

Accelerator Performance

R. Dixon



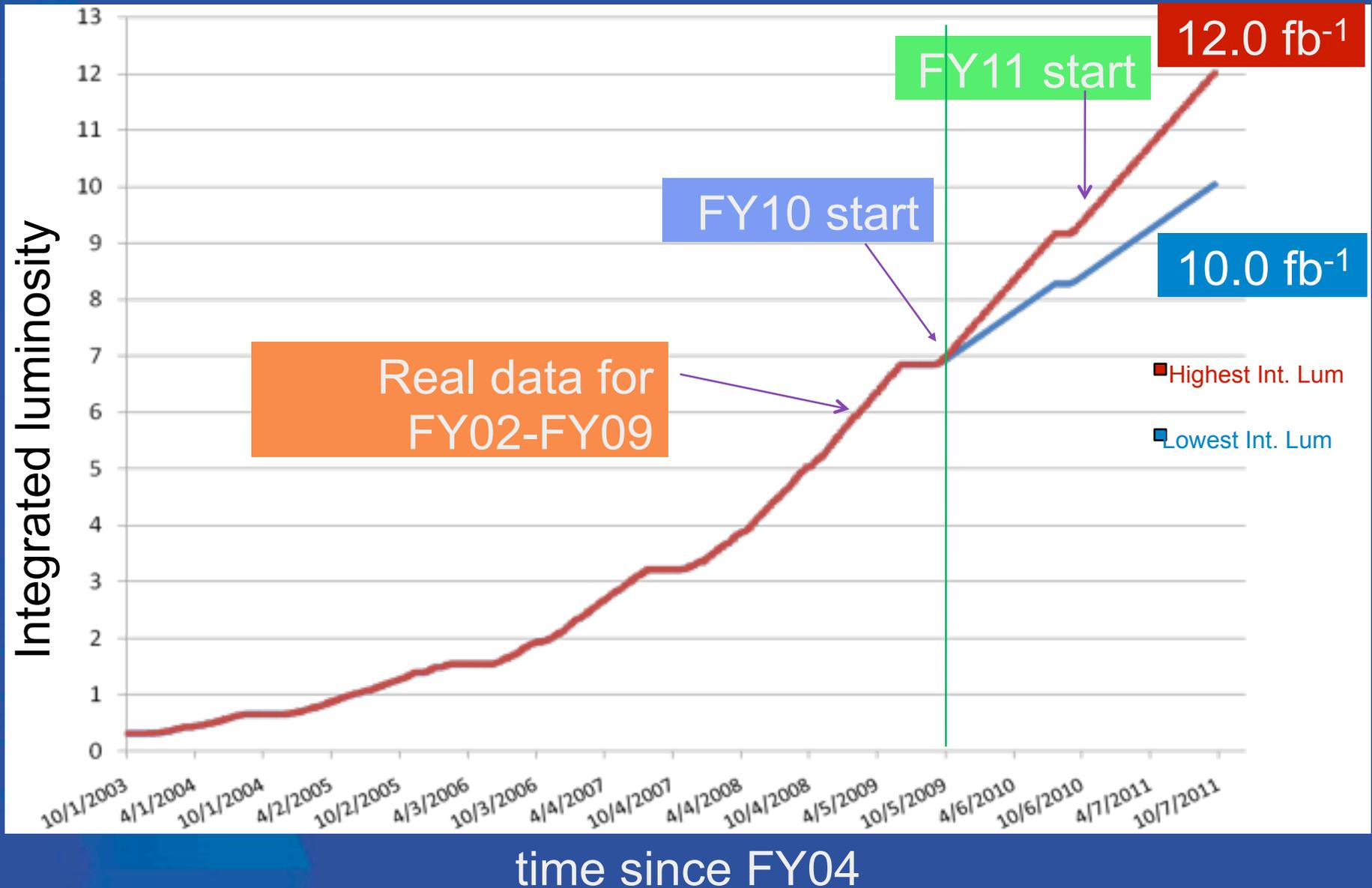
Overview

- Collider
 - Goals, Performance, and Projections
- Neutrino
 - Performance, Goals, and Projections
 - Target issues
- Other Fixed-Target
 - Test Beam
 - SeaQuest
- Tevatron Studies

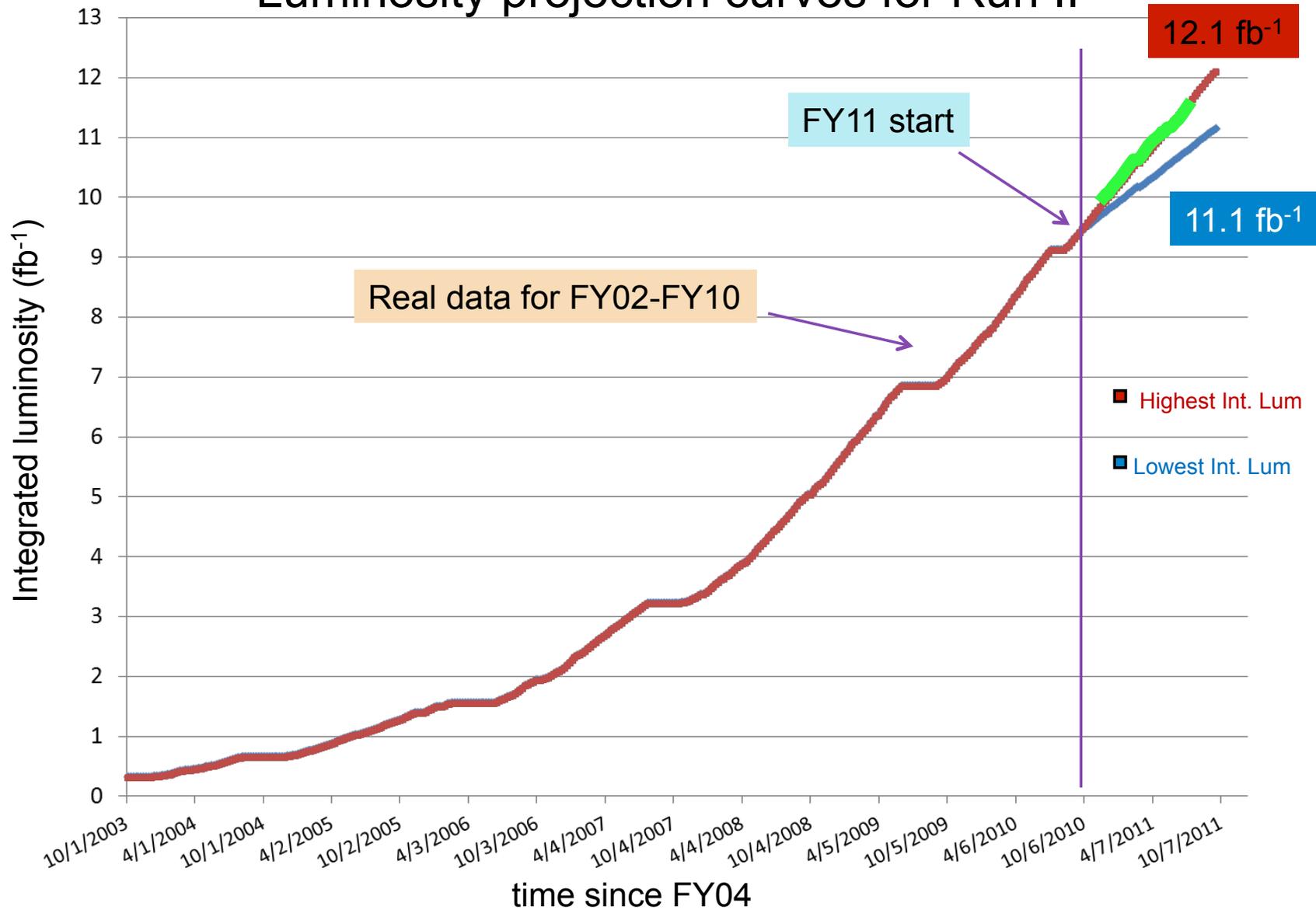
2011 Goals

- Collider
 - 52 weeks scheduled
 - Design curve = 2700 pb-1
 - Subtract: 2 weeks for unscheduled downtime
 - Subtract : 6 weeks for possible end of run accelerator studies
 - Subtract: 15% to get to 90% confidence level
 - ⇒ Performance Metric: 2000 pb-1
- NuMI
 - 50 weeks scheduled
 - Design curve = 3.4E20
 - Base curve = 2.4E20
 - Take 2B+D weighted average to get 90% confidence
 - ⇒ Performance Metric: 2.7E20

Luminosity Projection Curves for Run II



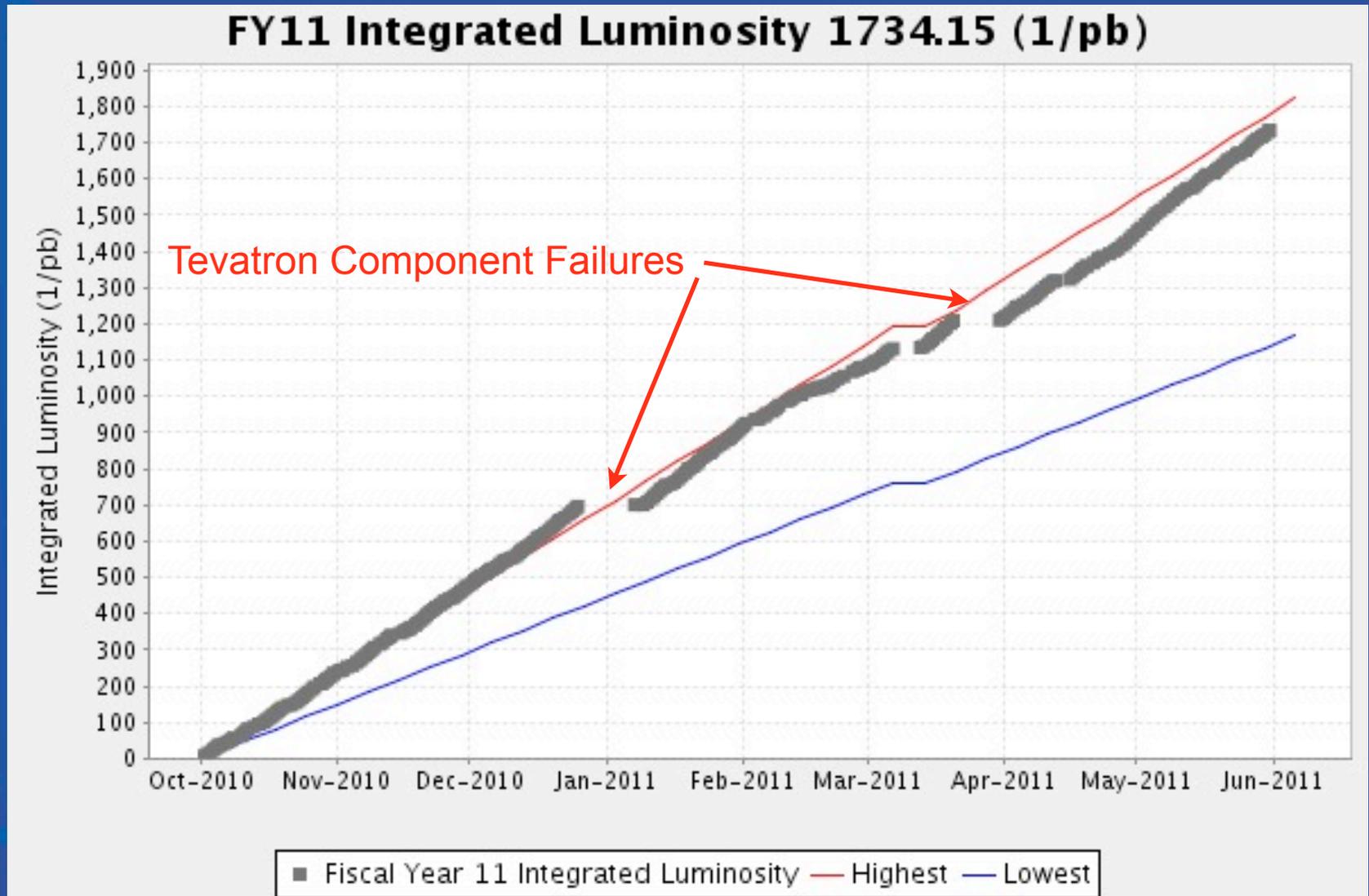
Luminosity projection curves for Run II



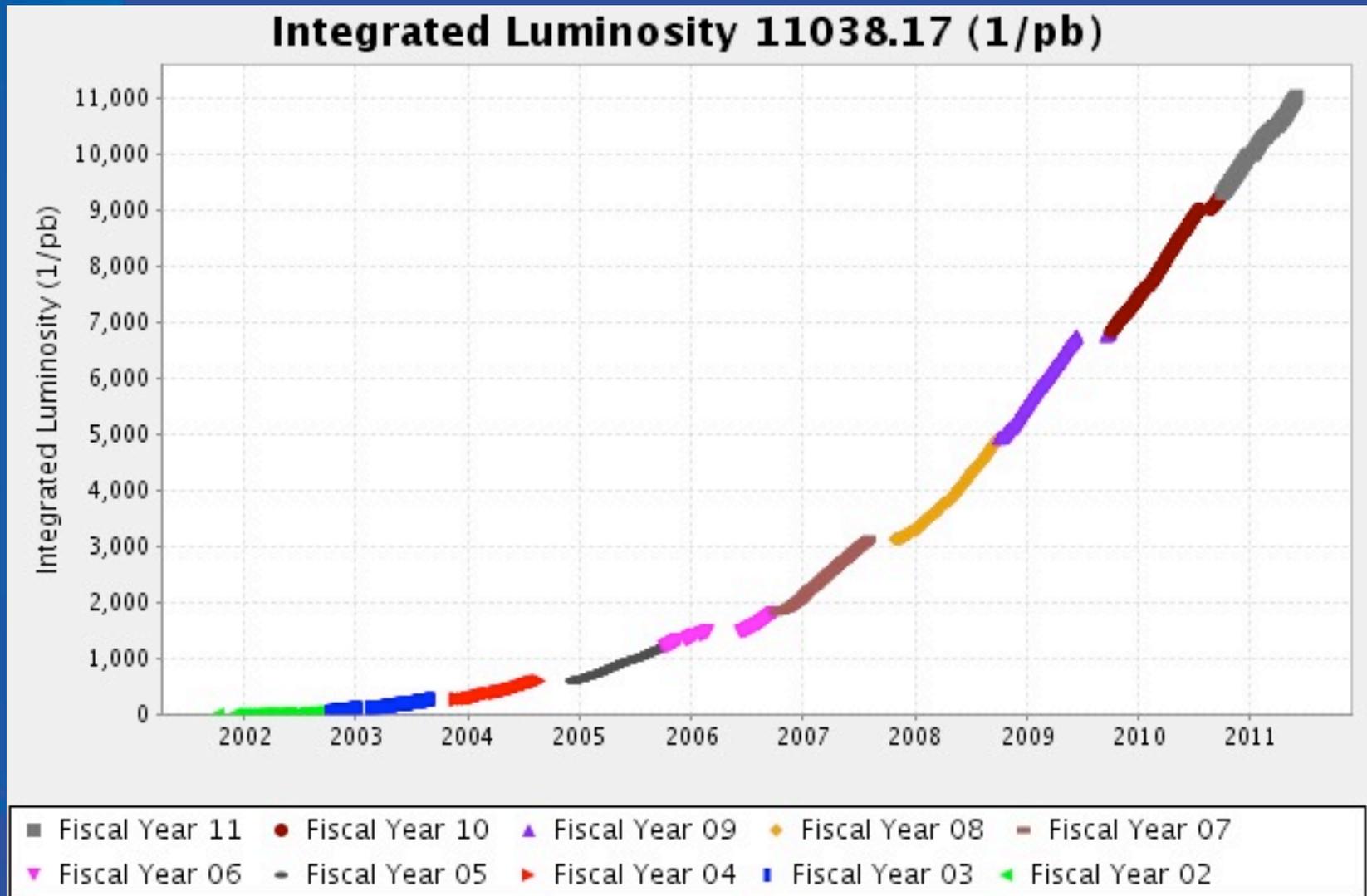
Projection Inputs

- The model predicts weekly integrated luminosity on the basis of 16 input parameters
- The inputs were selected in most cases by looking at the current performance of the machine
- The FY11 weekly projections were increased to 34 pb⁻¹ for “minimum” and 53 pb⁻¹ for “maximum”
- The “maximum” and “minimum” luminosity projections assume, as always, 100 and 120 HEP hours per week, respectively

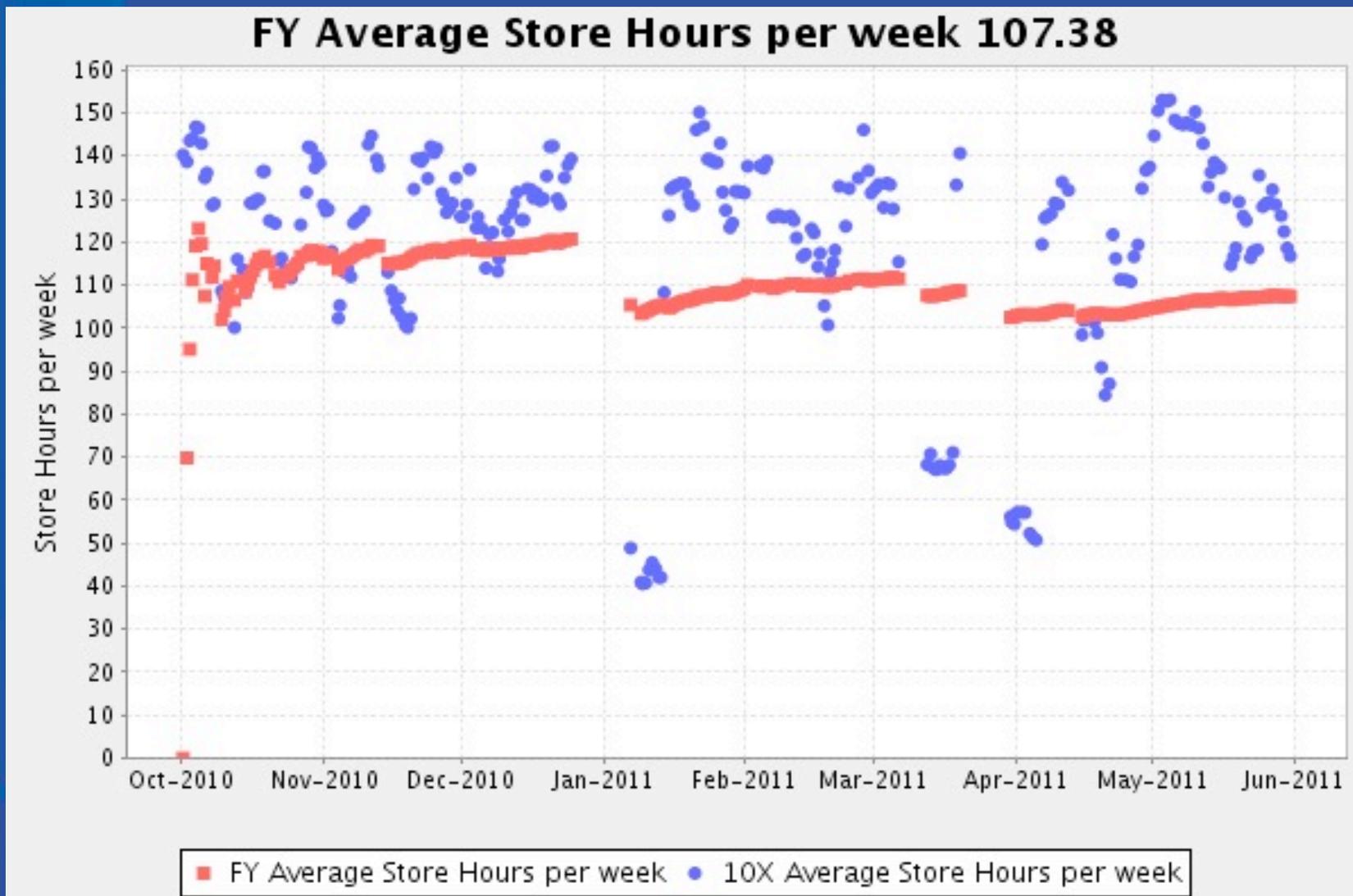
Luminosity Detail



Total Integrated Luminosity

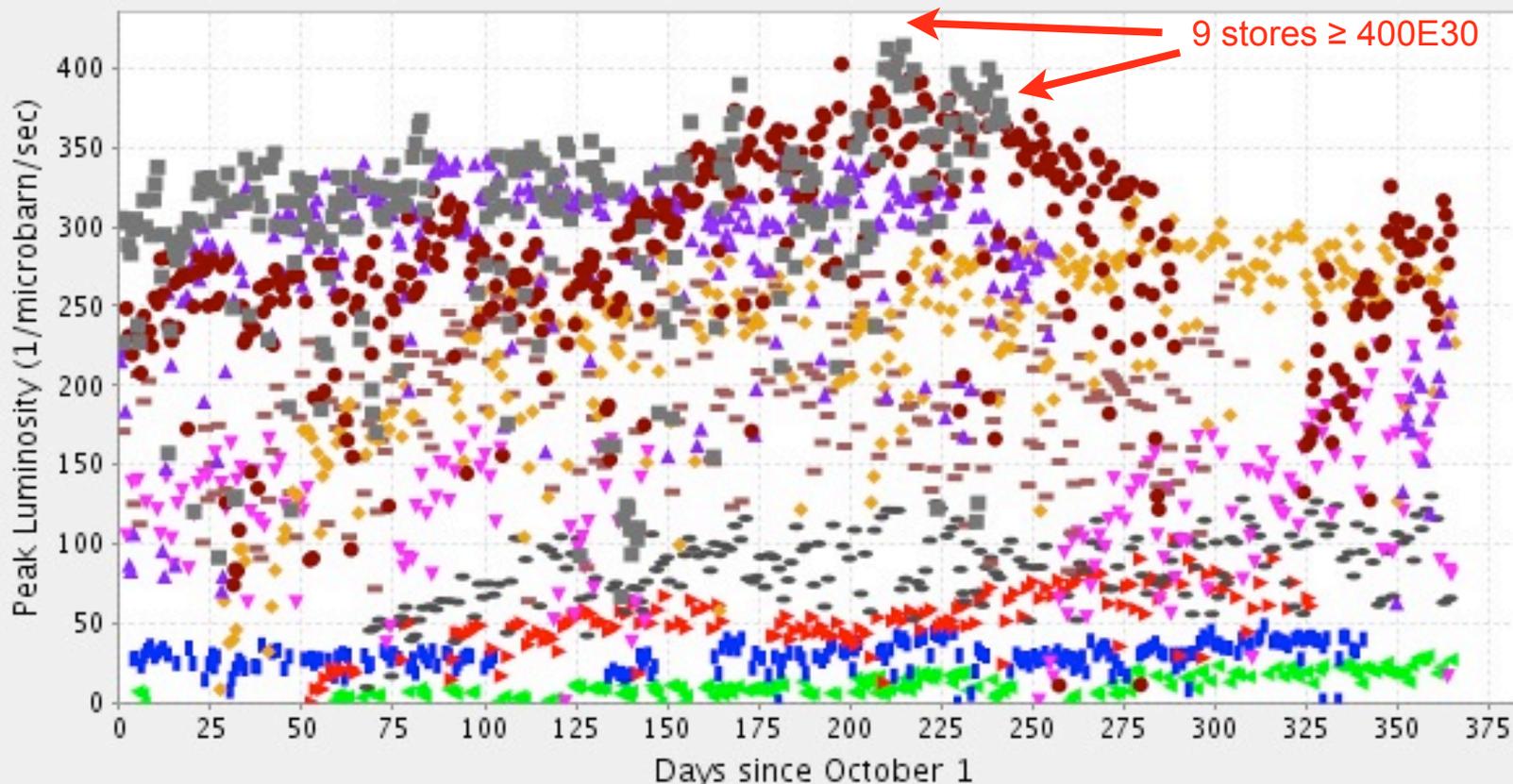


Store Hours

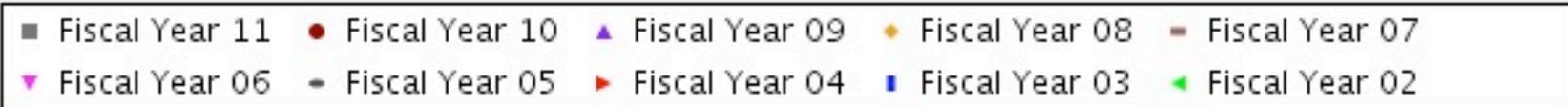


Initial Luminosity Optimization

Peak Luminosity (1/microbarn/sec) Max: 414.0 Most Recent: 366.1

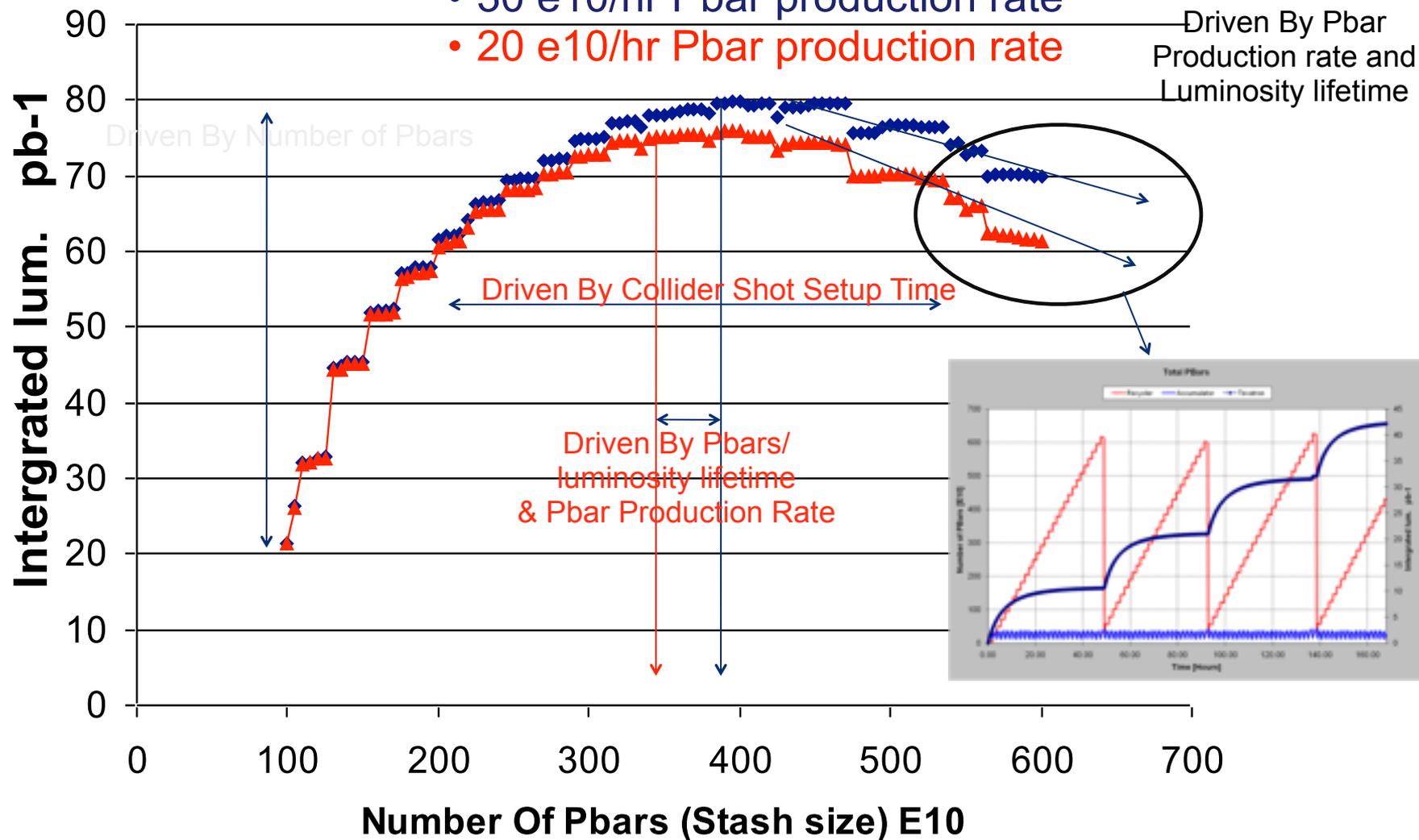


9 stores $\geq 400E30$



Optimizing the Model

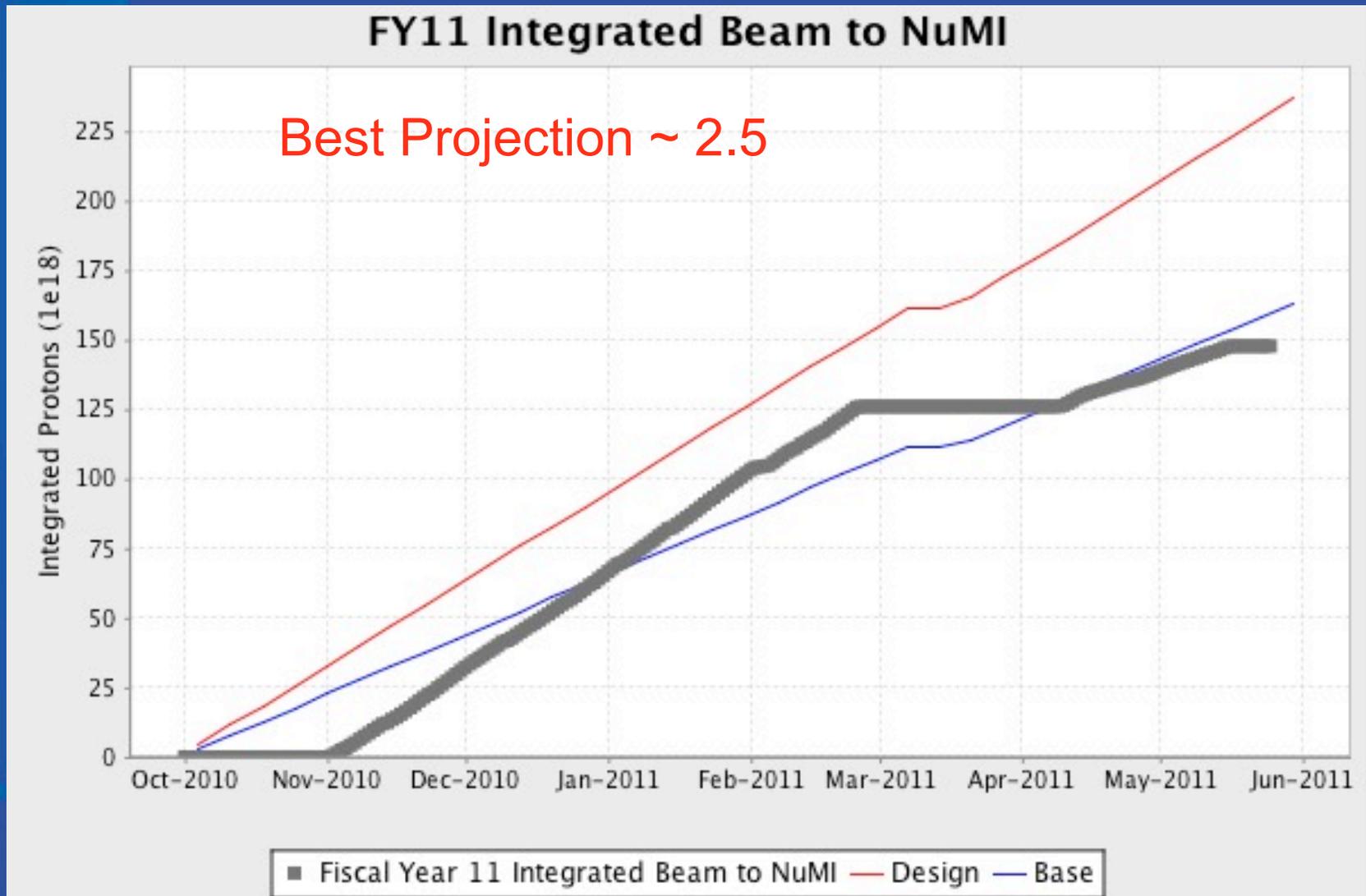
- 30 e10/hr Pbar production rate
- 20 e10/hr Pbar production rate



Accelerator Studies at the Tevatron

- FNAL, CERN, BNL scientists pursuing topics of general interest and relevant for LHC machine upgrades (*collimation + beam-beam*)
 - Scheduling dedicated study periods, also being opportunistic when possible
- Recently conducted crystal collimator studies (26 hrs over 2 weeks)
 - Test new crystal designs and instrumentation at end of colliding beam stores
 - Visitors from CERN and INFN (part of T-980 Collaboration)
- Hollow electron beam collimation
 - Completed 13 hrs of planned dedicated studies (~50% of proposed plan)
- Planning beam-beam studies during 2 week block at end of August
 - Mainly 3×3 colliding beam stores + AC dipole studies: ~35 hrs total time
 - Expect visitors from CERN and BNL
- Other shorter studies to be completed during June-August

NuMI Beam Performance



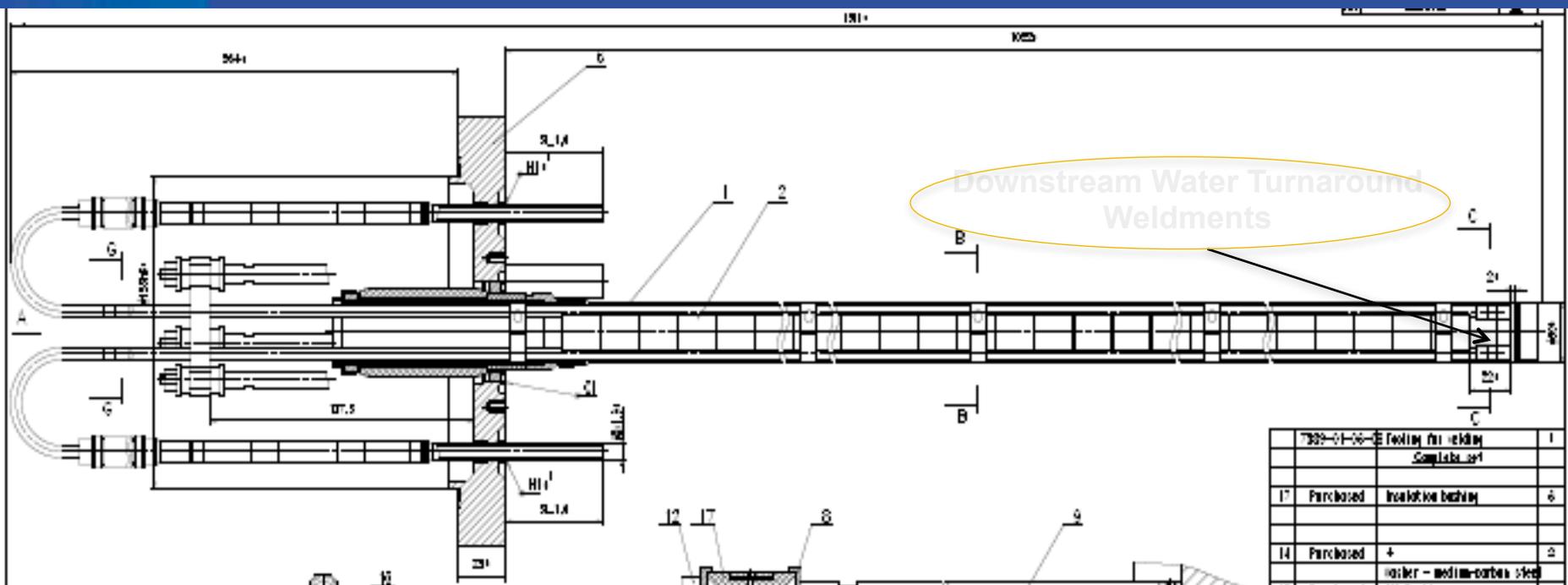
NuMI Target History

target	1st POT	last POT	weeks operation	Integrated POT	max beam power	max POT/spill	reason taken out of service
NT01	5/1/05	8/13/06	67	1.60E+20	270 kw	3.00E+13	drive stuck in high energy position
NT02	9/11/06	6/12/09	144	6.10E+20	340 kw	4.00E+13	graphite deteriorating, 10%-15% fewer nu/POT at peak
NT03	9/11/09	7/12/10	44	3.10E+20	375 kw	4.40E+13	break at ceramic tube-holder (probably water leak -> explosion)
NT04	8/22/10	9/17/10	4	2.00E+19	375 kw	4.30E+13	water leak -> explosion (blew off beryllium window)
NT05	10/29/10	2/24/11	17	1.30E+20	337 kw	4.00E+13	water leak -> eventual external water leak (water turnaround fell off)
NT06	4/7/11	5/16/11	6	2.00E+19	305 kw	3.50E+13	water leak -> eventual external water leak

Summary of Target Issues

- 2 Failures of the water turnaround
 - Turn around redesigned at FNAL
 - Changing to from stainless to titanium cooling line
- 1 Water leak at the upstream end of target
 - Adding bellows
- RAL design analysis
- Two redesigned targets due this summer
- Developing technology for titanium water cooling lines

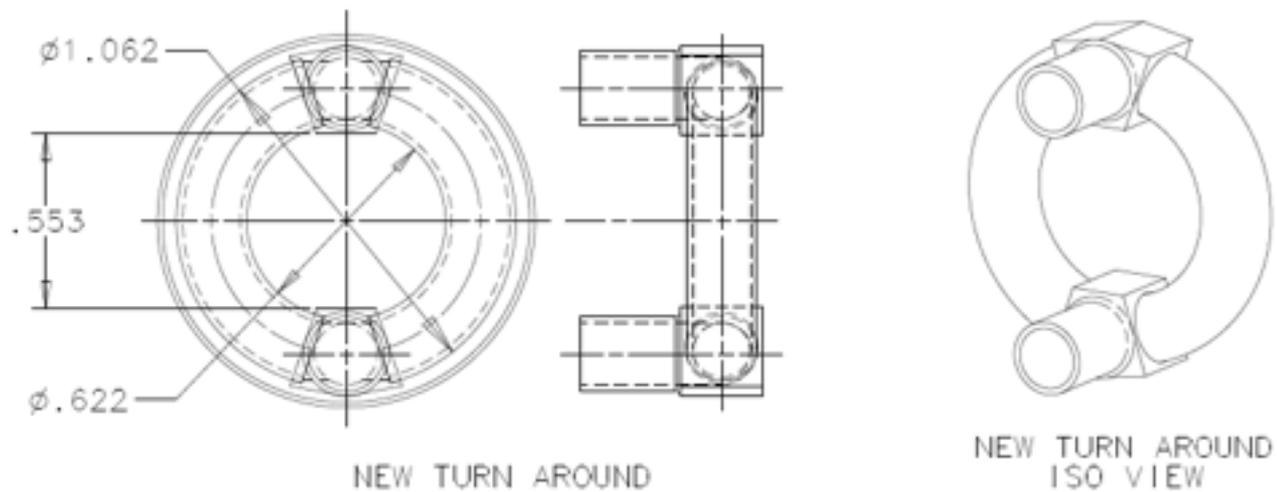
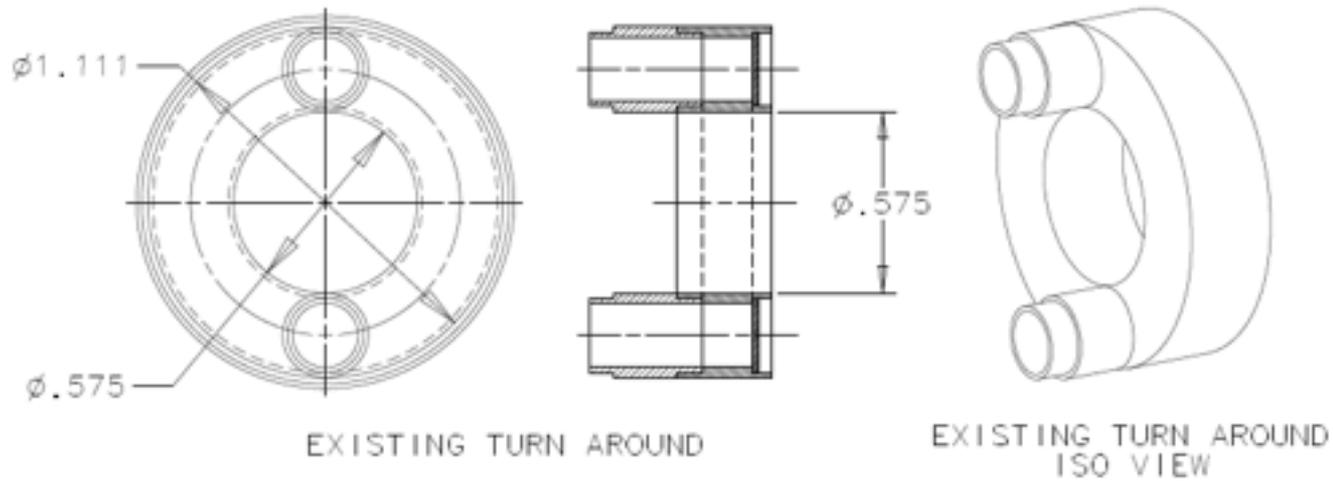
NuMI Target Layout



NuMI Target

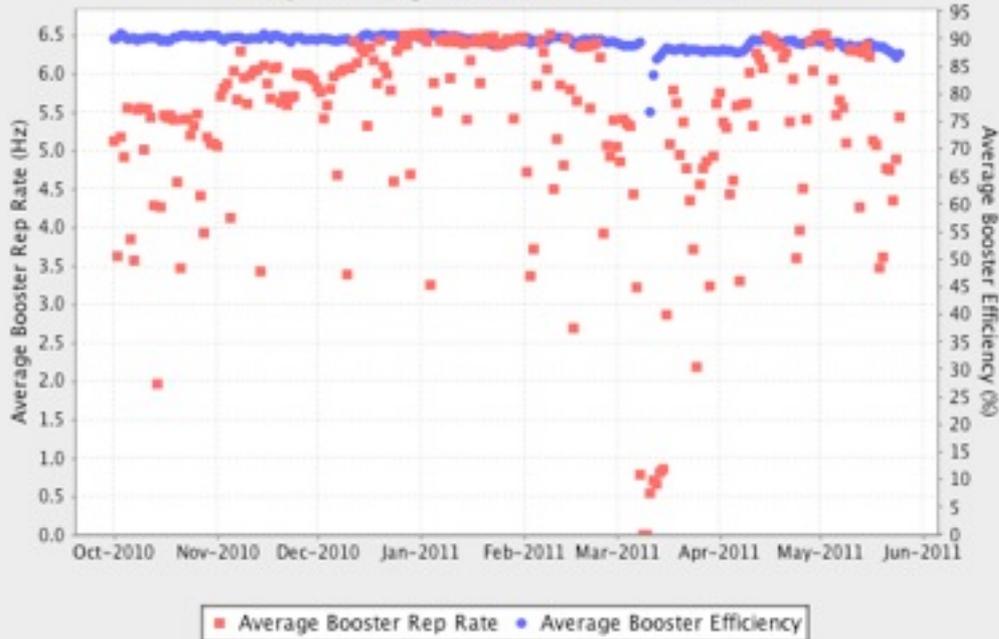


Turnaround Retro fit

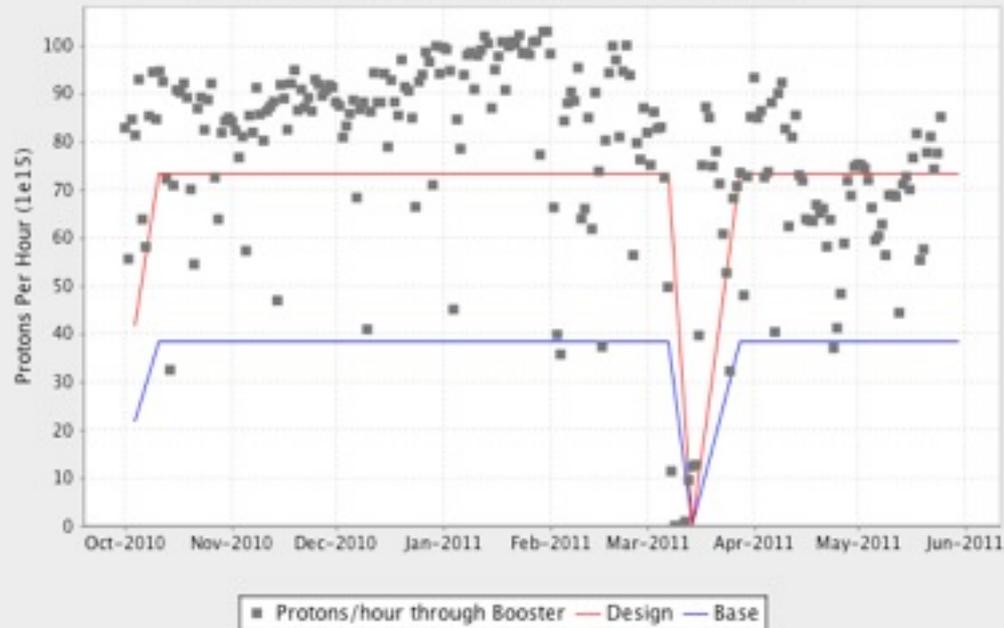


8-GeV Booster Performance

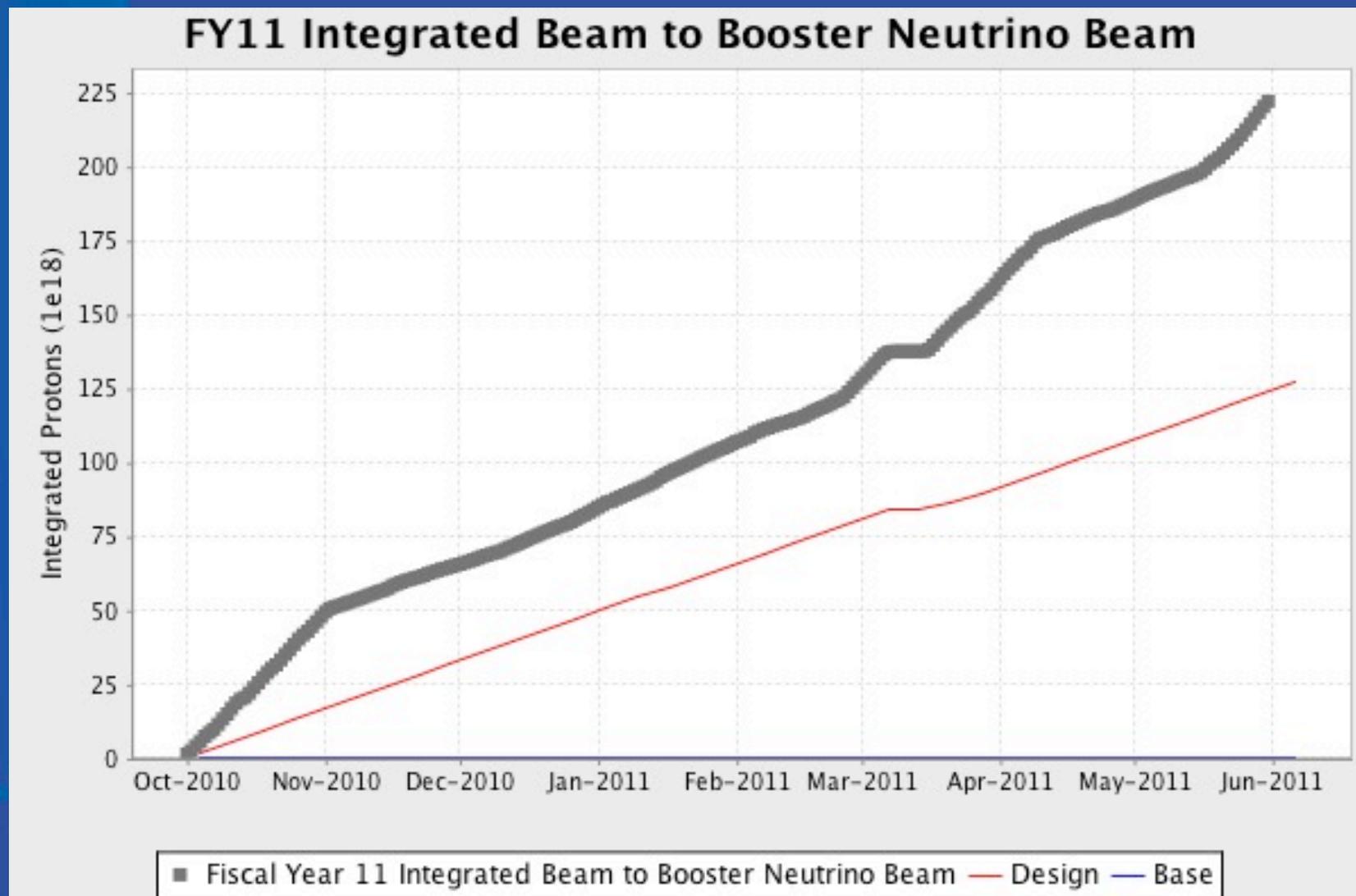
Daily Average Booster Performance



Average Protons/Hour through Booster



8- GeV Neutrino Beam Performance



Proton Improvement Plan Progress

- Replacing Cockroft-Walton with RFQ
 - RFQ will be delivered this summer
- Booster Solid State Upgrade underway
 - 4 out of 19 stations installed with two more installations scheduled for next month
 - Purchasing and assembling remaining stations
- Plans for Booster RF Upgrade
 - Refurbishing Booster Cavities
- Utility upgrades for higher rep rate
- Investigating Linac Modulator upgrades

Test Beam and SeaQuest

- Test beam runs $\leq 50\%$ of time as needed
 - 5% impact on stacking
 - Adding second test beam in the meson area
- SeaQuest beam issues
 - Radiation Shielding– resolved
 - Old equipment and infrastructure– resolved
 - Leak in buried vacuum pipe– in process
 - Pipe is ~ 700 feet long and diameter varies around 30 inches
 - Investigating by trying to run a camera through the pipe
 - Plan will be to insert a smaller diameter Pipe inside the existing pipe

Summary

- Collider running
 - Will meet performance goals on luminosity
 - End of Tevatron Studies in process
- Neutrino beams
 - Three target failures this year
 - Installing NT01
 - Waiting for two new targets to be delivered this summer
- Test beam also running as needed
- SeaQuest installation continues