 December 5, 2003

MINUTES OF THE "SAFETY HEARING" for the Neutrino Factory

Experiment: Neutrino Factory in the ISR-Facility TT 2A (802)

Present: Harold G. Kirk, F. Szoncso /TIS, A. Desirelli /TIS, Pierre Carbonez /TIS, B. Pichler /TIS
Excused: T. Otto /TIS

Cc: R. Trant /TIS, H.G. Menzel /TIS, W.Weingarten /TIS, A.P. Bernardes /TIS, G.Daems /AB T. Otto /TIS, J. Gulley /TIS F. Corsanego /TIS

Meeting held: November 20, 2003
Chairman: F. Szoncso /TIS
Spokesman (Presentation): Harold G. Kirk (Brookhaven National Laboratory)
Minutes: B. Pichler /TIS

1) **Introduction by** F. Szoncso**:**

Introducing all present
Brief references to safety procedures at CERN

The aim of the meeting was to discuss the future project and to communicate relevant safety matters before the experiment is presented to the "research board".

2) **Presentation of the Neutrino Factory experiment by** : Harold G. Kirk BNL

Collaboration between: RAL (GB), CERN (CH), KEK (JP), BNL and Princetion (both USA)
For detailed information of the experimental layout refer to:
Copies in the Annex 1: "Targetery Concept for a Neutrino Factory"

Place of installation: In the ISR facility TT2A (see slide p.18 and p.19 of NF-target.pdf)

Time of installation at CERN: Installation and delivery 2005 for 2006 beam run.
Running time of the experiment: approximately 1 month (200 shots).

Experiment uses a transient magnetic flux density of B = 15 T. A pulsed pre-cooled solenoid reaches this flux density in approximately ten seconds, with a temperature rise of 30 ^{o}K.
Proton bunches are sent onto a mercury target of 7 - 8 litres, located inside a target chamber. Mercury stays within the target chamber but reaches velocities of more than 10 m/s. Experiment estimates to need 200 pulses for its study.

3) **Matters concerning:**

3.1 "Mechanical safety" (A.Desirelli):

- Design layout of the installation was submitted: Piping system:
- will not be used if LN_2 dewar can be used

Pressure vessel use with approximately 1 bar.
No LN_2 in the magnet when beam is fired,

3.2) "Electrical safety" (F.Szoncso):

Direct current: Battery power supply was discussed (See Annex1 p.24 ff) or possibility of powering with a rectifier. Experiment would need 500 truck-type lead batteries providing 600 V 7200 A for a few dozen seconds. Switches could be mechanical or semi-counductor. It was clearly stated that this amount of batteries requires a reserved room that is properly ventilated, and a plan on how to dispose of these batteries after the experiment.
Should the experiment use a rectifier a transient power of 4.2 MW net would be required. It was felt that the old Gargamelle supply used last for experiment NOMAD could be used for this purpose, without even displacing it from building

- Mechanical switch: needs to be able to cut power supply
- Cabling: ref. IS23
- Grounding: "insulated configuration" recommended as is the case in practically all CERN magnet circuits. Ground-fault detection with interlock is mandatory.

3.3) "Gas and chemical safety" (J. Gulley):

- No flammable gas used. Batteries see above.

3.4) "Fire safety" (F. Corsanego):

3.5) "Radiation safety" (T. Otto/P. Carbonez) :

The recommendation of CERN's radiation protection group is to find an alternate position for the planned Hg irradiation than the tunnel TT2a. The reasons are:

- this tunnel is not ventilated (and thus releases are not monitored) . In case of radioactive Hg spillage we would have incalculable releases into the environment. This is contrary to our operating license.

Tunnel TT2, upstream of the D3 dump would offer similar beam parameters and significantly better safety conditions for your intended experiment. For a comprehensive radiological safety study, we would need documented stimates (by Monte-Carlo or analytical methods) of:

- the activation of the Hg target, listing the major contributing isotopes
- air activation (by isotopes)
- activation of a "typical" beam line element, e.g. a block of copper in one metre distance form the traget. Here, the interesting quantity would be the expected dose equivalent rate at the surface, but we could also do with activation by isotope.

In the TT2-position, an estimate of the Hg activation alone would be sufficient, as there would be a beam dump behind your setup and the area is ventilated.

In any case the following items need to be considered:

- it is impossible to arrange a beam dump behind the Hg set-up. The secondary particle cascade would irradiate and activate beam line elements downstream of the target, creating un-optimised radiation levels for maintenance after the experiments.

- Hg-Target: double containment (followed up and verified by RP- group)
- Window stability: Quartz

3.6) Laser equipment (F. Szoncso):

- A LASER beam is used for readout purposes. Supposedly class IIIb. Registration to be done with Roland MAGNIER <Roland.Magnier@cern.ch>

3.7) General remarks:

The GLIMOS (or technical coordinator) informs all participants about all the risks present and provides operating procedures, procedures in case of emergency, a complete list of specialists with list of telephone numbers, etc.

All participants for the experiment need to have attended the newcomers Safety course.

3) **CONCLUSION:**

Safety inspections must be organised (requested by the GLIOMS or technical coordinator) before the new installation will go into operation: general safety, LASER, electrical, with written reports. In case batteries will be used remedy to requirements in chapter 3.2 at an early stage.

4) ANNEX:

- Targetry Concept for a Neutrino Factory: **“**NF-TargetryConcept.pdf”