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Gem Daq System
Hardware Installation

This document describes how to set up the GEM DAQ system's hardware for the test beam.

Hardware Installation

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1. System overview

A schematic overview of the system is shown in Figure 1.

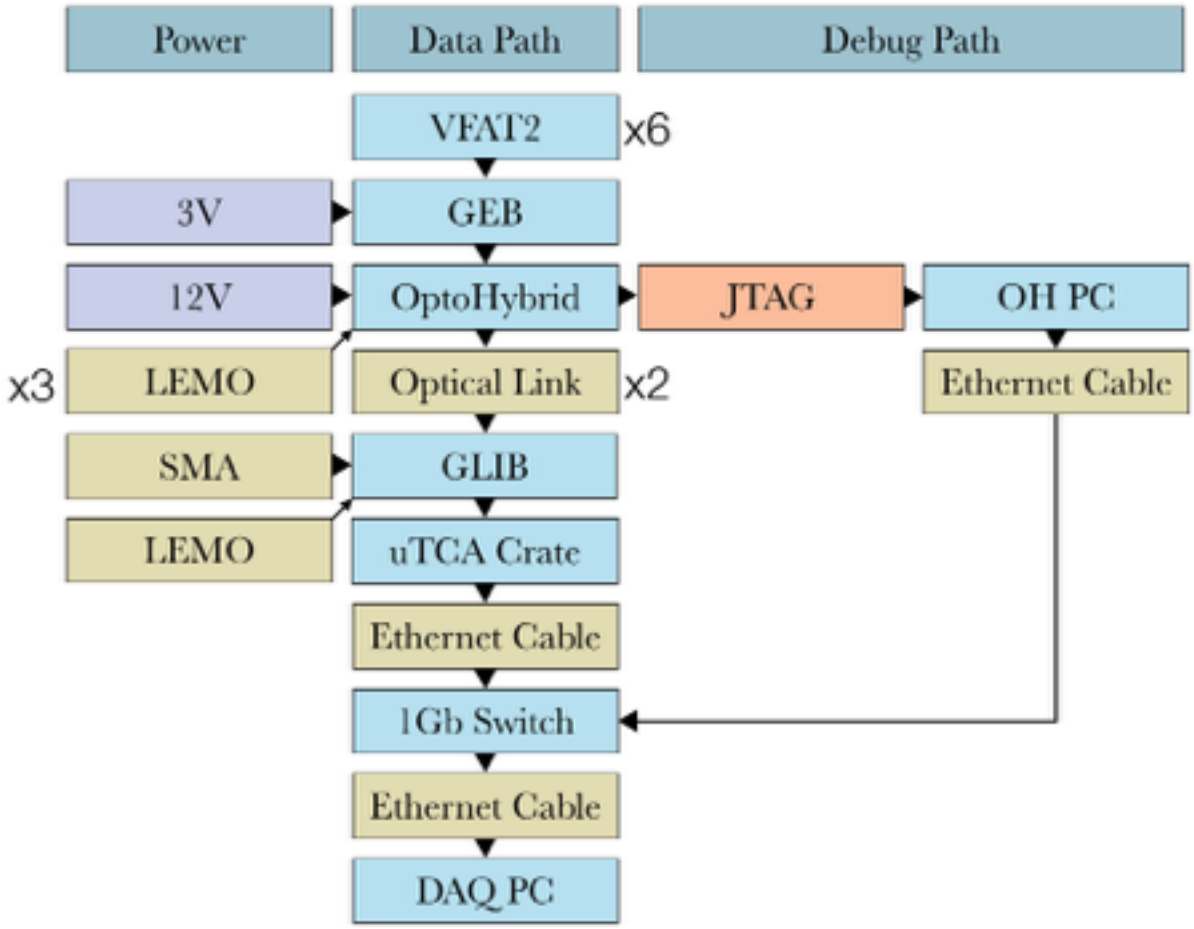

Figure 1: schematic overview of the GEM DAQ system.

2. Hardware components

System components:

- 3x CMS VFAT2 Hybrid - CERN
- 3x CMS Totem Hybrid - CERN
- 3x Flat ribbon cables for CMS Totem Hybrid - CERN
- 1x GEB - CERN
- 1x Power cable for GEB - CERN
- 1x OptoHybrid - CERN
- 1x Power cable for OptoHybrid - CERN
- 1x OptoHybrid expansion board with connected TI MSP430 MCU - ULB
- 4x LEMO cable - CERN
- 4x Optical transceiver - CERN
- 2x Optical fibres - CERN
- 1x JTAG programmer - ULB
- 1x GLIB - ULB
- 1x GLIB expansion board - ULB
- 1x SMA cable - ULB
- 1x LEMO to SMA adaptor - ULB
- 1x BNC to SMA - ULB
- 4x BNC to LEMO - ULB
- 1x uTCA crate - ULB
- 3x Ethernet cable - ULB
- 1x 1 Gb Ethernet switch - CERN
- 1x OptoHybrid PC - ULB
- 1x DAQ PC - ULB

Components required for testing:

- 1x Multimeter
- 1x Oscilloscope
- 1x Soldering iron
- 1x Tool box

3. OptoHybrid

Before mounting the OptoHybrid, depicted in Figure 2, on the GEB, multiple components have to be attached to the board.

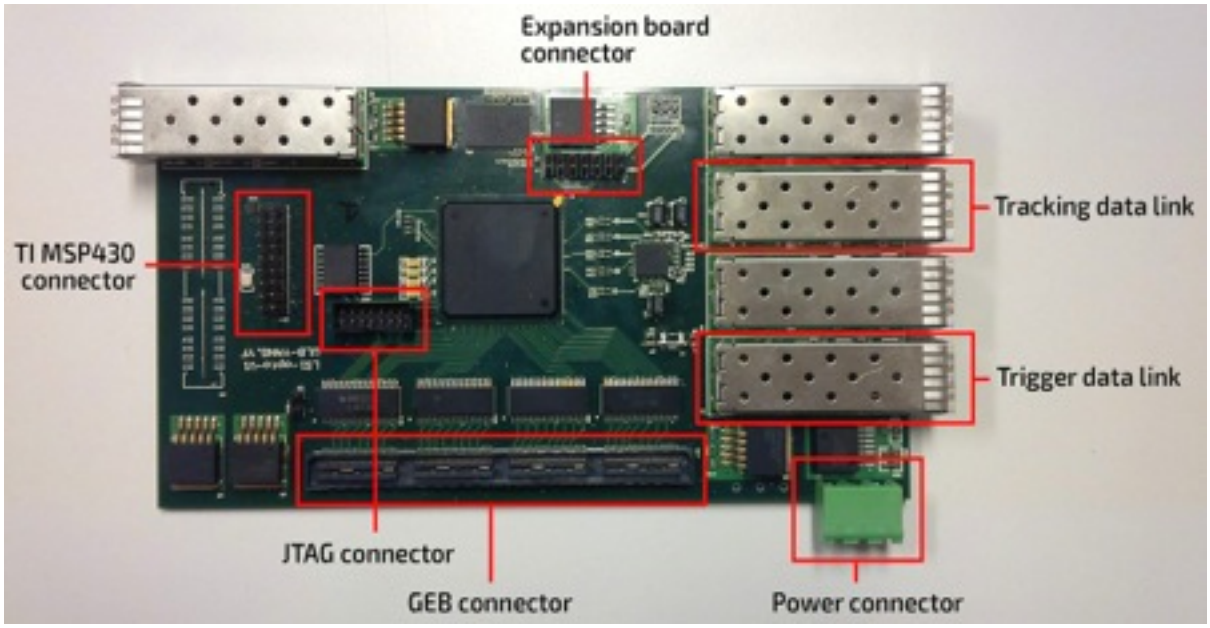

Figure 2: picture of the OptoHybrid.

3.1. OptoHybrid expansion board and TI MSP430 MCU

The OptoHybrid expansion board, represented in the bottom right corner of Figure 3, has to be mounted on the OptoHybrid at the site labeled “Expansion board connector" in Figure 2, with the LEMO connectors facing towards the edge of the board.

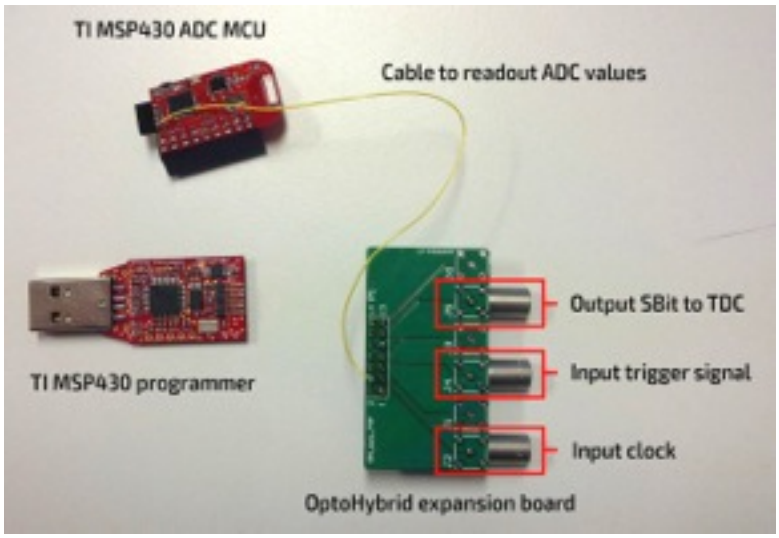

Figure 3: picture of the OptoHybrid’s expansion board.

The attached TI MSP430 MCU, represented in the top left corner of Figure 3, has to be mounted on the OptoHybrid at the site labelled “TI MSP430 connector" in Figure 2, with the black onboard connector facing the GEB connector.

The TI MSP430 programmer is not used.

3.2. JTAG programmer

One JTAG programmer has to be connected to the OptoHybrid at the site labeled “JTAG connector" in Figure 2.

3.3. Optical transceivers and optical fibres

Two optical transceivers have to be inserted in the OptoHybrid at the sites labeled “ Tracking data link” and “Trigger data link” in Figure 2.

Two optical fibres have to be attached to the previously inserted optical transceivers.

3.4. Power connector

Connect the power cable to the OptoHybrid at the site labeled “Power connector" in Figure 2.

3.5. Ready-to-install OptoHybrid

A picture of the OptoHybrid after the installation of all the components is represented in Figure 4.

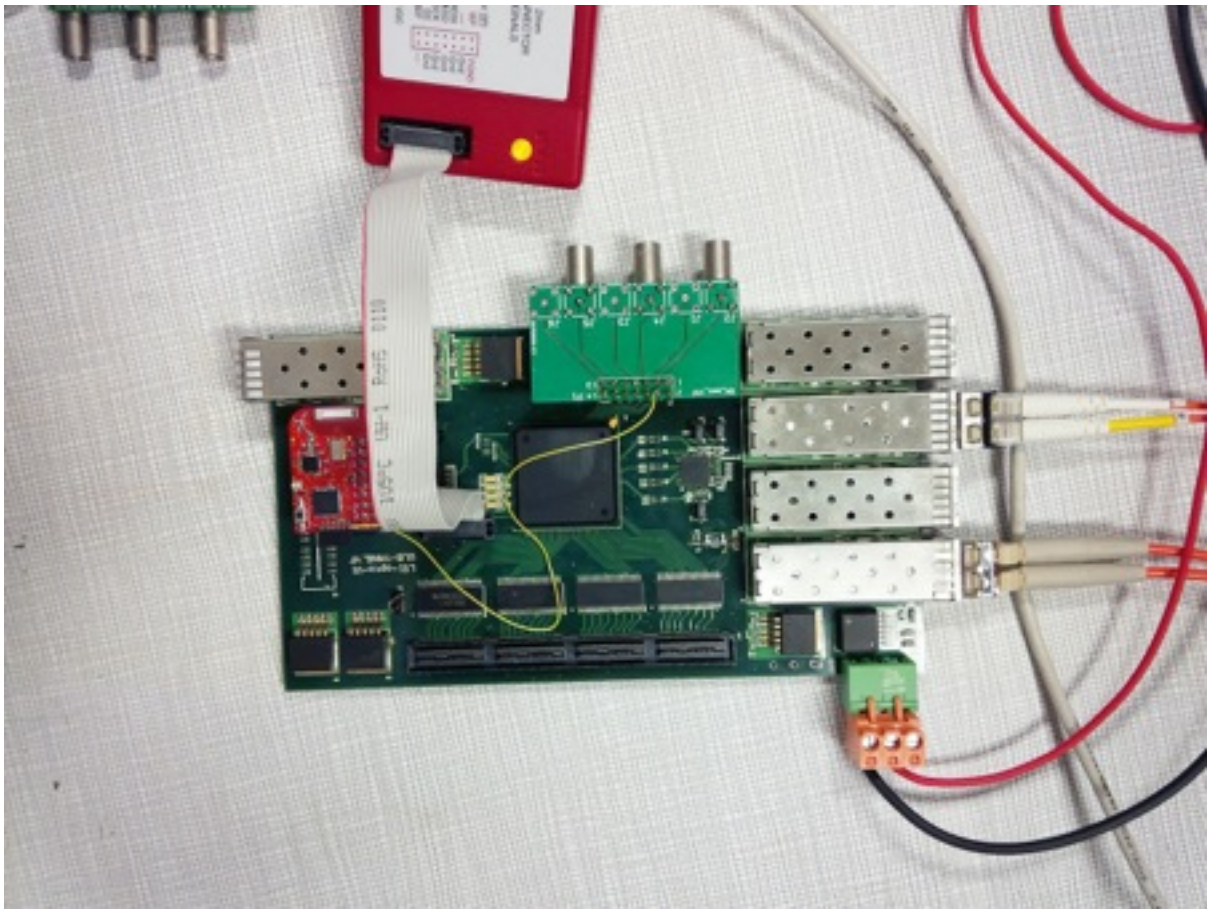

Figure 4: picture of the ready-to-install OptoHybrid.

At this point, two tests have to be performed.

First power on the OptoHybrid and check that the red LED on the TI MSP430 board is on and that the green LED is off. If this is not case, ensure that the board is well connected to the OptoHybrid. If the LEDs configuration remains different than previously described, refer to Appendices A.

Then connect the JTAG programmer to the OptoHybrid PC. Check that the light on the JTAG programmer turns orange and then green. If it doesn't, ensure that the programmer is well connected to the board. If the light does not turn green, refer to Appendices A.

Once those tests are done, power off the OptoHybrid.

3.6. Mounting on the GEB

Now that the OptoHybrid is installed, it can be mounted on the GEB. A picture of the OptoHybrid mounted on the GEB is represented in Figure 5.

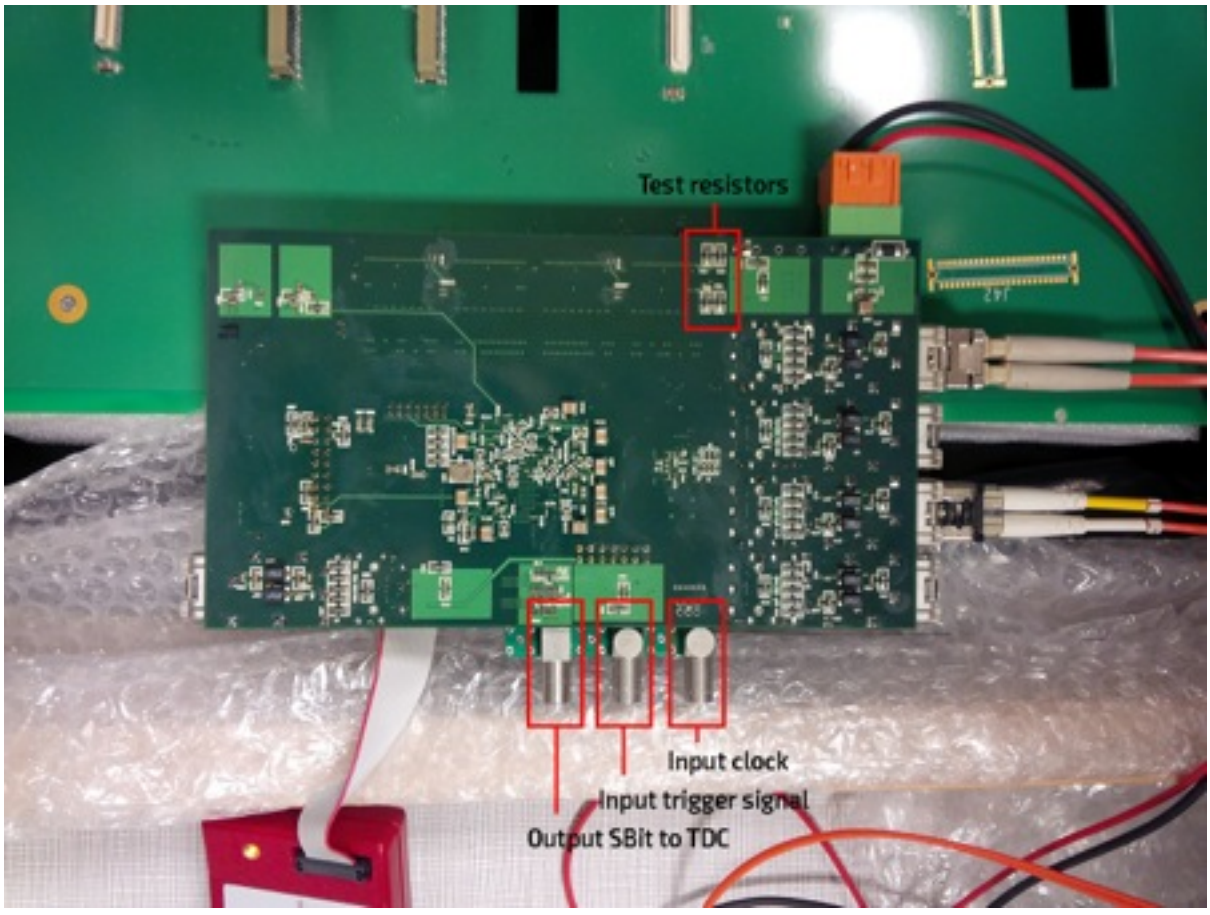

Figure 5: picture of the OptoHybrid mounted on the GEB.

To ensure that the OptoHybrid is well connected to the GEB, which due to the connector's design is non-trivial, a second test has to be done at this point. Using a multimeter, ensure that the resistance between the points listed bellow is null :

- between point A in Figure 6 (second pad from the top on connector J57) and R93 on the OptoHybrid which is located in the area labelled “Test resistors” in Figure 5 (side of the resistor closest to the label) ;
- between point B in Figure 6 (second pad from the top on connector J57) and R94 on the OptoHybrid which is located in the area labelled “Test resistors” in Figure 5 (side of the resistor closest to the label) ;
- between point C in Figure 6 (second pad from the top on connector J58) and R95 on the OptoHybrid which is located in the area labelled “Test resistors” in Figure 5 (side of the resistor closest to the label) ;
- between point D in Figure 6 (second pad from the top on connector J58) and R96 on the OptoHybrid which is located in the area labelled “Test resistors” in Figure 5 (side of the resistor closest to the label) ;

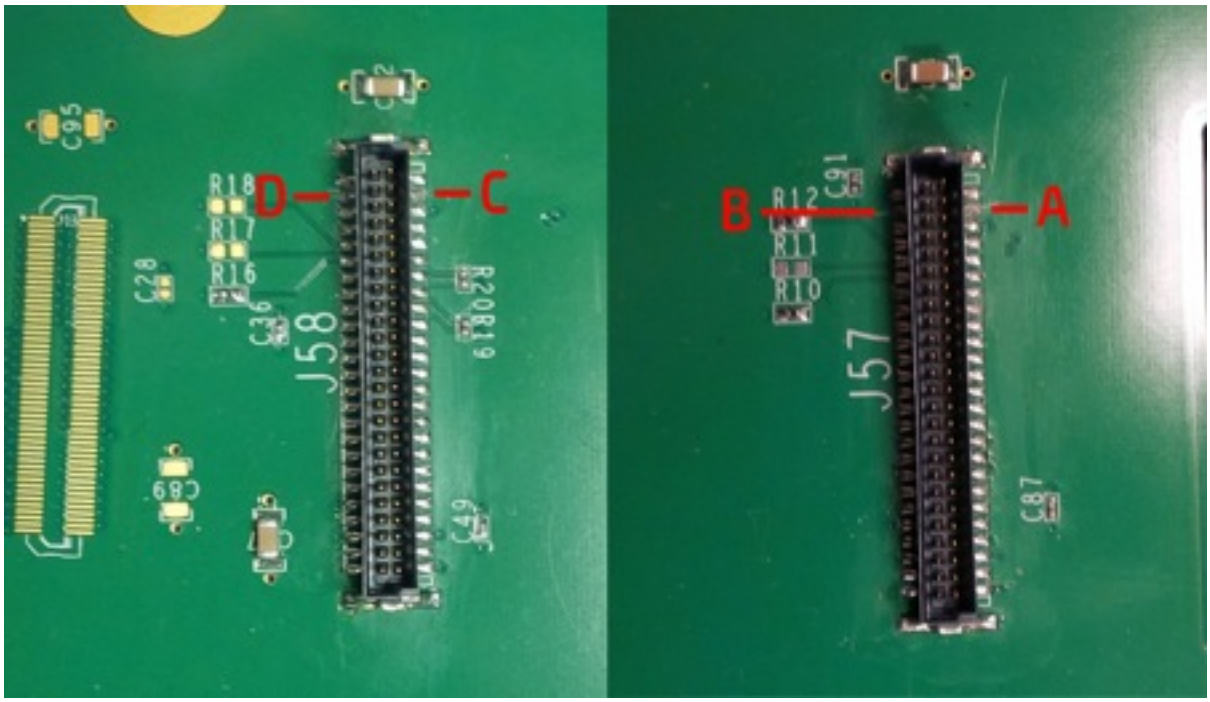

Figure 6: picture of the test points on the GEB.

3.7. External connections

Connect the JTAG programmer to the OptoHybrid PC, the power connector to a 12 V source, and the three LEMO cables to the clock source, trigger source, and TDC respectively. The two optical fibres remain unconnected at this points.

4. GEB

Install 3 CMS VFAT2 Hybrids and 3 Totem VFAT2 Hybrids on the sites indicated in Figure 7. Then connect the power connector to a 3 V source.

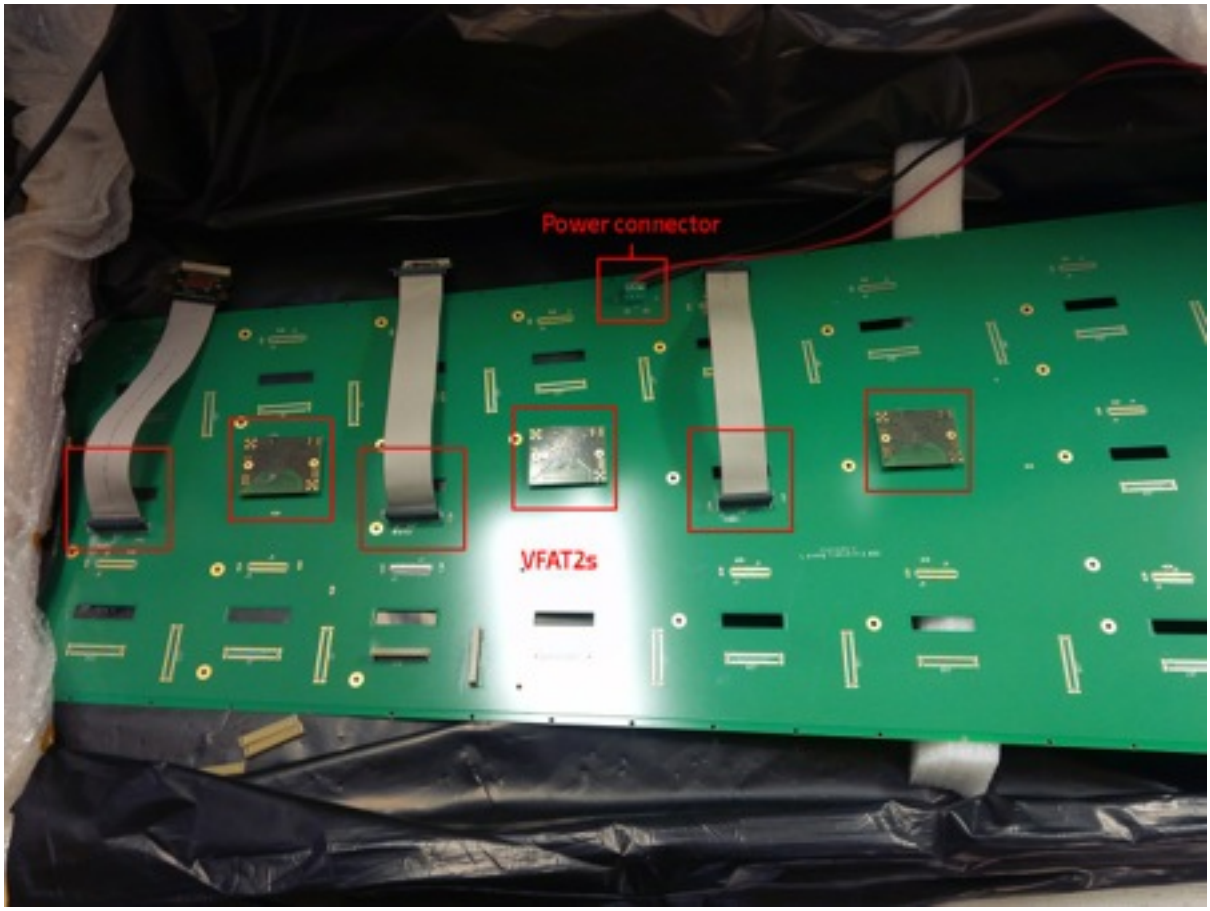

Figure 7: picture of the GEB.

5. GLIB

Before inserting the GLIB, depicted in Figure 8, in the uTCA crate multiple components have to be attached to the board.

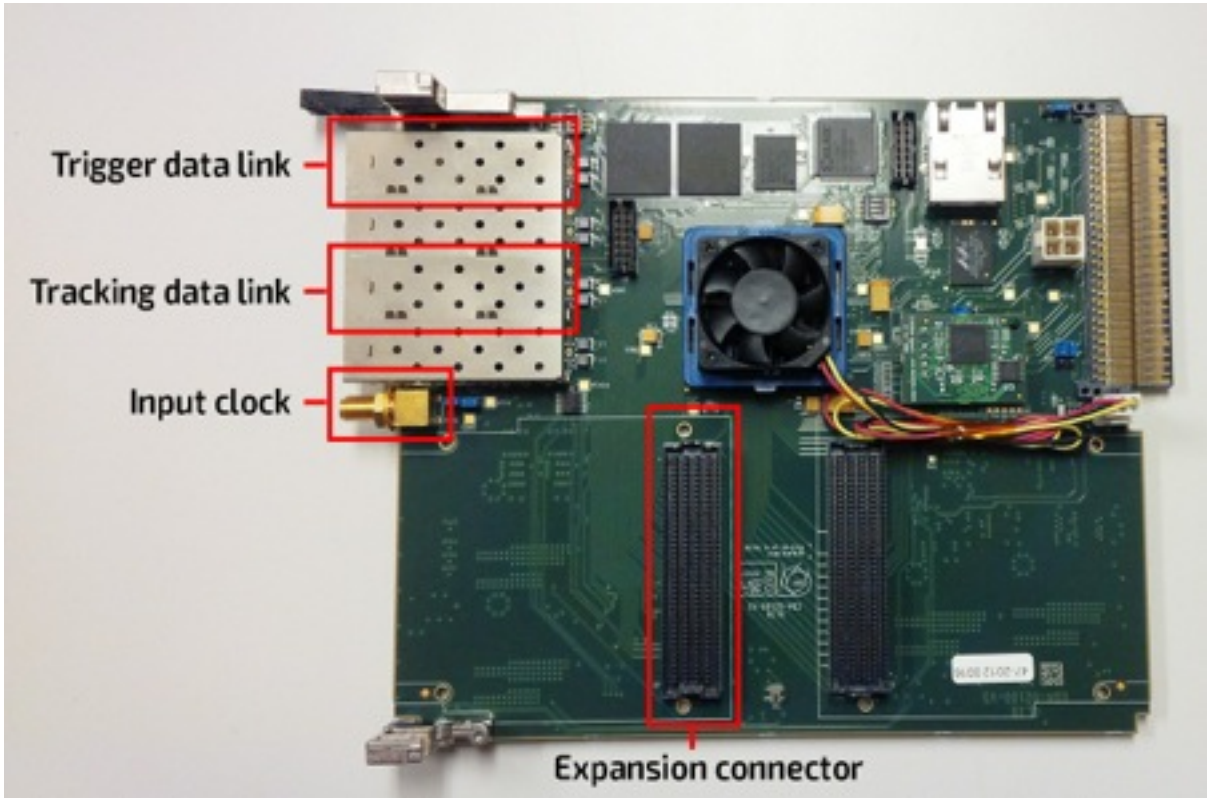

Figure 8: picture of the GLIB.

5.1. Jumpers configuration

Ensure that the jumpers J14, J10, and J11 are positioned as shown in Figure 9.

J14 should make the bridge between pins 2 and 3 (from left to right on the picture).

J10 should make the bridge between pins 1 and 2 (from left to right on the picture).

J11 should make the bridge between pins 2 and 3 (from top to bottom on the picture).

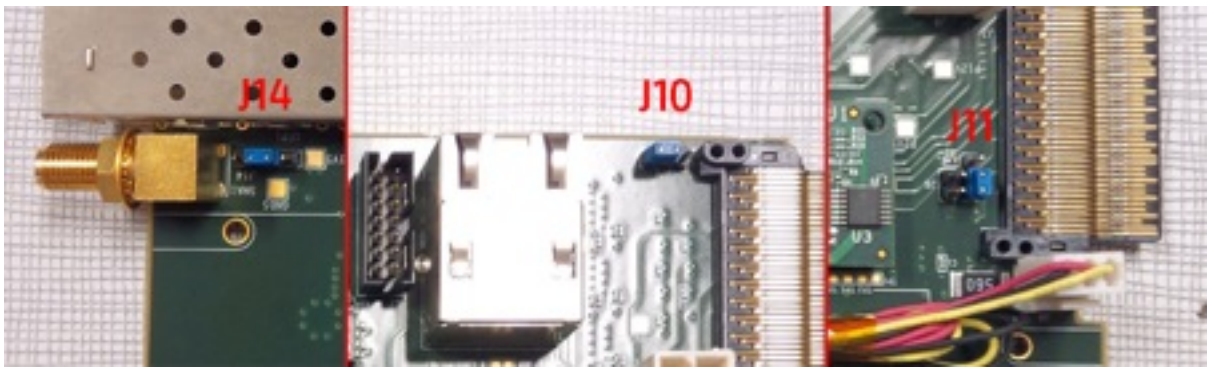

Figure 9: picture of jumpers on the GLIB.

5.2. GLIB expansion board

Connect the a LEMO cable from the site labelled “Output SBit to TDC” in Figure 10 to the TDC.

The GLIB expansion board, represented in Figure 10, has to be mounted on the GLIB at the site labeled “Expansion connector" in Figure 8.

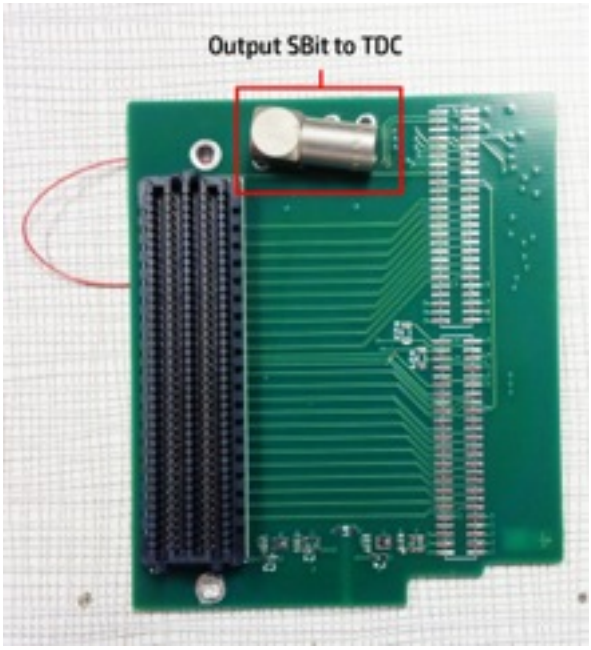

Figure 10: picture of the GLIB’s expansion board.

5.3. Input clock

Connect the external 40 MHz clock to the SMA connector labelled “Input clock” in Figure 8.

5.4. Optical transceivers and optical fibres

Two optical transceivers have to be inserted in the GLIB at the sites labeled “ Tracking data link” and “Trigger data link” in Figure 8.

Two optical fibres have to be attached to the previously inserted optical transceivers.

Be sure to plug the same optical fibre in the “Tracking data link” and “Trigger data link” on both the OptoHybrid and the GLIB.

5.5. Ready-to-install GLIB

A picture of the GLIB after the installation of all the components is represented in Figure 11.

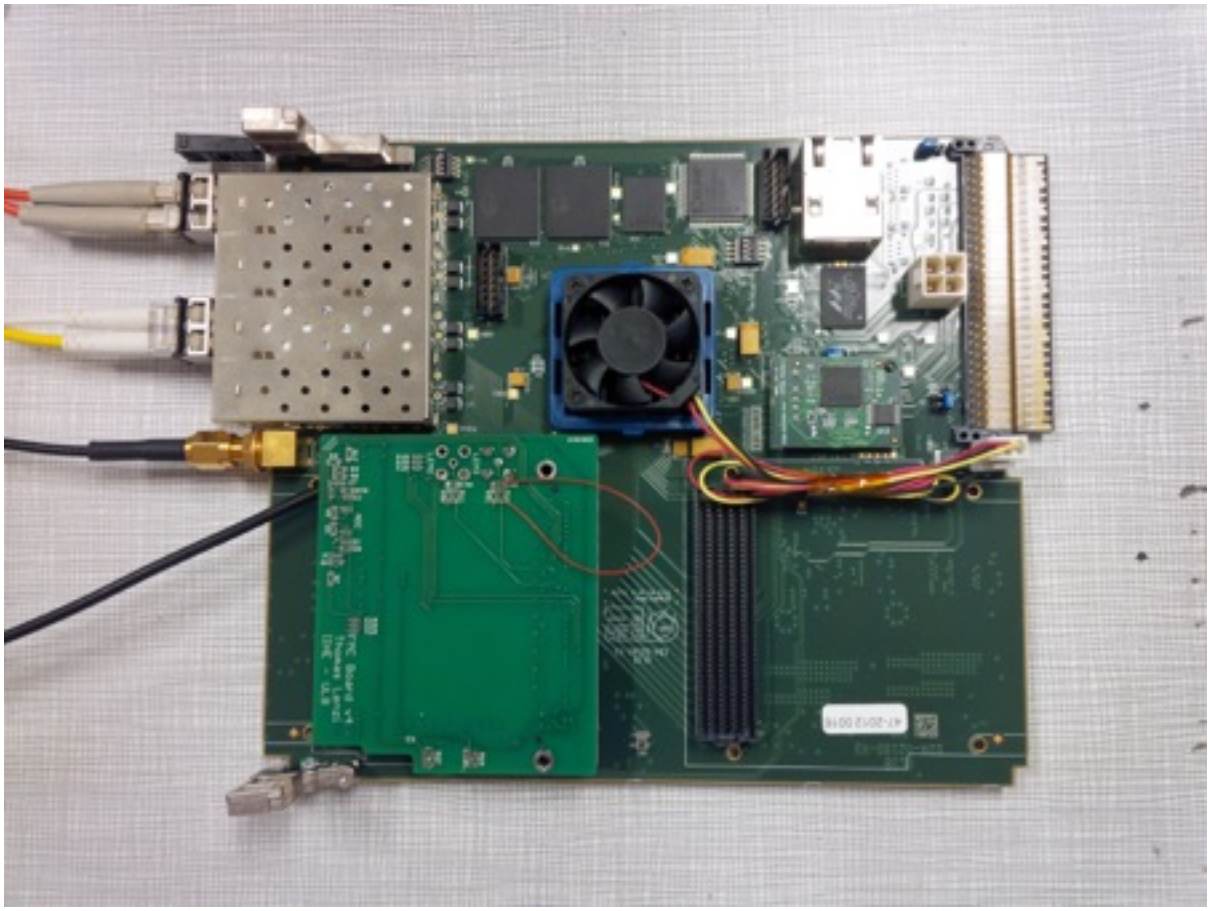

Figure 11: picture of the ready-to-install OptoHybrid.

6. uTCA crate

Install the empty uTCA crate, shown in Figure 12, in the rack (if the MCH is already install you can skip the next step) and power it up.

Figure 12: picture of the empty uTCA crate.

Next insert the MCH in the MCH2 slot as shown in the left image in Figure 13. Once the MCH is in place a blue LED should light up. When the blue LED is on, you can press the handle in order to start the MCH as shown in the right image in Figure 13. When the MCH boots, other LEDs will come up indicating the system is ready to be used.

Figure 13: picture of the MCH installed in the uTCA crate.

Once the MCH is booted up, connect an Ethernet cable in one of the port and make sure the LED on the connector turns on indicating that the connection is established.

Finally, insert the mounted GLIB in one of the AMC slots as shown in Figure 14 (the GLIB in that picture is not yet mounted). Once the GLIB is in place, press the handle in order to power in up.

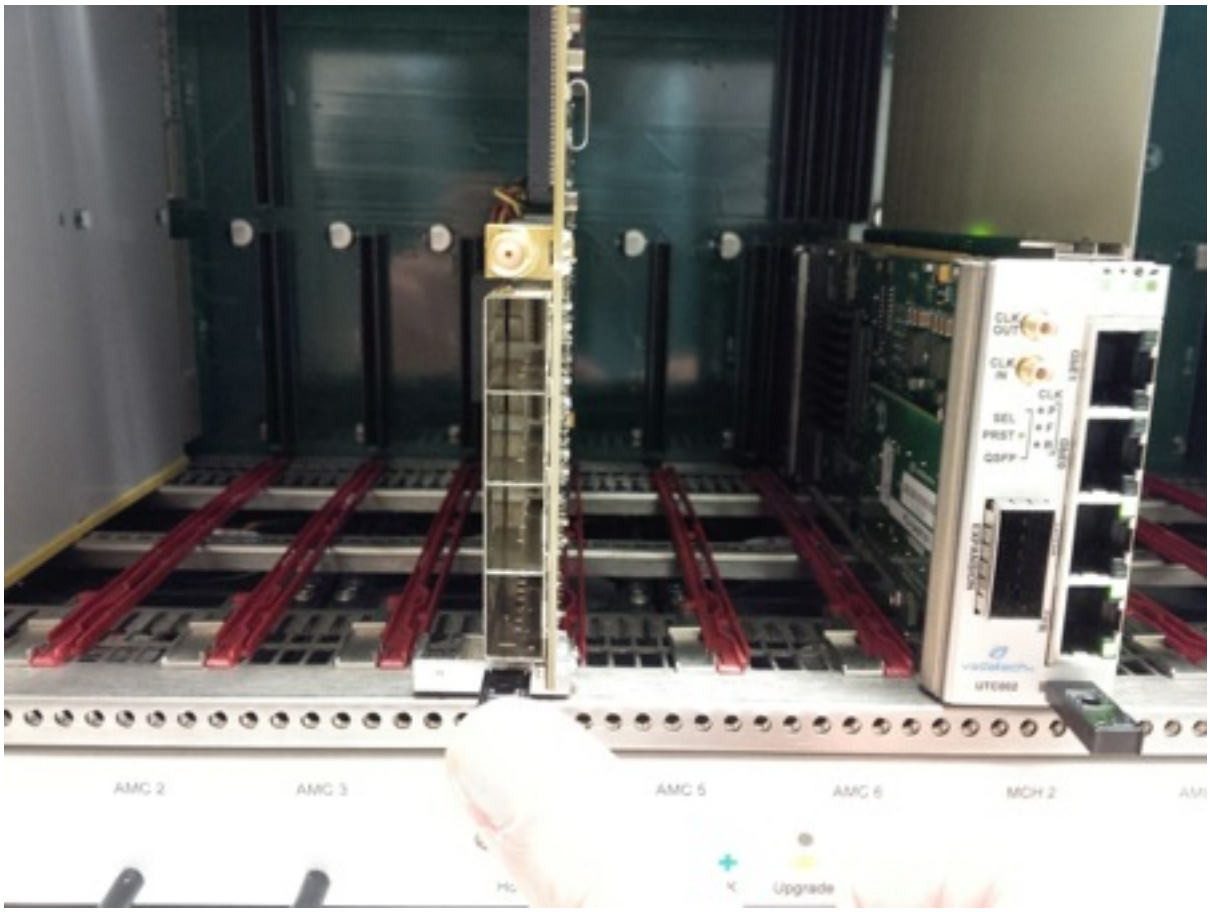

Figure 14: picture of the GLIB inserted in the uTCA crate.

At this point you should ensure that the GLIB is accessible through the network by trying to PING it.

```
$ ping <GLIB IP>
```

You can also execute the following command

```
$ arp –a
```

and ensure that the GLIB's MAC address appears : 08:00:30:F1:00:A0.

7. OptoHybrid PC

Place the OptoHybrid PC close to the OptoHybrid in the beam area and connect the JTAG programmer USB cable to it. Connect the PC to the network using an Ethernet cable and power it on.

8. DAQ PC

The DAQ PC should be installed in the control room and be connected to the network.

Appendices A

In case of problems, emergencies, etc. you can call me:

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