Serial Command Link Description
D-Zero Run II Trigger DAQ System

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|        DRAFT COPY         |                Original Rev.     2-AUG-1995
|  NOT GOOD FOR PRODUCTION  |                 Current Rev.  24-APRIL-1997
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The idea of the Serial Link (SCL) is to have a single common path that carries all of the information that a Geographic Section needs to know in order to operate in the D-Zero Run II environment. The SCL will carry the following general types of information from the "Hub-End" out to all 128 Geographic Sections:

- Timing Information.
- Results of Level 1 Trigger decisions.
- Results of Level 2 Trigger decisions.
- Requests for the Geographic Sections to Initialize.

The SCL will return to the Hub-End the following information from each of the 128 Geographic Section:

- The L1 and L2 Busy signals from each Geographic Section
- The L1 and L2 Error signals from each Geographic Section
- The Initialize Acknowledge signal from each Geographic Section
- Two spare signals from each Geographic Section

There are a number of motivations for wanting a single link to carry all of this information. These include:

- A single link allows easy control of the time delay in transporting information from the SCL Hub-End to the Geographic Sections.
- Putting all of this information onto a single link guarantees that the various components of this information stream arrive in the correct time order at the Geographic Section.
- Having all of this information on a common transport media makes it easy for hardware diagnostics to "listen" to what the Geographic Section is being told and there by check the operation of that Geographic Section.

- A common SCL Receiver Mezzanine card can be used in all Geographic Sections. This card decodes all information that is transported from the Hub-End and presents this information to the Geographic Section. We gain the advantage of using a common SCL Receiver although not all Geographic Sections will need to use all of the information that is presented to it.

This document only attempts to describe the information that is carried on the SCL and how it is presented at the Geographic Section end of the SCL. For details about the SCL Receiver mezzanine card see the document "Serial Command Link Hardware" that was written by Mark Baert.

Definition of a few jargon terms used in this document:

- "Tick" a 132 nsec period, i.e. 7 RF buckets. The first RF bucket of a tick is the RF bucket that contain particles, if this tick contains a real beam crossing. A frame of SCL information is transmitted once every tick.
- Two terms that are used as event identifiers (Geographic Section Beam Crossing Number and Geographic Section Level 1 Trigger Number) have the prefix words "Geographic Section" to help differentiate these terms from similar terms used else where in D-Zero. The prefix "Geographic Section is appropriate because other event identifiers will be used once an event has been transported to later stages of the DAQ L3 system.
- "Markers" are used to inform the Geographic Section about the current state of the accelerator as seen at D0 (e.g. is this the beginning of an accelerator turn).
- "Indicators" tell a Geographic Section that it should take some action. They can be thought of as commands which a Geographic Section must respond to.
- "Advisors" tell all Geographic Section that some significant information is being distributed during the current SCL frame.
- "Numbers" Crossing Numbers are used to associate Indicators with the beam crossing for which they have been issued. Transfer Numbers are numbers associated with Indicators for the purpose of DAQ system synchronization. Qualifier Numbers are used to qualify, or add additional meaning to Indicators and Advisors.
- "Flags" are signals that are asserted in response to some condition and remain asserted until they are acknowledged.
- "Status signals" are used by the Geographic Section to tell the Trigger Framework it's present status, (e.g. Busy or Error conditions).

Information Transported from the Hub-End to the Geographic Sections

The Hub-End of the SCL is a set of modules called the SLIM modules. Each SLIM module contains a number of SCL channels. The following are the sources of the information that is transported from the Hub-End of the SCL to the Geographic Sections:

1. Master Clock
2. Level 1 Trigger Framework
3. Level 2 Trigger Framework

The information that is transported from the Hub-End to the Geographic Sections is described in the following paragraphs. All of this information is decoded by the SCL Receiver Mezzanine card and presented to the Geographic Section via pins that connect the SCL Receiver to the supporting circuit board.

The following information originates in or is controlled by the Master Clock

1. A 53.104 MHz Clock.
2. A 7.59 Mhz Clock (a.k.a. the 132 nsec tick clock).
3. An 8 bit count of which 132 nsec period in a turn this currently is. There are 159 of these ticks during a turn. These are numbered 1 through 159.
4. A 16 bit count of how many turns there have been. Note that this 16 bit turn count rolls over once every 1.3 seconds.
5. A marker which indicates if this 132 nsec period is the first 132 nsec period in a turn.
6. A marker which indicates if this 132 nsec period contains a real beam crossing in the D-Zero detector. This means that this Tick is both part of a Super Bunch and that this tick is scheduled to have its first RF bucket contain particles.
7. A marker which indicates if this 132 nsec period is part of a 2 usec accelerator gap during which there will be no Level 1 triggering (i.e. there is no possibility of an L1 Accept being issued 27 "ticks" from now as a resulting of activity that occurred during this 132 nsec period). This is called the Sync Gap.
8. A marker which indicates if this 132 nsec period is part of a 2 usec accelerator gap during which there will be only Cosmic or pulser Level 1 triggering.
9. A spare marker.

Notes about the SCL information that originates in the Master Clock or that is controlled by the Master Clock:

- This information is sent on the SCL early enough so that it arrives at the Geographic Section end of the SCL at the time at which the indicated activity actually takes place (e.g. the Geographic Sections learn that this is the first 132 nsec period in a turn at the time at which this is actually happening in the in the D-Zero Detector).

- This information must be sent out from the Hub-End early enough so that it reaches the furthest Geographic Section in time. Because the Hub-End sends this information to all Geographic Sections simultaneously and because some Geographic Sections will need additional time to transport this information out into their front-end electronics, there is the possibility that Geographic Sections that include no additional delay will effectively be receiving this SCL Master Clock information BEFORE the indicated activity actually takes place. If this is the case, then it is the responsibility of these Geographic Sections to include provisions for inserting a delay before they make use of this SCL transported Master Clock information. There is the possibility that this delay could be achieved by making the SCL connection to these Geographic Sections physically longer.

- All of this information that is generated by or controlled by the Master Clock is information that indicates what is CURRENTLY going on in the accelerator and D-Zero detector.

- The 7.59 MHz (132 nsec) clock is the basic clock in the system. The positive rising edge of this clock indicates the beginning of each 132 nsec period.

- Item #3 above, the 8 bit count of which 132 nsec period in a turn is currently taking place, may be generated locally by a counter that is incremented by the 7.59 MHz clock and is reset to the value one by the marker which indicates the first 132 nsec period in a turn.

- Item #4 above, the 16 bit count of turns, may be generated locally by a counter that is incremented by the marker which indicates the first 132 nsec period in a turn and is reset to zero by the Geographic Section Initialization process that is described below.

- The 8 bit count of which 132 nsec period in a turn this is, together with the 16 bit turn count uniquely identify the particular beam crossing that is currently taking place in the D-Zero detector. This combination is called the Geographic Section Beam Crossing Number. It is updated every 132 nsec tick whether or not a given tick is part of a super bunch or not. A given Geographic Section Beam Crossing Number remains unique for a period of 1.3 seconds.

- All five of the "markers" are updated for each 132 nsec period. The state of these markers indicate the conditions for the 132 nsec period following the positive edge of the 7.59 MHz clock. The state of all five markers is presented to the Geographic Section via separate pins on the SCL Receiver Mezzanine card. The state of these markers only changes at the instant of the positive edge of the 7.59 MHz clock (i.e. the marker signals that are given to the Geographic Section are the output from a D-Latch on the SCL Receiver and these D-Latches updated on the positive edge of the 7.59 MHz clock).

- All five of the "markers" are glitch free. That is, if one of the markers is high (or low) during two successive 132 nsec periods, then it is guaranteed that there will be no glitches in this signal during the transition between these 132 nsec periods.

- Together items #7 and #8 above inform the Geographic Sections about the accelerator gaps that occur between super bunches. There are three of these gaps per accelerator turn. Each gap is about 2 usec long. None of the 132 nsec periods that are part of one of these gaps contain any real beam crossings. From the point of view of Level 1 Triggering we consider there to be two types of accelerator gaps which are described below.

  During at least one of these accelerator gaps each turn there is no possibility of an L1 Accept resulting from activity that occurred during any of the 132 nsec periods that are part of this gap. The front-ends are not even responsible for capturing their detector information during this type of gap. The marker described in item #7 above indicates to the Geographic Sections whether or not they are currently in an accelerator gap of this type. This type of accelerator gap, which is guaranteed not to produce any L1 Accepts, is call the "Sync Gap".

  If desired one or both of the other two accelerator gaps each turn can allow the possibility of a Level 1 Accept being issued 27 "ticks" later as a result of activity that occurred during a 132 nsec period that was part of one of these gaps. This activity could be a Level 1 cosmic trigger or some kind of pulser trigger. The marker described in item #8 above indicates to the Geographic Sections whether or not they are currently in an accelerator gap of this type.

  Note that a Level 1 Accept can be issued during any of these gaps described above. What is described in the three paragraphs above are gaps during which no, or only limited, activity could result in a Level 1 Accept being issued 27 ticks later.

- Figure number 1 shows two views of the SCL clock signals and some of the "markers". The upper part of this figure shows two periods of 132 nsec, the 7 RF buckets in each of these periods, the relationship of the 7.59 MHz clock to the periods, and the location of the RF bucket that contains the beam crossing in these periods.

  The lower section of figure number 1 shows a sequence of 11 periods of 132 nsec in the vicinity of the beginning of turn marker. Note that as the SCL is used at D-Zero in Run II, the beginning of turn marker will always occur near the end of an accelerator gap that does not generate any L1 accepts, i.e. near the end of the Sync Gap.

The following information on the SCL comes from the Level 1 Framework

1. During every 132 nsec period an advisor is sent from the L1 Framework to all 128 of the Geographic Sections. This advisor shows whether or not a Level 1 Accept is being issued during this 132 nsec period. Note that not all L1 Accepts involve all Geographic Sections.

2. During any 132 nsec period that the advisor in item #1 above is active, then the following additional information is sent from the L1 Framework to all 128 Geographic Sections.

(a) An individual indicator is sent to each Geographic Section to show whether or not the Level 1 Accept that is being issued during this 132 nsec period requires the particular Geographic Section to perform the L1 part of its DAQ cycle. Note that not all Level 1 Accepts go to all Geographic Sections. By watching just this single indicator a Geographic Section can determine if it is being sent a Level 1 Accept.

(b) The Level 1 Accept Qualifiers. With every Level 1 Accept that is issued, 16 qualifier bits are sent to all of the Geographic Sections.

A given Level 1 Accept Qualifier is either asserted or negated depending on whether or not any of the Level 1 Specific Triggers, that belong to the subset of Specific Triggers that COOR has defined for this Qualifier, actually fired during the Level 1 Accept. These Level 1 Accept Qualifiers may be used by such systems a Level 2 Pre-Processors to control whether or not a Level 2 Pre-Processor actually processes the data from a given event.

3. During every 132 nsec period (except those during which a L2 Trigger decision is being advertized) the L1 Framework sends out a Geographic Section Level 1 Trigger Number. The Geographic Section L1 Trigger Number is just exactly the Geographic Section Beam Crossing Number from the beam crossing whose Level 1 Trigger Decision is being distributed during the current 132 nsec period.

   Thus, like the Geographic Section Beam Crossing Number, the Geographic Section Level 1 Trigger Number is made up of two parts:

   (a) The 16 bit turn count from the beam crossing that resulted in this Level 1 trigger decision and

   (b) The 8 bit count indicating which 132 nsec period in the turn contained the beam crossing that resulted in this Level 1 trigger decision.

   The Geographic Section Level 1 Trigger Number allows the front-end Geographic sections to verify that they are capturing or discarding detector information from the proper beam crossing in response to Level 1 trigger decisions.

4. The SCL will not advertize a L1 Accept and a L2 Decision during the same 132 nsec period.

5. As used in D-Zero Run II the Level 1 Framework will enforce a minimum time spacing between successive L1 Accepts. This minimum time spacing between L1 Accepts is set by a programmable parameter in the L1 Framework.

6. During any 132 nsec period, the Level 1 Framework may need to request that the Geographic Sections "Initialize". A request to Initialize could result from a Geographic Section reporting either an L1 error or an L2 error.

   The initialization processes begins when the Level 1 Framework advertizes to all Geographic Sections, via the Initialize Flag Signal on the SCL, that the Geographic Sections need to Initialize. The Level 1 Framework will continue to request the initialization

and the SCL will continue to transport this request to the Geographic Sections until all Geographic Sections have first asserted their INIT-ACK Signal (indicating that they have received the request to Initialize) and then cleared their INIT-ACK Signal (indicating that they have completed their initialization).

When the Level 1 Framework asserts the Initialize Flag Signal it can not wait arbitrarily long for a given Geographic Section to return an active INIT-ACK Signal indicating that the Geographic Section has received the request to initialize. The Level 1 Framework will wait for a duration of 1 turn for the Geographic Sections to return active INIT-ACK Signals before timing out and sending an alarm.

To insure that the Level 1 Framework recognizes the INIT-ACK Signal, the Geographic Sections must send out an active INIT-ACK Signal for a duration of at least one turn.

Once the Level 1 Framework has received an active INIT-ACK Signal from a Geographic Section it can not wait arbitrarily long for the Geographic Section to drop its INIT-ACK Signal indicating that the Geographic Section has completed its initialization process. The Level 1 Framework will wait for a duration of 100 msec for the Geographic Section to clear its INIT-ACK Signal before timing out and sending an alarm.

Once the Level 1 Framework sees that all Geographic Sections have completed their initialization process then the Level 1 Framework will stop asserting the Initialize Flag signal.

The Level 1 Framework will drop the Initialize Flag during the early part of a turn (between 10 and 20 ticks into a turn) and it guarantees that it will not send out any Level 1 Accepts until well after the first crossing of the next turn. Thus, after they see the Initialize signal drop, the Geographic Section can use the next occurrence of the marker that indicates the first 132 nsec period of a turn to begin incrementing any local counters that indicate the current Geographic Section Beam Crossing Number.

After the Initialize Flag has dropped, the first occurrence of the the marker that indicates the first 132 nsec period of a turn will indicate the beginning of turn number 1, and 132 nsec period number 1. During the period that the Initialize signal is active the turn count is held at zero.

Once the initialization process is complete, the Level 1 Framework guarantees that it will not begin requesting another initialization for at least one turn.

The initialization process is illustrated in figures number 2 and number 3. Figure number 2 shows the various steps in the initialization process and figure number 3 shows the end of the initialization process when the Initialize Flag is dropped.

The following information on the SCL comes from the Level 2 Framework

1. During each 132 nsec period an advisor is sent from the Level 2 Framework to all 128 Geographic Sections. This advisor shows whether or not a Level 2 Decision is being advertized during this 132 nsec period.

2. During any 132 nsec period that the advisor in item #1 above is active, then the following additional pieces of information are sent to all 128 Geographic Sections:

   (a) A individual indicator is sent to each Geographic Section to show whether the Level 2 decision that is currently being advertized involves a Level 1 Accept that this Geographic Section took part in AND that the Level 2 Decision is to Reject this L1 trigger.

   (b) A individual indicator is sent to each Geographic Section to show whether the Level 2 decision that is currently being advertized involves a Level 1 Accept that this Geographic Section took part in AND that the Level 2 Decision is to Accept this L1 trigger.

   Note that for a given Level 2 Decision, different (a) and (b) indicators may/will be sent to different Geographic Sections. Note also that it is completely legal for a given Geographic Section to see the advertizement of a Level 2 Decision where it receives both indicators (a) and (b) above in the negated state. This just means that the L2 Decision that is being advertized is for a Level 1 Accept that this Geographic Section did not take part in.

   (c) Whenever a Level 2 Decision is advertized, then the Geographic Section Level 1 Trigger Number of the Level 1 Accept that this Level 2 Decision goes with must also be sent to the Geographic Sections. This is to enable the Geographic Sections to verify that they are going to pass up to Level 3 or dump the event data from the proper Level 1 Accept. The Geographic Section Level 1 Trigger Number is in the same format as is used during Level 1 Accepts messages. That is:

      i. The 16 bit turn count from the beam crossing that resulted in the Level 1 Accept whose Level 2 Decision is now being advertized and

      ii. The 8 bit count indicating which 132 nsec period in the turn contained the beam crossing that resulted in the Level 1 Accept whose L2 Decision is now being advertized.

   (d) Whenever a Level 2 Decision is being advertized and the result of that Level 2 Decision is an Accept, then the event that is sent up to Level 3 must be assigned a strictly sequential Geographic Section Level 3 Transfer Number. This is a 16 bit number that the VBD's and the Data Cables use to verify that they are transporting the proper event.

3. The SCL will not advertize a L1 Accept and a L2 Decision during the same 132 nsec period.

4. As used in D-Zero Run II the Level 2 Framework will enforce a minimum time spacing between advertizing L2 Decisions. This minimum time spacing between sending out L2 Decisions is set by a programmable parameter in the L2 Framework.

Information Transported from the Geographic Section to the Hub-End

The SCL Receiver mezzanine card also drives 7 "user signals" from each Geographic Section back to the Hub-End. These 7 signals are: the L1 and L2 Busy, the L1 and L2 Error, the Initialize Acknowledge, and two spare status lines.

These 7 signals are communicated as TTL levels from the supporting circuit board to the SCL Receiver mezzanine card.

The SCL will not just update these signals at the Hub-End once every 132 nsec rather it will continuously transport these signals from the SCL Receiver to the Hub-End.

The SCL Receiver Mezzanine Card

In each Geographic Section the SCL is received by a SCL Receiver mezzanine card. This card is common to all Geographic Sections whether they are Front-End crates, or Level 1 or Level 2 Trigger crates. The SCL Receiver mezzanine card decodes the information on the SCL and presents this information as TTL signals on pins that connect it to the supporting circuit board. All of these TTL signals are voltage high in their logic one asserted state.

The information that is presented to the supporting circuit board is described in the tables below. Except for the 53.104 MHz clock and the 7.59 MHz clock all of this information is updated once every 132 nsec. All of this information comes from D-Latches at the output of the SCL Receiver card. These D-Latches are updated by the rising edge of the 7.59 MHz clock, i.e. at the beginning of each 132 nsec period. All of this information is glitch free (i.e. a signal that does not change states between successive 132 nsec periods will remain constant and glitch free during the transition between these periods). All signals that make a transition between successive 132 nsec periods will remain constant until ?? nsec before the positive edge of the 7.59 MHz clock (which marks the boundary between 132 nsec periods) and will have attained their new valid state with ?? nsec after the positive edge of the 7.59 MHz clock.

The SCL Receiver provides a strobe signal (the 7.59 MHz clock) to let the supporting circuit board know when all of this data is valid. Each positive edge of the 7.59 MHz clock indicates to the supporting circuit board that a new 132 nsec period is beginning and that all of the data has been updated to reflect the conditions during this current tick. This data should be examined by the supporting circuit board to see what action, if any, it needs to take.

The following three pages are a a description of the functional pinout of the SCL Receiver card showing the information that is sent from the Hub-End to the Geographic Sections.

Information that comes from the Master Clock:

Information Presented to the Supporting Circuit Board	Number of pins
53.104 MHz Clock	1
7.59 Mhz Clock (i.e. a 132 nsec clock)	1
Counter of the current 132 nsec periods during this turn.	8
Counter of the current turn around the accelerator.	16
Marker if this 132 nsec period is the "beginning" of a turn.	1
Marker if this 132 nsec period contains a real beam crossings.	1
Marker if this 132 nsec period is part of a gap that results in no Level 1 Accepts, i.e. a Sync Gap.	1
Marker if this 132 nsec period is part of a gap that results in only cosmic or pulser Level 1 Accepts.	1
Spare marker about this 132 nsec period.	1

Information that comes from the Level 1 Framework:

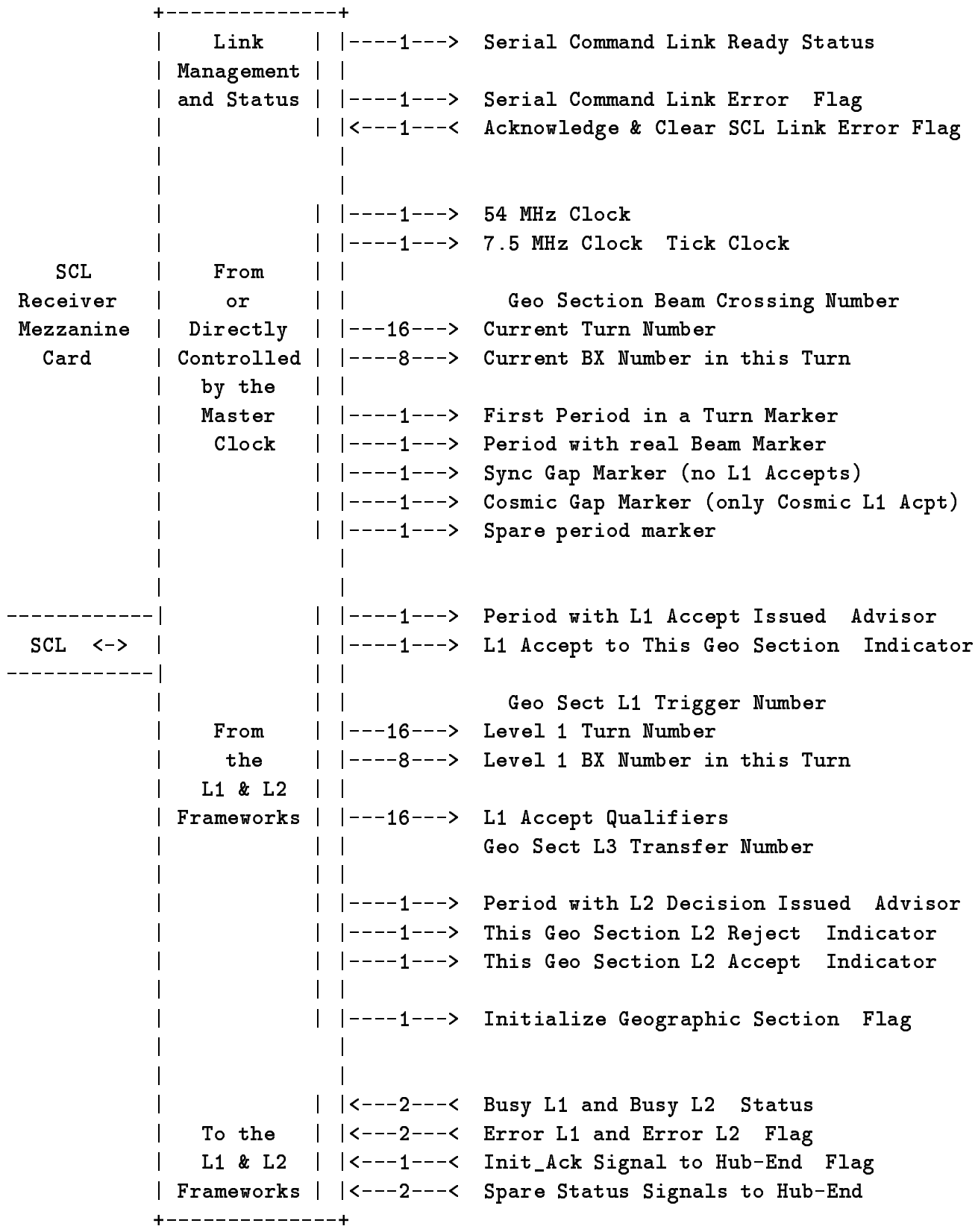
Information Presented to the Supporting Circuit Board	Number of pins
Advisor that this 132 nsec period contains a Level 1 Accept.	1
Indicator that this Geographic Section received a Level 1 Accept.	1
Geographic Section Level 1 Trigger Number: The 8 bit number identifying which 132 nsec period around a turn contained the beam crossing that this (i.e. the current) Level 1 Trigger Decision belongs to.	8
The 16 bit turn count identifying the turn that contained the beam crossing that this (i.e. the current) Level 1 Trigger Decision belongs to.	16
Level 1 Accept Qualifiers The Level 1 Accept Qualifiers come off of the SCL Receiver on the same pins as are used by the Geographic Section Level 3 Transfer Number from the Level 2 Framework.	16
Flag signaling that all Geographic Sections are to "Initialize".	1

Information that comes from the Level 2 Framework:

Information Presented to the Supporting Circuit Board	Number of pins
Advisor that this 132 nsec period contains a Level 2 Decision.	1
Indicator if this Geographic Section is being told that this Level 2 Decision belongs to a Level 1 Accept that this Geographic Section received and that the Level 2 Decision is to Reject this event.	1
Indicator if this Geographic Section is being told that this Level 2 Decision belongs to a Level 1 Accept that this Geographic Section received and that the Level 2 Decision is to Accept this event.	1
Geographic Section Level 1 Trigger Number to identify which Level 1 Accept is now receiving its Level 2 Decision. This comes off the SCL on the same pins as the Geographic Section Level 1 Trigger Number that is associated with Level 1 Decisions from the L1 Framework.	
The 8 bit number identifying which 132 nsec period around a turn contained the beam crossing that caused the Level 1 Accept that this Level 2 Decision belongs to.	8
The 16 bit turn count identifying the turn that contained the beam crossing that caused the Level 1 Accept that this Level 2 Decision belongs to.	16
The Geographic Section Level 3 Transfer Number that is being assigned to the event that just received an L2 Confirm during this 132 nsec period. The Geographic Section Level 3 Transfer Number comes off of the SCL Receiver card on the same pins as are used by the L1 Accept Qualifiers from the Level 1 Framework.	16

Adding up the above tables shows that 77 pins carry information from the SCL Receiver mezzanine to the supporting circuit board. Many additional pin will be needed to carry ground and power from the supporting circuit board to the SCL Receiver. An additional 7 pins are used to carry the Busy, Error, INIT-ACK, and spare status signals from the Supporting circuit board to the SCL Receiver. A block drawing of the SCL Receiver showing the I/O signals that connect it to the supporting circuit board is shown on the next page.

SCL Receiver Mezzanine Card Showing Its I/O Connections



Notes about the diagram on the previous page

The SCL connection on the left side of the SCL Receiver Mezzanine block indicates both the G-Link connection that brings information to the Geographic Section and the differential ECL link that carries information back to the Hub-End.

In this sketch only the "user signals" are shown. The internal signals such as the G-Link Receiver's STAT0:1 that are sent back to the Hub-End are not shown.

The Link Management and Status are shown at the top because that is the first thing that the user would need to look at before believing anything else.

For the SCL to operate it is not necessary for the circuit board that supports the SCL Receiver Mezzanine to make any connections to the three Link Management Signals. However, by using these signals the supporting circuitry can determine the status of the SCL connection to the Hub-End (and thus the validity of the SCL information that it is receiving) in the following way.

1. The "Serial Command Link Ready Status" signal indicates the current status of the SCL connection to the Hub-End. When the Geographic Section sees this signal asserted it indicates that the SCL is connected to the Hub-End that that its G-Link receiver is Synchronized with the Hub-End Transmitter.

2. The Geographic Section can determine if there has been any interruption of the SCL connection by examining the "Serial Command Link Error Flag" signal. This signal is set by even a momentary disturbance in the SCL connection. This signal can only be cleared by the "Acknowledge & Clear SCL Link Error Flag" pin.

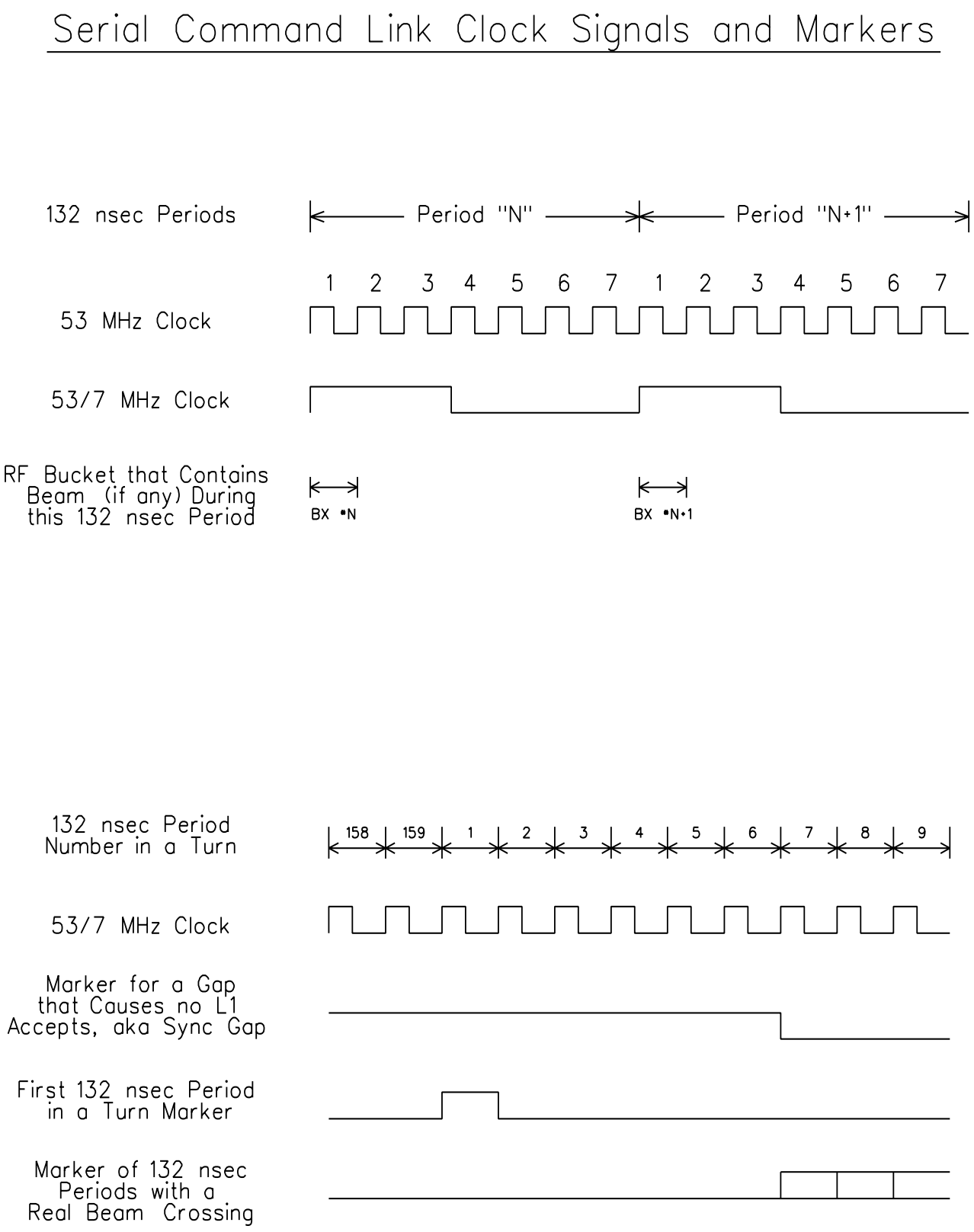
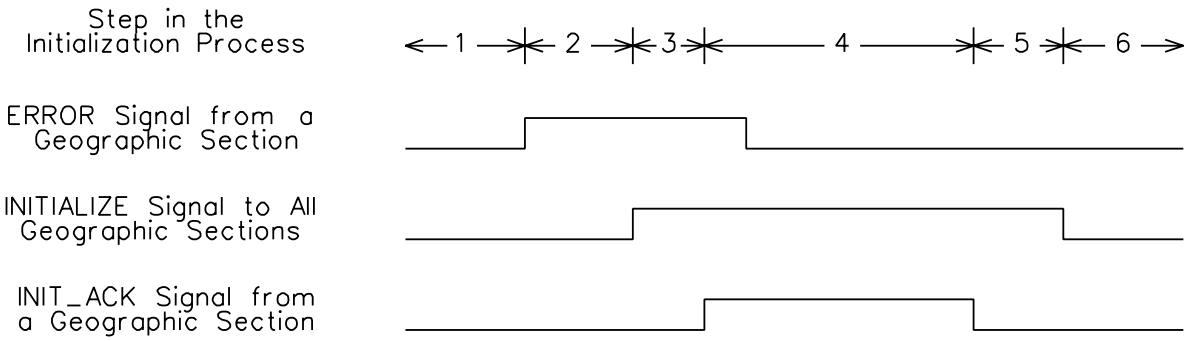


Figure 1: Serial Command Link, Clock Signals and Markers, Two Time Scales

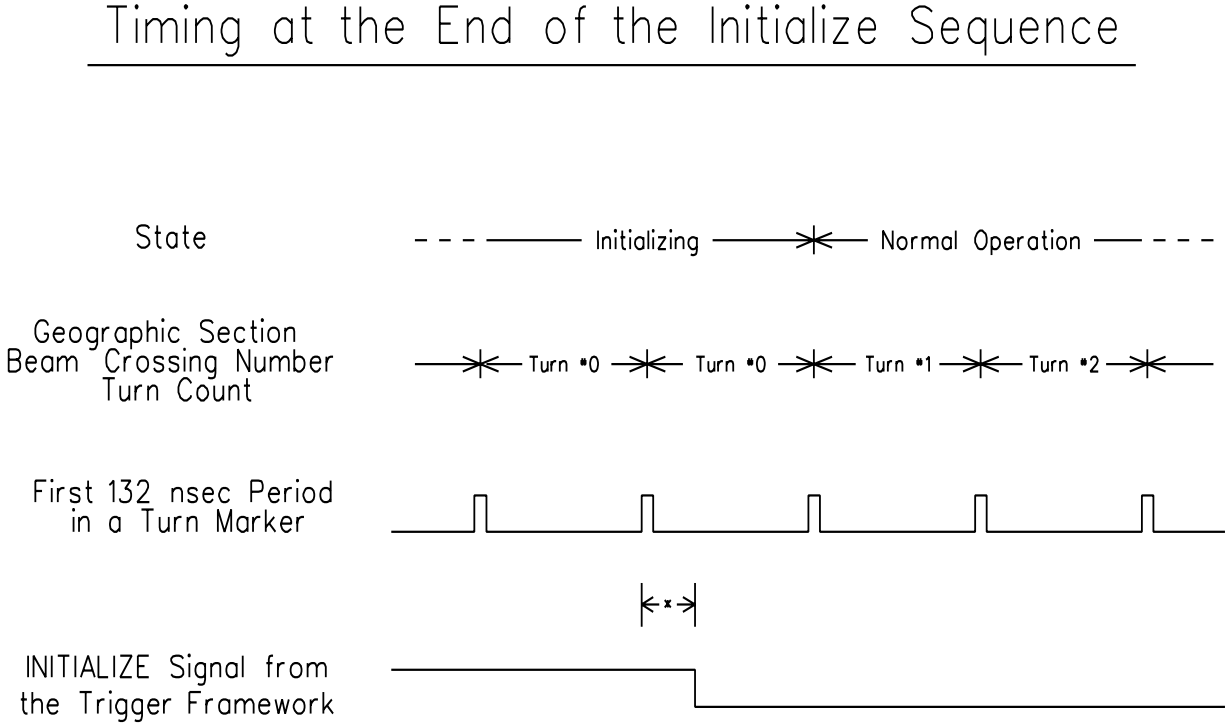
Sequence of Steps in the Initialization Process



Notes about the Steps Taken During Initialization:

1. The Geographic Sections are operating without error. At the end of step #1 a Geographic Section discovers an error and begins sending the ERROR Signal back to the Trigger Framework.
2. The Trigger Framework receives the ERROR Signal and at the end of step #2 the Trigger Framework begins sending out the INITIALIZE Signal.
3. All Geographic Sections receive the INITIALIZE Signal and begin their initialization processes. Each Geographic Section indicates that it has received the INITIALIZE Signal by raising its INIT_ACK Signal.
4. The Framework waits for all Geographic Sections to first raise their INIT_ACK Signal (indicating that they have received the INITIALIZE) and then the Framework waits for all Geographic Sections to drop their INIT_ACK Siganl (indicating that they have completed their Initialization process). Also during this period the ERROR Signal that caused this Initialization should drop (because the Geographic Section that it is coming from is Initializing).
5. When the Framework sees that all Geographic Sections have completed iInitialization, it will wait for the next occurrence of the "First 132 nsec Period of a Turn Marker" and then 10 to 20 ticks later it will drop the Initialization Signal.
6. When the Geographic Sections see the INITIALIZE Signal drop then on the next occurrence of the "First 132 nsec Period of a Turn Marker" the Geographic Sections begin to allow their Geographic Section Beam Crossing Number counters to increment. At this point normal Framework and triggering operation resumes. The Geographic Sections need to be able to accept new L1 triggers or else they need to be sending a BUSY Signal to the Framework.

Figure 2: Steps in the Initialization Process



x Note: The Trigger Framework guarantees that the delay between the "First 132 nsec Period in a Turn Marker" and the falling of the INITIALIZE Signal will be between 10 and 20 periods of 132 nsec (i.e. between 10 and 20 ticks).

Figure 3: Details of the End of the Initialization Process