

# Electronics Laboratory Course Instructions

## COCADE – Coffee Can Detector

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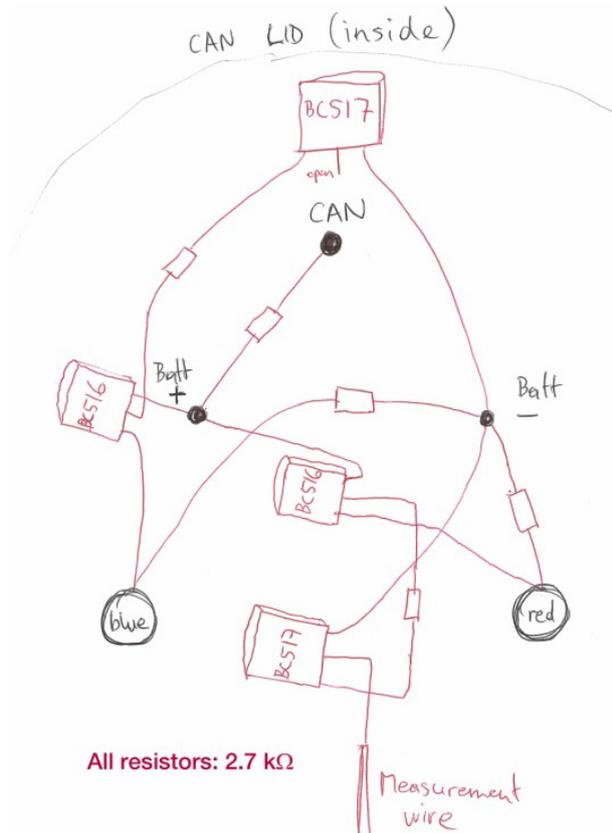
### Introduction

The coffee can detector is a very simple, battery-operated ionization chamber with air as the detection medium. The drift voltage is less than 9V and the measured signal is amplified by Darlington transistors. Due to the simple construction, the coffee can detector can be assembled by students within a few hours. On the other hand, the precision is also limited and a medium-strength radioactive source is needed to achieve meaningful meter readings. Due to time constants in the range of seconds, only integral measurements can be done.

### Program

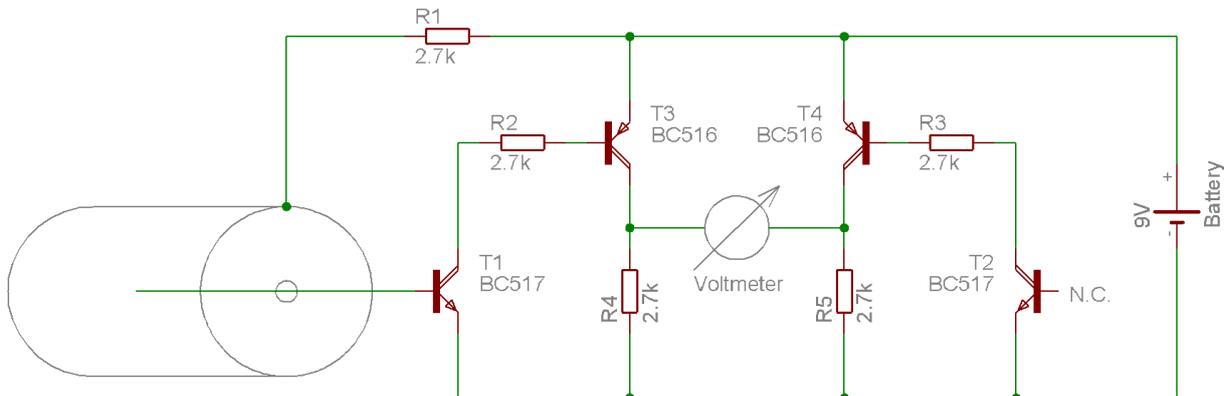
1. Introduction of the project, explanation of concept and schedule (~30')
2. Mechanical construction of the detector (~30')
3. Soldering of the amplifier circuit (~2.5h)
4. Source measurement (~30')
5. Calculation and comparison with measurement (~30')
6. Discussion (~30')

## Inside the can



Amplifier circuit inside the can and sense wire (bottom)

## Circuit



## Measurements

- Explain the circuit. What is the role of the right half of the circuit?
- What is the overall amplification of the circuit, i.e. which current is needed on the sense wire to read 1V on the meter? Assume the following amplification factors:  $B_{BC517} = 10k$ ,  $B_{BC516} = 100k$
- Illuminate the can with a  $^{90}\text{Sr}$  source ( $\beta^-$ ). The activity of the source is referred to  $4\pi$  solid angle, consider the geometry. Also consider the absorption/deflection of the can wall. On average, a beta particle generates about 50 electron-ion pairs per cm in air. Compare the calculated ionization with your measurement.