ASTA User's Facility:

Recent News

1st Users' Meeting
1st Program Advisory Cmt'ee mtg
Snowmass & oncoming DOE review

Vladimir Shiltsev - APC
ASTA Director (Interim)

FNAL All Experimenter's Meeting
Aug 26, 2013

U.S. DEPARTMENT OF ENERGY

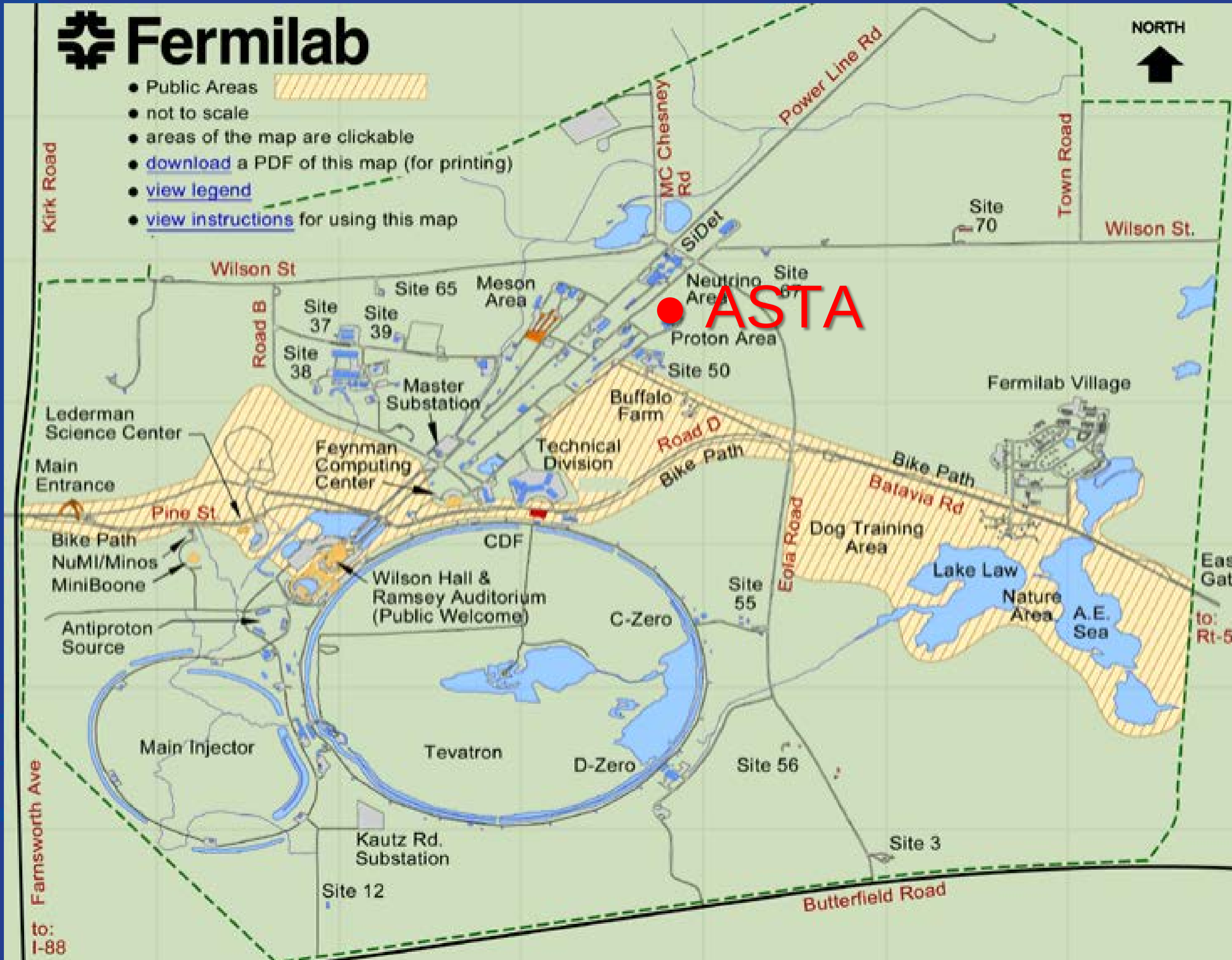
Fermilab

ASTA Facility

Advanced Superconducting Test Accelerator

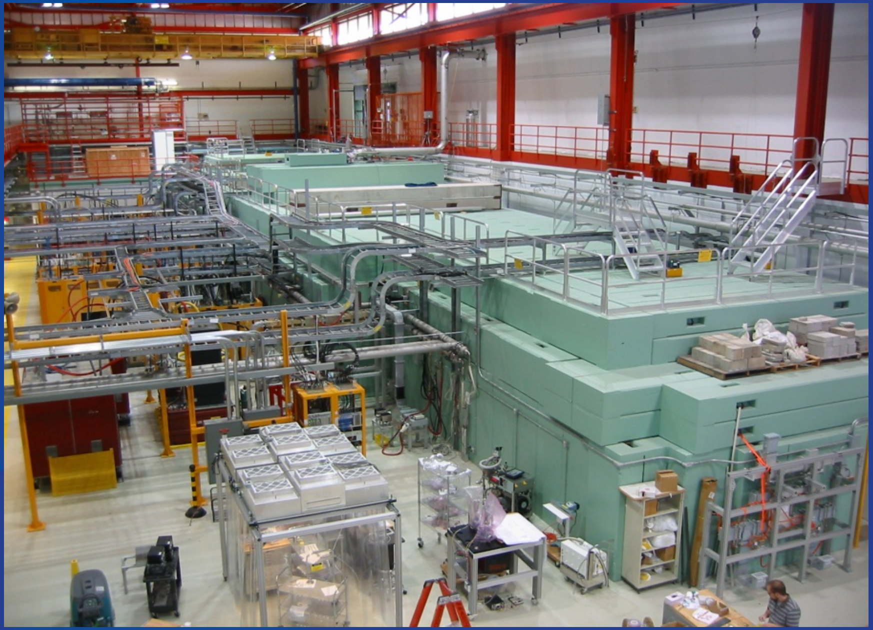
(formerly known as NML… now significantly expanded)

1.3 GHz SC RF Cryomodule transportation to ASTA



Fermilab
Public Areas
not to scale
areas of the map are clickable
download a PDF of this map (for printing)
view legend
view instructions for using this map
NORTH
ASTA
Kirk Road
Wilson St
Power Line Rd
MC Chesney Rd
SiDet
Town Road
Site 70
Wilson St.
Site 65
Meson Area
Neutrino Area
Site 67
Site 37
Site 39
Road B
Proton Area
Site 38
Site 50
Master Substation
Fermilab Village
Buffalo Farm
Lederman Science Center
Main Entrance
Feynman Computing Center
Technical Division
Road D
Bike Path
Batavia Rd
Pine St.
CDF
Dog Training Area
Eola Road
Bike Path
NuMI/Minos
MiniBoone
Wilson Hall & Ramsey Auditorium (Public Welcome)
Site 55
Lake Law
Nature Area
A.E. Sea
East Gate
to: Rt-59
Antiproton Source
C-Zero
Main Injector
Tevatron
D-Zero
Site 56
Farnsworth Ave
Kautz Rd. Substation
Site 3
Site 12
Butterfield Road
to: I-88

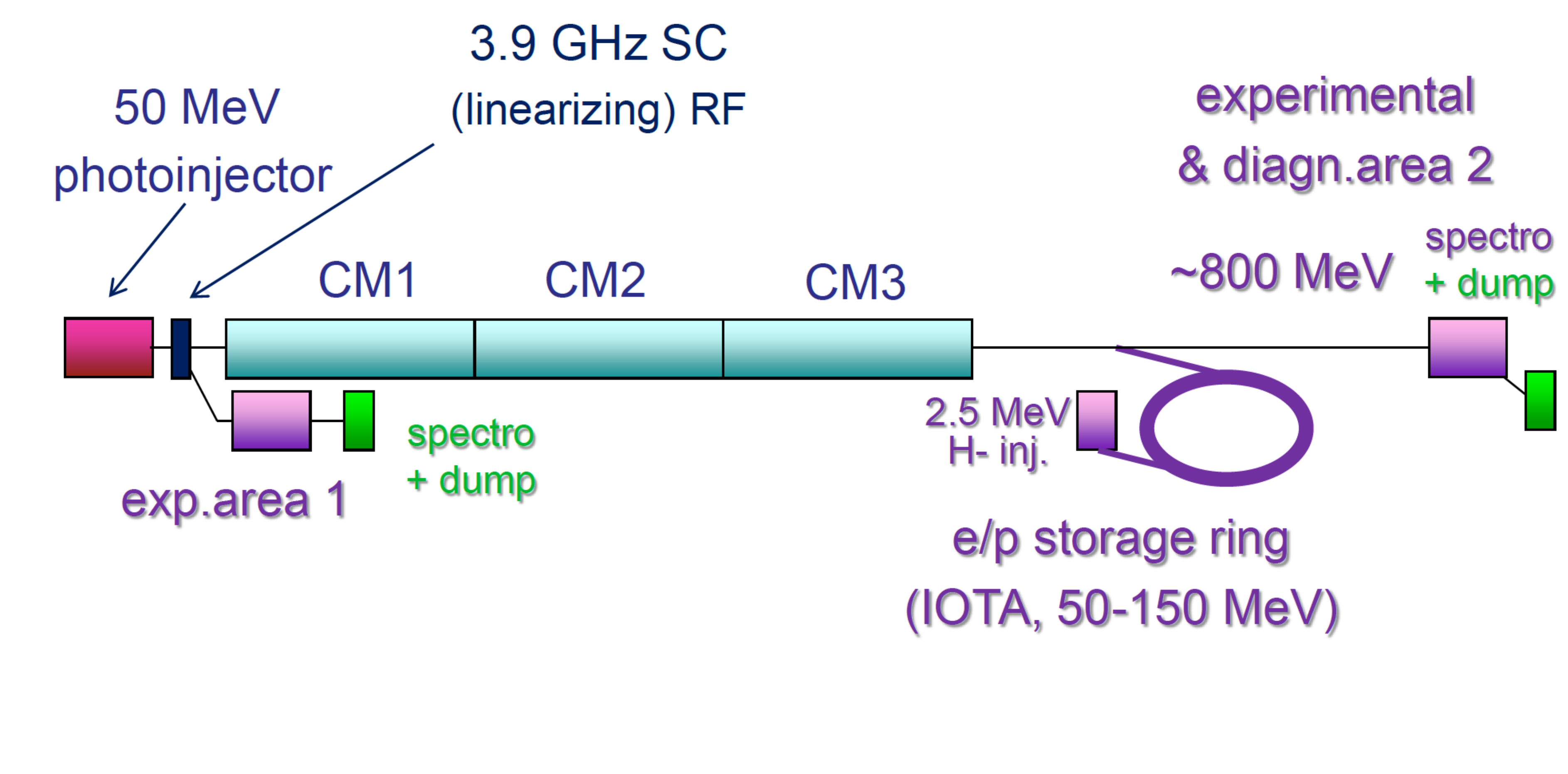
ASTA → Accelerator R&D Users Facility



Background

- Construction of ASTA and NML began in 2006 as part of the ILC/SRF R&D Program and later American Recovery and Reinvestment Act (ARRA).
- The Facility was motivated by the goal of building, testing and operating a complete ILC RF unit
- To date, an investment of $74M has been made, including $18M of ARRA funding, representing ~80% completion of the facility
- It was recognized early in the planning process that an e- beam meeting the ILC performance parameters was itself a power resource of interest to the wider Advanced Accelerator R&D community.

ASTA Users Facility (Proposal)



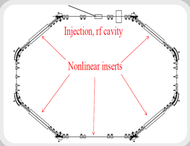
Three Experimental Areas capable of hosting 5-9 experiments at once

Can serve community of 100-150 users (in ~3-5 years)

Beam parameters for EA1-EA3: 50 MeV, 300-800 MeV, IOTA - see

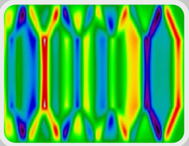
ASTA Science Thrusts

Intensity Frontier of Particle Physics



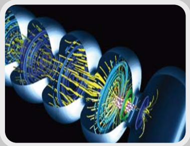
- Nonlinear, integrable optics
- Space-charge compensation

Energy Frontier of Particle Physics



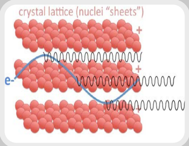
- Optical Stochastic Cooling
- Advanced phase-space manipulation
- Flat beam-driven DWFA in slabs

Superconducting Accelerators for Science



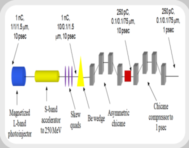
- Beam-based system tests with high-gradient cryomodules
- Long-range wakes
- Ultra-stable operation of SCLs

Novel Radiation Sources



- High-brightness x-ray channeling
- Inverse Compton Gamma Ray source

Stewardship and Applications

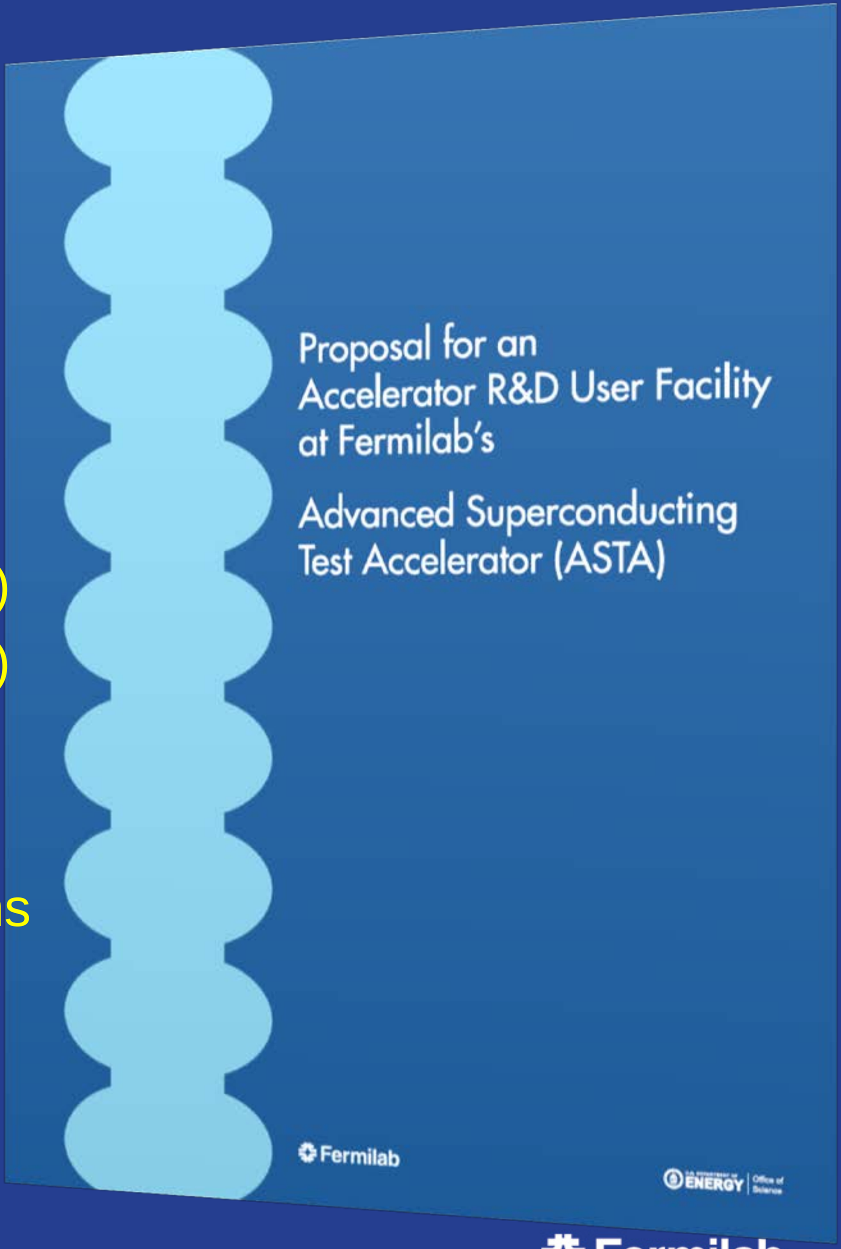


- Generation and Manipulation Ultra-Low Emittance Beams for Future Hard X-ray FELs
- XUV FEL Oscillator

ASTA

As Proposed to DOE in Feb'2013

- 60 co-authors from 13 institutions
- 24 proposals and growing
  - ~1/2 for HEP (IF, EF, SCRF)
  - ~1/2 – Stewardship and Applications
- At all ASTA experimental areas
  - Exp Area 1 (50 MeV) (10)
  - Exp Area 2 (300-800 MeV) (12)
  - Exp Area 3 (IOTA Ring) (5)
- Broad spectrum of proponents:
  - University groups & National Programs
  - SBIR companies & International
  - Large National Laboratories
  - Detector R&D groups



http://asta.fnal.gov/

Strong Institutional Support of ASTA Proposal

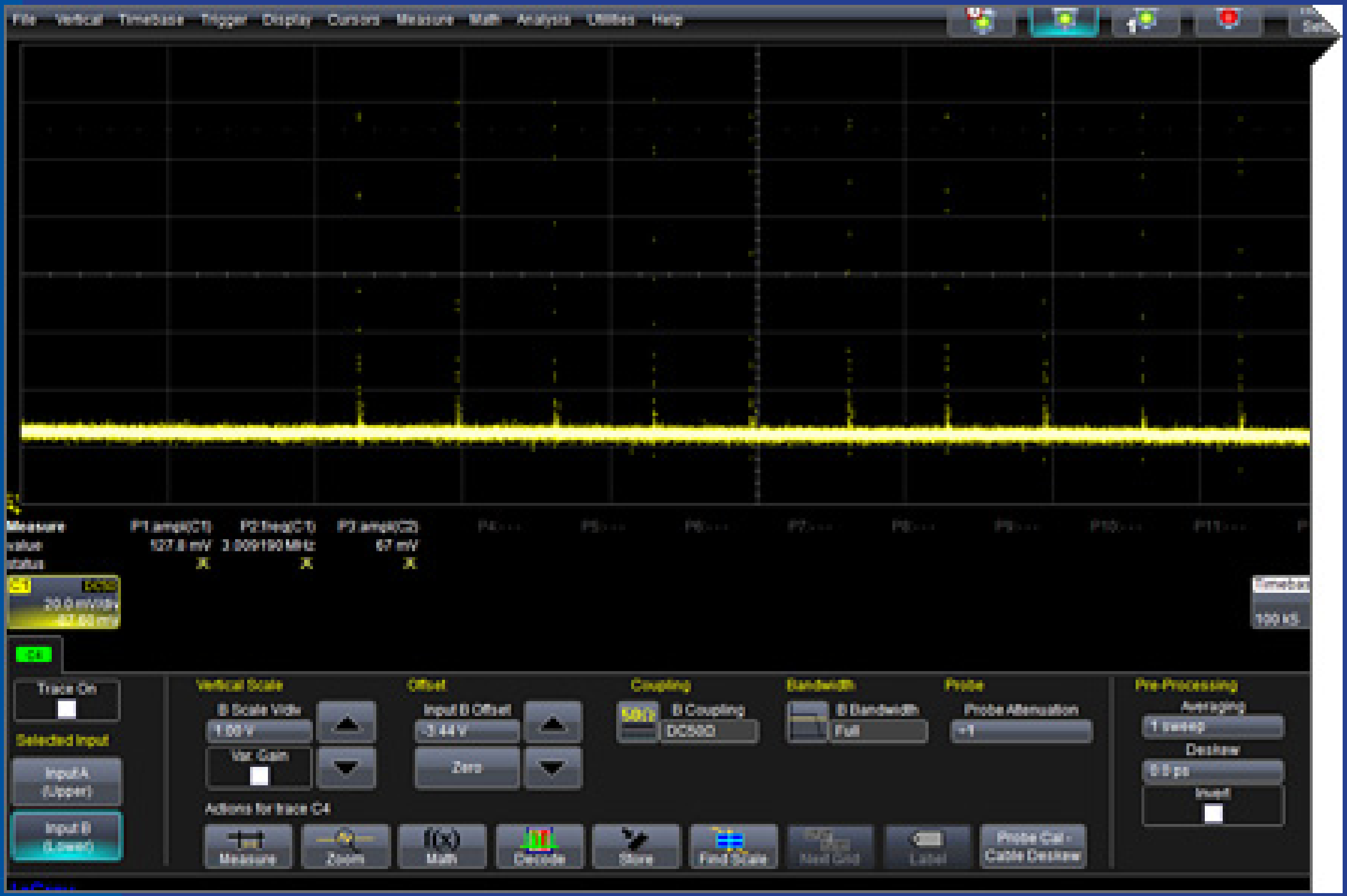
Argonne National Laboratory	A.Zholents
Brookhaven National Laboratory	T.Roser
CERN	S.Myers, O.Bruening
Colorado State University	S.Biedron, S.Milton
ComPASS	P.Spentzouris
Illinois Institute of Technology	L.Spentzouris
Indiana University	S.Y.Lee
International Linear Collider (ILC)	L.Evans, M.Harrison
John Adams Institute for Accelerator Science	A.Seryi
Joint Institute for Nuclear Research	I.Meshkov
US LHC Accelerator Physics Program (LARP)	E.Prebys
Lawrence Berkeley National Laboratory	S.Gourlay
US Muon Accelerator Program (MAP)	M.Palmer
Northern Illinois University	D.Hedin, L.Lurio, L.Freeman, P.Vohra
Oak Ridge National Laboratory	J.Galambos
Princeton Plasma Physics Laboratory	R.Davidson, E.Gilson, I.Kaganovich
RadiaBeam Technologies, LLC	S.Boucher
Tech-X Corporation	J.Cary
Thomas Jefferson National Accelerator Facility	A.Hutton
US Particle Accelerator School (USPAS)	W.Barletta

ASTA Developments

- 2012 - ASTA Proposal developed by Fermilab and prospective users
- Dec 2012 – DoE OHEP briefed on ASTA… encouragment…
- Feb 6-8, 2013 – Fermilab's *Accelerator Advisory Committe*e on ASTA:
  - *The AAC strongly encourages FNAL to pursue the ASTA Proposal*.
- Feb 26, 2013 - ASTA Proposal submitted to DOE
- Mar 8, 2013 - ASTA Proposal reviewed by *OHEP GARD* Review panel
- Apr 24, 2013 – NSF/NPS briefed on ASTA
  - "*…very timely*!" – NSF's *"Accelerator Science"* program (June)
- Jun 14, 2013 – ASTA welcomed by *FNAL Users Executive Committee*
- Jun 20, 2013 – First beam from ASTA photoinjector (!)
- Jul 23-24, 2013 - ASTA 1st Users and PAC meeting at Fermilab
- Oct 22-24, 2013 – DOE OHEP review of ASTA Proposal
  - *Together with FACET-II (SLAC) and ATF-II (BNL)*

Fermilab

1st Photoelectrons in ASTA (06/20/2013)



- Not yet at full RF power/ energy
- Not yet full current
- Elvin Harms’s group (AD/APC) is working on that

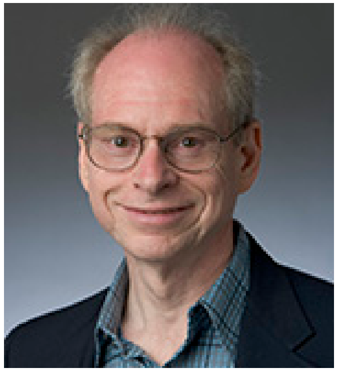
The ASTA Team

ASTA Team:

ASTA Interim Director, Vladimir Shiltsev

E-mail: shiltsev@fnal.gov

Telephone: 630-840-5241



ASTA Program Advisory Committee Chair, Gerald Dugan

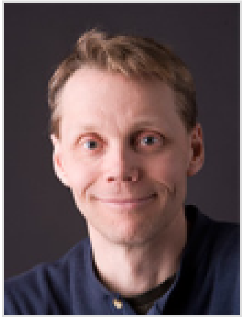
E-mail: gdugan@fnal.gov

Telephone: 630-840-8907

Elvin Harms
Commissioning & Operations

J. Leibfritz
Installation & Engineering

Philippe Piot
Physics



Sergei Nagaitsev
IOTA

Peter Garbincius
Program Office

This and more info – see our permanent Web-site

http://asta.fnal.gov/

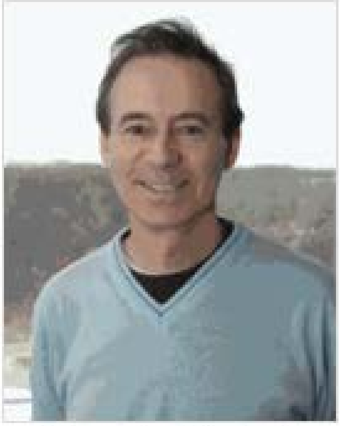
ASTA Program Advisory Committee

Gerald Dugan (Chair)
Cornell University
Send Email

Michael Blaskiewicz
Brookhaven National Laboratory
Send Email

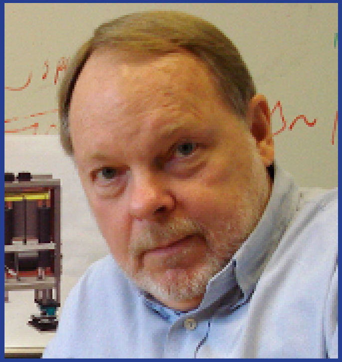
John Byrd
Lawrence Berkeley National Laboratory
Send Email

Georg Hoffstaetter
Cornell University
Send Email



Alexander Zholents
Argonne National Laboratory
Send Email

Marco Venturini
LBNL



Richard York
MSU

1st ASTA Users Meeting
(July 23-24, 2013 Fermilab)

84 participants : majority (2/3) from external institutions

36 talks in 1.5 days 6 more proposals + 24 = 30

PAC recommendations

The committee recommends that the ASTA proposal be re-structured to emphasize the three major accelerator science and technology areas which are its main focus:

- *Superconducting RF system development.* This work supports both the intensity frontier (for example, through its application to Project X) and the energy frontier (for example, through its application to the ILC). The effort addresses key unsettled issues in this technology development, and is a natural conclusion to work already started. There is a big leverage to the existing investment in these systems, and lessons that will be learned during completion and commissioning of the SCRF systems are a major part of the technology development R&D.

- *Experiments at the IOTA storage ring.* This work supports the intensity frontier (through its application to high current proton accelerators). The outlined program to develop machine understanding using electron beams as probes, followed by performance demonstrations in the space-charge dominated regime using proton beams, is an excellent approach. Pioneering work at IOTA in nonlinear lattices would have wide applications for all future accelerators.

- *Development of methods for emittance transformations/exchanges.* This work supports advanced acceleration experiments and applications for light sources. It is a natural extension of the pioneering flat-beam and emittance exchange work done at A0. The flexibility afforded by the ASTA beam lines allows a major broadening of this work with numerous important applications.

ASTA at Snowmass

- White paper **SNOW13-00018** *arxiv: 1304.0311*
- WG6 Summary (Capabilities Frontier):

Snowmass 2013 & Accelerator Capabilities for HEP

William Barletta
Director, US Particle Accelerator School
Dept. of Physics, MIT
For Study Group Conveners

Hadron colliders:
LHC-Lumi & Energy upgrades, VLHC

Technical challenges	Capabilities (existing / planned)
• High performance SC wire	Critical industry couplings
• High Field SC magnets	LBNL, FNAL, BNL, CERN
• SR & photon-stops	Existing e-rings
• Collimation	LHC, RHIC, Main Inj.
• Injectors – SCRF	PXIE (FNAL), SNS(limited)
• Injectors – Space charge	Booster, AGS, PS, ASTA
• Beam cooling (optical, coherent)	ASTA (FNAL), RHIC cool

Injector studies need new, dedicated facilities

Lepton colliders:
ILC and beyond

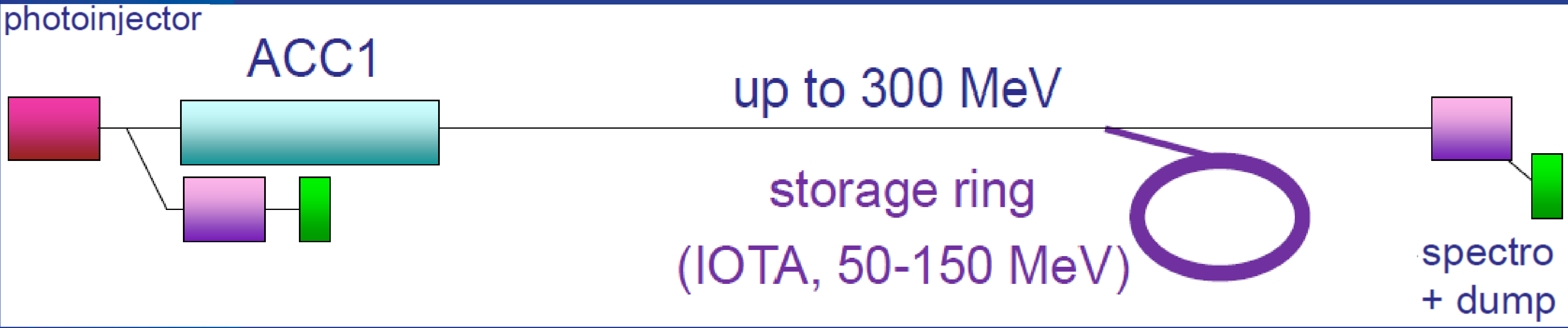
Risk reduction areas	Capabilities (existing / planned)
• ILC: SRF-system no beam	JLab, Cornell, Industry
/with beam	/ DESY, KEK, ASTA,
• ILC: FF, Damping rings, e+ production	KEK, Cornell, LLNL

Intensity frontier accelerators :
Includes Project X, DAEdALUS, Neutrino Factory

Challenges	Facilities (existing / planned)
• Pr X – H⁻ source & chopping	PXIE, SNS
– CW SC RF low-beta	PXIE, Atlas (ANL)
– pulsed SC RF, space charge	ASTA (FNAL)
• DAEdALUS – H_2^+ source	LNS Catania
– Multi-MW cyclotrons	PSI, RIKEN, ORNL, Best
• Neutrino factory	see Muon Collider
• Instabilities, collimation, extraction	FNAL, RHIC
• Dedicated high power targetry	Critical need

ASTA FY14-15 plans (tent.)

Overall – Stage I ("barebone") facility and experiments



- FY13: Start commissioning 50 MeV PI and install 1st experiments / start SRF CM commissioning
- FY14: 1st experiments at 50 MeV
  RF commissioning of SRF cryomodule
  Install 300 MeV beamline to dump
  Continue IOTA construction
- FY15: More experiments at 50 MeV and 300 MeV beam
  Finish IOTA construction and installation

“1st wave” of ASTA Experiments: FY14

- Neural Neworks in SRF control:
  - Colorado State University
  - 1st SC RF Cryomodule (no beam → with beam)
- X-ray channeling radiator:
  - Vanderbilt and NIU
  - 50 MeV e- beam and highest brightness low-current source
- New non-intercepting beam diagnostics:
  - APC Exp.Beam Phys Dept and AD Instrum. Dept
  - 50 MeV e- beam
- Tagged photons (planning to start)
  - D.Christian , et al with low intensity 50 MeV e-
- Acceleration in Carbon Nanotubes (planning to start)
  - NIU , with 50 MeV e-