All Experimenter's Meeting

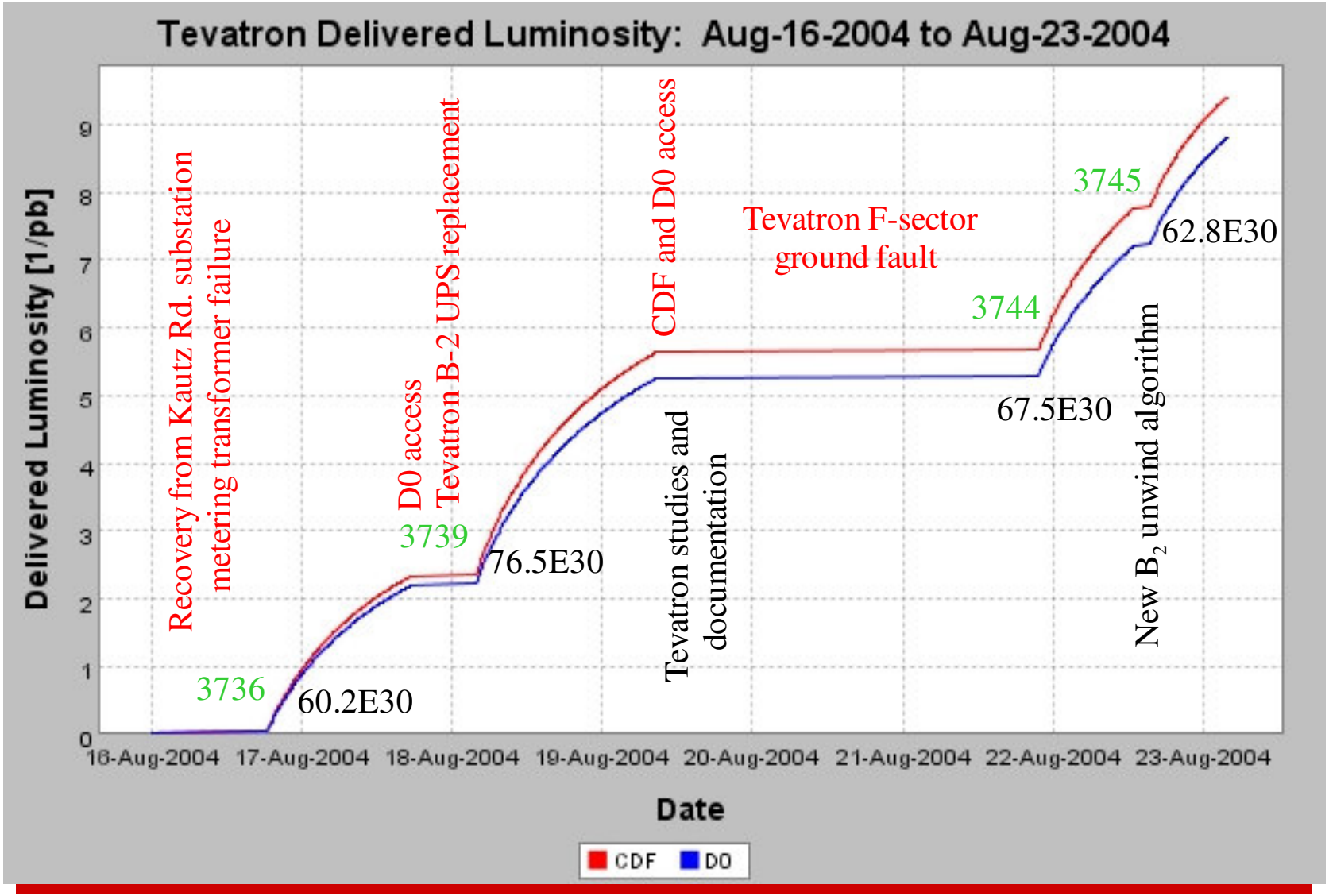
Dave McGinnis

August 23, 2004

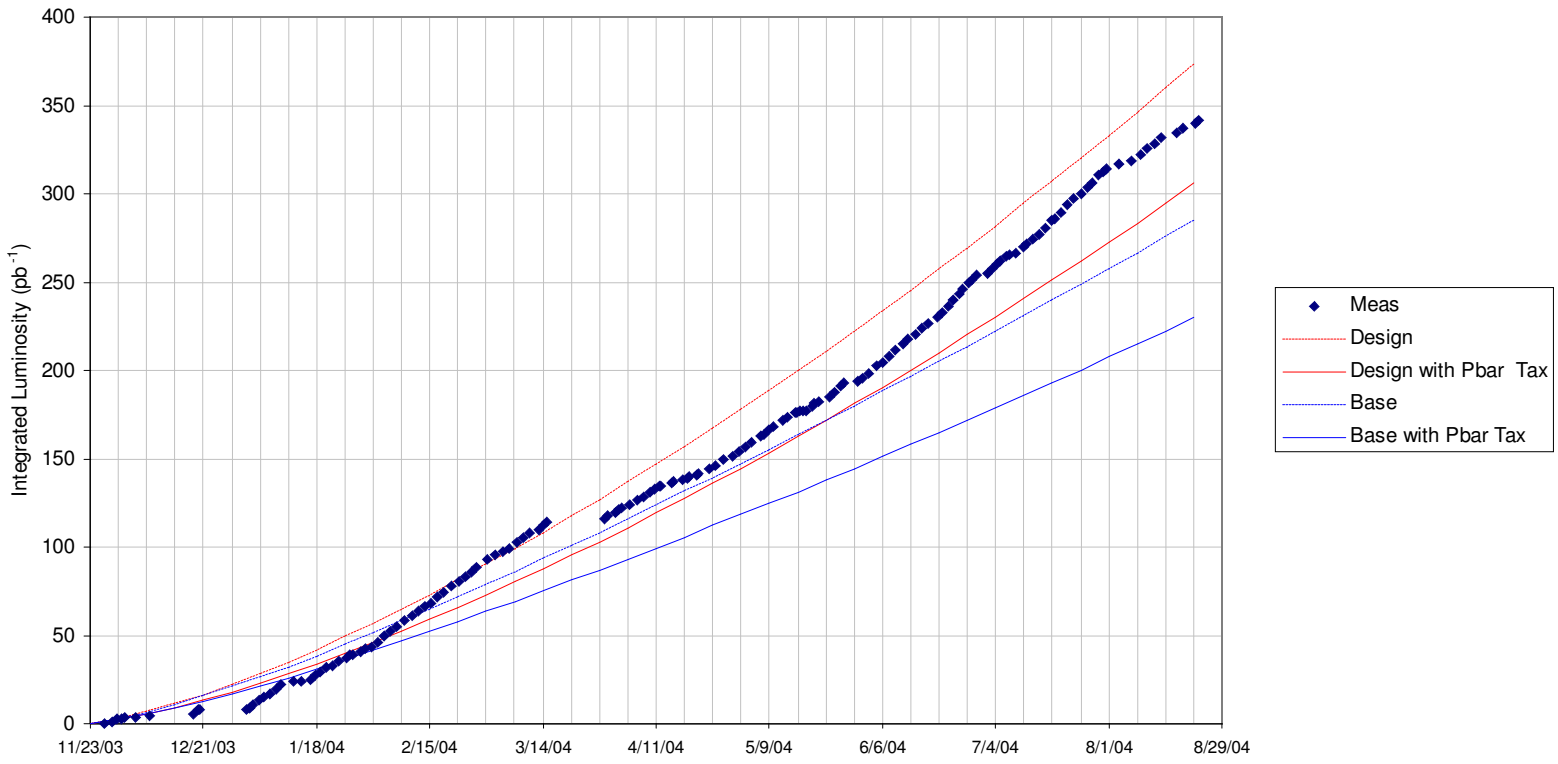
Store Summary

Store	Initial Lum. (E30)	Deliv'd Lum. (nb^{-1})	Termination	Time (hr)	Stack Size (E10)	Comments
3736	60.2	2,311	Planned	23.2	123.9	
3739	76.5	3,334	Planned	29.3	165.3	
3744	67.5	2,113	Planned	15.3	160.8	
3745	62.8	1,649	Planned	12.7	129.7	No dry squeeze prior to shot setup (new B_2 unwind algorithm)

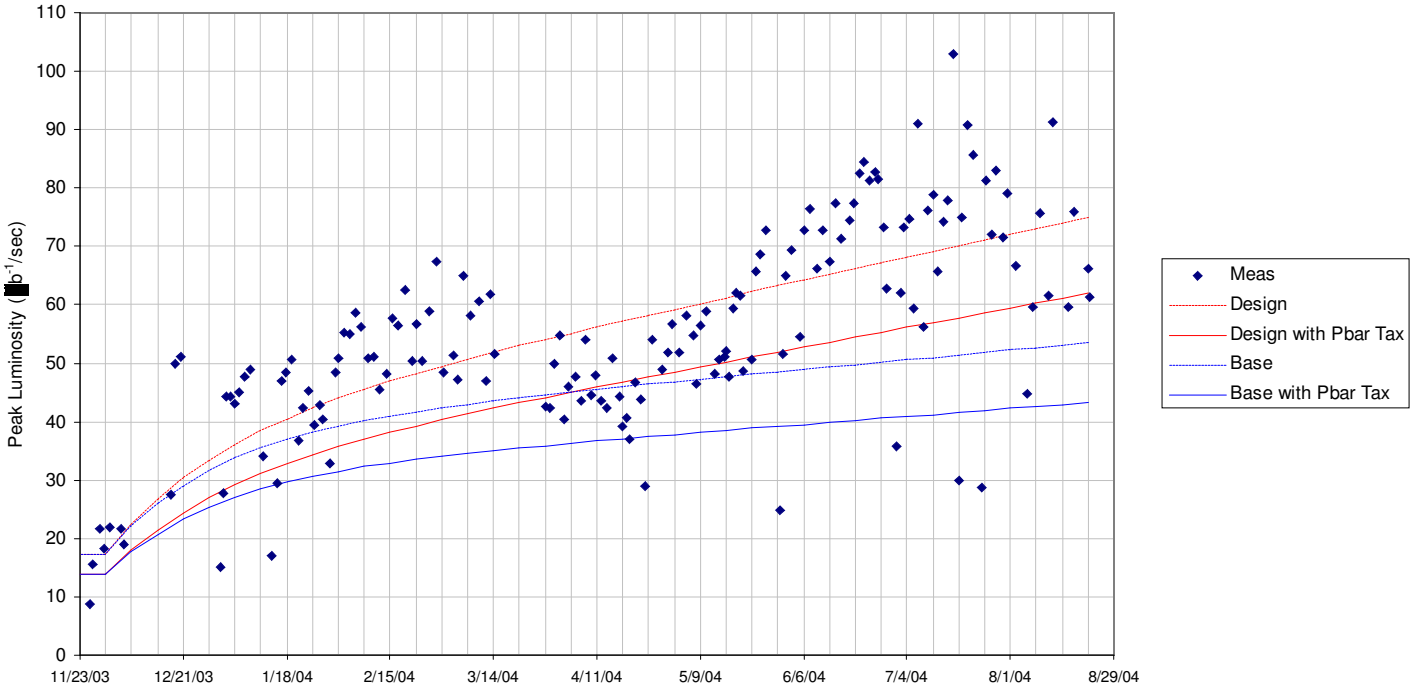
Store Summary



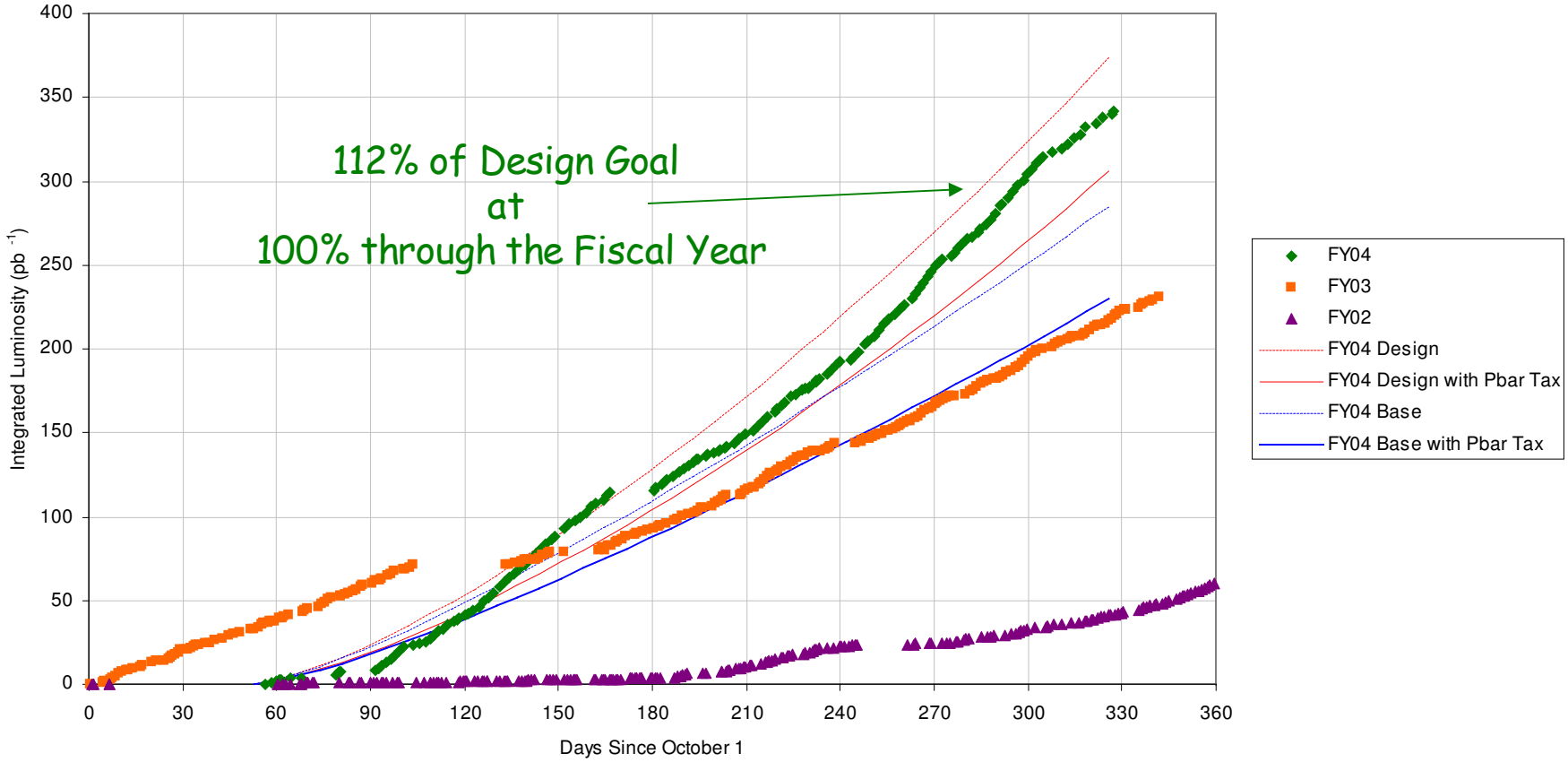
FY04 Integrated Luminosity



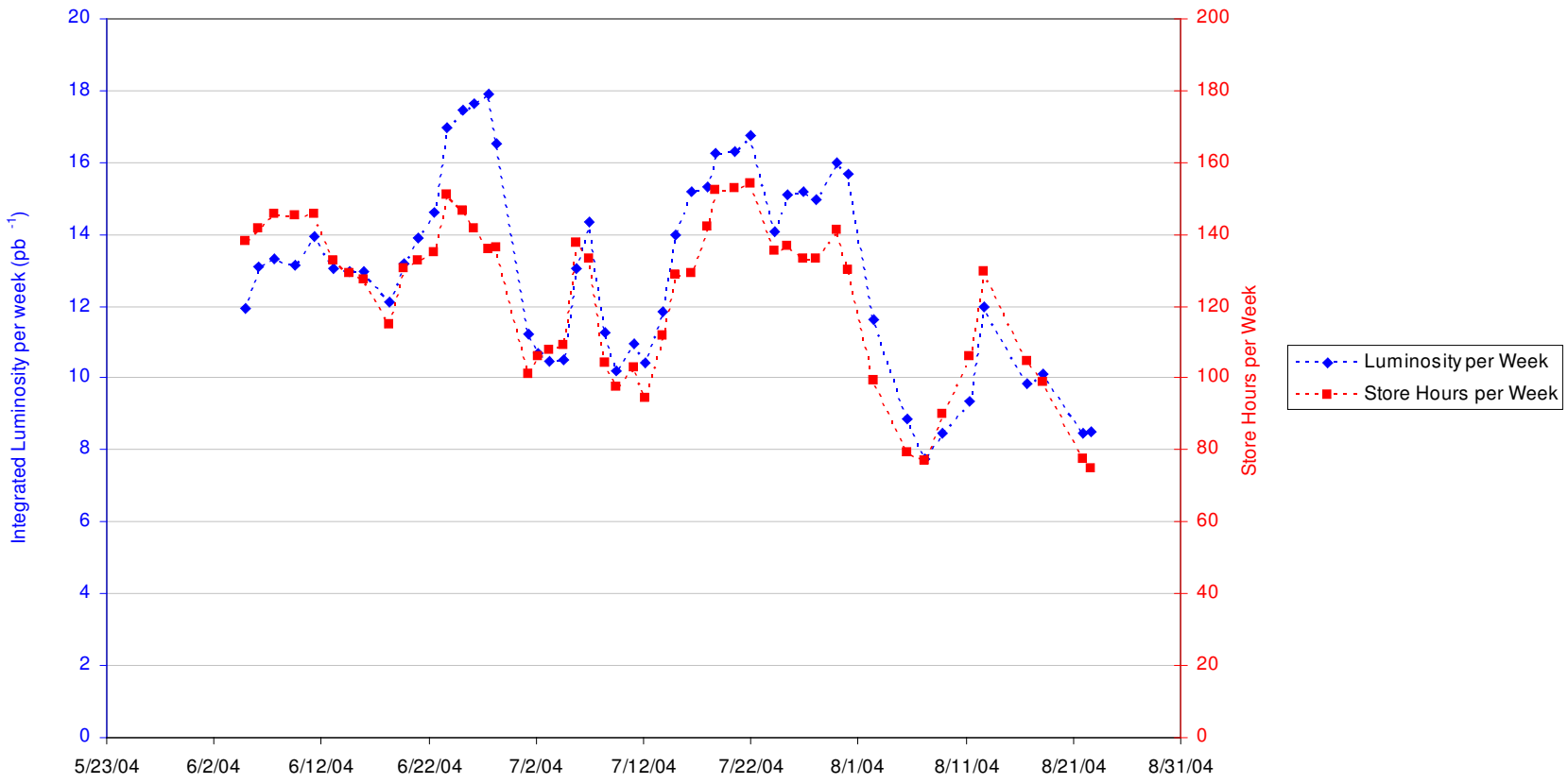
FY04 Peak Luminosity



Integrated Luminosity

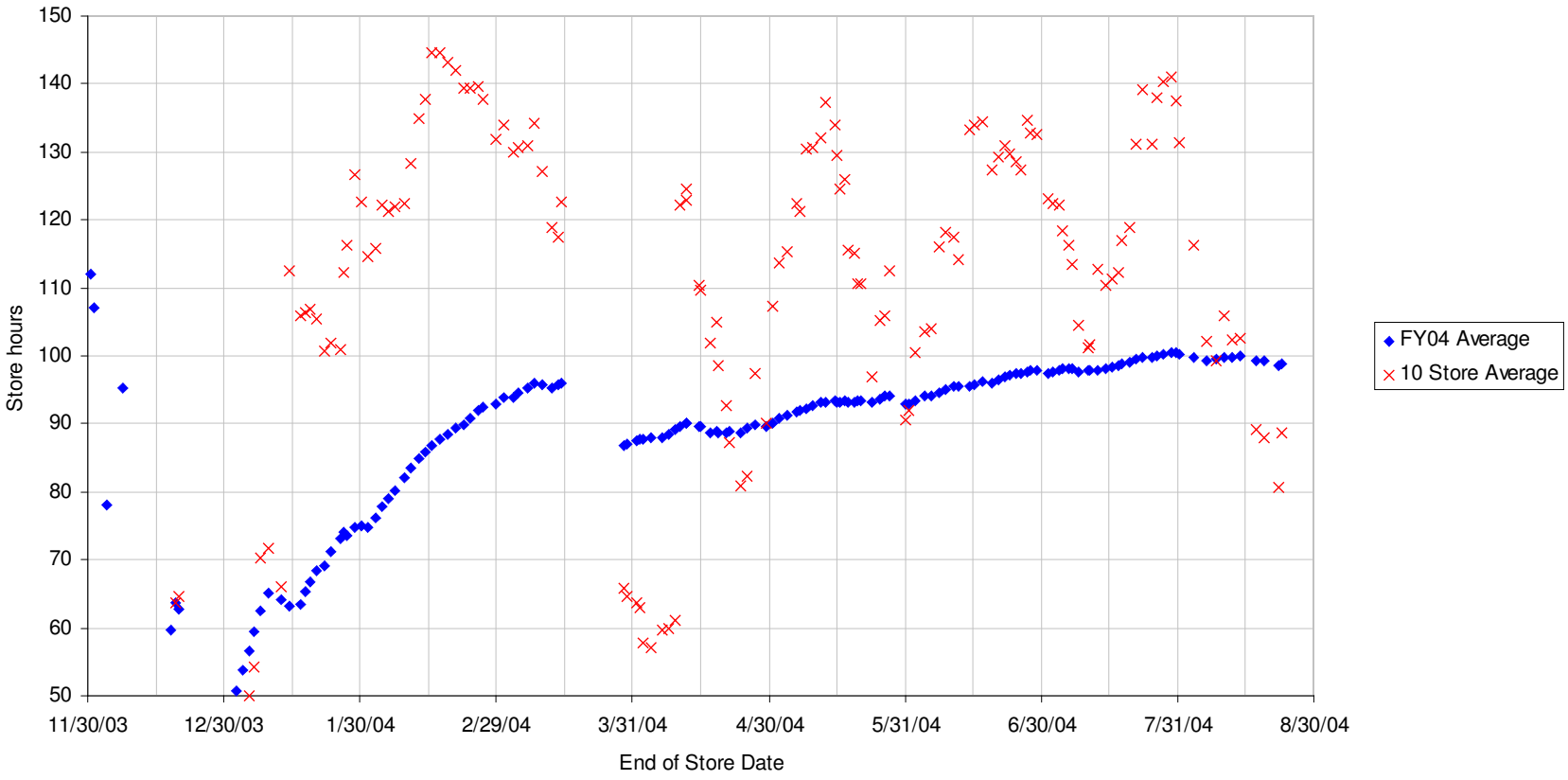


Integrated Luminosity and Store Hours per Week

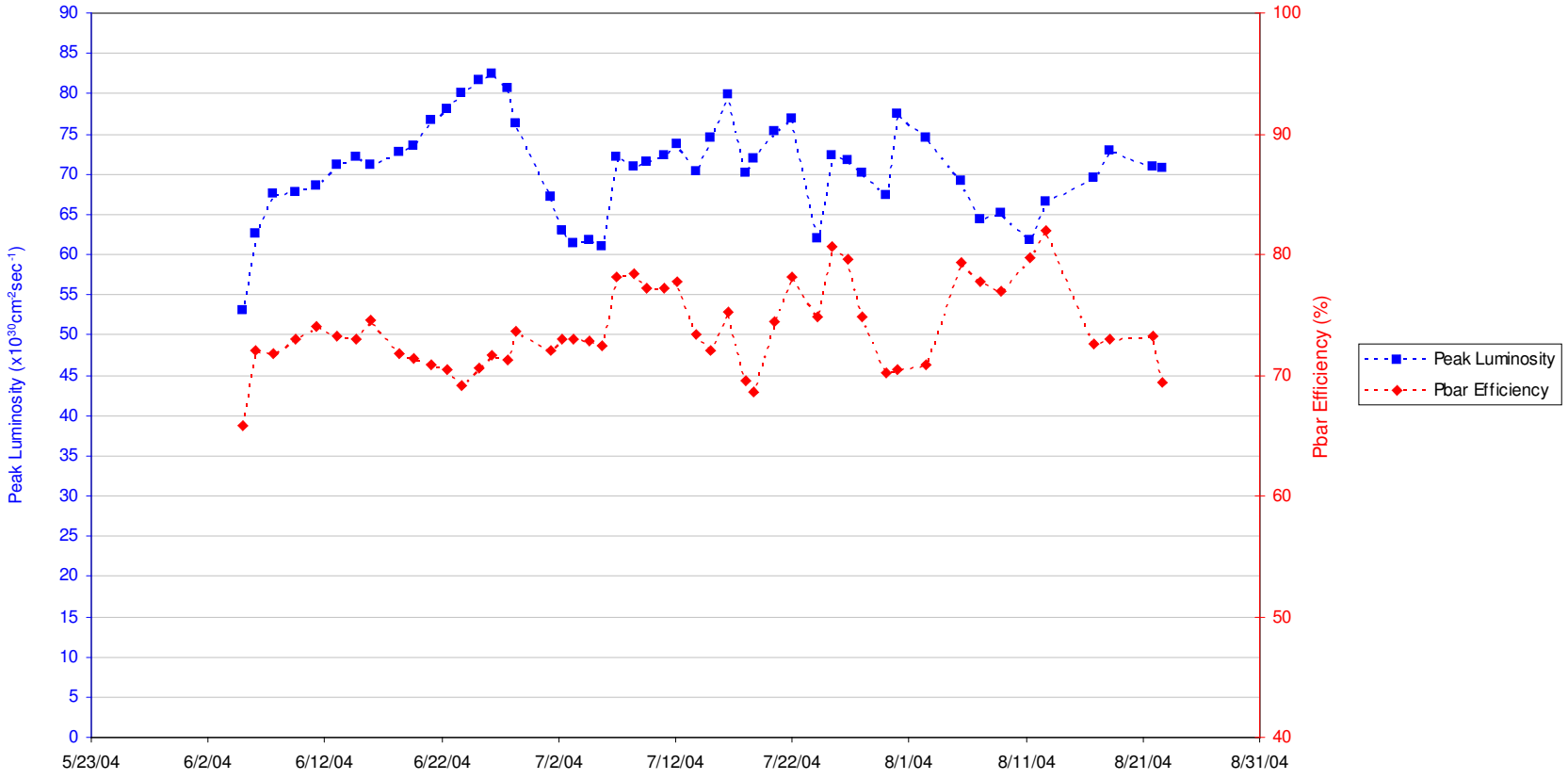


5 Store Running Average

FY04 Average Store Hours per Week



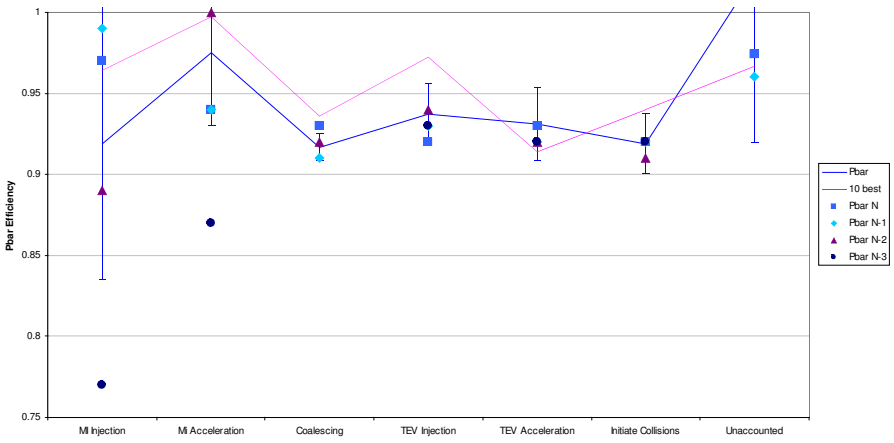
Peak Luminosity and Pbar Efficiency

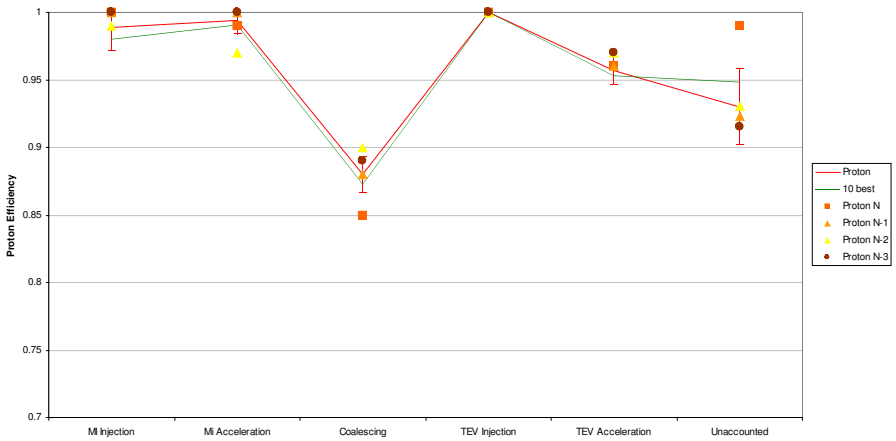


5 Store Running Average

Collider Transmission Efficiency*

- Peak Luminosity up by 7%
  - Unstacked Pbars down by 7%
    - Store Length up by 73%
  - Pbar Transfer efficiency down by 6%
  - Protons per bunch is down by 5%
  - Effective Emittance down by 20%
  - Stacking Rate is down 41%



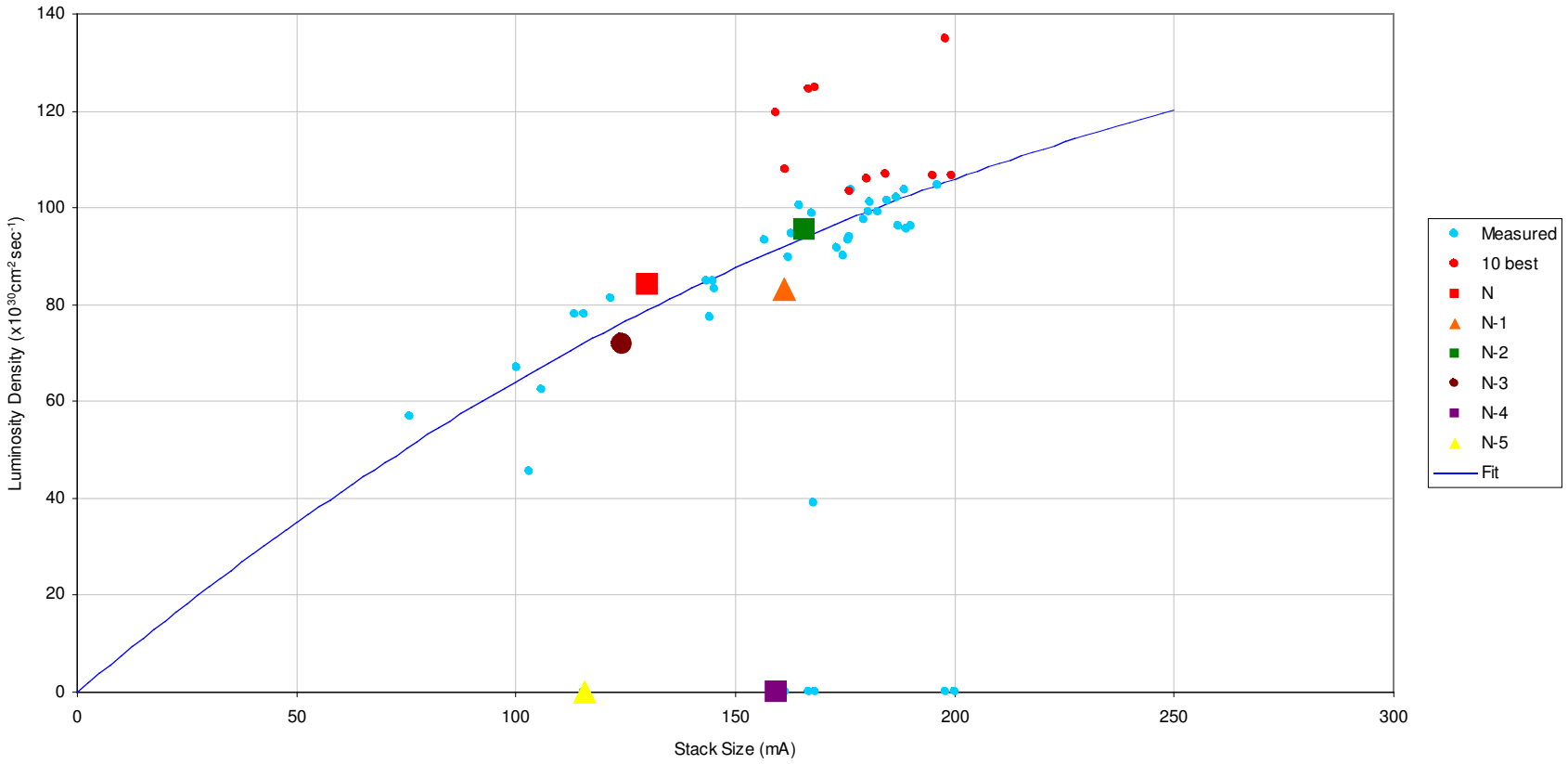


*Of the past 10 stores w.r.t the FY04 Goals

Data Summary Table

				Store Parameters					
Parameter	Last Store	Best Store	Last 10 stores Average	Best 10 stores Average	FY04 Average	End of FY03	FY04 (End) Design	FY04 (End) Base	
Initial Luminosity (Average)	61.2	102.8	66.3	87.6	54.3	36.1	61.9	43.3	$x10^{30}cm^{-2}sec^{-1}$
Integrated Luminosity per Store (Averaged)	1630	4241	2636	3221	2116	1089	2000	1300	nb^{-1}
Luminosity per week (Averaged)	-	-	8.5	-	8.5	6.4	11.3	7.4	pb^{-1}
Store Length	13.0	32.4	26.0	26.7	24.6	14.9	15.0	15.0	Hours
Store Hours per week	-	-	82	-	99	88	85	84	Hours
Shot Setup Time	2.0	2.4	2.5	2.6	2.5	2.3	2.2	2.2	Hours
				TEVATRON Parameters					
Parameter	Last Store	Best Store	Last 10 stores Average	Best 10 stores Average	FY04 Average	End of FY03	FY04 (End) Design	FY04 (End) Base	
Protons per bunch	250	246	248	249	236	237	260	260	$x10^{9}$
Antiprotons per bunch	23	43	26	36	27	22	31	25	$x10^{9}$
Proton Efficiency to Low Beta	80	85	77	77	76	58	-	-	%
Pbar Transfer efficiency to Low Beta	65	86	75	81	73	63	80	77	%
HourGlass Factor	0.70	0.66	0.68	0.67	0.68	0.70	0.65	0.65	
Initial Luminosity Lifetime	6.5	5.2	6.7	6.0	7.7	9.5	8.3	7.0	hours
Asymptotic Luminosity Lifetime	18.9	17.7	19.2	19.3	23.2	25.1	25.0	25.0	hours
Effective Emittance	15.9	16.9	16.6	17.0	17.9	21.6	21.0	23.0	π-mm-mrad
				Antiproton Parameters					
Parameter	Last Store	Best Store	Last 10 stores Average	Best 10 stores Average	FY04 Average	End of FY03	FY04 (End) Design	FY04 (End) Base	
Zero Stack Stack Rate	11.1	13.2	10.6	12.7	11.4	11.5	18.0	13.7	$x10^{10}$/hour
Normalized Zero Stack Stack Rate	2.0	2.5	2.3	2.4	2.3	2.3	3.6	2.7	$x10^{-2}$/hour
Average Stacking Rate	8.4	6.8	5.4	6.4	5.8	7.1	9.3	7.6	$x10^{10}$/hour
Stacking Time Line Factor	93	86	71	78	78	88	75	75	%
Stack Size at Zero Stack Rate	348	309	363	321	301	300	300	300	$x10^{10}$
Protons on Target	5.9	5.3	4.9	5.2	5.0	5.0	5.0	5.0	$x10^{12}$
Start Stack	130	198	140	179	155	144	155	130	$x10^{10}$
End Stack	5	17	10	18	20	16	15	15	$x10^{10}$
Unstacked Pbars	125	181	130	161	135	128	140	115	$x10^{10}$

Stack Size Potential



Studies

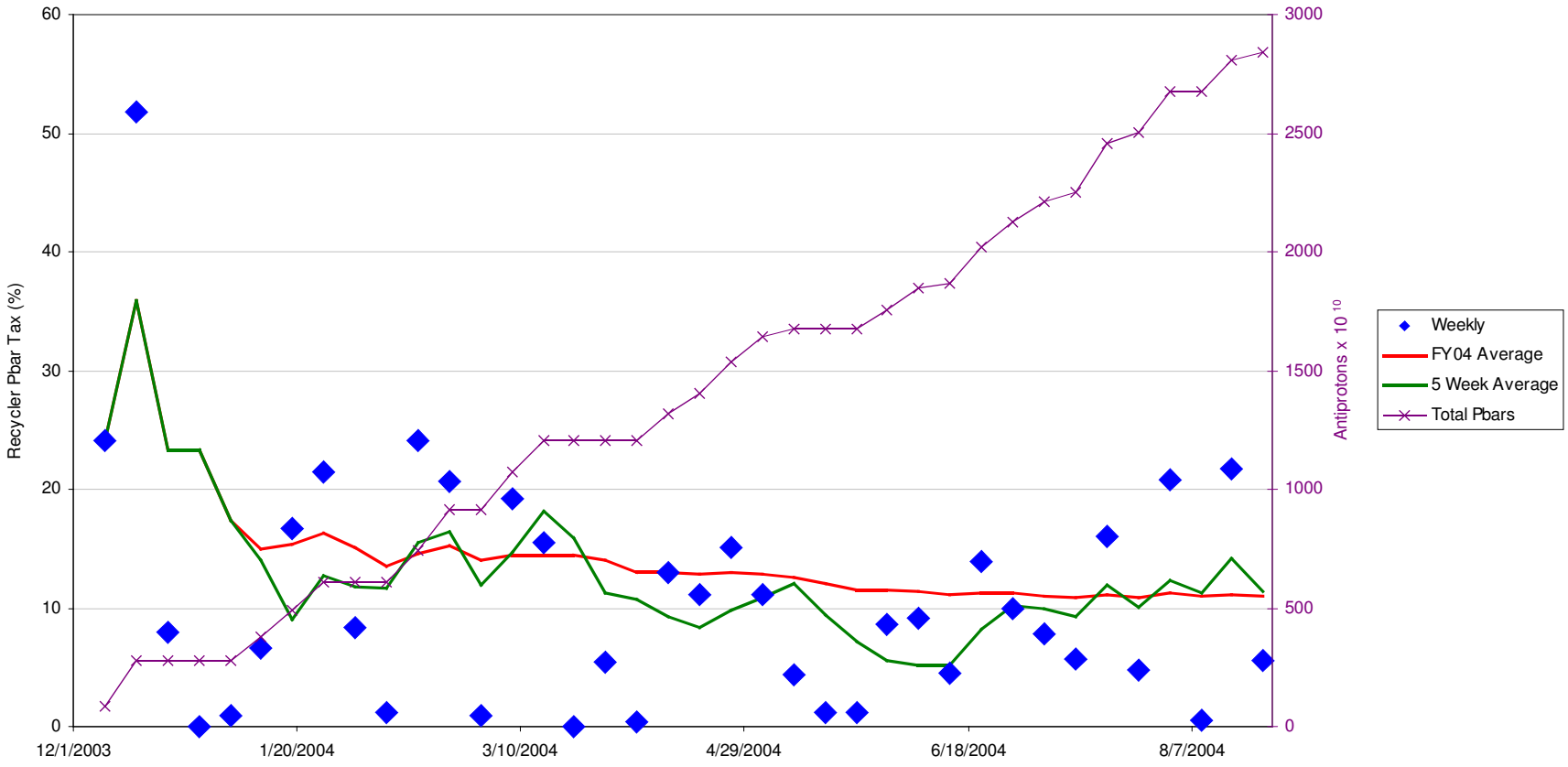
Pbar Studies

Date	Duration (Hr)	Description
8/16/2004	2.5	D/A studies while stacking
8/17/2004	1.6	D/A studies while stacking
8/18/2004	8.2	Reverse protons, Debuncher aperture and documentation
8/21/2004	7.0	D/A studies while stacking
8/21/2004	0.5	Tune measurement while ramping to shot lattice
8/21/2004	1.3	Tunes across aperture and flying wires
	21.1	Sum for Week
	553.5	Sum for Year
	14.7	Average Per Week

TEV Studies

Date	Duration (Hr)	Description
8/16/2004	3.6	Orbit smoothing and check-out
8/17/2004	0.6	End of store, 12Hz orbit compensation
8/19/2004	3.9	Coupling, E0 collimator and documentation
8/22/2004	0.0	New B2 algorithm
	8.1	Sum for Week
	626.2	Sum for Year
	16.5	Average per Week

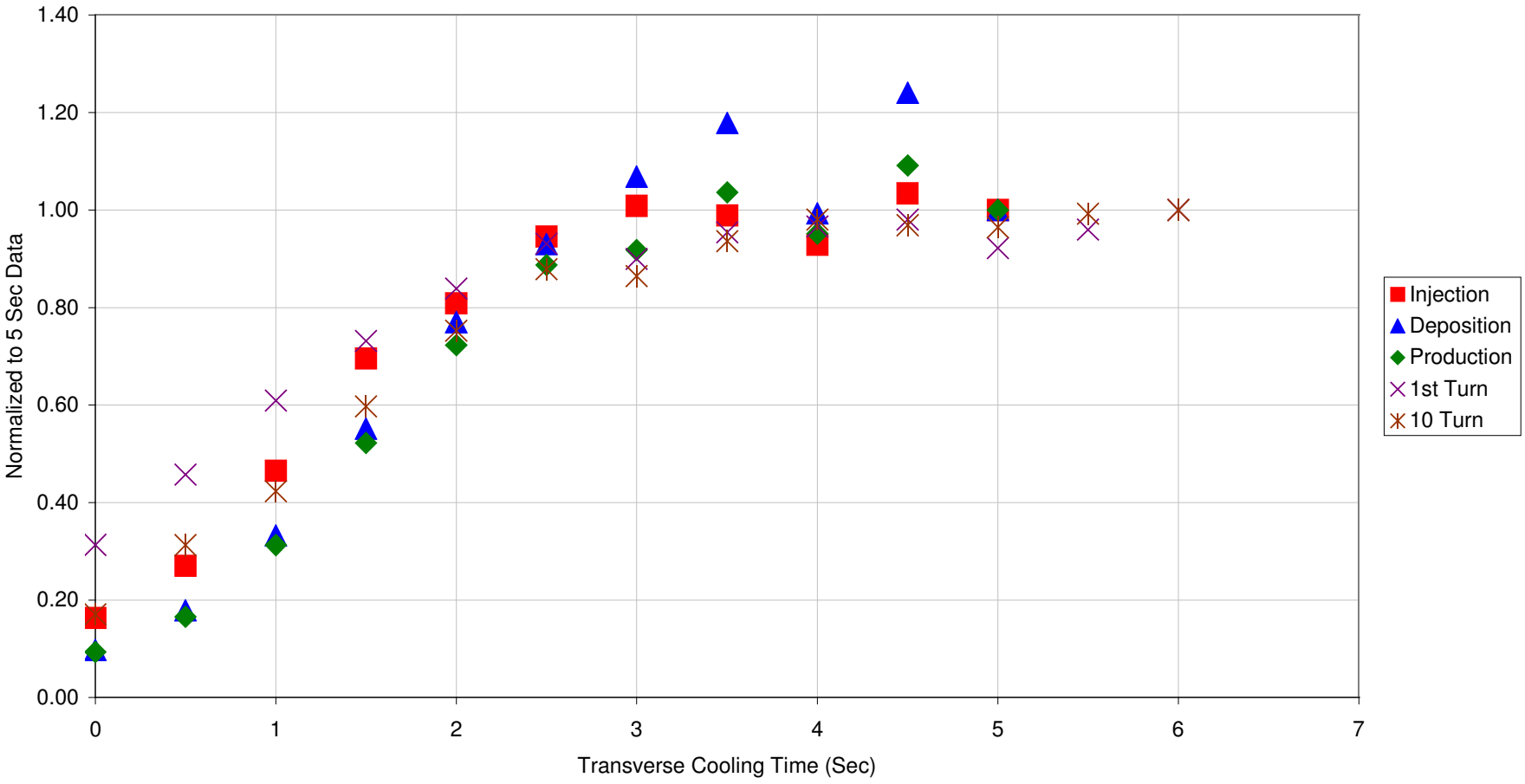
Recycler Pbar Tax



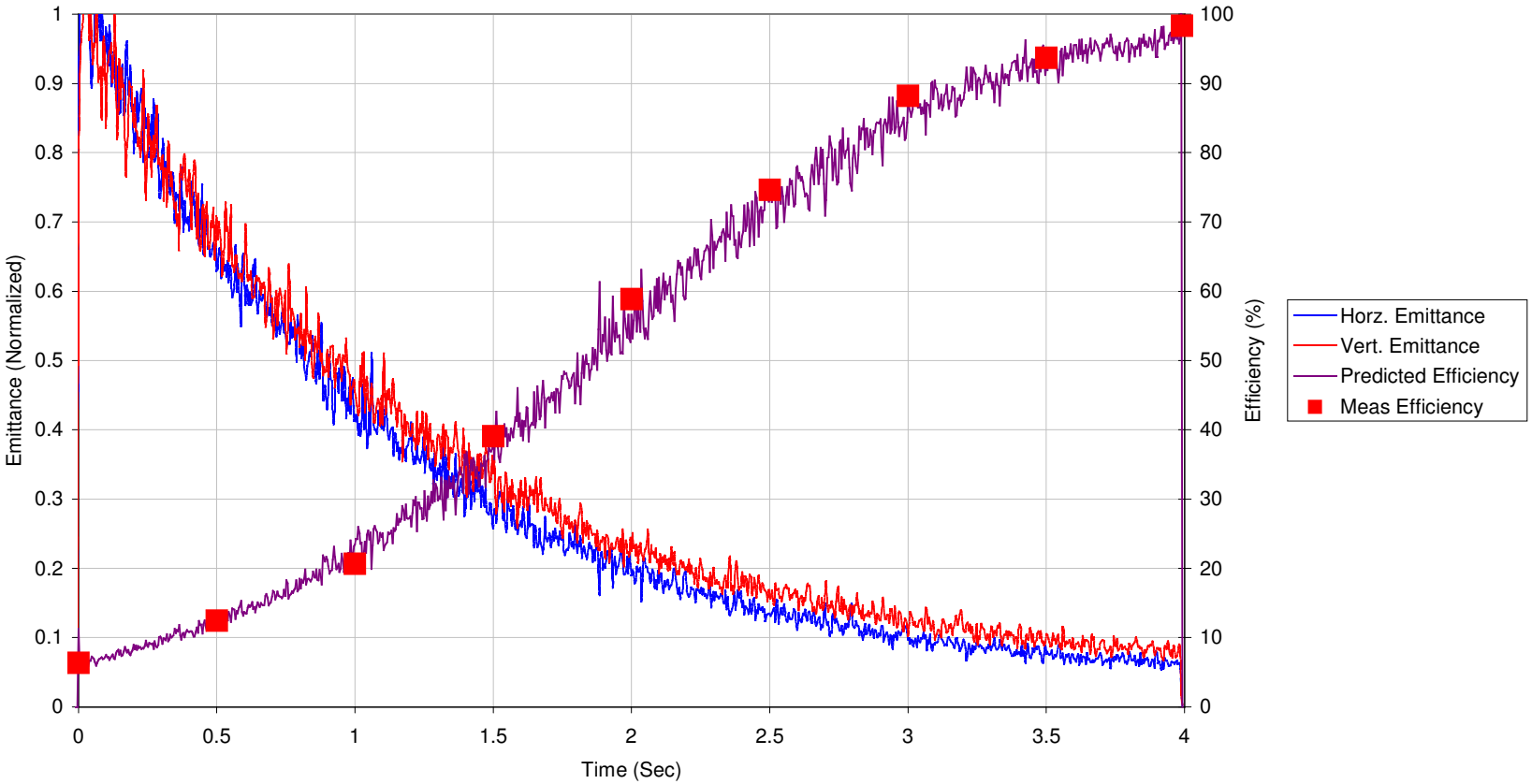
Pbar Production

- We have achieved almost every goal for FY04 with the exception of Pbar production
- Main Injector Project: More Pbars
  - projected - 3.3x
    - More protons on target - 2x ($5x10^{12}/2.5x10^{12}$)
    - Faster Pbar cycle rate - 1.6x (2.4sec/1.5sec)
  - delivered – 2.1x
    - More protons on target – 2.1x ($5.4x10^{12}/2.5x10^{12}$)
    - Faster Pbar cycle rate - 1x (2.4sec/2.4sec)
- Pbar Production
  - Goal for this year was $18x10^{10}$ pbars/hr
  - We are at $13.5x10^{10}$ pbars/hr
  - We have finished an extensive pbar plan that has checked and/or upgraded almost all of the cooling systems in the Antiproton Source
    - The present systems in their current configuration should be able to handle a flux of $29x10^{10}$ pbars/hr
  - We have recently narrowed the problem down to an measurements that imply an extremely small effective "aperture" in the transfer line between the Debuncher to Accumulator
    - Direct measurements are very difficult because of the very small amount of pbars transmitted through this line

Pbar Production vs Debuncher Cooling Period



Pbar Production and Debuncher Emittance vs Debuncher Cooling Period



Plans for FY05

- Install electron cooling in the Recycler in Fall '04 shutdown
- Run Slip Stacking at 8×10^{12} protons/pulse every 2 secs
- Increase the pbar production aperture by 25%
- Stack at small stacks with a rate of 26×10^{10} pbars/hr
- Run the complex in Mixed Pbar operations
  - Assume the gain from Mixed Pbar operations is "break-even" (pessimistic?)
- Commission electron cooling for operations by the end of FY05

Accelerator Focus

		Luminosity Parameters				
Parameter	Best Store	Best of FY04	Best of FY03	FY04 (End) Design	FY05 (End) Design	
Initial Luminosity (Average)	102.8	87.6	43.7	61.9	99.3	$x10^{30}cm^{-2}sec^{-1}$
Integrated Luminosity per Store (Averaged)	4241	3221	1518.5	2000	3500	nb^{-1}
Luminosity per week (Averaged)	-	-	-	11.3	17.4	pb^{-1}
Store Length	32.4	26.7	17.8	15.0	20.0	Hours
Store Hours per week	-	-	-	85	100	Hours
Shot Setup Time	2.4	2.6	2.1	2.2	2.6	Hours
		TEVATRON Parameters				
Parameter	Best Store	Best 10 stores Average	End of FY03	FY04 (End) Design	FY04 (End) Base	
Protons per bunch	246	249	241.2	260	260	$x10^{9}$
Antiprotons per bunch	43	36	25.6	31	44	$x10^{9}$
Proton Efficiency to Low Beta	85	77	54.8	-	-	%
Pbar Transfer efficiency to Low Beta	86	81	63.5	80	76	%
HourGlass Factor	0.66	0.67	0.6	0.65	0.65	
Initial Luminosity Lifetime	5.2	6.0	8.9	8.3	6.4	hours
Asymptotic Luminosity Lifetime	17.7	19.3	23.7	25.0	25.0	hours
Effective Emittance	16.9	17.0	22.4	21.0	18.5	π-mm-mrad
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Average Stacking Rate	6.8	6.4	7.8	9.3	10.4	$x10^{10}$/hour
Stacking Time Line Factor	86	78	94.8	75	75	%
Stack Size at Zero Stack Rate	309	321	299.7	300	300	$x10^{10}$
Protons on Target	5.3	5.2	5.1	5.0	8.0	$x10^{12}$
Start Stack	198	179	158.8	155	231	$x10^{10}$
End Stack	17	18	12.9	15	23	$x10^{10}$
Unstacked Pbars	181	161	145.9	140	208	$x10^{10}$