

# Package ‘tican’

November 9, 2025

**Type** Package

**Title** Plot and Analyse Time-Intensity Data

**Version** 1.1.0

**Maintainer** Samuel James Tingle <samjamestingle@gmail.com>

**Description** Plots and analyzes time-intensity curve data, such as data from (contrast-enhanced) ultrasound. Values such as peak intensity, time to peak, area under the curve, wash in rate and wash out rate are calculated.

**License** MIT + file LICENSE

**Encoding** UTF-8

**RoxygenNote** 7.3.3

**URL** <https://github.com/sjtingle/tican>

**BugReports** <https://github.com/sjtingle/tican/issues>

**Suggests** knitr, rmarkdown

**VignetteBuilder** knitr

**NeedsCompilation** no

**Author** Samuel James Tingle [aut, cre]

**Repository** CRAN

**Date/Publication** 2025-11-09 21:10:02 UTC

## Contents

tic_analyse . . . . .	2
tic_auc . . . . .	3
tic_wir . . . . .	4
tic_wor . . . . .	5
tpeak . . . . .	5

<b>Index</b>	<b>7</b>
--------------	----------

tic\_analyse

*Plot and analyse time-intensity data***Description**

This function plots and analyzes time-intensity data, such as data from (contrast-enhanced) ultrasound cineloops. Peak intensity and time to peak intensity are calculated from a smoothed curve through the data (loess smoother). Area under the curve is calculated from the raw data using the trapezium method for integration. Time to peak proportion (for example time to 90 percent of peak) can also be calculated. If selected, WiR (wash in rate) is the maximum upslope before the peak value. If selected, WoR (wash out rate) is the absolute value of the maximum downslope following the peak value (with larger values representing higher wash out rate). Both WiR and WoR are calculated based on the slope of the LOESS curve, as they are sensitive to noise in the raw data.

**Usage**

```
tic_analyse(
  data,
  timevar,
  intensityvar,
  loess.span = 0.1,
  AUCmax = NULL,
  peakproportion = NULL,
  calc_wir = FALSE,
  calc_wor = FALSE,
  plotresult = TRUE,
  ...
)
```

**Arguments**

<code>data</code>	A dataframe with time and intensity values as columns.
<code>timevar</code>	A character string (in quotes) with the dataframe column name for the time variable.
<code>intensityvar</code>	A character string (in quotes) with dataframe column name for the intensity variable.
<code>loess.span</code>	A number between 0 and 1, with larger values resulting in a smoother curve.
<code>AUCmax</code>	A number - the maximum time that area under the curve is measured until.
<code>peakproportion</code>	A number between 0 and 1 which is used in the time to peak proportion calculations.
<code>calc_wir</code>	TRUE or FALSE to determine whether WiR is calculated.
<code>calc_wor</code>	TRUE or FALSE to determine whether WoR is calculated.
<code>plotresult</code>	TRUE or FALSE to determine whether a plot of the results is generated.
<code>...</code>	Additional arguments to be passed into the <code>loess()</code> function.

**Details**

Blue dashed lines represent peak and time to peak values. If selected, solid purple lines represent WiR and WoR, and dashed green lines represent time to peak proportion.

A plot of the data is generated and a dataframe with the results is returned.

**Value**

A dataframe with the results. Depending on the plotresult argument can also return a plot of the smoothed curve.

**Examples**

```
# Example usage: Please see package vignettes on CRAN
```

---

tic_auc	<i>Return area under curve from time-intensity data</i>
---------	---

---

**Description**

This function returns area under curve from raw time intensity curves using the trapezoid method. It is recommended that plotresult is set to TRUE in the first instance to visually confirm the analysis.

**Usage**

```
tic_auc(data, timevar, intensityvar, AUCmax = NULL, plotresult = FALSE)
```

**Arguments**

data	A dataframe with time and intensity values as columns.
timevar	A character string (in quotes) with the dataframe column name for the time variable.
intensityvar	A character string (in quotes) with dataframe column name for the intensity variable.
AUCmax	A number - the maximum time that area under the curve is measured until.
plotresult	TRUE or FALSE to determine whether a plot of the results is generated.

**Details**

A plot of the data is generated and a dataframe with the results is returned.

**Value**

Area under the curve. Depending on the plotresult argument can also return a plot of the raw data.

## Examples

```
# Example usage: Please see package vignettes on CRAN
```

---

tic_wir	<i>Return wash in rate from time-intensity data</i>
---------	---

---

## Description

This function returns the wash in rate from time-intensity curve data. Raw data is smoothed using a loess smoother. Wash in rate is calculated as the maximum upward slope of the loess curve before peak intensity is reached. It is recommended that `plotresult` is set to `TRUE` in the first instance to visually confirm the analysis.

## Usage

```
tic_wir(data, timevar, intensityvar, loess.span = 0.1, plotresult = FALSE, ...)
```

## Arguments

<code>data</code>	A dataframe with time and intensity values as columns.
<code>timevar</code>	A character string (in quotes) with the dataframe column name for the time variable.
<code>intensityvar</code>	A character string (in quotes) with dataframe column name for the intensity variable.
<code>loess.span</code>	A number between 0 and 1, with larger values resulting in a smoother curve.
<code>plotresult</code>	<code>TRUE</code> or <code>FALSE</code> to determine whether a plot of the results is generated.
<code>...</code>	Additional arguments to be passed into the <code>loess()</code> function.

## Value

The wash in rate. Depending on the `plotresult` argument can also return a plot of the smoothed curve with the calculated slope shown.

## Examples

```
# Example usage: Please see package vignettes on CRAN
```

---

tic_wor	<i>Return wash out rate from time-intensity data</i>
---------	--

---

### Description

This function returns the wash out rate from time-intensity curve data. Raw data is smoothed using a loess smoother. Wash out rate is calculated as the absolute value of the most negative slope of the loess curve after peak intensity is reached. A higher number therefore refers to faster washout. It is recommended that plotresult is set to TRUE in the first instance to visually confirm the analysis.

### Usage

```
tic_wor(data, timevar, intensityvar, loess.span = 0.1, plotresult = FALSE, ...)
```

### Arguments

data	A dataframe with time and intensity values as columns.
timevar	A character string (in quotes) with the dataframe column name for the time variable.
intensityvar	A character string (in quotes) with dataframe column name for the intensity variable.
loess.span	A number between 0 and 1, with larger values resulting in a smoother curve.
plotresult	TRUE or FALSE to determine whether a plot of the results is generated.
...	Additional arguments to be passed into the loess() function.

### Value

The wash out rate (negative slope). If plotresult=TRUE also draws a plot.

### Examples

```
# Example usage: Please see package vignettes on CRAN
```

---

ttpeak	<i>Return time to peak from time-intensity data</i>
--------	---

---

### Description

This function returns the time to peak from time-intensity curve data. Raw data is smoothed using a loess smoother, and the time of peak is returned. Time to a specified proportion of the peak (e.g. time to 90% of peak) can be calculated. It is recommended that plotresult is set to TRUE in the first instance to visually confirm the analysis.

**Usage**

```
ttpeak(  
  data,  
  timevar,  
  intensityvar,  
  loess.span = 0.1,  
  peakproportion = NULL,  
  plotresult = FALSE,  
  ...  
)
```

**Arguments**

<code>data</code>	A dataframe with time and intensity values as columns.
<code>timevar</code>	A character string (in quotes) with the dataframe column name for the time variable.
<code>intensityvar</code>	A character string (in quotes) with dataframe column name for the intensity variable.
<code>loess.span</code>	A number between 0 and 1, with larger values resulting in a smoother curve.
<code>peakproportion</code>	A number between 0 and 1 which is used in the time to peak proportion calculations. If a number is entered the function will return the time to peak proportion.
<code>plotresult</code>	TRUE or FALSE to determine whether a plot of the results is generated.
<code>...</code>	Additional arguments to be passed into the <code>loess()</code> function.

**Value**

The time at which the loess curve is at its peak. Depending on the `plotresult` argument can also return a plot of the smoothed curve.

**Examples**

```
# Example usage: Please see package vignettes on CRAN
```

# Index

tic\_analyse, [2](#)  
tic\_auc, [3](#)  
tic\_wir, [4](#)  
tic\_wor, [5](#)  
ttpeak, [5](#)