THE FRONT-END SYSTEM FOR MARE IN MILANO

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ABSTRACT

The first phase of MARE consists of 72 μ-bolometers composed each of a crystal of AgReO4 readout by a Si:P thermistor. The spread in the thermistor characteristics and bolometer thermal coupling leads to different energy conversion gain and optimum operating point of the detectors. Detector biasing levels and voltage gain are completely remote adjustable by the front end system developed, the subject of this discussion, achieving the same signal range at the input of the DAQ system. The front end consists of a cold buffer stage, a second pseudo differential stage followed by a gain stage, an antialiasing filter and a battery powered detector biasing set up. The DAQ system can set, remotely, all the necessary parameters of the electronics, managed by a μ-controller located on each board. Fiber optics are used for the communication between the DAQ and the front end. The clocked elements of the front end are maintained in sleep mode, to suppress interferences, during normal operation and are waked up only during the setting phase. With our system an automatic DC detector characterization is possible that allows finding the optimum operating point of every detector of the array.

A very low level of noise has been achieved. Its figure is about 1.5 nV/√Hz at 1 Hz and 1 nV/√Hz at high frequencies.
Front-End setup

= EMI Disturbance

= Detector Signal

Other Channels
Noise distribution of 130 sampled JFETs. The optimum is for 1/f noise between 120 and 140 K.
The front-end is fully programmable. A $\mu$-controller based on the ARM family is the manager on every main board. It communicate with the DAQ with an optically coupled serial link: USB $\Rightarrow$ RS232 $\Rightarrow$ I2C.

4 Channels per main board
40 channels Front-End module

Low noise, Ultra-Low drift Voltage Supply

Effect of the presence of the GND-buffer-differentiator

Base-line With GND-buffer

Base-line+Signal no-GND-buffer

40 channels Front-End module

2 Ω 0.75 F

+4 Pream. Noise

Preamplifier + GND-buffer noise

Signals from 4 channels
Detector biasing is settable in amplitude. It is input from our ultra-stable and low noise power supply powered by batteries.

A short pulse can be given, selected in amplitude, to any detector channel.

A pulse-biasing module manages 20 channels.
Antialiasing filter

The filter is based on a programmable in frequency 6 poles Bessel or Thomson active low pass architecture.

3 channels are laid-out on a single module.

48 channels are in a single rack.
Conclusions

The front-end is ready.

Bolometers are going to start their job.

Signals are waited from its back.