**Frontend:**

$U_{outMax}$ = 400 mV (max. swing)

$C_{fbPre}$ = 400 fF

=> Qmax = 160 fC = 83 MIP (max. charge the preamp can integrate)

from Martin van Beuzekom:

to retain linearity for 10 MIP signals, the margin in the preamp for piled-up events is 83-10 = 73 MIP.

...

$$\tau = \frac{-T}{\ln\left(1-\frac{1}{74}\right)}$$

ex.: for a high strip occupancy of 1 MHz: $\tau$ = 73,5 µs

=> the feedback resistor may not be larger than 184 MΩ ($R_{fb} = \tau / C_{fb}$)

**Beetle FE 1.0 / Beetle 1.0 / Beetle 1.1:**

1 MIP signals, occupancy of 2.5% (1 MHz), FE starts to saturate after 270 µs. (3.2 $\tau$ )

max. $\Delta Q/\Delta t$ = 2 nA

**Beetle FE 1.1 (ex. Set 3E)**

15 MIP signals, 25%, no saturation

max. $\Delta Q/\Delta t$ = 288 nA