Fermilab Accelerator Advisory Committee

Report of the May 10-12, 2006 Meeting

Committee: J. Corlett (LBNL, Chair), G. Geshonke (CERN), K-J Kim (ANL), S-I Kurokawa (KEK), T. Raubenheimer (SLAC), H. Weise (DESY),
Apologies: S. Chattopadhyay (TJNAF), G. Hoffstaetter (Cornell), S. Milton (ANL), M. Minty (DESY), H. Padamsee (Cornell), S. Peggs (BNL)
DOE Observer: B. Strauss (DOE HEP)

Committee assignments to address points of the charge:

1. Proton Improvement Plan and its immediate follow-ons:
   Günther Geschonke
   Tor Raubenheimer

2. High Intensity Neutrino Source R&D:
   Hans Weise
   Shin-ichi Kurokawa
   Kwang-Je Kim
   John Corlett

3. High Intensity Neutrino Source synergies:
   Tor Raubenheiner
   John Corlett

Introductory remarks

The committee recognizes the hard work involved in preparing for this meeting, and would like to thank the presenters for well-prepared materials. The meeting demonstrated the excellence in accelerator physics and technologies resident at Fermilab and with their collaborators, and provided the committee with an interesting and enjoyable review of plans for the future of neutrino science facilities at Fermilab.

Executive Summary

The committee was charged with addressing plans to develop the Fermilab neutrino programs beyond the end of the Tevatron Run II, with two main aspects; development of existing infrastructure to improve proton production, and R&D towards a new superconducting linac-based proton source for neutrino science applications referred to as the High Intensity Neutrino Source (HINS). In addition, synergies between the HINS R&D and other accelerator projects of interest to Fermilab and/or the Office of Science were discussed.

The committee recognizes the significant successes and performance improvements accomplished in the Tevatron Run II in the year since the last FAAC meeting, notably the commissioning and now routine operations of electron cooling of the anti-proton beam in the recycler ring. The collider, however, is planned to cease operations at the end of September, 2009. As momentum for the ILC builds within the HEP community, ILC activities have become the priority for Fermilab.

The neutrino physics program at Fermilab has also developed, and Mini-Boone and NuMI have both been supported simultaneously with proton and anti-proton production for the Tevatron. Following the end of collider operations and the movement of energy frontier physics elsewhere, neutrino physics remains a viable experimental program at Fermilab. The committee considers it important that capabilities are developed and R&D carried out to maintain options for an experimental HEP program in U.S., beyond Run II, based on a strong neutrino program at Fermilab. The committee supports the proposed accelerator developments leading to improved performance using existing accelerator assets, and an R&D program to pursue further enhancements with a new high-power proton injector.

The Proton Improvement Plan is designed to gradually increase the beam power on target for neutrino production, by modifications to the existing accelerators. The program is staged such as to allow an increase from the present 240 kW to 1 MW in a logical way, first up to 400 kW in parallel with the present operational schedule of Run II, then following the shut-down of the Tevatron in steps initially to 700 kW, then to 1000 kW. Each stage includes successively more machines of the Fermilab complex, which become available once the collider operation is ended. The underlying principle of this scheme is to increase the intensity of bunches stored and accelerated in the Main Injector, which are then extracted and transferred onto the target in one turn. In addition, the cycle time is reduced and the repetition rate increased. The committee considers the required implementation of slip-stacking, transient beam loading compensation, and RF controls to be quite challenging, and requiring detailed planning and resource allocation. The committee fully endorses this program, is convinced that the chances of success are good, and recommends implementation of the first stage to 400 kW, and continued planning for the following stages.

A possibility that has been discussed extensively for the longer term future neutrino program at Fermilab is the development of a high power (>2 MW) neutrino source based on a superconducting H^- linac. Fermilab's approach (formerly know as the Proton Driver) has been modified over the last year to align this effort more closely with the laboratory's ILC strategy. The reorientation of the program into the HINS R&D now focuses on a 90 MeV test facility to be built in the former Meson Laboratory. The set-up shall be used to study the acceleration of beam with superconducting spoke resonators, and to demonstrate technology allowing multiple RF structures including the RFQ, the warm accelerator section, and the superconducting spoke cavities to be powered from a single klystron. In parallel to setting-up this test facility, a study program has been launched to investigate the 8 GeV H^- beam transport, injection into the Main Injector, intensity limitations in the Main Injector, and details of targeting the 2 MW beam. The R&D plan aims for a complete 90 MeV linac starting with the ion source, followed by an RFQ section, a Medium Energy Beam Transport (MEBT) line, a room temperature accelerator section, and two different kinds of superconducting spoke resonators (ß=0.22 and 0.4). The plan has a number of challenges, requires development of several technologies, and many of the components are at the frontier of R&D in this field. The overall schedule seems to be ambitious but manageable, and the committee supports the plan, with the recommendation that a detailed schedule with milestones and deliverables be developed. In addition, the committee recommends that sufficient diagnostics be included in the test facility to fully verify success as well as understand unexpected results, and that detailed simulations be performed to verify the vector modulator specifications and performance.

The HINS program includes many R&D topics and there are clear synergies between this R&D and the Radioactive Isotope Accelerator (RIA), as well as more generic accelerator R&D. In some cases, there are also clear synergies with the ILC accelerator R&D and possibly the ILC construction project.

More detailed comments and recommendations for each point of the charge are given below.

1) Proton Improvement Plan

The Proton Improvement Plan presented to the committee would achieve the world's highest beam power on target for neutrino production, with a relatively modest investment. The plan is staged in an attractive way, making good use of existing assets. The full implementation requires only one year shutdown after Run II, assuring a continuous physics program. The 400 kW stage could be introduced gradually in parallel with present collider operation during the years from 2007 to 2008. The 700 kW stage could be operational in 2011, followed by 1 MW in 2013. While no major risks in the program were identified, the program is recognized to be technically ambitious with demanding requirements on the RF systems and beam control. The whole scheme relies on slip-stacking which, in spite of being demonstrated, still requires a considerable development effort. Machine protection with the increased beam power needs careful study to ensure reliable operations.

400 kW on target

The development of this scheme is already well developed and in progress. Protons from the Booster are directly transferred to the Main Injector, and the repetition rate of the Booster will be increased to 9 Hz from the present 7.5 Hz.

i) Booster issues

The Booster hardware already operates at 15 Hz, while the beam is pulsed at 7.5 Hz. The main difficulty is to keep beam loss under control in order to avoid too much activation of machine components, and even equipment damage. Presently it is thought that about 400 W total beam loss is the maximum acceptable. Several measures are being implemented to reduce this beam power loss, including improved collimation systems, beam cleaning, better orbit control, new and sophisticated corrector magnets, and a new injection scheme. The committee considers the present predictions to be somewhat conservative, and that eventually the beam loss can be further reduced.

ii) Main Injector
It is planned to accumulate protons in the Main Injector using "slip-stacking", in order to allow injection of 11 batches from the Booster, instead of the present seven. The committee made a particular effort to assess the present status of slip-stacking, since the success of the whole program relies to a large extent on the successful implementation of this technique. The technique is demonstrated and is presently in use, however, the committee considers that more development is needed to implement the technique in other machines. In addition, other aspects of the RF system require considerable improvements. The program will become gradually operational in the years from 2007 to 2009. While this is a challenging program, the committee considers that the chances of success are high.

SNuMI phase one: 700 kW on target
This second step of the proton improvement plan, know as Super NuMI, will be introduced after the end of Tevatron operations. Its main feature is to pre-load batches from the Booster in the Recycler to reduce the Main Injector cycle time.

i) Booster
The repetition rate of the Booster is to be increased to 15 Hz, which is not expected to be a problem, since all foreseen improvements will already be installed. However, attention still has to be given to the control of beam loss.

ii) Recycler
The Recycler has to be converted from operation with protons to antiprotons with a cycle time of 1.5 s. Several new components need to be installed: new injection and transfer lines, new kickers and two new RF systems for slip-stacking of up to 12 booster batches. The kickers are demanding technology. This phase of the program relies on the successful implementation of slip-stacking.

iii) Main Injector
Two RF stations have to be added, such that the cycle time can be reduced to 1.5 s. No particular difficulties are expected here.

SNuMI phase two: 1 MW on target
In this part of the program the Accumulator is introduced into the chain, to momentum-stack protons before loading them into the Recycler. Protons are to be transferred from the Linac to the Booster, from there into the Accumulator (momentum stacked, and rebunched), then into the Recycler (box-car stacked) and finally into the Main Injector (for acceleration from 8 to 120 GeV), from where they are ejected in one turn onto the target.

i) Accumulator
A new injection line has to be built and the machine has to be converted to operation with protons. The machine was originally designed for momentum-stacking particles, however not with an RF system, and a new RF system will therefore be required. This machine will require RF gymnastics, de-bunching, re-bunching etc., which the committee considers to be state of the art, and not trivial.

ii) Recycler
The protons are injected into the Recycler using standard box-car stacking.

iii) Main Injector
Modifications to the RF system are required, and a second power tube added to each amplifier may be beneficial to improve reliability. The question of electron cloud effects is being studied, and this could turn out to be a difficulty. Presently, however, it is not possible to make reliable predictions. The committee recommends to aggressively pursue electron cloud simulations and if necessary to develop counter-measures to be included in design considerations from the beginning.

iv) Target, Horn
The NuMI beam line is already designed for 400 kW on target. For the following stages solid engineering is under way. The main challenges are activation and radiation problems. Hands-on maintenance will be difficult, and appropriate means have to be designed into the system from the beginning; component reliability is of particular importance in this area. In addition, the target-horn arrangement will be moved between the different stages of the project. A study of environmental impact of this facility is already under way.

v) Beam protection
With the much higher beam power, a single misdirected batch has potential of damaging machine components. It appears that the most problematic area is target and the horn, where a mis-steered beam could damage the window of the decay channel. The committee recommends continued detailed study of this complex issue.

2) High Intensity Neutrino Source (HINS) R&D Program

Overall Layout of the 90 MeV Front-End

i) The Different Stages
The HINS experimental R&D program is being built-up in the Meson building. Within this program high power RF distribution with 4.5 millisecond pulse duration will be demonstrated in an RF component test facility. Installation of the 325 MHz klystron together with its modulator and pulse transformer is to be completed by early FY07. Waveguide components including hybrids, circulators, and loads, building up a high-power vector modulator (IQM or in-phase/quadrature modulator), will be developed. The inclusion of a cavity test cave will allow for performance tests of the various 325 MHz RF cavities (both room-temperature and superconducting) up to full power (~100 kW maximum pulsed). Installation of a spoke resonator test cryostat is planned for October, and the first room-temperature resonator is scheduled to see high power in the fall of this year. The magnetron ion source is based on an existing Fermilab dual-plasmatron system, and the low energy beam transport section will use an industrially built RFQ (delivery expected December 2006).

The room-temperature cross-bar H-type (RT-CH) cavities together with superconducting solenoid magnets will form the room-temperature section, scheduled for installation in

FY07/beginning FY08. Two buncher cavities to be designed by LBNL will be procured in 2007, and should be supplemented by the chopper and its pulser in 2008.

The first superconducting spoke resonator cryostat (SSR1, ß=0.22) is planned for installation in the end of FY08/beginning of FY09. The second type of cryostat (SSR2) is scheduled for the last year of the R&D program. 90 MeV linac operation is foreseen for 2009 and 2010.

ii) Comments on the overall layout
The overall schedule seems to be ambitious but manageable. The final goal of the R&D project will be a fully operational 90 MeV linac combining known and new accelerator technologies. Since the set-up features the first acceleration of H^- Ions in a superconducting spoke resonator, and use of high-power IQM techniques for control of multiple cavity types from a single power source, the committee recommends incorporating ample beam diagnostics throughout the accelerator, and also diagnostics in the RF transmission lines. In addition, the committee recommends that the incorporation of steering magnets in the linac be investigated.

RF Powering Using a Single 325 MHz Klystron

The plan includes powering all RF resonators from the RFQ up to the 90 MeV level, including both warm and cold components, with a single klystron. R&D with respect to the RF power components is well under way. A number of waveguide pieces, the klystron, and the pulse transformer are already available. The RF distribution concept is clear. Nevertheless, the committee is not completely convinced about its feasibility. Due to the different time constants of warm and cold RF sections, amplitude and phase regulation of the individual resonators using IQ modulators is critical. The committee recommends performing detailed simulations in order to verify the present assumptions and IQM specifications. The behaviour of the RF vectors at beam injection should be studied carefully.

Superconducting Spoke Resonators (SSR)

The use of superconducting spoke resonators (type SSR1 for ß=0.22, and type SSR2 for ß=0.4) is promising, and the committee is encouraged to see the continuation of earlier work done for example at Argonne National Laboratory. Nevertheless, this type of superconducting cavity has not been tested with beam. Therefore it is important to understand whether potential Higher Order Modes can decrease the beam quality, given the high H^- beam current design of 45 mA. Also the fact that all spokes and all input couplers have the same axial orientation might be an issue. The committee recommends to asses the strength of field asymmetry in the spoke resonators, and its impact on the beam.

Frequency Tuner in the Cold Mass

Like all other superconducting accelerator cavities, the spoke resonators need frequency tuning while operating at low temperatures. The high quality factor results in a sensitivity of the order of 0.1 mm length variation corresponding to 100 kHz range frequency variation. The SSR design includes a mechanical system translating a rotational movement into a length change of the cavity. A stepping motor is required at cold temperature (at 4 K level, outside the Helium vessel), and such systems are in use at other accelerators, e.g. the TESLA style cavities at DESY. Nevertheless, the committee recommends that the whole tuner system (stepping motor and gear system) be tested at operational temperature for its function and long time reliability. This could be done even before attaching it to the SSR, and should be done before ‘burying’ it inside the cryostat.

Power Coupler

The SSR input coupler needs to transmit up to 35 kW at 325 MHz. Although the coupler has two windows (cold and warm) in order to improve reliability, the overall design is nice and simple. Since a single initial tuning seems to be sufficient, all cold moving parts can be avoided.

Superconducting Solenoids inside the SSR Cryostats

All solenoids in the room temperature and in the spoke resonator sections are designed to be superconducting. The strength of the solenoids is remarkable. The short focal length of about 13 cm corresponds to a maximum field of 5 T. Accurate alignment is required, and a precision of 0.2 mm at cold temperature was stated. This is comparable to the alignment accuracy required in ILC type cryostats, and the committee recommends the development of an overall alignment strategy. The question of checking the alignment after installation and cool-down should be addressed, for example are stretched wire-systems under consideration? In principal beam based alignment could be done, however, beam position monitors are not jet integrated into the overall cryostat design. From the reports it was also not clear how the solenoids are supported inside the cold mass, how the vacuum forces will be taken into account, and whether correction coils and beam steering magnets are integrated into the design. The committee recommends a detailed mechanical support and alignment plan be developed, including correction magnets and beam position monitors.

The fringe field of the superconducting solenoid is clearly an issue. At the cavity surface, the remanent field of the 5 T solenoid should be reduced to below 0.1 mT, a factor of almost 10^{-5}. If the cavities are cold when switching on the solenoid current, a fringe field of up to 10 mT may be accepted due to shielding effects, however, the implications of a cavity quench with the solenoids powered were not presented. The committee recommends careful study of all possible scenarios involving the leakage field from the solenoid into the SSR. Necessary measures to reduce it to an acceptable level should be investigated. In addition, shielding of the earth’s magnetic field using high permeability material is required. The solenoid fringe field might impact the mechanical design of such a shield.

The LEBT Chopper and its Pulser

The LEBT chopper has challenging specifications, with about 2 kV drive voltage, a repetition rate of 53 MHz, and a rise/fall time of less or equal to 2 ns. The presently achieved 400-500 V into 50 ohms at 53 MHz repetition rate is a good starting point, but a pulser producing up to 2.5 kV pulse is a crucial R&D item. The committee recommends development of a strategy that leads to the realization of the goal, and suggests checking if synergy exists with ILC damping ring kicker pulsers, where techniques are being explored with the aim of a few MHz at the 10 kV level. In addition the extended tail of the chopper pulse might be an issue, and the committee suggests that the impact of ripple in the pulse remaining after 2 ns be assessed.

High Power RF Amplitude and Phase Modulator (IQM)

The single RF source for both normal and superconducting resonators requires amplitude and phase modulation at high power level (typically 40–120 kW for cavities, and 275 kW at RFQ drive loops). The specification for this 325 MHz device is determined by the phase tuner slew rate, and present simulations yield a required 1 deg / μs rate. The work looks very promising, and measurements of the component devices (stripline hybrid, circulators, and phase shifters) support the design concept. In addition, a 1.3 GHz waveguide hybrid has been ordered from industry to develop into an IQM. The committee considers that such a device offers new possibilities in achieving high stability in amplitude and phase of accelerating fields in superconducting resonators.

High Power RF System

The overall high power RF plan seems to be in good shape. The klystron, based on the JPARC 325 MHz design, has been delivered by Toshiba. The pulse transformer has also been delivered, and many waveguide components are in hand. The concept for the long pulse (up to 4.5 ms) bouncer modulator is well developed. The committee appreciates that the modulator design includes accommodating a 10 MW Multi-Beam-Klystron connected directly to the transformer, and recognizes that this may have benefits to other programs (see synergies section below). The stable long pulse operation of such klystrons is an issue with the ILC R&D work. Concerning the LLRF system the committee recognizes the importance of the integration of the high power IQMs. The adaptation of the state-of-the-art LLRF systems (SNS, DESY and others) has already started in collaboration with LBNL and continued development is essential.

Ion Source

The plan for the H^- source is to provide a known and reliable magnetron, although it is recognized that this will not reach the final goal of 45 mA with 0.24 pi mm mrad RMS emittance. The magnetron installation in the Meson building is planned for fall 2006. On the long term a different type of ion source is required, and there is significant interest in using an RF multi-cusp volume source similar to the DESY or SNS design. The committee suggests following the R&D work on such sources very closely since the final source specification is challenging.

H- Injection

The H^- injection program is well defined, and no fatal problems were discovered so far. It is clear that the scaling of the stripping foil physics from the measured 200 MeV data to 8 GeV is perhaps risky, and the committee supports the plan to investigate additional measurements at 400 MeV and above 800 MeV.

<u>3) Synergies with the HINS</u>

Spoke cavities

Spoke cavities are an excellent concept but have not been fully demonstrated, and the HINS program will demonstrate the capability by accelerating beam.

Long Pulse Modulator

It was suggested that the design for the long-pulse (4.5 ms pulse length) modulator might allow for an optimization of the ILC RF system. A long-pulse modulator might be used to optimize the

ILC RF design, however the specific implementation would likely not be based on a large step-up transformer like the Fermilab design, and the adoption of such an option would require many other technological demonstrations including long-pulse option of the ILC klystrons, cavities, and RF distribution system.

While the specific long-pulse modulator may not have direct application to the ILC design, the system would still be very useful to prove the ILC technology. Both the RF distribution system and the klystrons have had trouble operating at the full 1.5 ms pulse length. It would be important to demonstrate improved designs at relatively long pulses to ensure that there are no nearby operational limitations.

I&Q Modulator (IQM)

The I&Q modulator is an innovative design with many possible applications: it is almost always desirable to have independent phase and amplitude control. Such a technology might have been useful in the SNS design where, instead, independent klystrons are used to power each SC cavity. In the ILC, the IQM would allow for more efficient use of the RF power, however, because of the larger component count, a detailed cost-gain analysis is needed. In the DESY XFEL, the IQM might allow for better energy control before the first bunch compressor where the energy stability is crucial. The technology also may prove to be important in other next-generation future superconducting linacs.

Electromagnetic Cavity Tuner

This is another innovative concept that may simplify the cavity tuner design. The system will be demonstrated on the 3.9 GHz cavities being fabricated at Fermilab for installation at DESY. These tuners should be evaluated for use with the XFEL and ILC along with the other tuner options.

Cavity Production Loop

High gradient cavity production is the largest R&D problem facing the ILC design. Developing a process to routinely achieve gradients of 30~35 MV/m is predicted to have a very large cost reduction in the ILC. It can be argued that approaching this problem with multiple independent R&D approaches is desirable to maximize the probability of success. The development of the proposed cavity processing scheme would likely benefit most other applications using superconducting cavities as well.

The HINS (formerly know as the Proton Driver) and the ILC Engineering Test Facility

The HINS and the ILC Engineering Test Facility have different goals, which make the synergy difficult. Clearly, operation of the HINS would provide confidence in the ILC RF system design but much of this experience can be gained at smaller test facilities and at the XFEL. The construction of the HINS would undoubtedly help industrialize the ILC RF system and the superconducting cavities and cryomodules, however it is also unlikely that the HINS could provide detailed information about the specific ILC installation as the tunnel configurations will likely be quite different. Finally, a HINS may be constructed from left-over cryomodules from an ILC Engineering Test Facility. This would be an excellent use of the technology if the ILC project is not pursued beyond the construction of a large engineering test facility.

Fermilab Accelerator Advisory Committee

May 10-12, 2006

Charge (Draft Rev. 3)

The Fermilab Accelerator Advisory Committee is asked to focus in its May 2006 meeting on efforts aimed at developing the Fermilab neutrino programs beyond the 2009 end of Run II, and the opportunities for aligning these efforts with the ILC program. Three primary topics will be discussed:

1. Proton Improvement Plan and its immediate follow-ons
The Proton Improvement Plan has been established, and work has started, with the goal of achieving up to 400 kW of beam power delivered to the NuMI target simultaneous with antiproton production for Run II. Following the completion of Run II certain assets will become available for the utilization in the neutrino program, and concepts are being developed for extending performance of the Main Injector complex to approximately 1 MW.

The committee is asked to review the plan for evolution of the neutrino complex from the present time through and beyond the end of Collider Run II and offer comments and recommendations relative to strategy, technical feasibility, and planning and execution.

2. High Intensity Neutrino Source R&D
A possibility that has been discussed extensively for the longer term future neutrino program is the development of a >2 MW neutrino source based on a superconducting H^- linac. Fermilab's approach has been modified over the last year to align this effort more closely with the laboratory's ILC strategy.

The committee is asked to review and offer comments and recommendations relative to the current plan, strategy, and development status of R&D in support of a High Intensity Neutrino Source.

3. High Intensity Neutrino Source Synergies
Identification of possible synergies, or multiple use applications, of technologies developed within the HINS R&D program could provide a cost effective means of advancing multiple options for Fermilab and/or the Office of Science. The most discussed synergy involves the β=1

superconducting linac that serves as the basis of both the ILC and HINS. However, other possibilities, while not developed in detail, may exist.

We would like to engage the committee in discussion on possible strategies to maximize mutual benefit to the HINS and other programs. This discussion will include:

- Possible synergies with the ILC
- Possible utilization of the HINS in support of a muon storage ring
- Possible connections with other Office of Science programs

We are interested in any reaction or advice the committee would provide in these areas.

As usual the committee is invited to issue comments or suggestions on any aspect of the programs discussed beyond those specifically included in this charge. It is requested that a concise report responsive to this charge be forwarded to the Fermilab Director by June 15, 2006. Thank you.

Fermilab Accelerator Advisory Committee
Agenda
May 10-12, 2006
Comitium, Wilson Hall 2SE
Revision 18-April-2006

Wednesday, May 10

8:30-9:00	Committee Executive Session	J. Corlett
9:00-9:20	Welcome and Presentation of Charge	S. Holmes

Proton Development Plan (Organized by Roger Dixon)

9:20-9:40	Overview of Plans for High Intensity Neutrino Beams	R. Dixon
9:40-10:15	Overview of the Proton Plan	E. Prebys
10:15-10:35	Break	
10:35-11:00	Overview of the SuperNuMI Plan	A. Marchionni
11:00-11:25	Targets and Horns	M. Martens
11:25-11:50	700 KW Proton Beam for Neutrinos	P. Derwent
11:50-12:15	1 MW Proton Beam for Neutrinos	D. McGinnis
12:15-12:30	Discussion	
12:15-1:15	Lunch	

High Intensity Neutrino Source R&D (Organized by Giorgio Apollinari)

1:15-1:35	Introduction, Plans, and Funding	G. Apollinari
1:35-2:05	Beam Dynamics/Linac Simulation	P. Ostrumov
2 :05-2 :35	Systems Integration and Meson Lab Setup	R. Webber
2:35-2:50	Discussion	
2:50-3:10	Break	
3:10-3:25	IQM and Phase Shifters	D. Wildman
3:25-3:45	Klystron and Modulator	A. Moretti/C. Jensen
3:45-4:10	Ion Source and RFQ	D. Moehs/G. Romanov
4:10-4:25	Solenoids and Room Temperature Section	T. Page
4:25-5:00	Discussion	
5:00-6:30	Committee Executive Session. Requests for supplementary or breakout presentations on Wednesday	
7:00	Dinner	

Thursday, May 11

High Intensity Neutrino Source R&D (cont.)

8:30-9:00	Spoke Cavities and Cryostats	T. Nicol
9:00-9:20	Focusing Solenoids	I. Terechkine
9:20-9:35	Main Injector Injection	D. Johnson
9:35-9:50	Discussion	
9:50-10:10	Break	

Discussions of HINS Synergies

10:10-11:00	Potential synergies related to the HINS R&D program	
11:00-12:00	Potential synergies related to construction of HINS	
11:00-11:15	Issues related to a dual use (ILC Test and HINS) facility	D. Bogert
11:15-12:00	Discussion	
12:00-1:00	Lunch	
1:00-5:00	Supplementary presentations and/or breakout discussions as requested by the committee. Committee Executive Session	

Friday, May 12

8:30-11:00	Committee Executive Session
11:00-12:00	Closeout
12:00	Adjourn

Additional Presentations

1. How does Tevatron work affect the Proton Development Plan. In particular is the roll-off of people from Run II consistent with the buildup of people on ILC and Proton initiatives? What are the implications if run into trouble achieving stacking goals? (R. Dixon)

2. More detailed overview of the technical issues with slip-stacking. What has been achieved and what remains to be done (for 2+9)? (A. Marchionni)

3. How serious is the single pulse accident at 1 MW? What can be damaged? What is the experience with one pulse going astray in NuMI? (A. Marchionni)

4. What is the analysis backing up the claim that the losses will be reduced with the new corrector system in the Booster? What are the expectations for performance with the new systems implemented. (E. Prebys)

5. Are there issues with operating waveguide in long pulse mode? (G. Apollinari)

6. How do you control the vectors of the warm and cold structures during filling (and after the pulse)? Can this all be done with a common IQ spec? (G. Apollinari)