SC Timing Trigger User Guide ATCA System

Thanks to Matt Weaver, Kukhee Kim, Mike Zelazny, Justin Chen and Ernest Williams. -Author: Carolina Bianchini Mattison

What does SC Timing Provides:

SC Timing Patterns from LCLS-II Project for Commissioning:

1. AC Rates (using Timeslot 3 and 6):0Hz, 1Hz, 10Hz, 30Hz, 60Hz, 90Hz, 110Hz, 119Hz, 120Hz
2. Fixed Rates: 0Hz, 1Hz ,10Hz, 50Hz, 100Hz, 120Hz, 200Hz, 500Hz, 1KHz, 1.4KHz, 5KHZ, 10KHz, 23KHz, 33KHz(special req. not in Tab 4 from PRD), 46KHz, 93KHz (special req. not in Tab 4 from PRD), 464KHz, 929KHz

The patterns 1) can be interleaved between multiple destinations (SC_DIAG0, SC_BSYD, SC_HXR, SC_SXR, SC_DASEL) up to max 120Hz total.

The patterns 2) can also be interleaved between multiple destinations (SC_DIAG0, SC_BSYD, SC_HXR, SC_SXR, SC_DASEL) up to max 929KHz.

And Special Triggers:

The Timing System provides the following Controls Sequence bits to satisfy other requirements. Such as:

- BPM Calibration bit, this bit is asserted to allow BPM calibration in between beam pulses when rate is less than 100Hz. This calibration bit can be found by selecting:

Rate Mode = Expt, Expt Seq Number = 1, Expt Seq Bit = 0, Destination Mode = Disable

- Keep Alive Trigger, beam request for SC_BSYD, this bit always scheduled as part of all patterns to currently trigger as following:

    - For Rates higher than 1KHz

  SC_BSYD will have 100Hz

    - For Rates lower or equal than 1KHz

  SC_BSYD 10Hz

    - For Rates lower or equal to 10Hz

  SC_BSYD 1Hz

(This trigger was extensively discussed, and the above trigger logic was agreed upon and replaces previously requirement to be always set to 10KHz).

This trigger is set on Engine 15 to always maintain a high priority on beam requests over other engines but schedules the beam request for destination 2 SC_BSYD. The setup to trigger on this bit is to select:

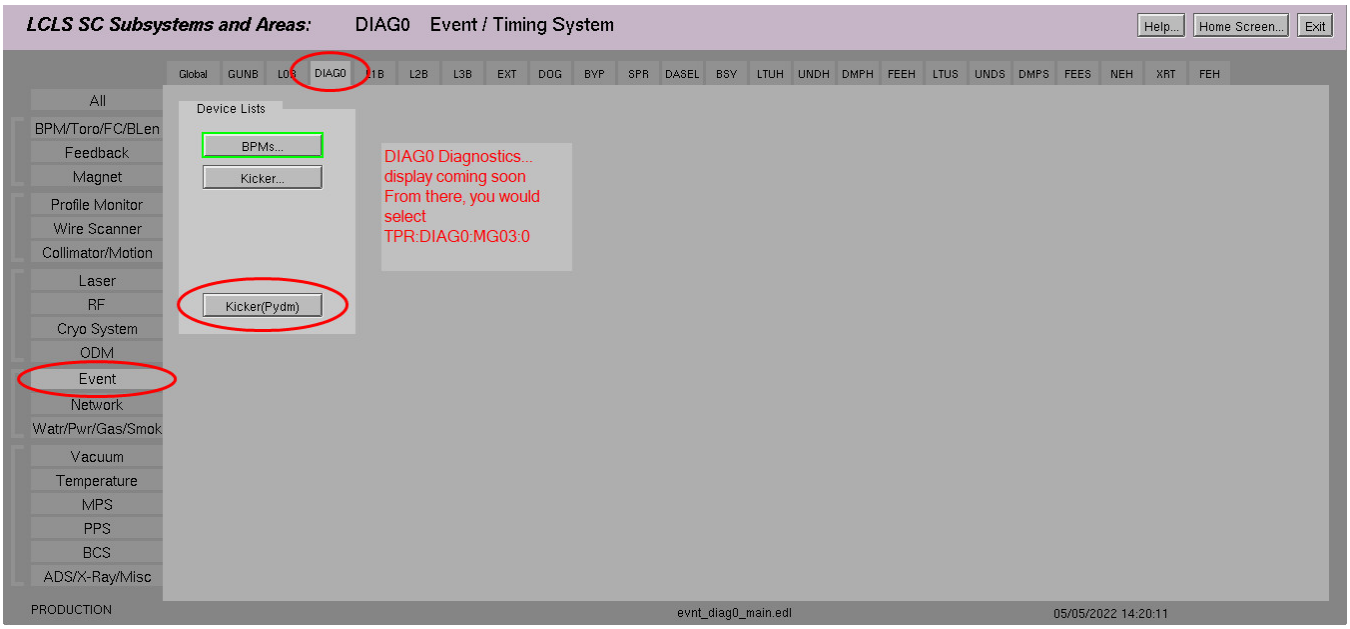
Rate Mode = Same as Beam Fixed/AC, Rate = Max allowed {120Hz or 1MHhz} Destination Mode= include, Destn = 2

- Kicker Magnet standby triggers for beam request above 10KHz to the SC_BSYD, will consist in two bits one for HXR and one for SXR to match the undulator requested rate. This is needed to maintain the kicker trigger thermal stability. This is not a requirement for SC_DIAG0.

- Data Acquisition triggers to match beam pulse location respect the destinations: SC_HXR, SC_SXR for 1H, TH and HH. (TBD SC_BSYD)

User Guide Start

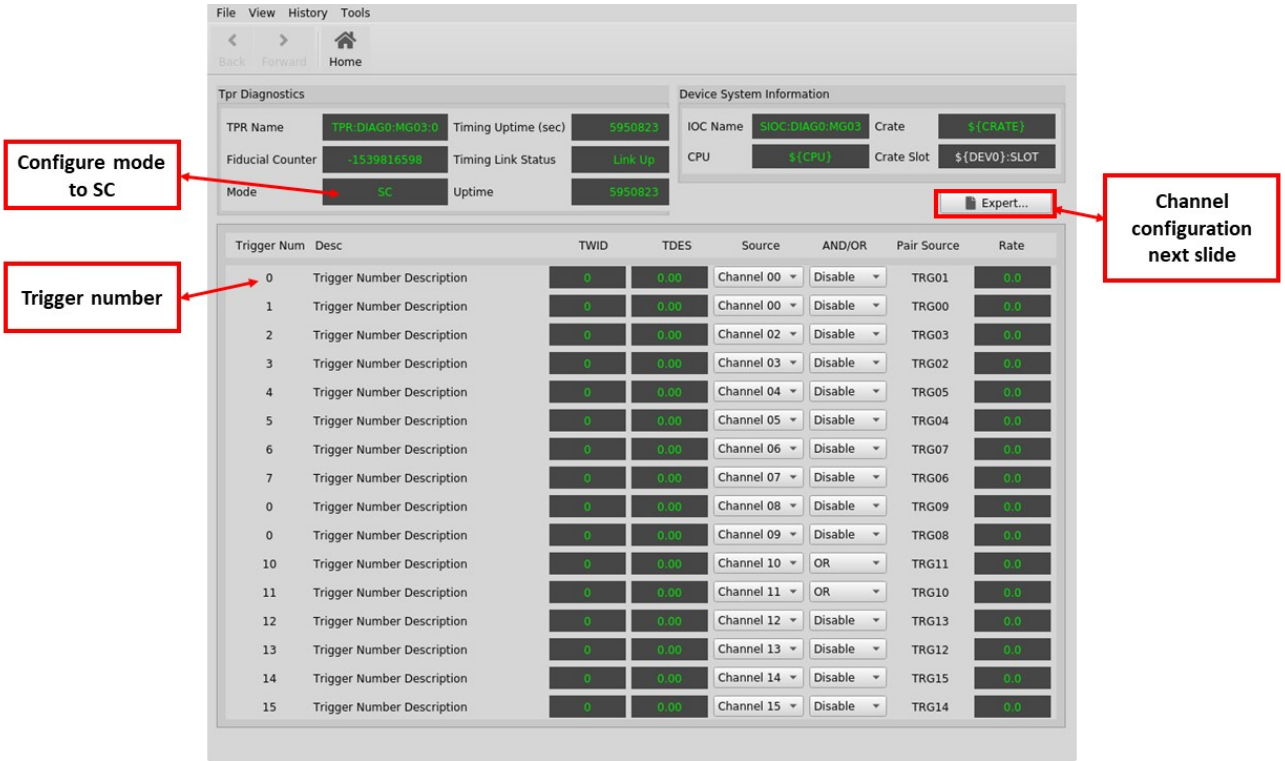
1) Access the timing trigger displays



$TOOLS/pydm/display/evnt/tprDiag.ui & $TOOLS/pydm/display/evnt/tprDiagExp.ui

*Add Example to how to open related display tprTrigger

*Autogen display from DB



*Fixing undefined macros

2)**General TPR Setup:**

2a) Make sure the MODE PV is set to SC, Link is up and set the Message Delay

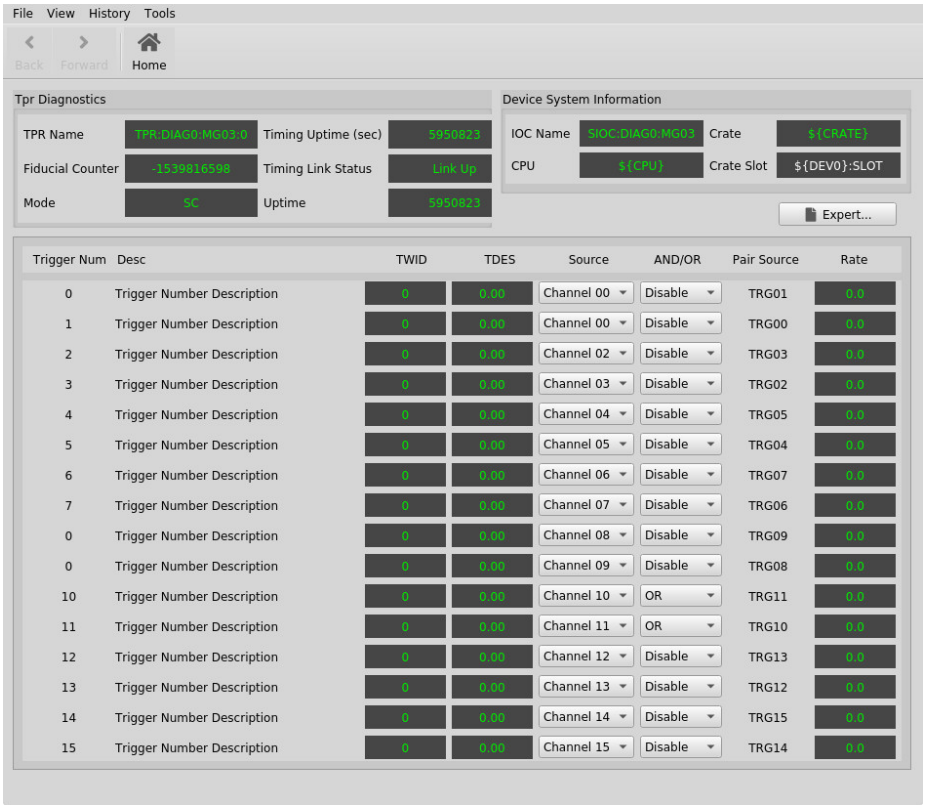
Define the Message Delay for your system: 107692 nsec is the default default delay calculated = Injector Laser 100 microsec + beam to your device (You time this) + fiber delay (TPG-Laser and TPG-fanout-ATCA)

Example = 112597 nsec BPMS Message Dealy set in Diag0

Set through caput!

2b)Setup TPR Trigger

The Triggers are linked to the firmware by the Firmware Engineer, talk to the Firmware Engineer to find out what is associated with each Trigger and then set meaningful names to each trigger "Desc".

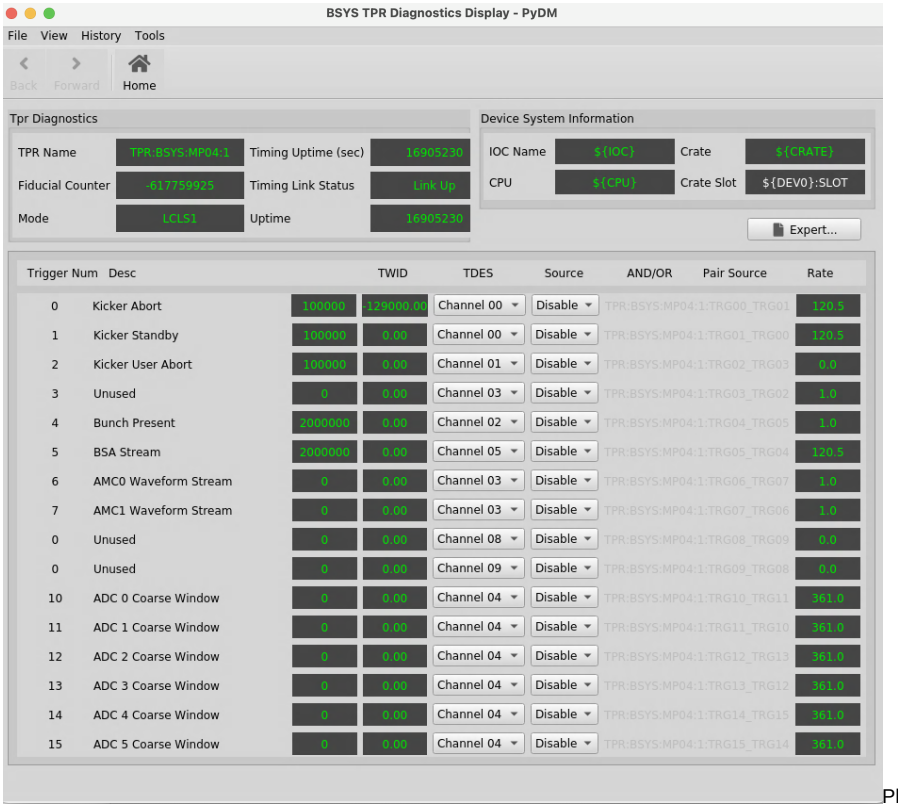


*Change the TWID and TDES to enterable fields Verify that SYS0 and SYS2 does update with Mode switching

*Allow to view NC and SC displays

$TOOLS/pydm/display/evnt/tprDiag.ui

This will help you understand how to setup the Channels used by your Triggers.



Please Note: This is an old TprTrigger module version but it is a Great example of naming your triggers!

$TOOLS/pydm/display/evnt/tprDiagExp.ui

Setup your Channel to be used as a Timing Pattern Filter, the Channel is the tool to use to filter the frames you want your system to trigger on.

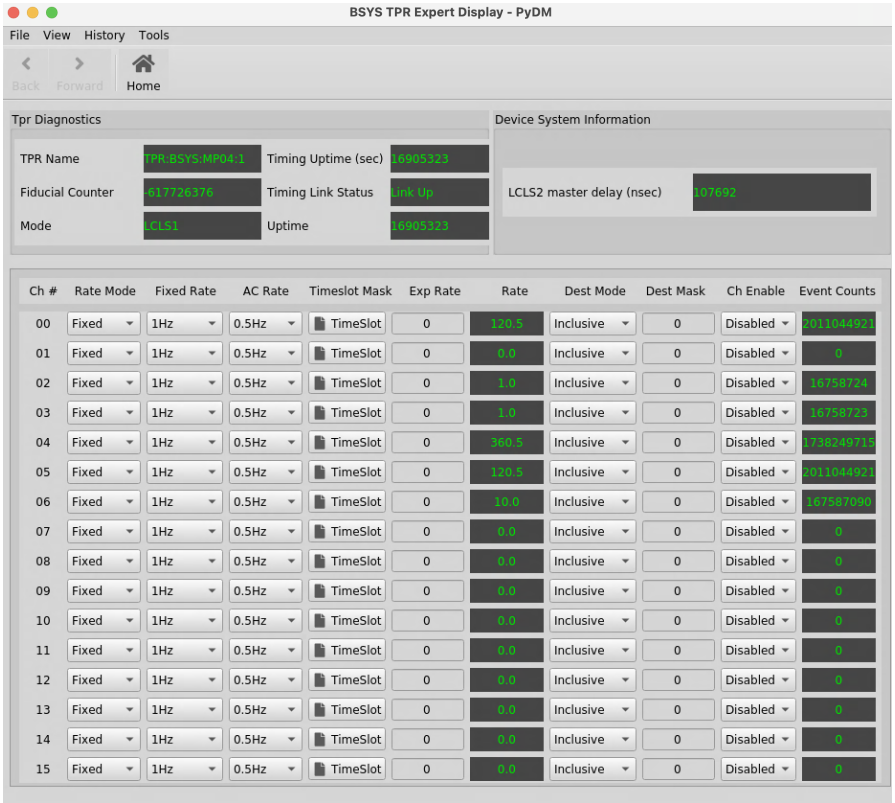
3)Setup the Channels

The Channel is a similar concept to an Event Code but it is configured at the Client (TPR) level instead of being globally defined in the TPG.

The Channel is the trigger logic that allows you to trigger your system.

Trigger 1: 1 Channel

Channel 1: N Triggers This means you can configure a Channel and re-use it for multiple triggers, just like an event code but at the Client level.



The Channel has different sections that needs to be setup:

Q1) Do you need to trigger when a Destination is included?

LASER 0X1
DIAG0 0X2
DUMPBSY 0X4
DUMPHXR 0X8
DUMPSXR 0X10
LESA 0X20

Q2) Do you need to trigger at a Lower Frequency?

if YES, AC or Fixed?

AC Rates out of the SC Laser will be scheduled on TS3 and TS6, keep this in mind!

Q3) Do you have a special trigger, like a Calibration, Kicker or BSA BUFF?

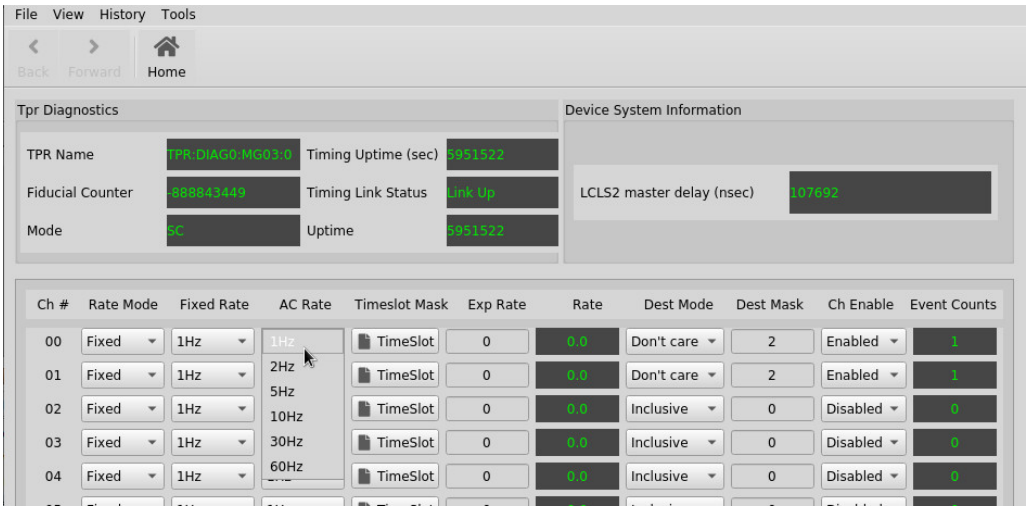
The SECTIONS of Channel setup are organized by column and repeated by row (x15 configurable channels)

Rate Mode can be Fixed, AC or Seq

Fixed Rates are 1Hz, 10Hz, 100Hz, 1KHz, 10KHz, 71.5KHz and 1MHz (929KHz) - If different, you are loading the wrong db!

AC Rates are 0.5Hz, 1Hz, 5Hz, 10Hz, 30Hz, 60Hz To achieve 120Hz INCLUDE TIMESLOT MASK TS3 and 6!

*0.5Hz Please review DB Should that be there?



Exp Rate THIS SECTION NEEDS EDITS! Apologies...

Dest Mode= Inclusive, Exclusive or Don't care

Dest Mask = Enter Destination bit

Use Cases:

3a) Trigger based on a Destination receiving Beam

Rate Mode = Fixed

Fixed Rate = 1MHz

Destination Mode = Include

Destination Mask = Dest Bit

Ch Enabled Only when you are done configuring, to avoid high undesired triggers on your device!

This will trigger your device in either Fixed rate or AC Rate beam, anytime there is beam.

3b) Trigger based on AC and/or Fixed Rate at a Lower rate than beam rate with Destination Requirement

Fixed Rate Case:

Rate Mode = Fixed

Fixed Rate = 10Hz

Destination Mode = Include

Destination Mask = Dest Bit

Ch Enabled Only when you are done configuring, to avoid high undesired triggers on your device!

AC Rate Case:

Rate Mode = AC

AC Rate = 10Hz

Destination Mode = Include

Destination Mask = Dest Bit

Ch Enabled Only when you are done configuring, to avoid high undesired triggers on your device!

3c)Trigger based on AC and/or Fixed Rate at a Lower rate than beam rate withOUT Destination Requirement

Fixed Rate Case:

Rate Mode = Fixed

Fixed Rate = 10Hz

Destination Mode = Don't care

Ch Enabled Only when you are done configuring, to avoid high undesired triggers on your device!

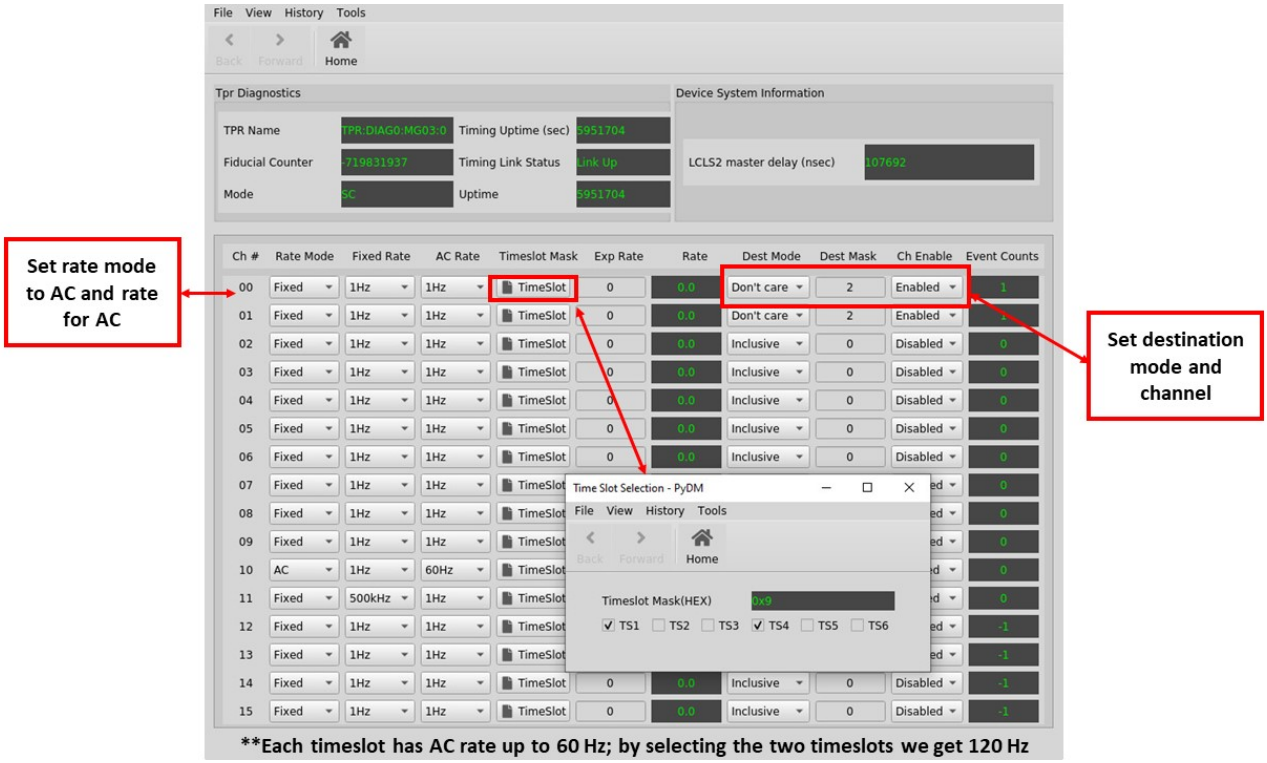
AC Rate Case:

Rate Mode = AC

AC Rate = 10Hz

Destination Mode = Don't care

Ch Enabled Only when you are done configuring, to avoid high undesired triggers on your device!

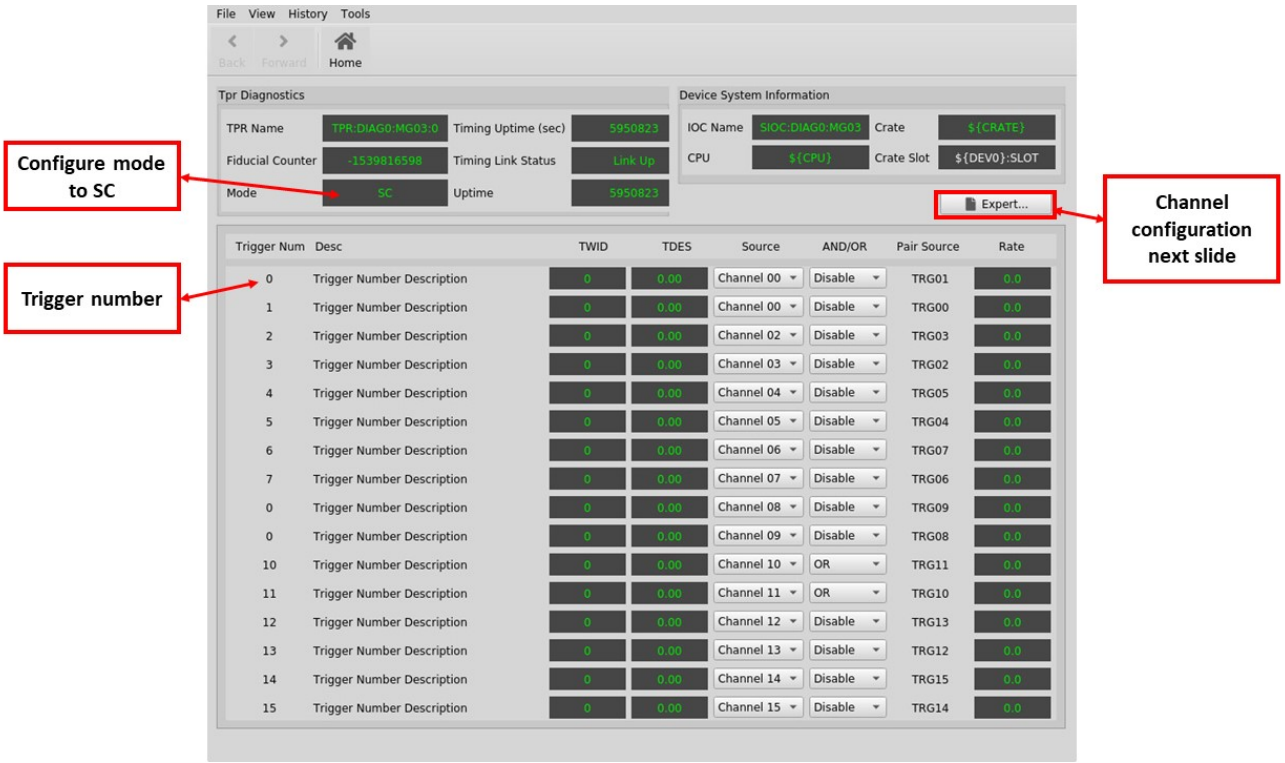


3d)

Trigger on special bits like the Calibration Bit for BPMS Control Sequence Setup

Trigger on special bits like the Standby Trigger for Kicker Control Sequence Setup Seq = # and bit = # & INCLUDE dest = # this provides the in time trigger.

Seq = # and bit = # & EXCLUDE dest = # this provides the out of time trigger.



3e)Trigger on a SYS BSA Buffer at 1Hz, 10Hz, 100Hz Control Sequence Setup