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BROOKHAVEN NATIONAL LABORATORY

managed by Brookhaven Science Associates
for the U.S. Department of Energy

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November 17, 2004

Professor Jos Engelen
Chief Scientific Officer
Deputy Director-General
CERN
CH – 1211 Geneva 23, Switzerland

Dear Professor Engelen,

With regard to the high-power proton beam target system proposal to CERN, P186, we have would like to respond to the questions posed by the Research Board at their meeting of 22nd of July.

We have had extensive discussions with the safety community at CERN. All relevant safety officers have been contacted. We attach relevant memoranda to this correspondence. In summary we state that no substantial issues have been raised which would inhibit our running. We agree to adhere to relevant codes and standards operable at CERN.

Supporting letters from the scientific community have been forwarded to you and we attach electronic versions to this correspondence.

The resources which we request from CERN are confined to providing the proton beam. Our budget of US$1.9M for concluding the experiment contains labor charges for the installation of all systems at CERN as well as fully decommissioning the experiment. The US Muon Collaborations is fully prepared to support the cost of this experiment assuming a three-year budget cycle and continued flat funding from the US Department of Energy.

Sincerely yours,

Harold G. Kirk

Kirk T. McDonald

20 September 2004

IDto2004-22m

MEMORANDUM

To: P. Cennini, DSO AB

cc: H. Haseroth, AB-ABP; A. Fabich, AB-ATB; Ch. Hill, RSO AB

From: Th. Otto, SC-RP

Conc.: Ventilation issues for Proposal INTC-P-186

Proposal INTC-P-186 (CERN-INTC-2004-016) foresees to install a Target system for a 4 MW, 24-GeV Proton Beam in transfer tunnel TT2a, upstream from the n-TOF target.
An exerimental campaign with not more than $3\cdot10^{15}$ protons from the PS on a mercury jet target is foreseen.

In principle, a target area should be equipped with a filtered and monitored ventilation system in order to reduce and to account for releases of radioactive air and aerosols into the environment.

The amount of radioactive air and aerosol produced by the the limited total beam intensity of the experiment proposed will not contribute significantly to the total releases from CERN. This circumstance allows to exceptionnaly deviate from the general principle.

The operation of the experiment proposed in INTC-P-186 for not more than $3\cdot10^{15}$ protons on target from the PS without filtered and monitored ventilation in transfer tunnel TT2a is authorised.

Thomas Otto

Th. Otto

Radiation Protection PS accelerator complex

11 May 2004
IDto2004-14m

MEMORANDUM

To: G. Daems, DSO AB; Ch. Hill, RSO AB; B. Pichler, SC-GS

cc: H. Haseroth, AB-ABP; H. Kirk, Brookhaven National Laboratory;

J. Aÿstö, Jyvaskylä University and INTC chairman;

H.-G. Menzel, SC-RP

From: Th. Otto, SC-RP

Conc.: Handling of irradiated mercury from a Hg-jet test experiment

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This memorandum focuses on the handling of a quantity of irradiated Hg (up to 10 litres) during and after its irradiation in a proton beam, irrespective of the place of the experiment's installation at CERN.
H. Kirk, one of the proponents of the experiment, estimated the residual activity of mercury with MCNPX, a standard Monte-Carlo program. In the model, the mercury jet was irradiated during 30 days with 200 proton pulses of $1.6\ 10^{13}$ protons each. The activity of those isotopes contributing at least 1% of the total activity after a waiting time of one month was calculated. The summed activity of these isotopes, 2.4 mCi (90 MBq), represents more than 50% of the total activity of the mercury at this time.
At CERN, unsealed radioactive sources with an activity exceeding the authorisation limit L_A, must be handled and stored in specially arranged work sectors in order to protect the workers and the environment. For a mixture of n isotopes, the numerical condition for free handling is $\sum_{i=1}^{n} \frac{A_i}{L_{A,i}} < 1$, where A_i denotes the activity of the i-th isotope in the mixture and $L_{A,i}$ its authorisation limit. The limited selection of isotopes given in the compilation by H. Kirk after a waiting time of one month represent an activity of the 22-fold of the composite authorisation limit. The details of this assessment can be found in the appendix. Obviously, during the experiment and immediately after its end, the activity of all isotopes will be even higher.

There are two possible ways of action open:

1.) The area where the experiment shall be installed is converted into a work sector for unsealed radioactive sources.
2.) The experimental apparatus is qualified according to the technical requirements of International Standard ISO 2919 "Sealed Radioactive Sources - General Requirements and Classification".

In both alternatives, SC-RP can assist with giving information on the technical requirements for either he work sector or the experimental apparatus.

Thomas Otto

Appendix

Residual activity in a Hg jet target after 30 days of irradiation with 200 pulses of 1.6 10^{13} protons each and one month waiting time. Data courtesy H. Kirk, BNL

		Activity		**Radiotoxicity**	
Isotope		Ci	Bq	L_A	$A_i/L_{A,i}$
103	Rh	1.30E-04	4.81E+06	2.00E+09	0.00
105	Ag	2.00E-04	7.40E+06	6.00E+06	1.23
113	In	2.30E-04	8.51E+06	2.00E+08	0.04
113	Sn	2.30E-04	8.51E+06	3.00E+06	2.84
121	Te	2.30E-04	8.51E+06	2.00E+07	0.43
125	I	1.40E-04	5.18E+06	7.00E+05	7.40
127	Xe	1.40E-04	5.18E+06	3.00E+08	0.02
146	Eu	5.70E-05	2.11E+06	4.00E+06	0.53
147	Eu	6.50E-05	2.41E+06	5.00E+06	0.48
188	Ir	9.60E-05	3.55E+06	8.00E+06	0.44
189	Ir	1.70E-04	6.29E+06	1.00E+07	0.63
195	Au	3.10E-04	1.15E+07	4.00E+06	2.87
203	Hg	4.30E-04	1.59E+07	3.00E+06	5.30
total:		**2.43E-03**			**22.21**

ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

Laboratoire Européen pour la Physique des Particules
European Laboratory for Particle Physics

MEMORANDUM

FROM : J. Gulley (SC/GS)

TO : A. Fabich (AB/ATB)

CC : P. Cennini (AB/ATB); T. Otto (SC/RP); B. Pichler (SC/GS); R. Trant (SC/GS).

Subject : Proposed use of mercury at CERN in the Experiment TT2A

This memorandum outlines some guidelines and preliminary remarks with respect to the proposed use of mercury in the TT2A experiment at CERN.

i.) The amount of mercury employed in the experiment should be kept to a minimum.

ii.) On arrival at CERN the mercury will be stored in a dedicated place (e.g. the chemical laboratory 3/1-031).

iii.) Use the type of container recommended by the manufacturer. Inspect containers for leaks before handling. Secondary protective containers must be used when this material is being carried. Label containers and keep them tightly closed when not in use. Use corrosion-resistant transfer equipment when dispensing.

iv.) A safe means of filling the system should be proposed (e.g. by vacuum pump).

v.) The leak-tightness of the closed system used for the experiment must be verified before operation and after any intervention on the system which risks to impair the leak-tightness.

vi.) Mercury monitoring devices which continuously measure the concentration of mercury in the surrounding air are to be employed at strategic points (inside and outside of the containment that will enclose the apparatus) to give an early warning of a leak or loss of containment. All mercury monitors must be calibrated according to the manufacturer's instructions and give an alarm sufficiently below the exposure limits (i.e. VME[1] = 0.05 mg/m^3, VLE[2] = 0.4 mg/m^3). Any alarms generated must be promptly dealt with.

vii.) Appropriate personal protective equipment, ppe (e.g. lab coat/coveralls, gloves, visor, safety goggles, boots, full-face respiratory equipment), must be made available for all persons who risk to come into contact with mercury during an intervention on the system or during an emergency. N.B. The minimum requirements for ppe must be defined based on the measured concentration and the activity in a similar way to the requirements laid down for the TTF Experiment. A portable mercury monitor is also deemed necessary. The type of gloves and the mercury vapour cartridge used in the respiratory protection must be specified. Cartridges and gloves must be kept outside of the immediate area where the mercury is used and must be changed on a regular basis. Respiratory protection is to be used only for work of short duration (e.g. filling, replacement of filters) or in case of an emergency[3].

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[1] VME = **v**aleur (limite) **m**oyenne d'**e**xposition.

[2] VLE = **v**aleur **l**imite d'**e**xposition **calculée sur une courte durée**,

[3] Respiratory protection using cartridges is only suitable for protection up to the maximum concentration of mercury specified by the supplier of the cartridge and respirator. Based on the measured concentration the degree of protection will have to be increased with an intervention by the CERN Fire Brigade required above a defined threshold. Whenever the concentration of mercury is unknown an air-supplied respirator must be used.

viii.) All filters used in the process must be maintained/replaced on a regular basis such that they continue to fulfil their requirements.

ix.) Procedures for handling, start-up, operation, shut-down, foreseeable interventions (e.g. filling, emptying, the replacement of filters used in the process) and what to do in an emergency (e.g. spill, first aid) to be drafted and posted at the workplace. The use of personal protective equipment (e.g. gloves, respiratory equipment) to be mentioned implicitly in the procedures where required.

x.) The Material Safety Data Sheet (MSDS) from the supplier of the mercury must be available for consultation by all users and by emergency personnel in the event of an accident.

xi.) Measures must be at-hand for immediate first aid in case of eye/skin contact with mercury (i.e. to flush with water).

xii.) A permanent watch must be maintained during the initial cycle (i.e. during and after filling).

xiii.) Suitable and sufficient warning panels to be put in place and be clearly visible (SCEM Nos. 50.55.89.560.7, 50.55.84.028.2 and 50.55.84.120.7).

xiv.) The number of people which it is reasonably foreseeable might be exposed to mercury must be kept to an absolute minimum; all such persons must register with their Medical Service and be properly trained regarding the hazards and safe use of mercury and the actions to take in an emergency. Unprotected persons should avoid all contact. Pregnant women or women that are breastfeeding must not be allowed to work in an area where it is foreseeable that they might be exposed to mercury. No visitors to be allowed.

xv.) Good personal hygiene measures should be adopted at the workplace (i.e. no eating/drinking/smoking. Washing facilities must be available for use by all persons working with mercury).

xvi.) At the end-of-life of the experiment the mercury shall be emptied as much as possible from the system into suitable containers and shall then be transported back to Oak Ridge National Laboratory. The emptied system and any other empty containers that might contain residues of mercury shall be considered as hazardous waste and be disposed of according to CERN Rules.

xvii.) Procedures and equipment must be in place to deal with a fire or a small spill/loss of containment of the mercury on the CERN site(s). Spills must be cleaned-up as thoroughly as possible (e.g. using vacuum spill clean-up equipment). The CERN Fire Brigade must be immediately alerted in case of a fire or a large spill/loss of containment.

xviii.) In the event of a spill of mercury on the CERN site(s) all contaminated waste, including protective clothing, shall be disposed of according to the CERN Rules. Contact SC/GS-GC.

xix.) The CERN Fire Brigade must be invited to visit the installation and must be informed when the mercury arrives at CERN.

For any questions or precision concerning the above remarks, please contact J. Gulley.

Attached: 'Fiche Toxicologique No. 55 – Mercure et composes mineraux' ; International Safety Card for Mercury.

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Comments from CERN's Safety Commission concerning:

NEUTRINO FACTORY /TT2A
CRYOGENIC INSTALLATIONS

- Supply of LN2 from a dewar installed outside between building 559 and 506.
- LN2 transfer line from the dewar to the magnet in TT2A.
- The magnet will contain 30 to 300 liters of LN2 (still not defined)

Documentation

1. Please provide P&ID's (Pipe & Instrumentation Drawing) for all the equipments, including date, version and drawing number.
2. Please provide a PFD (Process Flow Diagram) for all the different modes (filling, quenching, warming up etc).
3. Please provide a list of all safety valves, their position and their settings for all cryogenic equipment in this project.
4. The pressure vessels (magnet and dewar) and it's accessories shall be conform to Directive 97/23/EC (EC declaration plus manufacturing documents such as material certificates, welding procedure specification, method of welding, certification of welders, pressure tests etc). Please contact E. Jonker (SC/GS) directly in this matter.
5. Please provide the documentation for the safety valves as indicated in the Directive 97/23/EC. Safety valves are category IV.
6. Please provide the calculations for sizing the safety valves.
7. The dewar shall be conform with the applicable cryogenic standard (depending on size).
8. The cryogenic valves shall be conform with EN1626.
9. Complete documentation shall be provided for the instrumentation (manufacturer, model, operating range, maintenance etc)
10. Please provide implementation drawings of the dewar, the transfer line and the magnet.

Pressure build up

11. Please assure that there are safety valves wherever cold gas/liquid could be trapped: vessels & pipes between valves.
12. Please show that no liquid can be trapped in the valve when operating it (ball valves and gate valves).

Other

13. Please assure good insulation of cold parts, which could come in contact with the atmosphere. This is important to avoid condensation of the air, which could form droplets of water or even liquefaction of air. Water risk to drop on electrical installations. Liquid air can cause cold burns and enrichment of oxygen (amplifications of fire)
14. Assure that all the instrumentation is adapted for the correct pressures and temperatures. Valves designed for a warm temperature risk to block in an open position if used cold etc.
15. Please assure that there is no humidity in the cryogenic installations.
16. Please assure that no one can get hurt in the case of a safety valve/bursting disc blowing!
17. Please allow good access to all the instrumentation! Bear in mind that the safety valves are to be dismounted and checked by SC every second year and that maintenance/repairs of the installation shall be possible.

Oxygen Deficiency Hazard (ODH)

18. Please make a study on which parts of the tunnel that risk to be affected directly or via the ventilation system in the event of a big nitrogen spillage (equipment braking, safety valves blowing). If the ventilation system cannot cope with the spillage, other means of how to remove the excessive amount of nitrogen shall be studied. If the fire fighters do not have the equipment for this, the project will have to organize the necessary equipment in collaboration with the firefighters. This study has to be done rapidly (I propose before 2005). It would be a shame to find out 2006 that TT2A can’t be used because there is no way to get rid of nitrogen spills. Please contact Michel Fressard TS/CV concerning ventilation in TT2 and P. Doebbeling SC/FB concerning the fire brigades capacities.
19. A complete study needs to be done concerning the ODH risk in the event of a big nitrogen spillage in the tunnel or elsewhere in the cryogenic system. The study shall include access rights and warning systems (O2 sensors, flashing panels, evacuation alarms, BIOCELLS etc). This study shall be finished at least 6 months before the commissioning of the cryogenic systems starts.

Gunnar Lindell
SC/GS

UNIVERSITÉ DE GENÈVE

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Prof. Alain Blondel
Neutrino Physics Group
alain.blondel@cern.ch

Prof. Jos Engelen
Chief Scientific Officer
Deputy Director General
CERN

Geneva 9 October 2004

Object : Target experiment P186 TTA2

Dear Prof. Engelen,

I write to you in my capacities of both coordinator of the ECFA-sponsored studies of future neutrino facilities for Europe, and scientific secretary of the European Muon Concertation and Oversight Group (EMCOG).

In your letter of 27 September you requested clarification of the support from the relevant scientific community for the proposed test among other important considerations concerning safety and required support from CERN. By this letter I would like to testify here that we are fully behind the proposed experiment. This proposal has been discussed at several working group meetings (Neutrino Factory Working Group and plenary meetings of the ECFA ”muon weeks”) and attracted great interest and unanimous support, despite the differences in configuration between the CERN and US scenarios. The conclusions of the more formal “EMCOG” meetings with representatives of various funding agencies were also very positive and attached in annex.

The liquid metal target has been considered the baseline option for target designs both in the Neutrino Factory design studies in the US and for the CERN scenario (see the recently published Yellow report CERN 2004-02 and Nufact-note-29). It is also the baseline option for a possible neutrino superbeam at CERN. (Simone Gilardoni’s Thesis)

The experiment P186, called by us ‘target experiment’ is an important step in the understanding of the behaviour of liquid jet targets in presence and absence of magnetic fields. It comes after several years of studies by a strong collaboration involving CERN from the start (Colin Johnson (now retired), Jacques Lettry, Helge Ravn, and the thesis of Adrian Fabich). The effect of beam and magnetic fields on liquid targets has been studied extensively both by dedicated experiments on one or the other aspect, and in extended thermo-dynamical simulations. Therefore it is now in an excellent position to check facts against calculations, a situation where a lot is guaranteed to be learned.

Let me address briefly the issue of differences between the various schemes for pion collection: in the US scenario, the baseline model for the subsequent collection of pions is a high-field tapered solenoid, while in the CERN case a collection system based on a horn was studied. It was found that the two systems provide reasonably similar performance for one sign of muons. The solenoid allows capture of both signs of muons. With relatively trivial design tricks, the two signs can be subsequently used simultaneously (with enough time difference to avoid confusion in the neutrino detectors) in a neutrino factory, thus doubling the efficiency. Moreover, keeping both signs is necessary for muon colliders. While European groups have oriented their studies towards a horn collection system, which is i) less expensive ii) more easily replaceable and iii) superbeam compatible, the solenoid system has advantages of its own and the choice is far from being made on either side of the Atlantic.

Another issue is that of the beam energy, which is 2.2 GeV in the baseline CERN scenario and 24 GeV (after the Brookhaven AGS capability) in the US. It has been shown that the pion production is more or less proportional to beam power, for all energies above pion threshold. The parameter which is different is the fraction of beam energy deposited in the target, which is larger for low energy beam. This problem is solved by using many more bunches to produce the same beam power (e.g. 2.2 GeV at 50 Hz at CERN and 24 GeV at 5 Hz at BNL), so that the energy deposition per passage of liquid is similar in both schemes.

To conclude, although the US and CERN based scenarios for Neutrino Factory designs are different, they both envisage a liquid mercury target. The experiment, which can run with or without magnetic field, will be extremely profitable and yield results that are essential for both schemes. Of course these results will transport very well to other energies at which one might chose for a high intensity proton driver in the future.

Let me now take my hat of member of SPC. Given i) the recommendations of the SPSC for CERN to support the studies towards a neutrino factory, ii) the likelihood that an intense neutrino program will be possible at CERN in the next decade, iii) the fact that CERN is very much short of resources, the opportunity that this experiment represents is quite extraordinary. Most of the hardware is paid from outside, an experienced team is willing to perform the experiment, and there exist local expertise at CERN. The issues of mercury safety and infrastructure are actually part of the learning process towards neutrino factories.

For all these reasons, I believe that the proposal to perform at CERN the liquid mercury target experiment is an opportunity that CERN should not miss.

With kind regards,

Alain Blondel

Minutes of the Meeting of the EMCOG 18 November 2003

Present: Carlo Wyss (CERN-DG, chair), Helmut Haseroth (CERN-AB), Ken Long (PPARC), Ken Peach (RAL), Marco Napolitano (INFN Napoli), Alain Blondel (Uni-Geneva, secretary) Rob Edgecock (RAL), Pascal Debu (CEA), Jacques Dumarchez (IN2P3), Andrea Pisent (INFN Legnaro)

Excused: John Ellis (CERN), François Pierre (CEA), Stavros Katzanevas (IN2P3) Jean-Eric Campagne (IN2P3), Albin Wrulich (PSI).

[...]

The European Muon Coordination and Oversight Group (EMCOG), received the letter of Intent CERN-INTC-2003-033 INTC-I-049. The oral presentation by the spokesperson H. Kirk from Brookhaven was followed by a discussion. This experiment aims at completing the scientific part of the R&D on liquid metal targets. This has been the object of a fruitful collaboration between CERN and BNL among others for several years, in the context of a coordinated international R&D program towards neutrino factories. Such targets also constitute the baseline solution for high intensity neutrino beams that could be produced by the Superconducting Proton Linac (SPL) under study at CERN. Locating this experiment at CERN would certainly encourage participation from European collaborators.

The experiment seems able to achieve its very important goal, and is therefore highly recommendable. Several clever cost saving solutions are envisaged. The requirements in infrastructure and in local support at CERN will have to be clarified in the proposal.

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DIPARTIMENTO di SCIENZE FISICHE
Complesso Universitario di Monte S. Angelo
Via Cintia 80126 NAPOLI

1 Nov 2004

from: Prof. Vittorio Palladino

to : Prof. Jos Engelen
CERN Chief Scientific Officer &
Deputy Director General

Object : Target experiment P186 TTA2

Dear Prof. Engelen,

I write to you in my vest of coordinator of the EC and ECFA sponsored Network BENE, "Beams for European Neutrino Experiments".

I understand you requested clarification of the support from the relevant scientific community for the P186 proposal. I would like to convey to the CERN management the warm and unconditional support of our BENE community.

This proposal has been submitted to several of the discussions promoted by BENE, both in Europe and in a larger international context, notably in the framework of the International forum provided yearly by the NuFact Workshops. It has gained undisputed recognition and proven essential to all existing scenarios for future superior neutrino facilities. It is not a hazard that it is being proposed jointly from the three main components of the international neutrino community from USA, Europe and Japan.

The interest of the experiment is larger than that, however. The liquid metal target is becoming the most promising way to sustain the impact of protons from a MultiMegaWatt power driver for a multiple set of different applications. While it presently is the baseline option emerged from multiple international neutrino driven studies, it has simultaneously been recognized as the most promising also by nuclear physics communities interested in high power and by the community focusing on accelerator driven systems.

While actively pushed by USA groups, the experiment is a cornerstone of the European neutrino strategy too. It will probe exactly the conditions of energy depositions per passage of liquid implied by current European options for the proton drivers. Much European work has gone into its conception. It will be a crucial step in the understanding of the behavior of liquid jet targets in presence and absence of magnetic fields.

More attention from European funding agencies should be actively sought too. The liquid mercury target experiment is a chance that CERN and Europe should not let go by.

Best regards ,

Vittorio Palladino

(Vittorio Palladino)

Fermilab

Physics Division • MS 112
Fermi National Accelerator Laboratory
P.O.Box 500 • Batavia, Illinois • 60510

13 October 2004

Prof. Jos Engelen
Chief Scientific Officer
Deputy Director General
CERN

Dear Prof. Engelen,

On behalf of the US Muon Collider and Neutrino Factory Collaboration (MC) we would like to express support for the P186 TTA2 Targetry experiment.

The MC fully endorses the proposed Targetry experiment as an important part of the global Neutrino Factory and Muon Collider R&D program. Targetry has consistently been recognized as a high-priority program by the technical review committee (MUTAC) that annually reviews the MC R&D program. This view has likewise been endorsed by the Muon Collaboration Oversight Group, MCOG. The MC has invested more than $4M over the last 6 years to develop the appropriate target technology. CERN personnel have participated in this development from the start, and have successfully demonstrated the behavior of liquid Hg jets in a high-field solenoid at Grenoble. A test of a liquid Hg jet inside a high-field solenoid with a suitably intense proton beam is the next step required to demonstrate and further develop the technology. Assuming continued funding at the present level, we plan over the next several years to make a further investment of about $2M in the Targetry program proposed for the P186 experiment. This is a very significant investment of our limited R&D funds, reflecting the importance we attach to this part of the global Neutrino Factory and Muon Collider R&D.

Sincerely,

S Geer — RB Palmer — M. Zisman

Steve Geer	Robert Palmer	Mike Zisman
(MC cospokesman)	(MC cospokesman)	(MC Project Manager)

c: A. Blondel
H. Haseroth
H. Kirk
K. McDonald

Fermilab

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13 October 2004

Prof. Jos Engelen
Chief Scientific Officer
Deputy Director General
CERN

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Sincerely,

S Geer | RB Palmer | M. Zisman

Steve Geer (MC cospokesman) | Robert Palmer (MC cospokesman) | Mike Zisman (MC Project Manager)

c: A. Blondel
H. Haseroth
H. Kirk
K. McDonald

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Prof. Jos Engelen
Chief Scientific Officer
Deputy Director General
CERN

Your ref. Our ref. Villigen PSI, October 15, 2004

Object: Proposal INTC-P-186, Studies of a Target System for a 4-MW, 24-GeV Proton Beam by Bennett et al.

Dear Prof. Engelen

The development of high-power targets is a crucial issue for facilities aiming at the production of high-intensity secondary beams. The concept presented in this proposal is very convincing in many respects. The combination of a liquid metal jet with a high-field solenoid is likely to become the solution of choice in the design of future performant target systems. The outcome of the proposed test will be a milestone in the advance of target technology and is eagerly awaited by the interested community.

Several difficulties or yet unsolved problems encountered or expected with other type of targets are avoided. There is no window suffering from stress or corrosion in contact with the liquid target material, which is an important aspect in relation with the high operational reliability requested in an accelerator environment. The extraction rate of low-energy pions and muons is higher than what is achievable in a solid target. Further, the absence of supporting structures allows for the use of a surrounding magnet arrangement and thus the efficient collection of the particles emitted in a very large solid angle.

The authors of the proposal have performed a sound analysis of the present knowledge in this field. Fondamental aspects of the interaction of beam and magnetic field with a liquid metal target are known from dedicated experiments. Comprehensive simulations of the thermodynamics involved during the energy deposition are available. It is therefore time to proceed to a large scale experiment under realistic conditions.

Considering the worldwide effort in the development of high-power accelerators I am convinced that the proposed test is an excellent investment in a technology of great importance for future projects at CERN and elsewhere. I therefore want to please the CERN Directorate to accept this proposal and to give the necessary support to the planned experiment.

Sincerely yours

Pierre A. Schmelzbach
Head of the ABE Accelerator Division