Preamp specification

70mV/fC to be matched with ±1V differential input range of an FADC

decay time = 600us nominally
CF x (RF1+RF2+RF3) , CF = 0.2pF, RF1-3=1GΩ

75ns rise time C_detector=33pF, with 50Ωcable

The distortion disappeared by disconnecting the terminated cables.
We could greatly reduce this undesired effect by:

(a) using separate filters for the +12V power supply used in the charge sensing stage and that used for the operational amplifiers, and
(b) re-laying out the ground via of C4 in such a way to separate it physically as much as possible from the ground vias used for the opamps power-supply filters

Special care has also been devoted to the connection between the “cold” and “warm” preamplifier boards. As shown in Fig. 3 such connection consists basically of the “drain” and the “feedback” wires plus an implicit ground link. Each of these links was realized with a twisted pair cable. The two wires of the first pair are “drain” and “ground”, the two wires of the second pair are “feedback” and “ground”. The “ground” wires provide an easy path for the high-frequency return currents, which greatly helps stabilize the feedback and reduce the Electro Magnetic Interferences (EMI) [3].

Cold part :
So, we found that the optimal solution consists of laying out a ground plane under all input/feedback devices but the feedback resistors

Noise measurement
Ortec 572 shaping time of 0.5 to 10us
ENC = 110 electrons with a shaping time of 6us
but flat in the 2 to 10us shaping time