

$L_n, L_x$  curves

ALQ Pos. 1

$T_n, T_x$  curves



Cutheat – TL curves

IRSLT



IRSL/BOSL = 0.88%



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)**

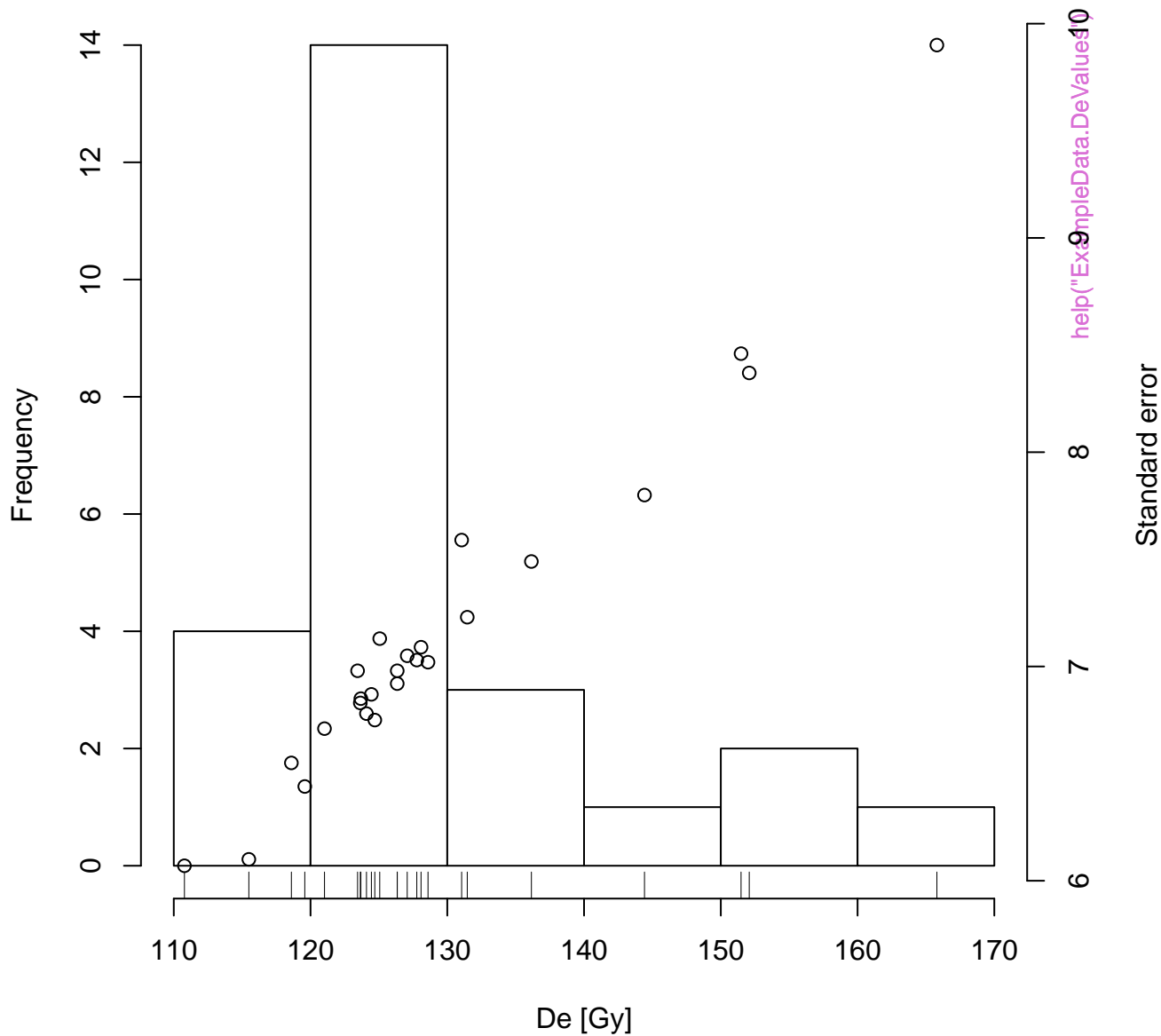




# Histogram



# 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")

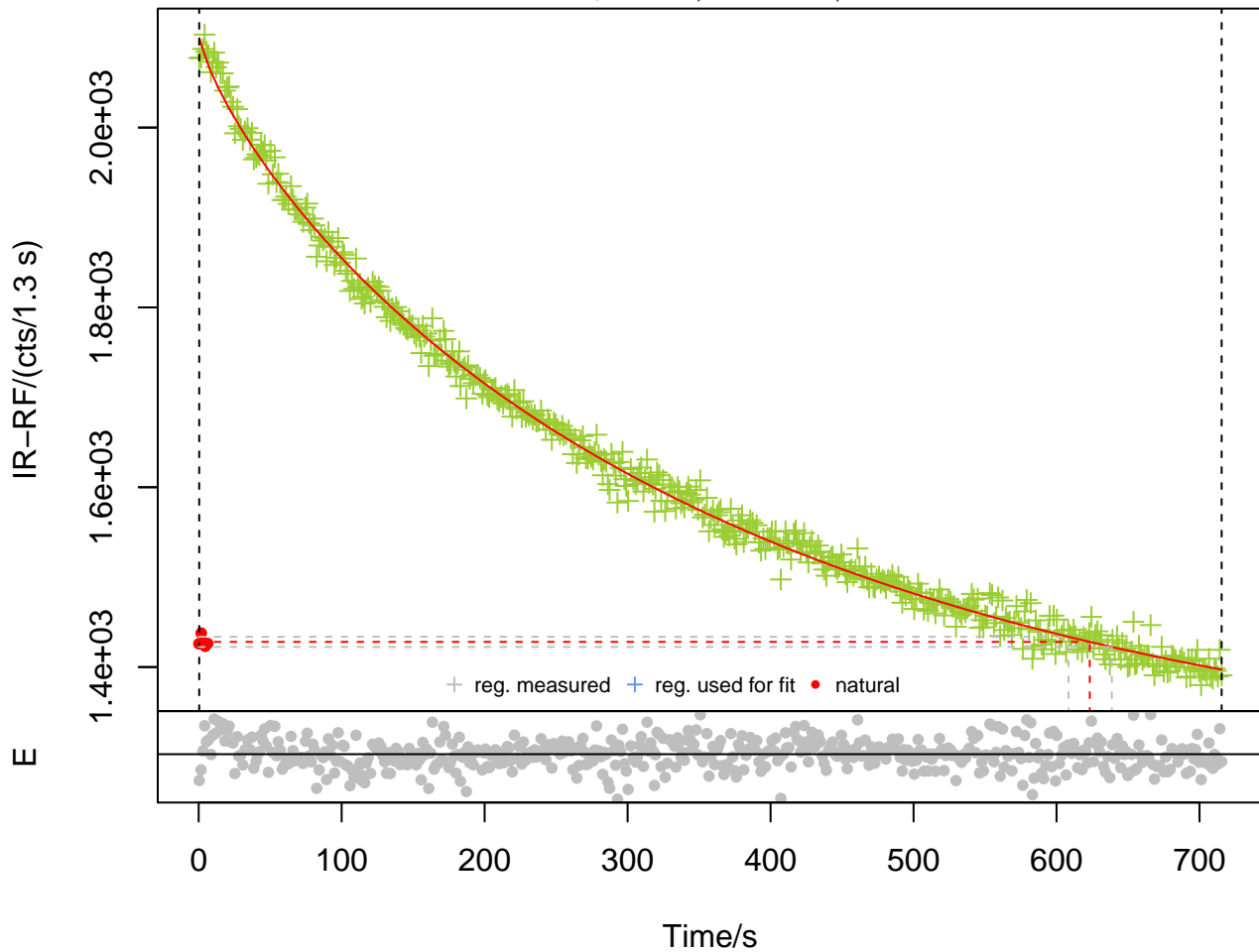
RLum.Data.Spectrum



help("ExampleData.XSYG")

# IR-RF

$D_e = 623.25$  (608.39 638.67)



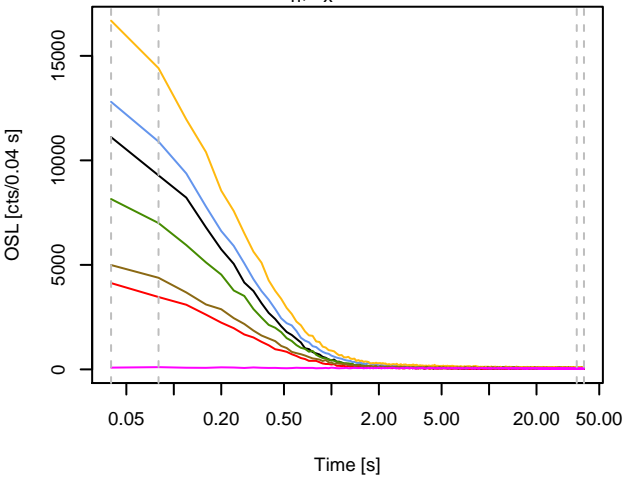
TL previous  $L_n, L_x$  curves



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)

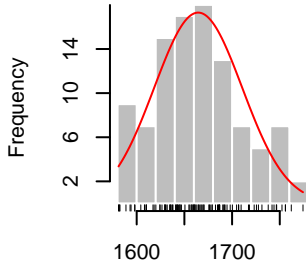
Growth curve

$D_e = 1677.16 \pm 46.11$  | fit: EXP

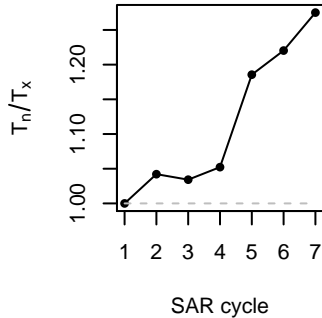


$D_e$  from MC simulation

$D_{eMC} = 1664.49 \pm 46.11$  | quality = 99.2 %



Test dose response

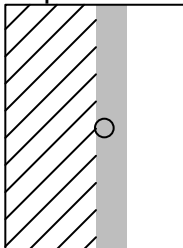


## Rejection criteria

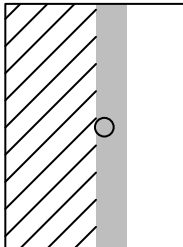
Recycling ratio



Recuperation rate



Palaeodose error



- 0.2    + 0.2

## IRSL



help("analyse\_SAR.CWOSL")



$L_n, L_x$  curves



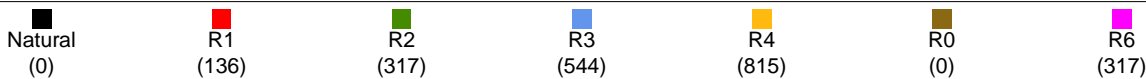
$T_n, T_x$  curves



Plateau test  $L_n, L_x$  curves

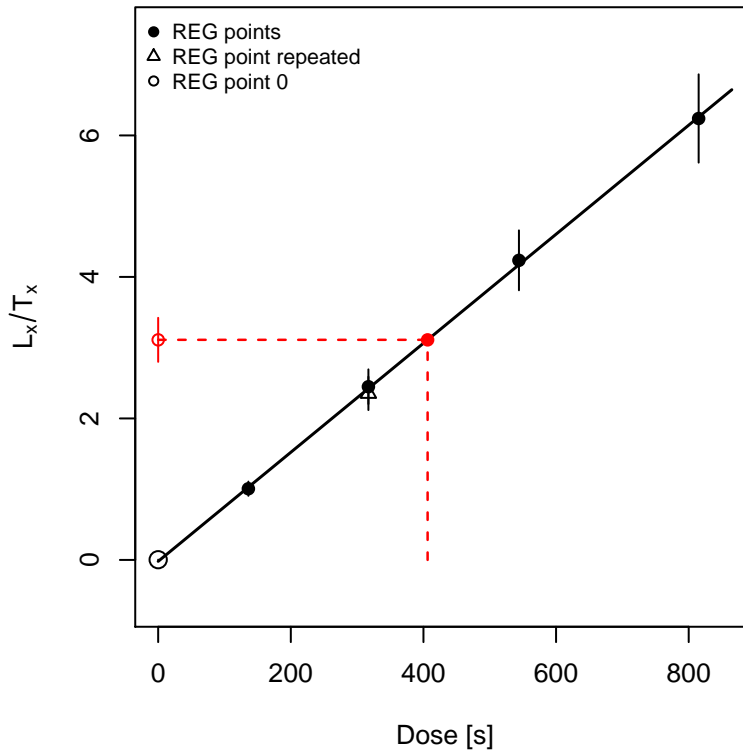


plateau Test  $T_n, T_x$  curves

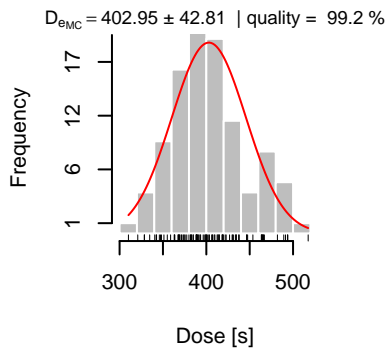


# Growth curve

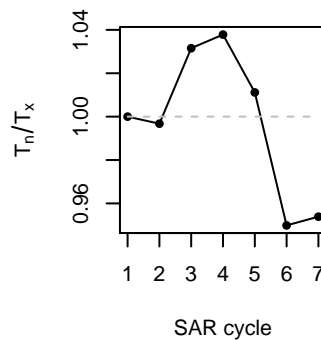
$D_e = 406.28 \pm 42.81$  | fit: LIN



## $D_e$ from MC simulation



## 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

TL previous  $L_n, L_x$  curves



# Pseudo pIRIR data set based on quartz OSL



# Pseudo pIRIR data set based on quartz OSL

TL previous  $T_n, T_x$  curves



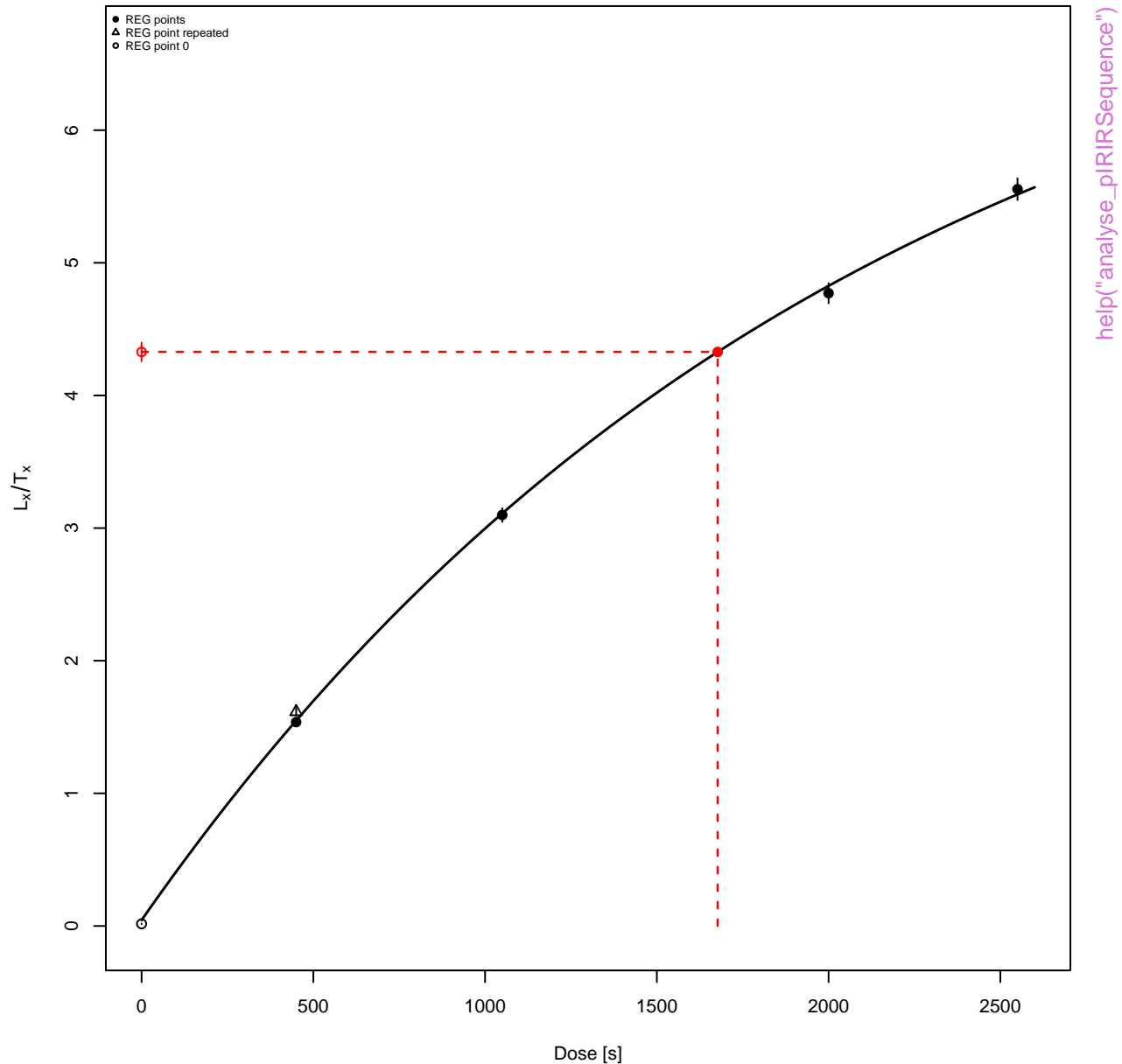
help("analyse\_pIRIRSequence")

# Pseudo pIRIR data set based on quartz OSL



# Pseudo pIRIR data set based on quartz OSL

$D_e = 1677.16 \pm 46.11$  | fit: EXP





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

D<sub>MC</sub> = 1664.49 ± 46.11 | quality = 99.2 %



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

$D_e = 1677.16 \pm 48.13$  | fit: EXP



help("analyse\_pIRIRSequence")

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

D<sub>e,MC</sub> = 1663.13 ± 48.13 | quality = 99.2 %



Dose [s]

n = 100 , valid fits = 100

help("analyse\_pIRSequence")

# Test dose response





## Summarised growth curves



# Sensitivity change



## Rejection criteria



# Monte Carlo Simulation

$n = 10000 \mid \hat{\mu} = 42 \mid \hat{\sigma} = 20 \mid \frac{\hat{\sigma}}{\sqrt{n}} = 0 \mid v = 0.89$





# Finite Mixture Model

$\sigma_b = 0.2 \mid n = 62$

## Normal distributions



## Proportion of components



## Statistical criteria



help("calc\_FiniteMixture")

used values = 22















# 3-parameter Minimum Age Model

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

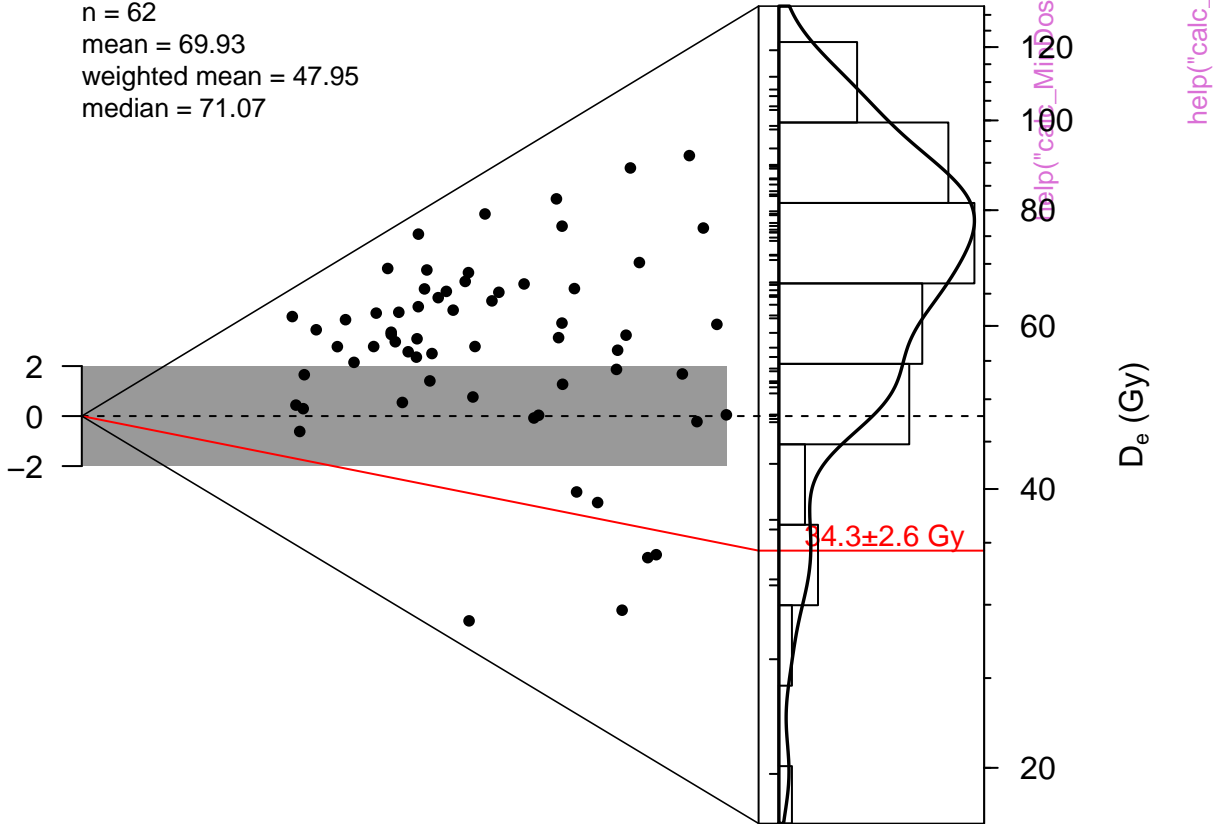
n = 62

mean = 69.93

weighted mean = 47.95

median = 71.07

Standardised estimate



Relative standard error (%)

n

20

10

6.7

0

15

0

5

Precision

10

15

Density (bw 0.1)

0.106

# D<sub>e</sub> distribution



# CW Curve Fit

Default



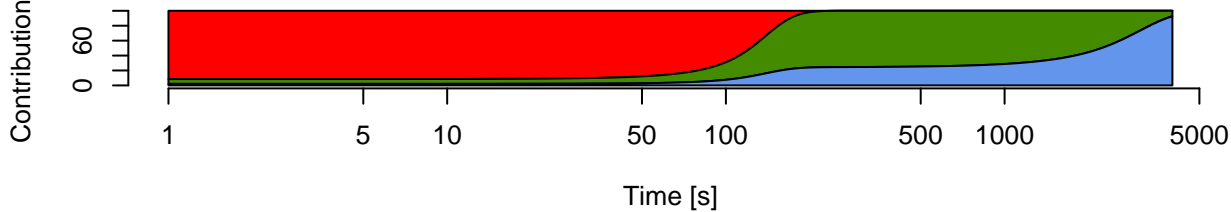
## Component contribution to sum curve



## Default



## Component contribution to sum curve





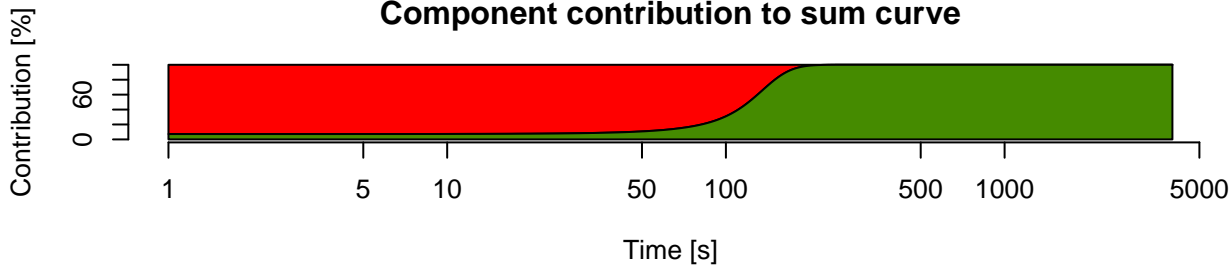
# Background



## Default



## Component contribution to sum curve



## Default



## Component contribution to sum curve

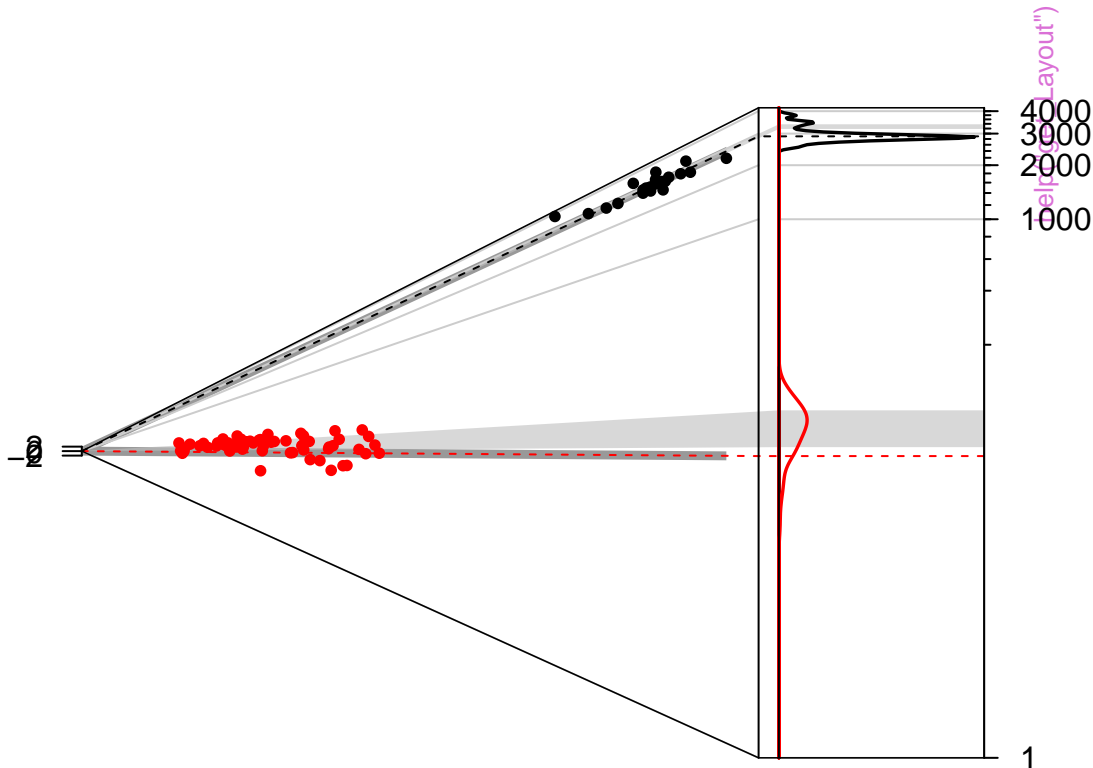


# D<sub>e</sub> distribution

n = 25

n = 62

Standardised estimate



Relative standard error (%)

10

5

3.3

0

10

20

30

0

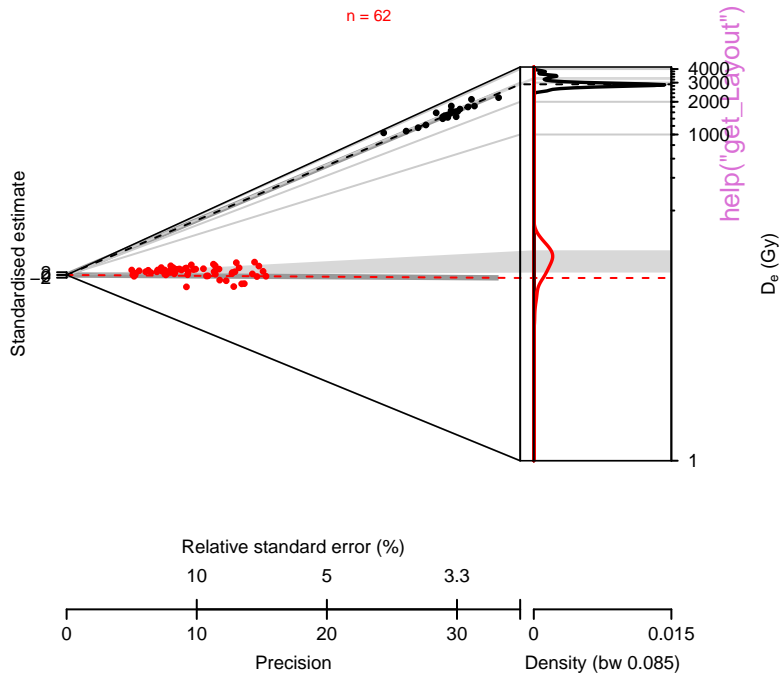
0.015

Precision

Density (bw 0.085)

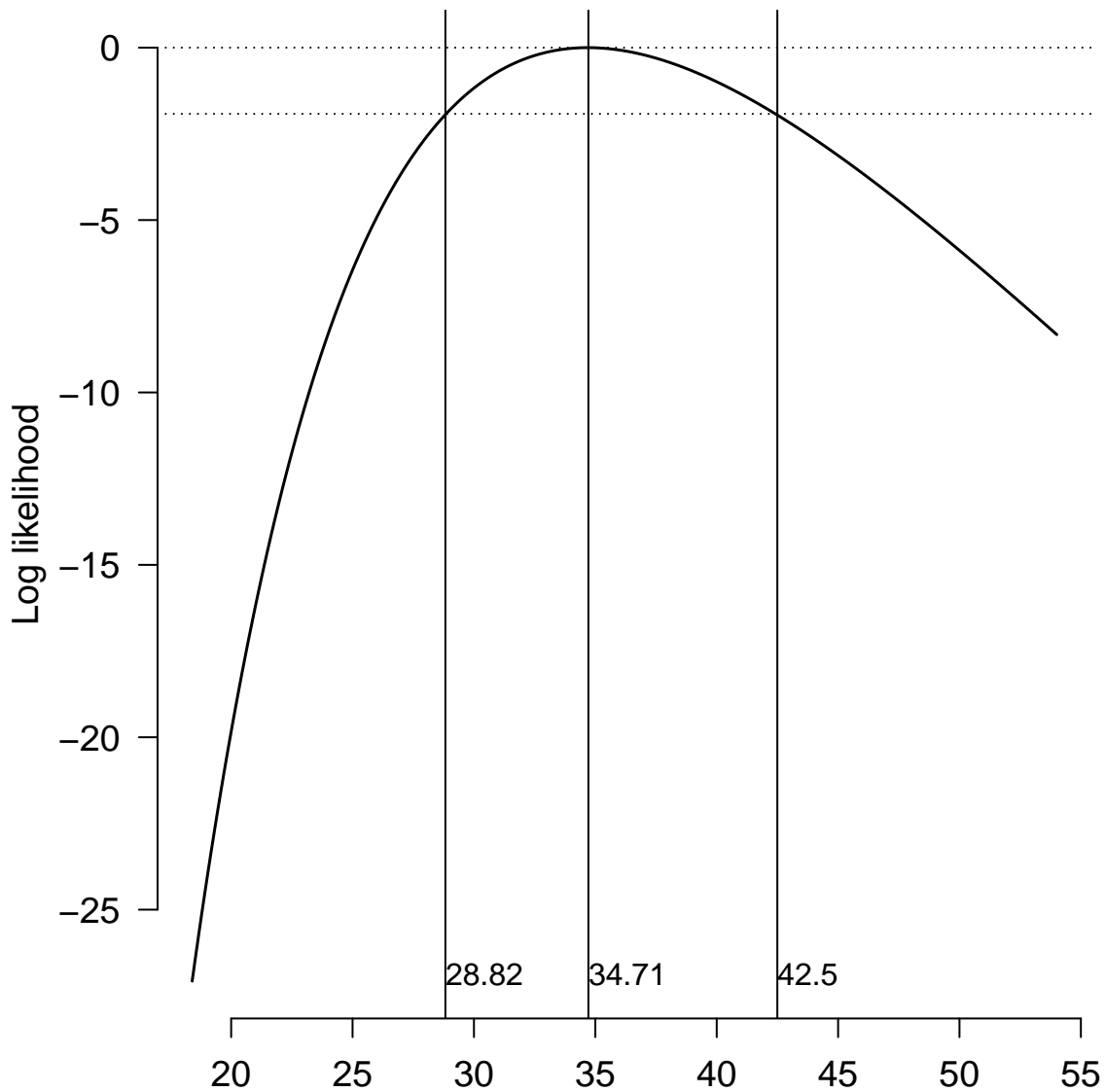
n = 25

n = 62



```
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)

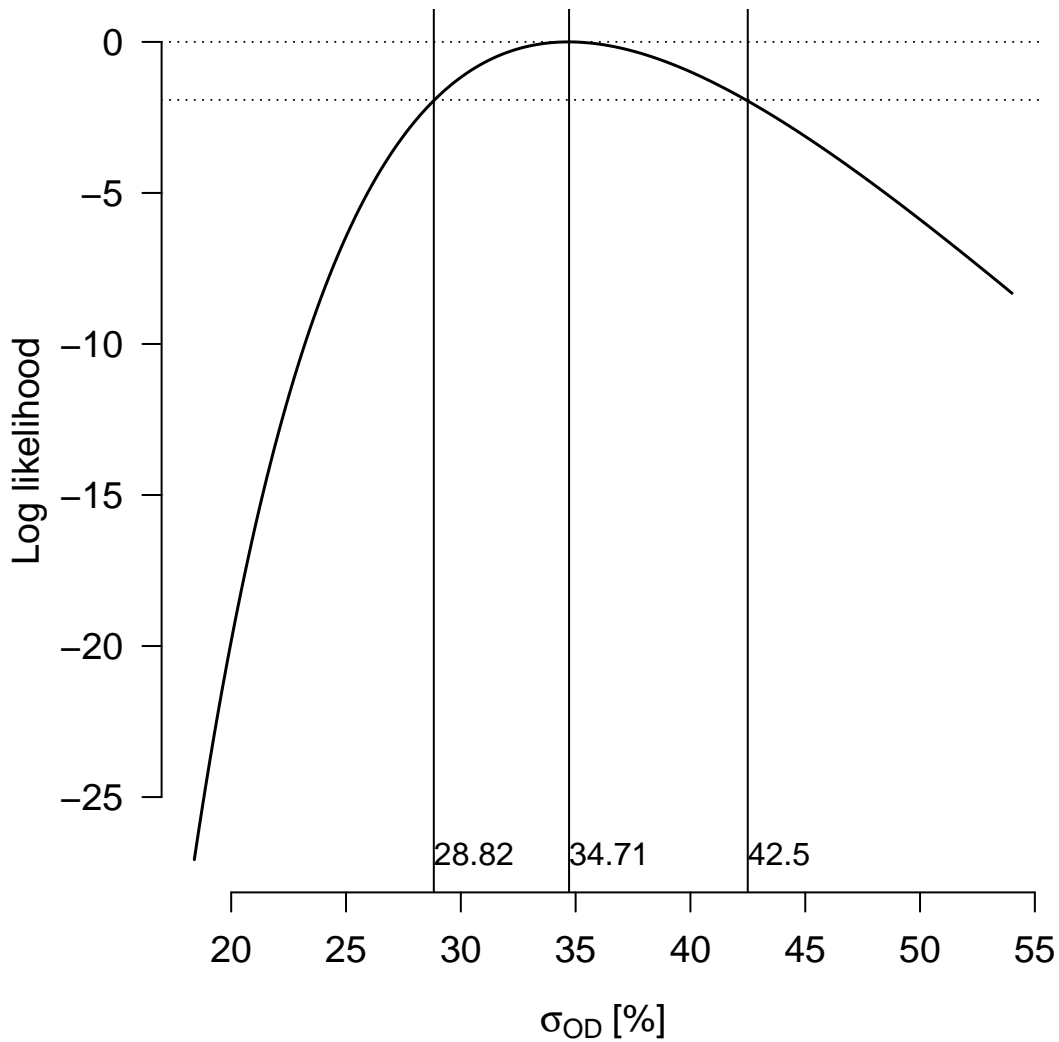


help("merge\_RLum.Data.Curve")

Profile log likelihood for  $\sigma_{OD}$

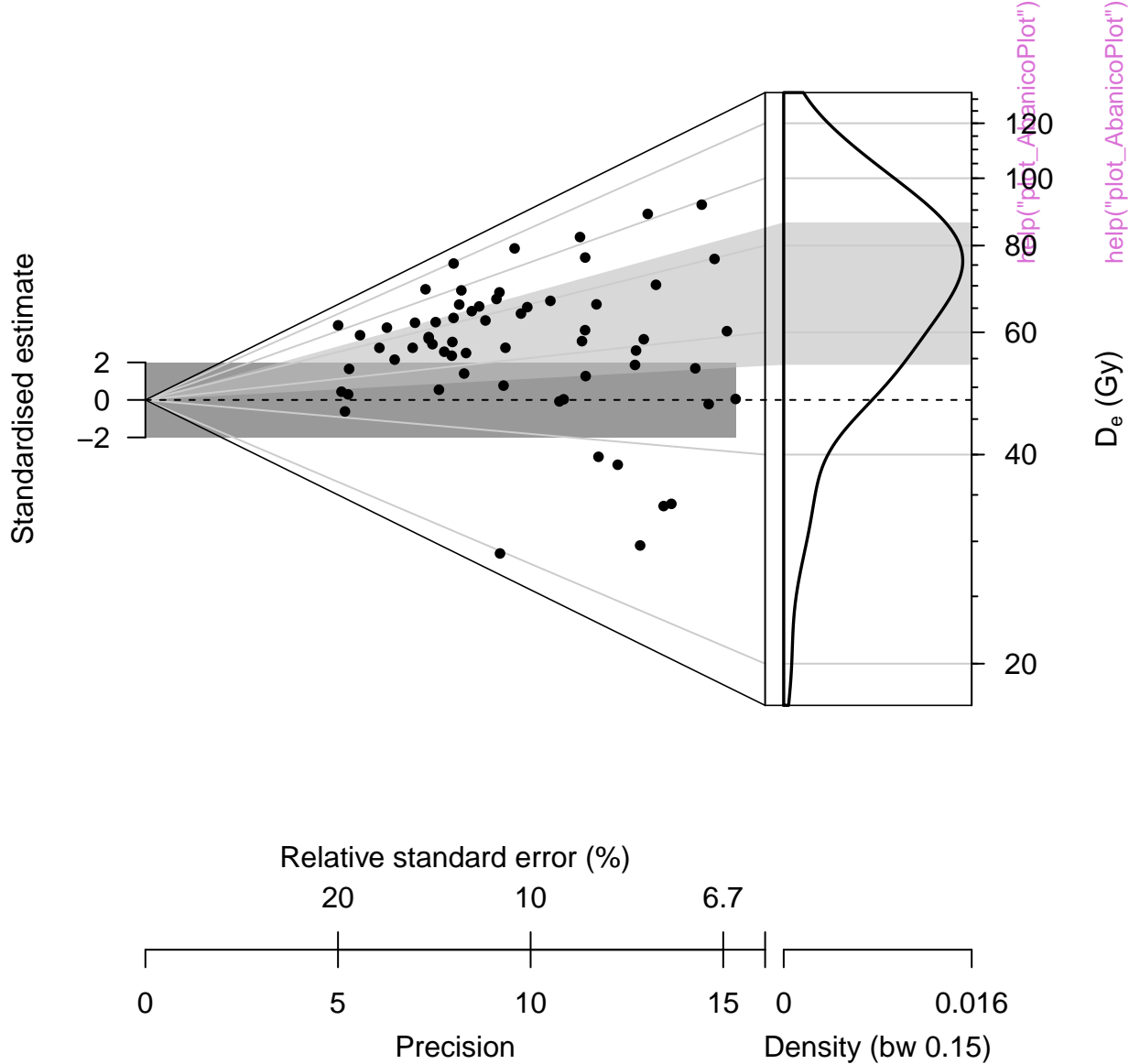


Profile log likelihood for  $\sigma_{OD}$



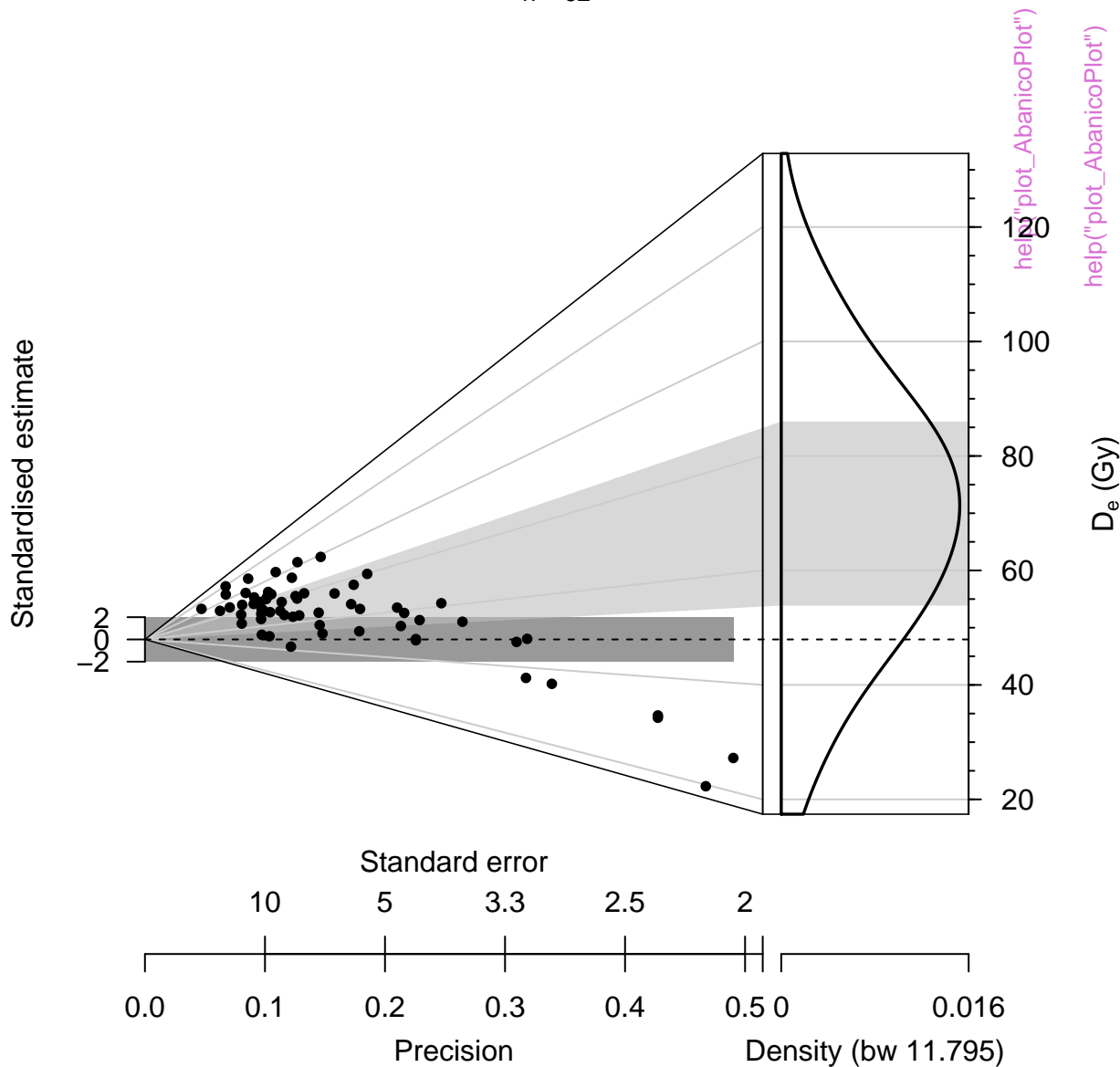
# D<sub>e</sub> distribution

n = 62



# D<sub>e</sub> distribution

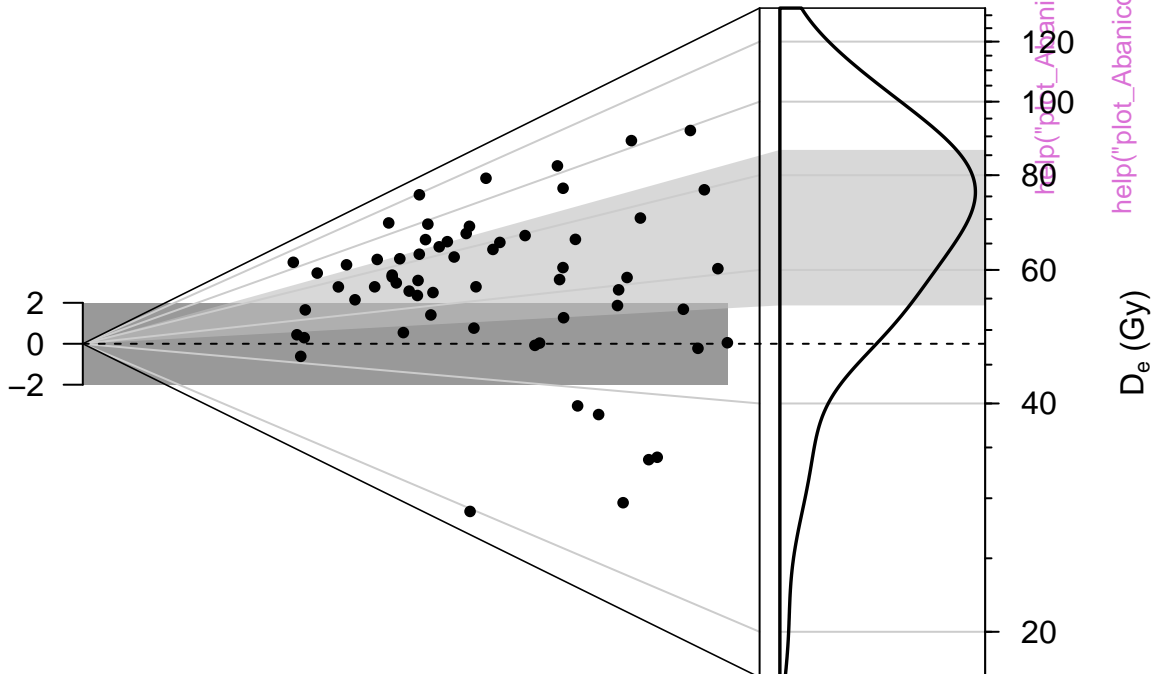
n = 62



# D<sub>e</sub> distribution

n = 62

Standardised estimate



Relative standard error (%)

20

10

6.7

0

5

10

15

0.016

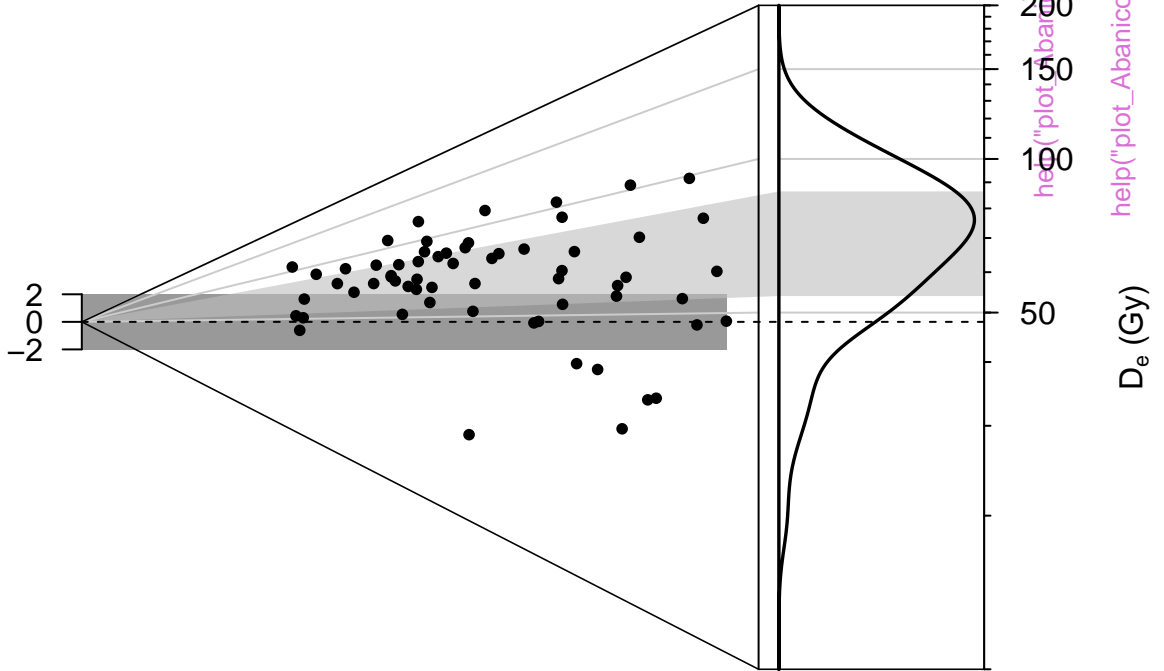
Precision

Density (bw 0.15)

# D<sub>e</sub> distribution

n = 62

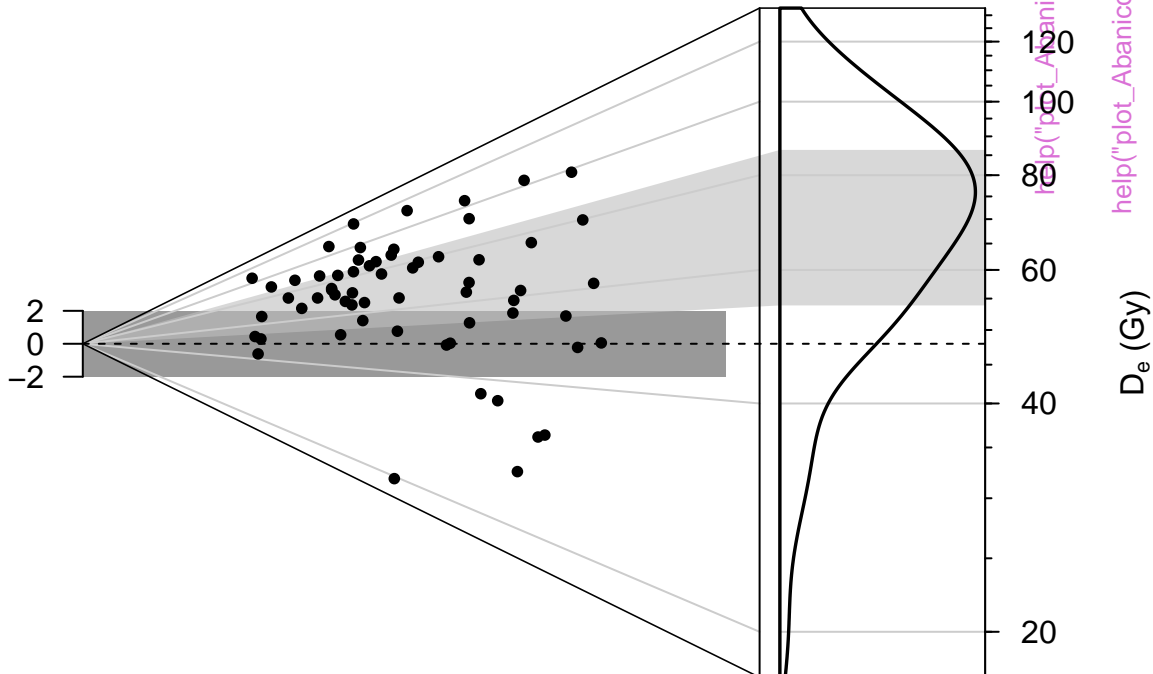
Standardised estimate



# D<sub>e</sub> distribution

n = 62

Standardised estimate



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

Standardised estimate



Relative standard error (%)

20

10

6.7

0

5

Precision

10

15

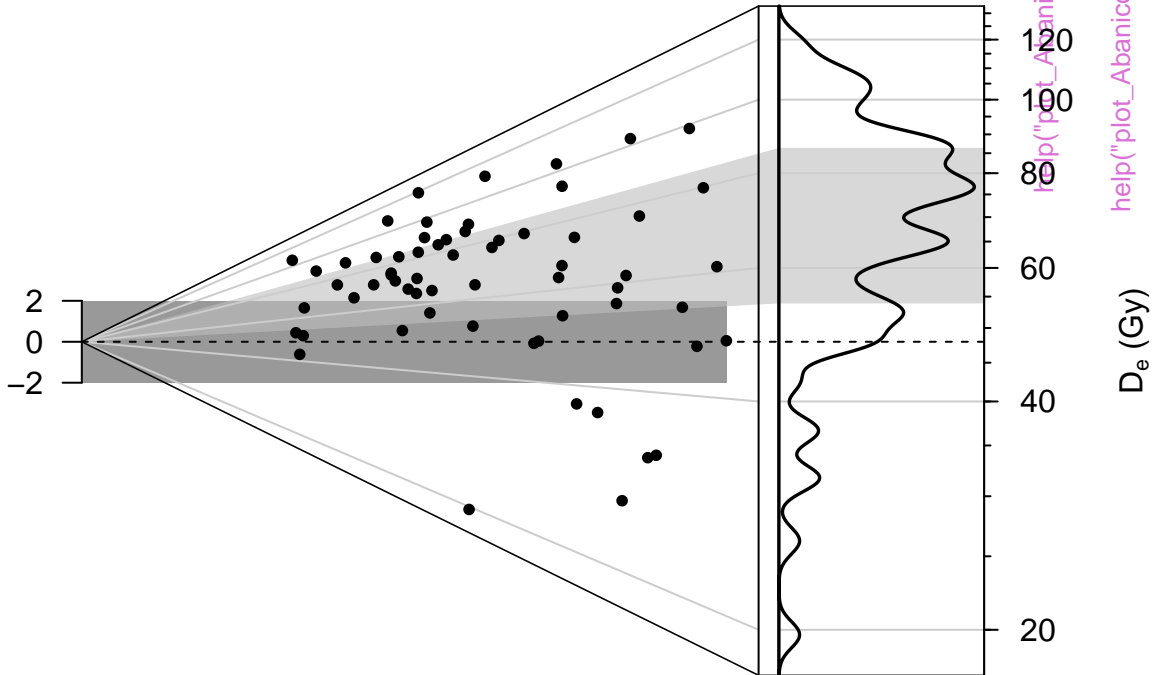
Density (bw 0.15)

0.016

# D<sub>e</sub> distribution

n = 62

Standardised estimate



Relative standard error (%)

20

10

6.7

0

5

Precision

10

15

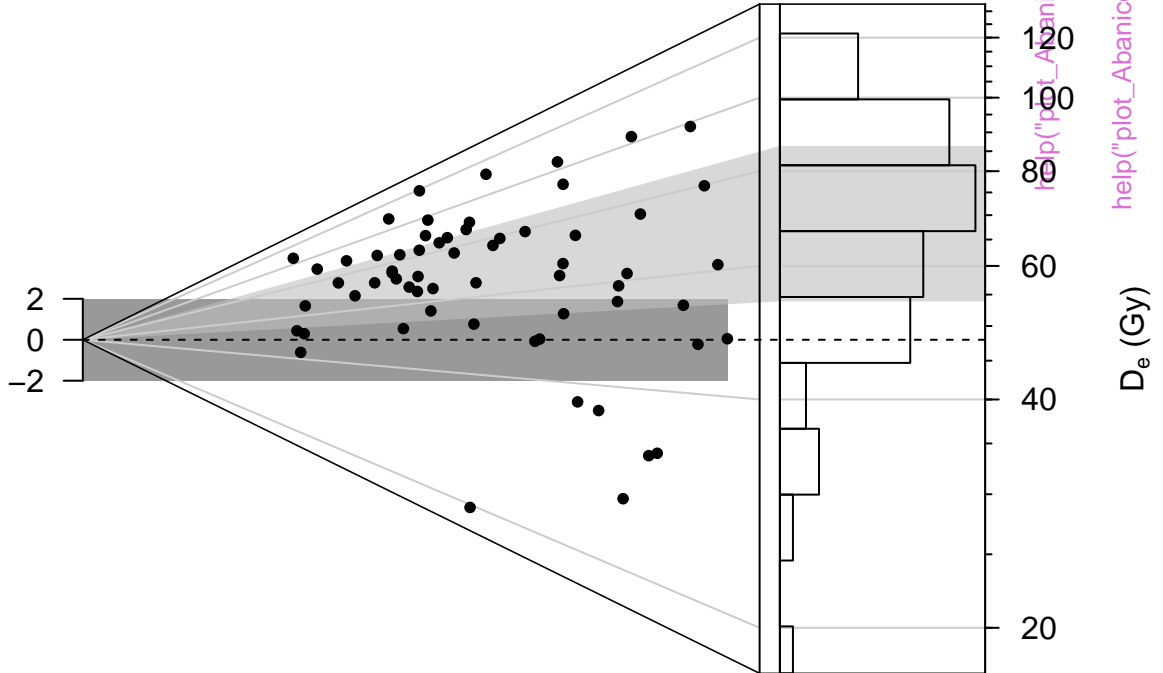
Density (bw 0.04)

0.264

# D<sub>e</sub> distribution

n = 62

Standardised estimate



Relative standard error (%)

n

20

10

6.7

0

15

0

5

Precision

10

15

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

help("plot\_AbanicoPlot")

120

100

80

60

40

20

# D<sub>e</sub> distribution

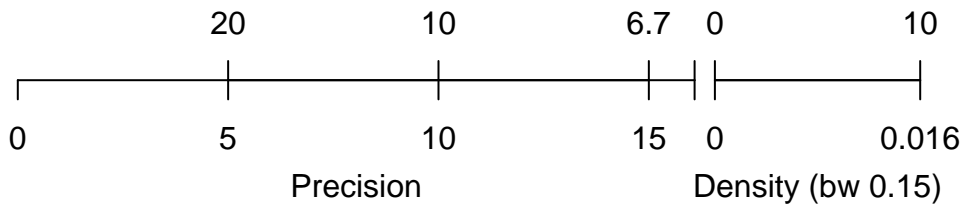
n = 62

Standardised estimate



Relative standard error (%)

n



# D<sub>e</sub> distribution

n = 62

Standardised estimate



Relative standard error (%)

20

10

6.7

0

5

Precision

10

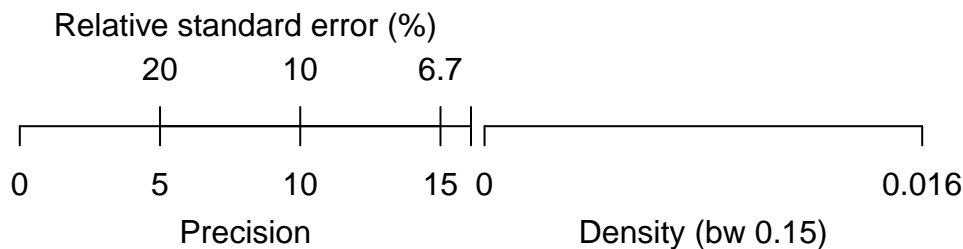
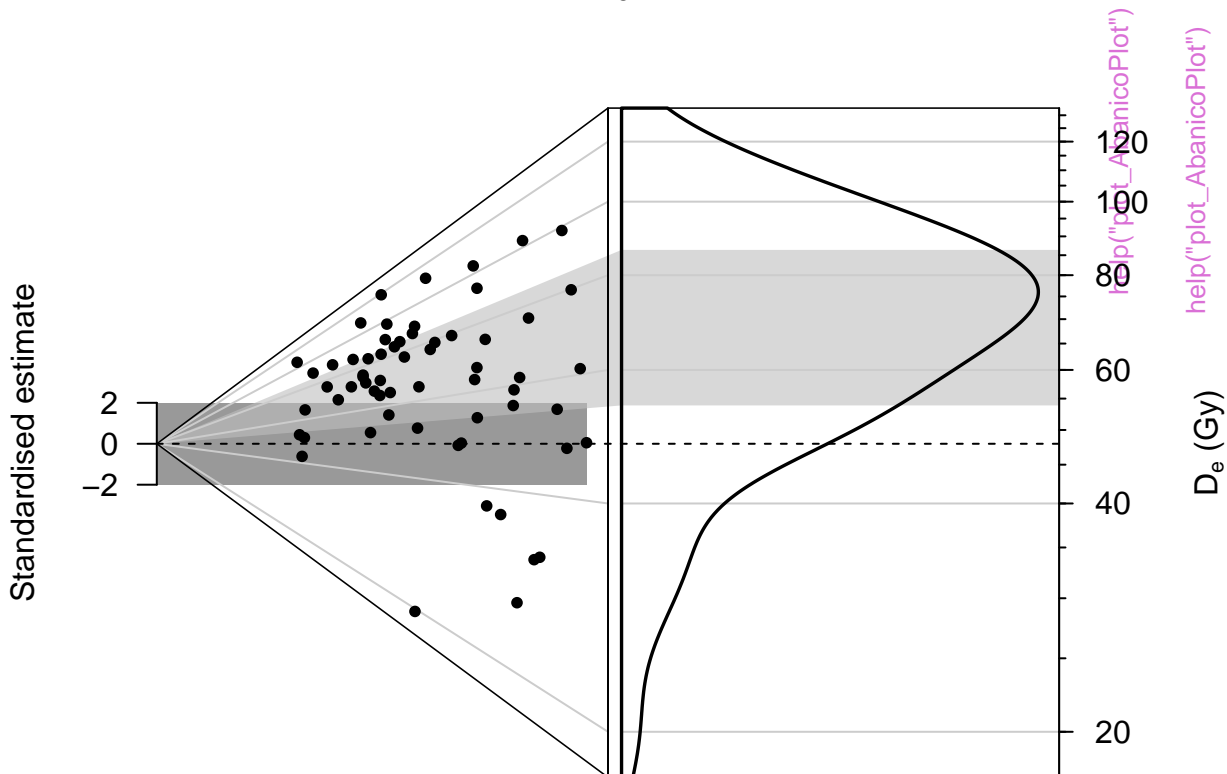
15

Density (bw 0.15)

0.016

# $D_e$ distribution

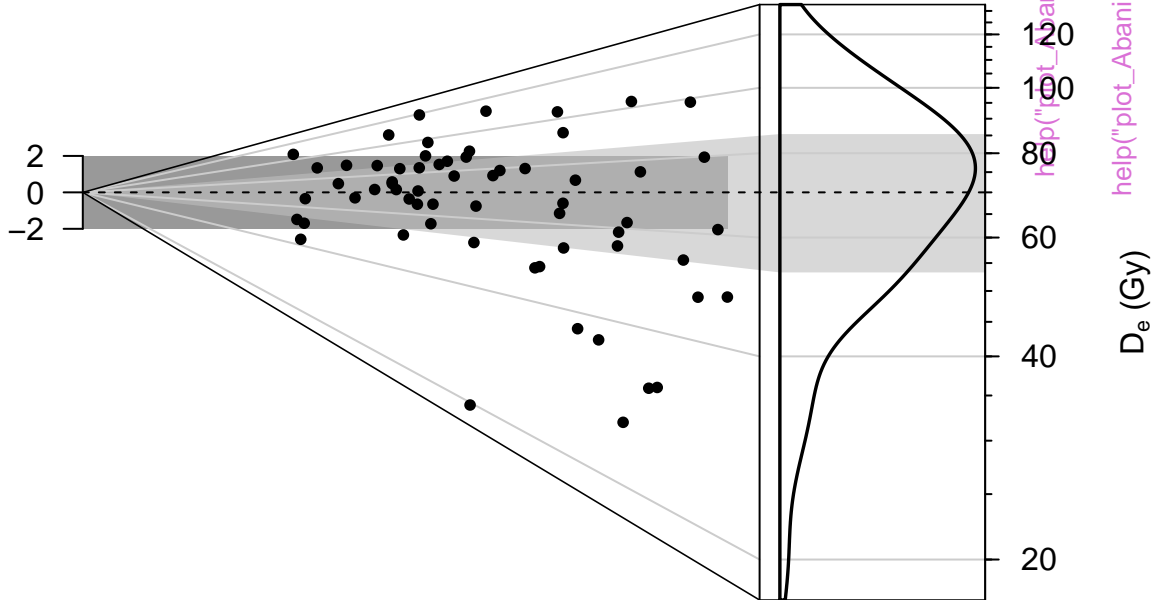
n = 62



# $D_e$ distribution

n = 62

Standardised estimate



Relative standard error (%)

20

10

6.7

0

5

Precision

10

15

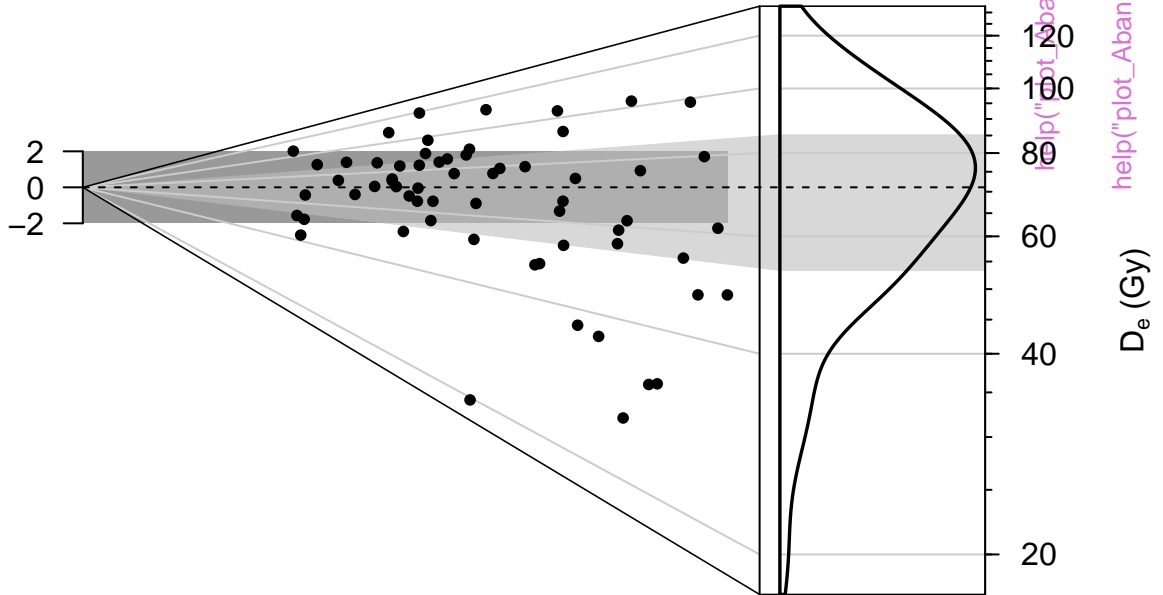
Density (bw 0.15)

0.016

# $D_e$ distribution

n = 62

Standardised estimate



Relative standard error (%)

20

10

6.7

0

5

10

15

0.016

Precision

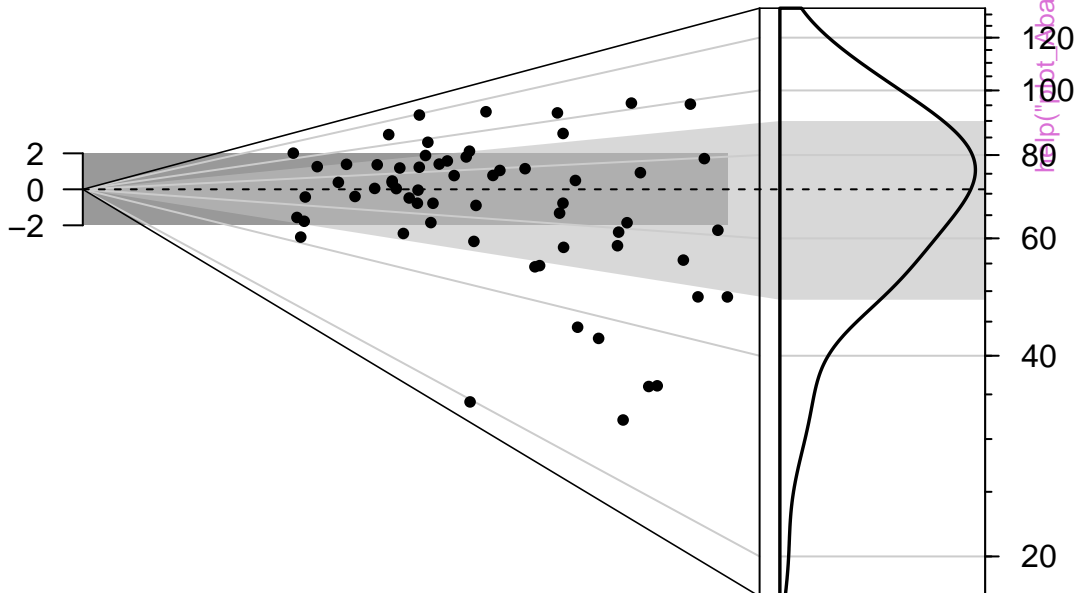
Density (bw 0.15)



# $D_e$ distribution

n = 62

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

Standardised estimate



Relative standard error (%)

20

10

6.7

0

5

Precision

10

15

Density (bw 0.15)

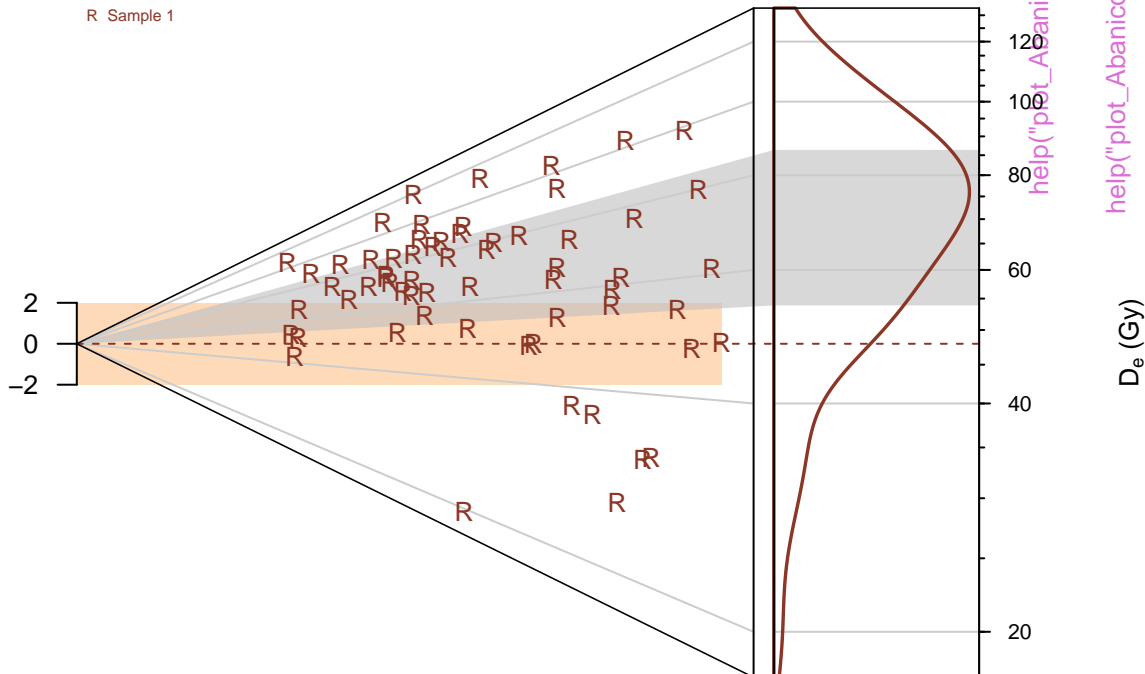
0.016

# D<sub>e</sub> distribution

n = 62

R Sample 1

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

Standardised estimate

0

help("plot\_AbanicoPlot")

help("plot\_AbanicoPlot")

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

Relative standard error (%)

20

10

6.7

0

5

Precision

10

15

Density (bw 0.15)

0.016

20

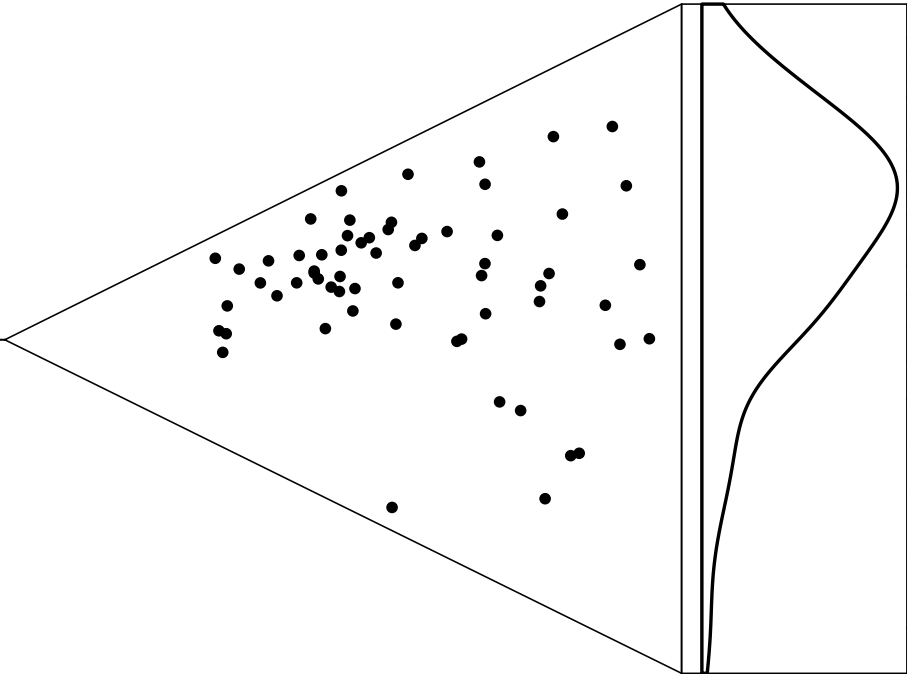
40

60

80

100

120



# D<sub>e</sub> distribution

n = 62



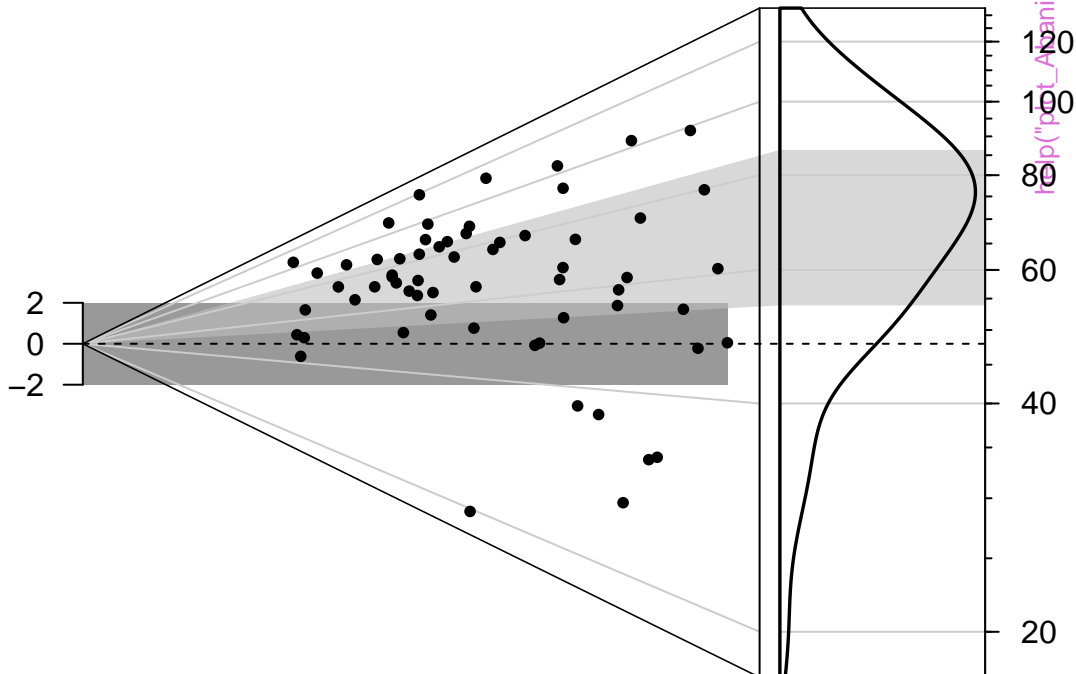
help("plot\_AbanicoPlot")

help("plot\_AbanicoPlot")

# D<sub>e</sub> distribution

n = 62

Scatter



Equivalent dose (Gy)

Data error (%)

20

10

6.7

0

5

10

15

0.016

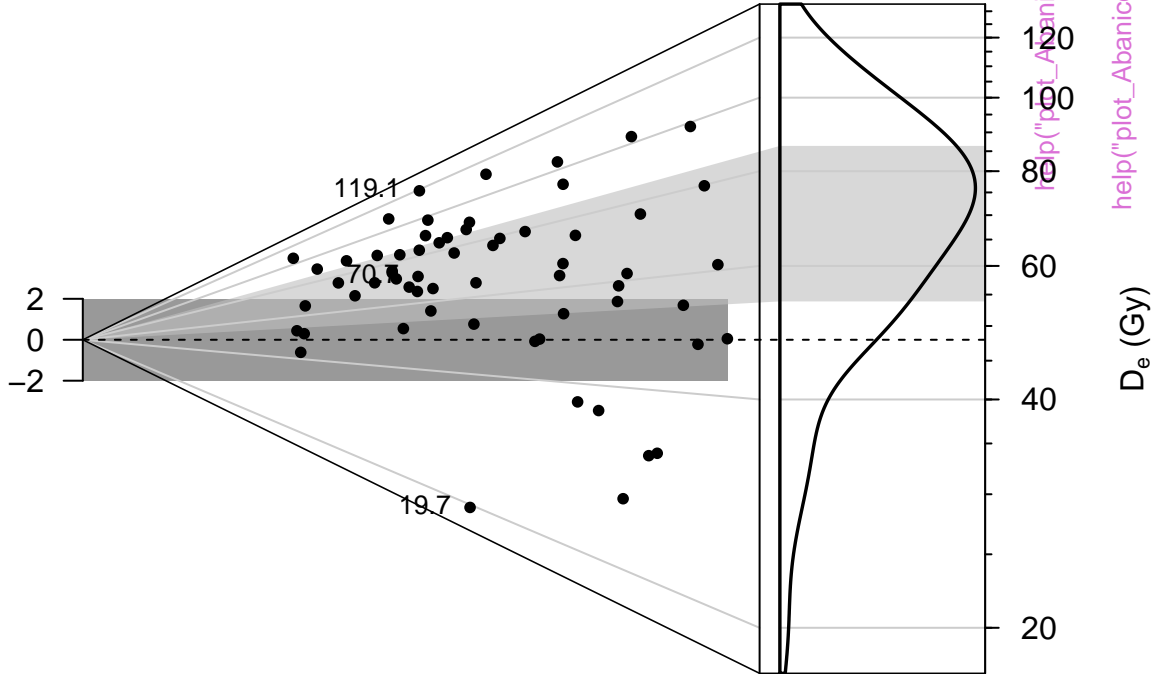
Data precision

Density (bw 0.15)

# D<sub>e</sub> distribution

n = 62

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 = 22.6 %

Standardised estimate



Relative standard error (%)

20

10

6.7

0

5

Precision

10

15

Density (bw 0.15)

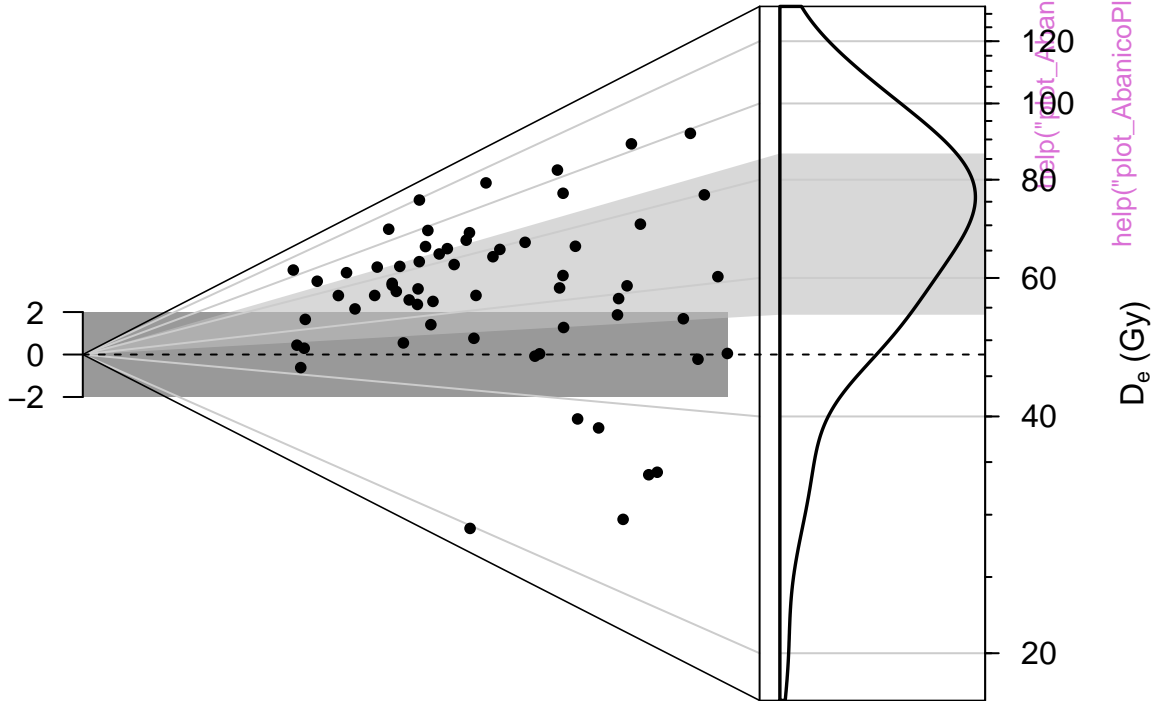
0.016



# D<sub>e</sub> distribution

weighted mean = 47.95  
median = 71.07

Standardised estimate



Relative standard error (%)

20

10

6.7

0

5

10

15

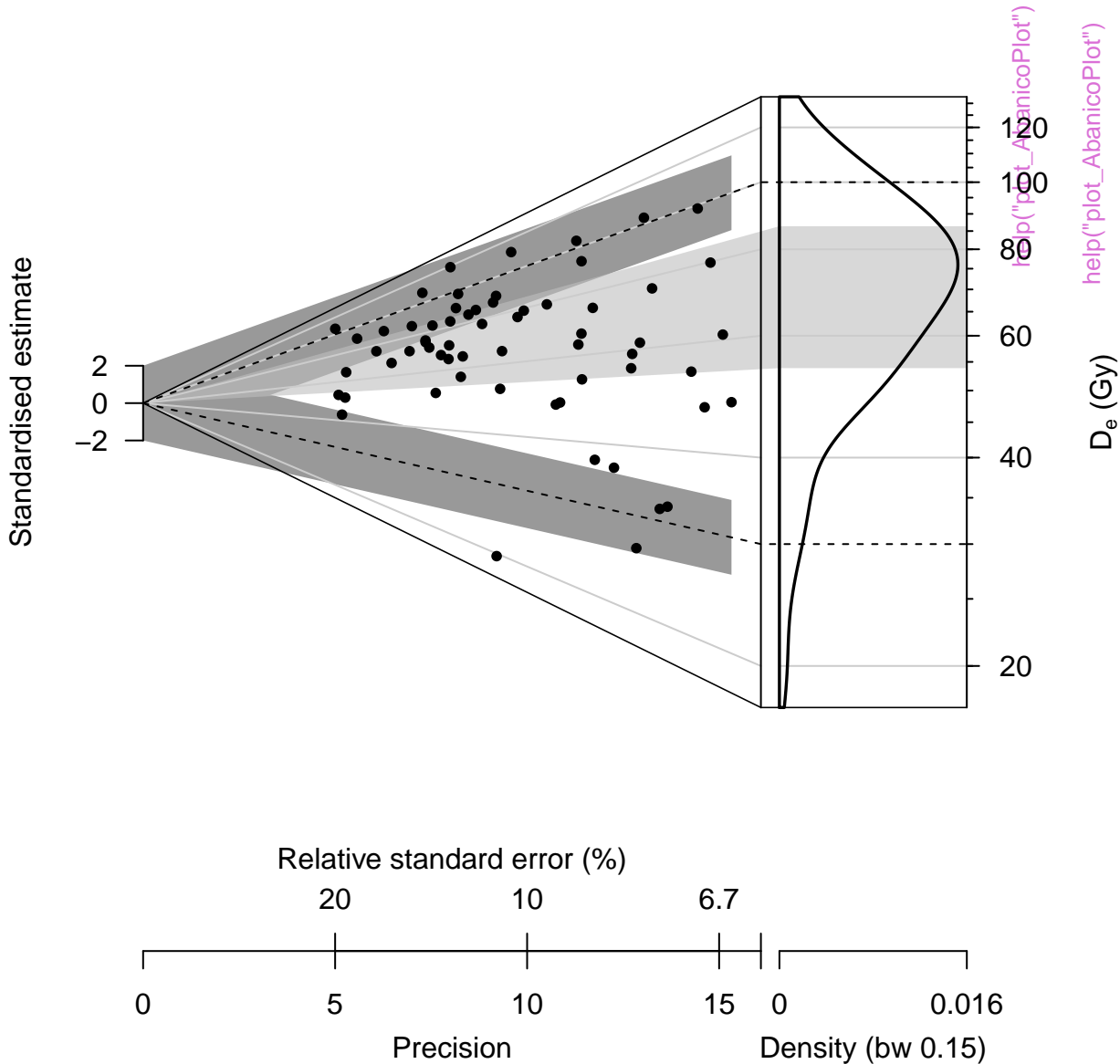
0.016

Precision

Density (bw 0.15)

# D<sub>e</sub> distribution

n = 62

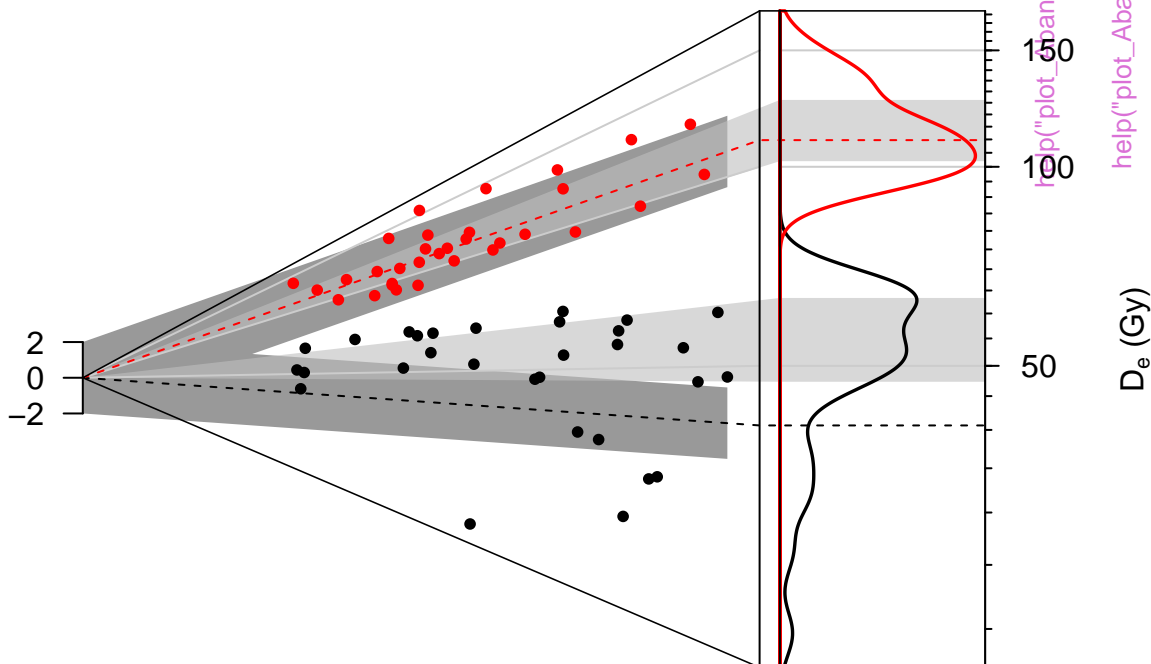


# D<sub>e</sub> distribution

n = 30

n = 32

Standardised estimate



Relative standard error (%)

20

10

6.7

0

5

10

15

0.032

Precision

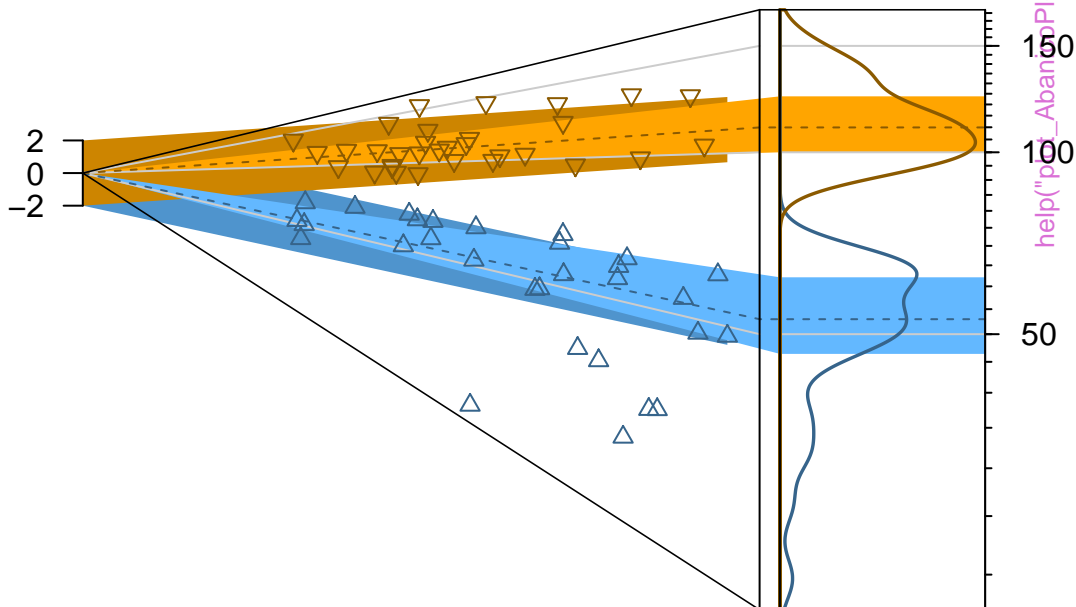
Density (bw 0.074)

# D<sub>e</sub> distribution

n = 30 | in 2 sigma = 70 % median = 52.94

n = 32 | in 2 sigma = 84.4 % median = 109.93

Standardised estimate



help("plot\_AbanicoPlot")  
D<sub>e</sub> (Gy)

Relative standard error (%)

20

10

6.7

0

5

10

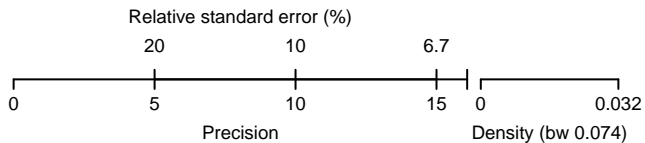
15

0.032

Precision

Density (bw 0.074)





`help("plot_AbanicoPlot")`

# Dose recovery test

Example data



# Dose recovery test





# Dose recovery test



# Dose recovery test



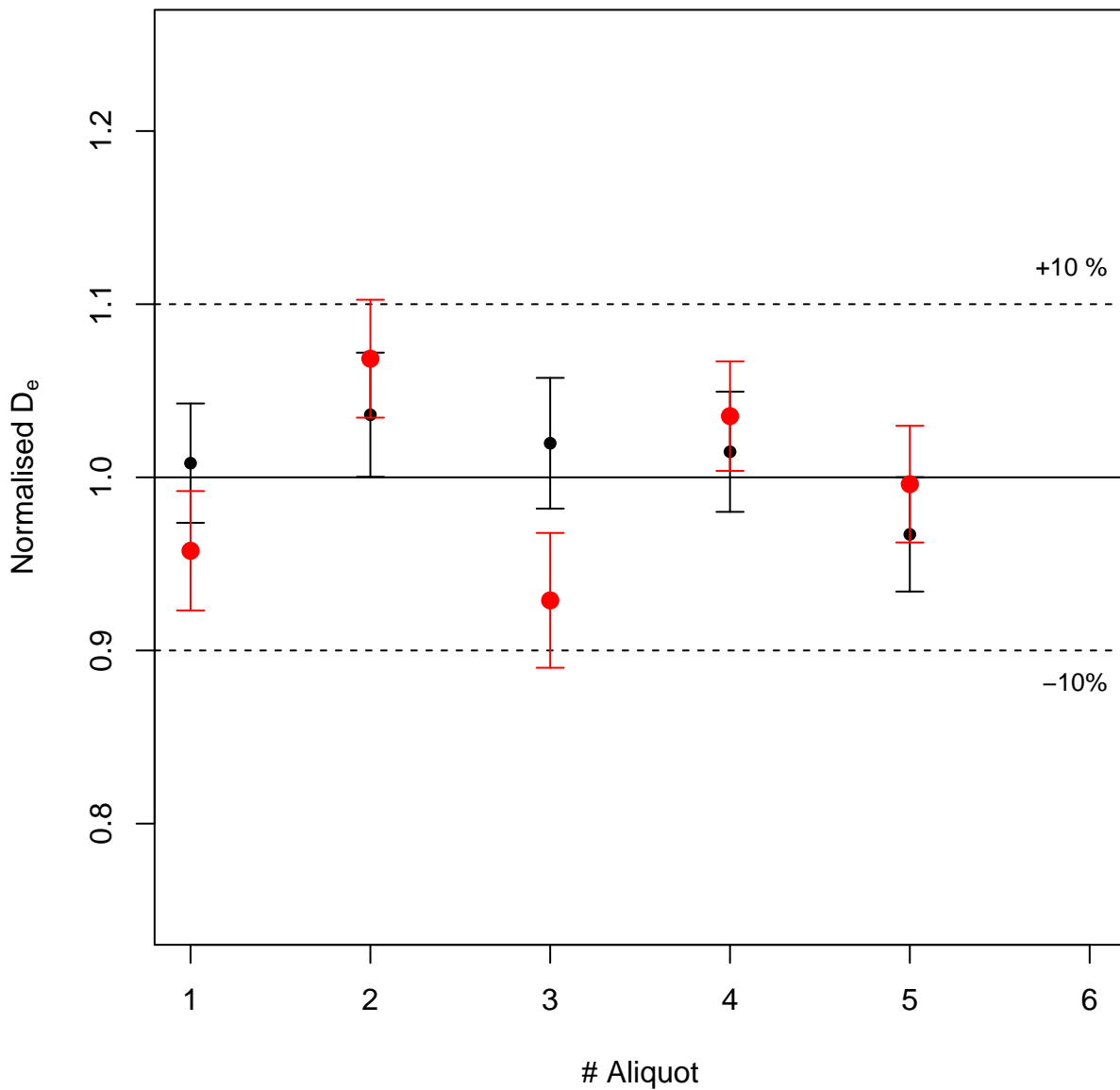
# Dose recovery test



# Dose recovery test

| n = 5 | weighted mean = 1.01 |

| n = 5 | weighted mean = 1 |



# Dose recovery test



# Dose recovery test

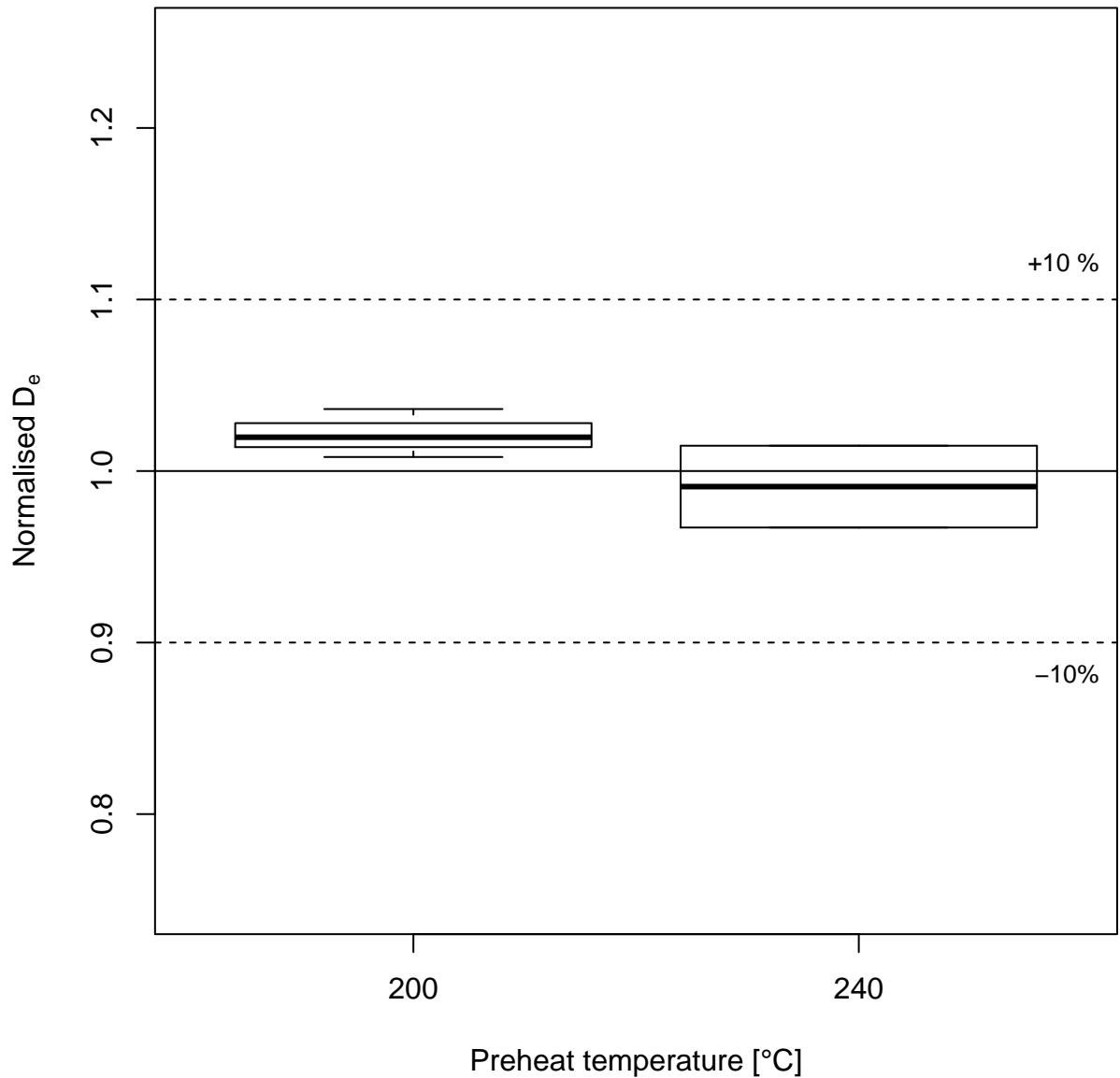
Example data



# Dose recovery test



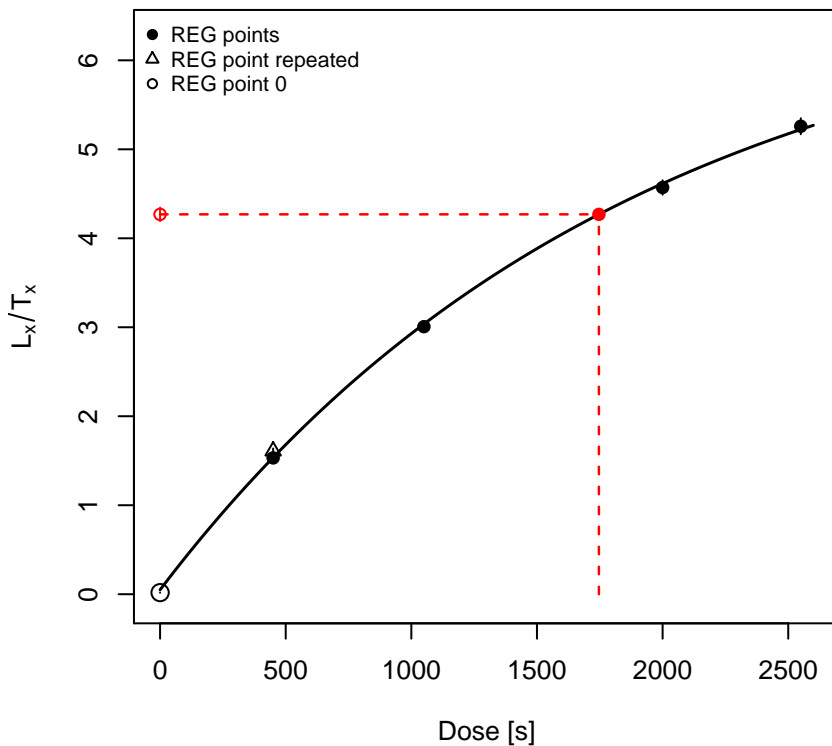
# Dose recovery test





# Growth curve

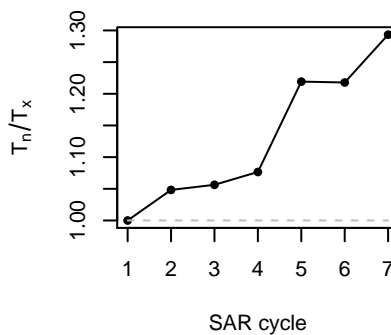
$D_e = 1746.54 \pm 57.45$  | fit: EXP



## $D_e$ from MC simulation



## Test dose response



# Growth curve

$D_e = 1746.54 \pm 59.97$  | fit: EXP



## $D_e$ from MC simulation

$D_{eMC} = 1732.18 \pm 59.97$  | quality = 99.2 %



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

## Test dose response



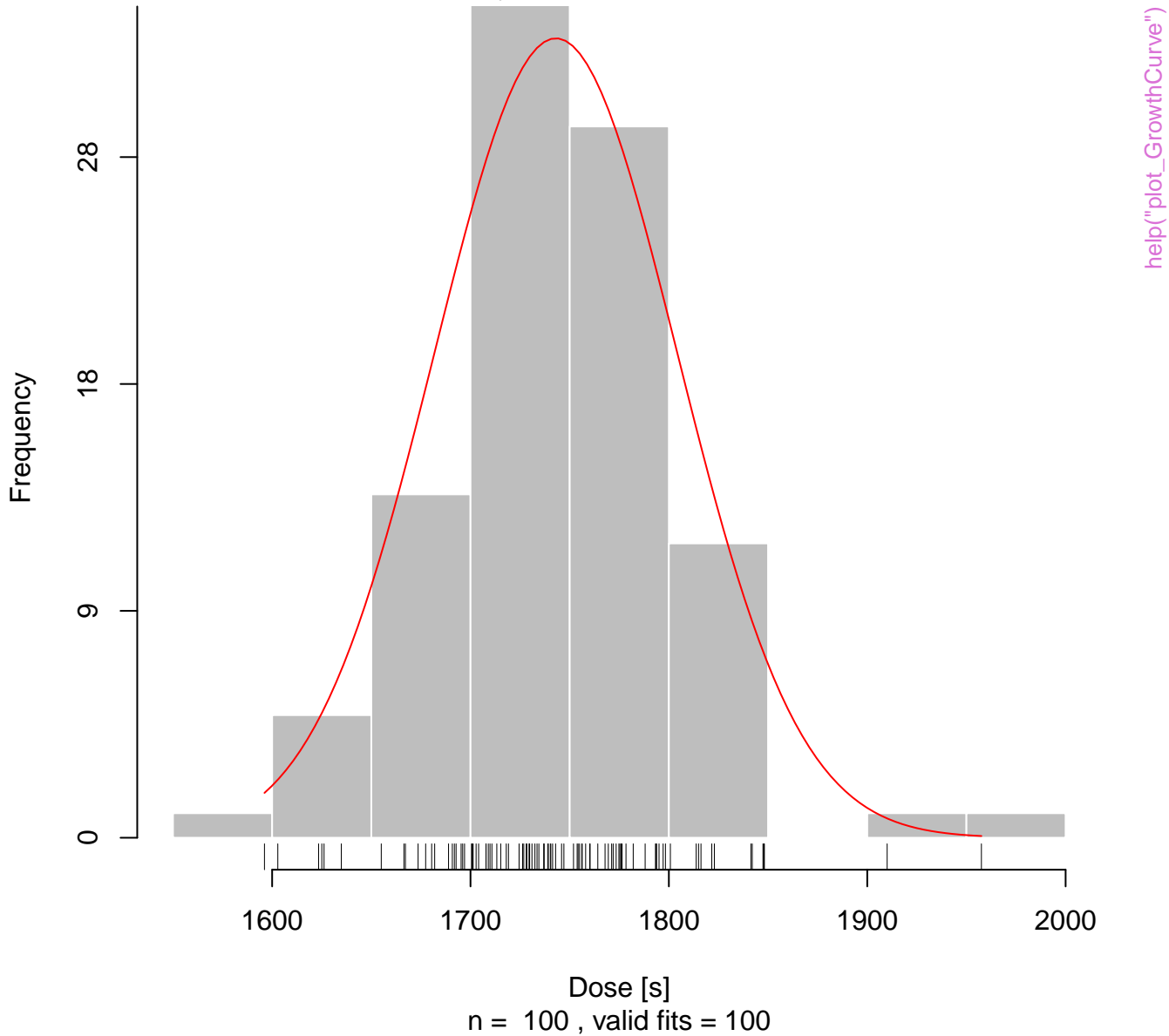
# Growth curve

$D_e = 1746.54 \pm 61.2$  | fit: EXP



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

D<sub>MC</sub> = 1743.04 ± 61.2 | quality = 99.8 %



# Test dose response



# Histogram



# Histogram of De-values

Example data set



# D<sub>e</sub> distribution

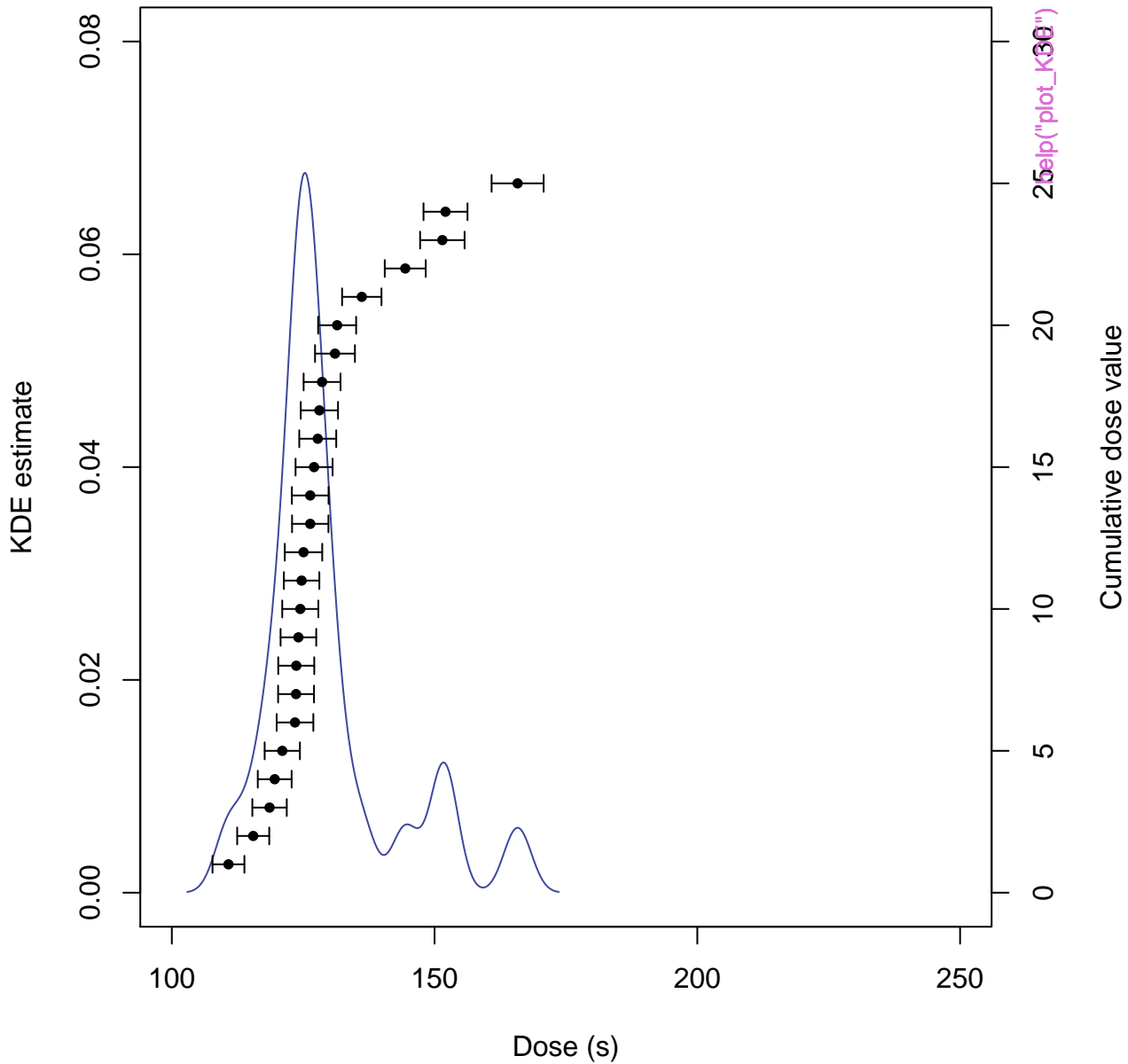




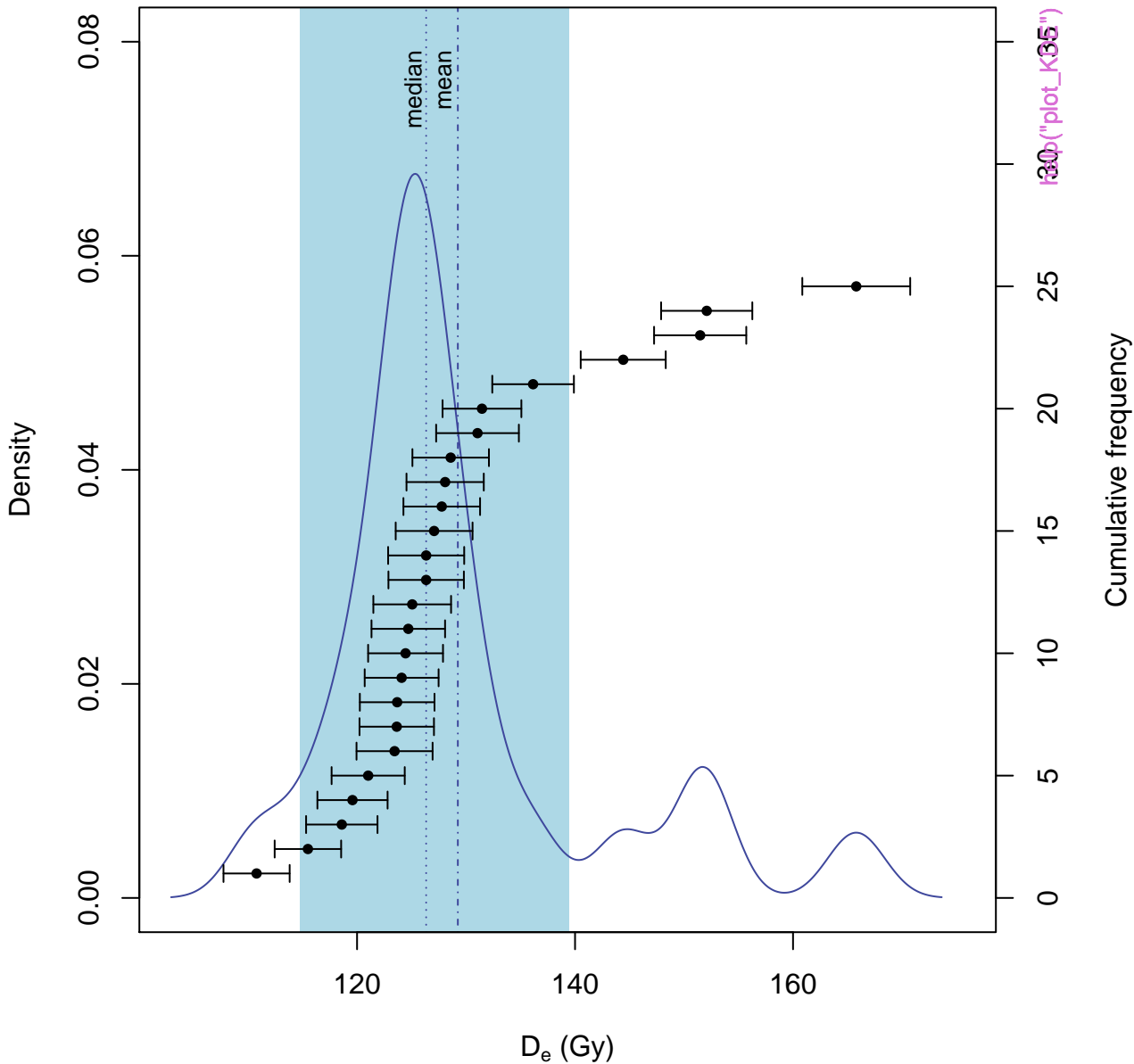
# D<sub>e</sub> distribution



# Dose distribution



**D<sub>e</sub> distribution**



# D<sub>e</sub> distribution

n = 25 | median = 126.34 | skewness = 1.34



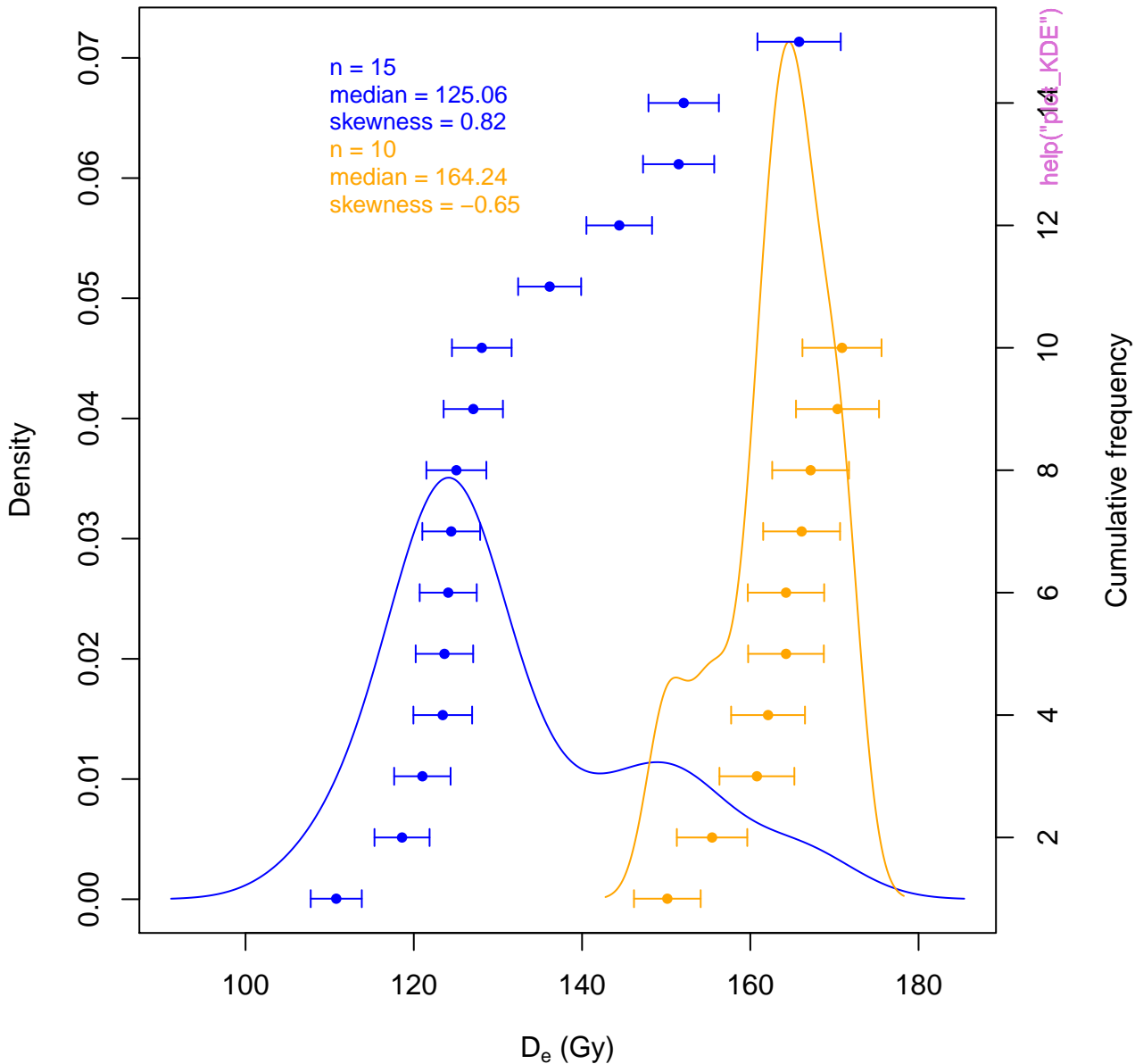
# D<sub>e</sub> distribution



**D<sub>e</sub> distribution**



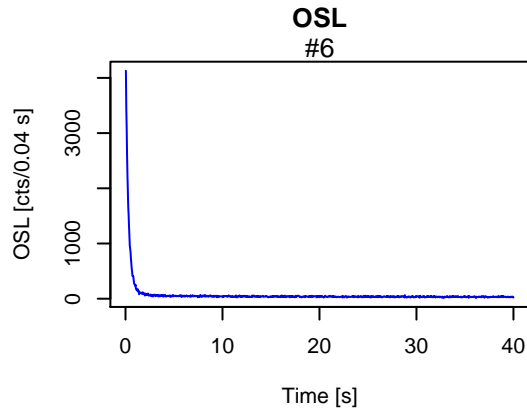
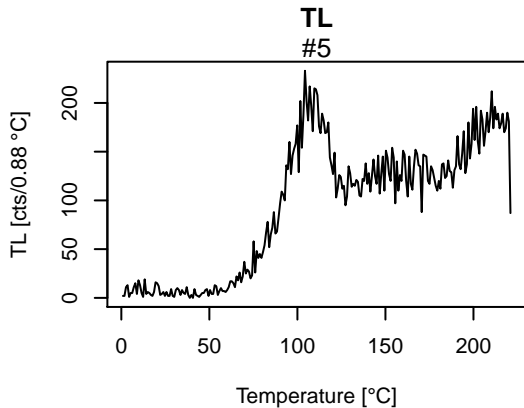
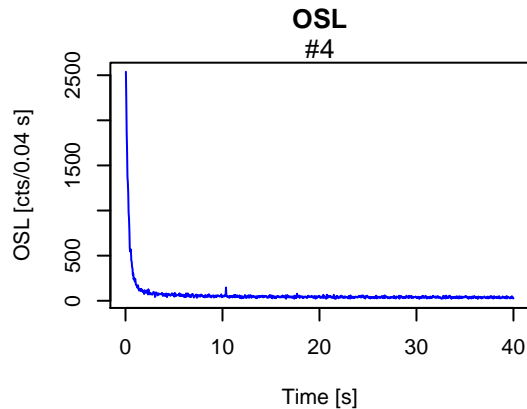
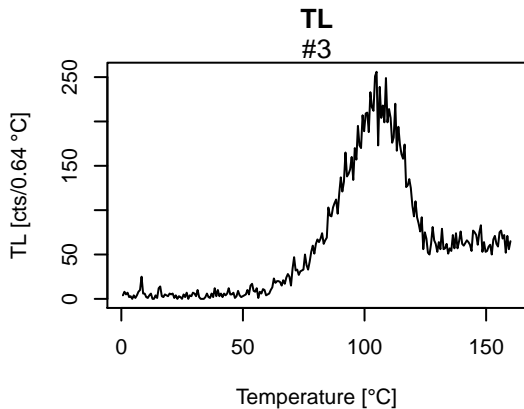
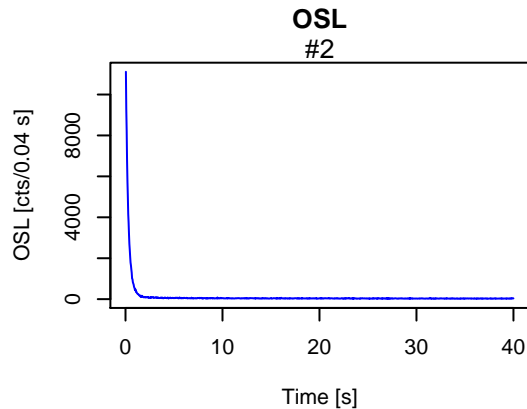
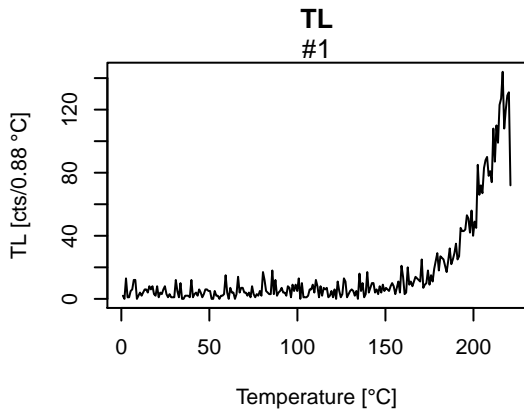
# D<sub>e</sub> distribution



**D<sub>e</sub> distribution**







help("plot\_RLum.Analysis")

**TL**  
**#7**



**OSL**  
**#8**



help("plot\_RLum.Analysis")

**TL**  
**#9**



**OSL**  
**#10**



**TL**  
**#11**



**OSL**  
**#12**





help("plot\_RLum.Analysis")





help("plot\_RLum.Analysis")

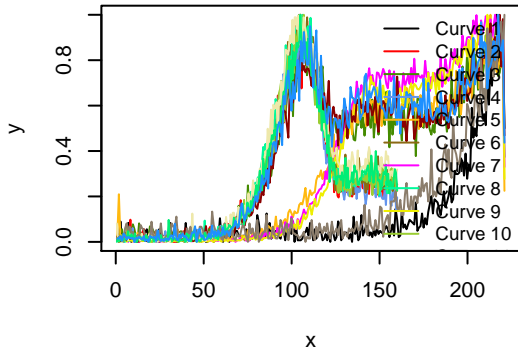




help("plot\_RLum.Analysis")



TL combined



# unkown curve type



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

# RLum.Data.Image





# RLum.Data.Spectrum



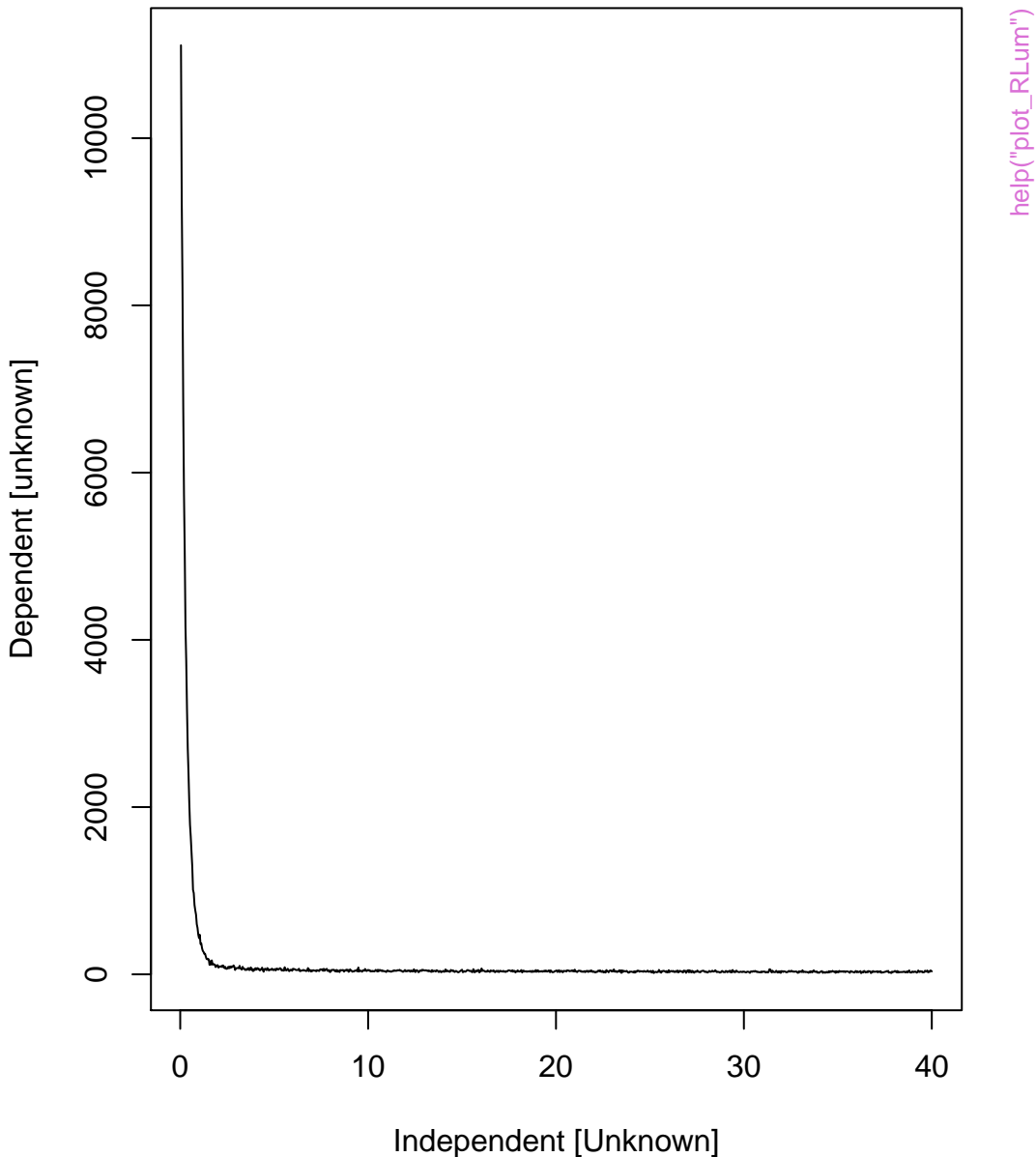
[help\("plot\\_RLum.Data.Spectrum"\)](#)

# RLum.Data.Spectrum



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

# unkown curve type



**Likelihood profile: gamma**

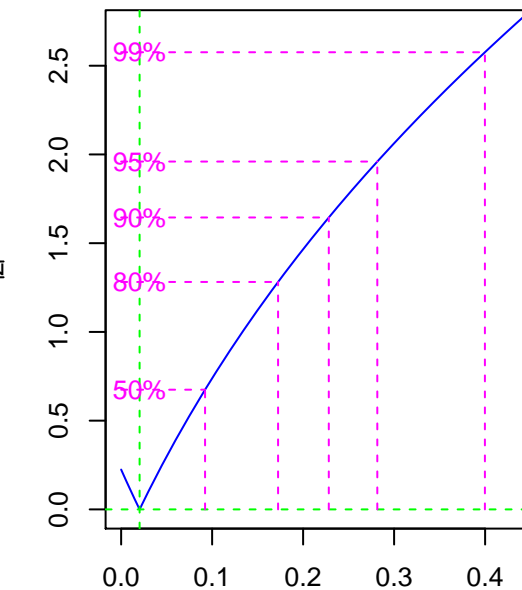


**Likelihood profile: sigma**



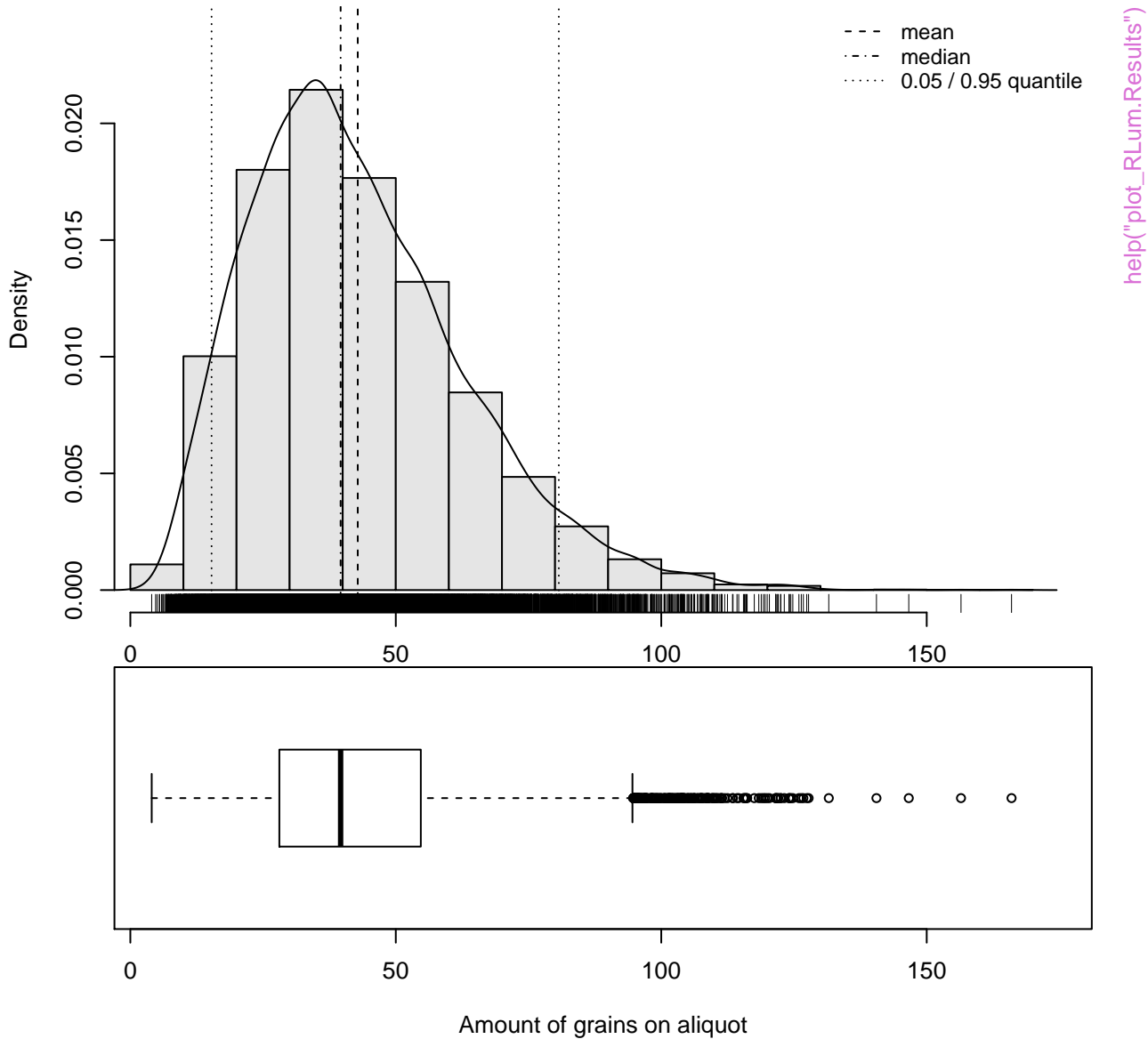
help("plot\_RLum.Results")

**Likelihood profile: p0**



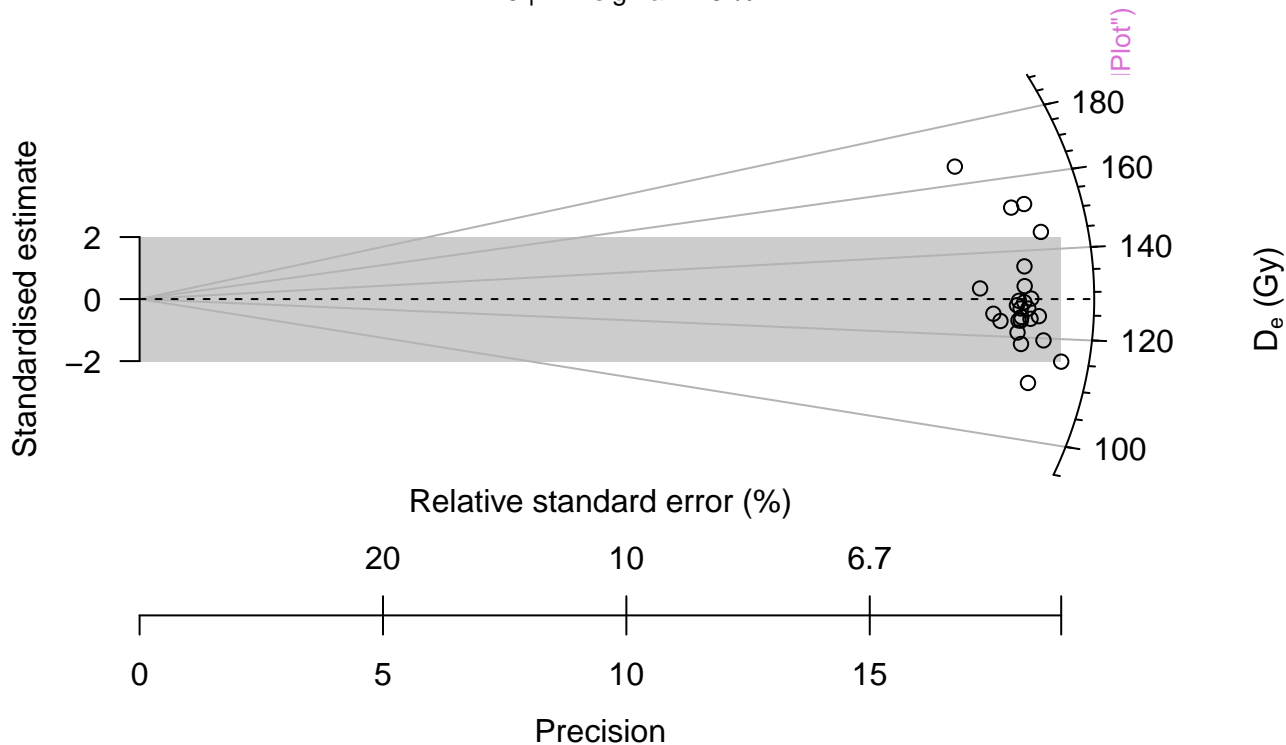
# Monte Carlo Simulation

$n = 10000 \mid \hat{\mu} = 43 \mid \hat{\sigma} = 20 \mid \frac{\hat{\sigma}}{\sqrt{n}} = 0 \mid v = 0.85$



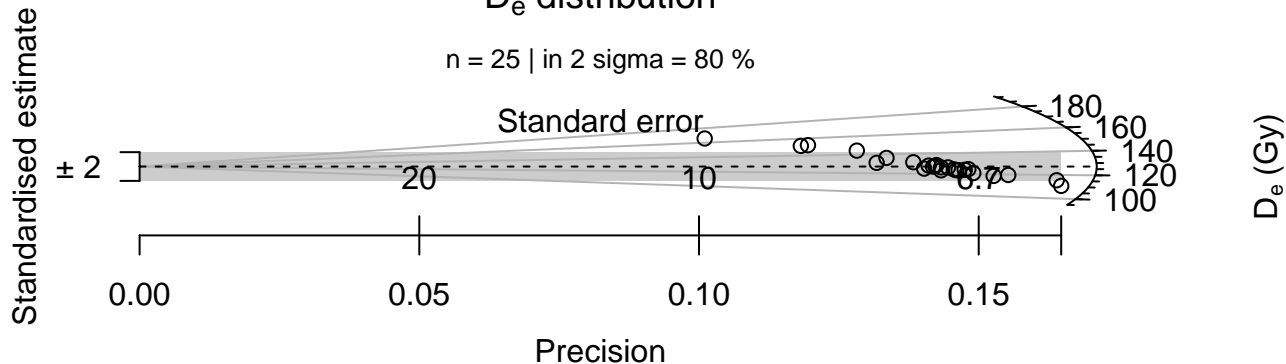
## D<sub>e</sub> distribution

n = 25 | in 2 sigma = 76 %



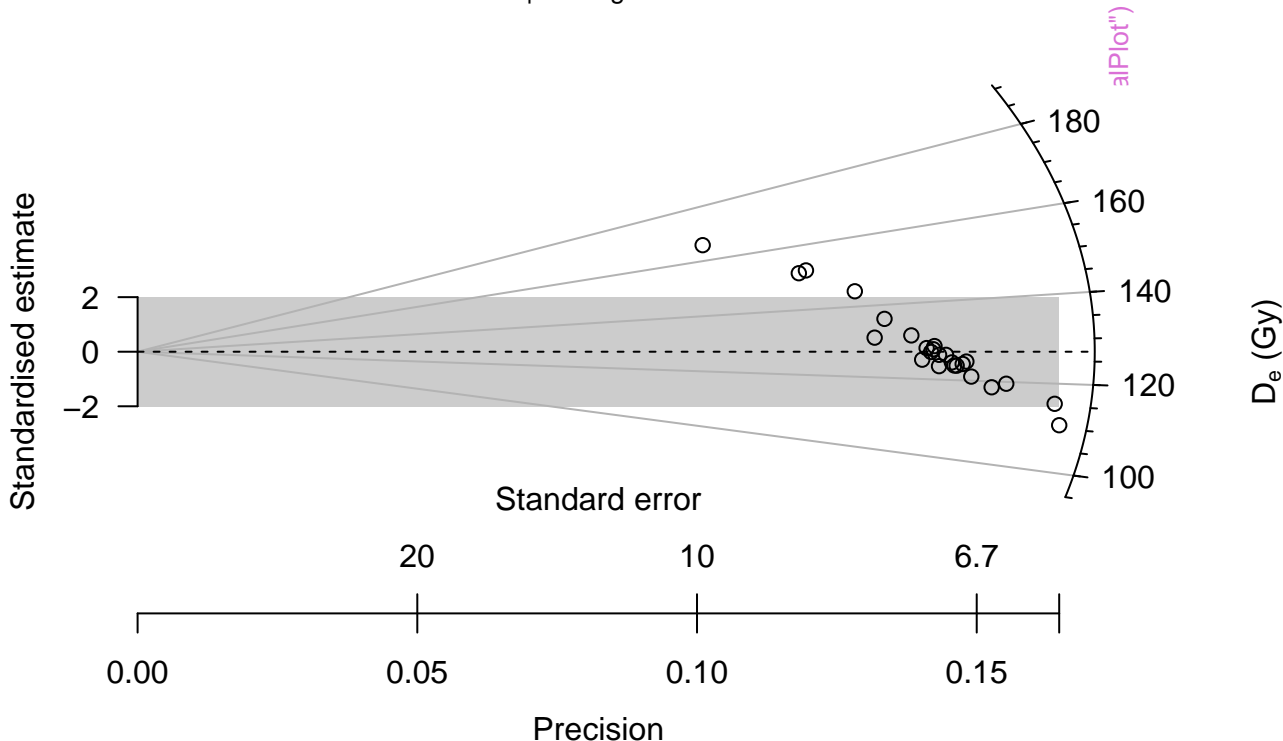
## D<sub>e</sub> distribution

n = 25 | in 2 sigma = 80 %



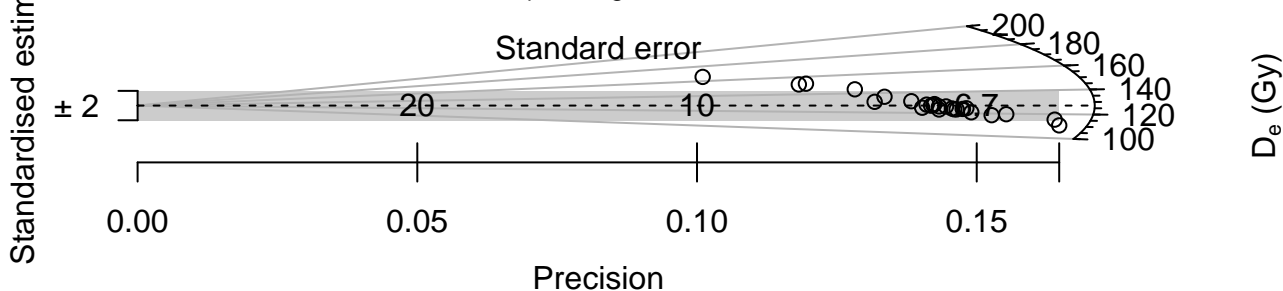
# D<sub>e</sub> distribution

n = 25 | in 2 sigma = 80 %



# D<sub>e</sub> distribution

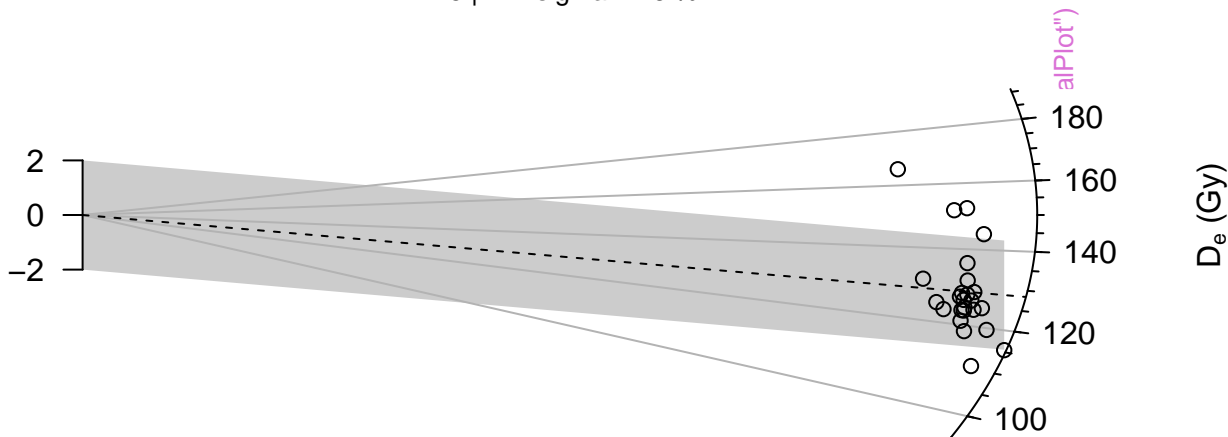
n = 25 | in 2 sigma = 80 %



## D<sub>e</sub> distribution

n = 25 | in 2 sigma = 76 %

Standardised estimate



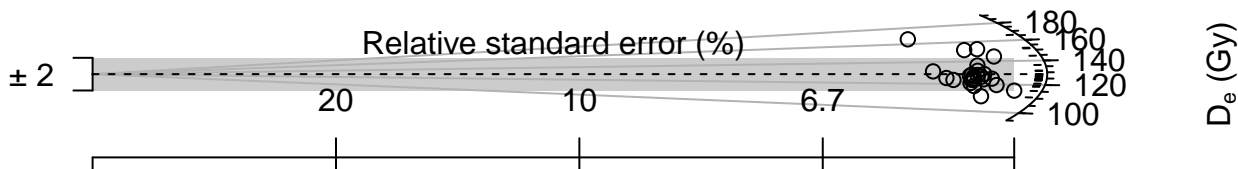
Relative standard error (%)



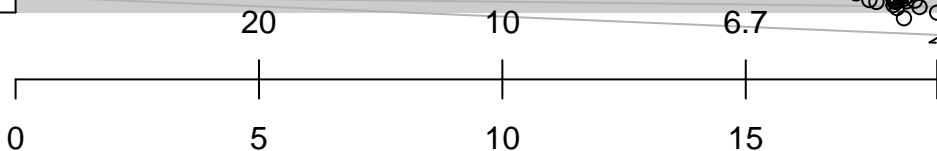
## D<sub>e</sub> distribution

n = 25 | in 2 sigma = 76 %

Standardised estimate



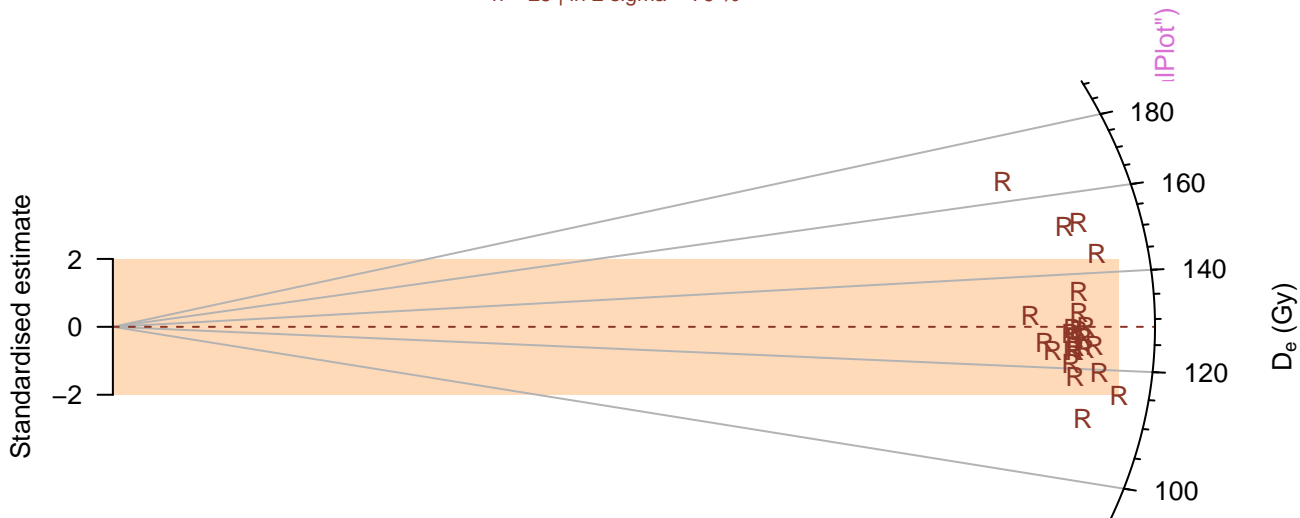
Relative standard error (%)



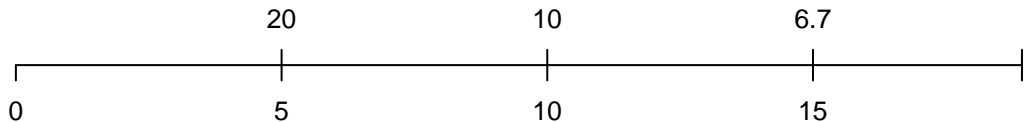


## D<sub>e</sub> distribution

n = 25 | in 2 sigma = 76 %



Relative standard error (%)



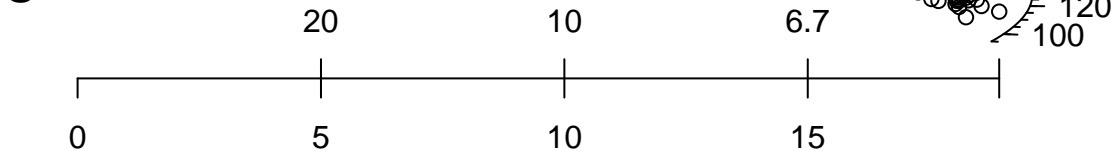
Precision

## D<sub>e</sub> distribution

n = 25 | in 2 sigma = 76 %



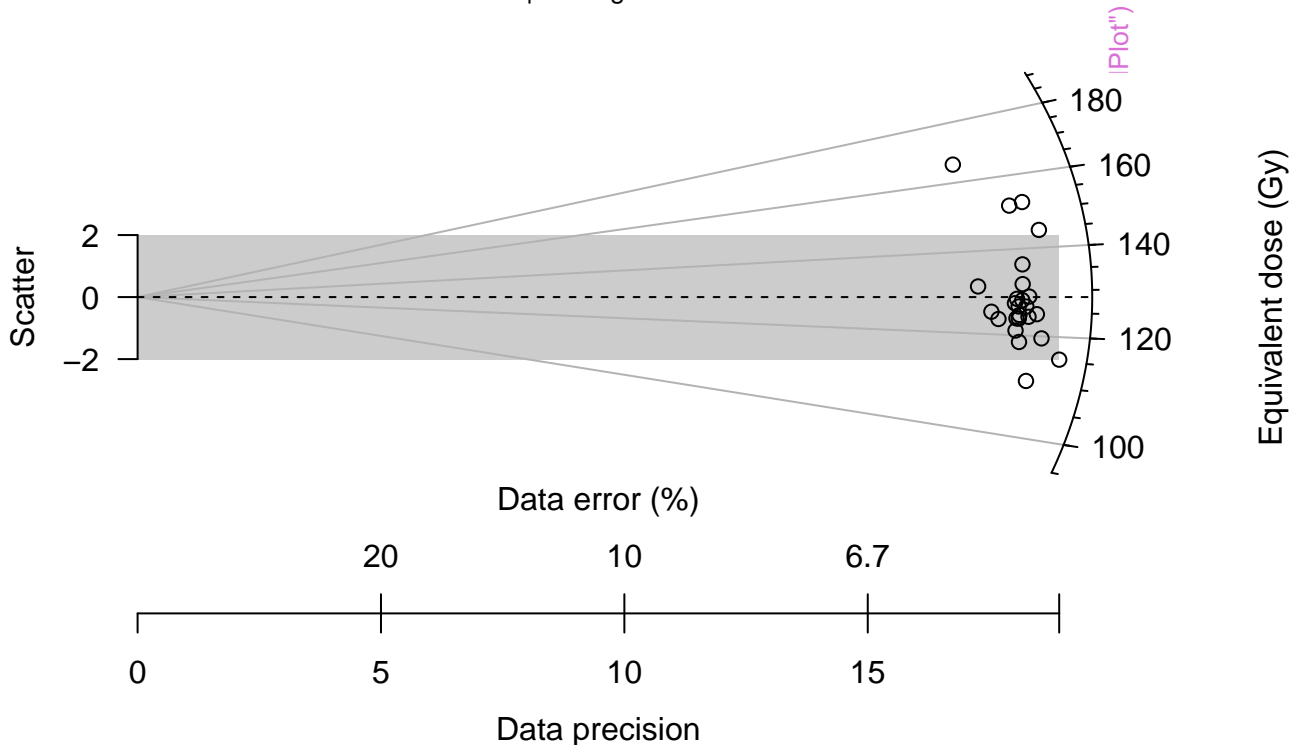
Relative standard error (%)



Precision

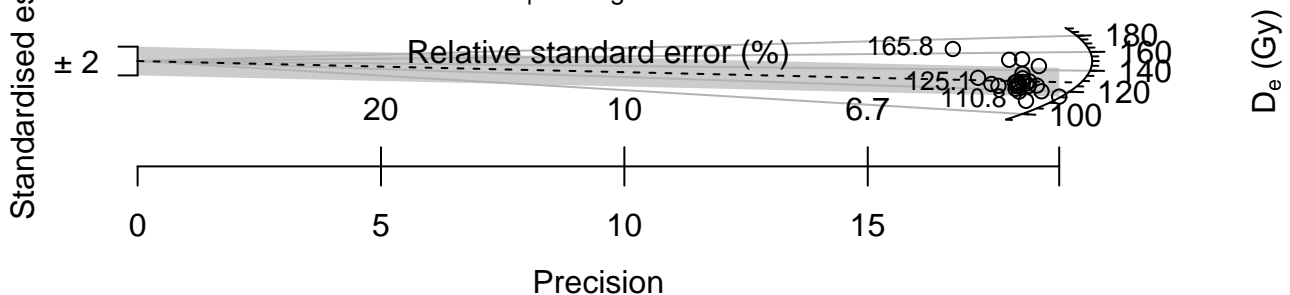
## D<sub>e</sub> distribution

n = 25 | in 2 sigma = 76 %



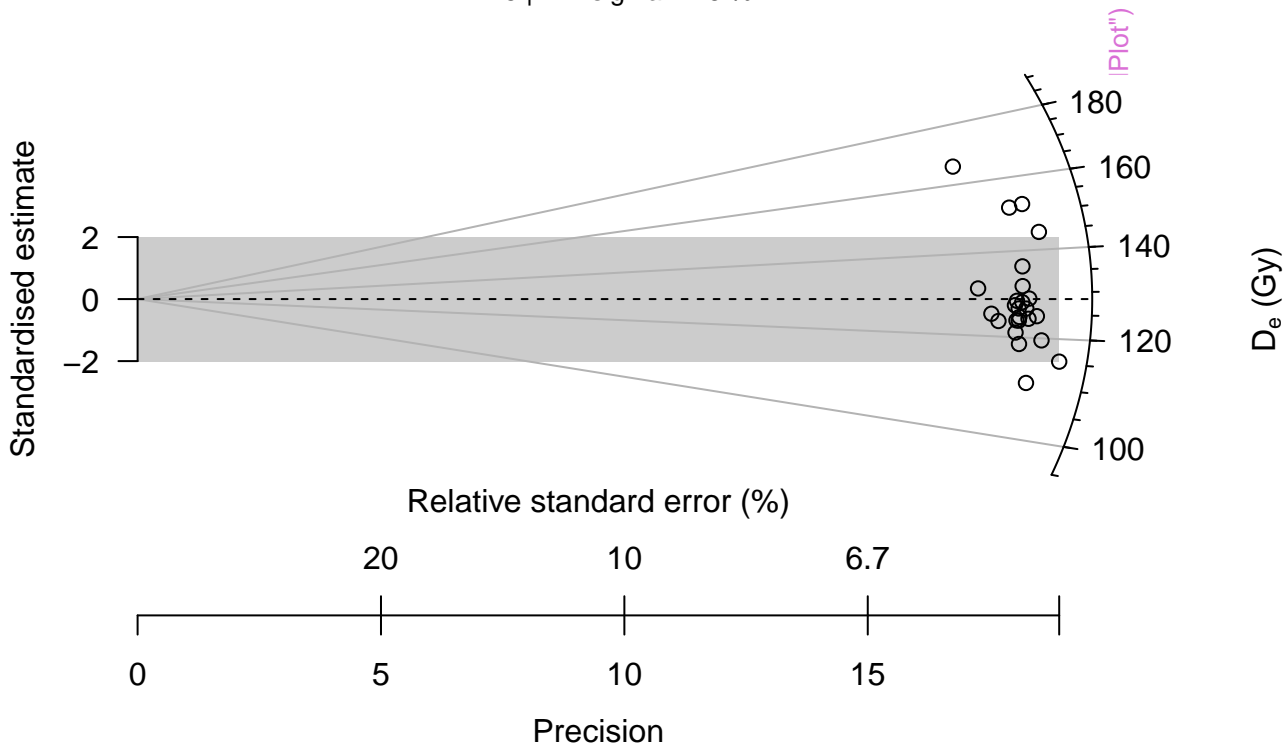
## D<sub>e</sub> distribution

n = 25 | in 2 sigma = 76 %



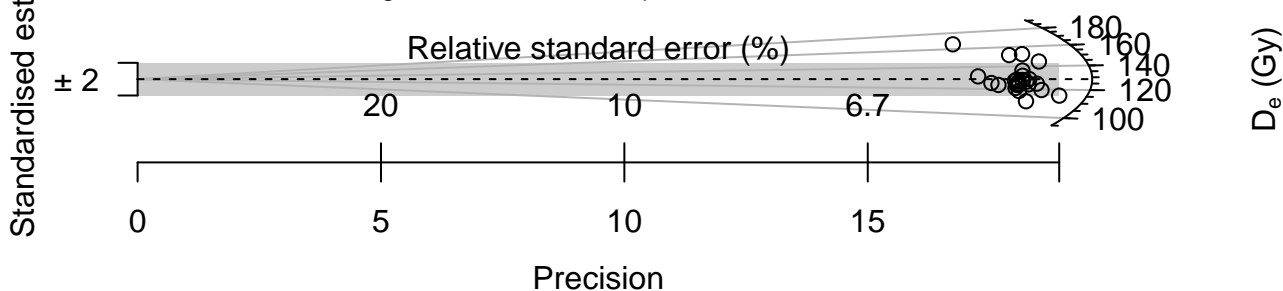
## D<sub>e</sub> distribution

n = 25 | in 2 sigma = 76 %



## D<sub>e</sub> distribution

weighted mean = 127.13 | median = 126.34



## D<sub>e</sub> distribution

n = 15 | in 2 sigma = 73.3 %

n = 10 | in 2 sigma = 100 %



## D<sub>e</sub> distribution

n = 15 | in 2 sigma = 73.3 %

n = 10 | in 2 sigma = 100 %

