



Effective Velocity and Time Offsets in the Barrel Calorimeter



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Method

1. Plot the z-coordinate of the points in the cluster versus the z-coordinates of the matched track for every channel and perform a linear fit on the outcome
2. The two quantities are related as follows:

$$z_{point} = p_0 + p_1 \cdot z_{track} \quad (1)$$

or more explicitly:

$$\frac{c_{eff,soft} \cdot (t_u - t_d)}{2} = \frac{c_{eff,soft} \cdot (t_{u,0} - t_{d,0})}{2} + \frac{c_{eff} \cdot (t_u - t_d)}{2} \quad (2)$$

where:

t_u : upstream time

t_d : downstream time

$t_{u,0}$: upstream time for particles hitting the center of BCAL

$t_{d,0}$: downstream time for particles hitting the center of BCAL

$c_{eff,soft} = 16.75 \frac{cm}{ns}$ (value from DBCALGeometry)

c_{eff} : the value we are after

$\Delta t = t_{u,0} - t_{d,0}$: the time offset

Method

Therefore:

$$c_{eff} = \frac{c_{eff,soft}}{p_1} \quad (3)$$

$$\Delta t = \frac{2 \cdot p_0}{c_{eff,soft}} \quad (4)$$

3. z_{track} calculation (changed since our last meeting):

- Take lots of radii (23 in total) inside the BCAL and find z_{track} for each one of them
- For each z_{point} check which of the calculated z_{track} is closest to it (belonging to the same layer, of course), and use this pair of values as the "correct" one
- The reason for the above scheme is that the previous method we used for determining z_{track} resulted in some irrelevant points (far from the fitted line).

4. Datasets

- Commissioning Run 2400
- Spring Run 3179
- Run 3220 (Cosmics)
- Run 3221 (Cosmics)

Results - Effective Velocity

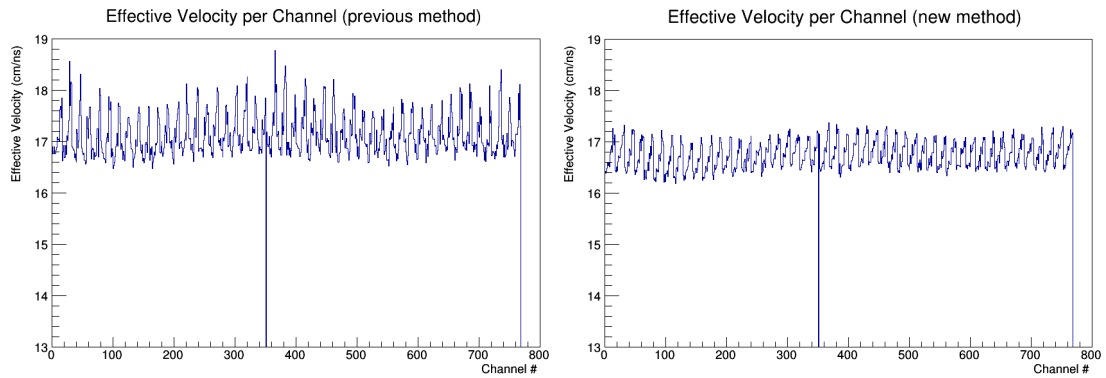


Figure 1: Effective velocity per channel using a) 4 BCAL radii to get the z-coordinate of the track (left) and b) 23 BCAL radii (right)

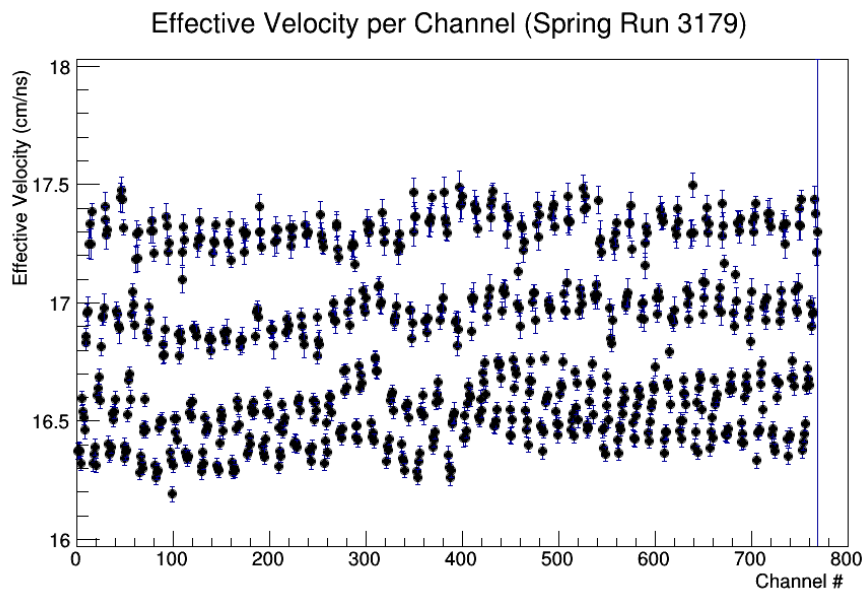


Figure 2: Effective velocity per channel for Spring Run 3179

Results - Effective Velocity

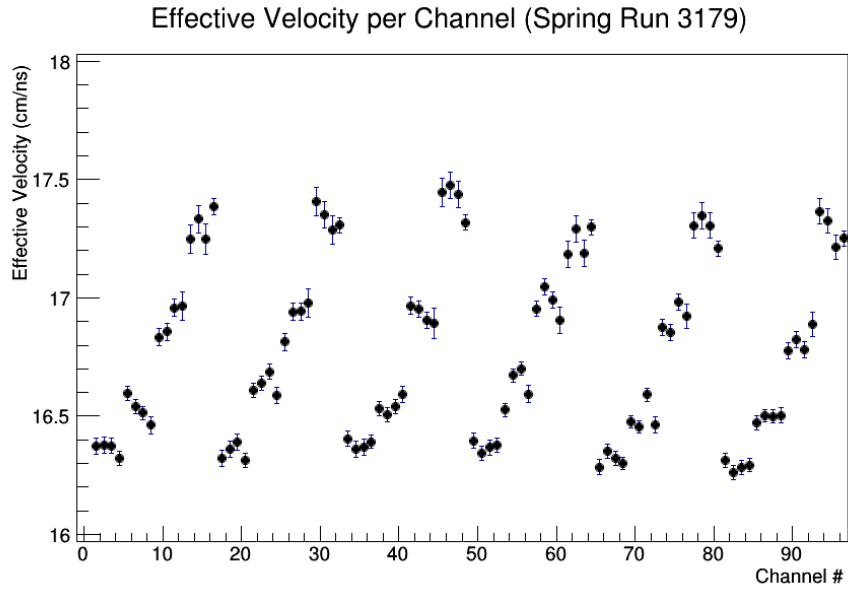


Figure 3: Effective velocity (Run 3179) for the first 6 modules of the BCAL

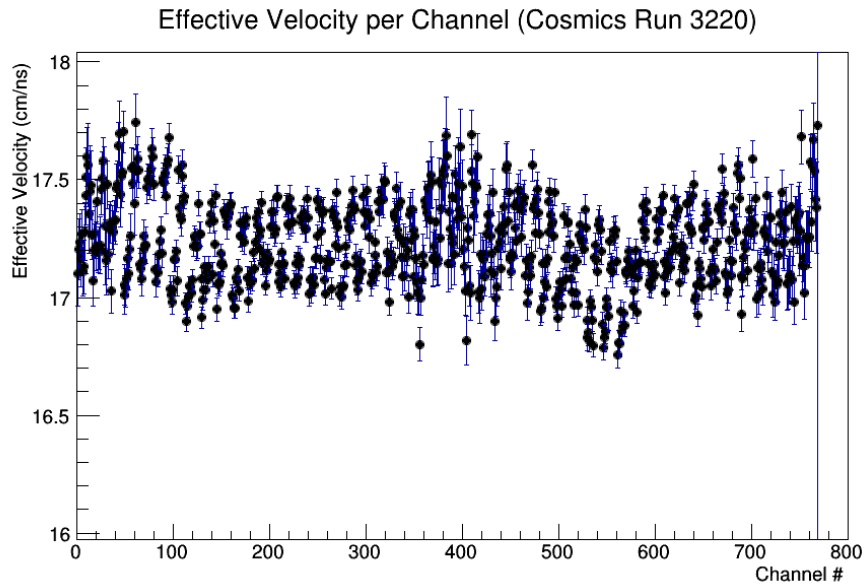


Figure 4: Effective velocity per channel for Cosmics Run 3220

Results - Effective Velocity

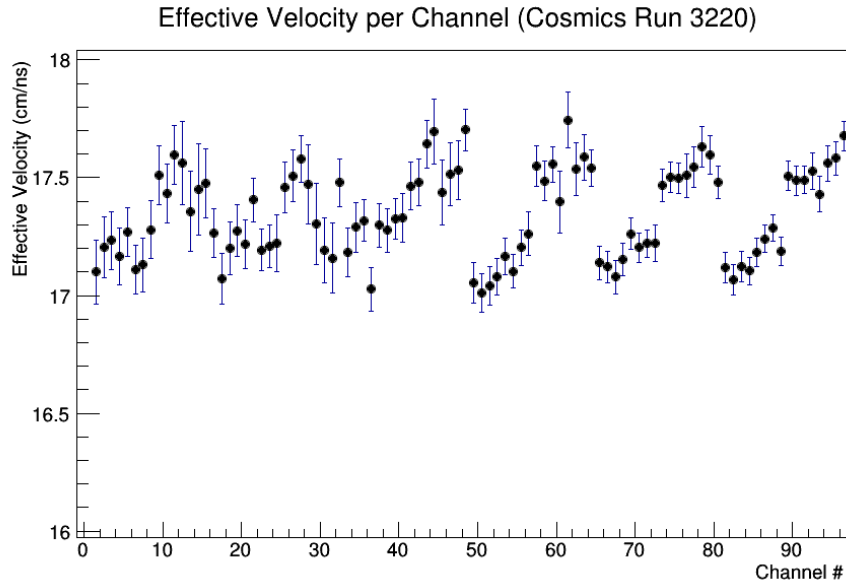


Figure 5: Effective velocity (Run 3220) for the first 6 modules of the BCAL

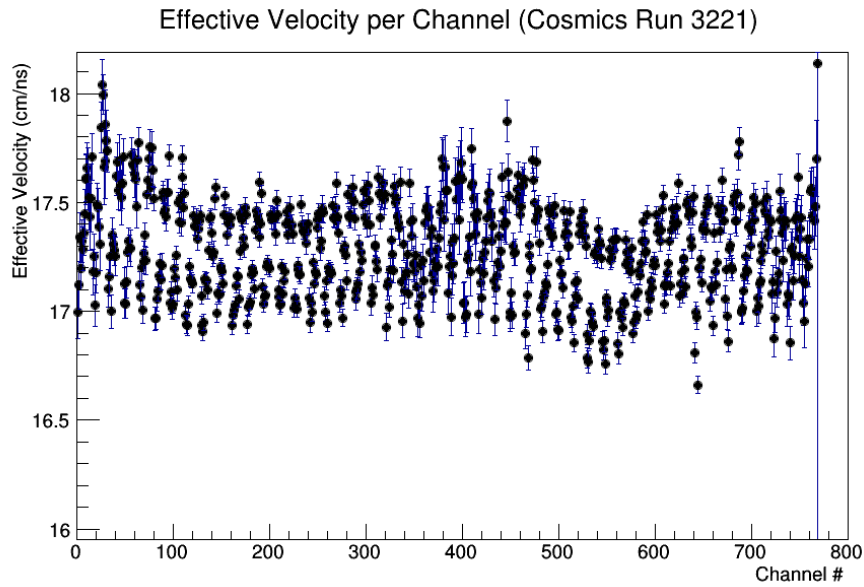


Figure 6: Effective velocity per channel for Cosmics Run 3221

Results - Effective Velocity

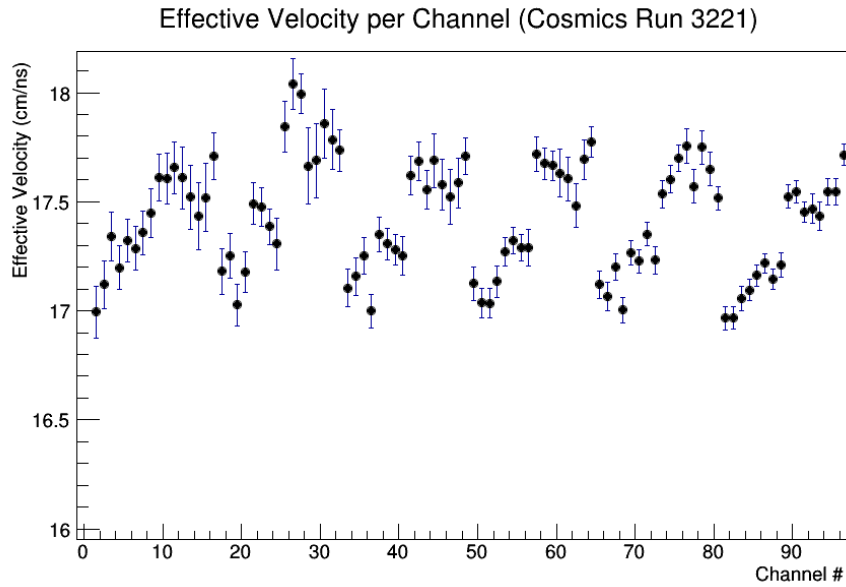


Figure 7: Effective velocity (Run 3221) for the first 6 modules of the BCAL

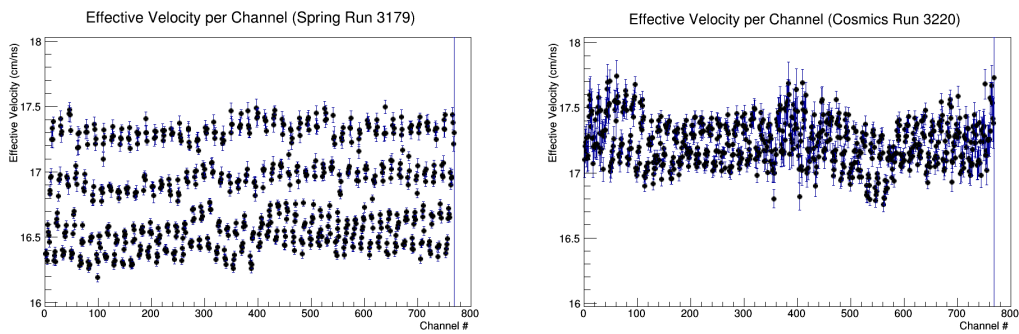


Figure 8: Comparison of Spring Run 3179 and Cosmics Run 3220

Results - Time Offsets

Time Offsets per Channel (Spring Run 3179)

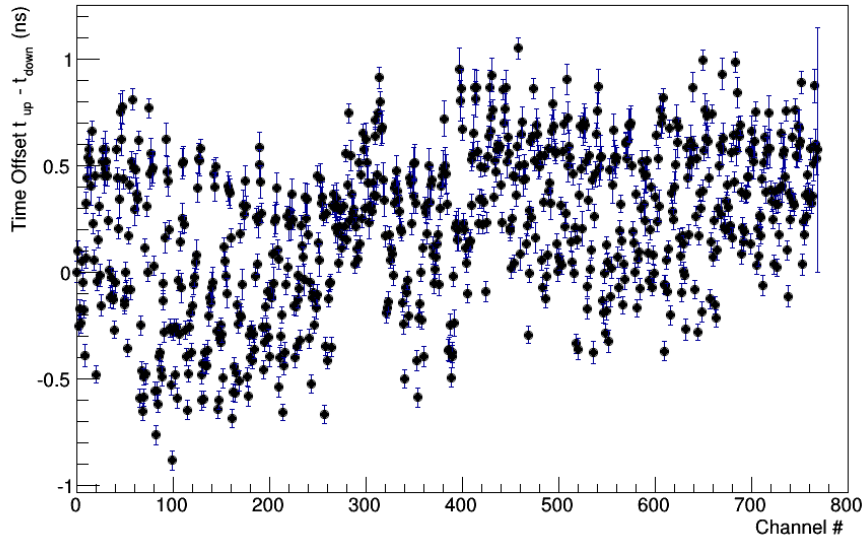


Figure 9: Time offsets for Spring Run 3179

Time Offsets per Channel (Cosmics Run 3220)

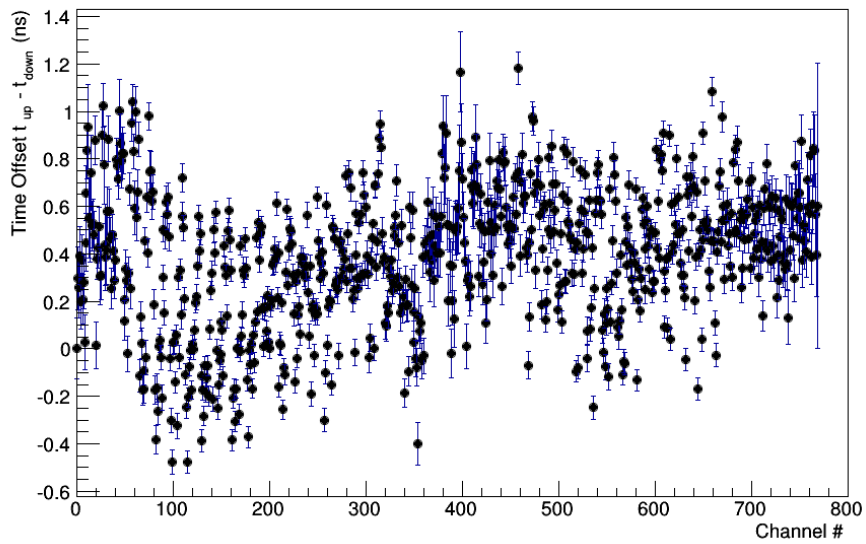


Figure 10: Time offsets for Cosmics Run 3220

Results - Time Offsets

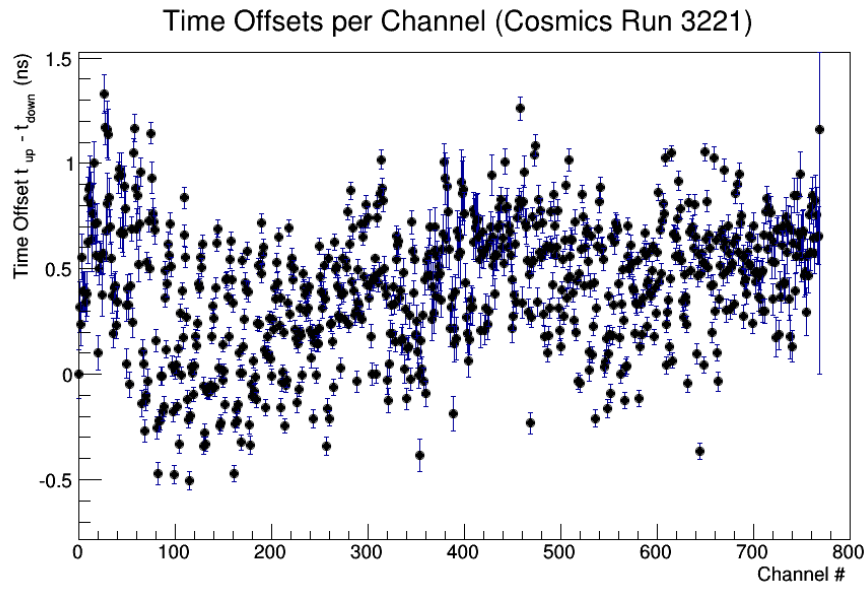


Figure 11: Time offsets for Cosmics Run 3221

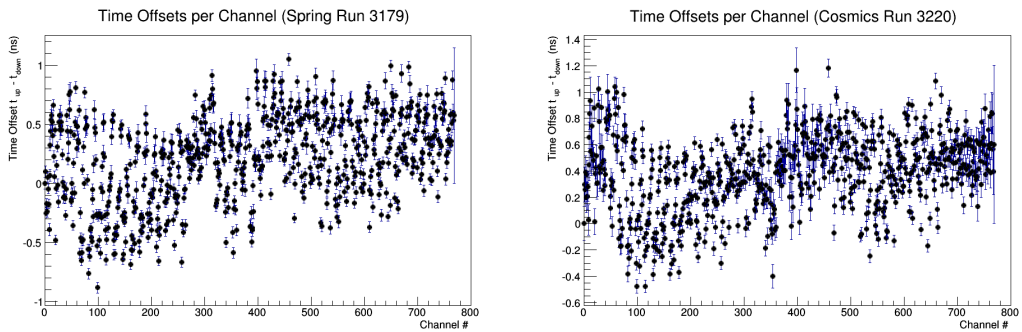


Figure 12: Comparison of Spring Run 3179 and Cosmics Run 3220

Comments

1. Effective velocity seems to be layer dependent
2. Cosmics give "better" results but some dependence is still visible
3. The results for the effective velocity are different for the Spring Run and the Cosmics Run
4. Time Offsets look reasonable

To-Do / Done

1. Errors
2. Investigate further (improve code, statistics)
3. ~~Try to use another method to get c_{eff} to cross check the results (not done - I will decide if I should do that based on the feedback)~~