ITMF, ICCTM
Stickiness Working group

Comparison of Stickiness results from different instruments, observations based on an International Round-trial

Centre
de coopération
internationale
en recherche
agronomique
pour le
développement

Gozé E., Frydrych R., Gourlot J.-P., Lassus S.
Cotton Technology Laboratory, Montpellier, France

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Outline of presentation

- ✓ **Reasons for organizing a round-test**
- ✓ **Experimental design and its implementation**
- ✓ **Data analysis and results**

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Reasons for organizing a round-test

For stickiness measurement, several types of instruments exist:

- **Mini-card**
- **Fibre Contamination Tester (FCT) and Fibre Quality Tester (FQT),**
- **Stickiness Cotton Thermodetector (SCT),**
- **High Speed Stickiness Detector (H2SD)**
- **…**

Reasons for organizing a round-test

The goals of the proposed round-test are:

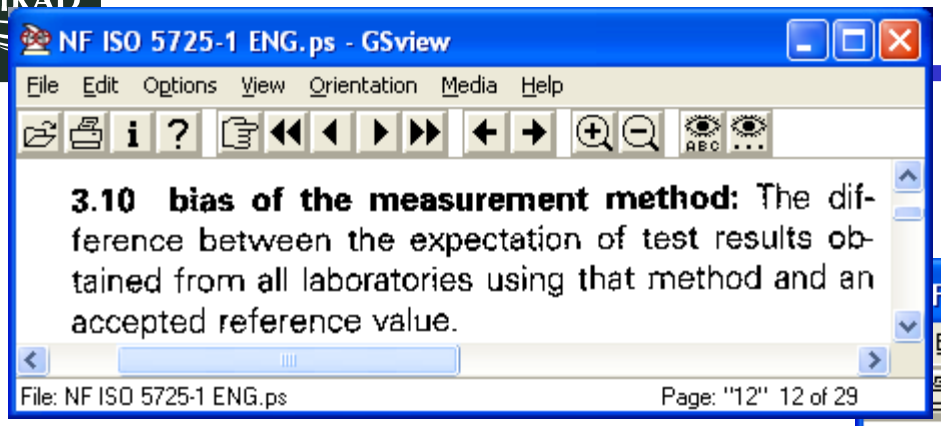
- **to quantify the accuracy of the results obtained from each type of instrument for a given cotton**

- **to check the relationship between results obtained from various types of instruments.**

- **Lack of accuracy is usually splitted into two components : (ISO 5725-1)**
  - **Bias (<> trueness)**
  - **Variability (<> precision)**

The bias is the mean departure from a true value determined with a reference instrument.

The variability is the departure between measurements made with the same instrument type.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3.10 bias of the measurement method: The difference between the expectation of test results obtained from all laboratories using that method and an accepted reference value.
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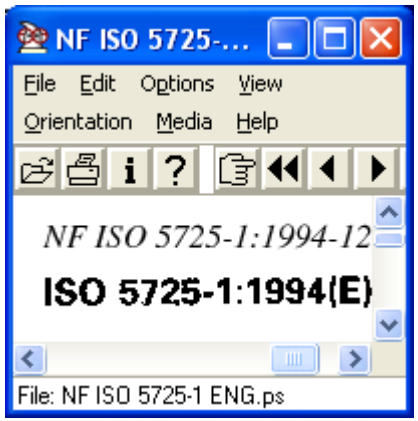
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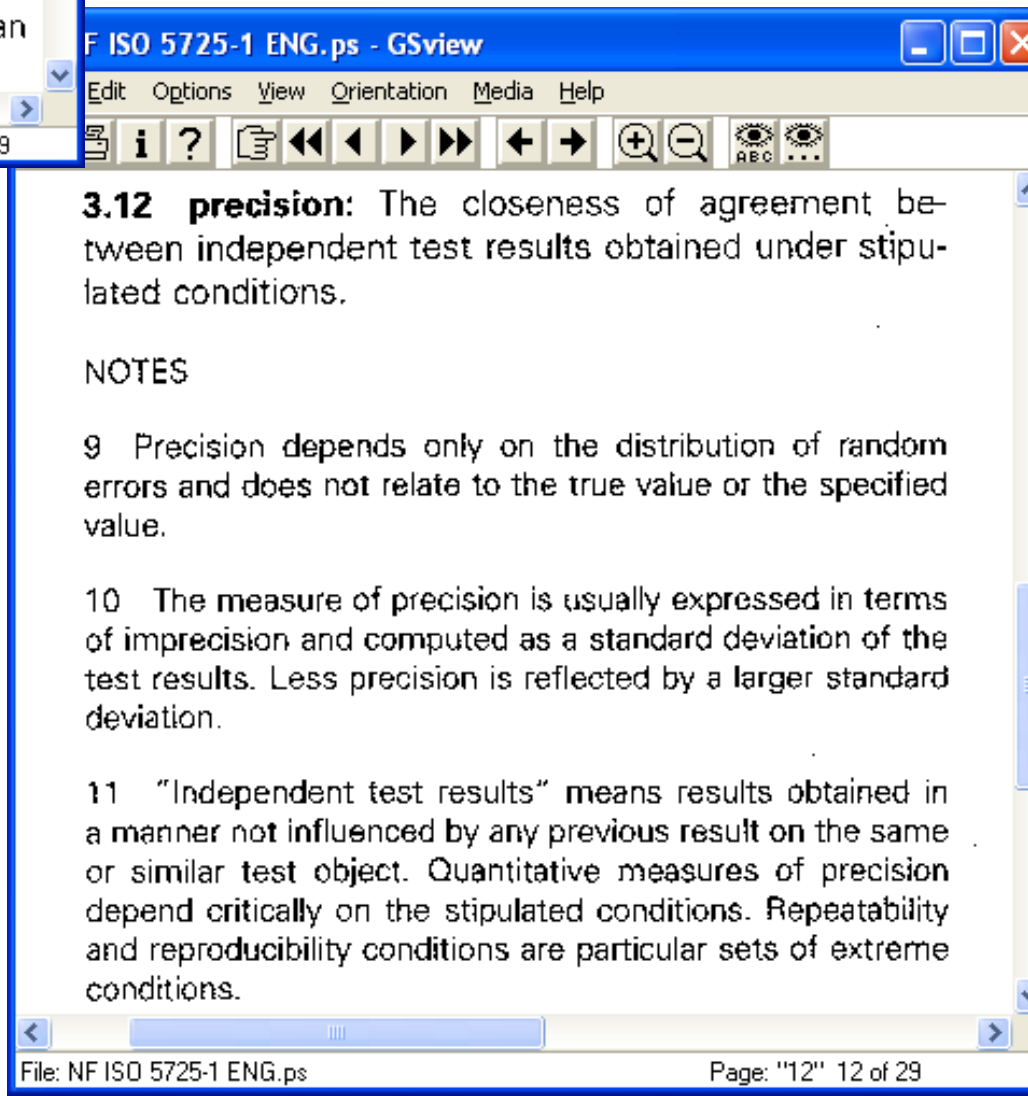
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3.12 precision: The closeness of agreement between independent test results obtained under stipulated conditions.
NOTES
9 Precision depends only on the distribution of random errors and does not relate to the true value or the specified value.
10 The measure of precision is usually expressed in terms of imprecision and computed as a standard deviation of the test results. Less precision is reflected by a larger standard deviation.
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Bias

- **Here the reference instruments are minicard and SCT…**
- **… but the other intruments are not aimed at measuring the same quantity.**
- **Even the two reference instruments differ: the minicard output is qualitative, the SCT is quantitative, and so are the other instruments tested.**

Variability

The variability of measurements has several components :

- **within samples**
- **within laboratories**
- **between laboratories**

repeatability

reproducibility

Outline

- ✓ Reasons for organizing a round-test
- ✓ **Experimental design and its implementation**
- ✓ Data analysis and results

Experimental design

Basics assumptions for preparing the round test:

- **homogenizing the material has been shown (ITMF, 2002) to reduce the variance of this distribution : separate round tests should be carried out for mixed and raw cotton**

Experimental design

We then included various cottons

- covering a range of stickiness

with 6 cottons min, 10 recommended

- contrasting between two sample preparations

Raw cottons
Mixed cottons

-With at least 8 laboratories

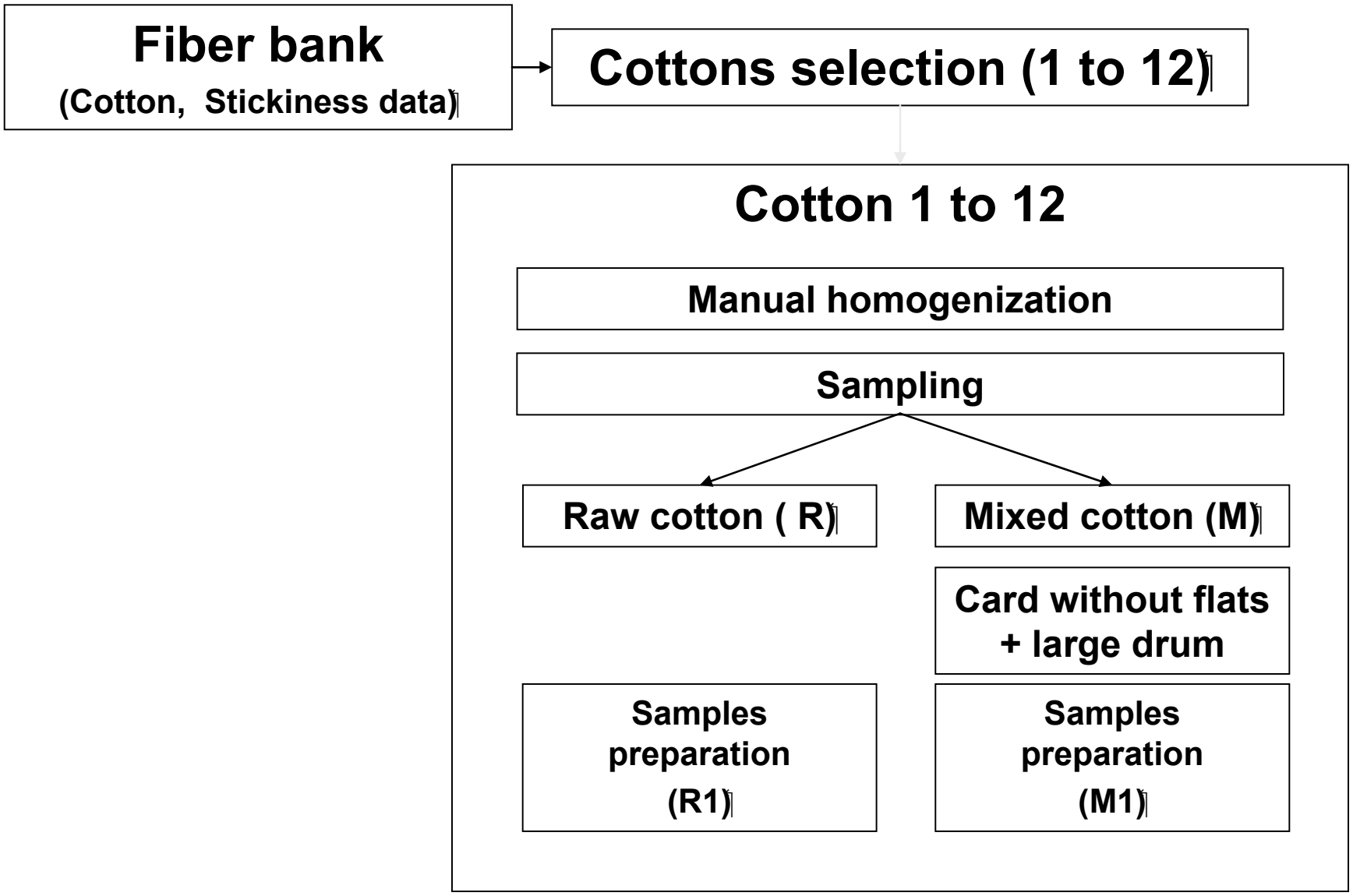
The recommended number of laboratories has not been achieved and these results should be considered as preliminary before a larger round test can be organized.

Otherwise, the round test design is not different from the one suitable for gaussian measurements : randomized in blocks within laboratories, with blind measurements.

Range of stickiness

Cotton	Stickiness level (H2SD)	Mixed Cotton (M)	Coton Raw (R)
1	50	M1 (2 blocks)	R1
2	0	M2 (2 blocks)	R2
3	80	M3 (2 blocks)	R3
4	15	M4 (2 blocks)	R4
5	50	M5 (2 blocks)	R5
6	30	M6 (2 blocks)	R6
7	17	M7 (2 blocks)	R7
8	20	M8 (2 blocks)	R8
9	10		R9
10	30		R10
11	45		R11
12	12		R12

Organization of the round-test



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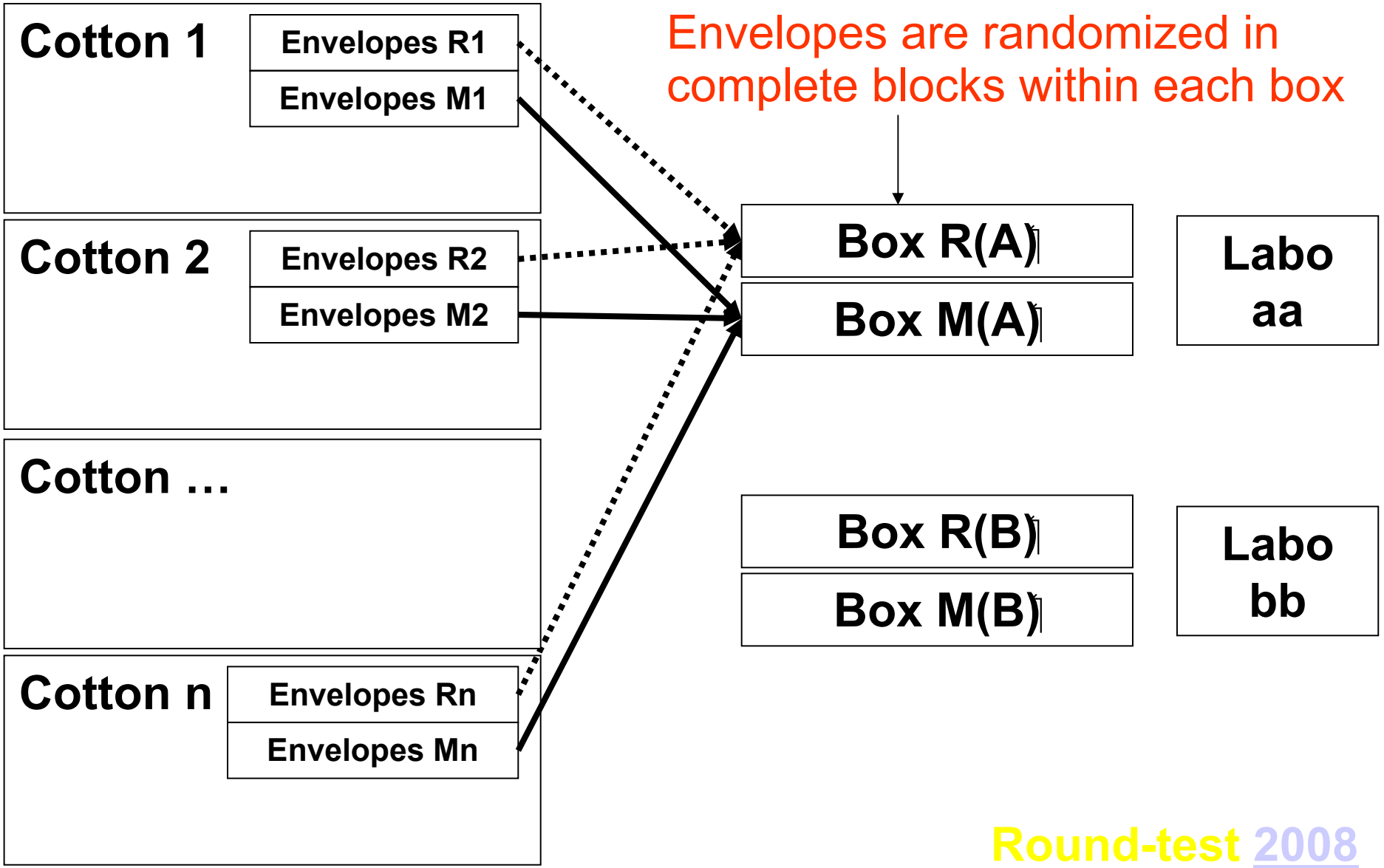


Plan of presentation

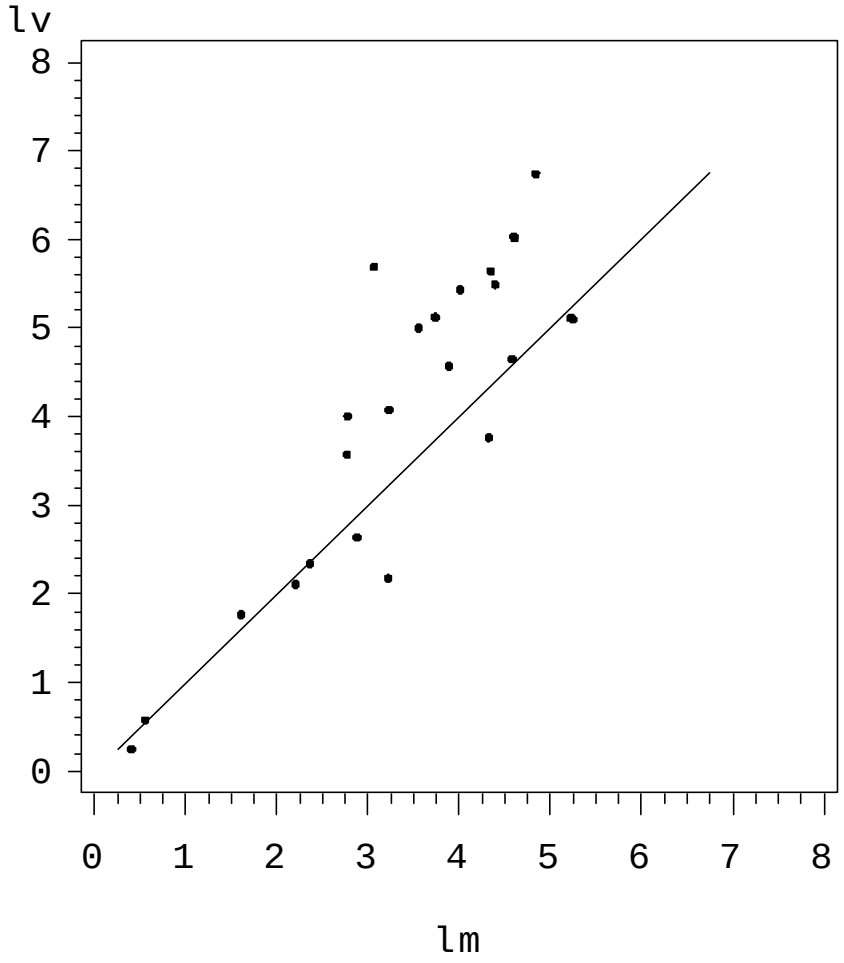
- ✓ Reasons for organizing a round-test
- ✓ Organisation of the Round Test
- ✓ **Results**

Number of copies of each instrument

Instrument	Raw		Mixed	
	Planned	Achieved	Planned	Achieved
Mini-card	3	1 (2?)	3	2
SCT	5	3	5	3
FCT/FQT	4	3	4	3
H2SD	5	4 (5?)	6	4 (5?)
HPLC	1	0	1	0

Mean to variance relationship

LogN(1+variance) vs LogN(1+mean)
etat=mixed Appareil=FCT_FQT



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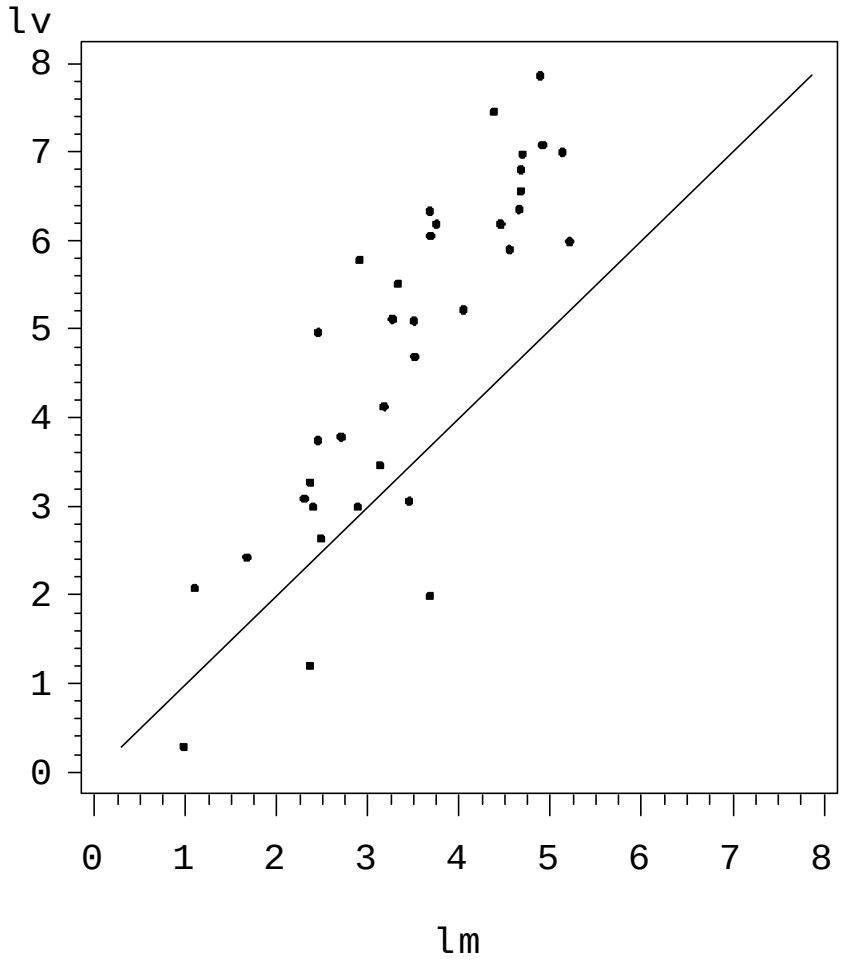

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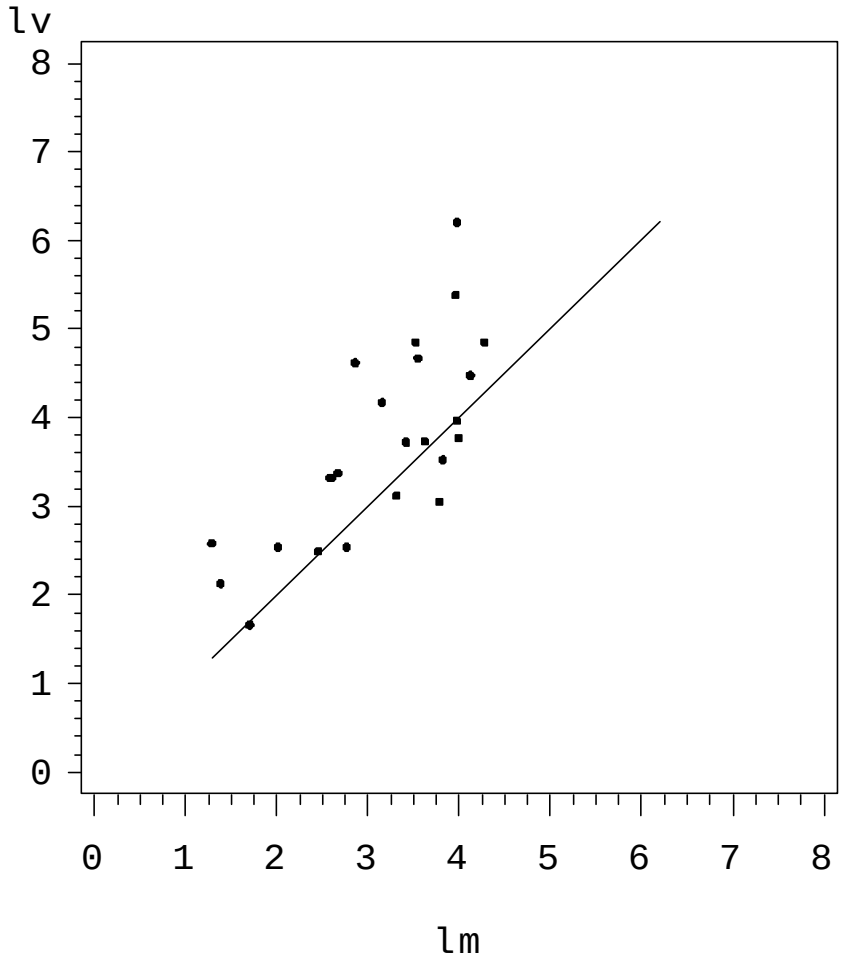
etat=mixed Appareil=H2SD



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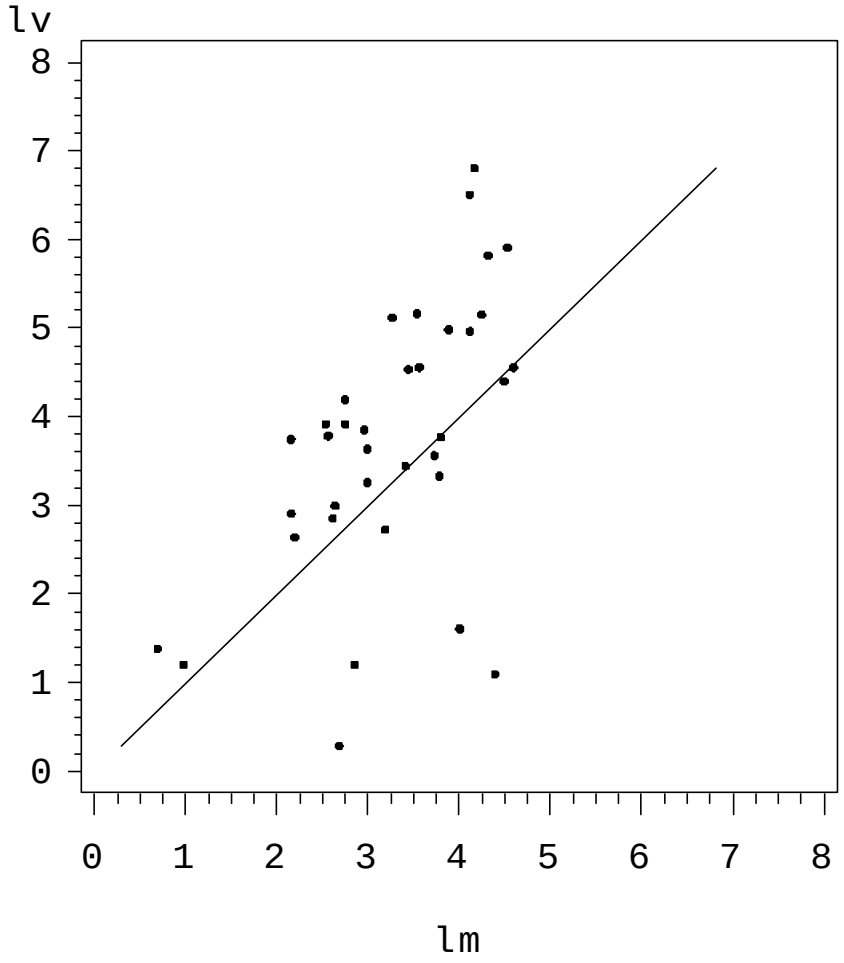

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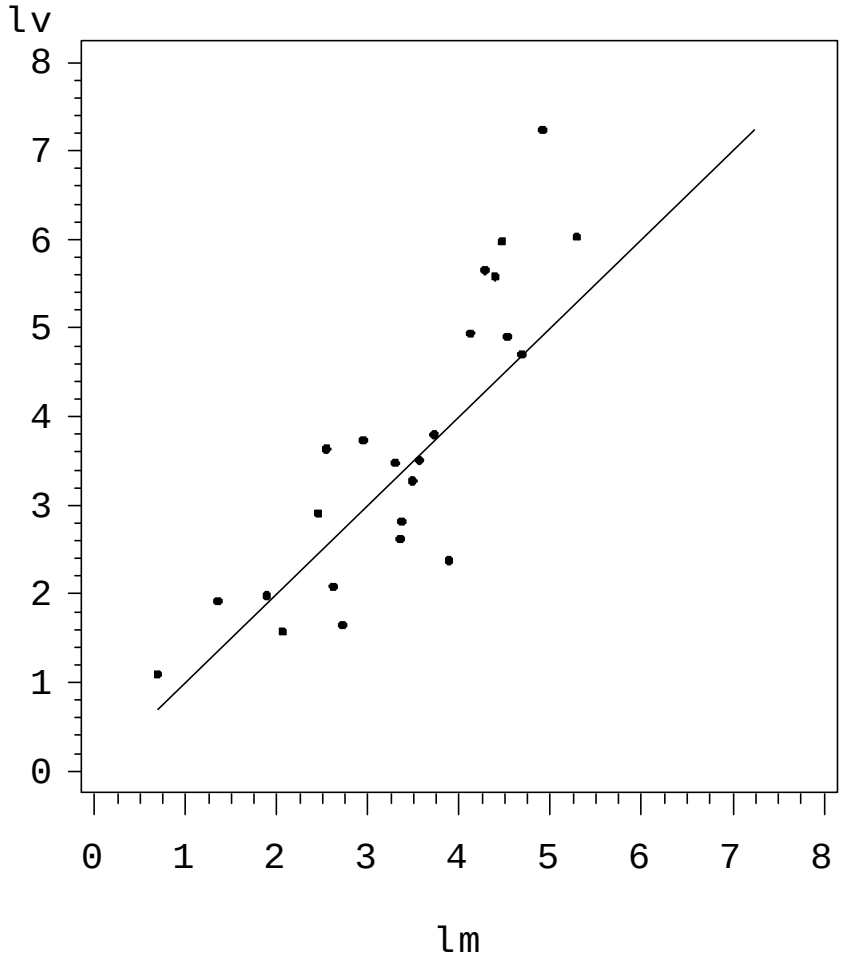

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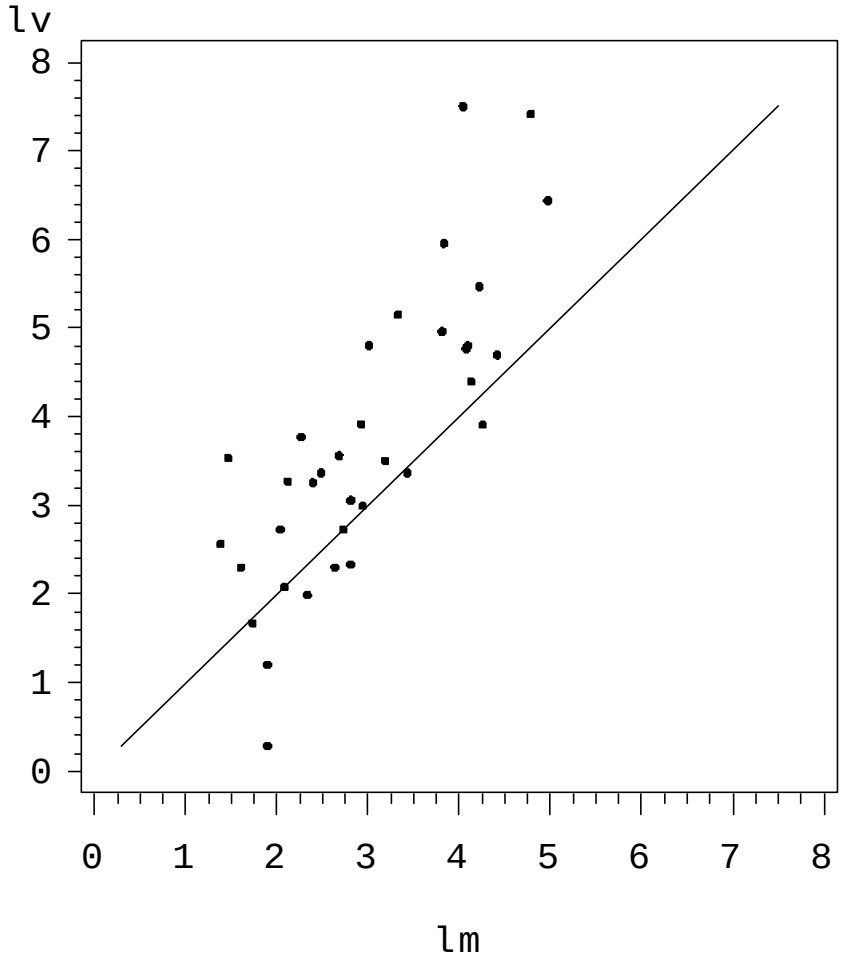

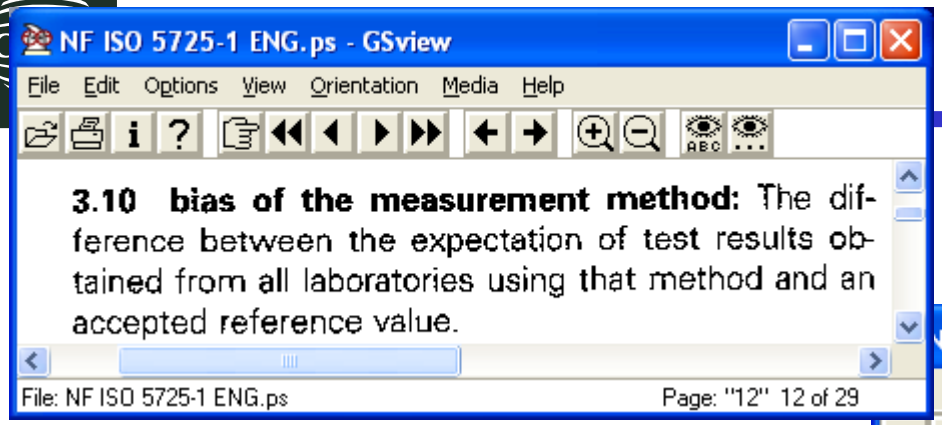
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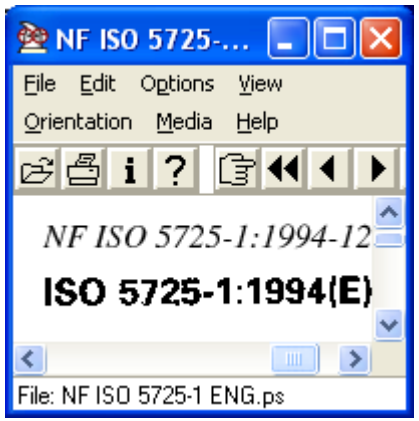
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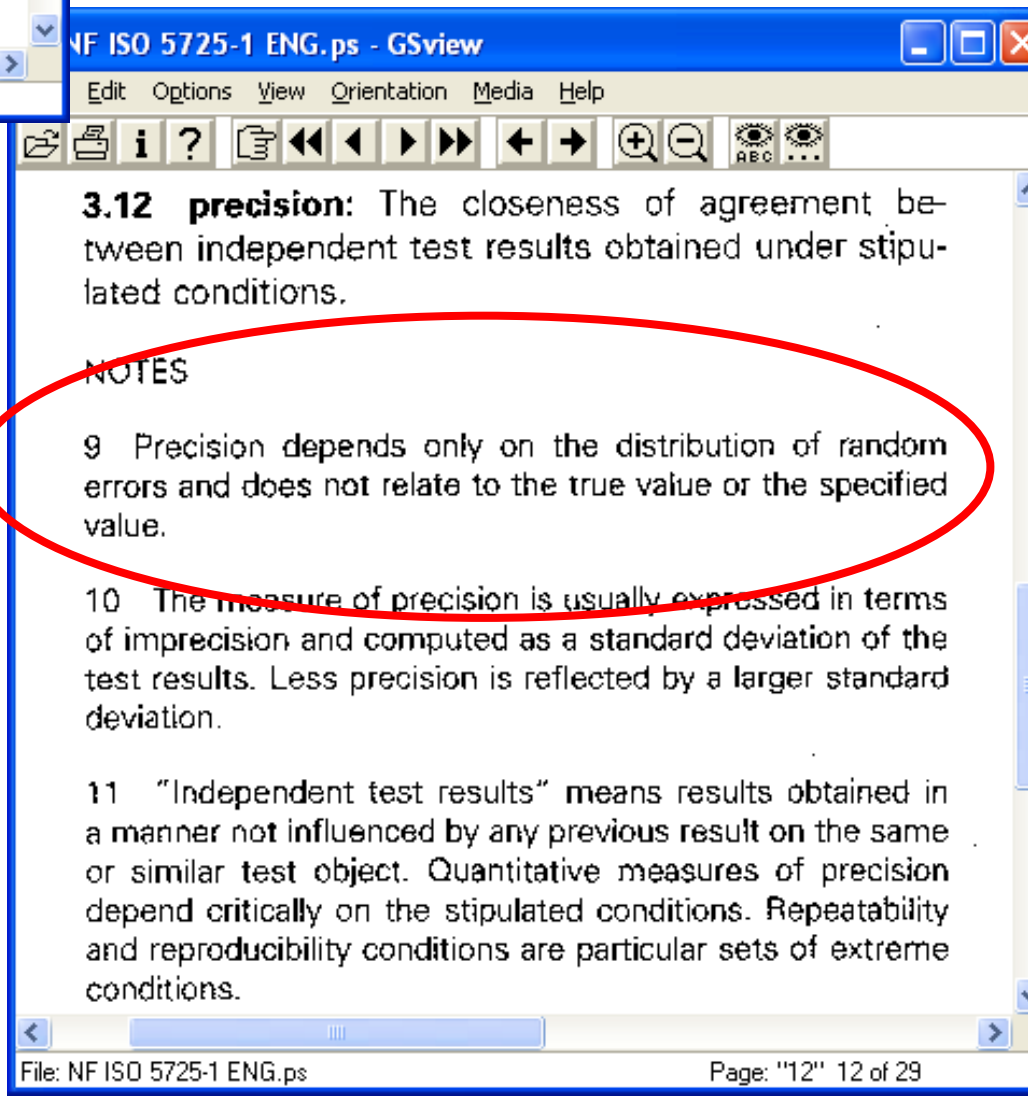
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Cotton i

- **E[Yijk] = Mi .**

Cotton i Lab j

- **E[Yijk] = Mi . Bj .**

Cotton x lab interaction

- **E[Yijk] = Mi . Bj . (MB)ij .**

Block within lab effect

- **E[Yijk] = Mi . Bj . (MB)ij . Cjk**

Neperian log scale

- $E[Yijk] = Mi \,.\, Bj \,.\, (MB)ij \,.\, Cjk$
- $\text{Log}(E[Yijk]) = m + a_i + b_j + (ab)_{ij} + c_{jk}$

Conditional distribution

- **E[Yijk] = Mi . Bj . (MB)ij . Cjk**

- **Log(E[Yijk]) = m + a_i + b_j + $(ab)_{ij}$ + c_{jk}**
- **Y | E[Y] = given its expection, Y follows a negative binomial of parameter k with overdispersion ø**

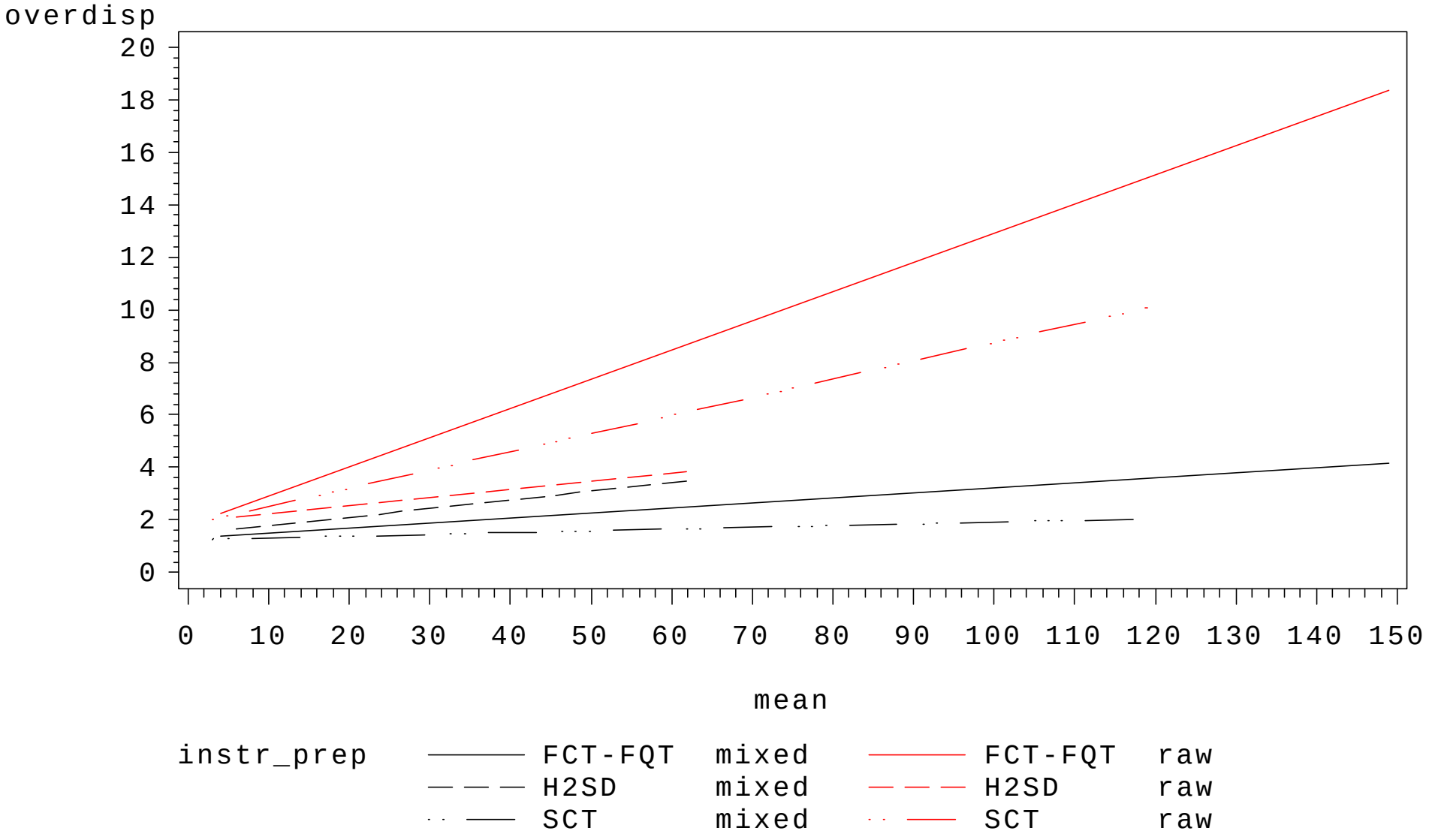
$$Var(Y|\mu) = ø\ \mu\ (1 + \mu/k)$$

- **Results were analyzed with the** generalized linear model **procedure of Sas (proc genmod)**

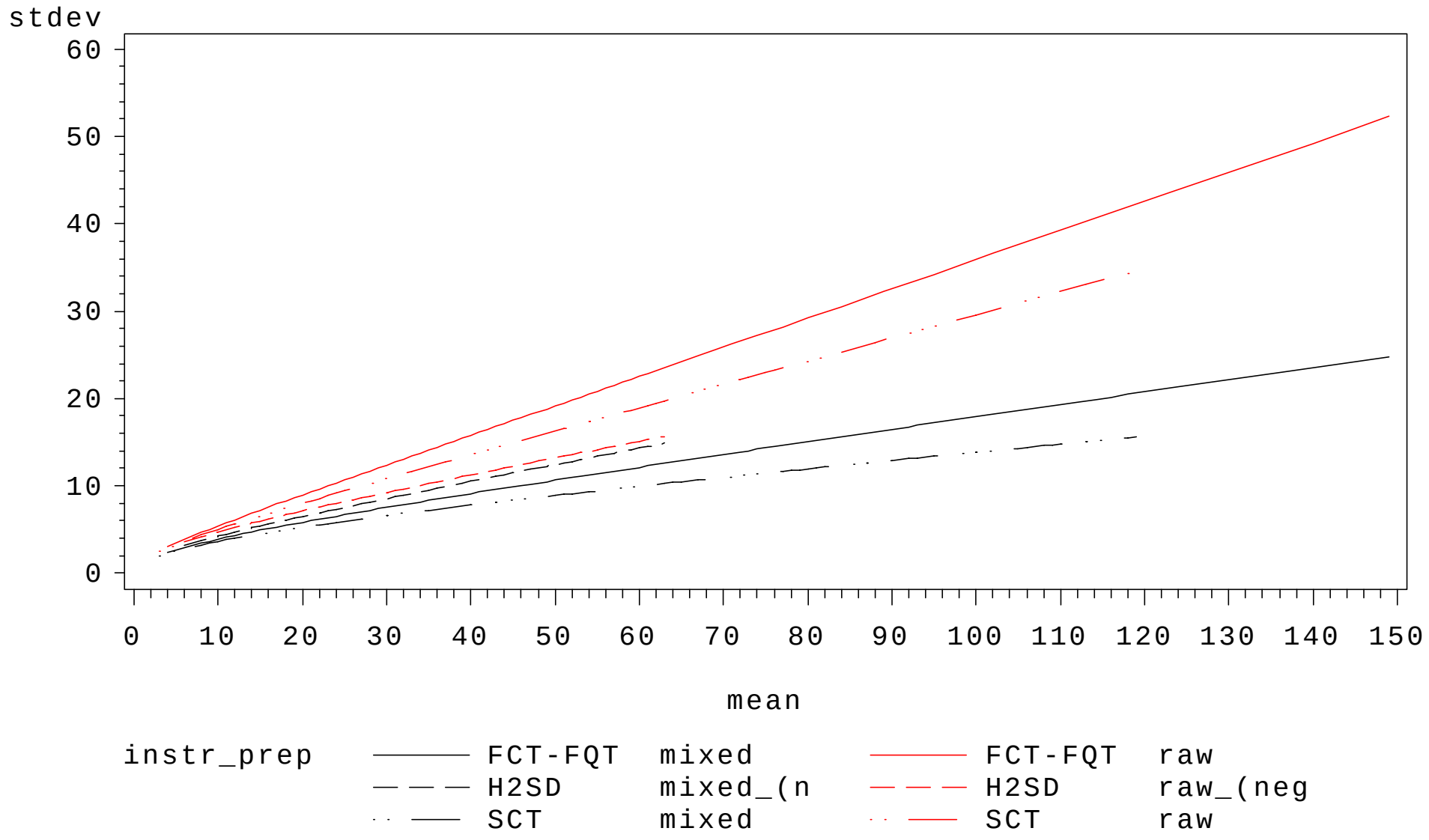
- **One device had incoherent results, and broke down shortly after the test : its data was discarded.**

- **Otherwise, the inspection of residuals did not show any outlier.**

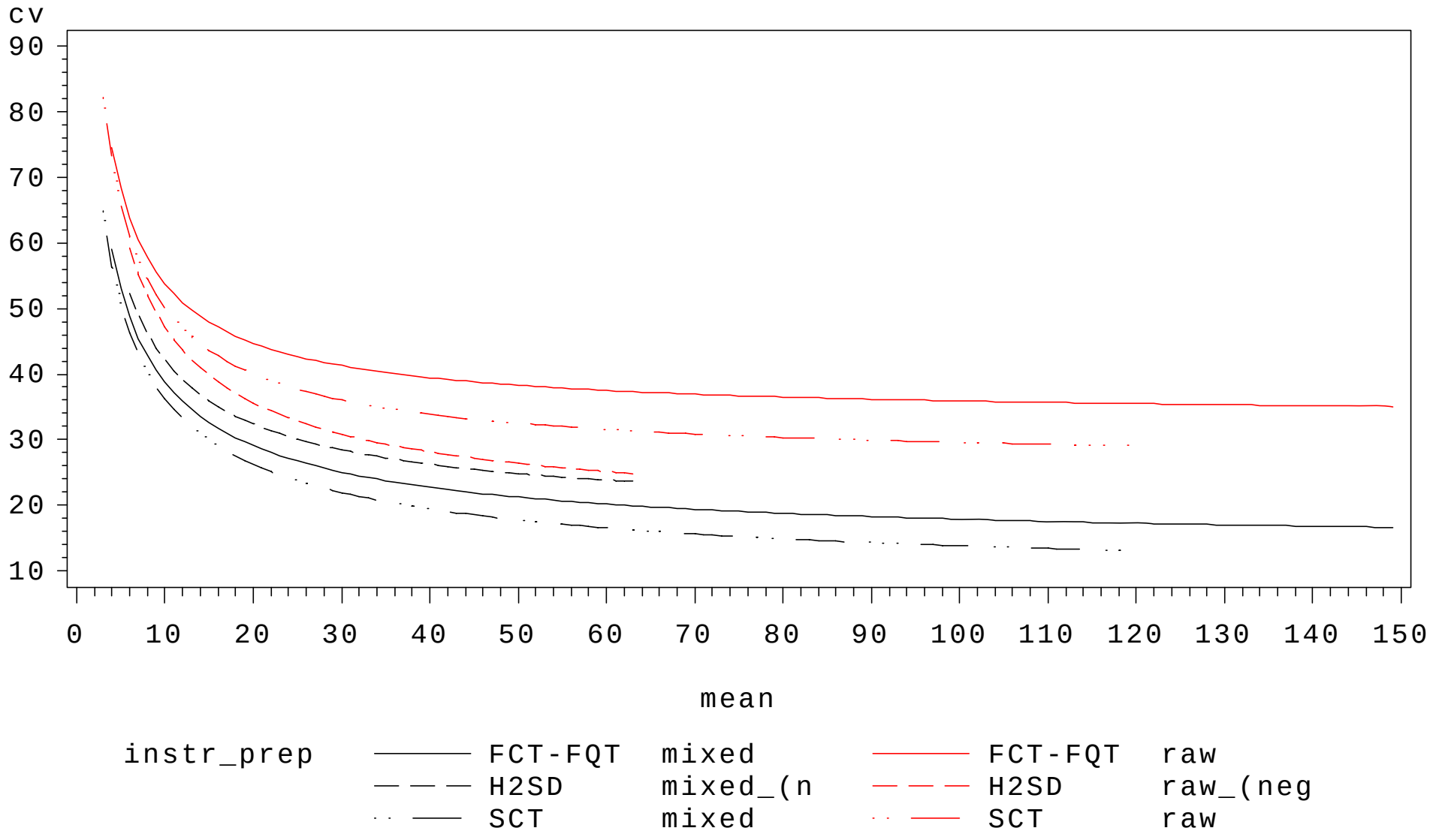
Overdispersion as a linear function of the mean



Within-sample repeatability standard deviation



Within-sample coefficient of variation



Blocks and lab effects

	Max difference between blocks means		Max difference between labs means		Labxcot inter
Preparation	Mixed	Raw	Mixed	Raw	Mixed/Raw
Instrument					
H2SD	+25%	+33%	+43%	+85%	No/No
FQT	+41%	+85%	+310%	+300%	Yes/No
SCT	+28%	+63%	+230%	+192%	Yes/No

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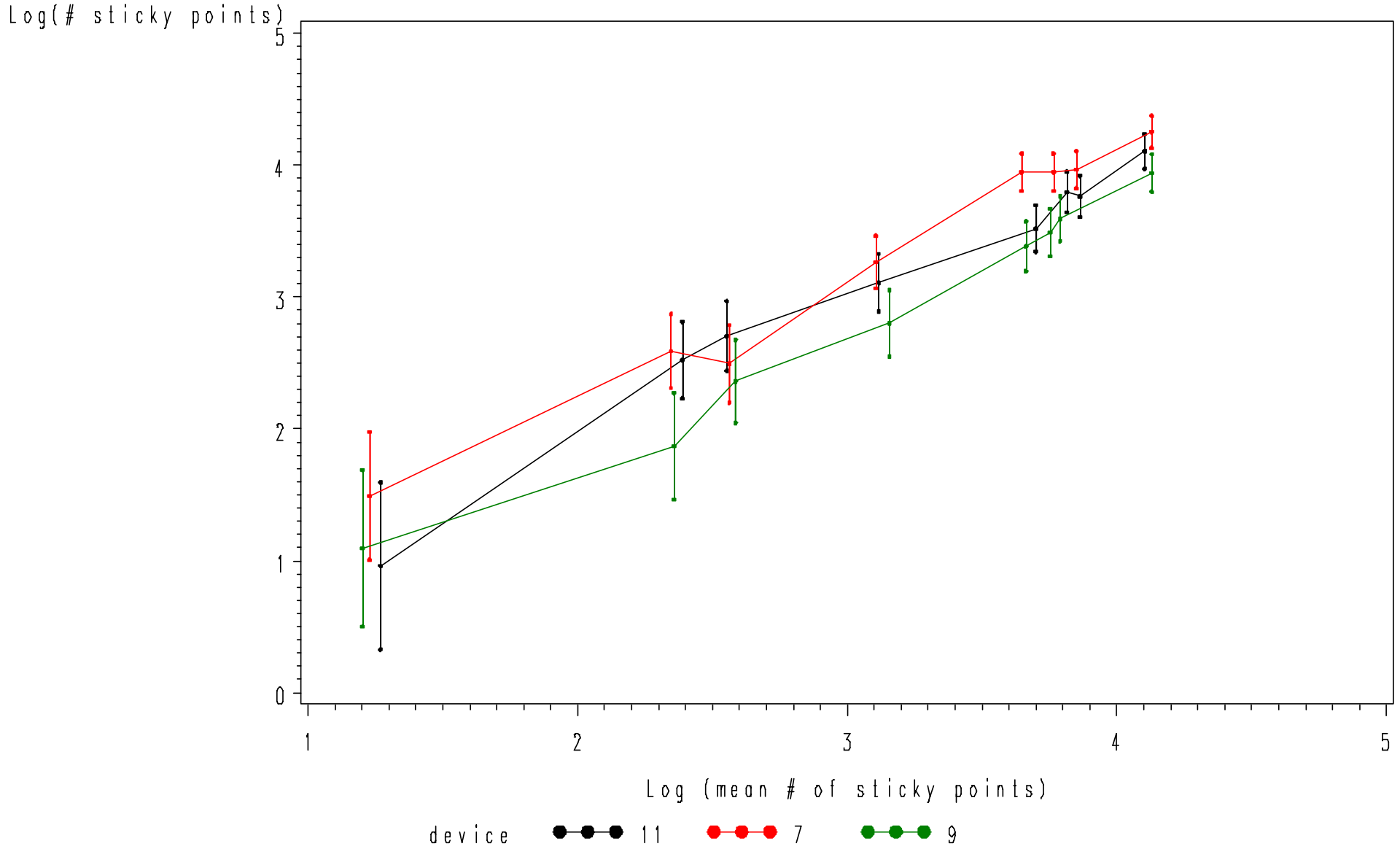
interaction plot H2SD mixed



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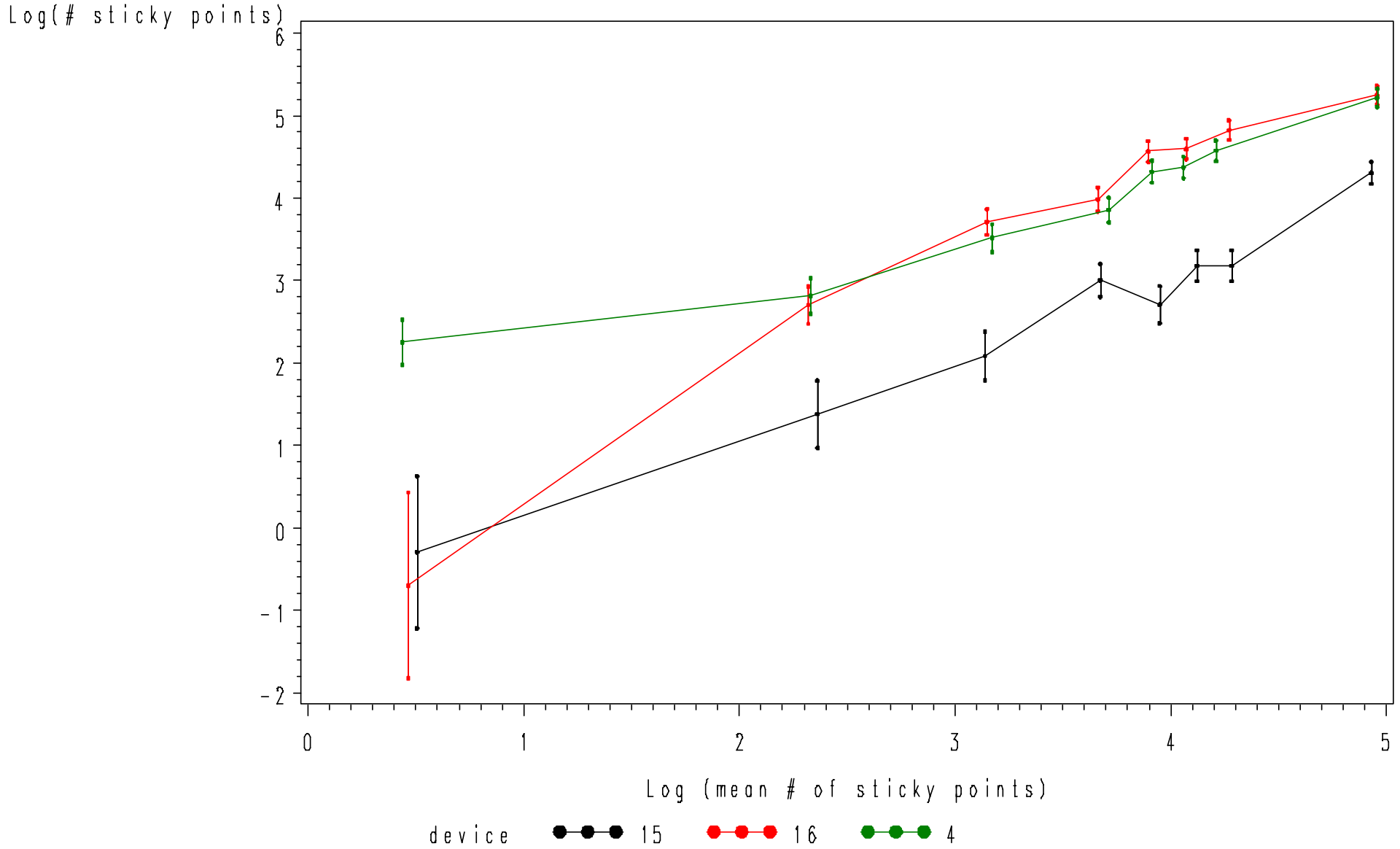
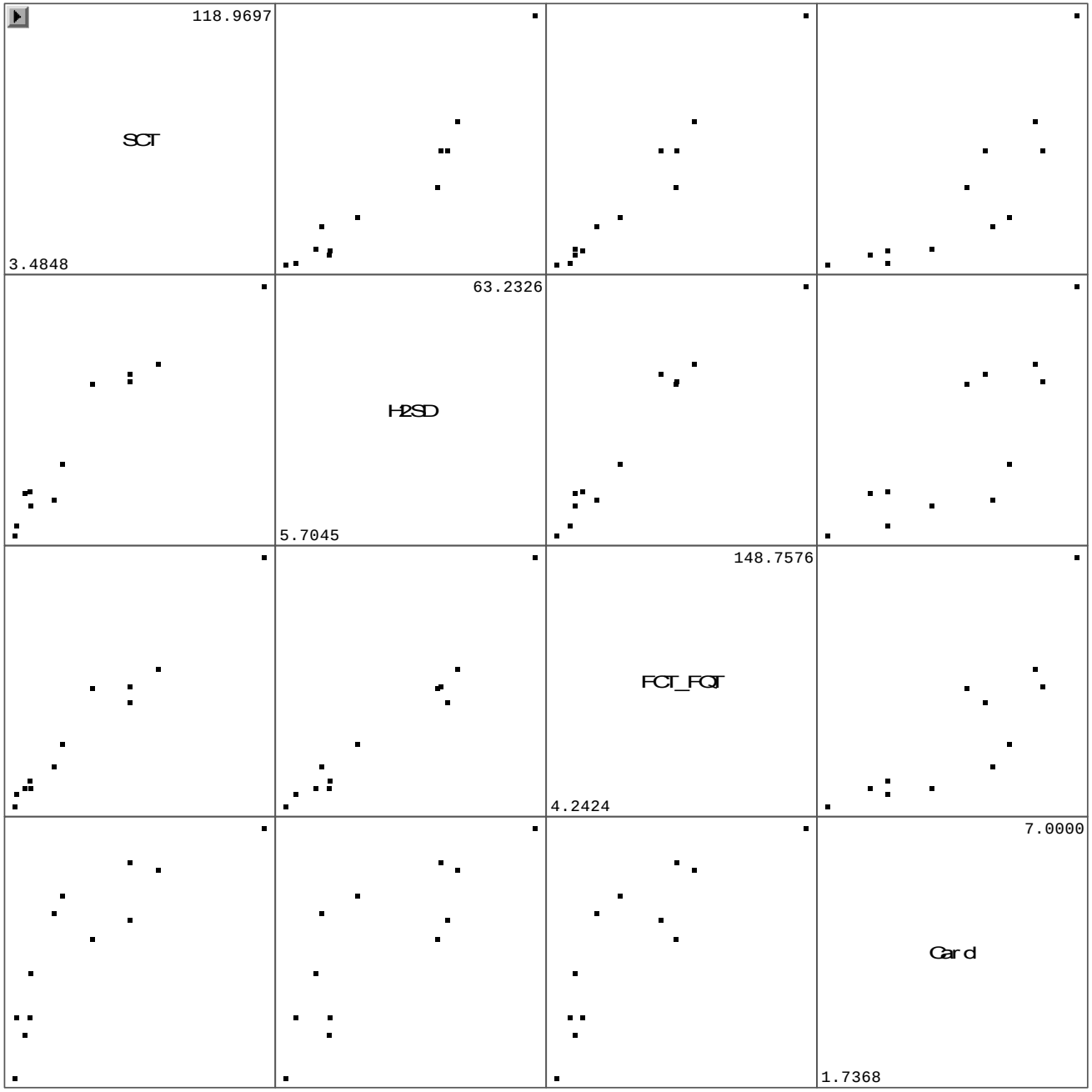
interaction plot FCT_FQT mixed

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SCT
3.4848
63.2326
H2SD
5.7045
148.7576
FCT_FQT
4.2424
7.0000
Card
1.7368

Summary

- These are preliminary results, too few labs per instrument
- Single CV calculation of analysis of variance are not appropriate, but a generalized linear model gives sensible results :
  - Within lab precision is not the same for all the instruments
  - Serious calibration problems