4. Nominal Set Up

Lets explore a nominal charge splitting and its performance. For the nominal values we split 20% into the HIGH gain channel and 4% into the LOW gain channel.

VLPC Output					
	MIP	5		15	pe per MIP
	pe	75		40	K VLPC Gain
	fC	480.6			
Charge Splitter					
		Drain	High Gain	Low Gain	
	%	76%	20%	4%	
	fC	365.26	96.12	19.224	
SIFT Disc			1	2	25mv/fC >20 fC
	gain		25.00	6.5	6.5mV/fC<20fC
	Vth		2.80	0.65	V
	5% delta Vth		120.15	12.50	mV
SIFT Ouput					
	Gain		0.40	0.40	
	fC		38.45	7.69	
SVX					
	scale		150.00	150.00	
	counts		65.62	13.12	

Table 1 Normal Running - Setting for 5 MIP threshold.

This first table calculates the conditions for normal running, with 5 MIPS input into the VLPC. If there are 15 pe per MIP then 5 MIPs corresponde to 75 pe, which is about 480 fC. Then at the charge splitter stage the 20% channel passes on 96 fC and the 4% channel 20 fC. In the SIFT chip the discriminator threshold and gain can be set. The HIGH gain SIFT channel sees 96 fC input so the threshold voltage conversion is 25mV/fC and thus the threshold needs to be set at 2.8V and the gain to 1. At this setting a threshold voltage change of 120mV would result in a 5% change in the thresold. This should be a good operation point for setting a tight threshold.

In the HIGH gain SIFT chip the input is only 20 fC so the conversion is 6.5mV/fC, the voltage setting is only 0.65V and the 5% change is 12 mV. This requires tight control on the threshold voltage and requires low noise operation in the SIFT to set a threshold on this channel.

The SVX has 65 counts int he HIGH gain channel and 13 counts in the LOW gain channel. The LOW channel is moved out of the noise, so the overlap of counts begins about here.

VLPC Output

MIP	97	15	pe per MIP
pe	1455	40	K VLPC Gain
fC	9323.6		

Charge Splitter

	Drain	High Gain	Low Gain
%	76%	20%	4%
fC	7086	1864.728	372.9456

SIFT Disc	1	2	25mv/fC >20 fC
gain			6.5mV/fC<20fC
Vth	0.40	0.40	V
5% delta Vth	-	-	mV

SIFT Ouput

Gain	0.40	0.40
fC	745.89	149.18

SVX

scale	150.00	150.00
counts	1,272.99	254.60

Table 2 Normal running - Low Gain channel Saturation.

This table shows where the nominal set up would saturate. When 97 MIPs are input into a VLPC the LOW gain channel has 150 fC into the SVX and its counts will saturate. In measuring a shower a count saturation value of 100 MIPs shold be more than sufficient.

VLPC Output				
	MIP	19	15	pe per MIP
	pe	285	40	K VLPC Gain
	fC	1826.3		
Charge Splitter				
		Drain	High Gain	Low Gain
	%	76%	20%	4%
	fC	1388	365.256	73.0512
SIFT Disc			1	2
	gain			
	Vth		0.40	0.40
	5% delta Vth		-	-
SIFT Ouput				
	Gain		0.40	0.40
	fC		146.10	29.22
SVX				
	scale		150.00	150.00
	counts		249.35	49.87

25mv/fC >20 fC
6.5mV/fC<20fC
V
mV

Table 3 Normal Running - High Gain channel saturation.

At about 20 MIPs the SVX counts for the HIGH gain channel saturates. At this point the LOW gain channel has about 50 counts which is well out of the background. Thus there should be sufficient overlap between HIGH and LOW gain counts.

VLPC Output

MIP	0.067	15	pe per MIP
pe	1.005	40	K VLPC Gain
fC	6.44		

Charge Splitter

	Drain	High Gain	Low Gain
%	76%	20%	4%
fC	4.8944	1.288008	0.2576016

SIFT Disc		1.00	2	25mv/fC >20 fC
gain	1	6.50	6.5	6.5mV/fC<20fC
Vth		0.41	0.40	V
5% delta Vth		0.42	0.17	mV

SIFT Ouput		
Gain	0.40	0.20
fC	0.52	0.05

SVX		
scale	25.00	150.00
counts	5.28	0.09

Table 4 Single p.e. input.

Can one see a single pe with the nominal set up? This table shows the calculated values with a single pe input. The HIGH gain into the SIFT is only 1.3 fC. Right at the noise background. Also the additional width to the pe peaks do to noise will be about 1 fC. Also the input into the SVX is only 1/2 fC, which is well into the SVX noise. One will not see a single pe peak here.

5. Set Up for 3 and 5 MIP Thresholds

VLPC Output				
	MIP	3	15	pe per MIP
	pe	45	40	K VLPC Gain
	fC	288.36		
Charge Splitter				
		Drain	High Gain	Low Gain
	%	60%	30%	10%
	fC	173.02	86.508	28.836
SIFT Disc			1	2 25mv/fC >20 fC
	gain		25.00	25 6.5mV/fC<20fC
	Vth		2.56	1.84 V
	5% delta Vth		108.14	72.09 mV
SIFT Ouput				
	Gain		0.40	0.20
	fC		34.60	5.77
SVX				
	scale		150.00	150.00
	counts		59.06	9.84

Table 5 Setting a 3 and 5 MIP threshold.

If the charge split is changed to 30% and 10% one could set up a 3 and a 5 MIP threshold simultaneously. In this table 3 MIPs are input. The HIGH gain channle has 86 fC into the SIFT chip. There the threshold would be set at about 2.5 V (~4.2 V for a 5 MIP threshold). The LOW gain channel has bout 30 fC and there the threshold would be set at about 1.8 V (~3V for 5 MIP). For both channels operation at this input and threshold values would be good. Also one channel could be set at 3 and the other at 5. Which was used for which is arbitrary.

The SVX counts on the HIGH gain channel is about 60 which allows for a good energy measurement at this low input.

VLPC Output				
	MIP	78	15	pe per MIP
	pe	1170	40	K VLPC Gain
	fC	7497.4		
Charge Splitter				
		Drain	High Gain	Low Gain
	%	60%	30%	10%
	fC	4498.4	2249.208	749.736
SIFT Disc			1	2 25mv/fC >20 fC
	gain		25.00	25 6.5mV/fC<20fC
	Vth		56.63	37.89 V
	5% delta Vth		2,811.51	1,874.34 mV
SIFT Ouput				
	Gain		0.40	0.20
	fC		899.68	149.95
SVX				
	scale		150.00	150.00
	counts		1,535.46	255.91

Table 6 LOW gain channel - count saturation.

We see from this table that the LOW gain SVX channel saturates at just under 80 MIPs. This should be fine for shower measurement. Note that the SIFT gain for this channel is 0.2, the LOW analog SIFT gain.

VLPC Output				
	MIP	13	15	pe per MIP
	pe	195	40	K VLPC Gain
	fC	1249.6		
Charge Splitter				
		Drain	High Gain	Low Gain
	%	60%	30%	10%
	fC	749.74	374.868	124.956
SIFT Disc			1	2 25mv/fC >20 fC
	gain		25.00	25 6.5mV/fC<20fC
	Vth		9.77	6.65 V
	5% delta Vth		468.59	312.39 mV
SIFT Ouput				
	Gain		0.40	0.20
	fC		149.95	24.99
SVX				
	scale		150.00	150.00
	counts		255.91	42.65

Table 7 HIGH gain channel - count saturation.

This table shows that the HIGH gain SVX count saturates at about 13 MIPs. Here the LOW gain channel is above 40 counts so the cross over region should be suficiently large.