

## Interpreting the STRmix drop-in parameters

There are some theoretical considerations that suggest that the shape of a curve fitted to the heights of drop-in peak should be gamma [1]. However we only ever see a tiny part of this curve, that bit that is above the analytical threshold (AT). There are some advantages to fitting a gamma to the data. First a gamma curve has no probability below 0. This fits with drop-in peak heights since these also cannot be less than 0. At the right hand tail the gamma gives less probability as the peak gets higher. Again this seems sensible. Drop-in peaks are expected to be small and the probability of a large drop-in peak should be less than that of a smaller drop-in peak.

As stated we only observe peaks at all when they are above the AT. It is often useful to drop the AT to inform this curve and then return it to its normal position for casework. These additional data would not be observed in casework but help inform the curve.

The curve is fitted using three parameters:  $\alpha$ ,  $\beta$ , and  $\text{Pr}(C)$ .

We illustrate this using data from Grand Rapids, Michigan (see figure 1). The AT in use for casework was 250RFU. However to facilitate fitting the curve data were collected down to an AT of 50RFU. There were 1798 loci scored in the data. 20 showed a drop-in peak above 50RFU and only 1 was above 250RFU. The observed drop-in rates are therefore 1.11% above 50 RFU and 0.06% above the casework AT 250RFU.

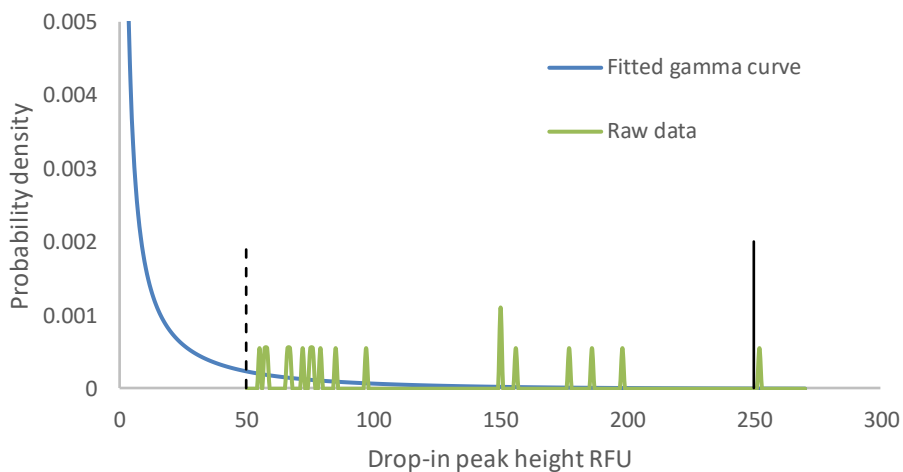


Figure 1. The raw data and fitted gamma curve. The casework AT = 250RFU and the value used collecting these data 50RFU are marked.

The curve fits with the parameters  $\alpha = 0.06$ ,  $\beta = 95.52$ , and  $\text{Pr}(C) = 0.3453$ .

$\text{Pr}(C)$  has been interpreted as the drop-in rate. This misunderstanding is aggravated by the STRmix output labelling it the drop-in frequency. This is changed in V2.7. The value 0.3453 (given as 34.53% in US v Gissantaner [2] and the associated Amicus letter) is in fact simply a curve fitting parameter. It is actually the area under the curve down to 0 RFU and as such is the drop-in rate if peaks could be measured down to 0 RFU. As given above the actual drop-in rate above the casework AT of 250RFU is 0.06%.

1. Puch-Solis, R., *A dropin peak height model*. Forensic Science International: Genetics, 2014. **11(0)**: p. 80-84.
2. *USA versus Gissantaner*. 2019, UNITED STATES DISTRICT COURT WESTERN DISTRICT OF MICHIGAN SOUTHERN DIVISION