FILG 24

SPIRE-RAL-NOT-001806

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The Stray Light Test in the RAL Cryostat

Introduction:

The following are the results of the stray light tests conducted in the LWS cryostat at RAL on the 23rd and 24th of January 1990. The following equipment was used:

1) Ge:Ga unstressed detector JLU1

2) Integrating amplifier JF4 #226

3) An IRL RS1 reset control box supplied by QMC

4) An RS1 interface box supplied by RAL

5) A digital storage oscilloscope (Nicolet D.S)

The integrating current was determied for various bias voltages (60mV to 300mV)

The detector:

The detector (JLU1) was set up as follows:

1) 1mm aperture attached with GE varnish directly over the detector cavity.

2) 50um edge filter attached with GE varnish directly over the detector aperture.

3) Bandpass filter (100 - 183um #S1206RC) attached directly over the detector aperture.

4) JF4 #226 integrating amplifier in detector block.

5) Black compound (shredded black rubber in GE varnish) on the pins of the detector and over all of the inside surface of the detector block.

Equipment Configuration:

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                               Comp |---------------|  trigger
-------- Res -------------          |   ---------   |  Chan1 -----------
| IA    |------|     RS1      |---------| RS1    |    |--------| Storage |
|       |------|              |         |        |             |         |
|       | Comp |              |         |        |             |         |
| (JF4) |------| Interface    |---------| G=100  |-------------| 'scope  |
-------- o/p -------------      o/p     ---------    o/p Chan2 -----------
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The reset and compensating pulses from the reset control box were sent, via RS1 interface, to the JF4. The compensating pulse was also connected to channel 1 of the storage oscilloscope to provide a trigger as well as to allow measurement of the compensating pulse.

The output from the JF4 was connected, via the RS1 interface, to the *100 pre-amplifier in the RS1 box. The output of this amplifier was connected to channel 2 of the storage oscilloscope.

Functional Test:

Before the cooldown and at certain stages in the cooldown, a functional test of the JF4 was performed to verify lead continuity and JF4 integrity. The functional test consisted of 3 seperate tests:

1) The output of the JF4 was measured with a DVM. At zero bias an output of about -2mV was seen. The bias voltage was increased (to (.4V) and it was verified that the output of the JF4 increased with increasing bias voltage. This test cannot be performed at liquid helium temperatures.

2) The heater current was set equal to 160uA. That the heater current could be set verifies continuity of the heater circuit.

3) The integrating current from the JF4 (the current drawn from -Vss was measured and checked against the expected value for the given temperature.

This functional test was performed at 300K before and after pumping the insulation vacuum. The integrating current was 22.5uA which is nominal for the JF4. The test was repeated during the cooldown at 150K, 119K and 4.2K with nominal results.

At 4.2K the interating current was measured as 10.3uA and the heater current as 161uA.

Detector Response at 1.5 - 1.6K:

The temperature of the detector block was reduced to between 1.5K and 1.6K by pumping over the liquid helium in the cold pot to which it was attached.

The following proceedure was used to determine the detector current at various bias voltages:

1) The bias voltage was set using the potentiometer on the RS1 interface and monitoring the voltage with a DVM. After setting the bias voltage the detector and JF4 were allowed a few minutes to settle.

2) Several resets were applied to the detector (using the manual reset switch) and the resulting trace examined to check that a section of the trace following the reset was sufficiently straight to allow measurement of its slope. If this was not so, a lower bias voltage would be selected.

3) While applying resets as above, the potentiometer on the RS1 was used to adjust the amplitude of the compensating pulse so as to remove the "step" that otherwise follows the reset. The amplitude of the compensating pulse was then measured using the storage oscilloscope.

4) Using a long time base if necessary, more resets were applied. The slope of the signal following the reset (dV/dt) is measured using the digital storage oscilloscope. The time interval for this measurment was chosen so that the voltage measured was never more than 5% of the bias voltage. Note that readings from the digital storage oscilloscope must be divided by 100 to give the output of the JF4.

5) Step 4 was repeated several times to obtain an average value for dV/dt. The detector current (Id) was then calulated from this average using:

   $Id(e/s) = (dV/dt)*C/G*e$ where

C	is the integrating capacitor for the JF4	= 7.5pF
G	is the gain of the JF4	= 0.9
e	is the electron charge	= 1.6 E-19 C

Results:

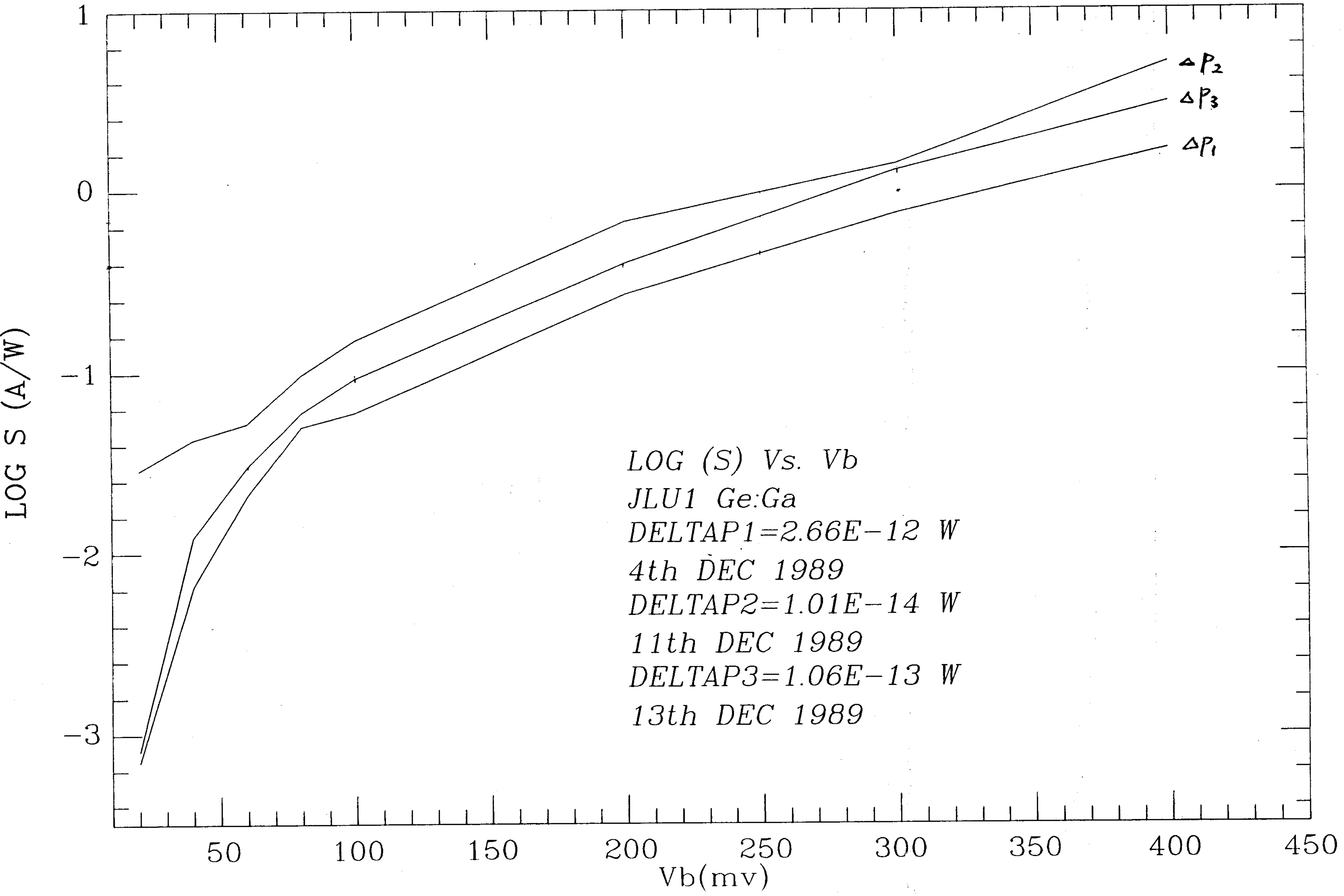
The following table shows the results for the bias voltages used.

- Bias is the measured bias voltage
- Id is the calculated detector current
- S is the detector responsivity obtained by QMC 13th Dec. 1989
- Pdet is the calculated power input to the detector

Bias (mV)	Delta t	Delta V	Id (e/s)	S(A/W)	Pdet(W)
60	1s	2.65mV	1.38 E5	3.02 E-2	7.31 E-13
100	1s	6.45mV	3.36 E5	9.31 E-2	5.77 E-13
200	200ms	5.10mV	1.33 E6	4.02 E-1	5.29 E-13
250	100ms	5.24mV	2.73 E6	6.60 E-1	6.62 E-13
300	100ms	8.49mV	4.42 E6	1.27 E 0	5.57 E-13

Conclusion:

The radiation input to the detector was of the order of 5 E-13 W (.5pW). This represents ~ a 500 fold reduction on the background observed during the test on the 23rd of November 1989


LOG (S) Vs. Vb
JLU1 Ge:Ga
DELTAP1=2.66E−12 W
4th DEC 1989
DELTAP2=1.01E−14 W
11th DEC 1989
DELTAP3=1.06E−13 W
13th DEC 1989
ΔP2
ΔP3
ΔP1
LOG S (A/W)
Vb(mv)
1
0
−1
−2
−3
50
100
150
200
250
300
350
400
450