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Ramp Development Procedures

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I Introduction

This document is a collection of the various procedures needed to develop the ramps required to modify the Accumulator lattice during shot setup. The ramps required to change the lattice are managed by console application P170 (Accumulator Ramp). The ramps for every device that is changed are stored in files that are read by or written to by P170. Presently the ramps for 90 devices are stored in P170 files. A list of ramped devices is given in Appendix A.

II Overview of P170 (Accumulator Ramp) Console Application

The P170 console application main page is shown in Figure 1. The blue background areas either accept user input or open a new window upon interrupt. This section explains the features that can be accessed from the main page.

OPTIONS: Allows changing various options as shown in Figure 2.

SEQ START: Starting sequence number of the next ramp execution. This number should match A:RMPSEQ if you are going to execute the ramps by interrupting on START.

SEQ STOP: Sequence number at which the next execution of the ramps will stop.

DISPLAY RAMP TABLE: Displays the ramp table for the device indicated to the right. The Ramp table for A:LQ is shown in Figure 3. IMPORTANT: after editing a ramp from the RAMP TABLE window, it is necessary to interrupt on the UPDATE button (in the 3rd row from the top of the window) to save the changes in console memory. Failure to UDATE causes the loss of all of your changes when you leave the RAMP TABLE window of the current device.

PRIMARY POINTS: Opens a window that allows selecting which ramp table index values are primary points. The significance of primary points will be discussed under "Retabling Options" below.

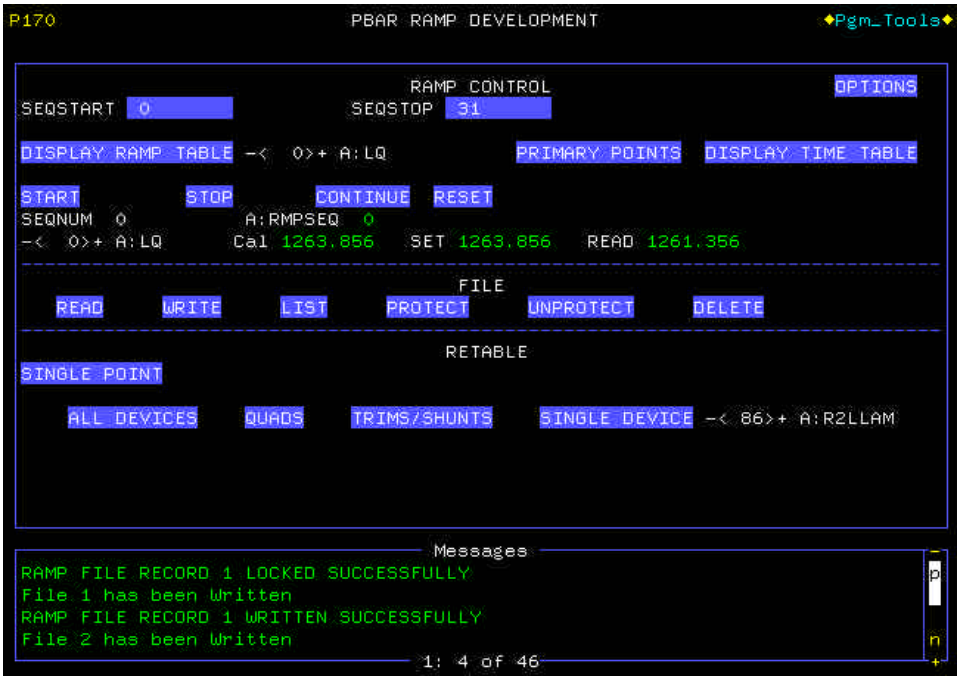

Figure 1 P170 Console Application main page.

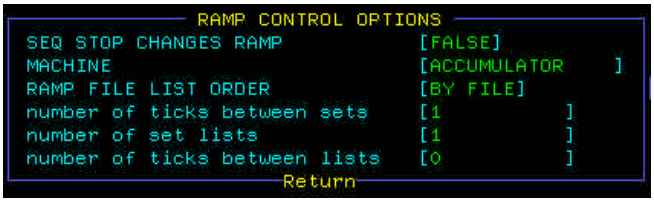

Figure 2 Ramp Control Options window that is opened when interrupting on the OPTIONS button in the upper right of the P170 main page.

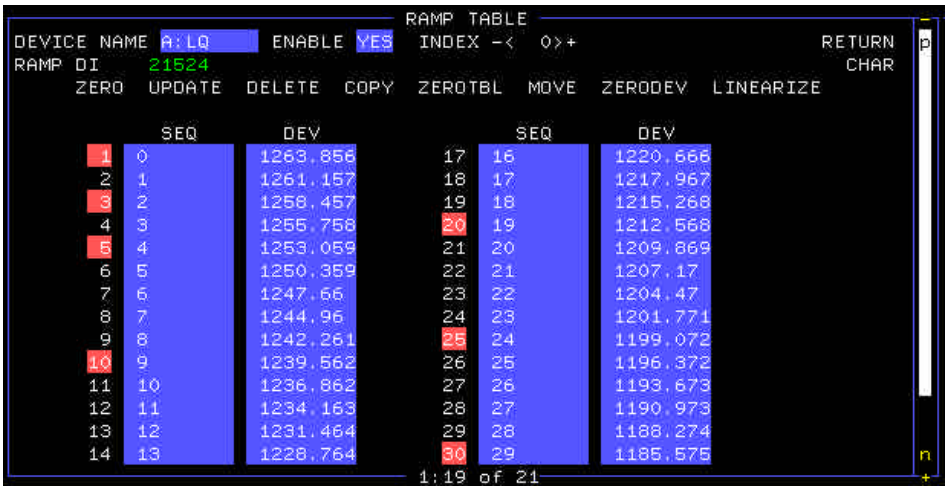

Figure 3 Ramp Table for A:LQ. The SEQ column gives the sequence number and the DEV column gives the corresponding device setting. The device settings for any sequence number can be directly edited from this window. The ramp table indices highlighted in red are PRIMARY points.

DISPLAY TIME TABLE: Opens a window that allows editing of the time ramp. The time ramp window is shown in Figure 4. The DELTA value for a given ramp index value specifies the time interval between that index and the previous index. The time units are number of periodic interrupts (one periodic interrupt is 1/15 = 0.067 sec). The SEQ value gives the sequence number in the device ramps associated with the given ramp index value. IMPORTANT: after editing the time ramp table it is necessary to interrupt on the UPDATE button. If you do not UPDATE, all changes will be lost when you exit the window.

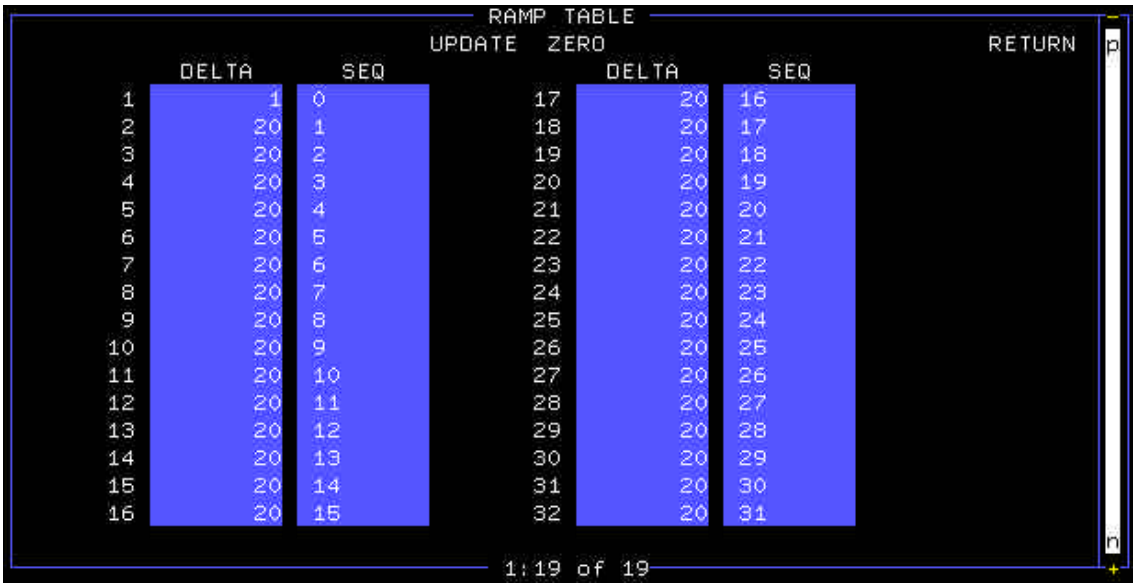

Figure 4 Time ramp table window.

A. Ramp Execution Commands

START: Initiates execution of the ramp tables. The current sequence number is displayed below the START button. The ramps will play up to the sequence number entered in the SEQ STOP box or until an interrupt on the STOP button.

STOP: Stop execution of the ramp tables. Use of this interrupt should be rare.

CONTINUE: Continues playing the ramps after halting ramp execution by interrupting on STOP or after increasing the value of SEQ STOP.

RESET: Resets some internal quantities. You should not need to use this.

B. Ramp File Management Commands

READ: Opens a list of ramp files. Select the file you want to use. The current operational file will always be file 1.

WRITE: Saves the ramps in console memory to a file. You can over-write an existing file or write to a new file.

LIST: Lists the ramp files available.

PROTECT: Protect a file from over-writing.

UNPROTECT: Remove over-write protection from a file.

DELETE: Deletes a ramp file.

C. Ramp Retabling Options

Retabling is the process by which the ramps are updated to reflect the current state of the Accumulator. There are a variety of retabling options. The buttons across the middle of the RETABLE box on the P170 main page determine which ramp tables are modified. These options are:

- ALL DEVICES: All enabled ramp tables
- QUADS[†]: All ramp tables with the Retable Quads flag set
- TRIMS/SHUNTS: All ramp tables with the Retable TrimShunt flag set
- SINGLE DEVICE: Only the ramp for device indicated to the right will be retabled.

There are also options that determine how much of each affected ramp table is modified. These options are:

SINGLE POINT: Overwrites the table value corresponding to the current SEQNUM. The ramp tables affected are:

TO ADJACENT PRIMARY POINTS: This option only works if the present SEQNUM is a primary point. Retabling to adjacent points overwrites the table points between the current SEQNUM and the adjacent primary points with a linear ramp in both directions.

III Initial Conditions

1. The Antiproton Source is set up for reverse protons. Setup Booster extraction for 1 turn, 40 bunches on the pbar study event
2. The Accumulator bend field is set so that A:BFIELD = 16,714.4 ± 0.2 Gauss.
3. Set up Fast Time Plots of A:IBEAM, A:EMT3HN, and A:EMT3VN versus A:RMPSEQ.
4. Pin the injection and extraction shutters open (i.e. turn off A:ISHUTC and A:ESHUTC, turn on A:ISHUTO and A:ESHUTO, verify that ISHUTO and ISHUTE get clock events).

[†] Only A:QSF1 and A:QSD have the Retable Quads flag set.

IV Overview of Ramp to Shot Lattice Development Plan

1. Correct tunes and orbit (if necessary) at each primary point
2. Correct the orbit using trim magnets only (don't use dipole shunts).
3. Once a ramp to SEQNUM = 31 has been established, set A:SEX10, A:SEX12, A:OCT10, and A:OCT12 to establish a good tune versus *Dp/p* profile. Linearize these multipole ramps.
4. With the new multipole ramps, re-correct the tunes and orbit at each primary point.
5. Correct coupling at SEQNUM = 31. Linearize SQ100, SQ607, SS106, and SS406 ramps.
6. Re-correct tunes at each primary point if necessary.
7. Match extraction beamlines to the new lattice.
8. Try out new lattice with antiprotons.

V Procedure for Building a Return to Stacking Lattice Ramp

(Procedure for the NNth iteration)

1. Ramp to Shot lattice using the ramp file named "Ramp to Shot Lattice NN"
2. Set A:RMPSEQ to 0
3. Read the ramp file named "Ramp to Stacking Lattice NN"
4. Correct tunes and orbit at each primary point. Save corrections into a file named "Ramp to Stacking Lattice NN+1"
5. When you've corrected all of the primary points do the following:
   a. Set A:RMPSEQ to 0
   b. Read in the file named "Ramp to Shot Lattice NN"
6. Correct tunes and orbit at each primary point. Save corrections into a file named "Ramp to Shot Lattice NN+1"
7. Repeat steps 3 – 6 until tunes and orbit no longer require correction.
8. Cycle the Accumulator buses, then ramp to the shot lattice and back to the stacking lattice, checking the tunes and orbit at each primary point.

VI Procedure: Ramp from SEQNUM A to SEQNUM B

1. Inject protons onto the extraction orbit.
2. Turn off ARF2. Bunch and move the beam with ARF3 to the core orbit (f_{rev} = 628884 Hz).
3. Knob A:R3LLAM down until A:R3HLFB reads about 20 Volts.
4. Launch P142 (VSA Longitudinal Profile) – run continuously to update A:CENFRQ.
5. Launch the Accumulator closed orbit application (P51). Monitor the horizontal and vertical orbit deviation from a normal core orbit file.
6. Launch P170 (Accumulator Ramp)
7. Interrupt on READ and select the latest ramp file.
8. Verify A:RMPSEQ is 0.
9. Set SEQ START to 0.
10. Set SEQ STOP to the sequence number you want to go to.
11. Check the alarm screen for anything unusual.
12. Interrupt on START to begin ramping.
13. Interrupt on STOP if you desire to stop ramping before arrival at SEQ STOP. To resume ramping to SEQ STOP, interrupt on CONTINUE.
14. After ramping is complete, you may make any measurements and/or corrections required.

15. To continue ramping beyond the current value of SEQ STOP, update the value of SEQ STOP with the new target sequence number, and interrupt on CONTINUE.
16. To restore devices after a round of ramp corrections, do the following:
    a. D1 save file 606 matches the top of the ramp.
    b. Run the P132 (Stochastic Cooling Sequencer) Ramp Development – Restore aggregate to restore busses.

VII Tune Correction

1. Ramp to a primary point.
2. If you are manually operating the spectrum analyzers, update the center frequency after each ramp execution (this allows for the change in revolution frequency).
3. Nominal horizontal tune is .696. Correct horizontal tune with A:QSF1 with a *0.1 knob factor (increasing QSF1 lowers the tune).
4. Nominal vertical tune is .684. Correct vertical tune with A:QSD with a *0.1 knob factor (increasing QSD lowers the tune).
5. Select the TO ADJACENT PRIMARY POINTS retabling option.
6. Interrupt on QUADS
7. Save ramp file.

VIII Orbit Correction

1. Enable the dipole trim ramps.
2. Ramp to a primary point.
3. Correct orbit using P145.
4. Select the TO ADJACENT PRIMARY POINTS retabling option.
5. Interrupt on TRIMS/SHUNTS.
6. Save ramp file.

IX Ramp file etiquette

1. Save updated ramps to your current working file after every retabling.
2. If you are uncertain about your correction, save to a new file.
3. Document in the Pbar electronic logbook what corrections are in each ramp file you've created.
4. DO NOT overwrite any files that are less than two weeks old. We have plenty of storage space.
5. DO NOT overwrite files 1, 2, 9, 10, 14, or 15.
6. DO NOT remove the protection from any file that you didn't write.
7. If you really – really think that you've made good progress, and you don't trust the rest of us not to mess it up, protect your file using the PROTECT button on P170.
8. At the end of each weeks study shifts the file corresponding to the best progress will be copied into file number 1, which will always be the operational file.

Appendix A Ramped Devices

Ramp Index	Device	Enabled	No Retable	Retable Quads	Retable TrimShunt	Disable retable on start
0	A:LQ	TRUE	FALSE	FALSE	FALSE	FALSE
1	A:QT	TRUE	FALSE	FALSE	FALSE	FALSE
2	A:QDF	TRUE	FALSE	FALSE	FALSE	FALSE
3	A:QSF1	TRUE	FALSE	**TRUE**	FALSE	FALSE
4	A:QSD	TRUE	FALSE	**TRUE**	FALSE	FALSE
5	A:QS103	TRUE	FALSE	FALSE	FALSE	FALSE
6	A:QS203	TRUE	FALSE	FALSE	FALSE	FALSE
7	A:QS303	TRUE	FALSE	FALSE	FALSE	FALSE
8	A:QS403	TRUE	FALSE	FALSE	FALSE	FALSE
9	A:QS503	TRUE	FALSE	FALSE	FALSE	FALSE
10	A:QS603	TRUE	FALSE	FALSE	FALSE	FALSE
11	A:QS106	TRUE	FALSE	FALSE	FALSE	FALSE
12	A:QS206	TRUE	FALSE	FALSE	FALSE	FALSE
13	A:QS306	TRUE	FALSE	FALSE	FALSE	FALSE
14	A:QS406	TRUE	FALSE	FALSE	FALSE	FALSE
15	A:QS506	TRUE	FALSE	FALSE	FALSE	FALSE
16	A:QS606	TRUE	FALSE	FALSE	FALSE	FALSE
17	A:QS108	TRUE	FALSE	FALSE	FALSE	FALSE
18	A:QS208	TRUE	FALSE	FALSE	FALSE	FALSE
19	A:QS308	TRUE	FALSE	FALSE	FALSE	FALSE
20	A:QS408	TRUE	FALSE	FALSE	FALSE	FALSE
21	A:QS508	TRUE	FALSE	FALSE	FALSE	FALSE
22	A:QS608	TRUE	FALSE	FALSE	FALSE	FALSE
23	A:QS110	TRUE	FALSE	FALSE	FALSE	FALSE
24	A:QS210	TRUE	FALSE	FALSE	FALSE	FALSE
25	A:QS310	TRUE	FALSE	FALSE	FALSE	FALSE
26	A:QS410	TRUE	FALSE	FALSE	FALSE	FALSE
27	A:QS510	TRUE	FALSE	FALSE	FALSE	FALSE
28	A:QS610	TRUE	FALSE	FALSE	FALSE	FALSE
29	A:QS111	TRUE	FALSE	FALSE	FALSE	FALSE
30	A:QS211	TRUE	FALSE	FALSE	FALSE	FALSE
31	A:QS311	TRUE	FALSE	FALSE	FALSE	FALSE
32	A:QS411	TRUE	FALSE	FALSE	FALSE	FALSE
33	A:QS511	TRUE	FALSE	FALSE	FALSE	FALSE
34	A:QS611	TRUE	FALSE	FALSE	FALSE	FALSE
35	A:QS114	TRUE	FALSE	FALSE	FALSE	FALSE
36	A:QS214	TRUE	FALSE	FALSE	FALSE	FALSE
37	A:QS314	TRUE	FALSE	FALSE	FALSE	FALSE
38	A:QS414	TRUE	FALSE	FALSE	FALSE	FALSE
39	A:QS514	TRUE	FALSE	FALSE	FALSE	FALSE
40	A:QS614	TRUE	FALSE	FALSE	FALSE	FALSE

Ramp Index	Device	Enabled	No Retable	Retable Quads	Retable TrimShunt	Disable retable on start
41	A:SEX10	TRUE	FALSE	FALSE	FALSE	FALSE
42	A:SEX12	TRUE	FALSE	FALSE	FALSE	FALSE
43	A:OCT10	TRUE	FALSE	FALSE	FALSE	FALSE
44	A:OCT12	TRUE	FALSE	FALSE	FALSE	FALSE
45	A:H100	TRUE	FALSE	FALSE	**TRUE**	FALSE
46	A:H105	TRUE	FALSE	FALSE	**TRUE**	FALSE
47	A:H201	TRUE	FALSE	FALSE	**TRUE**	FALSE
48	A:H204	TRUE	FALSE	FALSE	**TRUE**	FALSE
49	A:H205	TRUE	FALSE	FALSE	**TRUE**	FALSE
50	A:H305	TRUE	FALSE	FALSE	**TRUE**	FALSE
51	A:H405	TRUE	FALSE	FALSE	**TRUE**	FALSE
52	A:H505	TRUE	FALSE	FALSE	**TRUE**	FALSE
53	A:H605	TRUE	FALSE	FALSE	**TRUE**	FALSE
54	A:V102	TRUE	FALSE	FALSE	**TRUE**	FALSE
55	A:V104	TRUE	FALSE	FALSE	**TRUE**	FALSE
56	A:V106	TRUE	FALSE	FALSE	**TRUE**	FALSE
57	A:V109	TRUE	FALSE	FALSE	**TRUE**	FALSE
58	A:V202	TRUE	FALSE	FALSE	**TRUE**	FALSE
59	A:V204	TRUE	FALSE	FALSE	**TRUE**	FALSE
60	A:V206	TRUE	FALSE	FALSE	**TRUE**	FALSE
61	A:V209	TRUE	FALSE	FALSE	**TRUE**	FALSE
62	A:V302	TRUE	FALSE	FALSE	**TRUE**	FALSE
63	A:V304	TRUE	FALSE	FALSE	**TRUE**	FALSE
64	A:V306	TRUE	FALSE	FALSE	**TRUE**	FALSE
65	A:V309	TRUE	FALSE	FALSE	**TRUE**	FALSE
66	A:V402	TRUE	FALSE	FALSE	**TRUE**	FALSE
67	A:V404	TRUE	FALSE	FALSE	**TRUE**	FALSE
68	A:V406	TRUE	FALSE	FALSE	**TRUE**	FALSE
69	A:V409	TRUE	FALSE	FALSE	**TRUE**	FALSE
70	A:V502	TRUE	FALSE	FALSE	**TRUE**	FALSE
71	A:V504	TRUE	FALSE	FALSE	**TRUE**	FALSE
72	A:V506	TRUE	FALSE	FALSE	**TRUE**	FALSE
73	A:V509	TRUE	FALSE	FALSE	**TRUE**	FALSE
74	A:V602	TRUE	FALSE	FALSE	**TRUE**	FALSE
75	A:V604	TRUE	FALSE	FALSE	**TRUE**	FALSE
76	A:V606	TRUE	FALSE	FALSE	**TRUE**	FALSE
77	A:V609	TRUE	FALSE	FALSE	**TRUE**	FALSE
78	A:SQ100	TRUE	FALSE	FALSE	FALSE	FALSE
79	A:SQ607	TRUE	FALSE	FALSE	FALSE	FALSE
80	A:SQ100R	TRUE	FALSE	FALSE	FALSE	FALSE
81	A:SQ607R	TRUE	FALSE	FALSE	FALSE	FALSE
82	A:SS106	TRUE	FALSE	FALSE	FALSE	FALSE
83	A:22406	TRUE	FALSE	FALSE	FALSE	FALSE

Ramp Index	Device	Enabled	No Retable	Retable Quads	Retable TrimShunt	Disable retable on start
84	A:RLLFS0	TRUE	FALSE	FALSE	FALSE	FALSE
85	A:RLLFS1	FALSE	FALSE	FALSE	FALSE	FALSE
86	A:R2LLAM	FALSE	FALSE	FALSE	FALSE	FALSE
87	D:FFTLOF	FALSE	FALSE	FALSE	FALSE	FALSE
88	A:FFTLOF	FALSE	FALSE	FALSE	FALSE	FALSE
89	A:IB	TRUE	FALSE	FALSE	FALSE	FALSE
90	V:APSLAT	FALSE	FALSE	FALSE	FALSE	FALSE