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## Effective Velocities and Time Offsets (Spring 2015 & Spring 2016)

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## Method - A reminder

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:

$$z_{point} = \frac{c_{eff,software} \cdot (t_{u,0} - t_{d,0})}{2} + \frac{c_{eff,software}}{c_{eff}} \cdot z_{track} \quad (2)$$

where:

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

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

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

$c_{eff}$  : the value we are after

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

Therefore:

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

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

### 3. $z_{track}$ calculation:

- Take 4 radii (middle of each layer) inside the BCAL and find  $z_{track}$  for each layer using these radii
- ~~Use cuts to throw away points that are "far" from the 45° line~~

### 4. Datasets

- **Spring 2015**

(a) Cosmics: 3218, 3219, 3220, 3221

(b) Production Runs: 3072 - 3082, 3084, 3158, 3160, 3161, 3163, 3164, 3165, 3168, 3169, 3170, 3173  
- 3180

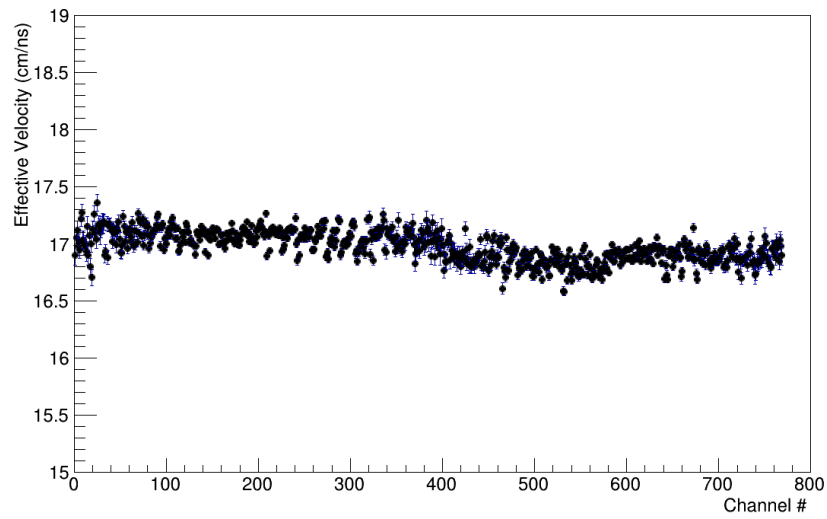
- **Spring 2016**

(a) Cosmics: 10017, 10026, 10181

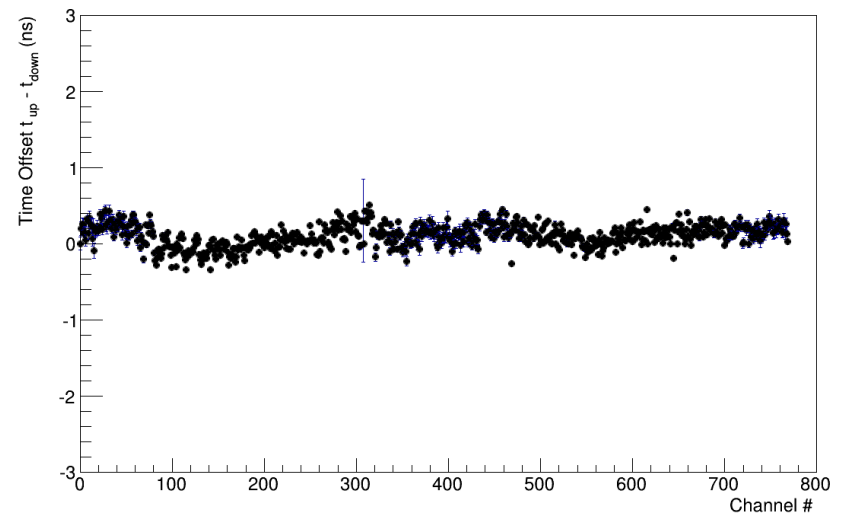
(b) Production Runs: 10332, 10344, 10346 - 10349, 10351, 10352, 10354, 10394, 10507

# What we currently have on CCDB

Cosmics - 20cm cut

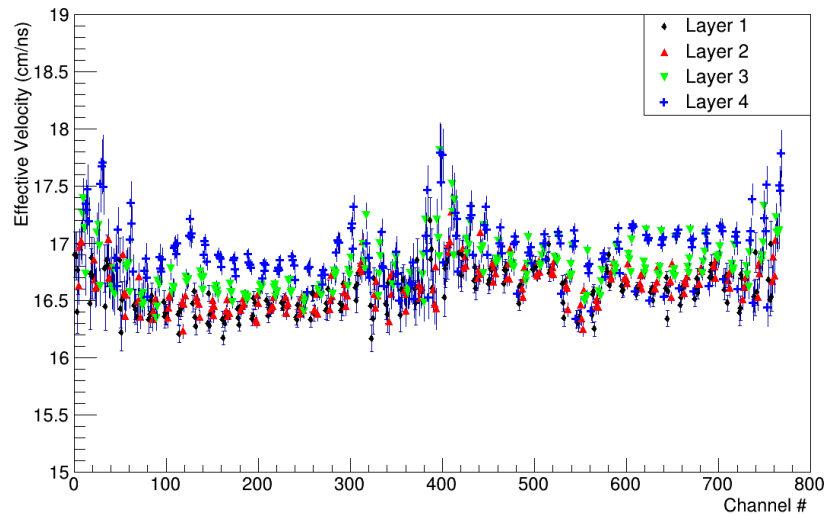


Cosmics - 20cm cut



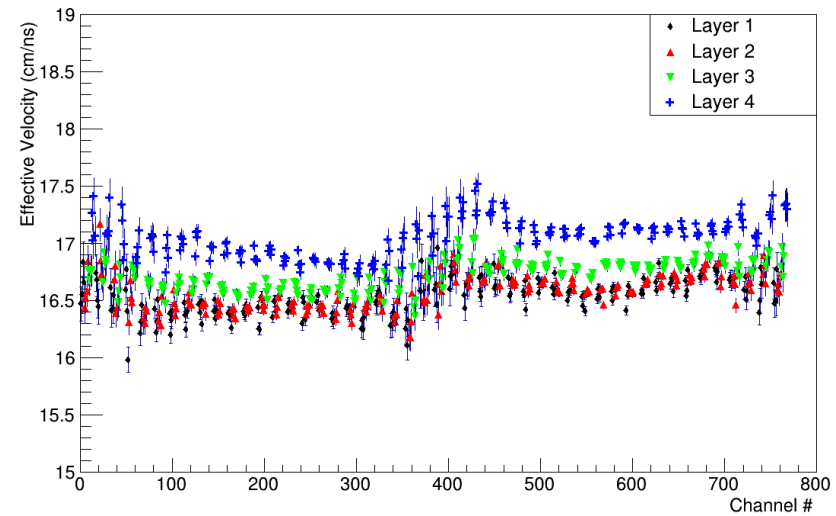
## Spring 2015

Effective Velocity per Channel - Cosmics



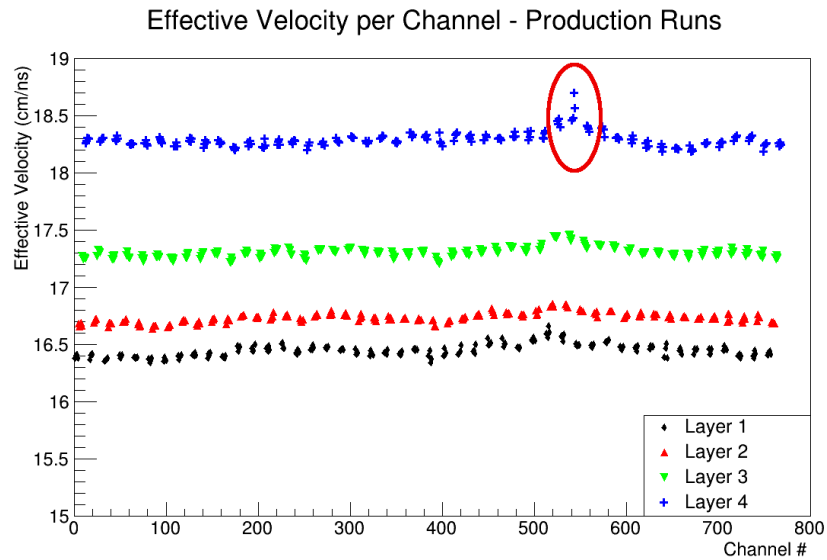
## Spring 2016

Effective Velocity per Channel - Cosmics

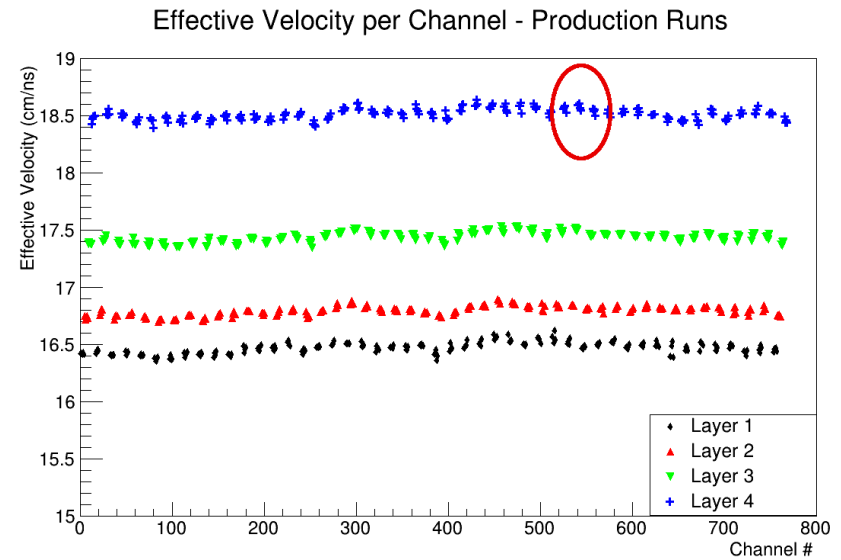


Similar behavior, smaller error bars

## Spring 2015

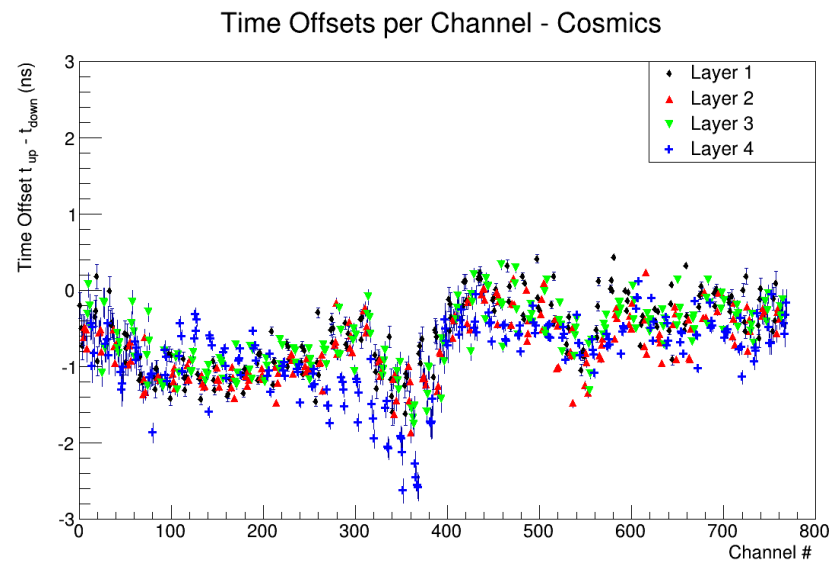


## Spring 2016

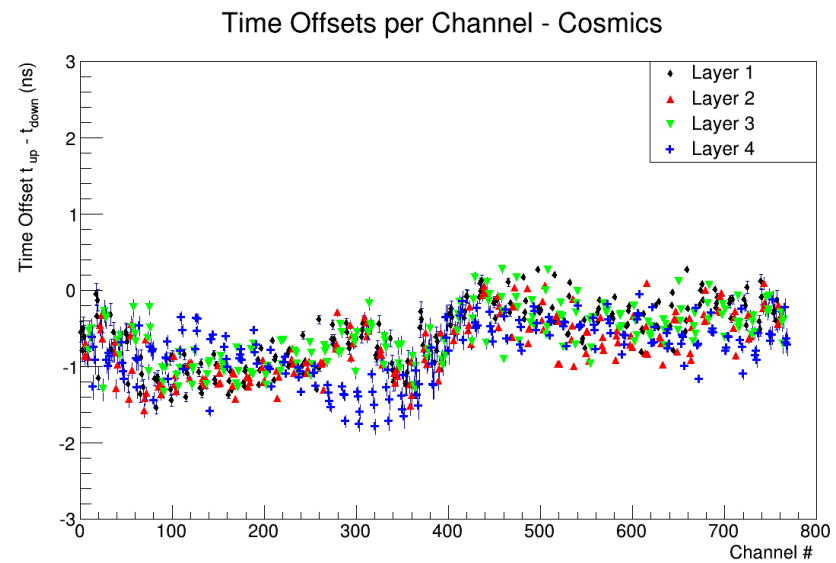


Similar behavior, Layers 3 and 4 have slightly higher values, "strange" behavior around channel #540 disappeared

## Spring 2015

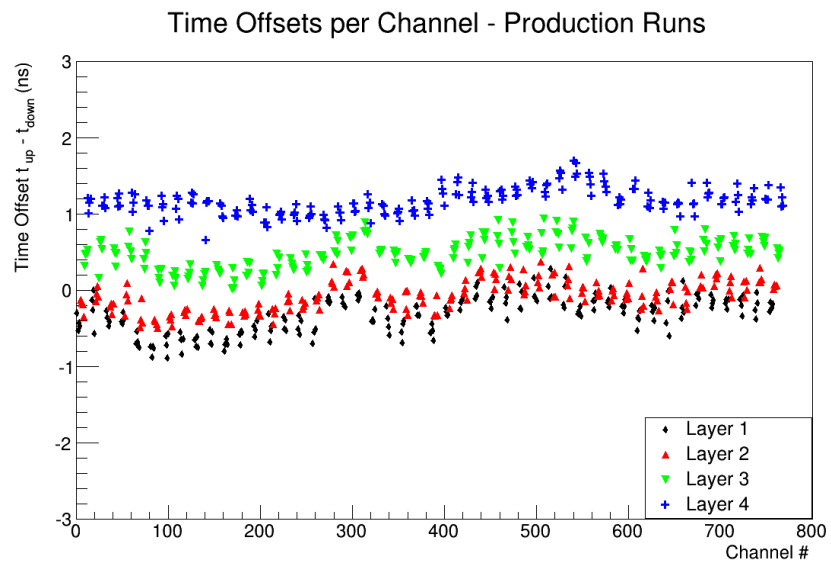


## Spring 2016

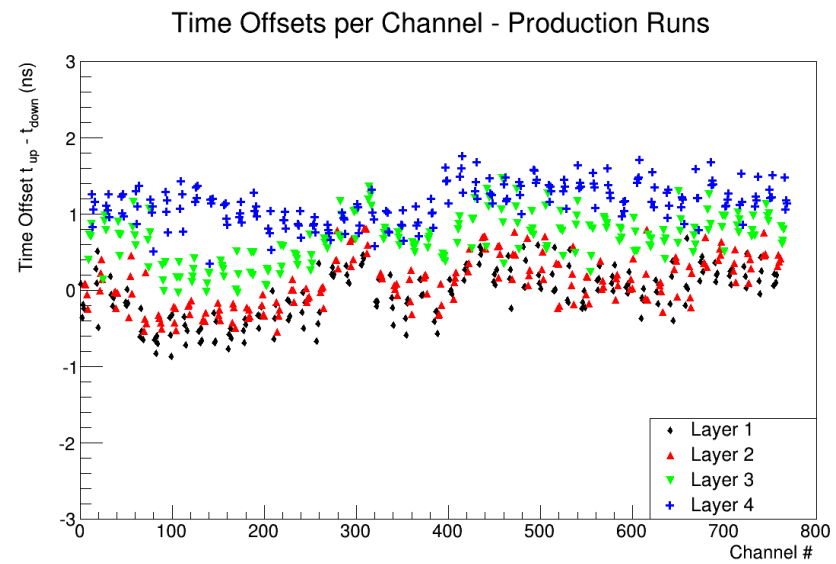


Similar behavior, Layer 4 improved

## Spring 2015



## Spring 2016



Similar behavior



## Comments - Suggestions

- Effective Velocities and Time Offsets exhibit layer dependence. See Elton's log entry [Log Entry 3350054](#)
  - No z-cuts were applied
  - Cosmics are not as stable as the production runs
  - Cosmics are not appropriate for determining velocities and offsets of the channels near 3 and 9 o'clock. This is to be expected (due to the way the cosmics hit the BCAL), and is verified from the large error bars in these regions
  - The Layer 1 values that we get from cosmics are similar to the production run values (for channels away from the 3 and 9 o'clock regions)
- ⇒ Suggestion: **Keep Layer 1 values from Spring 2016 production data.** Then, for each BCAL module, assign these Layer 1 values to the rest of the Layers as well. For example, Channels 1, 5, 9 and 13 will have exactly the same value of  $c_{eff}$  and  $\Delta t$ . **To-Do:** Update CCDB accordingly
- ⇒ **To-Do:** New DBCALGeometry::C\_EFFECTIVE value:  $16.45 \frac{cm}{ns}$  (very close to the new CCDB values)