MI-0261

GFSDA In the Main Injector

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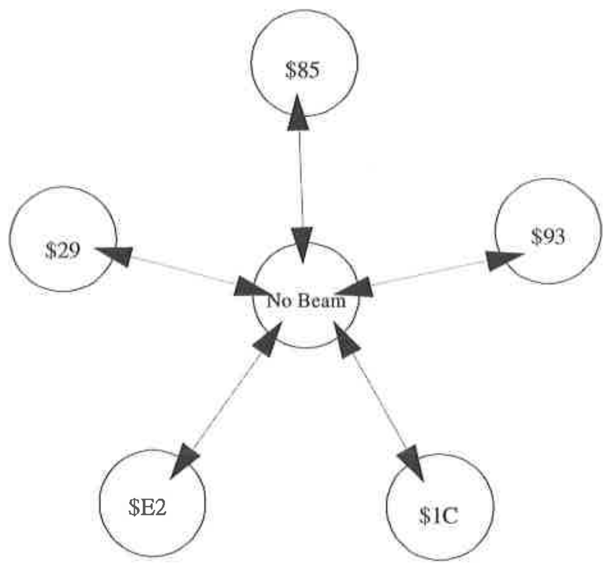
For the last two weeks, GFSDA has been running reliably and taking data in the Main Injector. In this note I shall briefly describe how the system is configured, show some examples of the data we have taken, and discuss its uses. I shall publish a more detailed "Users Manual" shortly.

GFSDA is currently configured in an extremely simple fashion. Its initial state is the "No Beam" state, a state whose only task is to watch for the TCLK events in its transition table, and undergo transitions to the proper data acquisition states when one of these events occurs. Right now, Main Injector TCLK events $29, $1C, $85, $93, and $E2 force transitions from the "No Beam" state. These states do the data acquisition. Data acquisition is simple - the Schottky detectors are digitized at the revolution frequency for a programmed time. Once data acquisition has been completed, the transition back to the "No Beam" state occurs either on a TCLK event or after a specified length of time in the state. All the information about the transition rules and data acquisition rules is programmed dynamically from console application I43. The current simple state diagram is shown in the figure below. I don't expect the state diagram to become any more complicated as more Main Injector operations are added. Instead, we shall simply add states and possibly add another finite state machine (a state can have a maximum of 8 transition rules) to the system, but all states will be entered from and return to a "No Beam" state.

GFSDA Transition Map



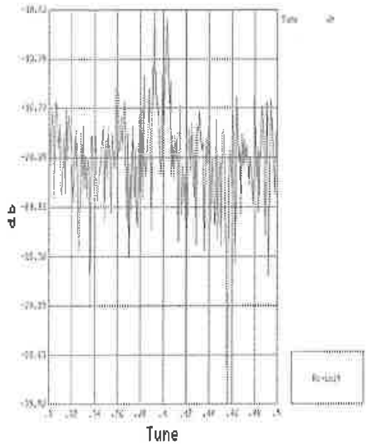
To illustrate the type of data GFSDA produces and the power it provides, I have included 9 tune spectra taken at 3 different times during a single $2E pulse (sorry for squeezing them onto the page). I plot the Horizontal and Vertical tune spectra and the correlation of the two spectra. Signals are clearly visible in the individual planes, and the correlation suppresses the random ("uncorrelated") background and enhances the peaks. Of course, going from these spectra to tunes requires some additional work - one would want to see that the measured tunes track changes in the quadrupole buses, etc. One can also see that if the Main Injector tunes can be made visible over the entire ramp, then they can also be measured in a single ramp. This is an enormous time savings over any other method available. These spectra were acquired through console application I44, which provides access to all the states and data, and also provides plotting options.

GFSDA can be used in conjunction with the pinger to measure tunes at points in the ramp in which there is not sufficient natural excitation of the beam. If the beam can be excited continually through the cycle, with a noise source as the damper input, for instance, it will be possible to measure the tune over the entire ramp on a single pulse.

The only known needed improvement in GFSDA involves the mechanism for leaving a state. Currently, whatever data acquisition has been specified must finish before the exit can occur, rather than having the exit event terminate data acquisition. Jerry Firebaugh is examining the microcode to see if this problem can be ameliorated. We can easily work around this problem by knowing the length of time that beam will be in the Main Injector for each cycle, and specifying the number of digitizations to be acquired to match that time, but it would be nice not to have to specify that information.

I shall work on a more complete manual for the use of the GFSDA system. In the meantime, I shall be glad to instruct people in the use of I43 and I44 so that we can make GFSDA into an easily accessible and important diagnostic in the Main Injector.

MI Pr Hor
14:36:27:74 Mon Mar 06 1900
MI #E2 Data State
.050 seconds



MI Pr Ver
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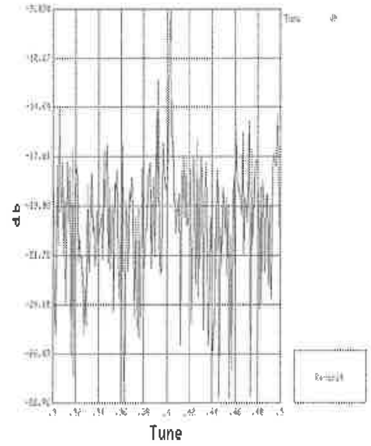
MI #E2 Data State
.050 seconds



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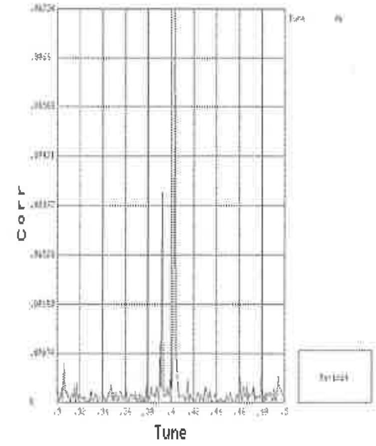

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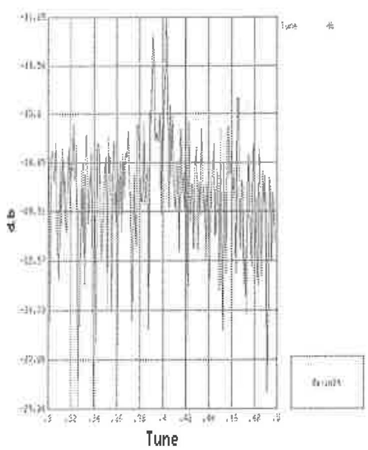
.200 seconds



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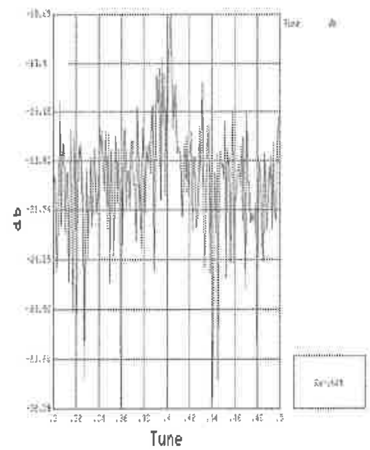

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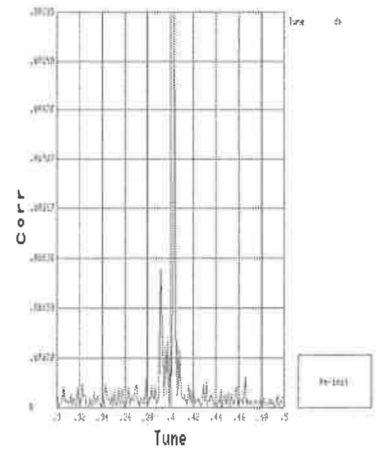

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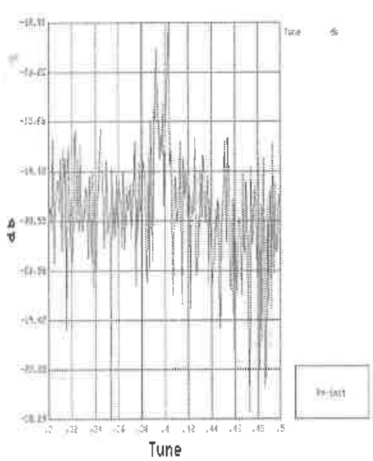

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MI #E2 Data State
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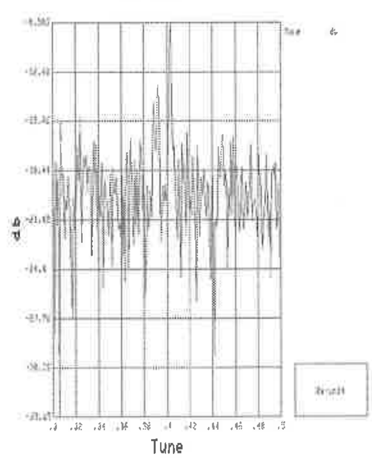

MI Pr Hor *MI Pr Ver
14:36:27:74 Mon Mar 06 1900
MI #E2 Data State
.500 seconds