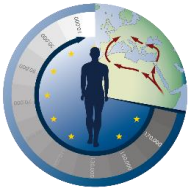


SFB 806 – Our Way to Europe

Universität zu Köln

‘Shiny’ new apps for luminescence: data documentation and analysis

David Strebler, Dominik Brill, Helmut Brückner

Institute of Geography – University of Cologne, Cologne, Germany

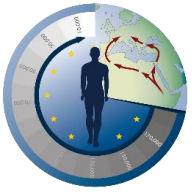
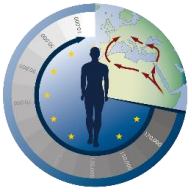


Table of contents



Introduction

What is shiny?

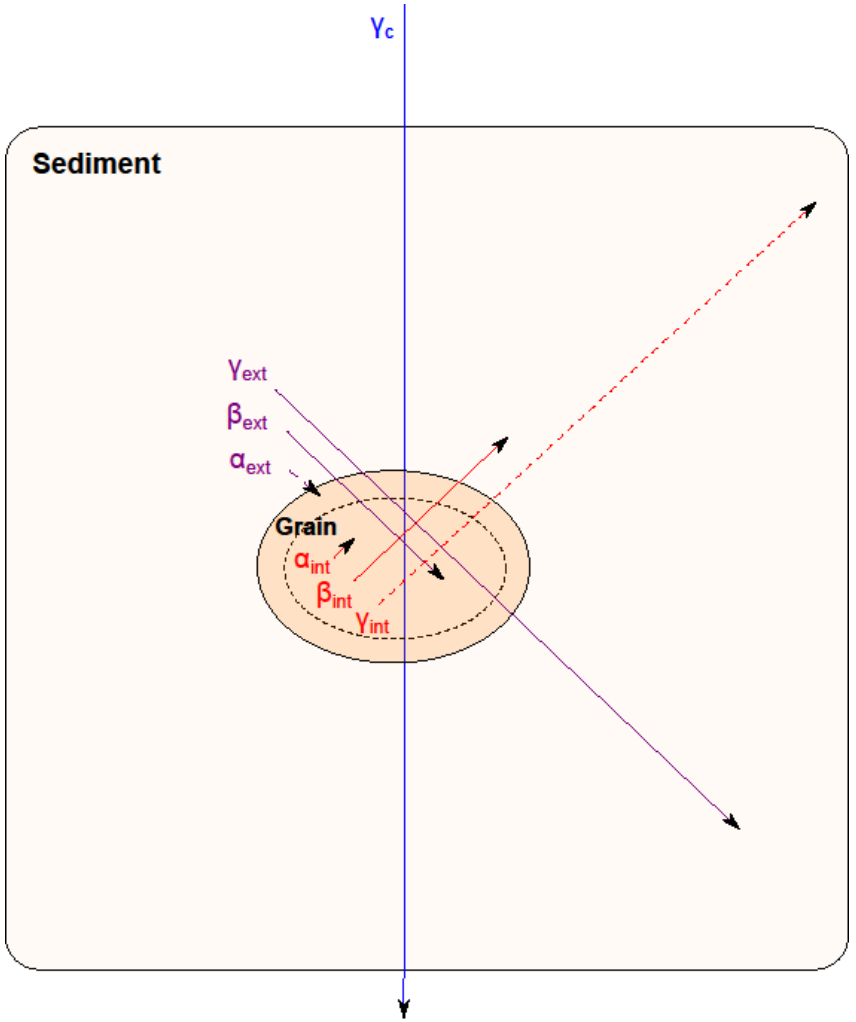
- **R** package that allows to 'turn your analyses into interactive web applications'.
  - Rstudio → GUI for **R**.
  - shiny → GUI for your scripts.
- 'Pure' **R** (no html, css, JS *required*).

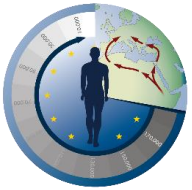
Why making apps?

- More user friendly
  - We are used to graphical user interfaces (GUI) rather than command line interfaces (CLI).
  - Interactive
  - No knowledge in **R** required.
- BUT
  - Less flexible
    - Only do what it is designed for.

shinyDRAC

- **DRAC**
  - Dose Rate and Age Calculator
  - open access, web-based program
    - Aberystwyth university
  - Input/output
    - .csv file
- ***Luminescence* R package**
  - *template_DRAC*
  - *use_DRAC*
  - *calc_CosmicDoseRate*





shinyDRAC: A graphical interface for Ḋ estimation

ShinyDRAC | Sample information | Input | Output | help

Equivalent dose

D_e [Gy]: 20 — δD_e: 0,2

General parameters

Context: sediment

Mineral: Q

Conversion factor: Guerinetal2011

Alpha size attenuation factor: Brennanetal1991

Beta size attenuation factor: Guerinetal2012-Q

Beta etch attenuation factor: Bell1979

Age estimation

Waiting for age calculation

Grain information

Ḋ based on:
- [ ] radioelement concentration
- [ ] direct measurement

Grain size [µm]: min 90 — max 125

Etch depth [µm]: min 8 — max 10

a-value: a 0 — δa 0

Sediment information

Ḋ based on:
- [x] radioelement concentration
- [ ] direct measurement

U [ppm]: 3.4 — δU: 0.51

Th [ppm]: 14.47 — δTh: 1.69

K [%]: 1.2 — δK: 0.14

- [ ] Rb from K

Rb [ppm]: 0 — δRb: 0

Density [mg/mm3]: ρ 1.8 — δρ 0.1

Water content m = (W-D)/D [%]: m 5 — δm 2

Dc information

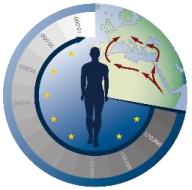
Ḋ based on:
- (•) geographical position
- ( ) in-situ measurement

Latitude: 30 — Longitude: 70

Altitude [m]: 150

- [x] field change correction
- [x] Scale for shallow depth

Depth [m]: ɪ 2.22 — δɪ 0.05



shinyDRAC: A graphical interface for Ḋ estimation

ShinyDRAC | Sample information | Input | Output | help

Input table

Site	Sample	Depth [m]	Grain				Sediment			
			U [ppm]	Th [ppm]	K [%]	a	U [ppm]	Th [ppm]	K [%]	W [%]
DRAC-example	Quartz	2.22 ± 0.05	NA ± NA	NA ± NA	NA ± NA	0 ± 0	3.4 ± 0.51	14.47 ± 1.69	1.2 ± 0.14	5 ± 2

☐ LaTeX source

Result table

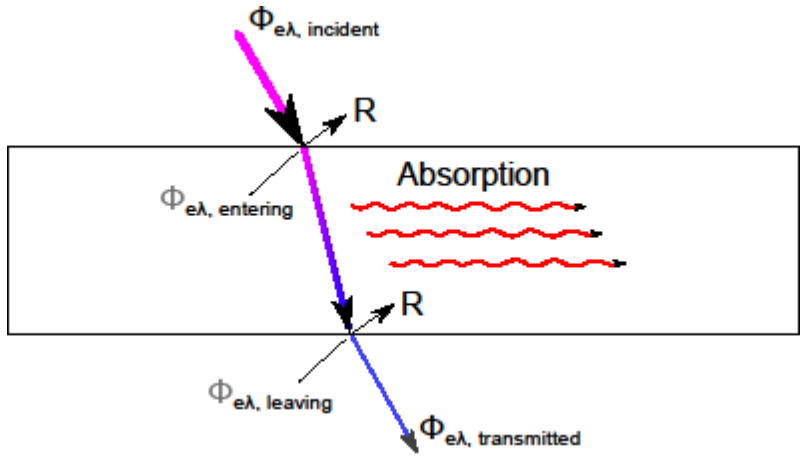
Site	Sample	Depth [m]	Ḋ [Gy/ka]					D_e [Gy]	Age [ka]
			α [Gy/ka]	β [Gy/ka]	γ [Gy/ka]	cosmic [Gy/ka]	Tot. [Gy/ka]		
DRAC-example	Quartz	2.22 ± 0.05	0 ± 0	1.56 ± 0.129	1.298 ± 0.103	0.154 ± 0.015	3.012 ± 0.166	20 ± 0.2	6.642 ± 0.371

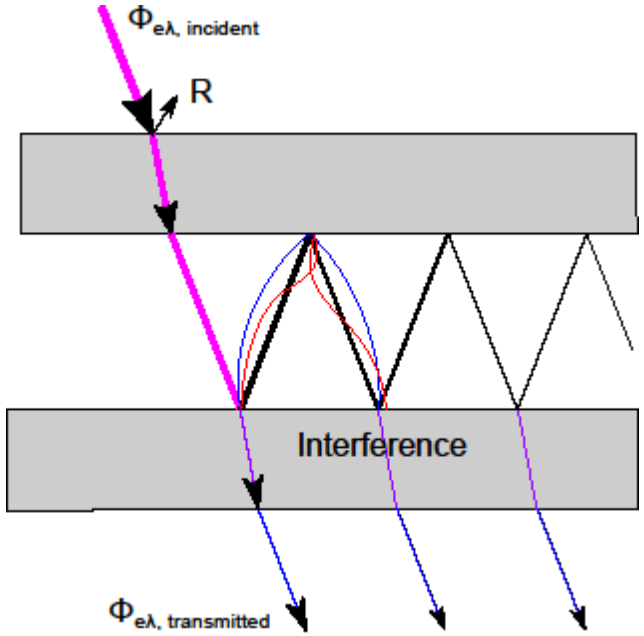
☑ LaTeX source

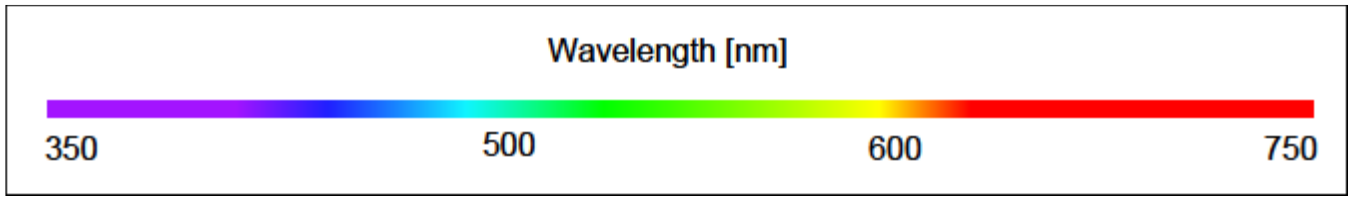
```
\usepackage{multirow}
 \usepackage{pdflscape}

 \begin{landscape}
 \begin{table}
 \renewcommand{\arraystretch}{1.5}
 \centering
 \begin{tabular}{|c|c|c|c|c|c|c|c|c|c|}
 \hline
 \multirow{2}{*}{Site} & \multirow{2}{*}{Sample} & \multirow{2}{*}{Depth} & \multicolumn{5}{c|}{$\dot{D}$ [Gy/ka]} & \multirow{2}{*}{$D_{e}$ [Gy]}& \multirow{2}{*}{Age [ka]} \\
 \cline{4-8}
 & & & $\alpha$ [Gy/ka] & $\beta$ [Gy/ka] & $\gamma$ [Gy/ka] & $D_c$ [Gy/ka] & Tot. [Gy/ka] & & \\
 \hline
 DRAC-example & Quartz & $ 2.22 \pm 0.05 $ & $ 0 \pm 0 $ & $ 1.56 \pm 0.129 $ & $ 1.298 \pm 0.103 $ & $ 0.154 \pm 0.015 $ & $ 3.012 \pm 0.166 $ & $ 20 \pm 0.2 $ & $ 6.642 \pm 0.371 $ \\
 \hline
 \end{tabular}
 \end{table}
 \end{landscape}
```


shinyLumReader: The *LumReader* package

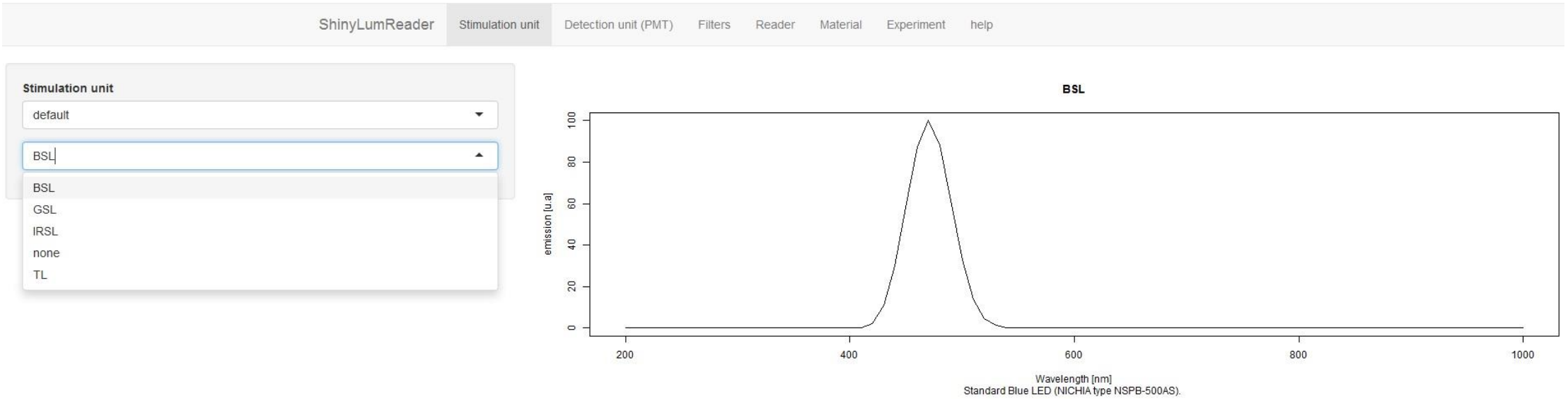
- Reader
  - Stimulation unit
    - TL vs. OSL
  - Detection unit
    - PMT
  - Filters
    - Absorption filter
    - Interference filter
- Experiment
  - Reader + Material
- Material
  - TL properties
  - OSL properties







shinyLumReader:
Simulating a luminescence experiment



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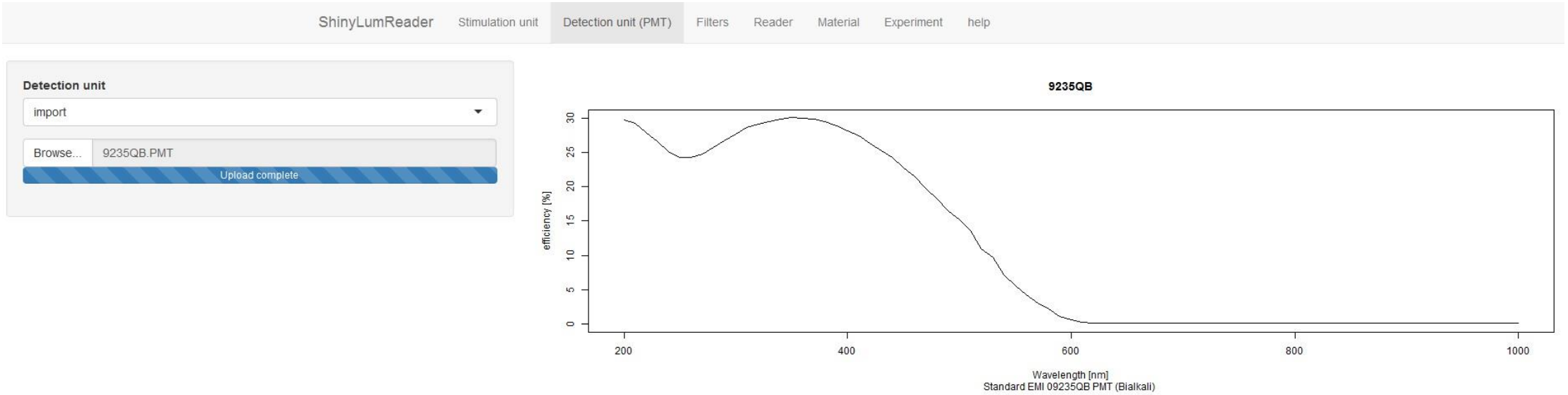
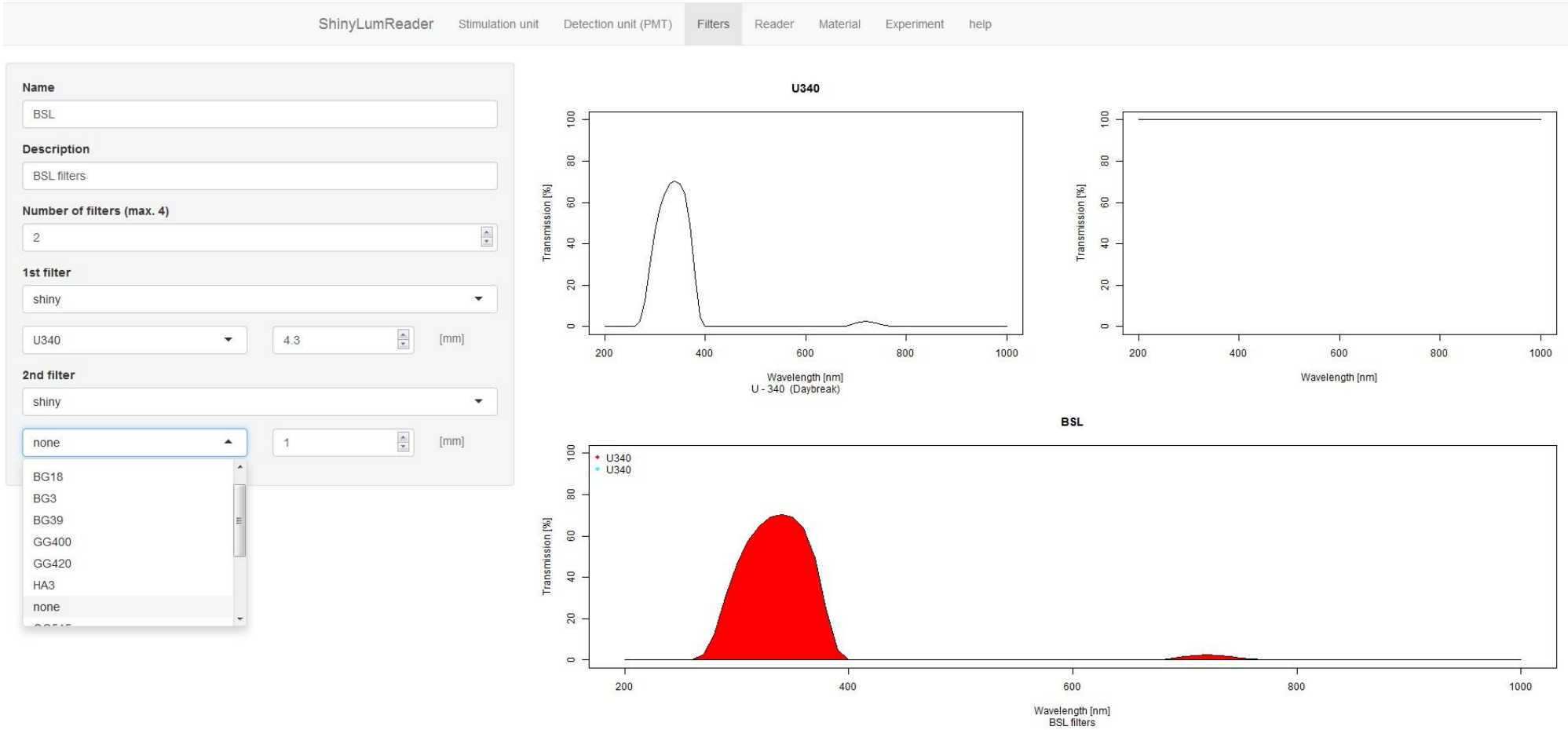
Simulating a luminescence experiment



shinyLumReader: Simulating a luminescence experiment



shinyLumReader:
Simulating a luminescence experiment

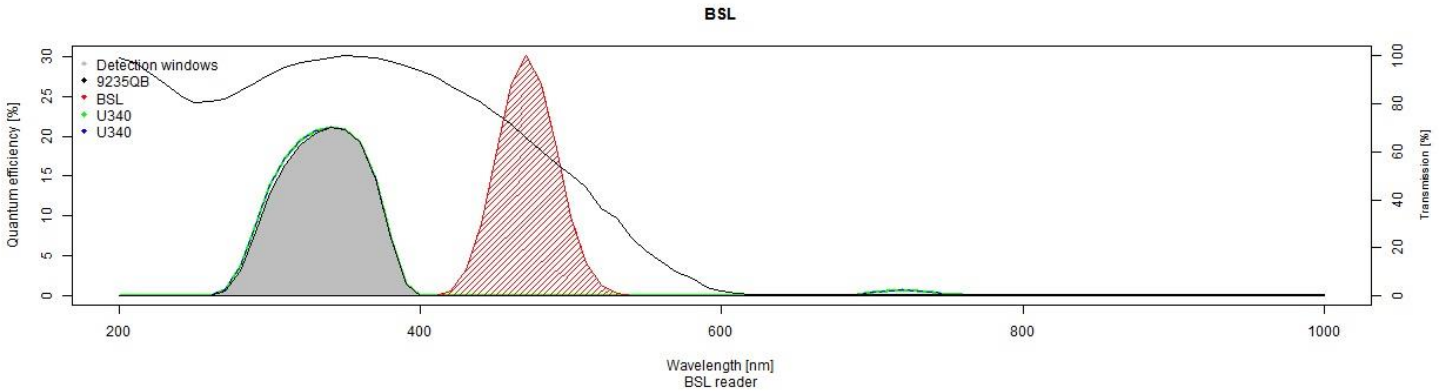
ShinyLumReader | Stimulation unit | Detection unit (PMT) | Filters | Reader | Material | Experiment | help

Name

BSL

Description

BSL reader



shinyLumReader:
Simulating a luminescence experiment

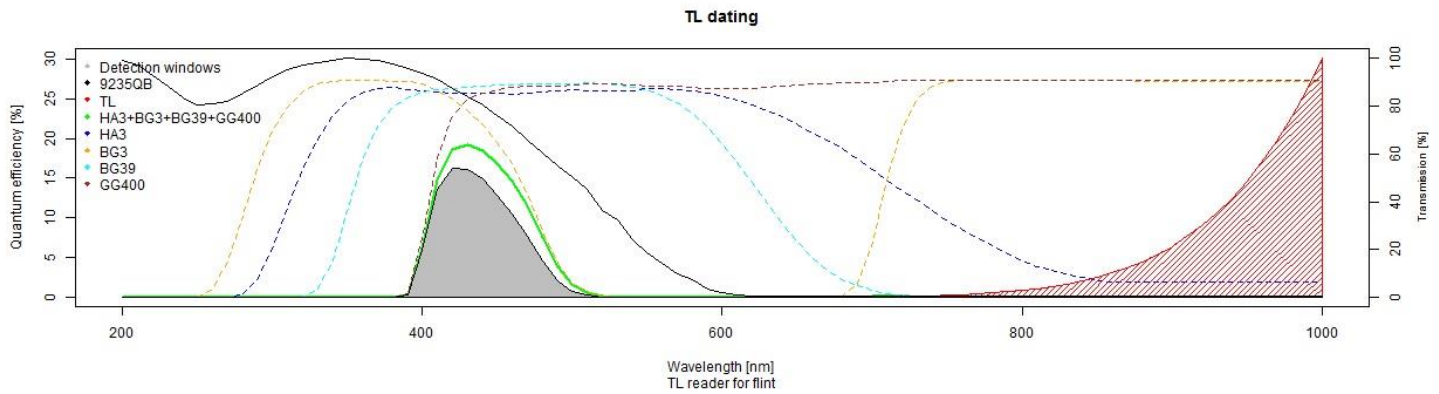
ShinyLumReader | Stimulation unit | Detection unit (PMT) | Filters | Reader | Material | Experiment | help

Name

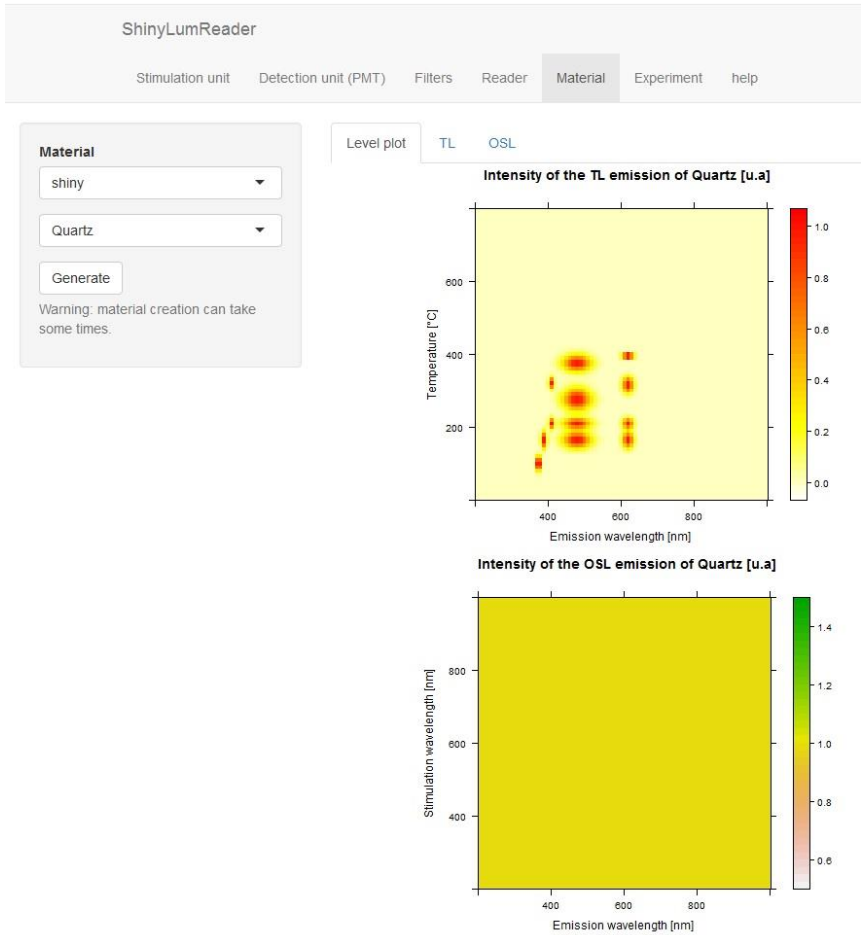
TL dating

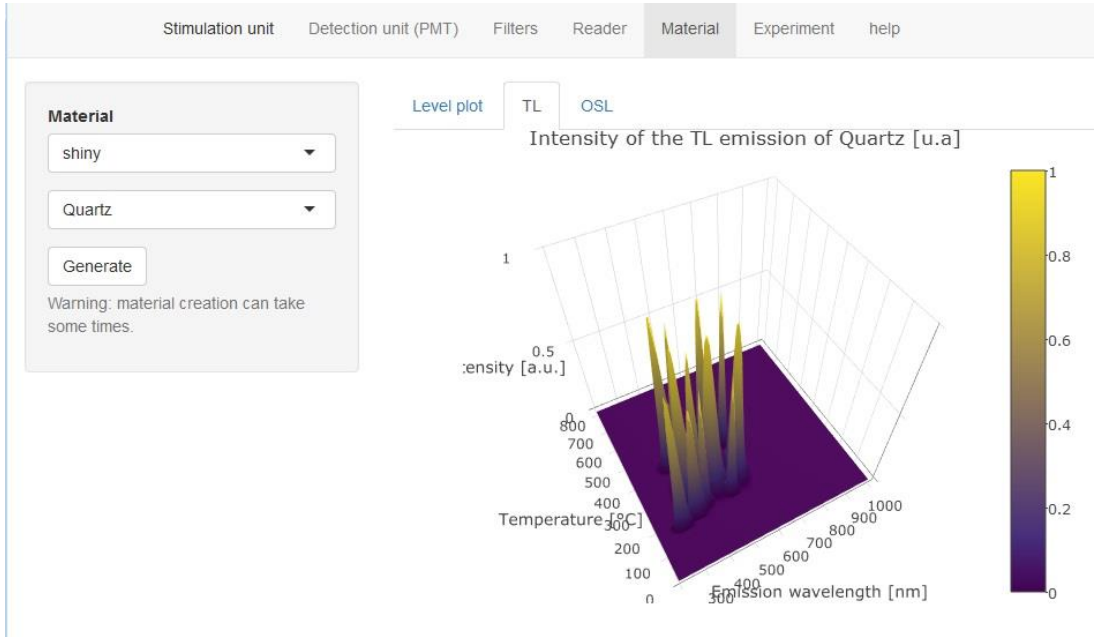
Description

TL reader for flint

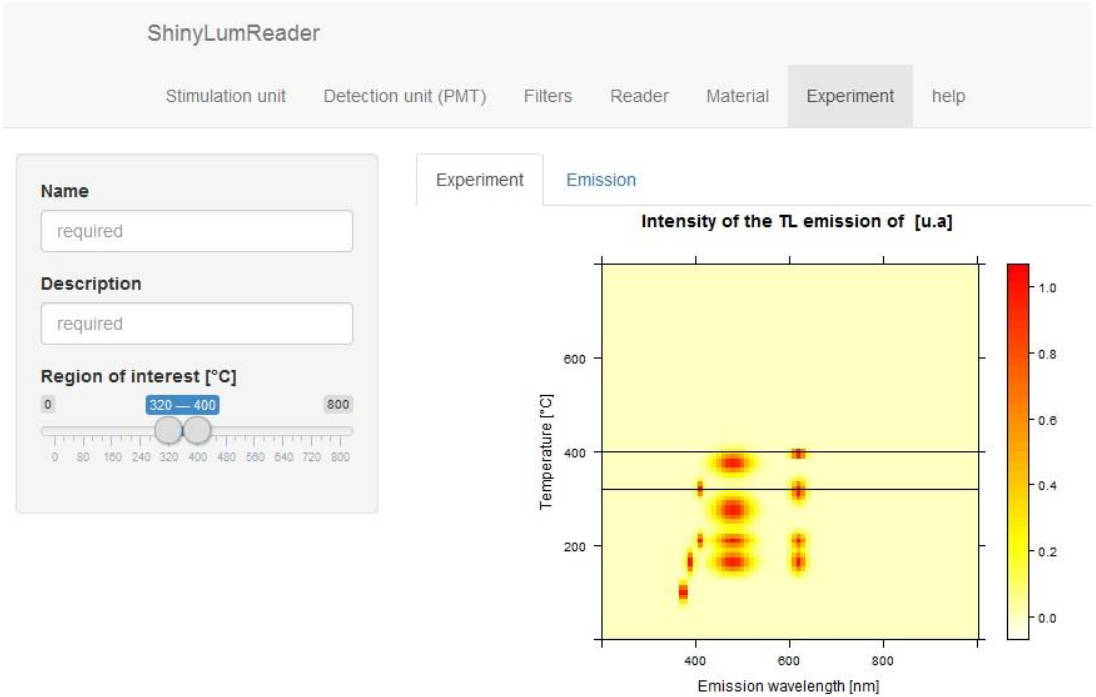


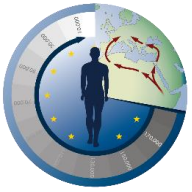
shinyLumReader:
Simulating a luminescence experiment





shinyLumReader: Simulating a luminescence experiment



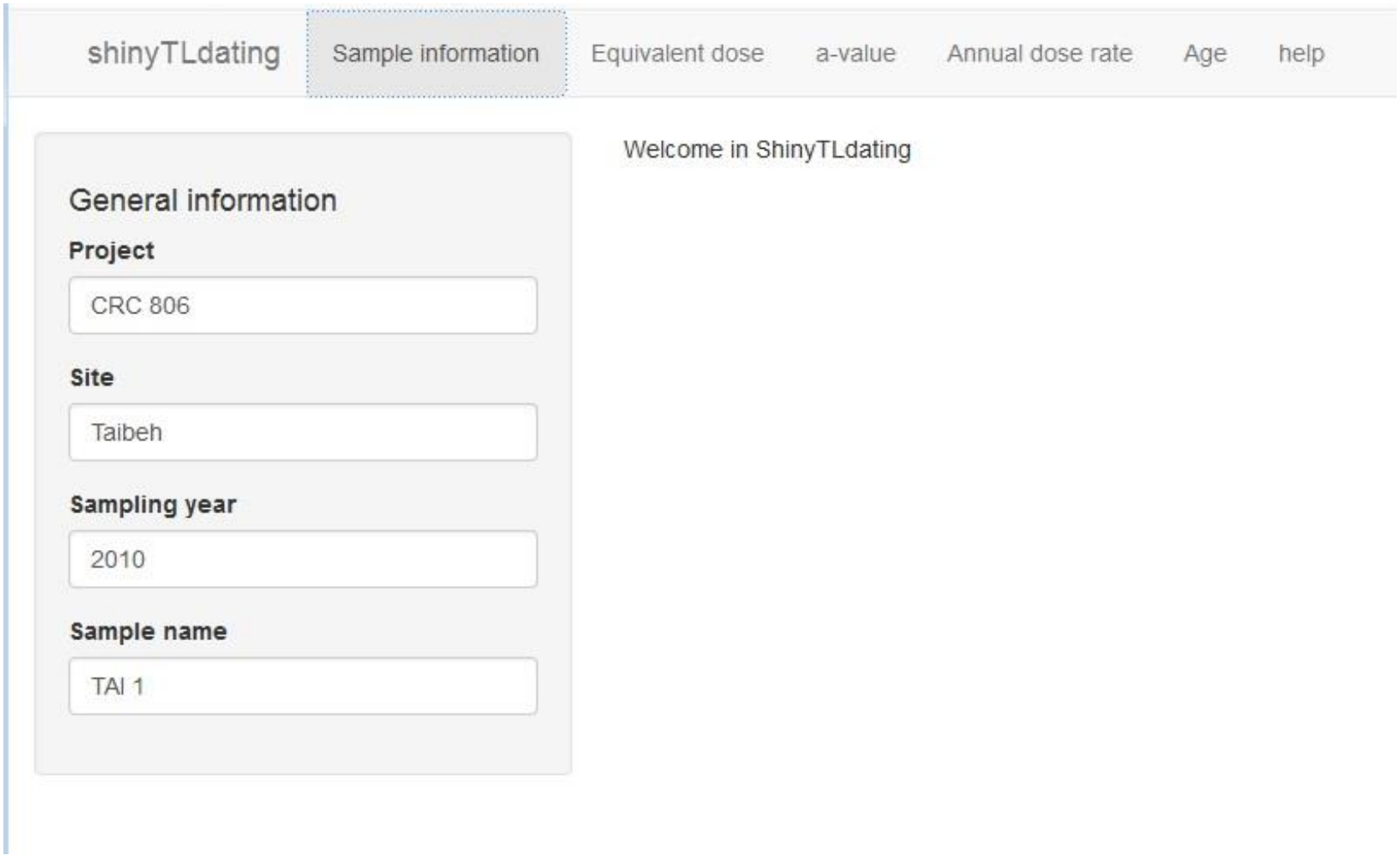


ShinyTLdating

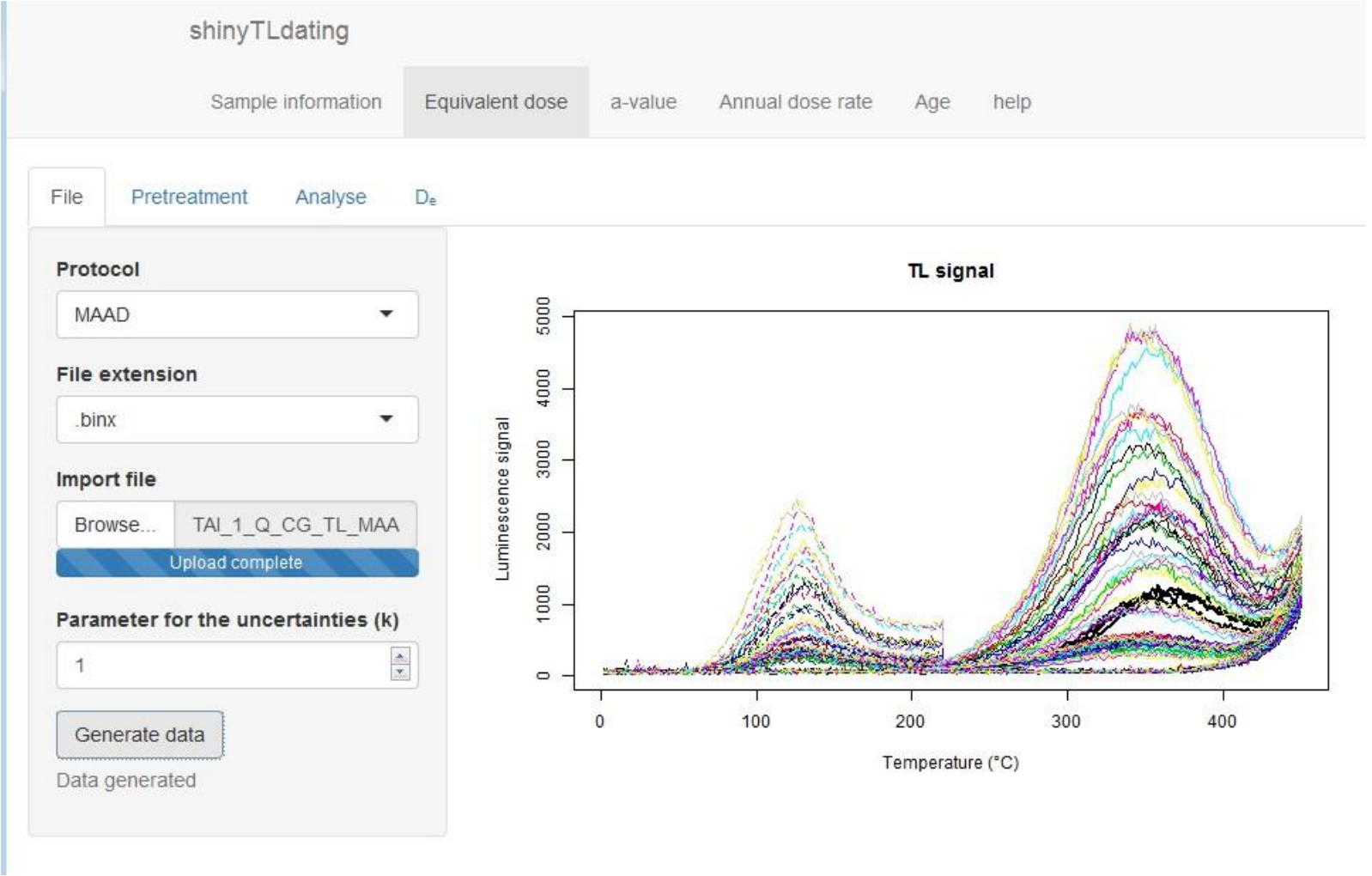
- Luminescence
  - Import files → BINX
  - OSL D_e → SAR
  - Stats & plots for SAR results
    - Abanico plot,…
- TLdating
  - Pretreatment
    - Remove PH, subtract BG, align peaks
  - TL D_e
    - SAR || MAAD
    - Growth curve || dose plateau
  - drac4flint & drac4ceramic

- ShinyTLdating
  - 'All inclusive'
    - D_e estimation
      - SAR || MAAD
    - a-value estimation
      - SAR || MAAD
    - $\dot{D}$ estimation
      - DRAC
    - Age calculation
  - Graphical user interface
    - No script or function to write
    - Easy to modify input parameters
    - Interactive

ShinyTLdating:
An app ‘all inclusive’



ShinyTLdating:
An app ‘all inclusive’



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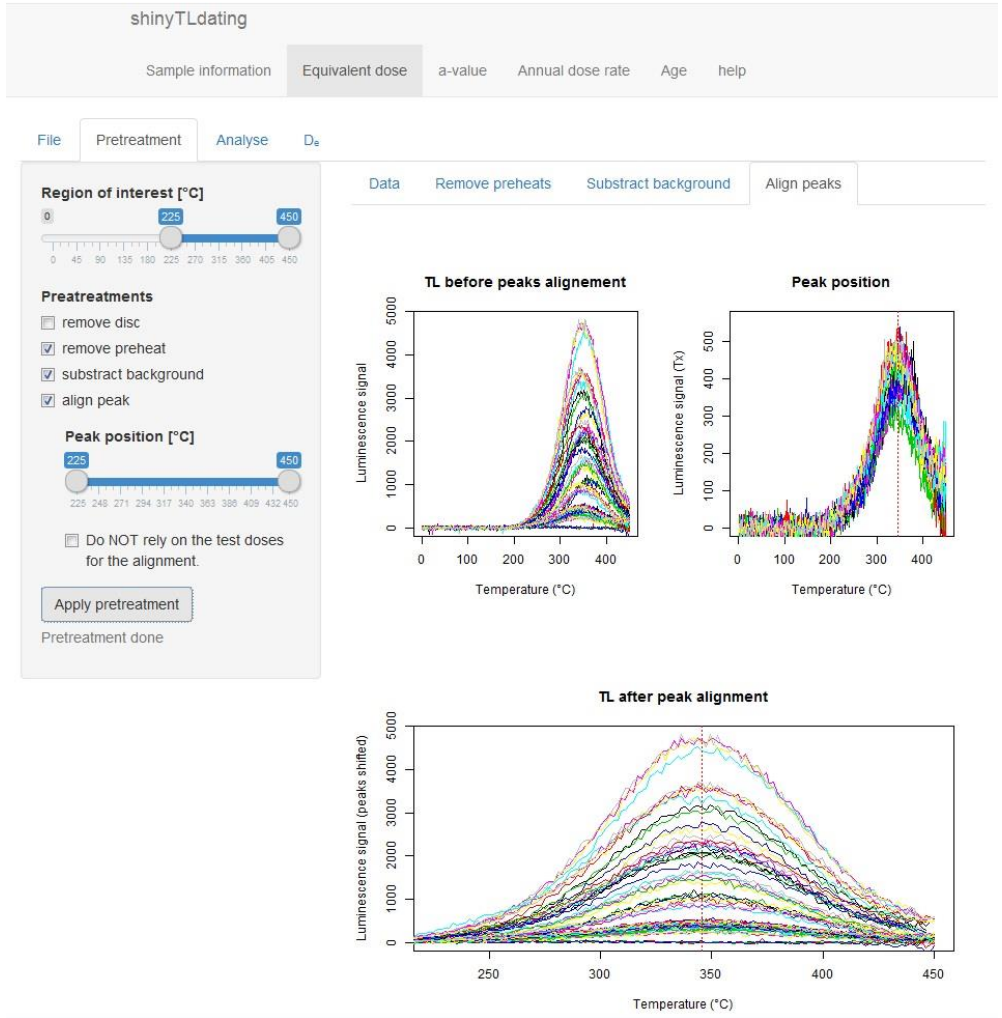
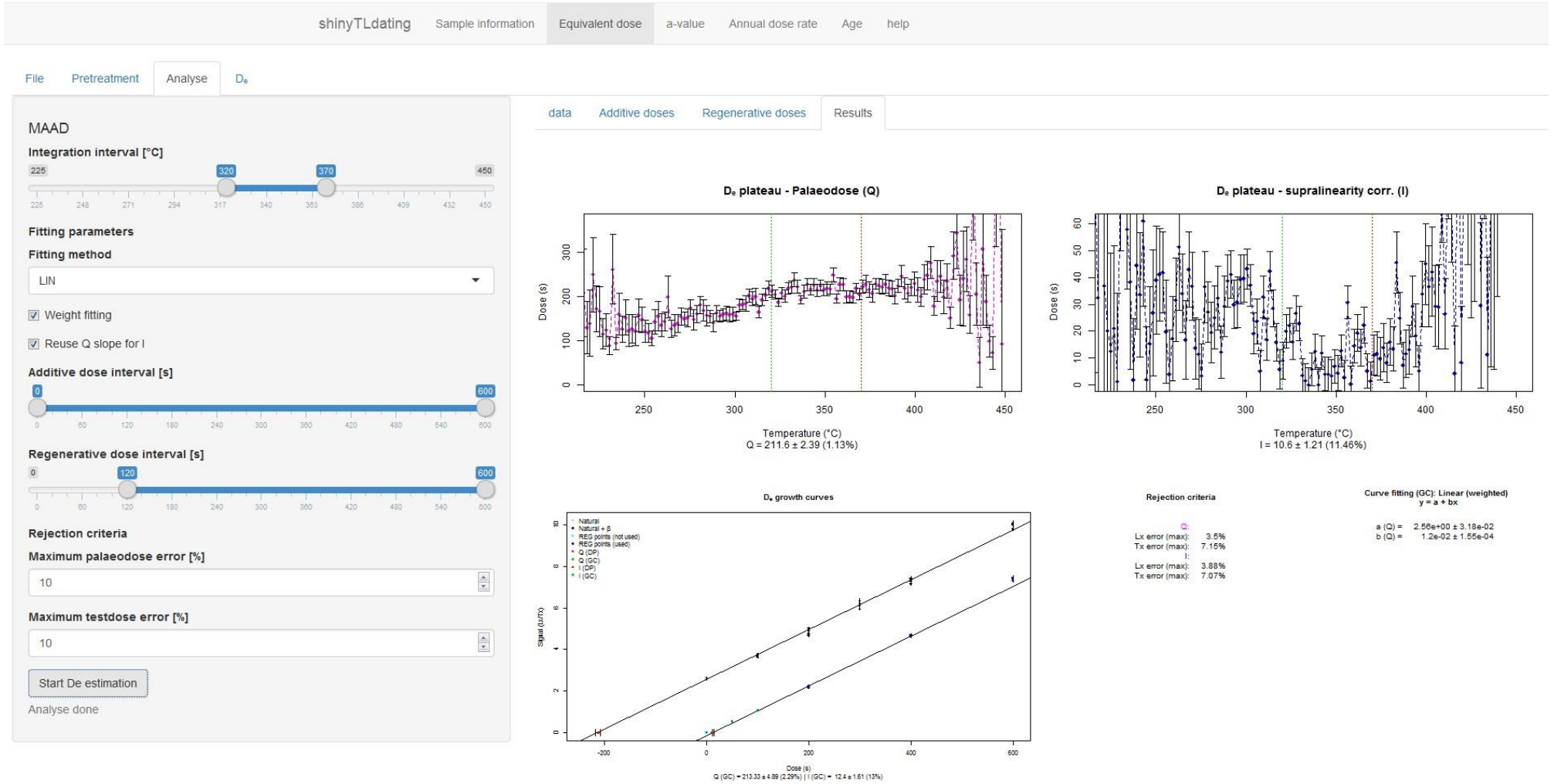
An app ‘all inclusive’



ShinyTLdating:
An app ‘all inclusive’



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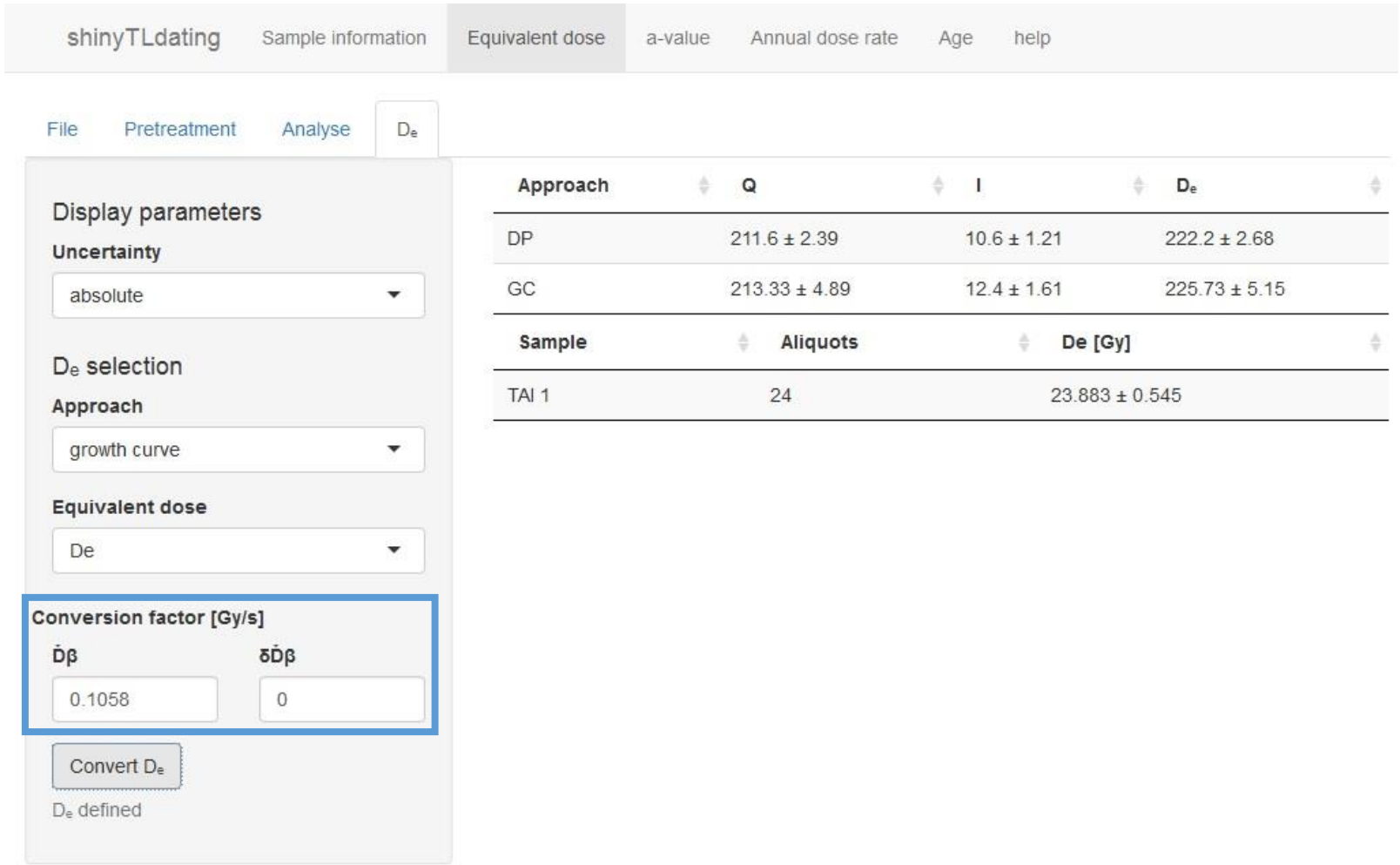

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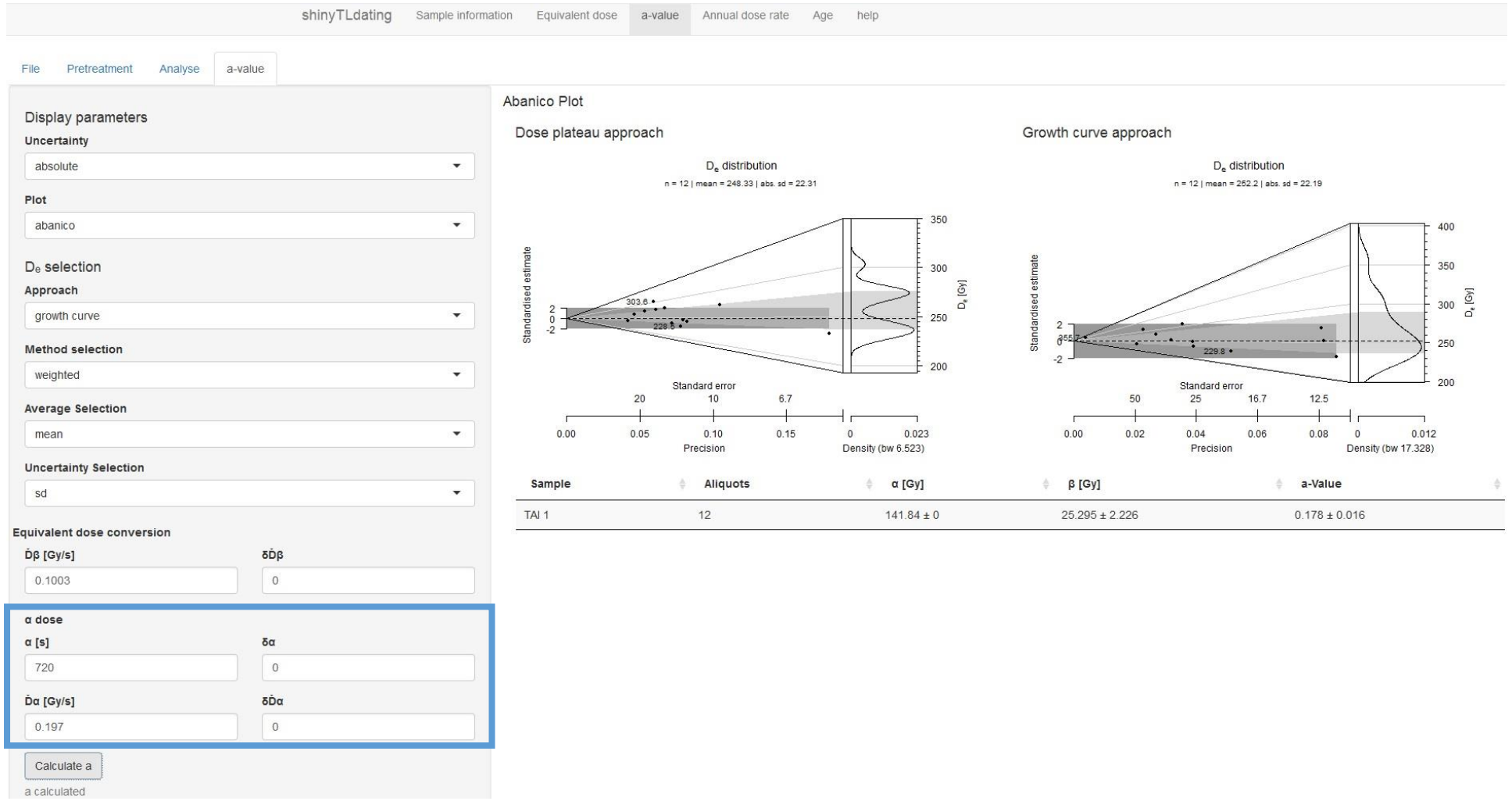
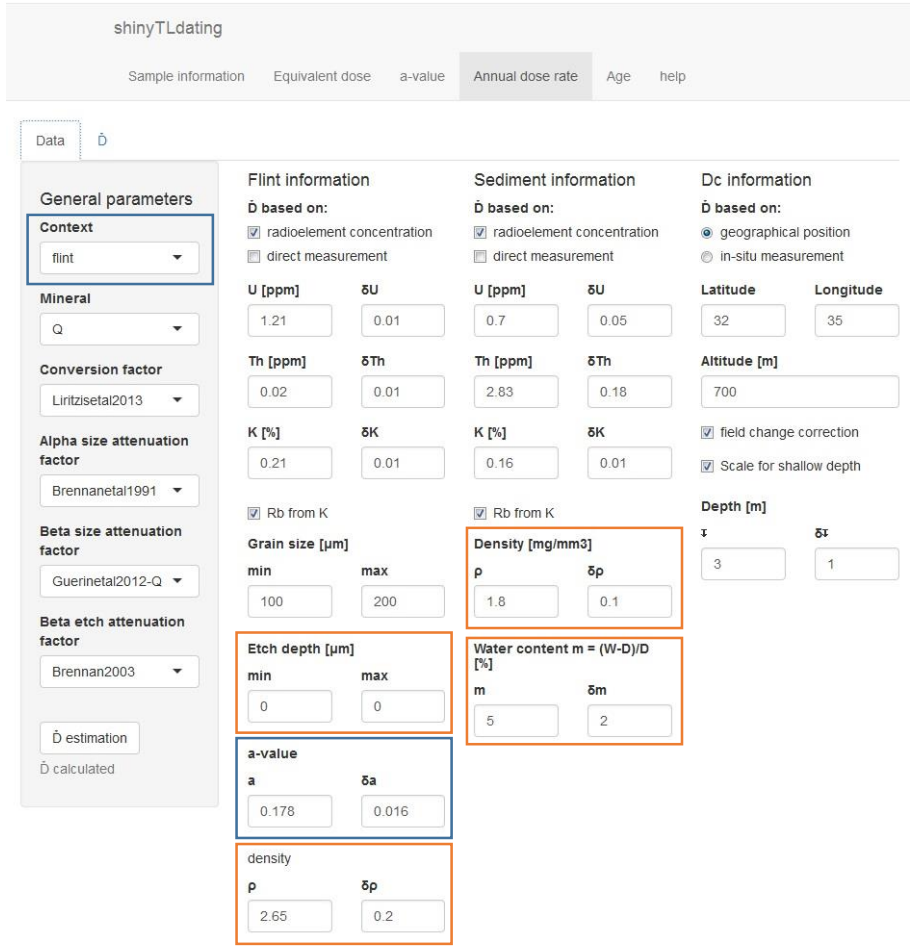


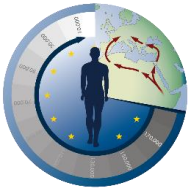
ShinyTLdating:
An app ‘all inclusive’



ShinyTLdating:
An app ‘all inclusive’

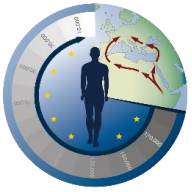
Conclusion & outlook

- 3 new apps
  - *ShinyDRAC* → https://dstreble.shinyapps.io/shinyDRAC/
  - *ShinyLumReader* → https://dstreble.shinyapps.io/shinyLumReader/
  - *ShinyTLdating* → https://dstreble.shinyapps.io/shinyTLdating/
- *Work in progress*
  - *Database for ShinyLumReader*
  - *More geometries for ShinyDRAC*
  - *More fitting methods for ShinyTLdating*
  - *Multiple samples*
- Just the beginning
  - *ShinyOSLdating*
  - *ShinyESRdating*
- *Complete toolbox for luminescence dating.*



Acknowledgment

- This project was realized in the context of the CRC 806 “Our way to Europe” funded by the German Research Foundation (DFG).



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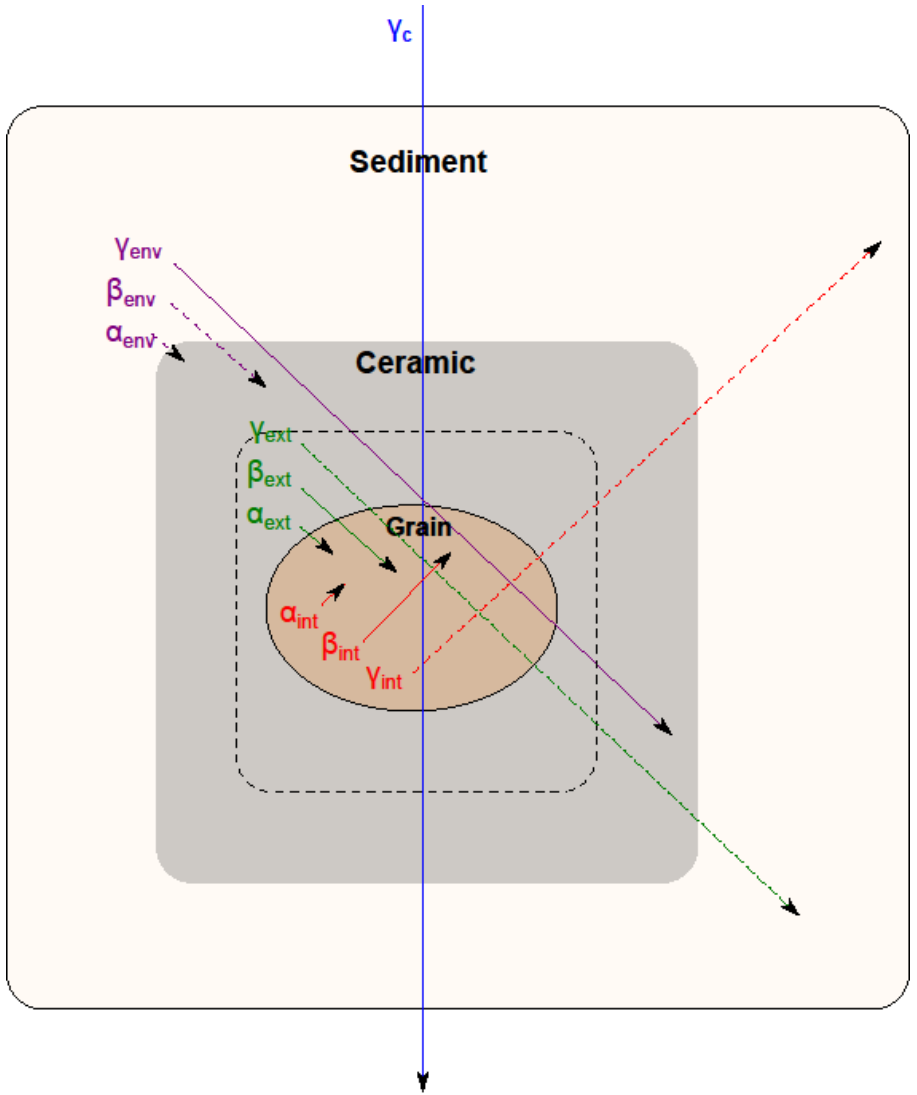
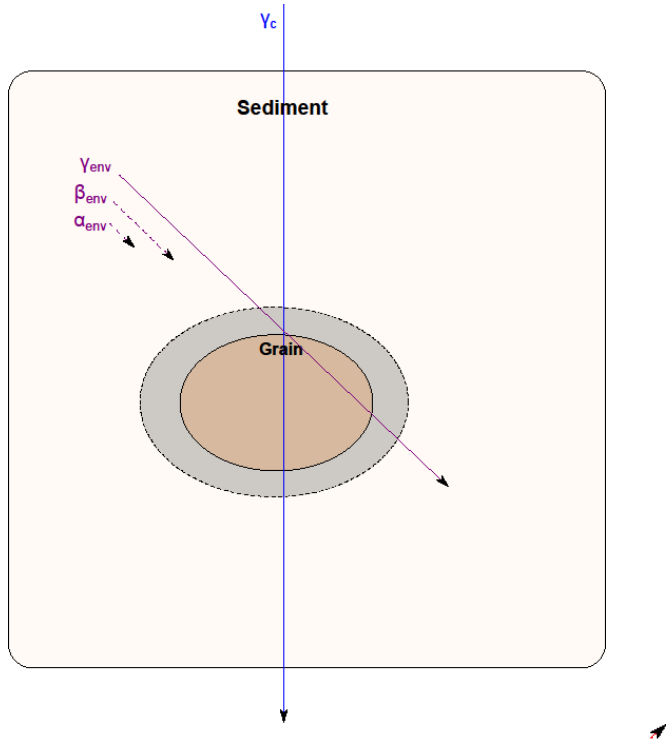
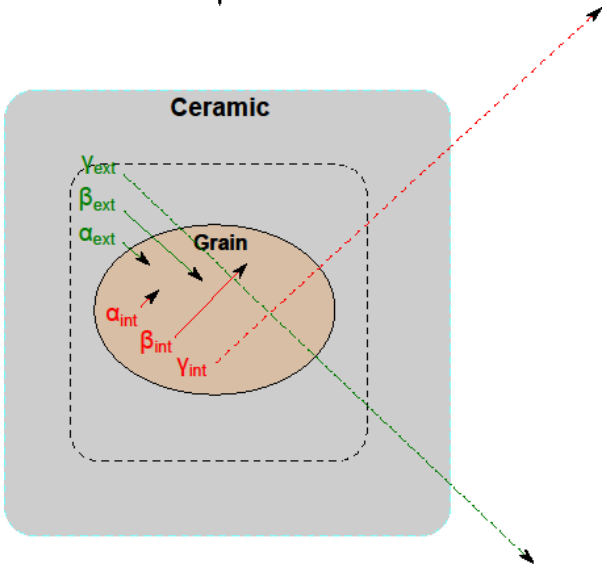
- Strebler D., *et al.* 2016. Using R for TL dating. Quaternary Geochronology, in press.

Complementary material

shinyDRAC: *drac4ceramic & drac4flint*







- Web links
  - Shiny
    - *ShinyLumReader*
      - https://dstreble.shinyapps.io/shinyLumReader/
    - *ShinyDRAC*
      - https://dstreble.shinyapps.io/shinyDRAC/
      - Github: https://github.com/dstreble/shiny_DRAC
    - *ShinyTLdating*
      - https://dstreble.shinyapps.io/shinyTLdating/
      - Github: https://github.com/dstreble/shiny_TLdating
  - R Package
    - *LumReader*
      - Github: https://github.com/dstreble/LumReader
    - *TLdating*
      - CRAN: https://CRAN.R-project.org/package=TLdating
      - Github: https://github.com/dstreble/TLdating
    - Luminescence
      - CRAN: https://CRAN.R-project.org/package=Luminescence
      - Github: https://github.com/R-Lum/Luminescence
  - DRAC
    - https://www.aber.ac.uk/en/iges/research-groups/quaternary/luminescence-research-laboratory/dose-rate-calculator/
    - Github: https://github.com/DRAC-calculator/DRAC-calculator