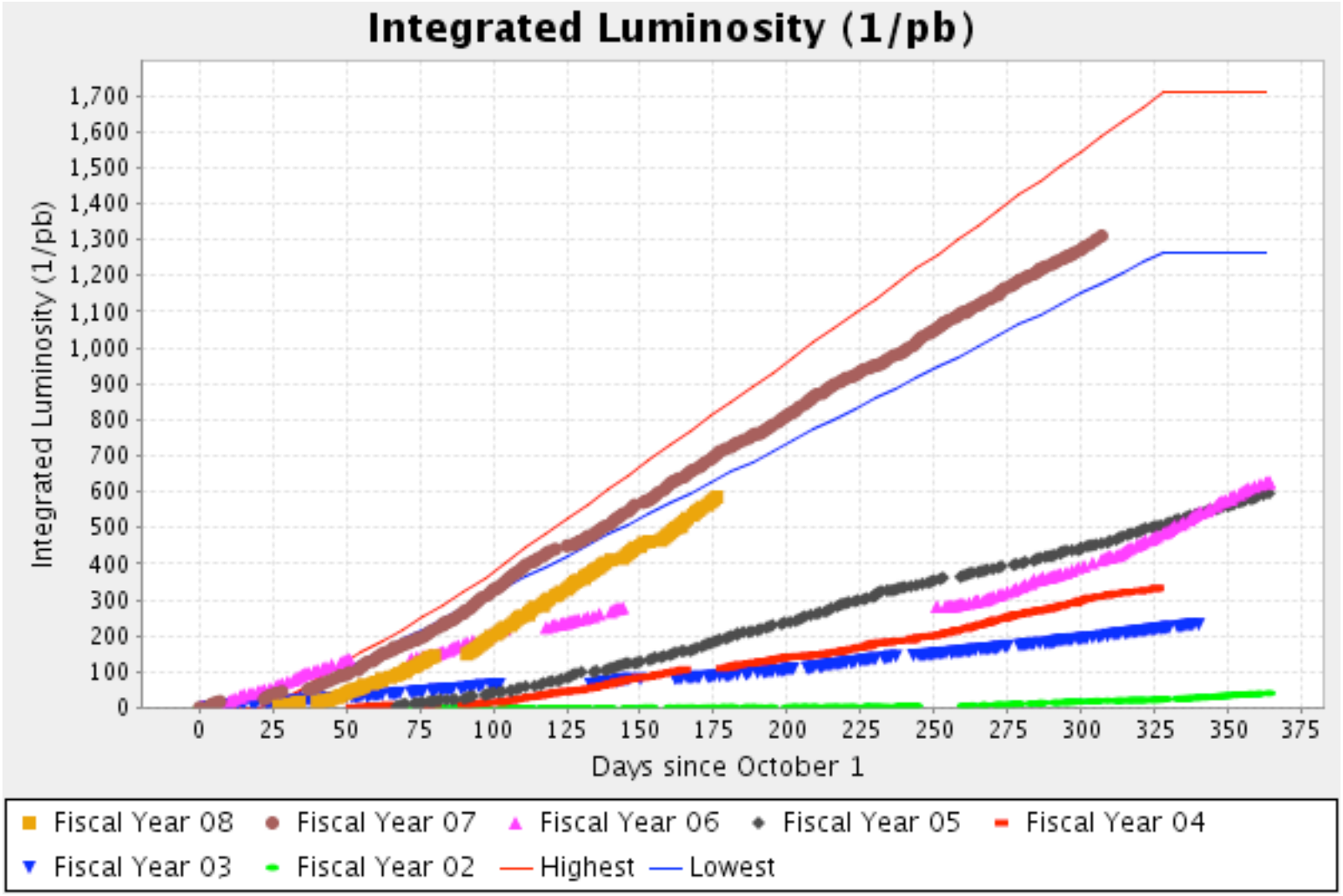
Accelerator Performance and Status

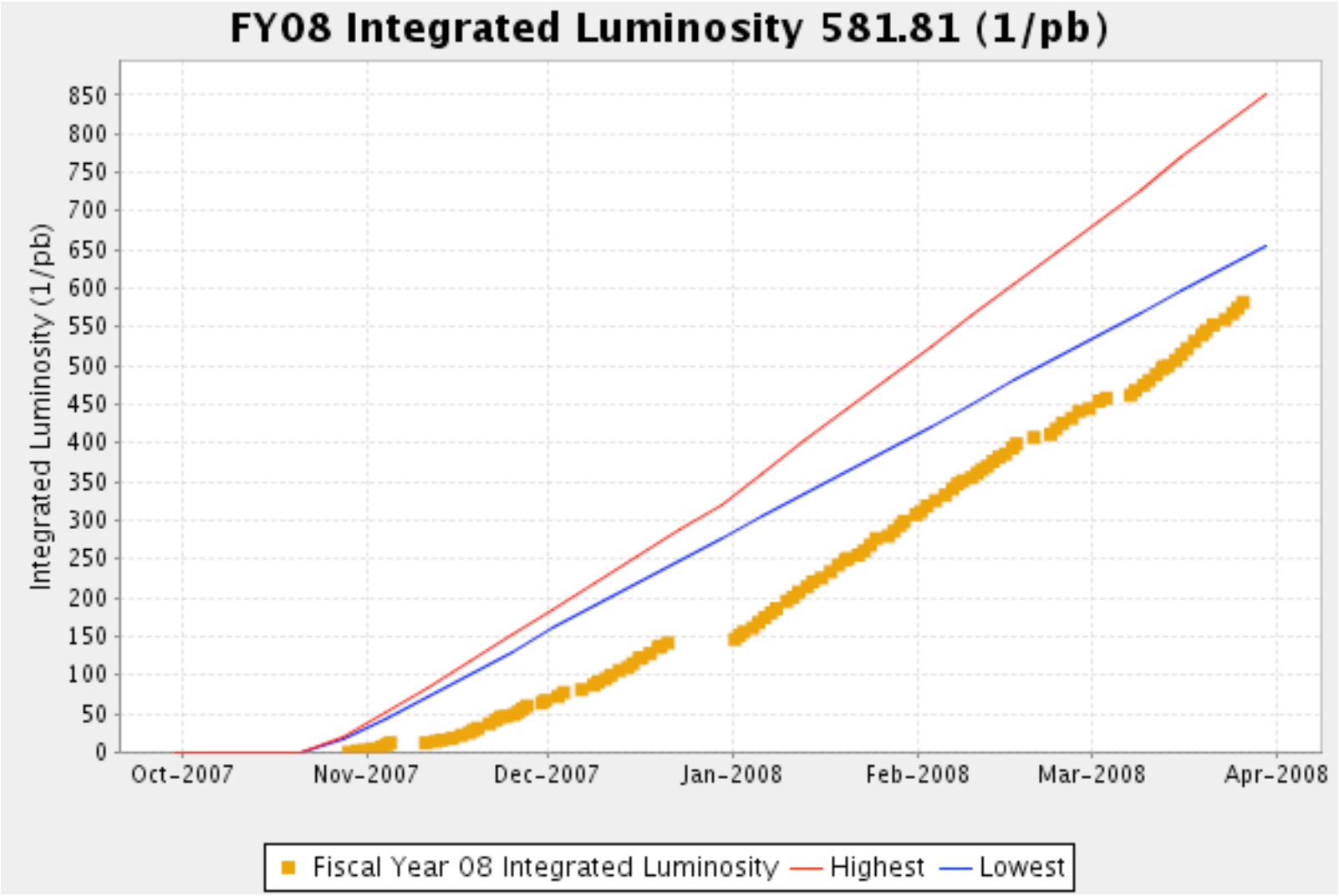
R. Dixon

Overview

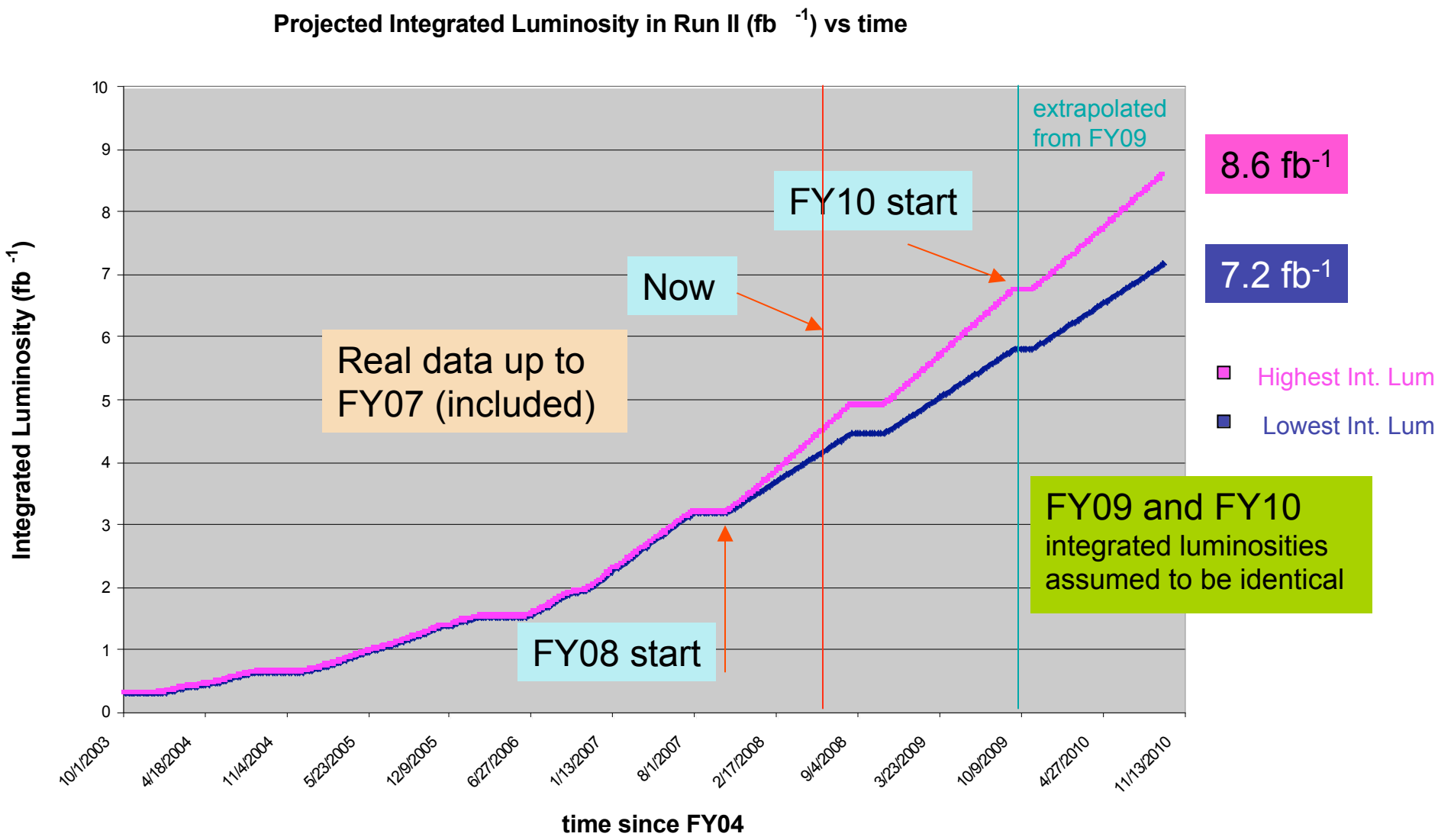
- Run II Performance Summary
  - Machine Performance
  - Luminosity Summaries
  - Performance Projections
  - Comparison to Luminosity data
- Neutrino Performance
  - Slip Stacking
  - Horn Reliability Issues
  - Performance
- Strategy

Luminosity Summary




FY08 Integrated Luminosity 581.81 (1/pb)
Integrated Luminosity (1/pb)
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
Oct-2007
Nov-2007
Dec-2007
Jan-2008
Feb-2008
Mar-2008
Apr-2008
Fiscal Year 08 Integrated Luminosity
Highest
Lowest

Luminosity projection curves for Run II



Inputs for FY08 and FY09 – Sc. IV (optimistic1)

Assuming 21 hour long stores and 6 pbar transfer shots between stores

- Number of protons per bunch 260, 270, 270, 270, 270, 270, 270, 270 x 10^9
- Luminosity Density @ 100 x 10^{10} 90.32, 92.126,…,92.126 μb^{-1} / sec
- Luminosity Density @ 300 x 10^{10} 190.34, 194.147,…,194.147 μb^{-1} / sec
- Init Tevatron Lifetime @ 80 μb^{-1}/sec 7.07, 7.14 hours
- Init Tevatron Lifetime @ 160 μb^{-1}/sec 6.59, 6.65, …,6.65 hours
- HEP store hours/week 110, 120,120, 120, 110, 120, 120, 120 hours
- Acc-Rec Transfer Efficiency @ 0x10^{10} 90, 92,…92%
- Acc-Rec Transfer Efficiency @ 300x10^{10} 90, 91,…91%
- Acc-Rec transfer time 0.19, 0.16, …, 0.16 hours
- Recycler lifetime 500 hours
- Recycler mining efficiency 93.8%
- Peak stacking rate 22, 25, 27,…, 27 x10^{10}/hour
- Half rate stack size 210, 250, …,250x10^{10}
- Maximum stack size 420, 500,…,500x10^{10}
- Timeline Utililization Factor 80, 83, …,83%
- Accumulator leftover factor 10%

With above inputs we should expect ~ 3545 pb^{-1} in 2 years

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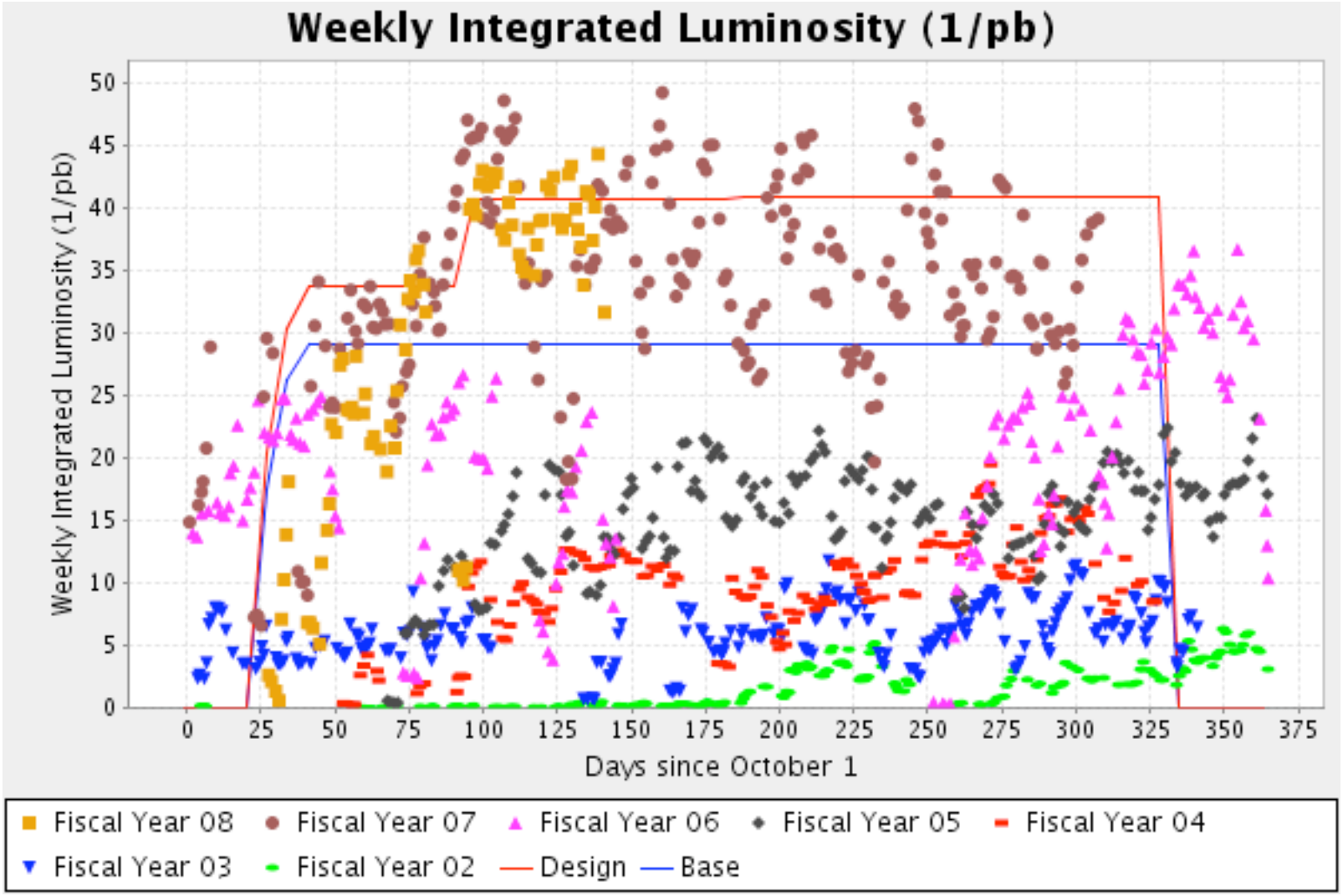
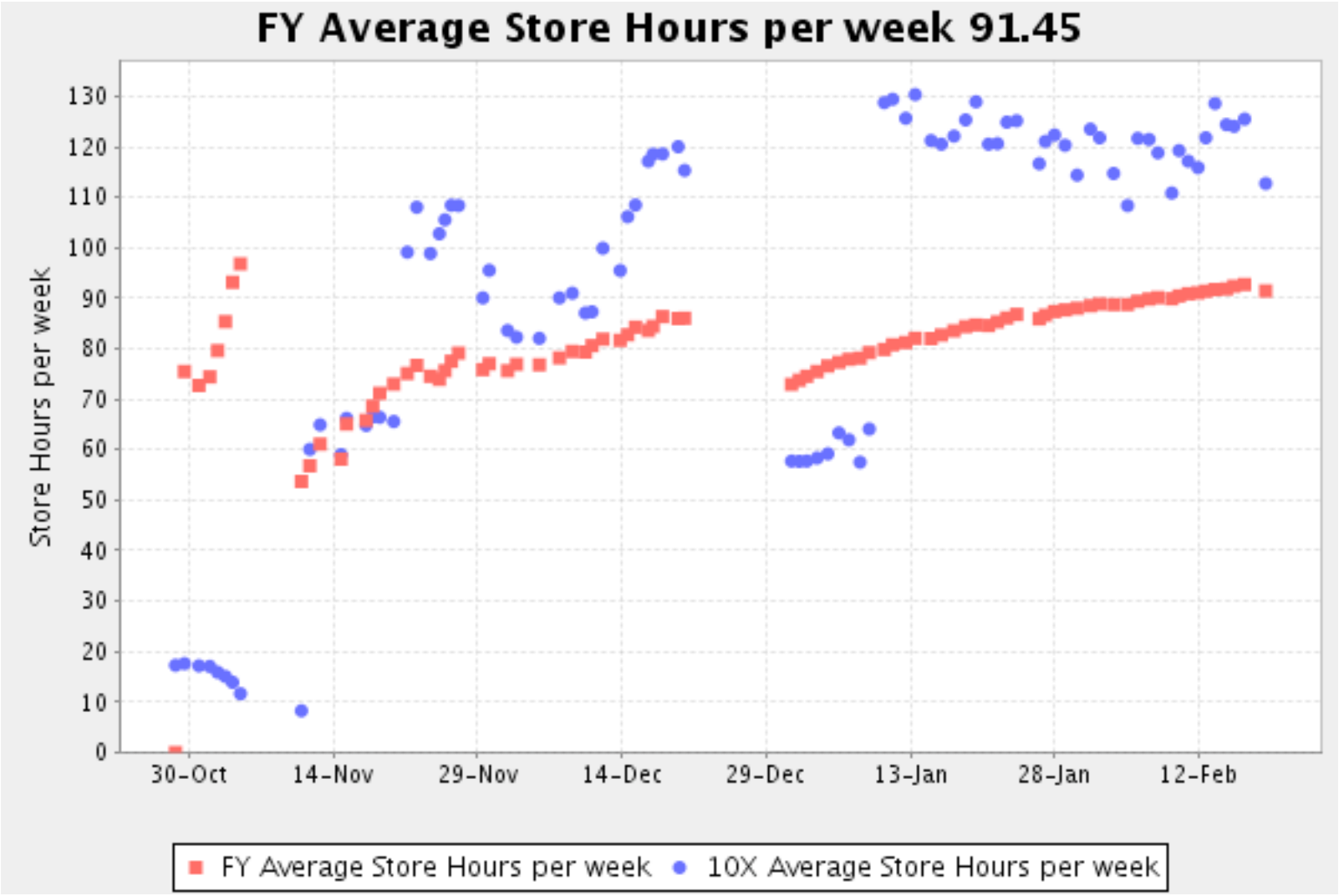
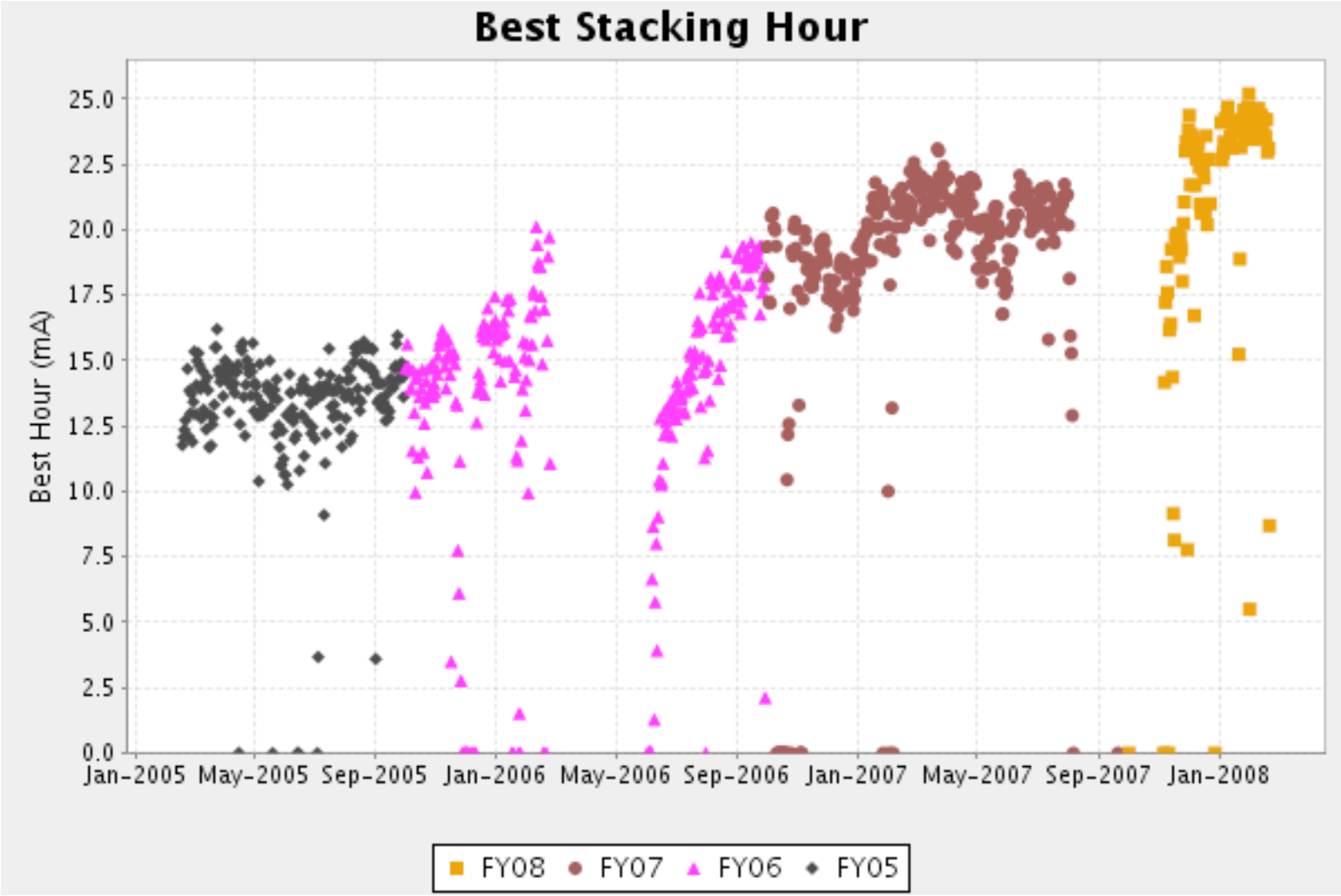
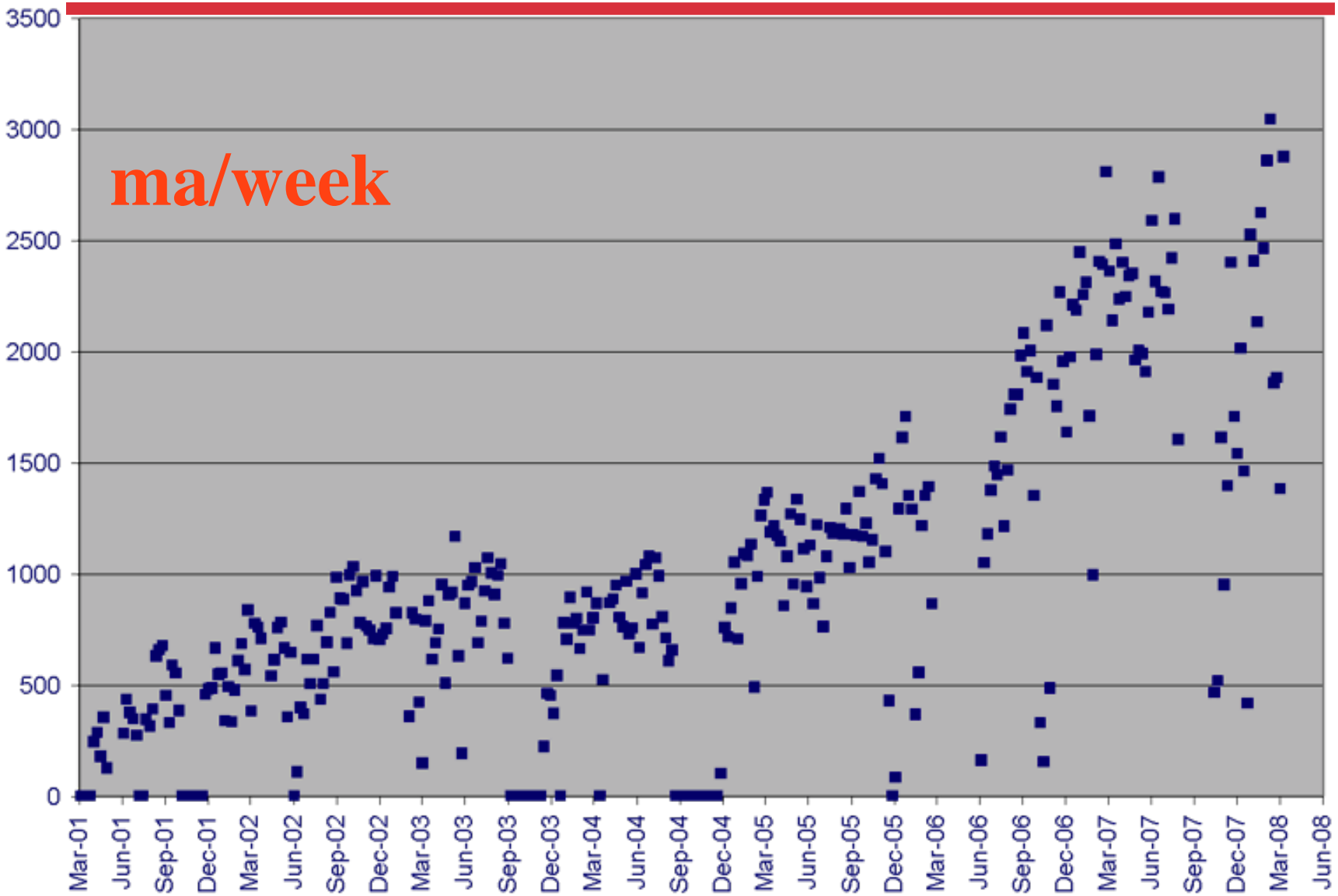
Integrated Luminosity per Week



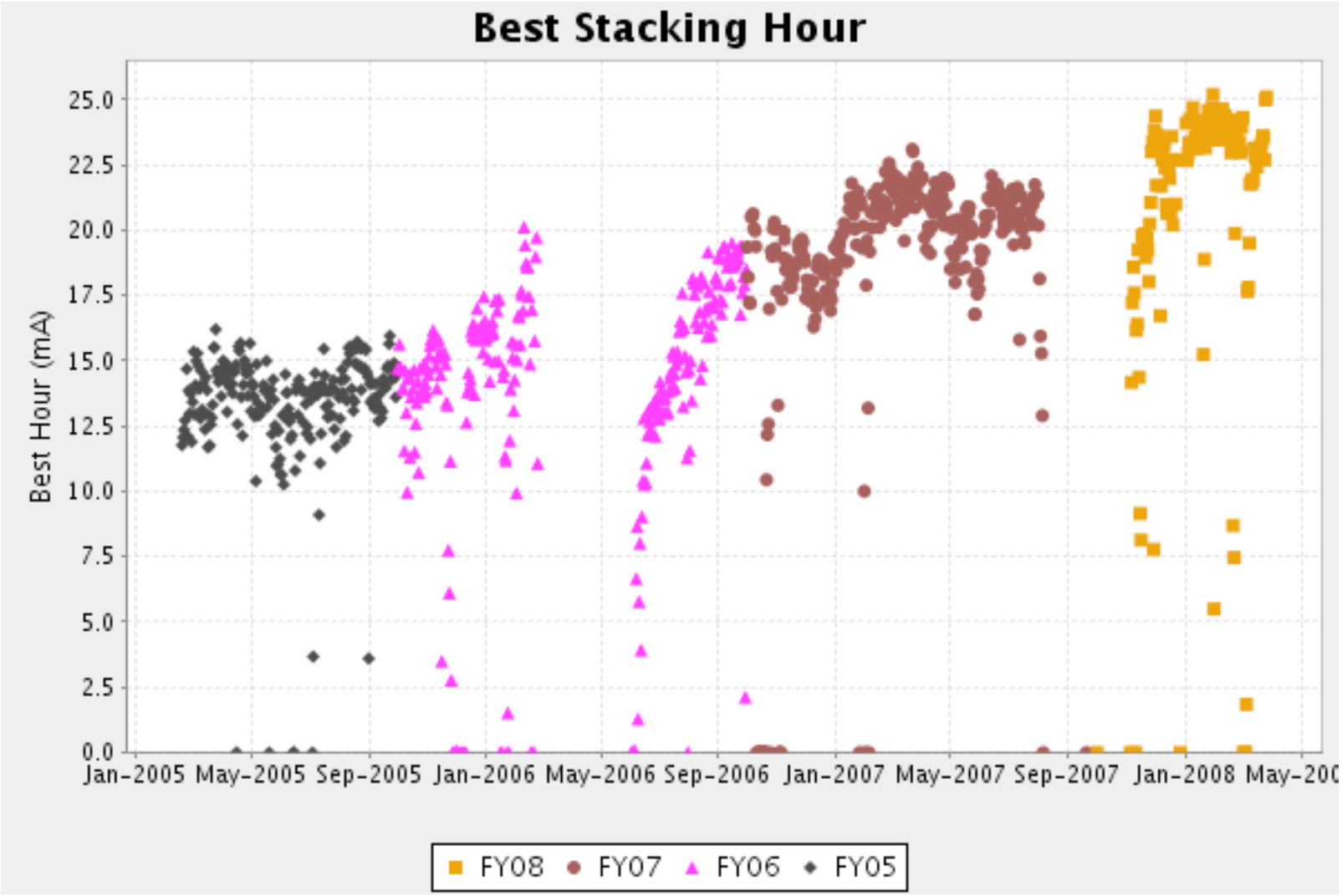

FY Average Store Hours per week 91.45
Store Hours per week
130
120
110
100
90
80
70
60
50
40
30
20
10
0
30-Oct
14-Nov
29-Nov
14-Dec
29-Dec
13-Jan
28-Jan
12-Feb
FY Average Store Hours per week
10X Average Store Hours per week


Best Stacking Hour
Best Hour (mA)
25.0
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
Jan-2005
May-2005
Sep-2005
Jan-2006
May-2006
Sep-2006
Jan-2007
May-2007
Sep-2007
Jan-2008
FY08
FY07
FY06
FY05

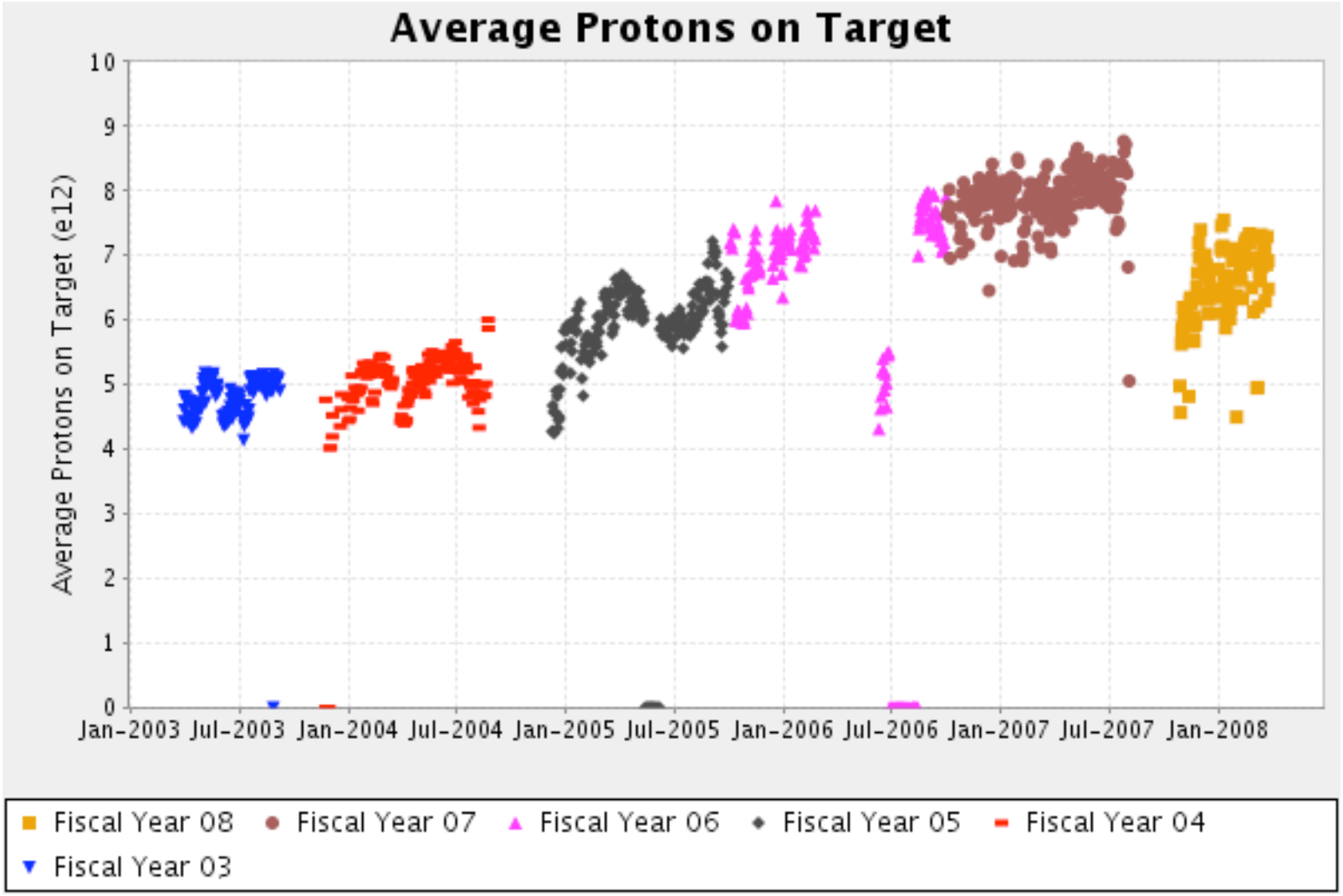
Weekly Stacking Rate



Stacking Rate per Hour



Protons on Target



Recent Records

- **Stacking in last 24 hours**

Most in an hour: 25.11 mA at Tue Mar 25 23:48:13 CDT 2008

Best: 25.19 mA on 30-Jan-08

(Accomplished with Steel Body Lens)

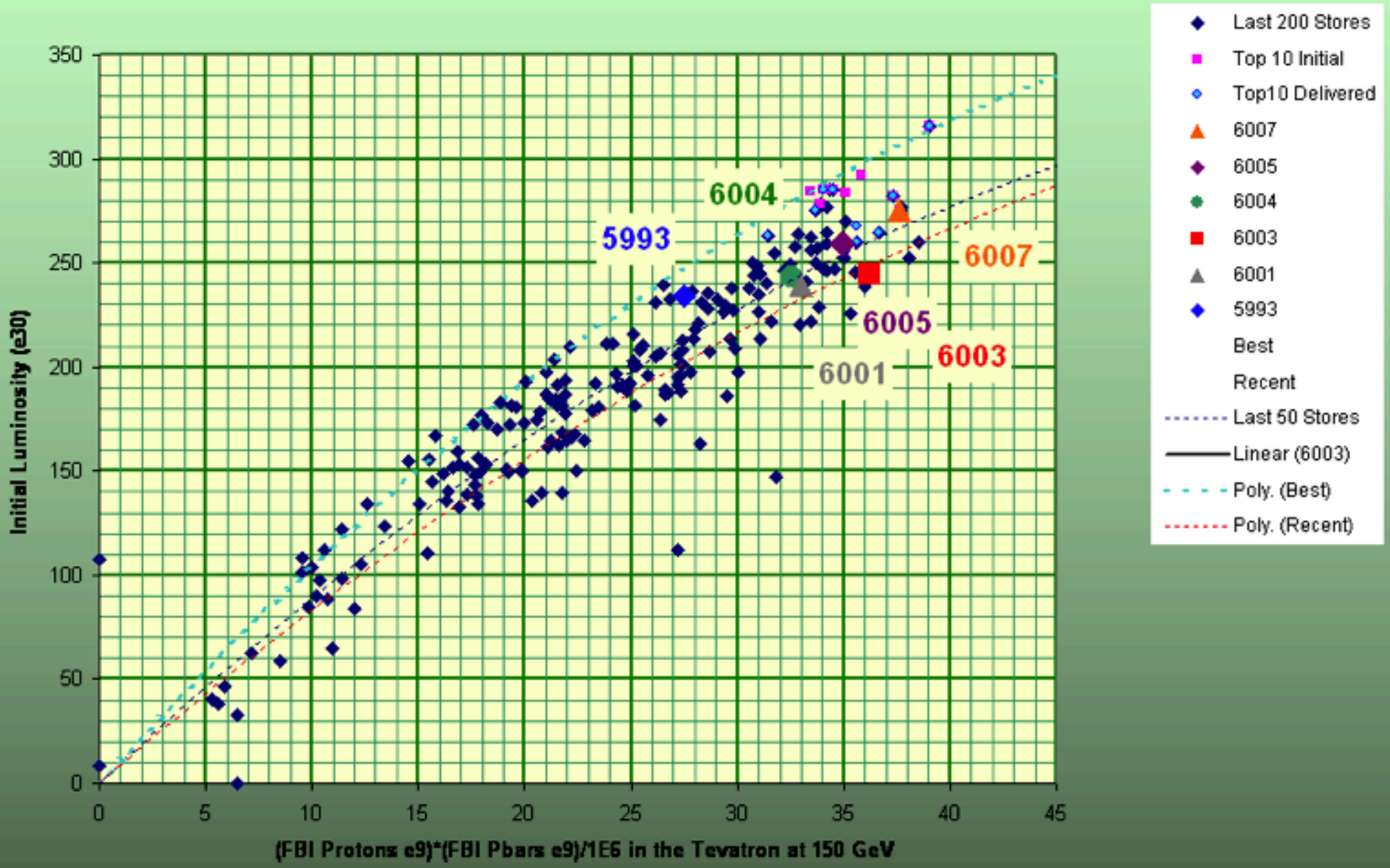
Record Initial Luminosity: 3.15E32

Record Delivered Luminosity for one week: 49.9 pb^{-1}

Continuing Improvements

- Stacking Rate
  - Equalizer to mitigate core heating
  - Debuncher Equalizer
  - Debuncher Notch filter
- Improve transfer efficiencies and times
- Ongoing effort of improving reliability of all machines.
- Orbit stabilization in theTevatron
- Antiproton brightness due to improvements in the Recycler

Average Initial Luminosity vs Protons*Pbars at 150GeV



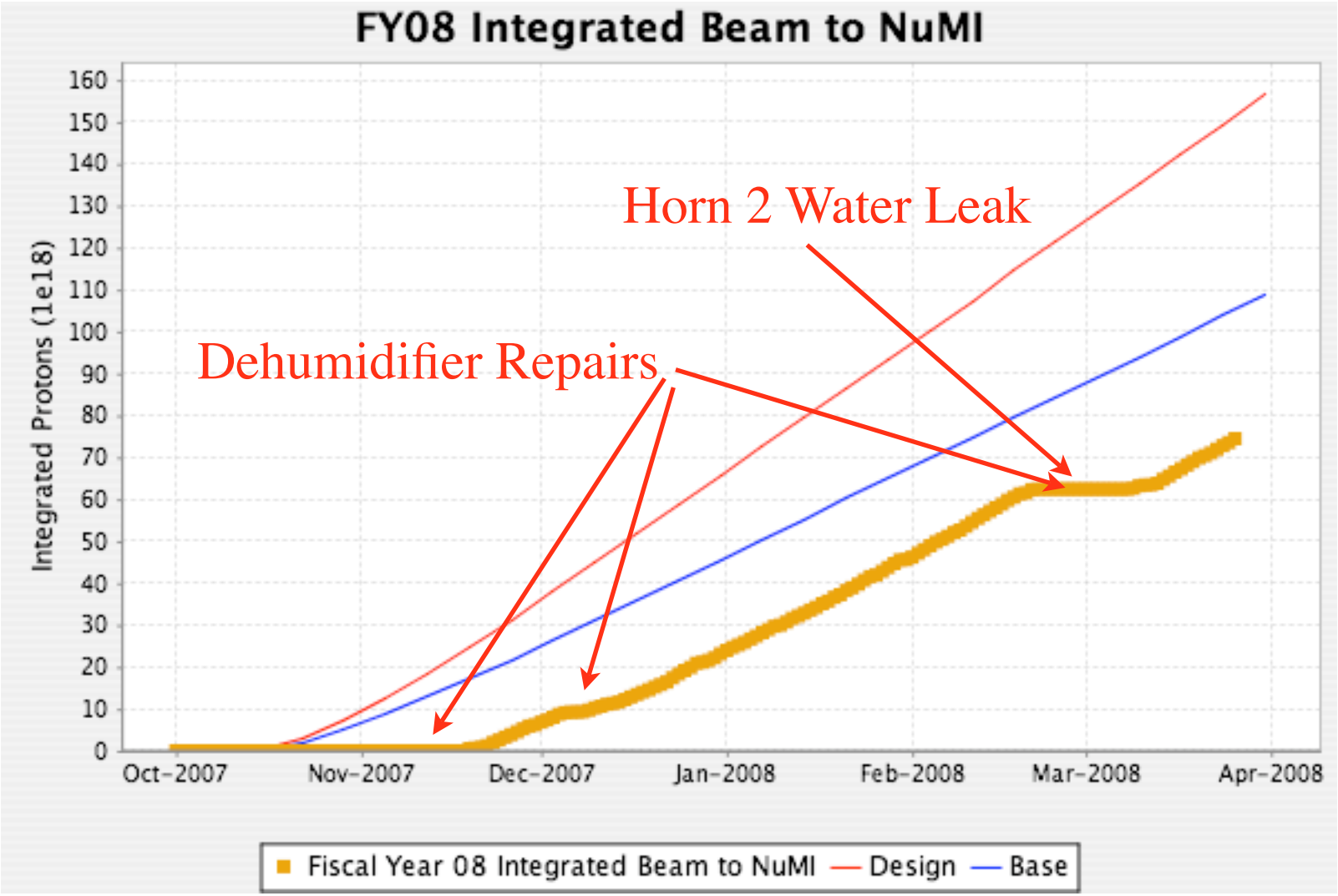
Store Terminations

Year	Stores	Normal Terminations	%Normal Terminations
2003	186	55	30%
2004	166	110	66%
2005	243	170	69%
2006	171	107	63%
2007/8	247	197	80%

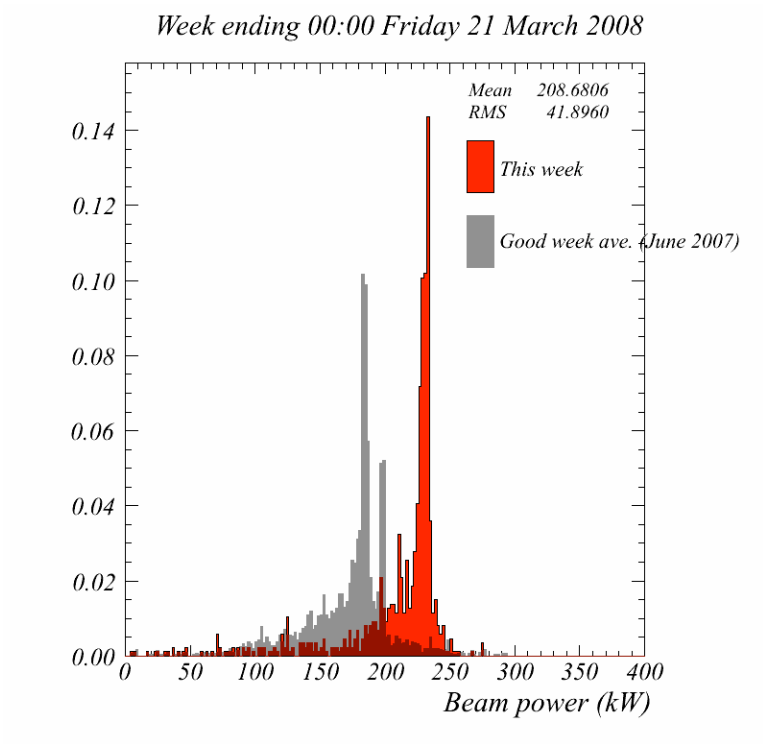
Run II Strategy

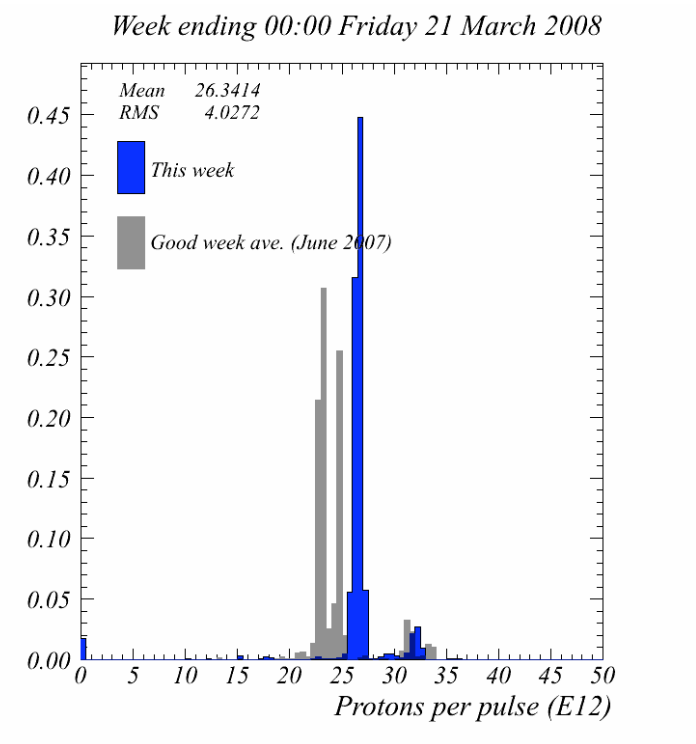
- Continue to make small improvements with short payback times
- Strive to increase reliability
- Maximize delivered luminosity
- Integrate Luminosity
  - Integrate Luminosity
    - Integrate Luminosity
      - Integrate Luminosity
        - Integrate Luminosity
      - Integrate Luminosity
    - Integrate Luminosity
  - Integrate Luminosity
- Integrate Luminosity

NuMI


FY08 Integrated Beam to NuMI
Integrated Protons (1e18)
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
Oct-2007
Nov-2007
Dec-2007
Jan-2008
Feb-2008
Mar-2008
Apr-2008
Horn 2 Water Leak
Dehumidifier Repairs
Fiscal Year 08 Integrated Beam to NuMI
Design
Base

Weekly Beam Parameters





<209 kW>

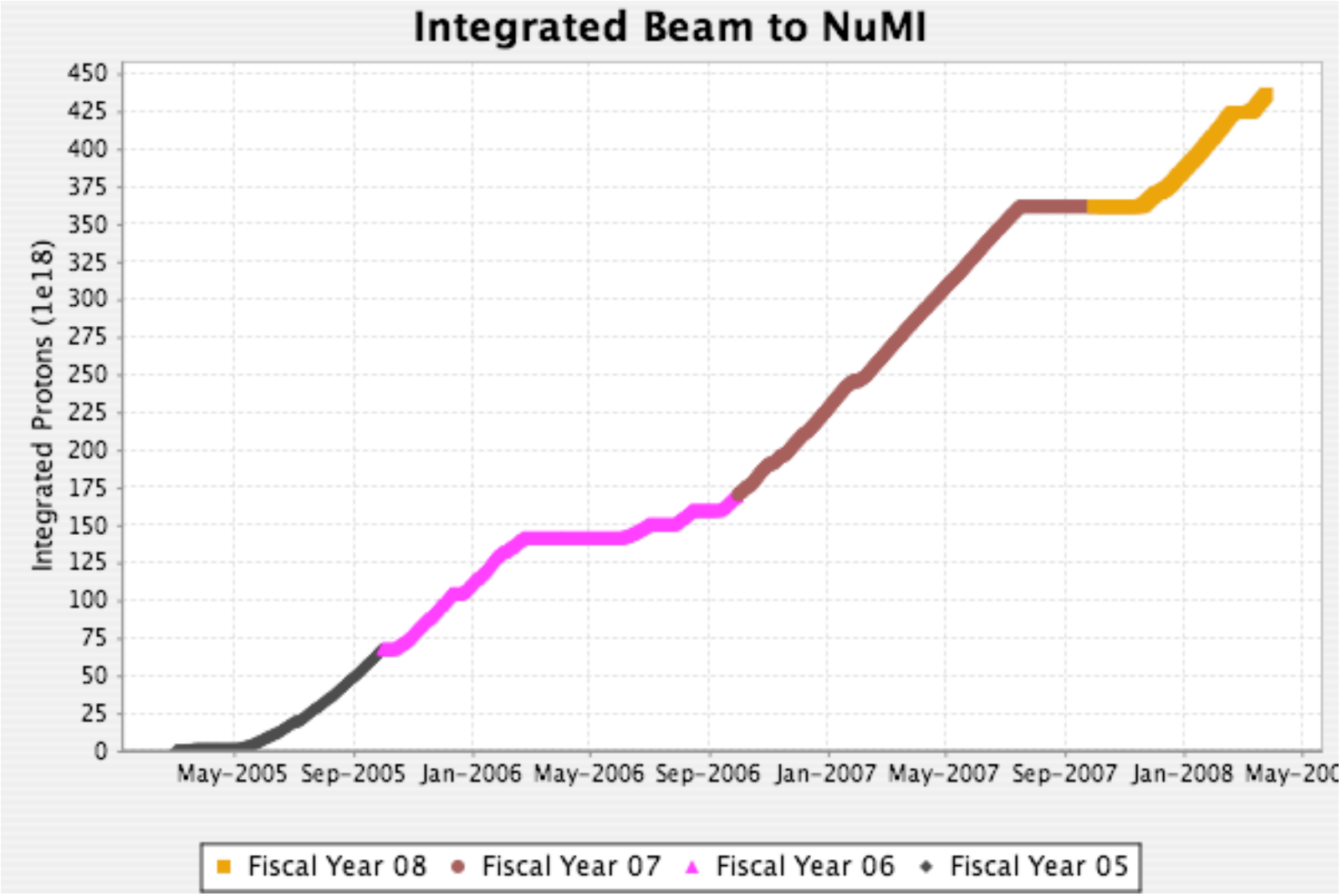
Best week <214 kW>

<2.63 E13 ppp>

Best to date !!

Previous best week 2.59 E13

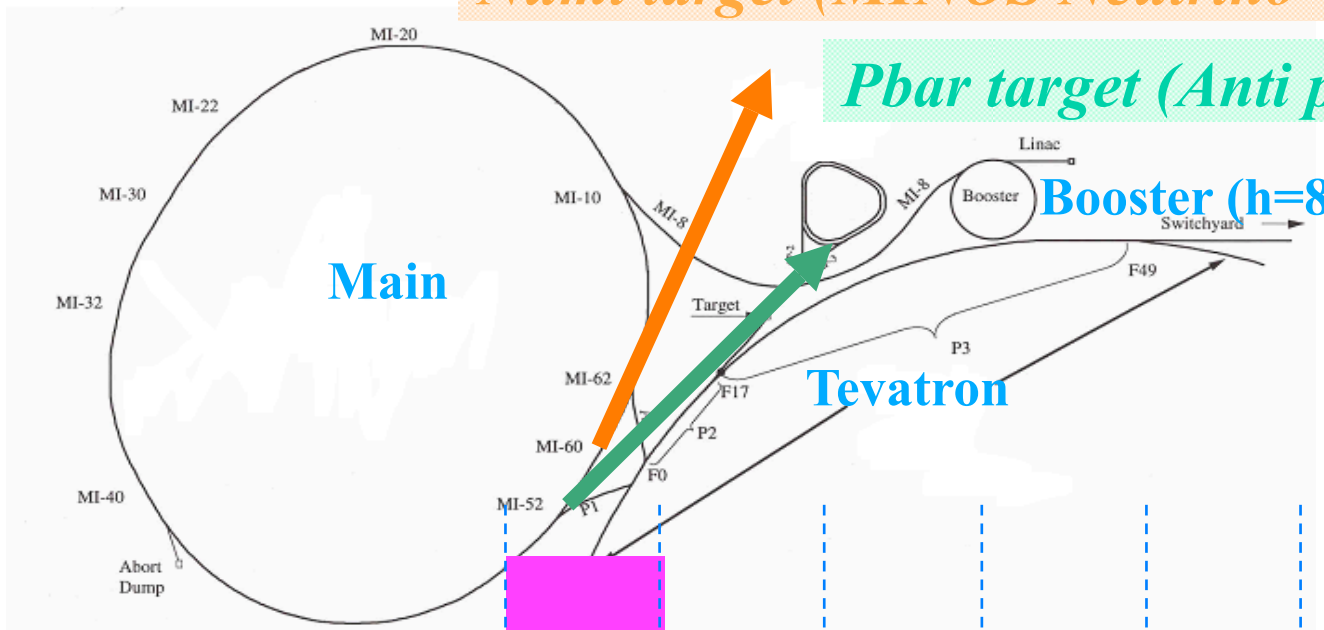
NuMI

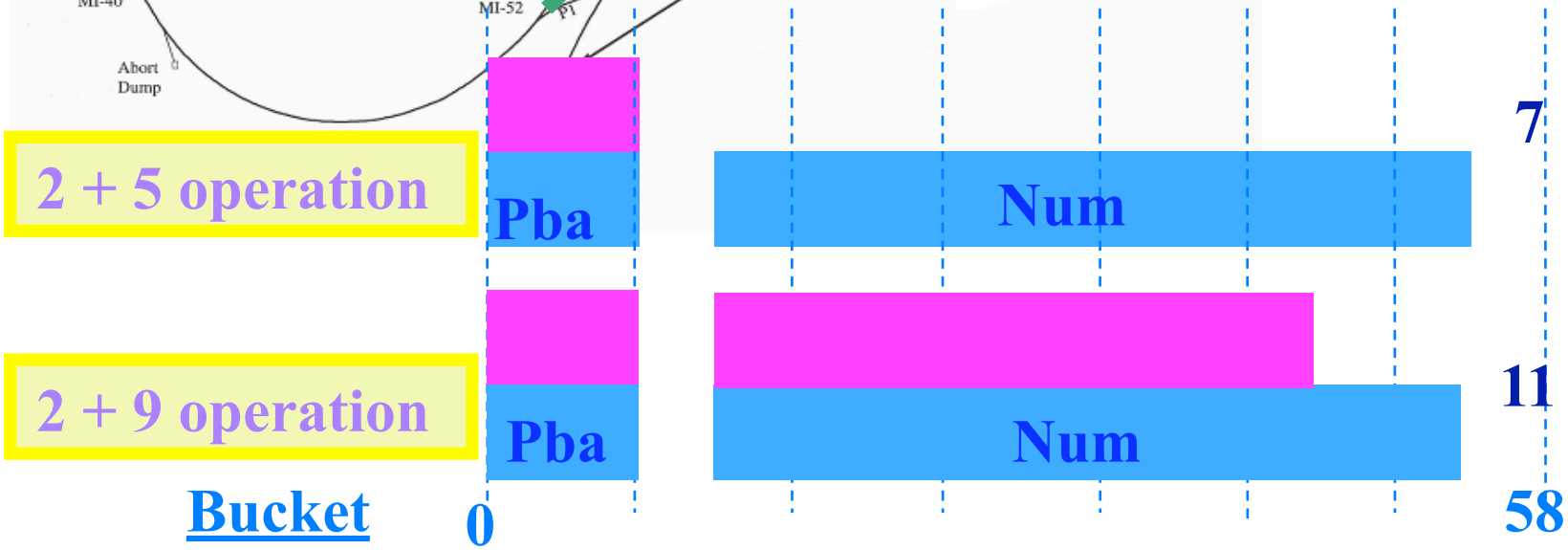

Integrated Beam to NuMI
Integrated Protons (1e18)
450
425
400
375
350
325
300
275
250
225
200
175
150
125
100
75
50
25
0
May-2005
Sep-2005
Jan-2006
May-2006
Sep-2006
Jan-2007
May-2007
Sep-2007
Jan-2008
Fiscal Year 08
Fiscal Year 07
Fiscal Year 06
Fiscal Year 05

MI mixed mode operations

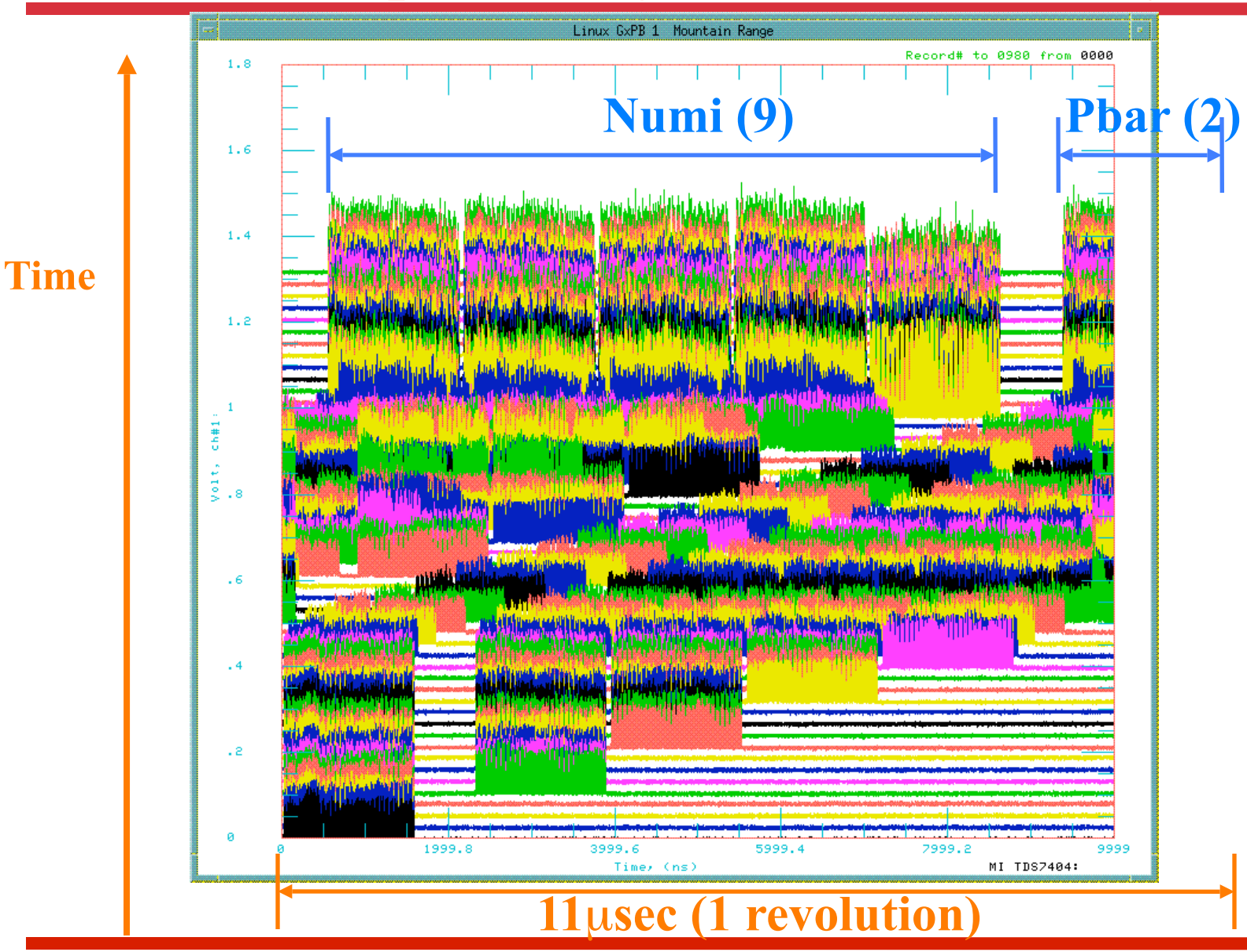
Numi target (MINOS Neutrino

Pbar target (Anti proton

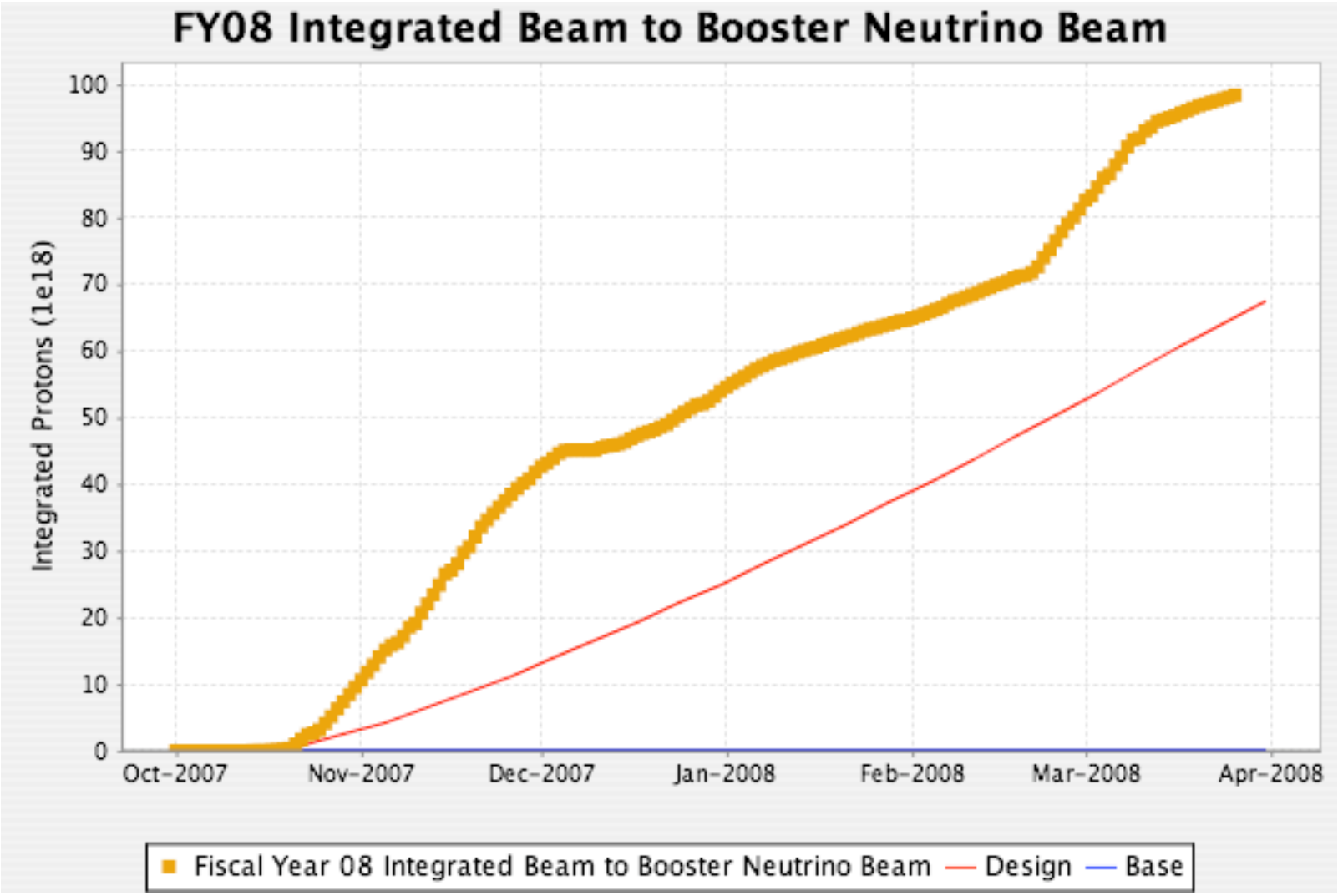




11 batch slip stacking on mixed mode cycle



BNB


FY08 Integrated Beam to Booster Neutrino Beam
Integrated Protons (1e18)
100
90
80
70
60
50
40
30
20
10
0
Oct-2007
Nov-2007
Dec-2007
Jan-2008
Feb-2008
Mar-2008
Apr-2008
Fiscal Year 08 Integrated Beam to Booster Neutrino Beam
Design
Base

Summary

- Collider Performance continues to improve
  - Making small improvements to stacking
  - Improving efficiencies
  - Improving reliability
  - Setting Records
- Beam Power to NuMI has increased due to slip stacking
  - Further improvements are being made with collimation system
  - Horn reliability continues to be an issue, but we have improved the installed horns
- BNB is doing too well