Run 2 PMG

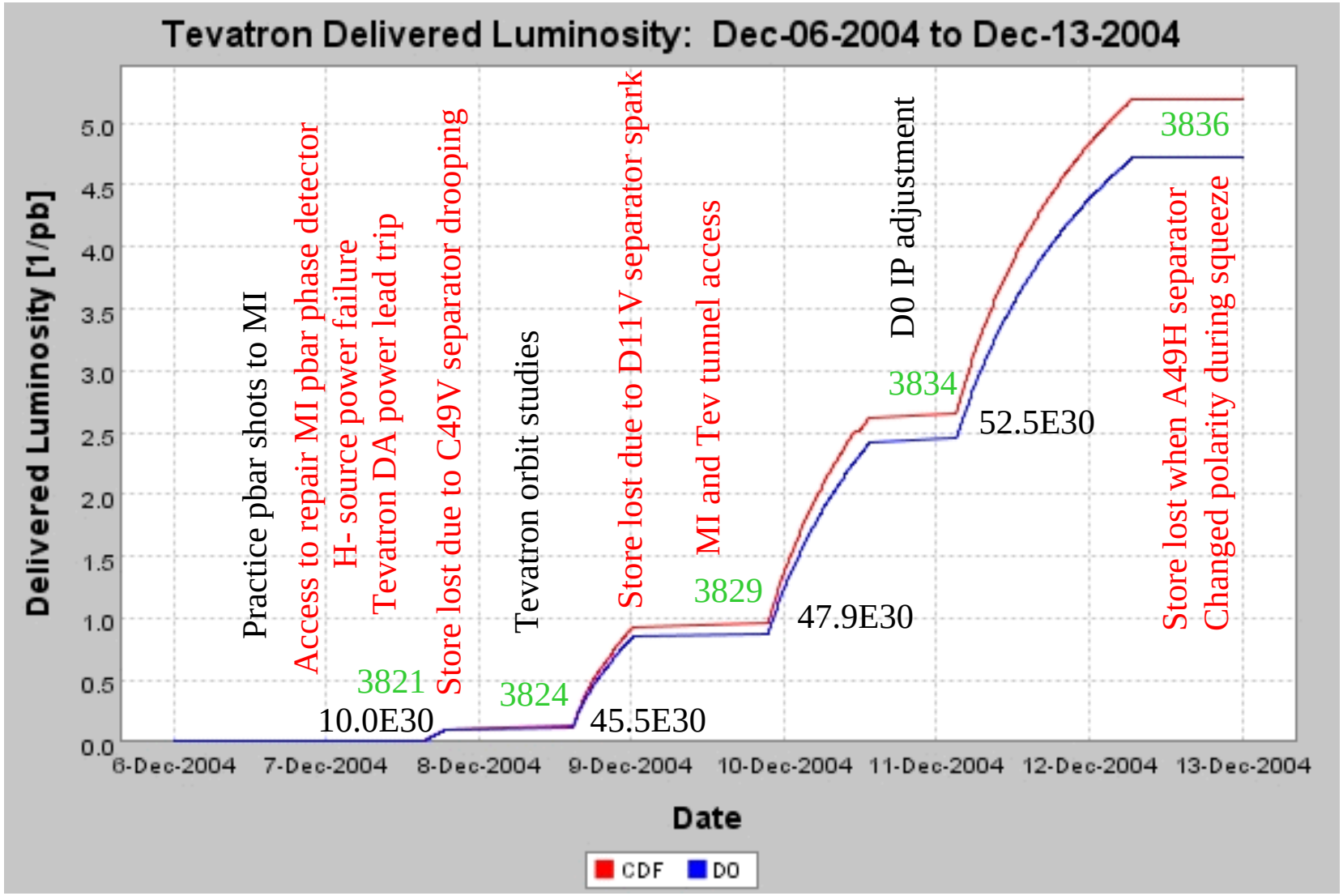
Dave McGinnis

December 16, 2004

Store Summary

Store	Initial Lum. (E30)	Deliv'd Lum. (nb^{-1})	Termination	Time (hr)	Stack Size (E10)	Comments
3821	10.0	103	Loss of store	3.3	75.9	Separator sparks, quench when C49V separator output sags
3824	45.5	832	Loss of store	9.9	103.4	Separator sparks, quench when D11V separator sparks
3829	47.9	1,702	Planned	16.3	136.8	B17H separator spark during squeeze
3834	52.5	2,576	Planned	28.1	152.6	B17H separator spark during squeeze
3836	0	0	Loss of store	0	172.8	A49H separator changed polarity during squeeze

Store Summary



Recent History of Separator Sparks

Separator	Date	Time (hr)	Occurence	Result
D11H	12/7	0	Spark during scrape	Emit growth, lum loss
D11H	12/7	1.4	Spark	Emit growth, lum loss
C49V	12/7	3.3	Spark	Quench, store loss
A49V	12/8	1.4	Sag	Emit growth, lum loss
D11H	12/8	2.7	Spark	Emit growth, lum loss
D11V	12/8	9.9	Spark	Quench, store loss
B17H	12/9	0	Spark (squeeze)	Emit growth, lum loss
B17H	12/11	0	Spark (squeeze)	Emit growth, lum loss
A49H	12/12	0	Ran to 0V (Scrape)	Quench, store loss
B11V	12/12	0.3	Spark	Quench, store loss

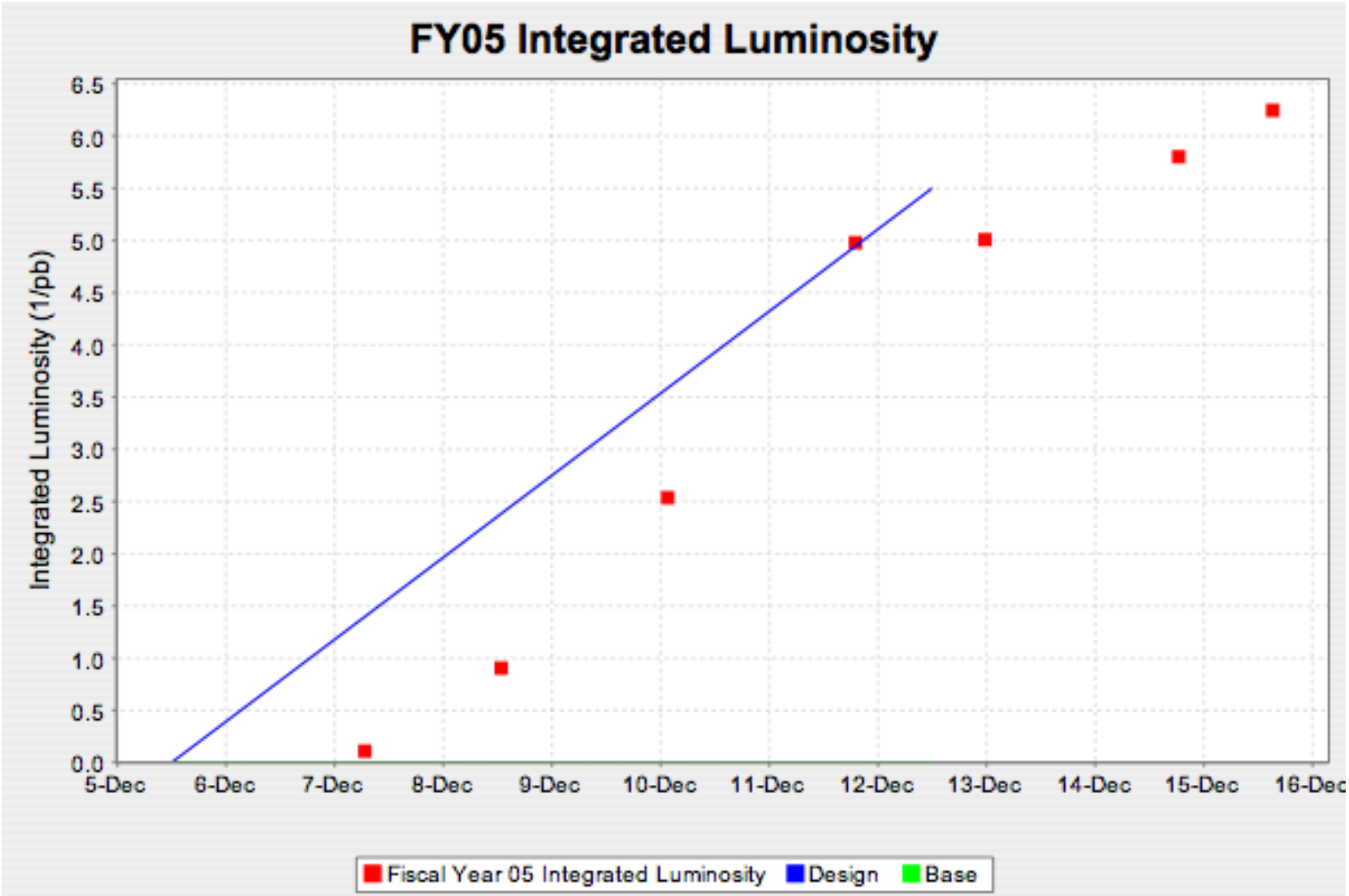
History of Separator Settings

Separator	Power Supply Voltage [kV]			
	Pre 3/1/04	3/2/04 - 8/6/04	8/6/04 - 8/27/04	12/8/04 -
B11H	89.2	105.1	109.2	108.1
B17H	36.0	44.6	46.3	46.4
C49H	93.5	103.0	107.0	110.1
D11H	82.7	96.0	100.0	105.8
D48H	5.3	58.2	58.7	50.2
A49H	90.7	103.0	107.2	110.1
B11V	95.4	110.1	114.6	110.1
C17V	48.4	57.4	59.6	58.2
C49V	90.5	103.2	107.6	103.4
D11V	99.8	115.1	120.0	110.1
D17V	-	-	-	100.8
A17V	5.1	29.6	30.7	67.8
A49V	76.7	86.9	90.7	110.1

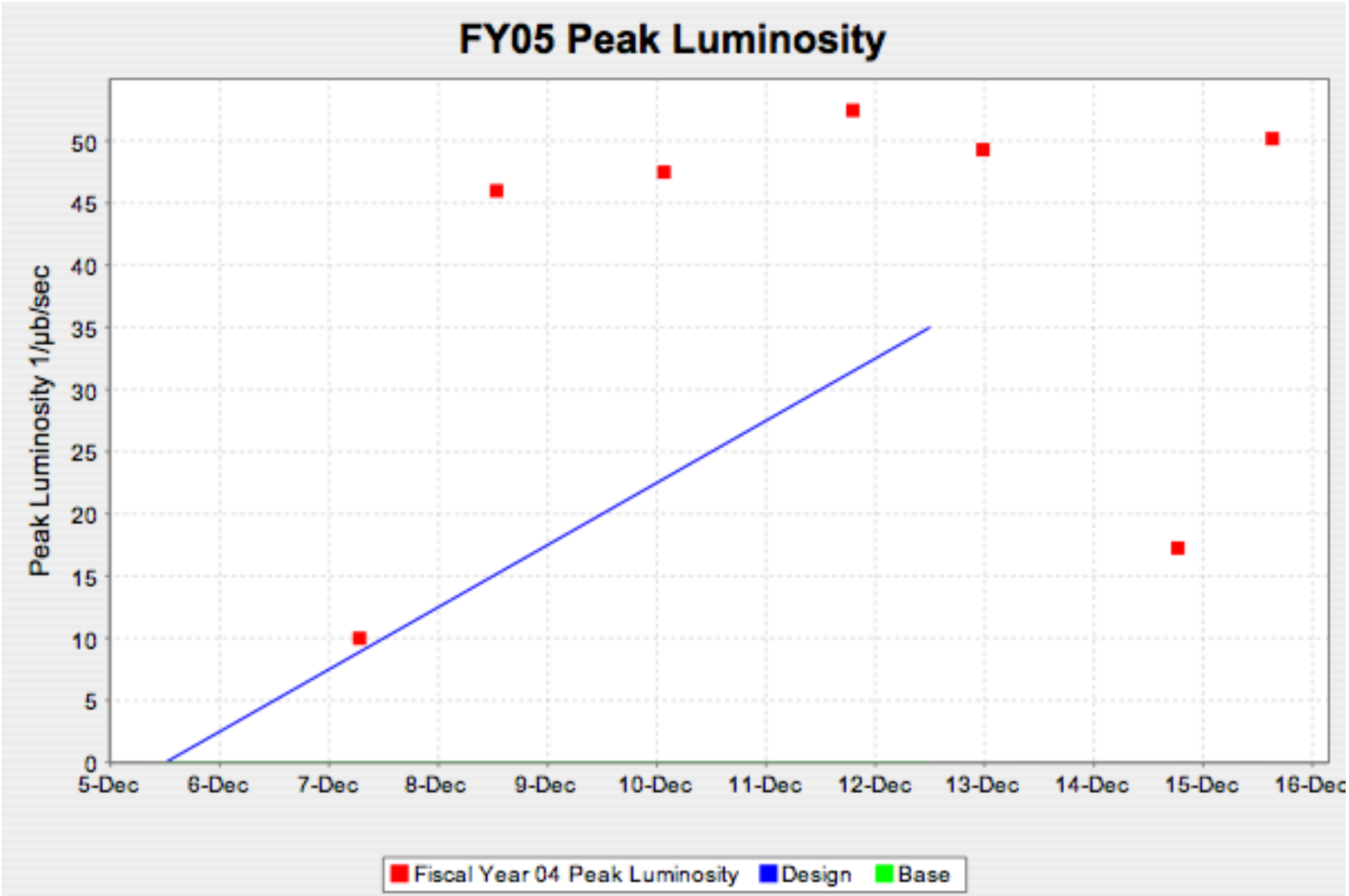
Separator Summary

- Separator Sparks seem to be random
  - Except D11 Separators got vented during the shutdown and were not baked
    - Rash of D11 sparks early on
    - Seems to have been conditioned
  - Some of the quenches dues to these sparks would have been MUCH more serious had it not been for the new over-sampling of the QPM system that was put in by EE support
- Voltage on separators are very close to pre-shutdown values
- The big difference:
  - We put polarity switches on all the separators during the shutdown so that we would be able test the pbar helix with protons.
  - We think that switching the polarity on the separators might cause the separators to be de-conditioned.
    - Used the polarity switches extensively during startup
      - Observed large sparking rates
      - also started up fast so we had little time to condition
    - Ran a bad script this weekend that reversed some of the polarity switches.
      - One of the switches that got reversed caused the store loss today.
- Plan
  - We ran alternate periods of conditioning and 14x0 stores for 16 hours (or more)
  - Do not flip separator polarity until we understand if this is what is causing the sparks
  - Try to understand if flipping switch causes sparks
    - Test setup?, etc..
  - Back down 10% on helix as a last option

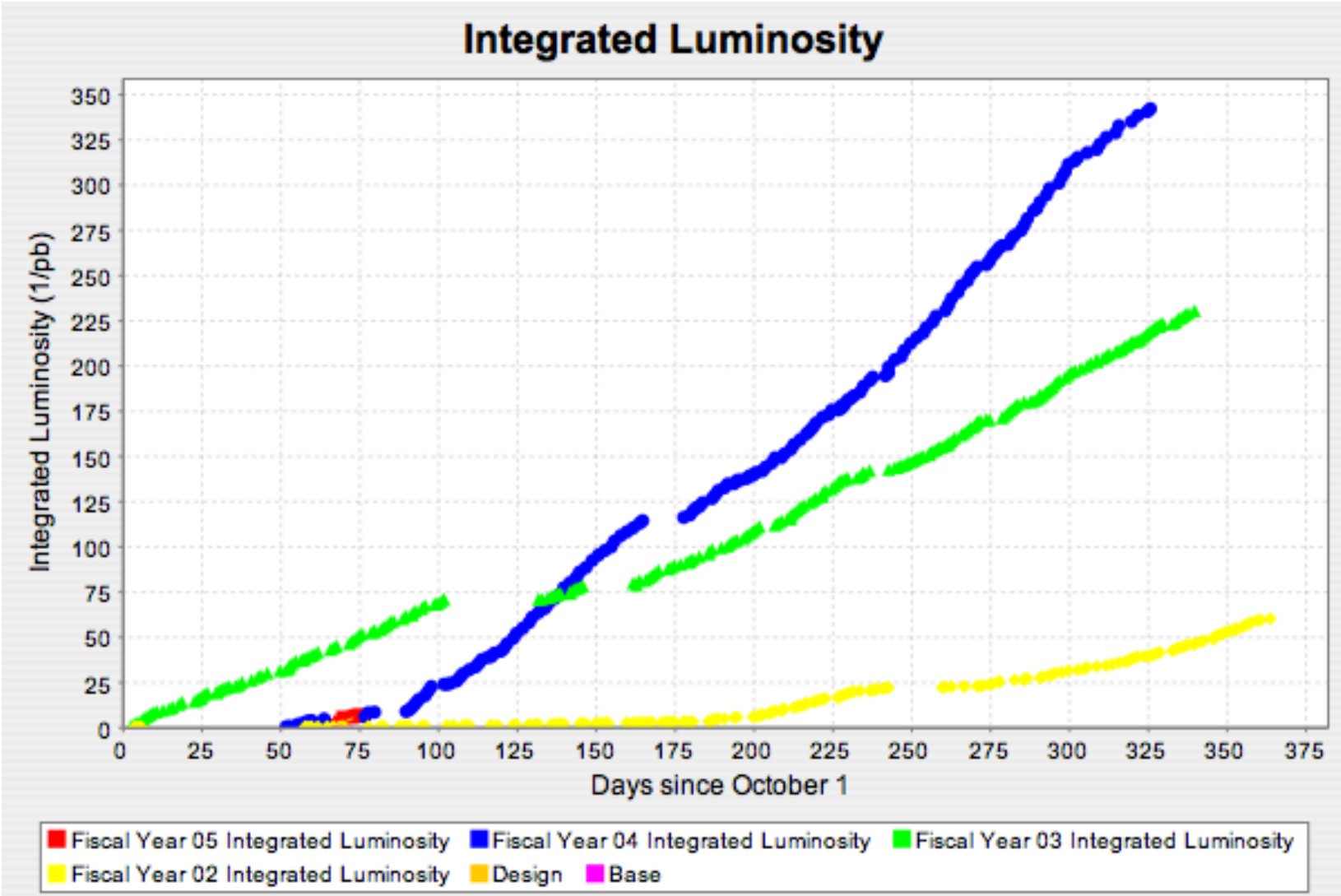
FY05 Integrated Luminosity



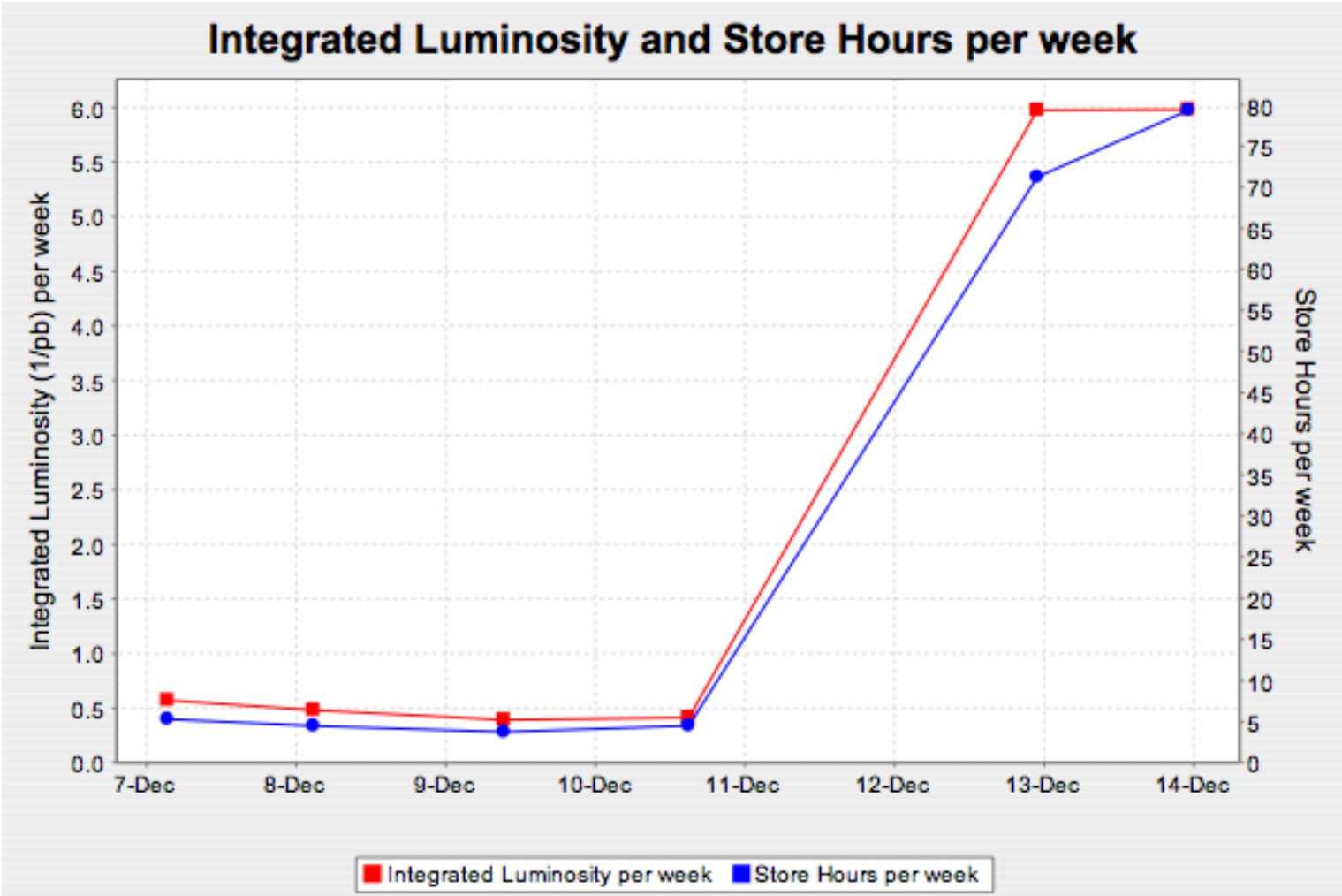
FY05 Peak Luminosity



Integrated Luminosity

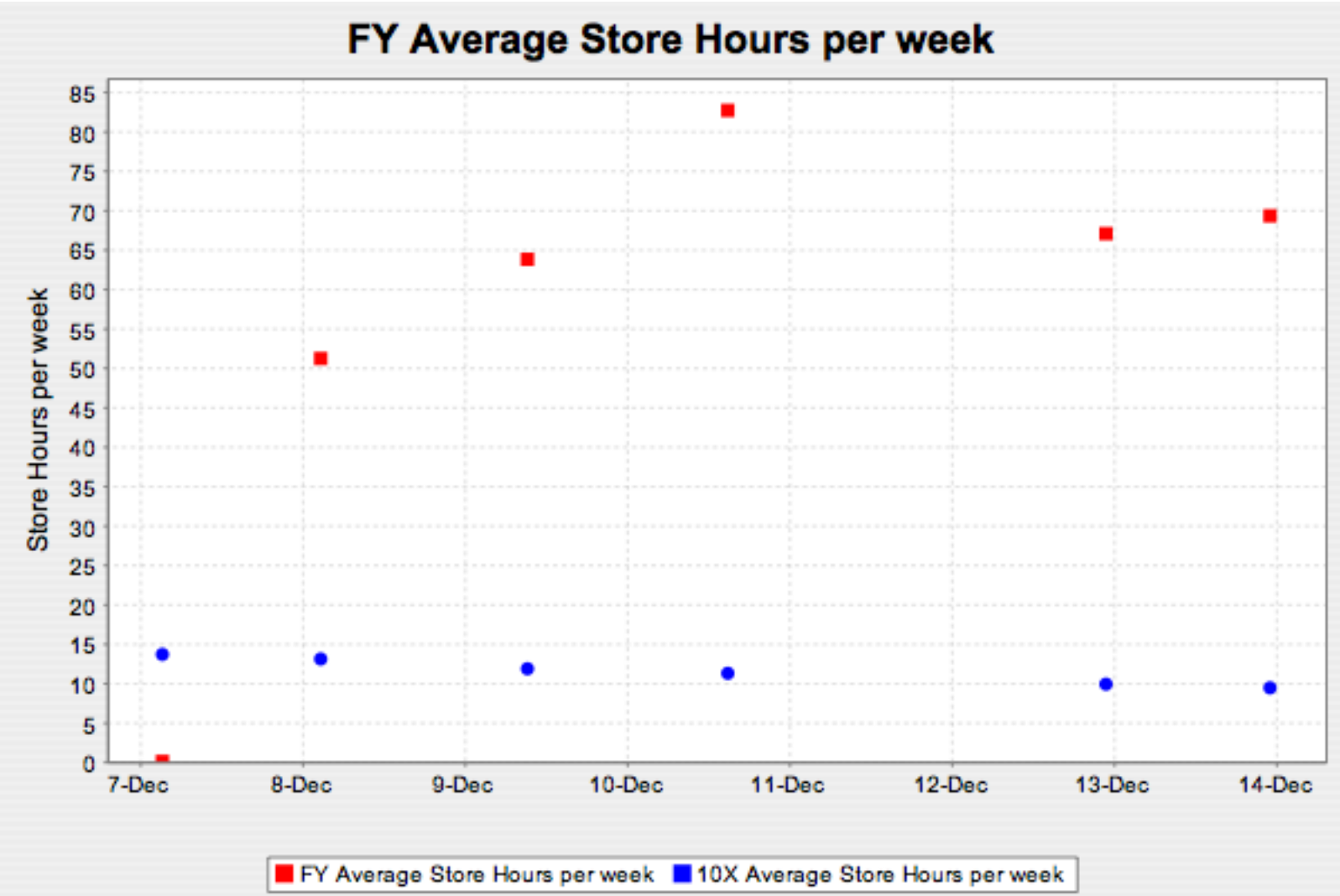


Integrated Luminosity and Store Hours per Week

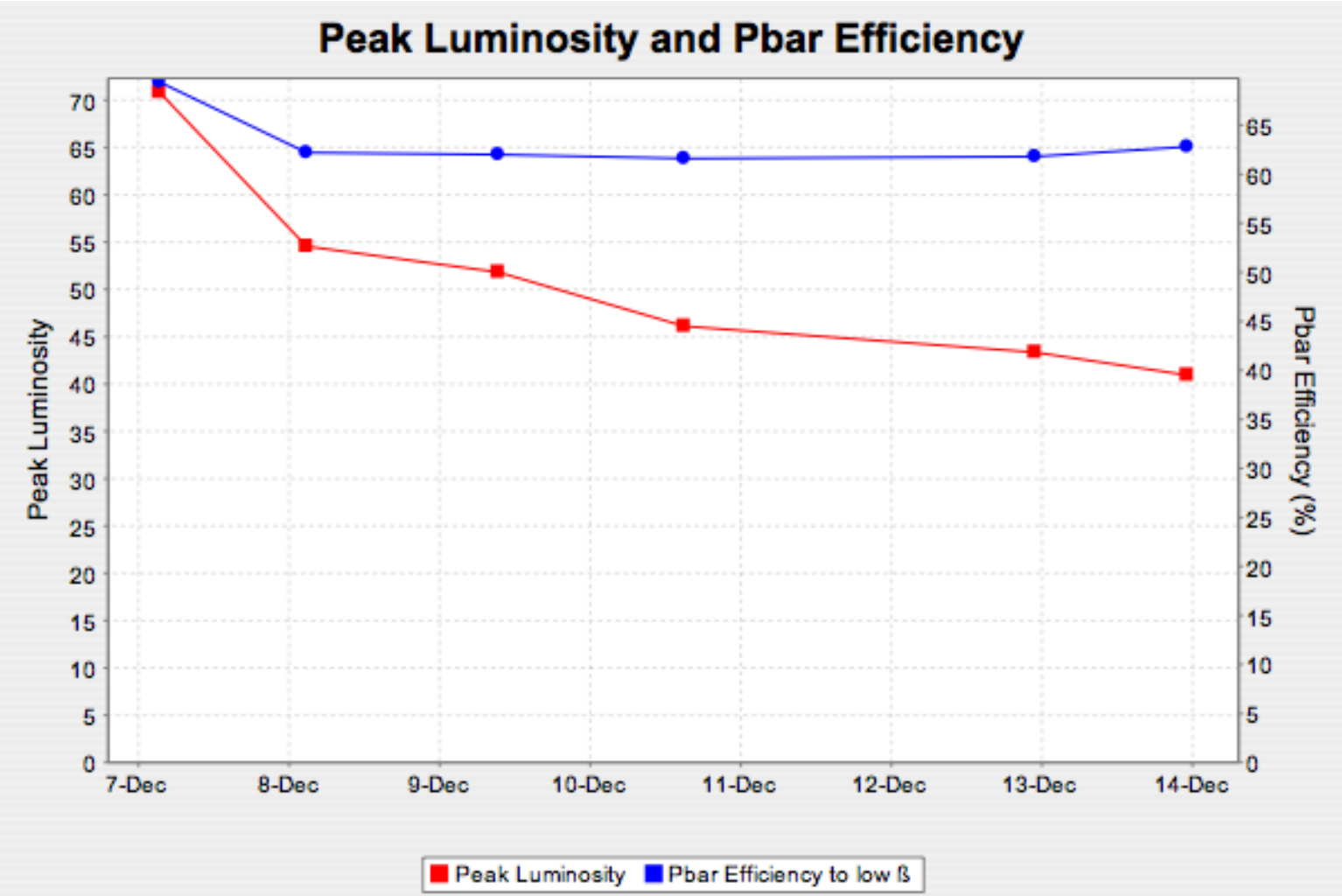


5 Store Running Average

FY05 Average Store Hours per Week

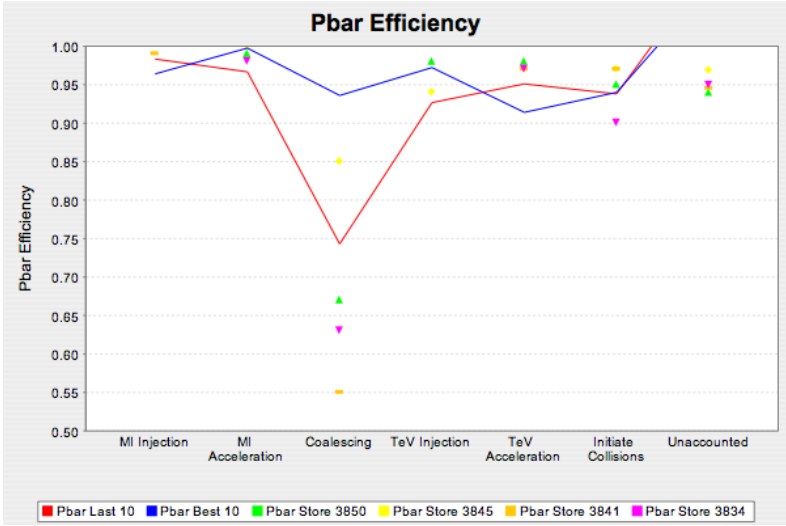


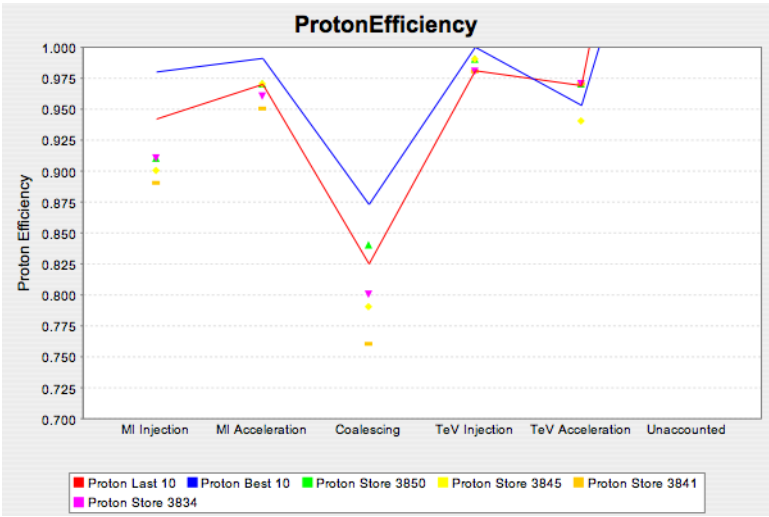
Peak Luminosity and Pbar Efficiency



5 Store Running Average

Collider Transmission Efficiency*

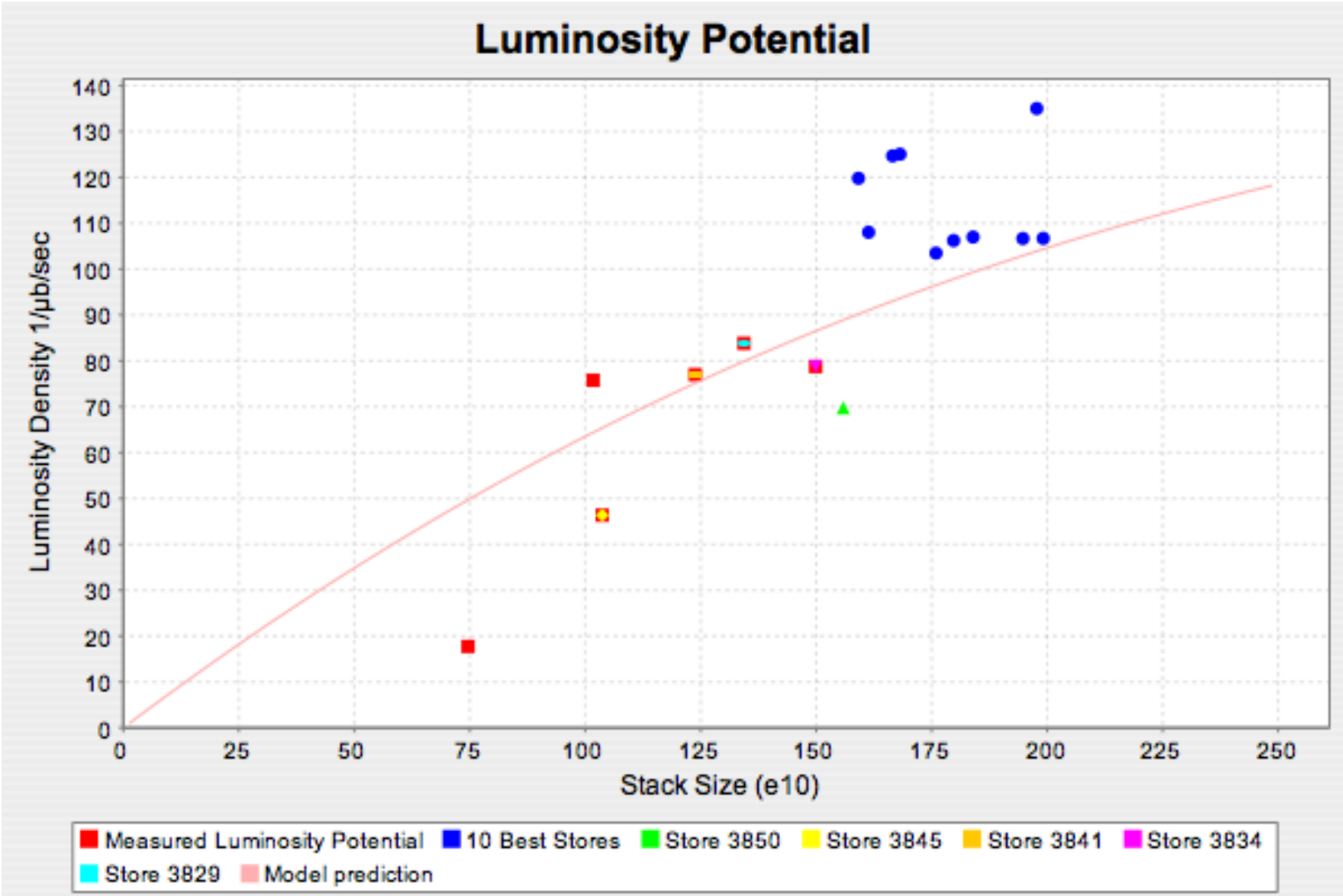




Data Summary Table

		Luminosity Parameters							
Parameter	Last Store	Best Store	Last 10 Stores (Ave)	Best 10 Stores (Ave)	FY Average	Previous FY	FY End Goal (Design)	FY End Goal (Base)	
Initial Luminosity (Average)	50.1	102.8	55.9	87.6	40.9	71.1	96.1	80.7	$x10^{30} cm^{-2} sec^{-1}$
Integrated Luminosity per Store (Avera	444.5	4240.9	1491.7	3296.4	1138.5	2660	3369	3190	nb^{-1}
Luminosity per week (Averaged)	-	-	0.9	-	6	11.8	16.8	12.7	pb^{-1}
Store Length	3.2	32.4	16.1	27	15.1	25.1	20	25	Hours
Store Hours per week	-	-	9.3	-	79.3	111	100	100	Hours
Shot Setup Time	2.8	2.4	3	2.6	3.1	2.6	2.6	2.6	Hours
		TEVATRON Parameters							
Parameter	Last Store	Best Store	Last 10 Stores (Ave)	Best 10 Stores (Ave)	FY Average	Previous FY	FY End Goal (Design)	FY End Goal (Base)	
Protons per bunch	225.1	245.8	220.9	249.1	190.5	247.4	260	260	$x10^{9}$
Antiprotons per bunch	23.5	43.2	23.2	35.9	19.7	30.1	42	34	$x10^{9}$
Proton Efficiency to Low Beta	61	85	66.8	77	55.8	77.4	-	-	%
Pbar Transfer efficiency to Low Beta	58	86	66.1	80.9	62.8	73.7	76	74	%
HourGlass Factor	0.6	0.7	0.7	0.7	0.7	0.7	0.6	0.6	
Initial Luminosity Lifetime	0	0	0	0	0	0	0	0	hours
Asymptotic Luminosity Lifetime	0	0	0	0	0	0	0	0	hours
Effective Emittance	16.9	16.9	15.5	17	14.7	17.9	18.5	17	π-mm-mrad
		Antiproton Parameters							
Parameter	Last Store	Best Store	Last 10 Stores (Ave)	Best 10 Stores (Ave)	FY Average	Previous FY	FY End Goal (Design)	FY End Goal (Base)	
Zero Stack Stack Rate	9.5	13	9.4	12.5	8.9	12.9	24.5	14	$x10^{10}$/hour
Normalized Zero Stack Stack Rate	1.8	2.4	1.9	2.4	1.9	2.3	3.1	2.3	$x10^{-2}$/hour
Average Stacking Rate	4.6	6.8	5.6	6.3	5.6	6.2	10.1	6.6	$x10^{10}$/hour
Stacking Time Line Factor	65.8	92.6	74.7	80.3	75.9	77.9	75	75	%
Stack Size at Zero Stack Rate	338.3	284.4	737.5	299.8	505.5	325.8	300	300	$x10^{10}$
Protons on Target	4.9	5.4	5	5.2	4.6	5.3	8	6.2	$x10^{12}$
Start Stack	156.1	198	127.3	178.9	122.9	161.4	216	181	$x10^{10}$
End Stack	10.6	17	7.8	18	6.8	13.8	15	15	$x10^{10}$
Unstacked Pbars	145.5	181	119.5	160.9	116.1	147.6	201	166	$x10^{10}$

Stack Size Potential



Studies

Pbar Studies

12/8/2004	1.0	D/A adjustments during shot setup
12/8/2004	0.8	Flying wires
	1.8	Sum for week
	1.8	Sum for year
	1.8	Average per week

TEV Studies

12/8/2004	7.0	D0 aperture and orbit adjustments
12/8/2004	3.0	Vertical damper check-out
12/8/2004	1.2	Bumper magnet check-out
12/10/2004	1.0	End of store, D0 IP orbit adjustment, phase 1
12/10/2004	0.5	End of store, Flying wires (thick vs. thin)
12/10/2004	0.8	A48 collimator position check
12/10/2004	7.5	D0 IP adjustment, phase 2 (implementation, transition through squeeze)
	21.0	Sum for Week
	21.0	Sum for Year
	21.0	Average per week

Recycler Pbar Tax for the Week = 5%

Short Term Plan

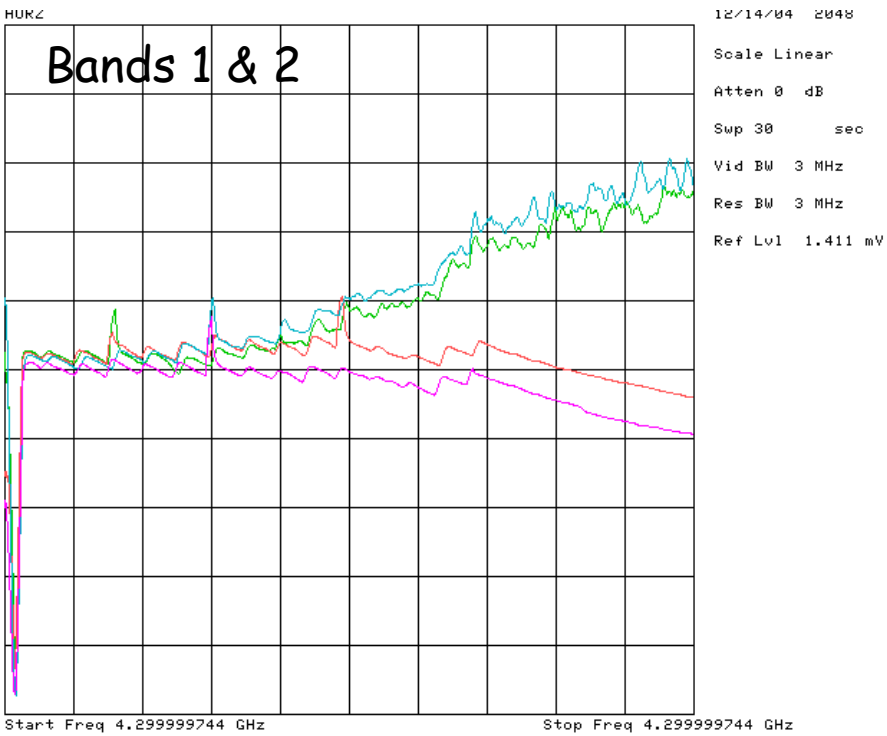
- Proton Source
  - Continue to turn up batch intensity for stacking
  - Tune for better efficiency for Mini-Boone
  - Support Slip-Stacking commissioning with cogging studies
- Main Injector
  - Commission slip-stacking on stacking cycles
  - Increase intensity and efficiency on coalescing
- Pbar Source
  - Increase stacking rate
    - Increase Debuncher aperture
    - Optimize Debuncher cooling
    - Beam Based Alignment of the D/A line
- Recycler
  - Prepare for Mixed Pbar Source shots for next week
- Tevatron
  - Get a hold of the separator spark problem
  - Optimize collision points (alpha bumps, separator scans, etc..)
  - Determine the plan for centering orbit through both detectors
    - Correctors
    - Low Beta quad moves
    - Will make the low beta moves in mid-January

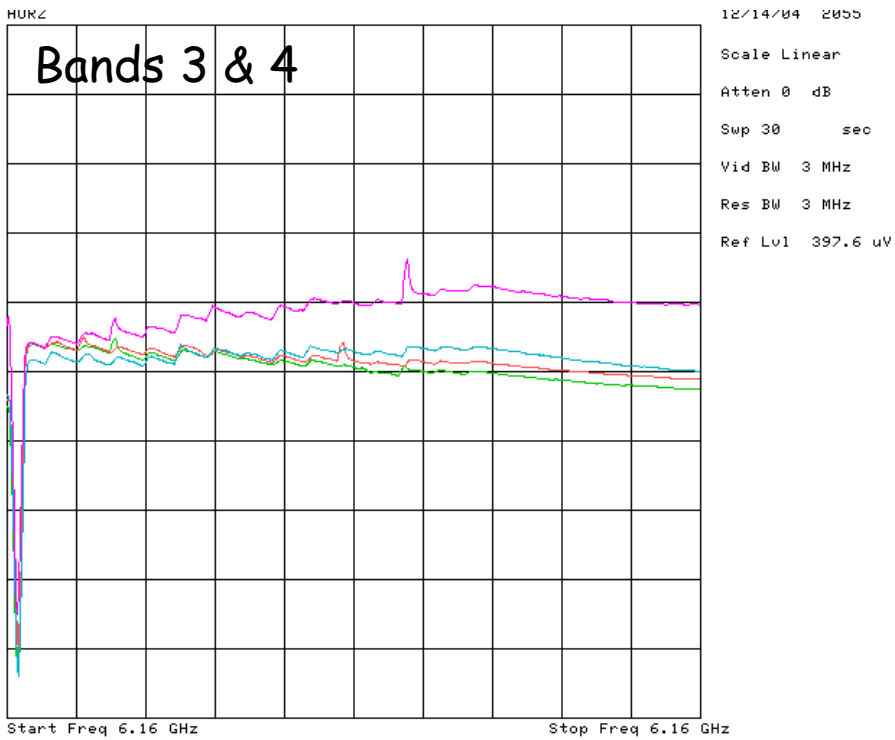
D/A Line Update

- Did an initial tune-up of the line using beam-based alignment
  - Got nominal performance
  - Not satisfied with the state of the instrumentation
    - Noisy
      - Had low intensity
      - Need to develop more sophisticated plot averaging
    - D/A SEMS still not functioning properly
- After instrumentation is improved we will do another pass
  - Map septa channel apertures
  - Find minimum kicker voltages
  - Beam base align the line
  - Measure the lattice transfer function

D/A Line Update

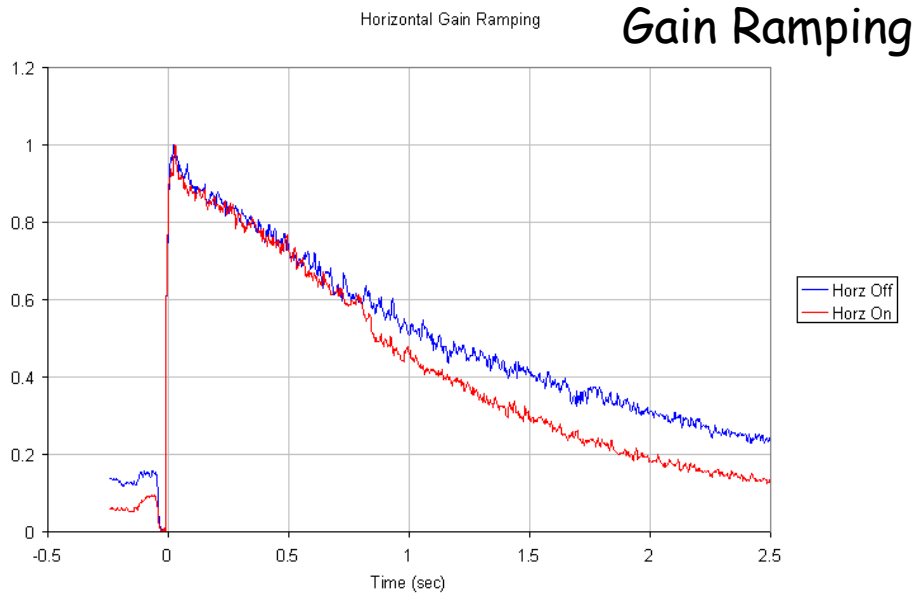
- Focused this week on optimizing Debuncher transverse cooling
  - Developed a new technique to optimize phasing
  - Commissioned gain ramping

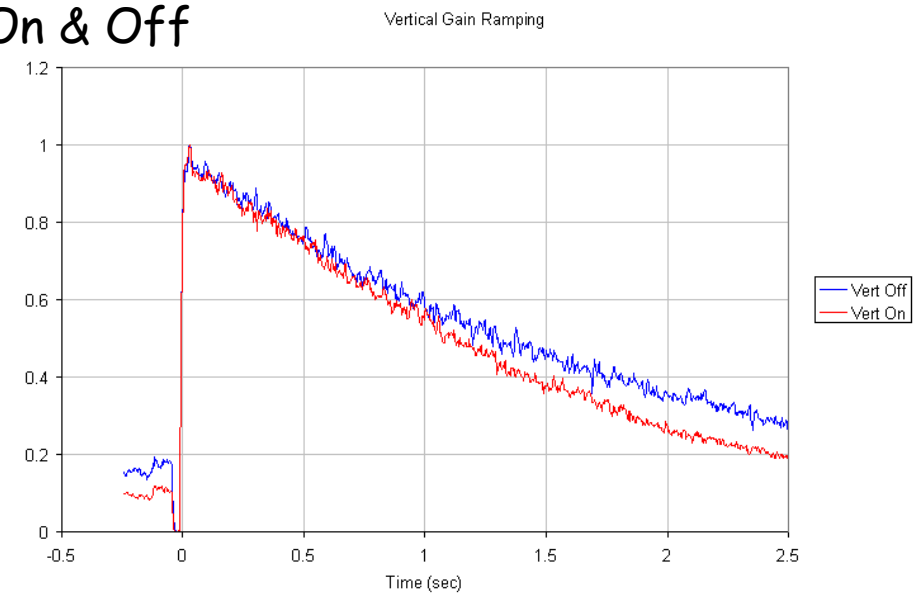
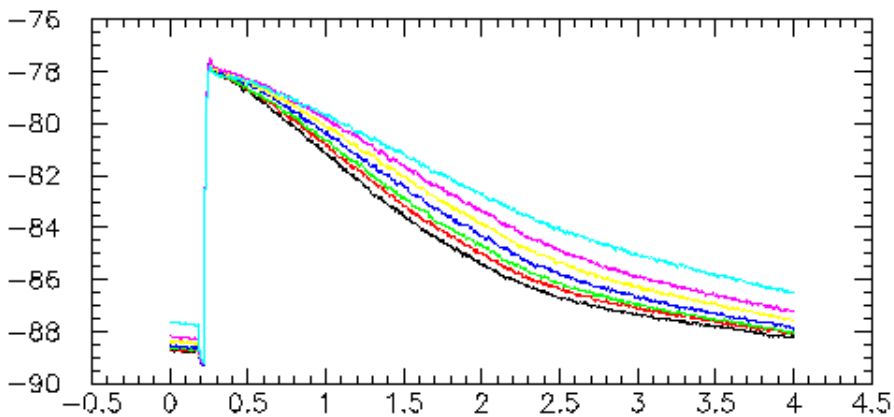
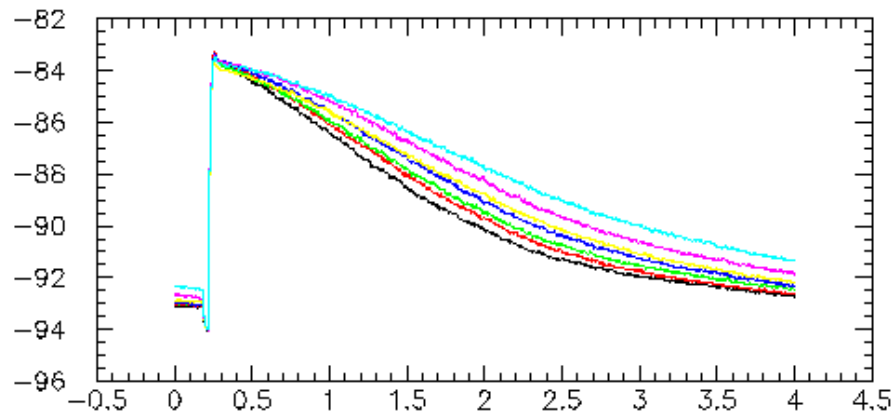




Debuncher Transverse Cooling Gain Ramping

Gain Ramping On & Off





Transverse Emittance vs Debuncher Gain