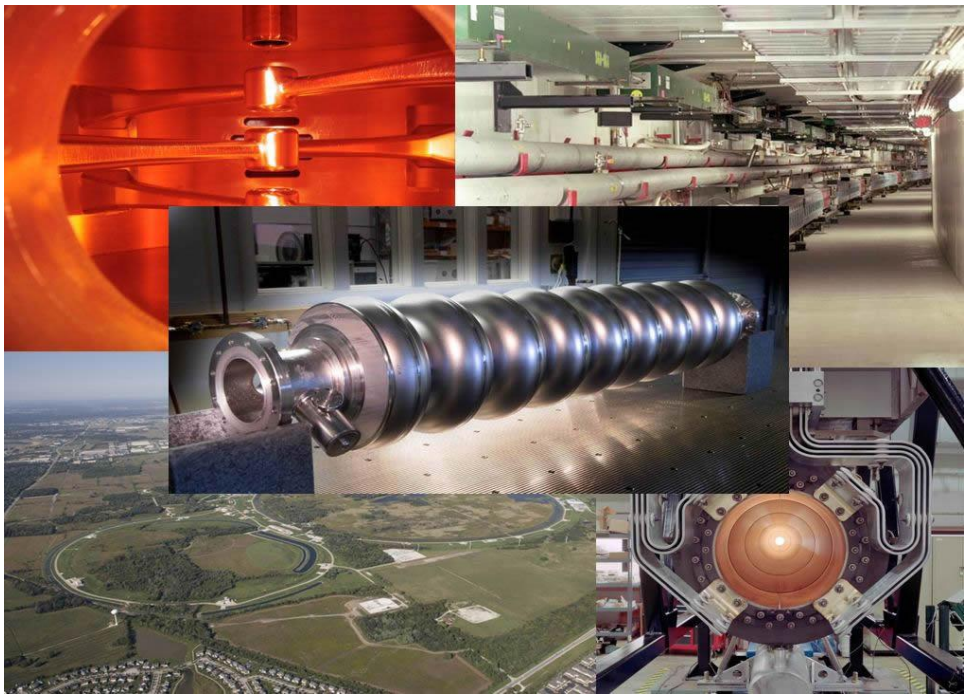
Report on Accelerator Physics and Technology Workshop for Project X

11/13/2007



The purpose of the workshop was to discuss accelerator physics and technology issues of Project X and explore possible areas of overlap and interest between various particle accelerator laboratories and universities.

Contents

Introduction

Project X is a concept for an intense 8 GeV proton source that provides beam for the Fermilab Main Injector and an 8 GeV physics program. The source consists of an 8 GeV superconducting linac that injects into the Fermilab Recycler where multiple linac beam pulses are stripped and accumulated. The 8 GeV linac consists of a low energy front end possibly based on superconducting technology and a high energy end composed of ILC-like cryomodules. The use of the Recycler reduces the required charge in the superconducting 8 GeV linac to match the charge per pulse of the ILC design; aligning Project X and ILC technologies

A workshop was held November 12-13, 2007 at Fermilab. The workshop drew 175 people from 28 different institutions. The purpose of the workshop was to discuss accelerator physics and technology issues of Project X and explore possible areas of overlap and interest between various particle accelerator laboratories and universities.

The workshop was organized into a plenary session followed by breakout sessions. There were five breakout sessions held concurrently. The sessions were:

1. Low Energy Linac
2. High Energy Linac
3. Recycler Ring
4. Main Injector Ring
5. 120 GeV targeting

The workshop agenda and talks can be found at
http://projectx.fnal.gov/Workshop/Index.htm.
The agenda and breakout agendas with links to the talks can also be found in Appendix B-E of this report. The organization of the workshop is outlined in Appendix A and the list of participants is found in Appendix F.

Talk Summary

Plenary Session

Introductory Remarks
S. Holmes (FNAL)
This talk discussed the priorities of Fermilab in the next decade and possible ILC scenarios. It introduced the concept of Project X in the context of these scenarios and the next steps for in Project X process. It concluded with the goals of the workshop.

Project X Overview
D. McGinnis (FNAL)
This talk gave the motivation of Project X in terms of the desire for a high flux proton source that is closely aligned with ILC technology. It delved into the concept of Project X and a brief description of the components of Project X. It discussed a possible schedule. The talk next described how the workshop would be organized and the workshop agenda.

Low Energy Linac Overview
R. Webber (FNAL)
The low energy linac is defined as the section of the linac operating at 325MHz. This talk discussed Project X parameters, a history of superconducting proton linacs at Fermilab and conceptual design of the low energy linac and issues concerning the linac in the Project X context. The talk next discussed the High Intensity Neutrino Source (HINS) R&D program. The talk finished with the objectives and agenda for the Low Energy Linac breakout session.

High Energy Linac Overview
S. Nagaitsev (FNAL)
The high energy linac is defined as the section of the linac operating at 1300 MHz. This talk gives an overview of the technical systems in the high energy linac and a description of an ILC RF unit. The talk also compares the Proton Driver linac design with the Project X design including a discussion of the $8\pi/9$ mode cavities for the $\beta=0.8$ section. The talk also discusses the RF Power, cryogenic, and site considerations. The talk ends with a description of the ILC superconducting RF R&D program.

Recycler Overview
A.Valishev (FNAL)
This talk describes the role of the Recycler in the Project X project with a parameter table. The talk describes the injection process including H- injection, stripping, and longitudinal and transverse phase space painting. Next beam stability and beam loss and beam loss management considerations including collimation are discussed. The talk concludes with the agenda and the major issues for the Recycler to be discussed at the workshop.

Main Injector Overview
V. Lebedev (FNAL)
This talk opens with the choice of Main Injector parameters for Project X. Next the evolution of parameters during the Main Injector acceleration cycle is presented. The talk describes the RF system required along with a discussion of a gamma-t jump system. The talk concludes with a description of beam instabilities, beam loss and beam loss management.

120 GeV Targeting Overview
J. Hylen (FNAL)
This talk opens with a description of the components that comprise a conventional neutrino beam line. The talk then moves to a discussion of the issues in upgrading the current NUMI beamline to handle a beam power up to 2 MW. The 2MW is a possible goal because the original system was designed for 0.4 MW with significant redundancy. The talk then moves to the requirements of a new beam line pointed at the DUSEL sight and a beam power greater than 2MW. The talk finishes a list of possible areas of collaboration.

Low energy Linac

Linac Beam Physics Design and Special Requirements of H- vs e
P.Ostroumov (ANL)
Ostroumov described the over-all design of the Project X Linac which incorporates the best known design principles of modern high intensity beam physics. These include adiabatic change of oscillation wave numbers across lattice transitions and axially symmetric beam parameters. The Linac is comprised of a 325 MHz low-energy section up to 0.6 GeV and a 1.3 GHz ILC-like section from 0.6 to 8 GeV. The special requirements of a machine for non-relativistic H- ions as compared to an electron machine were highlighted. Peter notes that the design is appropriate for CD-0 approval and that R&D for the machine is well advanced, with the exception of the triple-spoke superconducting cavities.

Linac Simulation Results and Issues
J. Carneiro (FNAL)
Carneiro presented benchmark simulations of the Linac with the codes TRACK and ASTRA in good agreement. H- stripping effects due to magnetic field, residual gas, and black body radiation have been incorporated into TRACK.

What It Will Take to Produce 1 Cryomodule per Month
R. Kephart (FNAL)
Kephart presented and overview of the SCRF facilities and infrastructure required to accomplish necessary R&D and to achieve a production rate of one cryomodule per month as would be called for by Project X. He notes that both total funding and funding profiles to build this infrastructure are a concern for a 2012 Project X start.

SNS Superconducting Linac Operating Experience and Issues
I. Campisi (SNS)
Campisi reviewed the superconducting Linac operating experience and issues of SNS. He described numerous cavity performance and system interaction issues, e.g. between cavity radiation and cold cathode gauges, that complicate operation and require careful monitoring, especially at turn-on, so as to avoid irreversible damage to the superconducting cavities. He notes that although many Operations "nuisances" are design dependent, there will always be "nuisances", and therefore any design should leave room for failures, gradient deratings, and for "unknown and known unknowns!"

325 MHz RF Distribution
A. Moretti (FNAL)
Moretti presented the "one-klystron-to-many-cavities" RF distribution system and control plan for the 325 MHz section of the Project X Linac. High power vector modulators are required at each cavity to dynamically achieve acceptable RF amplitude and phase control.

Room Temperature Cavity Design
G. Romanov (FNAL)
Romanov described the electromagnetic and mechanical design and status of the room temperature spoke cavities for the 2.5-10 MeV front-end of the Linac. The first of 16 cavities

has been RF conditioned, successfully passing all high power tests, the next three cavities are being fabricated and the design of cavities #5-#16 is nearly complete.

SC Spoke Cavity Design and Status
T. Khabiboulline (FNAL)
Khabiboulline presented the design and status of the superconducting spoke cavities and cavity drive couplers for the 10-600 MeV section of the Linac. There are two single-spoke designs and one triple-spoke design required. The first single-spoke cavity has been fabricated and is expected to undergo RF power testing, CW and pulsed, with power coupler in 2008.

Superconducting Solenoid Design
I. Terechkine (FNAL)
Terechkine presented the design and status of the superconducting solenoid magnets that are to provide transverse beam focusing throughout the first 100 MeV of the Linac. Some of the magnets also incorporate dipole windings for beam steering correction. Design is complete for the solenoids for the room temperature section of the Linac and production is anticipated in 2008. A test stand and cryostat to facilitate determination of the solenoid magnetic axis and measurement of low level fringe fields is needed.

History of SNS Design and Decisions
R. Kustom (ANL)
Kustom reminded the group of the history of the SNS design and technology choices. The decision to use superconducting RF in the Linac came very late in the development of the project and was accepted because it offered a 30% reduction of tunnel length, a 12 MW reduction in electrical power requirements, and greater flexibility for future upgrades. Notably, it was perceived that there existed a significant industrial base for building superconducting cavities, whereas not for RT cavities! The late decision allowed little time for cavity R&D, set the warm-to-cold transition energy at 185 MeV so as to avoid an additional, lower β, cavity design, and determined what was considered to be a conservative design gradient (which is even proving difficult to achieve operationally).

Argonne Collaboration Report - Accelerator Physics and Spoke Cavities
D. Geesaman (ANL)
Geesaman described Argonne's efforts in support of the HINS Linac physics design and superconducting cavity development. He proposed that Argonne might be interested to take on responsibility for an integrated section of the Project X Linac, particularly the superconducting triple-spoke section.

Brookhaven Collaboration Report - Instrumentation
R. Connolly (BNL)
Connolly provided an update on the H- neutralization laser profile monitor for HINS that is being developed as part of the BNL-FNAL collaboration.

Berkeley Collaboration Report - Buncher Cavities and LLRF
A. Ratti (LBNL)

Ratti described LLRF controls hardware and firmware development for HINS, also buncher cavity design and fabrication oversight.

High energy Linac

Project X and ILC: differences and similarities
C. Adolphsen (SLAC)
Adolphsen has described differences and similarities in ILC and Project X linac designs. He concluded that the rf distribution system needs to be modified although it will use similar components. Quads and instrumentation would likely differ. LLRF will be challenging for the low-beta beams. Power Sources and cavities could be essentially identical. Civil and Cryo Layout could be similar. Producing 300 cavities and 13 sources would help jump-start US industry - need 16,000 cavities and 600 sources for the ILC.

RF Distribution for Project X
C.Nantista (SLAC)
Nantista described possible rf power distribution scheme for Project X. He concluded that the configuration and components used will depend on (1) the degree of control required in setting the power, phase, and coupling at each individual cavity, (2) which, if any, of these parameters need to be changeable remotely and (3) whether and what fast (not mechanical) control is needed.

LLRF Challenges in Project X
B.Chase (FNAL)
Chase gave an overview of the present state-of-art in multicavity LLRF controls. He concluded that (1) Project X LLRF shares many of the same control issues as the ILC (by design), (2) the High Power Vector Modulators and their bandwidth are key to regulation, and (3) there are no show stoppers that he sees in achieving LLRF specifications.

Project X Cryogenics
A. Klebaner (FNAL)
Klebaner gave a design concept for the Project X cryogenics system. He stated that design plant capacity needed for Project X is 8kW (equivalent at 4.5 K). The total installed plant power is about 2MW. He made the following conclusions: (1) contributions from other laboratories are needed to help address Project X design challenges, (2) Project X cryogenic system operating temperatures and pressure levels are largely determined by the choice of the ILC style cryomodules, (3) most of the design challenges are similar to those that ILC and XFEL are faced with, addressing these design challenges will benefit projects that utilize long strings of the ILC cryomodules and (4) Project X cryogenic system is technically feasible.

Project X Civil Design & Site Considerations
D. Bogert (FNAL)
Bogert's talk was largely based on previous Proton Driver studies. These studies concluded that the total project cost (civil construction only) is estimated at $81M in 2006 dollars. The scope of the project is not unusual for Fermilab and is similar to MI. Also, he expects no surprises during the environmental assessment development.

Automated linac retuning
J. Galambos (SNS)
Galambos has described an automated cavity fault recovery scheme in operation at SNS. This scheme is essential for high beam availability at SNS.
R&D on beta=0.81 cavities: status report
W. Hartung (MSU)
Hartung presented the status of beta=0.81 cavities project at MSU. He concluded that (1) the RF performance reached in all 4 single-cell prototy pecavities is reasonable. The performance is adequate for use in a proton linac; (2) two 7-cell cavities have been fabricated, one from fine grain Nb and the other from large grain Nb. They have not yet been tested.

Electron Beams in the b=1 linac - Preliminary look at an e- source at 1 GeV location
P. Piot (NIU)
Piot has described two options for an electron source as well as possible applications of electron beams in the Project X.

Linac Instrumentation
N. Eddy (FNAL)
Eddy has presented the initial considerations for linac beam instrumentation.

Recycler and Main Injector

Many of the accelerator physics issues are common for the Main Injector and the Recycler. Due to this reason, two of the three breakout sessions were held jointly for the Main Injector and Recycler groups. Altogether there were 13 talks at the Main Injector and Recycler breakout sessions.

SNS Ring Beam Status
S. Danilov (ORNL)
This talk summarized operational experience at SNS with the focus on high intensity related issues. The conclusions relevant to Project X are: a) major sources of particle losses are scattering at the stripping foil and instabilities (ep and resistive wall); b) careful design of the collimation system has to be provisioned; c) various mechanisms of distribution painting at injection can be used to mitigate space charge.

Experimental Observations of Instabilities at Main Injector
I. Kourbanis (FNAL)
Presently, two types of collective instabilities are observed in the machine: transverse resistive wall instability and longitudinal mode-1 instability. The former is mitigated with tune chromaticity and dampers. The latter is controlled with beam loading compensation.

Theoretical Expectations for Instabilities
A. Burov (FNAL)
The talk discusses high intensity operation of the Main Injector and the Recycler. Resistive wall and electron cloud are identified as the two major sources of instabilities. For the Project

X parameters these instabilities should not present a problem if phase space painting, high betatron tune chromaticity and broadband dampers are used.

Electron Cloud and Vacuum
M. Furman (LBNL)
The talk presented an overview of electron cloud physics. Based on theoretical predictions which are in qualitative agreement with observations, the threshold beam intensity in electron cloud density for the Main Injector is a factor of 3 lower than proposed in Project X. The Recycler has not been looked at. A number of ways exist for reduction of the electron cloud density but overall the issue is one of the biggest challenges for the project.

Collimation Constraints in Main Injector for Project X
N. Mokhov (FNAL)
The talk gave a summary of radiation control constraints, specified parameters of the existing collimation system and necessary changes for Project X. In short, the existing collimation system is adequate for Project X with the exception of primary collimators.

Current Recycler Operations
C. Gattuso (FNAL)
This was an overview of the machine for experts from outside of the laboratory. Machine configuration and various operational issues specific to the Recycler were discussed.

Transfer Lines, H- Stripping and Injection
D. Raparia (BNL)
This talk was a detailed summary of work at different laboratories covering aspects related to H- transport and stripping, beam line design and matching, beam loss and collimation, beam stability, foil issues, phase space painting, etc. The conclusion of the talk said that although 8GeV stripping does not seem to be a show stopper, a number of practical realization issues have to be resolved and more experimental data are necessary.

SNS Laser Stripping Development
A. Aleksandrov (ORNL)
The talk discussed recent advances in laser stripping as a novel and promising technique. The proof of principle experiment has been successfully performed at SNS and further developments are expected within the next two years. Project X parameters present more favorable conditions for laser stripping because of a longer optimal wavelength.

Present MI Operation and Near Future Plans
I. Kourbanis (FNAL)
The talk discussed recent advances in Present high intensity operation and described the mode ("2+5"), where 2 slipped stacked Booster batches are used in the antiproton production and other 5 batches are sent to NUMI. Future (already commissioned) high intensity operation will be in the mode ("2+9"), where "9" represent 9 NUMI batches of which eight are slip-stacked.

Gamma Transition Jump

I. Kourbanis (FNAL)
Kourbanis presented W. Chou's (Fermilab) talk. The talk presented details of γt-system. The perturbation to the machine optics, location and design of pulsed quads as well as their power supplies were discussed.

Transition Crossing Simulations
I. Kourbanis (FNAL)
The talk discussed transition crossing where machine impedance and beam space charge were taken into account. It was suggested that a γt-jump greater than $\pm 1/2$ unit will be required to reduce the longitudinal emittance blow-up and eliminate the beam loss due to transition crossing.

RF Feedback and Measurements of Electron Cloud Density
J. Byrd (LBNL)
Discussed the method of measurement of electron cloud density developed at LBNL and demonstrated at PEP-II. The method is based on dependence of the electromagnetic wave propagation through vacuum chamber on the density of electron cloud. Opposite to the conventional electron cloud detectors this technique allows to measure electron cloud density integrated over large distance.

Main Injector RF System Upgrade for Project X
J. Reid (FNAL)
In this talk the present Main Injector RF system was described and requirements for the Project X upgrade were specified. New RF cavities and power amplifiers have to be developed for both the Main Injector and the Recycler. For this, the choice of the RF frequency has to be made as early as possible.

Main Injector Transverse Dampers
P. Adamson (FNAL)
This presentation described experience with the present Main Injector transverse digital damper. Preliminary consideration of a damper for Project X was discussed and two options for realization were outlined.

Recycler Extraction and Main Injector Injection
D. Johnson (FNAL)
This talk covered the following topics: present layout of extraction/injection lines and nearest future upgrades, possible Project X beam parameters relevant to extraction options. The analysis yielded that single turn injection/extraction is feasible while resonant extraction from the Recycler at ½ integer is probably not practical. It was suggested that 1/3 integer resonant extraction could be considered.

Parallel Simulation Tools for Project X
R. Ryne (LBNL)
In this talk, a general description of the SciDAC/ComPASS project was given along with demonstration of capabilities of some of the simulation codes.

120 GeV Targeting

120 GeV Targeting Overview
J. Hylen (FNAL)
An overview of conventional neutrino beamline and a list of issues associated with upgrading NuMI to ~2 MW or building a new neutrino beamline pointing to DUSEL. The conclusion is that there are no show stoppers for upgrading the NuMI beamline, but a risk analysis is needed because of reduced redundancy in the NuMI systems.

Engineering Issues for the NuMI Beamline at 2 MW
P. Hurh (FNAL)
A presentation on the engineering challenges of operating the NuMI Beamline at ~2 MW. The challenges include Thermal Shock/ Stress Waves in targets, Heat Removal, Radiation Damage, Radiation Accelerated Corrosion, Remote Positioning, and Radioactive Component Removal and Repair.

Activation and Remote Handling
J. Sheppard (SLAC)
A discussion on activation and remote handling of beamline components. Presented activation calculations and remote handling systems from RAL and ORNL. Conclusion was that repairs are inevitable and radiation work should be integrated into plans from the beginning. Another observation was that remote handling is probably more expensive than one would like to admit.

High Power Targets for Project X and Beyond
K. McDonald (Princeton)
A presentation on the issues with high power targets including solid targets and liquid targets. Interesting results from target experience including target damage due to cavitation and studies with proton beam on a liquid mercury jet for the CERN MERIT experiment.

IHEP 2 Megawatt Target Design
J. Hylen (FNAL)
Presentation on the conceptual design done by IHEP on a 2 MW target for NuMI. More work is needed on the target design, but the initial studies suggest that the target design would work for Project X parameters.

Experimental Radiation Damage Assessment of High Power Accelerator Targets Nick Simos, BNL
A presentation on high power targets with emphasis on experimental results on radiation damage. A number of target materials are considered and results from target irradiation studies were presented.

Expressions of Interest

Low energy Linac

- ANL
  - Accelerator physics design, simulation, and modeling
  - Superconducting RF cavity design, production, and testing
  - Integrated superconducting triple-spoke segment of Linac
- BNL
  - Beam Instrumentation
- JLab
  - Superconducting RF cavity development, production, cleaning, testing, and industrialization
  - Cryomodule assembly
  - Low level RF work
  - Cryogenics design
  - SRF system integration and industrialization
- LBNL
  - Front-end Linac design, fabrication, and integration (up to ~100 MeV)
  - Low level RF system design and construction
  - High voltage modulator design
  - H- stripping
  - Laser profile measurement
- University of Maryland
  - Modeling of solenoid lattice optics
  - Emittance growth and halo formation simulation studies (WARP code)

High energy Linac

- ANL
  - Design optimization, integration
  - Linac beta<1 section
  - ILC-like linac sections
  - Controls system
  - Electron source
- JLab
  - Design optimization, integration
  - Linac beta<1 section
  - ILC-like linac sections
  - Cryogenics design
  - LLRF system
  - Electron source
- LBNL
  - Design optimization, integration
  - LLRF system
- MIT-Bates

    - Electron source
    - Instrumentation
- MSU
    - Design optimization, integration
    - Beam dynamics, lattice, interfaces
    - Linac beta<1 section
- NIU
    - Electron source
- SLAC
    - Design optimization, integration
    - RF power systems
    - Fast phase/amplitude shifters
    - Controls
    - Instrumentation
    - High availability, dc power
- SNS
    - Design optimization, integration
    - Beam dynamics, lattice, interfaces
    - ILC-like linac sections
    - RF power systems
    - Fast phase/ampl shifters
    - Cryogenics design
    - LLRF system
    - Instrumentation
    - Servicing “hot” cryomodules

Recycler and Main Injector

- BNL
    - Electron cloud issues: Possible experiments in RHIC with bunch trains of 3e11 ppb (instrumentation in place).
    - Impedance and Instabilities: Study of beam break-up instability at transition (experience from AGS and RHIC)
    - H- Injection into recycler ring: Design of H- transport and injection systems (based experience from SNS effort)
    - RF & feedback systems: Design of high intensity RF systems for MI/RR (based experience from AGS and SNS effort)
    - Beam line and ring components: H- transport line and injection system
    - Extraction: Design of 3rd integer slow extraction system (experience from slow extraction from AGS and AGS Booster)
    - Transition crossing: Experience with bipolar gamma-t jump and chromaticity jump.
    - Transition crossing: Test of “duck under” crossing
- Cornell
    - Electron cloud issues: CESR available for e-cloud investigations starting in Spring 2008 for three years.

- LBNL
    - Electron cloud issues: e-cloud physics, mitigation, and instrumentation
    - Impedance and Instabilities: Characterize and understand limitations in recycler ring and main injector
    - Simulations and general beam dynamics: Beam simulations and modeling, halo & beam loss, space-charge tune shift.
    - H- Injection into recycler ring: Laser stripping, foil engineering issues, injection losses and absorber
    - RF & feedback systems: Broadband feedback systems, main RF upgrades, 2nd harmonic RF systems
    - Beam line and ring components: Vacuum systems, beam transport lines
- SLAC
    - Quantify instability thresholds due to electron cloud in the Main Injector and Recycler using the simulation codes being benchmarked against the experiments at PEP-II.
    - Suggest modifications to the vacuum chamber design to mitigate the effects of electron cloud, if necessary.
    - Develop an accurate impedance budget for the rings and estimate the threshold of impedance driven instabilities, in particular, simulating the microwave instabilities with a Vlasov solver.
    - Study beam dynamics and beam losses including full machine nonlinearity, space charge, and realistic collimators.
- SNS
    - Impedance and Instabilities: 2 types of SNS ring-present instabilities (ep and resistive wall) will be main issues for the recycler – SNS instability mitigation approach (chamber TiN coatings, electron collection, impedance reductions, feedback (under development)) could be useful for Project X
    - H- Injection into recycler ring: Foil scattering – one of main problems for both projects. Laser stripping development is of mutual interest (is a must for Project X).
    - H- Injection into recycler ring: Painting self consistent space charge distributions could be extremely beneficial to SNS (and Project X as well)
    - Beam line and ring components: Collimation design has to rely on most realistic mechanisms for particle loss

120 GeV Targeting

- ANL
    - Target Thermal Shock Simulations and Testing - James Grudzinski
    - Thermal Analysis and Cooling - James Grudzinski
    - Target Hall Remote Handling. Investigate Work Cell Modification, Telemanipulators - James Grudzinski
- BNL
    - Irradiation Investigations of Project-X target, Window, and Horn Materials - Nick Simos

    - Prototyping of Project-X Target System Design Options - Nick Simos
    - Target Thermal Shock Simulations and Testing - Nick Simos
    - Testing of Materials in Target Hall Type Environment - Nick Simos
- FNAL
    - Irradiation Investigations of Project-X target, Window, and Horn Materials - Nikolai Mokhov
    - Remote Handling Facility at C0 Assembly Hall - P. Hurh
    - Upstream Decay Pipe Window Replacement – P. Hurh
- IHEP
    - Prototyping of Project-X Target System Design Options - Valeri Garkusha
- UCB
    - Characterization of Target Hall Environment - Prof. Tom Devine, Department of Materials Science and Engineering, UCB.
    - Testing of Materials in Target Hall Type Environment- Prof. Tom Devine, Department of Materials Science and Engineering, UCB.
- ORNL
    - Target Thermal Shock Simulations and Testing - Bernie Riemer
    - Target Hall Remote Handling. Investigate Work Cell Modification, Tele-manipulators - Tom Burgess (ORNL) ,Van Graves (ORNL)
- Princeton
    - Irradiation Investigations of Project-X target, Window, and Horn Materials - Kirk McDonald
- University of Texas at Austin
    - Prototyping of Project-X Target System Design Options - Sacha Kopp
    - Instrumentation - Sacha Kopp
    - Focusing Systems - Sacha Kopp

Appendix A. Organization

Organizers

Steve	Holmes	holmes@fnal.gov
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Breakout Session Chairs

Low Energy Linac

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High Energy Linac

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120 GeV Targeting

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Appendix B. Agenda

Project X Workshop Agenda

November 12-13, 2007

Ramsey Auditorium

Monday
11/12/2007

8:30-	9:00	Registration	
9:00-	9:15	Introductory Remarks	Steve Holmes
9:15-	9:45	Project X Overview	Dave McGinnis
9:45-	10:15	Low Energy Linac Overview	Bob Webber
10:15-	10:45	High Energy Linac Overview	Sergei Nagaitsev
10:45-	11:00	Coffee Break	
11:00-	11:30	Recycler Overview	Alex Valishev
11:30-	12:00	Main Injector Overview	Valeri Lebedev
12:00-	12:30	120 GeV Targeting Overview	Jim Hylen
12:30-	13:30	Lunch	
13:30-	15:00	Breakout Sessions	
15:00-	15:30	Coffee Break	
15:30-	16:30	Breakout Sessions	
16:30-	17:45	Summary of Breakout Sessions	15 minutes by chairs
18:00-	20:00	Reception in Wilson Hall	

Tuesday
11/13/2007

8:30-	9:00	Registration	
9:00-	10:30	Breakout Sessions	
10:30-	11:00	Coffee	
11:00-	12:00	Breakout Sessions	
12:00-	13:00	Lunch	
13:00-	13:40	Low Energy Linac Report	
13:20-	13:40	High Energy Linac Report	
13:40-	14:00	Recycler Report	
14:00-	14:20	Main Injector Report	
14:20-	14:40	120 GeV Targeting Report	
14:40-	15:10	Coffee Break	
15:10-	15:30	Summary and Future Plans	Dave McGinnis
15:30-	15:45	Closing Remarks	Young-Kee Kim

Appendix C. Linac Breakout Agenda

Low Energy Linac Breakout Session

Chaired by Bob Webber (FNAL) and Peter Ostroumov (ANL)

Plenary Session Talks - Ramsey Auditorium	
30 min	Low Energy Linac Overview - Webber
30 min	High Energy Linac Overview - Nagaitsev

Breakouts	
Low Energy Linac	**High Energy Linac**

Breakout #1 --- (Nov. 12, 2007 -- 13:30 - 15:00) --- Issues Common to Entire Linac

	Meeting Room - One West (WH1W)
30 min	Linac Beam Physics Design and Special Requirements of H- vs e- -- Ostroumov (ANL)
12 min	Linac Simulation Results and Issues -- Carneiro (FNAL)
24 min	What It Will Take to Produce 1 Cryomodule per Month -- Kephart (FNAL)
24 min	SNS Superconducting Linac operating experience and issues -- Campisi (SNS)

Breakout #2 --- (Nov. 12 -- 15:30 - 16:30) ---

-	Meeting Room - One East (WH1E)
15 min	325 MHz RF Distribution -- Moretti (FNAL)
15 min	Room Temperature Cavity Design --
15 min	SC Spoke Cavity Design and Status --
15 min	Superconducting Solenoid Design --

Breakout #2 --- (Nov. 12 -- 15:30 - 16:30) ---

-	Meeting Room - One West (WH1W)
20 min	Project X and ILC: Differences and Similarities -- Adolphsen (SLAC)
20 min	RF Distribution for Project X -- Nantista (SLAC)
20 min	LLRF Challenges -- Chase (FNAL)

Breakout #3 --- (Nov. 13 -- 9:00 - 10:30) ---

	Meeting Room - One East (WH1E)
30 min	History of SNS Design and Decisions --
15 min	Argonne Collaboration Report - Accelerator
15 min	Brookhaven Collaboration Report -
15 min	Berkeley Collaboration Report - Buncher
15 min	Discussion of Present Conceptual Design

Breakout #3 --- (Nov. 13 -- 9:00 - 10:30) --- Linac

-	Meeting Room - One West (WH1W)
15 min	Cryo Systems Needed for Project X --
15 min	PrX Civil Construction and Layout -- Bogert (FNAL)
15 min	Automated Linac Re-tuning -- Galambos (SNS)
15 min	MSU Collaboration Report - Beta 0.8 Cavities --
15 min	Electron source at a 2-GeV location -- Piot (NIU)
15 min	Linac Instrumentation -- Eddy (FNAL)

Breakout #4 --- (Nov. 13 -- 11:00 - 12:00) --- Low

	Meeting Room - One East (WH1E)
	session details to be planned after Day 1

Breakout #4 --- (Nov. 13 -- 11:00 - 12:00) --- High Energy

	Meeting Room - One West (WH1W)
	session details to be planned after Day 1

Appendix D. Rings Breakout Agenda

Recycler Breakout Session

Chaired by Alex Valishev (FNAL) and Thomas Roser(BNL)

Plenary Session Talks - Ramsey Auditorium	
30 min	Recycler Overview - Valishev - (describe current vision of Project X Recycler upgrade)
30 min	Main Injector Overview - Lebedev - (describe current vision of Project X Main Injector upgrade)
Breakouts	
Recycler	**Main Injector**
Breakout #1 (Monday, 11/12/2007, 13:30 - 15:00) ***Issues Common to Both Rings,*** *chair - Thomas Roser*	
	Meeting Room - One North (WH1N)
20 min	SNS Ring Beam Status - Danilov (ORNL)
20 min	Experimental Observations of Instabilities at Main Injector - Kourbanis (Fermilab)
15 min	Theoretical Expectations for Instabilities - Burov (Fermilab)
20 min	Electron Cloud, EP Instability and Requirements for Vacuum- Furman (LBNL)
15 min	Beam Loss and Collimation - Mokhov (Fermilab)
Breakout #2 (11/12/2007, 15:30 - 16:30) ***Issues relative to particular design choices for Recycler*** *chair - Alex Valishev*	*Breakout #2 (11/12/2007, 15:30 - 16:30)* ***Issues relative to particular design choices for Main Injector*** *chair - Valeri Lebedev*
Meeting Room - One North (WH1N)	**Meeting Room - Race Track (WH7N)**
20 min — Present RR operation - Gattuso (Fermilab)	20 min — Present MI Operation and Near Future Plans - Kourbanis (Fermilab)
20 min — Transfer lines, H- stripping and injection - Raparia (BNL)	20 min — Gamma Transition Jump - Chou/Johnson (Fermilab)
20 min — SNS Laser Stripping Development - Aleksandrov (ORNL)	20 min — Transition Crossing Simulations - Kourbanis (Fermilab)
Breakout #3 (Tuesday, 11/13/2007, 9:00 - 10:30) ***Issues Common to Both Rings,*** *chair - John Corlett*	
	Meeting Room - One North (WH1N)
20 min	RF, Feedback and Measurements of Electron Cloud Density - Byrd (LBNL)
20 min	RF System and Beam Loading Compensation - Reid (Fermilab)
15 min	Transverse Damper - Adamson (Fermilab)
15 min	Injection and Extraction - Johnson (Fermilab)
20 min	Modeling of Ring Performance - Ryne (LBNL)
Breakout #4 (60 minutes) ***Discussions and Expressions of Interest for Future Collaboration***	
60 min	**Meeting Room - One North (WH1N)** / **Meeting Room - Race Track (WH7N)**

Appendix E. 120 GeV Targeting Breakout Agenda

120 GeV Targeting Breakout Session

Chaired by Mike Martens(FNAL) and Nick Simos(BNL)

Plenary Session Talks Ramsey Auditorium	
30 min	120 GeV Targeting Overview - Jim Hylen
Breakouts	
	Breakout #1 (90 minutes)
	Meeting Room - Snake Pit (WH2E)
30 min	Engineering Issues for the NuMI Beamline at 2 MW -- Pat Hurh
30 min	Activation and Remote Handling - John Sheppard
30 min	High Power Targets for Project X and Beyond - Kirk McDonald
	Breakout #2 (60 minutes)
	Meeting Room - Snake Pit (WH2E)
30 min	IHEP 2 Megawatt Target Design - Jim Hylen
30 min	Issues with Liquid vs. Solid Targets - John Sheppard
	Breakout #3 (90 minutes)
	Meeting Room - Snake Pit (WH2E)
30 min	Experimental Radiation Damage Assessment of High Power Accelerator Targets - Nick Simos
30 min	Issues and Challenges of High Power Targets for Muon Colliders - Kirk McDonald
30 min	Discussion
	Breakout #4 (60 minutes) ***Discussions and Expressions of Interest for Future Collaboration***
	Meeting Room - Snake Pit (WH2E)
	Details of this session to be planned after Day 1

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