

# Switching between HEP and RHIC

- Review of Switching Operations
  - PPM (Pulse-to-Pulse Modulation)
  - Supercycle Switching (ppm on demand)
  - Mode Switching (non-ppm for slow devices)
- Switching Experience
  - E949 (931, 930) and RHIC
  - Gold, deuterons, and polarized protons for RHIC
- Expectations for RSVP and RHIC

# Switching between HEP and RHIC

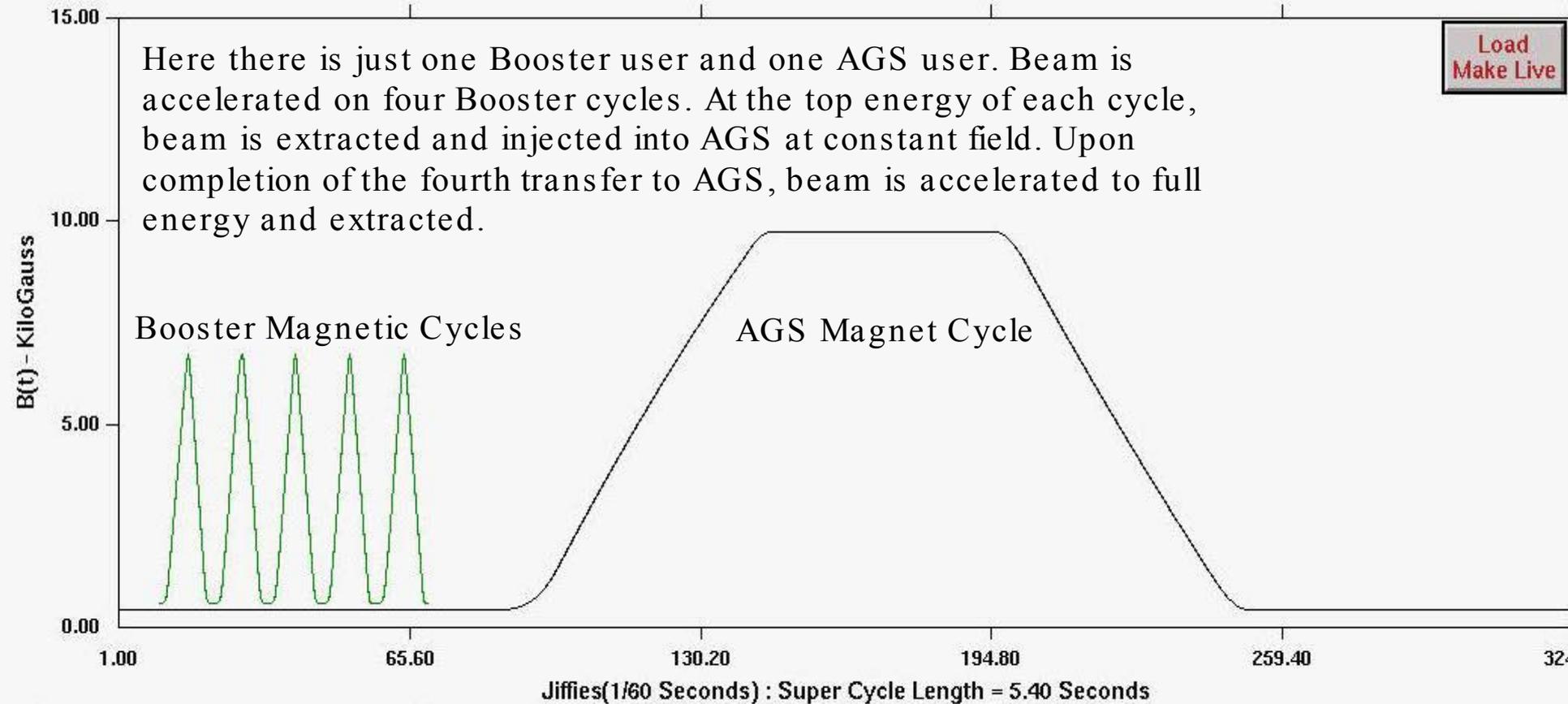
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# PPM Switching

- Switching of device setpoints between Booster or AGS pulses. (The setpoints are modulated on a pulse-to-pulse basis—hence the name “ppm”.)
- Four different sets of setpoints are possible. One therefore can have four “users” of accelerator devices, each user specifying a set of setpoints.
- The “supercycle” dictates which users are to be active and when they are to be invoked.

# Typical Supercycle

SuperMan / File: \*LIVE\*B / TABLE B  
 File Setup Mode SuperCycle AgsCycle BoosterGroup Rules Table Diagnostics Misc Help



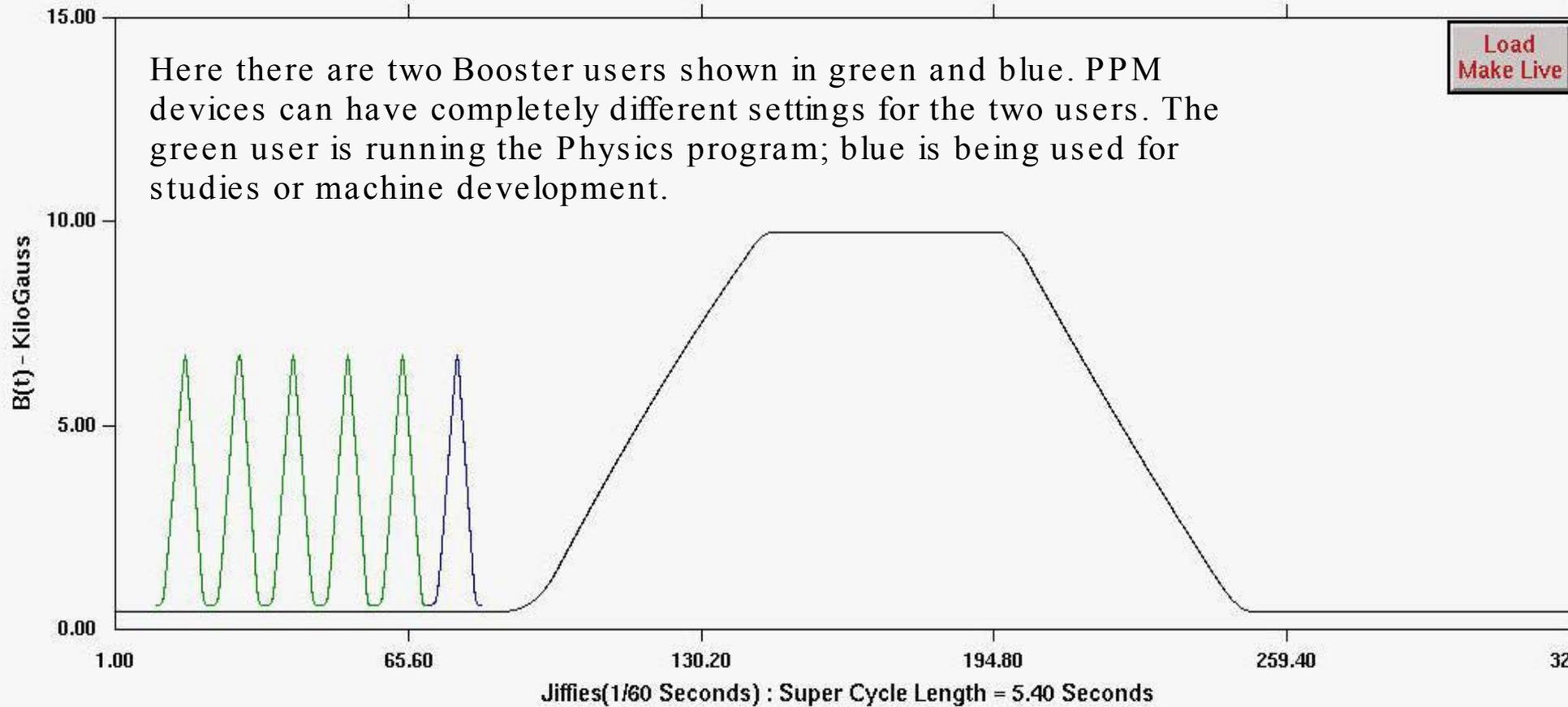
Load Make Live

Linac					LGE
Tandem	TU1	TT0	TT0	TT0	TBE
Booster	BT1				
	BUT	BPP	BPP	BPP	BPP
	BPP	BFR	BFR	BFR	BFR
	BFR	BT0	BT0	BT0	BT0
	BT0	BT1	COG	BT3	COG
		COG		COG	
					BGE

# PPM Example 1

Load Make Live

Here there are two Booster users shown in green and blue. PPM devices can have completely different settings for the two users. The green user is running the Physics program; blue is being used for studies or machine development.

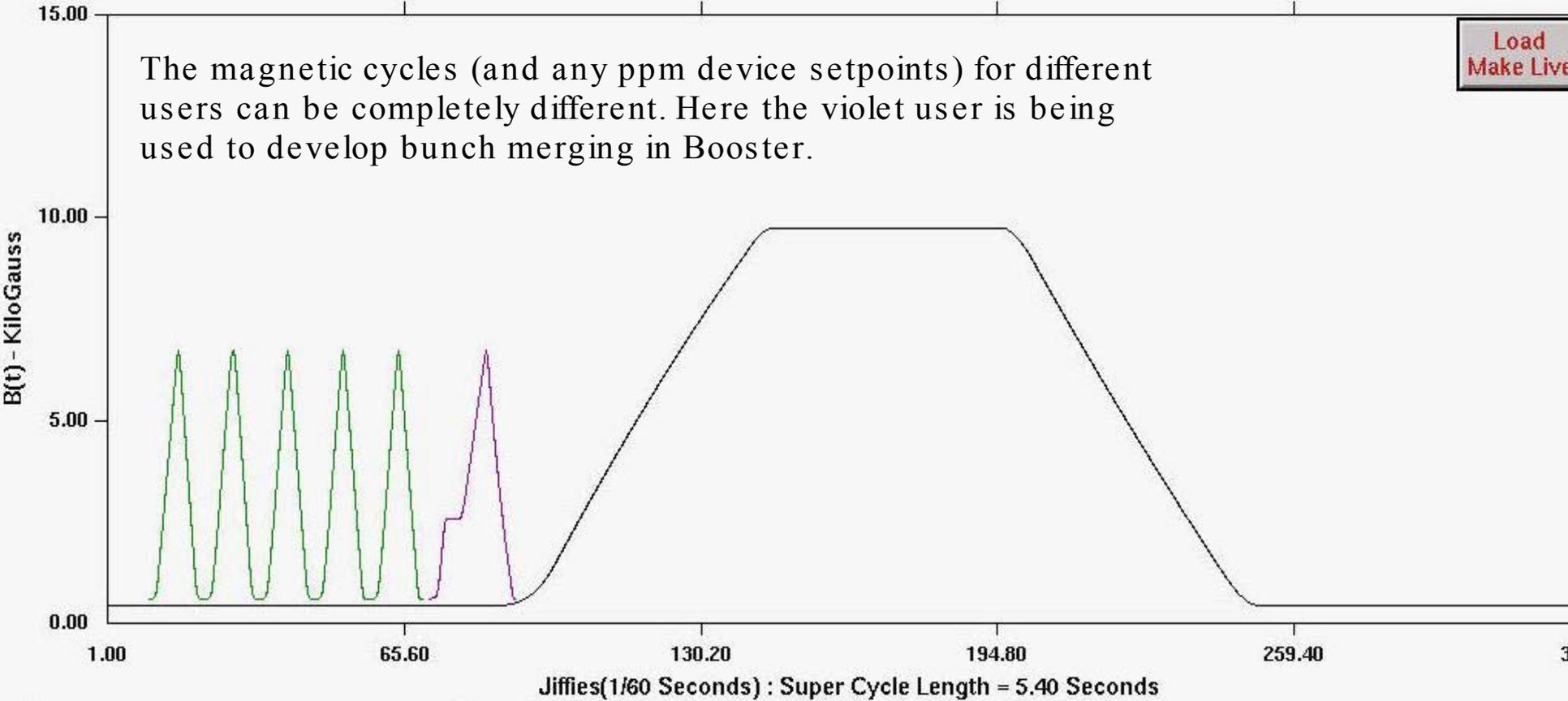


Linac Tandem		LGE						
TU1		TT0	TT0	TT0	TT0	TT0	TBE	
BU1	BPP	BPP	BPP	BPP	BU4	BGE		
BPP	BFR	BFR	BFR	BFR	BPP			
BFR	BT0	BT0	BT0	BT0	BFR			
BT0	BT1	COG	BT3	COG	BT0			
	COG	COG	COG					

# PPM Example 2

Load  
Make Live

The magnetic cycles (and any ppm device setpoints) for different users can be completely different. Here the violet user is being used to develop bunch merging in Booster.



Linac  
andem  
Booster

LGE									
TU1	TT0	TT0	TT0	TT0	TT0	TT0	TBE		
BU1	BPP	BPP	BPP	BPP	BPP	BU2	BGE		
BPP	BFR	BFR	BFR	BFR	BFR	BPP			
BFR	BT0	BT0	BT0	BT0	BT0	BFR			
BT0	BT1	COG	BT3	COG		BT0			
	COG		COG			BT1			
						BT4			



# Supercycle Switching

- Often we want to switch from one supercycle setup to another on demand.
- This is called “context switching”, “pulse stealing” or “ppm on demand”.
- Different supercycles are stored in Tables that can be invoked on demand (see next slide).
- Very useful for commissioning different modes of operation while the Physics program is running.

# Supercycle Pulse Manager

**SCPulseManager** [X] [ ] [X] [ ] [X] [ ]

Setup Help

Wed Jan 14 11:10:19 2004 Default Statistics since Wed Jan 14 11:09:48 2004

<b>Ags Cycle</b>					33581	33582	33583	33584	33585	33586	Table A: 0    Table B: 6 Table C: 0    Table D: 0
<b>Table</b>	-	-	-	-	B	B	B	B	B	B	

**Default SuperCycle**

<b>Name</b>	<b>Length(s)</b>	<b>Booster</b>	<b>Ags</b>	<b>Description</b>
wsrgz	5.4	U1	U1	

System Default PPM User: RHIC\_Au\_U1

**Pulse Stealing**

Table	Pulses	Count	Name	Length(s)	Booster	Ags	Description
A	Take 1	0	aef	5.4	U1	U3	
B	Take 1	0	wsrgz	5.4	U1	U1	
C	Take 1	0	Silica	5.4	U3	U2	
D	Take 1	0	pwtest35	5.4	U1/U4	U1	RHIC_Au_U1

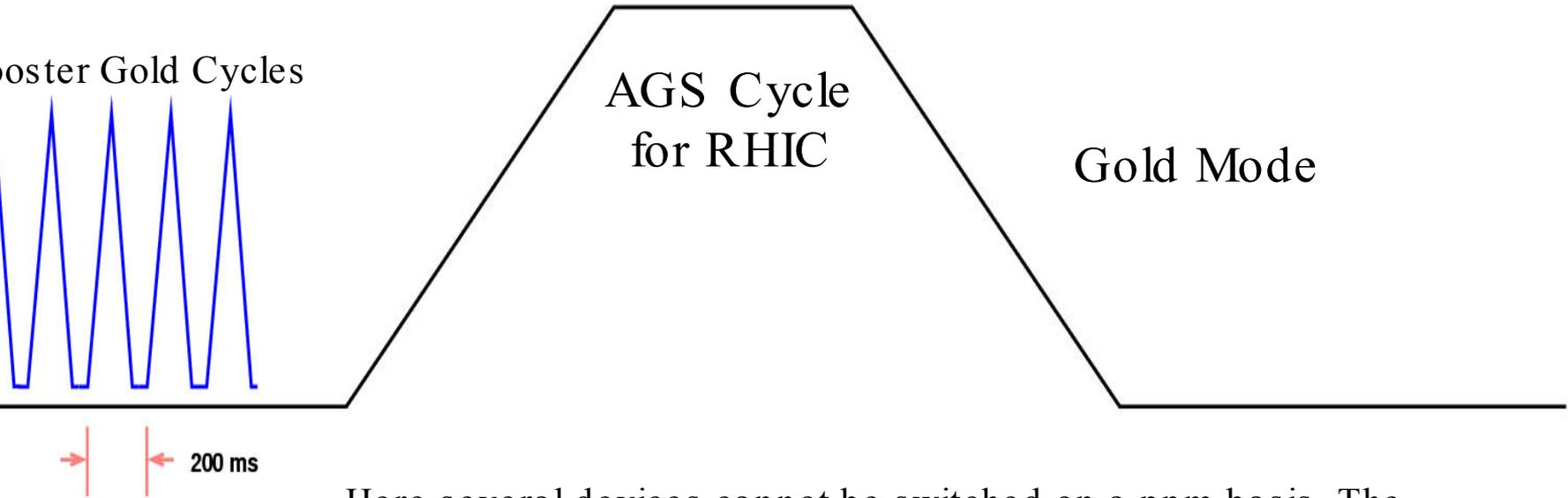
**Round Robin**

<b>A Pulses</b>	<b>B Pulses</b>	<b>C Pulses</b>	<b>D Pulses</b>
0	0	0	0

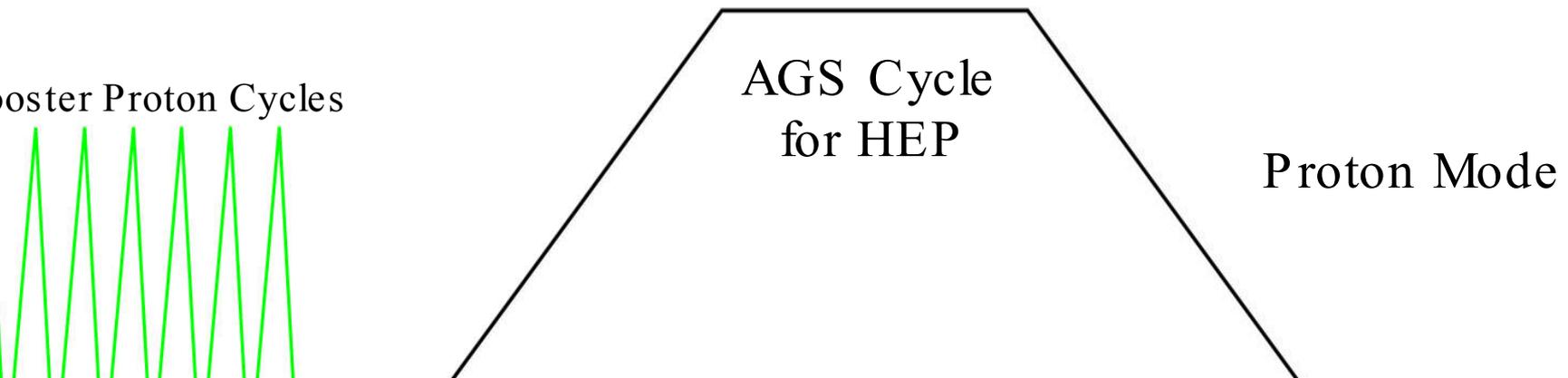
# Mode Switching

- We use mode switching to switch devices that cannot be switched on a pulse-to-pulse basis:
  - Booster H-minus Injection Foil
  - BTA Magnet Setpoints
  - BTA Stripping Foil
  - AGS Injection Kicker
  - AGS VHF Cavity
  - ATR Magnet Setpoints

# Mode Switching Example



Here several devices cannot be switched on a ppm basis. The application for switching these non-ppm devices is shown in the next slide....



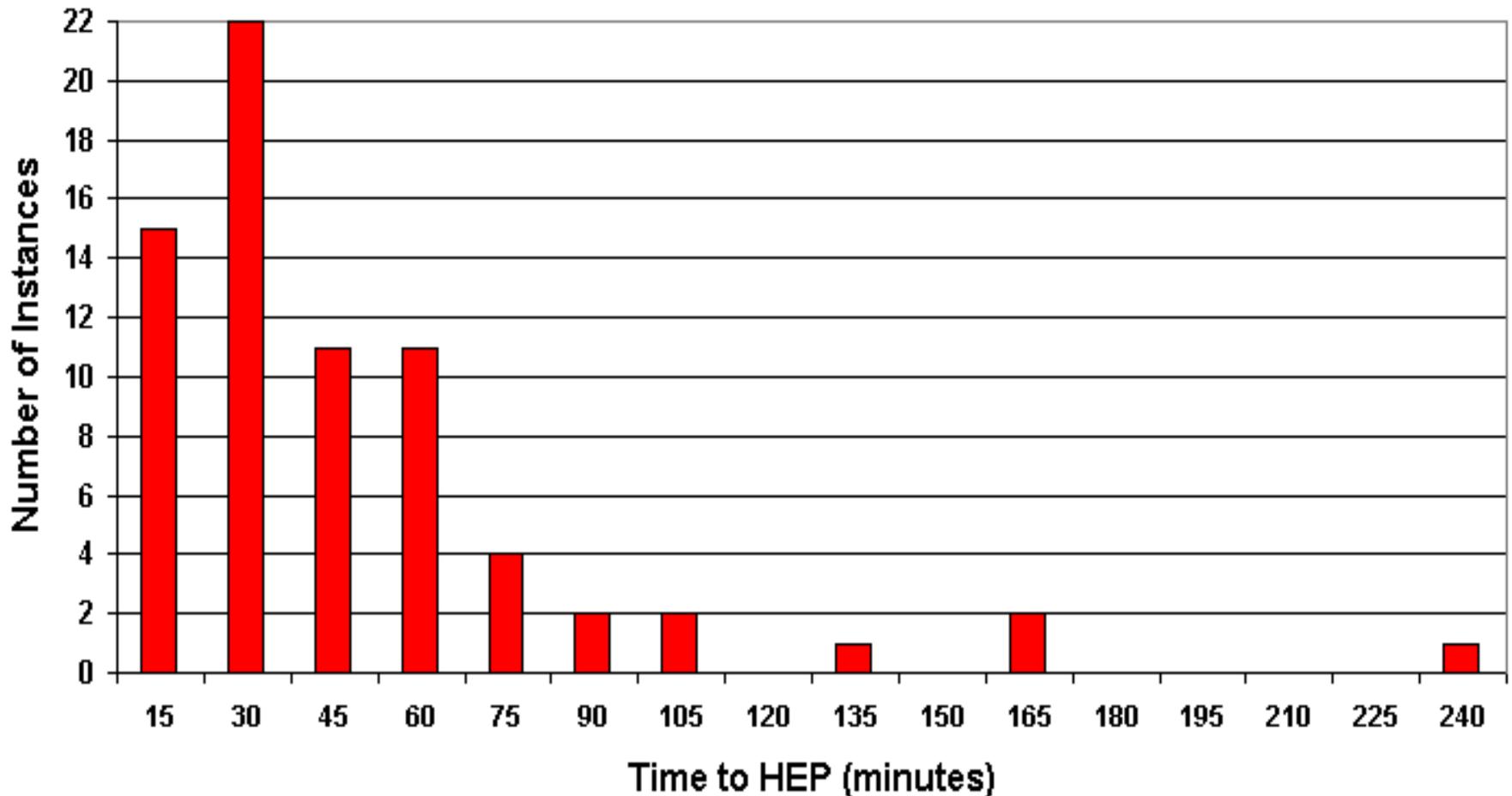


# Mode Switching Experience

- Proton SEB (E949, 931, 930) concurrent with RHIC (September—October 2001)
  - 15 min switching time
- RHIC Operation with Gold and Deuterons; Polarized Proton studies in Booster and AGS (January—March 2003)
  - 3 min switching time; 5 to 10 min to fill RHIC

# Switching Time to Restore HEP

Time to Restore Proton SEB/HEP after RHIC physics program is running  
(for the period 10/1/2001 to 11/6/2001)



# RSVP and RHIC

- Demonstrated mode switching capability between HEP and RHIC.
  - 15 min proton-gold switch in FY02
  - 3 min deuteron-gold switch in FY03
- Context Switching may be useful for times when RHIC only needs beam on a pulse stealing basis.
  - Several devices would need to become ppm capable (BTA foil, BTA magnets, AGS injection kicker, AGS VHF cavity).
  - Radiation security system must keep high intensity proton beam out of RHIC.