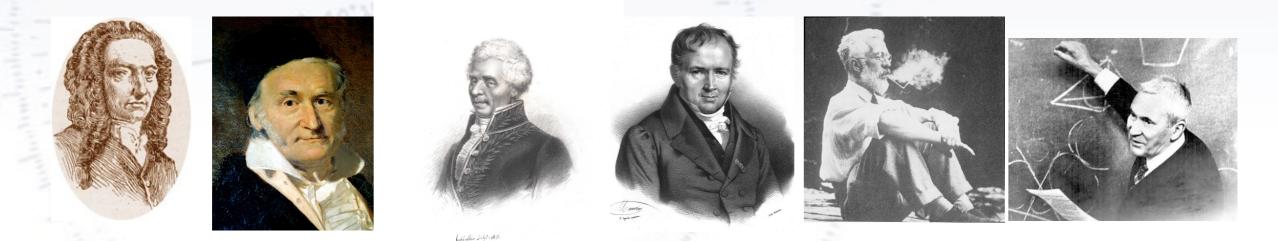
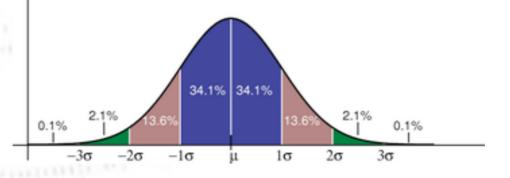
### Applied Statistics Estimating the length of the table

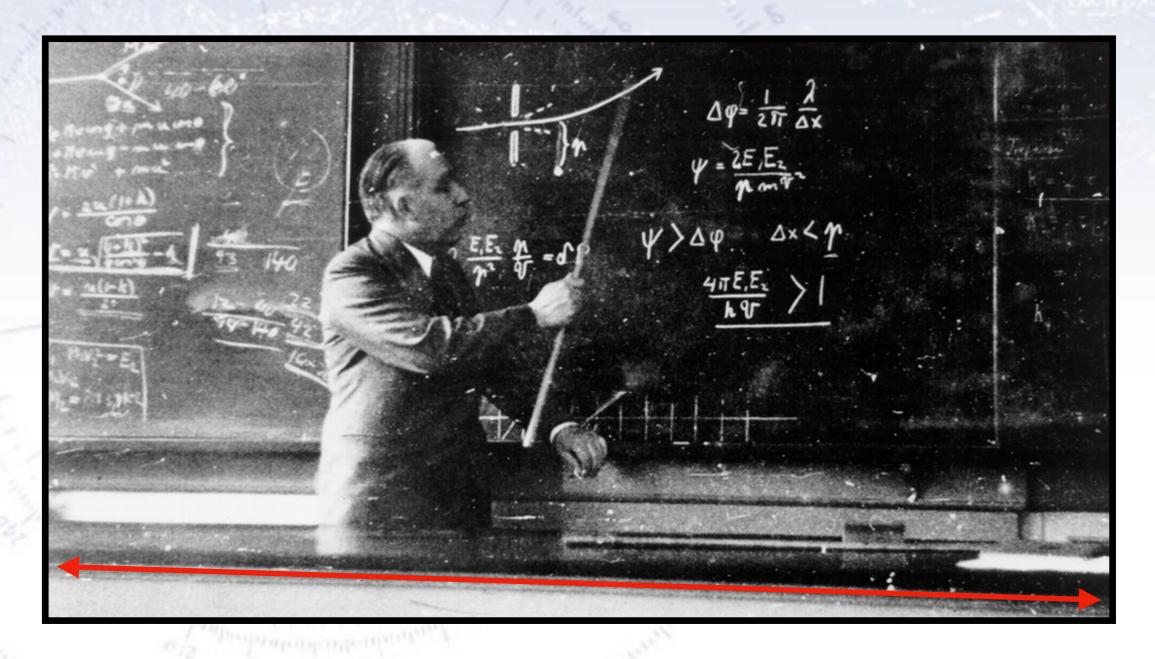


Troels C. Petersen and Mathias Luidor Heltberg (NBI)



"Statistics is merely a quantisation of common sense"

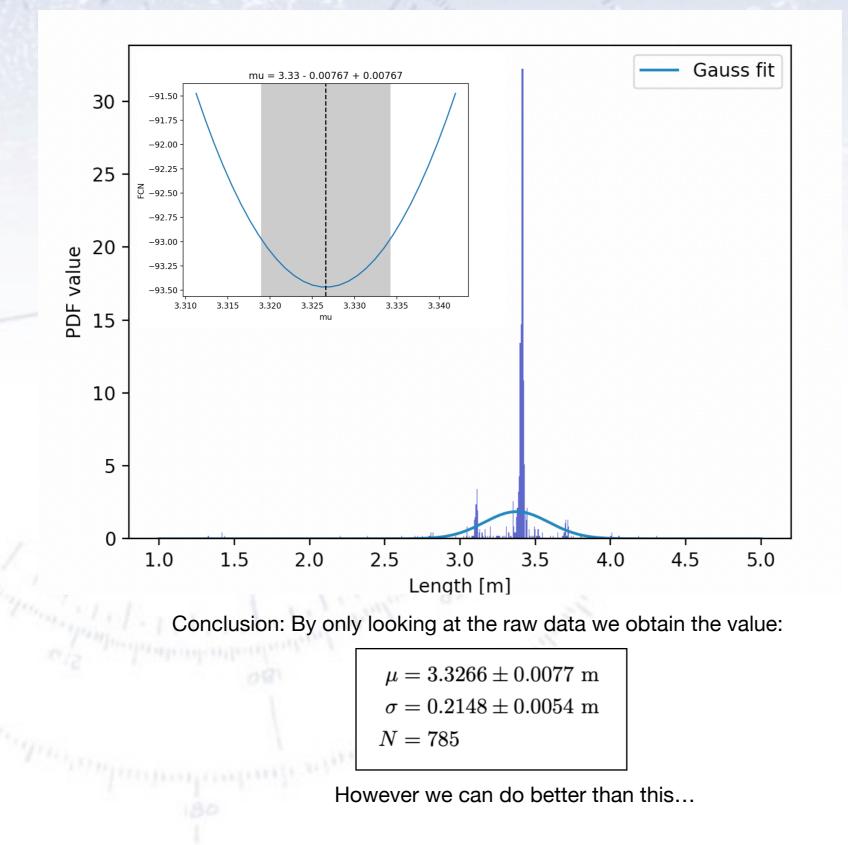
#### The table in auditorium A



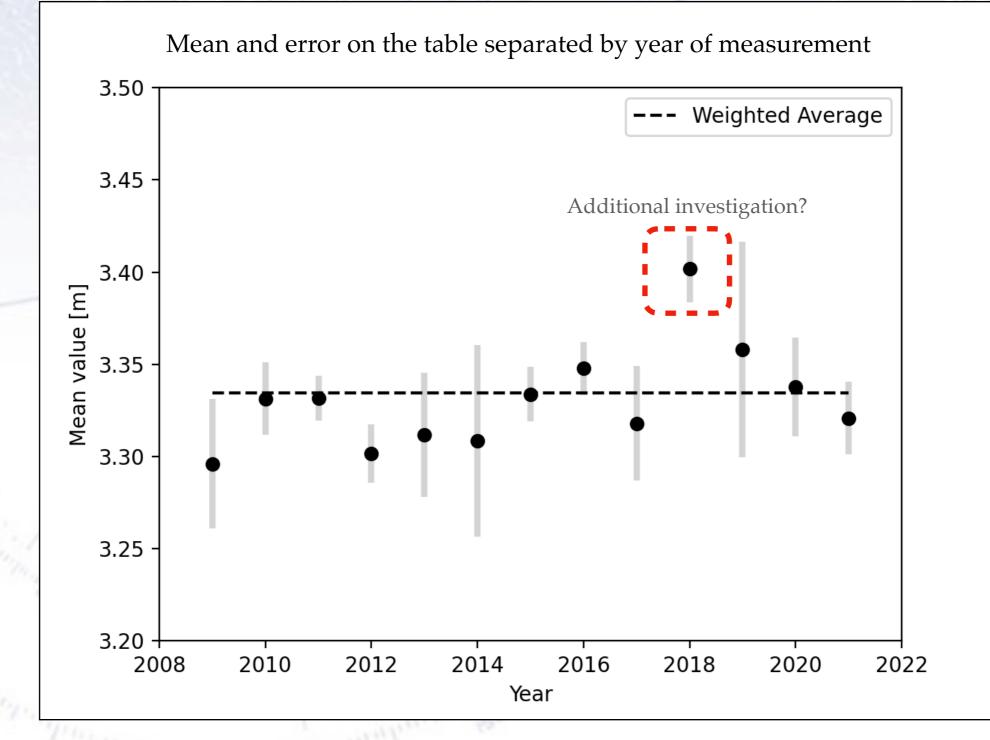
"Everything is vague to a degree you do not realise till you have tried to make it precise."

[Bertrand Russell, 1872-1970]

#### The data at first glance



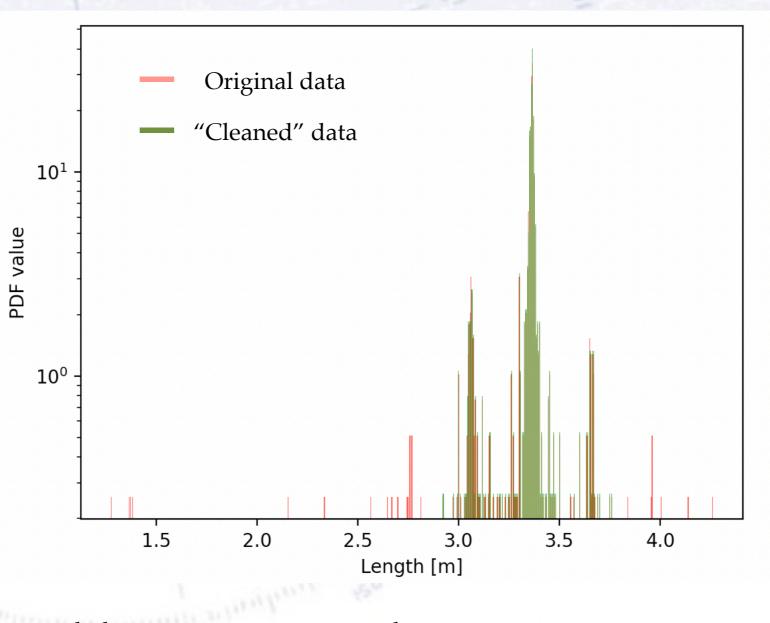
#### Crosschecking



These measurements seem to be in OK agreement - however the 2018 seems to be off...

#### First rejection criteria

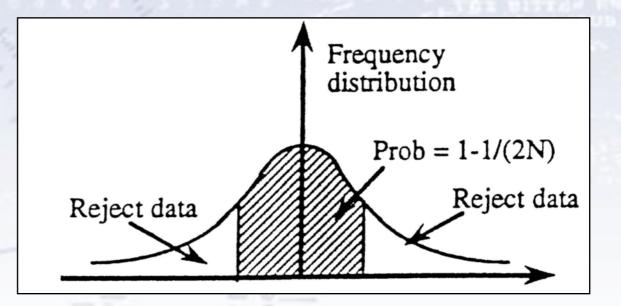
We will start by removing the "worst" points. Here I remove the points that are more than 4 std's away from the mean.



With this we reject 24 points - so the data sample consist of 761 points.

#### Removing data points

Removing improbable data points is formalised in **Chauvenet's Criterion**, though many other methods exists (see Peirce, Grubbs, etc.)



The idea is to assume that the distribution is Gaussian, and ask what the probability of the farthest point is. If it is below some value, which is to be determined ahead of applying the criterion, then the point is removed, and the criterion is reapplied until no more points should be removed.

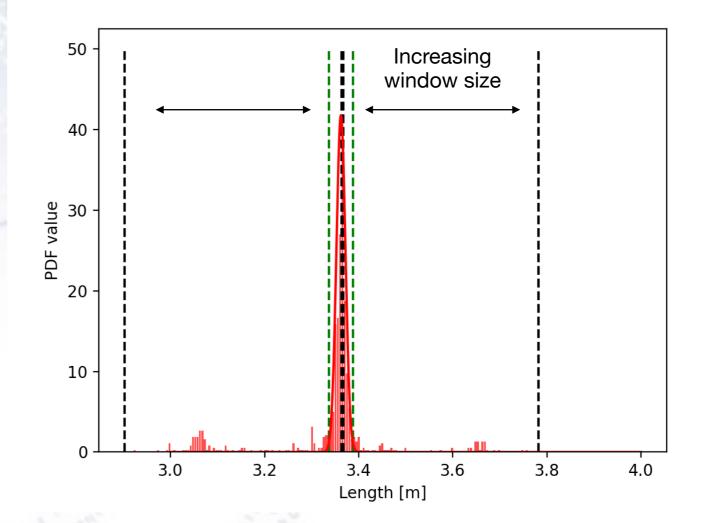
We choose to say, that if the outermost point in the Gaussian case has **less than 5**% **chance of being this far out** (taking the total number of points into account), then I reject it.

However, **ALWAYS keep a record of your original data**, as it may contain more effects than you originally thought.

### Is the central peak gaussian?

In order to apply the criterion however, we should have something that is somewhat gaussian.

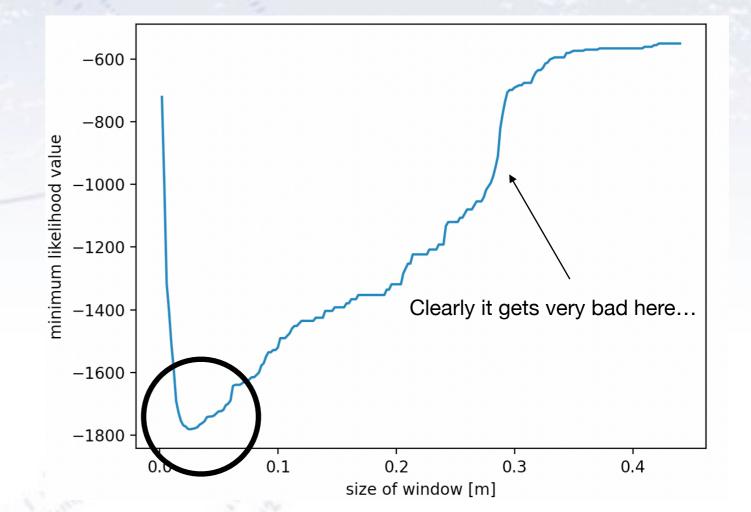
We therefore want to start by identifying the "most gaussian" part of the distribution be increasing the window size of the fitting



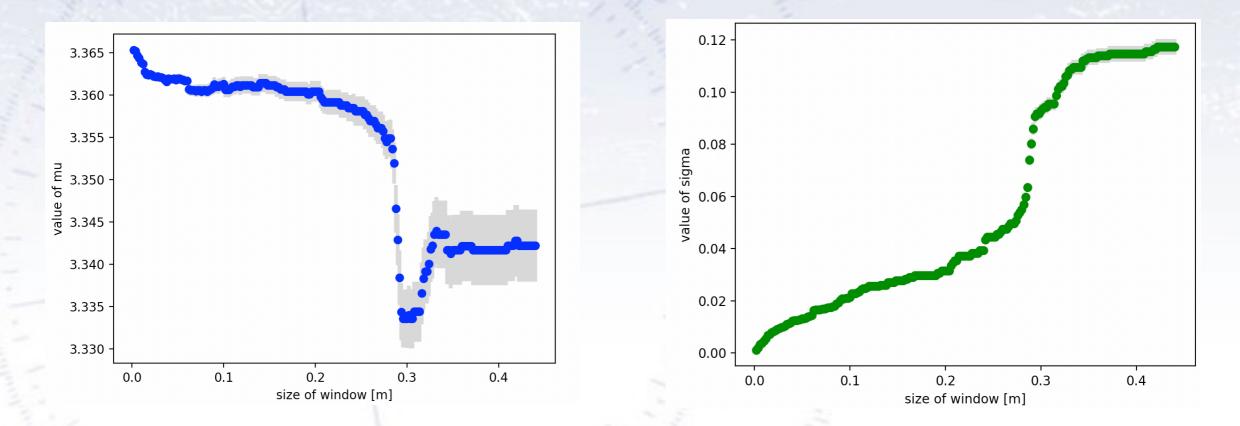
# Finding the most gaussian window

Here we search for the value of the maximal likelihood as a function of the window size.

This means that if we consider this window, we will work with data as gaussian as it comes for this distribution.

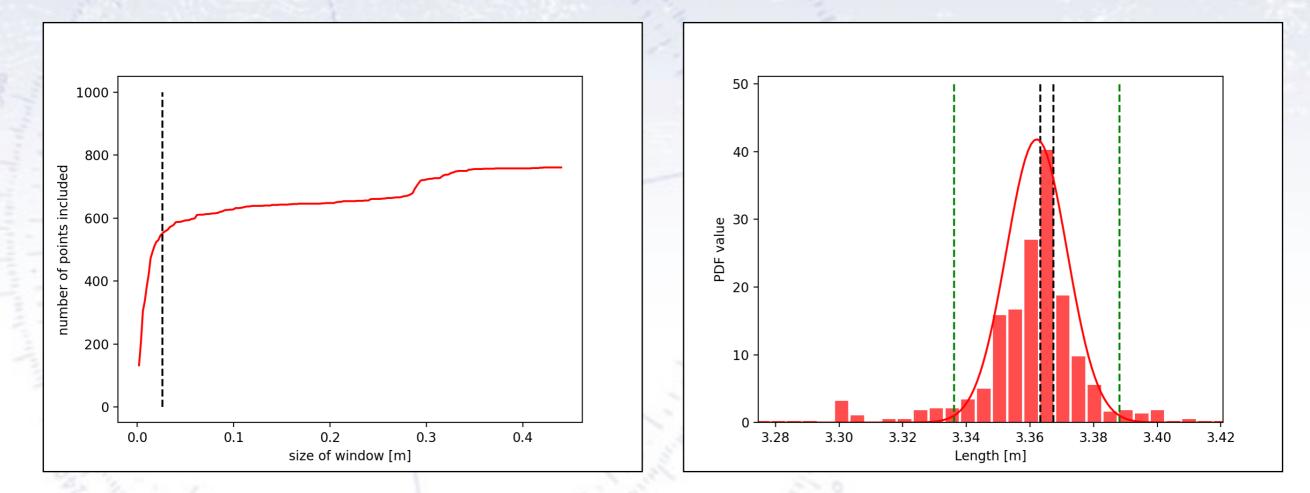


### Is the central peak gaussian?



As we follow how the likelihood changes, we can extract the parameter estimates and their uncertainties as extracted from the parameter fits.

### Is the central peak gaussian?



At this optimal likelihood, we note that we include 571 datapoints out of the original 761.

Drawing the green lines, to show our range of fitting, we can now use this standard deviation and reject points more than 4 sigmas away.

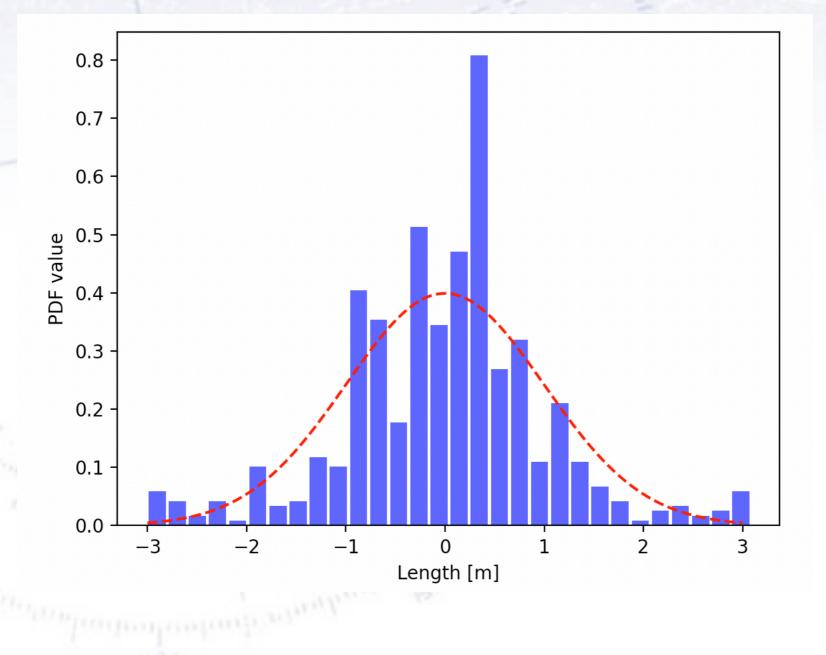
#### Weighted results

Considering the quoted uncertainties, we first need to evaluate their quality.

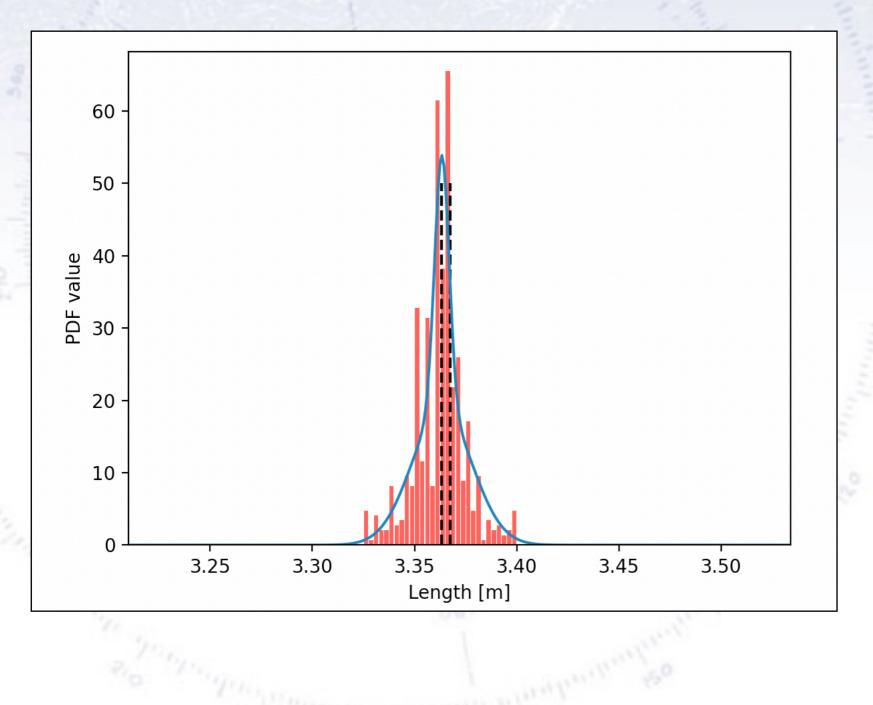
 $x_i - \mu$ 

 $\sigma_i$ 

The plot to consider is a **PULL** plot, i.e. the distribution of: z =



## Fitting the centered data with a double gaussian - unweighted case

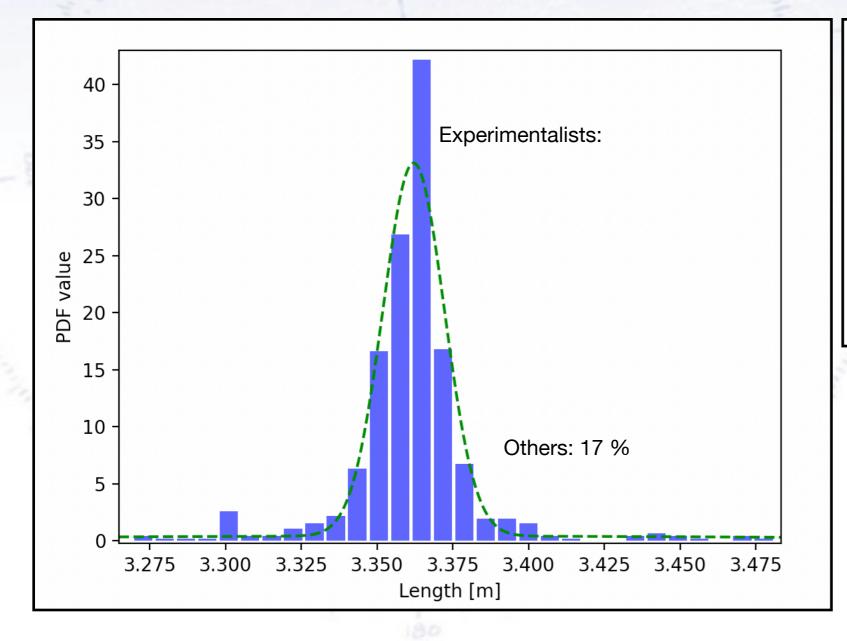


We realised that the center around the peak fitted OK with a double gaussian.

This also allows foran interpretation of the model: All measurers can be divided into two groups the precise ("experimentalists") and the sloppy ("Others").

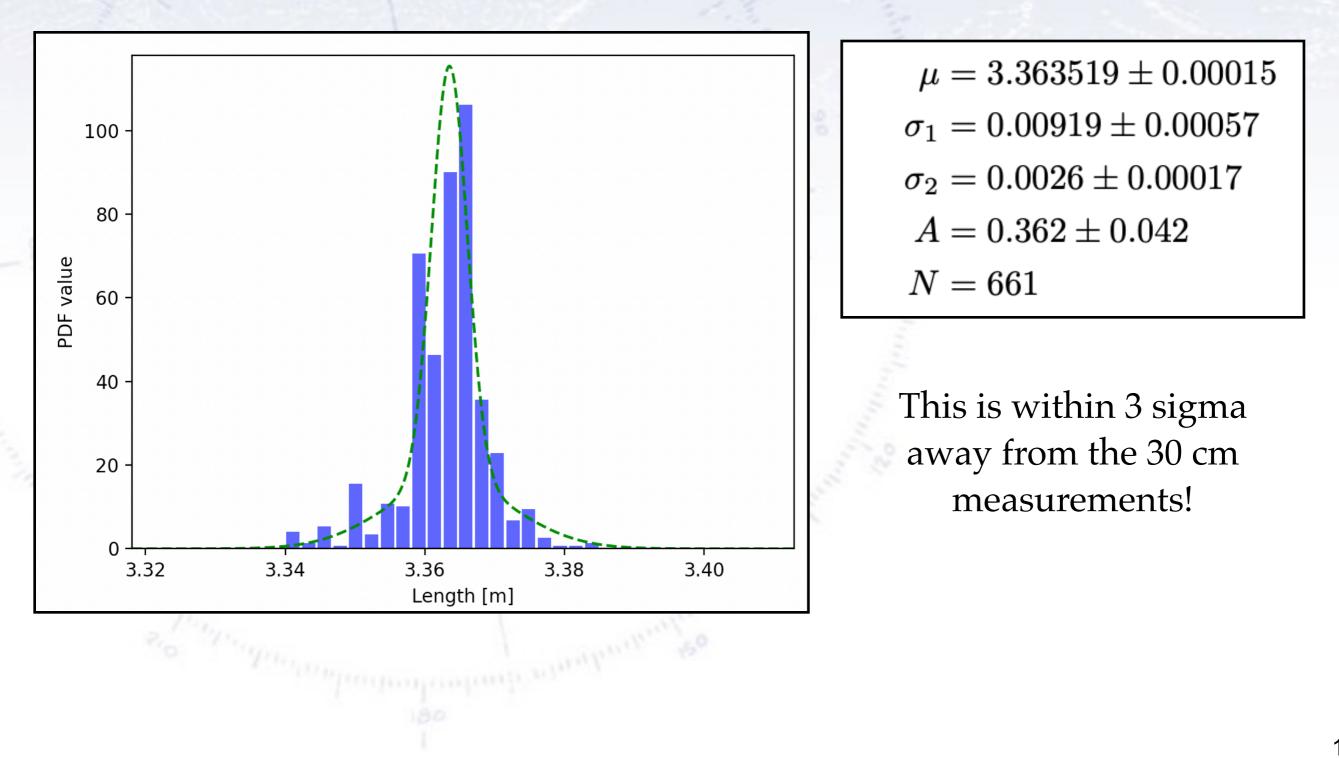
## Weighted results with double gauss fit - 30cm

$$f(x|\mu,\sigma_1,\sigma_2,A) = \frac{A}{\sqrt{2\pi}\sigma_1} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma_1}\right)^2} + \frac{1-A}{\sqrt{2\pi}\sigma_2} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma_2}\right)^2}$$



 $\mu = 3.36207 \pm 0.00047$   $\sigma_1 = 0.159 \pm 0.012$   $\sigma_2 = 0.01015 \pm 0.00046$   $A = 0.1676 \pm 0.0177$ N = 648

# Weighted results with double gauss fit - 2m



### Fitting for a result

A completely different approach is to fit the RAW data, hence describing all data points instead of excluding some.

This approach is philosophically more clean, but certainly not easy!

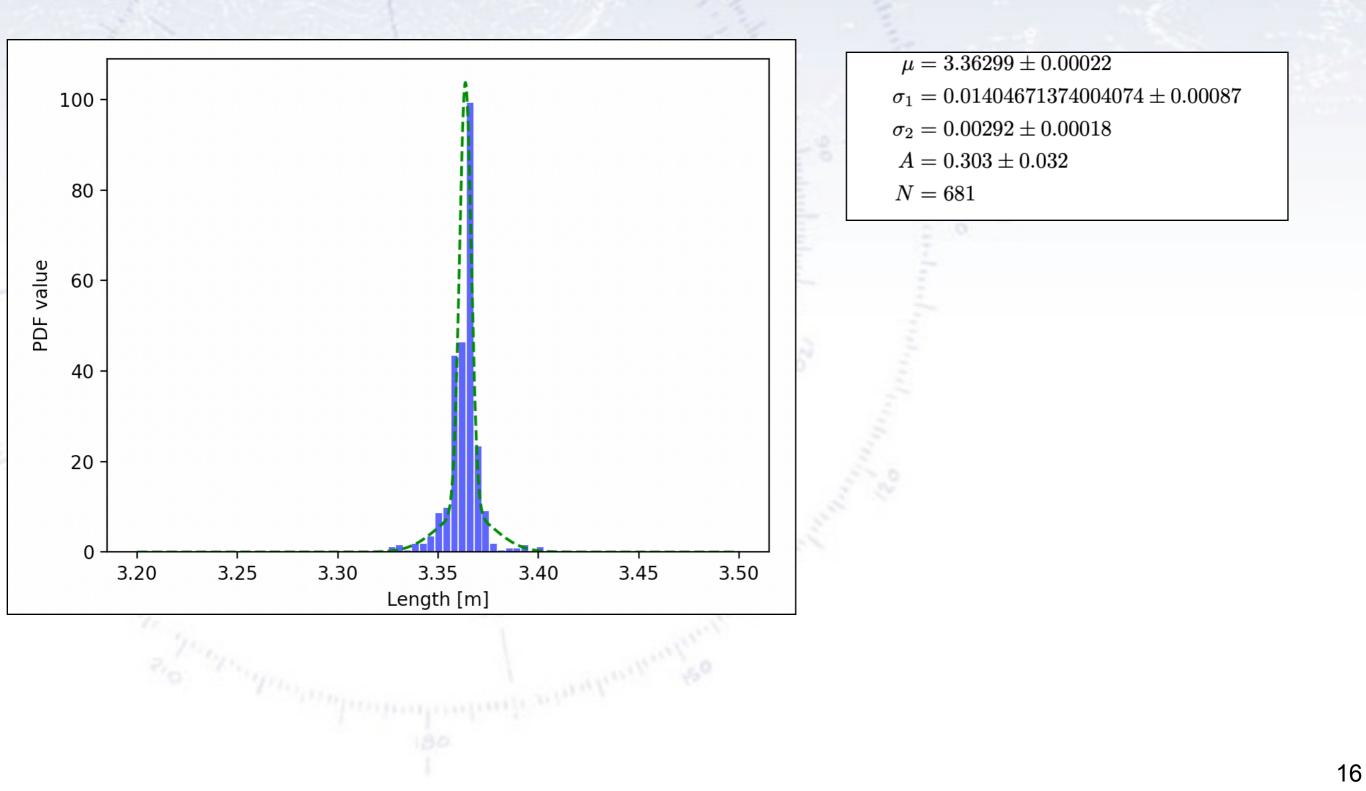
Challenges:

- Measurements has many different resolutions.
- There are several peaks in the data (30cm case).
- Some measurements are clearly rounded.

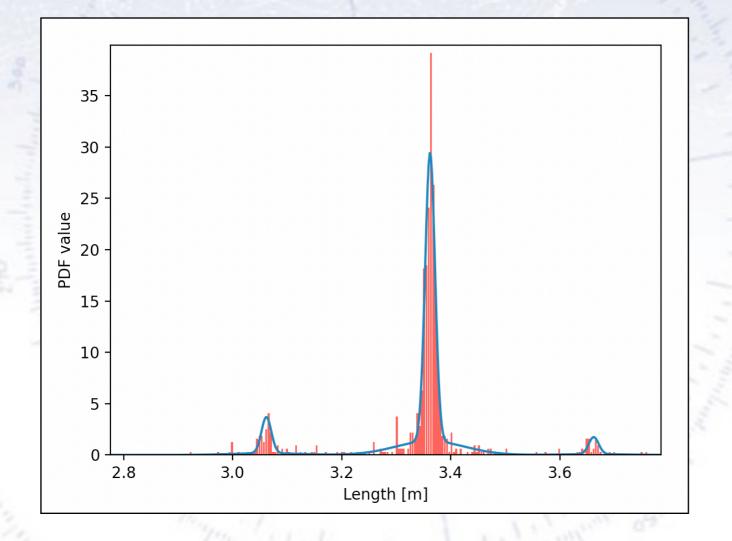
While all of these can be accommodated, it is still a challenge, at the following "fitting around" took me half and hour!

With four parameters I can fit an elephant, and with five I can make him wiggle his trunk. John von Neumann

#### Fitting with double gaussian unweighted 2 m case



# Fitting all three peaks - with a double gaussian



FCN = -1403 EDM = 0.000112	(Goal: 0.0001)	Ncalls = 208 (208 total) up = 0.5		
Valid Minimum	Valid Parameters	No Parameters at limit		
Below EDM threshold (goal x 10)		Below call limit		
Hesse ok	Has Covariance	Accurate	Pos. def.	Not forced

 $\mu = 3.36182 \pm 0.00043$   $\sigma_1 = 0.00898 \pm 0.00042$   $\sigma_2 = 0.0629 \pm 0.0045$   $A = 0.749 \pm 0.023$   $C_1 = 0.0439 \pm 0.0075$   $C_2 = 0.107 \pm 0.011$ 

With this function, we have 6 free parameters and included "all" datapoints (except the outliers) so N = 761.

Note the uncertainty on the length of the table is 430 micrometer!

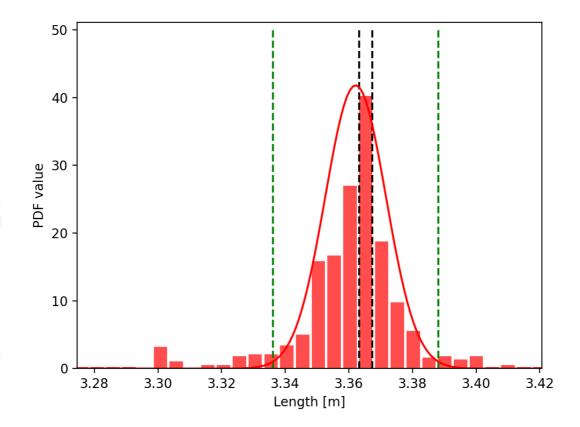
This is also within 3 sigma away from the 2 m measurements!

#### Does it have to be gaussian?

The Central limit Theorem, tells us that data is typically gaussian. This is a strong argument, that is typically good enough for our main hypotheses to be approximatively right.

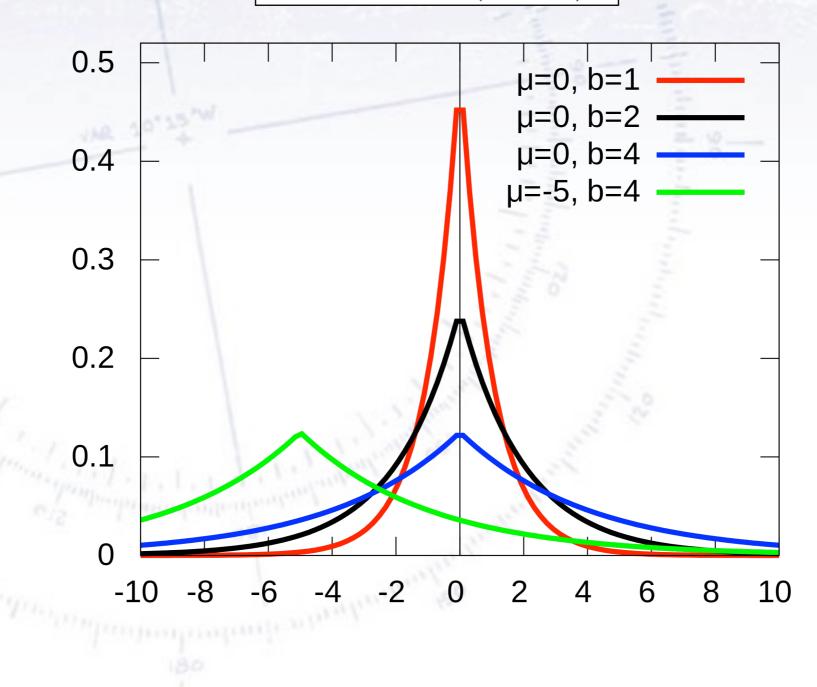
However having looked at the data, it is clearly not gaussian... The double gaussian worked better because the tails were not punished as much...

ince the gaussian falls like  $exp(-x^2)$ , then maybe something decaying more slowly - as exp(-x)...

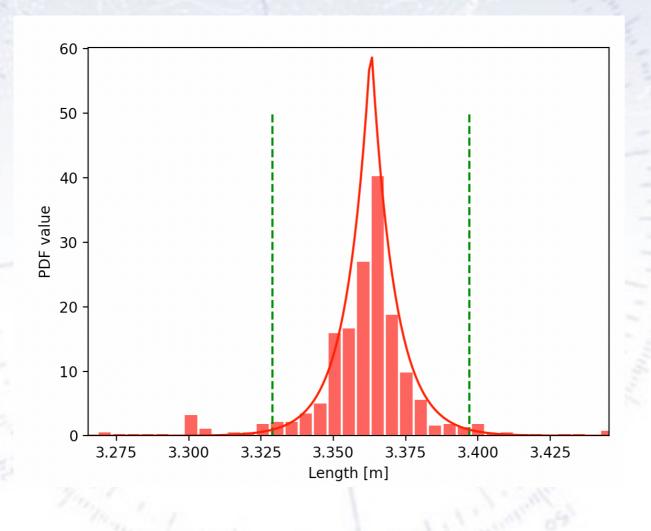


#### The Laplace distribution

$$igg| f(x \mid \mu, b) = rac{1}{2b} \exp igg( -rac{|x-\mu|}{b} igg)$$



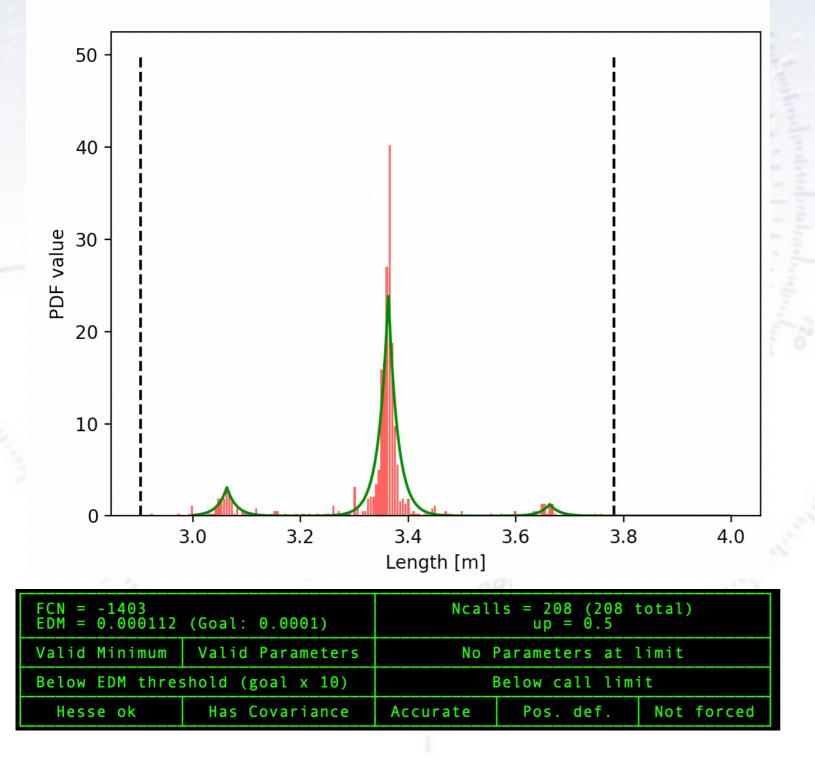
# Fitting with the Laplace distribution



 $\mu = 3.363000 \pm 0.000019$  $b = 0.00815 \pm 0.00034$ N = 571.0

Finding the region with the lowest likelihood gives a range with 571 datapoints included. Here we can use Minuit to find the two parameters and their uncertainty

# Fitting "all" data with the Laplace distribution

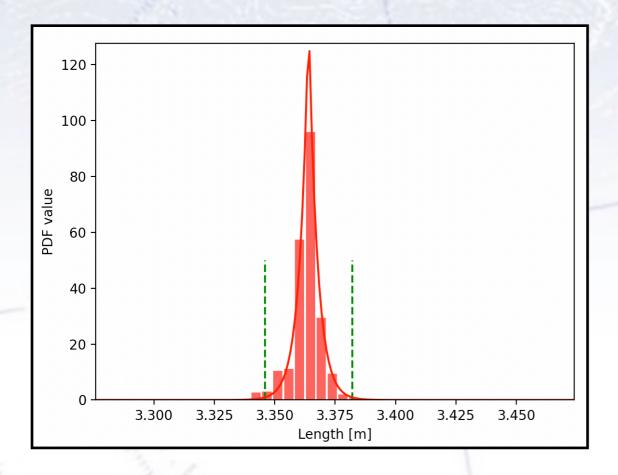


 $\mu = 3.3629999 \pm 0.0000162$  $b = 0.01740 \pm 0.00065$  $C_1 = 0.0445 \pm 0.0076$  $C_2 = 0.1080 \pm 0.0113$ N = 765

With this function, we need only 4 free parameters and need only to reject the datapoints more than 4 sigma away from the original dataset!

Note the uncertainty on the length of the table is 16 micrometer!

#### Comparing with the 2m case



$$\label{eq:multiplicative} \begin{split} \mu &= 3.3639999 \pm 0.0000025 \\ b &= 0.00362 \pm 0.00014 \\ N &= 663 \end{split}$$

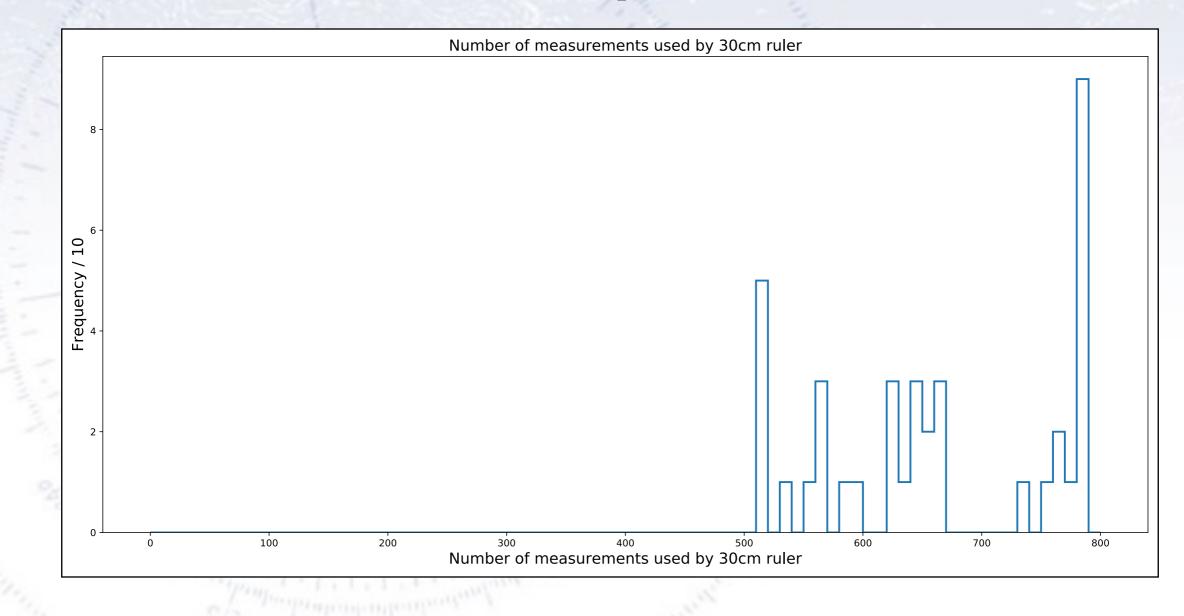
From the dataset of two meters, we can apply the same method, fitting the Laplace distribution, and here we get an uncertainty on the micrometer. Note however that the actual value is 1 millimetre longer than the 30 cm case...

Do we trust errors this small...? Hmm by using common sense we would expect an error on the mean to be approximately 2mm/sqrt(625) approx 80 um...

### Your analyses

#### Your measurement results

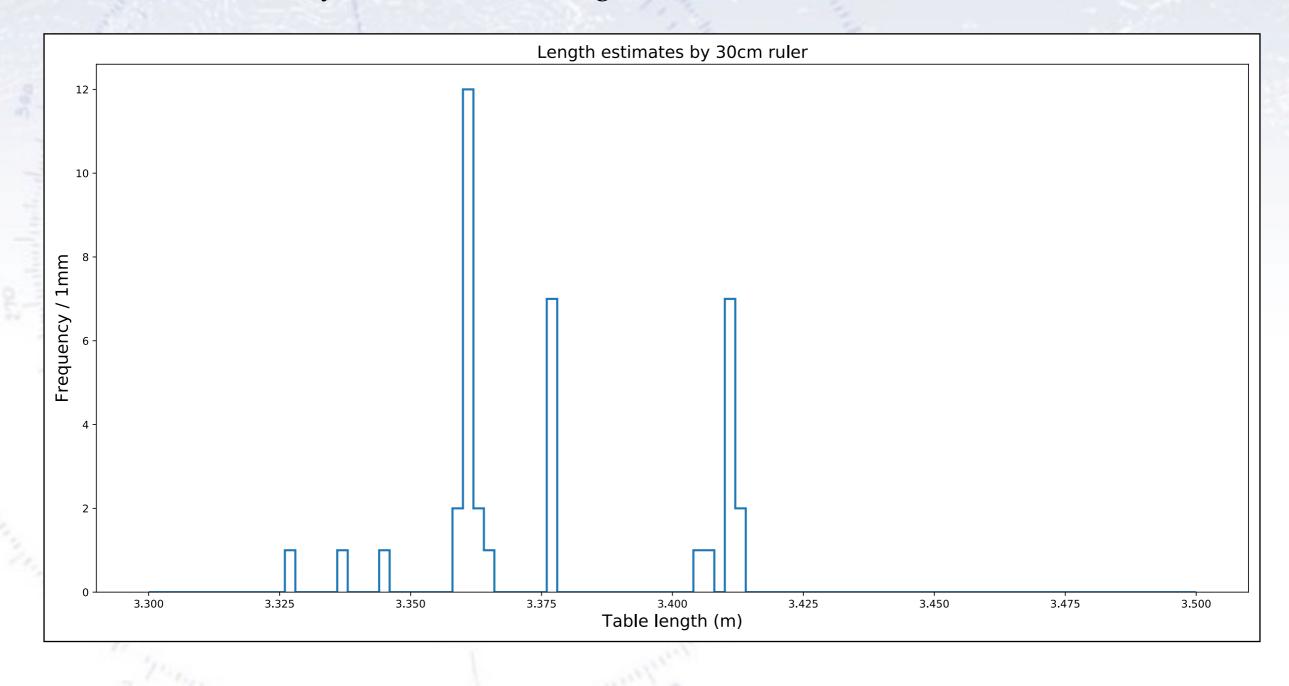
The number of measurements used varied quiet a bit.



But remember that the impact is only sqrt(N), and thus not that important!

#### Length results

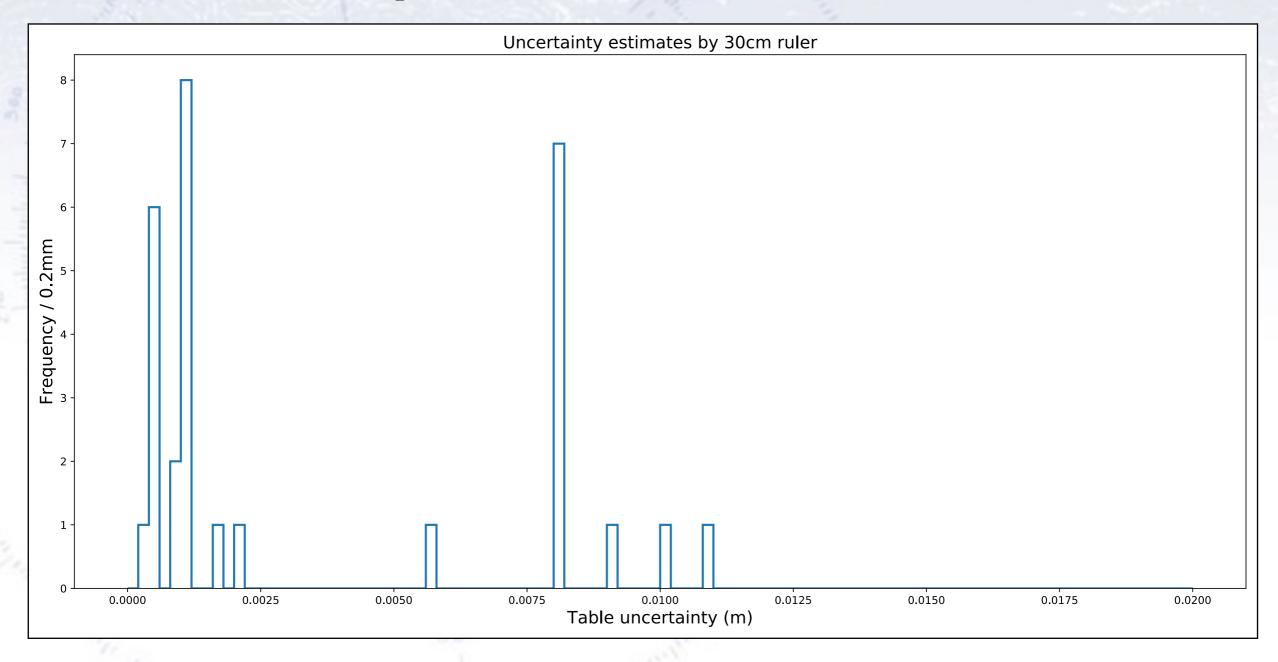
Results are relatively consistent... though some are above 3.4m, which is not correct!



I got: L(unweighted) =  $3.36227 \pm 0.00061$  m, L(weighted) =  $3.36371 \pm 0.00035$  m

#### Uncertainties

The uncertainties varied quite a bit - almost a factor 100! Think about that.



I got: L(unweighted) =  $3.36227 \pm 0.00061$  m, L(weighted) =  $3.36371 \pm 0.00035$  m

#### Conclusions

#### Specifically on the analysis:

- Greatest improvement came from simply removing mis-measurements!
- Weighted result was a further improvement, but required good uncertainties.
- The uncertainties are accepted as "reasonable", as they have good pull distributions, and improve the result.
- The 30cm and 2m results match, giving credibility to the stated precision.

#### More generally:

- What appears to be a trivial task, turns out to require some thought anyhow. (Ask yourself how many fellow students would have been able to get a good result and error?)
- There were several choices to be made in the analysis:
  - 1. Which measurements to accept.
  - 2. Which uncertainties to accept.
  - 3. To correct or discard understood mis-measurements.
- All this can be solved with simple Python code.



#### **Bonus Slides**

### ...a fair hearing?

Rejected 30cm measurements:

$ \begin{array}{c} 304: \mbox{L=1,275} \ dL=-2071 \ Nsig=1.09 \ p=0.00000000, \ p \ all=0.00000000 > 2 \ pmin=0.050 \ N=495 \ mean=3.3640 \ rms=0.169 \ > Rejected \\ 42: \mbox{L=1,370} \ dL=-1984 \ Nsig=1.39 \ p=0.00000000, \ p \ all=0.00000000 > 2 \ pmin=0.050 \ N=493 \ mean=3.3542 \ rms=0.138 \ > Rejected \\ 44: \mbox{L=2,663} \ dL=-0738 \ Nsig=7.39 \ p=0.00000000, \ p \ all=0.00000000 > 2 \ pmin=0.050 \ N=493 \ mean=3.3564 \ rms=0.0995 \ > Rejected \\ 146: \mbox{L=2,766} \ dL=-0738 \ Nsig=7.39 \ p=0.00000000, \ p \ all=0.00000000 > 2 \ pmin=0.050 \ N=493 \ mean=3.3564 \ rms=0.0995 \ > Rejected \\ 147: \mbox{L=2,760} \ dL=-0.668 \ Nsig=7.39 \ p=0.00000000, \ p \ all=0.00000000 > 2 \ pmin=0.050 \ N=493 \ mean=3.3578 \ rms=0.0803 \ > Rejected \\ 147: \mbox{L=2,764} \ dL=-0.668 \ Nsig=7.89 \ p=0.00000000, \ p \ all=0.00000000 > 2 \ pmin=0.050 \ N=488 \ mean=3.3578 \ rms=0.0687 \ > Rejected \\ 130: \mbox{L=3,076} \ dL=-0.618 \ Nsig=7.89 \ p=0.00000000, \ p \ all=0.00000000 > 2 \ pmin=0.050 \ N=488 \ mean=3.3578 \ rms=0.0687 \ > Rejected \\ 131: \mbox{L=3,076} \ dL=-0.618 \ Nsig=7.59 \ p=0.00000000, \ p \ all=0.00000000 > 2 \ pmin=0.050 \ N=488 \ mean=3.3561 \ rms=0.0687 \ > Rejected \\ 131: \mbox{L=3,160} \ dL=-0.618 \ Nsig=7.59 \ p=0.00000000, \ p \ all=0.00000000 > 2 \ pmin=0.050 \ N=488 \ mean=3.3603 \ rms=0.0687 \ > Rejected \\ 131: \mbox{L=3,160} \ dL=-0.187 \ Nsig=5.21 \ p=0.000000000, \ p \ all=0.000000000 > 2 \ pmin=0.050 \ N=482 \ mean=3.361 \ rms=0.0287 \ > Rejected \\ 131: \mbox{L=3,170} \ dL=-0.178 \ Nsig=5.21 \ p=0.000000000, \ p \ all=0.000000000 > 2 \ pmin=0.050 \ N=482 \ mean=3.363 \ rms=0.0287 \ > Rejected \\ 131: \mbox{L=3,170} \ dL=-0.178 \ Nsig=5.21 \ p=0.000000000, \ p \ all=0.000000000 > 2 \ pmin=0.050 \ N=482 \ mean=3.363 \ rms=0.0287 \ > Rejected \\ 131: \mbox{L=3,260} \ dL=-0.178 \ Nsig=5.21 \ p=0.000000000, \ p \ all=0.000000000 > 2 \ pmin=0.050 \ N=482 \ mean=3.363 \ rms=0.0287 \ > Rejected \\ 131: \mbox{L=3,260} \ dL=-0.178 \ Nsig=5.21 \ p=0.0000000000 \ p \ all=0.000000000 > 2 \ pmin=0.050 \ N=473 \ mean=3.3$	304: L=1.275 dL=2.071 Nsig=10.89 p1=0.00000000, p_all=0.00000000 >? pmin=0.050 N=495 mean=3.3460 rm	ns=0.1901 -> Rejected
$\begin{array}{c} 42: \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$		
$ \begin{array}{c} 44 \\ \label{eq:1} \\ 44 \\ \label{eq:1} \\ 44 \\ \label{eq:2} \\ 44 \\ \label{eq:2} \\ 45 \\ \label{eq:1} \\ 46 \\ \label{eq:2} \\ \label{eq:2} \\ 46 \\ \label{eq:2} $	368: L=1.365 dL=1.985 Nsig=11.97 p1=0.00000000, p_all=0.00000000 >? pmin=0.050 N=494 mean=3.3501 rm	ns=0.1659 -> Rejected
$ \begin{array}{llllllllllllllllllllllllllllllllllll$	42: L=1.370 dL=1.984 Nsig=14.19 p1=0.00000000, p_all=0.00000000 >? pmin=0.050 N=493 mean=3.3542 rm	s=0.1398 -> Rejected
$      158: L=4.140 \ dl=0.782 \ Nsig=8.41 \ pt=0.00000000, p_all=0.00000000 >? pmin=0.050 \ N=490 \ mean=3.3580 \ rms=0.0820 \ -> Rejected 143: L=2.670 \ dl=0.686 \ Nsig=8.18 \ pt=0.00000000, p_all=0.00000000 >? pmin=0.050 \ N=480 \ mean=3.3564 \ rms=0.0860 \ -> Rejected 27: L=2.740 \ dl=0.645 \ Nsig=8.64 \ pt=0.00000000, p_all=0.00000000 >? pmin=0.050 \ N=480 \ mean=3.3578 \ rms=0.0861 \ -> Rejected 27: L=2.744 \ dl=0.614 \ Nsig=8.84 \ pt=0.00000000, p_all=0.00000000 >? pmin=0.050 \ N=480 \ mean=3.3578 \ rms=0.0766 \ -> Rejected 27: L=2.744 \ dl=0.614 \ Nsig=9.55 \ pt=0.00000000, p_all=0.00000000 >? pmin=0.050 \ N=485 \ mean=3.3591 \ rms=0.0482 \ -> Rejected 280: L=2.769 \ dl=0.591 \ Nsig=1.40 \ pt=0.00000000 \ p_all=0.00000000 >? pmin=0.050 \ N=485 \ mean=3.3603 \ rms=0.0482 \ -> Rejected 280: L=2.769 \ dl=0.157 \ Nsig=5.27 \ pt=0.00000000 \ p_all=0.00000000 >? pmin=0.050 \ N=482 \ mean=3.3616 \ rms=0.0419 \ -> Rejected 291: L=3.205 \ dl=0.157 \ Nsig=5.20 \ pt=0.00000000 \ p_all=0.00000000 >? pmin=0.050 \ N=482 \ mean=3.3616 \ rms=0.021 \ -> Rejected 213 \ L=3.470 \ dl=0.117 \ Nsig=3.29 \ pt=0.00000000 \ p_all=0.0000000 \ p_all=0.0000000 \ N=0.000000 \ N=0.0000000 \ N=0.0000000 \ N=0.0000000 \ N=0.0000000 \ N=0.0000000 \ N=0.00000000 \ N=0.000000000 \ N=0.0000000000 \ N=0.0000000000 \ N=0.0000000000 \ N=0.000000000000 \ N=0.0000000000 \ N=0.0000000000000000 \ N=0.00000000000000000000000000000000000$	44: L=4.260 dL=0.902 Nsig= 8.39 p1=0.00000000, p_all=0.00000000 >? pmin=0.050 N=492 mean=3.3582 rms	s=0.1075 -> Rejected
$ \begin{array}{c} 143: L=2.670 \ dL=0.686 \ Nsig = 7.98 \ p1=0.00000000, \ p_all=0.00000000 ?? \ pmin=0.050 \ N=488 \ mean=3.3564 \ ms=0.0860 \ > Rejected \\ 477: L=2.700 \ dL=0.645 \ Nsig = 8.19 \ p1=0.000000000, \ p_all=0.00000000 ?? \ pmin=0.050 \ N=488 \ mean=3.3578 \ rms=0.0887 \ > Rejected \\ 427: L=2.79 \ dL=0.600 \ Nsig = 9.55 \ nsig=10.49 \ p1=0.000000000, \ p_all=0.00000000 ?? \ pmin=0.050 \ N=487 \ mean=3.3578 \ rms=0.0887 \ > Rejected \\ 427: L=2.79 \ dL=0.600 \ Nsig = 9.55 \ nsig=10.49 \ p1=0.00000000, \ p_all=0.00000000 ?? \ pmin=0.050 \ N=488 \ mean=3.3601 \ rms=0.0887 \ > Rejected \\ 313: L=3.955 \ dL=0.595 \ Nsig=10.49 \ p1=0.000000000, \ p_all=0.00000000 ?? \ pmin=0.050 \ N=488 \ mean=3.3601 \ rms=0.0887 \ > Rejected \\ 303: L=2.768 \ dL=0.591 \ Nsig=11.60 \ p1=0.000000000 ?? \ pmin=0.050 \ N=488 \ mean=3.3601 \ rms=0.0488 \ > Rejected \\ 313: L=3.400 \ dL=0.182 \ Nsig=5.21 \ p1 \ p1=0.00000000 \ \\ Pall=0.00000000 \ \ pall=0.00000000 \ \ Pall=0.0000 \ N=482 \ mean=3.3616 \ rms=0.0321 \ > Rejected \\ 313: L=3.255 \ dL=0.113 \ Nsig=4.06 \ p1 \ P1=0.000000000 \ \ Pall=0.0000 \ N=482 \ mean=3.3631 \ rms=0.0274 \ > Rejected \\ an=3.3622 \ rms=0.0279 \ > Rejected \\ an=3.3632 \ rms=0.0274 \ > Rejected \\ an=3.3628 \ rms=0.0274 \ > Rejected \\ an=3.3628 \ rms=0.0256 \ > Rejected \\ an=3.3628 \ rms=0.0256 \ > Rejected \\ an=3.3624 \ rms=0.0254 \ > Rejected \\ an=3.3624 \ rms=0.$	146: L=2.563 dL=0.793 Nsig= 7.97 p1=0.00000000, p_all=0.00000000 >? pmin=0.050 N=491 mean=3.3564 rm	s=0.0995 -> Rejected
$\begin{array}{c} 477: \mbox{$1=2,70$} \ dl=0.658 \ Nsig= 8.19 \\ 308: \mbox{$1=4,004$} \ dl=0.645 \ Nsig= 8.64 \\ 308: \mbox{$1=4,004$} \ dl=0.645 \ Nsig= 8.64 \\ 308: \mbox{$1=2,764$} \ dl=0.614 \ Nsig= 8.64 \\ 312: \mbox{$1=2,759$} \ dl=0.600 \ Nsig= 9.55 \\ 1=0.00000000, \mbox{$1=0$} \ pl=0.00000000 > ? \ pmin=0.050 \ N=485 \ mean=3.3578 \ ms=0.0687 \ > Rejected \\ 407: \mbox{$1=2,759$} \ dl=0.600 \ Nsig= 9.55 \\ 1=0.00000000, \mbox{$2$} \ pmin=0.050 \ N=485 \ mean=3.3578 \ ms=0.0687 \ > Rejected \\ 269: \mbox{$1=2,769$} \ dl=0.591 \ Nsig=11.66 \\ pl=0.0000000, \mbox{$2$} \ pmin=0.050 \ N=485 \ mean=3.3631 \ ms=0.0628 \ > Rejected \\ 269: \mbox{$1=2,769$} \ dl=0.591 \ Nsig=11.66 \\ pl=0.0000000, \mbox{$2$} \ pmin=0.050 \ N=483 \ mean=3.3631 \ ms=0.0498 \ > Rejected \\ 300: \mbox{$1=2,320$} \ dl=0.175 \ Nsig= 5.27 \ pti \\ 11: \mbox{$1=3,205$} \ dl=0.175 \ Nsig= 5.27 \ pti \\ 11: \mbox{$1=3,205$} \ dl=0.175 \ Nsig= 5.27 \ pti \\ 11: \mbox{$1=3,205$} \ dl=0.175 \ Nsig= 5.27 \ pti \\ 11: \mbox{$1=3,205$} \ dl=0.175 \ Nsig= 5.21 \ pti \\ 11: \mbox{$1=3,205$} \ dl=0.175 \ Nsig= 5.21 \ pti \\ 12: \mbox{$1=3,205$} \ dl=0.175 \ Nsig= 5.21 \ pti \\ 12: \mbox{$1=3,470$} \ dl=0.107 \ Nsig= 3.02 \ pti \\ 12: \mbox{$1=3,470$} \ dl=0.107 \ Nsig= 3.02 \ pti \\ 12: \mbox{$1=3,470$} \ dl=0.107 \ Nsig= 3.02 \ pti \\ 12: \mbox{$1=0,00002883, p_all=0.01354566 > ? pmin=0.050 \ N=473 \ mean=3.3631 \ ms=0.0226 \ > Rejected \\ 31: \mbox{$1=3,470$} \ dl=0.107 \ Nsig= 3.08 \ pti \\ 10: \mbox{$1=0,015$} \ pti \\ 10: \mbox{$0=0,017$} \ Nsig= 3.08 \ pti \ ns=0.0246 \ > Rejected \ attrave{$1=3,3631$} \ ms=0.0276 \ > Rejected \ attrave{$1=3,3631$} \ ms=0.0266 \ > Rejected \ attrave{$1=3,3631$} \ ms=0.0276 \ > Rejected $	158: L=4.140 dL=0.782 Nsig= 8.41 p1=0.00000000, p_all=0.00000000 >? pmin=0.050 N=490 mean=3.3580 rm	s=0.0929 -> Rejected
$ \begin{array}{llllllllllllllllllllllllllllllllllll$	143: L=2.670 dL=0.686 Nsig= 7.98 p1=0.00000000, p_all=0.00000000 >? pmin=0.050 N=489 mean=3.3564 rm	s=0.0860 -> Rejected
$ \begin{array}{c} 427: \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$	477: L=2.700 dL=0.658 Nsig= 8.19 p1=0.00000000, p_all=0.00000000 >? pmin=0.050 N=488 mean=3.3578 rm	s=0.0803 -> Rejected
$\begin{array}{c} 407: L=2.759 \ dL=0.600 \ Nsig=9.55 \ p1=0.00000000, p_all=0.00000000 >? \ pmin=0.050 \ N=485 \ mean=3.3691 \ ms=0.0628 \ > \ Rejected \\ 313: L=3.955 \ dL=0.591 \ Nsig=10.49 \ p1=0.00000000, p_all=0.00000000 >? \ pmin=0.050 \ N=484 \ mean=3.3603 \ ms=0.0498 \ > \ Rejected \\ 320: L=2.768 \ dL=0.591 \ Nsig=1.410 \ p1=0.00000000, p_all=0.00000000 >? \ pmin=0.050 \ N=483 \ mean=3.3603 \ ms=0.0498 \ > \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $		
$\begin{array}{c} 407: L=2.759 \ dL=0.600 \ Nsig=9.55 \ p1=0.00000000, p_all=0.00000000 >? \ pmin=0.050 \ N=485 \ mean=3.3691 \ ms=0.0628 \ > \ Rejected \\ 313: L=3.955 \ dL=0.591 \ Nsig=10.49 \ p1=0.00000000, p_all=0.00000000 >? \ pmin=0.050 \ N=484 \ mean=3.3603 \ ms=0.0498 \ > \ Rejected \\ 320: L=2.768 \ dL=0.591 \ Nsig=1.410 \ p1=0.00000000, p_all=0.00000000 >? \ pmin=0.050 \ N=483 \ mean=3.3603 \ ms=0.0498 \ > \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $	427: L=2.744 dL=0.614 Nsig= 8.93 p1=0.00000000, p_all=0.000000000 >? pmin=0.050 N=486 mean=3.3578 rm	s=0.0687 -> Rejected
$\begin{array}{c} 313: L=3.955 \ dl=0.595 \ Nsig=10.49 \ pl=0.00000000, \ pall=0.00000000 > 2 \ pmin=0.050 \ N=484 \ mean=3.3603 \ rms=0.057 \ >> \ Rejected \\ 269: L=2.768 \ dl=0.591 \ Nsig=1.80 \ dl=0.591 \ Nsig=1.80 \ pl=0.00000000, \ pall=0.00000000 > 2 \ pmin=0.050 \ N=483 \ mean=3.3603 \ rms=0.0419 \ >> \ Rejected \\ 33: L=3.160 \ dl=0.182 \ Nsig=5.20 \ pl=0.00000000 \ pall=0.00000000 > 2 \ pmin=0.050 \ N=483 \ mean=3.3603 \ rms=0.0419 \ >> \ Rejected \\ 31: L=3.205 \ dl=0.178 \ Nsig=5.20 \ pl=0.00000000 \ pall=0.00000000 > 2 \ pmin=0.050 \ N=483 \ mean=3.3619 \ rms=0.031 \ >> \ Rejected \\ 32: L=3.205 \ dl=0.118 \ Nsig=5.20 \ pl=0.0157 \ Nsig=5.20 \ pl=0.00002883, \ pall=0.01354566 > 7 \ pmin=0.050 \ N=473 \ mean=3.3623 \ rms=0.0274 \ >> \ Rejected \\ 31: L=3.470 \ dl=0.107 \ Nsig=3.99 \ pl=0.00002883, \ pall=0.01354566 > 7 \ pmin=0.050 \ N=473 \ mean=3.3623 \ rms=0.0274 \ >> \ Rejected \\ 33: L=3.470 \ dl=0.107 \ Nsig=3.99 \ pl=0.00002883, \ pall=0.01594736 > 7 \ pmin=0.050 \ N=473 \ mean=3.3623 \ rms=0.0264 \ >> \ Rejected \\ 31: L=3.467 \ dl=0.104 \ Nsig=3.99 \ pl=0.00002438, \ pall=0.01594736 > 7 \ pmin=0.050 \ N=473 \ mean=3.3623 \ rms=0.0264 \ >> \ Rejected \\ 30: L=3.260 \ dl=-0.103 \ Nsig=4.99 \ pl=0.00002883, \ pall=0.01594736 > 7 \ pmin=0.050 \ N=473 \ mean=3.3628 \ rms=0.0264 \ >> \ Rejected \\ 31: L=3.455 \ dl=0.098 \ Nsig=3.99 \ pl=0.00002438, \ pall=0.01711099 \ Pall=0.01711070 \ N=468 \ mean=3.3628 \ rms=0.0254 \ >> \ Rejected \\ 31: L=3.455 \ dl=0.098 \ Nsig=3.99 \ pl=0.00006418, \ pall=0.0252774 > \ pmin=0.050 \ N=468 \ mean=3.3624 \ rms=0.0244 \ >> \ Rejected \\ 31: L=3.450 \ dl=-0.088 \ Nsig=3.99 \ pl=0.00005418 \ pall=0.0252774 > \ pmin=0.050 \ N=468 \ mean=3.3624 \ rms=0.0244 \ >> \ Rejected \\ 31: L=3.450 \ dl=-0.088 \ Nsig=3.99 \ pl=0.00005418 \ pall=0.0252774 > \ pmin=0.050 \ N=468 \ mean=3.3624 \ rms=0.0244 \ >> \ Rejected \\ 31: L=3.450 \ dl=-0.088 \ Nsig=3.89 \ pl=0.00005418 \ pall=0.0252774 > \ pmin=0.050 \ N=468 \ mean=3.3624 \ rms=0.0244 \ >> \ Rejected \\ 31: L=3.450 \ dl=-0.088 \ Nsig=3.89 \ pl=0.$		
$\begin{array}{c} 263: L=2.768 \ dl=0.591 \ \text{Nsig}=11.86 \ p1=0.00000000, \ pall=0.00000000 > 2 \ pmin=0.050 \ \text{N}=483 \ mean=3.3591 \ rms=0.0498 \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$		
380: L=2.769 dL=0.591 Nsig=14.10 p1=0.0000000. p all=0.0000000 > 2 pmin=0.050 N=482 mean=3.3603 rms=0.0321 >> Rejected   131: L=3.180 dL=0.162 Nsig=5.65 p Rejected: an=3.3616 rms=0.0321 >> Rejected   202: L=3.205 dL=0.157 Nsig=5.20 p Rejected: an=3.3621 rms=0.0232 >> Rejected   312: L=3.470 dL=0.113 Nsig=4.06 p1 ft <td></td> <td>-</td>		-
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		
Ti: L=3.200 dL=0.162 Nsig= 5.21 p1 320: L=3.205 dL=0.157 Nsig= 5.20 p 319: L=3.215 dL=0.142 Nsig= 4.96 p1Kejected: 41 data points from the 30cm sample, 63 data points from the 2m sample, 1: L=3.250 dL=0.113 Nsig= 4.06 p1 63 data points from the 2m sample, 1: L=3.471 dL=0.108 Nsig= 3.92 pn=3.3619 rms=0.0311 -> Rejected an=3.3623 rms=0.0226 -> Rejected an=3.3632 rms=0.0279 -> Rejected an=3.3632 rms=0.0270 -> Rejected an=3.3630 rms=0.0270 -> Rejected an=3.3628 rms=0.0268 -> Rejected an=3.3628 rms=0.0281 -> Rejected	133 L = 3 180 dL = 0 182 Nsig= 5 65 p1 an=3 3616 rm	-
$ \begin{array}{llllllllllllllllllllllllllllllllllll$	71: L=3.200 dL=0.162 Nsig= 5.21 p1 Rejected: n=3.3619 rms	-
$ \begin{array}{c} 19: \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$	220: 1 = 2 205 dl = 0 157 Noig= 5 20 n1	
$\begin{array}{c} 194: L=3.221 \ dL=0.142 \ Nsig= 4.96 \ p1\\ 1: L=3.250 \ dL=0.113 \ Nsig= 4.06 \ p1\\ 1: L=3.470 \ dL=0.108 \ Nsig= 3.92 \ p1\\ 13: L=3.470 \ dL=0.107 \ Nsig= 3.95 \ p1=0.00002883, p_all=0.01354566 >? pmin=0.050 \ N=473 \ mean=3.3632 \ rms=0.0270 \ > Rejected \ an=3.3632 \ rms=0.0266 \ -> Rejected \ an=3.3628 \ rms=0.0246 \ -> Rejected \ an=3.3624 \ rms=0.0238 \ -> Re$		-
$\begin{array}{c} 1: L=3.250 \ dL=0.113 \ Nsig= 4.06 \ pt \\ \hline \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		-
$ \begin{array}{c} 175: L=3.471 \ dL=0.108 \ Nsig= 3.92 \ p \\ 33: L=3.470 \ dL=0.107 \ Nsig= 3.95 \ p \\ 13: L=3.470 \ dL=0.107 \ Nsig= 3.95 \ p \\ 14: L=3.467 \ dL=0.107 \ Nsig= 3.96 \ p \\ 14: L=3.467 \ dL=0.104 \ Nsig= 3.98 \ p \\ 14: L=3.467 \ dL=0.104 \ Nsig= 3.98 \ p \\ 14: L=3.467 \ dL=0.103 \ Nsig= 4.05 \ p \\ 14: L=3.460 \ dL=0.103 \ Nsig= 4.05 \ p \\ 14: L=3.461 \ dL=0.098 \ Nsig= 3.98 \ p \\ 14: L=3.461 \ dL=0.098 \ Nsig= 3.98 \ p \\ 14: L=3.460 \ dL=0.097 \ Nsig= 3.96 \ p \\ 14: L=3.460 \ dL=0.097 \ Nsig= 3.96 \ p \\ 14: L=3.460 \ dL=0.097 \ Nsig= 3.98 \ p \\ 14: L=0.00003687, p_all=0.01710909 >? pmin=0.050 \ N=471 \ mean=3.3628 \ rms=0.0256 \ -> Rejected \ -> Re$		-
13: L=3.470 dL=0.107 Nsig= 3.95 p1=0.00002883, p_all=0.01354566 >? pmin=0.050 N=473 mean=3.3632 rms=0.0260 -> Rejected   13: L=3.470 dL=0.107 Nsig= 3.98 p1=0.00002883, p_all=0.01594736 >? pmin=0.050 N=473 mean=3.3628 rms=0.0260 -> Rejected   13: L=3.467 dL=0.104 Nsig= 3.98 p1=0.00003406, p_all=0.01594736 >? pmin=0.050 N=471 mean=3.3625 rms=0.0262 -> Rejected   230: L=3.260 dL=0.103 Nsig= 3.98 p1=0.00002507, p_all=0.01171573 >? pmin=0.050 N=470 mean=3.3628 rms=0.0226 -> Rejected   241: L=3.461 dL=0.098 Nsig= 3.93 p1=0.00004185, p_all=0.01943772 >? pmin=0.050 N=469 mean=3.3628 rms=0.0249 -> Rejected   43: L=3.455 dL=0.092 Nsig= 3.93 p1=0.00004185, p_all=0.01710909 >? pmin=0.050 N=468 mean=3.3628 rms=0.0241 -> Rejected   43: L=3.455 dL=0.093 Nsig= 3.90 p1=0.0000418, p_all=0.0256478 >? pmin=0.050 N=468 mean=3.3622 rms=0.0234 -> Rejected   43: L=3.450 dL=0.088 Nsig= 3.80 p1=0.0000418, p_all=0.0256478 >? pmin=0.050 N=468 mean=3.3622 rms=0.0234 -> Rejected   31: L=3.450 dL=0.088 Nsig= 3.87 p1=0.00007216, p_all=0.0150323265 >? pmin=0.050 N=464 mean=3.3622 rms=0.0234 -> Rejected   324: L=3.4450 dL=0.088 Nsig= 3.99 p1=0.00005540, p_all=0.01910567 >? pmin=0.050 N=463 mean=3.3612 rms=0.0227 -> Rejected   331: L=3.450 dL=0.088 Nsig= 3.99 p1=0.00005540, p_all=0.01910567 >? pmin=0.050 N=461 mean=3.3618 rms=0.0227 -> Rejected <td< td=""><td></td><td>2</td></td<>		2
13: L=3.470 dL=0.107 Nsig= 4.02 p1=0.00002883, p_all=0.01354566 >? pmin=0.050 N=473 mean=3.3630 rms=0.0266 -> Rejected   154: L=3.467 dL=0.104 Nsig= 3.98 p1=0.00003406, p_all=0.01594736 >? pmin=0.050 N=472 mean=3.3628 rms=0.0263 -> Rejected   130: L=3.260 dL=0.103 Nsig= 3.98 p1=0.00003423, p_all=0.01599227 >? pmin=0.050 N=471 mean=3.3628 rms=0.0258 -> Rejected   230: L=3.260 dL=0.103 Nsig= 3.98 p1=0.00002507, p_all=0.01171573 >? pmin=0.050 N=470 mean=3.3628 rms=0.0258 -> Rejected   444: L=3.461 dL=0.098 Nsig= 3.93 p1=0.00004185, p_all=0.01943772 >? pmin=0.050 N=469 mean=3.3628 rms=0.0249 -> Rejected   79: L=3.460 dL=0.092 Nsig= 3.83 p1=0.00006418, p_all=0.02952774 >? pmin=0.050 N=468 mean=3.3626 rms=0.0241 -> Rejected   13: L=3.455 dL=0.093 Nsig= 3.90 p1=0.00004898, p_all=0.02256478 >? pmin=0.050 N=466 mean=3.3622 rms=0.0231 -> Rejected   43: L=3.450 dL=0.088 Nsig= 3.80 p1=0.00005540, p_all=0.02532365 >? pmin=0.050 N=463 mean=3.3622 rms=0.0224 -> Rejected   33: L=3.450 dL=0.088 Nsig= 3.93 p1=0.00003637, p_all=0.01710567 >? pmin=0.050 N=463 mean=3.3622 rms=0.0227 -> Rejected   33: L=3.450 dL=0.088 Nsig= 3.99 p1=0.0000383, p_all=0.0141157 ?P min=0.050 N=464 mean=3.3622 rms=0.0227 -> Rejected   33: L=3.450 dL=0.088 Nsig= 4.01 <td>133: L=3.470 dL=0.107 Nsig= 3.95 p</td> <td>-</td>	133: L=3.470 dL=0.107 Nsig= 3.95 p	-
$ \begin{array}{llllllllllllllllllllllllllllllllllll$		
$ \begin{array}{llllllllllllllllllllllllllllllllllll$	· · ·	-
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79: L=3.460 dL=0.097 Nsig= 3.96 43: L=3.455 dL=0.092 Nsig= 3.83 113: L=3.455 dL=0.093 Nsig= 3.83 113: L=3.455 dL=0.093 Nsig= 3.80 113: L=3.455 dL=0.090 Nsig= 3.85 114: L=3.455 dL=0.090 Nsig= 3.85 115: L=3.450 dL=0.088 Nsig= 3.80 115: L=3.450 dL=0.088 Nsig= 3.80 111: L=3.450 dL=0.088 Nsig= 3.93 111: L=3.450 dL=0.088 Nsig= 4.01 111: L=3.450 dL=0.088 Nsig= 4.02 111: L=3.445 dL=0.084 Nsig= 4.02 111: L=3.445 dL=0.084 Nsig= 4.02 111: L=3.445 dL=0.084 Nsig= 4.03 111: L=3.445 dL=0.084 Nsig= 4.03<	• · · · · · · · · · · · · · · · · · · ·	-
$\begin{array}{llllllllllllllllllllllllllllllllllll$		-
113: L=3.455 dL=0.093 Nsig= 3.90 433: L=3.272 dL=0.090 Nsig= 3.85 81: L=3.450 dL=0.088 Nsig= 3.80 345: L=3.450 dL=0.088 Nsig= 3.80 s1: L=3.450 dL=0.088 Nsig= 3.87 351: L=3.450 dL=0.088 Nsig= 3.93 s1: L=3.450 dL=0.088 Nsig= 4.01 351: L=3.450 dL=0.088 Nsig= 4.01 324: L=3.448 dL=0.086 Nsig= 4.01 324: L=3.448 dL=0.086 Nsig= 4.02 167: L=3.447 dL=0.086 Nsig= 4.02 167: L=3.445 dL=0.084 Nsig= 4.02 162: L=3.445 dL=0.084 Nsig= 4.08p1=0.00004898, p_all=0.01256478 >? pmin=0.050 p1=0.00007216, p_all=0.02697886 >? pmin=0.050 p1=0.00005540, p_all=0.02532365 >? pmin=0.050 p1=0.00003083, p_all=0.01910567 >? pmin=0.050 p1=0.00003083, p_all=0.01910567 >? pmin=0.050 p1=0.00003299, p_all=0.01332302 >? pmin=0.050 p1=0.00003155, p_all=0.01332302 >? pmin=0.050 N=459 mean=3.3612 rms=0.0217 N=459 mean=3.3612 rms=0.0213 N=459 mean=3.3612 rms=0.0209 N=459 mean=3.3612 rms=0.0209 N=459 mean=3.3612 rms=0.0209 N=457 mean=3.3610 rms=0.0206 N=457 mean=3.3610 rms=0.0206 N=457 mean=3.3610 rms=0.0206 N=457 mean=3.3610 rms=0.0206 N=457 mean=3.3610 rms=0.0206 N=457 mean=3.3610 rms=0.0206		-
$\begin{array}{llllllllllllllllllllllllllllllllllll$		-
81: L=3.450 dL=0.088 Nsig= 3.80 p1=0.00007216, p_all=0.03292944 >? pmin=0.050 N=464 mean=3.3624 rms=0.0231 -> Rejected   345: L=3.450 dL=0.088 Nsig= 3.87 p1=0.00005540, p_all=0.02532365 >? pmin=0.050 N=463 mean=3.3622 rms=0.0227 -> Rejected   351: L=3.450 dL=0.088 Nsig= 3.93 p1=0.00004175, p_all=0.01910567 >? pmin=0.050 N=463 mean=3.3620 rms=0.0224 -> Rejected   333: L=3.450 dL=0.088 Nsig= 4.01 p1=0.00003083, p_all=0.01411413 >? pmin=0.050 N=461 mean=3.3618 rms=0.0220 -> Rejected   324: L=3.448 dL=0.086 Nsig= 3.99 p1=0.00003299, p_all=0.01506122 >? pmin=0.050 N=460 mean=3.3616 rms=0.0217 -> Rejected   167: L=3.447 dL=0.086 Nsig= 4.02 p1=0.00003155, p_all=0.01434519 >? pmin=0.050 N=459 mean=3.3612 rms=0.0213 -> Rejected   162: L=3.445 dL=0.084 Nsig= 4.00 p1=0.00002276, p_all=0.01034822 >? pmin=0.050 N=457 mean=3.3610 rms=0.0206 -> Rejected		-
345: L=3.450 dL=0.088 Nsig= 3.87 p1=0.00005540, p_all=0.02532365 >? pmin=0.050 N=463 mean=3.3622 rms=0.0227 -> Rejected   351: L=3.450 dL=0.088 Nsig= 3.93 p1=0.00004175, p_all=0.01910567 >? pmin=0.050 N=463 mean=3.3620 rms=0.0224 -> Rejected   333: L=3.450 dL=0.088 Nsig= 4.01 p1=0.00003083, p_all=0.01411413 >? pmin=0.050 N=463 mean=3.3618 rms=0.0224 -> Rejected   324: L=3.448 dL=0.086 Nsig= 3.99 p1=0.00003299, p_all=0.01506122 >? pmin=0.050 N=460 mean=3.3616 rms=0.0217 -> Rejected   167: L=3.447 dL=0.086 Nsig= 4.00 p1=0.00003155, p_all=0.01434519 >? pmin=0.050 N=458 mean=3.3612 rms=0.0209 -> Rejected   126: L=3.445 dL=0.084 Nsig= 4.08 p1=0.00002276, p_all=0.01034822 >? pmin=0.050 N=457 mean=3.3610 rms=0.0206 -> Rejected		s=0.0231 -> Rejected
351: L=3.450 dL=0.088 Nsig= 3.93 333: L=3.450 dL=0.088 Nsig= 4.01 324: L=3.448 dL=0.086 Nsig= 3.99 167: L=3.447 dL=0.086 Nsig= 4.02 167: L=3.445 dL=0.084 Nsig= 4.00p1=0.00004175, p_all=0.01910567 >? pmin=0.050 p1=0.00003083, p_all=0.01411413 >? pmin=0.050 p1=0.00003299, p_all=0.01506122 >? pmin=0.050 p1=0.00002922, p_all=0.01332302 >? pmin=0.050N=462 mean=3.3620 rms=0.0224 -> Rejected N=461 mean=3.3618 rms=0.0220 -> Rejected N=460 mean=3.3616 rms=0.0217 -> Rejected N=459 mean=3.3614 rms=0.0213 -> Rejected N=458 mean=3.3612 rms=0.0209 -> Rejected N=458 mean=3.3610 rms=0.0206 -> Rejected N=457 mean=3.3610 rms=0.0206 -> Rejected N=457 mean=3.3610 rms=0.0206 -> Rejected		-
333: L=3.450 dL=0.088 Nsig= 4.01 p1=0.00003083, p_all=0.01411413 >? pmin=0.050 N=461 mean=3.3618 rms=0.0220 -> Rejected   324: L=3.448 dL=0.086 Nsig= 3.99 p1=0.00003299, p_all=0.01506122 >? pmin=0.050 N=460 mean=3.3616 rms=0.0217 -> Rejected   167: L=3.447 dL=0.086 Nsig= 4.02 p1=0.00002922, p_all=0.01332302 >? pmin=0.050 N=459 mean=3.3614 rms=0.0213 -> Rejected   126: L=3.445 dL=0.084 Nsig= 4.00 p1=0.00003155, p_all=0.01434519 >? pmin=0.050 N=458 mean=3.3612 rms=0.0209 -> Rejected   162: L=3.445 dL=0.084 Nsig= 4.08 p1=0.00002276, p_all=0.01034822 >? pmin=0.050 N=457 mean=3.3610 rms=0.0206 -> Rejected		, i i i i i i i i i i i i i i i i i i i
324: L=3.448 dL=0.086 Nsig= 3.99 p1=0.00003299, p_all=0.01506122 >? pmin=0.050 N=460 mean=3.3616 rms=0.0217 -> Rejected   167: L=3.447 dL=0.086 Nsig= 4.02 p1=0.00002922, p_all=0.01332302 >? pmin=0.050 N=459 mean=3.3614 rms=0.0213 -> Rejected   126: L=3.445 dL=0.084 Nsig= 4.00 p1=0.00003155, p_all=0.01434519 >? pmin=0.050 N=458 mean=3.3612 rms=0.0209 -> Rejected   162: L=3.445 dL=0.084 Nsig= 4.08 p1=0.00002276, p_all=0.01034822 >? pmin=0.050 N=457 mean=3.3610 rms=0.0206 -> Rejected	· · · · ·	-
167: L=3.447 dL=0.086 Nsig= 4.02 p1=0.00002922, p_all=0.01332302 >? pmin=0.050 N=459 mean=3.3614 rms=0.0213 -> Rejected 126: L=3.445 dL=0.084 Nsig= 4.00 p1=0.00003155, p_all=0.01434519 >? pmin=0.050 N=458 mean=3.3612 rms=0.0209 -> Rejected 162: L=3.445 dL=0.084 Nsig= 4.08 p1=0.00002276, p_all=0.01034822 >? pmin=0.050 N=457 mean=3.3610 rms=0.0206 -> Rejected		2
126: L=3.445 dL=0.084 Nsig= 4.00 p1=0.00003155, p_all=0.01434519 >? pmin=0.050 N=458 mean=3.3612 rms=0.0209 -> Rejected 162: L=3.445 dL=0.084 Nsig= 4.08 p1=0.00002276, p_all=0.01034822 >? pmin=0.050 N=457 mean=3.3610 rms=0.0206 -> Rejected	• · · · · · · · · · · · · · · · · · · ·	,
162: L=3.445 dL=0.084 Nsig= 4.08 p1=0.00002276, p_all=0.01034822 >? pmin=0.050 N=457 mean=3.3610 rms=0.0206 -> Rejected		-
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		, i i i i i i i i i i i i i i i i i i i
393: L=3.285 dL=0.076 Nsig= 3.82 p1=0.00006640, p_all=0.02975990 >? pmin=0.050 N=455 mean=3.3610 rms=0.0199 -> Rejected		-
		-

29

#### Excluded data due to bad pull

30cm: Warning! Large pull: L = 3.4700 +- 0.0080	pull = 13.60	2m: Warning! Large pull:	L = 3.0600 +- 0.0050	pull = -60.59
30cm: Warning! Large pull: L = 3.3700 +- 0.0010	pull = 8.80	2m: Warning! Large pull:		pull = 19.35
30cm: Warning! Large pull: L = 1.3700 +- 0.0100	pull = -199.12	2m: Warning! Large pull:		pull = 5.05
30cm: Warning! Large pull: L = 4.2600 +- 0.1000	pull = 8.99	2m: Warning! Large pull:		pull = 9.57
30cm: Warning! Large pull: L = 3.3000 +- 0.0100	pull = -6.12	2m: Warning! Large pull:		pull = -8.59
30cm: Warning! Large pull: L = 2.6700 +- 0.0100	pull = -69.12	2m: Warning! Large pull:		pull = 6.06
30cm: Warning! Large pull: L = 2.5630 +- 0.0200	pull = -39.91	2m: Warning! Large pull:		pull = 106.03
30cm: Warning! Large pull: L = 4.1400 +- 0.0400	pull = 19.47	2m: Warning! Large pull:		pull = -8.17
30cm: Warning! Large pull: L = $3.4670 + 0.0120$	pull = 8.82	• • •		pull = -12.95
30cm: Warning! Large pull: $L = 3.4710 + 0.0050$	pull = 21.96	2m: Warning! Large pull:		
30cm: Warning! Large pull: $L = 3.4470 + 0.0050$	pull = 17.16	2m: Warning! Large pull:		pull = -65.39
	pull = -4.52	2m: Warning! Large pull:		pull = -199.99
30cm: Warning! Large pull: $L = 3.2210 + 0.0310$		2m: Warning! Large pull:		pull = -79.92
30cm: Warning! Large pull: L = 3.3470 +- 0.0010	pull = -14.20	2m: Warning! Large pull:		pull = 4.50
30cm: Warning! Large pull: L = 3.3650 +- 0.0005	pull = 7.60	2m: Warning! Large pull:		pull = 27.71
30cm: Warning! Large pull: L = 3.3670 +- 0.0010	pull = 5.80	2m: Warning! Large pull:		pull = 33.85
30cm: Warning! Large pull: L = 3.3290 +- 0.005	Deiested		L = 4.0160 + 0.1010	pull = 6.47
30cm: Warning! Large pull: L = 3.2600 +- 0.002	Rejected:		L = 3.0640 + 0.0050	pull = -59.79
30cm: Warning! Large pull: L = 3.4240 +- 0.005		20 1	L = 3.6600 +- 0.0120	pull = 24.75
30cm: Warning! Large pull: L = 3.3050 +- 0.01	38 data points from the	30cm sample,	L = 3.3550 +- 0.0010	pull = -7.95
30 cm: vvarning! Large pull: L = $3.3000 + 0.01$	<b>-</b>	-	L = 3.7500 +- 0.0050	pull = 77.41
30cm: Warning! Large pull: L = 2.7680 +- 0.020	45 data points from the	e 2m sample.	L = 3.3690 +- 0.0010	pull = 6.05
30cm: Warning! Large pull: L = 3.4200 +- 0.00	-	-	L = 3.0070 +- 0.0080	pull = -44.49
30cm: Warning! Large pull: L = 3.3900 +- 0.00	Each and every one wa	as inspected!	L = 3.1680 +- 0.0050	pull = -38.99
30cm: Warning! Large pull: L = 1.2750 +- 0.003	J		L = 3.0600 +- 0.0050	pull = -60.59
30cm: Warning! Large pull: L = 4.0040 +- 0.0300	pull = 21.43	2m: Warning! Large pull:	L = 3.3720 +- 0.0020	pull = 4.53
30cm: Warning! Large pull: L = 3.9550 +- 0.0550	pull = 10.80	2m: Warning! Large pull:	L = 3.1500 +- 0.0100	pull = -21.29
30cm: Warning! Large pull: L = 3.2150 +- 0.0110	pull = -13.29	2m: Warning! Large pull:	L = 2.3640 +- 0.0300	pull = -33.30
30cm: Warning! Large pull: L = 1.3650 +- 0.0050	pull = -399.24	2m: Warning! Large pull:	L = 3.4200 +- 0.0050	pull = 11.41
30cm: Warning! Large pull: L = 3.4110 +- 0.0050	pull = 9.96	2m: Warning! Large pull:	L = 3.3720 +- 0.0011	pull = 8.23
30cm: Warning! Large pull: L = 3.4500 +- 0.0050	pull = 17.76	2m: Warning! Large pull:	L = 3.3970 +- 0.0030	pull = 11.35
30cm: Warning! Large pull: L = 2.7690 +- 0.0050	pull = -118.44	2m: Warning! Large pull:	L = 3.6050 +- 0.0150	pull = 16.14
30cm: Warning! Large pull: L = 3.3080 +- 0.0100	pull = -5.32	2m: Warning! Large pull:	L = 3.3070 +- 0.0050	pull = -11.19
30cm: Warning! Large pull: L = 3.3700 +- 0.0010	pull = 8.80	2m: Warning! Large pull:	L = 3.3730 +- 0.0020	pull = 5.03
30cm: Warning! Large pull: L = 2.7590 +- 0.0020	pull = -301.10	2m: Warning! Large pull:		pull = 6.53
30cm: Warning! Large pull: L = 2.7440 +- 0.0500	pull = -12.34	2m: Warning! Large pull:		pull = -199.59
30cm: Warning! Large pull: L = 3.3350 +- 0.0010	pull = -26.20	2m: Warning! Large pull:		, pull = -249.49
30cm: Warning! Large pull: L = 3.4610 +- 0.0100	pull = 9.98	2m: Warning! Large pull:		pull = -5.16
30cm: Warning! Large pull: L = 2.7000 +- 0.0300	pull = -22.04	2m: Warning! Large pull:		pull = -5.15
0 0 1	in the second se	2m: Warning! Large pull:		pull = -97.95
		2m: Warning! Large pull:		pull = 6.85
		2m: Warning! Large pull:		pull = -96.72
		2m: Warning! Large pull:		pull = 12.20
		2m: Warning! Large pull:		pull = 14.55
		2m: Warning! Large pull:		pull = 8.05
		2m: Warning! Large pull:		pull = -59.59
			L = 0.0000 + 0.0000	puii00.00

#### Excluded data due to bad pull

30cm	: Warning! Large pull: L = 3.4700 +- 0.0080	pull = 13.60	2m: Warning! Large pull:	L = 3.0600 +- 0.0050	pull = -60.59
30cm	: Warning! Large pull: L = 3.3700 +- 0.0010	pull = 8.80	2m: Warning! Large pull:	L = 3.7500 +- 0.0200	pull = 19.35
30cm	: Warning! Large pull: L = 1.3700 +- 0.0100	pull = -199.12	2m: Warning! Large pull:		pull = 5.05
30cm	: Warning! Large pull: L = 4.2600 +- 0.1000	pull = 8.99	2m: Warning! Large pull:		pull = 9.57
	: Warning! Large pull: L = 3.3000 +- 0.0100	pull = -6.12	2m: Warning! Large pull:		pull = -8.59
	: Warning! Large pull: L = 2.6700 +- 0.0100	pull = -69.12	2m: Warning! Large pull:		pull = 6.06
	: Warning! Large pull: L = 2.5630 +- 0.0200	pull = -39.91	2m: Warning! Large pull:		pull = 106.03
	: Warning! Large pull: $L = 4.1400 + 0.0400$	pull = 19.47	2m: Warning! Large pull:		pull = -8.17
	: Warning! Large pull: $L = 3.4670 + 0.0120$	pull = 8.82	2m: Warning! Large pull:		pull = -12.95
	: Warning! Large pull: $L = 3.4710 + 0.0050$	pull = 21.96	2m: Warning! Large pull:		pull = -65.39
	: Warning! Large pull: $L = 3.4470 + 0.0050$	pull = 17.16	2m: Warning! Large pull:		pull = -199.99
	: Warning! Large pull: $L = 3.2210 + -0.0310$	pull = -4.52	2m: Warning! Large pull:		pull = -79.92
	: Warning! Large pull: $L = 3.3470 + 0.0010$	pull = -14.20			
	: Warning! Large pull: $L = 3.3650 + 0.0005$	pull = 7.60	2m: Warning! Large pull:		pull = 4.50
	: Warning! Large pull: $L = 3.3670 + 0.0010$	pull = 5.80	2m: Warning! Large pull:		pull = 27.71
	: Warning! Large pull: L = 3.3290 +- 0.00	puil - 5.60	2m: Warning! Large pull:		pull = 33.85
		Dejected		L = 4.0160 + 0.1010	pull = 6.47
	: Warning! Large pull: $L = 3.2600 + 0.002$	Rejected:		L = 3.0640 + 0.0050	pull = -59.79
	: Warning! Large pull: $L = 3.4240 + 0.005$	20 data mainta frame la	20	L = 3.6600 + 0.0120	pull = 24.75
	: Warning! Large pull: $L = 3.3050 + 0.010$	38 data points from the	sucm sample,	L = 3.3550 + 0.0010	pull = -7.95
	: Warning! Large pull: $L = 3.3000 + 0.011$		0 1	L = 3.7500 + 0.0050	pull = 77.41
	:: Warning! Large pull: L = 2.7680 +- 0.020	45 data points from the	e 2m sample.	L = 3.3690 +- 0.0010	pull = 6.05
	:: Warning! Large pull: L = 3.4200 +- 0.00		-	L = 3.0070 +- 0.0080	pull = -44.49
	:: Warning! Large pull: L = 3.3900 +- 0.00	Each and every one w	as inspected!	L = 3.1680 +- 0.0050	pull = -38.99
	:: Warning! Large pull: L = 1.2750 +- 0.001	<b>y</b>	I	L = 3.0600 +- 0.0050	pull = -60.59
	:: Warning! Large pull: L = 4.0040 +- 0.0300	pull = 21.43	2m: Warning! Large pull:		pull = 4.53
	:: Warning! Large pull: L = 3.9550 +- 0.0550	pull = 10.80	2m: Warning! Large pull:		pull = -21.29
	:: Warning! Large pull: L = 3.2150 +- 0.0110	pull = -13.29	2m: Warning! Large pull:	L = 2.3640 +- 0.0300	pull = -33.30
	:: Warning! Large pull: $L = 1.3650 + 0.0050$	pull = -399.24	2m: Warning! Large pull:	L = 3.4200 +- 0.0050	pull = 11.41
	: Warning! Large pull: $L = 3.4110 + 0.0050$	pull = 9.96	2m: Warning! Large pull:	L = 3.3720 +- 0.0011	pull = 8.23
	: Warning! Large pull: $L = 3.4500 + 0.0050$	pull = 17.76	2m: Warning! Large pull:	L = 3.3970 +- 0.0030	pull = 11.35
	: Warning! Large pull: $L = 2.7690 + 0.0050$	pull = -118.44	2m: Warning! Large pull:		pull = 16.14
	: Warning! Large pull: L = 3.3080 +- 0.0100	pull = -5.32	2m: Warning! Large pull:	L = 3.3070 +- 0.0050	pull = -11.19
30cm	: Warning! Large pull: L = 3.3700 +- 0.0010	pull = 8.80	2m: Warning! Large pull:	L = 3.3730 +- 0.0020	pull = 5.03
30cm	: Warning! Large pull: L = 2.7590 +- 0.0020	pull = -301.10	2m: Warning! Large pull:	L = 3.3760 +- 0.0020	pull = 6.53
30cm	: Warning! Large pull: L = 2.7440 +- 0.0500	pull = -12.34	2m: Warning! Large pull:	L = 2.3650 +- 0.0050	pull = -199.59
30cm	: Warning! Large pull: L = 3.3350 +- 0.0010	pull = -26.20	2m: Warning! Large pull:		pull = -249.49
30cm	: Warning! Large pull: L = 3.4610 +- 0.0100	pull = 9.98	2m: Warning! Large pull:		pull = -5.16
30cm	: Warning! Large pull: L = 2.7000 +- 0.0300	pull = -22.04	2m: Warning! Large pull:		, pull = -5.15
		in the second second	2m: Warning! Large pull:		pull = -97.95
			2m: Warning! Large pull:		pull = 6.85
	Notice that al	and magging mant		L = 3.4605 + 0.0020	pull = 06.72
	inolice, that clo	ose measurement	2m: Warning! Large pull:		pull = 12.20
	with too areall	annone and rejected	2m. Warning! Large pull.	L 0.0540 + 0.0200	pull 11.55
	with too small	errors are rejected!	2m: Warning! Large pull:		pull = 8.05
			2m: Warning! Large pull:		pull = -59.59
			ggg. puilt		

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