Abnormal response in high thresholds

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The hybrids with ASICs are tested in the room, the warm and the cold temperatures. The temperature is defined at the temperature of thermistors on the hybrids, and 27 deg.C in the room, 37 deg.C in the warm, and 0 deg.C in the cold conditions. The tests include a response curve where the input charges are 0.5, 0.75, 1.0, 1.25, 1.5, 2.0, 3.0, 4.0, 6.0, and 8.0 fC. Occasionally, we have seen large responses in the highest 8 fC, with large input noises, in the room temperature measurement. In the cold temperature condition, this effect has been pronounced and we have paid attention to this problem, recently.

An example is shown in the ASIC hybrid, 20220170200178, with the ASICs of Z40615-W14, in this note. Attached are: (pages are counted for the plots only)

(1) Page 1-4: Response curve plots in the room temperature condition

The pages 1 and 3 are, after fitting, the vt50s, gains, offsets, and input noises, at 2fC, of the link0 and link1, respectively. The pages 2 and 4 are response curves, gains, output noises, and input noises, as a function of input charges. A larger input noises are visible in a few chips, but otherwise the response curves are normal.

(2) Page 5: Threshold scan for the input charge of 8fC. Very normal s-curves (in log plot) and (sort of) uniform in the channel maps.

(3) Page 6-9: Response curve plots in the cold temperature condition

In the pages 6 and 8, spikes are visible in the gain plots (and anti-spikes in the offset plots). In the pages 7 and 9, larger responses are seen in nearly all chips at 8fC in the response curves, and larger noises at 8fC.

(4) Page 10: Threshold scan for 8fC in the cold

To see the behavior at 8fC, a threshold scan plot was made for the input charge of 8fC. The threshold behavior of channels are very "spiky" in the channel maps. Two chips, S01 and S09, are in larger responses.

(5) Page 11: Threshold scan for 6 fC in the cold

At a lower input charge, e.g., 6fC, the "spiky" nature is diminishing, still visible in the two chips, S01 and S09, but small.

(6) Page 12: Vdd=4.4V, threshold scan for 8fC, in the cold

Up to the page 11, the Vdd power supply was set at default, 4.0V. The dependence for Vdd was tested. The threshold scan was for 8fC at the Vdd=4.4V. Compared with the plots in the page 10, the "spiky" nature has become less, but the S02 and S09 which show "hopping" of responses, i.e., responses decrease and increase again in higher thresholds. Very strange behavior.

(7) Page 13: Vdd=4.8V, threshold scan for 8fC, in the cold

At the Vdd=4.8V, the responses become normal. Nearly no "spiky" nature in the channel maps.

The explanation of this effect from the ASIC designers is

“this is due to different temperature coefficients for the gain and the threshold DAC and you arrive to a situation that the threshold DAC (actual value of the threshold voltage) saturates and you can't discriminate high pulses” and

“we should not see any problem with timewalk test up to 8 fC since in this test the threshold is kept at fixed (and low) value (but the calibration pulse DAC outputs 8 fC)”

(8) Page 14-15: Timewalk plots of the module, 20220170200133: no abnormality was seen at 8fC

After accumulating statistics, we have seen the effect, though smaller, even at 6 fC, occasionally. Taking the

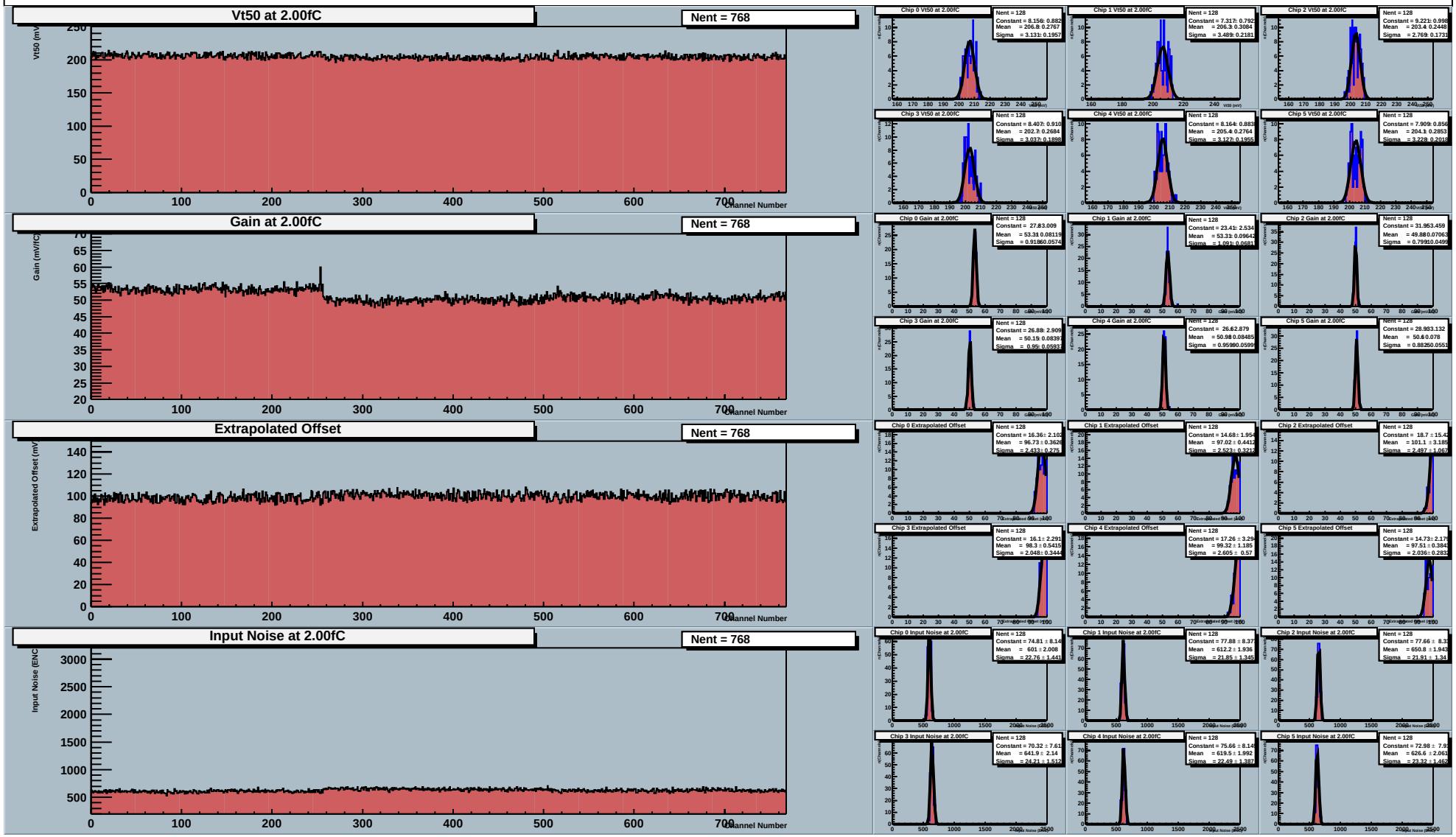
suggestion from the ASIC designers, “ignore it. We are not going to use the modules in the experiment with threshold at 8 fC or so”, a proposal for the future QA is

1) Response curve scan up to 6 fC, warm or cold

2) Eliminate 6fC if there is problem even at the threshold

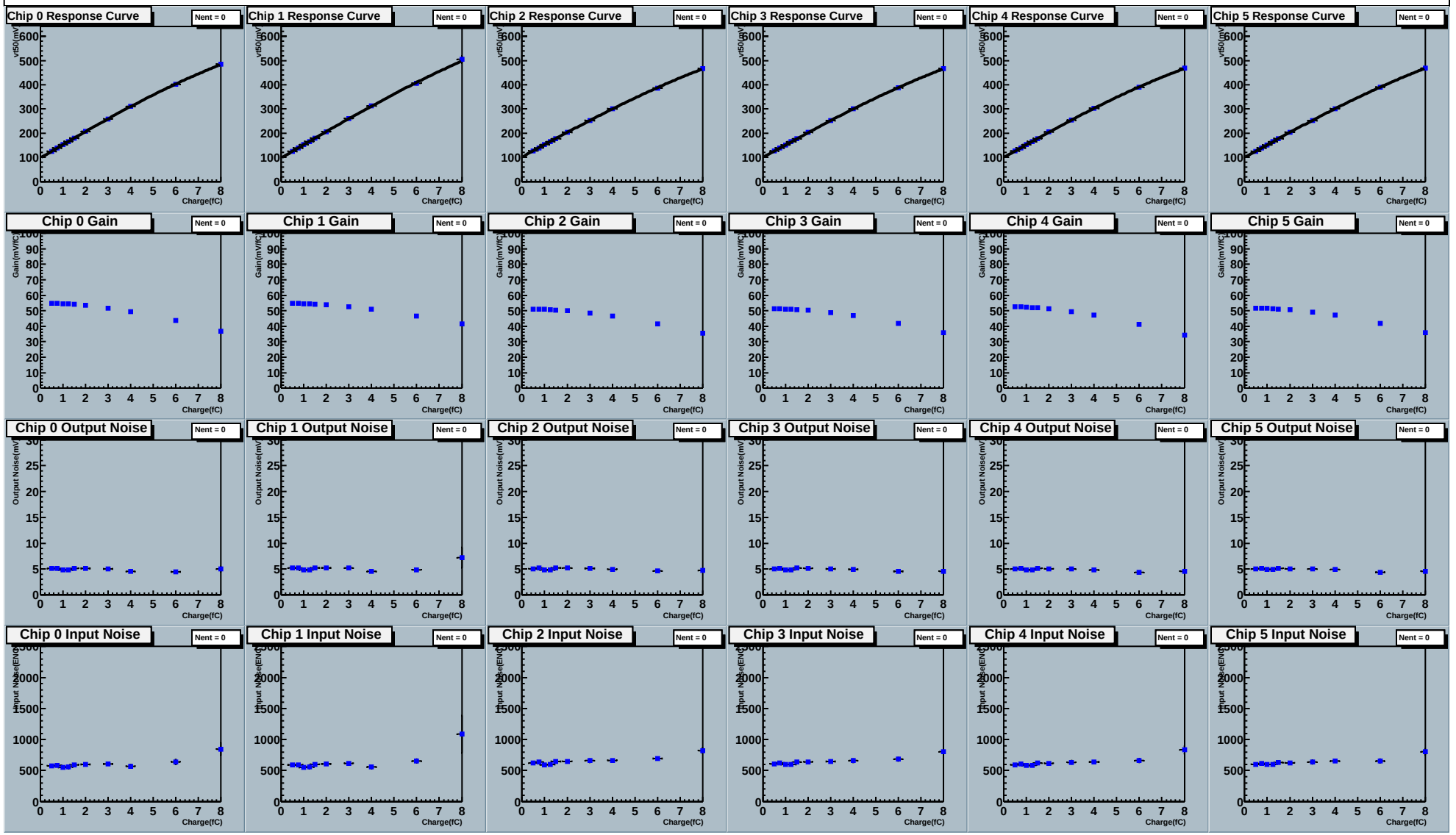
ATLAS SCT Module Test: Response vs. Channel - Thu Oct 10 12:06:34 2002 - UNKNOWN - Module 20220170200017

Page 1 Run 6415 Start Scan 44 Module 0 Stream 0 - Type .



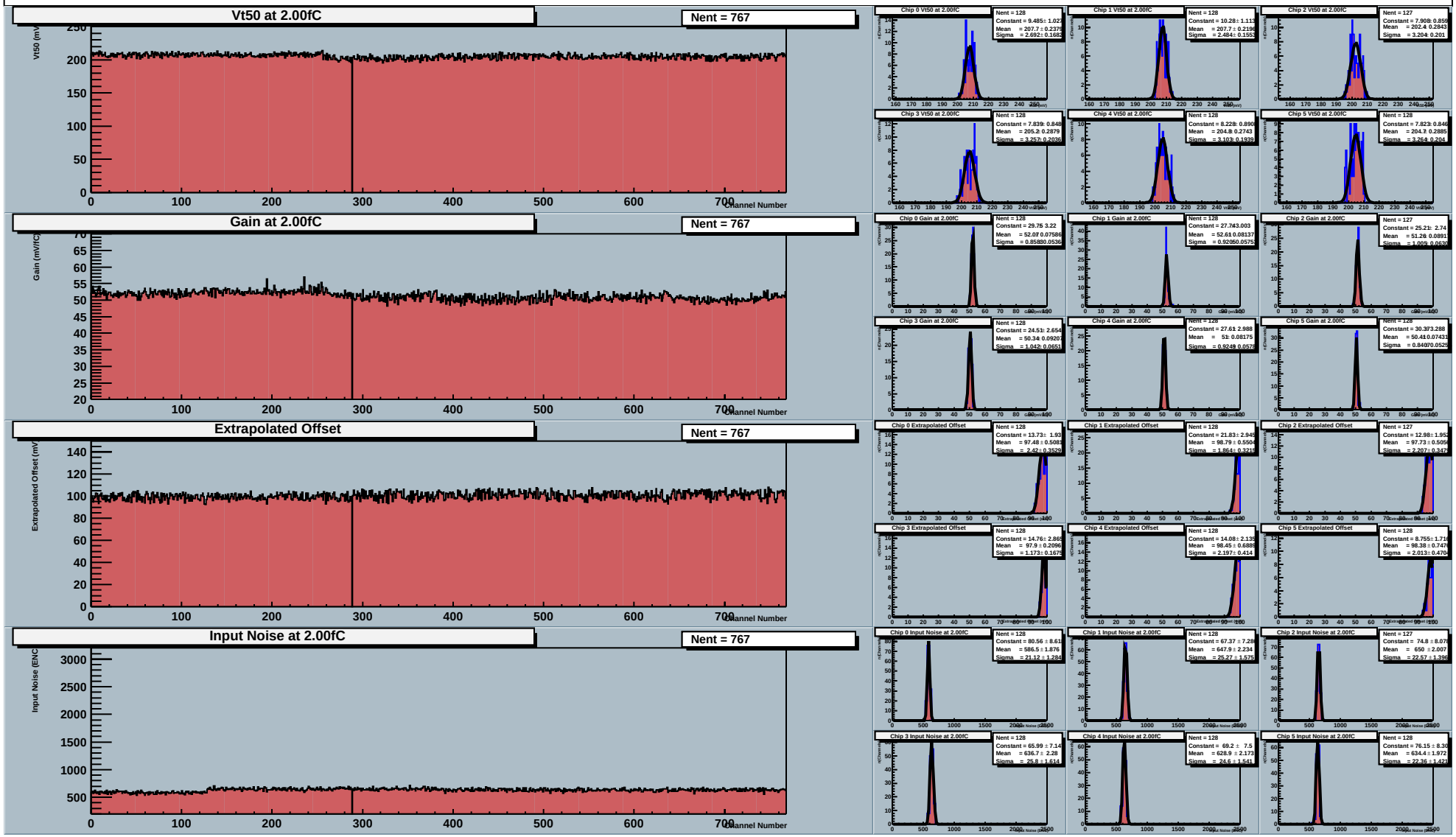
ATLAS SCT Module Test: Response Curve - Thu Oct 10 12:06:34 2002 - UNKNOWN - Module 20220170200178hDac

Page 2 Run 6415 Start Scan 44 Module 0 Stream 0 - Type .



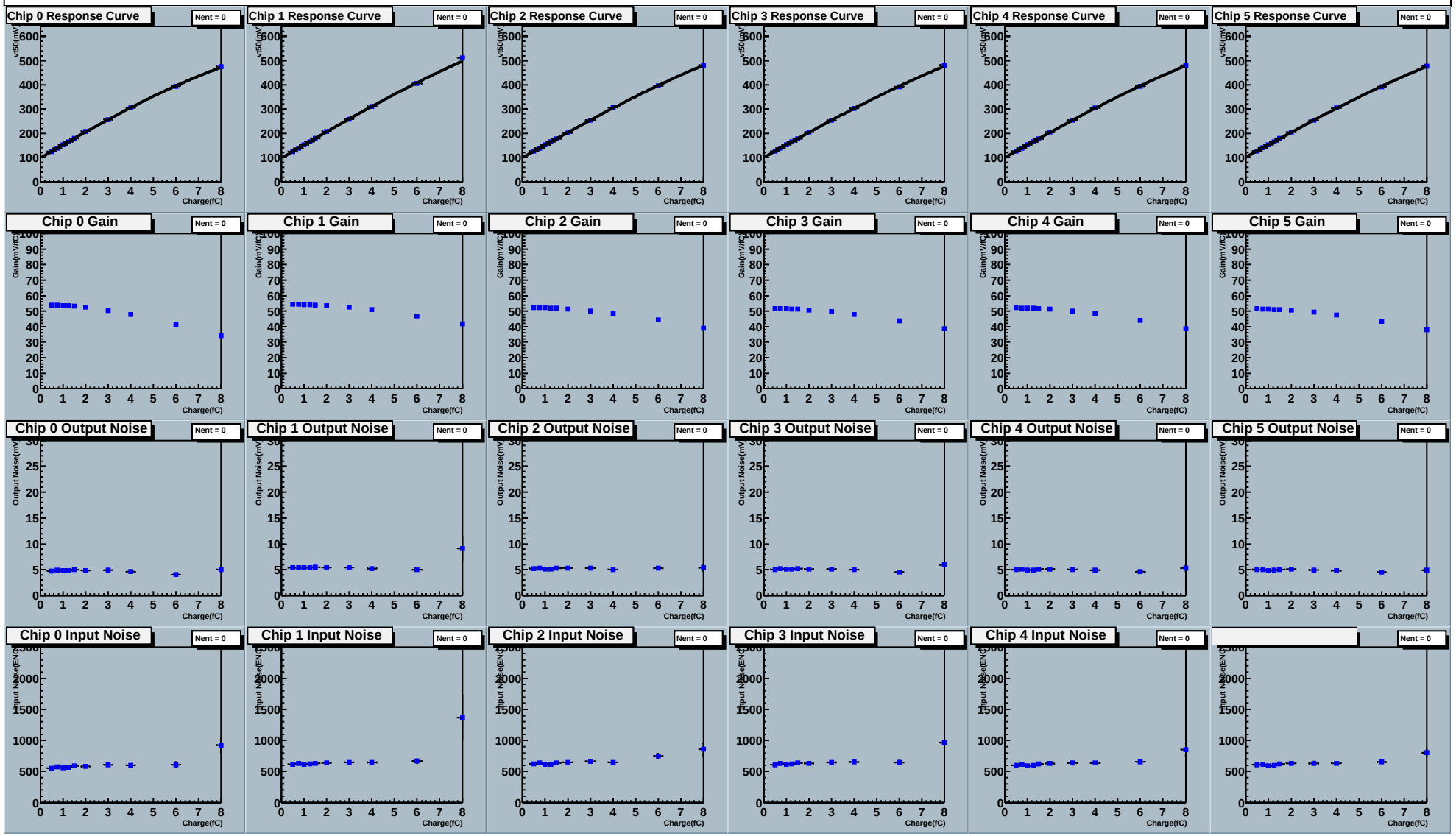
ATLAS SCT Module Test: Response vs. Channel - Thu Oct 10 12:06:34 2002 - UNKNOWN - Module 20220170200017

Page 3 Run 6415 Start Scan 44 Module 0 Stream 1 - Type .



ATLAS SCT Module Test: Response Curve - Thu Oct 10 12:06:34 2002 - UNKNOWN - Module 20220170200178hDac

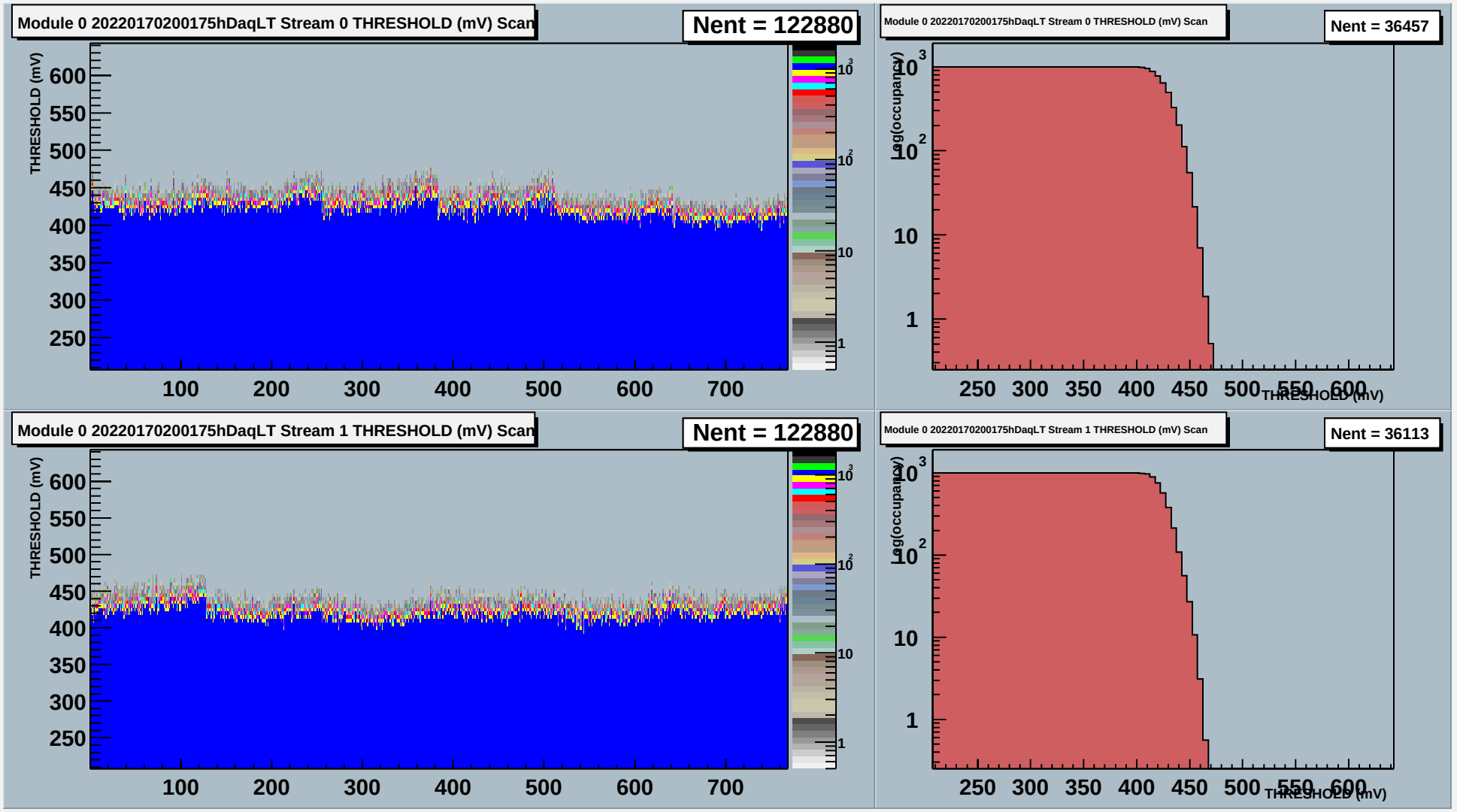
Page 4 Run 6415 Start Scan 44 Module 0 Stream 1 - Type .



ATLAS SCT Scan Comparison - log scale

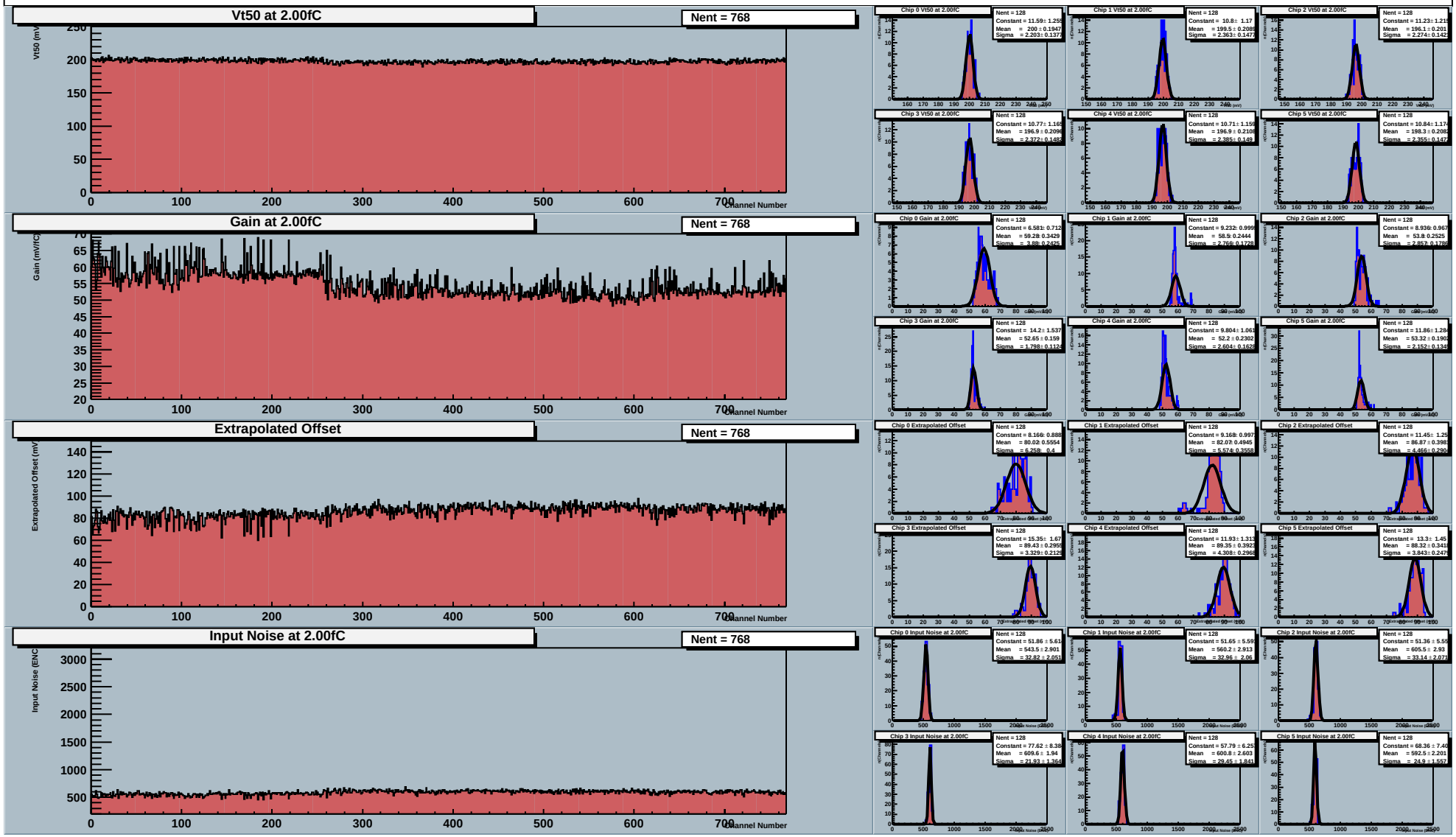
Run 6434 Scan 53 Module 0 Stream 0 (Projection of ch 0 to ch 767) vs

Run 6434 Scan 53 Module 0 Stream 1 (Projection of ch 0 to ch 767)



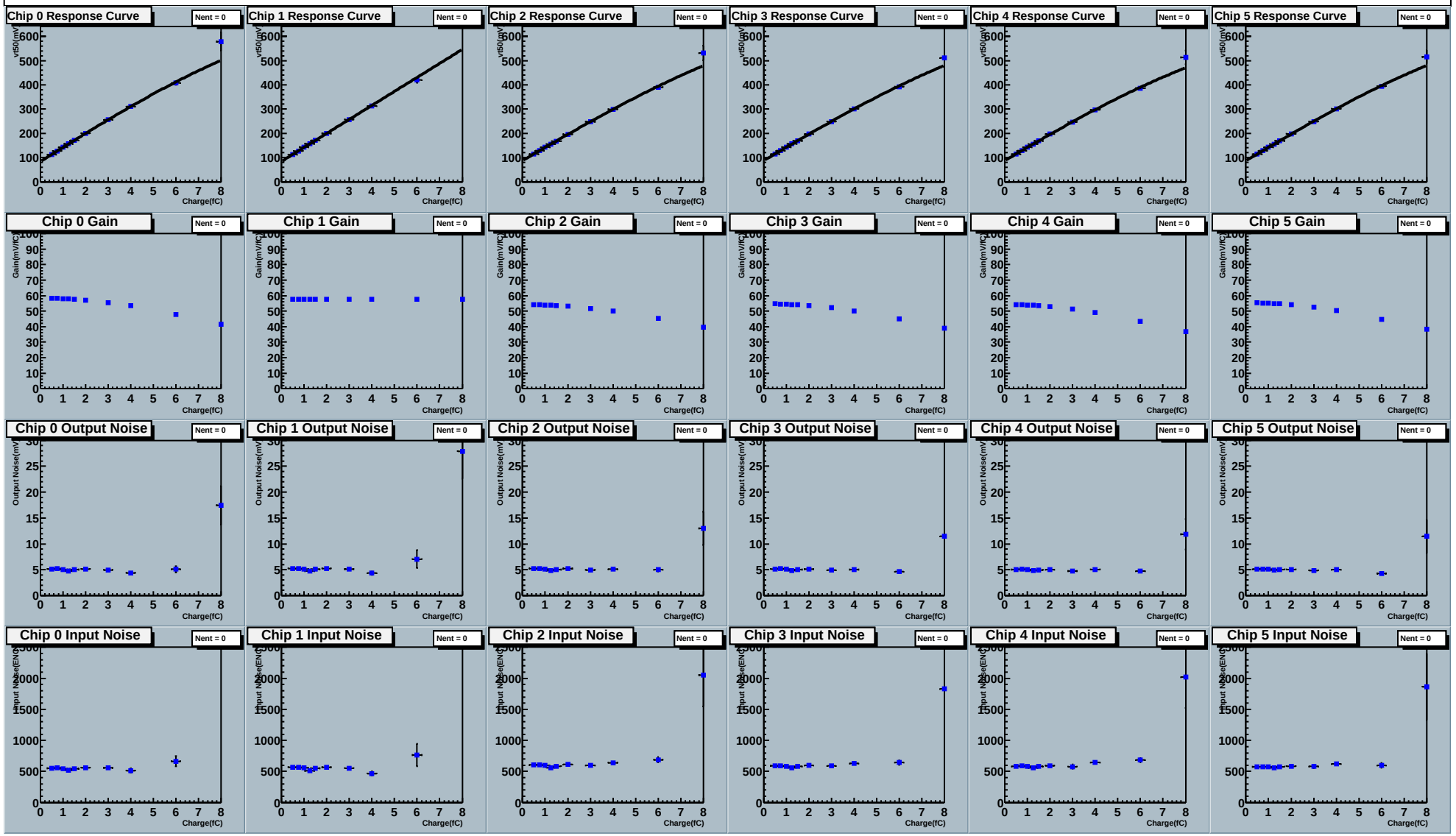
ATLAS SCT Module Test: Response vs. Channel - Tue Oct 15 13:23:56 2002 - UNKNOWN - Module 20220170200017

Page 1 Run 6734 Start Scan 44 Module 0 Stream 0 - Type .



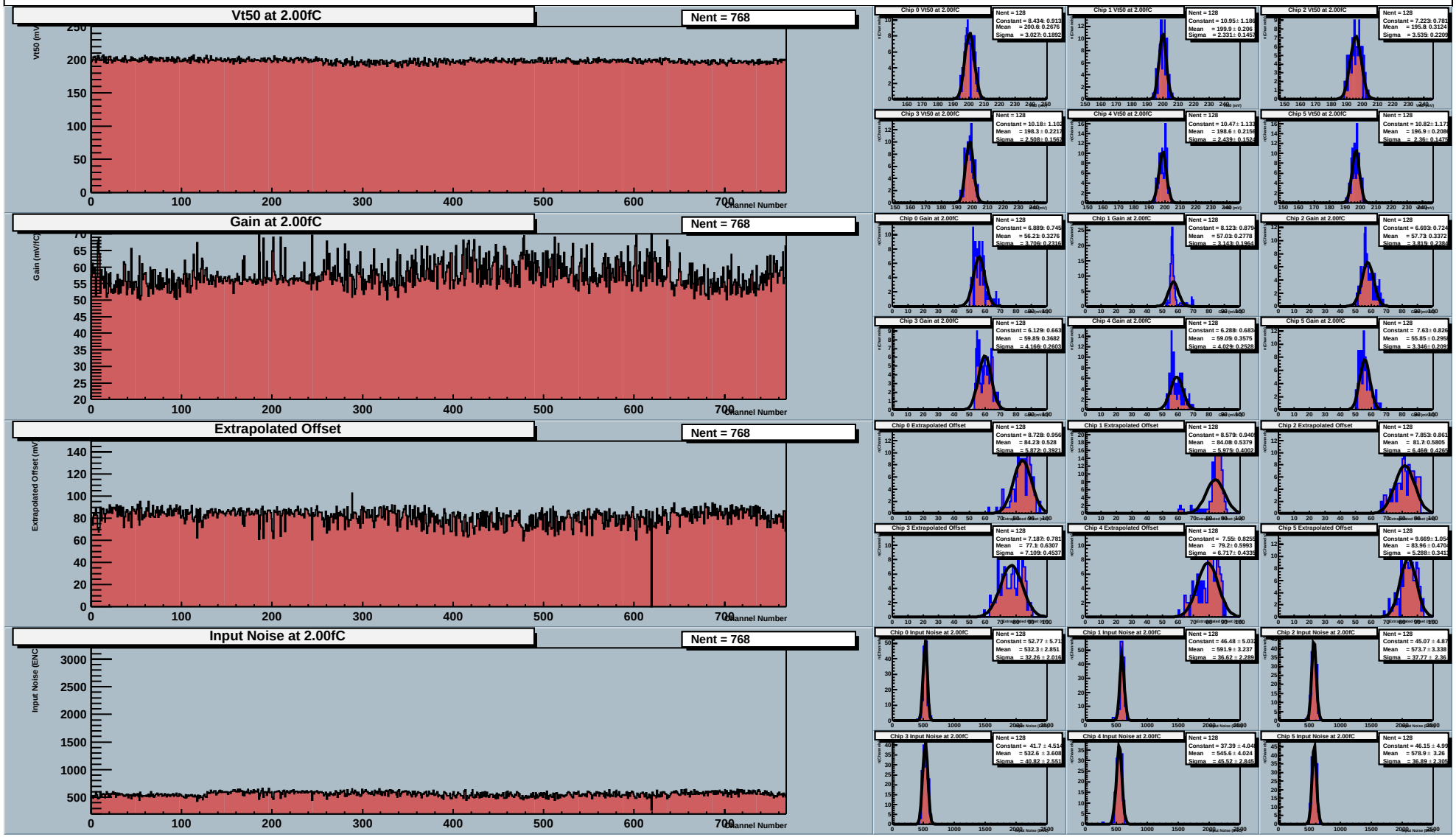
ATLAS SCT Module Test: Response Curve - Tue Oct 15 13:23:56 2002 - UNKNOWN - Module 20220170200178hDaq

Page 2 Run 6734 Start Scan 44 Module 0 Stream 0 - Type .



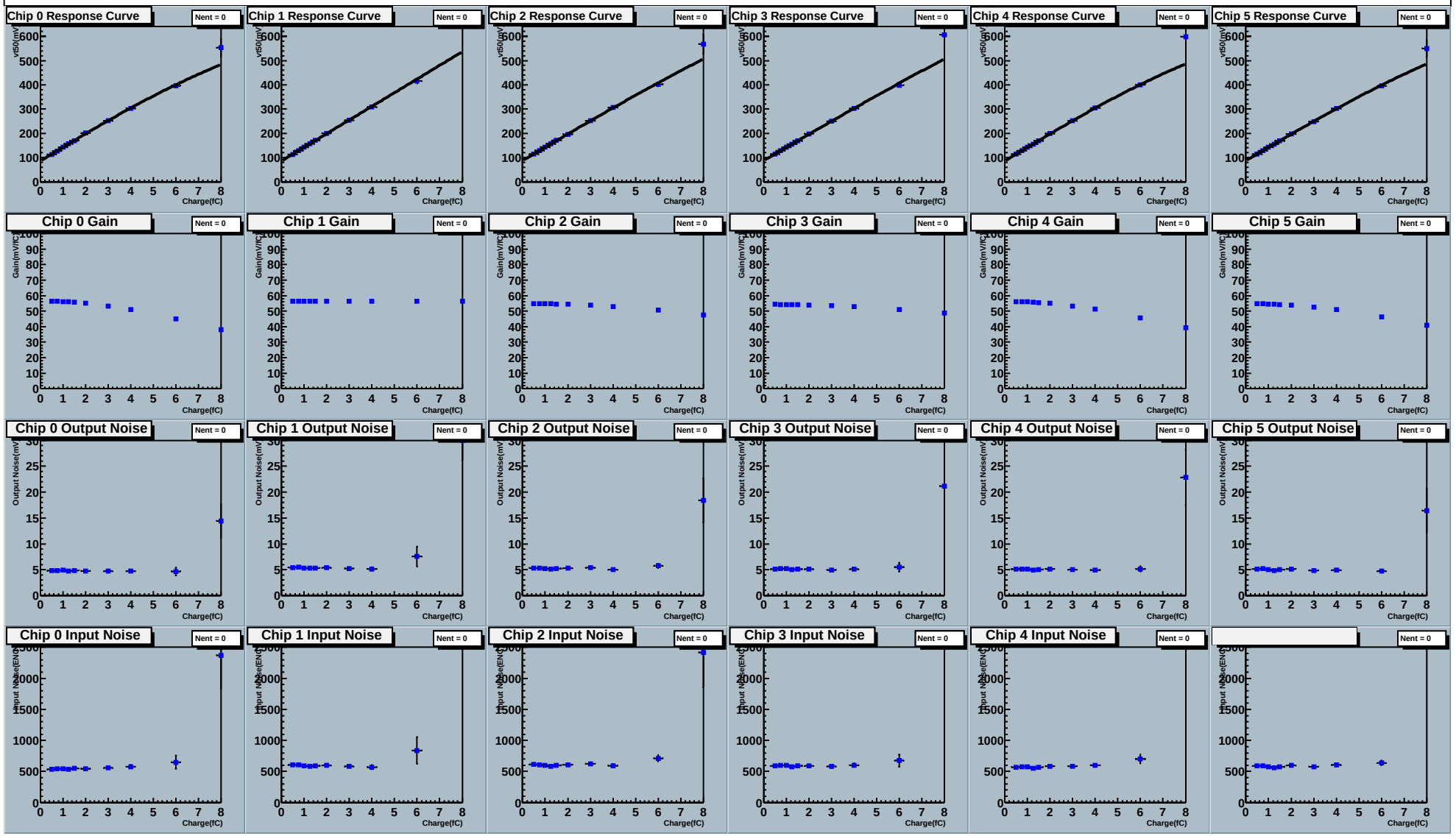
ATLAS SCT Module Test: Response vs. Channel - Tue Oct 15 13:23:56 2002 - UNKNOWN - Module 20220170200017

Page 3 Run 6734 Start Scan 44 Module 0 Stream 1 - Type .



ATLAS SCT Module Test: Response Curve - Tue Oct 15 13:23:56 2002 - UNKNOWN - Module 20220170200178hDaq

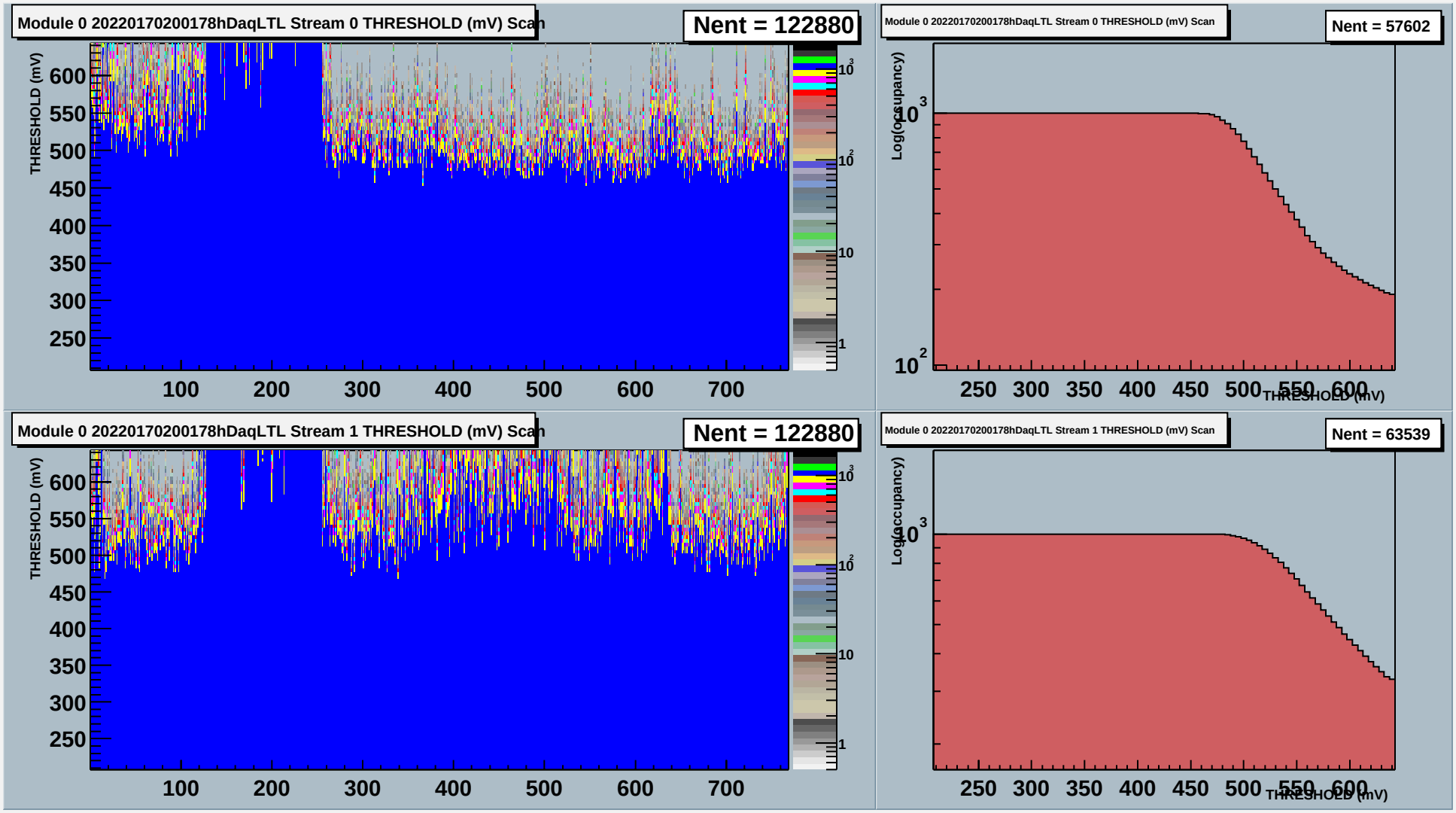
Page 4 Run 6734 Start Scan 44 Module 0 Stream 1 - Type .



ATLAS SCT Scan Comparison - log scale

Run 6734 Scan 53 Module 0 Stream 0 (Projection of ch 0 to ch 767) vs

Run 6734 Scan 53 Module 0 Stream 1 (Projection of ch 0 to ch 767)



ATLAS SCT Scan Comparison - log scale

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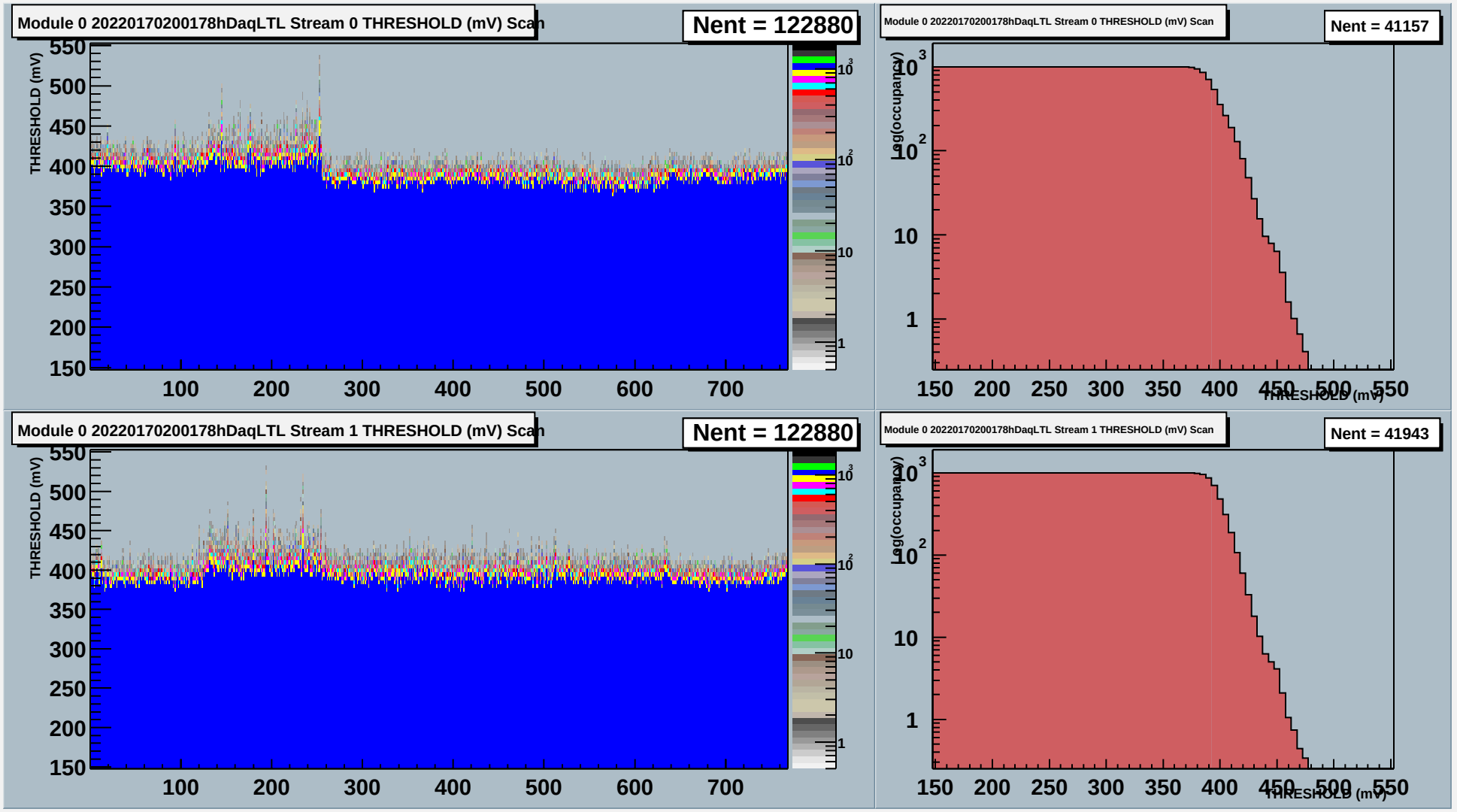
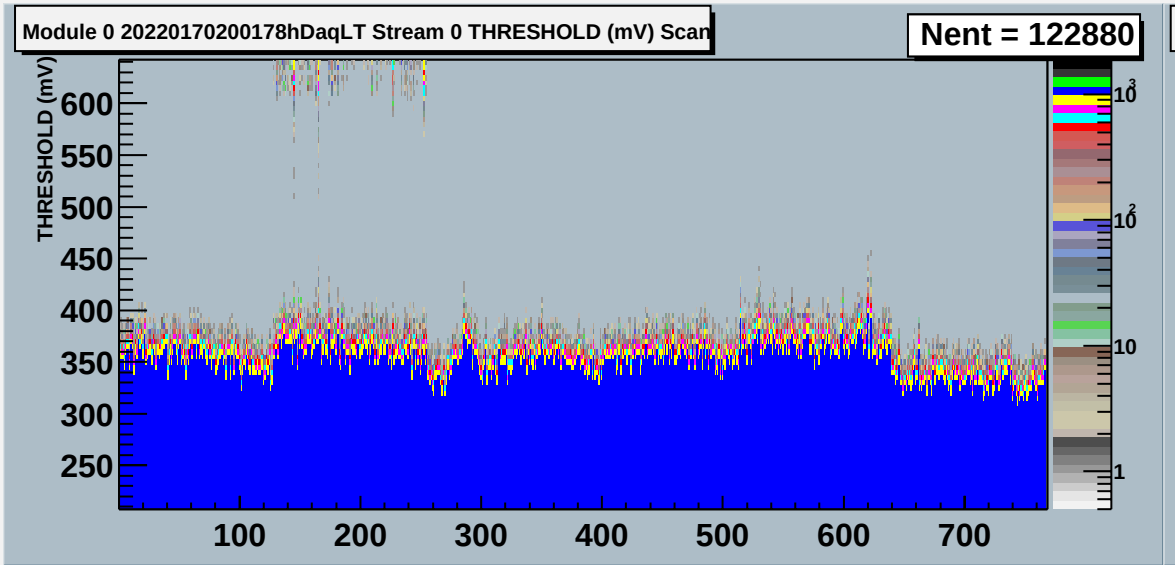
Run 6734 Scan 52 Module 0 Stream 1 (Projection of ch 0 to ch 767)

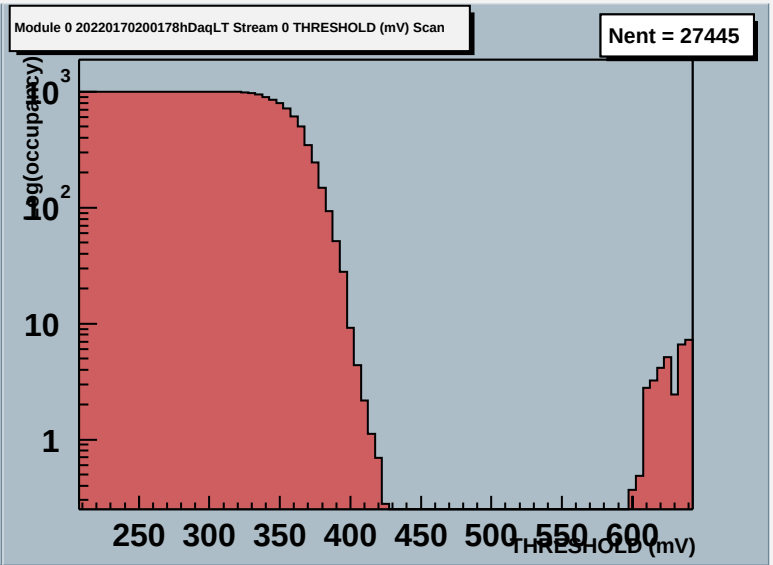


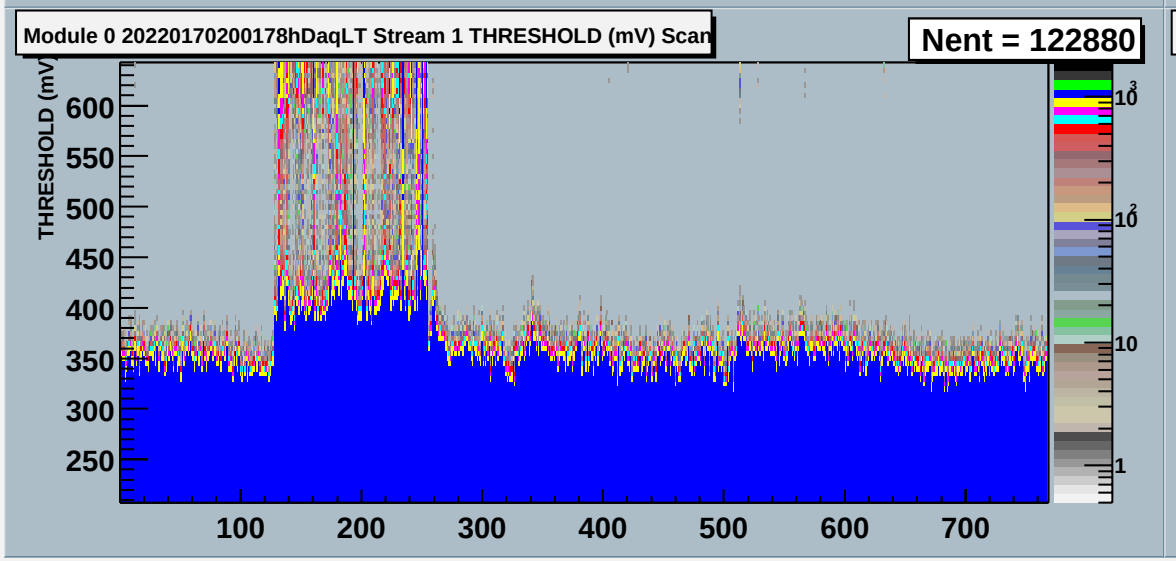
ATLAS SCT Scan Comparison - log scale

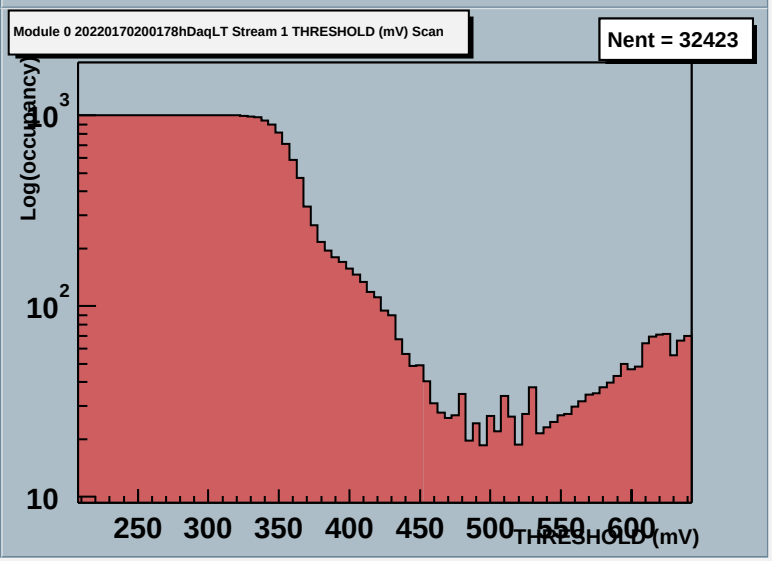
Run 4316 Scan 12 Module 0 Stream 0 (Projection of ch 0 to ch 767) vs

Run 4316 Scan 12 Module 0 Stream 1 (Projection of ch 0 to ch 767)





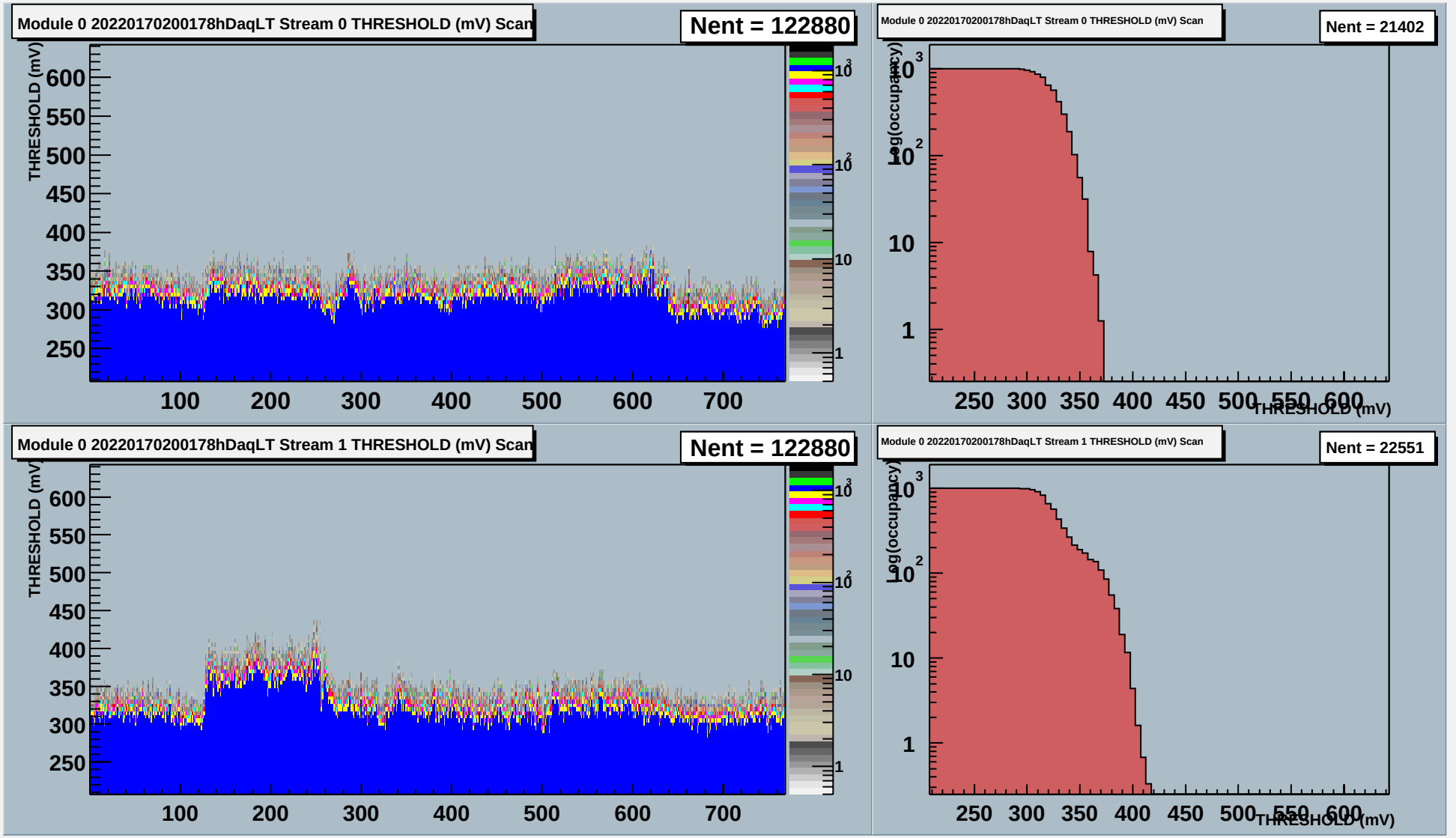




ATLAS SCT Scan Comparison - log scale

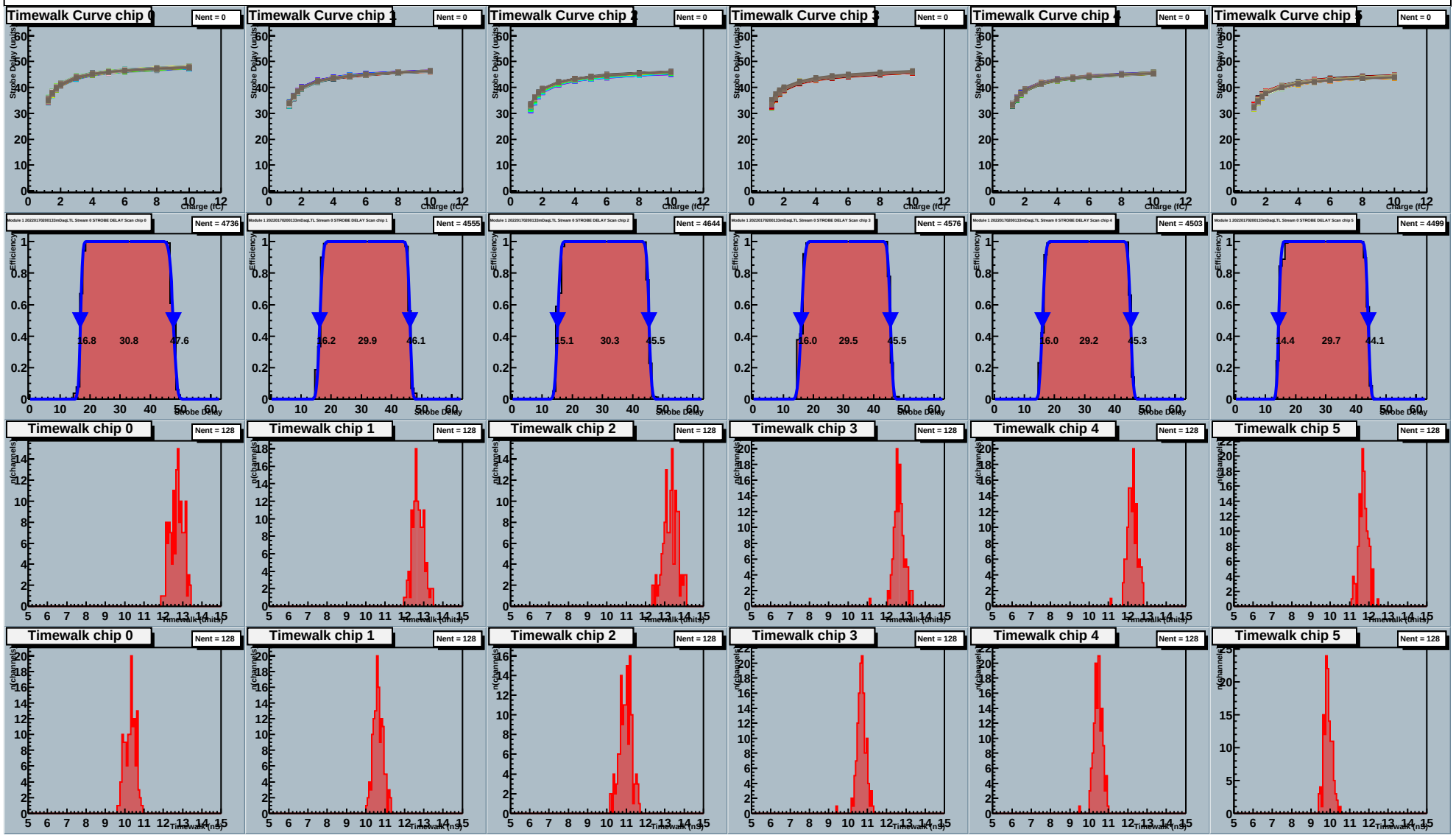
Run 4316 Scan 20 Module 0 Stream 0 (Projection of ch 0 to ch 767) vs

Run 4316 Scan 20 Module 0 Stream 1 (Projection of ch 0 to ch 767)



ATLAS SCT Module Test: Timewalk Curve - Sat Oct 05 22:22:28 2002 - UNKNOWN - Module 20220170200133mDaq

Page 1 Run 4156 Start Scan 55 Module 1 Stream 0 - Type .



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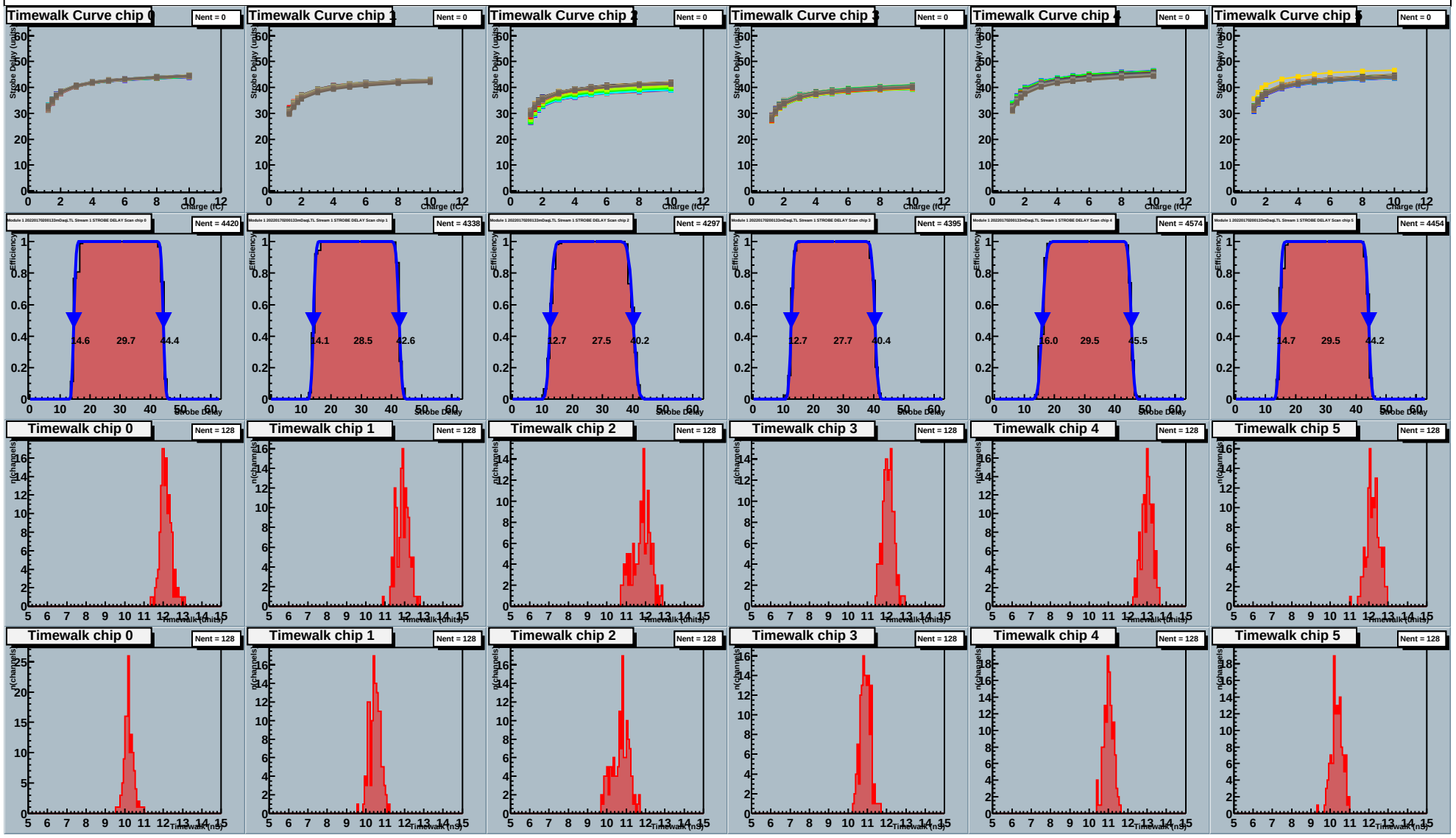
Page 3 Run 4156 Start Scan 55 Module 1 Stream 1 - Type .