ELOG
ARIANNA

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Overview

We performed two different cold Pulser tests in Aldrich park. In both of the tests ran, the temperature of the Pulser's outer surface was monitored. The thermometer used was a DS18B20 Digital Thermometer that has a temperature range of -55°C to 125°C (data sheet attached separately).

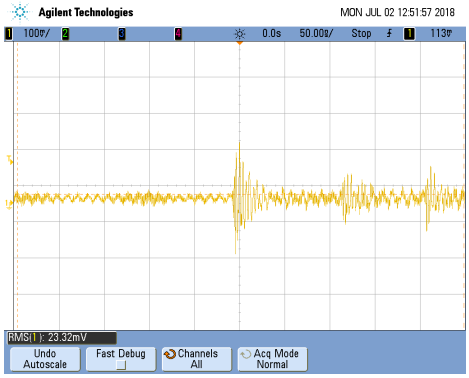
The first setup was used to roughly see if dry ice can bring the pulser down to a temperature low enough to see different types of pulses as Chris Persichilli saw in ELOG 2095. The second setup was used to roughly determine at what temperature the pulser started emitting different types of pulses. The temperature of the pulser's surface reach roughly -10°C when multiple pulses were being seen. In both tests, the results seem to be consistent with the pulser emitting multiple pulses rather than one single pulse at cold temperatures. Below is a more detailed explanation of each setup and its corresponding data.

Setup 1

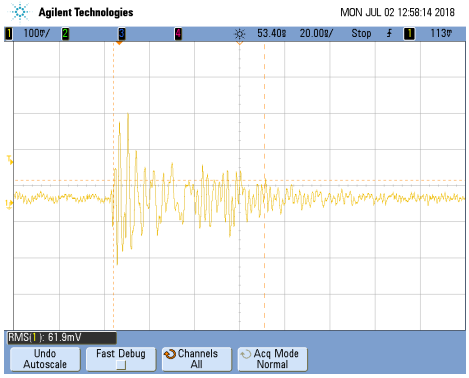
Data from the pulser was taken when cooled down with dry ice and isolated with fiber glass thermal insulation. The temperature sensor was taped to the surface of the pulser. A cooler was used to hold the insulator, dry ice, and pulser. The insulation took the shape of the cooler inside and a bottom layer of dry ice was placed. One spot was left open to rest the sensor on the insulation; this was to get a better temperature estimate of the pulser rather than the dry ice itself. The pulser and antenna were horizontally orientated and placed at a height of roughly 0.5m from the ground while the distance between the antenna and pulser was approximately 10m. The pulser was being chilled in the cooler prior to taking data. We began collecting data when the surface of the pulser was roughly -45°C. Then we took dry ice out and left the cooler open to warm up the pulser to see a change in the pulses detected. Note that data was not taken between -40°C and 10°C due to rewiring the digital thermometer. We had seen enough data by then to later try and find what temperature the pulser begins to emit multiple pulses. We broke up the results by what was seen last season and by what seems to be new types of pulses emitted.

Pulses Seen Before

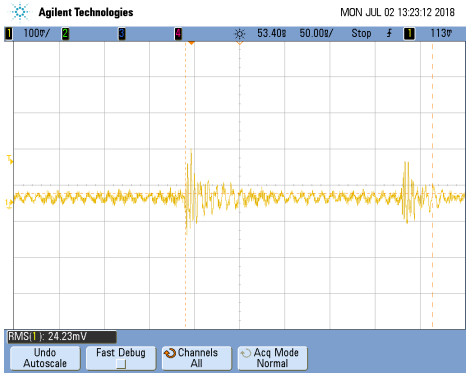
Using C. Persichilli's naming scheme for the pulses:



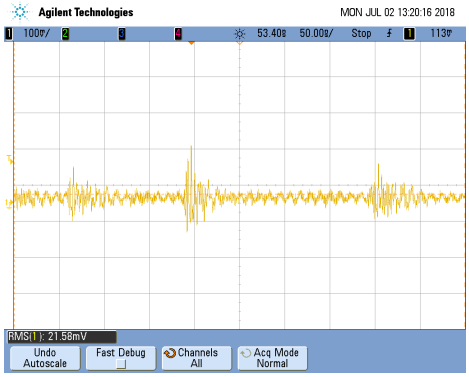
(a) T = −48°C, Type 4 Signal



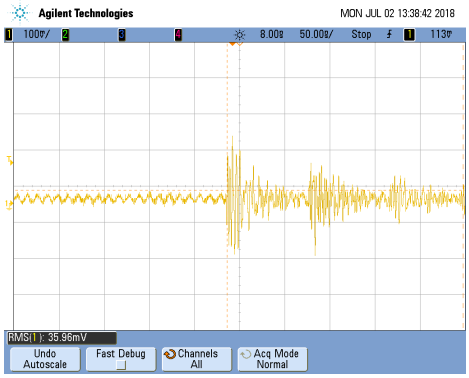
(b) T = −51°C, Type 7 Signal



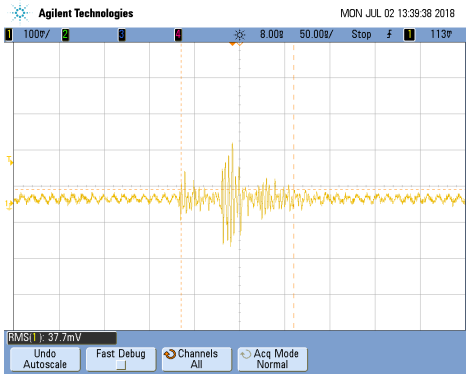
(c) T = −53°C, Type 5 Signal



(d) T = −44°C, Type 7 Signal



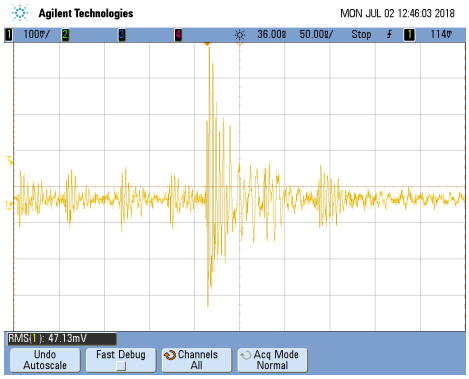
(e) T = 12°C, Type 4 Signal



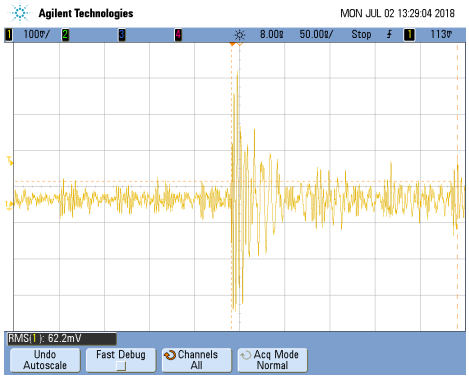
(f) T = 13°C, Type 4 Signal

Figure 1: Pulses emitted at different temperatures. The temperature for each figure is the temperature of the pulser's surface.

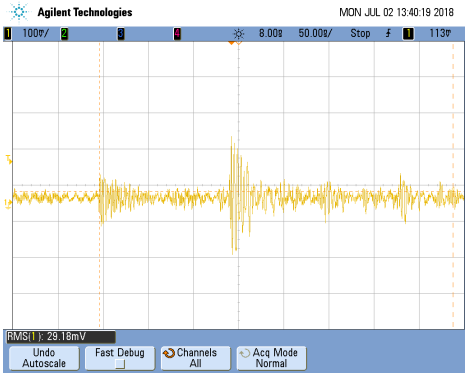
New Pulses



(a) T = −45°C



(b) T = −49°C



(c) T = 14°C

Figure 2: All figures have the same volt divisions being 100mV and figures a, c, & d have time divisions of 50ns while figure b has time divisions of 20ns.

Single pulses were not being emitted when the temperature was above 0°C, however, we believe this is because as the pulser's outer temperature was above 0°C, internal temperature was still below 0°C.

Setup 2

In this setup, the pulser and antenna were still 10m apart, however, they were now placed 1.2m off the ground with cardboard pillars. This time we added dry ice as we collected data to lower the temperature and find out what temperature is when multiple pulses begin to appear. At first the temperature of the pulser was at ambient temperature, 28°C. When the pulser's surface temperature was above −10°C, only single pulses were being emitted. However, below this temperature is when single pulses became less frequent.

While the pulser was at it's lowest temperature (due to using the same dry ice from Setup 1), the antenna was repositioned to be at a 45° angle with respect to the pulser and collected data there. After some data, we placed the antenna and pulser parallel once more and the temperature was then brought up from −45°C to 10°C. Although the temperature was later above −10°C, multiple pulses were still being seen. Again, we believe this was most likely due to the internal temperature still being at low temperatures. The data will follow the conclusion below.

Conclusion

It seems to be clear that the pulser is emitting more pulses than the intended single pulse. Most of the pulses are happening within a 500 nanosecond window from the main pulse. There are still single pulses emitted, however, they seem to be random. The source of the multiple pulses could not be determined. One speculation of the batteries being a source seems to not be right since the tests were all ran with the same battery without fully discharging them. We speculate that the source may come from the dipole's spacing as the temperature is brought down below 0°C.