

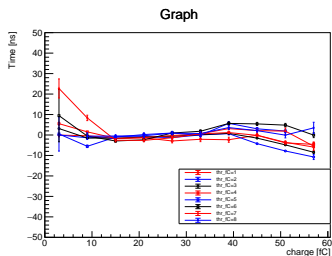
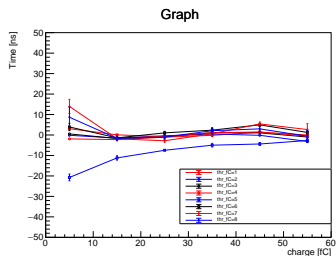
# Time Calibration Updates

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# Intro

- ▶ Time walk and time reference were originally 60 ns effects
- ▶ After two iterations, time walk effect is around 5 ns (below)
- ▶ Next step: another iteration of time walk corrections
- ▶ Next step: propagation velocity measurement
- ▶ Simulations and Riccardo's measurement give about  $v=0.5c$
- ▶ Use central 300 mm in z for measurement  $\implies \approx 2$  ns effect



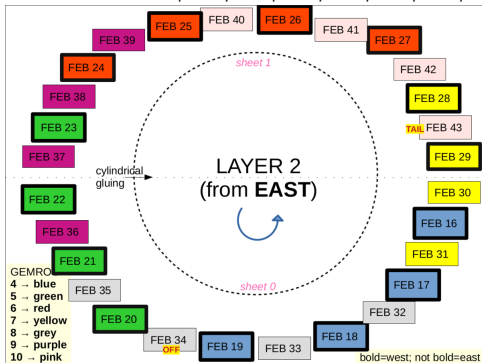
Left is runs 11-16, right is run 17

# Method

- ▶ Use runs 11-17 after two iterations of time walk and time reference
- ▶ Fit with usual function:

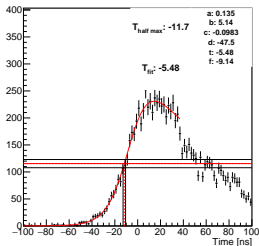
$$a + \frac{b \cdot e^{-c \cdot (x-d)}}{1 + e^{-(x-t)/f}}$$

- ▶ Take time at half max of the fit curve as the rising time
  - ▶ More stable than taking  $t$  from the formula
- ▶ Use results from FEBs 18, 19, 25, 26, 33, 34, 40, 41

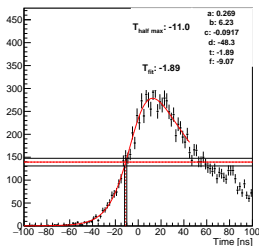


# Layer 1 FEB 2

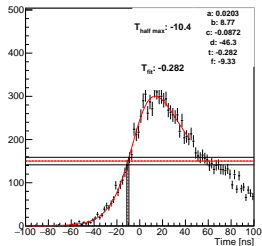
Readout 2 Time, 125<d<180 mm



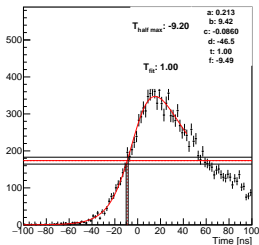
Readout 2 Time, 180<d<235 mm



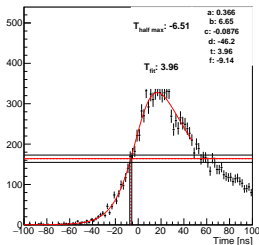
Readout 2 Time, 235<d<290 mm



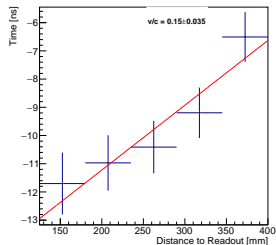
Readout 2 Time, 290<d<345 mm



Readout 2 Time, 345<d<400 mm

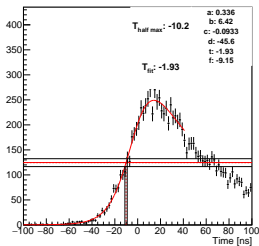


Time at Half Max (fit) versus Distance to Readout 2

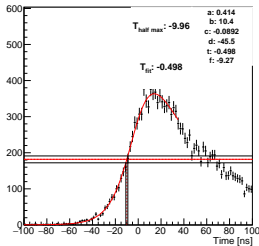


# Layer 1 FEB 6

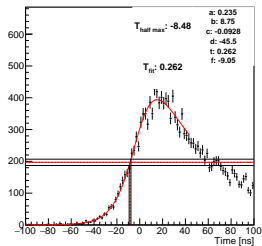
Readout 6 Time, 125<d<180 mm



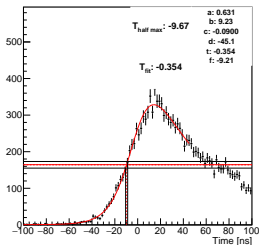
Readout 6 Time, 180<d<235 mm



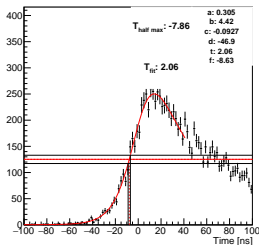
Readout 6 Time, 235<d<290 mm



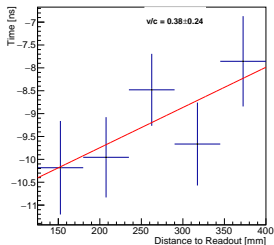
Readout 6 Time, 290<d<345 mm



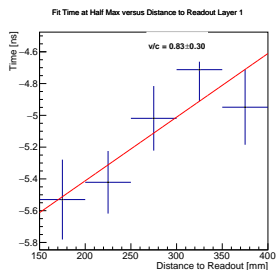
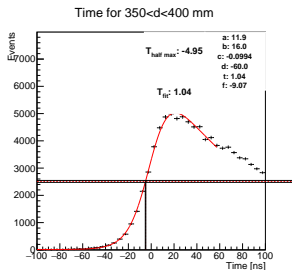
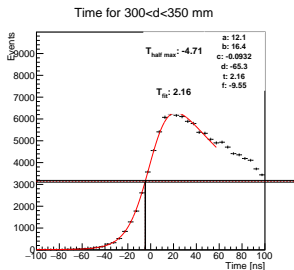
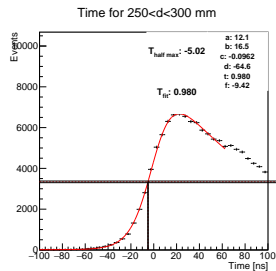
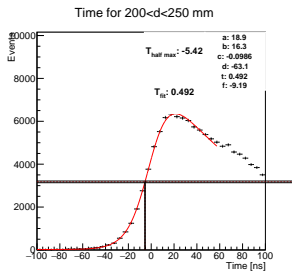
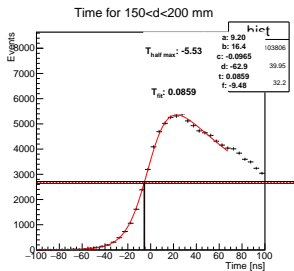
Readout 6 Time, 345<d<400 mm



Time at Half Max (fit) versus Distance to Readout 6

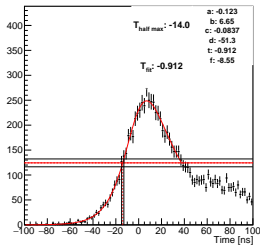


# Layer 1 Combined

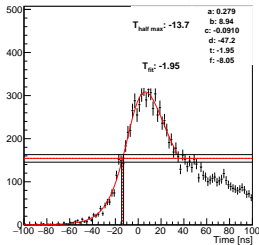


# Layer 2 Feb 18

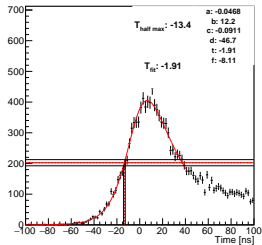
Readout 18 Time, 200<d<260 mm



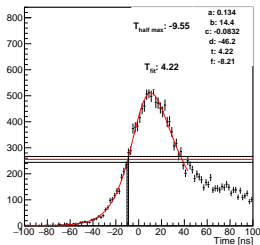
Readout 18 Time, 260<d<320 mm



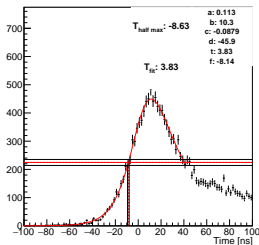
Readout 18 Time, 320<d<380 mm



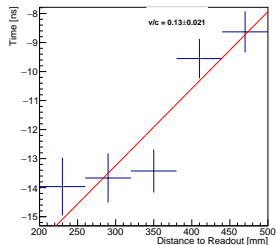
Readout 18 Time, 380<d<440 mm



Readout 18 Time, 440<d<500 mm

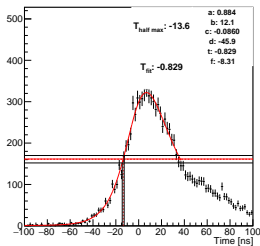


Time at Half Max (fit) versus Distance to Readout 18

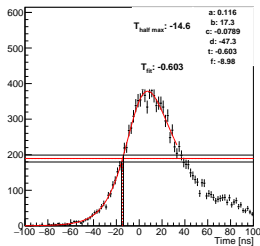


# Layer 2 Feb 19

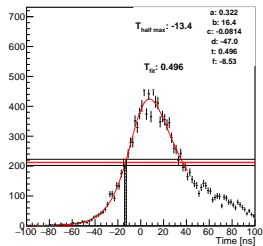
Readout 19 Time, 200<d<260 mm



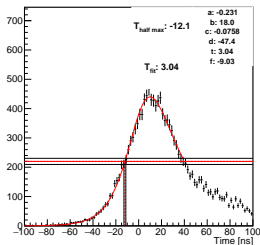
Readout 19 Time, 260<d<320 mm



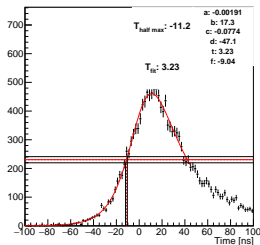
Readout 19 Time, 320<d<380 mm



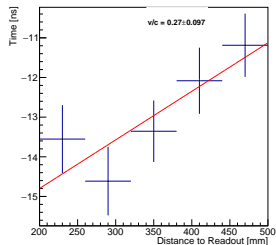
Readout 19 Time, 380<d<440 mm



Readout 19 Time, 440<d<500 mm



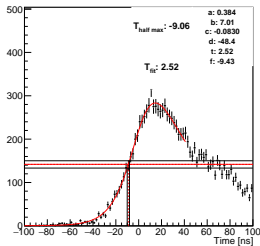
Time at Half Max (fit) versus Distance to Readout 19



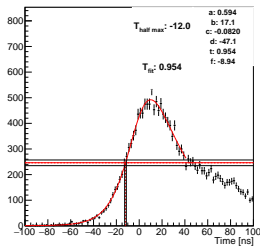


# Layer 2 Feb 25

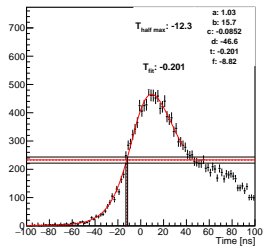
Readout 25 Time, 200<d<260 mm



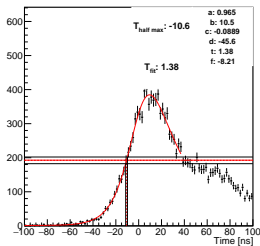
Readout 25 Time, 260<d<320 mm



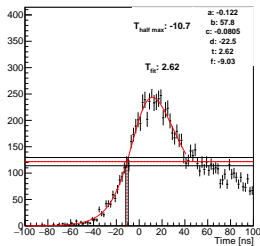
Readout 25 Time, 320<d<380 mm



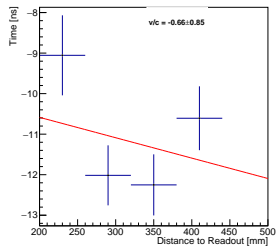
Readout 25 Time, 380<d<440 mm



Readout 25 Time, 440<d<500 mm

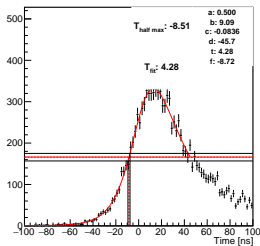


Time at Half Max (fit) versus Distance to Readout 25

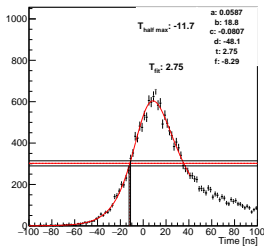


# Layer 2 Feb 26

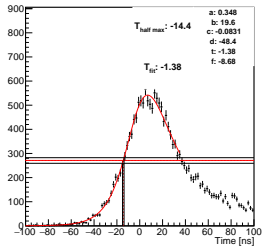
Readout 26 Time, 200<d<260 mm



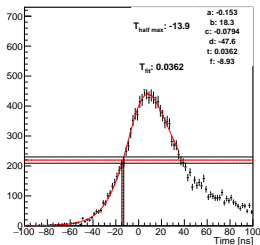
Readout 26 Time, 260<d<320 mm



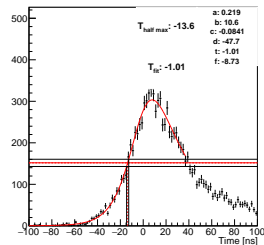
Readout 26 Time, 320<d<380 mm



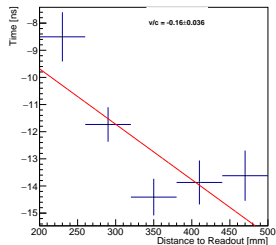
Readout 26 Time, 380<d<440 mm



Readout 26 Time, 440<d<500 mm

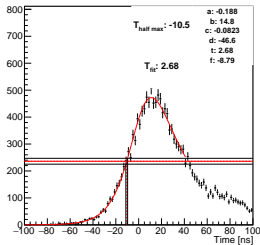


Time at Half Max (fit) versus Distance to Readout 26

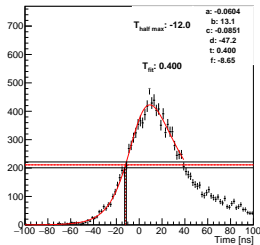


# Layer 2 Feb 33)

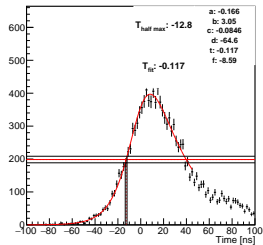
Readout 33 Time, 200<d<260 mm



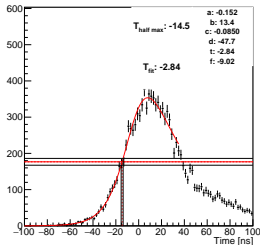
Readout 33 Time, 260<d<320 mm



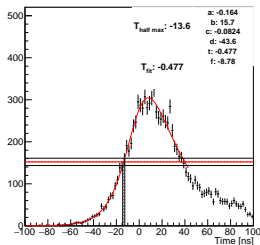
Readout 33 Time, 320<d<380 mm



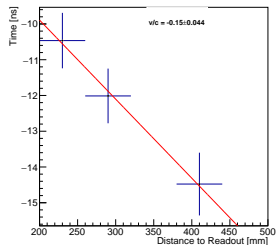
Readout 33 Time, 380<d<440 mm



Readout 33 Time, 440<d<500 mm

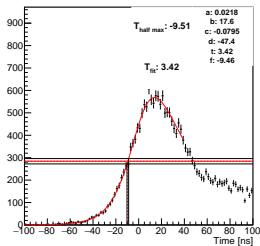


Time at Half Max (fit) versus Distance to Readout 33

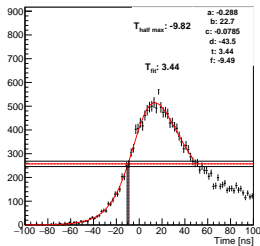


# Layer 2 Feb 34

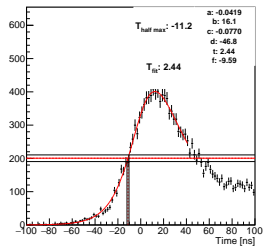
Readout 34 Time, 200<d<260 mm



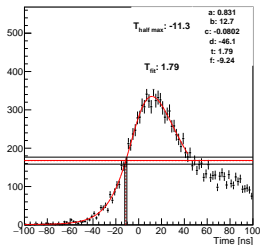
Readout 34 Time, 260<d<320 mm



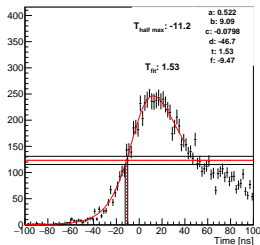
Readout 34 Time, 320<d<380 mm



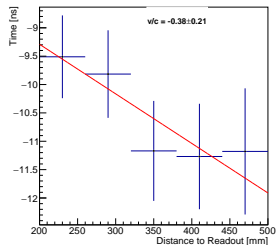
Readout 34 Time, 380<d<440 mm



Readout 34 Time, 440<d<500 mm

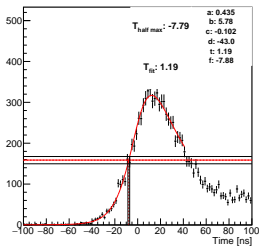


Time at Half Max (fit) versus Distance to Readout 34

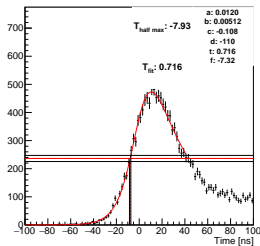


# Layer 2 FEB 40

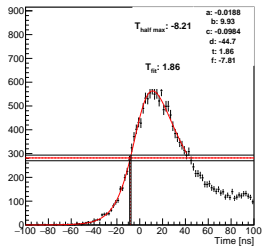
Readout 40 Time, 200<d<260 mm



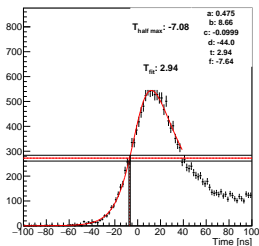
Readout 40 Time, 260<d<320 mm



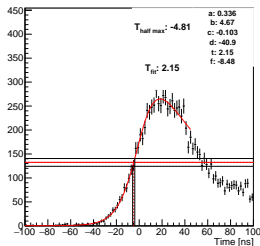
Readout 40 Time, 320<d<380 mm



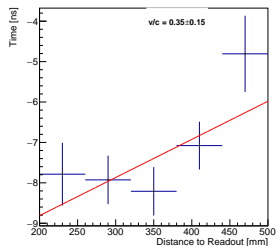
Readout 40 Time, 380<d<440 mm



Readout 40 Time, 440<d<500 mm

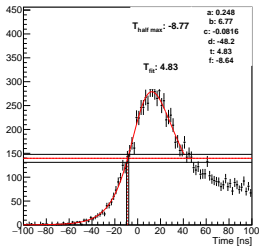


Time at Half Max (fit) versus Distance to Readout 40

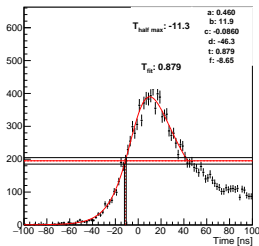


# Layer 2 Feb 41

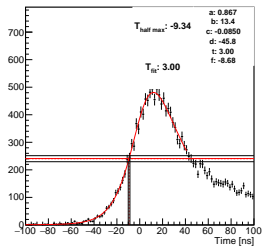
Readout 41 Time, 200<d<260 mm



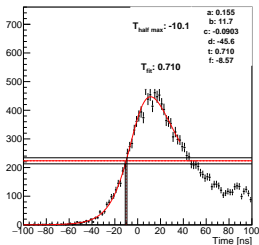
Readout 41 Time, 260<d<320 mm



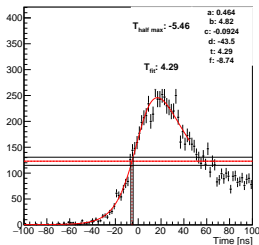
Readout 41 Time, 320<d<380 mm



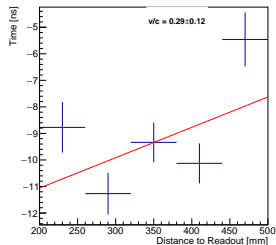
Readout 41 Time, 380<d<440 mm



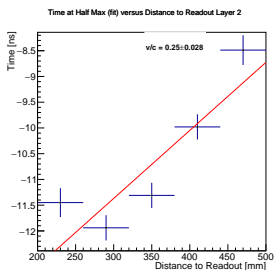
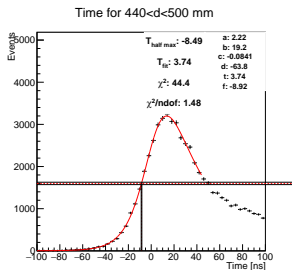
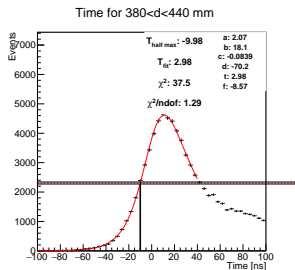
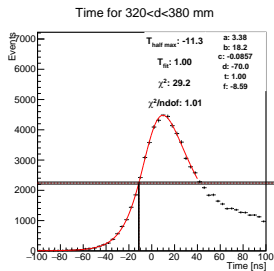
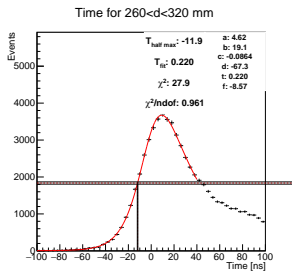
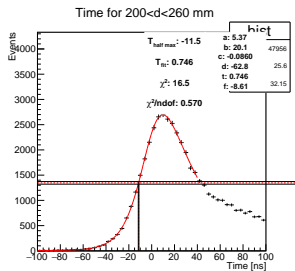
Readout 41 Time, 440<d<500 mm



Time at Half Max (fit) versus Distance to Readout 41



# Fits for FEBs 17-20 and 39-41 combined



# Summary

- ▶ Results are improved
- ▶ FEBs 25, 26, 33, and 34 all have negative velocities
- ▶ Velocities are systematically below 0.5 c

Feb	Velocity ( $v/c$ )
2	$0.15 \pm 0.04$
6	$0.38 \pm 0.24$
Total	$0.83 \pm 0.30$

Feb	Velocity ( $v/c$ )
18	$0.13 \pm 0.02$
19	$0.27 \pm 0.10$
25	$-0.66 \pm 0.85$
26	$-0.16 \pm 0.04$
33	$-0.15 \pm 0.04$
34	$-0.38 \pm 0.21$
40	$0.35 \pm 0.15$
41	$0.29 \pm 0.12$
Total	$0.25 \pm 0.03$

