FY03 Goals, Constraints, Strategies

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Director's Run II Review
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FY03 Integrated Luminosity Goals

Base goals:

- 200 pb^{-1} 10/1/02 – 10/1/03

(this implies an average of 5 pb^{-1}/week over 40 weeks)

For example: 5 stores/week @ 16 hours/store @ peak luminosity of 3.0E31 $cm^{-2}sec^{-1}$

- 10 pb^{-1}/week by 10/1/03 (current record is 6.7 pb^{-1}/week)

For example: 5.5 stores/week @ 16 hours/store @ peak luminosity of 5.4E31 $cm^{-2}sec^{-1}$

Stretch goals:

- 320 pb^{-1} 10/1/02 – 10/1/03

(this implies an average of 8 pb^{-1}/week over 40 weeks)

For example: 5 stores/week @ 16 hours/store @ peak luminosity of 4.8E31 $cm^{-2}sec^{-1}$

- 15 pb^{-1}/week by 10/1/03

For example: 6 stores/week @ 16 hours/store @ peak luminosity of 7.6E31 $cm^{-2}sec^{-1}$

Above numbers assume no improvement in luminosity lifetime

FY03 Luminosity Parameter Status and Goals

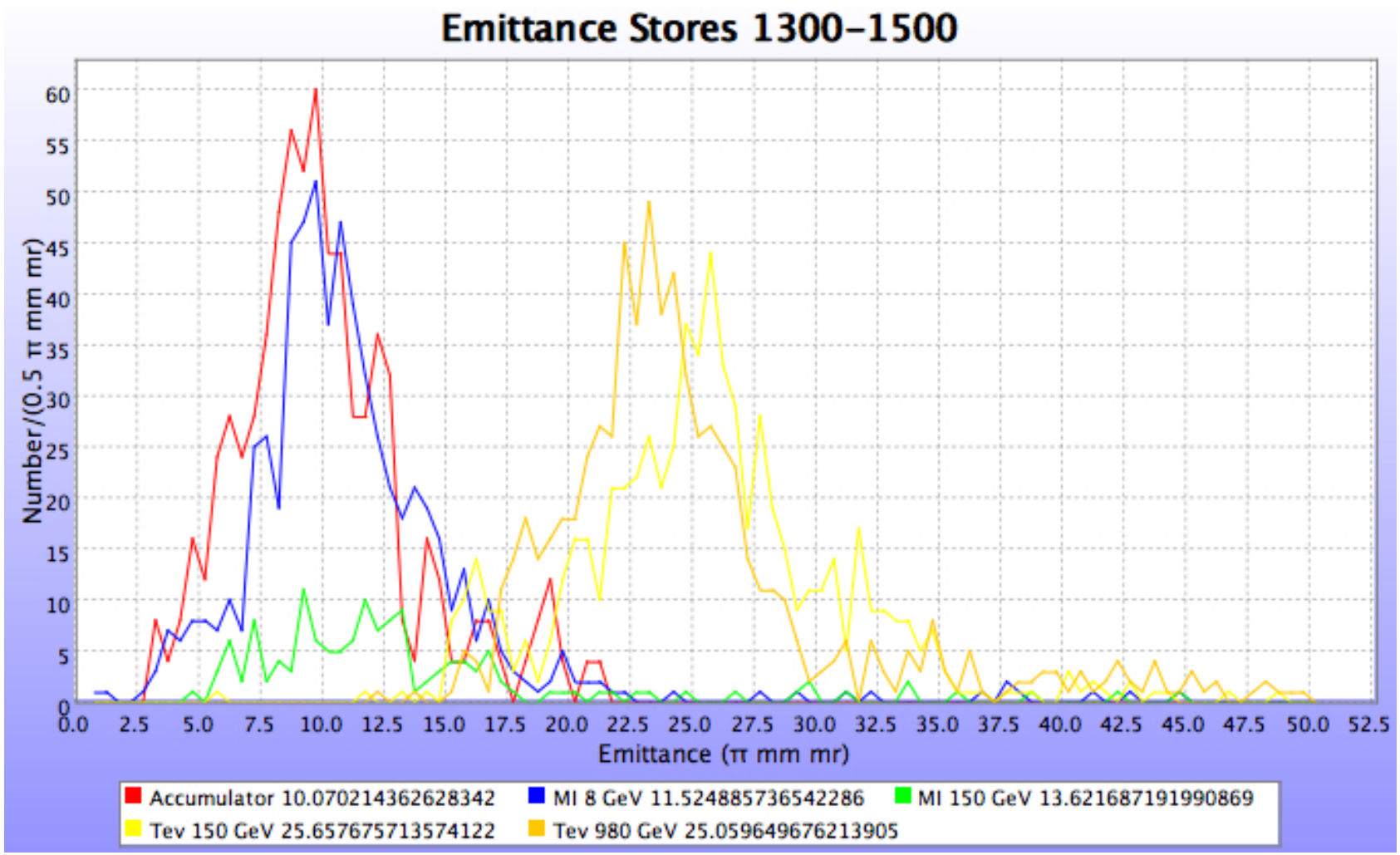
	Best store to date	FY03 goals	Run IIa goals
max. antiproton stackrate (E10/hr)	12.4	18	18
max. antiproton stacksize (E10/hr)	142	140	165
Accumulator extraction efficiency	.92	.90	.90
pbar xfer eff.	.65	.70	.80
pbars/bunch at low beta (E9)	23.8	27.3	33.0
protons/bunch at low beta (E9)	172	200	270
emit. at low beta (π-mm-mrad)	16.8	16.9	17.5
peak luminosity (E31 $cm^{-2}sec^{-1}$)	3.61	5.4	8.6
Long. Emittance (eV-sec)	5.3	3.0	2.5

Proton and Pbar Efficiencies

Shot Summary, store 1836, Wed Oct 09 05:58:21 CDT 2002,
Initial Stack Size = 142.7875 E10

	Proton Intensity E9	Step Efficiency %	Cumulative Efficiency %	Pbar Intensity E9	Step Efficiency %	Cumulative Efficiency %
Accumulator				1308.00		
MI 8Gev	12625.47			1276.72	97.61	97.61
MI 150Gev	12573.59	99.59	99.59	1281.61	100.38	97.98
Coalescing	9969.54	79.29	78.96	1086.13	84.75	83.04
Inject Protons	8893.86	89.21	70.44			
Pbar Injection porch	8685.24	97.65	87.12			
Inject Pbars	7109.04	81.85	71.31	1065.11	98.06	81.43
Before Ramp	7089.89	99.73	71.12	987.18	92.68	75.47
Flattop	6648.10	93.77	66.68	916.65	92.86	70.08
Squeeze	6368.24	95.79	63.88	874.94	95.45	66.89
Initiate Collisions	6335.31	99.48	63.55	877.54	100.30	67.09
Remove Halo	6235.34	98.42	62.54	858.14	97.79	65.61
HEP	6229.06	99.90	62.48	855.48	99.69	65.40
Initial Luminosity	37.10	CDF		34.64	DZero	
Shot Setup Time	172.62	min				

Pbar Emittances



Antiproton Source FY03 Goals

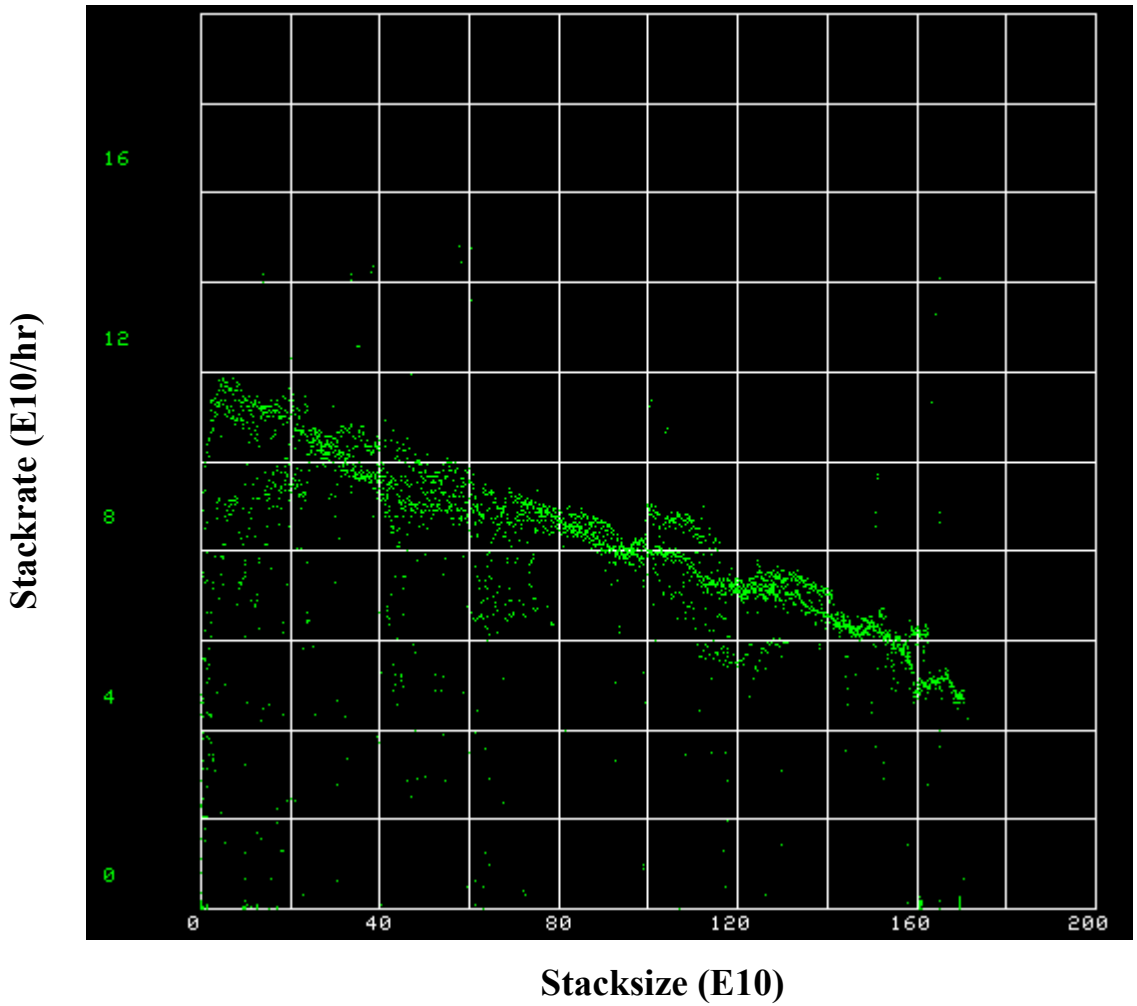
FY03 Goals:

Peak stack rate of 18E10/hr

Stack to 200E10 in 20 hours

Reduced emittances for shots

Current Stacking Performance: Stackrate vs.Stacksize



Proton Source FY03 Goals

Proton Source is currently capable of supporting RunIIa goals for Collider protons.

Proton Source is currently capable of 90% of Run IIa goals for antiproton stacking cycles. Goal for FY03 is 100%.

Proton Source upgrades for FY03 are primarily aimed at providing increased intensity to the MiniBooNE experiment without increasing losses.

MI FY03 Goals

Reduce longitudinal emittance growth on $2B and $29 cycles (protons to Tevatron and protons to pbar target) – build longitudinal dampers

Achieve a 90% coalescing efficiency for high intensity protons (currently at 80-85%)

Install and commission hardware upgrades for 2.5Mhz operation

(Intensity on $29's (stacking cycles) can probably be reached with increased Booster intensity)

Tevatron FY03 Goals

Improve MI→ Tevatron transfers (smaller emittance)

Commission transverse and longitudinal dampers (higher proton intensity)

Remove C0 Lambertson magnets, open 150 GeV helix (mitigates long-range beam-beam)

Modify A0 straight section (mitigates long-range beam-beam

Understand source of instabilities and emittance growth

Understand beam-beam effects

Recycler FY03 Goals

Improve vacuum by at least a factor of 3

Improve Accumulator → Recycler transfer efficiency to >90% (currently at ~80%)

Develop Accumulator→Recycler fast transfer techniques

Improve Recycler RF manipulations to reduce longitudinal emittance growth

Build, install, and commission new BPM system

Improve diagnostics and software in general

<u>Fully commission the Recycler for luminosity production from 200E10 pbar stacks</u>

Other FY03 Goals

Improve reliability

Over the last 10.5 months:

27% of stores end unintentionally (abort or quench or both) – the unattainable goal is 0%; a reasonable goal is 15%

70.5 hrs/week of store time – goal is 90 hrs/week

Develop a complete data acquisition and analysis system

Constraints in FY03

Experimenters want maximum integrated luminosity for Summer conference

Dedicated studies are limited to ~5 shifts every other week (Lab management decree)

Recycler requires substantial #'s of antiprotons for commissioning

Key personnel are required on several projects

At least a 6 week shutdown is required for

Recycler vacuum upgrade
C0 Lambertson replacement
A0 straight section modification
Miscellaneous infrastructure maintenance tasks
Many other smaller installation/upgrade tasks

M&S items over ~10K$ each have been identified for a total over 2.7M$

MiniBooNE operation has not had a significant effect on Collider operations

Short Term Strategy

Now to January shutdown:

- **Continuing cooling improvements in the Accumulator and Debuncher – should yield higher stacking rates**
- **Pbar coalescing improvements in MI – should yield 90% coalescing efficiency and improved Acc → low beta pbar efficiency**
- **1st pass at longitudinal mode damper for protons in MI – should yield smaller proton longitudinal emittances in Tevatron**
- **Lattice match in MI→Tev beamline; improved injection oscillation correction – should lead to smaller pbar transverse emittance and improved Acc → low beta pbar efficiency**
- **Completion of Tevatron transverse dampers – should yield higher proton intensities at low beta**
- **Continue dedicated Tevatron studies on instabilities, emittance growth, and beam-beam effects**
- **Continue parasitic Recycler commissioning with protons**
- **"Shots off the bottom" – send last 10% of each pbar stack to the Recycler for continuing commissioning; shoot large stacks of pbars to the Recycler every other week**
- **Store and cool 200E10 antiprotons in the Recycler**
- **Continue preparations for January shutdown**

"January" shutdown

Experimenters (at least CDF) are lobbying for delaying the "January" shutdown until June

Major tasks are:

1) Recycler vacuum improvements (we are prepared)

2) Tevatron C0 Lambertson replacement (we are prepared)

3) Tevatron A0 straight section modification (long lead-time item might nix this)

Also:

1) Infrastructure maintenance (heat exchangers, power feed cables, ...)

2) NUMI installation

3) Shielding around B0 low beta quads

4) Tevatron vacuum improvements

5) Numerous smaller installations/upgrades in all tunnel enclosures

Strategy after shutdown

- **Commission new helix in Tevatron – should yield higher Acc → low beta pbar efficiency and improved proton lifetime at 150 GeV**
- **Continue dedicated Tevatron studies on instabilities, emittance growth, and beam-beam effects**
- **Continuing cooling improvements in the Accumulator and Debuncher – should yield higher stacking rates and smaller pbar emittances**
- **Commission new Recycler BPMs**
- **Continue parasitic Recycler commissioning with protons**
- **"Shots off the bottom" – send last 10% of each pbar stack to the Recycler for continuing commissioning; shoot large stacks of pbars to the Recycler every other week**
- **Store and cool 200E10 antiprotons in the Recycler**
- **Commission pbar fast transfers from Acc-->Recycler**
- **Build and install new BPMs for MI – required for 2.5MHz operation in MI**
- **Commission 2.5MHz operation in MI**
- **Commission full damper system in MI – should yield reduced proton longitudinal emittance at low beta and increased stacking rate**
- **More resources should become available by summertime for longer term ("Run IIb") projects**

Recycler Integration

Recycler integration – ie., routinely stack antiprotons in the Recycler and shoot antiprotons from the Recycler to the Tevatron – will require substantial dedicated study time. This is accounted for in the luminosity profile for FY03.

A critical question to be answered after the vacuum upgrade is "What will be the antiproton equilibrium emittance for large stacks in the Recycler?"

It is felt that this integration can commence next summer.

Antiproton recycling will probably not become operational in FY03.

The Recycler project is now receiving substantial assistance from outside the Beams Division, including assistance at the management level.

Summary

Run IIa FY03 activities are being "projectized". Project leaders are assigned, tasks are defined, and resources (personnel, study shifts, $$'s) are being assigned to tasks. Substantial help is being provided from outside the Beams Division. This formal plan will be presented in a talk this afternoon.