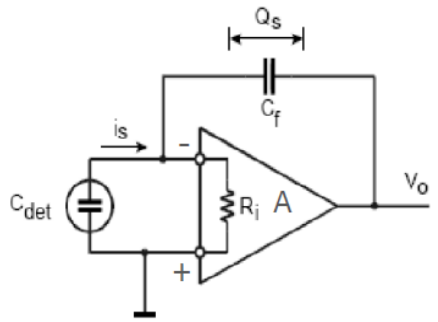
RD_FCC

2° Meeting

18/03/2021

1st requirement: max parasitic capacitance

PREAMPLIFICATORE DI CARICA – CARICA RACCOLTA



ATTENZIONE: il guadagno A è stato determinato interpolando un grafico potrebbe essere inferiore

- Guadagno inferiore = perdite maggiori

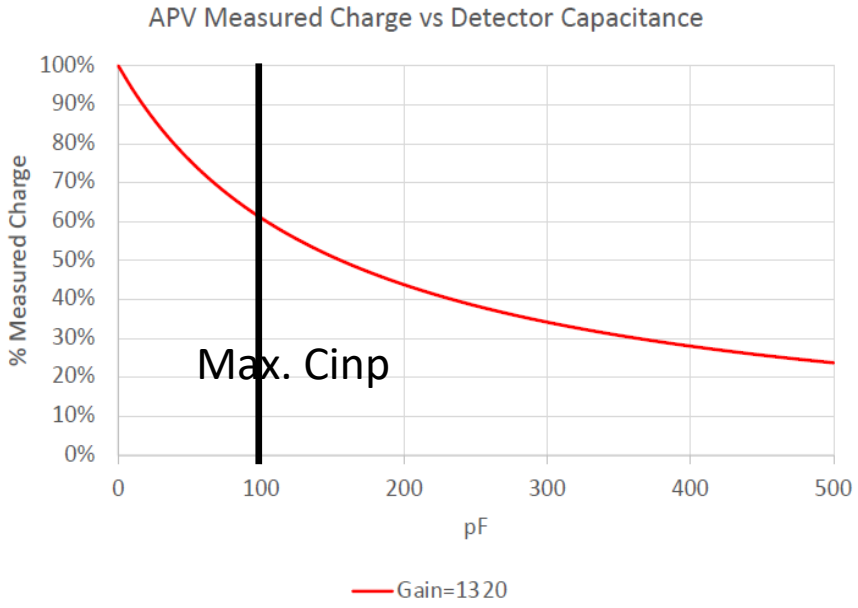
APV:

- $A \approx 1038$
- Cf=0.15pF

} Cin=198-99 pF

By G. Felici

carica misurata / carica totale $\frac{Q_i}{Q_S} \approx \frac{1}{1+\frac{C_{det}}{A \cdot C_f}}$

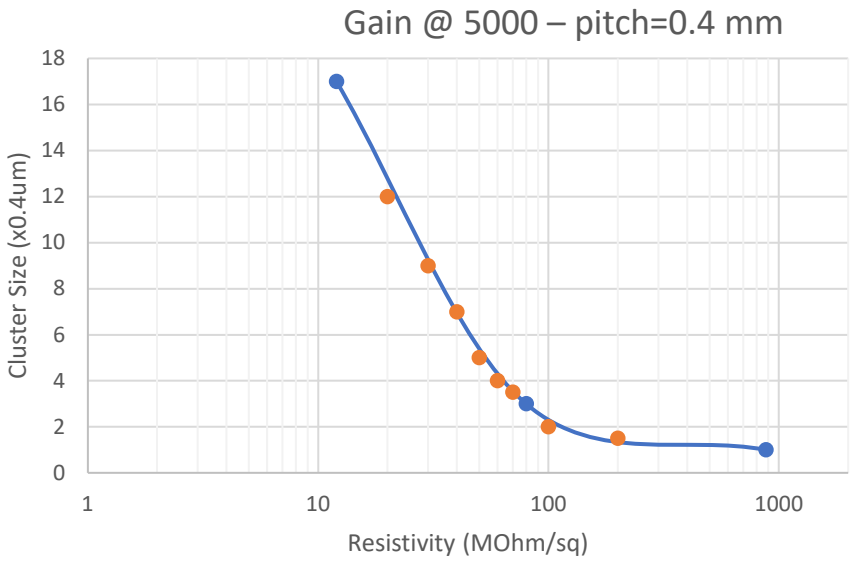


The Maximum capacitance < 100 pF → decrease strip width (already discussed with Rui)

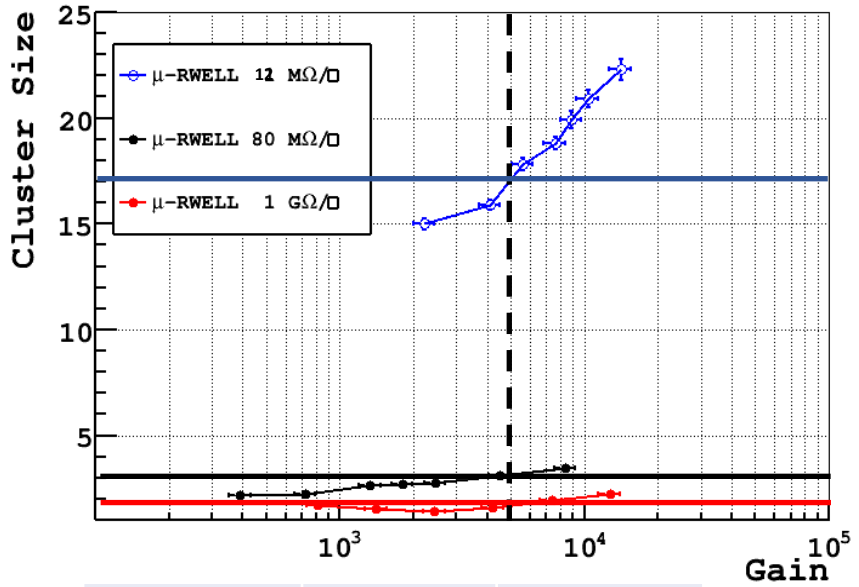
2nd requirement: resistivity value

Taking into account the measured CL vs Res beahvour, we evaluted the CL @ G=5000 (blue curve) for different resistivity values (orange dots) and different strip pitch

NOTE: CL correleted with CC method for space resolution measurement



Ar/ISO=90/10 & strip pitch = 0.4 mm



	400 um	800 um
Res [MOhm/sq]	CL	CL
10	17	8.5
20	12	6
30	9	4.5
40	7	3.5
50	5	2.5
60	4	2
70	3.5	1.75
100	2	1
200	1.5	0.75

3rd requirement: resistivity & pitch

- Protos active area: 5 x 40 cm2
- Pre-shower: strip pitch=0.4 mm & strip width=0.15 mm:
  resistivity: 10, 30, 50, 70, >100-200 MOhm/sq.
  n. 5 protos (spare x2)
- Muon: pitch=0.8 /1.2/1.6 mm & width=0.15 mm
  resistivity=30/20/10 MOhm/sq
  n. 3 protos (spare x2)

	0.4	0.8	1.2	1.6
Res	CL	CL	CL	CL
10	17	8.5	5.7	4.3
20	12	6	4.0	3.0
30	9	4.5	3.0	2.3
40	7	3.5	2.3	1.8
50	5	2.5	1.7	1.3
60	4	2	1.3	1.0
70	3.5	1.75	1.2	0.9
100	2	1	0.7	0.5
200	1.5	0.75	0.5	0.4

Drift gap:
10 mm higher primary ionizzation → higher S/N

TB proposal: 2 possible choice (based on protos active area 5x40 cm2)

SETUP with protos B2B in enemy:

- N.2 Trackers (X,Y) for data cleaning → 4APVx2= 8 APV
- N. 5 protos with different resistivity x 2 =10 protos→ 10 APV
- N.3 protos with different pitch x 2 = 6 protos → 6 APV

TOT= 24 APV

- PRO:

  better control of systematics

- CONTRO:

  large number of DLC foils

  detector cost (16 protos + spare)

  time for the TB: 1 week for the first 8 protos and 1 weeks for the 8 protos

  in case of a proto(s) production failure → the enemy method doesn't work

SETUP with protos NO enemy:

- N.2 Trackers (X,Y) for data cleaning & tracking → 4APVx2= 8 APV
- N. 5 protos with different resistivity = 5 protos with strip pitch=0,4 mm → 5 APV
- N.3 protos with different pitch = 3 proto → 3 APV

TOT= 16 APV

- PRO:

  time for the TB: two weeks for all the protos → only one setup

  contribution from external tracker directly measured adding 2 RWELL trackers (only in X) in special runs.

- CONTRO:

  ????

Summary

1) To maximise the S/N → strip width= 0.15 mm
2) Pre-shower → spatial resolution vs resistivity value (pitch=0.4 mm)
3) Muon → pitch strip studies
4) Setup optimization for TB → No-enemy + 2 Trackers (X,Y) + 2 trackers (only X)
5) No IB for 2 or more strips OR-ed
6) Detector production → ELTOS+CERN (in agreement with Rui)

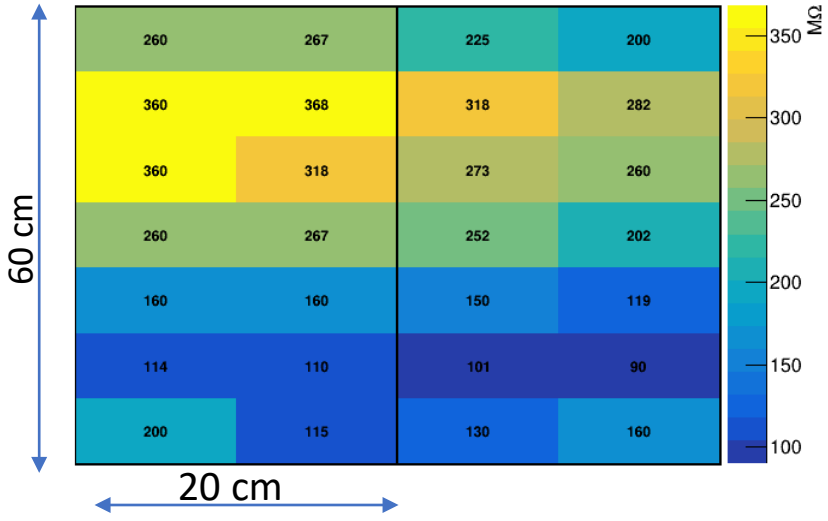
Task

1) Detector design → LNF next week
2) Detector production → LNF
3) Mechanics for the TB → Fe, Bo
4) APV electronics → P. Giacomelli

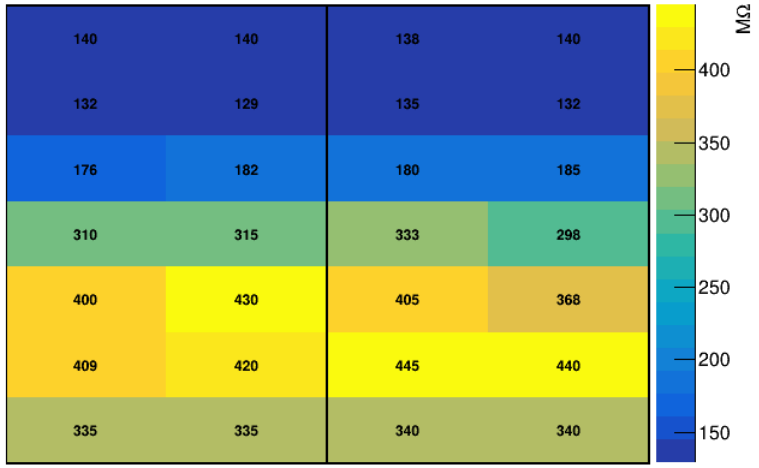
backup

DLC foils @ LNF

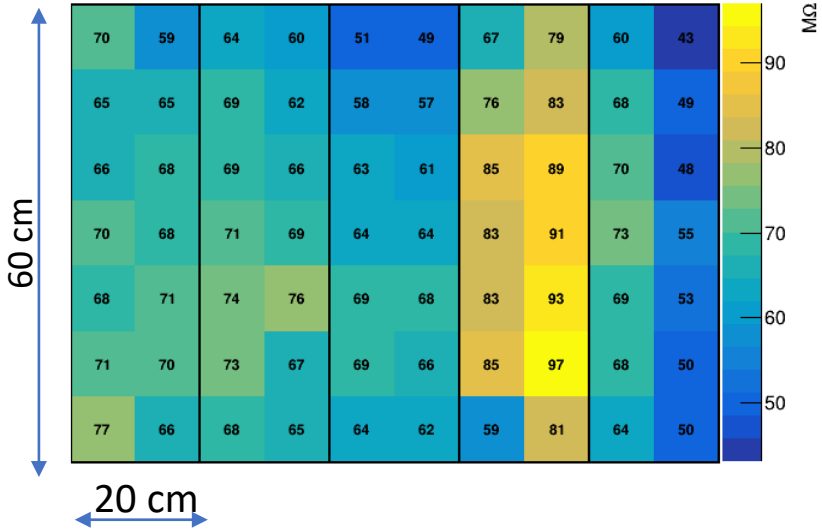
Foglio 1 (vecchio)



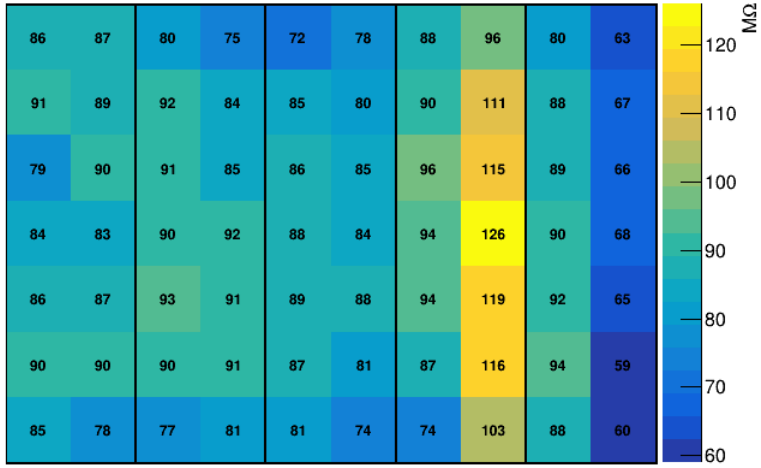
Foglio 2 (vecchio)



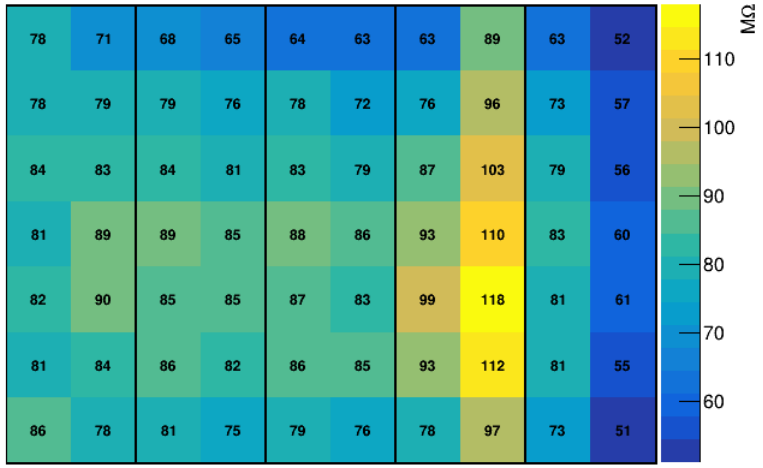
Foglio 3



Foglio 4



Foglio 5

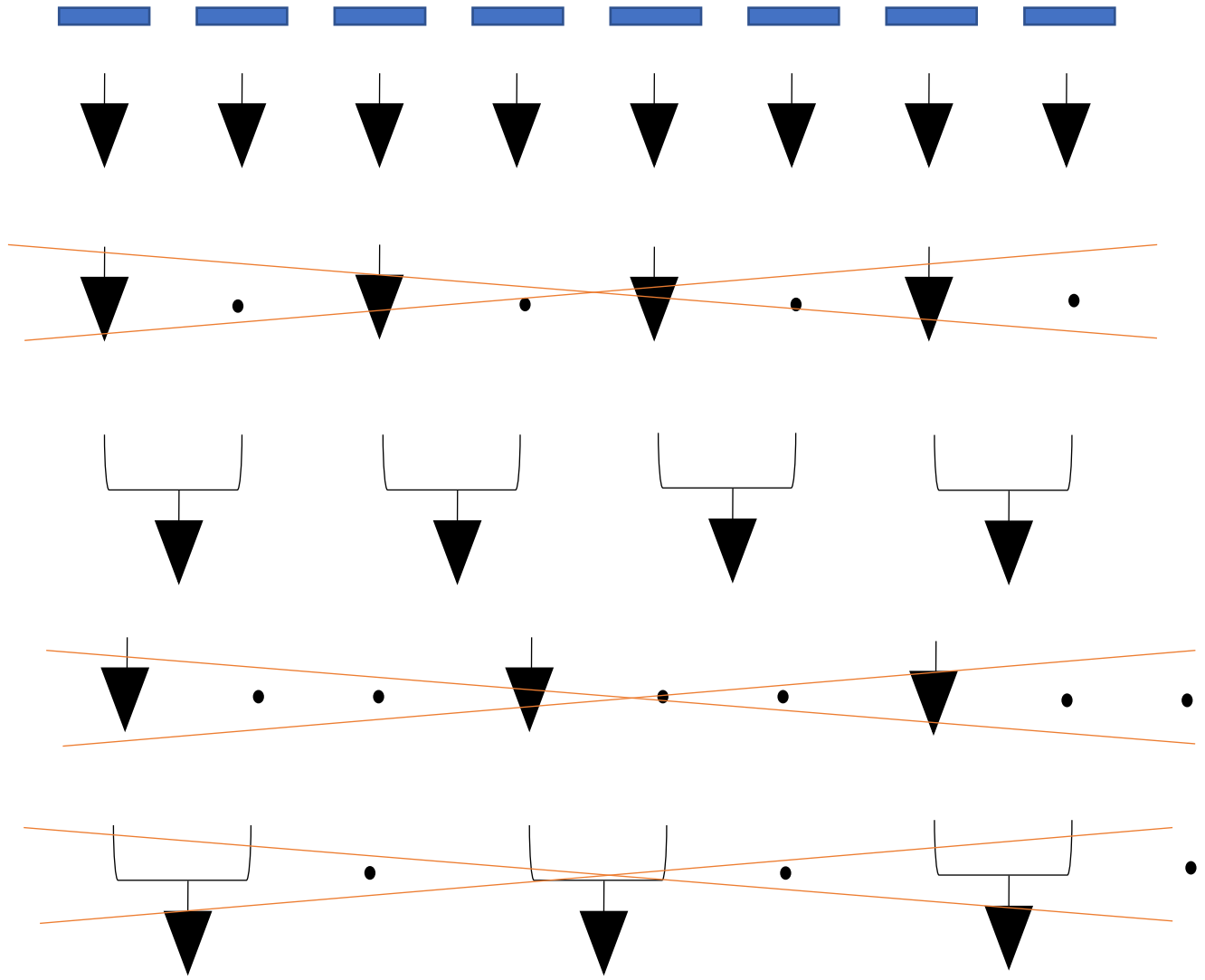


Intermediate Board (I)

	0.4/0.15			0.8-1.2-1.6/0.15		
	pitch (mm)	width (mm)	Cinp (pF)	pitch	width	Cinp
All APV	0.4	0.15	21.6	0.8	0.15	21.6
1 strip APV/1 strip float	0.8	0.15	21.6	1.2	0.15	21.6
2 strips OR	0.8	0.30	43.2	1.6	0.15	21.6
1 strip APV/2 strips float	1.2	0.45	64.8			
2 strips OR APV/1 strip float	1.2	0.3	43.2			
3 strip OR	1.2	0.45	64.8			
1 strips APV/3 strip float	1.6	0.15	21.6			
2 strips OR APV/2 strip float	1.6	0.3	43.2			
3 strips OR APV/1 strip float	1.6	0.45	64.8			
4 strips OR	1.6	0.6	86.4			

Intermediate Board (II)

pitch=0.4 width=0.15



NOTE:

All strips connected to APV
p=0.4 & w=0.15

Even strips connected to APV
Odd strips floating
p=0.8 & w=0.15

2 strips in OR connected to APV
p=0.8 & w=0.3

1 strip connected to APV
2 strips floating
p=1.2 & w=0.15

2 strips OR connected to APV
1 strip floating
p=1.2 & w=0.3

APV, Noise & Signal

Noise with 25 ns sample =(396 + 60 * Cinp) e- rms

→ Cinp= 50 pF Noise= 3636 e- <-> 0.6 fC

→ Cinp= 100 pF Noise= 7272 e- <-> 1.2 fC

→ Cinp= 150 pF Noise= 10908 e- <-> 1.8 fC

Charge realesed by a 150 GeV/c muon (10 mm drift gap, Ar/CO2/CF4):

130 e- primary ionization * 5000 = 650 000 e- <-> 104 fC

Considering 4 strips (not equaly shared) → 26 fC/strip