MICE TOF and EMCAL front-end electronics

RC shaper design

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• **Purpose:** To be used in the charge measurement scheme for shaping/stretching the PMT pulses prior to discretization by a FLASH ADC.

• **Principle:** Several stages of active RC low-pass filtering of the input signal preserving proportionality between shaped voltage pulse area and input charge.

• **Groups involved in the design and test work:** DPNC-University of Geneva, INFN - Roma III, INFN - Milan, Sofia University.
Characteristics:

- Jumper selectable differential or single-ended input (to be used with EMCAL or TOF photomultipliers respectively).
- On-board termination of the signal cable (twisted pair or coaxial).
- Variants of 2-stage and 4-stage RC low-pass filtering.
- Fixed shaping time constant (in the range 20-60ns, giving ~ 200-500ns effective pulse duration). Changeable by re-soldering a few resistors/capacitors.
- Fixed gain, changeable by re-soldering 1..3 resistors.
- Single-ended output (50 Ohms).
- Baseline offset zeroing (by a multi-turn trimming potentiometer).
- Jumper selectable output polarity.
- Possibility for input signal monitoring.
- 16 channels in a single-width NIM module (surface-mounted design on a 2-layer printed circuit board).
Electrical schematic

Input selection:
Tw. pair 100 Ohms (differential);
Tw. pair 100 Ohms (single ended);
Coax 50 Ohms (single ended);
Simulated RC shaping with differential input signal coming through 20 m twisted pair
Simulated RC shaping with single-ended input signal coming through 20 m twisted pair
PCB layout of a single channel
(top side of the two-layer board)

Estimated total board space needed for 1 module:
19x18cm (max. size 19x22cm)
COST ESTIMATION
for a 16 channel NIM module

For 4-stage RC filtering:

- Electronic components: 225 €
- Mechanical parts, connectors: 140 €
- Board production (2-layer PCB): 55 €
- Work (comp. soldering, mechanical work...): 60 €

Total: 480 €

Cost per 1 channel: approx. 30 €

For a 2-stage variant:

Total: 410 €

Cost per 1 channel: approx. 26 €