

# Developing a Cloud Chamber to Measure Cosmic Ray Muons

Ryan Van Ostrand   Caroline Van Berkum   Emily Grace

## Introduction

Prior to this project Northwestern had no means of seeing subatomic particles. We developed an innovative method using standard equipment to detect subatomic interactions. The intent of this project was primarily to create a working cloud chamber with a secondary goal of measuring the cosmic ray muon attenuation for each floor of Van Peurseem Hall.

## Method

Our method for building a cloud chamber is as follows,

- 1) Found a clear glass or plastic container.
- 2) Glued felt to the bottom of the container.
- 3) Poured Isopropyl Alcohol onto the felt.
- 4) Placed container on metal tray (Black).
- 5) Placed this metal try on dry ice.
- 6) Blackened the outsides of the container with two sides open for viewing and light.
- 7) Shined a flashlight on the lower part of the chamber after 15 minutes to allow the chamber to fill with vapor.

After these steps were performed we had a working cloud chamber that we took to each floor of VPH.

- 8) We took four 15 second videos of each floor and counted the cosmic ray muons in each video to get the results in Table 1. The screenshots of those videos for each floor can be seen in the middle column.

## Pictures



Figure 1: The basement of Van Peurseem Hall

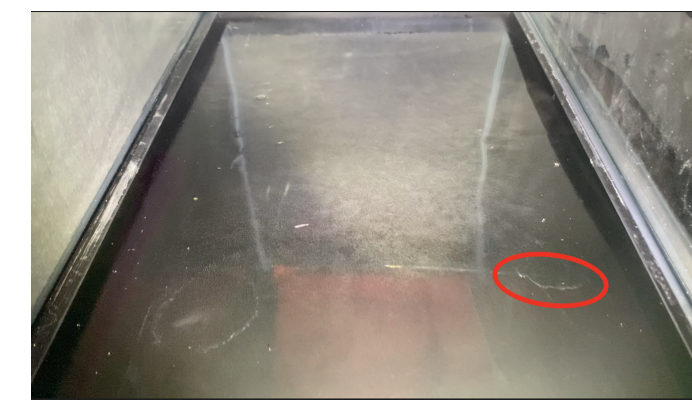


Figure 2: The 1st floor of Van Peurseem Hall

## More Pictures



Figure 3: The second floor of Van Peurseem Hall

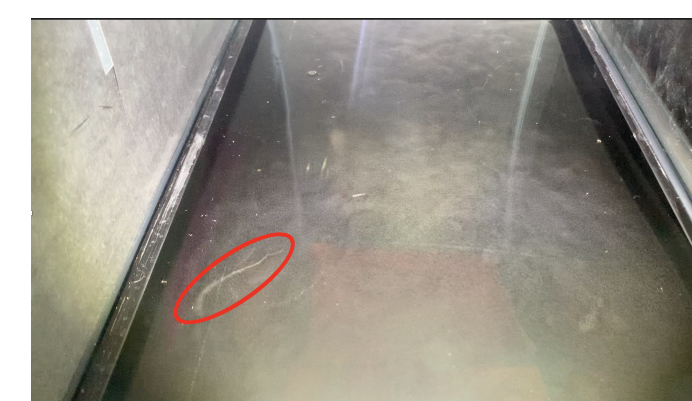


Figure 4: The third floor of Van Peurseem Hall

## Results

Floor	Trial 1	Trial 2	Trial 3	Trial 4	Average
Basement	16	15	17	17	16.25
1st Floor	21	17	17	18	18.25
2nd Floor	23	23	20	17	20.75
3rd Floor	24	25	24	31	26

Table 1: Results from each level in VPH

"22 x 26 x 1 cm - Cloud Chamber Measurement Dimensions"

## Discussion

This change in cosmic ray muons is caused by both the physical matter that particles pass through between floors and the distance travelled since these particles entered the atmosphere. Further this allowed to make observations of time dilation. These numbers demonstrate that the cloud chamber is functional as attenuation between floors is present. There is a potential that our data is inaccurate, but we will plan to further develop this project by developing a formulaic approach to the attrition seen between floors.