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Characterization of Teledyne MCMs Destined for the Mini-Tower

Six MCMs assembled and encapsulated at Teledyne are being shipped to Pisa today for use in the mini-tower. A seventh was already sent to Pisa before Christmas, and an eighth is on its way from Teledyne and will be shipped later. Six will be used in the mini-tower, and two more will be used in the working tray that will be put through qualification testing. The serial numbers in this shipment are 70, 75, 77, 79, 80, and 82.

The MCMs were tested at Teledyne prior to encapsulation. At that time some rework was done to replace bad chips. In some cases the replacement chips had the same bad behavior, suggesting problems with the printed wiring board. Due to time constraints, some relatively minor known problems were not repaired. As a result, none of these MCMs is perfect.

Recently we retested these MCMs at UCSC, to see if any new problems occurred during encapsulation and shipping. All of the existing problems are identical to what was seen prior to encapsulation, except that a few GTFE G-version chips are now found to be oscillating at a higher threshold level than seen previously. Therefore, we conclude that the encapsulation procedure worked well and did not damage the MCMs. The problem of oscillating G chips is due to a well-known and understood instability that has been repaired in the flight submission. For the mini-tower we will have to live with it by raising the threshold on those chips, or if that doesn't work, by masking all channels from trigger and data on those chips.

Note that some of the MCMs have problems with the wire-bonding pads for the wire bonds meant to go from the MCM pitch adapter to the SSDs. This was due to problems with the design and quality of the pitch adapters used for these boards. We will lose some mini-tower detector channels due to these problems, but the solution for the flight modules is well understood.

The following table gives the status of known readout problems with these modules. These problems will have to be taken into account when setting up the mini-tower for readout. Because of the redundant readout, by optimizing the initialization of the system, it should be possible to read data from most of the good chips. In fact, many of the problems are avoided by the standard configuration in which the left half is read out to the left and the right half is read out to the right.

SN	GTFE	GTRC	GTFE Adrs.	Status
70	F2	V3	23	This chip does not work well for read-event-data when event buffer #1 is used.
75	G	V3	1	This chip does not work well for read-event-data when event buffer #0 is used.
			23	After encapsulation, this chip is showing oscillations up to a threshold of at least 14 DAC counts.
77	G	V3	11	Even before encapsulation this chip showed oscillations up to a threshold of at least 14 DAC counts.
79	F2	V3	8	This chip does not respond well for reading out configuration registers from the right side. It works well from the left side.
			16	This chip shows a very peculiar behavior when the calibration channel pattern [0,13,26,39,52] is used. In that case it returns the data [0,13,26,38,52]. All other calibration channel patterns work fine.
			8 or 9	One of these two chips appears to have a bad I/O cell. The symptom is that in the right-hand direction, the Layer-OR signal is not seen from chip addresses 0 through 8.
80	F2	V3	3	This chip does not respond at all but does pass data and trigger (with one exception noted below). It was replaced once at Teledyne, but that did not fix the problem, which probably is in the printed wiring board.
			2 or 3	In the right-hand direction the Layer-OR signal is not seen from chip addresses 0 through 2.
			20 or 21	One of these two chips appears to have a bad I/O cell. The symptom is that in the left-hand direction, the Layer-OR signal is not seen from chip addresses 21 through 23.
82	G	V3	7	This chip does not respond well when reading the configuration registers from the right side. It works well from the left side.
			10	This chip frequently shows bad event data (channels other than those that were pulsed). It may be due to oscillations but has not been understood in detail.
			15	This chip frequently shows bad event data (channels other than those that were pulsed). It may be due to oscillations but has not been understood in detail.

