



# Zebra

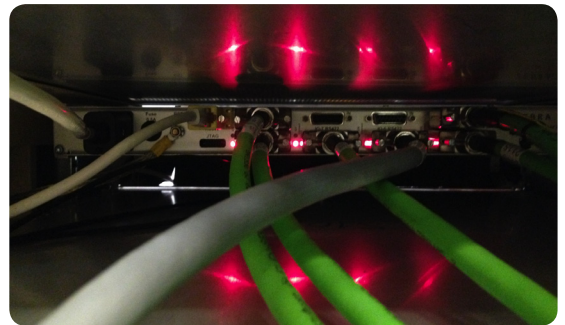
## Application Notes

### Imaging and high speed tomography

X-ray tomography allows researchers to reconstruct a three dimensional image of an object from a series of two dimensional projections taken at different orientations. In order to accurately reconstruct the three dimensional image, it is crucial to know the exact orientation of each of the projections.

The joint engineering, environmental and processing beamline (I12) at Diamond Light Source makes use of Zebra's position capture and position compare features, along with its ability to convert different signal types and levels to ensure that each frame of captured data is precisely related to the orientation of the sample under study.

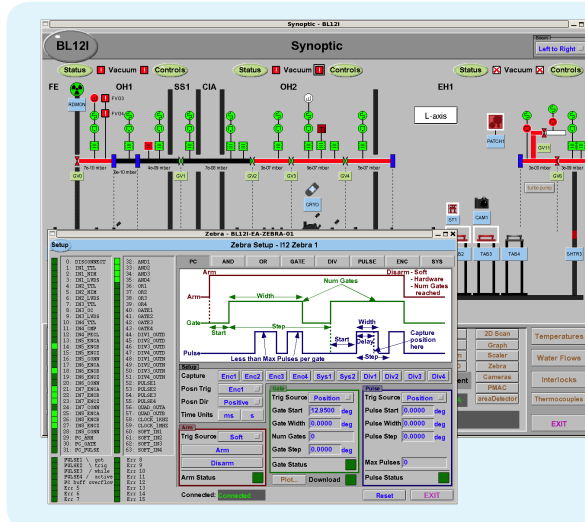
The installation of Zebra on I12 has led to significant improvement in the accuracy of data collection. I12 uses a pair of Zebra units to synchronise the movement of the sample stage to the triggering of the detectors.



Zebra 1 reading encoder signals



Zebra 2 relaying TTL and LVDS signals

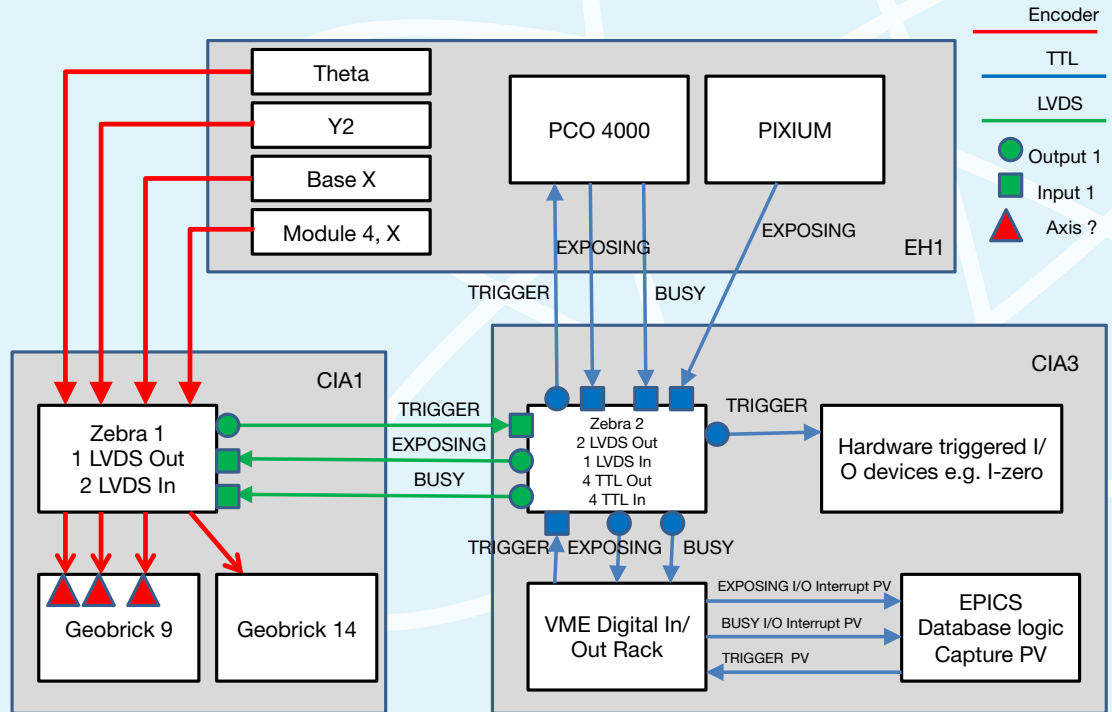


Zebra setup accessed via graphical user interface

Diamond Light Source uses EPICS in conjunction with GDA, their own acquisition software, to control its beamlines. Zebra's logic and gating functions can be accessed via this interface.



## Signalling for Continuous and Step Scans on I12



### Step scan mode

When I12 is operating in step scan mode, Zebra passes TTL signals through to the detectors to trigger and routes the returned busy and exposing signals back to the EPICS database. This allows the detector to be read out as the stage moves into its new position, saving around 400ms per step.

### Continuous scan mode

When I12 operates in continuous scan mode, two Zebra units are used together to synchronise the movement of the sample stage to the triggering of the detectors. Zebra 1 reads the encoder signals and sends a trigger signal to Zebra 2. Zebra 2 triggers the detector and feeds the exposing and busy signals back to Zebra 1. As soon as the busy signal drops another signal is sent from Zebra 1, which continues to read the encoders. In this way, the precise information on the position of the sample stage is available for each frame of collected data. If the measurements need to be repeated, the sample stage can be reset to a precise position. I12 was not able to operate this kind of continuous scan before the installation of Zebra.

### Future operations

I12 allows users to bring their own equipment to the beamline in order to collect data samples undergoing an external stress, temperature change or some similar dynamic condition. Typical examples of equipment provided by the user may be temperature controllers, furnaces or pressure cells. Zebra allows these pieces of user provided equipment to synchronise with the beamline's systems, provided that they output one of the many signal types that Zebra can accept. This would allow the detector to be triggered in response to a change to the sample's environment, as well as knowing the precise position at which that frame was captured. Staff at I12 plan to add this functionality to their beamline in the near future.