1 Finding shorts

1.1 Principle

When the input of two channels are shorted, any signal at the input of one of them will be split up between both. When using the internal calibration facility of the APV chip, signal is applied on every 8th channel. This means that the two neighbouring inputs of the probed channel should not get any signal. If there is a short to one of the neighbours, the signal is split up and decreases significantly in height. A short can thus be found by applying a cut on the calibration signal height.

1.2 Descrption

To detect the shorts we perform a calibration run in peak mode with the inverter off. The calibration charge that is injected into the amplifier inputs is roughly corresponding twice the charge that a MIP generates in a 300 μm silicon sensor. The latency is chosen such that the sampling occurs at the pulse maximum. The expected signal is around 70 ADC counts and a signal less that 50 ADC counts is considered a short (see fig.1).

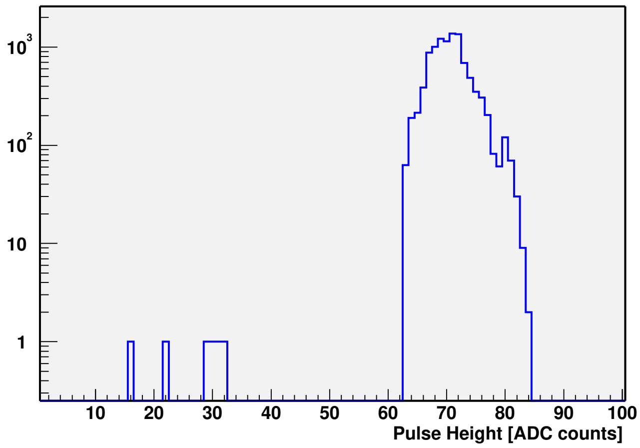

Figure 1: Pulseheight distribution for all 512 channels of 21 hybrids.

2 Finding opens

2.1 Principle

To find opens, a signal is injected through capacitive coupling into the pitch adapter lines. Since all channels on the hybrid see simoultaneously a charge at their inputs, the on-chip common mode subtraction of the APV tries to compensate for it, resulting in a more or less flat output at the end of the shaper stage. If one of the APV-pa bonds is lifted, or if a pa line is broken, no signal is present on that channel, and the common mode subtraction will make it stick out sharply with respect to its neighbours.

2.2 Descrption

To find opens or broken pa lines, we apply a positive TTL edge on a wire, that is brought closely to the sensor side of the pitch adapter. The capacitive coupling is mostly going to the bond pads, so that it even becomes possible to detect broken pa lines that are open close to the bond pads. The pedestal is measured in peak mode with the inverter stage off. For a hybrid without faults the result is a more or less smooth pedestal distribution (see fig.2 a)). The pedestals at the edges of the APV chips are pulled downwards. The result of a hybrid with open bonds and broken pa lines is shown in fig.2 b). The faulty channels stick out as positive spikes from the rest.

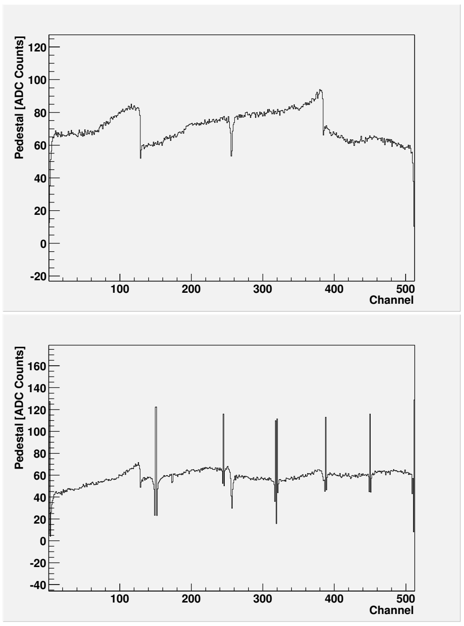

Figure 2: Pedestal distribution with signak injected into the pitch adapter. The first plot is a hybrid with no opens, the hybrid on the second plot had n opens.

A naive approach to find opens by applying an absolute cut on the pedestal values does not work, because the average pedestal values can vary considerably from chip to chip. We therefore have to subtract the average pedestal value chip-wise. Still the slope in the pedestal distribution of a single chip, which is due to imperfect capacitive coupling to the signal wire, makes it sometimes difficult

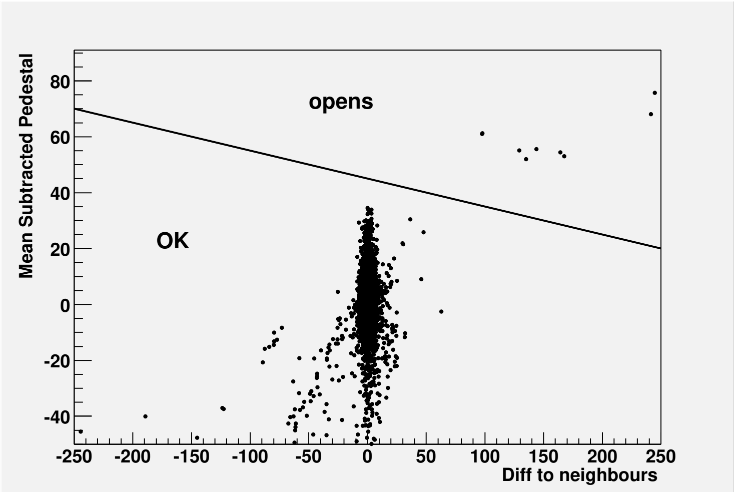

Figure 3:

to apply a single cut on these values. To cope with this we also consider the difference of a pedestal values to its neighbours. Fig.3 shows a scatter plot of the average-subtracted pedestal values against the difference to the neighbours. The faulty channels group in the top right corner. We use a straight line to separate them from the bulk of good channels that is also shown in the figure giving raise to the following condition for bad channels:

$$y - a \cdot x > b$$

where the slope a =-0.1 and the abscissa b =45 ADC counts.