

SUPPLEMENTAL MATERIALS AND METHODS

At the core of the input recovery method lies the non-linear optimization (lsqnonlin, MATLAB) of the objective function (Supp. Eq.2), which has as input

- 1) a vector p with 9 parameters (7 parameters of the Feng sub-function (Supp. Eq.1), and $p(8)$ and $p(9)$ weights for the constraint %5 and %6)
- 2) fit_data (the structure with all fixed and updated parameters, such as tail samples and performance parameters, explained in detail below)

While the optimization is ongoing, inside the objective function, the y data (fitted recovered input) is calculated for every iteration until convergence.

Supp. Eq. 1 (Feng Input):

$$(p(2)*(t - p(1)) - p(3) - p(4)) * \exp(p(5)*(t - p(1))) + p(3) * \exp(p(6)*(t - p(1))) + p(4) * \exp(p(7)*(t - p(1)))$$

Supp Eq. 2 (pseudo code of the objective function to be minimized at each iteration):

Objective_function=

$$\begin{aligned} & [fit_data.weight1.*((fit_data.latesamples_y - y(p,fit_data,t))./fit_data.latesamples_standarddev); \%1 \\ & fit_data.weight2.*((fit_data.parameters_average - p(1:7))./fit_data.parameters_standarddev); \%2 \\ & fit_data.weight3.*(((m1_intercept + m1_r.*p(5)./p(2))) - max_peak)); \%3 \\ & fit_data.weight4.*(((m2_intercept + m3_r.*vss) - p(2)))); \%4 \\ & p(8).*(((m3_intercept + m3_r.*dose) - AUC_2_to_4_min)); \%5 \\ & p(9).*(MRT_fitted_curve_5_to_100_min - MRT_original_curve_5_to_100_min)]; \%6 \end{aligned}$$

$y()$ is the function that produces the recovered fitted curve with parameters p (Feng function), the

fit_data (structure) and t the time column. In fit_data the used fields by the objective function are:

weights1-4 that have been optimized and fixed during training.

latesamples_y: the list of the activity concentration of the late samples

latesamples_standarddev: the standard deviation of the activity concentration of the late samples

parameters_average: the average of the parameters of Feng input before the fitting (fixed by training)

parameters_std: the standard deviation of the parameters of Feng input before the fitting (fixed by training)

m1_intercept and m1_r: refer to the regression of Step 4a1 in the manuscript

m2_intercept and m2_r: refer to the regression of Step 4a2 in the manuscript

m3_intercept and m3_r: refer to the regression of Step 4a3 in the manuscript

max_peak: maximal activity at the peak

vss: volume of distribution at steady state (see Eq.5 in the main text)

dose: injected dose in MBq

AUC_2_to_4_min = is recalculated at each iteration

MRT_fitted_curve_5_to_100_min = mean retention time of the tail is recalculated at each iteration