

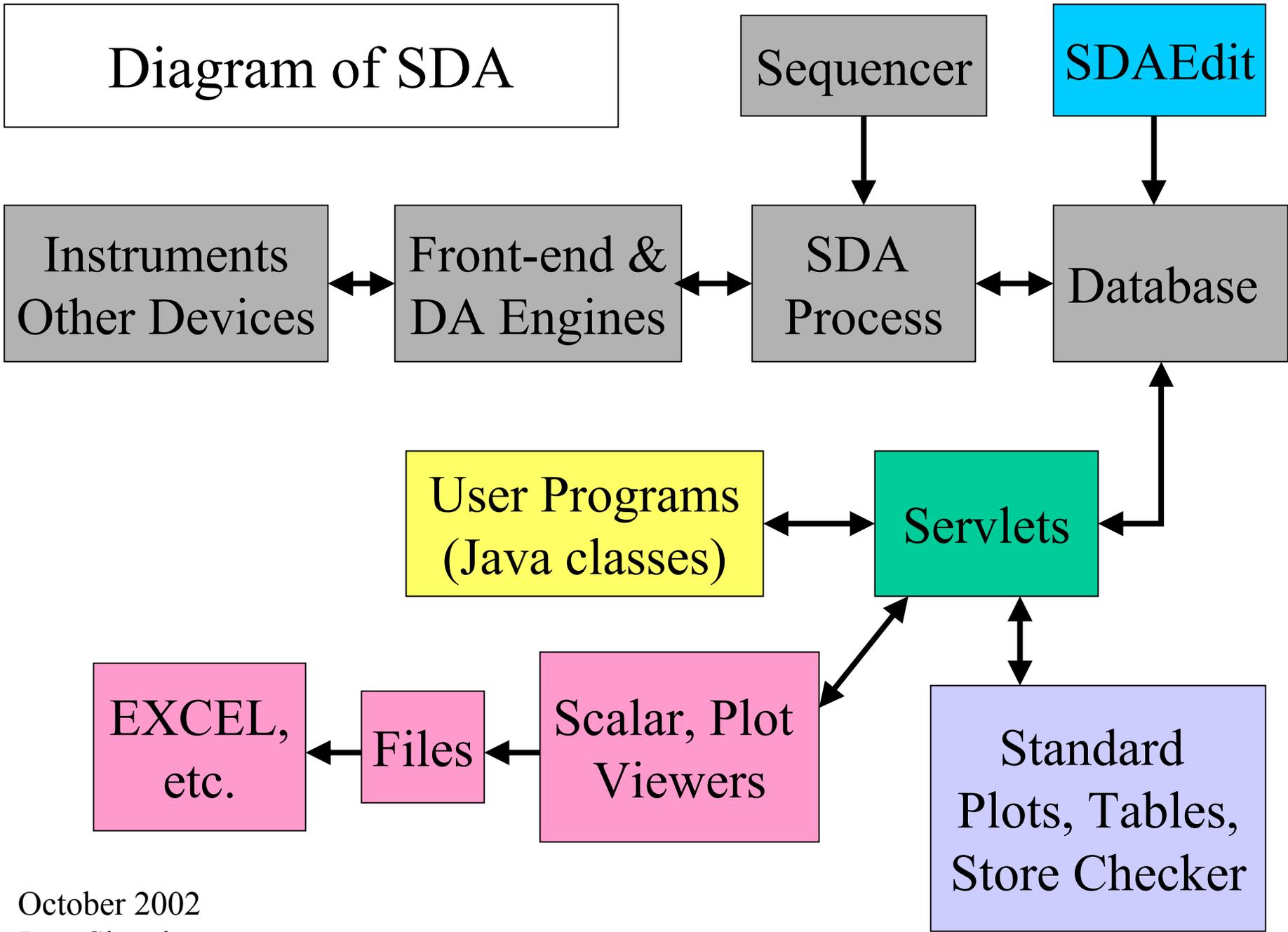
# SDA – Shot Data Analysis

## Outline

- Description of SDA
- Examples
- Plans for 2003

SDA is a system for acquiring, archiving and analyzing data from stores. It is complementary to special studies and the data loggers.

# Diagram of SDA



# Inputs to SDA

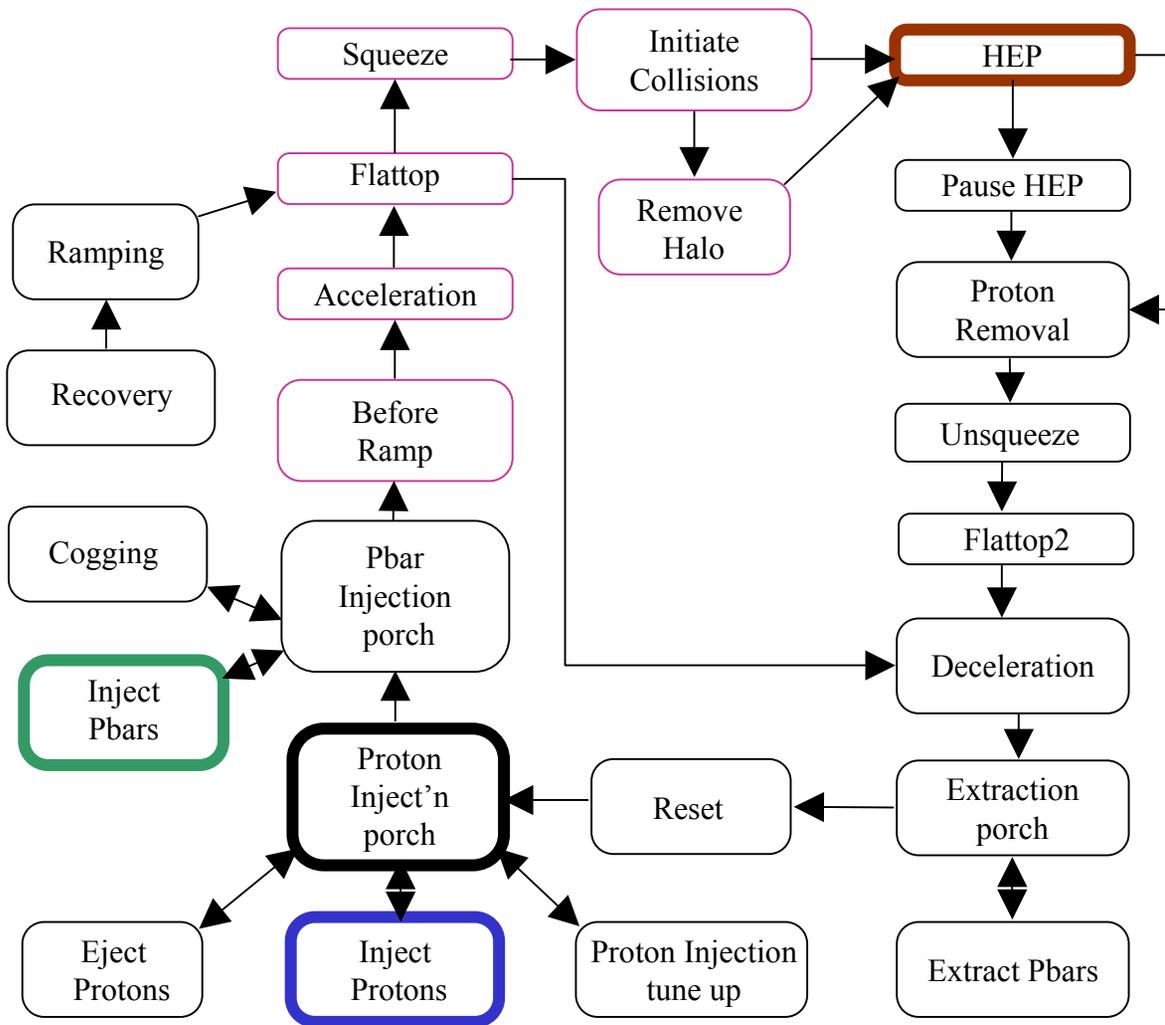
- Longitudinal, transverse emittances
- Intensities, DC and bunched
- Beam positions
- Settings
  - Magnets, collimators, etc.
  - Tunes, chromaticities
- Computed devices
- Data from CDF, D0
  - Luminosity
  - Losses
  - Luminous region position, size

# Cases and Sets

## Specifying when SDA data is collected

- Cases correspond to steps in a store
- Each case has a list of devices to read
- Sets are repeated data collections for a case
  - on a specific event, such as each proton bunch injection
  - at time intervals, e.g. every 10 minutes during HEP
- Readout times can be different for each device
- Cases can be concurrent

# Tevatron HEP Collider State Diagram



Cases and Sets

36 sets p injection  
 9 sets for pbar injection  
 set every 10 min - HEP

Not shown are MI,  
 Pbar Source,  
 Recycler States

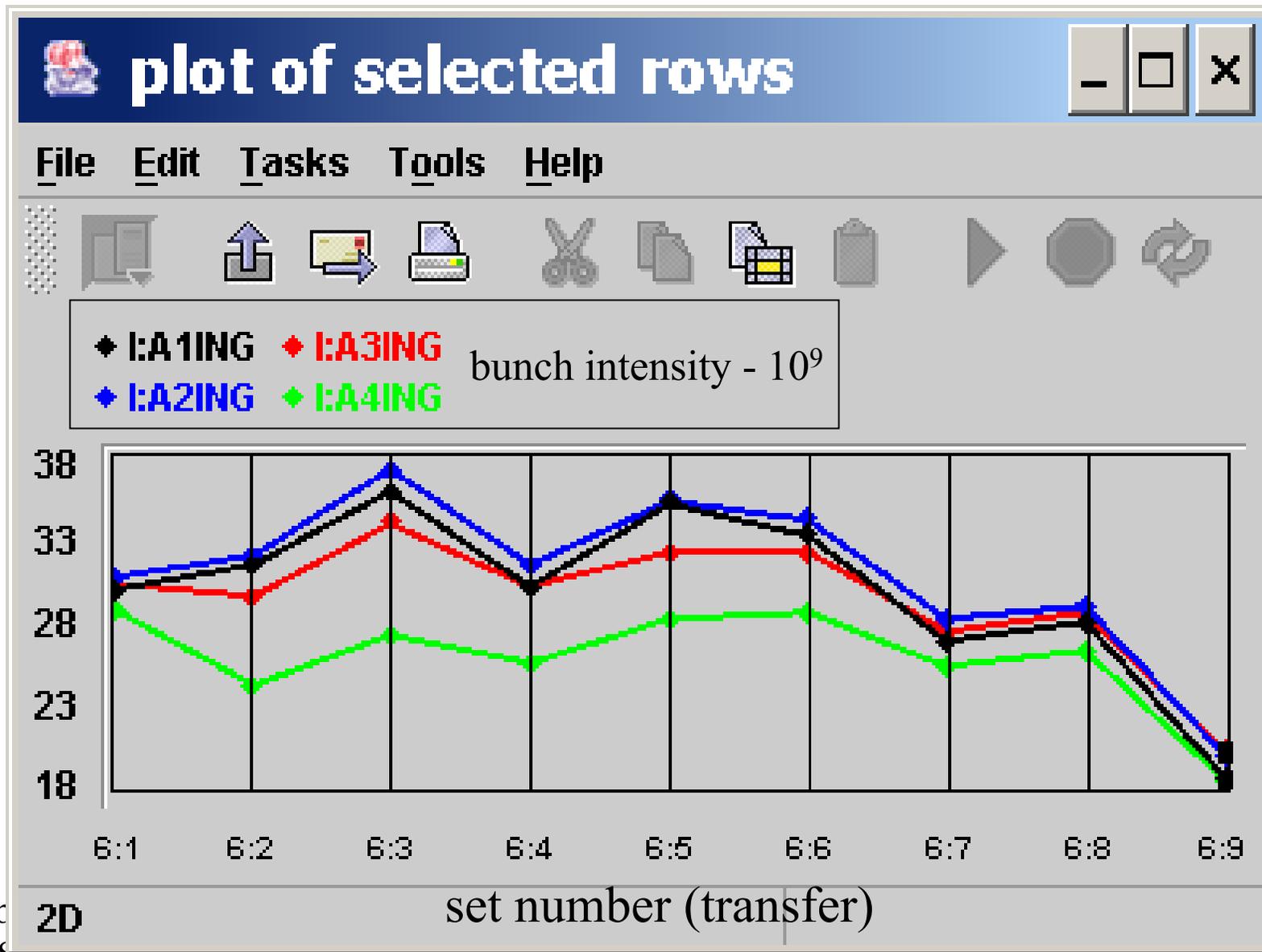
# SDA Viewer Window

## Case Unstack Pbars- Store 1843

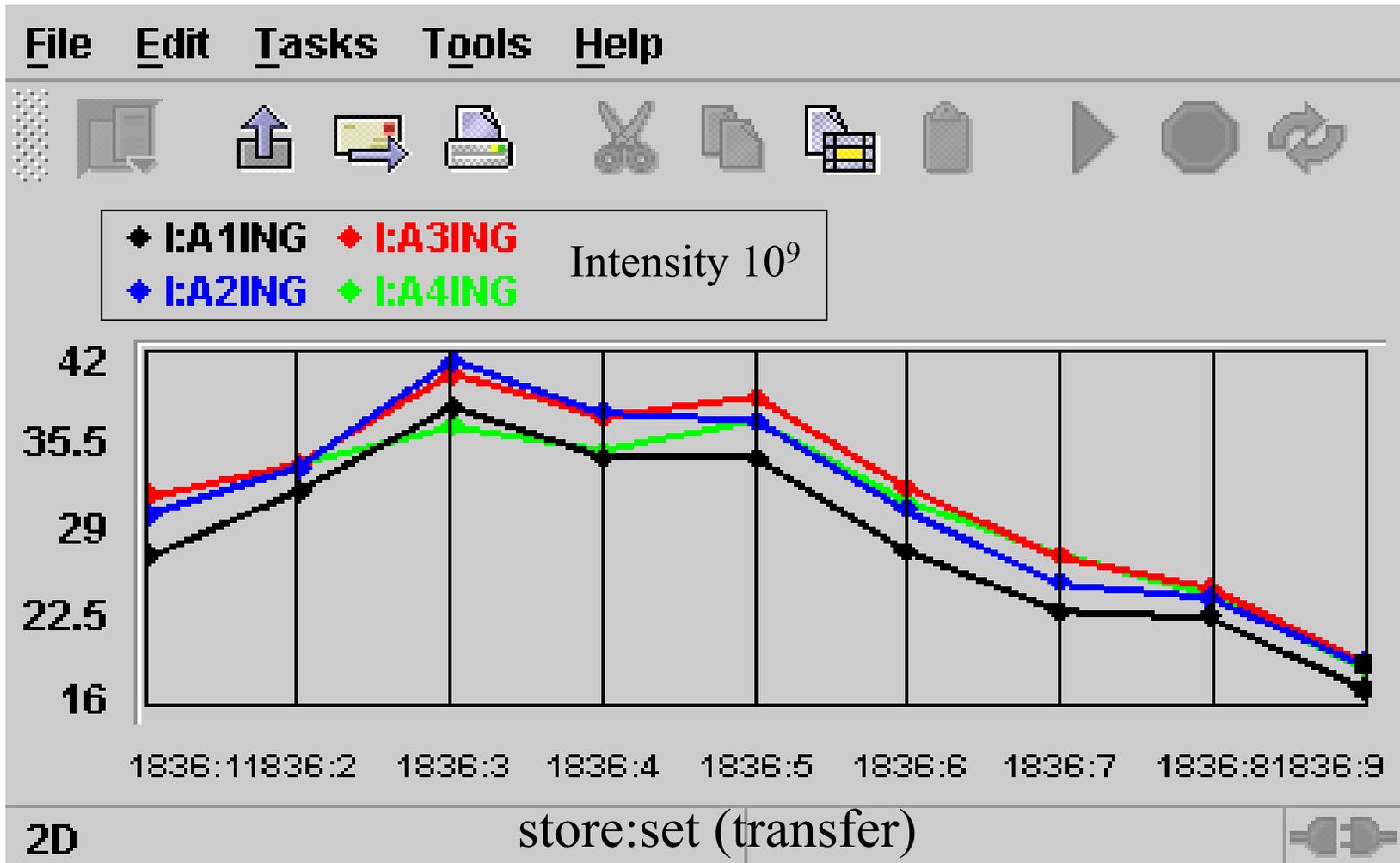
device	description	894:Unstac...							
A:BMFRAC	dbeam_fraction	0.109	0.128	0.153	0.173	0.212	0.24	0.291	0.31
A:CASE	SDA case alias	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
A:CENFRQ	Acc Center Rev Fre...	6.2893E5	6.2893E5	6.2893E5	6.2893E5	6.2894E5	6.2894E5	6.2894E5	6.2894E5
A:CINDEX	SDA collection inde...	2.0	12.0	22.0	32.0	42.0	52.0	62.0	72.0
A:EKIK	ACCUMULATOR EX...	58.186	58.186	58.186	58.186	58.186	58.186	58.186	58.186
A:EKIKP	A:EKIK F.P.FACTOR...	-0.082	0.038	-0.162	-0.122	-0.202	-0.162	-0.162	-0.202
A:EKIKTG	Acc Ex Kik 4222 Sta...	13.585	13.585	13.585	13.585	13.585	13.585	13.585	13.585
A:FILE	SDA shot/store nu...	894.0	894.0	894.0	894.0	894.0	894.0	894.0	894.0
A:FINDEX	SDA file index	15528.0	15528.0	15528.0	15528.0	15528.0	15528.0	15528.0	15528.0
A:FLOWPC	df_lower_pc	6.2893E5	6.2893E5	6.2893E5	6.2894E5	6.2894E5	6.2894E5	6.2894E5	6.2894E5
A:FUPPC	df_upper_pc	6.2891E5	6.2891E5	6.2891E5	6.2891E5	6.2891E5	6.2892E5	6.2892E5	6.2892E5
A:IBEAMB	Accum DCCT Big B...	169.188	152.988	137.587	118.387	98.988	77.988	57.988	39.988
A:R1LLPS	ARF1 VCO PHASE ...	214.75	214.75	214.75	214.75	214.75	214.75	214.75	214.75
A:R4CDPS	Arf4 Cavity Phase S...	-44.0	-44.0	-44.0	-44.0	-44.0	-44.0	-44.0	-44.0
A:R4HLPS	Arf4 Phase	-44.0	-44.0	-44.0	-44.0	-44.0	-44.0	-44.0	-44.0
A:R4LLPS	Arf4 Phase Shift	0E0							
A:R4MIPS	ARF-4 MI Phase Set...	-57.905	-57.905	-57.905	-57.905	-57.905	-57.905	-57.905	-57.905
A:RLLFS1	ARF h=1 Frequency...	6.2893E5	6.2893E5	6.2893E5	6.2893E5	6.2894E5	6.2894E5	6.2894E5	6.2894E5
A:SET	SDA set alias	1.0	2.0	3.0	5.0	6.0	7.0	8.0	9.0
A:SETTIM	SDA set arm time ...	7342.0	7456.0	7592.0	7834.0	7950.0	8054.0	8188.0	8288.0
A:STACKB	Accum Stack Before...	120.6	120.6	120.6	120.6	120.6	120.6	120.6	120.6

# Pbar Bunch Intensities in MI before Transfer

Case Inject Pbars - Store 1787

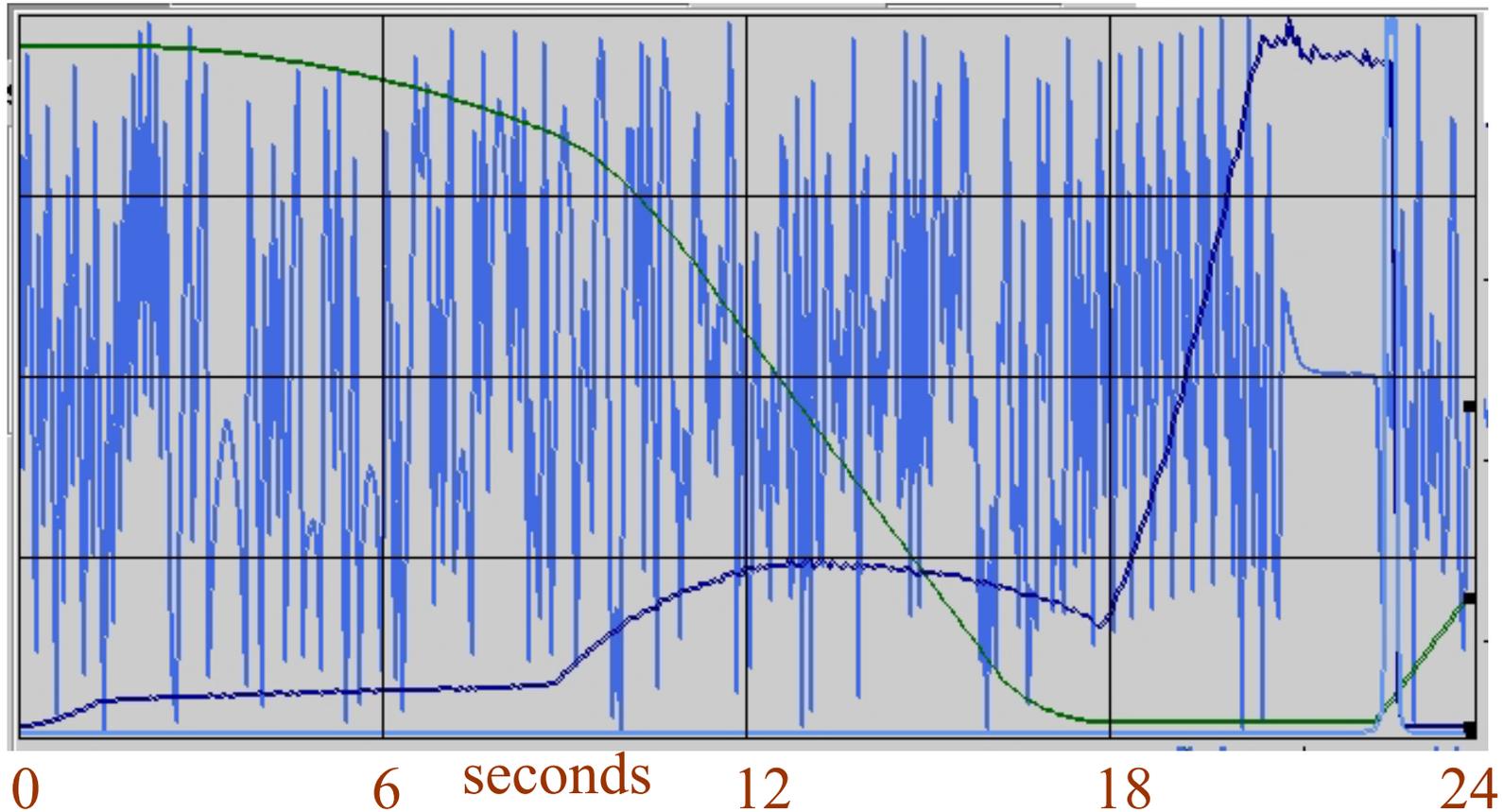


# MI Bunch Intensities After RF Compensation - Store 1836



# Snapshots and Fast Time Plots Capture High Frequency Data- (PlotViewer)

## Accumulator RF During Unstacking

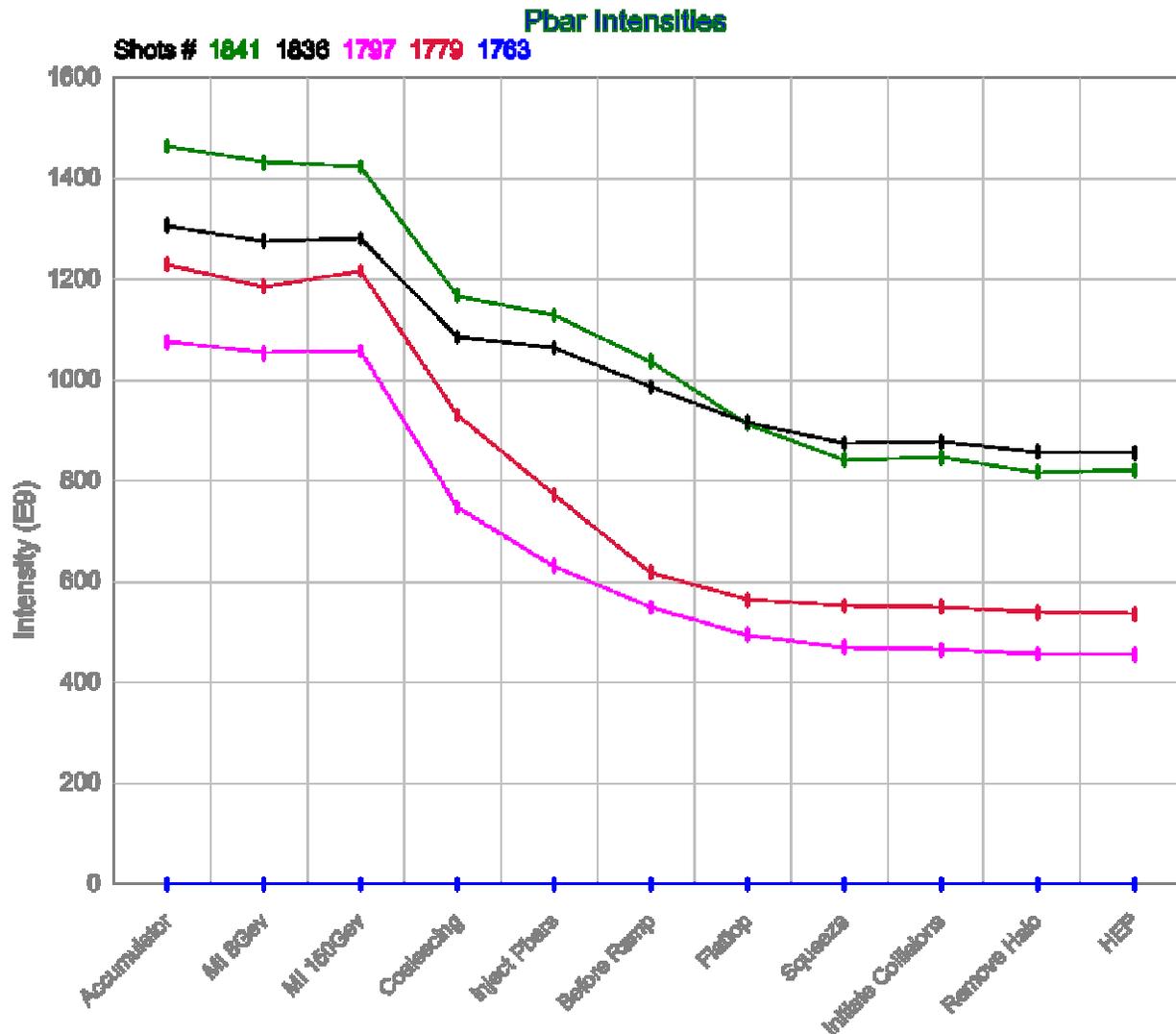


October 2002  
Jean Slaughter

RF4 cavity frequency, RF4 Cavity Volts 9

RF4 MI phase error, 53 MHZ

# Standard Plot for Pbar Intensities



# Store Checker

- Purpose
  - Monitor instrumentation and DAQ
  - Monitor accelerator performance
- Checks SDA data for specified cases/sets
  - $\text{Min} < \text{device value} < \text{max}$
  - $\text{Min} < (\text{difference in time of 2 devices}) < \text{max}$
  - $\text{Min} < (\text{difference in value of 2 devices}) < \text{max}$
- Jobs run automatically every store
- “Standard” and “private” lists
- Results on WWW for “standard” list
- Lists on WWW

Store Checker results - Microsoft Internet Explorer provided by Beams Divisio...

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites Media Print Mail News RSS

Address [http://hepjava1.fnal.gov/StoreChecker/results/1787\\_Results.html](http://hepjava1.fnal.gov/StoreChecker/results/1787_Results.html)

Standard Device Check						
Case	Set	Device Name	Low	High	Value	Error
Inject Protons: Booster to MI	19	B:CHGB	2.0	20.0	-0.056	Less than Min.
Inject Protons: Booster to MI	20	B:CHGB	2.0	20.0	-0.053	Less than Min.
Inject Protons: Booster to MI	21	B:CHGB	2.0	20.0	-0.054	Less than Min.
Inject Protons: Booster to MI	22	B:CHGB	2.0	20.0	-0.052	Less than Min.
Inject Protons: Booster to MI	23	B:CHGB	2.0	20.0	-0.049	Less than Min.
Inject Protons: Booster to MI	24	B:CHGB	2.0	20.0	-0.039	Less than Min.
Inject Protons: Booster to MI	25	B:CHGB	2.0	20.0	-0.049	Less than Min.
Inject Protons: Booster to MI	26	B:CHGB	2.0	20.0	-0.041	Less than Min.
Inject Protons: Booster to MI	27	B:CHGB	2.0	20.0	-0.054	Less than Min.
Inject Protons: Booster to MI	28	B:CHGB	2.0	20.0	-0.042	Less than Min.
Inject Protons: Booster to MI	29	B:CHGB	2.0	20.0	-0.052	Less than Min.
Inject Protons: Booster to MI	30	B:CHGB	2.0	20.0	-0.037	Less than Min.
Inject Protons: Booster to MI	31	B:CHGB	2.0	20.0	-0.039	Less than Min.
Inject Protons: Booster to MI	32	B:CHGB	2.0	20.0	-0.056	Less than Min.
Inject Protons: Booster to MI	33	B:CHGB	2.0	20.0	-0.037	Less than Min.
Inject Protons: Booster to MI	34	B:CHGB	2.0	20.0	-0.054	Less than Min.
Inject Protons: Booster to MI	35	B:CHGB	2.0	20.0	-0.054	Less than Min.
Inject Protons: Booster to MI	36	B:CHGB	2.0	20.0	-0.054	Less than Min.
Proton Injection tune up	1	T:IBEAM	1.5	10.0	1.5	Less than Min.
Proton Injection tune up	1	I:IBEAMM	0.01	10.0	0.01	Less than Min.
Standard Set number check						
Case	Sets	Sets Expected				
Unstack pbars	14	9				
Transfer pbars from Accum to MI	14	9				
Accelerate pbars in the MI	14	9				

Done Internet

# Store Checker Results

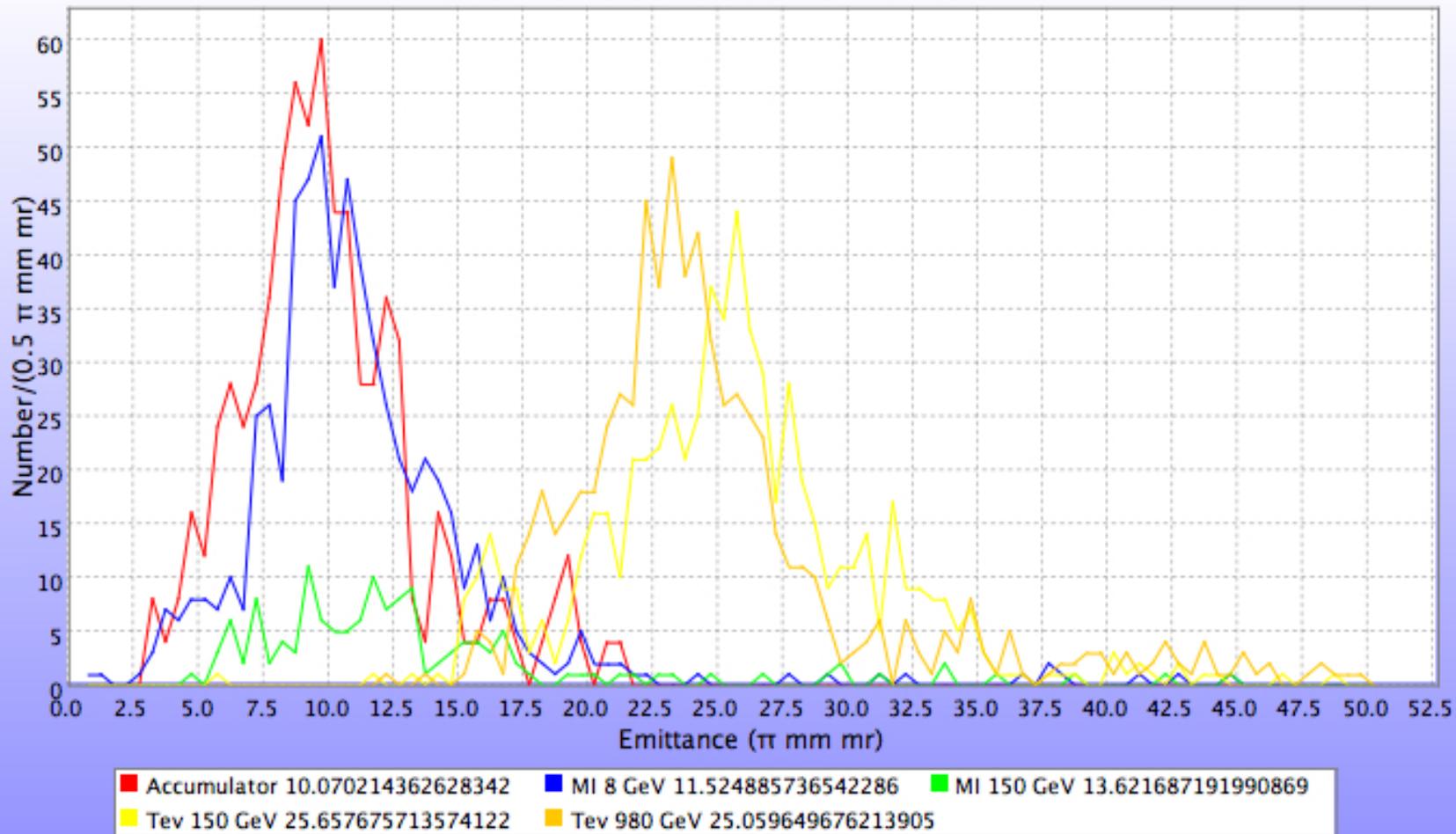
When MiniBoone started running, errors were detected. B:CHGB had to be sampled and held at a different time.

# Examples of User Analyses

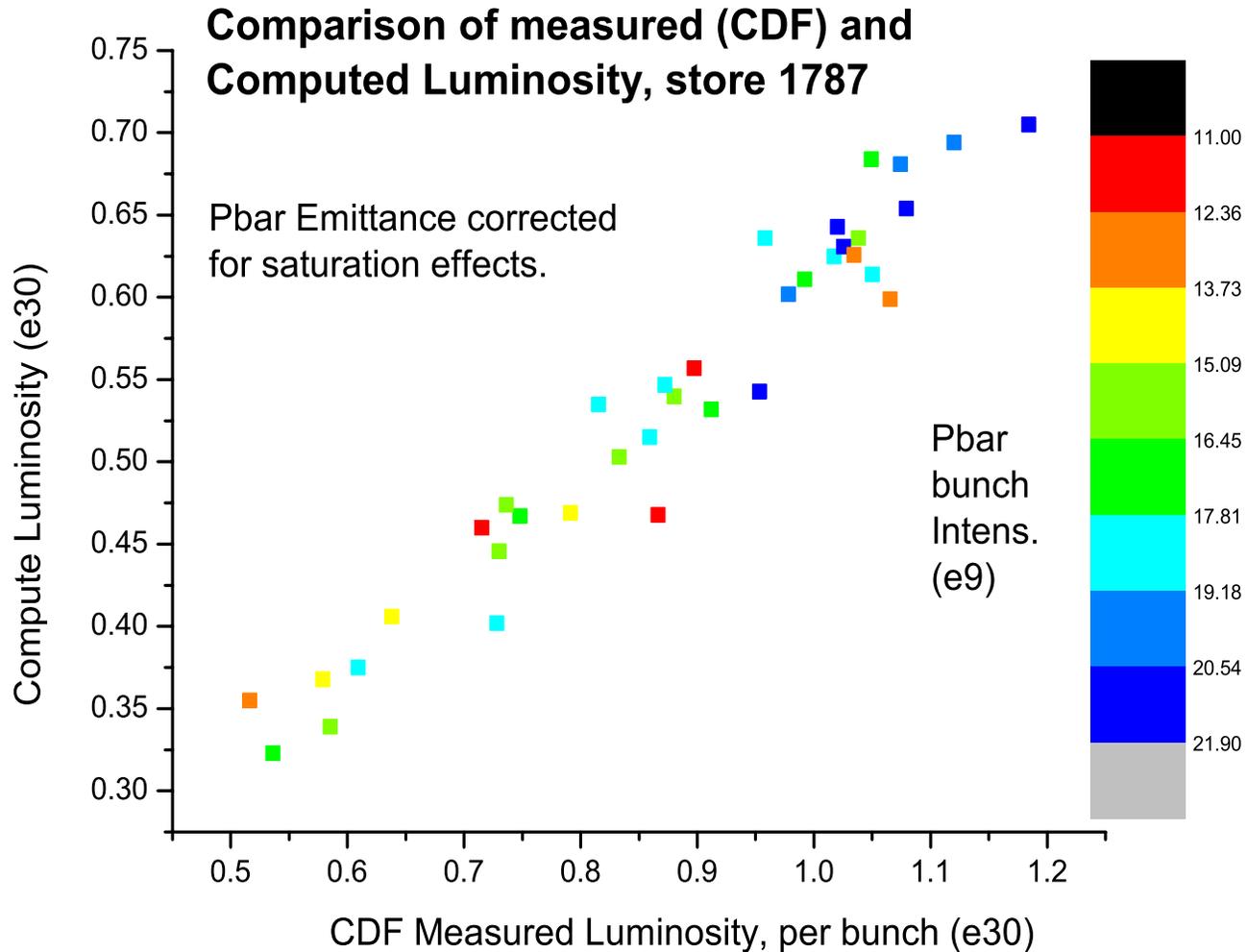
- Tool kit of Java classes to directly access the data (Computing Division)
- Three examples
  - Emittances for stores 1300-1700
  - Calculated versus measured luminosity at CDF
  - Measured HEP pbar lifetime compared to lifetime expected from interactions

# User Analysis Combining Many Stores

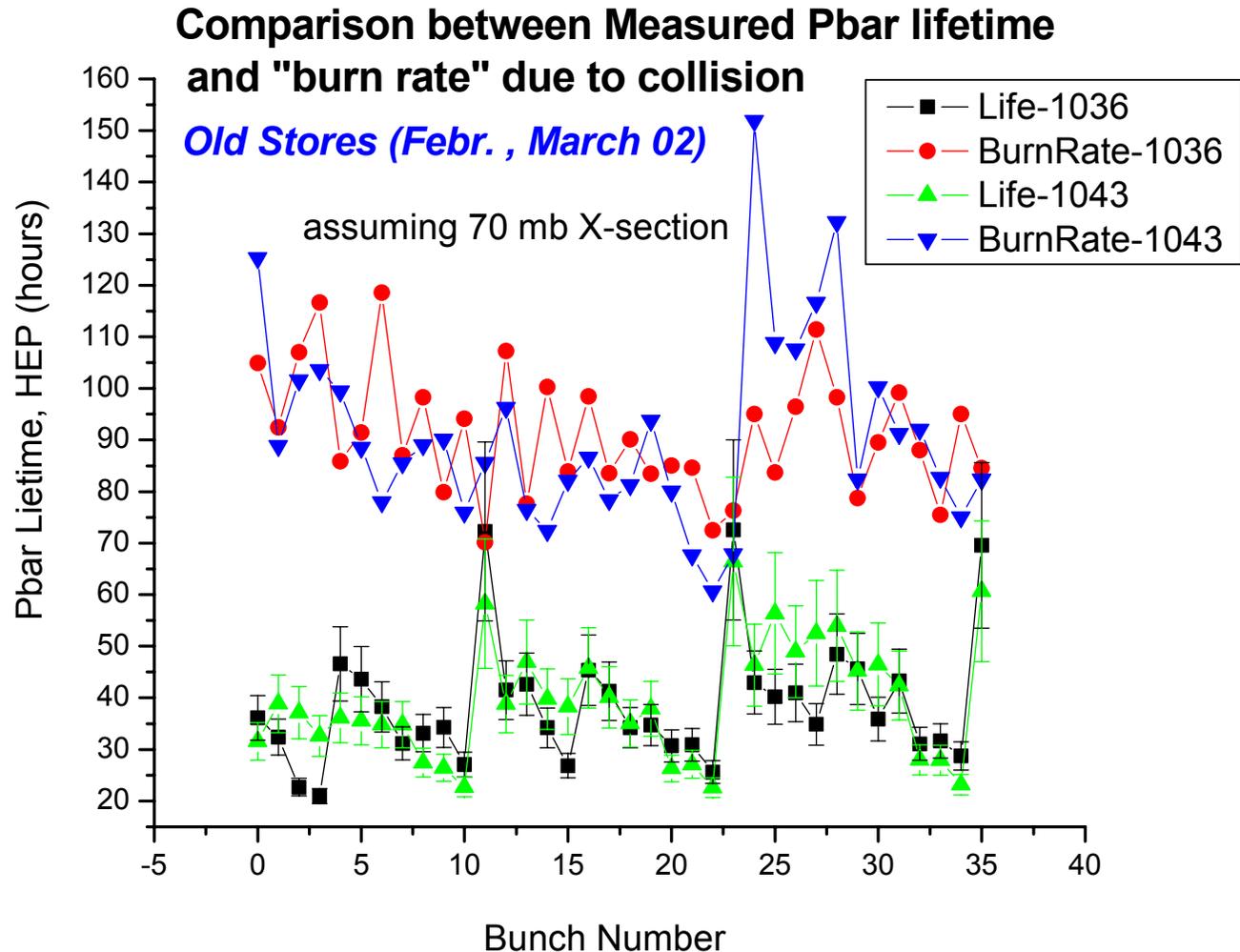
**Emittance Stores 1300–1500**



# Measured Versus Computed Luminosity



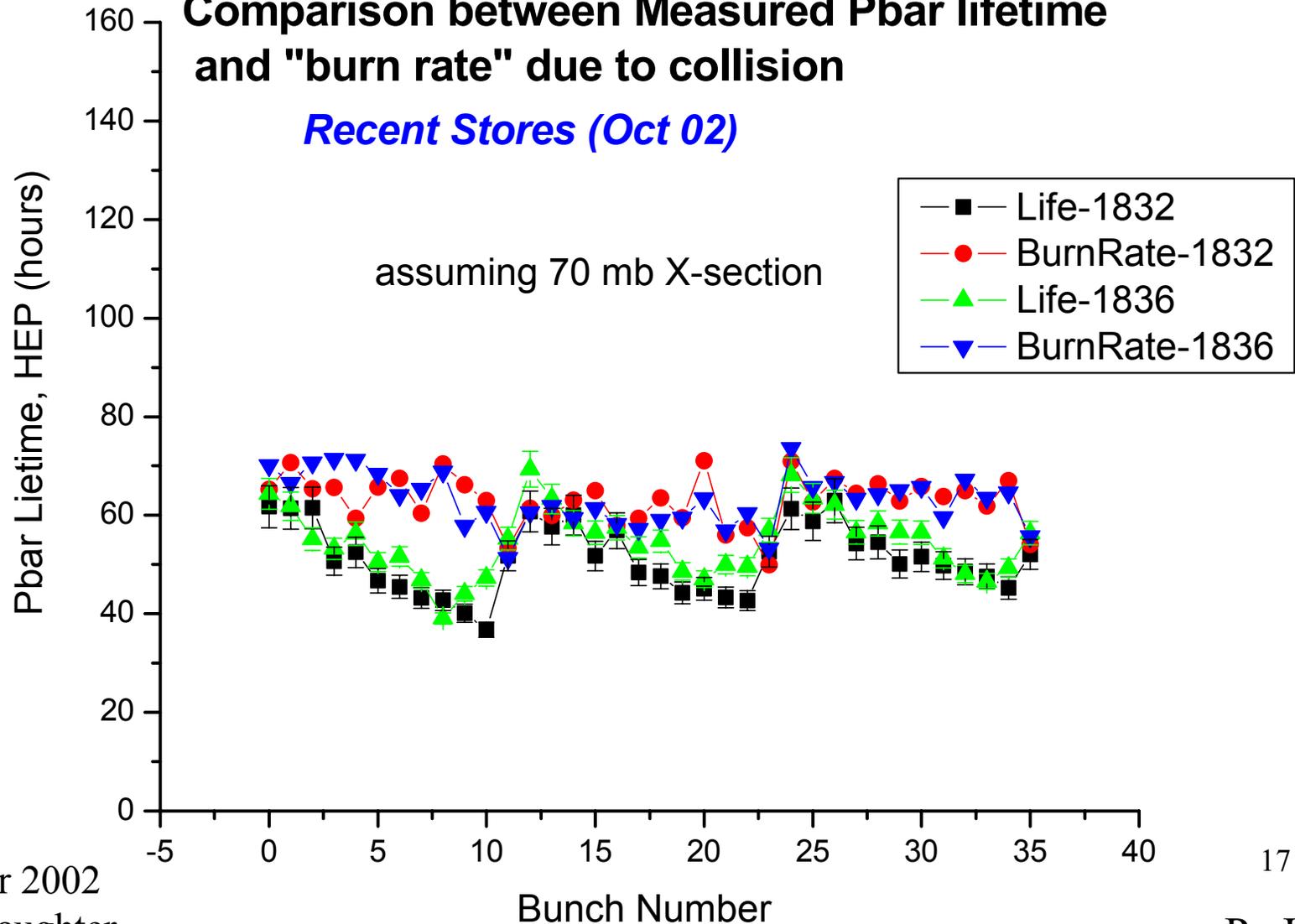
# Measured Pbar Lifetime Versus Lifetime Due to Collisions - March



# Measured Pbar Lifetime Versus Lifetime Due to Collisions - October

Comparison between Measured Pbar lifetime  
and "burn rate" due to collision

*Recent Stores (Oct 02)*



# Jobs for 2003

- Finish and then maintain SDA infrastructure
  - Still some DAQ errors
  - More flexible user access to data
  - Physics classes in Java tool kit
- Finish reviewing inputs
- Study instrumentation
- Standard plots and tables
  - Emittances
  - Automated shots log
  - Automated summary spreadsheets
- User requests and education
- Long term archiving of (non-SDA) data logger data

# Ongoing Operations in 2003

- Dedicated analyses
- Monitoring of SDA inputs
  - Instrumentation problems
  - DAQ problems
- Monitoring of stores
  - Assimilating all the information
  - **Group of physicists to review data and follow up on what's found**

# SDA Team

- Controls Department
  - K. Cahill, B. Hendricks, M. McCusker, T. Bolshakov
- Computing Division
  - P. Lebrun, S. Panacek, A. Kulyavtsev, N. Kouropatkine, R. Rechenmacher
- Systems Departments
  - E. Harms, J. Annala, D. Capista
- Headquarters
  - M. Church, J. Slaughter
- CDF, D0
  - L. Feligioni, K. Carrel

# Summary

- SDA infrastructure should be complete in 6 months
- Shot analysis is a continuing part of operations

# Two Types of Data

- Lumberjack data
  - Fixed frequencies, i.e. non-triggered
  - Used for studies
  - Circular buffers – data is overwritten after 1-30 days
  - Any user can modify any archive configuration
- SDA data
  - Triggered at specific events
  - Only during stores
  - Permanent archive
  - Standard content

Backup Slide