Collider Run II Shot Setup Documentation

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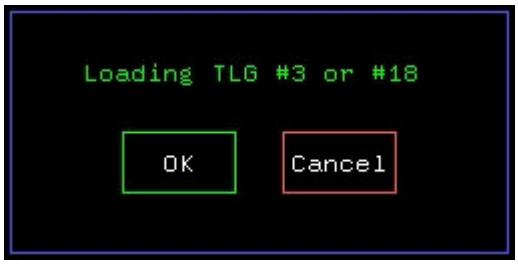
Send suggestions and comments to ad-pbar-tuning-adminNOSPAM@fnal.gov (remove "NOSPAM")

Sequencer: Pbar
Collider Aggregate: **Run II Load Collider Pbars**
Previous Aggregate: Run II Prepare to Load Pbars
Purpose of this Aggregate:
How to get back to stacking form here: Finish this aggregate and then run both the Run II Revert to Stack Lattice and the Run II Return to Stacking aggregates.

::: ACKNOWLEDGE .



::: SHOT_LOG COMMENT .
Enters the following comment into the Pbar portion of the shot scapbook at http://www-bd.fnal.gov/cgi-mach/machlog.pl?nb=scrap03.
Time- Loading Pbars. The starting Stack size is 161.1875. - Sequencer

::: SHOT_LOG COMMENT .
Enters the following comment into the Pbar portion of the shot scapbook at http://www-bd.fnal.gov/cgi-mach/machlog.pl?nb=scrap03.
Time- **MI data for Pbars.** - Sequencer

::: LOAD_TLG 18 REPEAT .
Loads TLG #18.

::: WAIT_DEVICE G:TLGSEQ .
Waits for the timeline to be loaded.

::: INSTRUCT 250 .

::: SETIT_DEVICE V:PSHOOT =2 .
Sets state V:PSHOOT to 2 (Ready for transfer).

::: SET_DEVICE A:VSARST =10 .
VSA heartbeat.

::: WAIT_DEVICE A:VSARST .
Wait for VSARST to be zero.

::: CTLIT_DEVICE A:CMPS01 OFF .
Core 4-8 GHz momentum PIN switch off.

::: CTLIT_DEVICE A:CPPS01 OFF .
Core 2-4 GHz momentum PIN switch off.

::: SETIT_DEVICE A:R4RDY =0 .
Sets ARF4 Ready to Run parameter to zero.

::: SET_DEVICE A:VSARST =1 .

```
      Restart measurement on VSA.
::: SET_DEVICE A:VSALER =1.4        .
      Sets the VSA longitudinal emittance request in units of eV-S.
::: SET_SEQ FILE 86                 .
      File #86 checks the SEM grid positions
      D:SM926  STATUS COMPARE       off                              ok
      D:SM921  STATUS COMPARE       off                              ok
      d:sm917  STATUS COMPARE       on                               ok
      D:SM917  STATUS COMPARE       off                              ok
      D:SM913  STATUS COMPARE       off                              ok
      D:SM909  STATUS COMPARE       off                              ok
      D:SM906  STATUS COMPARE       off                              ok
      d:sm900  STATUS COMPARE       on                               ok
      D:SM900  STATUS COMPARE       off                              ok
::: CHECK_DEVICE A:ESHTST READING   .
      Verifies that the Accumulator extraction shutter is open (A:ESHTST = 1).
::: CHECK_DEVICE A:ISHTST READING   .
      Verifies that the Accumulator injection shutter is open (A:ESHTST = 1).
::: CHECK_DEVICE A:EKIKTG READING   .
      Verifies that the Accumulator extraction kicker start timer is set to and
      MIBS value of 13.58491 MI revolutions.
::: SET_SEQ FILE 84                 .
      File #84 CW RF gated for shots
      A:R2LLT1 SET DEVICE           24                               ok
      A:R2LLT1 SET TIMER REFER      91                               ok

      A:R2LLT2 SET DEVICE           0                                ok
      A:R2LLT2 SET TIMER REFER      91                               ok
      A:R2LLT2 TURN DEVICE ON                                        ok

      A:R1HLSC DIG_ALARM ENABLE                                      ok
      A:R4HLSC DIG_ALARM ENABLE                                      ok

::: SETIT_DEVICE A:R4LLAM =0        .
      Sets ARF4 amplitude control parameter to zero.
::: CTLIT_DEVICE A:R4HLSC ON        .
      Turns on ARF4 HLRF.
::: CTLIT_DEVICE A:R4LLAM ON        .
      Turns on ARF4 amplitude control.
::: CTLIT_DEVICE A:R1HLSC ON        .
      Turns ARF1 HLRF on.
::: CTLIT_DEVICE A:EKIK   ON        .
      Turns on the Accumulator extraction kicker.
::: CTLIT_DEVICE A:EKIKQ  ON        D
      Turns on the Accumulator extraction kicker.
::: CHECK_DEVICE A:R3SPRD OFF       .
      Turns off the AFR3 Beam Spread enable parameter.
::: CTLIT_DEVICE A:RLLEXF ON        .
      Turns on the ARF4 extraction orbit frequency parameter.
::: CTLIT_DEVICE A:R4MIPS ON        .
      Turns on the ARF4 to Main Injector phase set point parameter.
::: SETIT_DEVICE A:R4BKMP -553      D
::: SETIT_DEVICE A:RCBKHD =10       D
::: EVENT 7A ENABLE                 .
      Enables TCLK event $7A (Main Injector BPM write profile mem).
::: EVENT 94 ENABLE                 .
      Enables TCLK event $94 (Accumulator injected pbar synch).
::: EVENT 9A ENABLE                 .
      Enables TCLK event $91 (Accumulator Pbar to Main Injector transfer prep).
::: INSTRUCT 252                    .
```

::: FTP RF 0 D
::: FTP Shot 0 .

Starts a FTP on the screen of the operator's choice that contains Accumulator RF unstacking parameters.

- Accululator LLRF Synth #1 parameter A:RFDDS1 (628700-628950 Hz).
- ARF4 Cavity Volts parameter A:R4HLFB from 0-1500 V.
- ARF4 MI phase error parameter A:R4MIPE from -10 - 10 degrees
- ARF1 fanback voltage parameter A:R1FANB from 0-60 KV.
- All over time from 0-24 seconds triggered on an event $91.

::: LOOP BEGIN: LOAD USER .

Starts the "Load" loop. The loop starts from this location and ends when the sequencer LOOP END: Load command is reached.

- USER option presents the user with a dialog box that asks how many times to run the loop. The loop should be run one time for each transfer from the Accumulator. For example, if 6 of the 9 transfers come from the Accumulator, then the Pbar Sequencer Operator would enter 6.
- Which transfers come from the Recycler and which transfers come from the Accumulator are determined by the T:PBXFR array as seen on P38 MCBINNI < 8>.
- Each loop iteration performs all of the necessary steps to extract 4 groups of 2.5MHz bunches to the Main Injector.
- The loop pauses on each Recycler transfer.
- The loop repeats once for each Accumulator transfer.

::: WAIT_DEVICE V:TSHOOT .

Waits for state V:TSHOOT to be 3 (ready for pbars).

::: SET_DEVICE A:SHTNUM +=1 .

Increments the Pbar Transfer Series shot number by one.

::: AUTO_PLOT Shoot .

Starts a FTP on the screen of the operator's choice to plot unstacking transfer efficiencies.

- Main Injector DCCT beam intensity readback I:IBEAMM from 0-0.32E12
- AP1 toroid beam intensity readback M:TOR105 from 0 - 25E10.
- AP3 toroid beam intensity readback M:TOR910 from 0 - 25E10.
- Accumulator DCCT beam intensity readback A:IBEAMB from stack size - stack size - 25 e10.
- All plotted over a time of 0-10 seconds triggered on an event $9A.

::: CUSTOM UNSTACK_FRACTION .

This command allows the operator to enter, from the data on the shot spreadsheet, the unstacking fraction. This command changes the parameter A:BMFRAC (dbeam_fraction) to "how much beam to unstuck"/A:IBEAMB.

::: WAIT_DEVICE A:VSAAVG .

Waits for A:VSAAVG (VSA #1 # of averages counter) to be 1.

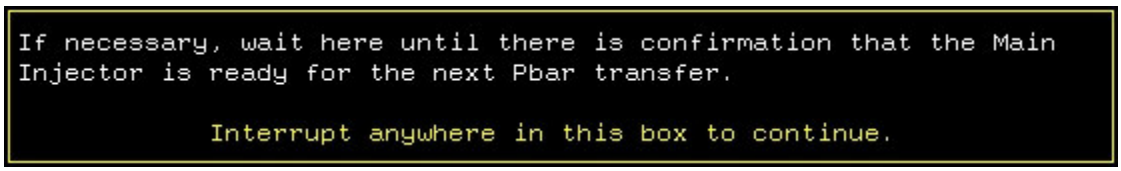
::: CHECK_DEVICE A:BMFRAC SETTING .

Checks the unstacking beam fraction.

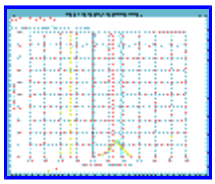
::: SETIT_DEVICE A:VSAMRK =7 .

Sets VSA #1 marker parameter to 7.

::: INSTRUCT 254 .



::: ACKNOWLEDGE .



::: SETIT_DEVICE A:VSAMRK =0 .
Sets VSA #1 marker parameter to 0, and then checks that it is at that value.

::: CHECK_DEVICE A:FLOWPC SETTING .
Checks value of A:FLOWPC (df_lower_pc) value in Hz.

::: CHECK_DEVICE A:FUPPC SETTING .
Checks value of A:FUPPC (df_uppoer_pc) value in Hz.

::: CHECK_DEVICE A:CENFRQ READING .
Checks value of the Accumulator center revolution frequency.

::: SET_DEVICE A:CNFRQU A:CENFRQ .
Sets A:CNFRQU (Accumulator Center Revolution Frequency unstacking) equal to A:CENFRQ (Accumulator center revolution frequency).

::: SET_DEVICE V:PBXFER V:XFER .
Sets V:PBXFER (next Pbar transfer number) equal to V:XFER (next Tev transfer number).

::: CHECK_DEVICE A:R2DDS1 READING .
Checks the Accumulator LLRF Synth #1/h parameter setting.

::: CHECK_DEVICE D:HT901 SETTING .
Checks the setting of D:HT901.

::: WAIT_DEVICE A:R4RDY .
Waits for A:R4RDY (ARF4 ready to run) to be equal to 1.

::: CHECK_DEVICE D:PERMIT ON .
Verifies that the Pbar beam permit is on.

::: EVENT 91 ENABLE .
Enables TCLK event $91 (Accumulator unstuck cycle reset).

::: WAIT_FOR EVENT 91 .
Waits for the next TCLK event $91.

::: SETIT_DEVICE V:PSHOOT =3 .
Sets state V:PSHOOT to 3 (Unstacking Pbars to the Tevatron), and then checks that it has that value.

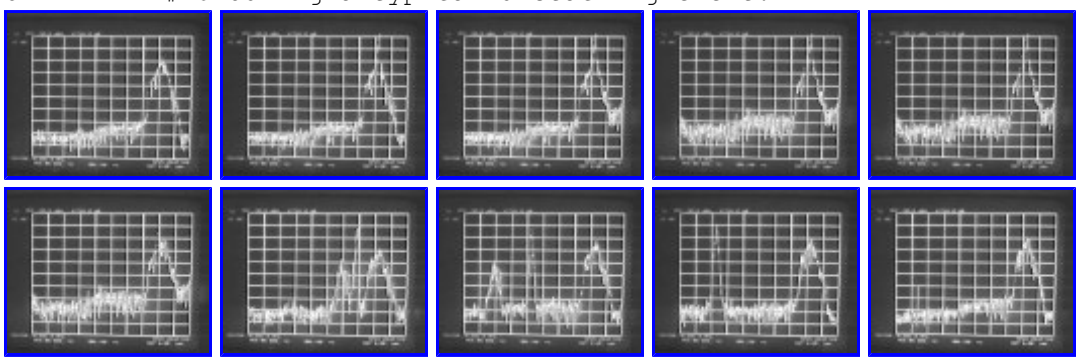
::: NOTIFY Unstacking .
Sends a Channel 13 Notify message to http://www-bd.fnal.gov/cgi-bin/notify_mes.pl?ch13=text.

::: EVENT 91 DISABLE .
Disabled the TCLK event $91 (Accumulator unstuck cycle reset).

::: WAIT_FOR SECS 6 .

::: CTLIT_DEVICE A:R1LLMR ON .
ARF1 phase lock to extract 53 MHz parameter is turned on.

```
::: CTLIT_DEVICE A:R1LLFP OFF       .
      ARF1 frequency program (curves) select parameter is turned off.
::: SET_DEVICE A:CNFRQU +=5.0       .
      Increment A:CNFRQU (Accumulator Center Revolution Frequency unstacking)
      by 5 Hz.
::: SET_DEVICE A:R2DDS1 A:CNFRQU    .
      Sets A:R2DDS1 (Accumulator LLRF Synth #1/h) to A:CNFRQU (Accumulator
      Center Revolution Frequency unstacking).
::: SET_DEVICE I:D5CQR1 =99         .
      Sets A:R2DDS1 (Accumulator LLRF Synth #1/h) to A:CNFRQU (Accumulator
      Center Revolution Frequency unstacking).
::: WAIT_FOR EVENT 94               .
      Wait for TCLK event $94 (Accumulator injected pbar synch).
      CATV PBAR #28 during a typical unstacking event.
```



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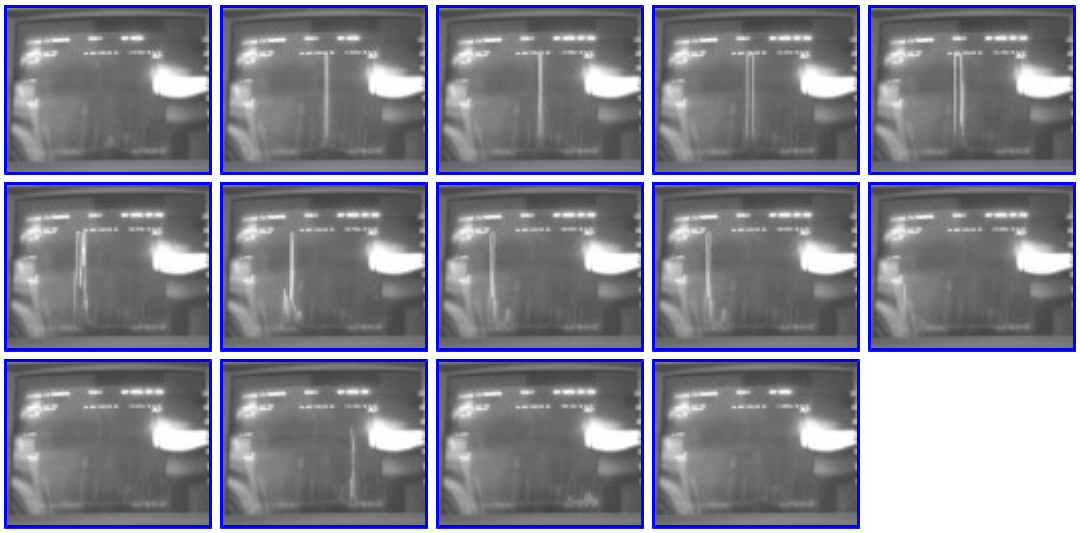
      CATV PBAR #16 during a typical unstacking event.
```



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      CATV PBAR #18 during a typical unstacking event.   This is the
      Accumulator Gap Monitor (Jello Display).
```
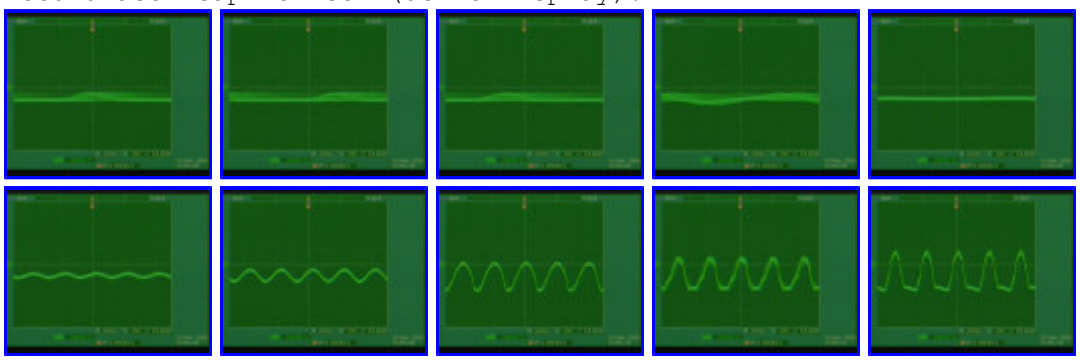
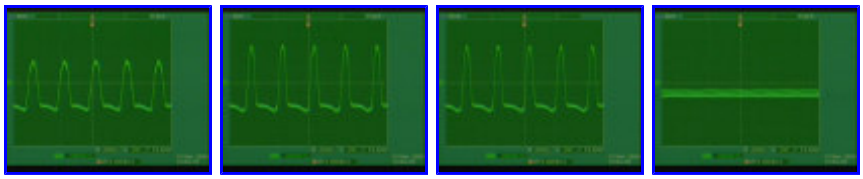
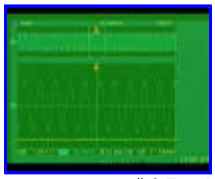
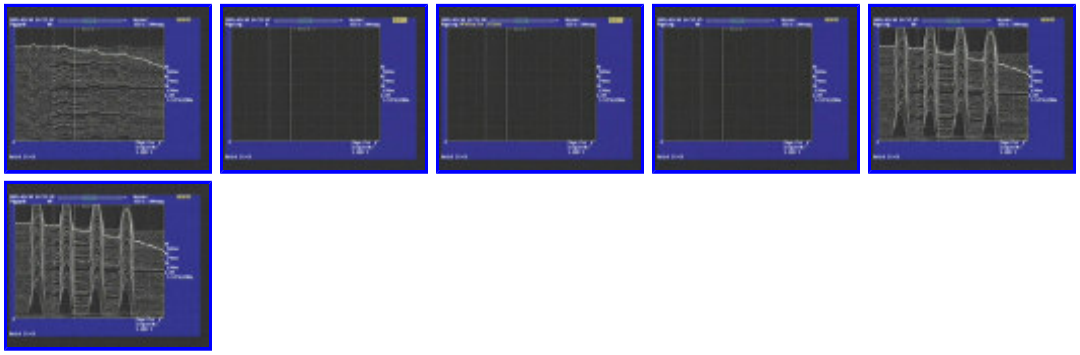





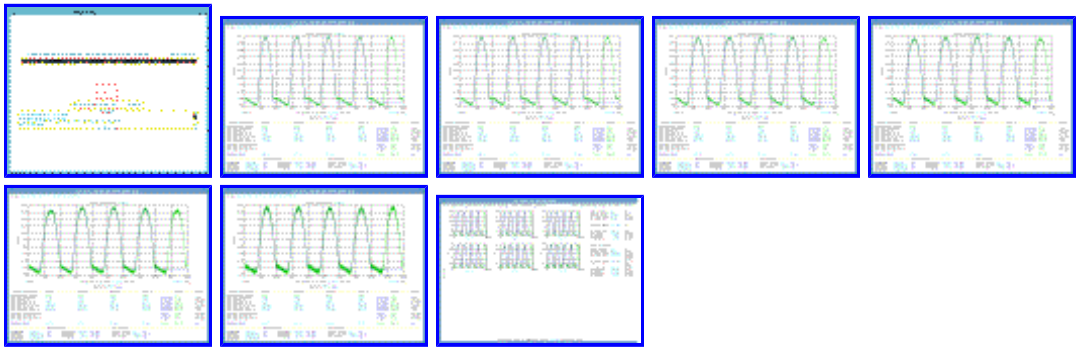
CATV PBAR #7 during a typical unstacking event. This is the Accumulator Wall Current Monitor, which is currently not functional.



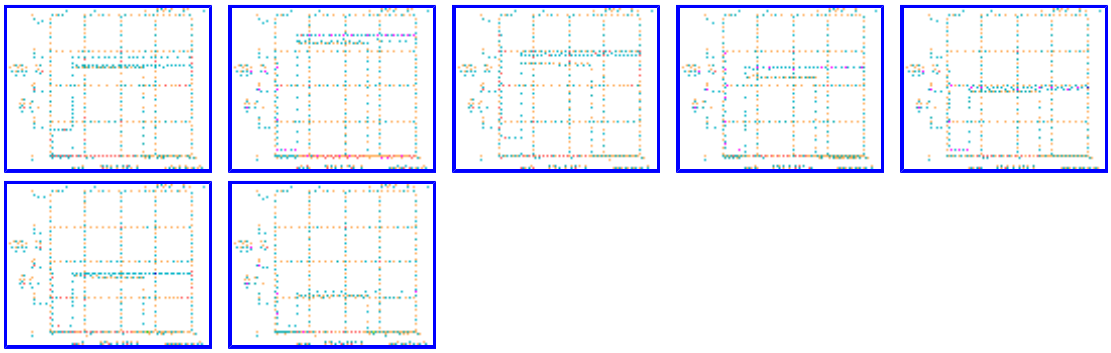
CATV MI #27 during a typical unstacking event. This is the Main Injector Wall Current Monitor.



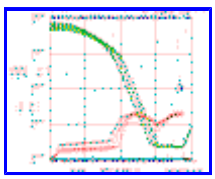
P207 during unstacking events.



Beam Transfer FTPs



RF FTPs



::: NOTIFY Inject Pbars .

Sends a Channel 13 Notify message to http://www-bd.fnal.gov/cgi-bin/notify_mes.pl?ch13=text.

::: SETIT_DEVICE V:PSHOOT =1 .
Sets state V:PSHOOT = 1 (not ready for transfer), and then checks that it is at that value.

::: SETIT_DEVICE A:VSARST =1 .
Sets VSA #1 Restart control parameter to 1 (Restart measurement).

::: WAIT_DEVICE A:VSARST .
Waits for A:VSARST to be zero.

::: SET_DEVICE A:CNFRQU A:CENFRQ .
Sets A:CNFRQU (Accumulator Center Revolution Frequency unstacking) equal to A:CENFRQ (Accumulator center revolution frequency).

::: SET_DEVICE A:CNFRQU +=5.0 .
Increment A:CNFRQU (Accumulator Center Revolution Frequency unstacking) by 5 Hz.

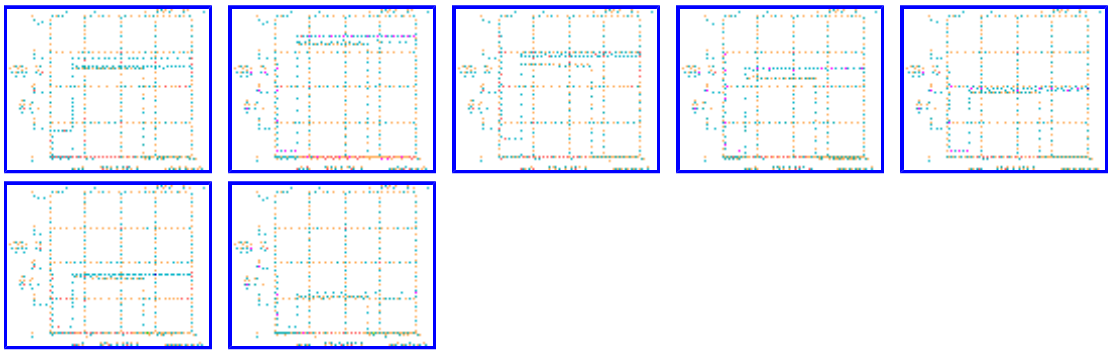
::: SET_DEVICE A:R2DDS1 A:CNFRQU .
Sets A:R2DDS1 (Accumulator LLRF Synth #1/h) to A:CNFRQU (Accumulator Center Revolution Frequency unstacking).

::: CUSTOM COOL_GAIN .
Sets core cooling PIN attenuators to values obeying an equation *mult(i)*(A:IBEAMB)+offset(i)*. The constants "offset" and "mult" are stored in a table maintained by the AD\Pbar department. Custom cooling gain usually undershoots cooling power for larger stacks.

::: WAIT_FOR SECS 5 .

::: COPY_SCREEN 0 SA D

::: SHOT_LOG IMAGE .
Adds the following plot into the Pbar portion of the shot scapbook at http://www-bd.fnal.gov/cgi-mach/machlog.pl?nb=scrap03. This plot represents the unstacking transfer efficiencies, and is repeated for all nine transfers.



::: SETIT_DEVICE A:VSARST =4 .
Sets A:VSARST (VSA #1 Restart Control) to 4 (center 4-8 GHz arrays on A:CENFRQ).

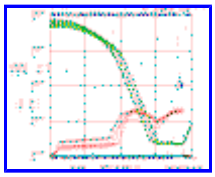
::: SETIT_DEVICE A:R4RDY =0 .
Sets A:R4RDY (ARF4 ready to run) to be equal to zero.

::: LOOP END:LOAD PBARS .
End of the Pbar extraction loop. After the loop has been executed nine times, the aggregate continues below.

::: INSTRUCT 256 .

```
   If there have been no problems loading the Tevatron with Pbars,
you have gotten to this point and can continue. If additional shots
to the Tevatron are needed, move up to the step
      LOOP BEGIN:LOAD PBARS 9 and play out the Sequencer from there
until the necessary number of shots are completed. If only a single
shot is needed, simply begin at the line below WAIT_DEVICE V:TSHOOT.

Do Not use this aggregate for Recycler shots. Play this one out and
move to Recycler Unstack & Transfer.

            Interrupt anywhere in this box to continue.
```

```
::: EVENT 7A DISABLE                .
      Disabled TCLK event $7A (Main Injector BPM write profile memory).
::: EVENT E1 DISABLE                .
      Disabled TCLK event $E1 (Recycler Pbars from Accumulator reset).
::: EVENT 9A DISABLE                .
      Disabled TCLK event $9A (Accumulator Pbar to Main Injector transfer prep).
::: EVENT 94 DISABLE                .
      Disabled TCLK event $94 (Accumulator injected Pbar synch).
::: CTLIT_DEVICE A:R1LLFP ON        .
      ARF1 frequency program (curves) select parameter is turned on.
::: CTLIT_DEVICE A:R1LLH2 OFF       .
      ARF1 phase lock to h=2 system is turned off.
::: CTLIT_DEVICE A:R1LLMR OFF       .
      ARF1 phase lock to extract 53 MHz is turned off.
::: CTLIT_DEVICE A:R4HLSC OFF       .
      Turns off ARF4 HLRF.
::: CTLIT_DEVICE A:R4LLAM OFF       .
      Turns off ARF4 amplitude control parameter.
::: CTLIT_DEVICE A:EKIK   OFF       .
      Turns off the Accumulator extraction kicker.
::: CTLIT_DEVICE A:EKIKQ   OFF     D
      Turns off the Accumulator extraction kicker.
::: CHECK_DEVICE A:R1LLPS SAVE_SET .
      Reads and saves the present setting of A:R1LLPS (ARF1 VCO phase control) in
      degrees.
::: CHECK_DEVICE A:R4MIPS SAVE_SET .
      Reads and saves A:R4MIPS (ARF4 Main Injector phase setpoint) in degrees.
::: SHOT_LOG Image                  .
      Adds the following plot into the Pbar portion of the shot scapbook at
      http://www-bd.fnal.gov/cgi-mach/machlog.pl?nb=scrap03. This plot represents
      the Accumulator RF unstacking parameters.
```



```
::: SETIT_DEVICE A:SHTNUM =0        .
      Resets the Pbar Transfer Series shot number to zero.
::: SETIT_DEVICE V:SETPBT =5        .
      Sets state V:SETPBT to 5.
ok  INSTRUCT 258                    D
```

Collider Aggregate: **Run II Load Collider Pbars** has been completed.

Next Aggregate: Run II Revert to Stack Lattice

How to get back to stacking form here: Finish this aggregate and

then run both the Run II Revert to Stack Lattice and the Run II Return to Stacking aggregates.