Run 2 PMG

Jim Morgan

January 19, 2005

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

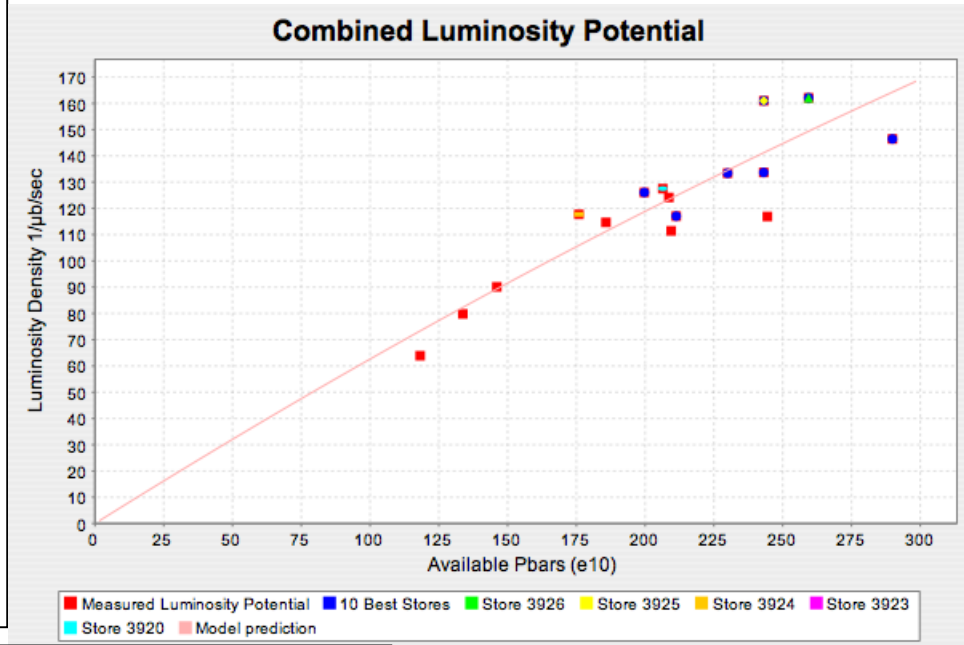
Peak Luminosity and Pbar Efficiency

5 Store Running Average

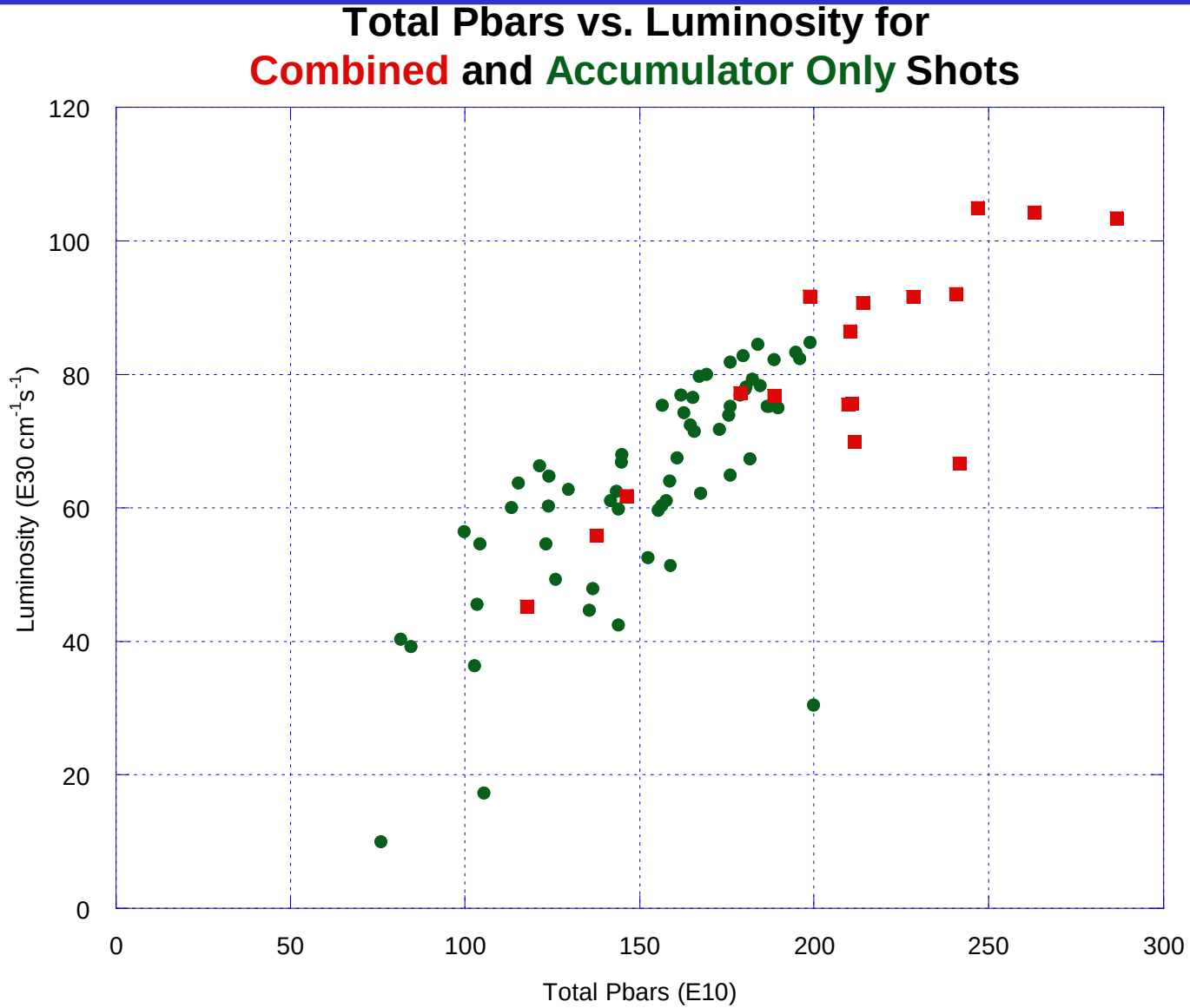
Collider Transmission Efficiency*

Transverse Emittances

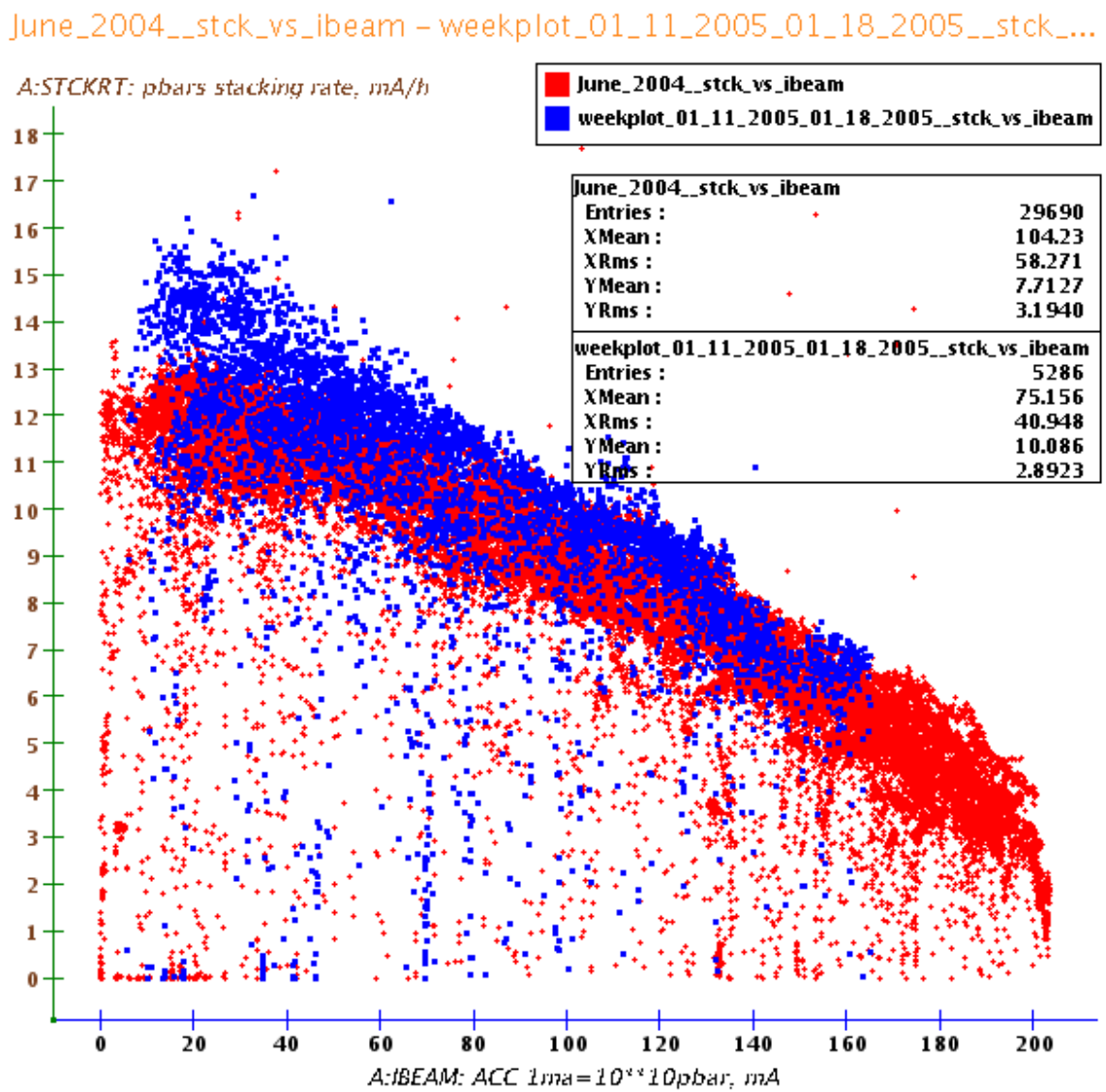
Luminosity Potential



Combined Shot Performance



Stack Size vs. Stacking Rate



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)	103.9	104	72	92	57	71.1	96.1	80.7	$x10^{30}cm^{-2}sec^{-1}$
Integrated Luminosity per Store (Avera	1010.6	4546.4	2647.9	3169.8	1962.2	2660	3369	3190	nb^{-1}
Luminosity per week (Averaged)	-	-	14.4	-	9.6	11.8	16.8	12.7	pb^{-1}
Store Length	3.3	31.8	24.7	24.5	20.2	24.5	20	25	Hours
Store Hours per week	-	-	134	-	99	108.3	100	100	Hours
Shot Setup Time	3	3.1	3	2.7	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	236.4	230.1	219.6	246.5	209.9	247.3	260	260	$x10^{9}$
Antiprotons per bunch	39.3	40.5	31	37.2	26.3	30.1	42	34	$x10^{9}$
Proton Efficiency to Low Beta	64.6	62.9	65.7	74	59.7	72.7	-	0	%
Pbar Transfer efficiency to Low Beta	65	206.6	85.61	69.3	75.9	88.6	76	74	%
HourGlass Factor	0.67	0.67	0.69	0.67	0.67	0.68	0.65	0.65	
Initial Luminosity Lifetime	0.0.0.0.0.0H	0	0	0	0	0	0	0	hours
Asymptotic Luminosity Lifetime	0.0.0.0.0.0H	0	0	0	0	0	0	0	hours
Effective Emittance	14.7	14.7	16	16.6	16.3	18.1	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	15.1	12.9	12.3	12.6	11.3	18.6	24.5	14	$x10^{10}$/hour
Normalized Zero Stack Stack Rate	2.4	2.2	2.1	2.3	2.1	2.3	3.1	2.3	$x10^{-2}$/hour
Average Stacking Rate	8.2	5	6	6.1	6.2	6.2	10.1	6.6	$x10^{10}$/hour
Stacking Time Line Factor	89.9	54.4	69.4	76.5	76.1	77.9	75	75	%
Stack Size at Zero Stack Rate	268.4	326.2	397.8	301.6	365.6	325.8	300	300	$x10^{10}$
Protons on Target	6.2	5.9	5.9	5.3	5.4	5.3	8	6.2	$x10^{12}$
Start Stack	259.7	243.4	190.6	225.7	153.8	170.7	216	181	$x10^{10}$
End Stack	41.5	34	20.8	27.4	13.2	15.8	15	15	$x10^{10}$
Unstacked Pbars	218.2	209.4	169.8	198.3	140.6	154.9	201	166	$x10^{10}$

Tev Studies

Date	Duration (Hr)	Description
12/16/2004	1.0	Orbit measurements
12/18/2004	6.5	Octupole/stability
12/18/2004	4.0	Reduce helix by 10%
12/19/2004	3.5	Tune/chromaticity stability at 150 GeV
12/20/2004	7.0	Octupole/stability
12/20/2004	1.0	Decoupling
12/21/2004	2.5	Decoupling/150 GeV lifetime
12/22/2004	1.0	Abort gap monitor check-out
12/29/2004	6.0	Octupole/stability
12/31/2004	4.0	Parse of squeeze
1/2/2005	1.1	Moist squeeze for beam measurements
1/5/2005	13.5	Orbit, tune and chromaticity adjustments after power outage
1/5/2005	3.3	Aperture scans and shottky saturation investigation
1/7/2005	0.3	Thin flying wires
1/7/2005	1.0	Separator scans
1/7/2005	1.2	Wet squeeze for separator measurements
1/8/2005	9.2	Octupole studies and quench recovery
	28.5	Sum for Week
	91.1	Sum for Year
	19.3	Average per week

Pbar Studies (Dedicated)

Date	Duration (Hr)	Description
12/8/2004	1.0	D/A adjustments during shot setup
12/8/2004	0.8	Flying wires
12/13/2004	0.3	Flying wires
12/13/2004	9.0	Revese protons, Debuncher aperture
12/14/2004	2.3	Debuncher cooling
12/15/2004	0.5	Debuncher cooling
12/16/2004	4.8	Reverse protons, Debuncher aperture
12/21/2004	0.5	AP-2 optics/aperture
	0.0	Sum for week
	19.2	Sum for year
	4.1	Average per week

Accomplishments Since the Last PMG

- Routine running of Combined Shots
  - Recycler is now operational
  - Record luminosity of $105 \times 10^{30} cm^{-2} sec^{-1}$
  - Potential for fast average stacking
    - Have to work on transfer time and transfer efficiency
- Routine running of slip-stacking
  - Averaging over 6×10^{12} protons on target
  - Have achieved stack rates of over 14×10^{10} pbars per hour
- IP Move at CDF (mostly in parallel with recovery from power outage)
- Record number of store hours per week
  - Separator problem seems to have settled down
- Running at record throughput for MiniBoone
- Routine running of Mixed Mode for SY120 with slip-stacking for pbar production

Focus for the Next PMG

- Pbar stacking is behind schedule.
  - Our stacking records are due to slip-stacking protons on target.
    - Protons on target have increased by at least 20% and we're only stacking 10-15% better.
  - None of our stacking improvements have come from increased rep-rate
    - No improvement yet on D/A transfer.
  - Our progress on the AP2-Debuncher apertures, as far as increasing the stacking rate, has been slow.
- We are developing a new approach for our study effort for pbar.
  - Pbar study strategy will shift from reverse proton studies to forward pbar studies
    - Will permit more study time
      - Easier to schedule
      - Less disruptive to operations
    - Concentrate on increasing directly the stacking rate
  - Reverse proton studies will be needed but used sparingly
- Increasing the amount of pbar studies will put more pressure on us to run our stores long and to minimize TEV studies in order for us to stay on the red curve.

Examples of Forward Pbar Studies

- AP2 – Debuncher Aperture
  - Build an intensity measurement system in the Debuncher by bunching the beam with the adiabatics.
  - Quad steering in the AP2 line using the Debuncher TBT.
  - Three bump around the Debuncher using presently verified 3 bumps and intensity monitor system.
  - Measure the Debuncher Injection kicker separation versus kicker voltage with the SEM
- D/A Line Studies
  - Get D/A SEMs working in forward pbar mode.
  - DRF2 slope removal.
  - Measure the Debuncher extraction septum apertures.
  - Find optimum Debuncher extraction kicker voltages
  - Align beam in center of quads using Acc. TBT (or D/A forward BPMs) and quad shunts
- Stacktail Cooling
  - Stacktail kicker tank moving.
  - Develop the deposition orbit stacktail schottky signal power technique for tuning leg 1 of the stacktail
  - Develop the deposition orbit stacktail schottky signal power technique for tuning the stacktail gain.

Examples of Reverse Proton Studies

- AP2 – Debuncher Aperture
  - Align Debuncher Injection Septum
  - Verify the rest of the three bumps in the Debuncher
  - Commission DEX Bump
- D/A line
  - Map Accumulator injection septa channel apertures
  - Find optimum Accumulator injection kicker voltages
  - Measure the lattice transfer function