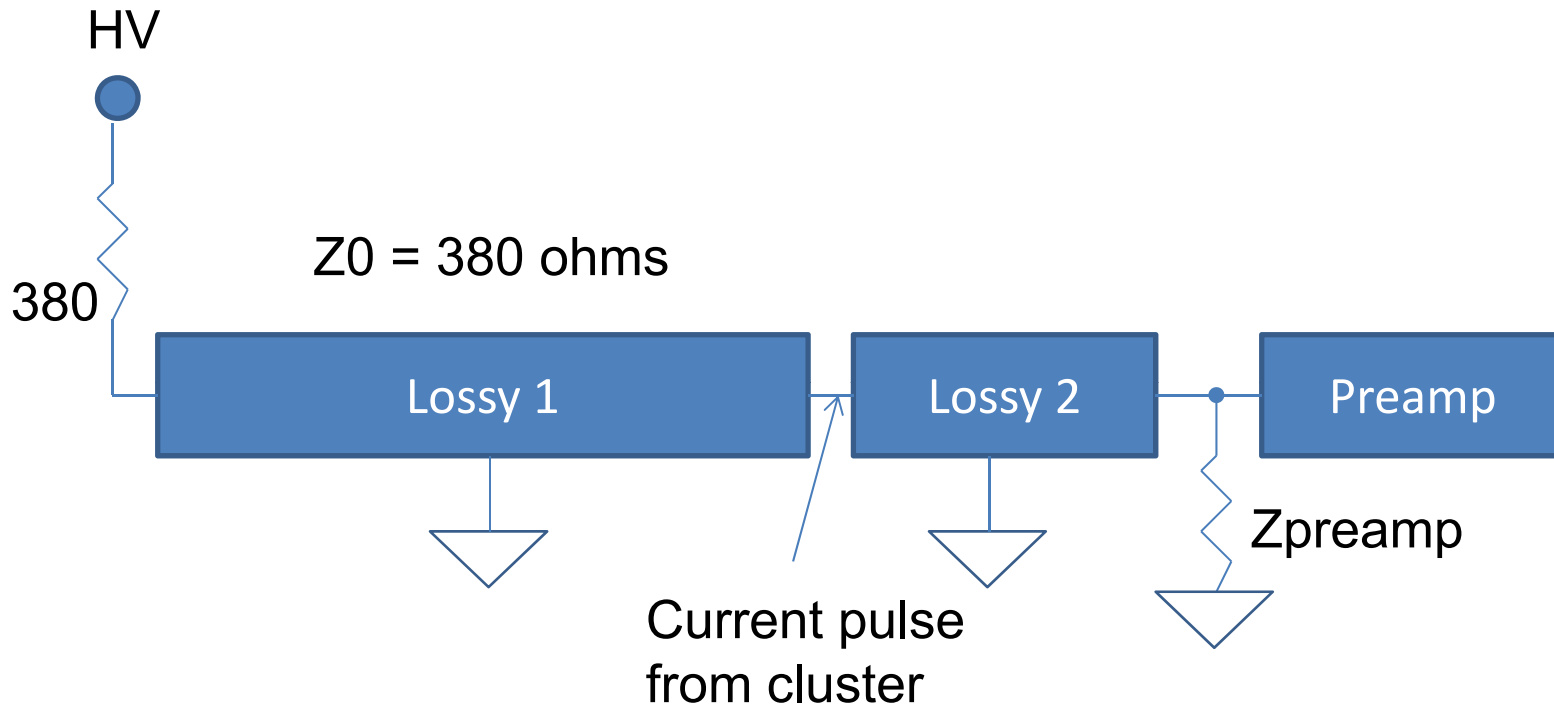


# DCH preamplifier developments In Montreal

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## DCH cell simplified electrical model



Example: 50,000 electrons in 1 nanosecond =  $8 \mu\text{A}$   
=> 1.52 millivolts in  $380/2$  ohms

## Optimizing with different values of Zpreamp

Input signal  $\approx Z_{\text{preamp}} / (Z_{\text{preamp}} + 380)$

Input noise  $\approx (Z_{\text{preamp}})^{(1/2)}$

Input Impedance	Relative signal	Relative input noise	S/N	Comments
50	0.116	1	0.116	Best bandwidth
180	0.321	1.66	0.193	Could match PCB traces
380	0.5	2.75	0.181	Matches DCH cell

## The 50 ohms preamplifier prototype:

Uses two very small size commercial RF gain blocks  
( Analog Devices AD8354)

Nominal Gain : 20 dB (each gain block)

Bandwidth : 1 MHz to 2.7 GHz

Noise figure : 4.2 dB

Operating voltage: 3 to 5 Volts

Measured output RMS noise of the preamplifier: 2.08 millivolts RMS

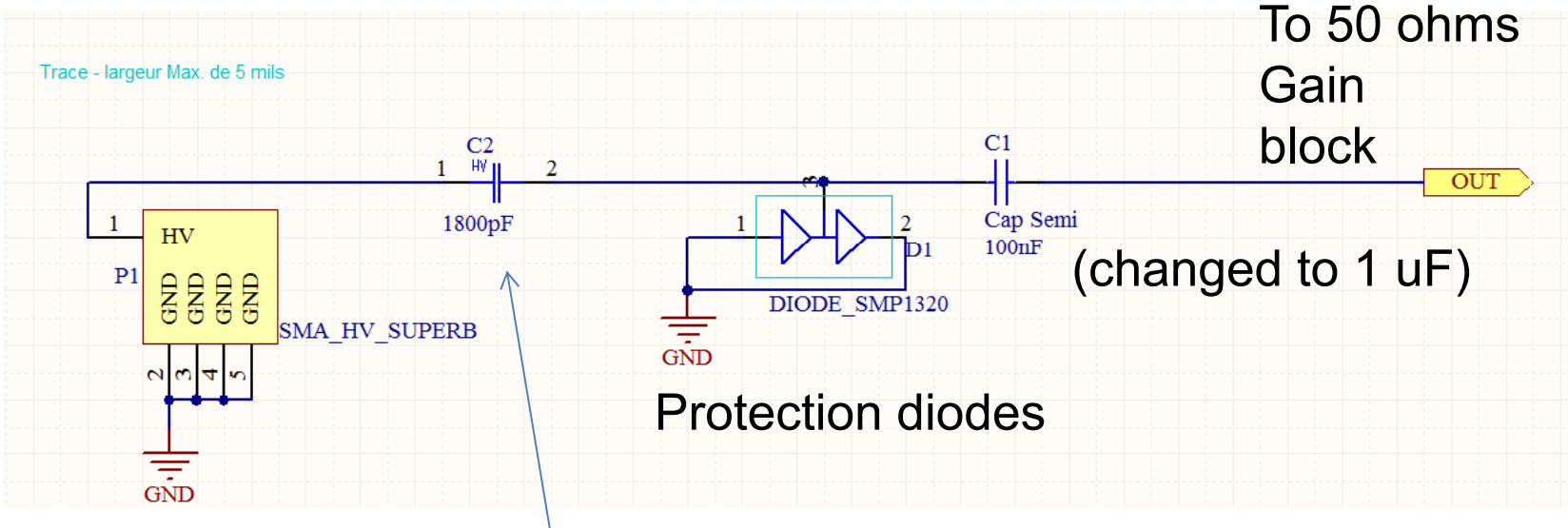
Measured overall gain with a 50 ohms source : 65

Theoretical thermal noise at 1 GHz bandwidth

with noiseless amplifier : 1.84 millivolts RMS

# The 50 ohms preamplifier prototype:

## Input circuitry



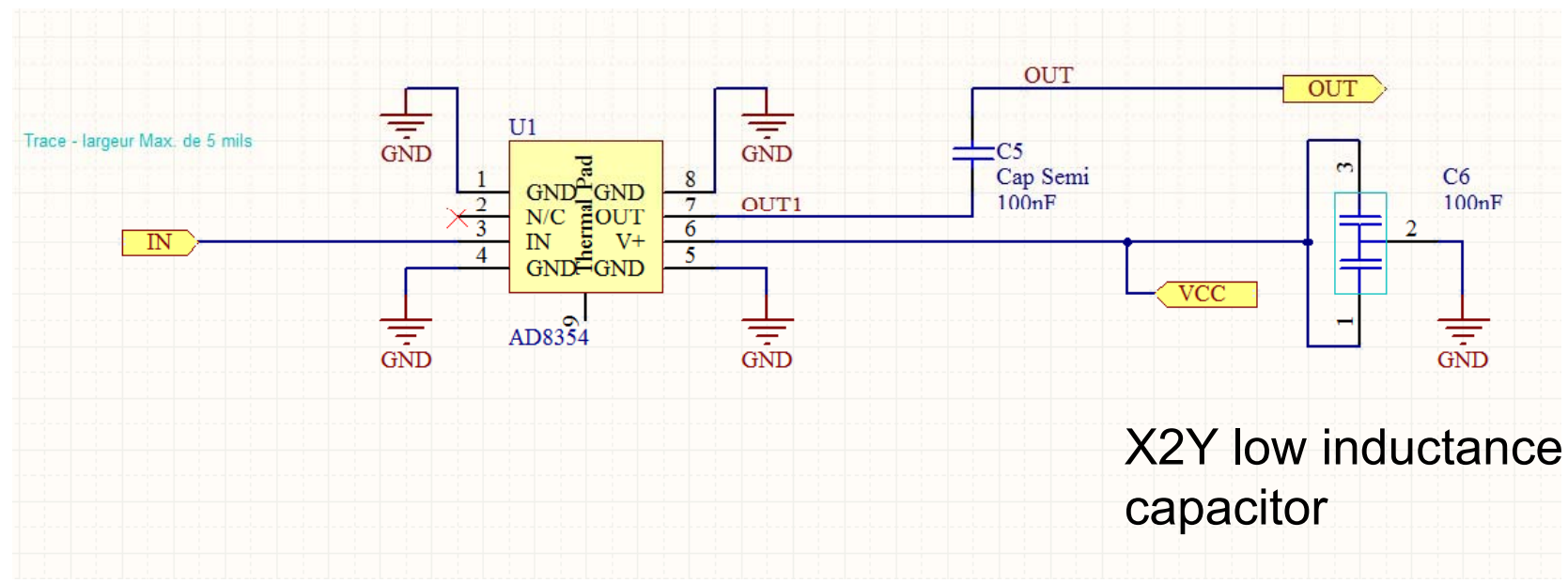
HV blocking capacitor

Note:  $RC = 90 \text{ nsec}$

Note: parallel input capacitance: 2 pf.

# The 50 ohms preamplifier prototype:

## Gain block



## The 180/380 ohms preamplifier front end prototypes:

Prototype has two separate PCBs:

- one 50 ohms amplifier

- one front end buffer card with a

  - BFG425W transistor in voltage follower configuration:

    - Transition frequency : 25 GHz

    - Feedback capacitance : 95 fF

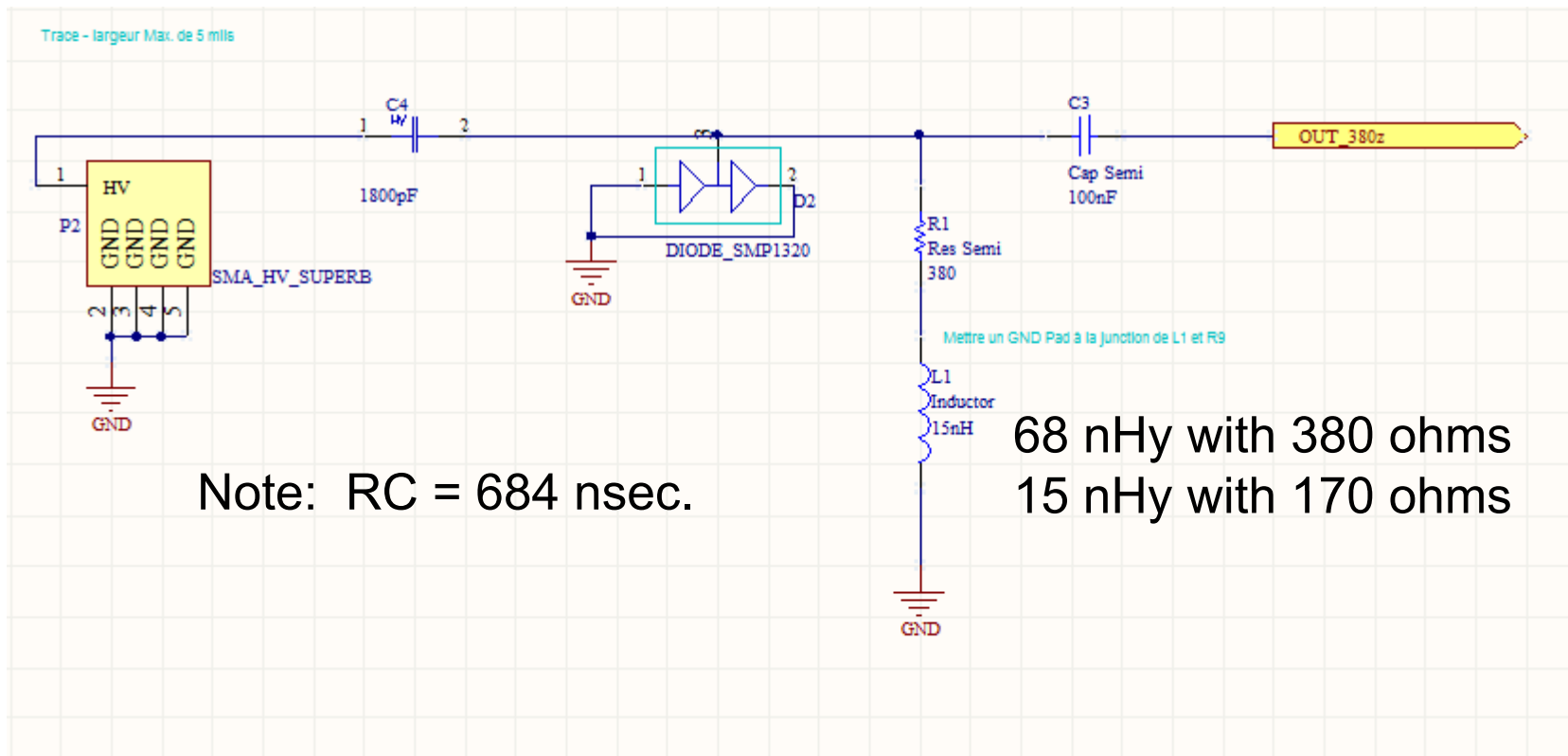
    - DC current gain ( $\beta$ ) : 80

Measured output RMS noise of the preamplifier combo:

3.3 millivolts RMS (with  $Z_{in} = 380$  ohms)

# The 180/380 ohms front end prototypes:

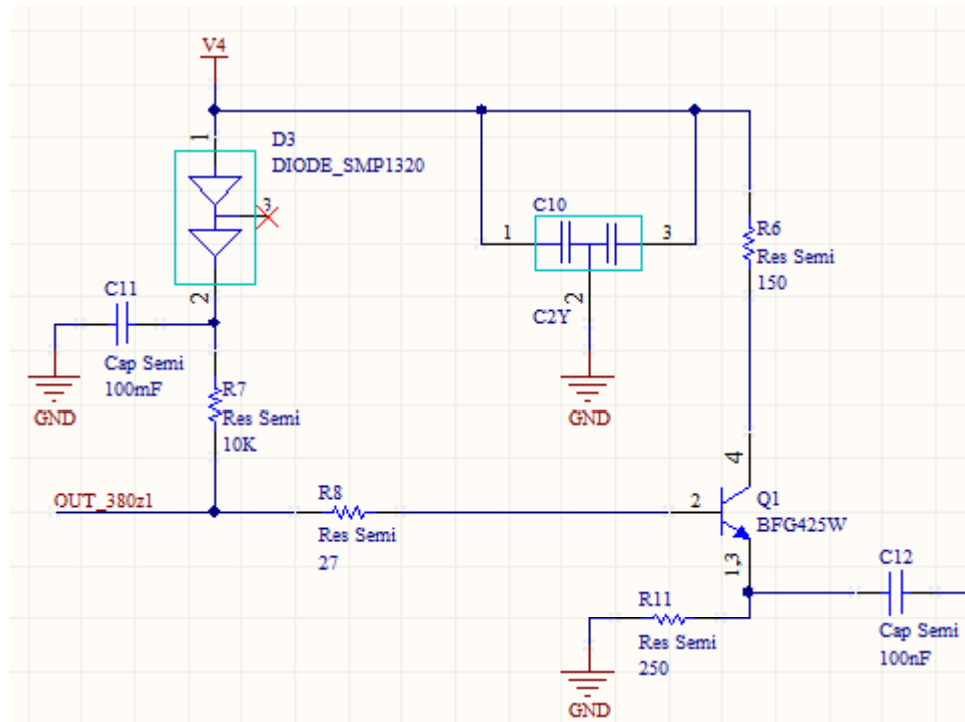
## Front end circuitry





# The 180/380 ohms Front end prototype:

## Voltage follower



50 ohms cable

## The 180/380 ohms integrated preamplifiers:

Prototype has a single PCBs:

- two 50 ohms gain block chips

- one front end

  - BFG425W transistor either

    - in unity gain voltage follower configuration

    - or in Gain = 2 inverting amplifier

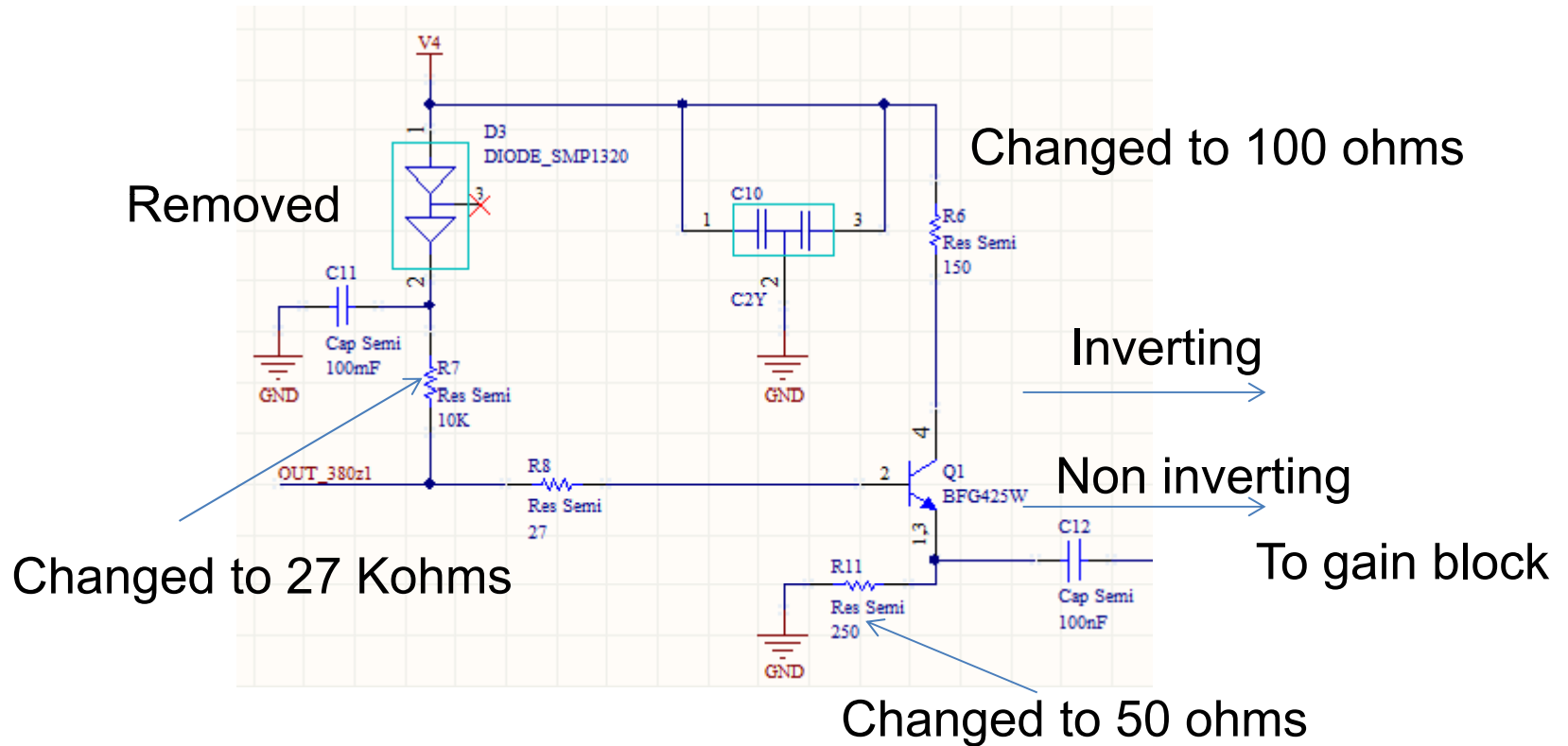
Measured noise (at TRIUMF):

  - Follower : 1.9 millivolts RMS

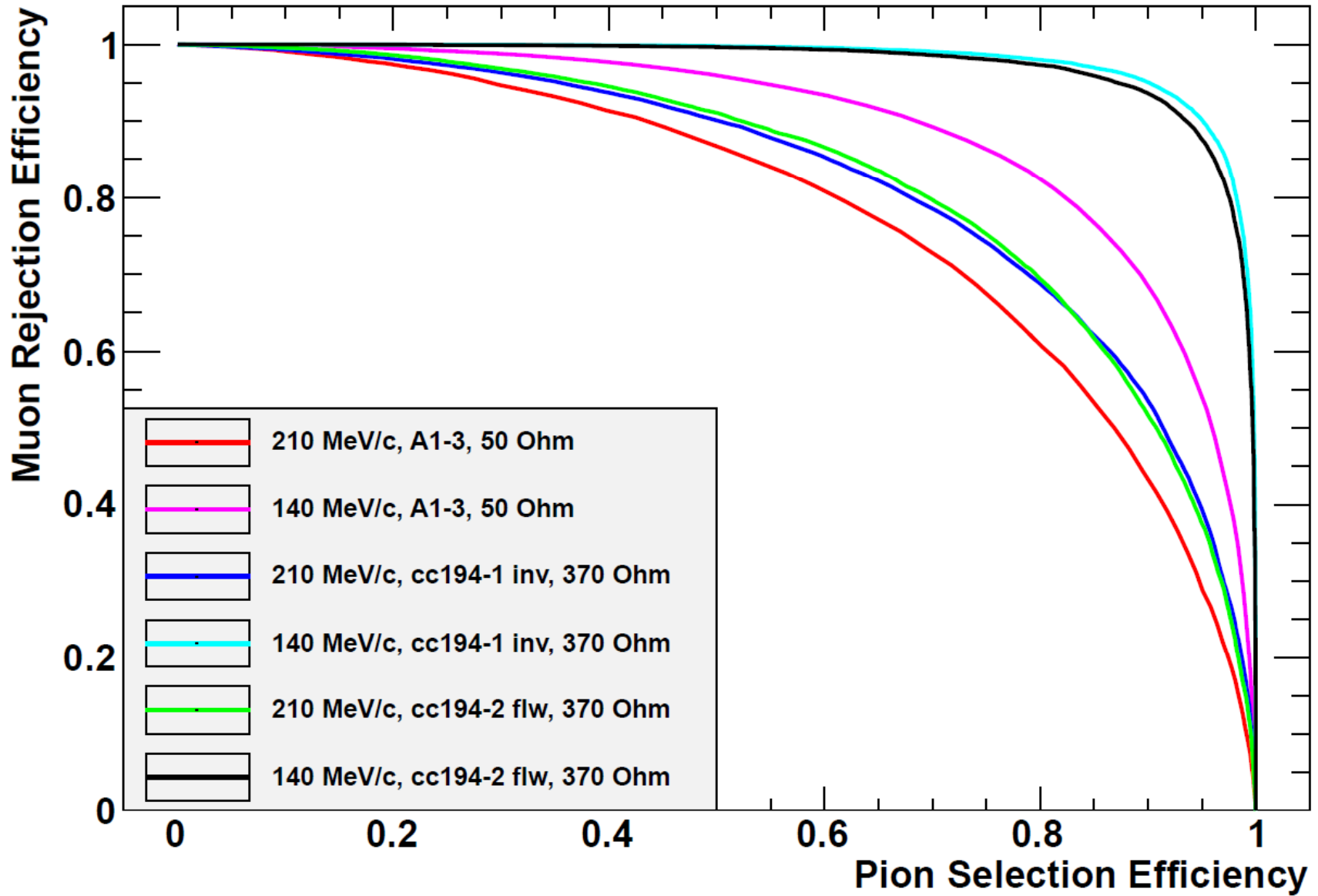
  - Inverting : 2.4 millivolts RMS

# The 180/380 ohms integrated Front end:

## Voltage follower



# Beam data analysis by J.F.



To be developed:

Multi channel preamplifiers