Real-time PAA Disinfection Control in Municipal Wastewater Treament

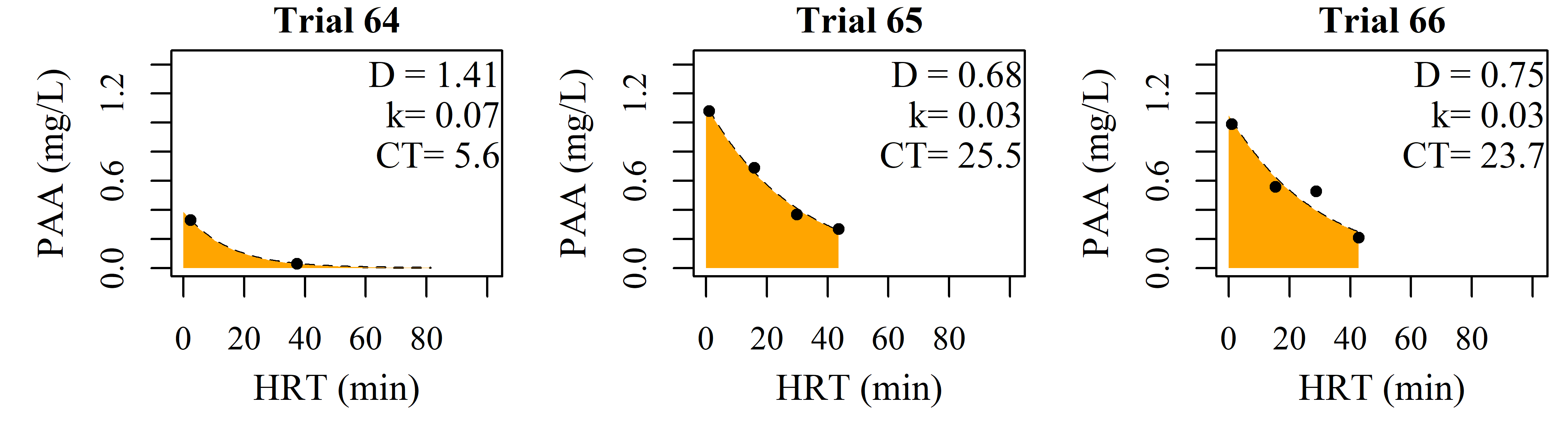
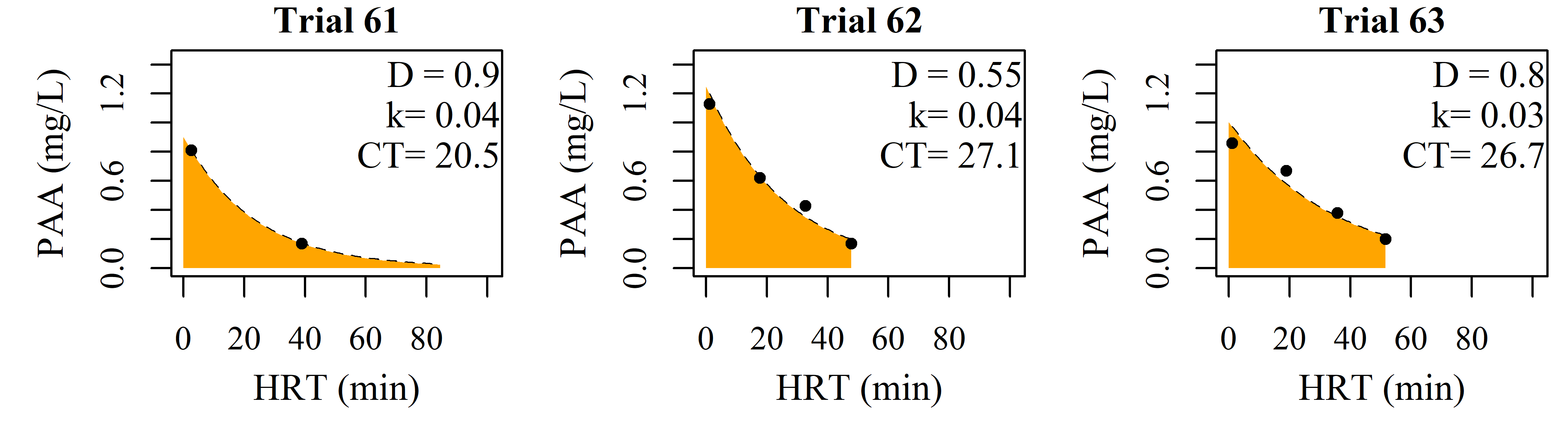
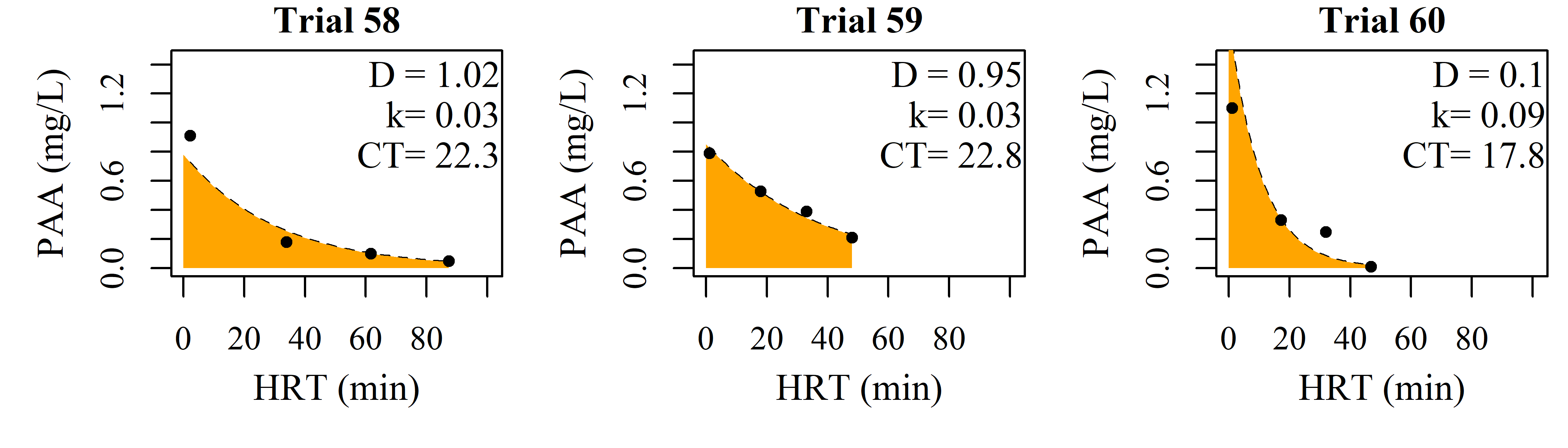
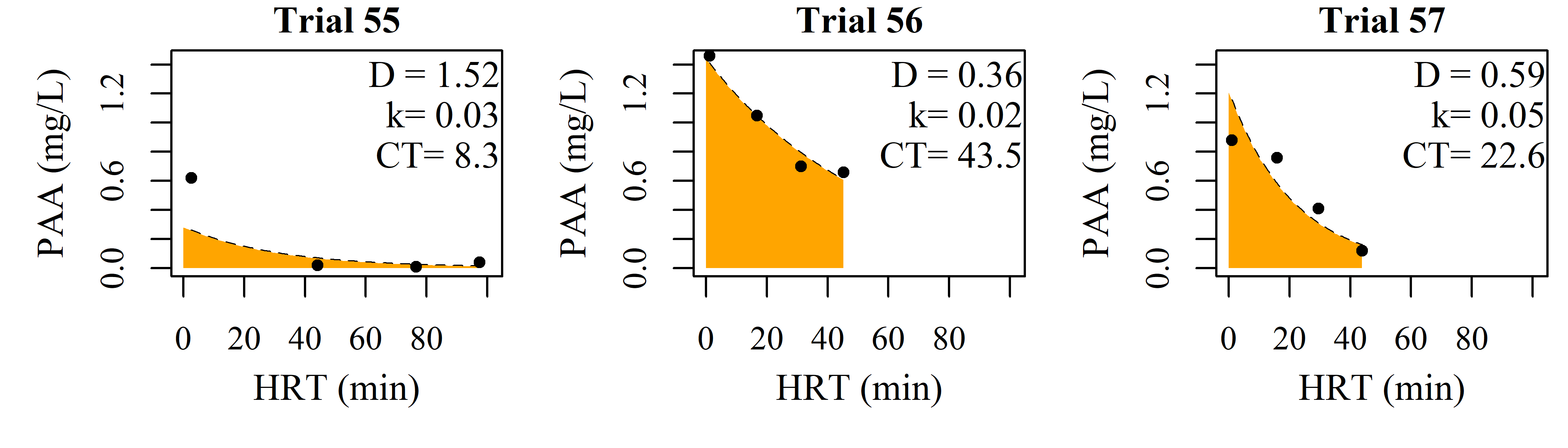
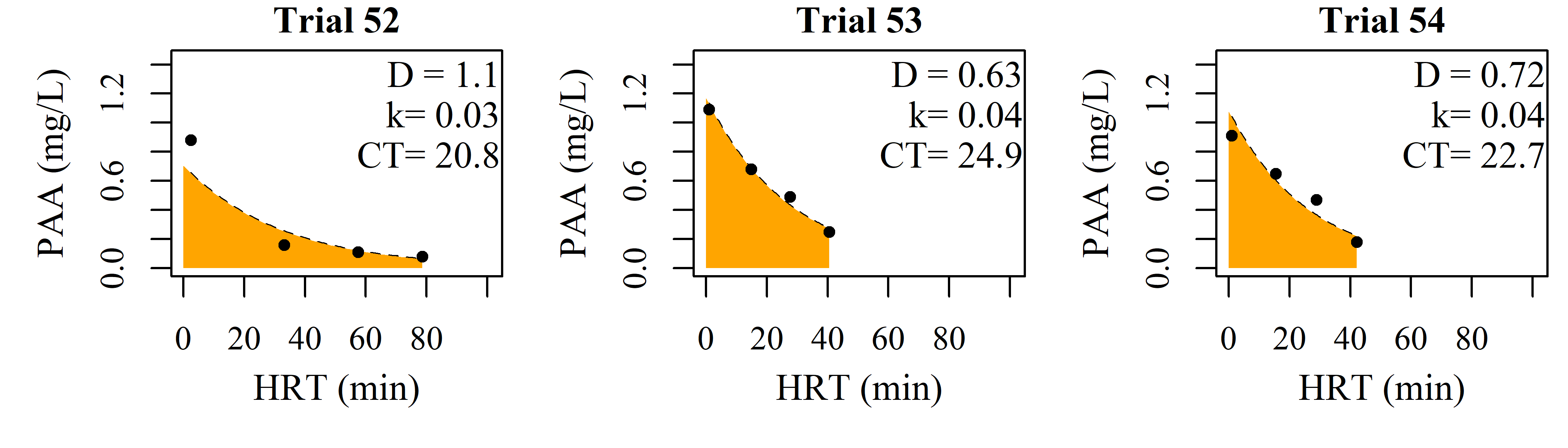
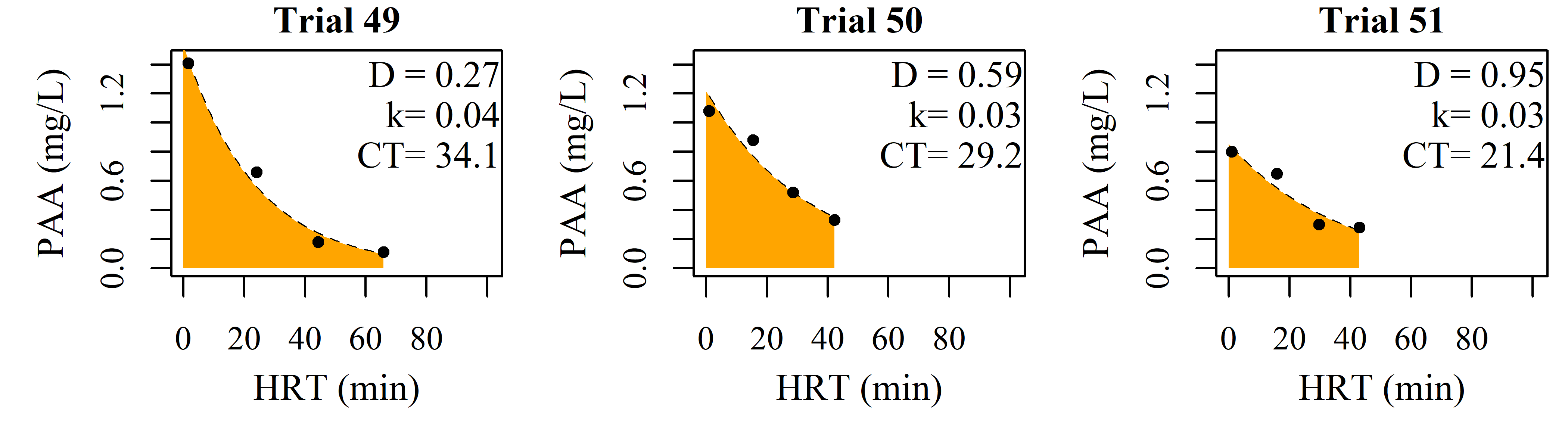
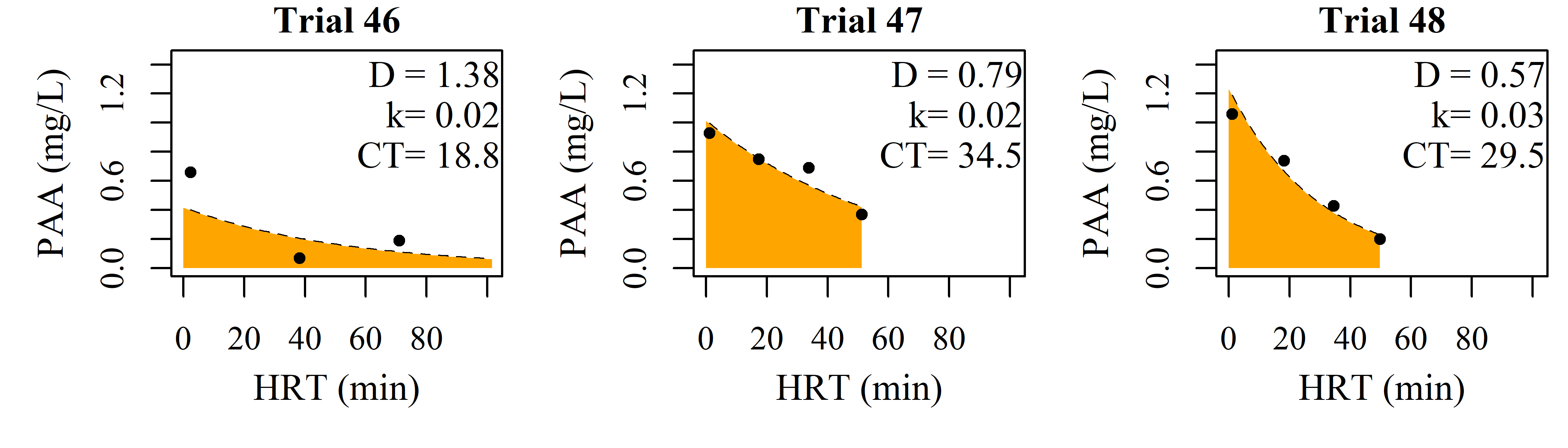
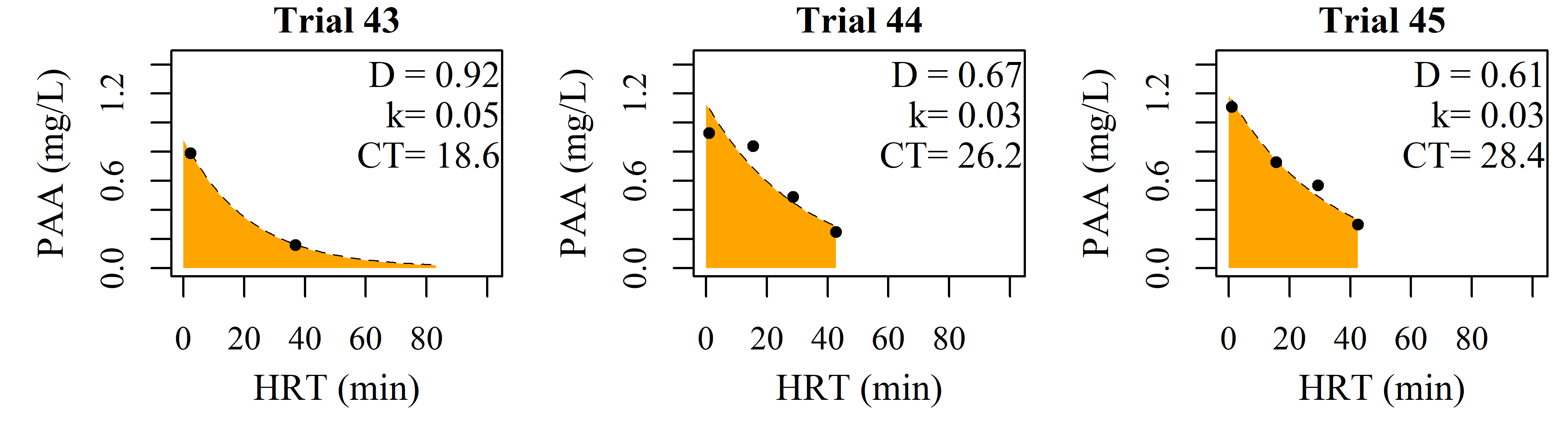
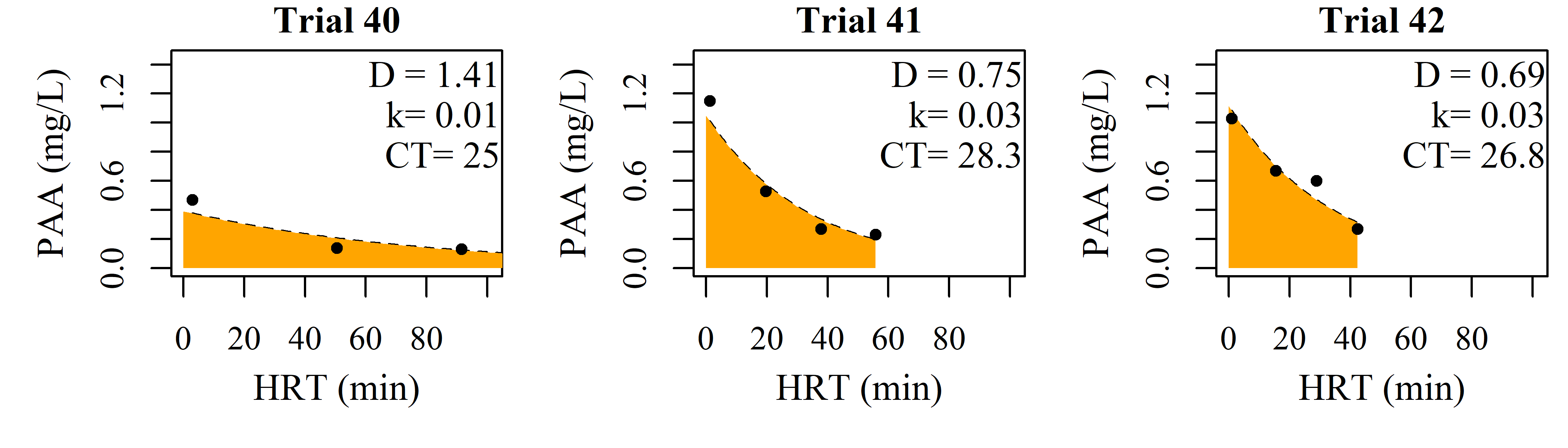
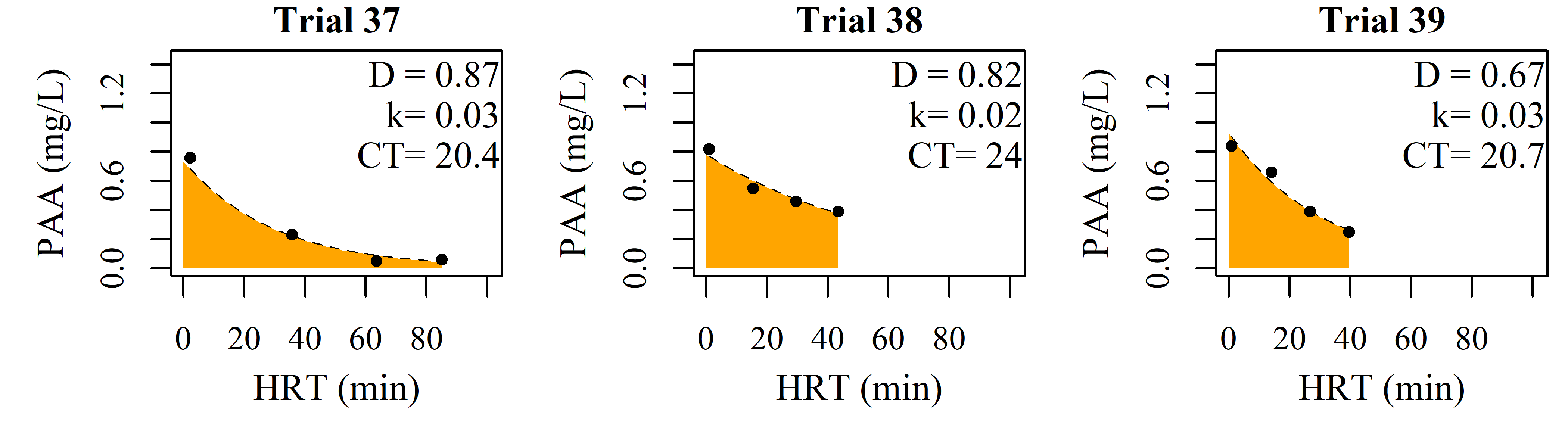
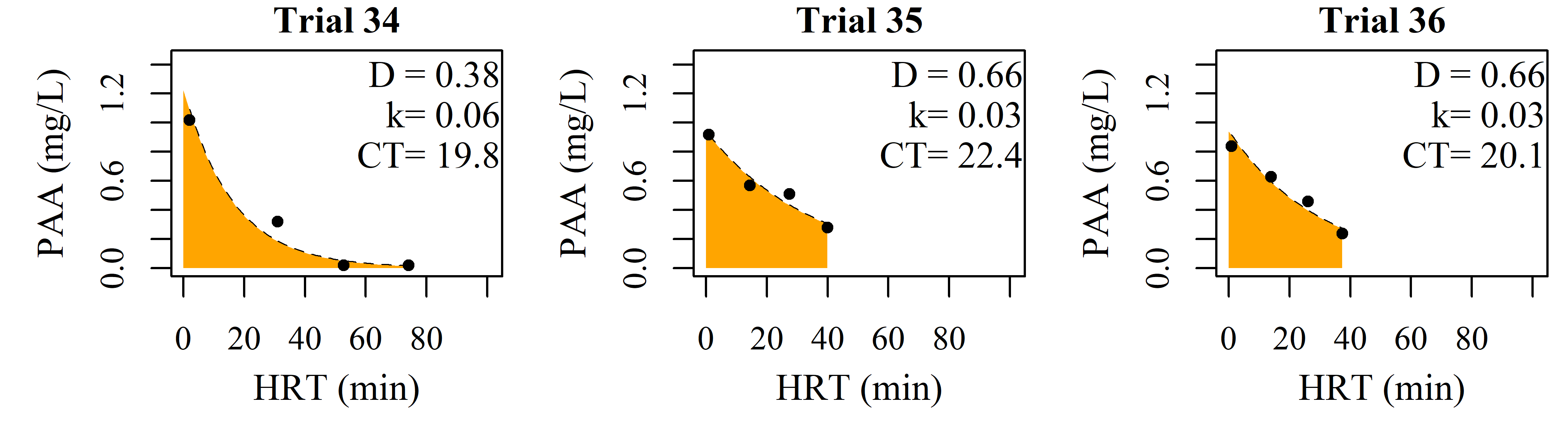
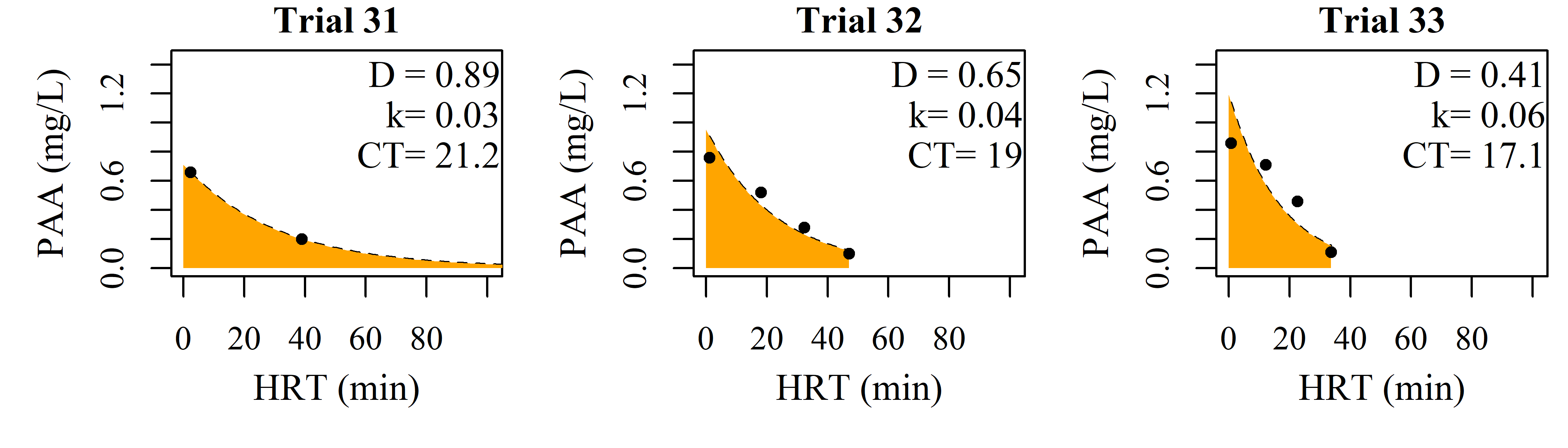
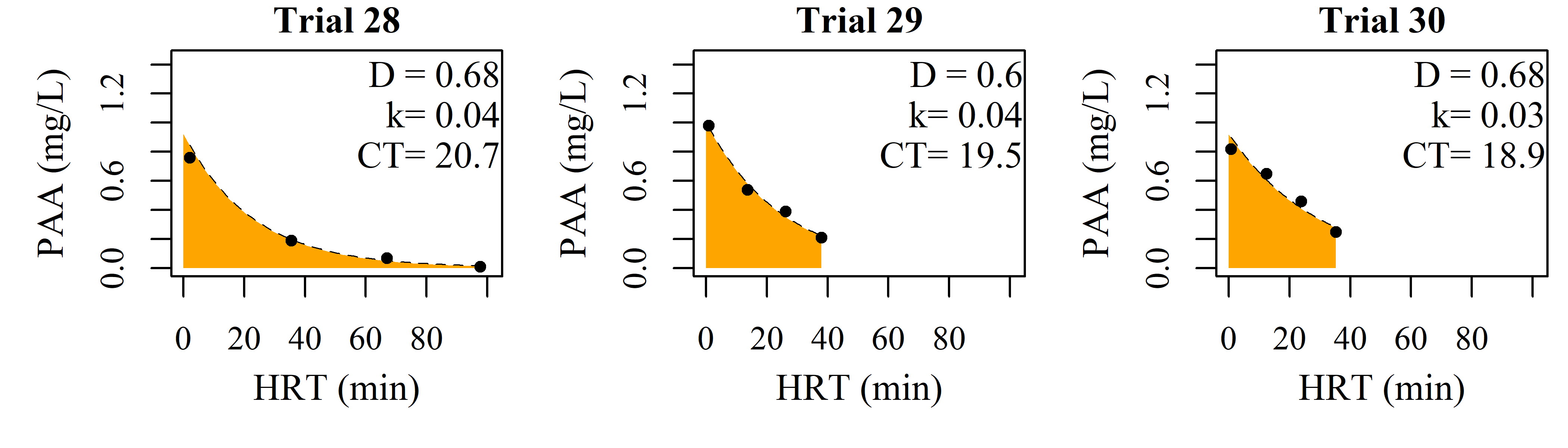
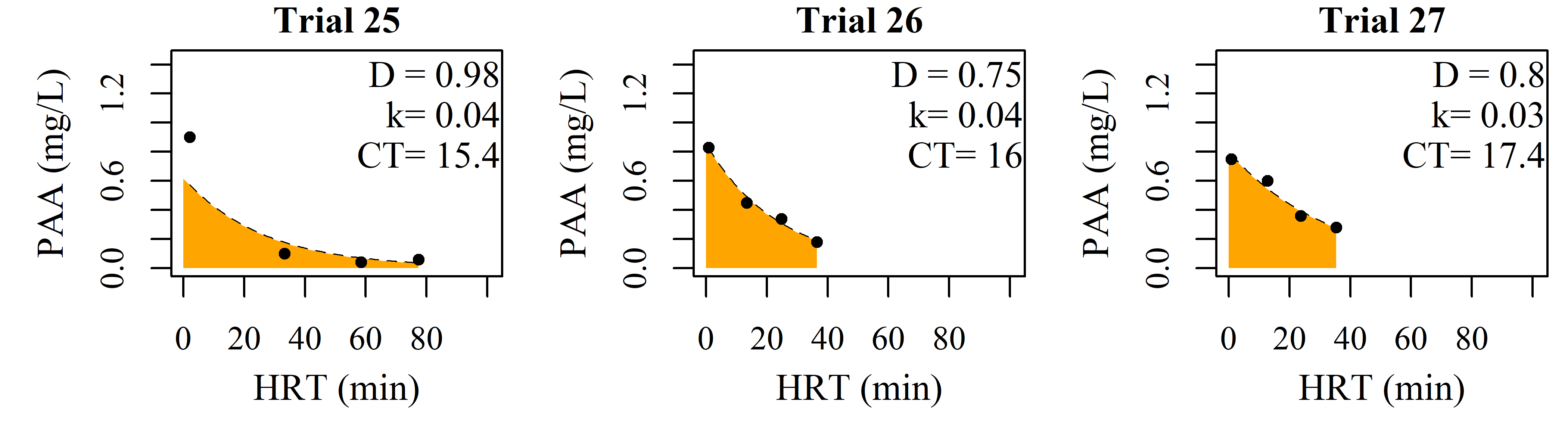
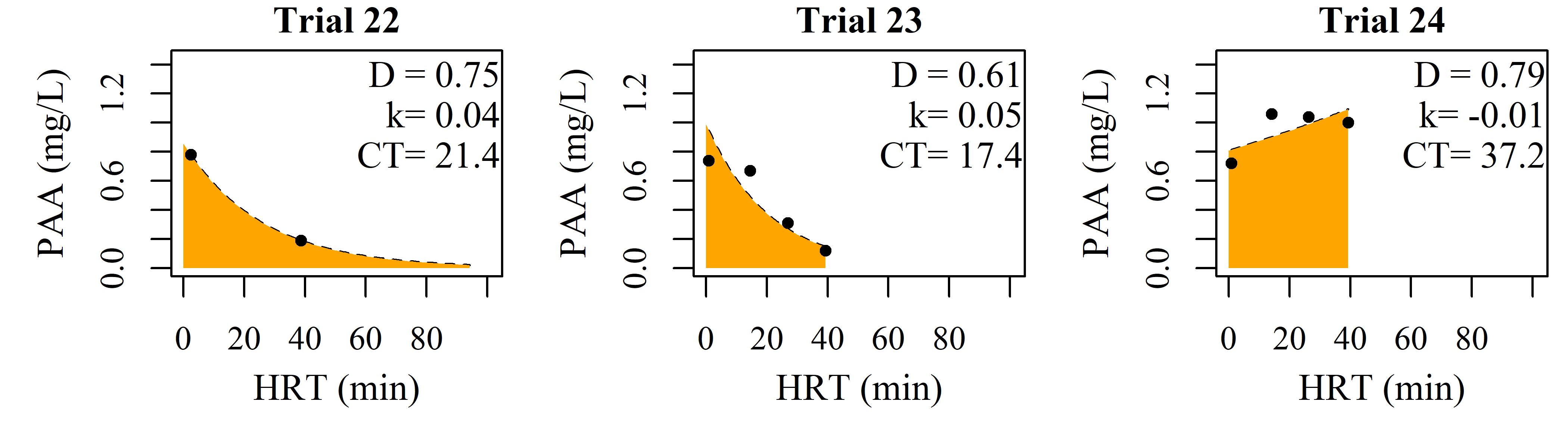
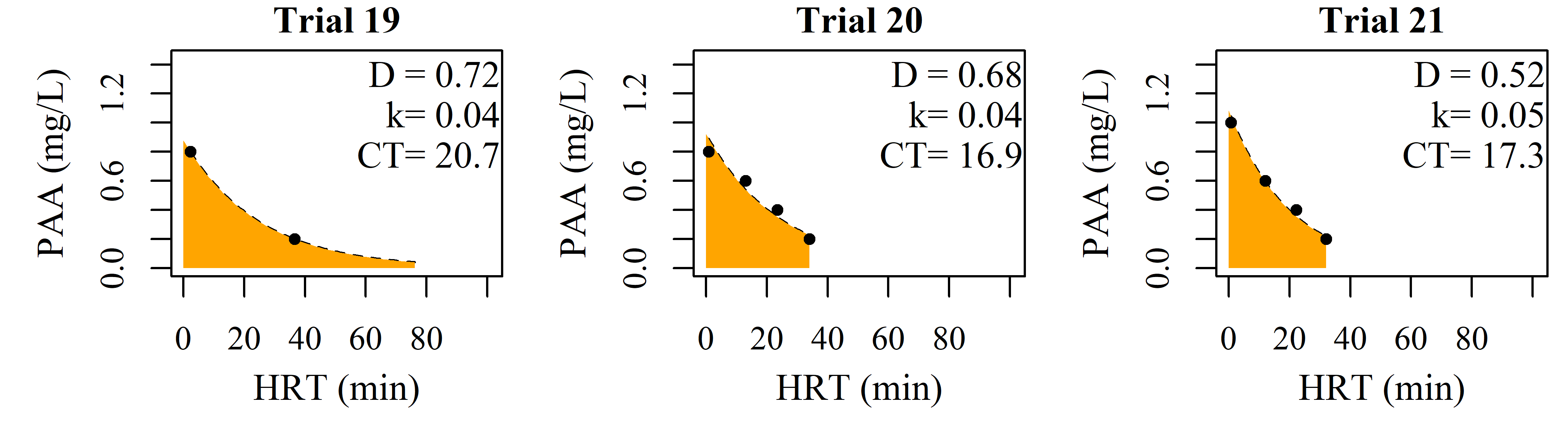
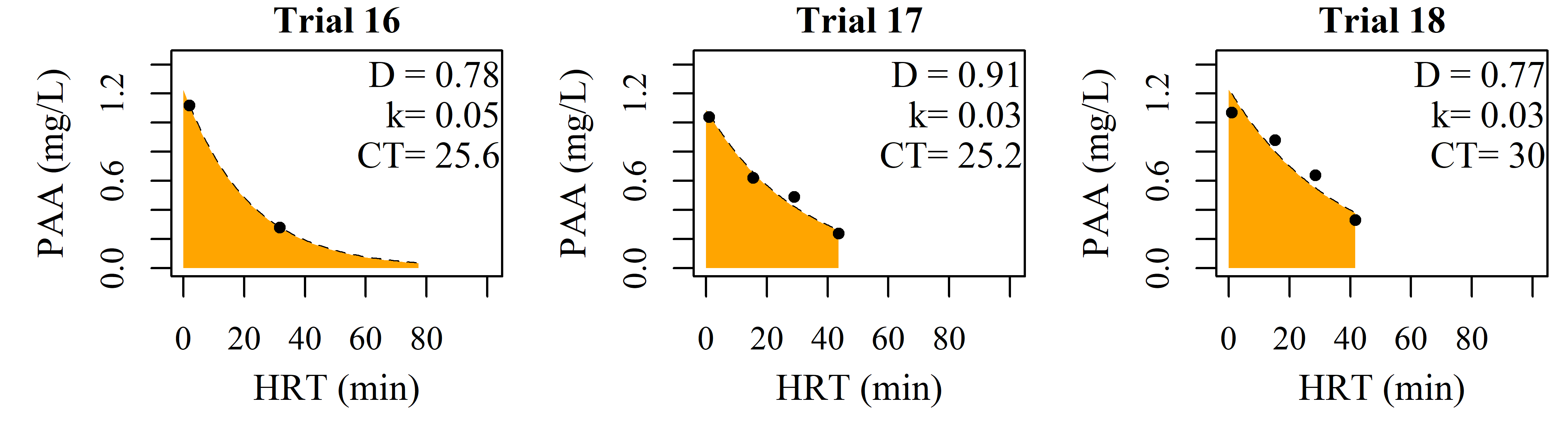
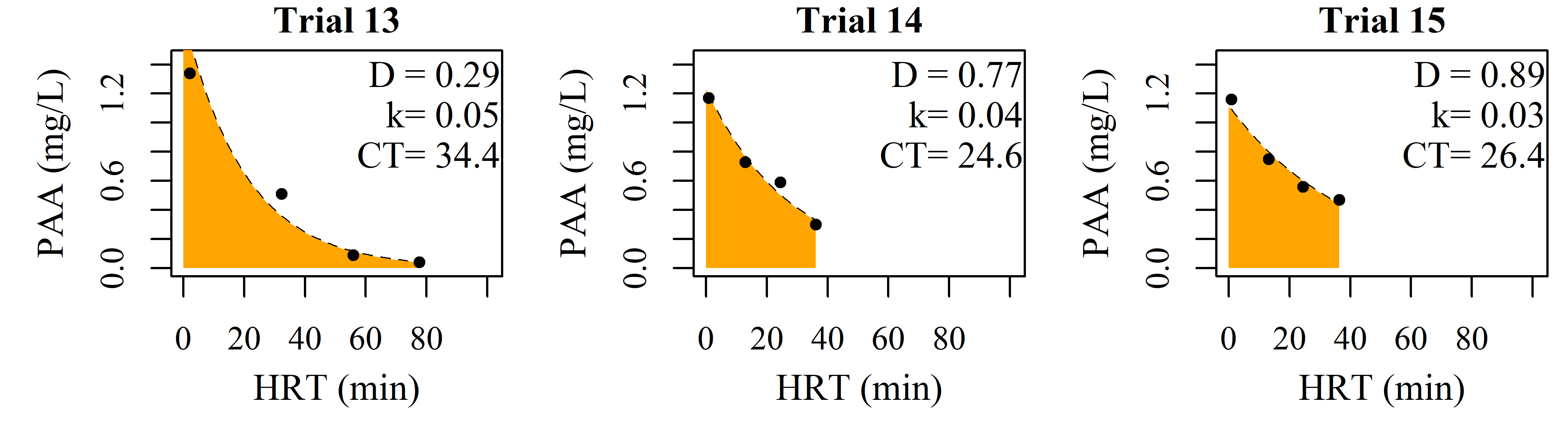
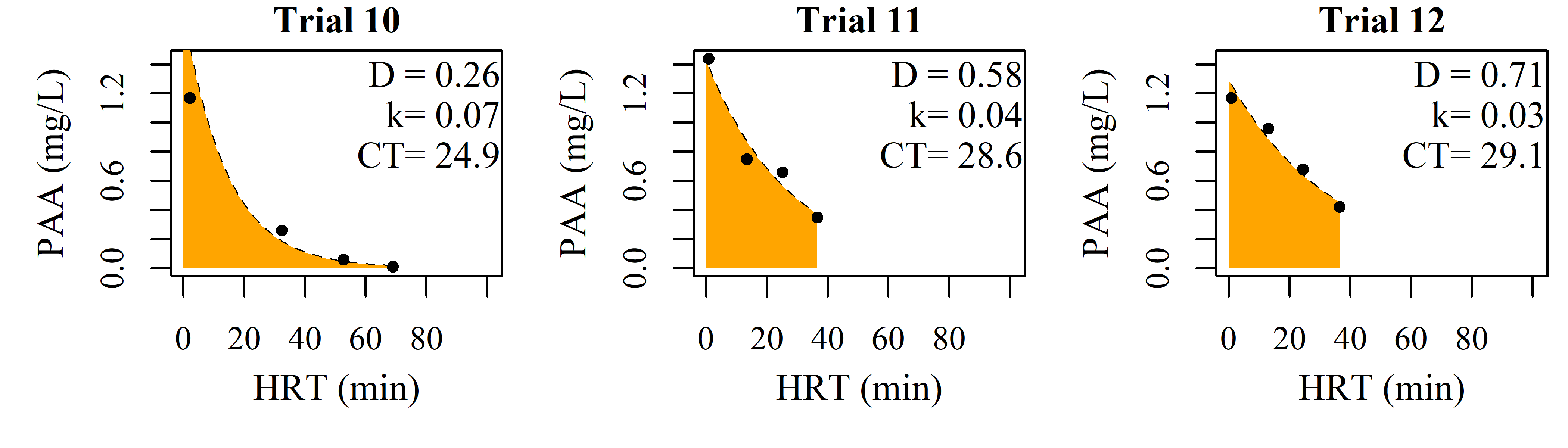
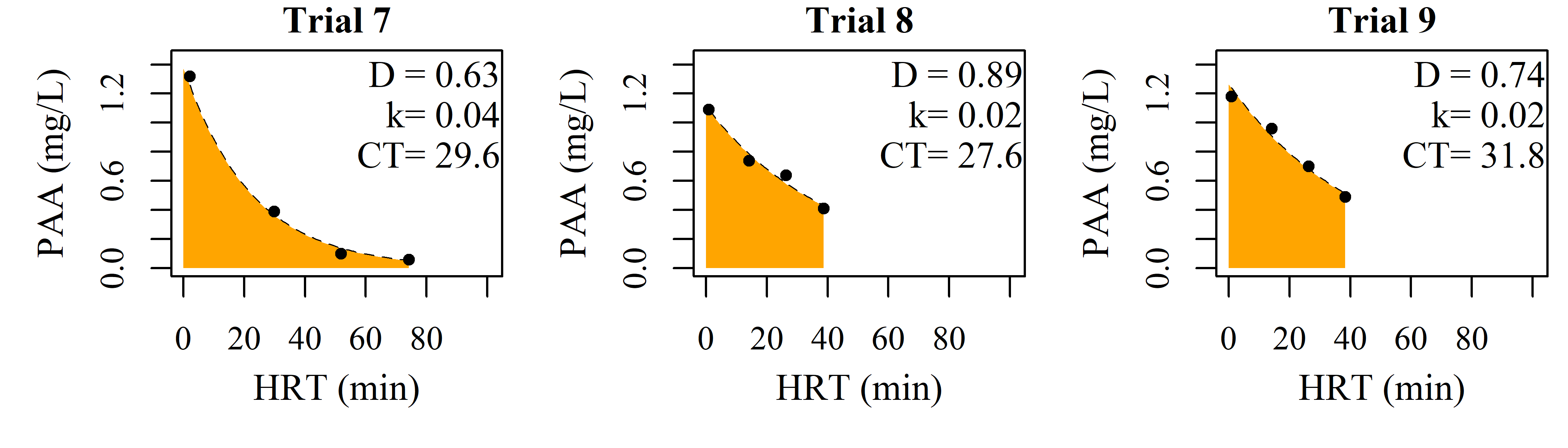
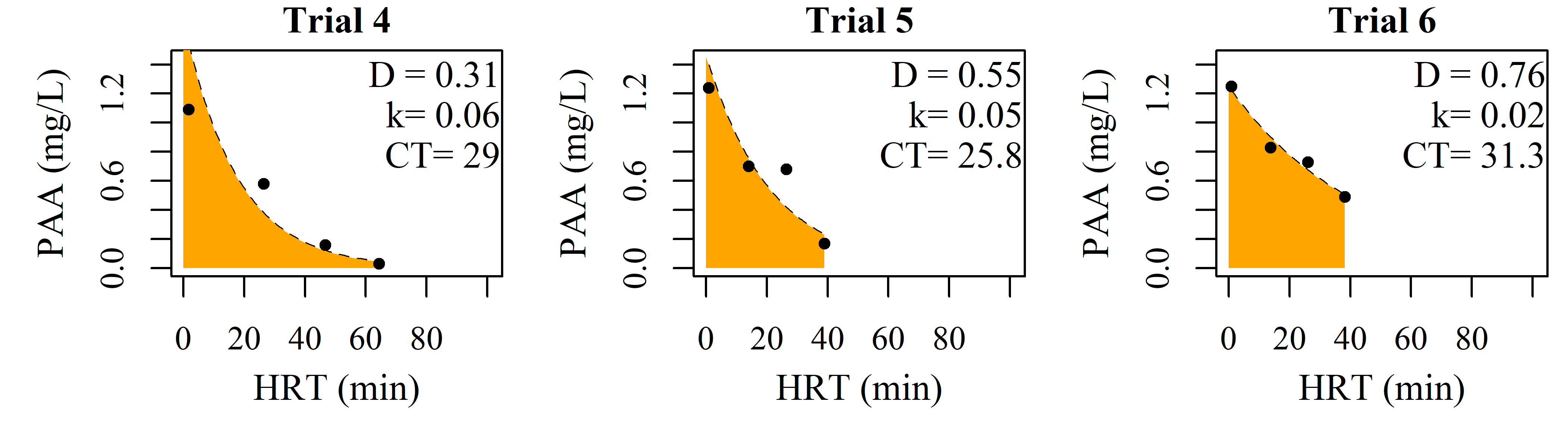
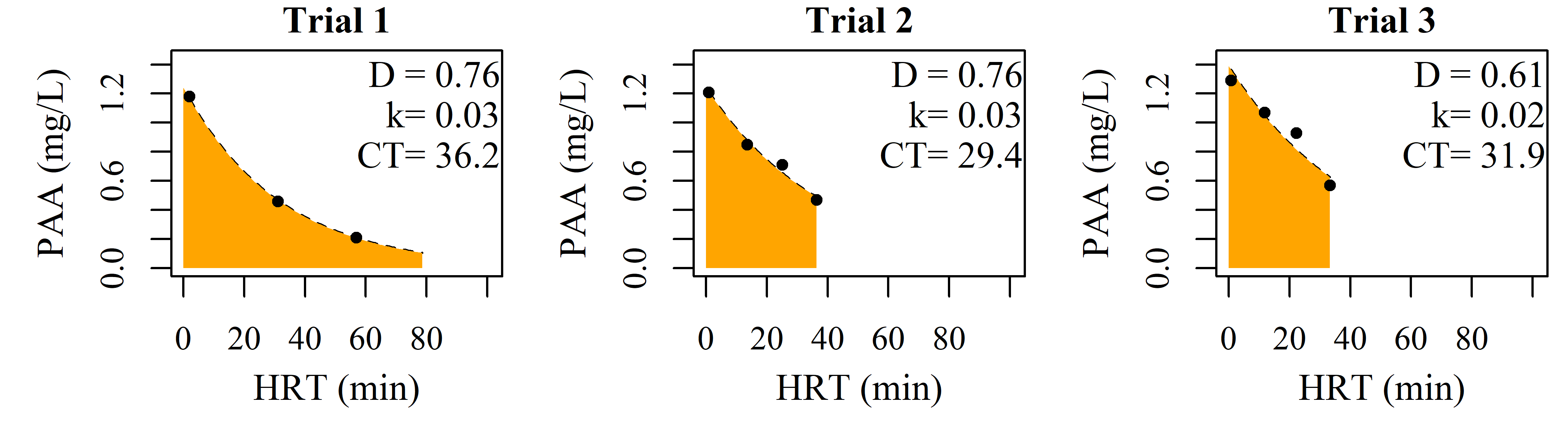
Kate Newhart

2019-12-19

# July 2019 Evaluation

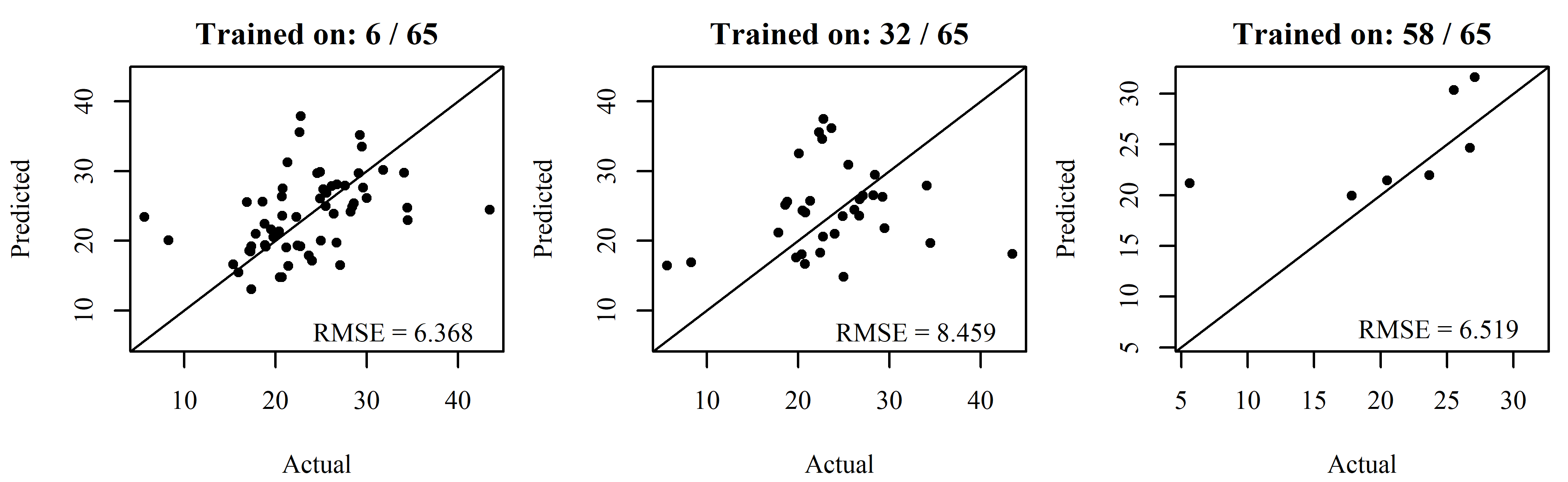
## Step 1: Calculate CT

For each sampling event and location, HRT was calculated to fit to a first-order decay model to generate PAA concentration as a function of time (). The integral of and the total disinfection potential () is where is the PAA cocentration at time 0 and is the model parameter for first-order decay. is not equal to the initial dose of PAA () but the residual after some initial PAA demand () has been consumed (). Model parameters and are fit for each sampling event and CT calculated (highlighted in orange below). Of the 66 sampleing events, only event #24 is excluded from further analysis due to poor data (PAA measured at the 1-minute sample location is less than all downstream locations).

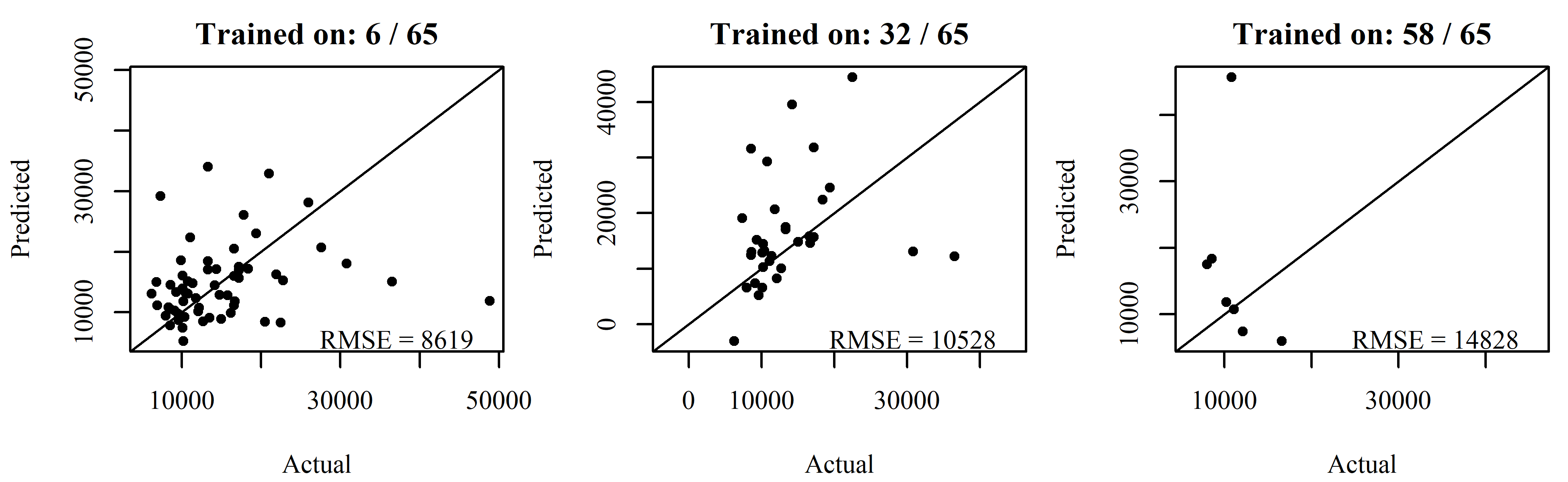


## Step 2: Predict CT

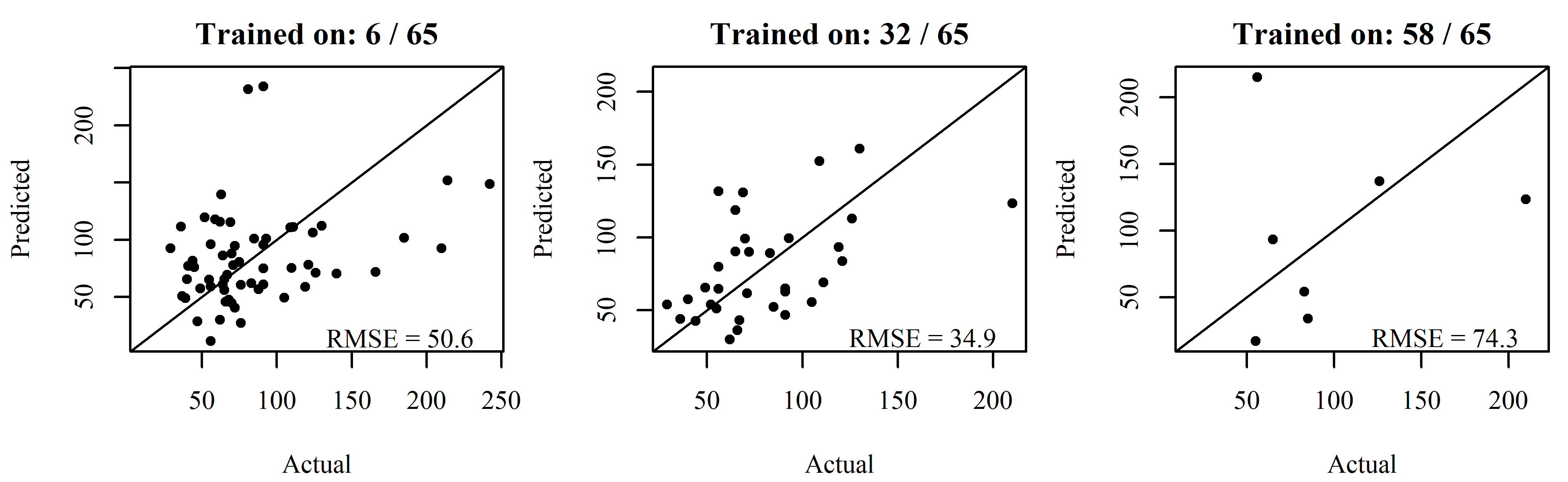
Using artifical neural networks (ANN), CT can be predicted from minute of the day, disinfection basin influent flow, PAA flow, PAA residual from a Chemscan instrument downstream of the 1-minute sample location, aerobic SRT of the secondary process, and a variety of water quality measurements taken at the effluent of the secondary process (ammonia, nitrate, nitrite, phosphorus, and TSS). A rolling window approach is used for testing in which a training dataset of *n* observations is used to fit a 1-layer ANN with 5 nodes. Observation is compared to the ANN prediction at time *n*+1 using root mean squared error (RMSE). The window then moves forward to include observations 2–(*n*+1) and test observation *n*+2. The window moves forward, is re-trained, and tested on a new obseration for the entire dataset (unitl all 65 sampling events have been used for training or testing).



## Predict Predisinfection E.coli



## Predict Final E.coli



## Step 6: Real-time *E. coli*