tBeeM

Thunderbolt Bit Error Eye Monitor

Version 1.0.1.4

Table of Content:

Revision History..... 3
Introduction..... 3
Installation..... 3
Topology Graph..... 4
- Discreet 4
- Integrated..... 4

Setup for an eye measurement on Host interface 5
Setup for an eye measurement on Device interface 6
Setup for an eye measurement on Device via Integrated TBT..... 7
How to get Route String through Tenlira 8
tBeeM Viewer..... 8
Saving Data..... 9
Device ID Mapping 9
Running Eye Measurement outside via CMD..... 10-11
Eye acquisition capabilities 12-13
Eye acquisition capabilities on Integrated TBT..... 14
Known Issues and Bug Reporting..... 15

Revision history

revision	Description	Date	Modified by
1.0.0.0	Preliminary version	31.3.16	Amnon zaideman
1.0.0.1	Bug fixes	31.5.16	Amnon Zaideman
1.0.0.2	Added device option bug fixes	31.7.16	Amnon Zaideman
1.0.0.3	Added create topology feature	29.8.16	Amnon Zaideman
1.0.0.4	Bug fixes	14.9.16	Amnon Zaideman
1.0.0.5	Added support for new project (Titan Ridge)	20.7.17	Shlomi Abekasis
1.0.0.6	Bug fixes	25.12.17	Shlomi Abekasis
1.0.0.7	Bug fixes	28.02.18	Shlomi Abekasis
1.0.0.8	Bug fixes	03.05.18	Shlomi Abekasis
1.0.0.9	ICL support	20.06.18	Shlomi Abekasis
1.0.1.0	Bug fixes	18.03.19	Shlomi Abekasis
1.0.1.1	GR support added	26.03.19	Edward Geinbom
1.0.1.2	TGL support added	15.07.19	Tal Perchuk
1.0.1.3	MR support added	10.09.19	Tal Perchuk
1.0.1.4	Minor issues fix	03.12.19	Tal Perchuk

Introduction

tBeeM is an Eye Monitor tool for thunderbolt devices and hosts.
tBeeM can read BER measurements from all available interfaces and plots an Eye Diagram according to the results.
Please note this is a performance evaluation tool only and it is used for debug and not testing. Any pass / fail criteria are determined only by testing done according to the Thunderbolt Electrical CTS.

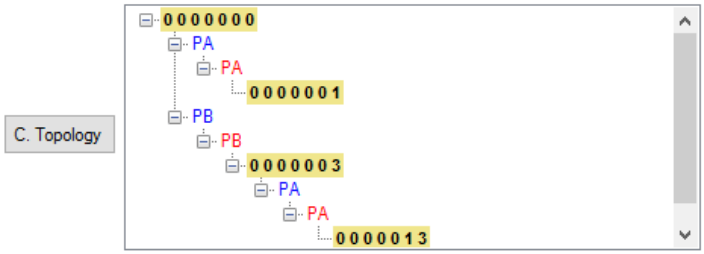
Installation

1) Latest Tenlira installed on platform
2) Active Tcl **8.5.18.0**
   http://www.activestate.com/activetcl/downloads
3) Matlab MCR tool version 8.1 (R2013a)
   http://www.mathworks.com/products/compiler/mcr/index.html

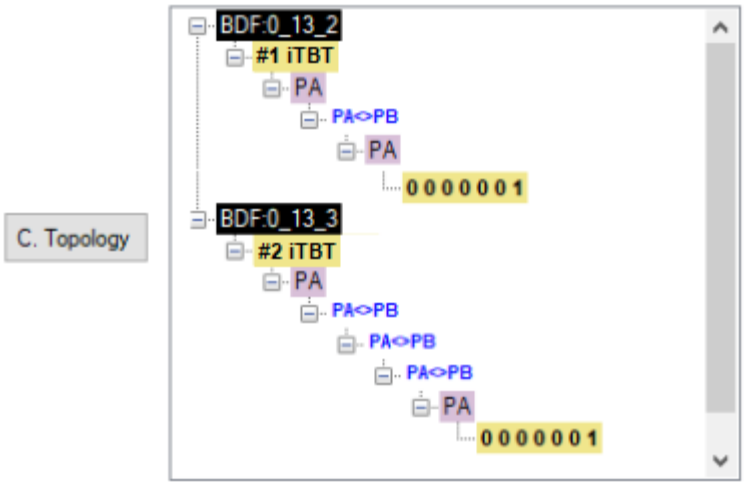
tBeeM tool comes as a single install executable. Run the file and follow the onscreen instructions to install the application.
Install active tcl
Run MCR.exe to install Matlab compiler runtime engine.
After installation is done run tBeeM by right click on tBeeM.exe in installation folder and choose “Run as Administrator”.

Topology graph

- Discreet:
  "Create topology" button scans for devices and graphically shows the topology route strings and active ports on screen.



- Integrated:
  First, check the "iTBT" checkbox.
  "Create topology" button will now scan the system for all integrated TBT and graphically show the topology route strings and active ports on screen.

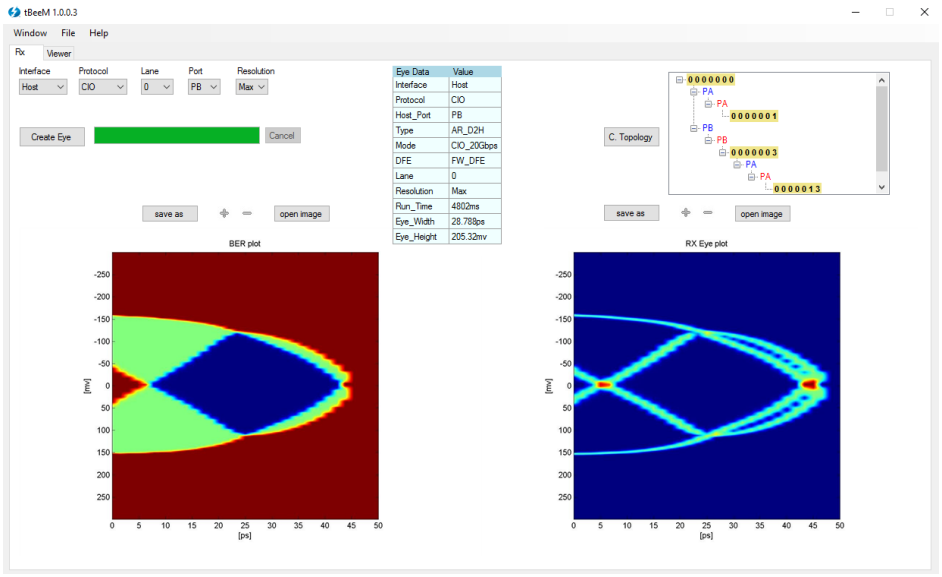


BDF – The PCIE Bus, Device and Function of the iTBT DMA driver. When capturing the eye, you will be asked for these values.

Setup for an eye measurement on Host interface

Choose **Window->Rx**

1) Choose **Interface - Host**
2) Choose **Protocol** (DP,CIO,PCIE,USB)
3) Choose **Lane/port**
4) Choose **Resolution/S.Count** (sample count).
5) Run **create eye**
   Create eye will start running tBeeM until a BER and Rx Eye (gradient of BER) plots will be shown



Setup for an eye measurement on Device interface

Choose **Window->Rx**

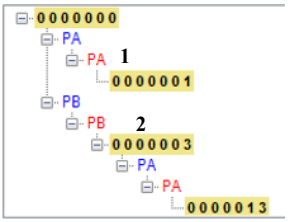
1) Choose **Interface – Device**
    a. If you already know the route string for the desired device use the checkbox "specify route" and insert the route string.

Note that not choosing Route string will do measurements on the first device found (tBeeM will search in both Host ports).

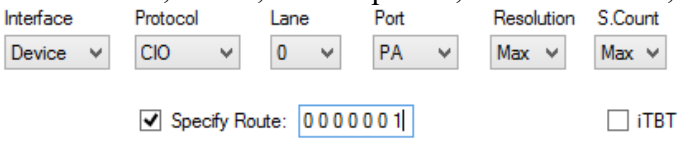
2) Choose **Protocol** (CIO,PCIE,USB)
3) Choose **Lane/port**
4) Choose **Resolution/S.Count** – the higher value, the longer run time.
5) Run **create eye**
   Create eye will start running tBeeM until a BER and Rx Eye (gradient of BER) plots will be shown

Examples

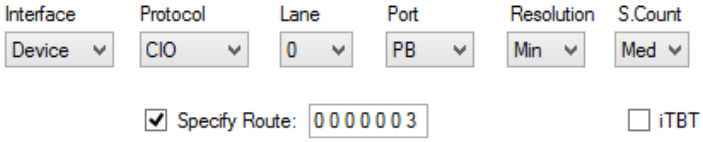
Following the topology graph:



1. Running Device eye measurement on Device side, with selected CIO; lane 0; Device port A; resolution Max; S.Count Max;



2. Running Device eye measurement on Device side, with selected CIO; lane 0; Device port B; resolution Min; S.Count Med;



Setup for an eye measurement on Device via Integrated TBT

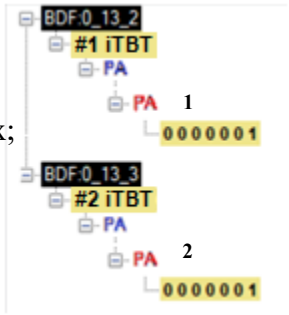
Choose **Window->Rx**

1) Select **iTBT** (integrated TBT).
2) Insert the Bus, Device and Function of the desired iTBT.
3) Choose **Interface – Device**
   Insert the route string according to the "C.Topology".

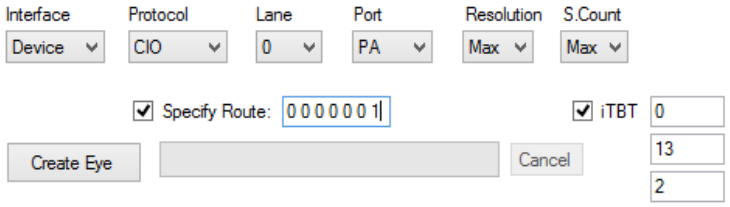
   * In iTBT use case, there is no support for Host (0 0 0 0 0 0 0).
4) Choose **Protocol** (CIO,PCIE,USB)
5) Choose **Lane/port**
6) Choose **Resolution/S.Count** – the higher value, the longer run time.
7) Run **create eye**
   Create eye will start running tBeeM until a BER and Rx Eye (gradient of BER) plots will be shown

Examples

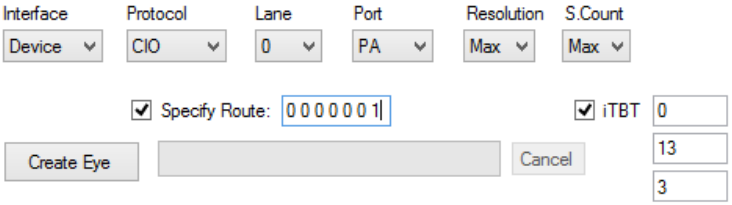
Following the topology graph:



1. Running Device eye measurement on Device side, with selected CIO; lane 0; Device port A; resolution Max; S.Count Max;

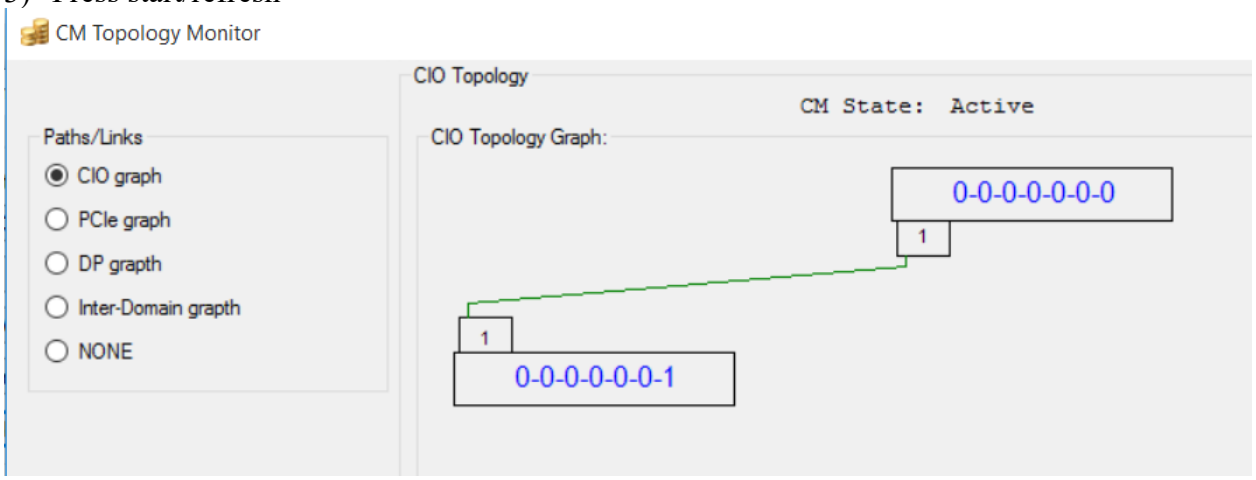


2. Running Device eye measurement on Device side, with selected CIO; lane 0; Device port A; Resolution Max; S.Count Max;



How to get Route String through Tenlira

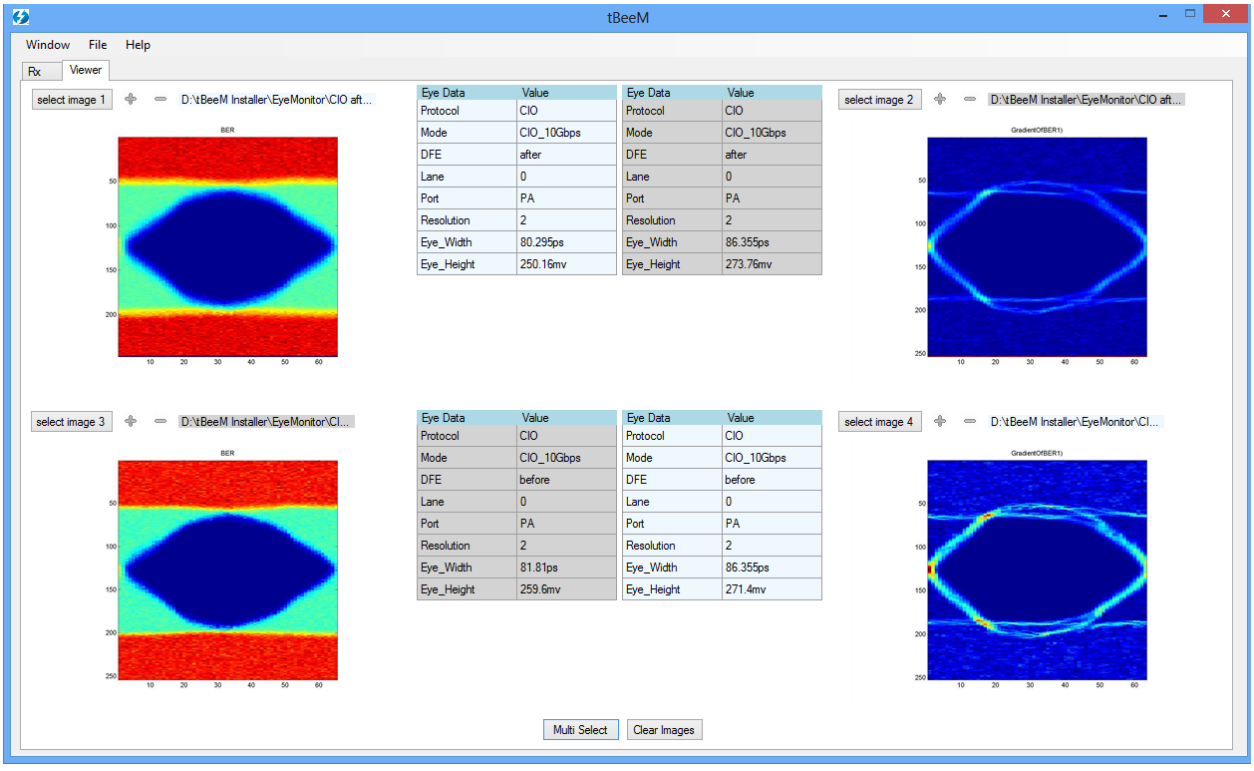
1) Open thunderbolt device in Tenlira application
2) Choose connection manager topology Monitor window
3) Press start/refresh



In this window you can find the desired Route String.

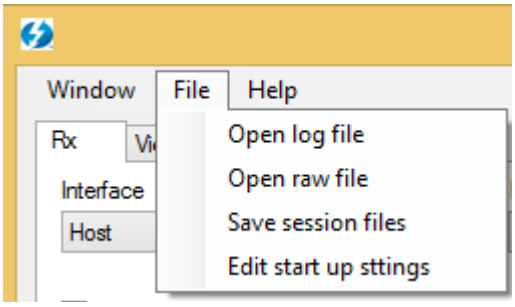
tBeeM Viewer

Choose **Window->viewer**
tBeeM tool has a viewer window for showing 4 captures at the same time for comparing eye plots.



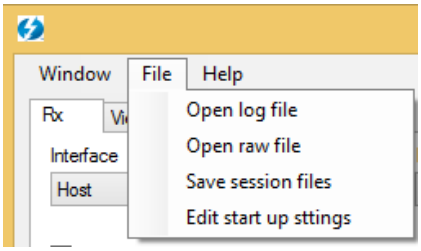
Saving data

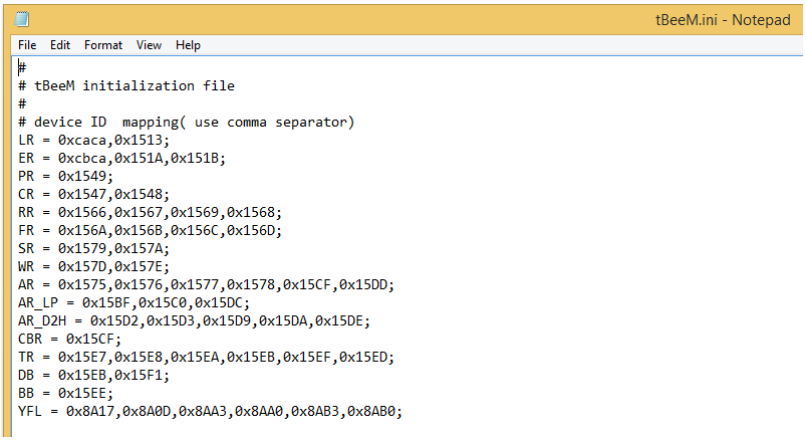
tBeeM creates 2 jpg images of the measurement chosen and simple data analysis of the results.
Each plot can be saved separately together with the data analysis using save as function.
For saving all data including logs and raw BER results choose **file ->save session files**



Device ID Mapping

tBeeM uses an external mapping for all TBT Device-IDs, the user can easily add a new device-id by selecting the file ->Edit start up settings:





Adding a new Device-id:

1. file ->Edit start up settings
2. Add to the bottom “device name = device id,..;” (e.g. XR = 0x1F1A, 0x1F2A;).
3. Save the file.

Running Eye Measurement outside via CMD

tBeeM allows the user to run eye measurements outside of Gui interface by using command line.

1) Run CMD.exe in administrator mode.
2) Using CMD, go to the tBeeM folder (e.g. "C:\Program Files (x86)\Intel\tBeeM\").
3) Command line :
    a. Running the Eye Capture:

Tclsh85 interface.tbc -interface <> -protocol < > -port <> -lane <> -resolution <> -samples < > -iTBT <> -Bus <> -Device <> -Function <> -matrixfilename < > -logfilename < > -debugfilename < >

- -interface: Host/ Device/"Device_0 0 0 0 0 0 1" (when none passed, default is Host).
- -protocol: CIO/ USB/ PCIE/ DP (when none passed, default is CIO).
- -port: 0 for PA, 1 for PB, SNK0 for sink 0, SNK1 for sink 1 (when none passed, default is 0).
- -lane: 0/1/2/3 (when none passed, default is 0).
- -resolution: 2 (highest)/4/8/16 (when none passed, default is 2). Controls the PI step across the eye acquisition (higher resolution will cause longer time acquisition).
- -samples: Max/ Med/ Min (when none passed, default is Max). Controls the number of samples in each point across the Eye capture window (higher sample count will cause longer time acquisition).
- -iTBT: 0/1 (when none passed, default is 0). Integrated TBT – indication of integrated TBT usage (e.g. ICL). once passed as 1, the user must also pass the PCIE BDF of the desired ridge. *** Eye monitor cannot be done on the integrated TBT.**
- -Bus: once iTBT is set to 1, user must pass the iTBT's PCIE Bus number.
- -Device: once iTBT is set to 1, user must pass the iTBT's PCIE Device number.
- -Function: once iTBT is set to 1, user must pass the iTBT's PCIE Function number.
- -matrixfilename: path for the raw eye output matrix. (e.g. matrix path\Matrix.log).
- -logfilename: path for the output data log. (e.g. log path\DataLog.log).
- -debugfilename: path for the output debug log. (e.g. debug path\DebugLog.dat).

Running this will result the following files:

- Raw matrix file of the ber count (in CIO/USB/DP, the matrix output is transpose) ("Matrix.log").
- Data log file with relevant data on current test ("DataLog.log").
- Debug log data file for future debug ("DebugLog.dat").

b. Running the Eye Analysis:

EyeAnalysis.exe <matrix path\Matrix.log> <log path\DataLog.log> <Matlab debug path\MatlabDebugLog.dat> <result path\res.log> <BER image path\ber.jpg> <Grad image path\grad.jpg>

* Matrix.log – the raw matrix output file (created by interface.tbc).
* DataLog.log – the data output file (created by interface.tbc).
* MatlabDebugLog.dat – designated path for Matlab output data for debug (must be different from the "DebugLog.dat").
* res.log – designated path for Matlab output analysis data.
* ber.jpg – designated path for Matlab output BER image.
* grad.jpg – designated path for Matlab output Gradient image.

Running this will result the following files:

- Debug log data file for future debug ("MatlabDebugLog.dat").
- Eye analysis data log with the eye width and height ("res.log").
- Ber image, showing heat level of the eye ("ber.jpg").
- Gradient image, showing the gradient of the eye ("grad.jpg").

4) For Device measurements change "Host" to "Device", tBeeM will search for a device in both Host ports.
5) For device with Route String change "Host" to "Device_<Route String>" (see examples).

Matlab analysis example:

EyeAnalysis.exe c:\tBeeM\mat.log c:\tBeeM\datalog.log c:\tBeeM\matdebuglog.dat c:\tBeeM\result.log c:\tBeeM\ber.jpg c:\tBeeM\grad.jpg

Eye acquisition capabilities:

The following diagram showing several eye captures:

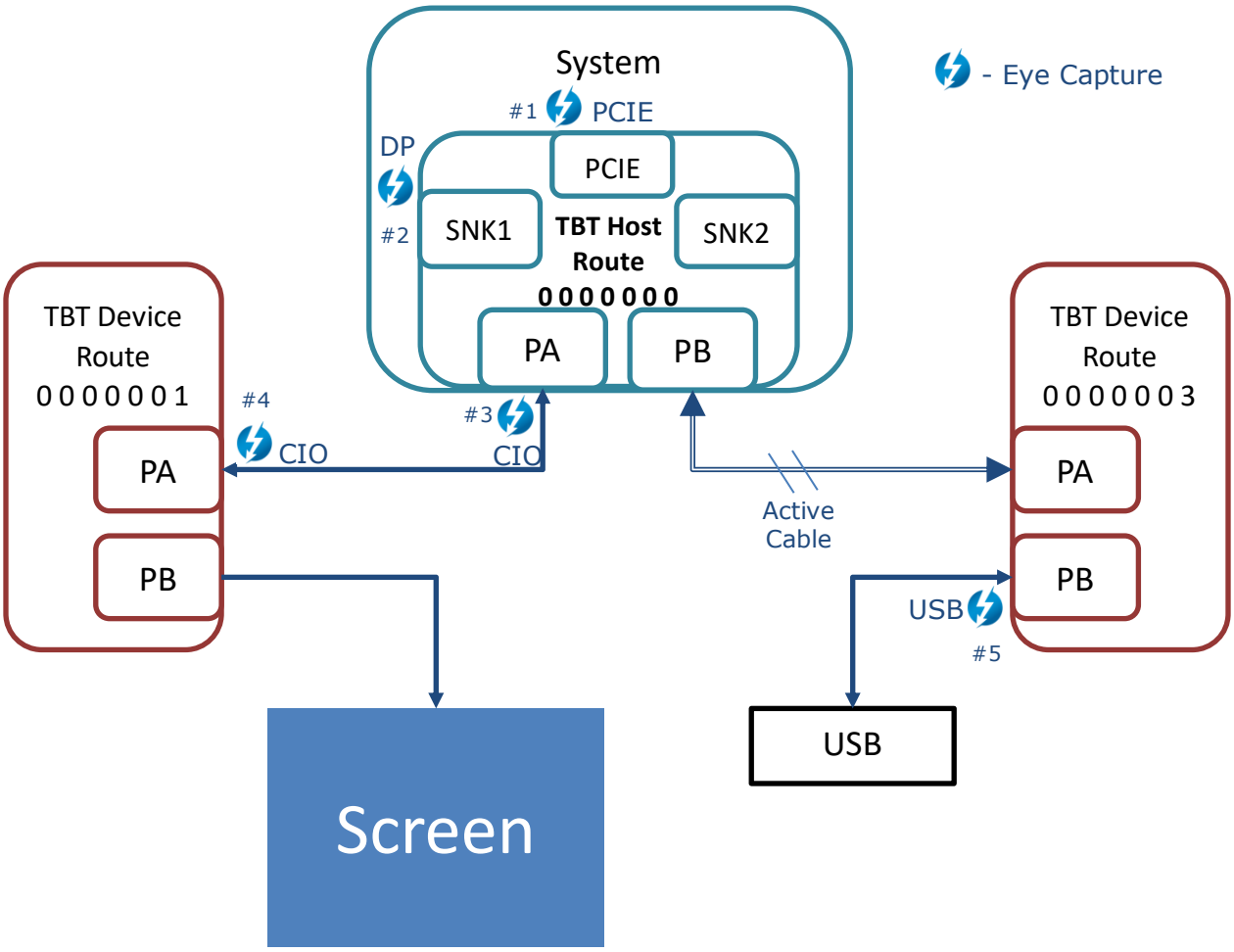


Figure 1

The following examples are correlated to the specified Eye captures shown in the figure:

1. PCIE – Capturing the Eye between the Ridge and CPU:

   Tclsh85 interface.tbc -interface Host –protocol PCIE –lane 0/1/2/3 –matrixfilename c:\tBeeM\mat.log -logfilename c:\tBeeM\datalog.log -debugfilename c:\tBeeM\debuglog.dat

   * lane can be selected from the following, 0,1,2,3.
   * Resolution will be set to max (2).
   * Samples will be set to max.

2. DP – Capturing the Eye between the Ridge and GPU via Sink 0:

Tclsh85 interface.tbc -interface Host –protocol DP –port SNK0 –lane 0/1/2/3 –resolution 4 –matrixfilename c:\tBeeM\mat.log -logfilename c:\tBeeM\datalog.log -debugfilename c:\tBeeM\debuglog.dat

* lane can be selected from the following, 0,1,2,3.
* DP port can be selected from the following, SNK0, SNK1.
* Samples will be set to max.

3. CIO – Capturing the Eye between the Host and Device via port A (Host side):

Tclsh85 interface.tbc -interface Host –protocol CIO –port 0 –lane 0/1 –samples Min –matrixfilename c:\tBeeM\mat.log -logfilename c:\tBeeM\datalog.log -debugfilename c:\tBeeM\debuglog.dat

* lane can be selected from the following, 0,1.
* port can be selected from the following, 0,1 (0-PA; 1-PB).
* Samples will be set to min.

4. CIO – Capturing the Eye between the Host and Device via port A (Device side):

Tclsh85 interface.tbc -interface “Device_0 0 0 0 0 0 1” –protocol CIO –port 0 –lane 0/1 –resolution 8 –samples Med –matrixfilename c:\tBeeM\mat.log -logfilename c:\tBeeM\datalog.log -debugfilename c:\tBeeM\debuglog.dat

* lane can be selected from the following, 0,1.
* port can be selected from the following, 0,1 (0-PA; 1-PB).
* Device’s route string is not constant, it is set according to the current setup.

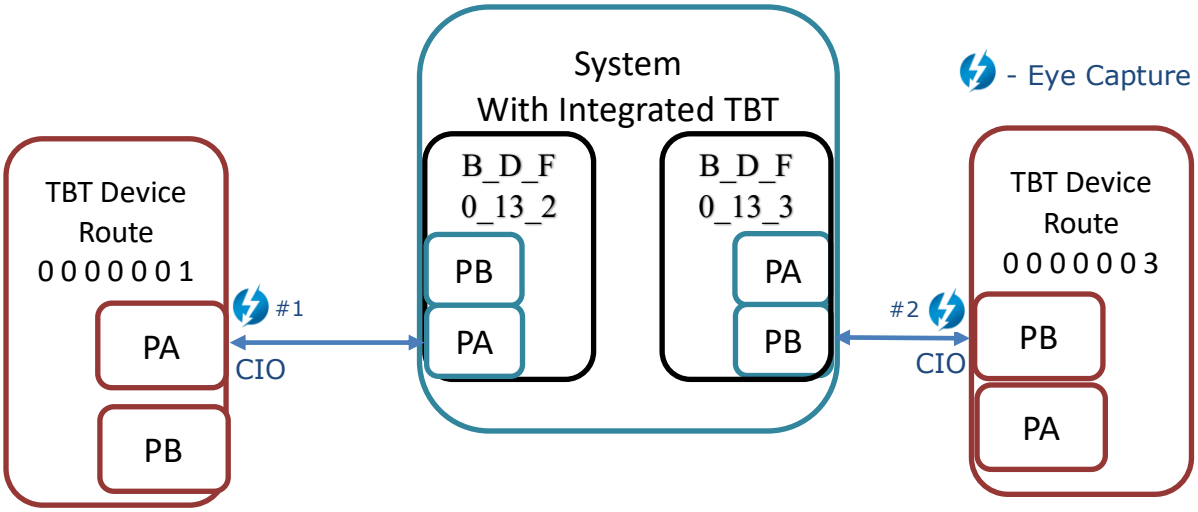
5. USB – Capturing the Eye between the Device and USB Device via port B (Device side):

Tclsh85 interface.tbc -interface “Device_0 0 0 0 0 0 3” –protocol USB –port 1 –lane 0/1 –matrixfilename c:\tBeeM\mat.log -logfilename c:\tBeeM\datalog.log -debugfilename c:\tBeeM\debuglog.dat

* lane can be selected from the following, 0,1.
* port can be selected from the following, 0,1 (0-PA; 1-PB).
* Resolution will be set to max (2).
* Samples will be set to max.
* Device’s route string is not constant, it is set according to the current setup.

Eye acquisition capabilities on Integrated TBT:

The following diagram showing several eye captures:



The following examples are correlated to the specified Eye captures shown in the figure:

1. CIO – Capturing the Eye between the Host and Device via port A (Device side):

   Tclsh85 interface.tbc -interface "Device_0 0 0 0 0 0 1" –protocol CIO –port 0 –lane 0/1 –resolution 8 –samples Med –iTBT 1 –Bus 0 –Device 13 –Function 2 –matrixfilename c:\tBeeM\mat.log -logfilename c:\tBeeM\datalog.log -debugfilename c:\tBeeM\debuglog.dat

   * lane can be selected from the following, 0,1.
   * port can be selected from the following, 0,1 (0-PA; 1-PB).
   * Device's route string is not constant, it is set according to the current setup.
   * BDF values are according to selected iTBT

2. CIO – Capturing the Eye between the Host and Device via port B (Device side):

   Tclsh85 interface.tbc -interface "Device_0 0 0 0 0 0 3" –protocol CIO –port 1 –lane 0/1 –resolution 8 –samples Med –iTBT 1 –Bus 0 –Device 13 –Function 3 –matrixfilename c:\tBeeM\mat.log -logfilename c:\tBeeM\datalog.log -debugfilename c:\tBeeM\debuglog.dat

   * Lane can be selected from the following, 0/1.
   * Port can be selected from the following, 0/1 (0-PA; 1-PB).
   * Device's route string is not constant, it is set according to the current setup.
   * BDF values are according to selected iTBT

Known Issues and Bug Reporting

- To report a bug on this utility, please submit the bug report to your Intel Field Representative.
- Please uninstall the previous version of the tool before installing the new version.
- In case tBeeM encounters an error producing an eye plot and measurements user can save log by using **file->save session files** and send back data for debug.
- In order to run USB mode, need to enter system debug mode (TBT force power).
- USB link can be lost when entering Ux states, in this case unplug/plug device.
- DP and CIO devices must be plugged in, in order to capture an eye.
- Close Tenlira before starting the Eye measurement (both can`t work simultaneously)
- **tBeeM does not support PCIE Gen 1 eye capturing.**
- PCIE link can be lost when entering Lx states (ASPM), PCIE must be in L0 state (ASPM disabled).