2015 Highlights
Accelerator Research in AD/APC

Vladimir Shiltsev

Strategic Plan for Accelerator R&D in the U.S.

In the wake of 2014 P5 Report - April 2015 report of the High Energy Physics Advisory Panel (HEPAP) subpanel on Accelerator R&D

We played key role helping the Panel to formulate recommendations on medium- and long-term R&D priorities:

- **R&D toward high power Multi-MW proton accelerators (IOTA, PIP-III)**
- **High power targetry**
- **SRF technology at lower cost**
- **High-field SC magnets for post-LHC**
- **Advanced acceleration beyond ILC**

April 6, 2015

20MeV e^- beam through FAST injector

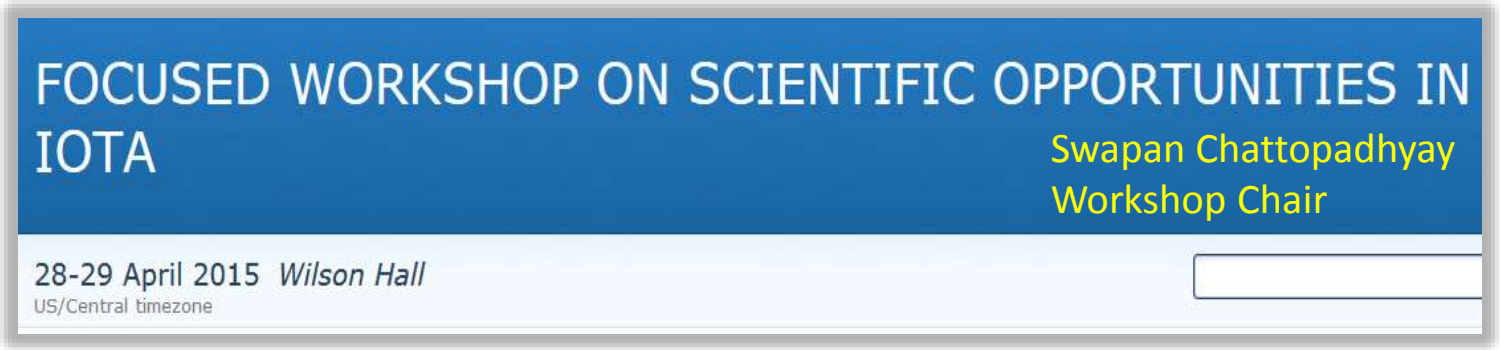
IOTA Ring Construction: Half-way Through

IOTA 30-deg. dipole

IOTA quadrupole at magnetic test

K.Carlsson and summer intern R.Castellotti with IOTA octupole

Scientific IOTA Collaboration Formed



- **22 Partners:**
  - ANL, Berkeley, BNL, BINP, CERN, Chicago, Colorado State, IAP Frankfurt, JINR, Kansas, LANL, LBNL, ORNL, Maryland, Michigan State, Northern Illinois, Oxford, RadiaBeam Technologies, RadiaSoft LLC, Tech-X, Tennessee, Vanderbilt
- **NIU-FNAL:** Joint Cluster of Research Excellence →

NIU/FNAL Joint Appointees:

Swapan Chattopadhyay

Michael J. Syphers (2015)

Philippe Piot

Bela Erdelyi

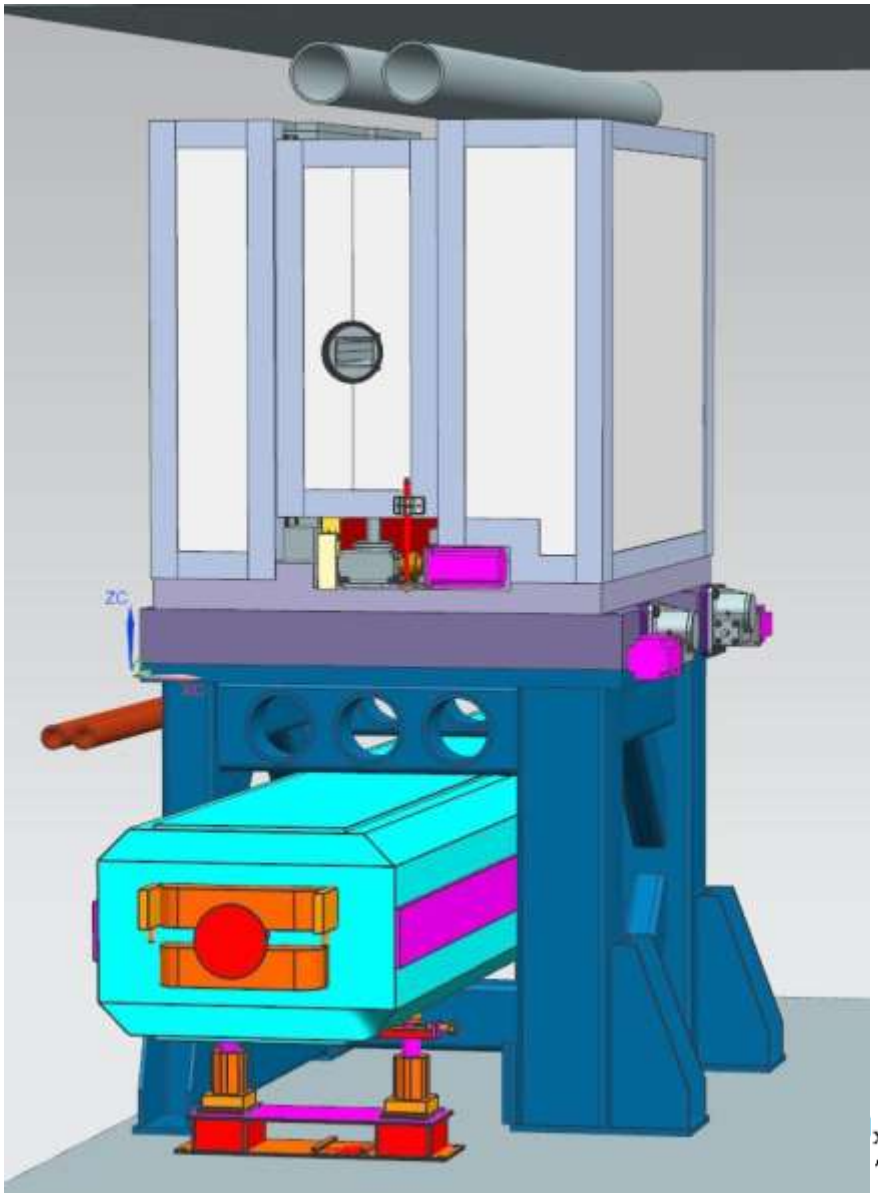
Young-Min Shin

FNAL Cluster members:

Sergei Nagaitsev

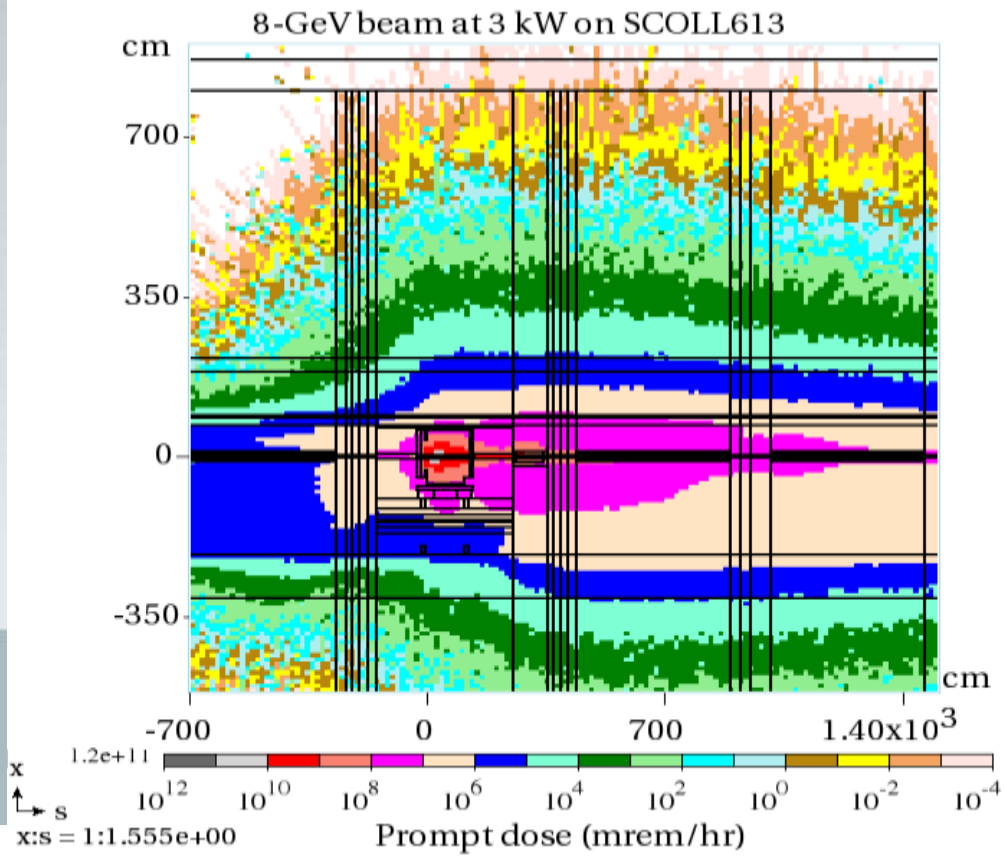
Vladimir Shiltsev

Recycler Collimation System Design



Recycler – last ring without dedicated collimation system: need one for 700kW operation

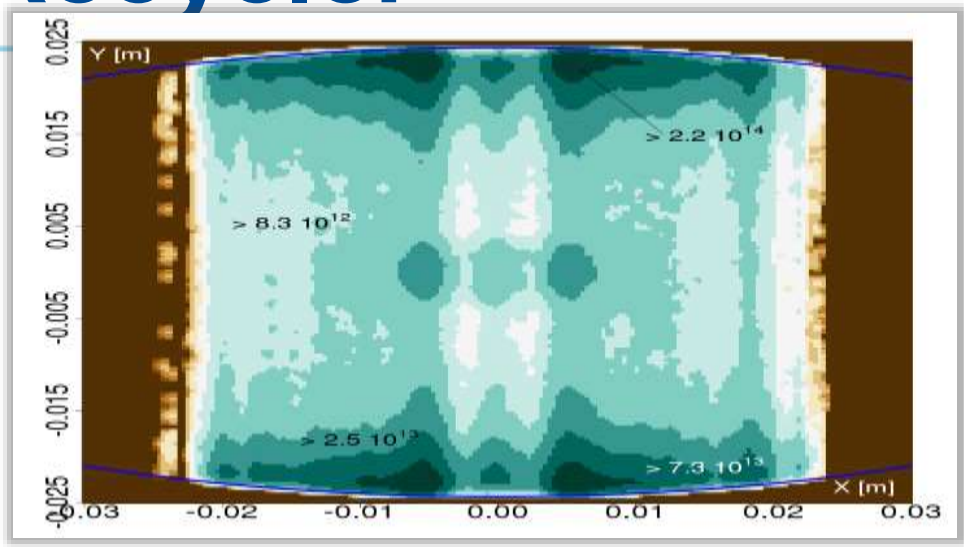
Conceptual design of the RR collimation system is done on the basis of thorough MARS calculations → shows excellent efficiency

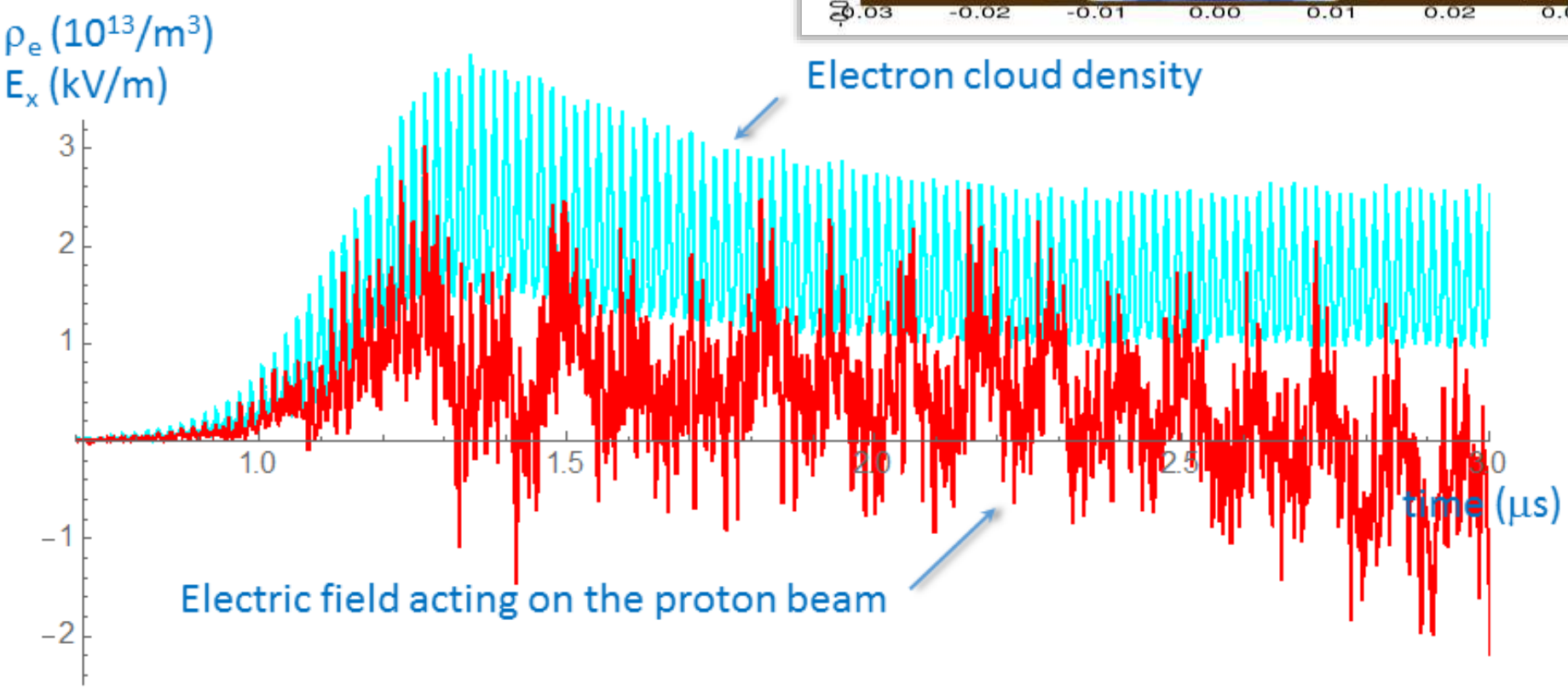


Electron Cloud in Recycler

Observed electron cloud in RR could/did lead to beam instability at high intensities

It is studied, understood (why horizontal), fixed for operations and modelled for PIP-II and PIP-III intensities

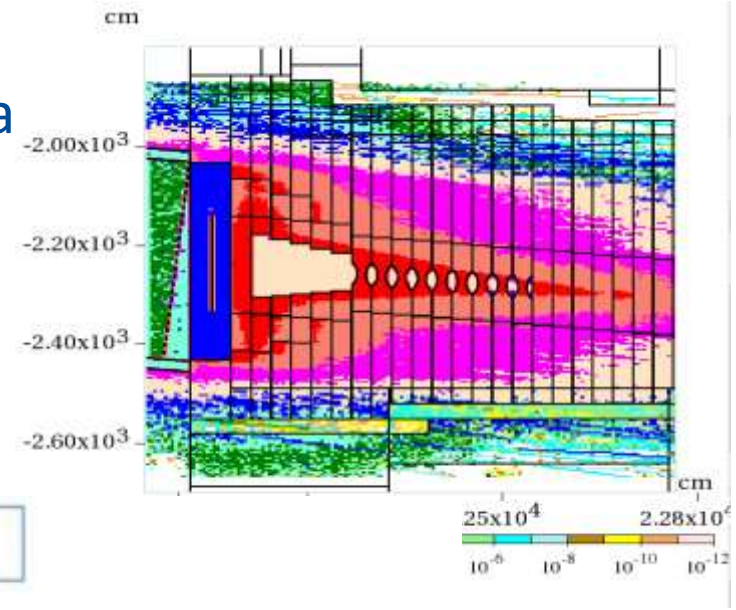




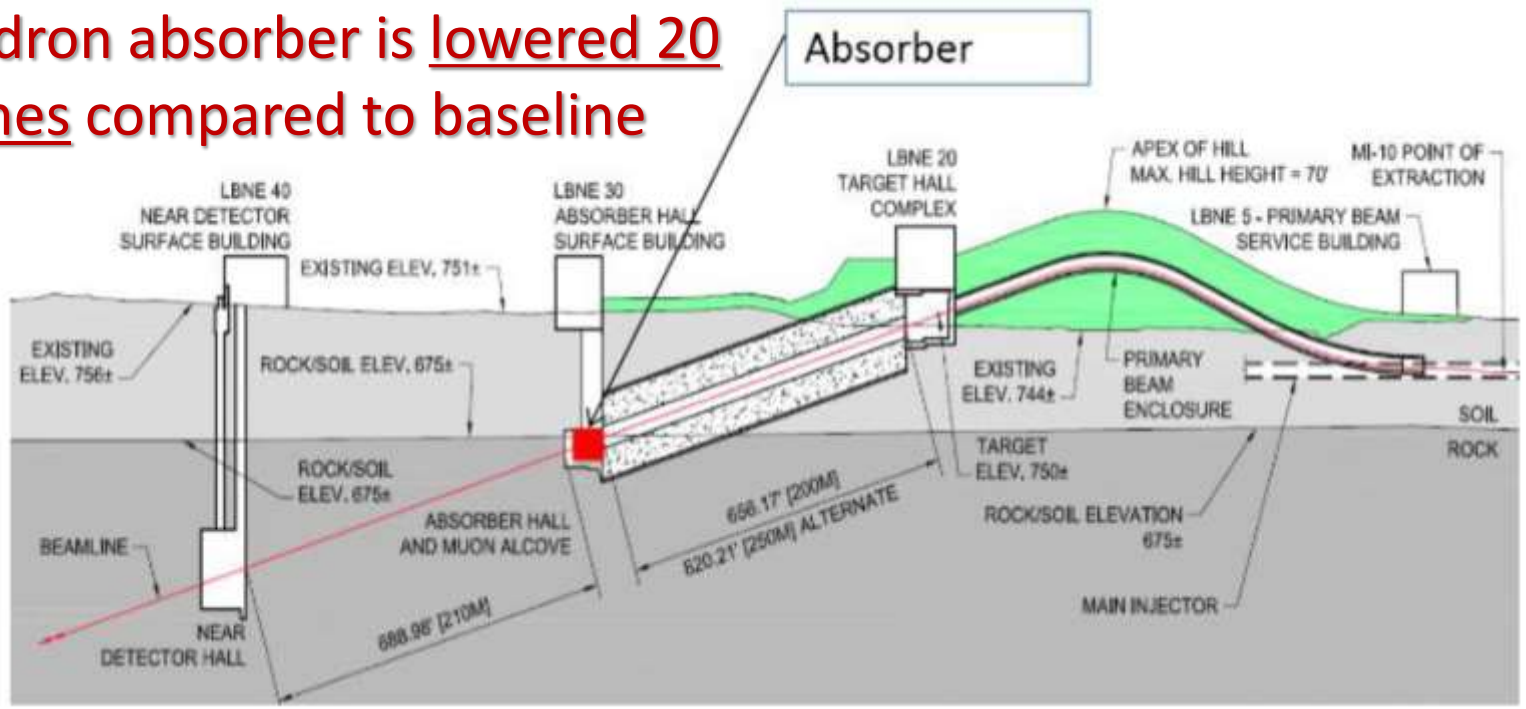
LBNF MARS Optimizations (Design)

LBNF: Maximizing ν-rate and minimizing energy deposition in the hadron absorber via

- optimized horn
- longer target
- "wings" at target upstream

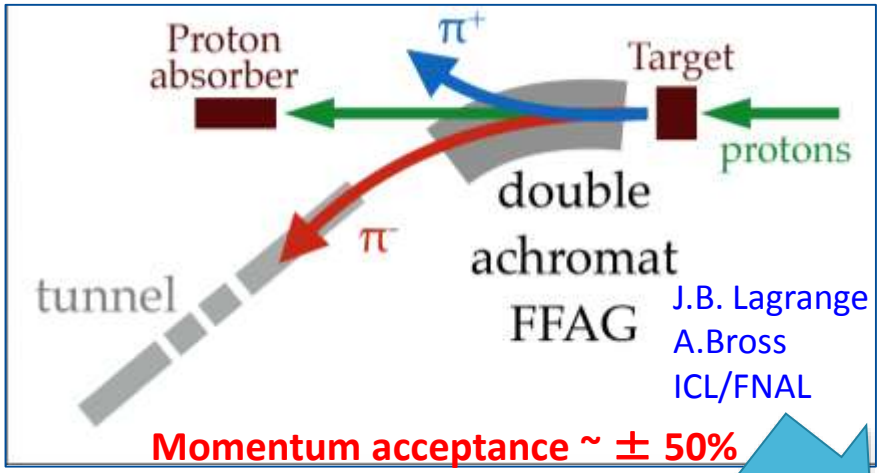


Peak energy deposition in the hadron absorber is lowered 20 times compared to baseline



Fermilab

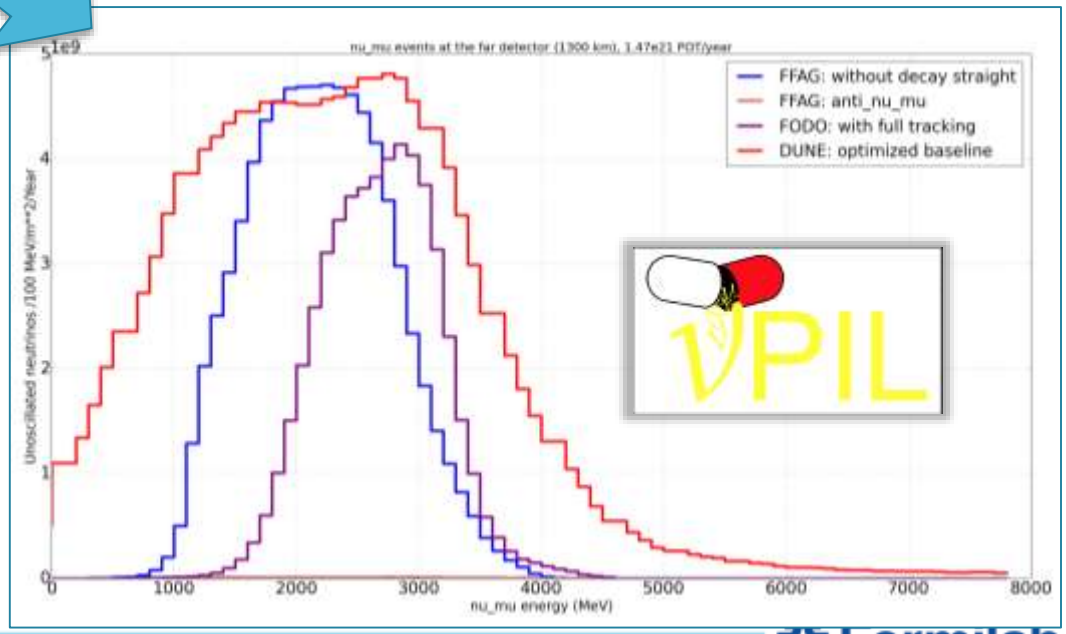
Novel Design Idea of Superbeams



Called Nu-Pi Line = nu-PIL

... uses double achromat FFAG after the target....

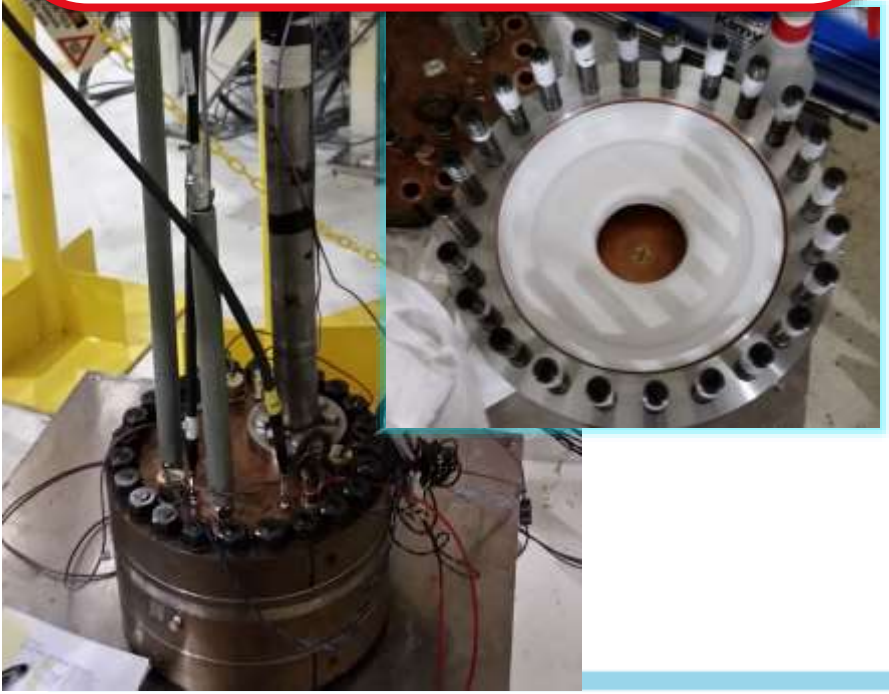
..to reduce unwanted DUNE high-energy neutrino tails (compare red and blue)

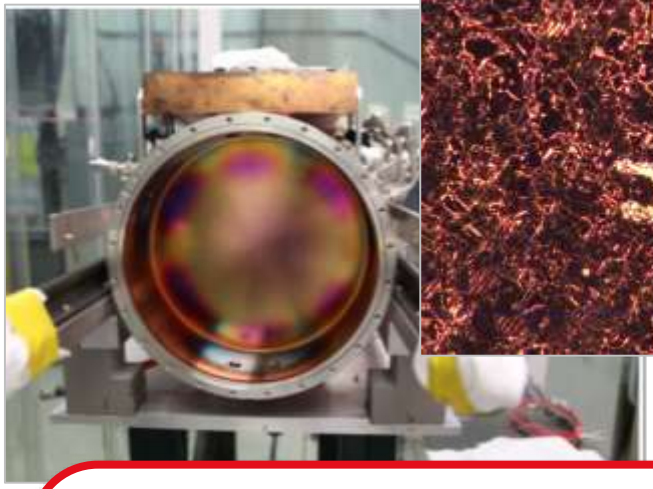


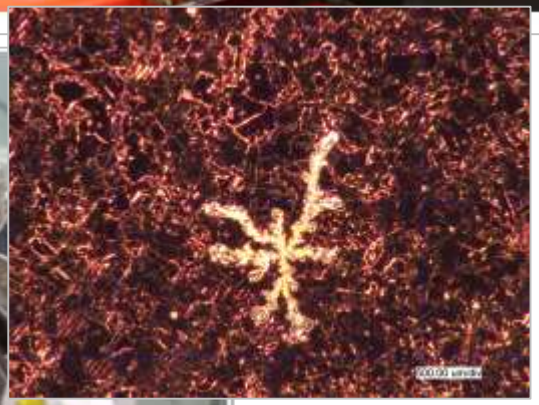
MuCool Test Area

High-Pressure RF Cavities

- Characterization of dielectric-loaded cavity materials
- Evaluation of plasma loading in "hybrid" cooling channel
- Complete results from the HPRF beam test was submitted to PRST-AB



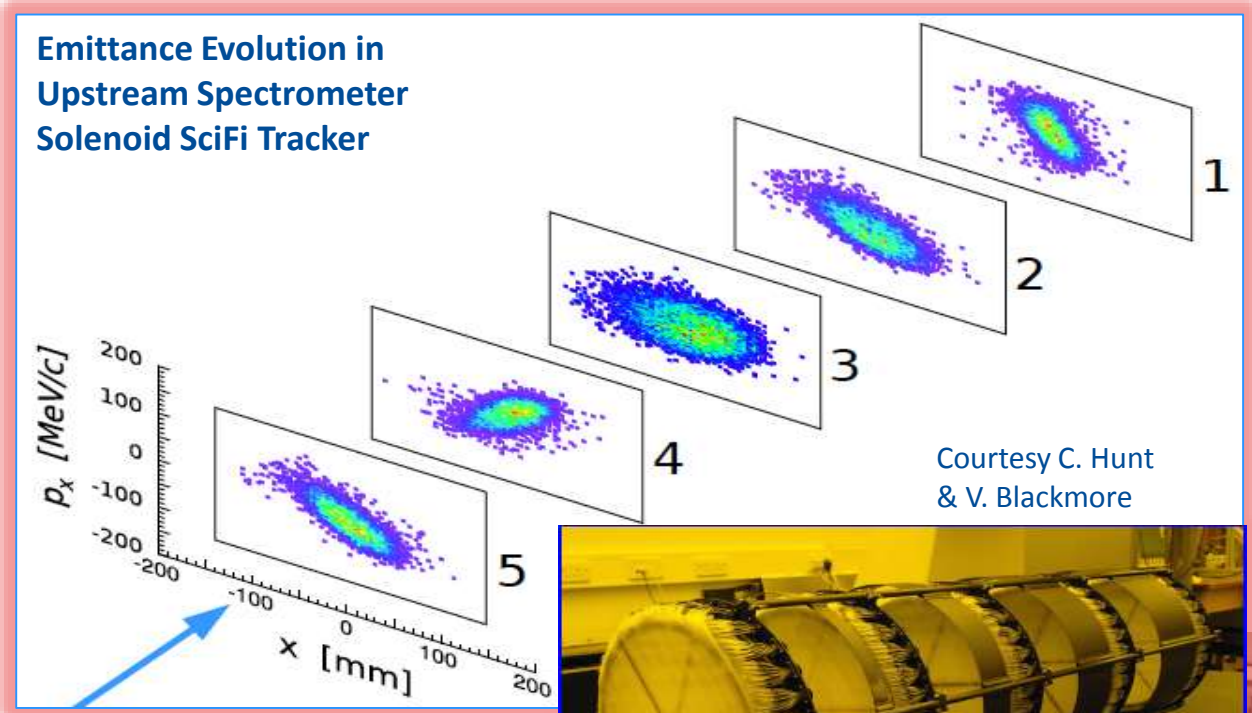




Characterization of "Modular" Vacuum RF Cavity

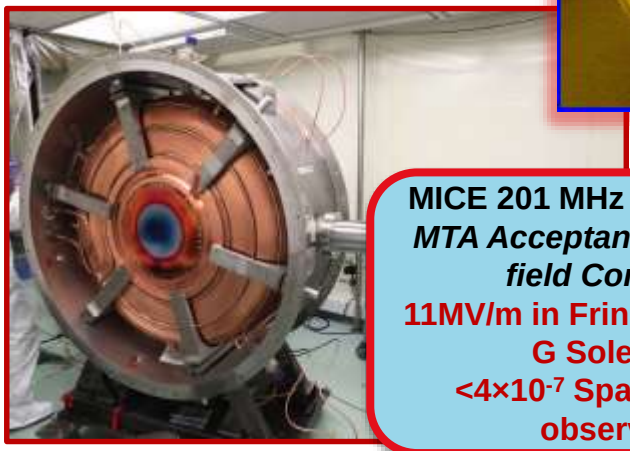
- Max. safe operating gradient 45 MV/m
- Completed study of breakdowns with B=0 ⇨ minimal surface damage
- Studies in B = 3T now underway

MICE Experiment @ RAI: First ~ Million of Muon Tracks Registered and Analyzed



Courtesy C. Hunt
& V. Blackmore

Support for MICE Step IV Commissioning



MICE 201 MHz RF Module –
MTA Acceptance Test in B-field Complete
11MV/m in Fringe of 5T Lab-G Solenoid
<4×10^{-7} Spark Rate (0 observed)

Joint Fermilab-University PhD Program

2015 PhD Graduates

Jeff Eldred
Indiana

Sriharsha Panuganti
NIU

Ao Liu
Indiana

Frederic Lemery
NIU

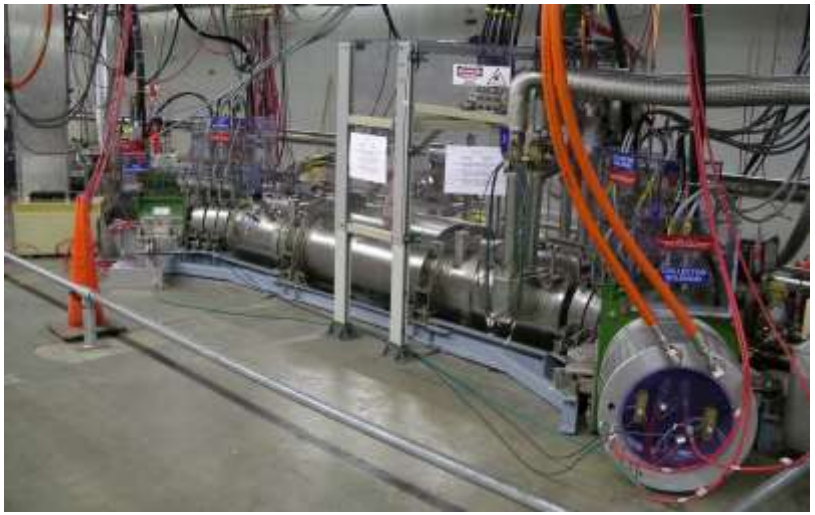
David Pavel Juarez Lopez got MS degree from Universidad de Guantajuato (Mexico) – worked on FAST

U.S. Particle Accelerator School in 2015

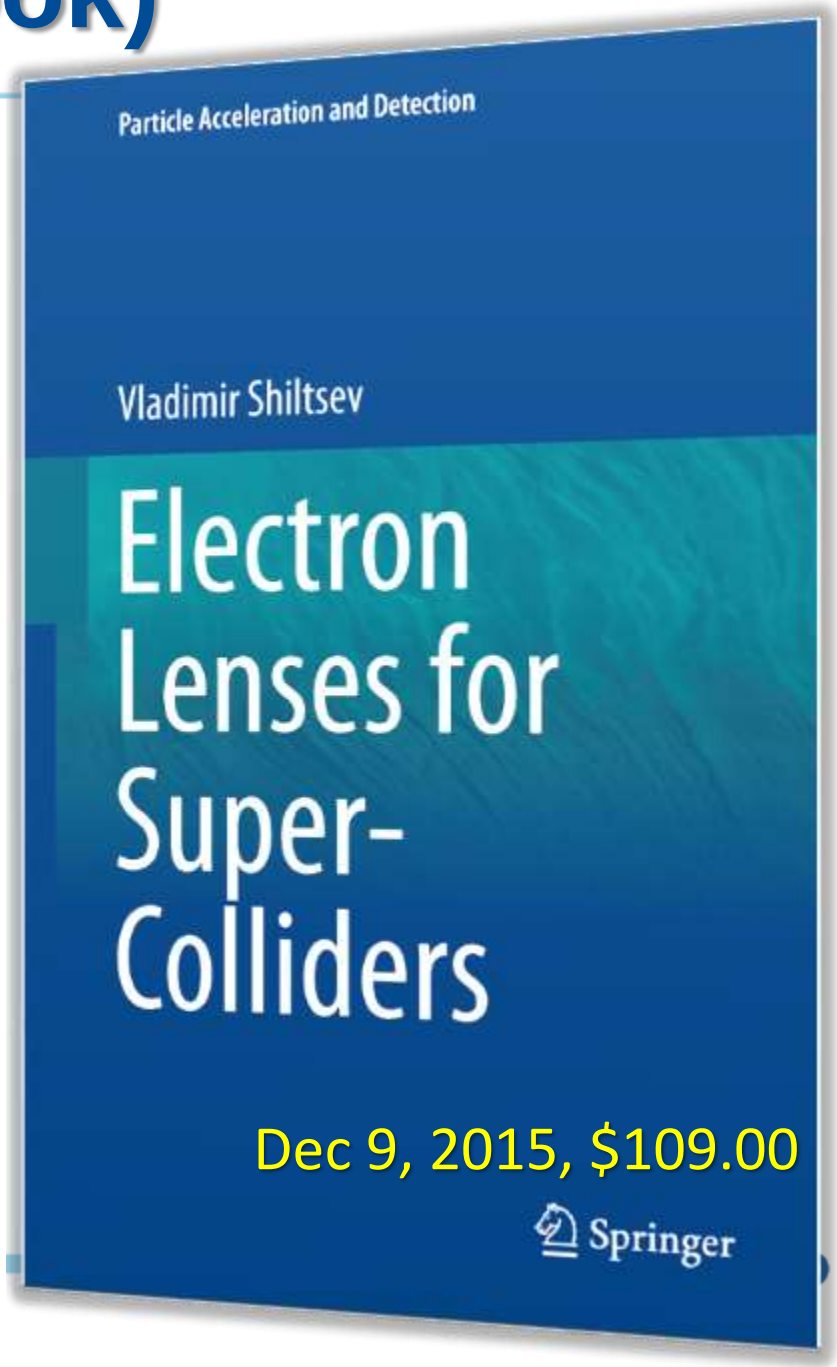
- Winter Session (January 19 - 30)
  - Sponsor: Old Dominion University
  - 135 students attended
- Summer Session (June 15 - 26)
  - Sponsor: Rutgers University
  - 125 students attended
- **Outstanding evaluation from HEPAP review (May 2015)**
  - *"USPAS effectively and efficiently serves the critical needs for accelerator workforce development and training in the U.S…The USPAS program is of high quality and remarkable breadth."*

Electron Lenses (book)

- Summarizes 17 years of combined experience of TEL-1 and TEL-2



- Many people worked on the Tevatron lenses compensation with e-lens program (operations, theory, studies, analysis)
- Now CERN wants similar ones for the LHC luminosity upgrades



Dec 9, 2015, $109.00

Accolades

- ***Publications : 23 publications*** in high impact refereed journals
  - incl. *Nature, Physical Reviews, JINST, NIM-A*
- ***Valery Lebedev*** – recognized as an ***Outstanding Referee*** for American Physical Society journals.
- **Vladimir Shiltsev** – ***Robert H. Siemann Award*** for outstanding contributions to the Physical Review Special Topics – Accelerators and Beams journal
- ***Jeffrey Eldred*** - ***NPSS Graduate Scholarship Award*** from the IEEE Nuclear and Plasma Sciences Society