

Accelerator Physics Center: Year Past, Year Ahead

APC General Meeting
June 2, 2009



Today's Topics

- State of the Center
- Priorities
- Safety
- Plans
- Misc.

Biggest Events Last Year

- ❖ **Continuing Resolution Oct'08-Mar'09**
 - ▲ first half of FY09
 - ▲ big hit on Muon Collider/NF R&D
- ❖ **DoE Accelerator Science Review Dec'08**
 - ❖ All the labs + NFMCC; FNAL: A0, Muon, General R&D
 - ❖ Report not released yet (!)
- ❖ **Project-X collaboration formed, timeline OK'd**
 - ❖ Director's Review, CD-0 in 2009
- ❖ **CR over, decent budget + ARRA funds for FNAL**
 - ❖ Direct effect on APC – NML building extension, HTS
 - ❖ Strong indirect effect (some pressure release)
- ❖ **New administration course on Sci/Tech/Innovation**
 - ❖ OHEP charged to steward accel. R&D in the US

as we see them now

- **Operation:**
 - Run II: →2011 ν -exp: till 2013
 - NOvA 2013-19, later, mu2e 2016-19
 - Long-base neutrino/DUSEL 2018-202X
- **Construction:**
 - NOvA: now-2012 mu2e: 2013-15
 - Project X 2013-2017
 - Lepton collider(ILC,MC) or NF: 202X, ~6yrs
- **R&D:**
 - SC RF and Project X: 2009-2013
 - lepton colliders now–2013 (eg MC FSDR)→ early 20's
 - general and Advanced ARD (ongoing)

Organization Chart (July 2009)

ACCELERATOR PHYSICS CENTER

V.Shiltsev, Director

M.Church, Deputy

E.Prebys, LARP, M.Bruce, Admin Associate
(A.Nestander), Budget Mgr.

Theory/Simulation Dept.

Yu.Alexahin (GL)

LARP Group

T.Sen (GL)

E-lens Group

(A.Valishev) (GL)

Energy Deposition Dept.

N.Mokhov, Head

SCRF Facility Design

Department

N.Solyak, Head

Muon Accelerator R&D Department

S.Geer, Head

MCTF Experiment Group

A.Jansson (GL)

NFMCC Group

A.Bross (GL)

HINS Department

R.Webber, Head

AARD Department

M.Church, Head

US PAS Office

S.Winchester (GL)

W.Barletta, Director (GS)

Accel.Education Dept.

(V.Lebedev), Coord.

Accel.PhD Program
(E.Prebys, Chair)

Peoples Fellowship
(M.Church, Comm.Chair)

Lee Teng Internship
(E.Prebys, Comm.Chair)

Accel.Summer Students
(A.Shemyakin, Prgm.Ldr.)

APC Personnel Profile

Category	06/2009
Scientific (no-term)	21
Engineers	4
Technicians	1
Computer Prof.	2
Admin. Staff	3
Scientific term (RA, AS, PF)	7
Guest Sci. & Eng.	3
<u>TOTAL</u>	<u>41</u>
Joint Appt's: IIT, NIU, ICLondon	4
PhD students & candidates	6

Changes

- 2 left (B.A. , V.K.) , 2 PhD students graduated
- Openings filled:
 - Associate Scientist (accepted – R.Madrak)
 - Application Physicist (acc't – I.Rakhno)
 - Associate Sci to repl.V.K. (J,Stancari – June 15)
 - International Fellow Proj.X (L.Jenner - ICL)
 - Computer Pro in A0 group (C.Tan)
- Current openings:
 - Research Associate (mu2e in ED Dept)
 - Research Associate (general, coming soon)
 - Peoples Fellowship (APC is just a hosts)
 - Joint Appointment with NIJ A0/NML (in process)

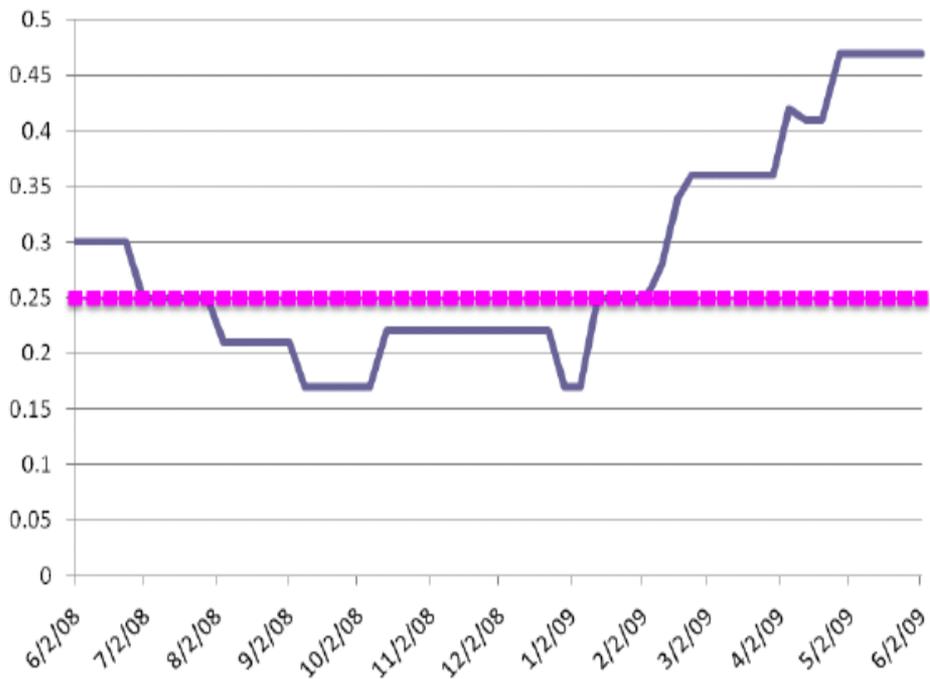


Lab's Safety Statistics

Includes Employees & subcontractors

	FY06	FY07	FY08	FY09	Goal
TRC Cases	29	31	12	13	<12
DART Cases	7	12	3	7	<5

Running 365-Day DART Rate (Goal = <0.25)



Outstanding Excellent Good Marginal Unsatisfactory

	% Required ES&H Courses	% Current ITNAs	TRC Cases	TRC Rate	DART Cases	DART Rate
AD	97.2%	97.8%	3	1.05	2	0.70
APC	99.1%	97.9%	0	0.00	0	0.00
BS	96.6%	100.0%	3	3.86	2	2.57
CD	97.1%	97.7%	0	0.00	0	0.00
CMS	100.0%	100.0%	0	0.00	0	0.00
DI	93.9%	93.9%	0	0.00	0	0.00
ES	95.8%	100.0%	0	0.00	0	0.00
F CPA	100.0%	92.3%	0	0.00	0	0.00
FE	95.0%	100.0%	4	6.10	2	3.05
FI	99.6%	100.0%	0	0.00	0	0.00
PD	93.8%	94.1%	2	0.80	1	0.40
TD	94.4%	93.8%	1	0.76	0	0.00
WR	95.9%	94.7%	0	0.00	0	0.00
Fermilab	95.9%	96.6%	13	1.16	7	0.62

Safety

- APC has good safety record so far +
- Please, continue to pay close attention to safety!
- Notice, new “2-man” rule in remote AD areas (incl. MDB, MTA, NML, E4R, etc)
- Notice: increase of traffic violations (signs!)
- Bob Webber is the APC Safety Coordinator
- Let me or him know if you see any safety issues (anywhere anytime)
- Best protection – understand what you’re doing! (think, plan, execute)

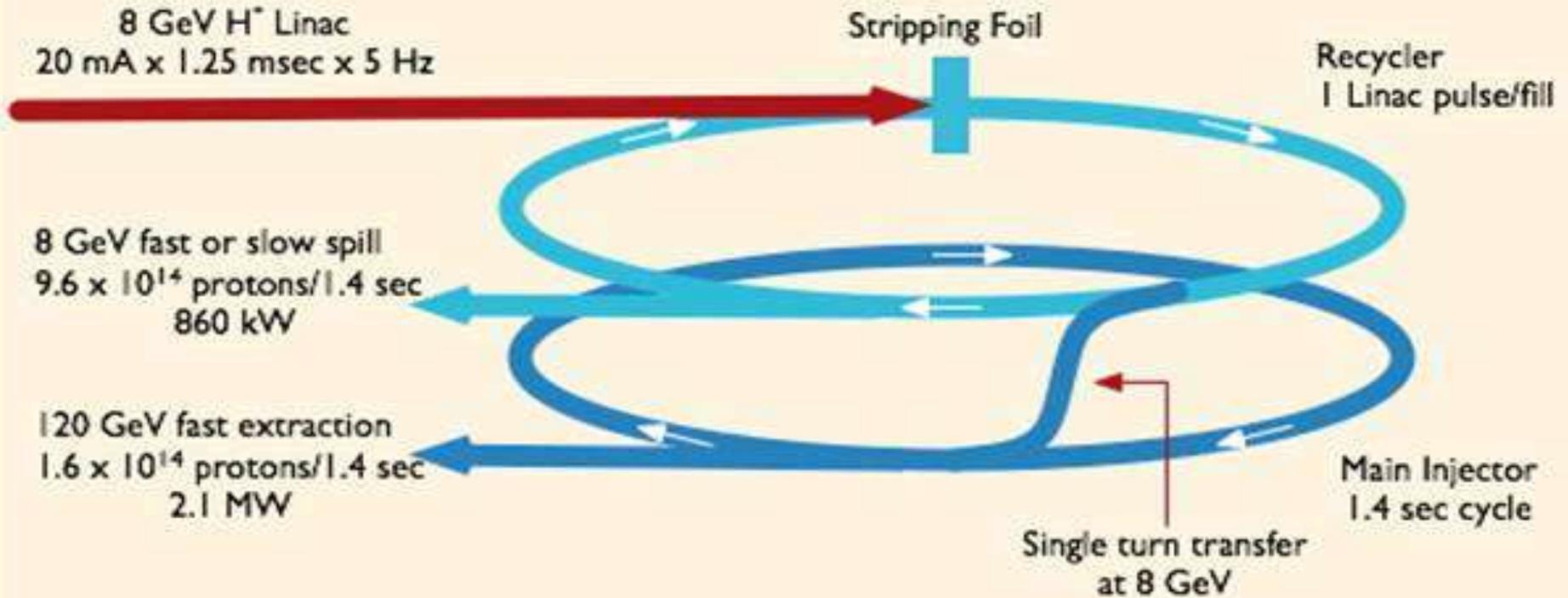
Cybersecurity

- DOE audit → serious shortcoming → “marginal” for the Lab
- “Tune IT Up” program launched
- ~All Fermi computer users will lose system administration privileges on their own computers
- Other measures (read FermiToday)
- Be serious about all that → it costs us all (a lot) !

APC Priorities (= Need x Capabilities)

- I. **Contribute to accelerator design of Project-X**
- II. **Carry out R&D programs on**
 - HINS
 - Muon Collider/Neutrino Factory
 - A0 Photoinjector
- III. **Current programs :**
 - Support Run II operations
 - LARP Accelerator Systems, General Accel. R&D, ILC
 - Educational programs (USPAS, PhD, Lee Teng, Int'l)
 - Develop novel theory and modeling tools
- IV. **New activities:**
 - Mu2e, DUSEL, g-2, etc

Project-X and Muon Complex



- Initial Configuration Document: 1 MW @ 8GeV
- MC/NF need: ~4MW @ different beam structure

Project X work at APC



To: Distribution
 From: Steve Holmes *S. D. Holmes*
 SUBJECT: PROJECT X SUBSYSTEMS ASSIGNMENTS AND AUTHORITIES

Initial subsystem assignments are as follows:

Project Management	Steve Holmes
325 MHz rf	Ralph Pasquinelli
1.3 GHz rf	John Reid
Cavities and Cryomodules	Mark Champion
Main Injector/Recycler	Ioanis Kourbanis
Instrumentation	Manfred Wendt
Controls	Jim Patrick
Cryogenics	Arkadiy Klebaner
Conventional Facilities	Russ Alber
8 GeV Transfer Line	Dave Johnson
Integration	Sergei Nagaitsev

I. Design work on :

- BD and Optics modeling (JPC, NS, et al)
- Injection System (DEJ, LV, etc)
- Electron Cloud studies/simul (RZ, CPA, etc)
- Energy Deposition simul (ED)
- Space Charge Effects and Compensation

II. HINS:

- Considered as viable Pr-X front-end

III. Muon Collider and Neutrino Factory:

- Upgrade scenarios under consideration
- International Fellow (PrX and bunching ring)

IV. New Department created:

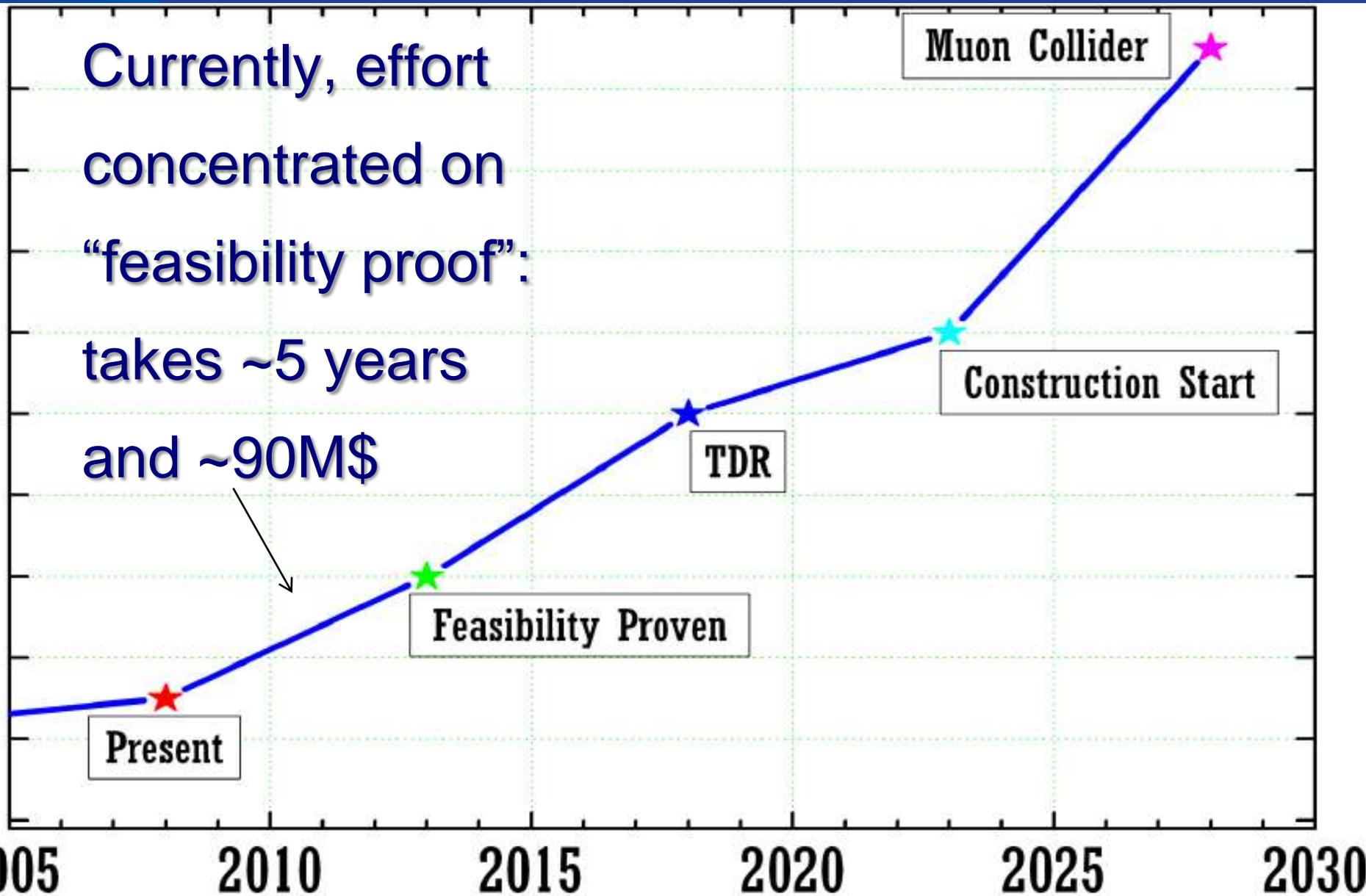
- SCRF Facility Design Department
- Starting July 1, 2009
- Both Project-X and ILC
- Staff from TD and APC
- Led by Nikolai Solyak

HINS at MDB: “Success Despite”

- ❖ As usual in hard times, R&D was under scare of funding cuts, but this time HINS went thru that
- ❖ Project de-scoped (90→60→30 MeV) but is now a viable candidate for Pr-X front-end
- ❖ Given all troubles, great progress last year:
 - ▲ 50 keV proton source works
 - ▲ 2.5 MeV RFQ delivered, trained, problems found
 - ▲ SC SSR showed about 3x the design gradient !
- ❖ Next year:
 - ❖ ≥ 2.5 MeV beam and its characterization
- ❖ **Bob Webber will present more detail picture**

Muon Collider Desired Timeline

Currently, effort concentrated on “feasibility proof”: takes ~5 years and ~90M\$



5 Year Plan of MC/NF R&D

- ❖ Will address key R&D issues, including
 - Maximum RF gradients in magnetic field
 - High pressure RF tests with ionizing beam
 - 6D cooling section prototype
 - Full start-to-end simulations
 - Proton bunching ring design
 - Magnet designs for acceleration, collider and HTS
- ❖ **Deliverables by ~2013:**
 - ❖ Muon Collider Feasibility Report and ν -Factory RDR
 - ❖ Results of hardware R&D to make technology choice
 - ❖ Cost estimate
- ❖ **Funding increase needed to ~20M\$/yr (about 3x present level); total cost 90M\$**

❖ Strategy with 5-yr plan:

- ▶ brief up DoE on physics and detector potential of MC
- ▶ as soon as DoE Rev'08 report is out → get 5yr plan reviewed
- ▶ Physics and detector workshop in Dec'08

❖ Technical Progress:

- ▶ a lot of design work on HCC, FOFO, IR, etc
- ▶ RF tests continue, 1st splash of 400MeV beam in MTA

❖ Next year:

- ❖ Get “real” beam in MTA

❖ Andreas will present more detail

APC Workshop

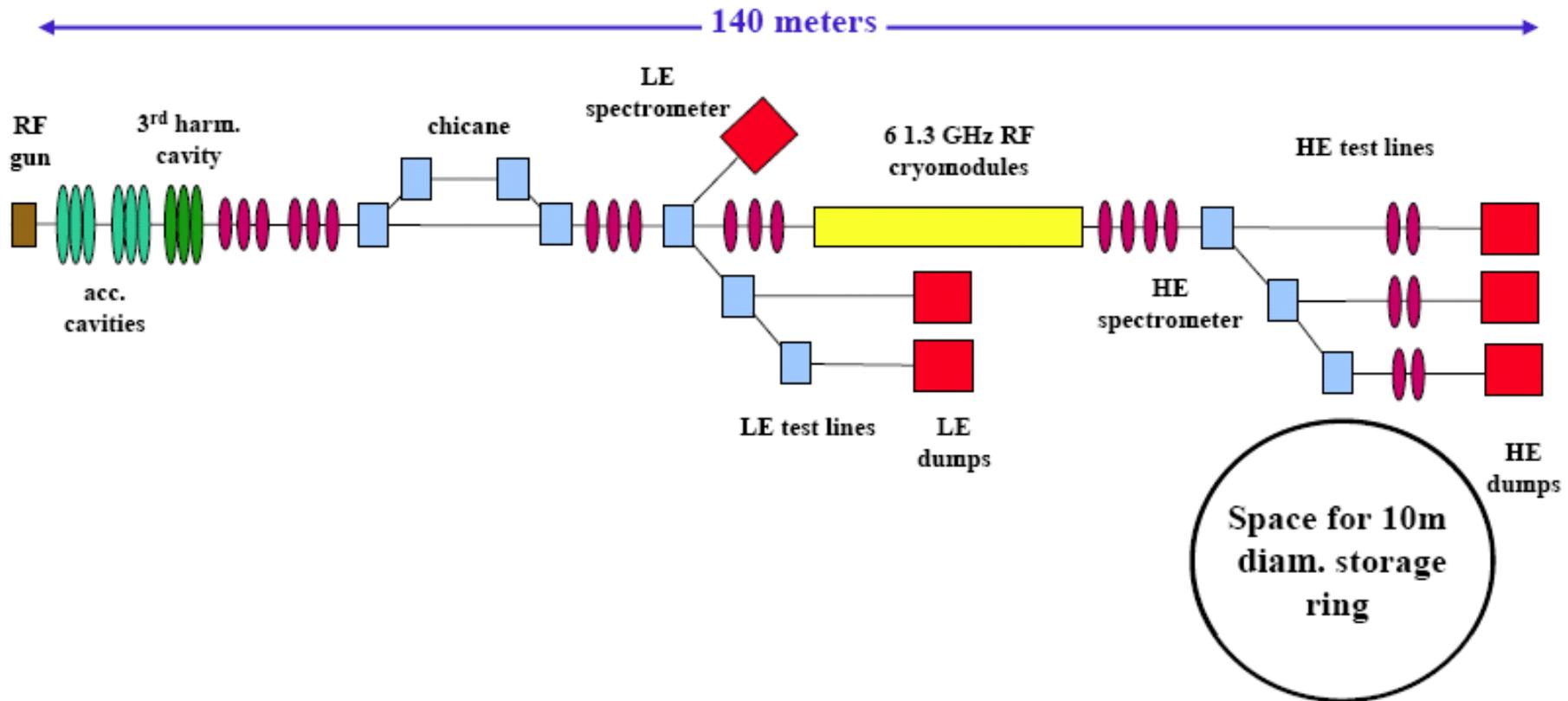
**FUTURE DIRECTIONS
FOR ACCELERATOR R&D AT FERMILAB**
May 11-13, 2009 - Lake Geneva, WI

50 participants worldwide with many world experts

CHARGE:- solicit and evaluate ideas for a future
Acc. R&D program in New Muon Lab

- solicit and evaluate proposals for high beam intensity R&D to enhance Pr-X, ILC, Muon Collider, ADS

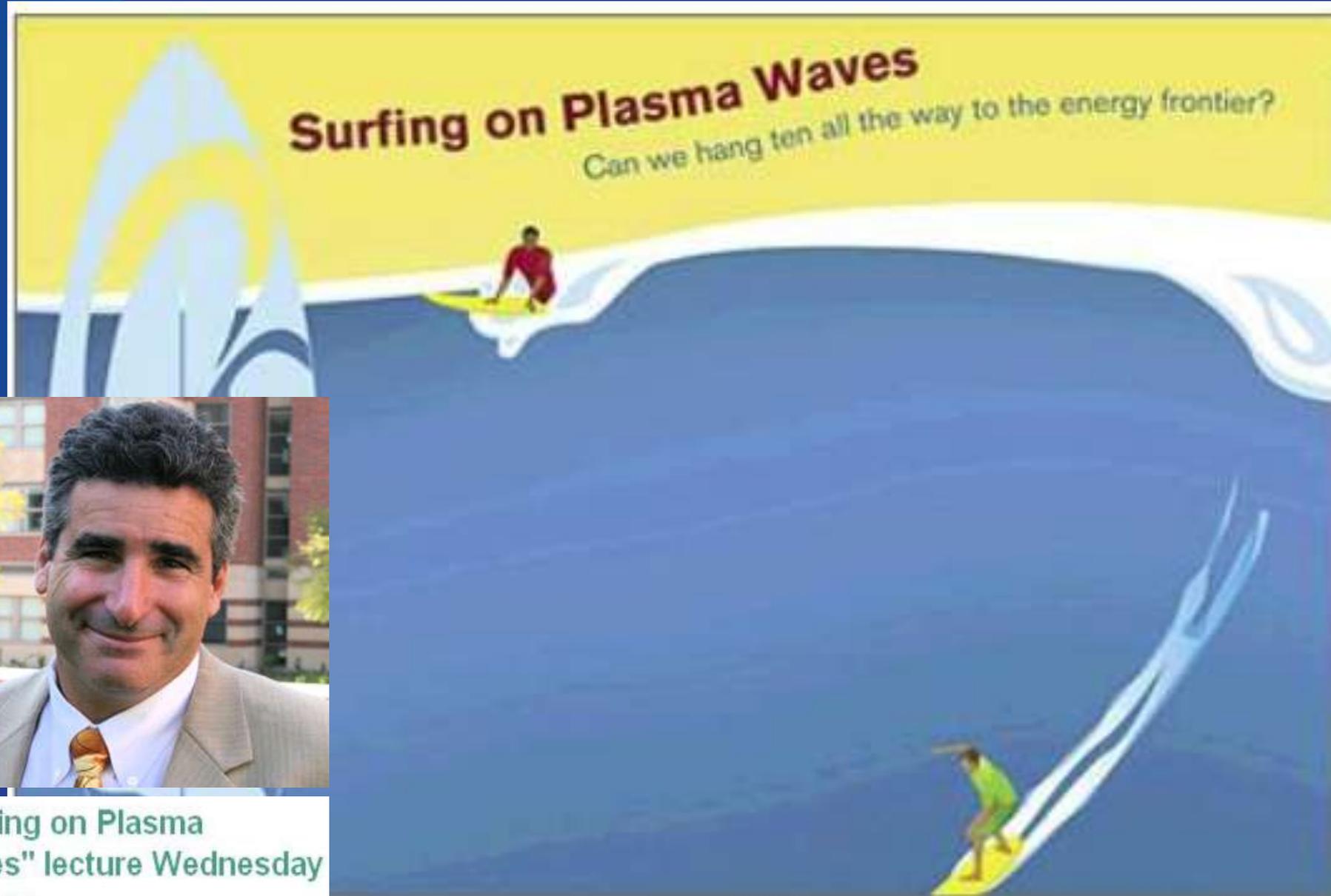
NML User's Facility Layout



(Preliminary) Summary

- **NML has the potential to be a unique User's Facility:**
 - ▲ Energy range of 40 – 1500 MeV; beam power up to 80 kW; pulse train up to 3000 bunches; “flat beams”
 - ▲ Infrastructure capability (cryogenics, RF, lasers, floor space for storage rings, expandability)
 - ▲ Fermilab's extensive accelerator operational experience and User support experience
- **>20 proposals presented, including:**
 - ▲ Dielectric wakefield accelerator tests in microslabs, plasma wakefield tests with long bunch trains, optical stochastic cooling proof-of-principal test, photoproduction of μ at 300 MeV for homeland security, test of “integrable optics” concept for high intensity rings,
 - ▲ many will require more than the minimal infrastructure plan for SCRF, with users' share (>1 beamline, lasers...)

Lecture Wed (sign up!)



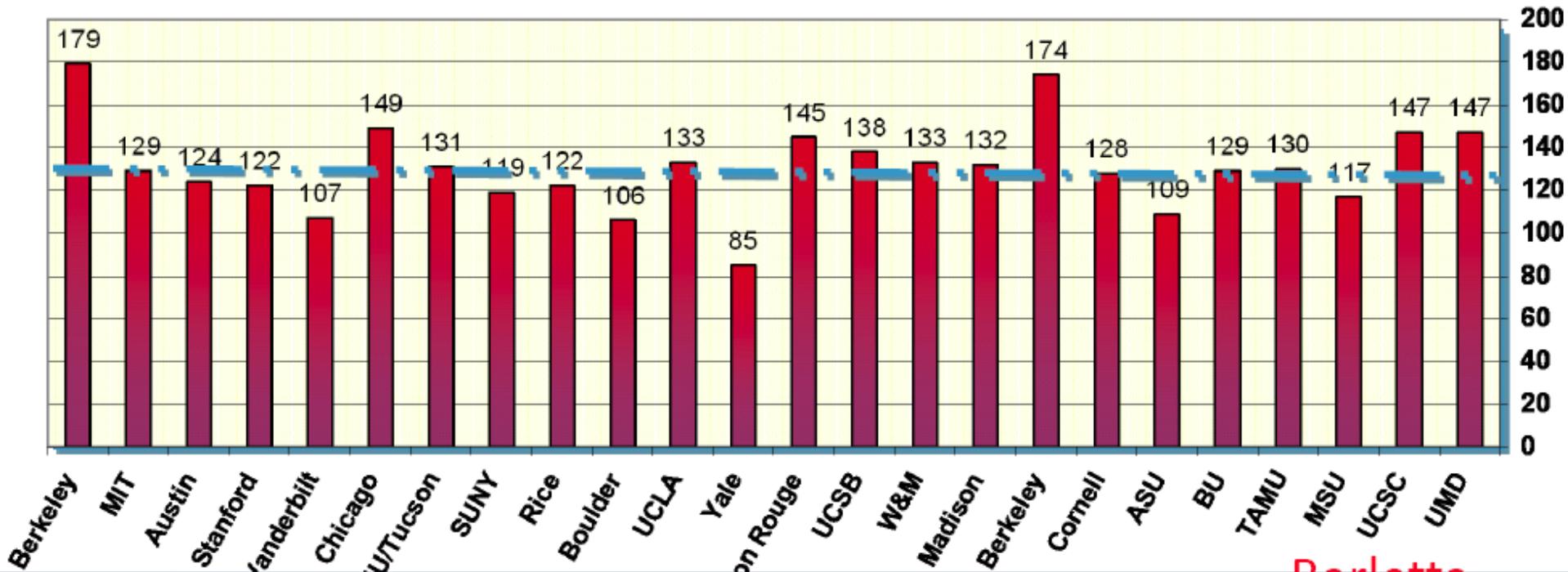
"Surfing on Plasma Waves" lecture Wednesday at 8 p.m.

LHC and ILC

- ❖ LHC work enjoys steady support from LARP+Lab
 - ▲ Eliana took part in “Day 1” commiss → return to CERN
 - ▲ successful beam-beam analysis → experiment @RHIC
 - ▲ LHC needs hollow e-collimator → studies in Tev, design
 - ▲ Important results from T980 experiment (bent crystal)
- ❖ ILC work still ongoing, collaboration with CLIC
 - ❖ The SC RF program at the lab is dual purpose
 - ❖ APC is involved in BD simul’s for ILC (RTML, ML)
 - ❖ Some small involvement to CLIC (GM, PM, BPMs)

US Particle Accelerator School

number of individual students



Two PAS sessions a year ~130 students/school:
 Last year >300 student in 2 schools, “waiting list”!
 Thinking of resurrecting international (CERN, JINR, KEK)

Success in Undergraduate Outreach: Teng Internship at FNAL and ANL

- Engage highly promising post-junior undergrads to study accelerator S&T
- Interns study “Fundamentals” at USPAS, undertake research project at the labs for ~2 mos in the summer
- ANL&FNAL select 11 interns ('08|+'09)



LEE TENG
UNDERGRADUATE
INTERNSHIP IN
ACCELERATOR
SCIENCE &
ENGINEERING

The Lee Teng Internship is a highly competitive education and research opportunity, open to students from US universities who have just completed their junior year in physics or engineering. Teng scholars will receive a full scholarship to attend the US Particle Accelerator School Summer Session followed by an eight-week research internship at Fermilab or Argonne National Laboratory. Research projects will be of sufficient depth for a senior thesis. The internship offers full travel support and a generous stipend.

For further information and to apply see
www.leetengscholar.org



Publications/Theses

- **Publications:** >30 in refereed journals during 2005-2008, including:
 - 3 in Phys Rev Lett and New Journal Phys
 - 14 in Phys Rev ST-AB and D
 - 16 in NIM-A and others
- More than 200 conference proceedings and preprints, e.g. PAC'09: 3 invited + 64 posters
- **Three PhD Graduates in 2007-2008:**
 - Poklonsky, Koeth, Miamoto

Awards/Prizes, etc

- ❖ R.Miyamoto - 2009 APS Award for Outstanding Doctoral Thesis Research in Beam Physics
 - ▲ supervised by S.Kopp, M.Syphers, A.Jansson
- ❖ 2008 FNAL Employee Perform. Recogn. Award
 - ❖ J,Steimel, R.Webber, R.Madrak,D.Wildman, A.Jansson
- ❖ APS Fellow
 - ❖ V.Shiltsev
- ❖ New Journal Of Physics “Best of 2009”
 - ❖ Article on Beam-Beam Compensation in Tevatron
- ❖ US PAS PAC09 student’s poster award:
 - ❖ Satomi Shiraishi - T980 PhD student