

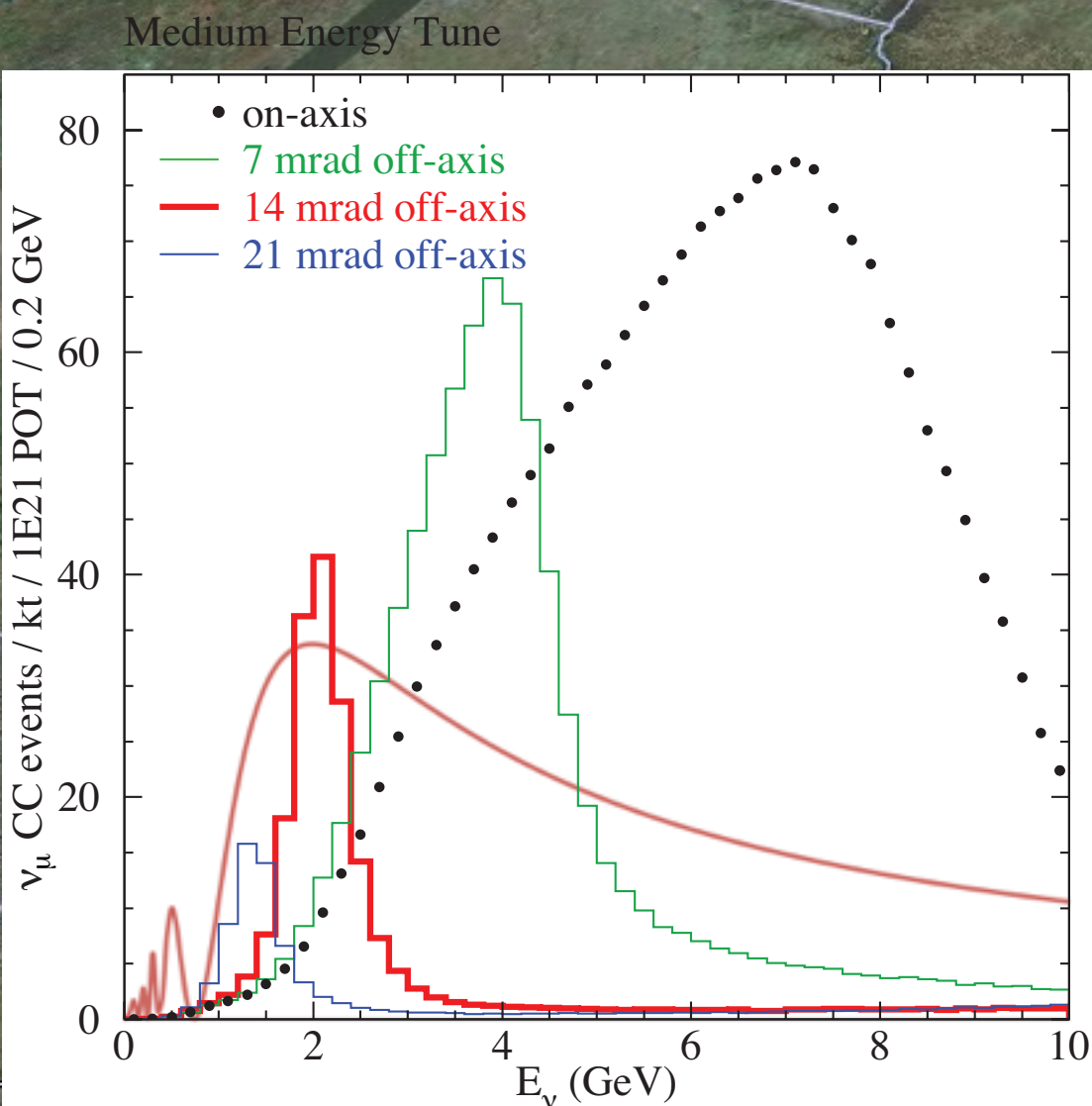
NOvA Experiment Status

Mark Messier
Indiana University

Workshop for Neutrino Programs with facilities in Japan
August 5, 2015

NOvA Experiment

Ash River, MN
810 km from Fermilab



Summary of sensitivity of $\nu_\mu \rightarrow \nu_e$ rates to physics parameters

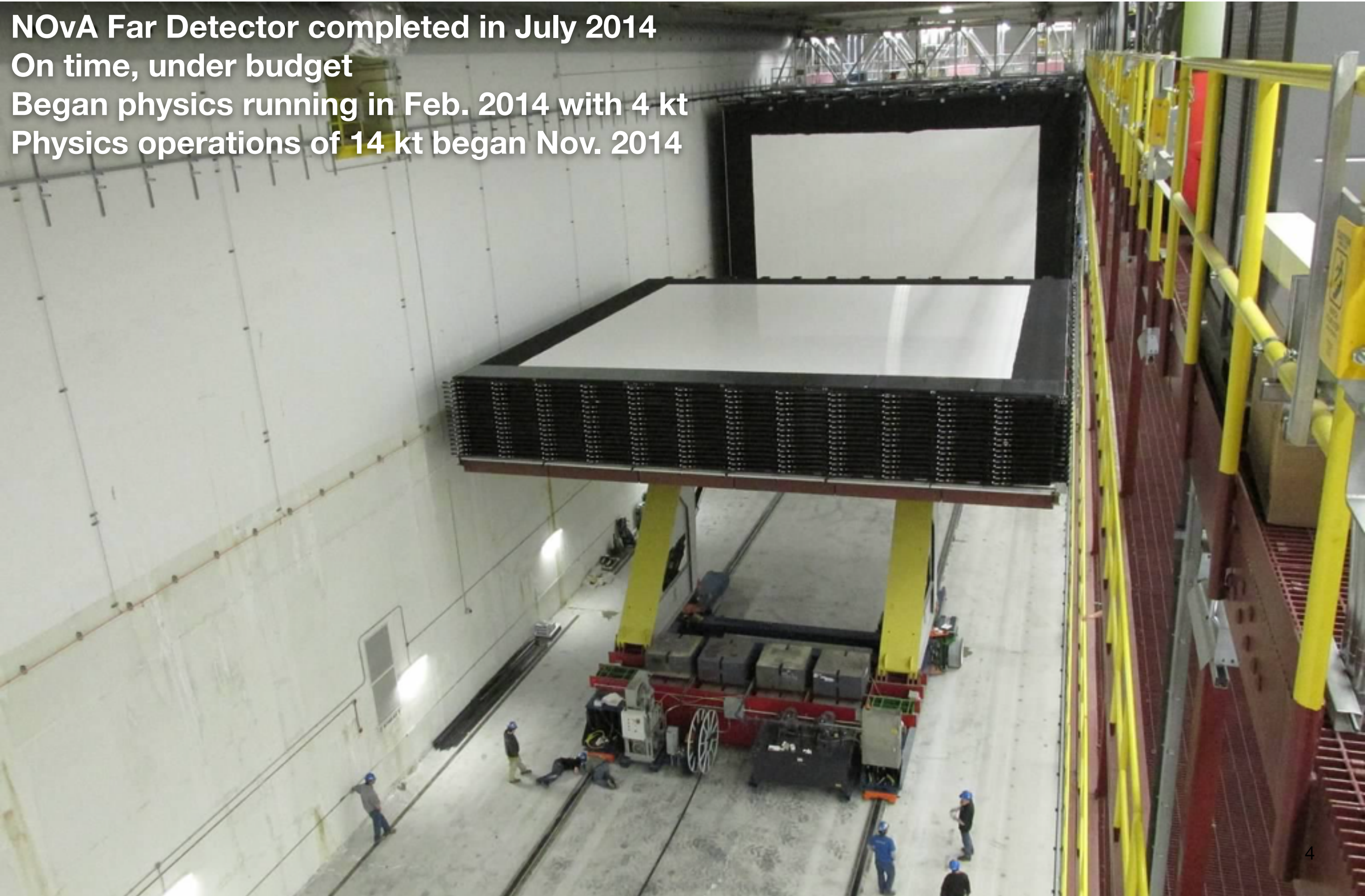
Factor	Type	Inverts for $\bar{\nu}$?	NOvA	T2K
Matter effect (mass ordering)	Binary	Yes	$\pm 19\%$	$\pm 10\%$
CP violation	Bounded, continuous	Yes	$[-22...+22]\%$	$[-29...+29]\%$
θ	Unbounded, continuous	No	$[-22...+22]\%$	$[-22...+22]\%$

Nota bene:

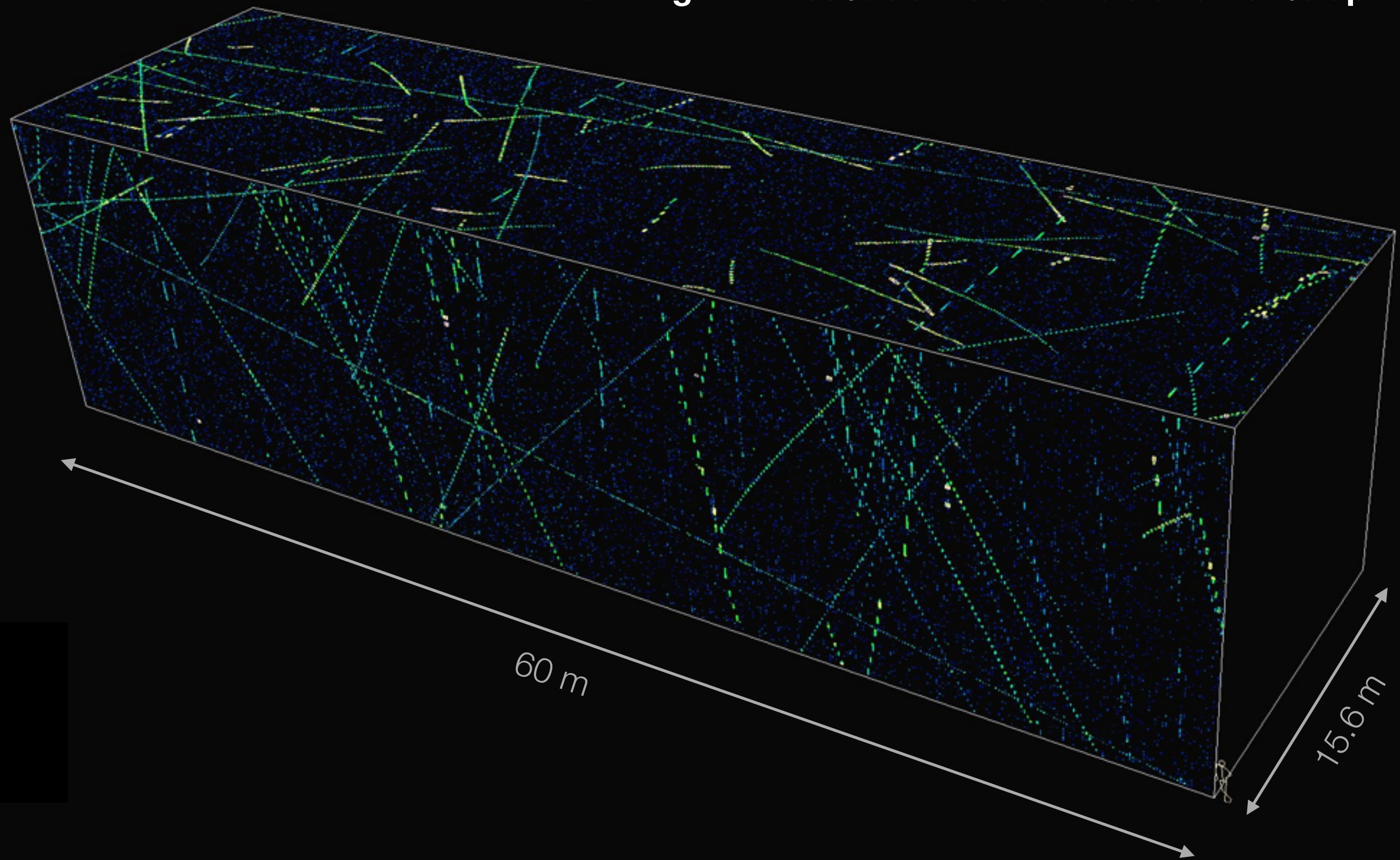
- Calculations are for rate only; there is some additional information in the energy spectrum
- These estimates neglect non-linearities in combining different effects
- In the calculation of the matter effect and CP violation effects the calculated values account for the fact that T2K runs at an energy on the first oscillation maximum while NOvA runs at an energy slightly above the oscillation maximum
- θ_{23} was varied inside the $\pm 2\sigma$ range found by a recent global fit (PRD 90, 093006)

NOvA Far Detector

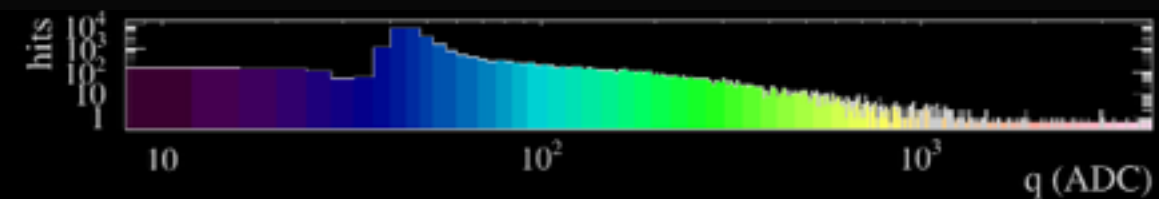
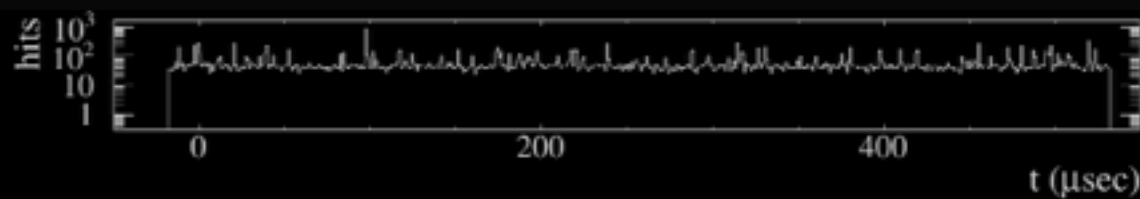
NOvA Far Detector completed in July 2014
On time, under budget
Began physics running in Feb. 2014 with 4 kt
Physics operations of 14 kt began Nov. 2014

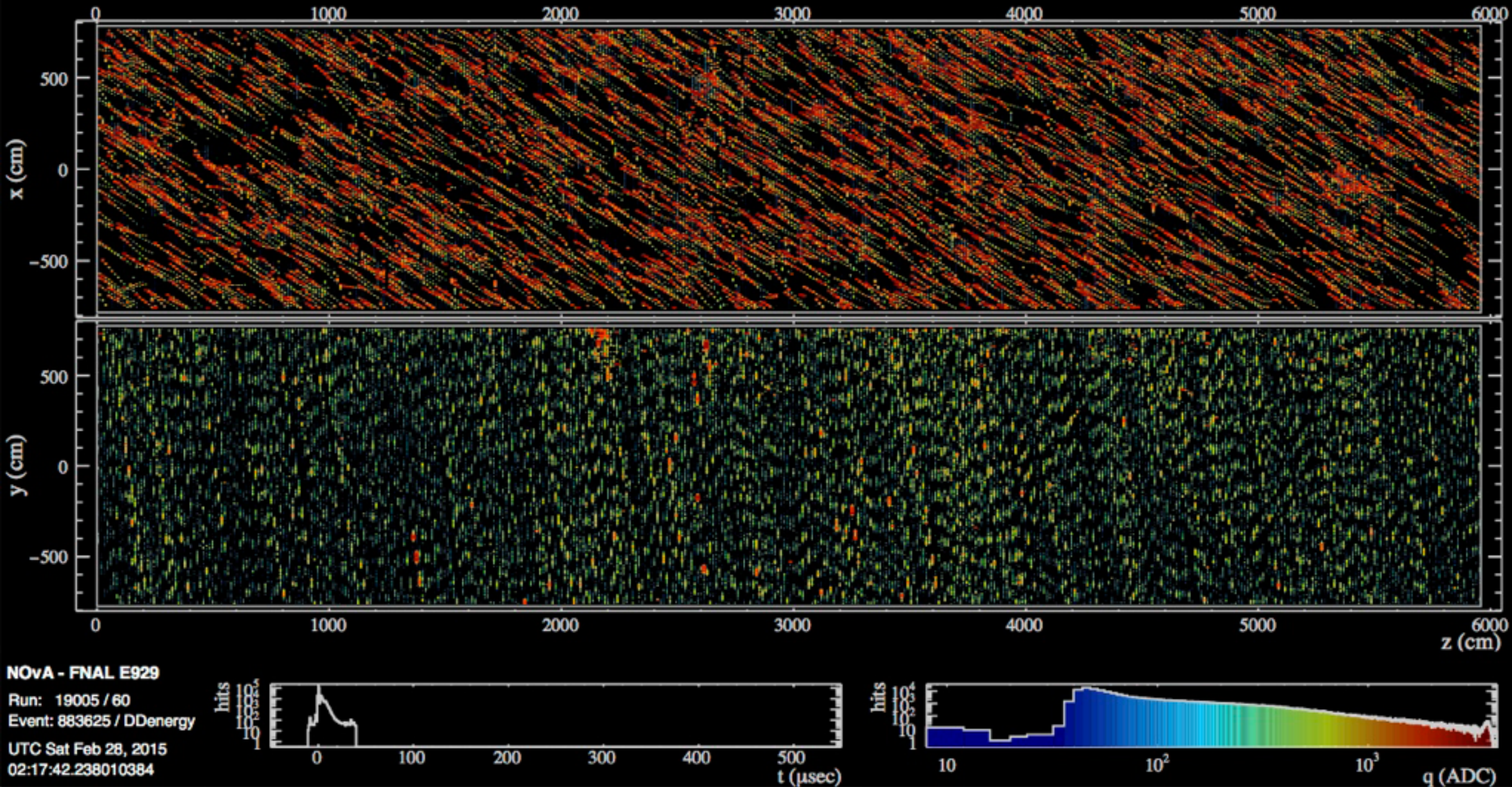


Running with >99% active channels and >95% uptime



Run: 18605 / 0
Event: 161 / PerCal
UTC Tue Jan 6, 2015
23:25:55.172218000

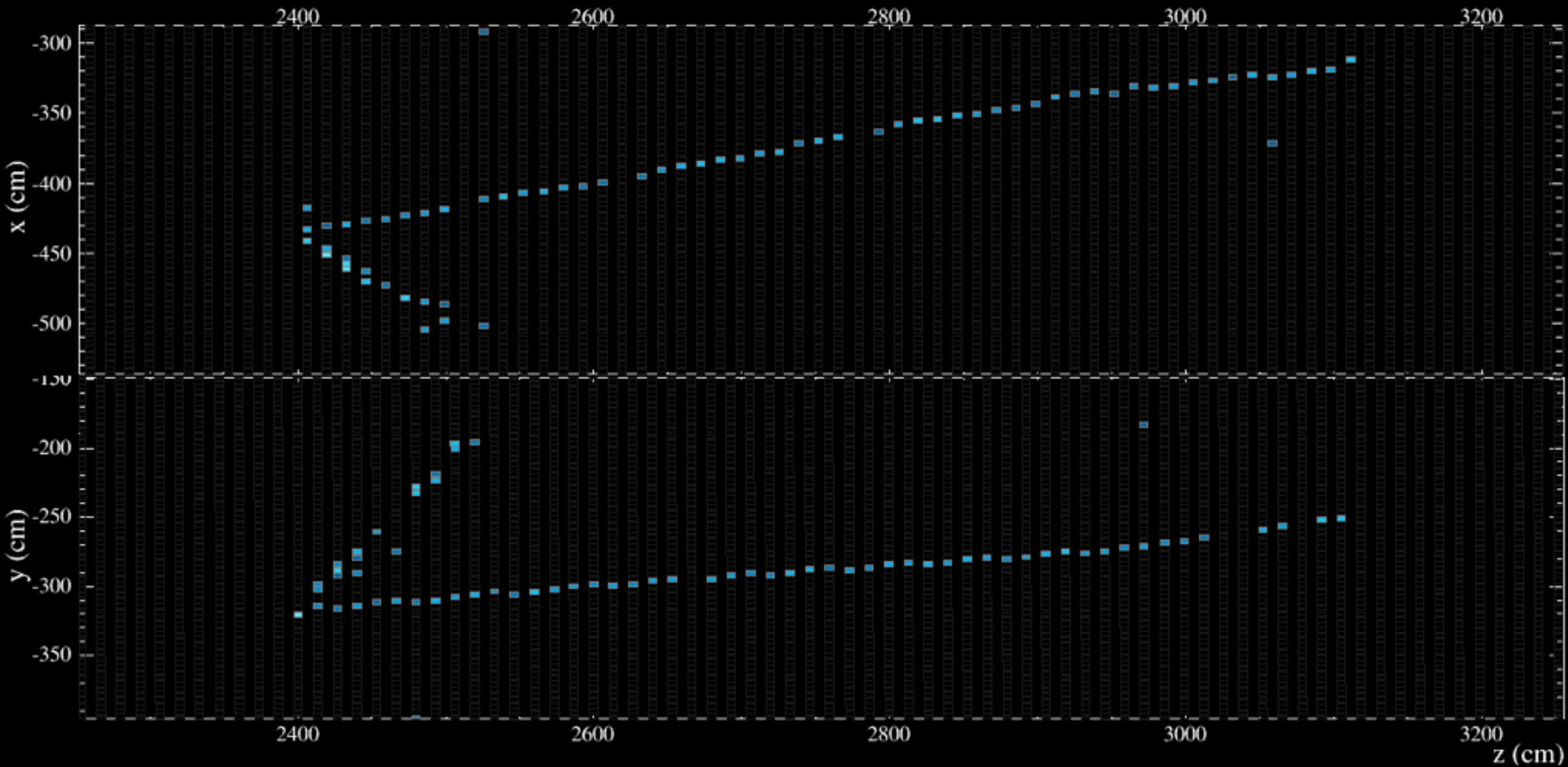




Massive air shower in
NOvA

NOvA Uses data driven triggers
to search for monopoles,
WIMPs, and supernovae

NOvA ν_μ Charged-current candidate



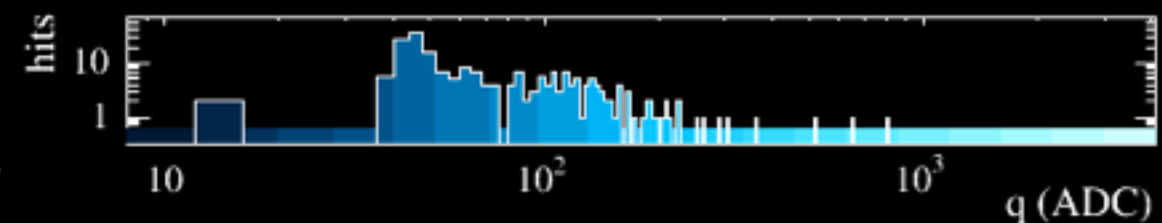
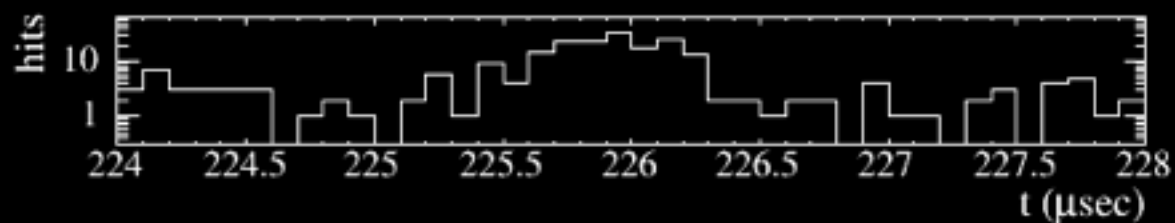
NOvA - FNAL E929

Run: 14828 / 38

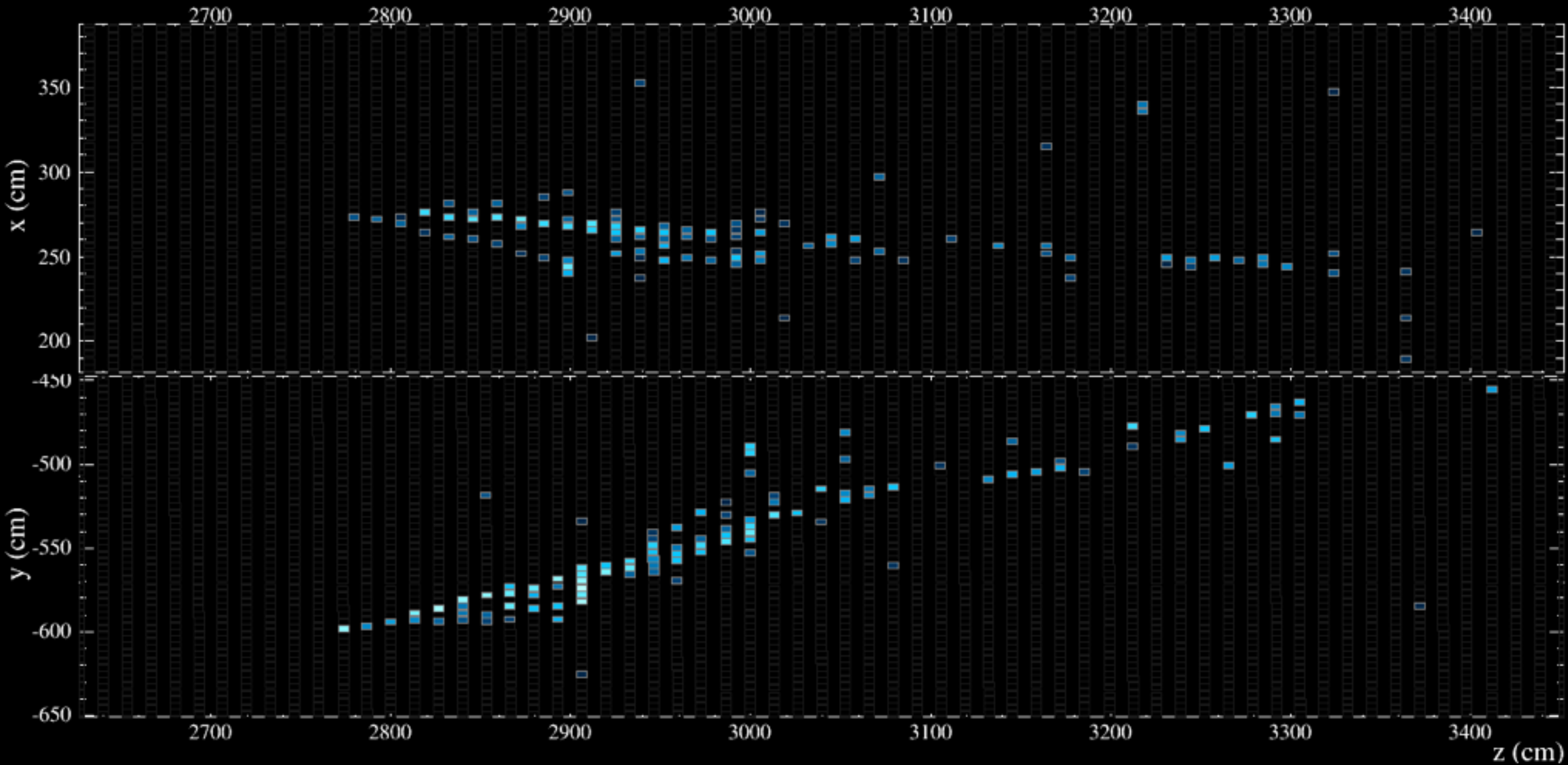
Event: 192569 / NuMI

UTC Tue Apr 22, 2014

21:41:51.422846016



NOvA ν_e^* Charged-current candidate



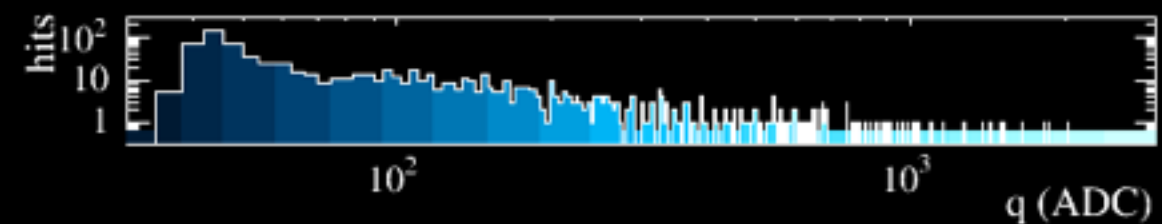
NOvA - FNAL E929

Run: 15392 / 55

Event: 125664 / NuMI

UTC Wed May 28, 2014

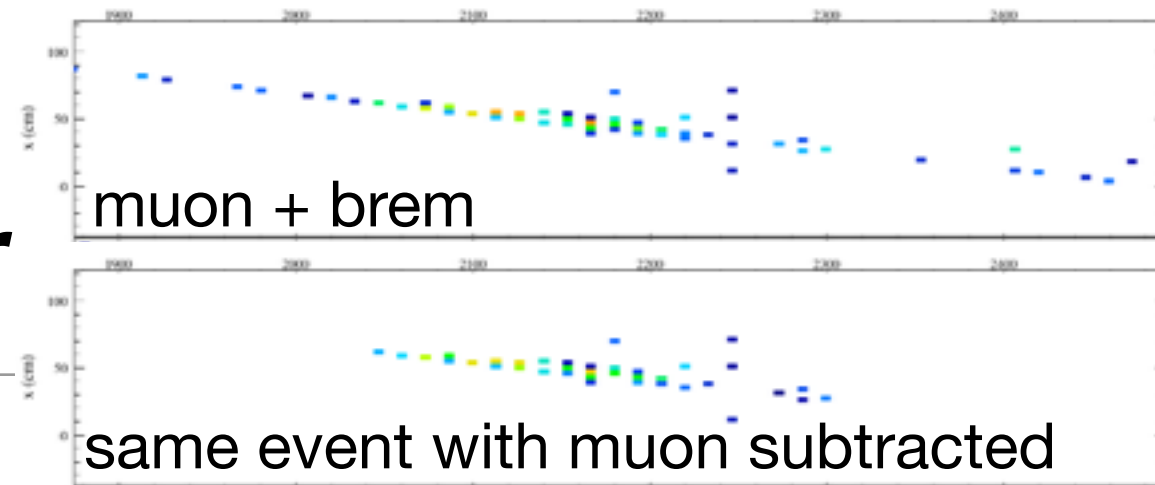
04:55:46.939251776



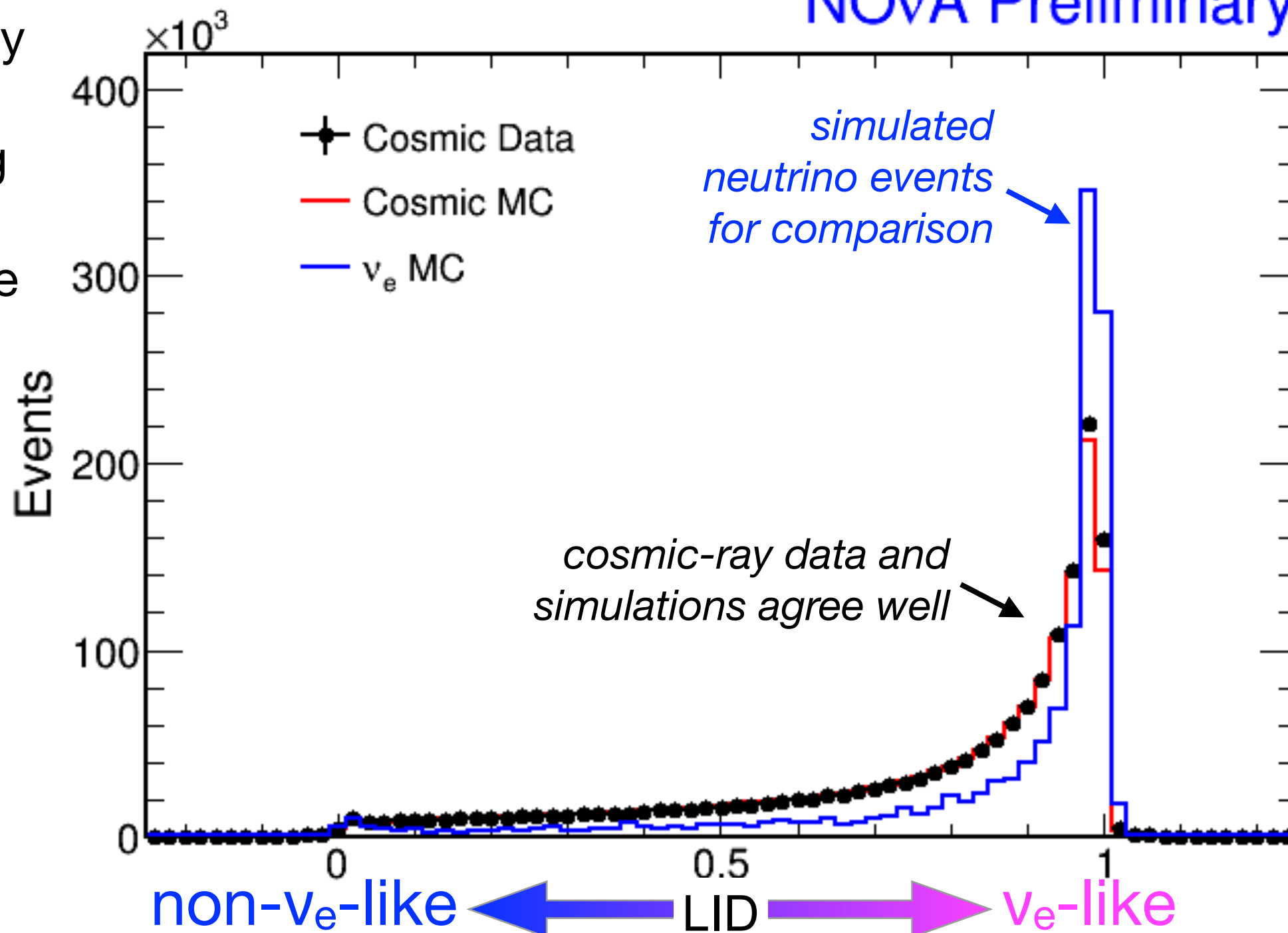
* particle IDs blinded until analysis finalized

NOvA: Particle ID at Far detector

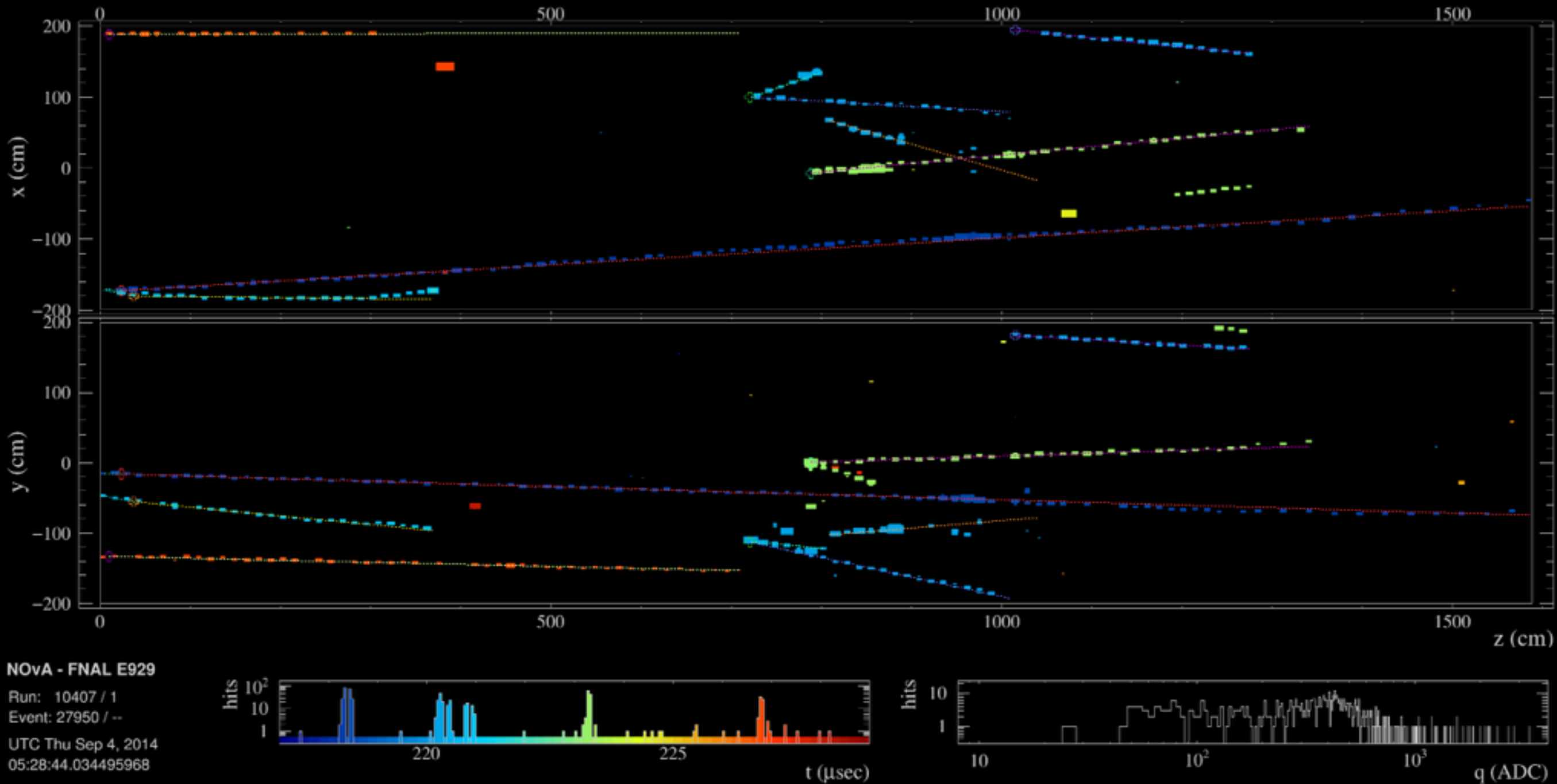
Using real
electron showers
from cosmic-ray
muons
bremsstrahlung
to tune up
electron particle
ID at the far
detector



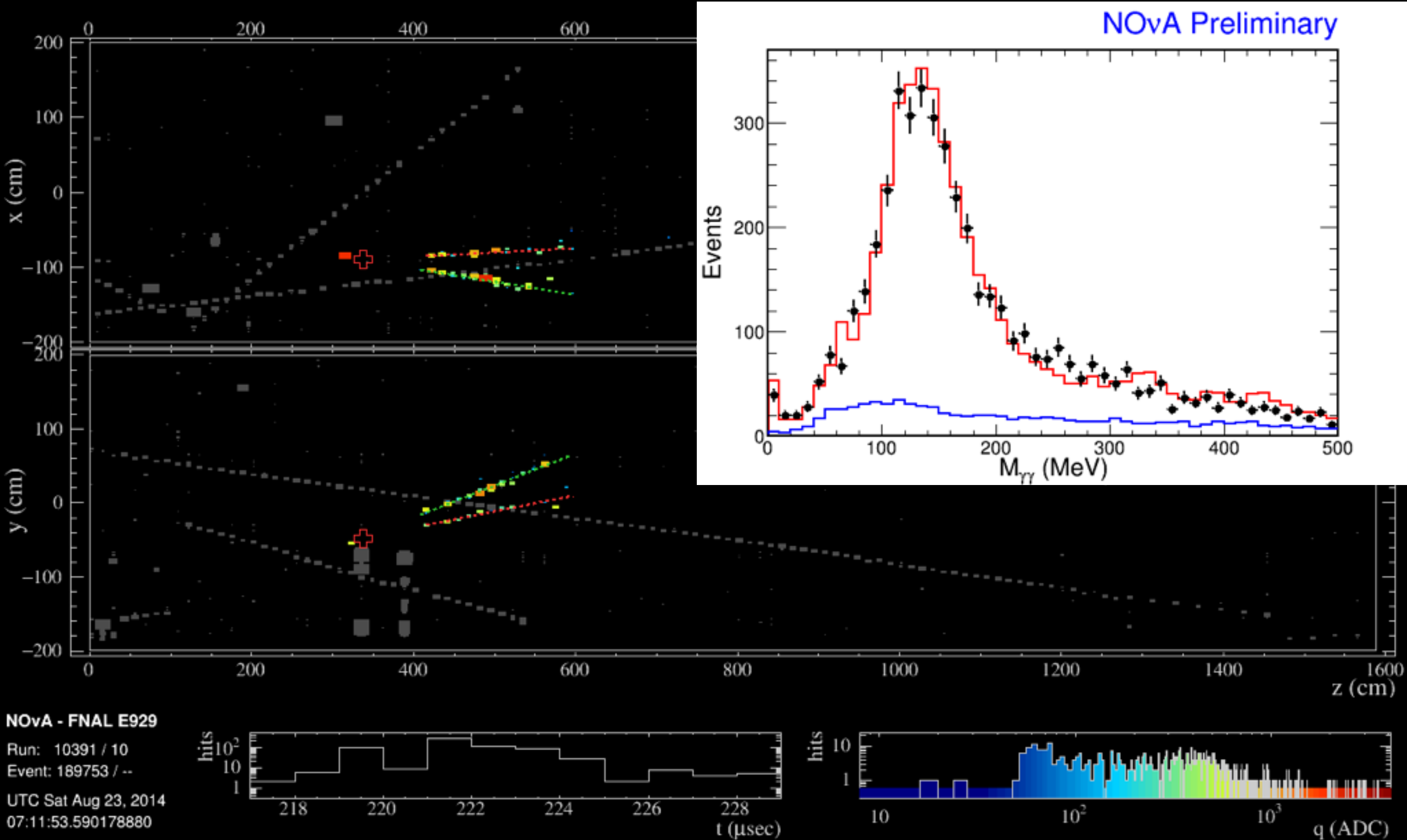
NOvA Preliminary



Near Detector Event Display



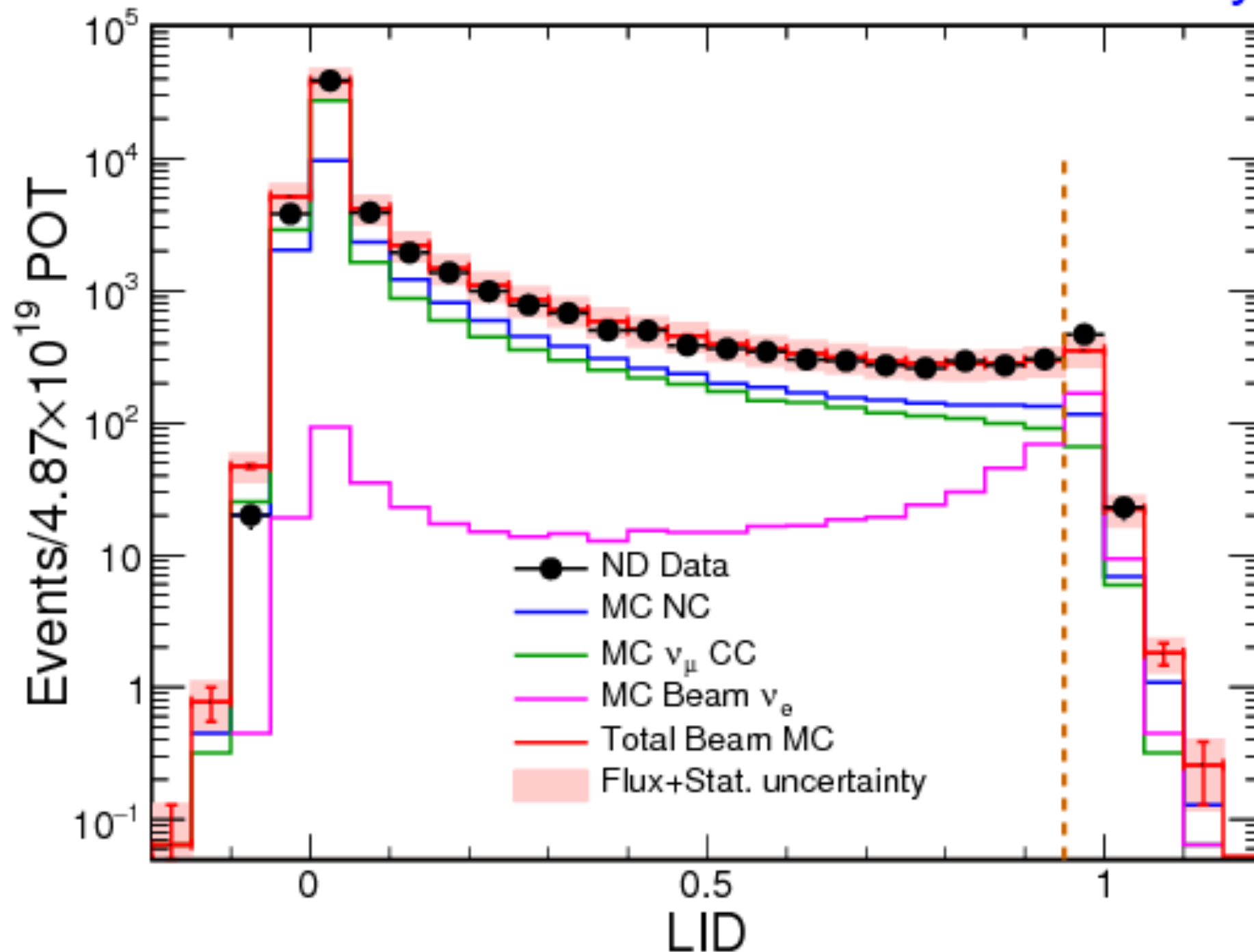
Colors show time
reconstructed tracks and vertices superimposed



Pi-zero reconstruction at ND

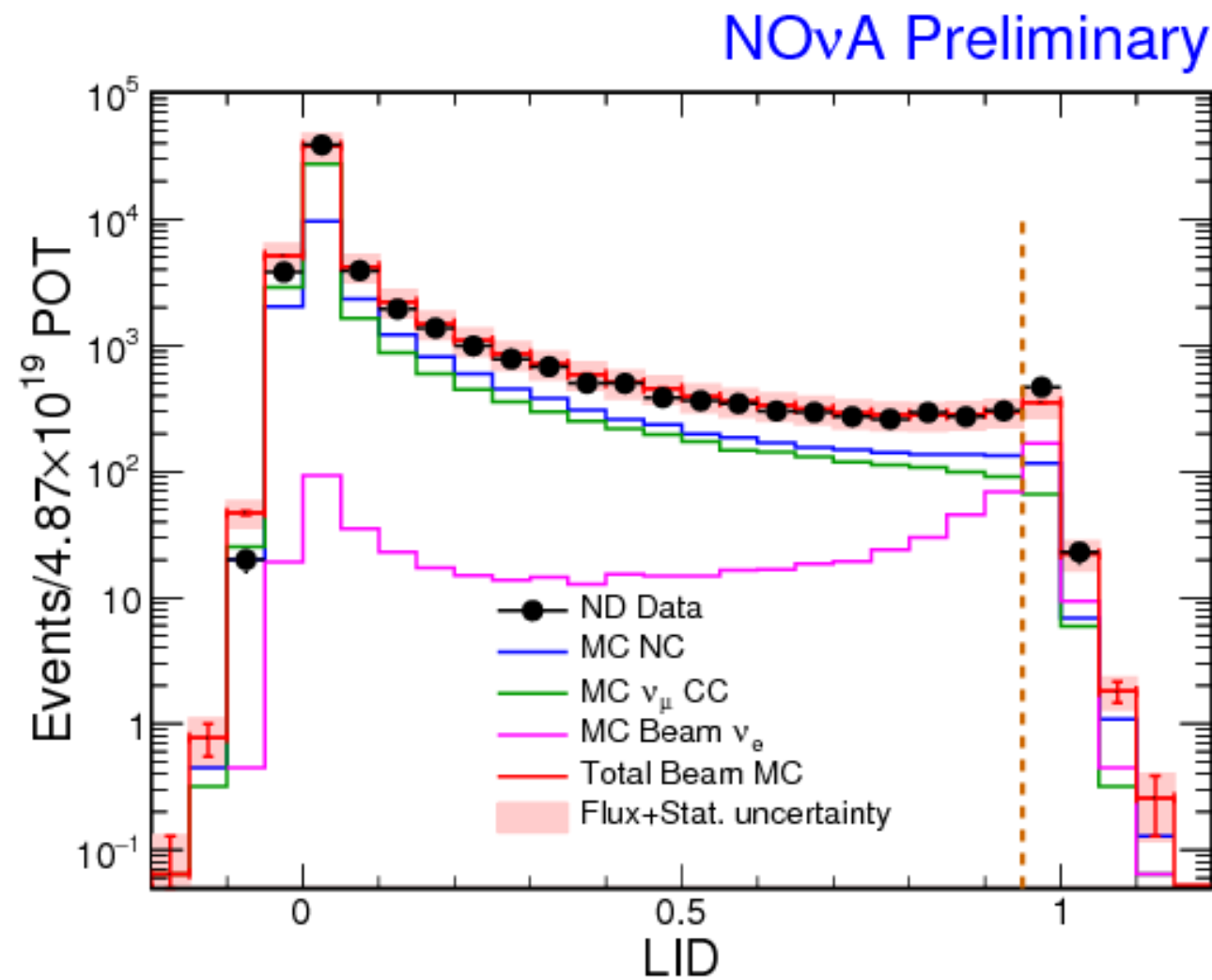
Particle Identification in Near Detector

NOvA Preliminary

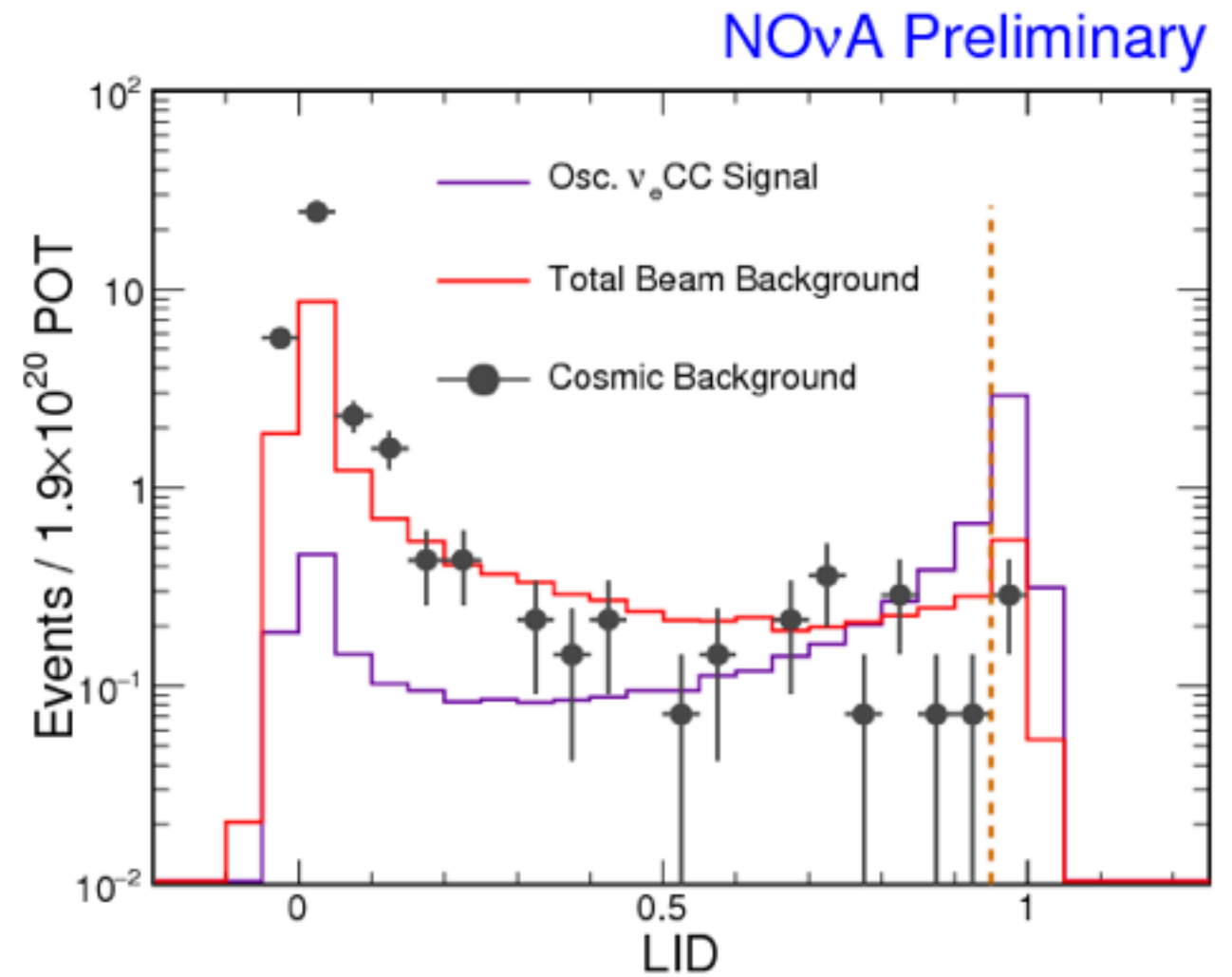


non- ν_e -like \longleftrightarrow ν_e -like

Background estimates at Far Detector

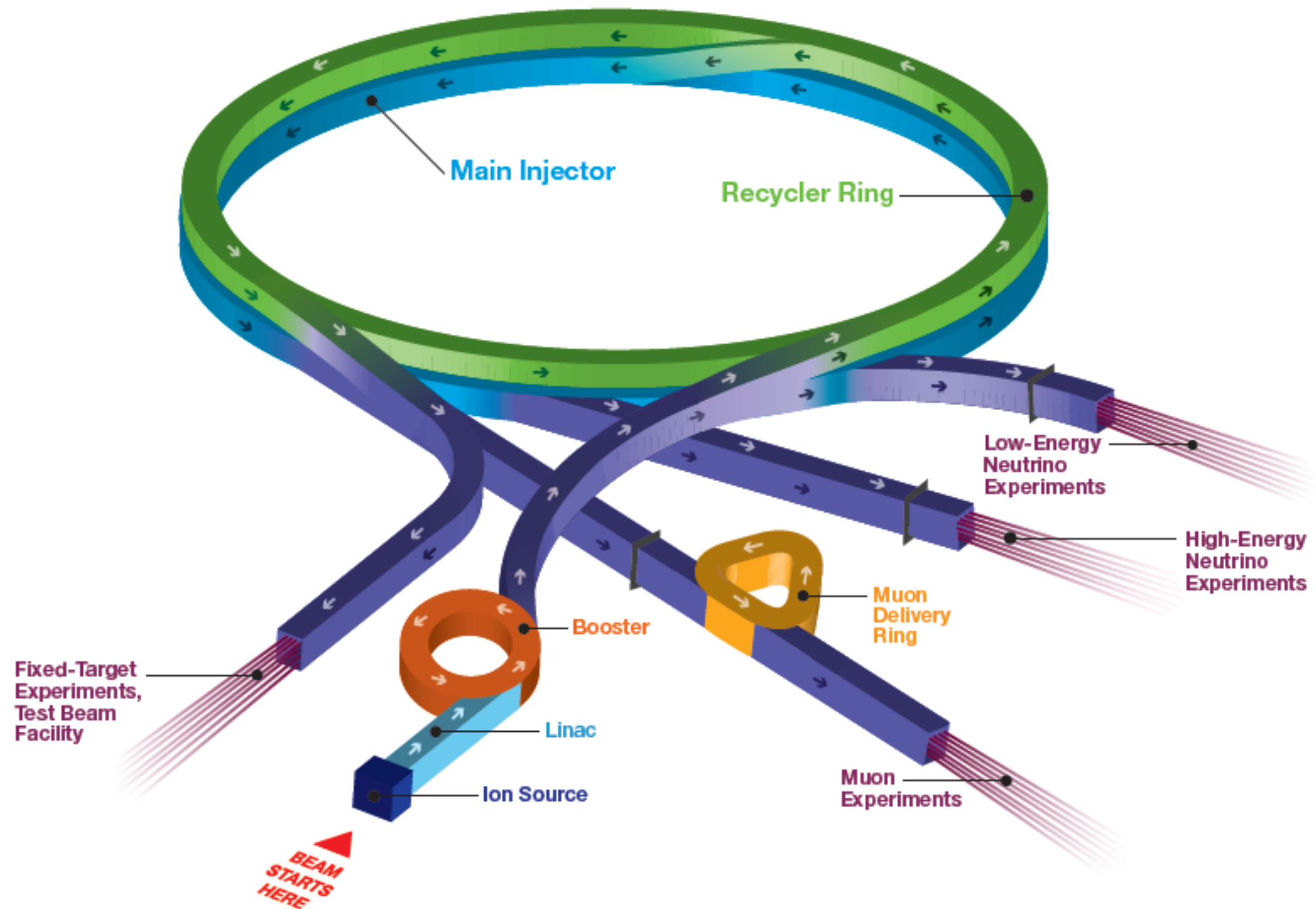


NEAR



FAR

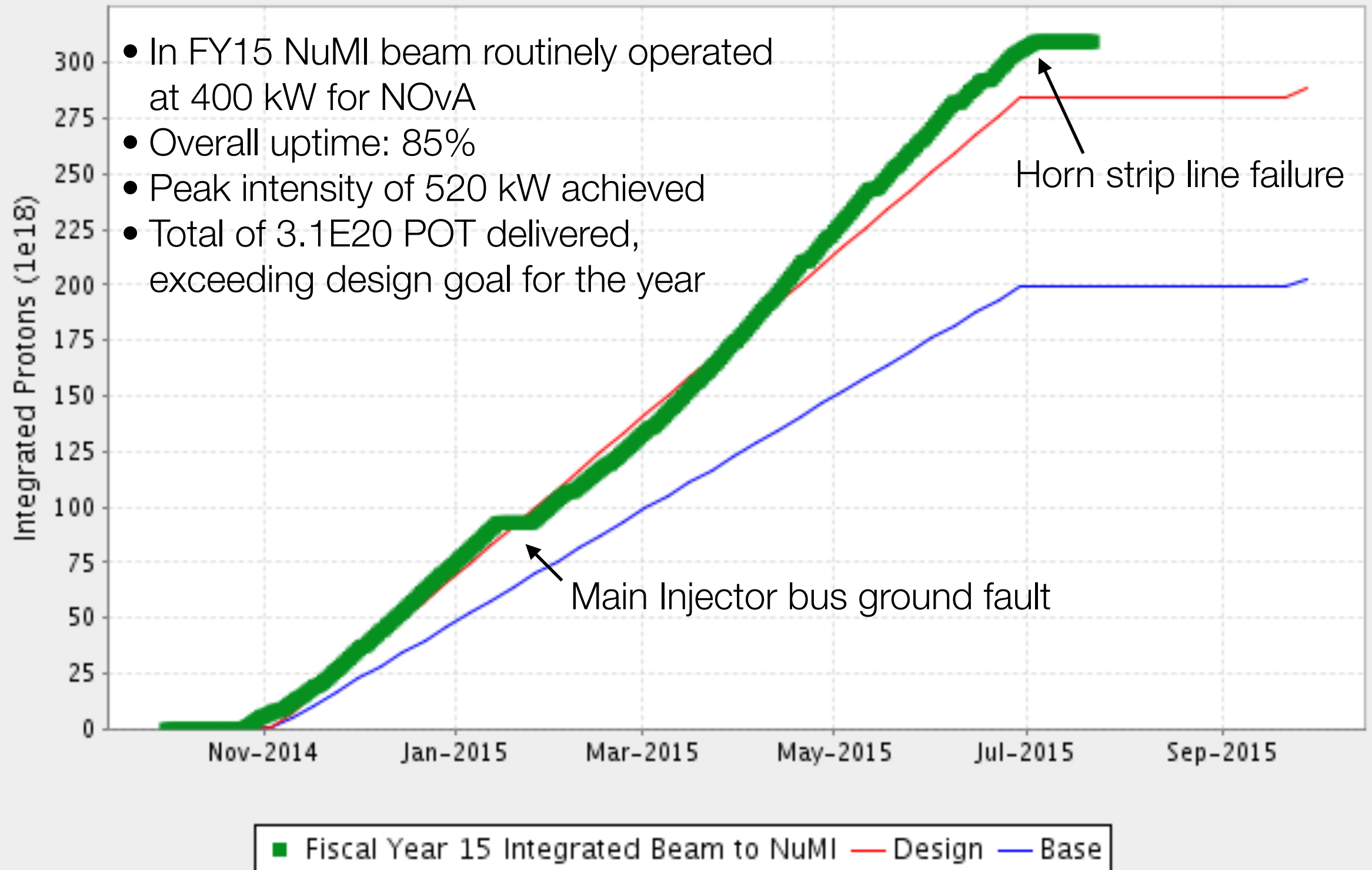
Accelerator status



Fermilab accelerator
complex

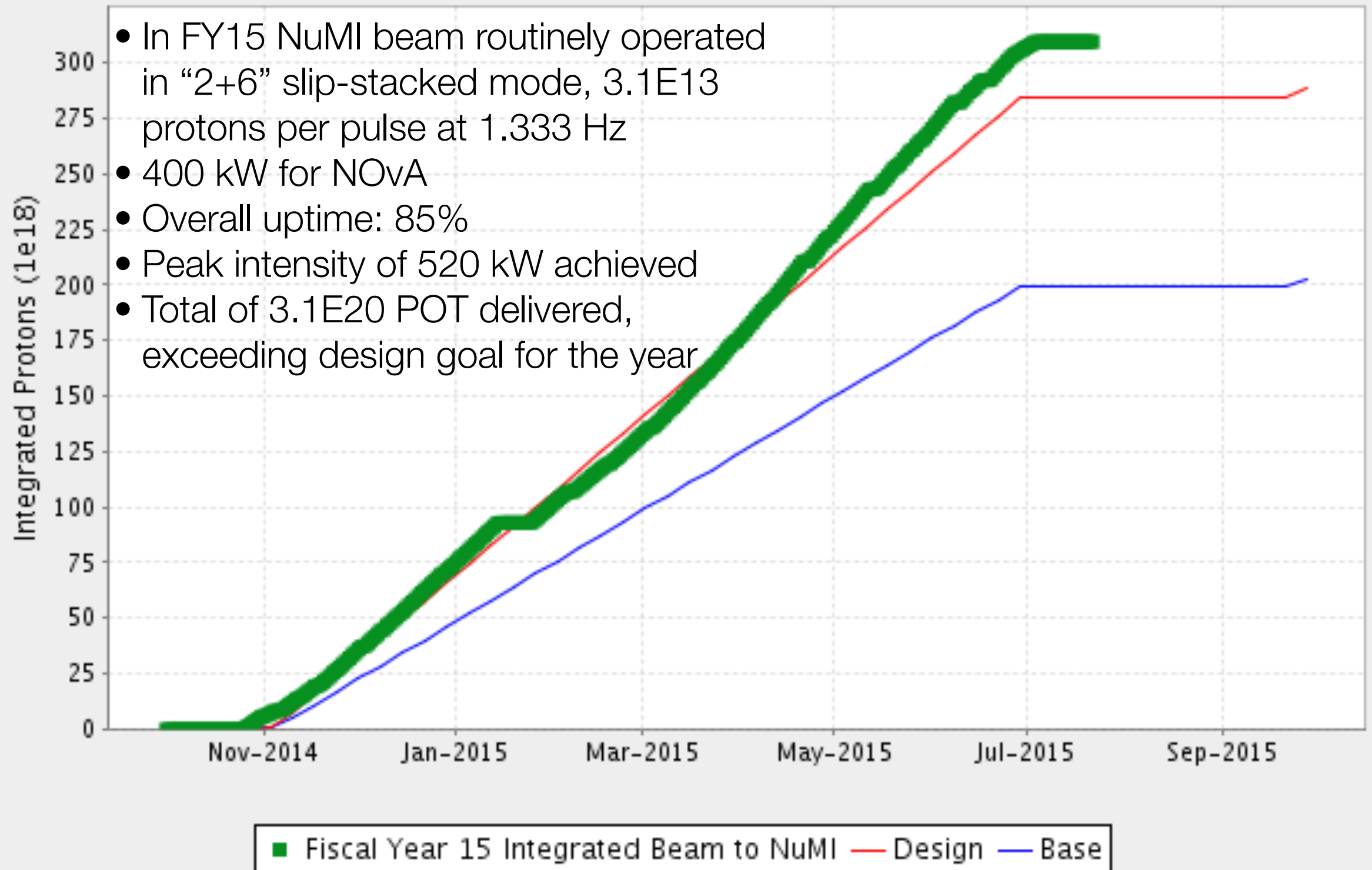
NuMI neutrino beam relies on
Linac, Booster, Main Injector,
and Recycler

FY15 Integrated Beam to NuMI



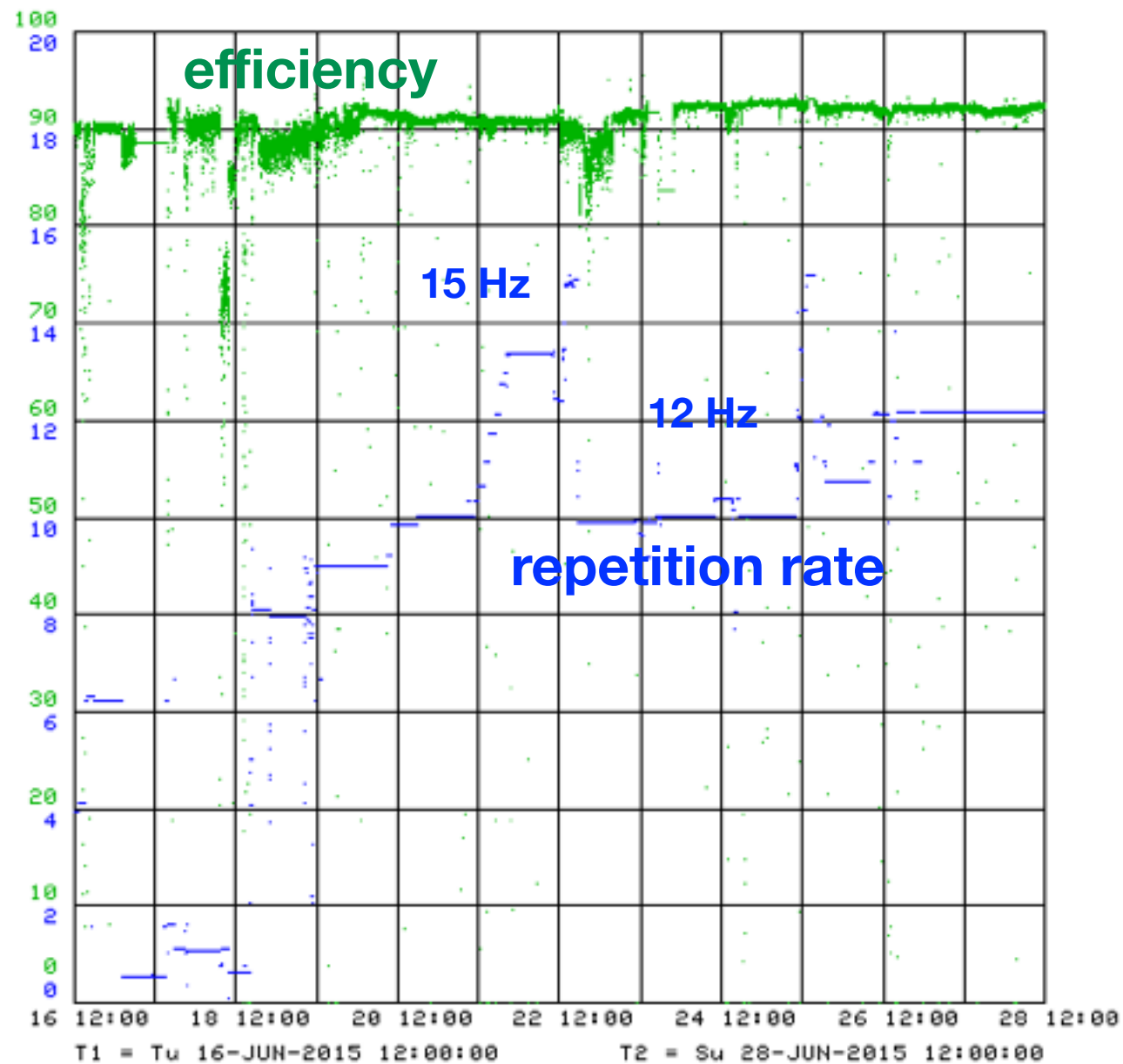
US FY2015 NuMI Beam
Performance

FY15 Integrated Beam to NuMI

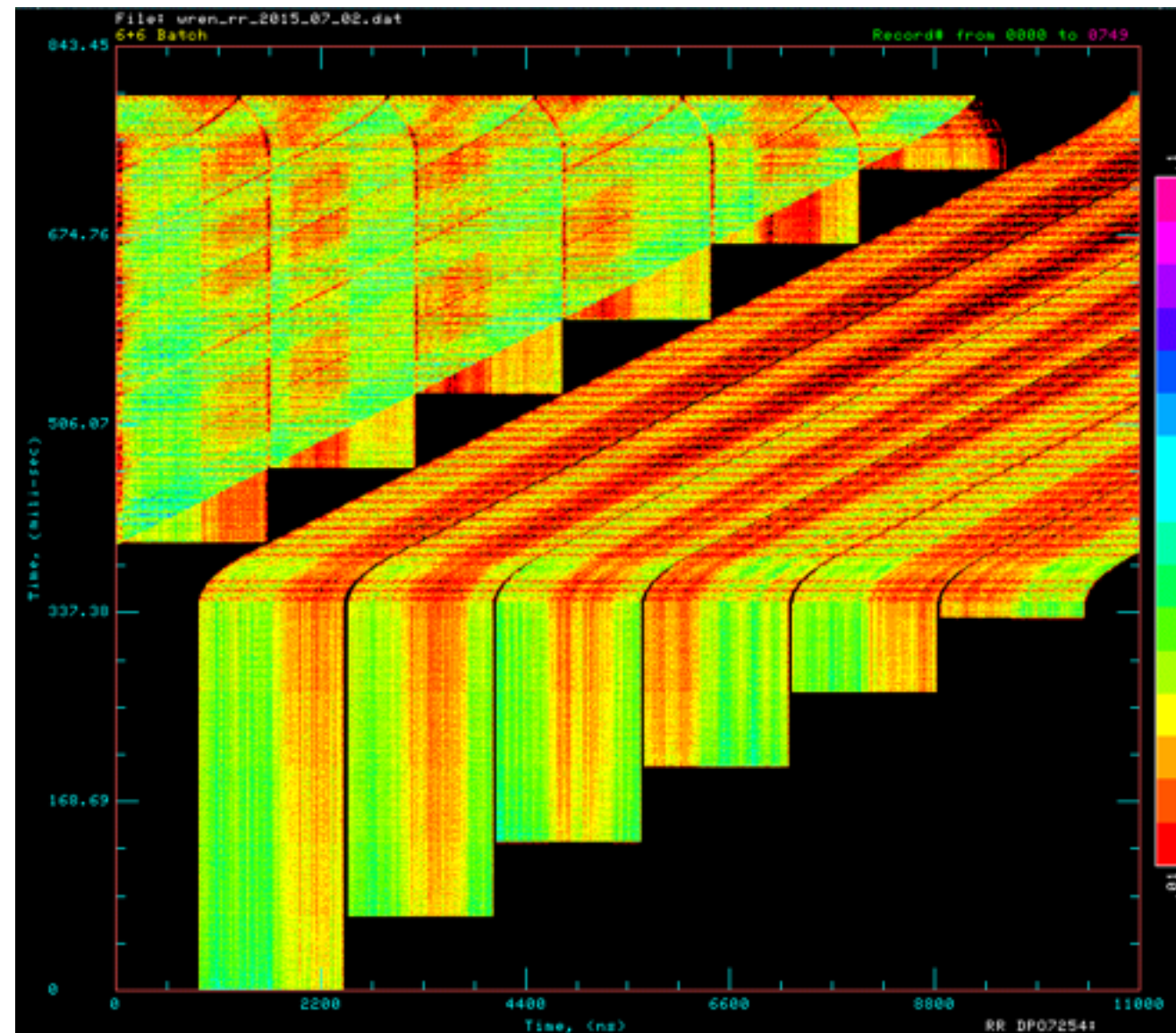


US FY2015 NuMI Beam
Performance

Booster operations at
>9 Hz

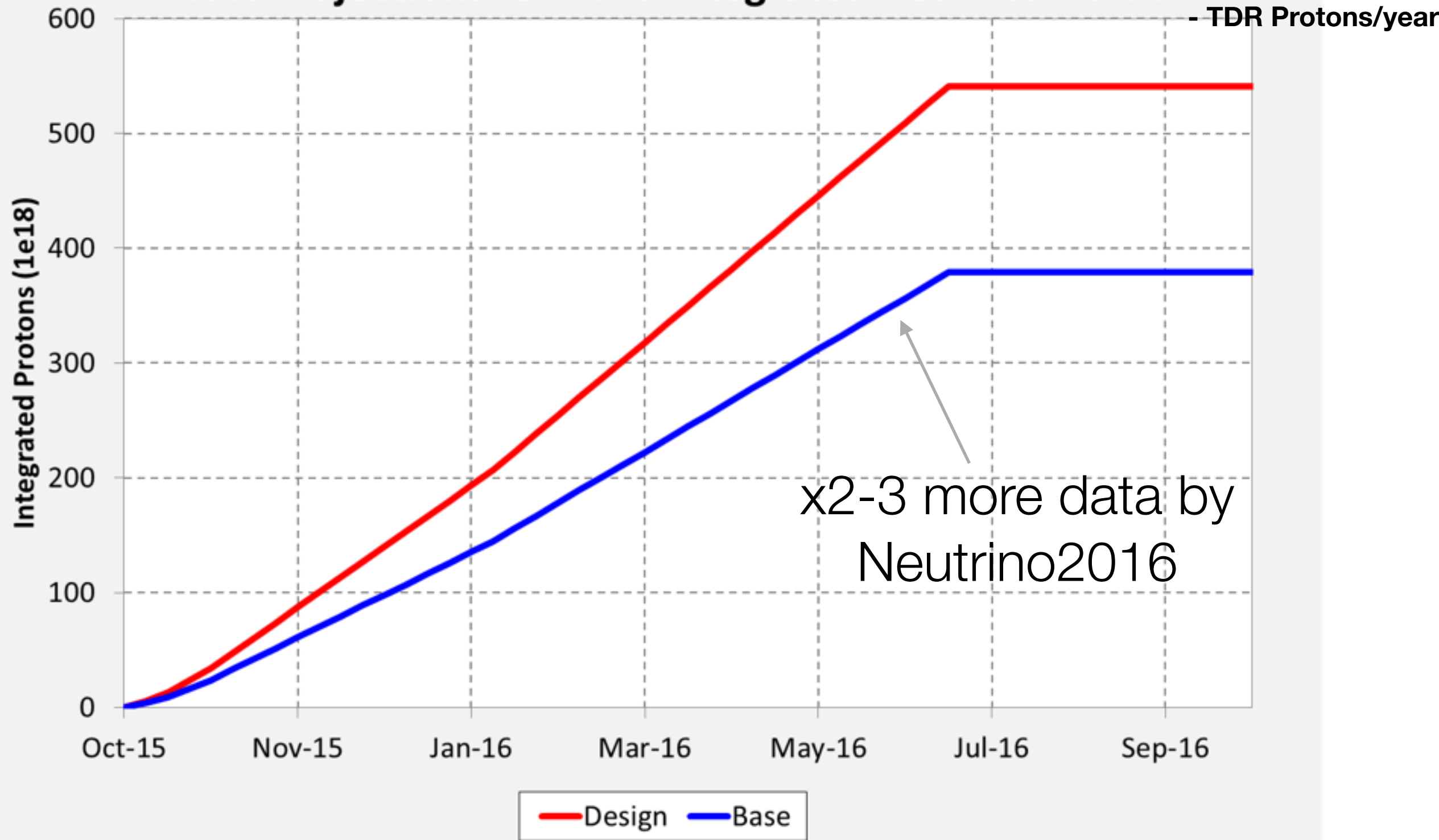


Low intensity tests of
6+6 slip stacking



Working toward future
700 kW operations

Draft Projections for FY16 Integrated Beam to NuMI



Draft projections for next
year

Projected to reach 700 kW by
March of 2016

	SIGNAL	Beam Background	Cosmic Background
$\nu_{\mu} \rightarrow \nu_e$: LID	4.6	1.0	0.4
$\nu_{\mu} \rightarrow \nu_e$: LEM	5.0	1.2	0.4
$\nu_{\mu} \rightarrow \nu_{\mu}$	34.2 (200 no oscillations)	1.9	0.4

First analysis counts: 2.74E20
POT equivalent (46% TDR-year)

- $\nu_{\mu} \rightarrow \nu_e$ numbers assume no matter or CP effect and maximal 23 mixing
- To be released this Thursday!

What might this mean? Combine with reactor theta13 constraint

