

$L_n, L_x$  curves

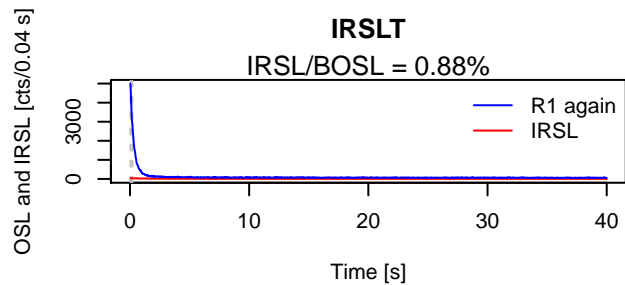
ALQ Pos. 1

$T_n, T_x$  curves

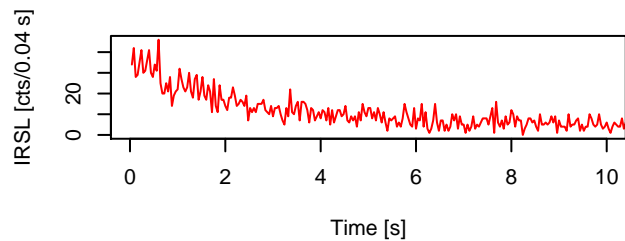


Cutheat – TL curves

IRSLT



IRSL curve (10 s)



help("Analyse\_SAR\_OSLdata")

unkown measurement





**Fig. 4 – Bos & Wallinga (2012)**



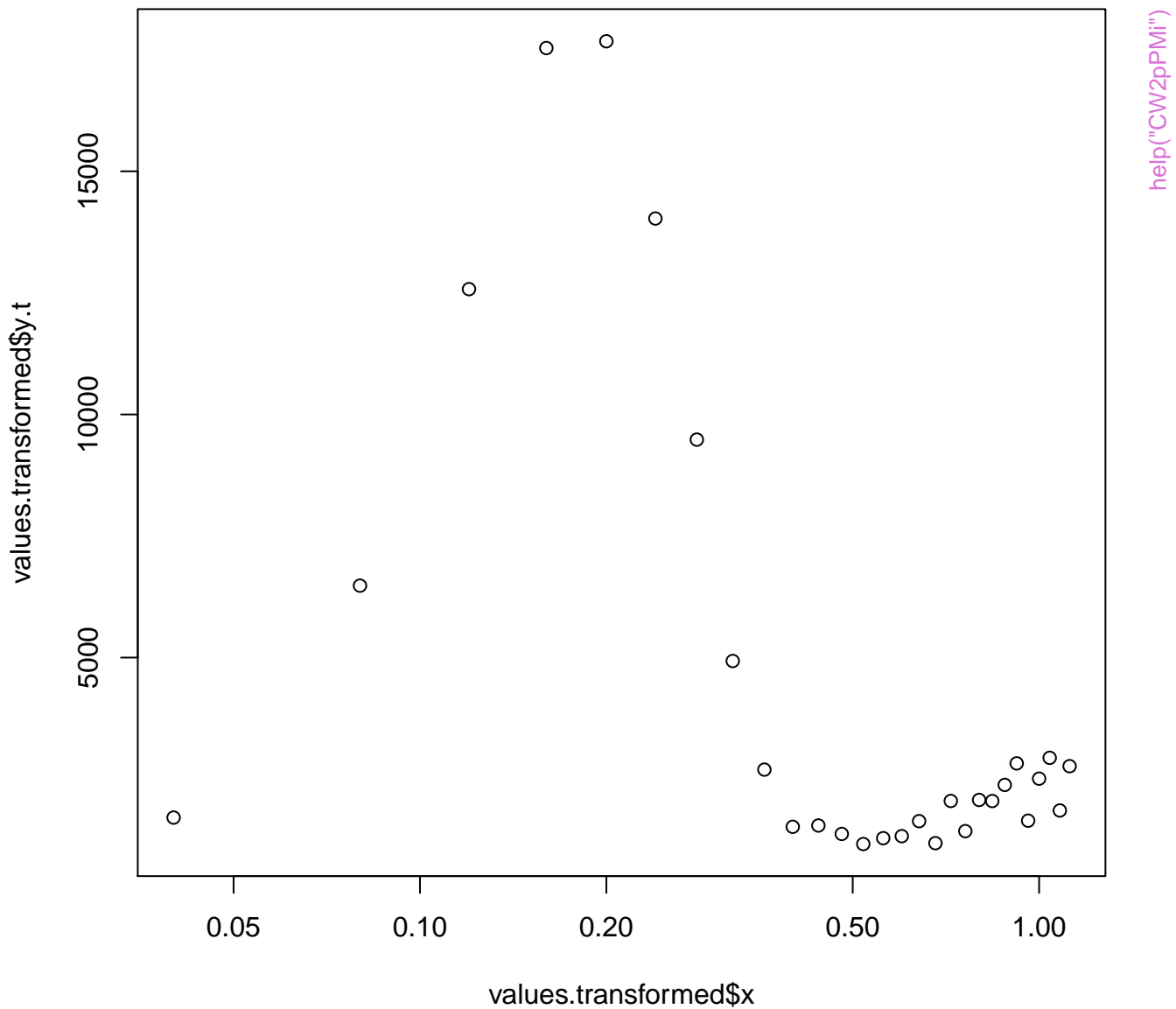


help("CW2pLM")



**Fig. 4 – Bos & Wallinga (2012)**







**Fig. 4 – Bos & Wallinga (2012)**





# Histogram



# Histogram





`help("ExampleData.FittingLM")`



help("ExampleData.LxTxData")



`help("ExampleData.LxTxOSLData")`



`help("ExampleData.LxTxOSLData")`



**RF**

#1



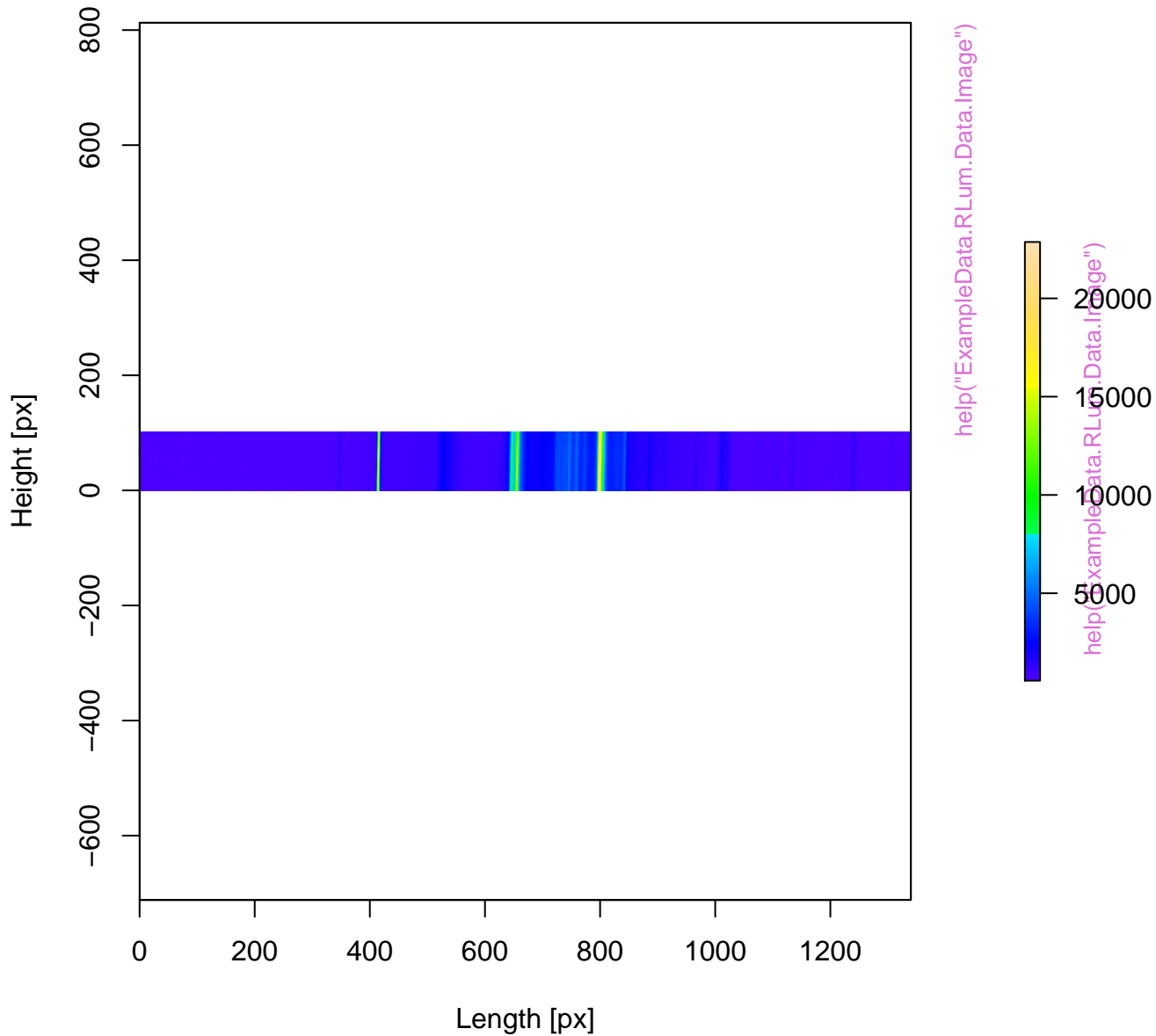
**RF**

#2



[help\("ExampleData.RLum.Analysis"\)](#)

# RLum.Data.Image



# OSL (UVVIS)



help("ExampleData.XSYG")

RLum.Data.Spectrum



help("ExampleData.XSYG")

# IR-RF

$D_e = 623.25$  [600.63 ; 635.8]

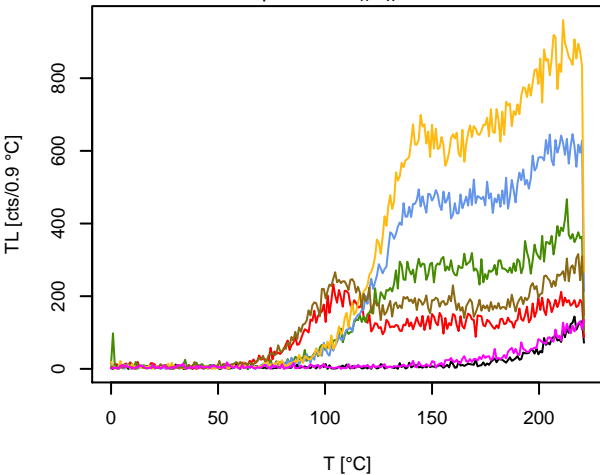


# IR-RF

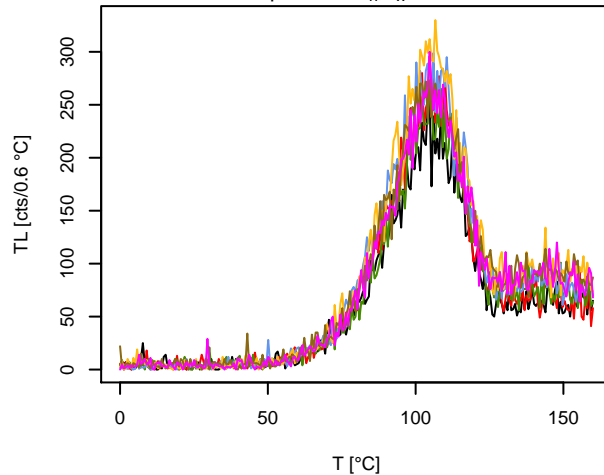
$D_e = 610.17$  [567.19 ; 653.15]



TL previous  $L_n, L_x$  curves



TL previous  $T_n, T_x$  curves



$L_n, L_x$  curves



$T_n, T_x$  curves



●  
Natural  
(0)

●  
R1  
(450)

●  
R2  
(1050)

●  
R3  
(2000)

●  
R4  
(2550)

●  
R5  
(450)

●  
R0  
(0)

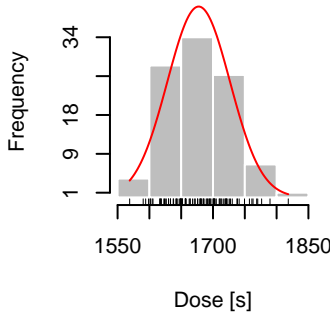
# Growth curve

$D_e = 1668.25 \pm 49.22$  | fit: EXP

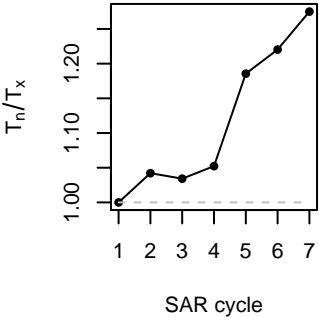


## $D_e$ from MC simulation

$D_{eMC} = 1677.48 \pm 49.22$  | quality = 99.4 %

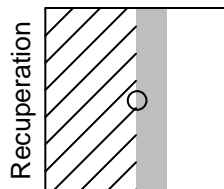


## Test dose response





## Rejection criteria



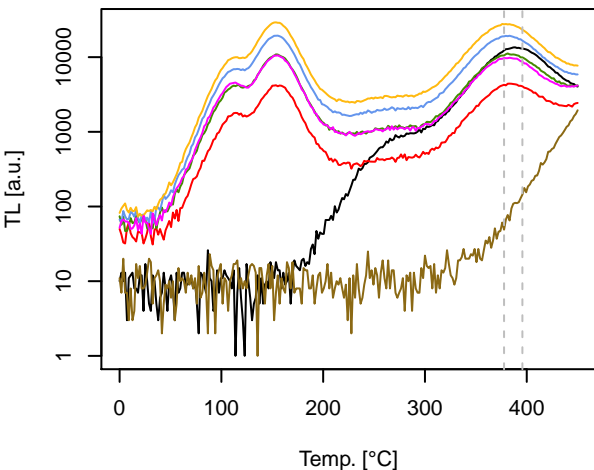
- 0.2      + 0.2

## IRSL

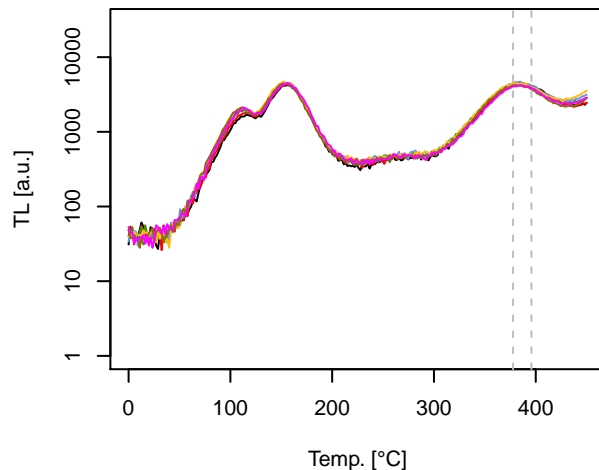


[help\("analyse\\_SAR.CWOSL"\)](#)

$L_n, L_x$  curves



$T_n, T_x$  curves



Plateau test  $L_n, L_x$  curves



plateau Test  $T_n, T_x$  curves



Natural  
(0)

Natural  
(136)

Natural  
(317)

Natural  
(544)

Natural  
(815)

Natural  
(0)

Natural  
(317)

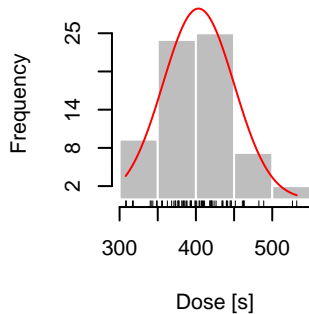
# Growth curve

$D_e = 406.8 \pm 46.54$  | fit: EXP

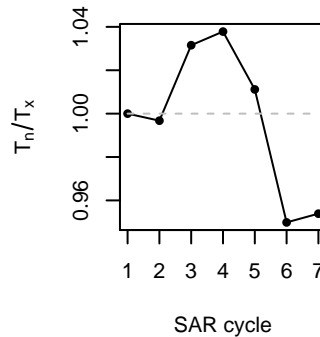


## $D_e$ from MC simulation

$D_{eMC} = 403.34 \pm 46.54$  | quality = 99.1 %



## Test dose response



## Pseudo pIRIR data set based on quartz OSL

TL  
pseudolRSL1  
pseudolRSL2

help("analyse\_pIRIRSequence")

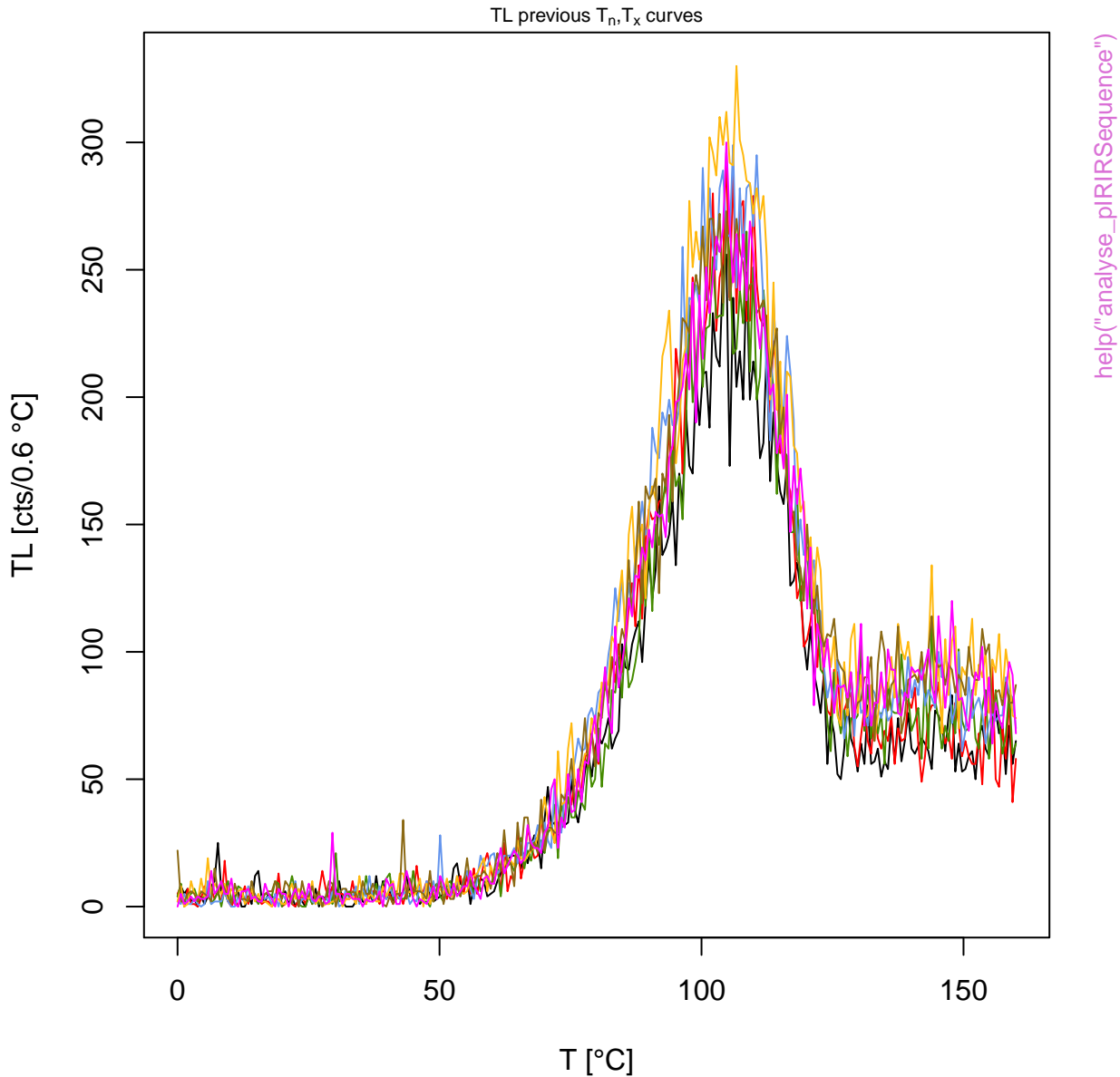
# Pseudo pIRIR data set based on quartz OSL



# Pseudo pIRIR data set based on quartz OSL



# Pseudo pIRIR data set based on quartz OSL



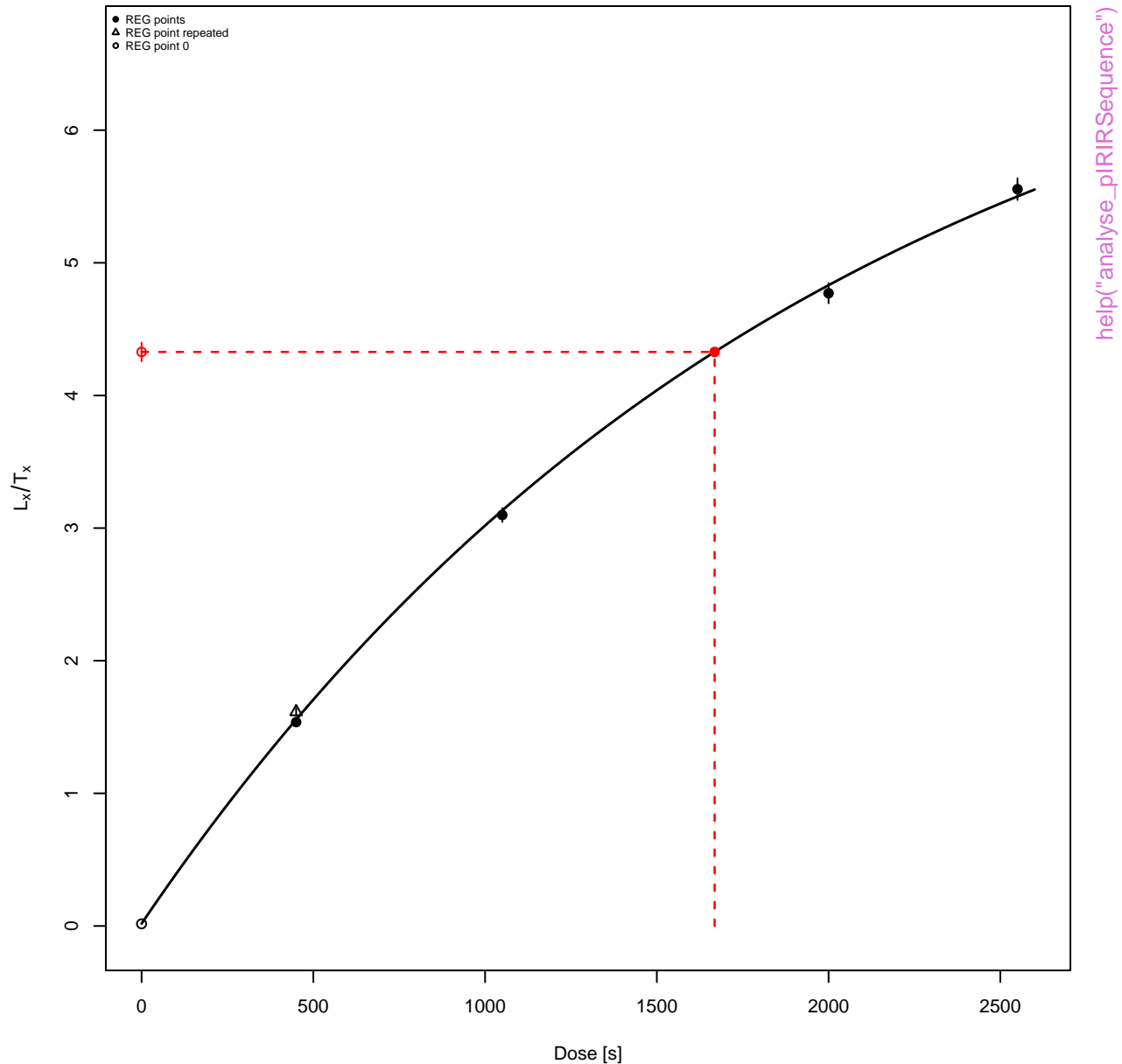
# Pseudo pIRIR data set based on quartz OSL





# Pseudo pIRIR data set based on quartz OSL

$D_e = 1668.25 \pm 41.38$  | fit: EXP



# D<sub>e</sub> from MC simulation

D<sub>eMC</sub> = 1666.57 ± 41.38 | quality = 99.9 %



help("analyse\_pIRIRSequence")

Test dose response



# Pseudo pIRIR data set based on quartz OSL



# Pseudo pIRIR data set based on quartz OSL





# Pseudo pIRIR data set based on quartz OSL

$D_e = 1668.25 \pm 47.59$  | fit: EXP



help("analyse\_pIRIRSequence")

# D<sub>e</sub> from MC simulation

D<sub>e,MC</sub> = 1669.37 ± 47.59 | quality = 99.9 %



Dose [s]

n = 100 , valid fits = 100

help("analyse\_pIRSequence")



# Test dose response



# Summarised Dose Response Curves



# Sensitivity change



## Rejection criteria



# OSL



`help("bin_RLum.Data")`

# OSL



help("bin\_RLum.Data")

# OSL



help("bin\_RLum.Data")

# Monte Carlo Simulation

$$n = 100 \mid \hat{\mu} = 43 \mid \hat{\sigma} = 20 \mid \frac{\hat{\sigma}}{\sqrt{n}} = 2 \mid v = 0.73$$





Profile log likelihood for  $\sigma_{OD}$



# Fast Ratio



help("calc\_FastRatio")

# Finite Mixture Model

$\sigma_b = 0.2 \mid n = 62$

## Normal distributions



## Proportion of components



## Statistical criteria



# Fuchs & Lang (2001)







help("calc\_I EU")

**Likelihood profile: gamma**



**Likelihood profile: sigma**



help("calc\_MaxDose")

**Likelihood profile: p0**



**Likelihood profile: gamma**



**Likelihood profile: sigma**



help("calc\_MinDose")

**Likelihood profile: p0**





**Likelihood profile: gamma**

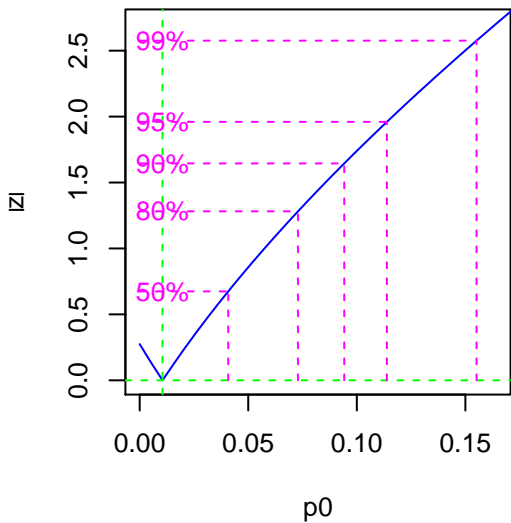


**Likelihood profile: sigma**



help("calc\_MinDose")

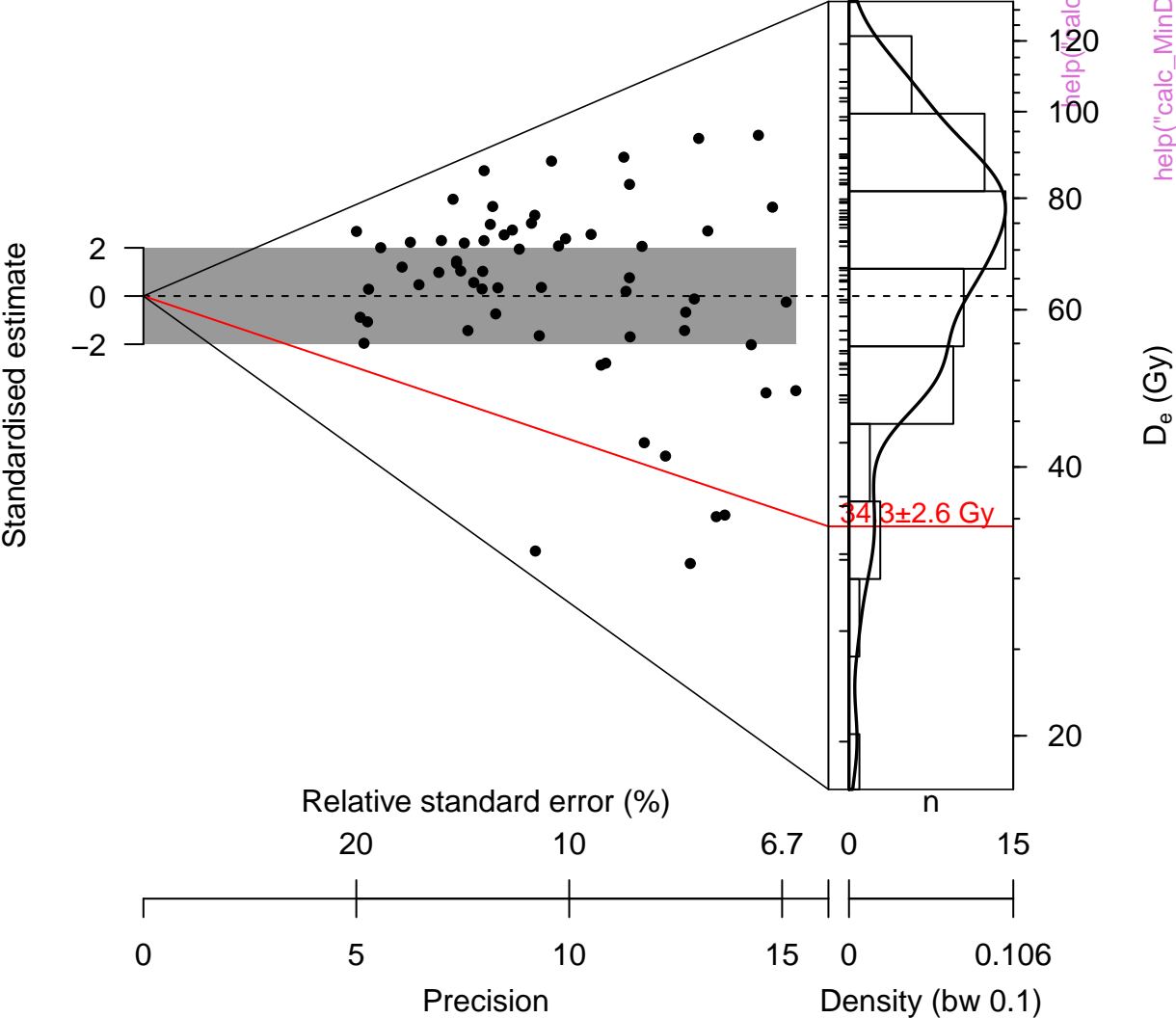
**Likelihood profile: p0**



# 3-parameter Minimum Age Model

Parameters:  $\sigma_b = 0.1$  ,  $\gamma = 3.5$  ,  $\sigma = 0.7$  ,  $\rho = 0.01$

n = 62  
mean = 65.99  
median = 69.64



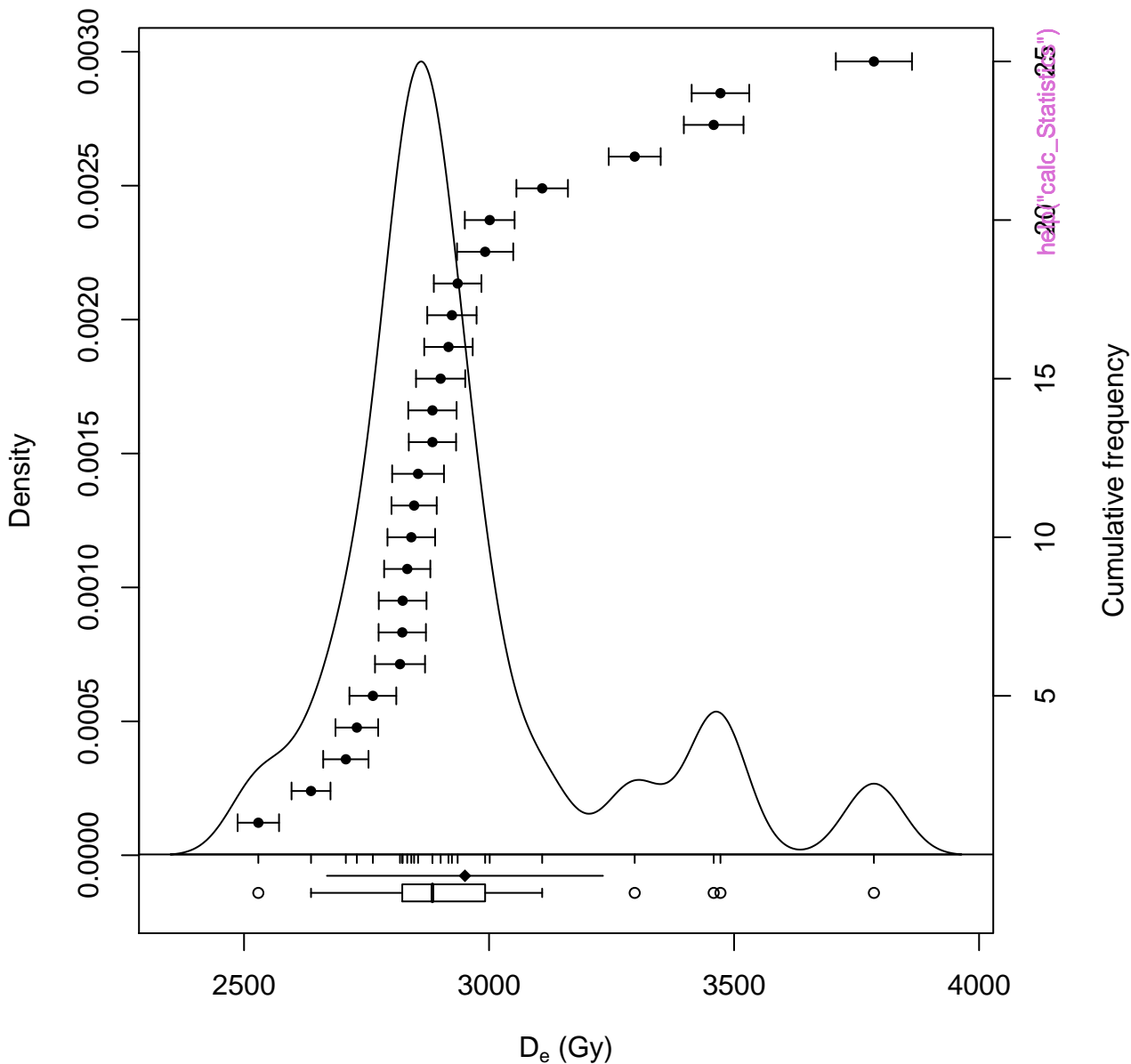
# Source Dose Rate Prediction

source type: Sr-90 | half-life: 28.9 a



help("calc\_SourceDoseRate")

# D<sub>e</sub> distribution



# Thermal Lifetime Contour Plot

(values quoted in Ma)



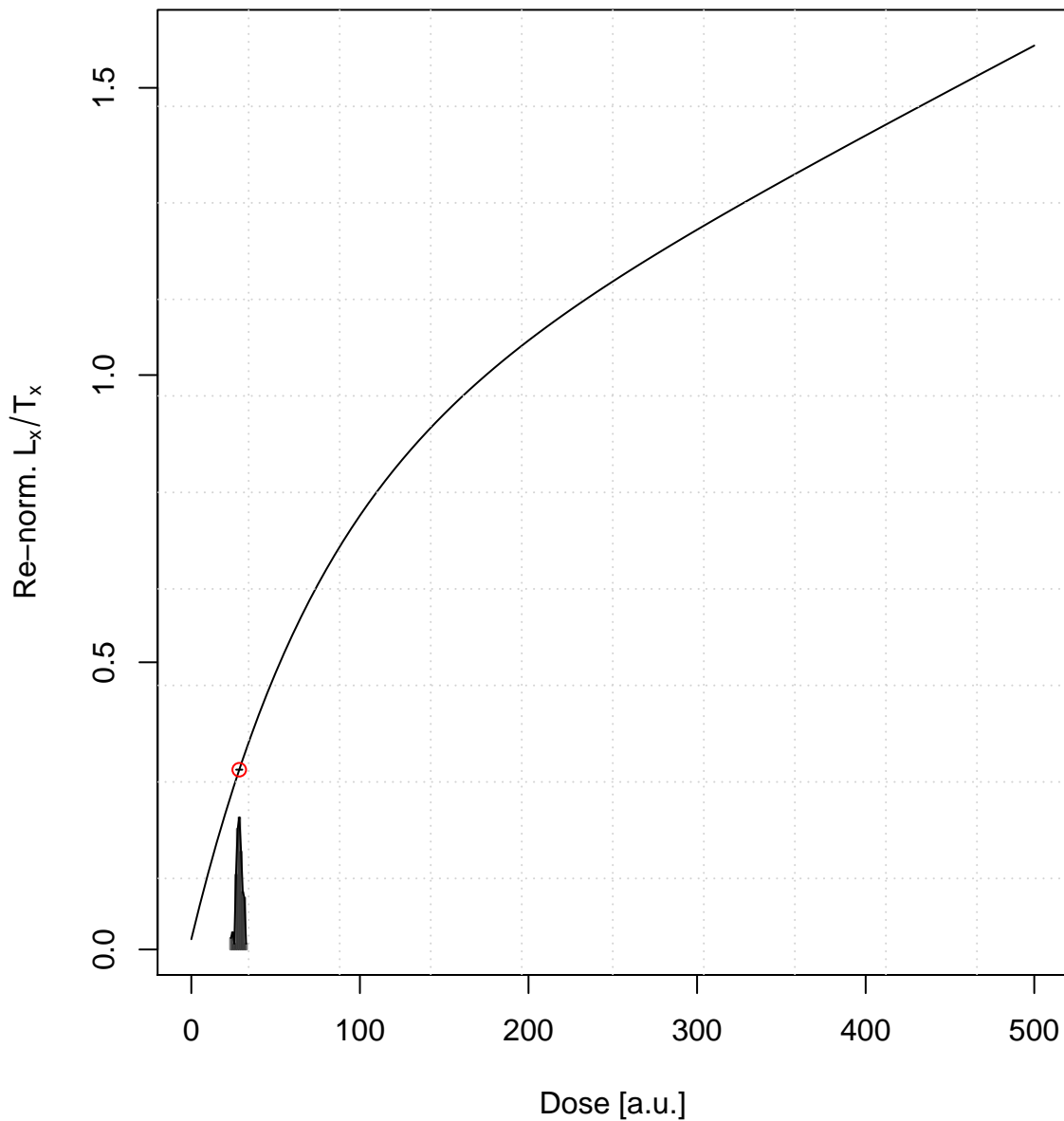
help("calc\_ThermalLifetime")

# Thermal Lifetime Density Plot



`help("calc_ThermalLifetime")`

# gSGC and resulting De



help("calc\_gSGC")

# CW Curve Fit

Default



## Component contribution to sum curve

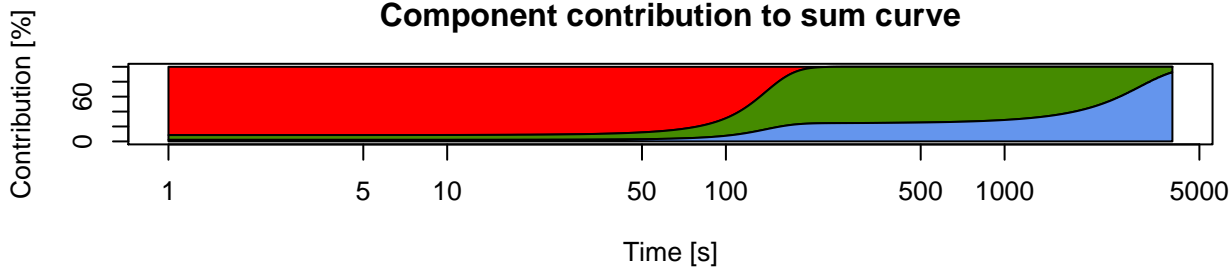




## Default



## Component contribution to sum curve



# Background



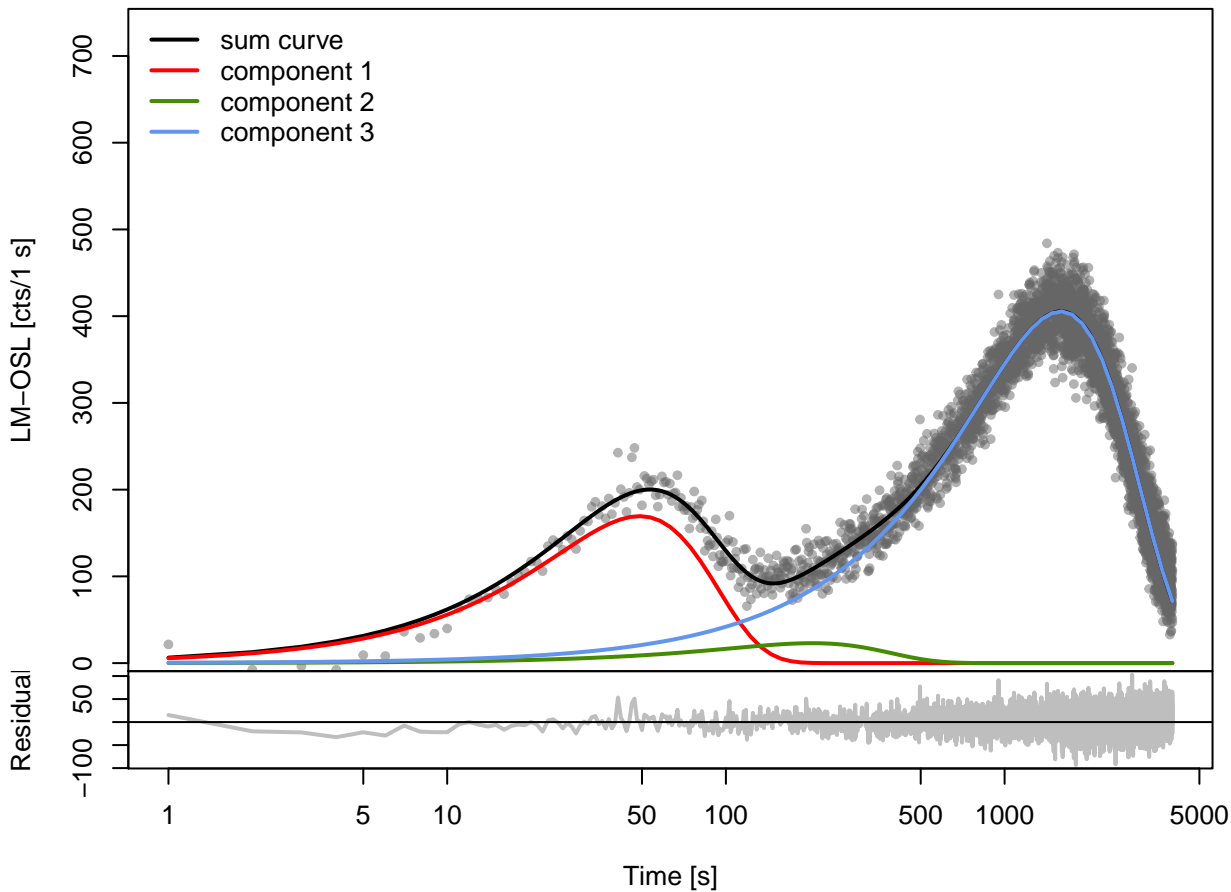
## Default



## Component contribution to sum curve



## Default



## Component contribution to sum curve

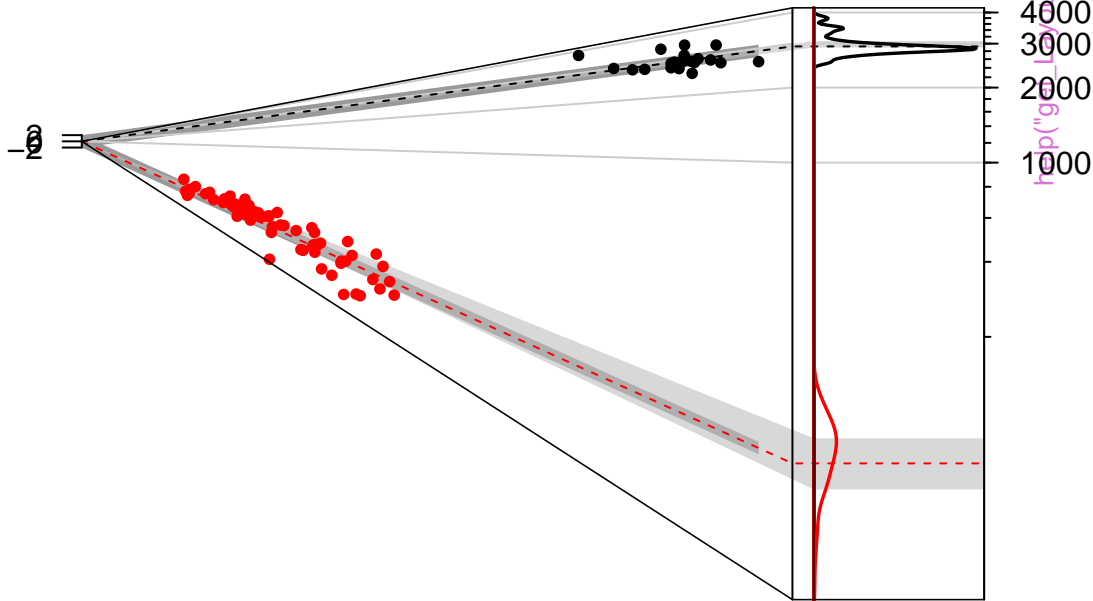


# D<sub>e</sub> distribution

n = 25 | in 2 sigma = 68 %

n = 62 | in 2 sigma = 41.9 %

Standardised estimate



$D_e$  (Gy)

help("get\_Layout")

Relative standard error (%)

10

5

3.3

0

10

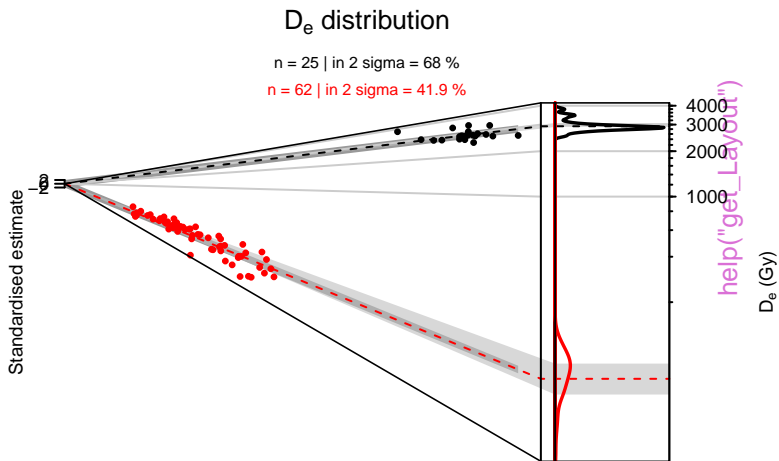
20

30

0.015

Precision

Density (bw 0.085)



help("get\_Layout")

Profile log likelihood for  $\sigma_{OD}$



# TL (UVVIS)



help("merge\_RLum.Data.Curve")

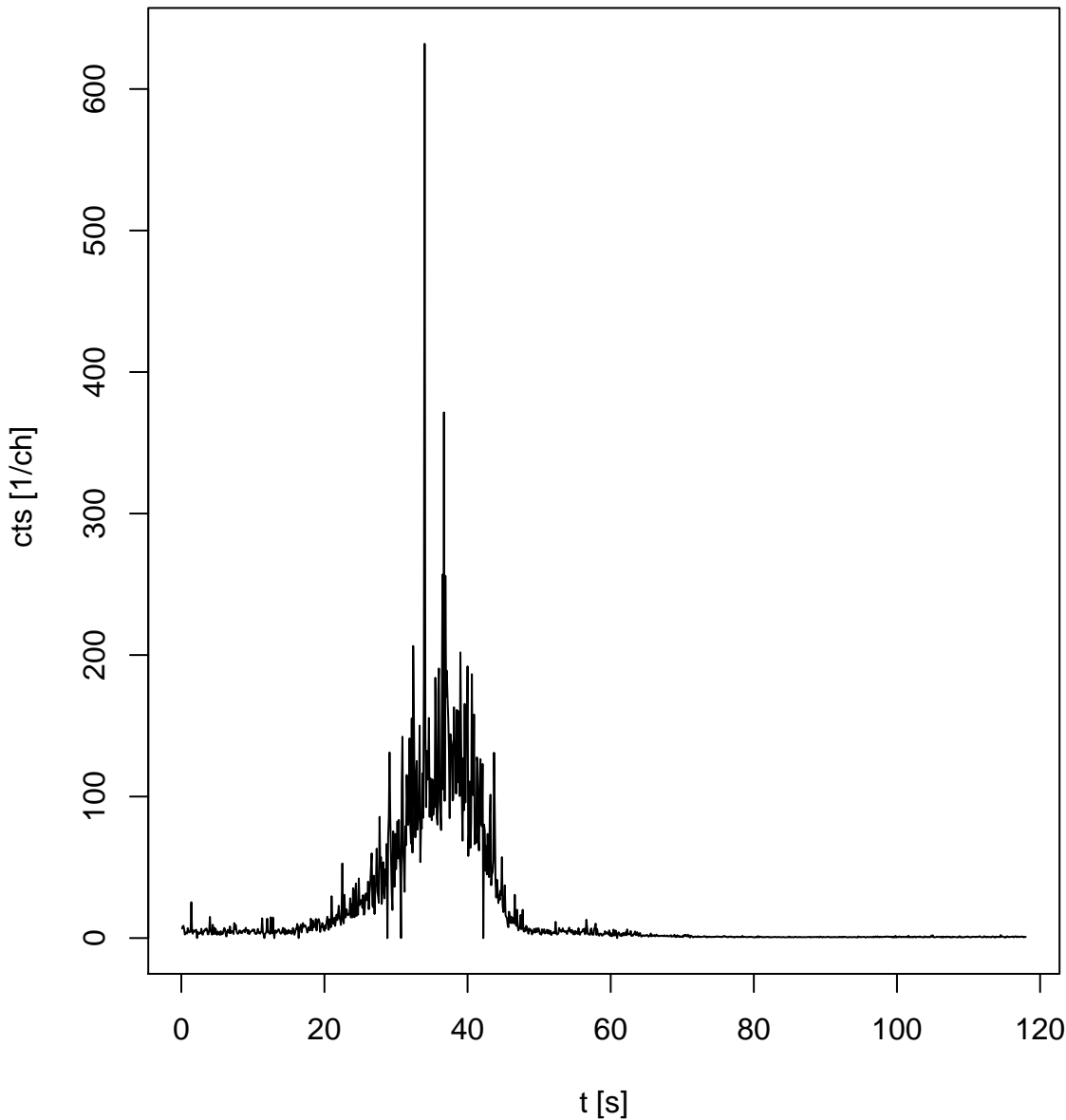


# TL (UVVIS)



help("merge\_RLum.Data.Curve")

# TL (UVVIS)



help("merge\_RLum.Data.Curve")

Profile log likelihood for  $\sigma_{OD}$

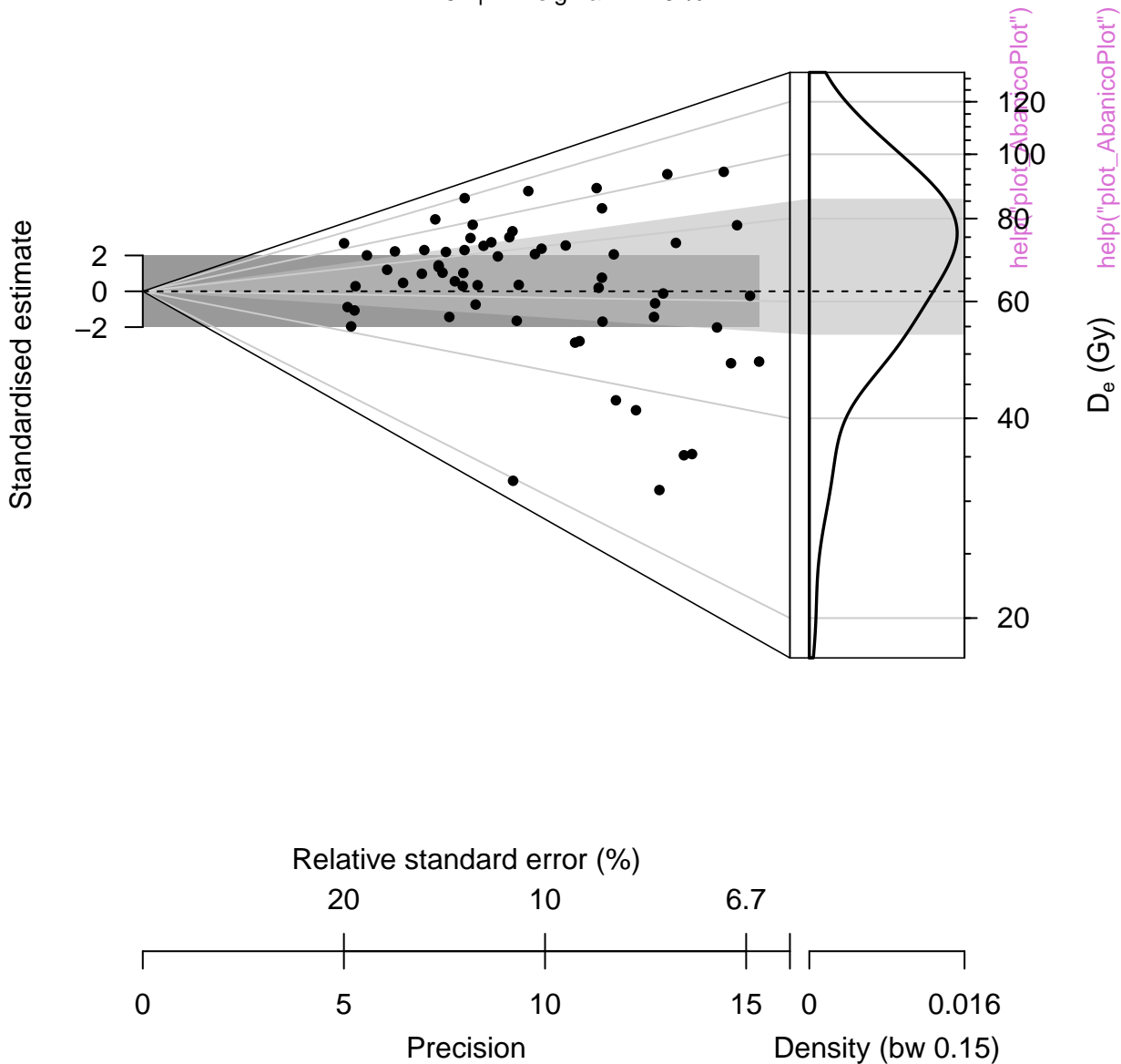


Profile log likelihood for  $\sigma_{OD}$



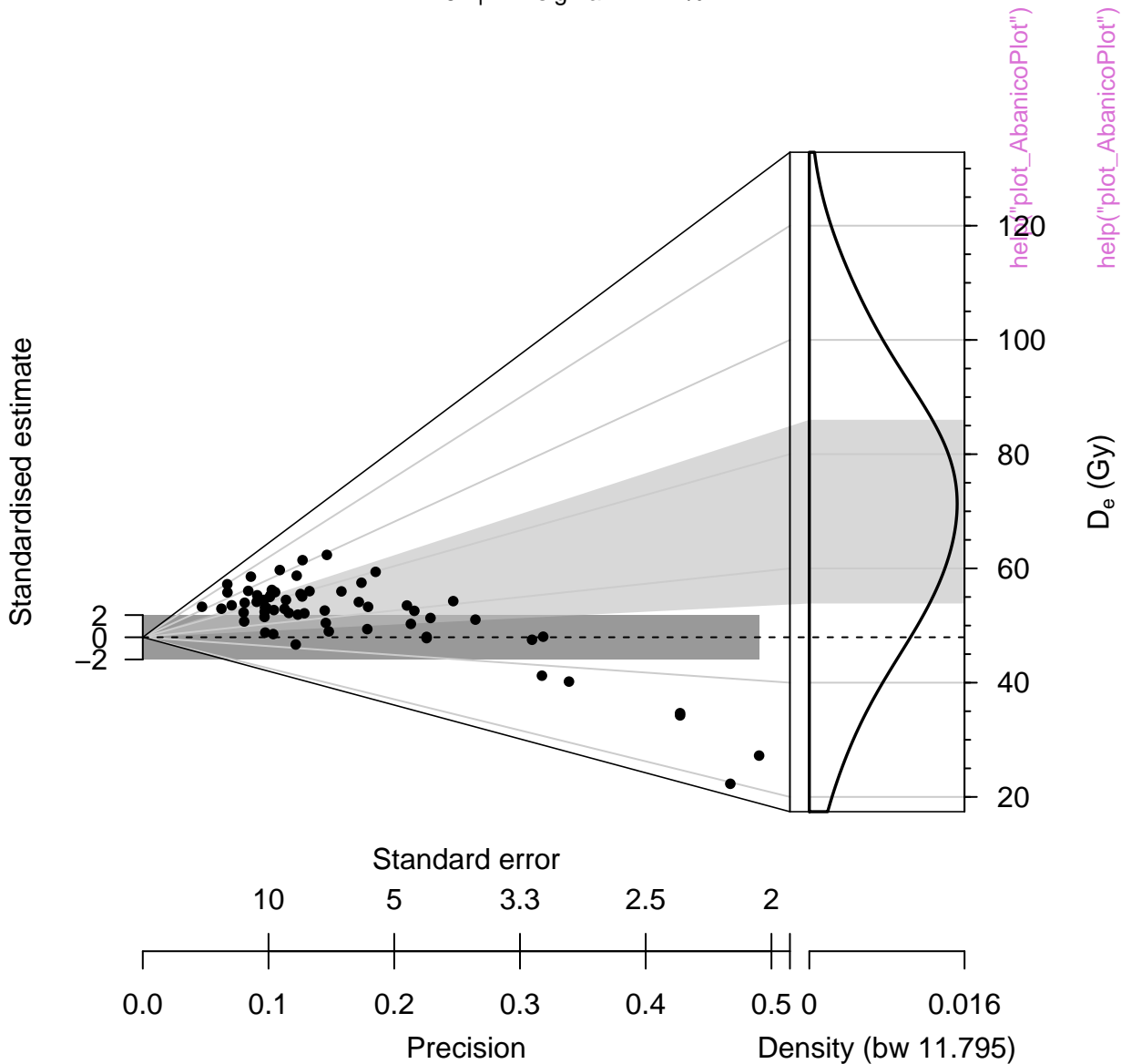
# D<sub>e</sub> distribution

n = 62 | in 2 sigma = 41.9 %



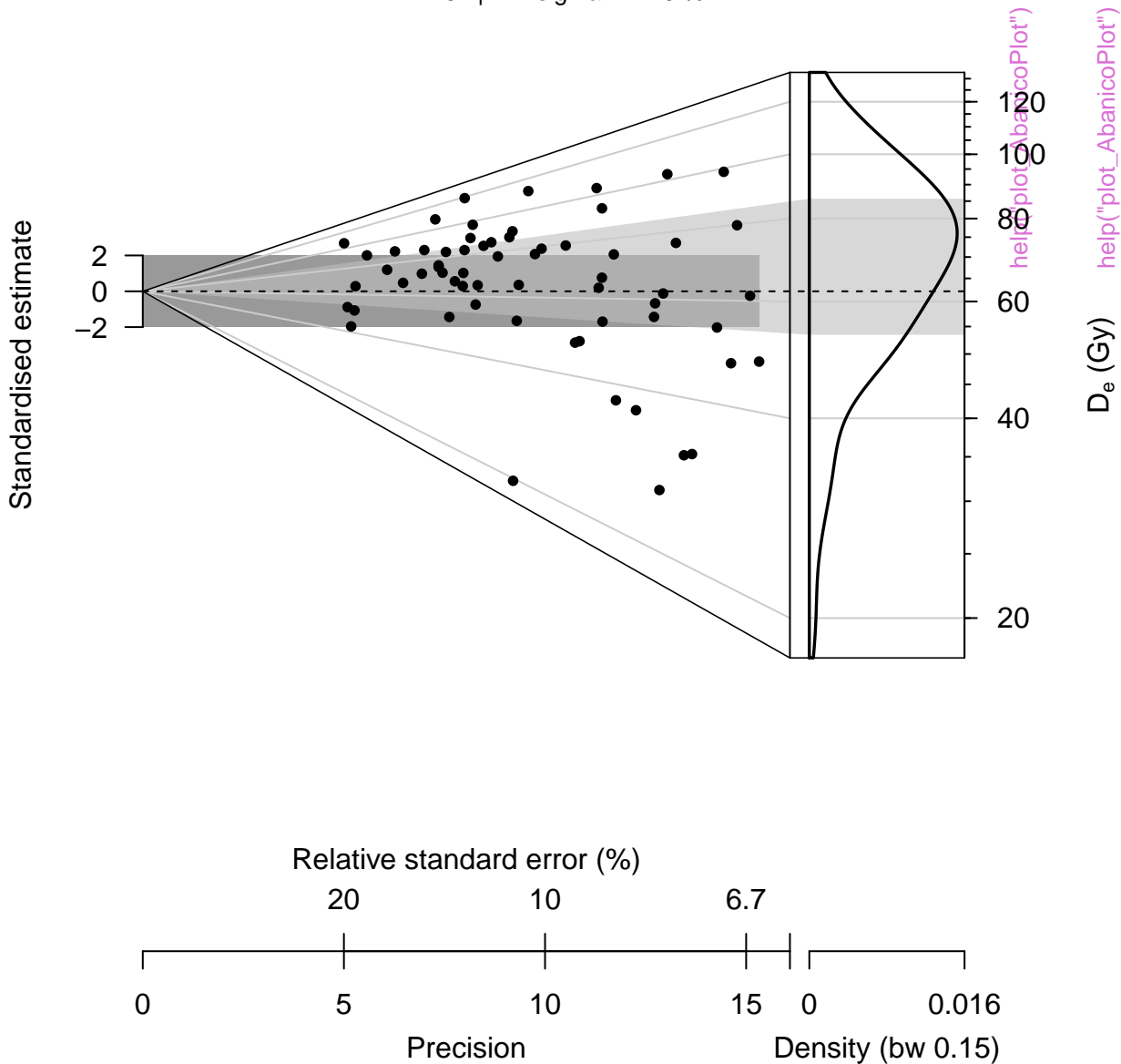
# D<sub>e</sub> distribution

n = 62 | in 2 sigma = 24.2 %



# D<sub>e</sub> distribution

n = 62 | in 2 sigma = 41.9 %



# D<sub>e</sub> distribution

n = 62 | in 2 sigma = 41.9 %

Standardised estimate



Relative standard error (%)

20

10

6.7

0

5

10

15

0

0.016

Precision

Density (bw 0.15)



# D<sub>e</sub> distribution

n = 62 | in 2 sigma = 41.9 %

Standardised estimate



D<sub>e</sub> (Gy)

help("plot\_AbanicoPlot")

help("plot\_AbanicoPlot")

Relative standard error (%)

20

10

6.7

5

0

5

10

15

200

0.016

Precision

Density (bw 0.15)

# D<sub>e</sub> distribution

n = 62 | in 2 sigma = 41.9 %

Standardised estimate



D<sub>e</sub> (Gy)

Relative standard error (%)

20

10

6.7

0

5

10

15

0

0.016

Precision

Density (bw 0.15)

# D<sub>e</sub> distribution

n = 62 | in 2 sigma = 41.9 %

Standardised estimate



Relative standard error (%)

20

10

6.7

0

5

10

15

0

0.264

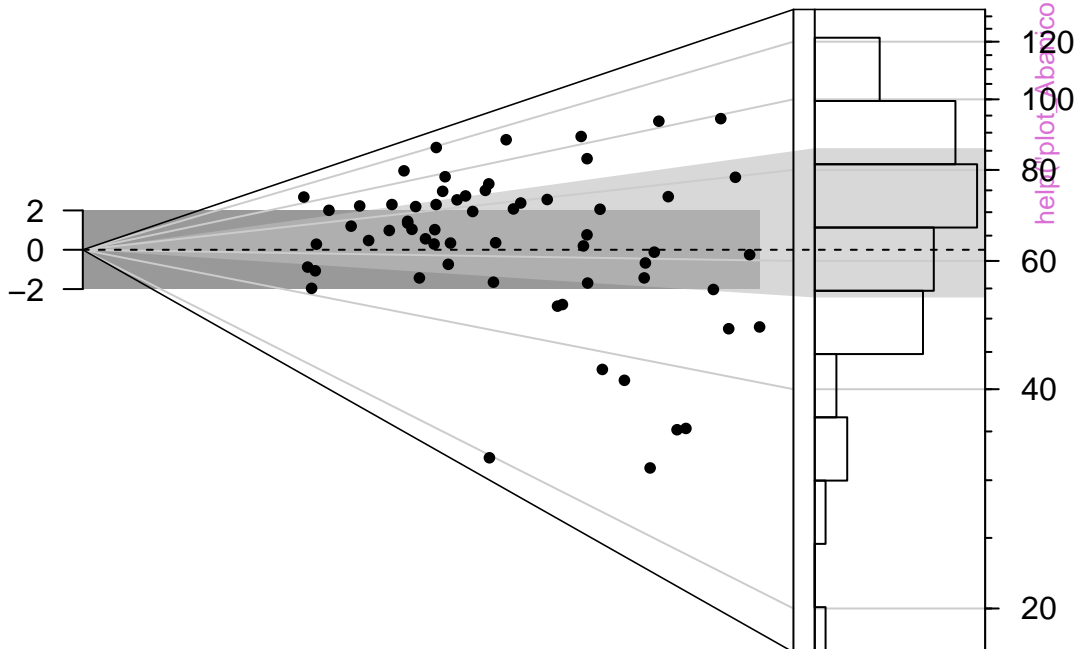
Precision

Density (bw 0.04)

# D<sub>e</sub> distribution

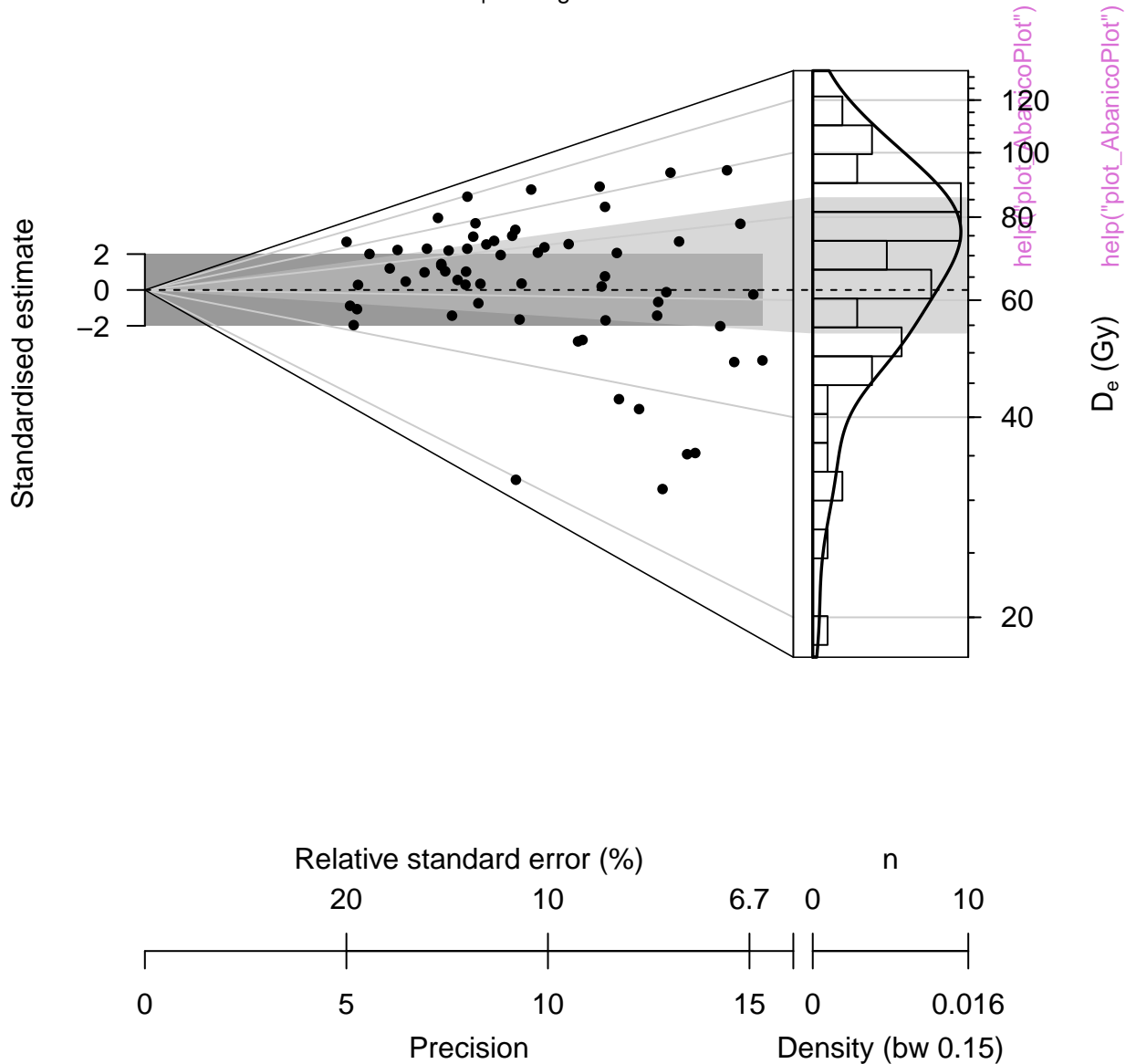
n = 62 | in 2 sigma = 41.9 %

Standardised estimate



D<sub>e</sub> (Gy)

n = 62 | in 2 sigma = 41.9 %



# D<sub>e</sub> distribution

n = 62 | in 2 sigma = 41.9 %

Standardised estimate



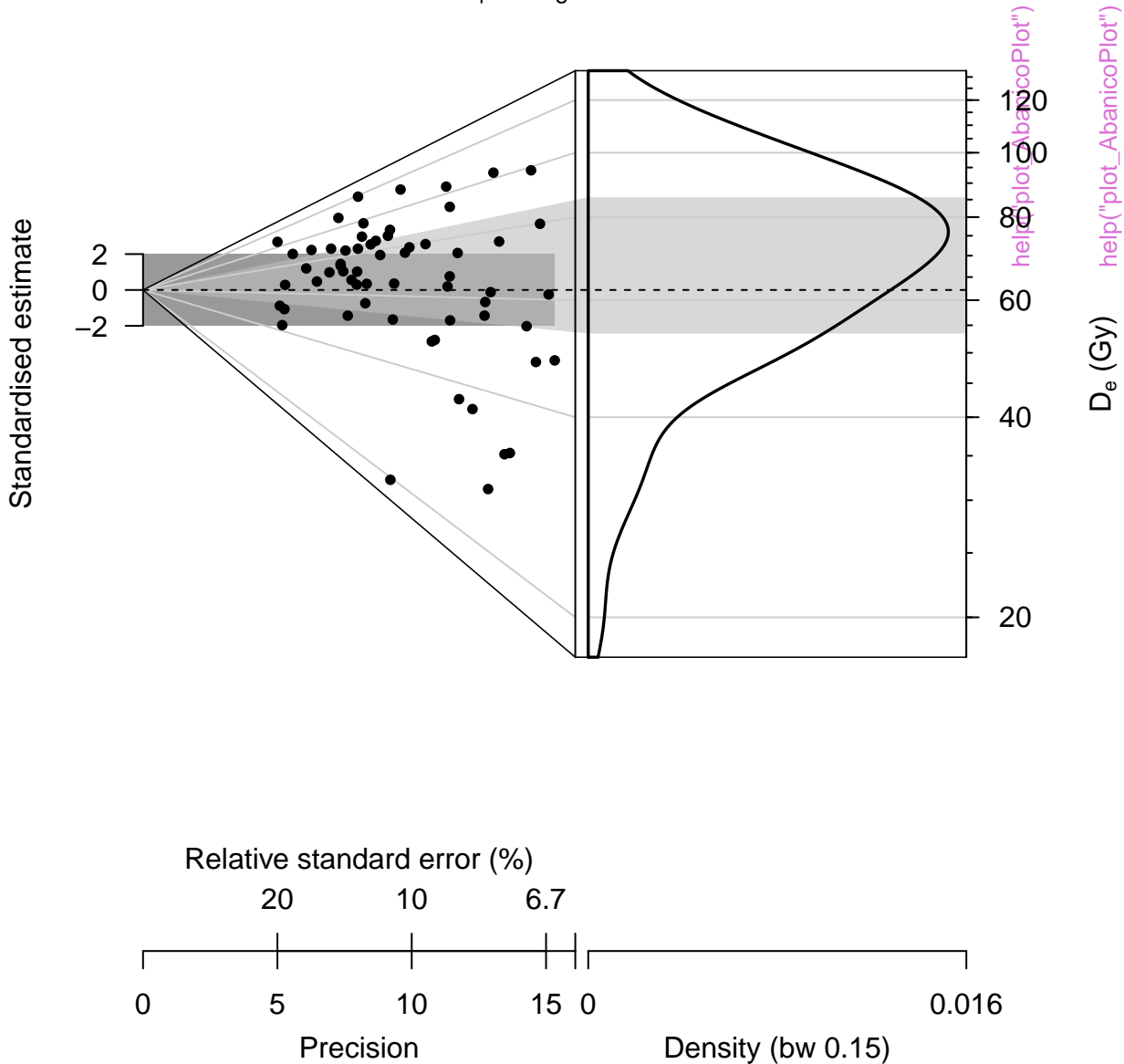
D<sub>e</sub> (Gy)

help("plot\_AbanicoPlot")

help("plot\_AbanicoPlot")

# D<sub>e</sub> distribution

n = 62 | in 2 sigma = 41.9 %



# D<sub>e</sub> distribution

n = 62 | in 2 sigma = 53.2 %

Standardised estimate



Relative standard error (%)

20

10

6.7

0

5

10

15

0.016

Precision

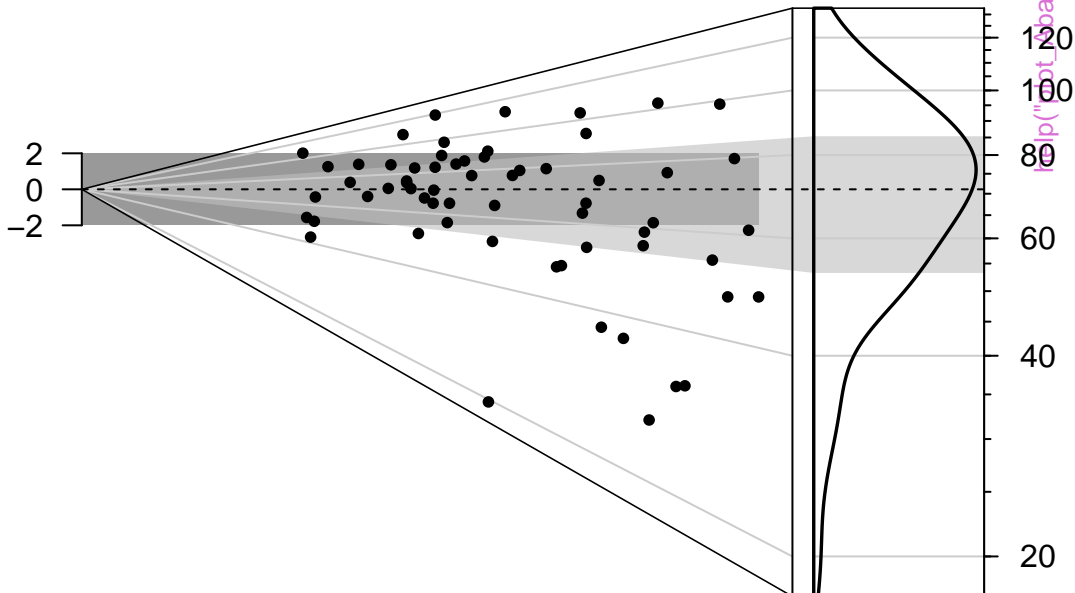
Density (bw 0.15)



# D<sub>e</sub> distribution

n = 62 | in 2 sigma = 54.8 %

Standardised estimate



D<sub>e</sub> (Gy)

Relative standard error (%)

20

10

6.7

0

5

10

15

0.016

Precision

Density (bw 0.15)

# D<sub>e</sub> distribution

n = 62 | in 2 sigma = 54.8 %

Standardised estimate



D<sub>e</sub> (Gy)

Relative standard error (%)

20

10

6.7

0

5

10

15

0.016

Precision

Density (bw 0.15)

# D<sub>e</sub> distribution

n = 62 | in 2 sigma = 41.9 %

Standardised estimate



D<sub>e</sub> (Gy)

Relative standard error (%)

20

10

6.7

0

5

10

15

0.016

Precision

Density (bw 0.15)

# D<sub>e</sub> distribution

n = 62 | in 2 sigma = 41.9 %

R Sample 1

Standardised estimate



help("plot\_AbanicoPlot")

help("plot\_AbanicoPlot")

D<sub>e</sub> (Gy)

Relative standard error (%)

20

10

6.7

0

5

10

15

0.016

Precision

Density (bw 0.15)

# D<sub>e</sub> distribution

n = 62 | in 2 sigma = 41.9 %

Standardised estimate

0

help("plot\_AbanicoPlot")

help("plot\_AbanicoPlot")

D<sub>e</sub> (Gy)

Relative standard error (%)

20

10

6.7

0

5

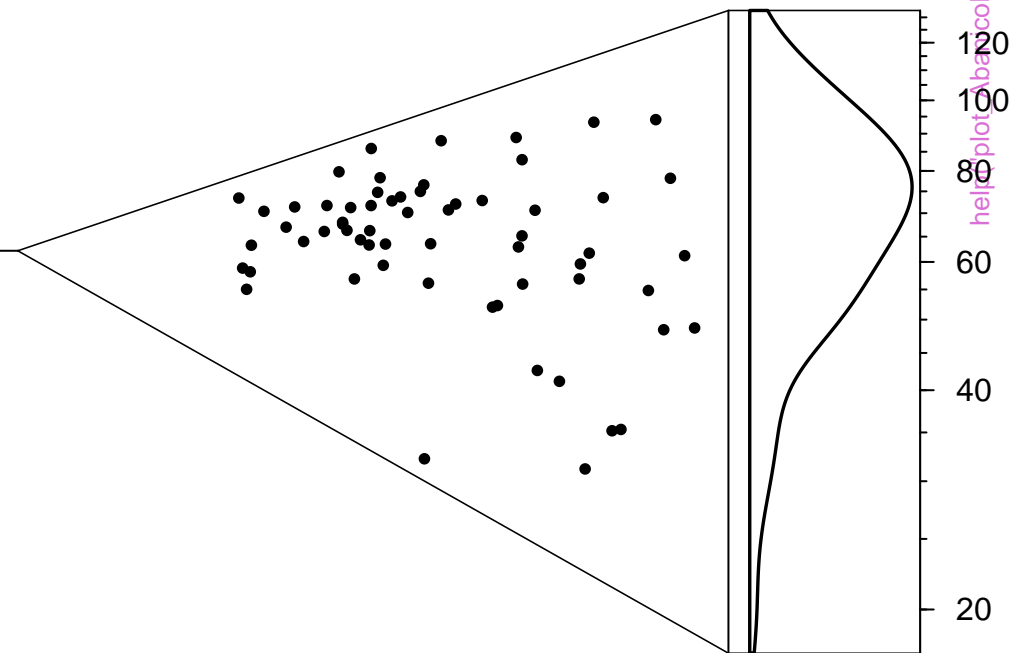
10

15

0.016

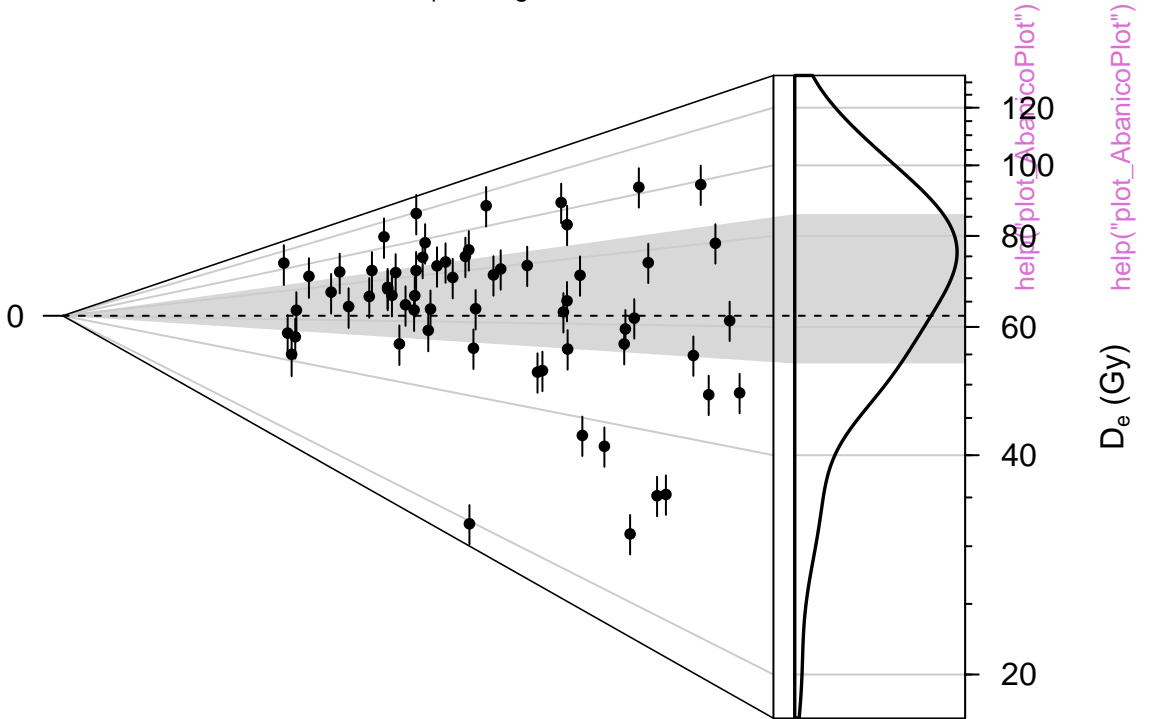
Precision

Density (bw 0.15)



# D<sub>e</sub> distribution

n = 62 | in 2 sigma = 41.9 %



Relative standard error (%)

20

10

6.7

0

5

10

15

0

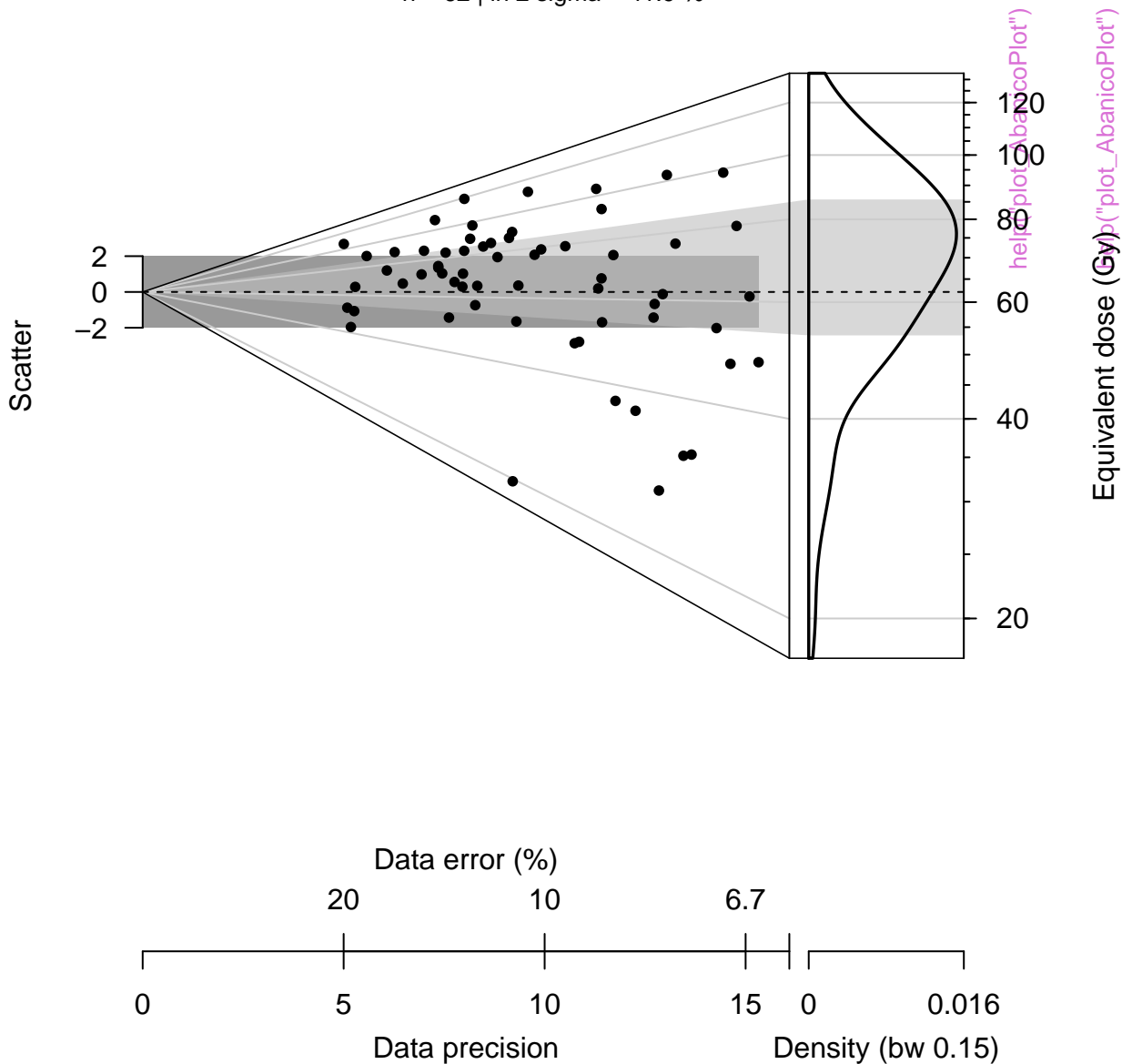
0.016

Precision

Density (bw 0.15)

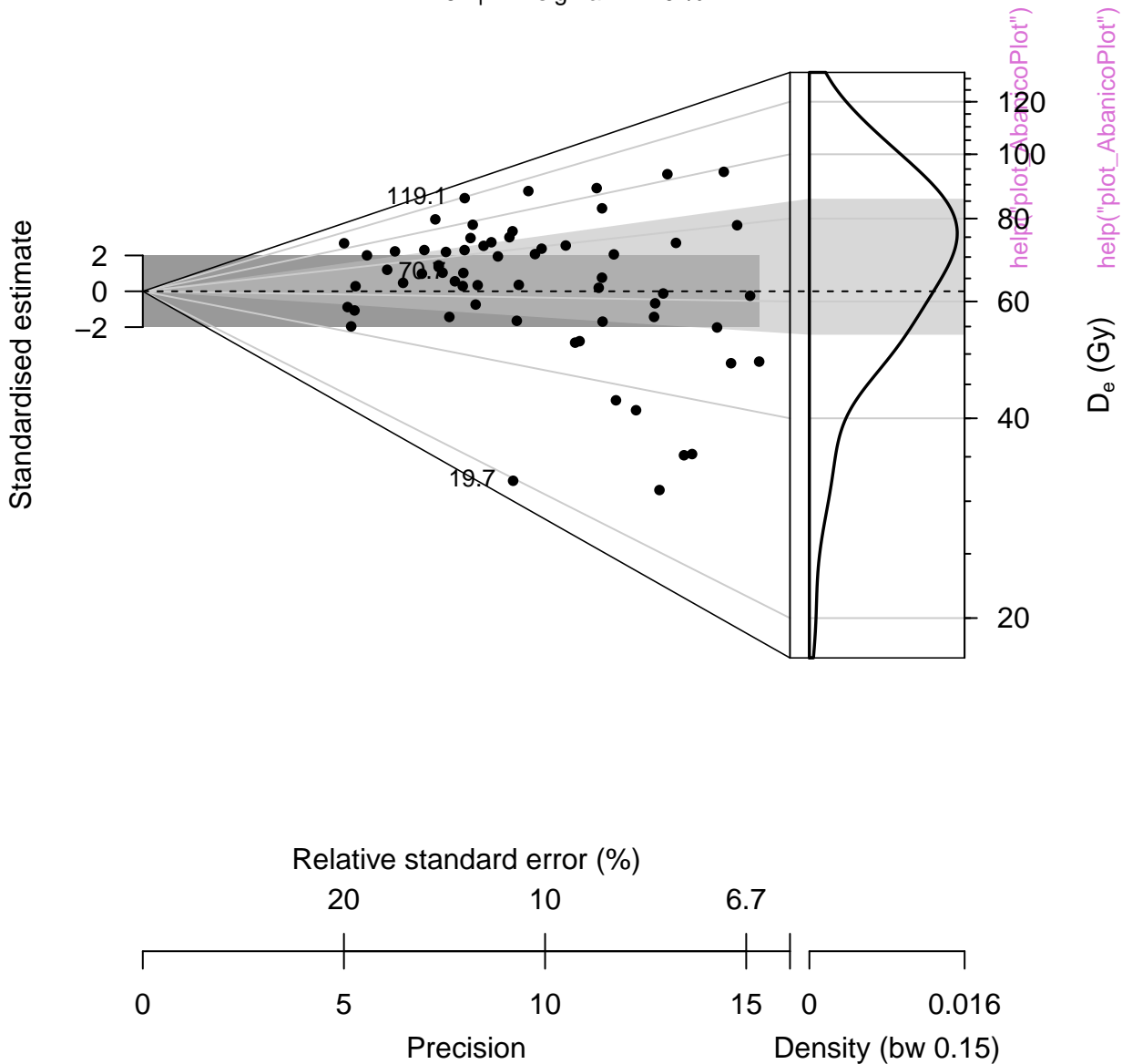
# D<sub>e</sub> distribution

n = 62 | in 2 sigma = 41.9 %



# D<sub>e</sub> distribution

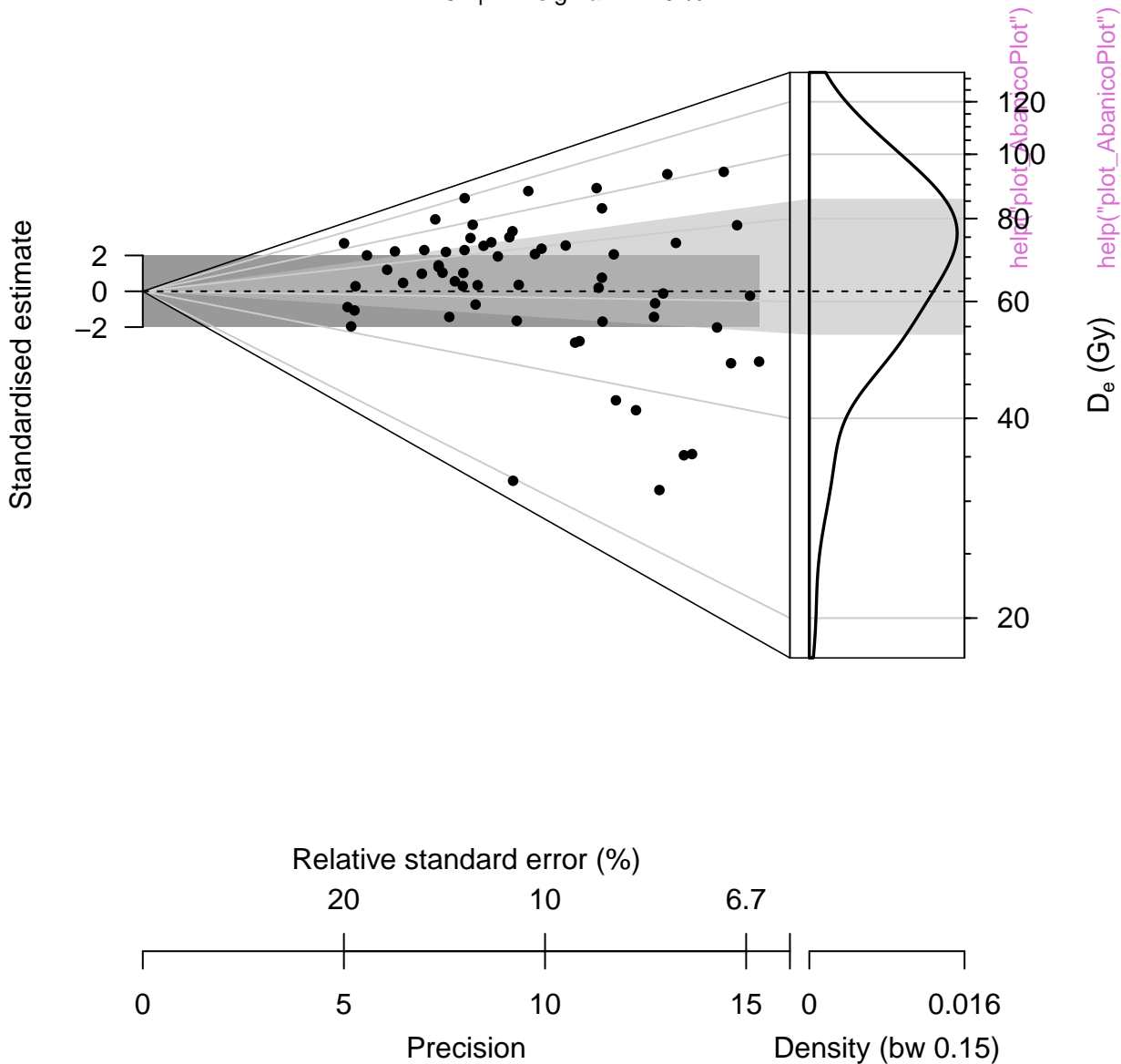
n = 62 | in 2 sigma = 41.9 %





# D<sub>e</sub> distribution

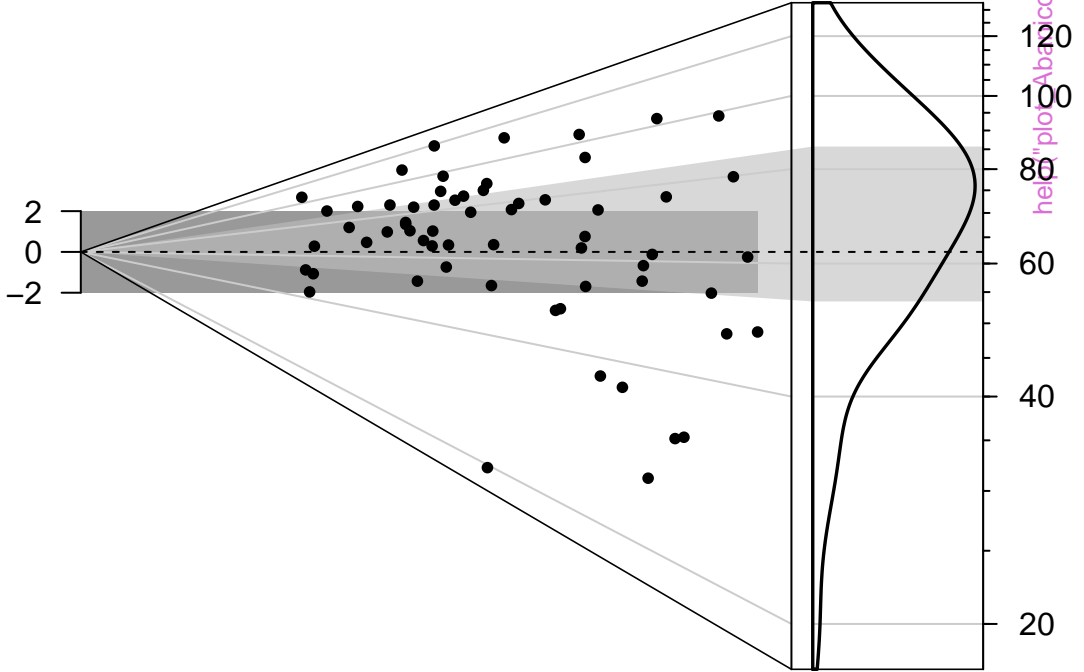
n = 62 | in 2 sigma = 41.9 %



# D<sub>e</sub> distribution

median = 69.75

Standardised estimate



Relative standard error (%)

20

10

6.7

0

5

10

15

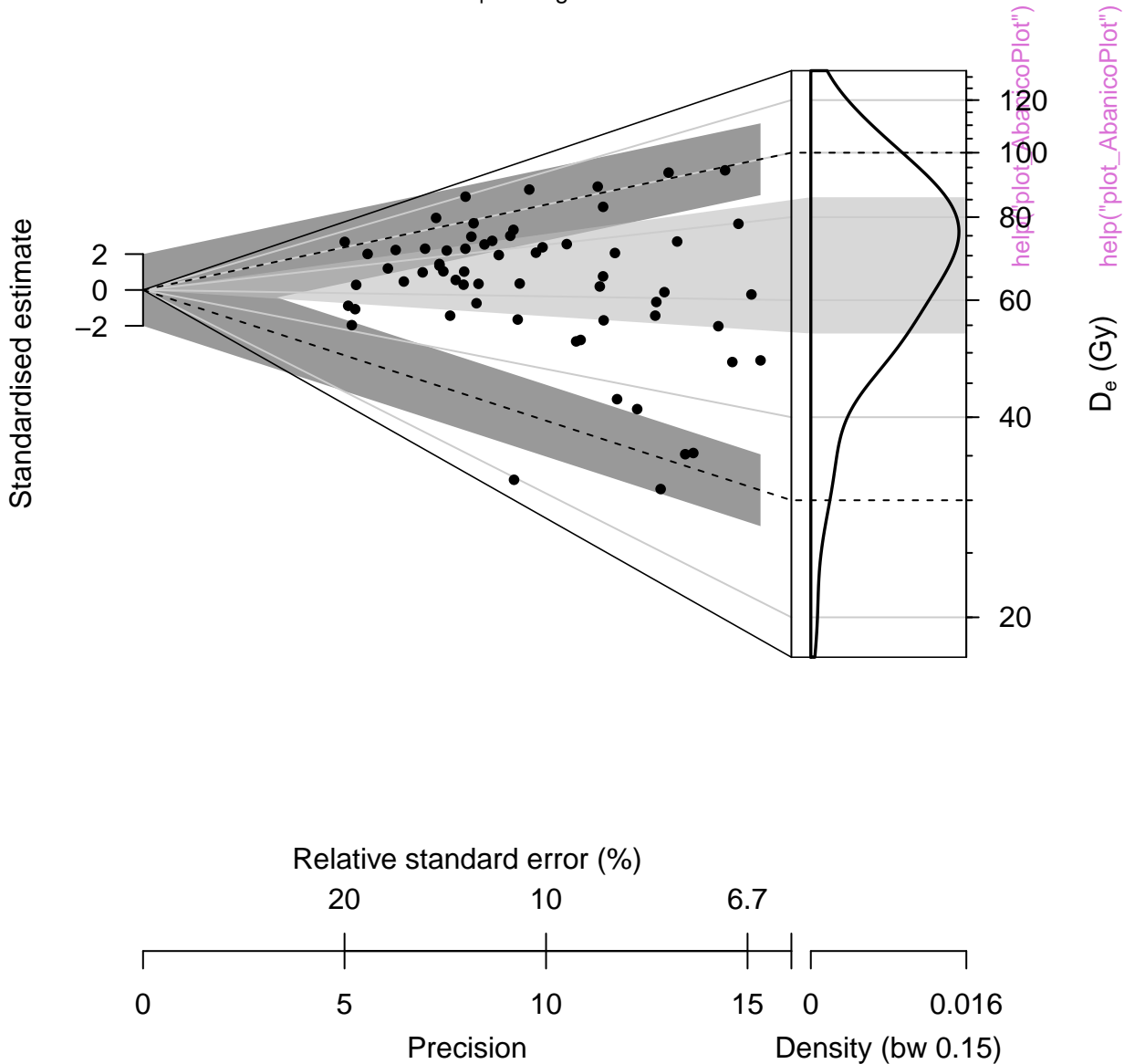
0.016

Precision

Density (bw 0.15)

# D<sub>e</sub> distribution

n = 62 | in 2 sigma = 41.9 %



# D<sub>e</sub> distribution

n = 30 | in 2 sigma = 46.7 %

n = 32 | in 2 sigma = 87.5 %

Standardised estimate



Relative standard error (%)

20

10

6.7

0

5

10

15

0

0.032

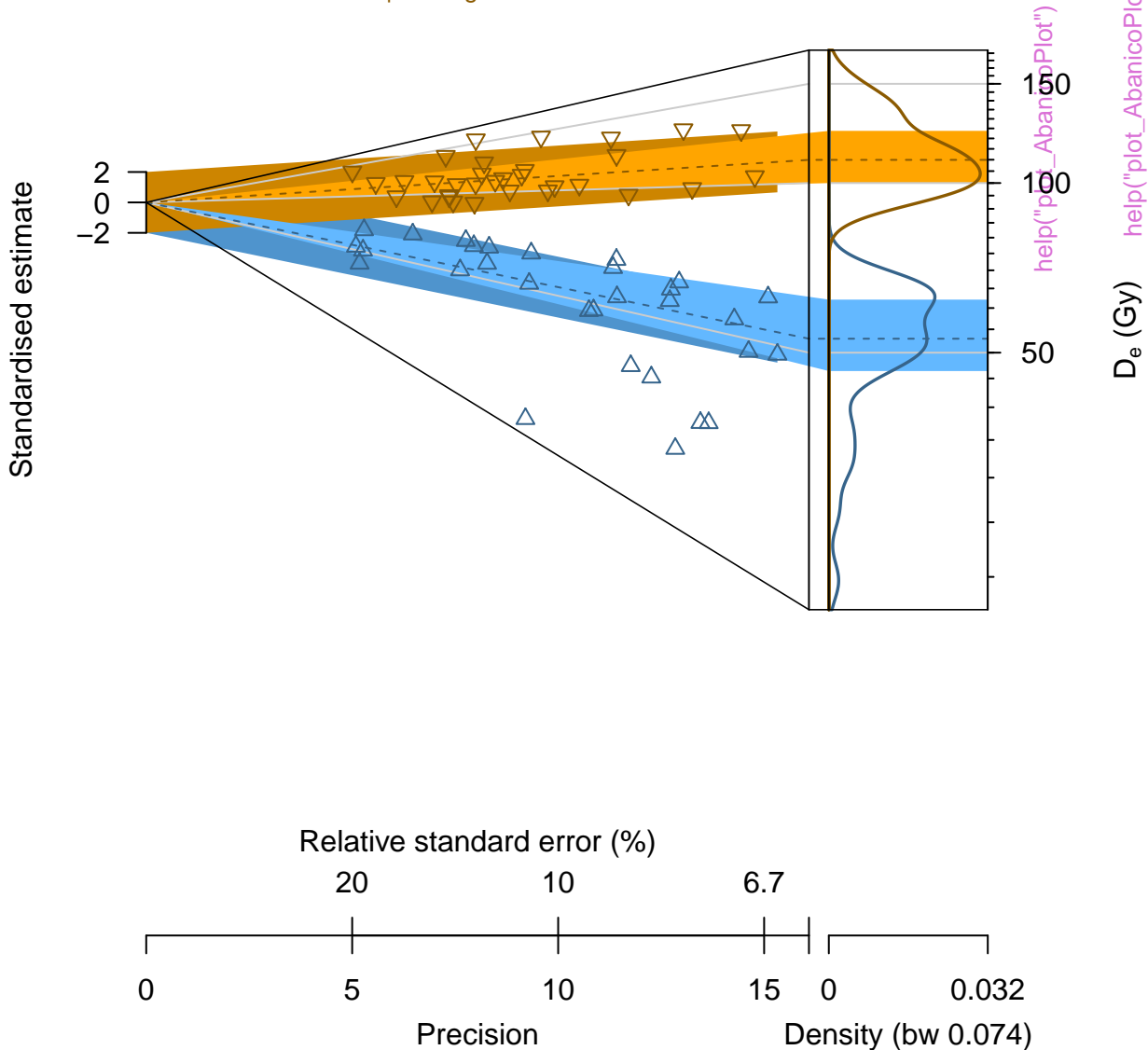
Precision

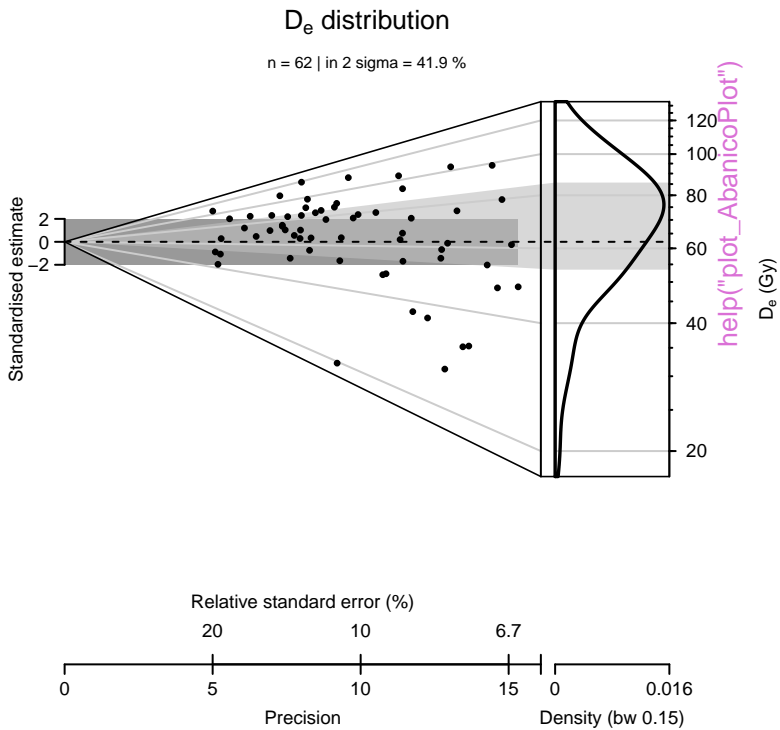
Density (bw 0.074)

# D<sub>e</sub> distribution

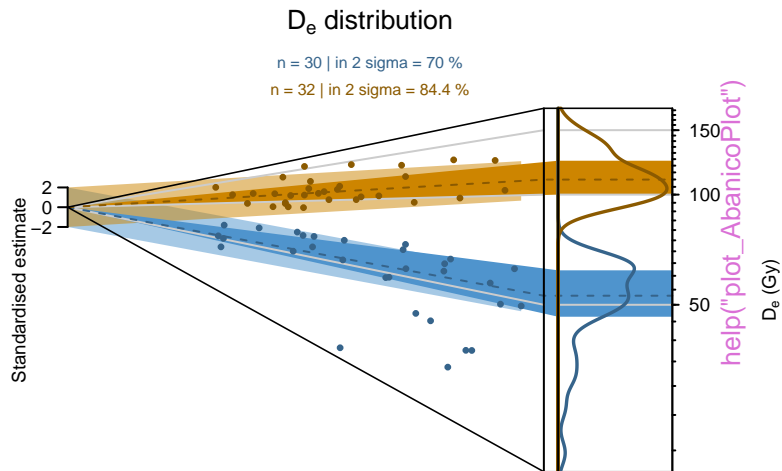
n = 30 | in 2 sigma = 70 % median = 53.39

n = 32 | in 2 sigma = 84.4 % median = 110.51





`help("plot_AbanicoPlot")`



help("plot\_AbanicoPlot")

# Dose recovery test

Example data

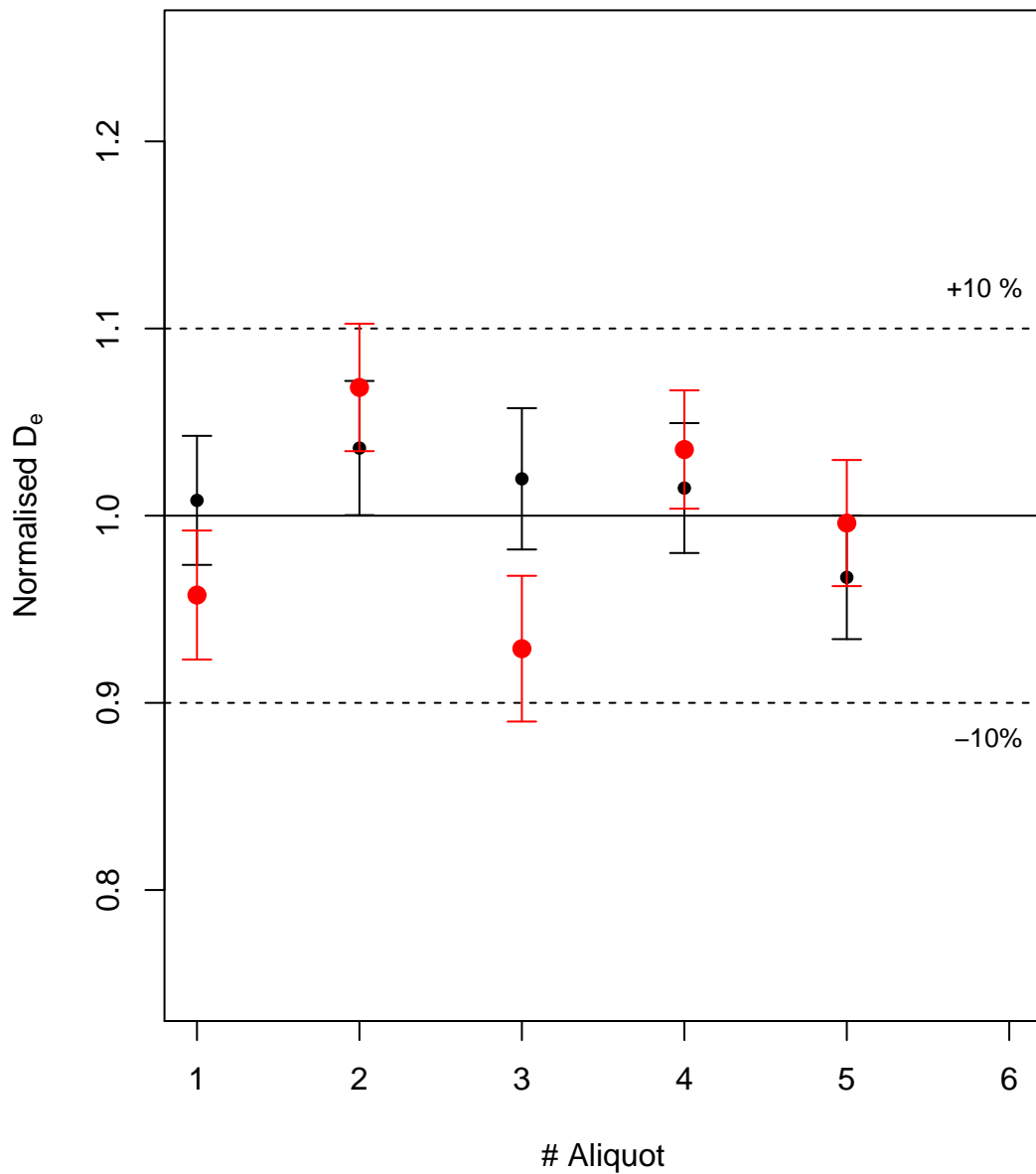




# Dose recovery test



# Dose recovery test



# Dose recovery test



# Dose recovery test



# Dose recovery test

| n = 5 | weighted mean = 1.01 |

| n = 5 | weighted mean = 1 |



# Dose recovery test



# Dose recovery test

Example data



# Dose recovery test





# Dose recovery test



## Filter Combination



`help("plot_FilterCombinations")`

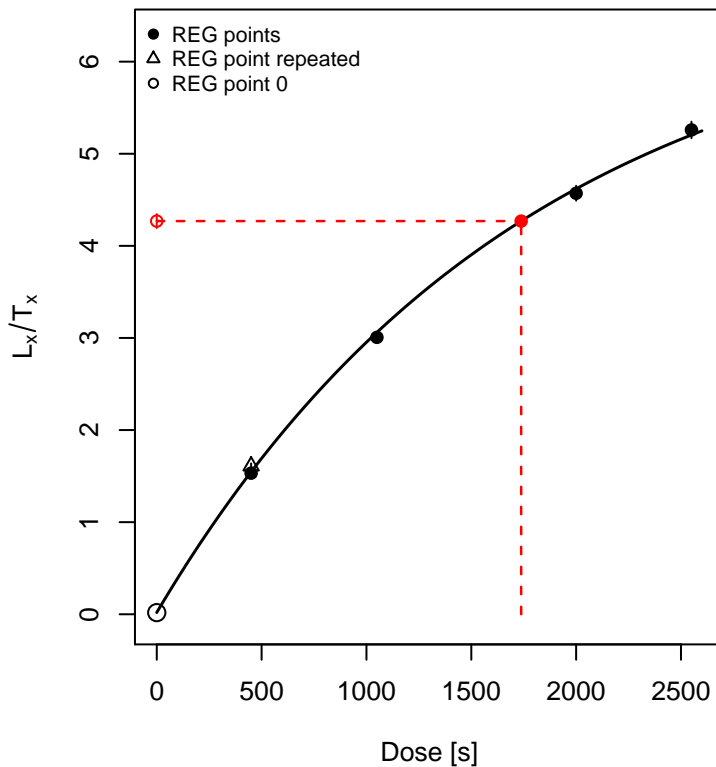
# Filter Combination



`help("plot_FilterCombinations")`

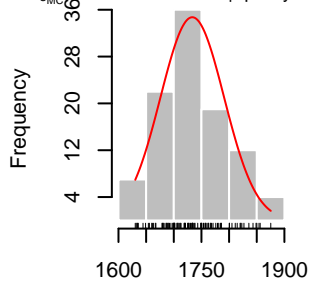
# Growth curve

$D_e = 1737.88 \pm 57.45$  | fit: EXP



$D_e$  from MC simulation

$D_{EMC} = 1733.43 \pm 57.45$  | quality = 99.7 %



Dose [s]  
n = 100 , valid fits = 100

Test dose response



# Growth curve

$D_e = 1737.88 \pm 54.9$  | fit: EXP



$D_e$  from MC simulation

$D_{eMC} = 1731.23 \pm 54.9$  | quality = 99.6 %



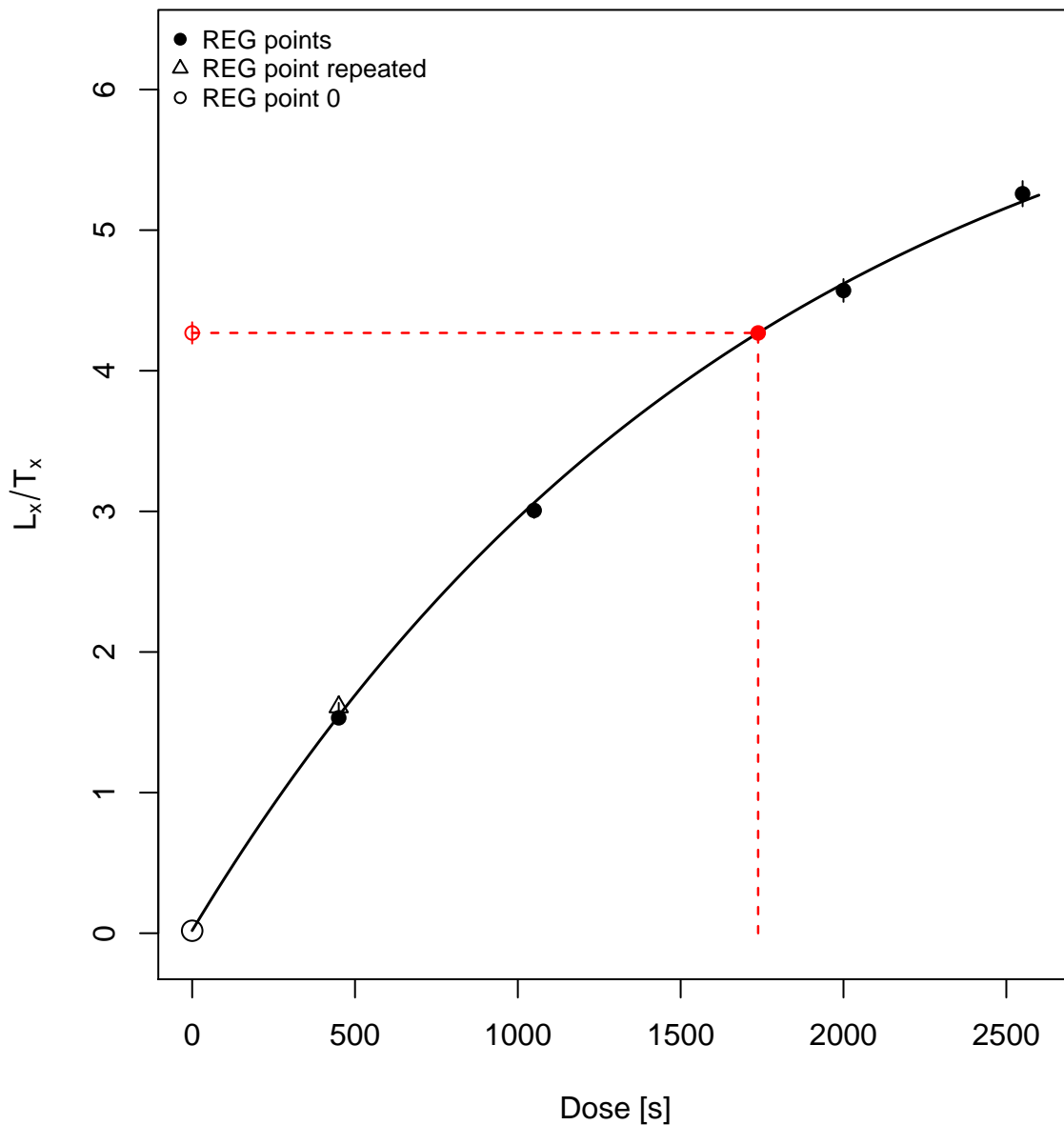
Dose [s]  
n = 100 , valid fits = 100

Test dose response



# Growth curve

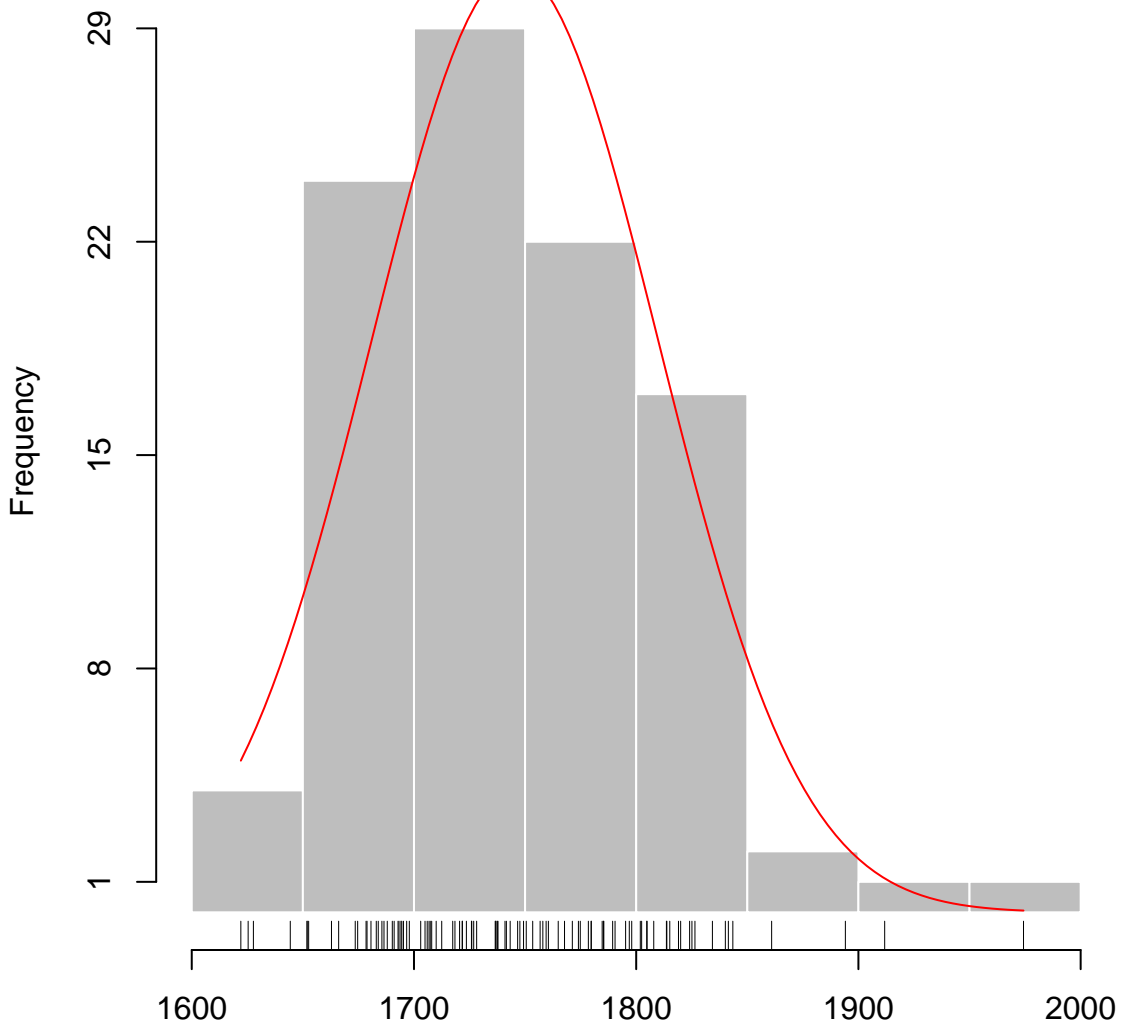
$D_e = 1737.88 \pm 64.53$  | fit: EXP



[help\("plot\\_GrowthCurve"\)](#)

# D<sub>e</sub> from MC simulation

D<sub>eMC</sub> = 1745.42 ± 64.53 | quality = 99.6 %

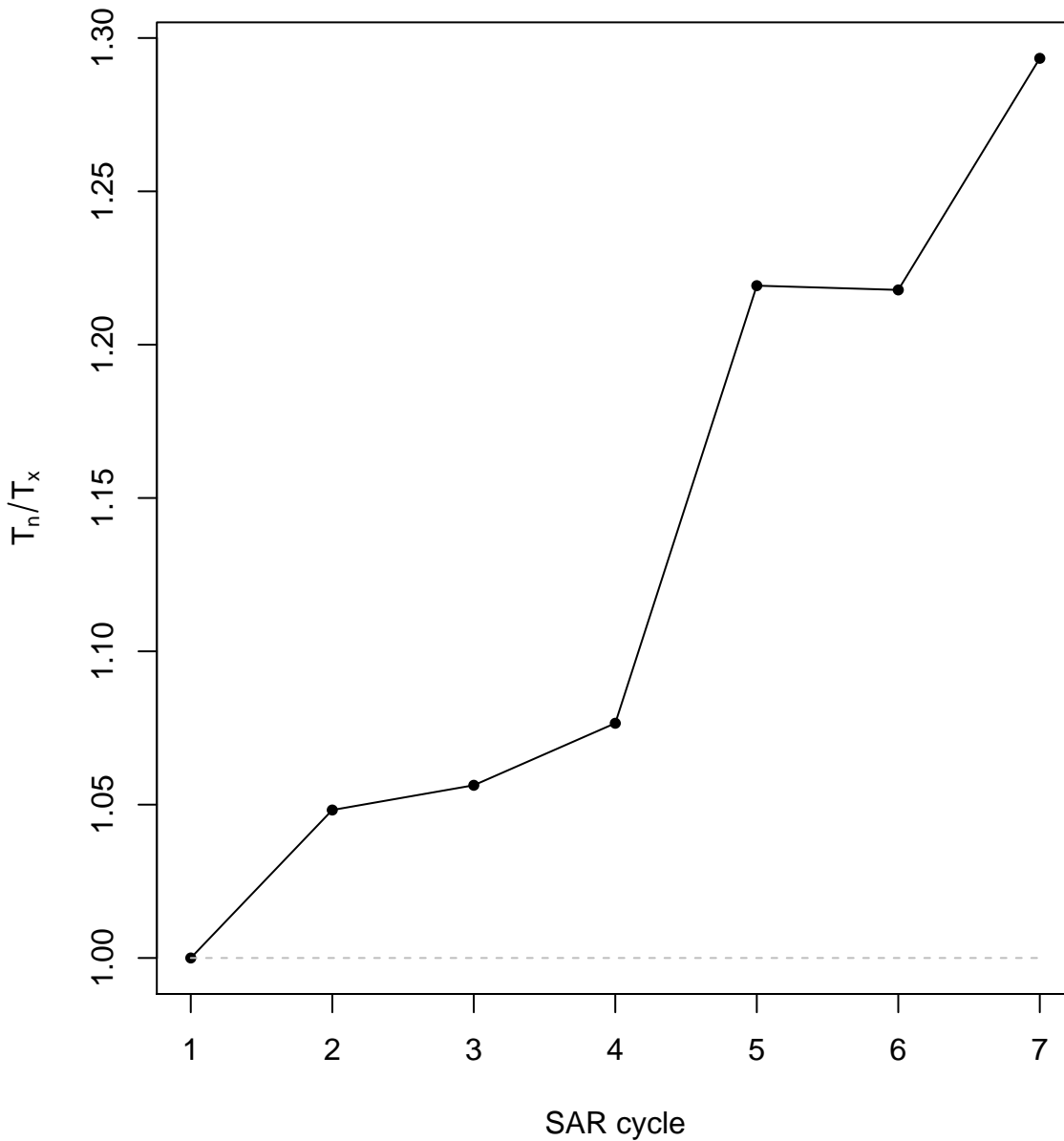


Dose [s]

n = 100 , valid fits = 100

help("plot\_GrowthCurve")

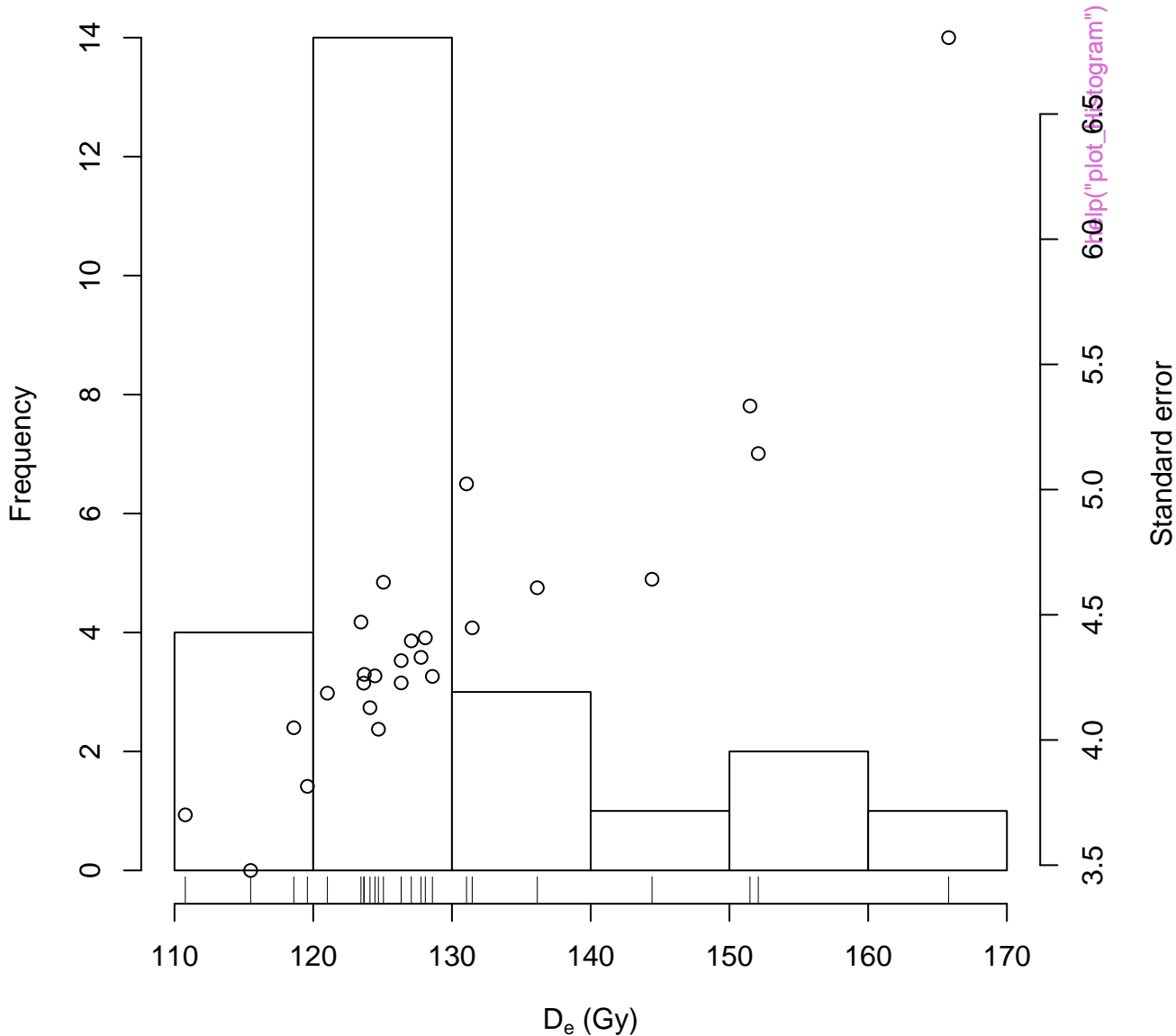
## Test dose response



help("plot\_GrowthCurve")

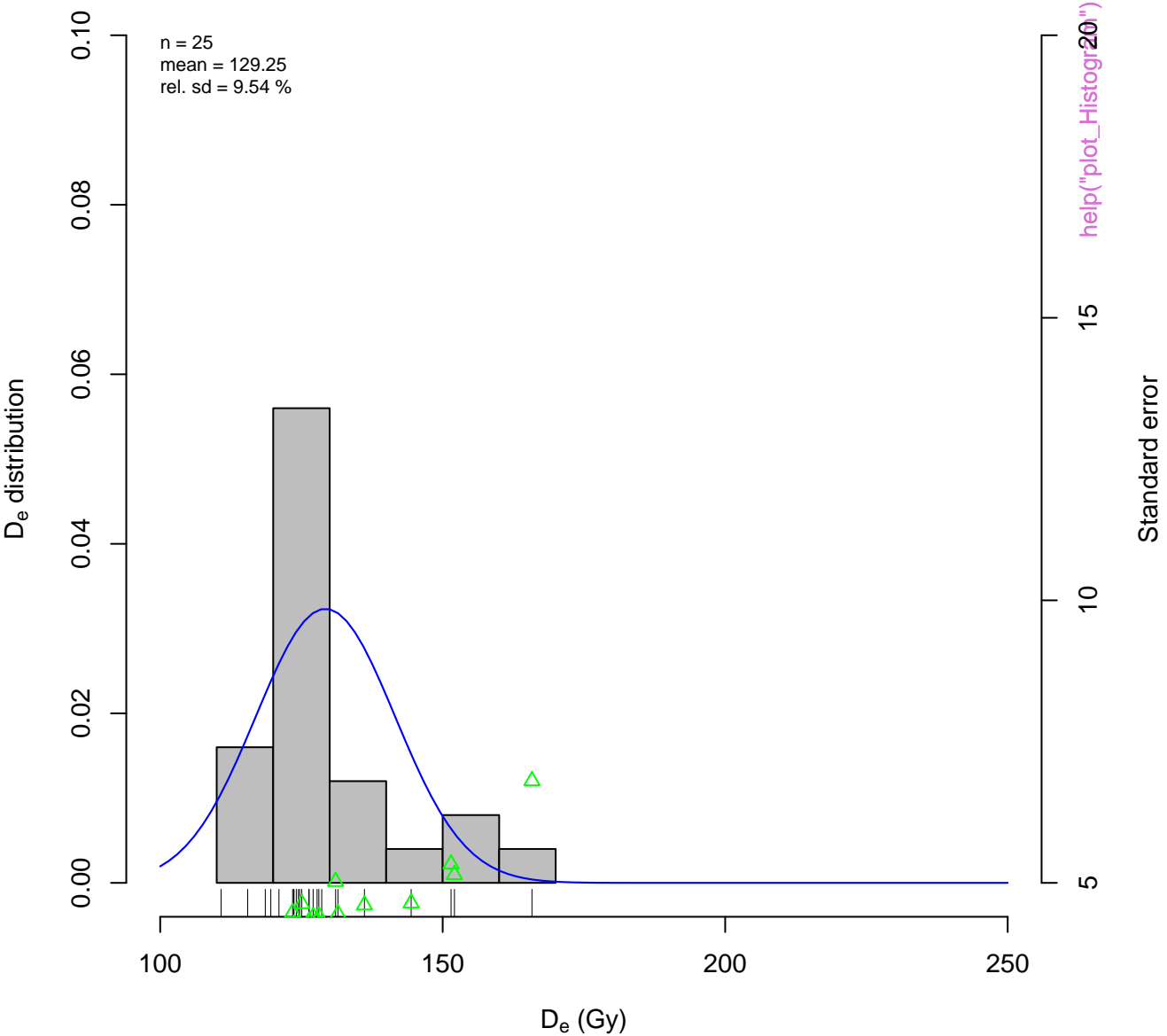


# Histogram

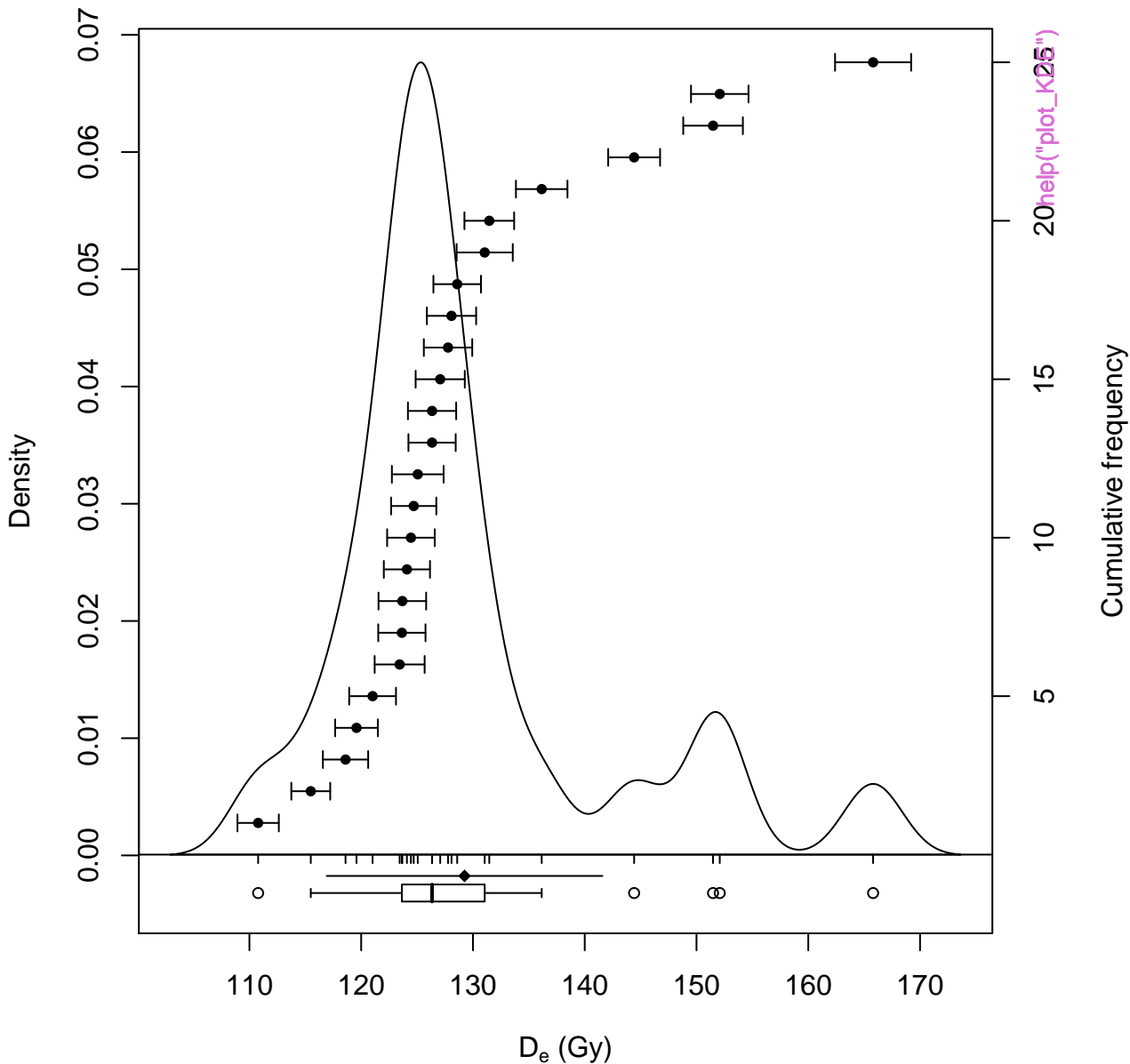


# Histogram of De-values

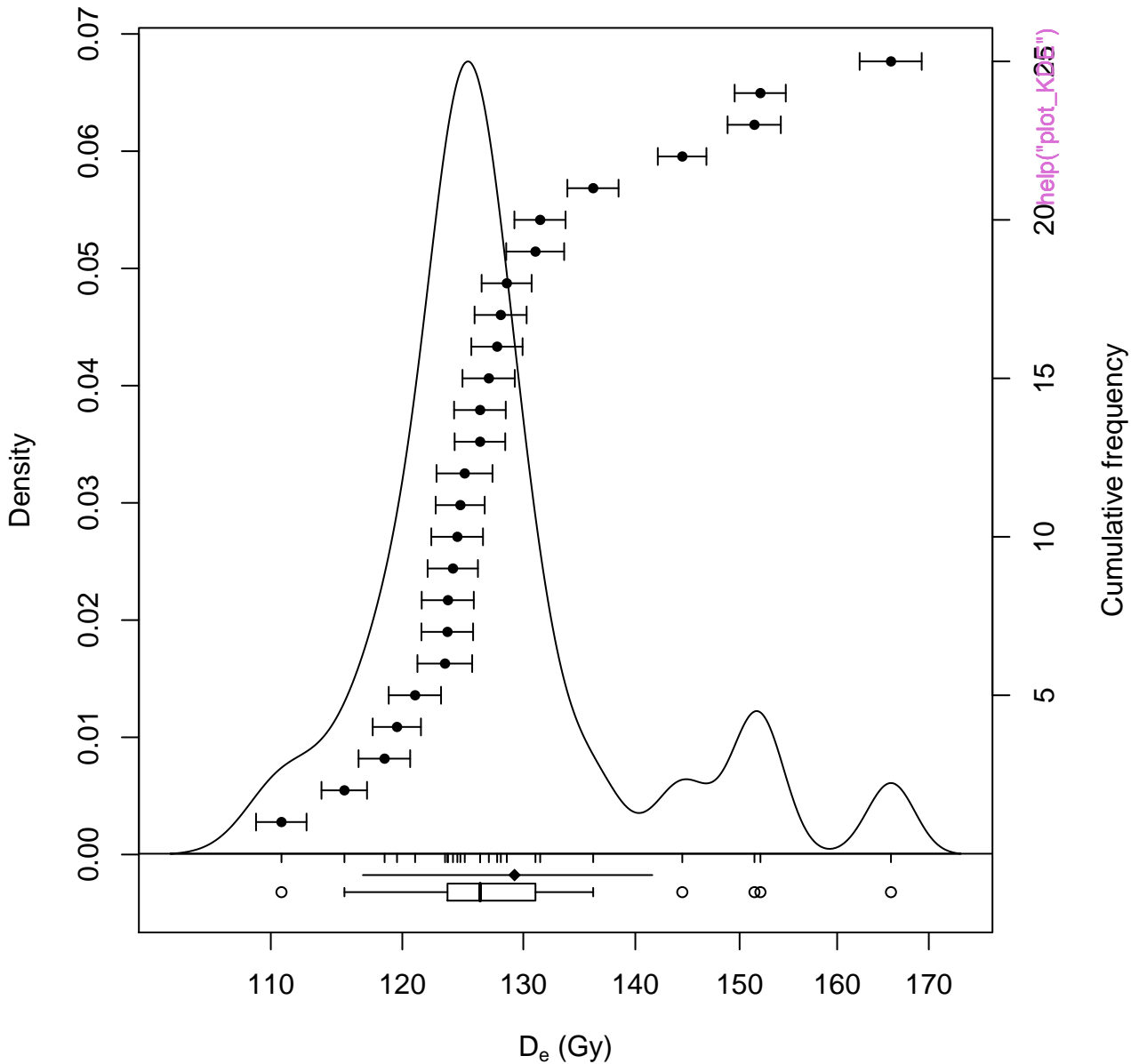
Example data set



# D<sub>e</sub> distribution



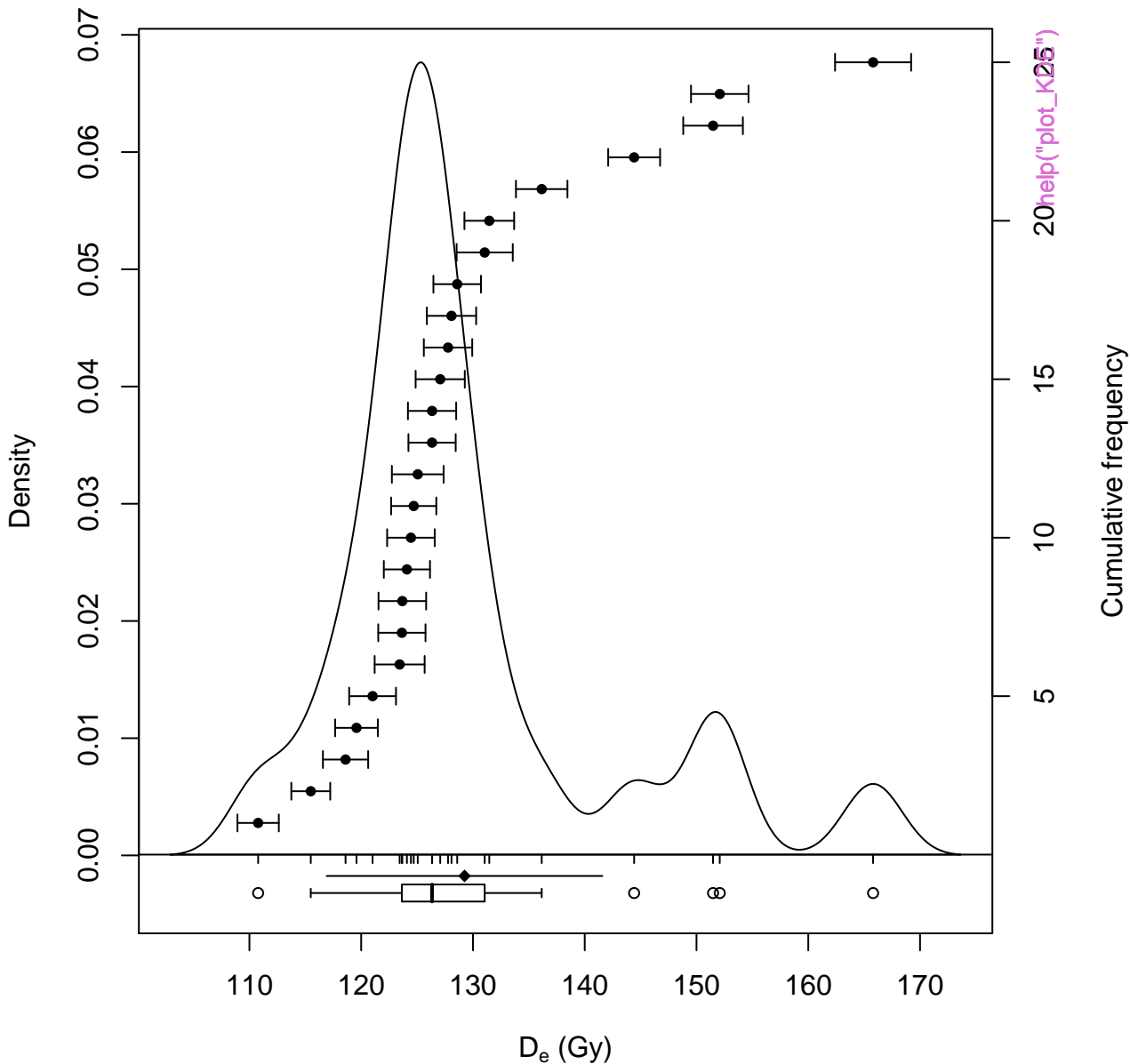
# D<sub>e</sub> distribution



# Dose distribution

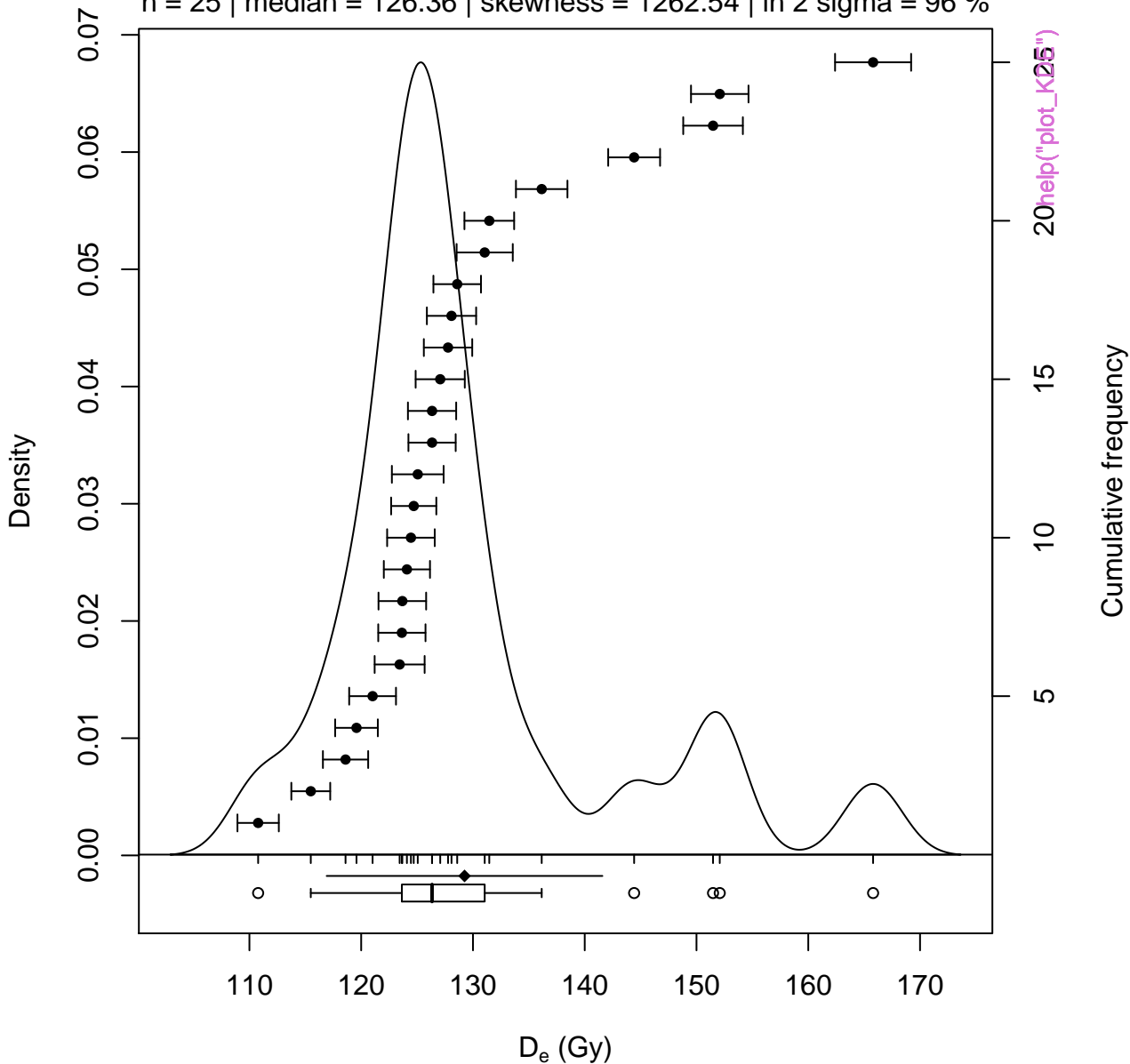


# D<sub>e</sub> distribution

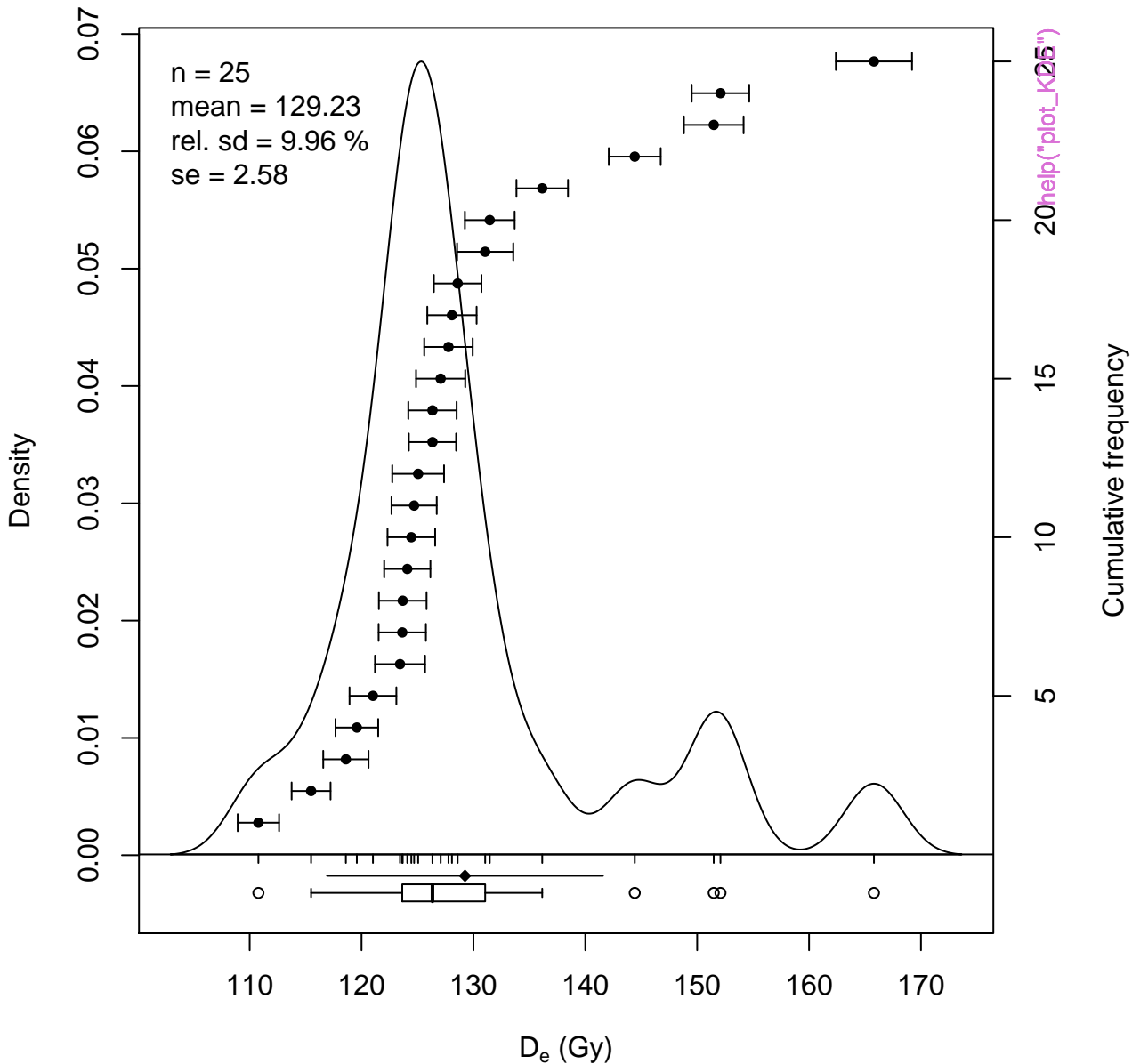


# D<sub>e</sub> distribution

n = 25 | median = 126.36 | skewness = 1262.54 | in 2 sigma = 96 %

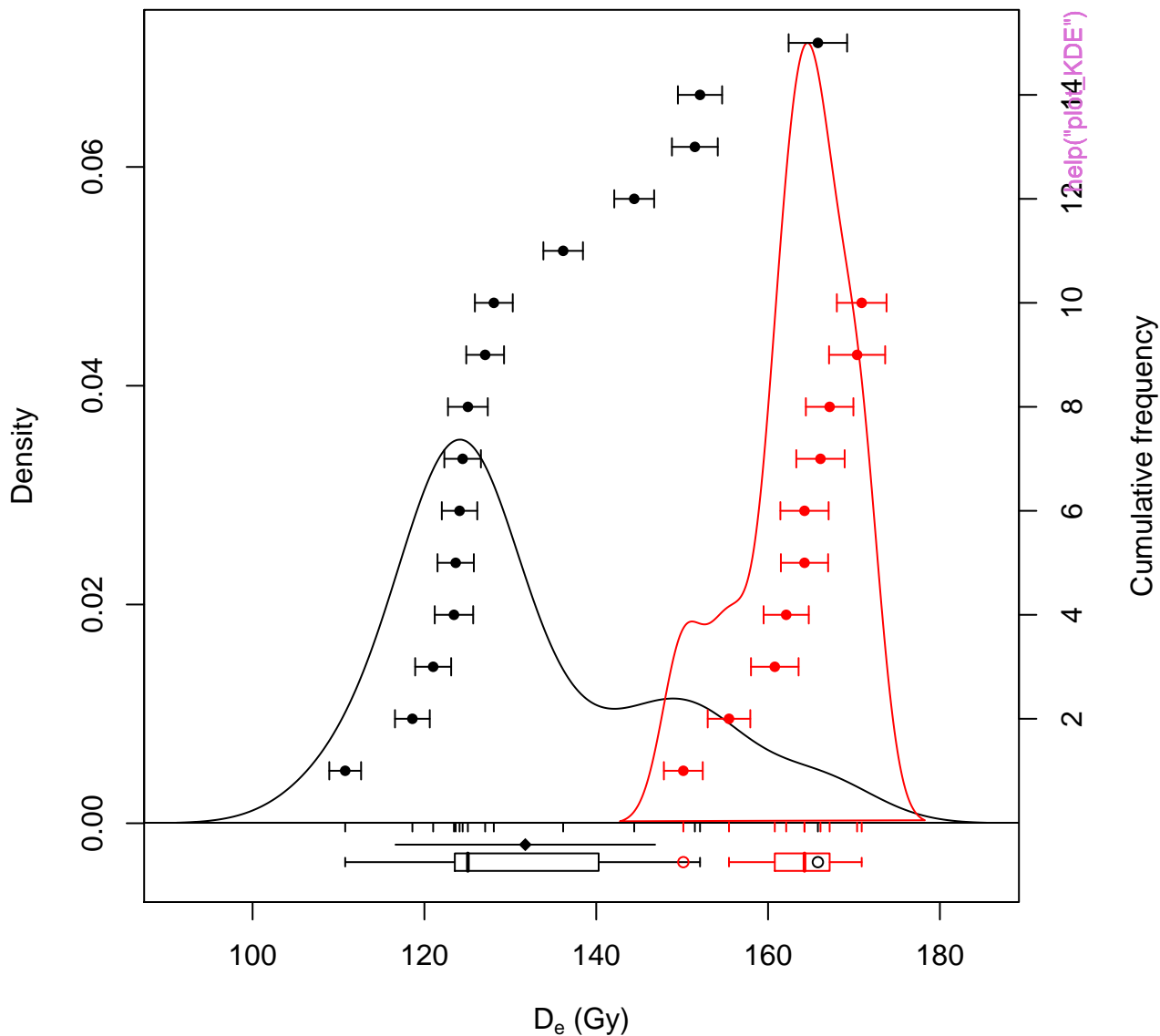


# D<sub>e</sub> distribution

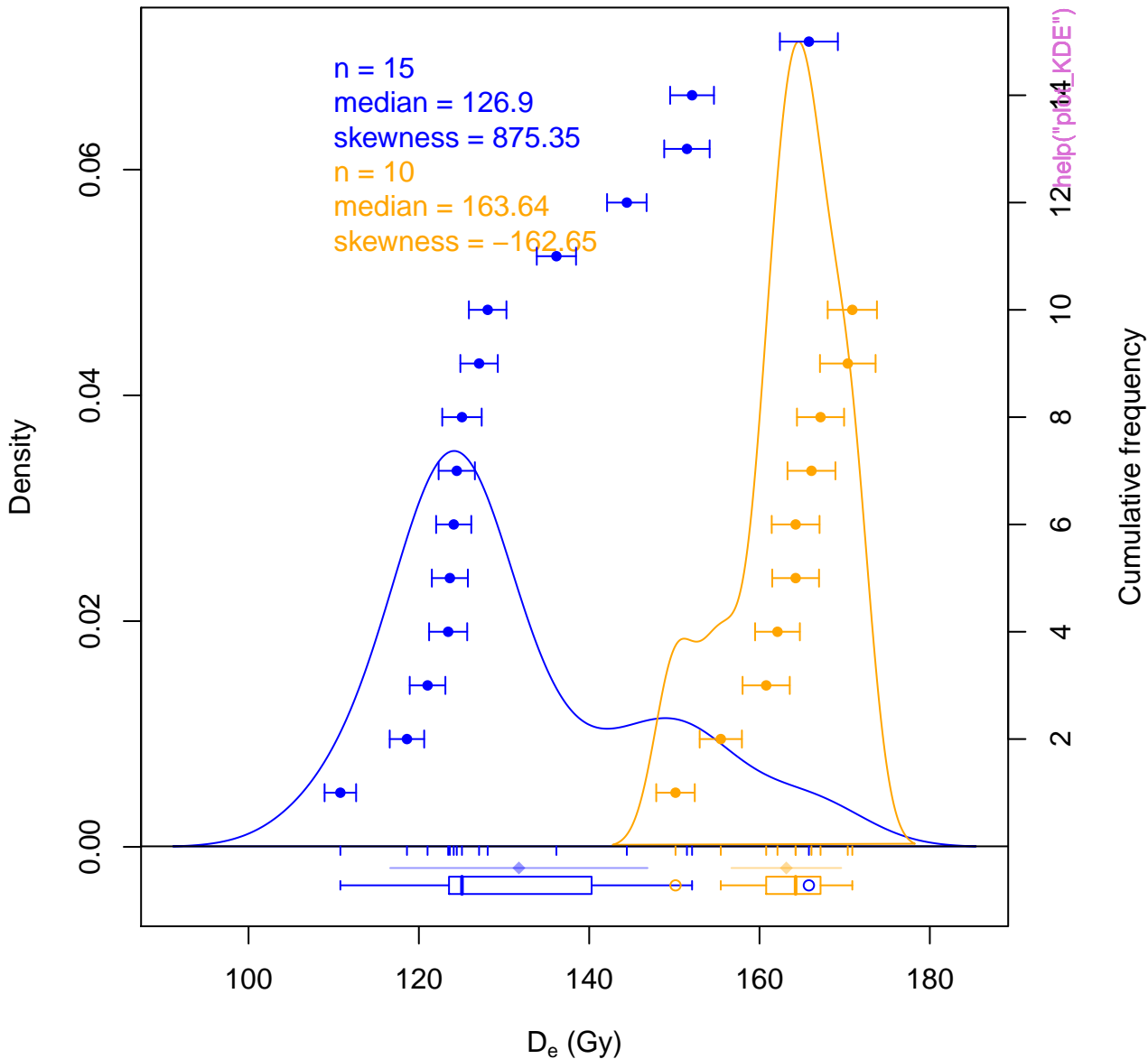




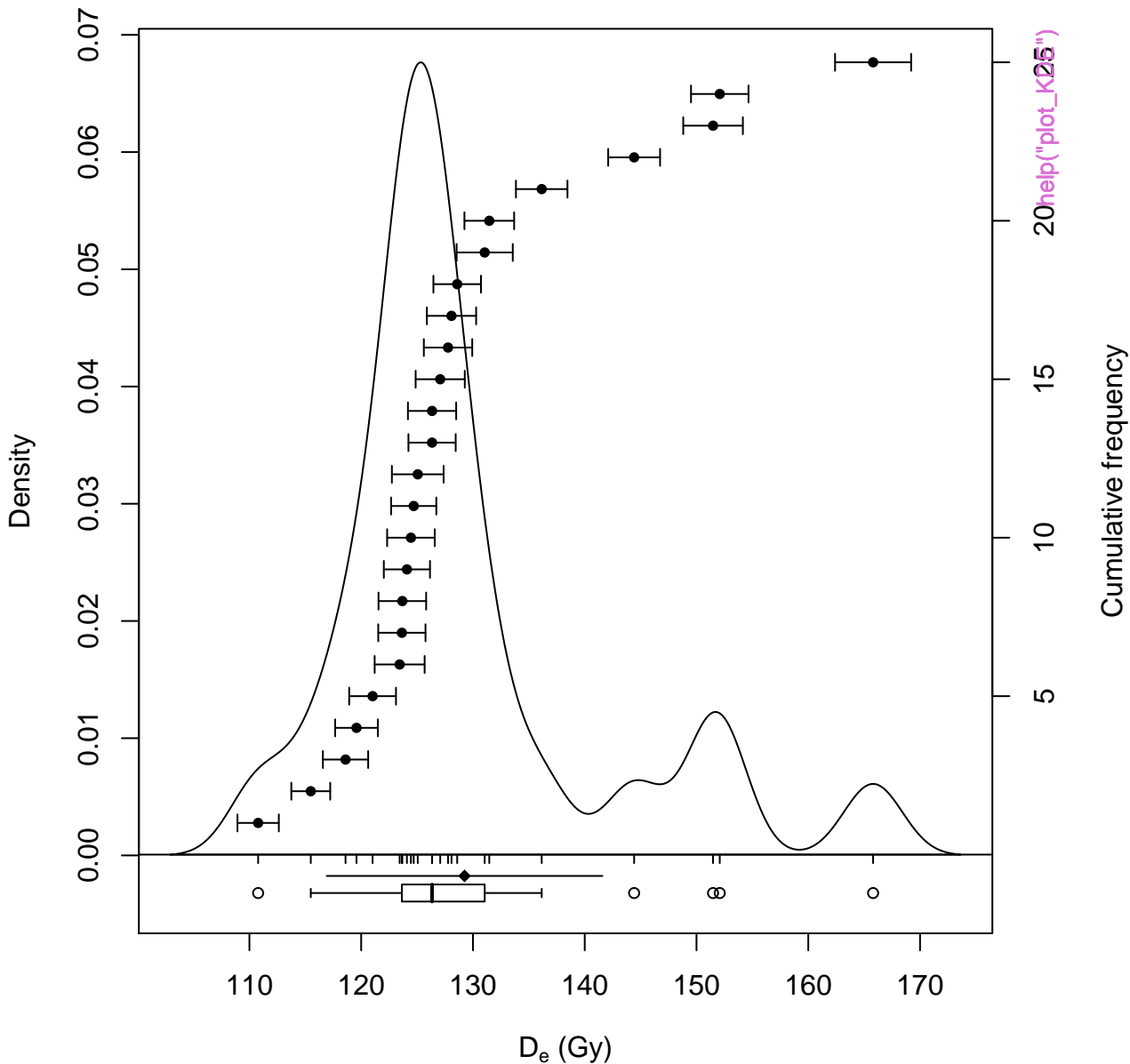
# D<sub>e</sub> distribution



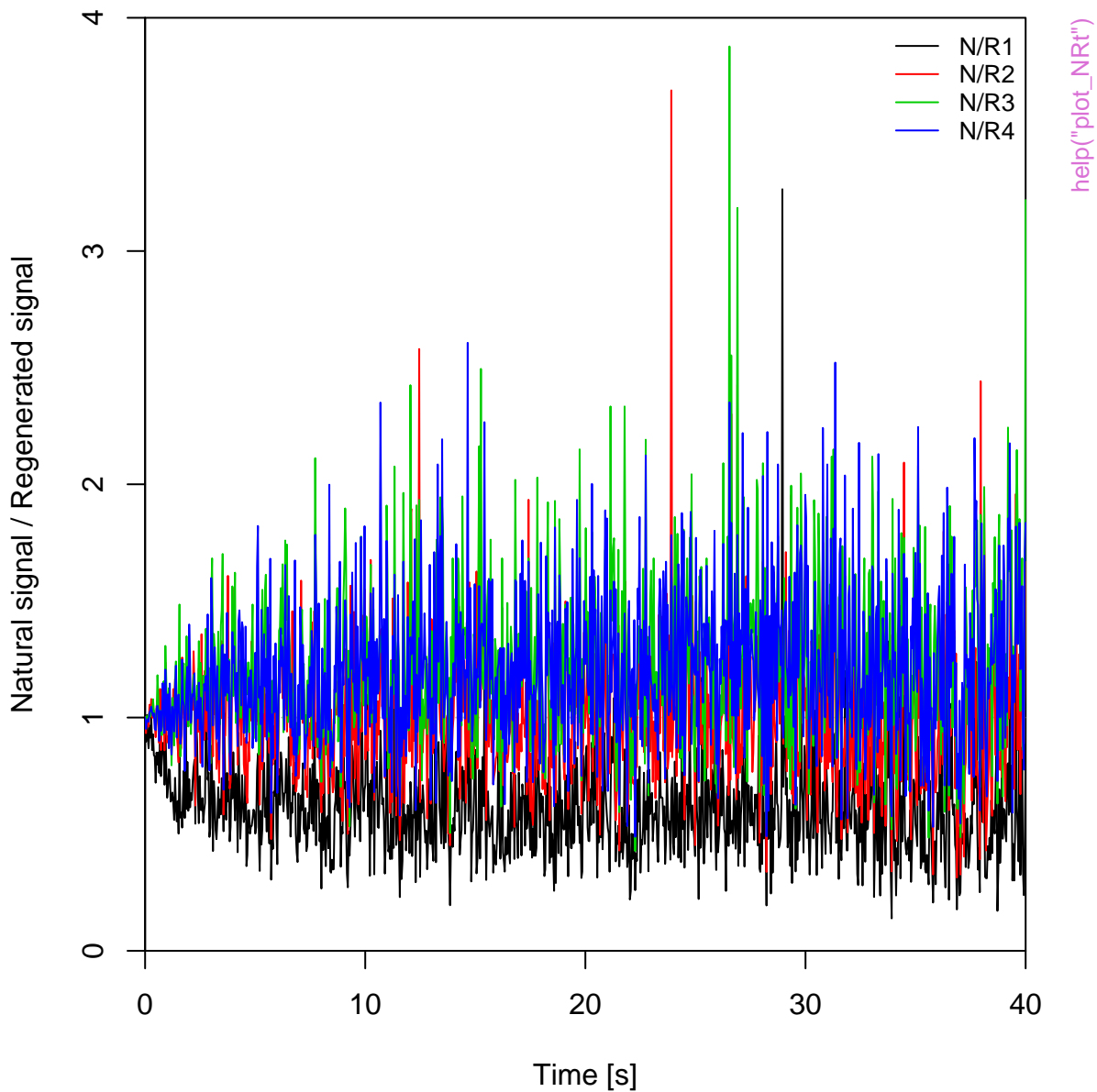
# D<sub>e</sub> distribution



# D<sub>e</sub> distribution



NR(t) Plot



NR(t) Plot



help("plot\_NRt")

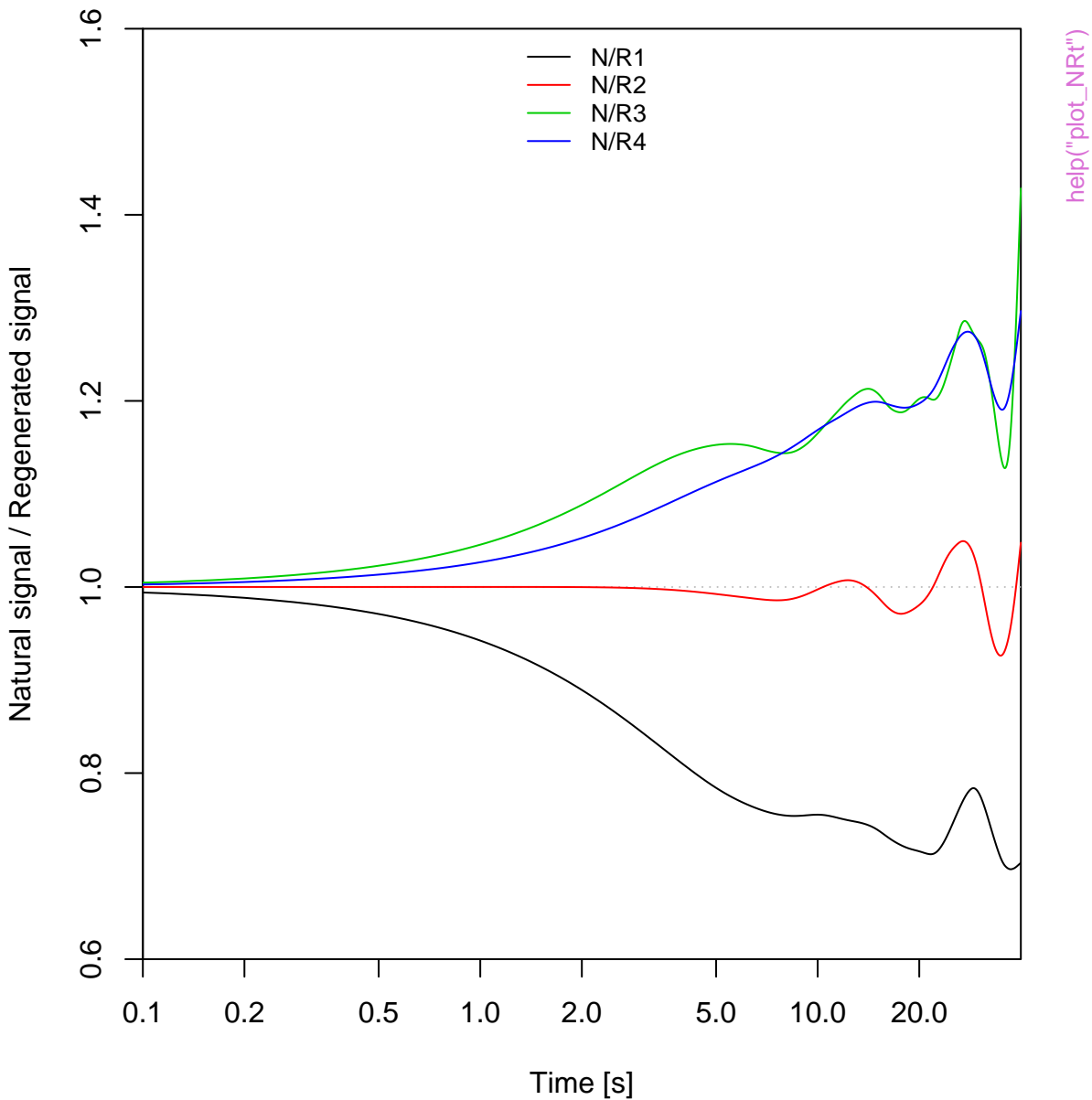
NR(t) Plot



NR(t) Plot



# NR(t) Plot





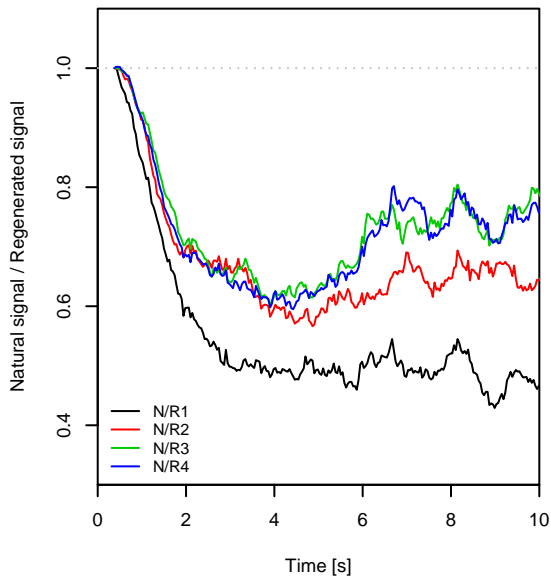
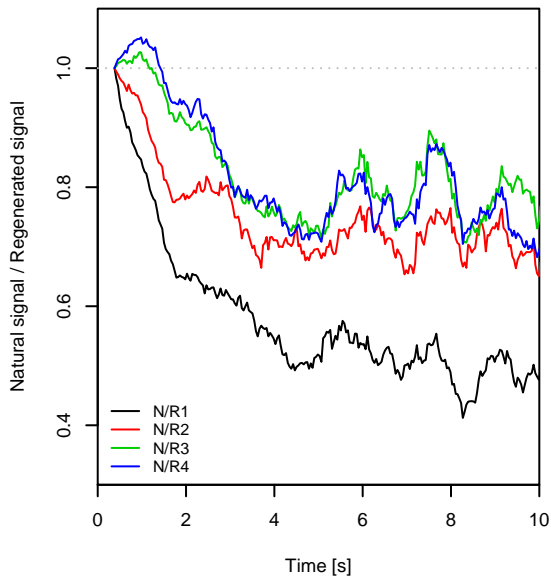
**TnTx(t) Plot**



**Aliquot #1****Aliquot #2**

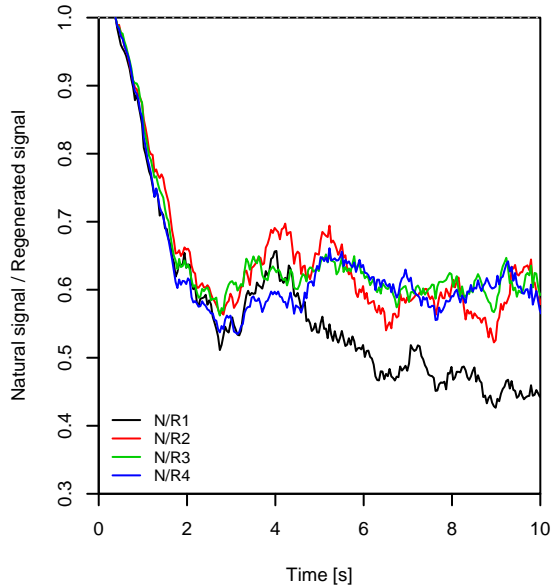
help("plot\_NRt")

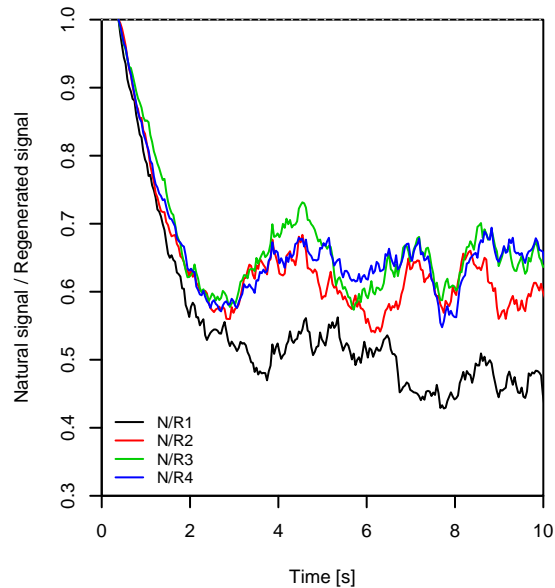
**Aliquot #3****Aliquot #4**

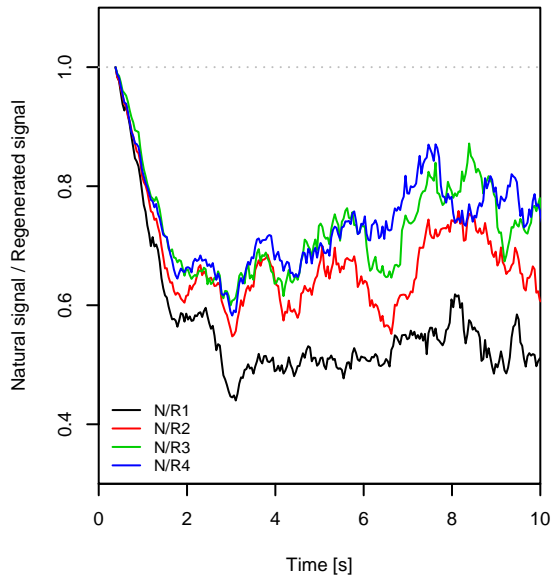
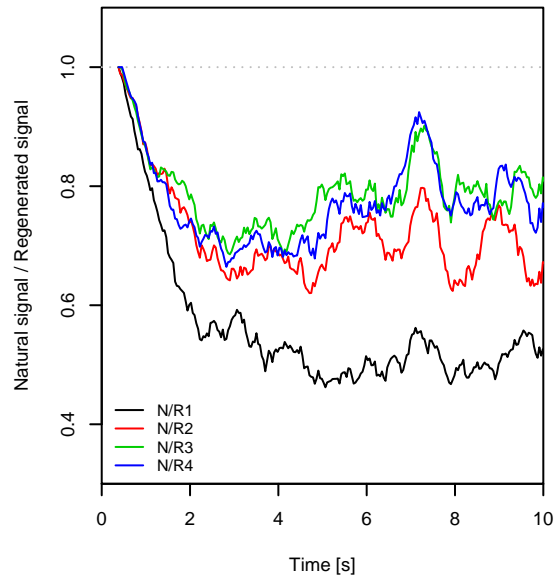
**Aliquot #5****Aliquot #6****Aliquot #7****Aliquot #8**

**Aliquot #9****Aliquot #10**

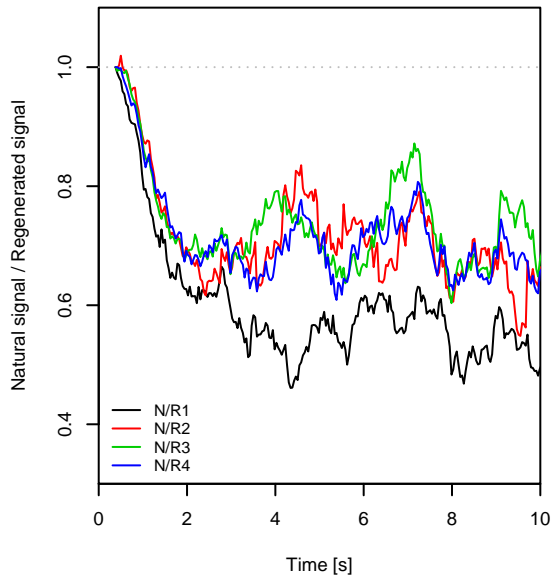
help("plot\_NRt")

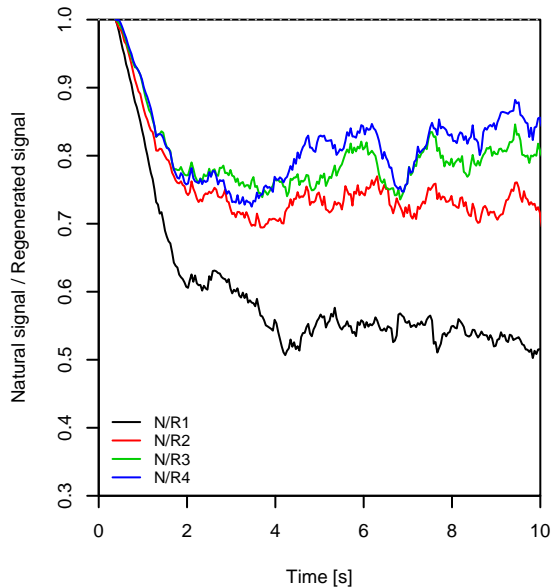
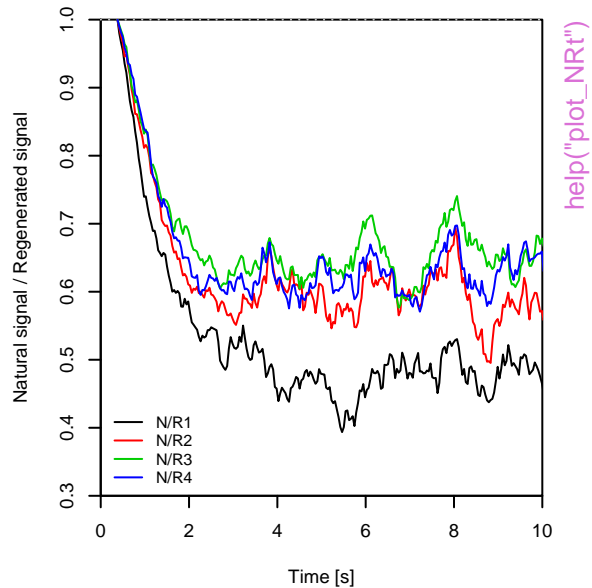
**Aliquot #11****Aliquot #12**

**Aliquot #13****Aliquot #14****Aliquot #15****Aliquot #16**

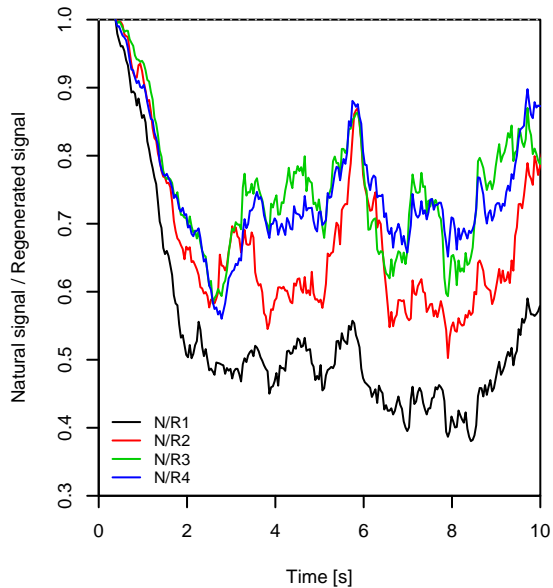
**Aliquot #17****Aliquot #18**

help("plot\_NRt")

**Aliquot #19****Aliquot #20**

**Aliquot #21****Aliquot #22**

help("plot\_NRt")

**Aliquot #23****Aliquot #24**

# TL combined





## unkown curve type



# RLum.Data.Image

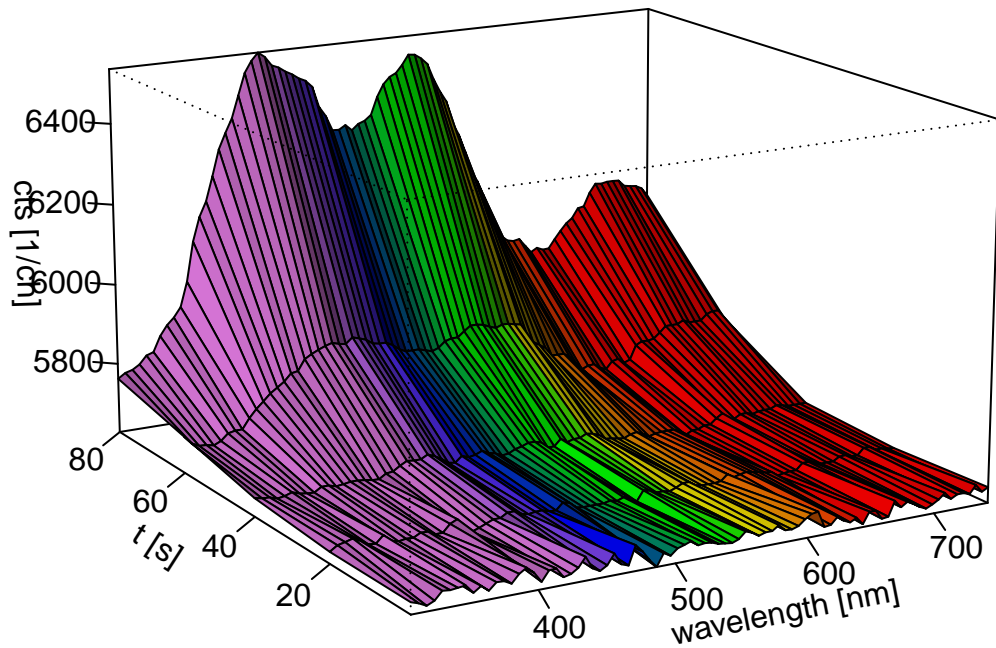


RLum.Data.Spectrum



[help\("plot\\_RLum.Data.Spectrum"\)](#)

# RLum.Data.Spectrum



`help("plot_RLum.Data.Spectrum")`

# RLum.Data.Spectrum



## unkown curve type



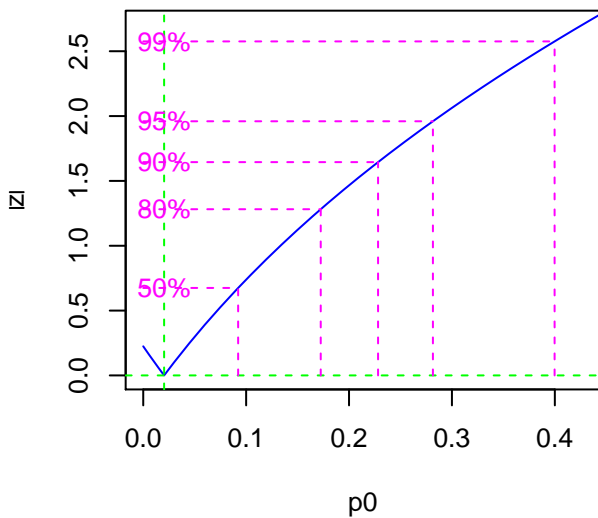
**Likelihood profile: gamma**



**Likelihood profile: sigma**



**Likelihood profile: p0**



help("plot\_RLum.Results")

# Monte Carlo Simulation

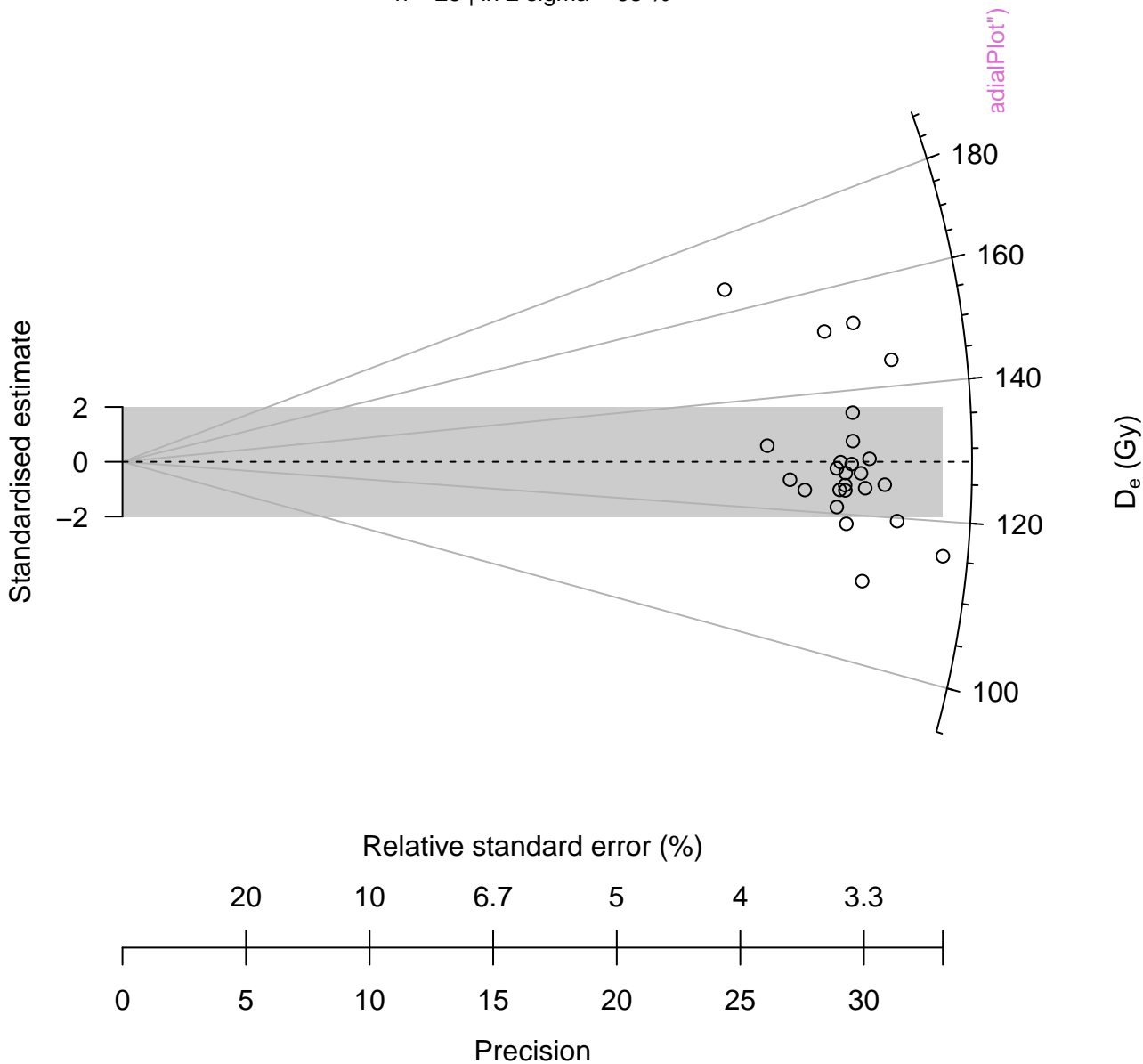
$$n = 100 \mid \hat{\mu} = 45 \mid \hat{\sigma} = 21 \mid \frac{\hat{\sigma}}{\sqrt{n}} = 2 \mid v = 0.84$$





# D<sub>e</sub> distribution

n = 25 | in 2 sigma = 68 %



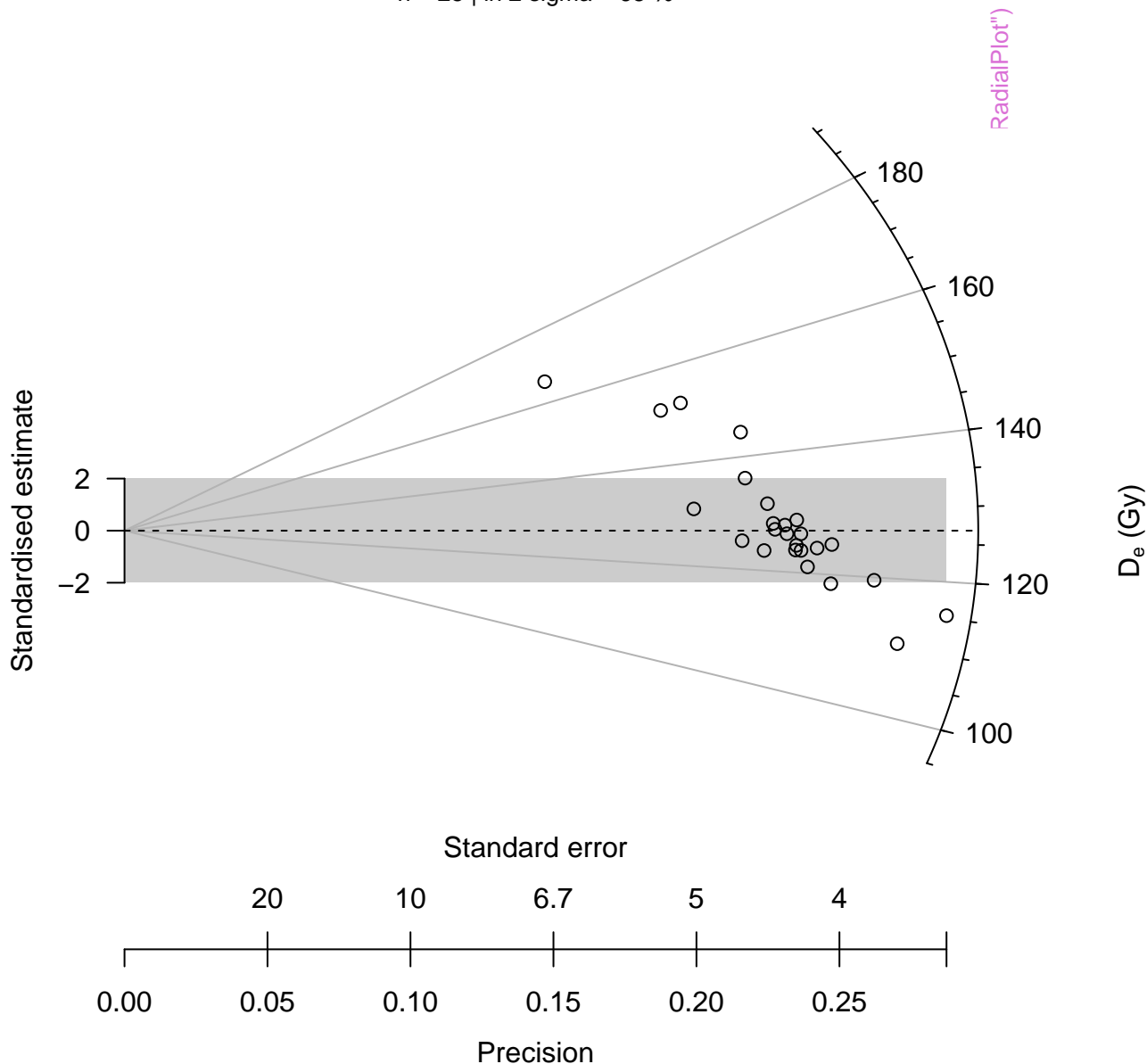
# D<sub>e</sub> distribution

n = 25 | in 2 sigma = 68 %



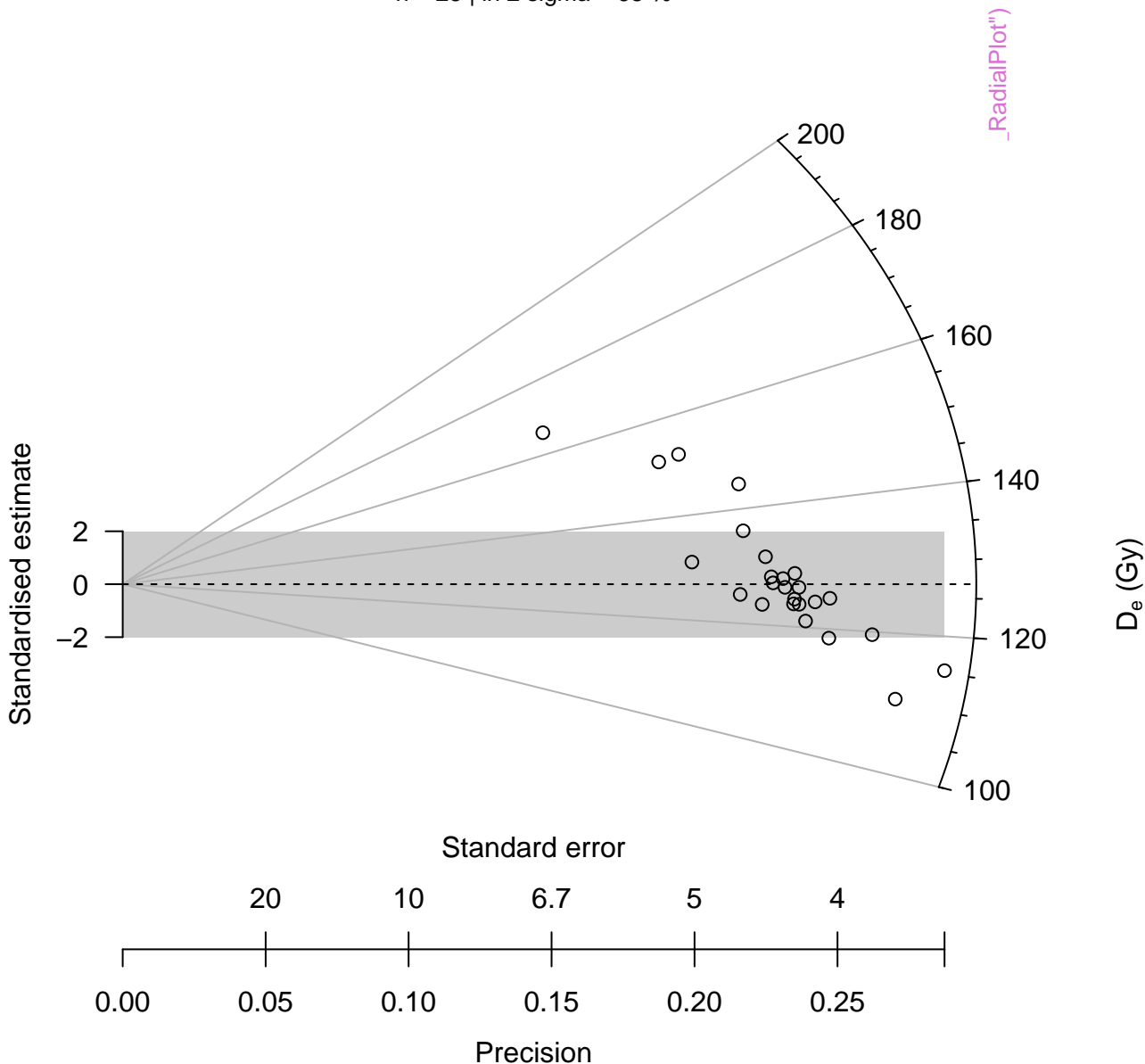
# D<sub>e</sub> distribution

n = 25 | in 2 sigma = 68 %



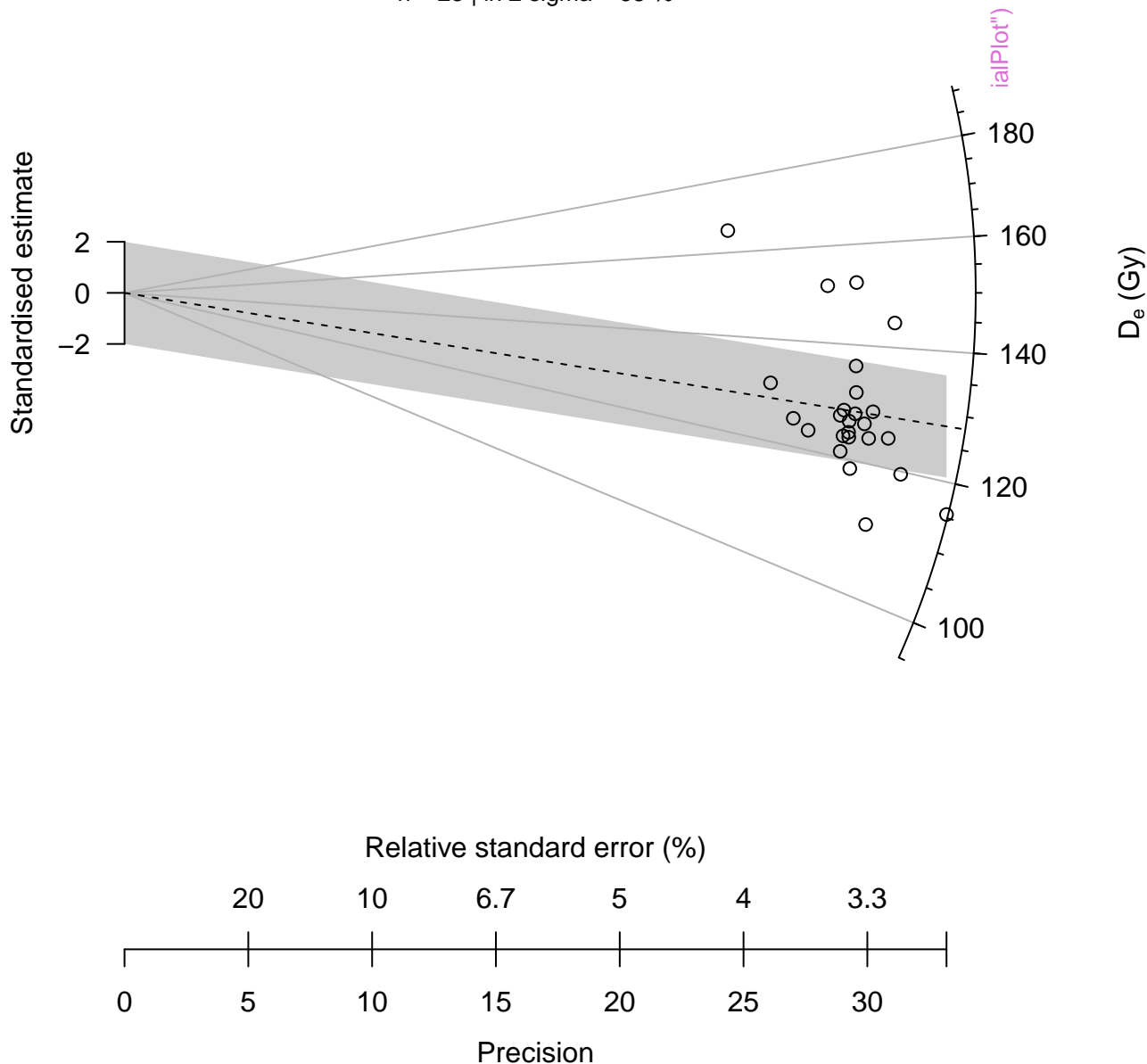
# D<sub>e</sub> distribution

n = 25 | in 2 sigma = 68 %



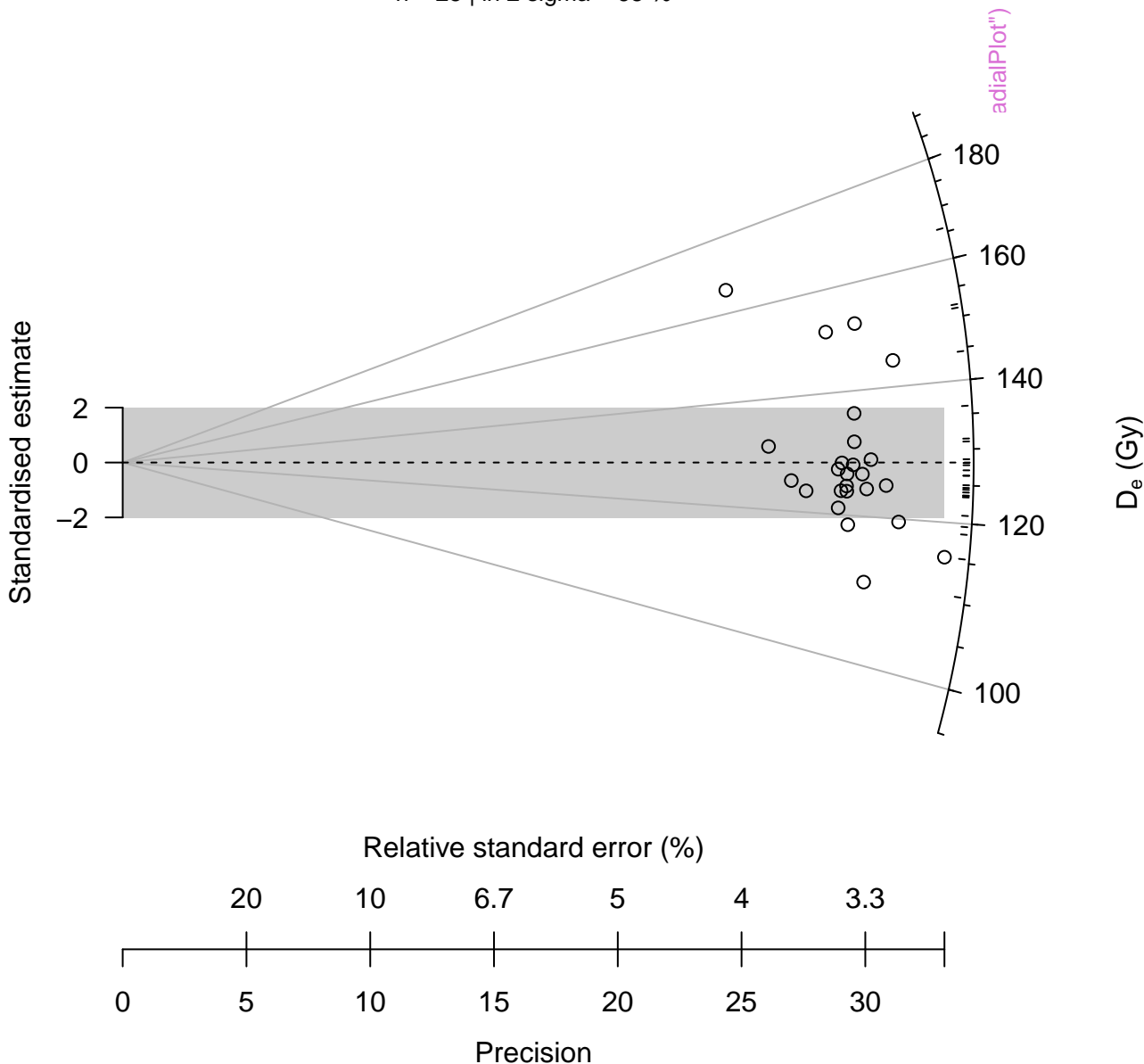
# D<sub>e</sub> distribution

n = 25 | in 2 sigma = 68 %



# D<sub>e</sub> distribution

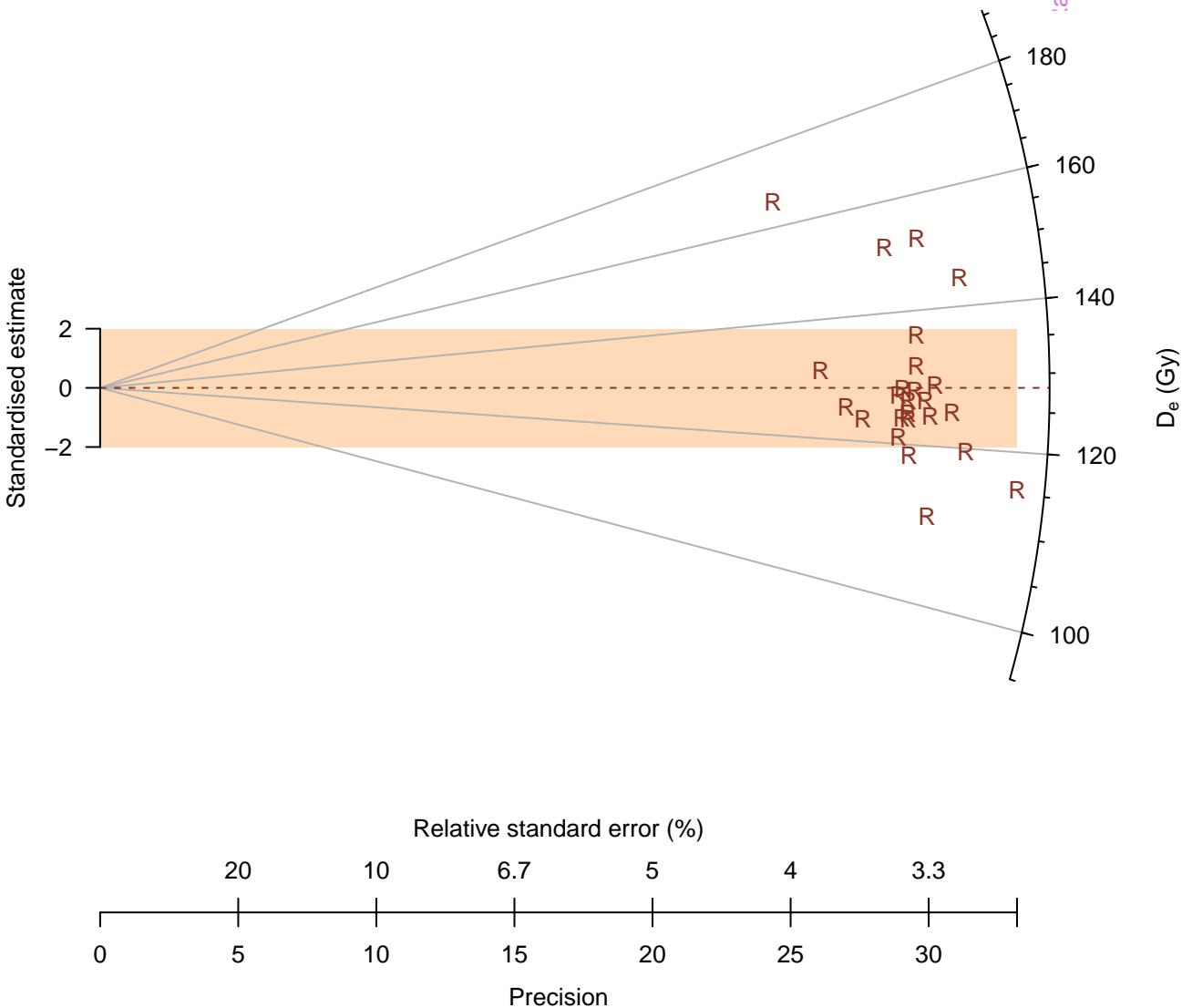
n = 25 | in 2 sigma = 68 %



# D<sub>e</sub> distribution

n = 25 | in 2 sigma = 68 %

radialPlot()



# D<sub>e</sub> distribution

n = 25 | in 2 sigma = 68 %

Standardised estimate

0

0

20

5

10

10

6.7

15

5

20

4

25

3.3

30

Precision

Relative standard error (%)

adialPlot")

180

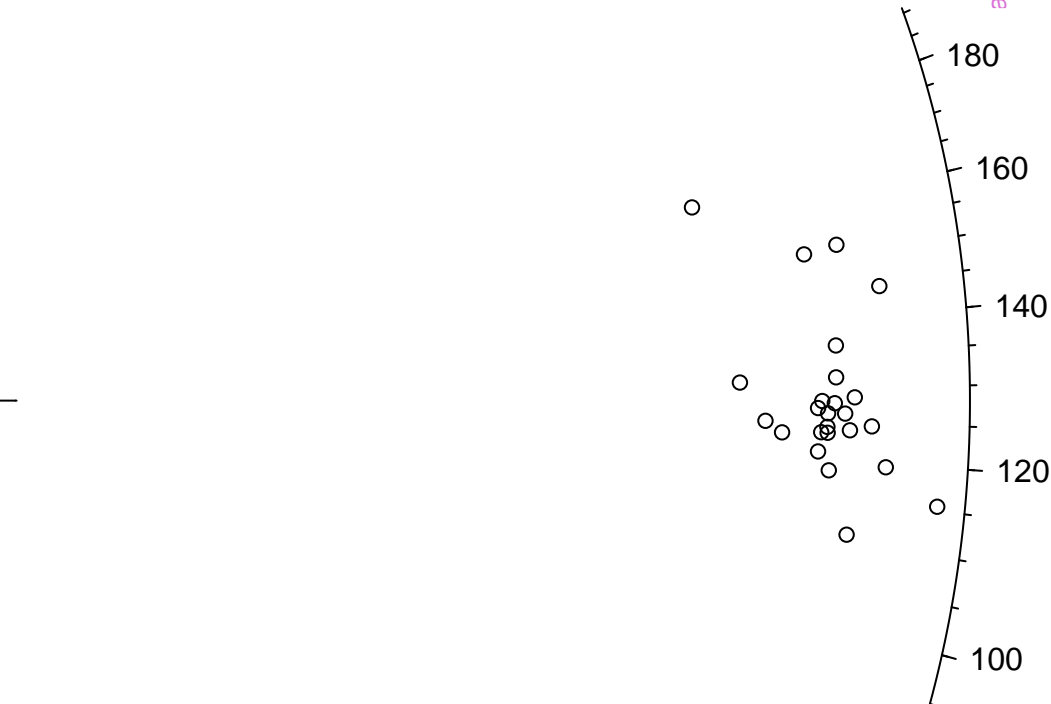
160

140

120

100

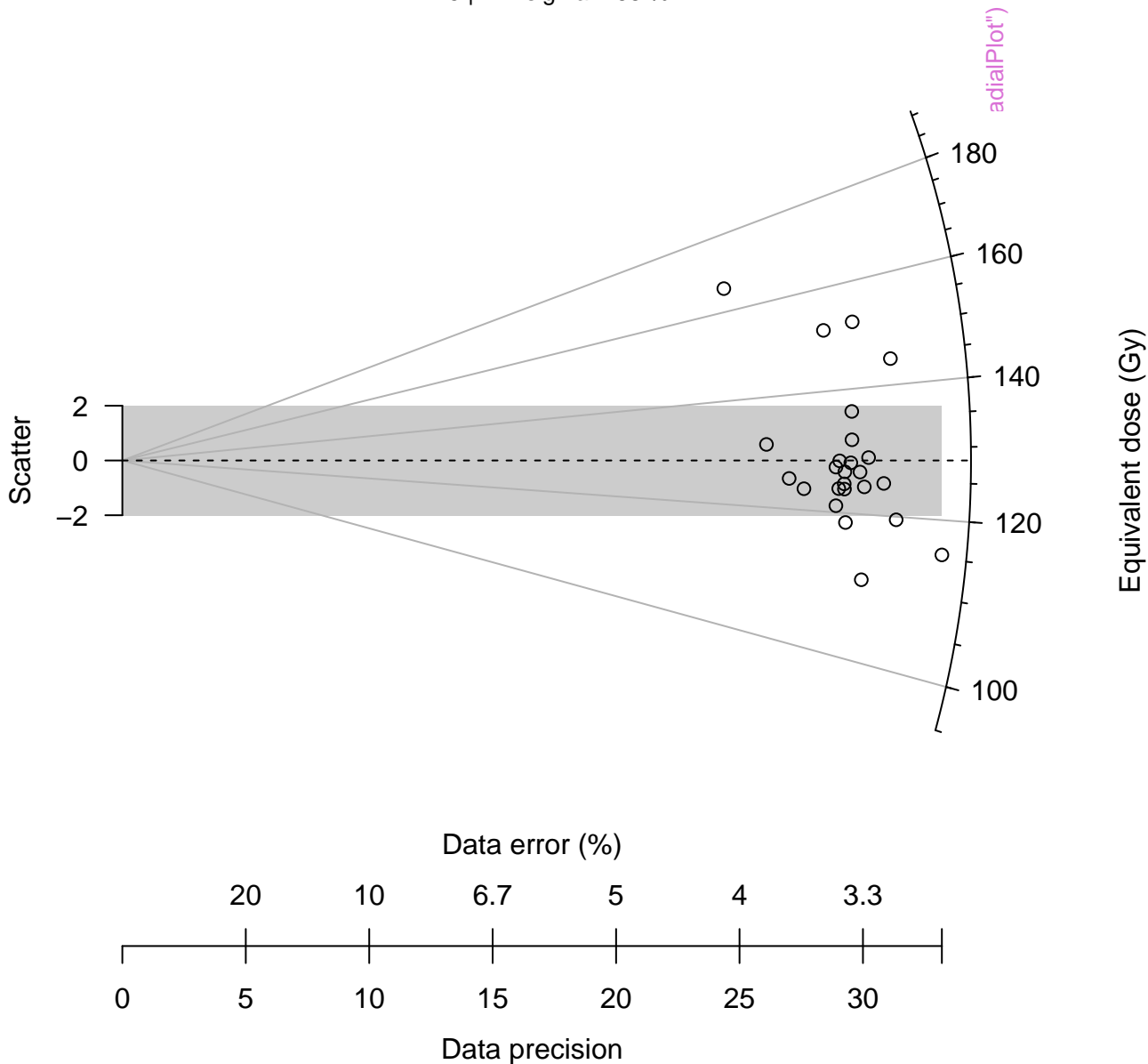
D<sub>e</sub> (Gy)





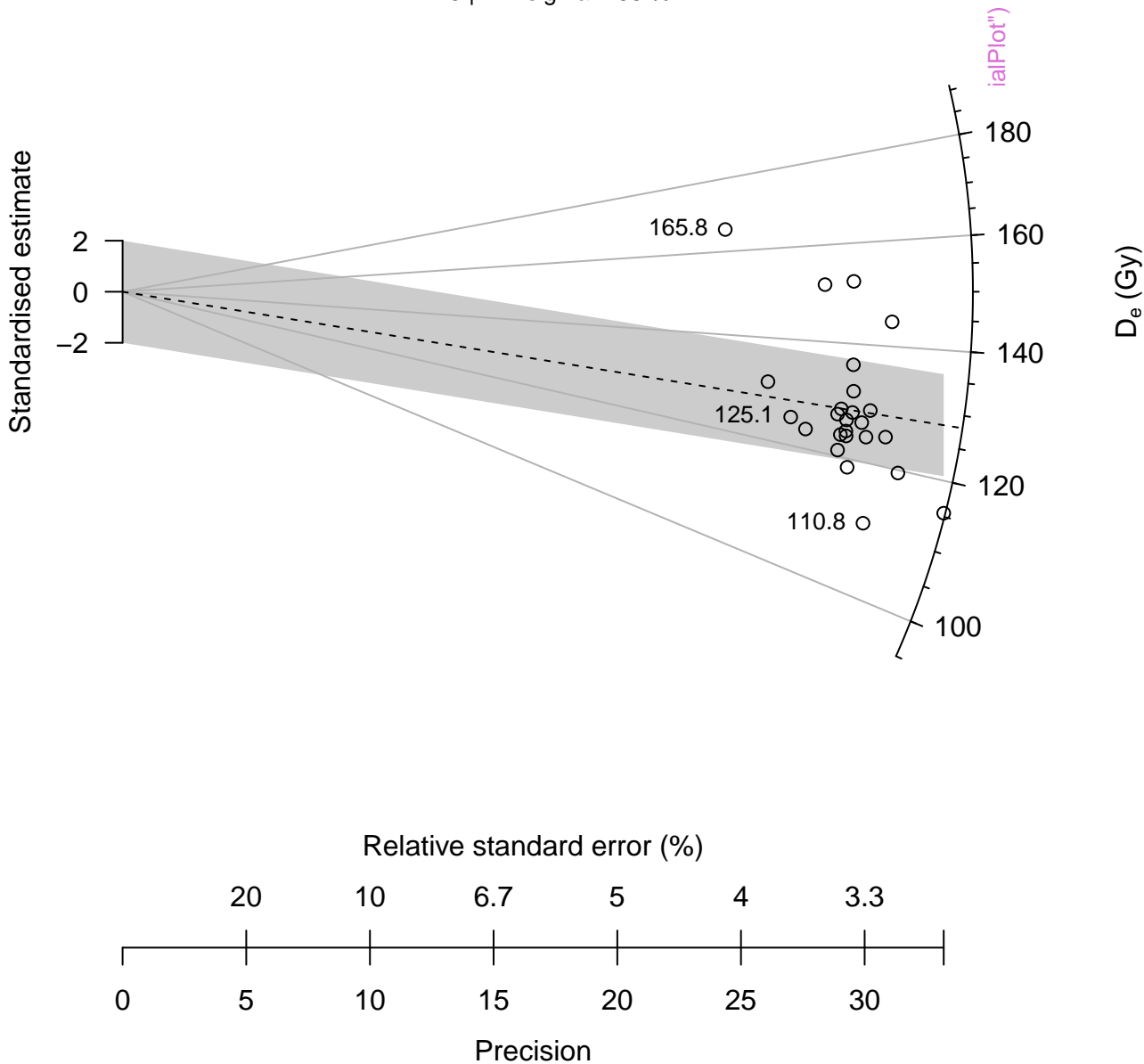
# D<sub>e</sub> distribution

n = 25 | in 2 sigma = 68 %



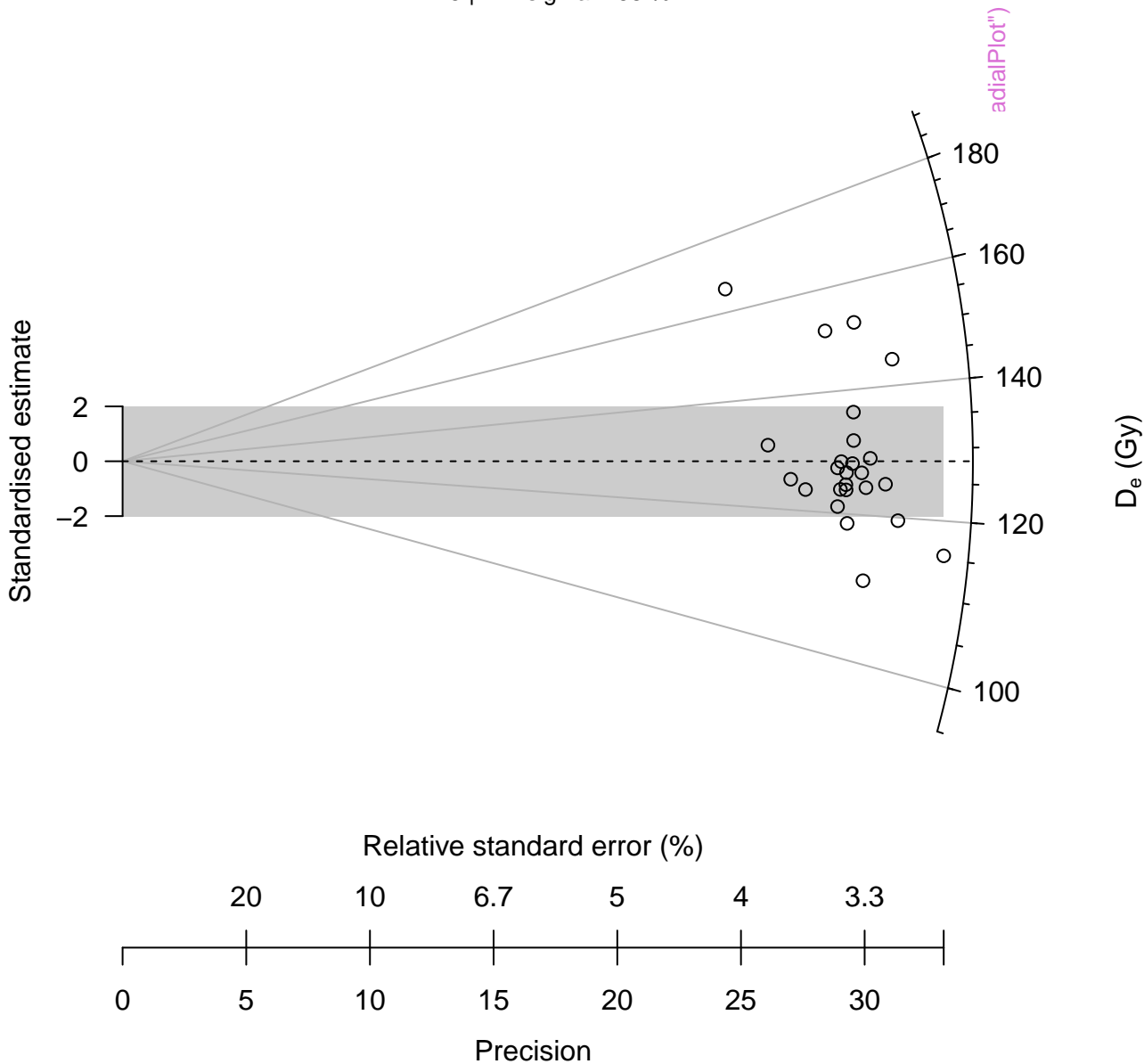
# D<sub>e</sub> distribution

n = 25 | in 2 sigma = 68 %



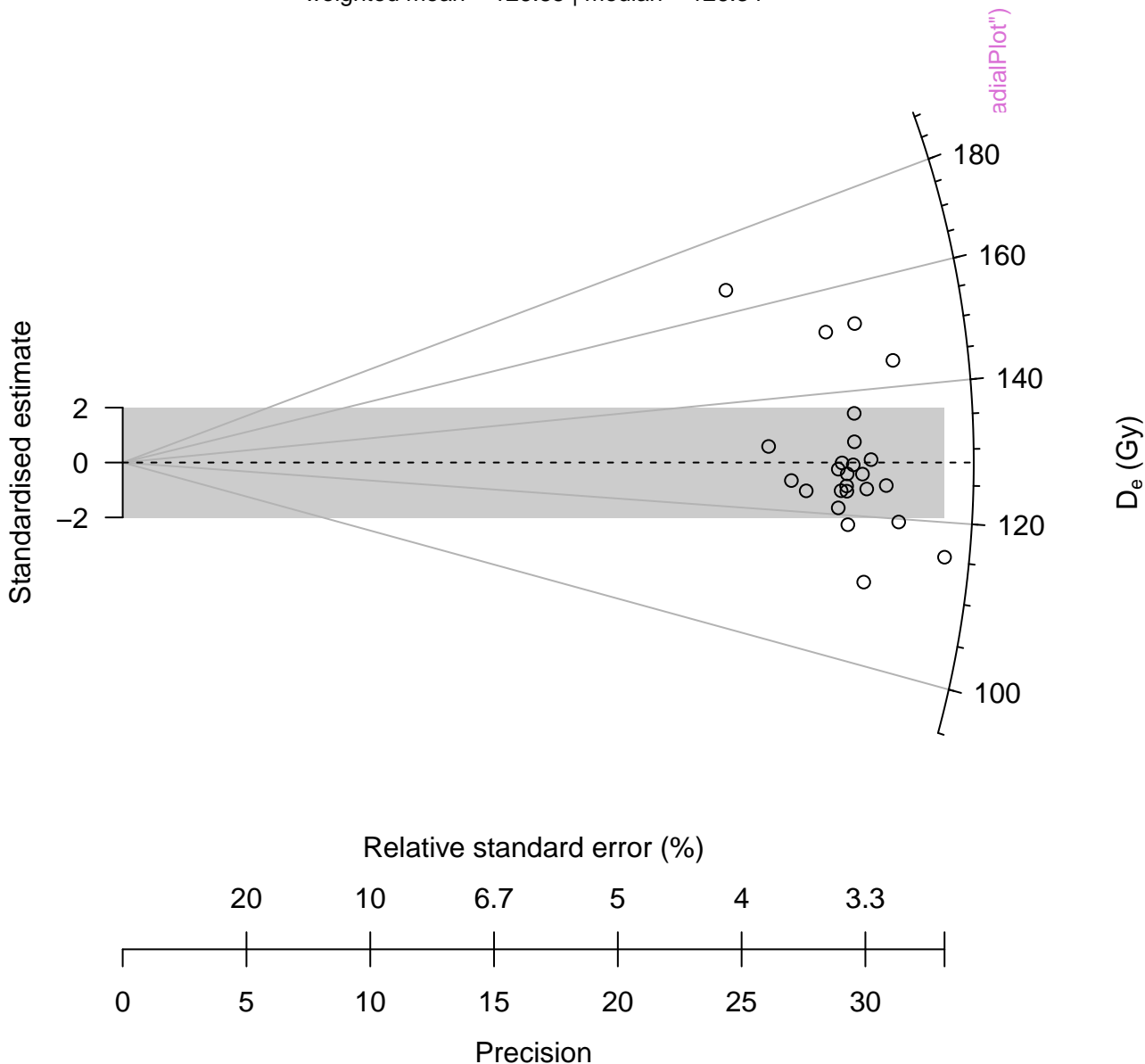
# D<sub>e</sub> distribution

n = 25 | in 2 sigma = 68 %



# D<sub>e</sub> distribution

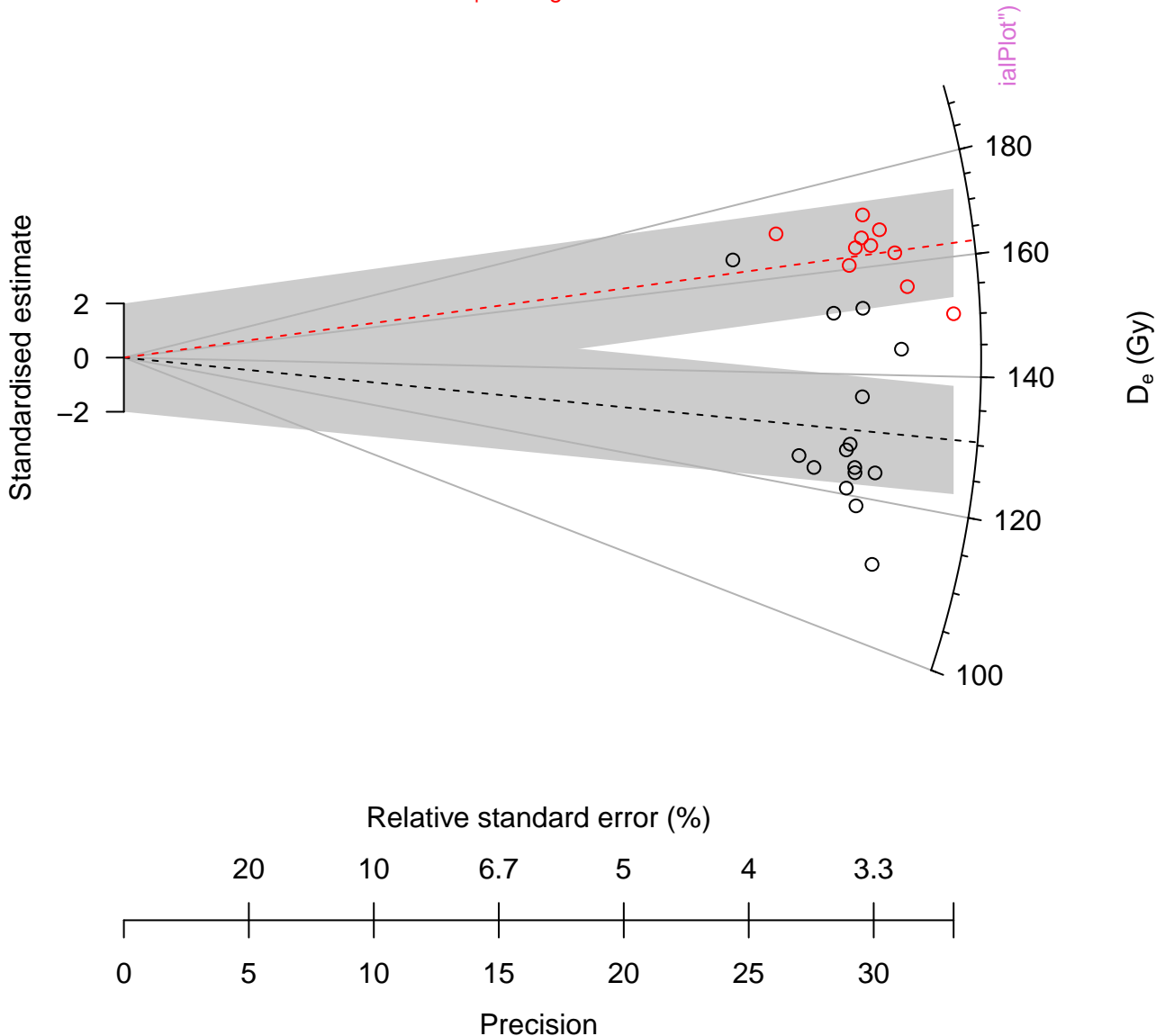
weighted mean = 126.85 | median = 126.34



# D<sub>e</sub> distribution

n = 15 | in 2 sigma = 53.3 %

n = 10 | in 2 sigma = 90 %



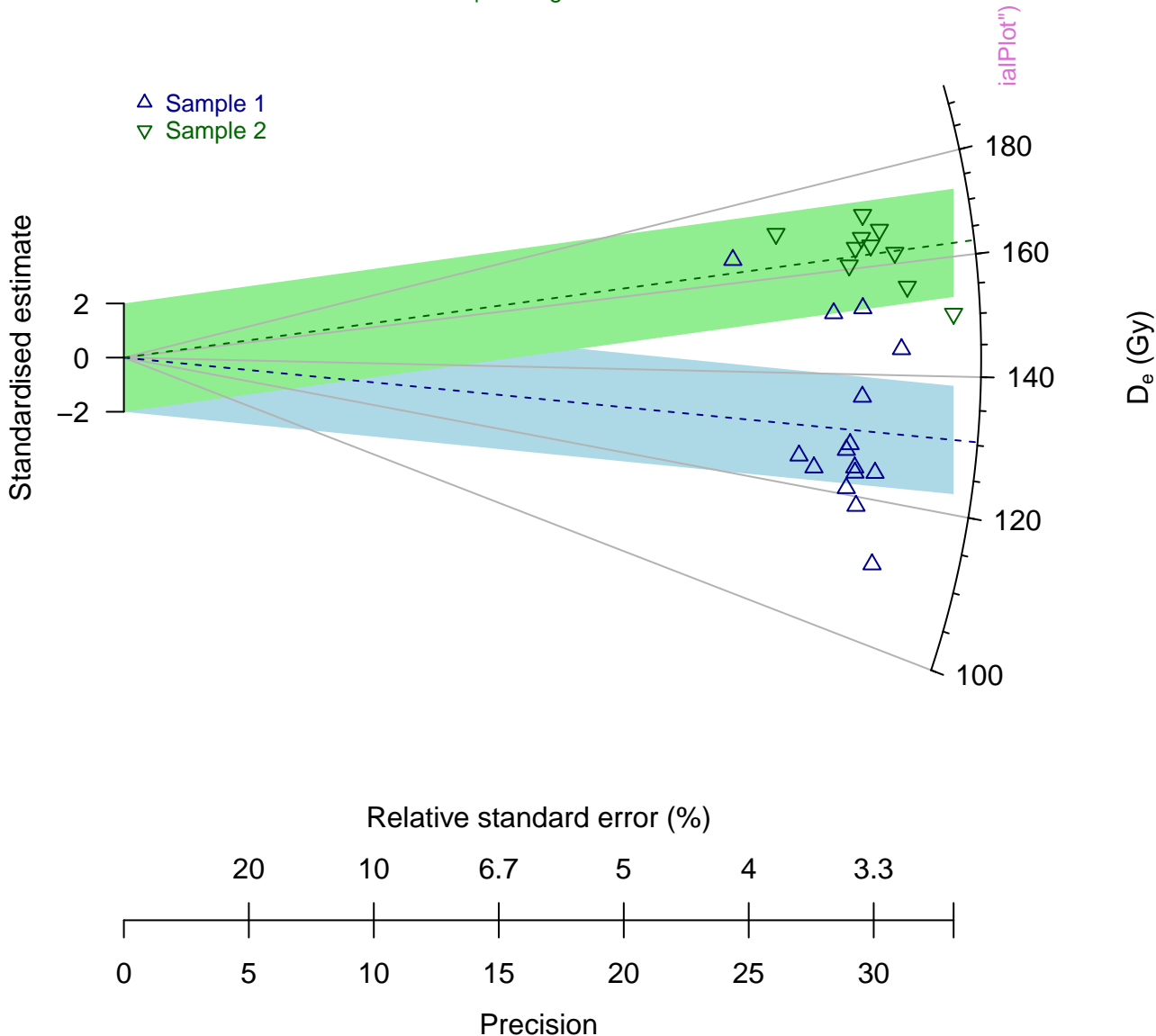
# D<sub>e</sub> distribution

n = 15 | in 2 sigma = 53.3 %

n = 10 | in 2 sigma = 90 %

△ Sample 1

▽ Sample 2



# Violin Plot

n = 25 | median = 126.34

Density



[help\("plot\\_ViolinPlot"\)](#)

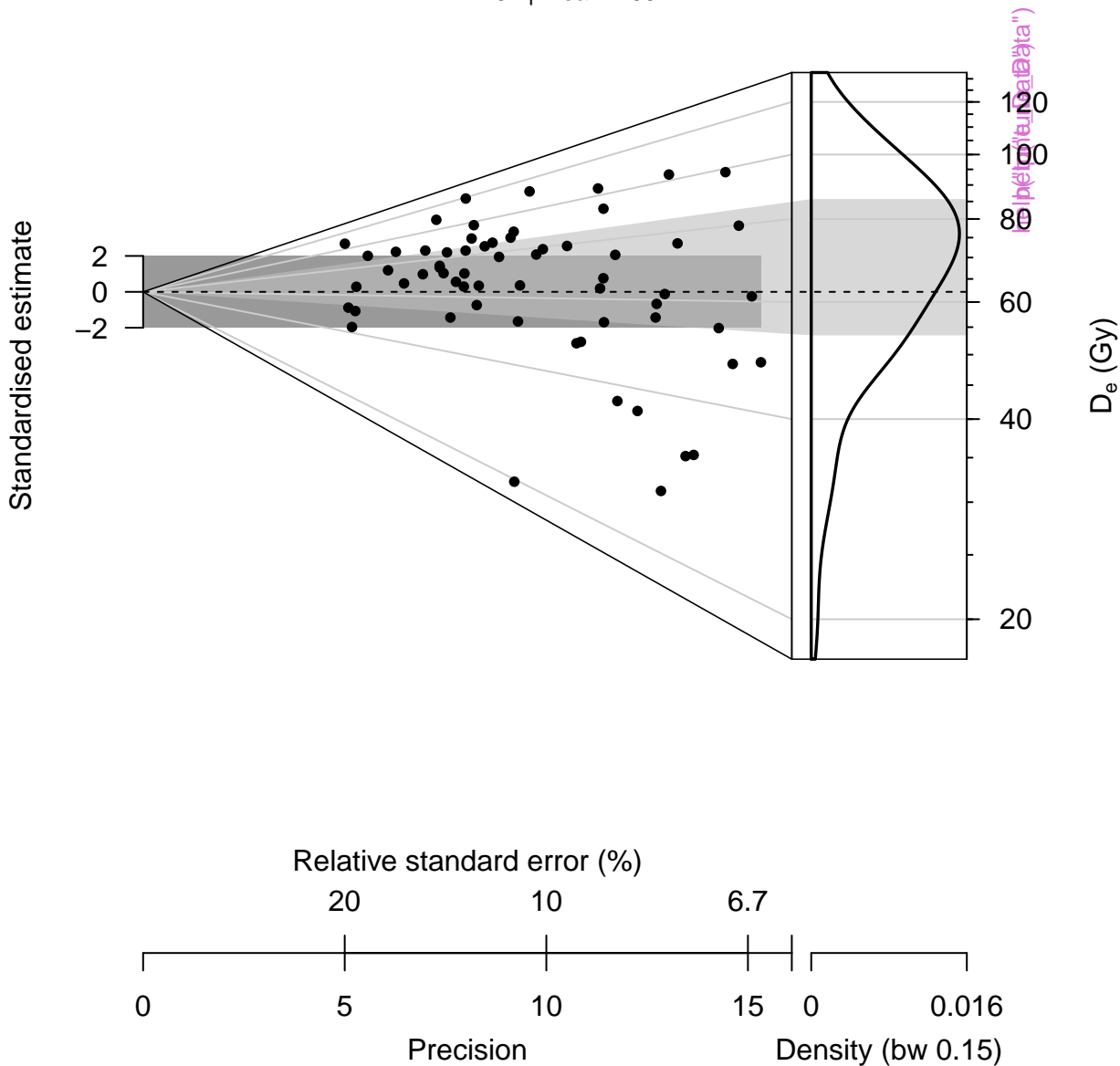
# OSL





# D<sub>e</sub> distribution

n = 62 | mean = 66



# D<sub>e</sub> distribution

n = 62 | mean = 66

