELIBERA

E' approvato lo schema di "Memorandum of Agreement for Collaboration on the electrical characterization of the superconducting cables for the solenoids of the Mu2e experiment at Fermilab", allegato alla presente deliberazione e di essa facente parte integrante. Il Presidente è autorizzato a sottoscriverlo.

Memorandum of Agreement

for Collaboration on electrical characterization of the superconducting cables for the solenoids of the Mu2e experiment at Fermilab

between

The Mu2e experiment under development at FERMILAB, Illinois (USA), hereinafter referred to as Mu2e, represented by Ronald Ray, Project Manager, on the one hand

and

The Istituto Nazionale di Fisica Nucleare, Rome, Italy, hereinafter referred to as INFN, represented by Fernando Ferroni, President, on the other hand.

Preamble

- a) The Mu2e experiment is progressing through the various approval stages at Fermilab. It seeks to measure the rare process of direct muon to electron conversion in the field of a nucleus. The experiment relies on the production, collection and transport of low-momentum muons to form muonic atoms in an aluminum stopping target. A fundamental role is played by the magnetic fields: the magnetic design naturally falls into three coupled superconducting solenoid systems: the Production Solenoid (PS), the Transport Solenoid (TS) and the Detector Solenoid (DS), contributing to a large fraction of the costs of the experiment.
- b) INFN is involved in the Mu2e experiment with groups located in Frascati, Genova, Lecce and Pisa.
- c) The INFN group located in Genova has significant experience in designing superconducting magnets involving aluminum stabilized conductors (Babar for PEP-II at SLAC, CMS at CERN). This group is also active in measuring critical currents of high current superconducting cables. This expertise has already proven helpful in developing the superconducting magnets for Mu2e. A prototype module of the TS solenoid has been developed and constructed at ASG Superconductors (Genova) under INFN oversight with funds coming from INFN and materials provided by Mu2e. Furthermore, INFN has already characterized the prototype conductors of the TS and DS Solenoids. The electrical characterization of the PS conductor is under way.

THE PARTIES AGREE AS FOLLOWS

Article 1: Parties to this MoA

The Parties to this MoA are INFN and Mu2e. The Parties acknowledge that INFN will rely on industries with recognized expertise in the field.

Article 2: Purpose of this MoA

INFN is participating to the Mu2e experiment where the magnet constitutes the most demanding technical system. INFN is already collaborating in the design, qualification and debugging of the magnetic system. The scope of this MoA is restricted to the electrical tests (conductor qualification) to be done on the superconducting cables involved in the Mu2e solenoids, as agreed between the Parties, and carried out by INFN. It further sets out organizational, managerial and financial guidelines to be followed by the Parties.

Article 3: Duration of this MoA and its Extension

3.1 This Memorandum of Agreement will become effective for each Party upon last signature. The conductor qualification will take place in two years in parallel with the construction of the Mu2e solenoids. A steering committee will manage this MoA, according to art.6, and will closely monitor progress.

3.2 This MoA may be extended at any time by mutual written agreement of the Parties.

Article 4: The activities to be performed

The activities to be performed will consist of critical current measurements of the conductor under production for Mu2e solenoids according to the following scheme:

4.1- Mu2e is responsible for the conductors. For each production length, Mu2e will send to INFN a sample of around 2 m in length. Four different conductor types are involved in the Mu2e solenoids: TS, DS1, DS2 and PS.

4.2- INFN has already developed the sample holders for each conductor type, and equipped them with Hall probes and cryogenic temperature sensors.

4.3- Upon receiving the samples from Mu2e, INFN will prepare the samples for the measurements in the facility Ma.Ri.S.A., integrate them in the sample holders and then in the measurement assembly.

4.4- The samples will be cooled to a temperature of 4.2 K using liquid Helium and the critical current will be measured by means of the transformer method.

4.5- It is expected that Mu2e will provide 19 samples of PS conductor, 11 samples of TS conductor, 8 samples of DS1 conductor and 4 samples of DS2 conductor. Total number of conductors is 42.

4.6- INFN will perform 21 measurement runs. In each run up to 2 samples can be tested. It is possible that only one sample can be tested due to unexpected problems (this statement is based on a long experience of previous similar measurements). In any case, not less than 32 samples will be tested.

4.7- INFN is also developing methods for measuring the Transfer Length (TL) of an aluminum stabilized conductor. The TL value has effects on the thermal stability of the conductor with respect to disturbances. It is possible that some measurement runs (among the 21 foreseen) will be devoted to TL measurements.

Article 5: Scheduling

The total time for performing all the planned activities is two years from the last signature of the MoA.

Article 6: Management

The R&D program is managed by a Steering Committee composed of three representatives for each organization, INFN and Mu2e. The Parties will nominate their representatives. At the first meeting of the Steering Committee, one of its members shall be appointed as Chair with the simple majority of the votes of the members present or represented.

Article 7: Financial Provisions

The costs of the conductor qualification program of this MoA are partly personnel costs (salary and travel) and partly direct costs for running the facility Ma.Ri.Sa. The INFN personnel involved in the measurement will be:

- 1) a senior scientist with a contribution of 0.5 FTE;
- 2) a PhD student with a contribution equivalent to 1 FTE,
- 3) a cryogenic technician with a contribution equivalent to 0.8 FTE,
- 4) a mechanical technician with a contribution equivalent to 0.2 FTE.

The cost per measurement is 5 k€ for each measurement run (consumables, maintenance, other expenses all included) for a total of 105 k€. It is agreed that Mu2e, in the framework of the collaboration with INFN, will cover the costs of the PhD student (54 k€) and the direct measurement costs (105 k€) for a total of 159 k€. This amount shall be directly paid to the INFN Central Administration.

Article 8: Amendments

This MoA may be amended at any time with the agreement of its signatories or of their appointed successors. Any such amendments will be subject to the prior agreement of the Steering Committee.

Article 9: Applicable Law

The Parties shall agree to refer to the regulations in force at the site where the activities are performed.

Article 13: Disputes

Any dispute concerning this MoA which cannot be solved amicably between the Parties, shall be submitted to the good offices of the Chair of the Steering Committee.

This MoA is produced in 2 originals that are signed by INFN and the Mu2e experiment.

Done in Batavia

For Mu2e

R. Ray – Mu2e Project Manager

Done in Rome

For INFN

Prof. F. Ferroni – President of INFN

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