XH - Germanium microstrip detector for dispersive X-ray spectroscopy

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Technology
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XCHIPS

To achieve fast readout speeds required for EDE the XCHIPS readout ASIC developed by CLRC is used. The key parameters of this ASIC:

- 128 charge integrating preamps
- 4 differential analogue outputs with 32:1 multiplexing of input data
- 2pC or 10pC selectable dynamic range,
- integration times in the range of 1µs – 1s
- device readout-time of 10µs
- non linearity 0.03%

Figure 5 shows the CAD layout of the XCHIPS

Detector head

To achieve best signal quality the 8 XCHIPS and 32 front end buffering amplifiers are placed within the cryostat. Placing this density of electronics within the cryostat has many technical challenges. One major difficulty being the electronics will not operate at 77K. This requires complex thermal engineering to ensure base temperature of the readout electronics is 240K.

To avoid heating the detector through the bonding wires an intermediate ceramic bonding stage fed to the cold finger is used. Figure 6 illustrates the detector head assembly.

Crystal

To reduce the leakage current of the detector it is operated within a cryostat at a base temperature of 77K. The 25 litre cryostat has been designed and fabricated by LBNL. It is estimated that the cryostat will provided a three day holding time. Figure 7 shows the completed cryostat at LBNL.

Data acquisition

The DAQ system hardware is provided by Sundance Multiprocessor Technology Ltd with interface software written by 3L Ltd. The system comprises:

- 32 x 14bit 5MHz ADCs
- 2x FPGA/DSP processing units
- 512MB data memory

The DAQ allows the system to handle data at the rate of 200MB/s and perform accumulation and data framing algorithms. The large system memory provides storage for a possible 100,000 independent time frames.

User interface

The user interface for the system has been built around the EDE technique and allows the user flexibility of system operation. The system is controlled both its own PC or via a TCP/IP connection from a beamline computer system. This flexibility provides simple standalone or integrated operation.

The User interface will allow for remote triggering and sequencing of external experimental equipment such as stop flow cells. Example data derived from the user interface is shown in figure 7.

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References

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