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# **20 MeV Electrons from IOTA Injector**

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# Main Ring Synchrotron (1971-1984)



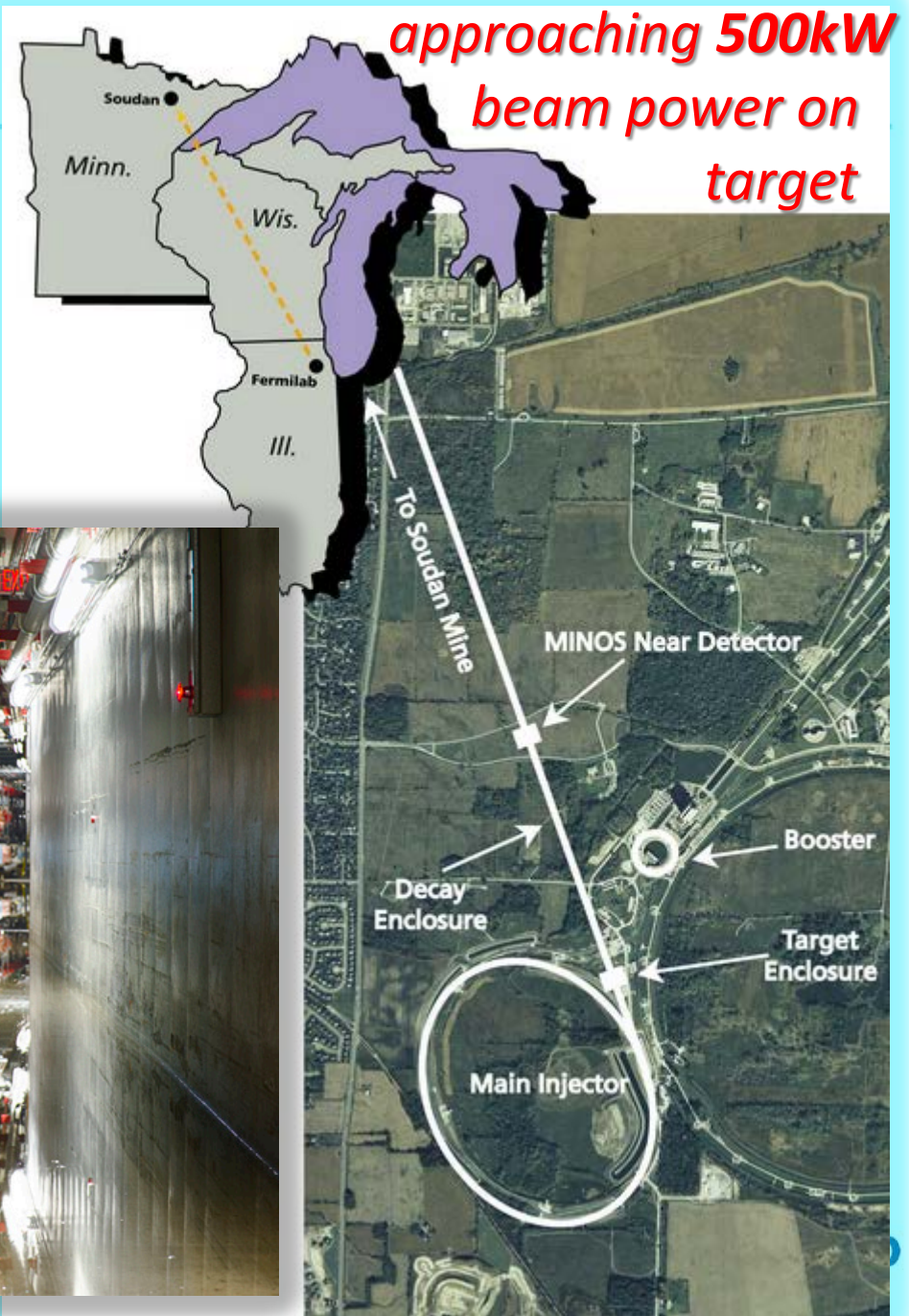


# Tevatron Collider





# Main Injector Synchrotron 1999- now





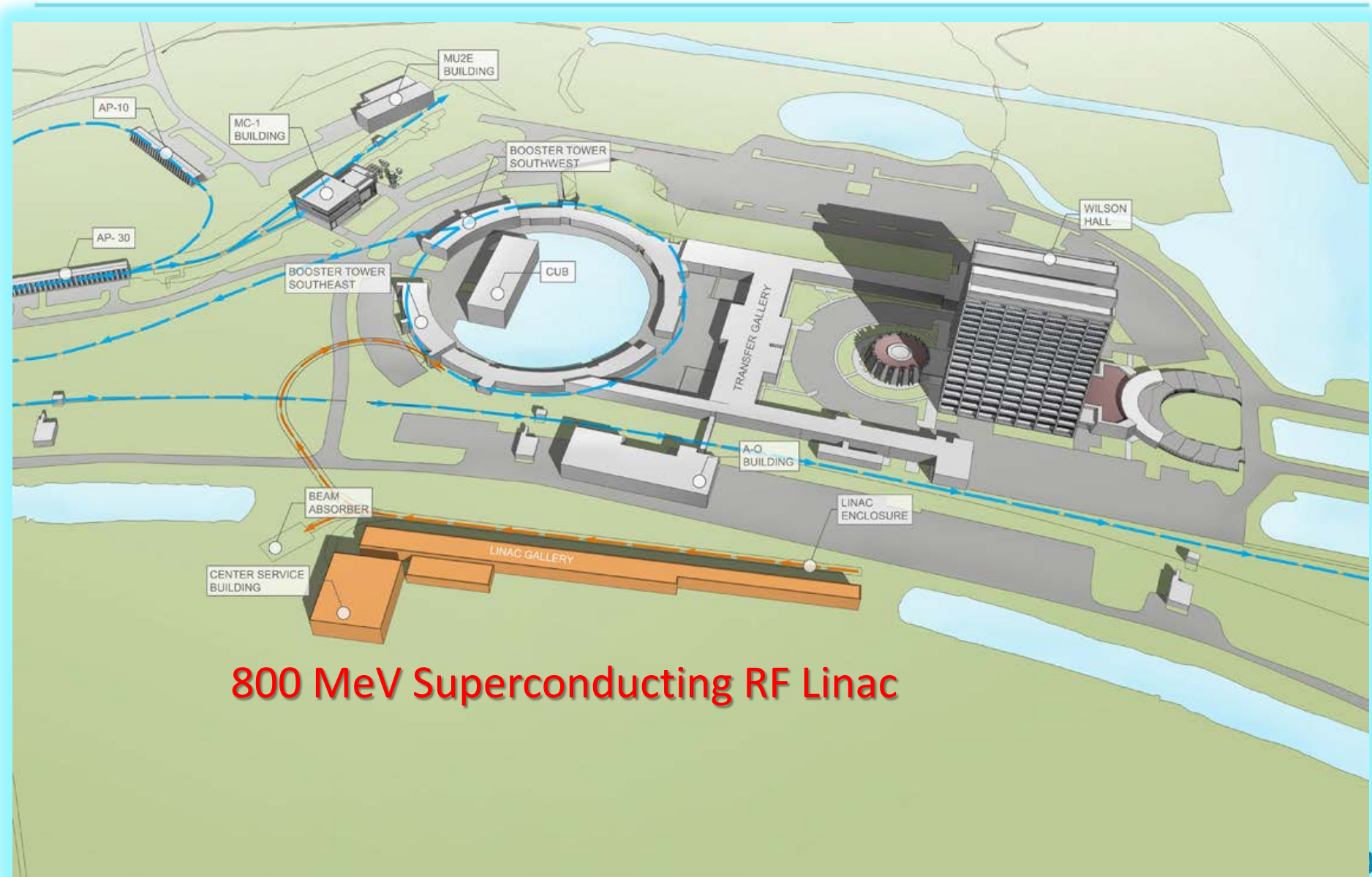
# Proton Improvement Plan (PIP) – 700kW



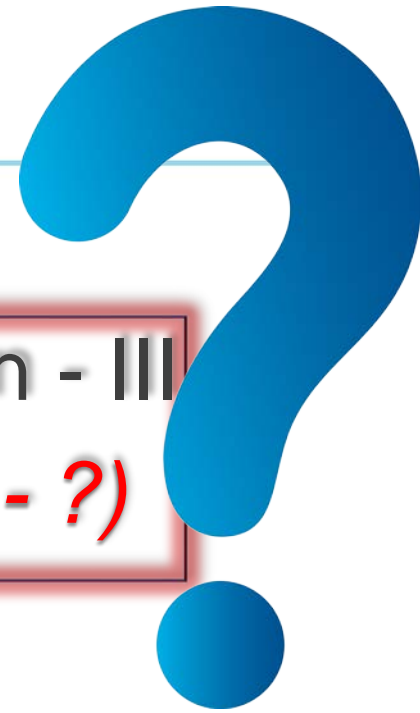
Refurbishing  
Booster Accelerating RF cavities

ermilab

# Proton Improvement Plan-II – **1200kW**



# What's in the Future?



Proton Improvement Plan - III  
**>2400kW ( *ca.2026 - ?* )**

Proton Improvement Plan - II  
**1200kW ( *now-2023* )**

Proton Improvement Plan  
**700kW ( *2013-now* )**

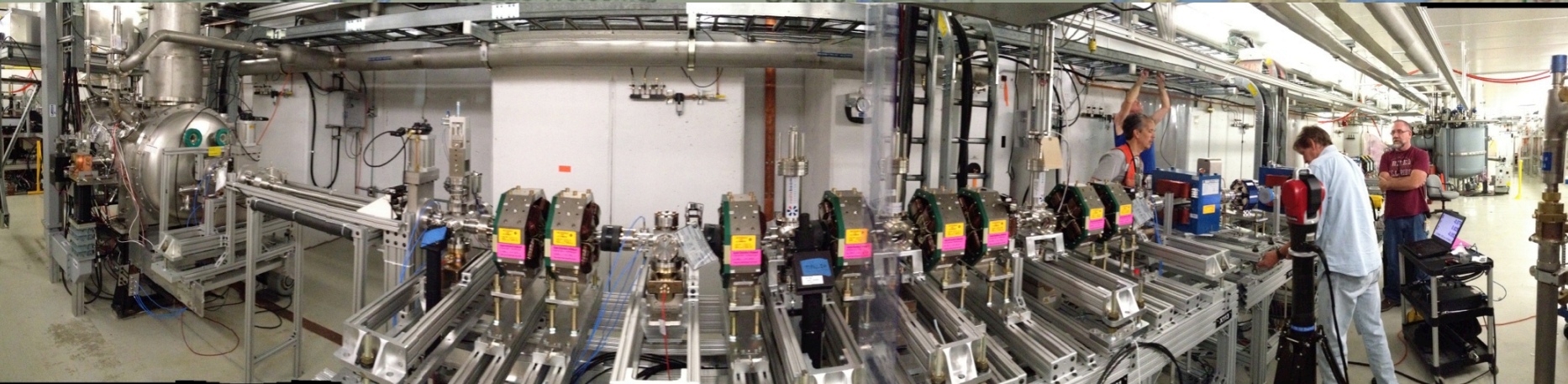


# PIP-III: Need R&D on New Accelerator

- MULTI-MW possible with new “*smart Booster*” ring
- IF we know how to increase beam current by a **factor of 3-4 while keeping beam losses  $<1\%$ :**
  - Very challenging ( after 50 years of development)
- TWO innovative ideas:
  - *Integrable Optics*
  - *Space Charge Compensation*
- NEED to test them experimentally:
  - R&D beam test facility: **FAST**

***Fermilab Accelerator Science and Technology facility***







# ~ Hundred People Were Building that Facility





# ~ Hundred Users Waiting For FAST

Annual Users Meetings and Workshops: 2013, 2014, 2015 ...



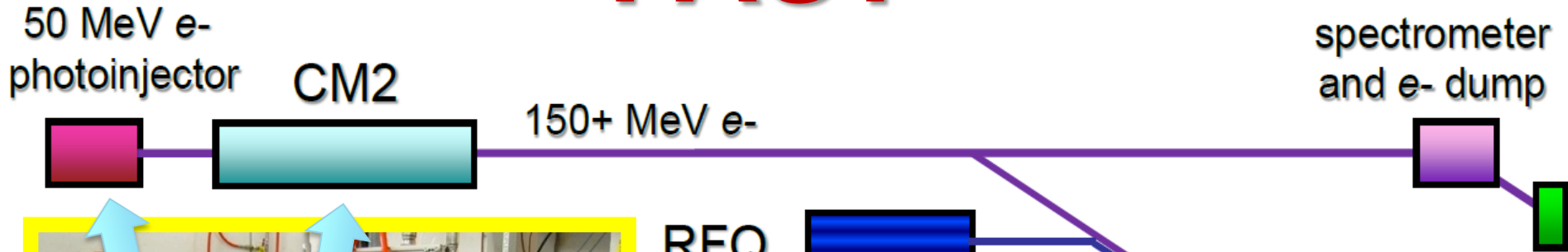
## Partnerships:

DOE labs: ANL, BNL, ORNL, JLab, LBNL, SLAC, LANL

U.S. Universities: 10      International: 5      Industry: 3



# FAST

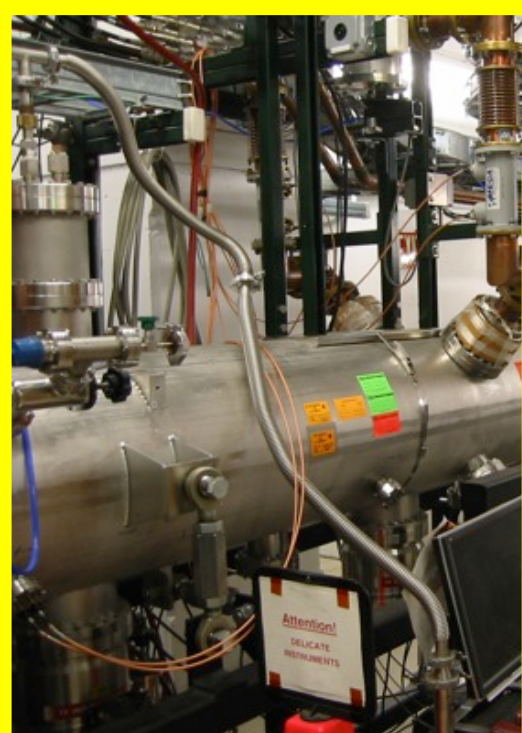


RFQ

2.7 MeV p+/H-

**IOTA**

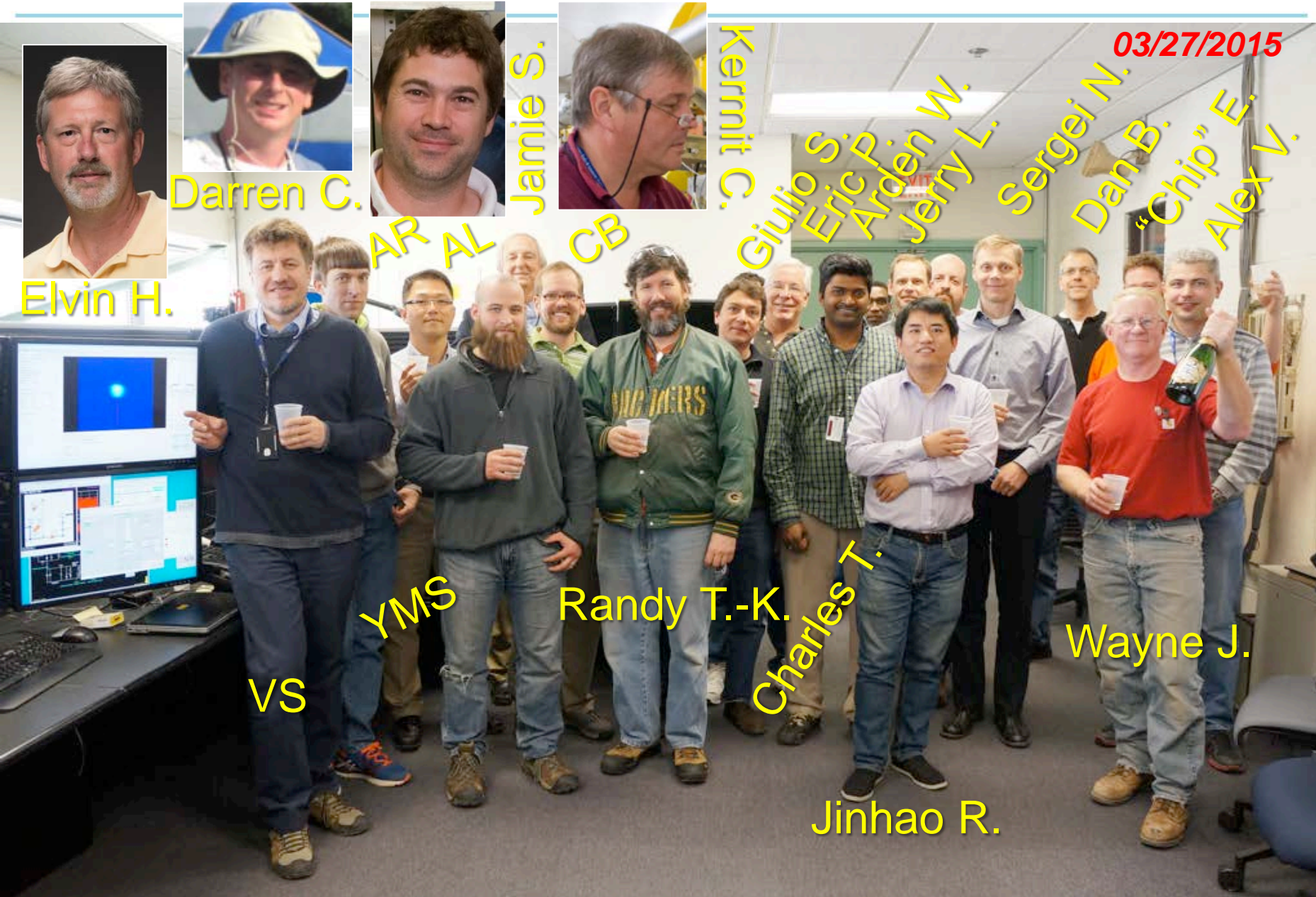
150 MeV e-  
2.5 MeV p+



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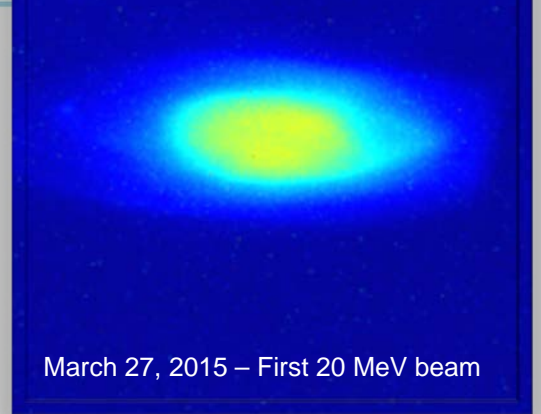


# 20 MeV Electrons out of IOTA Injector!



# What are we celebrating ?

BTW: Record high ELECTRON energy on FNAL site!



- **electron** beam accelerated by SRF cavity to 20,000,000 Volt and safely delivered to beam dump

## What's next ?

- **electron** beam accelerated to 50 MeV (early FY16)
- **IOTA ring** built (FY17)
- **electron** beam 150 MeV injected into IOTA (end FY17)
- **proton** beam 70 MeV/c injected into IOTA (end FY18)
- **research** at IOTA @ FAST (2019-2025)
- **Nobel Prize (2026?)**