

Wireplane Bias Voltage Test

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1 Introduction

This is a quick summary of the two wireplane bias voltage tests performed on January 13th, 2016 and January 20th, 2016 as part of the LArIAT Run II commissioning. In both tests, the collection wireplane showed no response to the applied voltage. A previous test, carried out by Jonathan and Bill in the week January 4th - January 8th applying an AC voltage to the wireplanes, is not considered here, being mainly a test of the bias filter box present in the system.

In Section 2, the test procedure adopted at Lab6 during the Run 1 commissioning is reported, as an indication of which kind of response has to be expected by the wireplanes in absence of problems. Section 3 and Section 4 illustrates the new tests of January 13th and 20th, respectively.

2 Bias Voltage Test for Run 1 commissioning

The test, carried on by Jonathan, Flor and Roberto, was performed applying a DC voltage to either the collection or induction bias voltage feedthrough. The output voltage was checked by a voltmeter probing the tension between a wire of the wireplane and the cryostat. When powering a specific plane (induction or collection), the voltage on the other plane was not checked. The shield plane was not checked. For each plane, the measurement was performed for applied voltages between 40 V and 100 V, at 10 V steps. Each set of measurements was repeated twice, first using a Droge power supply, then using an ACNET controlled power supply. Results are reported in Table 1 and 2 for Droge and ACNET power supplies, respectively.

Outcome of the test can be summarized as:

- collection and induction plane have similar output voltage for the same applied voltage;
- there is a linear dependence between applied and output voltage;
- output voltage is independent of the power supply.

Applied Voltage (V)	Collection Plane (V)	Induction Plane (V)
40	11.9	11.5
50	14.8	14.80
60	17.5	17.6
70	20.1	20.2
80	23.3	24.3
90	26.4	26.3
100	29.5	29.3

Table 1: Bias voltage test performed during Run I commissioning with a Droge power supply.

Applied Voltage (V)	Collection Plane (V)	Induction Plane (V)
40	11.9	11.5
50	14.8	14.8
60	17.5	17.6
70	20.7	20.5
80	23.3	24.3
90	26.2	26.3
100	29.2	29.1

Table 2: Bias voltage test performed during Run I commissioning with an AC-NET power supply.

3 01/13/2016 First Bias Voltage Test of Run II commissioning

As in the previous test, voltage was applied to each single wireplane and read out by a voltmeter probing between wires and cryostat. Differences respects to the previous test are:

- when applying voltage to a specific wireplane, all the wireplanes were checked. For instance, when powering the collection plane, shield and induction plane were checked as well, to make sure no voltage was seen on them;
- only one power supply has been used and only one DC voltage, 10 V, has been applied to each plane;
- shield plane has been tested too;
- test has been performed both including and excluding the bias filter box from the system.

Results of the test are shown on Table 3 and Table 4 for measurements performed bypassing and including the bias filter in the system, respectively. In both cases, no response has been seen from the collection plane, regardless of which plane was powered. For shield and induction plane, a non-zero tension

Bias Filter Bypassed	Collection Plane Powered (10V Applied Tension)	Induction Plane Powered (10V Applied Tension)	Shield Plane Powered (10V Applied Tension)
Collection Plane Measured Tension (V)	0.5	0.4	0.4
Induction Plane Measured Tension (V)	1.6	3.4	1.2
Shield Plane Measured Tension (V)	2.2	1.4	8.2

Table 3: Results of the bias voltage test performed with a single DC tension applied, 10 V, and bias filter excluded from the system. Each column reports the tension measured at the various wireplanes when powering a specific plane.

Bias Filter Included	Collection Plane Powered (10V Applied Tension)	Induction Plane Powered (10V Applied Tension)	Shield Plane Powered (10V Applied Tension)
Collection Plane Measured Tension (V)	0.5	0.3	0.5
Induction Plane Measured Tension (V)	2.5	3.3	2.8
Shield Plane Measured Tension (V)	3.5	6.6	8.4

Table 4: Results of the bias voltage test performed with a single DC tension applied, 10 V, and bias filter included in the system. Each column reports the tension measured at the various wireplanes when powering a specific plane.

has been observed on the wires when powering the plane. A lower tension has been also observed on these planes when powering a different plane.

A new test has been performed a week later, varying the applied DC voltage to look for changes in the read-out tension of each plane. Results of this test are shown in the next Section.

4 01/20/2016 Second Bias Voltage Test of Run II commissioning

Differences respects to the previous test are:

- each plane has been tested twice, injecting a 10 V and 20 V DC tension;
- tests have only been performed excluding the bias filter from the system, as during Run I commissioning tests.

Results are shown on Table 5, Table 6, and Table 7 for collection, induction and shield plane, respectively.

	Collection Plane Powered 10V Applied Tension	Collection Plane Powered 20V Applied Tension
Collection Plane Measured Tension (V)	0.3	0.5
Induction Plane Measured Tension (V)	0.4	0.4
Shield Plane Measured Tension (V)	0.1	0.1

Table 5: Results of the bias voltage test performed on the collection plane for two applied DC voltages, 10 V and 20 V.

	Induction Plane Powered 10V Applied Tension	Induction Plane Powered 20V Applied Tension
Collection Plane Measured Tension (V)	~ 0	~ 0
Induction Plane Measured Tension (V)	3.4	6.4
Shield Plane Measured Tension (V)	~ 0	~ 0

Table 6: Results of the bias voltage test performed on the induction plane for two applied DC voltages, 10 V and 20 V.

For induction and shield plane, doubling the applied voltage doubles the read-out tension on the plane, while the tension on the other two planes stays the same. In addition, the read-out tension at 10 V applied voltage is compatible with what measured during the test of the previous week. This is a hint we can reliably set a bias voltage for these two planes. On the other side, the collection plane seems to not respond to any applied voltage (or have a very little response).

By means of a mirror on a stick, it has been possible to give a look at the signal cable connected to the bias voltage card of the collection plane, placed on the back of the TPC respect to the front flange. Figure 1 shows the image reflected by the mirror. The cable seems to be strongly pulled on a side and not strain-relieved. It is possible than that the cable is damaged or its connector not completely plugged into the card. The extraction of the TPC for a close inspection of cable and bias card seems at this point necessary.

	Shield Plane Powered 10V Applied Tension	Shield Plane Powered 20V Applied Tension
Collection Plane Measured Tension (V)	1.0	1.0
Induction Plane Measured Tension (V)	0.7	0.7
Shield Plane Measured Tension (V)	8.3	16

Table 7: Results of the bias voltage test performed on the shield plane for two applied DC voltages, 10 V and 20 V.

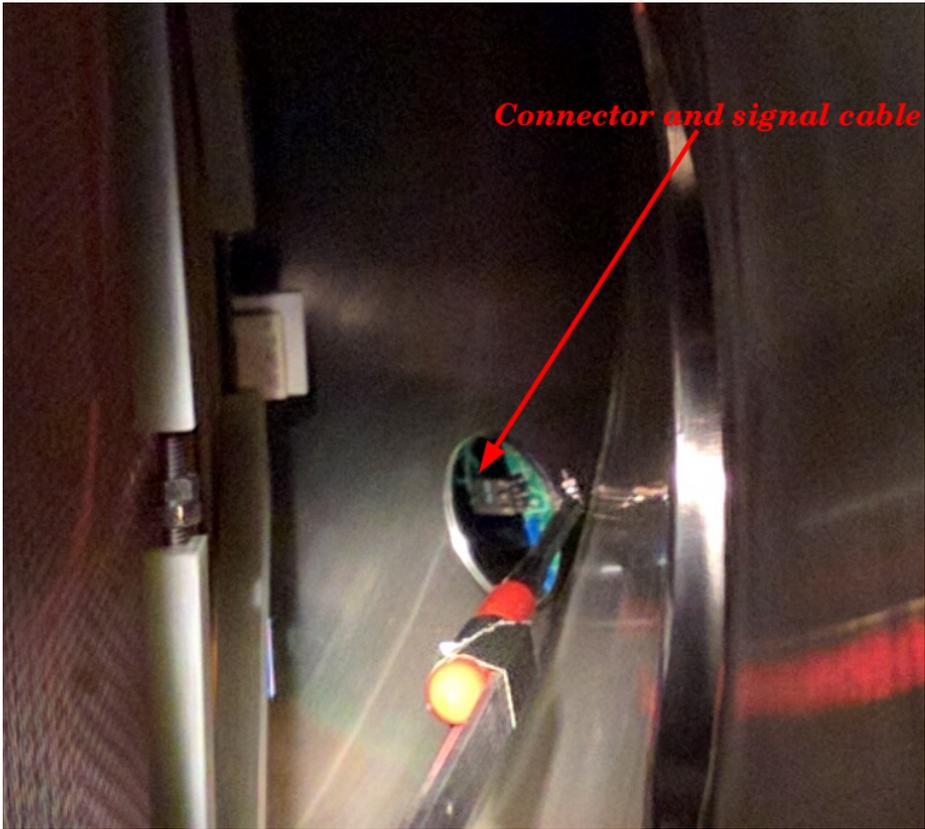


Figure 1: Picture of the mirror reflecting the collection bias voltage card with its connected cable.