

# **Calibration of Surface Contamination Monitors**

## **UKAS Accredited Organisations**

### **2007 Comparison**

### **Preliminary data**

# ISO17025

**5.9.1 The laboratory shall have quality control procedures for monitoring the validity of tests and calibrations undertaken. ....This monitoring shall be planned and reviewed and may include .....**

**b) participation in inter-laboratory comparison or proficiency-testing programmes;**

.....

## **Normal expectations:**

- **Comparison participation at least annually**
- **Initial analysis of results within a few months of participation**
- **Evaluation and resolution of discrepancies (non-conformances) before next assessment visit**
- **Use of “type-test” data for comparison - not average performance**
- **Standardised reporting of instrument response**
- **Reporting of all raw data to allow meaningful evaluation**

# UKAS Accredited Organisations

- DML** – Devonport (pending)
- DRMS** – Aldermaston
- DSTL** – Alverstoke
- JCL** – Dounreay
- NUKEM(H)** – Harwell
- NUKEM(W)** – Winfrith
- HMS SULTAN** – Gosport (training establishment)

# **Schedule**

- 10 July**
- meeting of UKAS labs
  - agreed comparison exercise
  - AP5AD and BP19DD with Electras
  - travelling C-14 benchmarking source
  - each participant ships to next
- August**
- organised rota and setting-up protocol
  - instruments and source assembled
  - reporting spreadsheets developed and agreed
- 21 August**
- first measurements
- 26 November**
- last measurements

# Instrument responses

Agreed all UKAS labs will report (on certificates) at least one of three standard response factors:

(1) Instrument response (emissions) =  $(R_s - R_b)/(SER/A_s)$

(2) Instrument response (activity) =  $(R_s - R_b)/(SER/A_s)/P$

(3)  $2\pi$  efficiency =  $(R_s - R_b)/(SER/A_s)/A_p$

(Assume cal. source area > probe area, 3 mm separation)

Also report on certificate:

P factor used

Probe area ( $A_p$ ) – normally manufacturer's stated value

Uncertainties

(Compliance statement as per M3003 App M)

# **Comparison reporting**

## **Spreadsheet completion**

### **(1) Calibration source data**

**nuclide, type, size, identifier, age, cal date, SER, uncertainty, uniformity data (if available), .....**

### **(2) All original individual observations**

**bgd, source readings with cal. sources, (snapshots and/or eye-averaging), linearity tests, .....**

### **(3) Uncertainty budgets**

**individual input and output quantities**

# Comparison – minimum outputs

**Comparison against type-test benchmarks (where available)**

**Compliance based on uncertainties and  $\pm 30\%$  (GPG14)**

**Comparison/acceptability of uncertainty budgets**

***Source uniformity data***

***Comparison of snapshot and eye-averaging techniques***

***Quality of calibration sources***

# Instruments

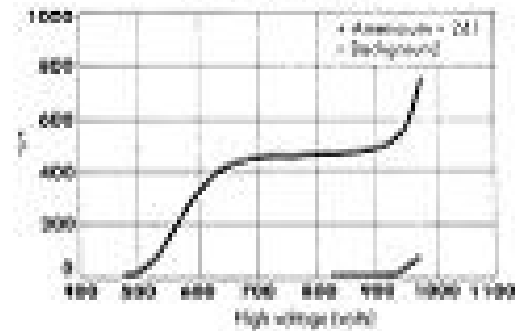
## Alpha Scintillation Probes

### AP5 Family

This hand-held ZnS probe with 100 cm<sup>2</sup> window, high transmission hex-grill and slim, wedge-shaped profile is popular for monitoring workplaces, benches, personnel and tools. The AP5RA version has a ruggedized hex-grill. Note: the thin radiation windows are field-replaceable.



AP5A Platform



### Alpha probe data (from Thermo catalogue)

Alpha efficiency is expressed as a percentage of the  $2\pi$  flux of a certified reference source

Probe	Radiation Window Area (cm <sup>2</sup> ) Shape	Isotope (MeV)	Efficiency (% surface emission)	Background s <sup>-1</sup>
AP5AD	100 rect.	241Am (5.486)	35%	< 0.1

# Instruments

## BP19 Family



These slim-profile probes with light alloy diecast housings and 100 cm<sup>2</sup> radiation windows are replacements for the BPS, weighing less, and mechanically stronger, with a new design of light seal. The BP18AD has a greater low energy beta efficiency and less

EC400 plastic phosphor in a light alloy diecast housing are ideal for general purpose and large area monitoring for low, medium and high-energy beta. The BP19DD is a thin window version offering better <sup>14</sup>C beta efficiency. This probe can be matched with Thermo's portable survey meters, such as the **Electra/Delta** series, **ASP-2**, **E-600**, or **RM-25**. See also HP-330B.

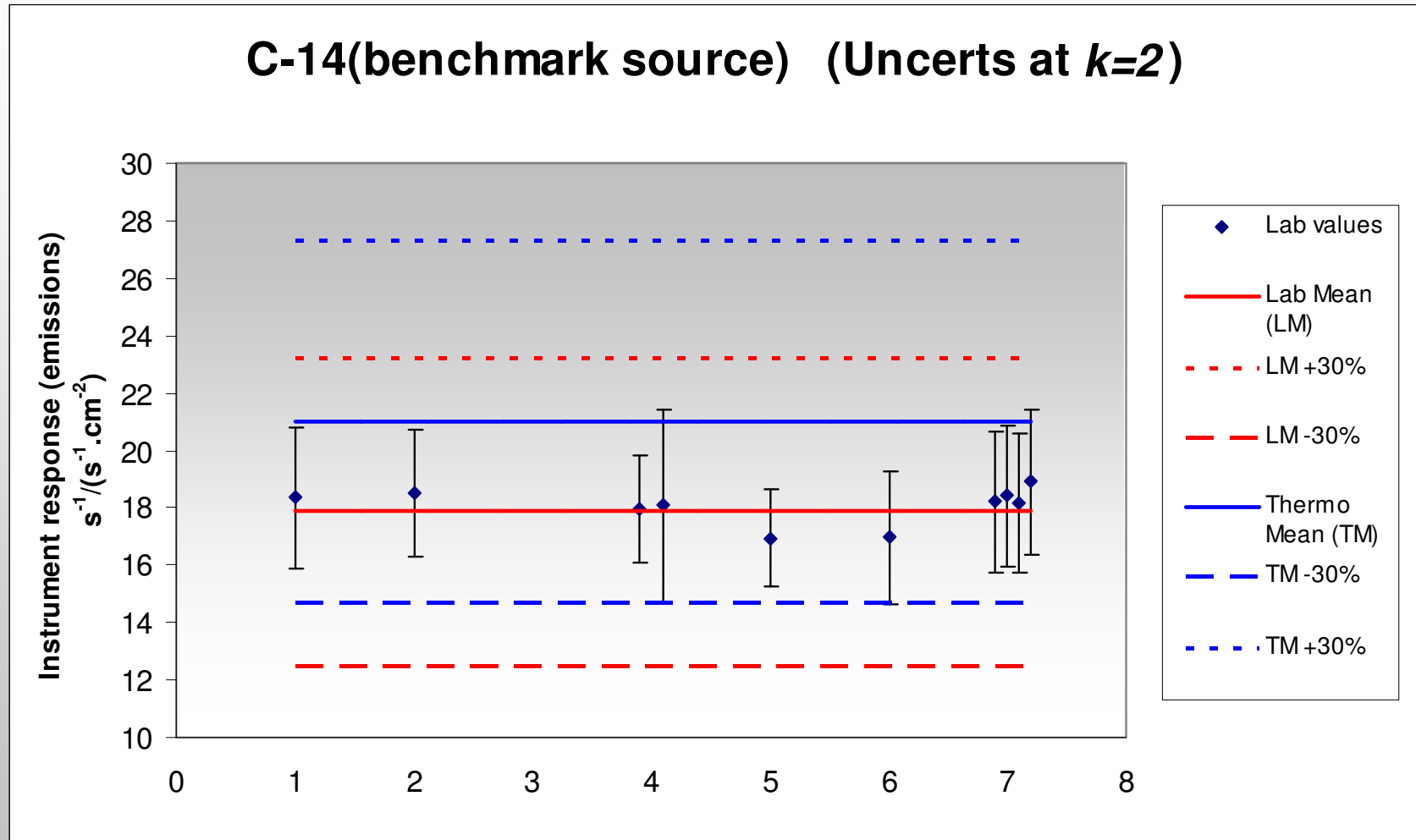
+ Slim profile, low weight

### Beta probe data (*from Thermo catalogue*)

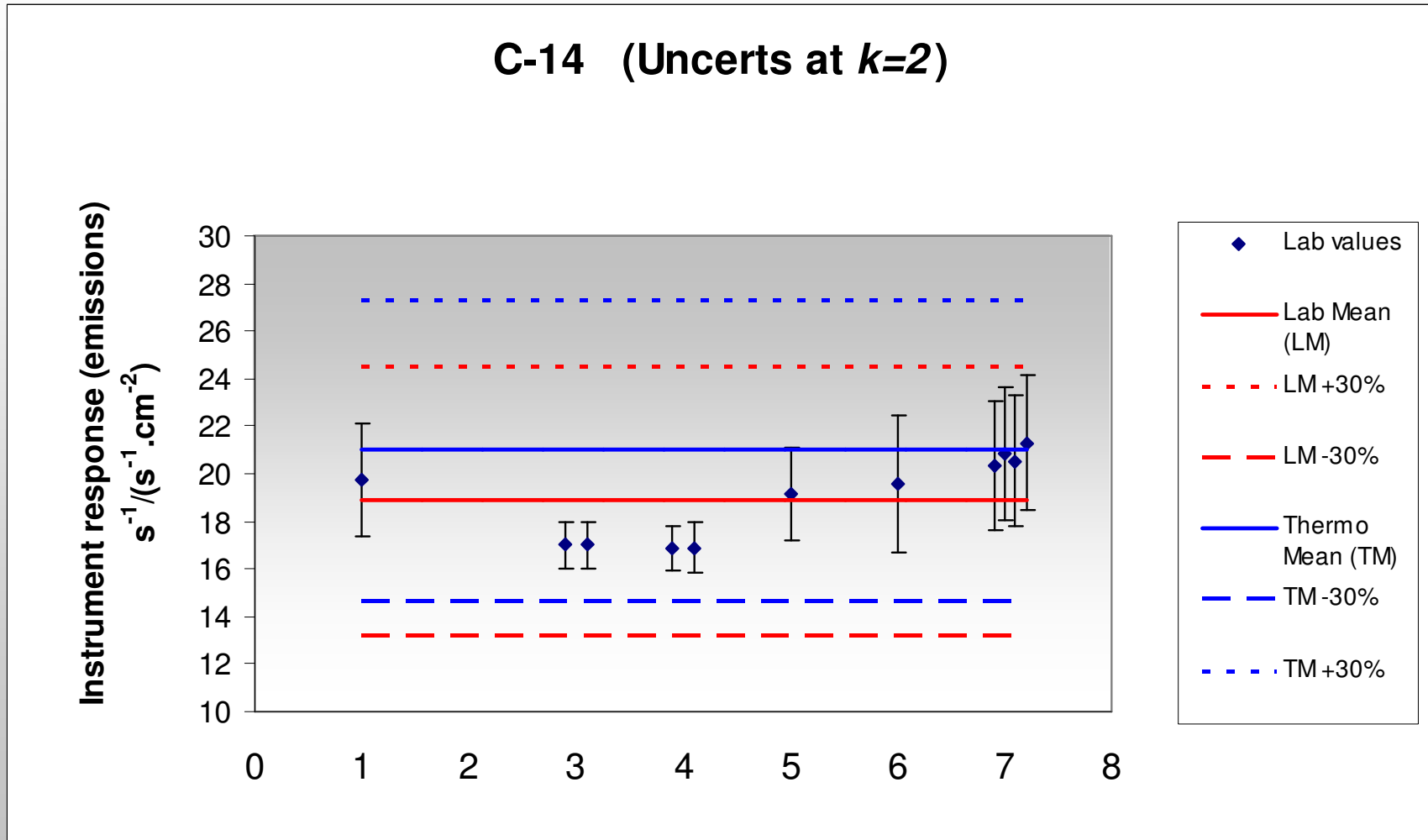
Alpha efficiency is expressed as a percentage of the 2π flux of a certified reference source

Probe	Radiation Window		Efficiency (% surface emission)				Background s <sup>-1</sup>
	Area (cm <sup>2</sup> )	Shape	Beta				
			<sup>14</sup> C	<sup>60</sup> Co	<sup>36</sup> Cl	<sup>90</sup> Sr/ <sup>90</sup> Y	
BP19DD	100	rect.	21%	34%	48%	51%	< 8

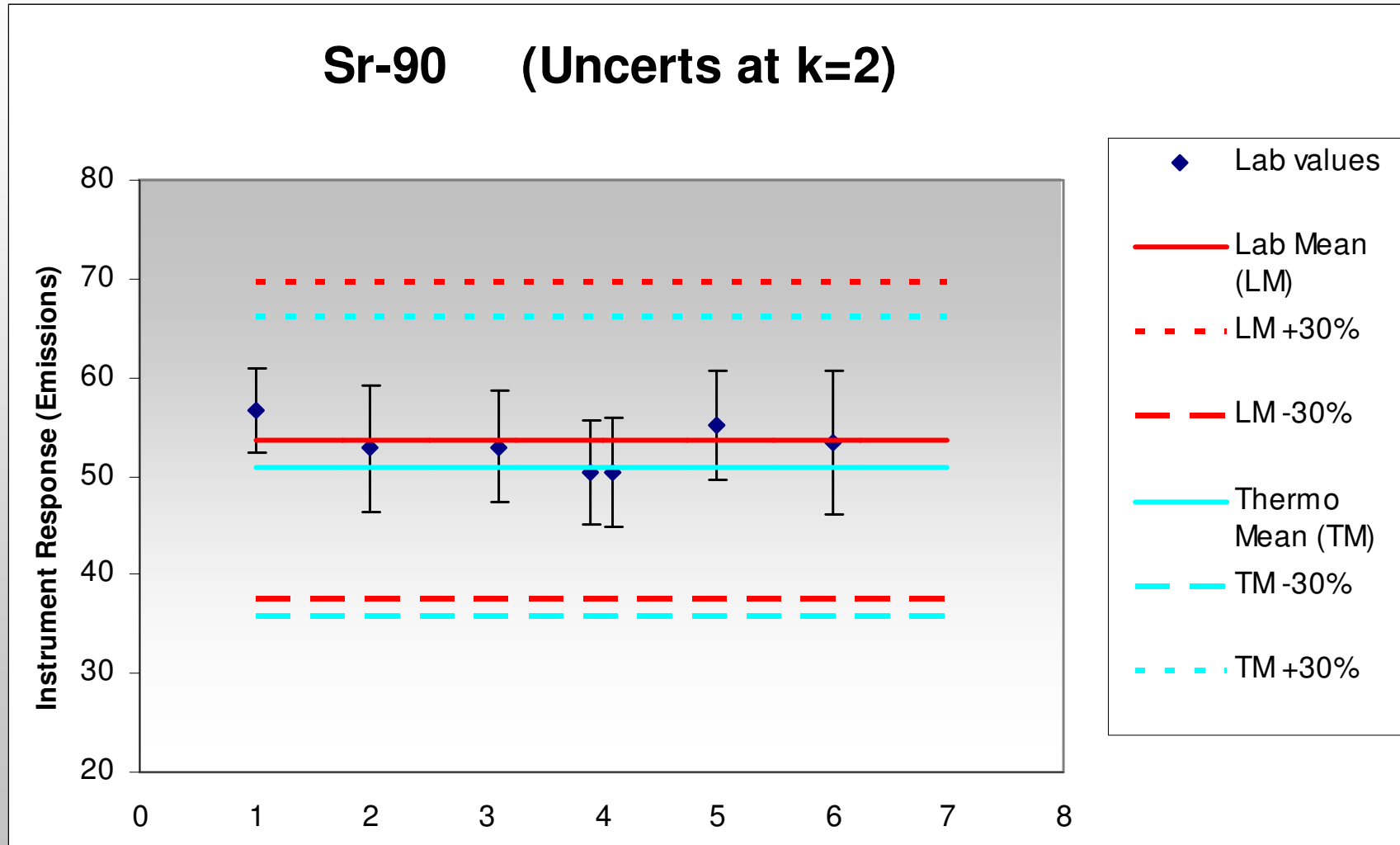
# BP19 results



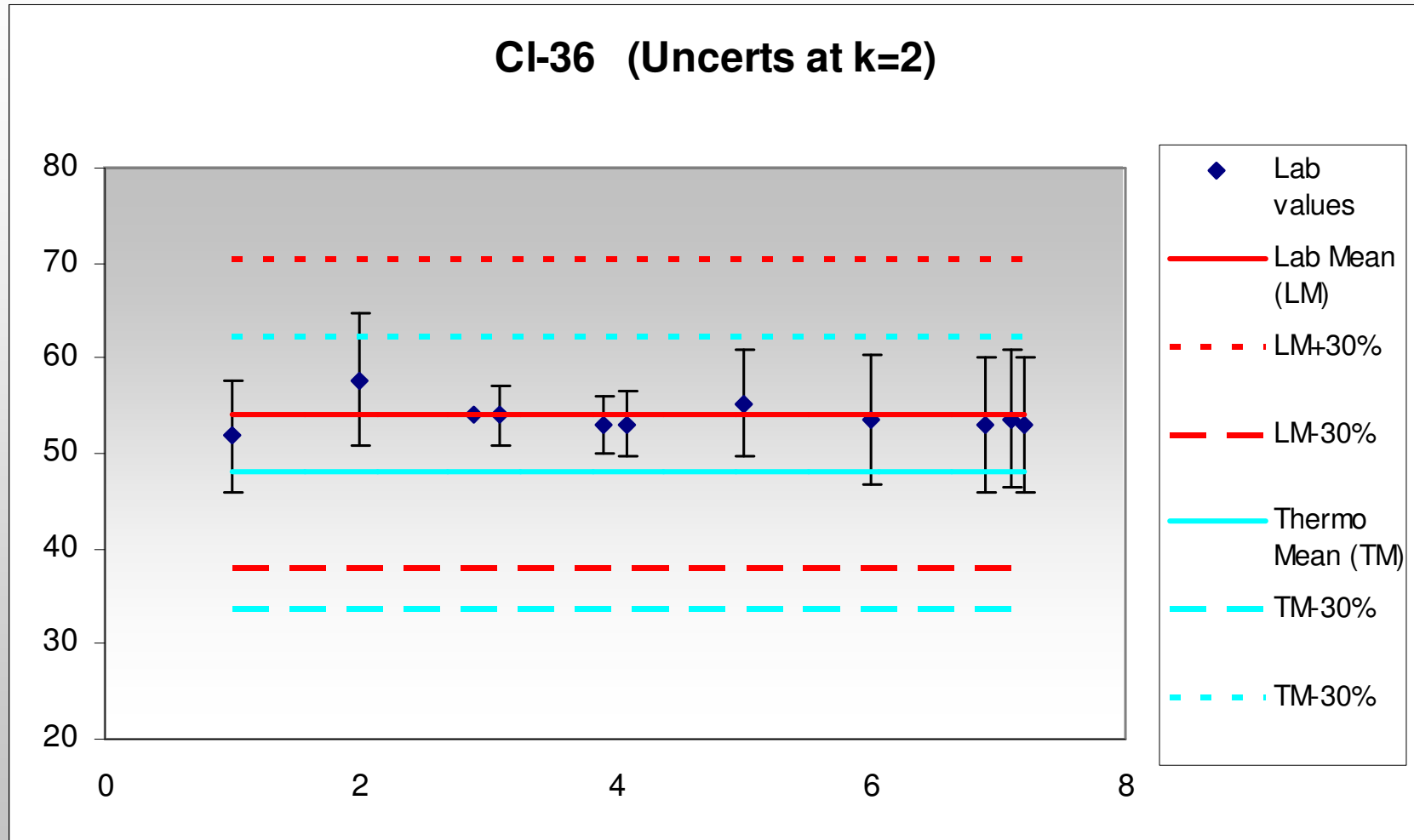
# BP19 results



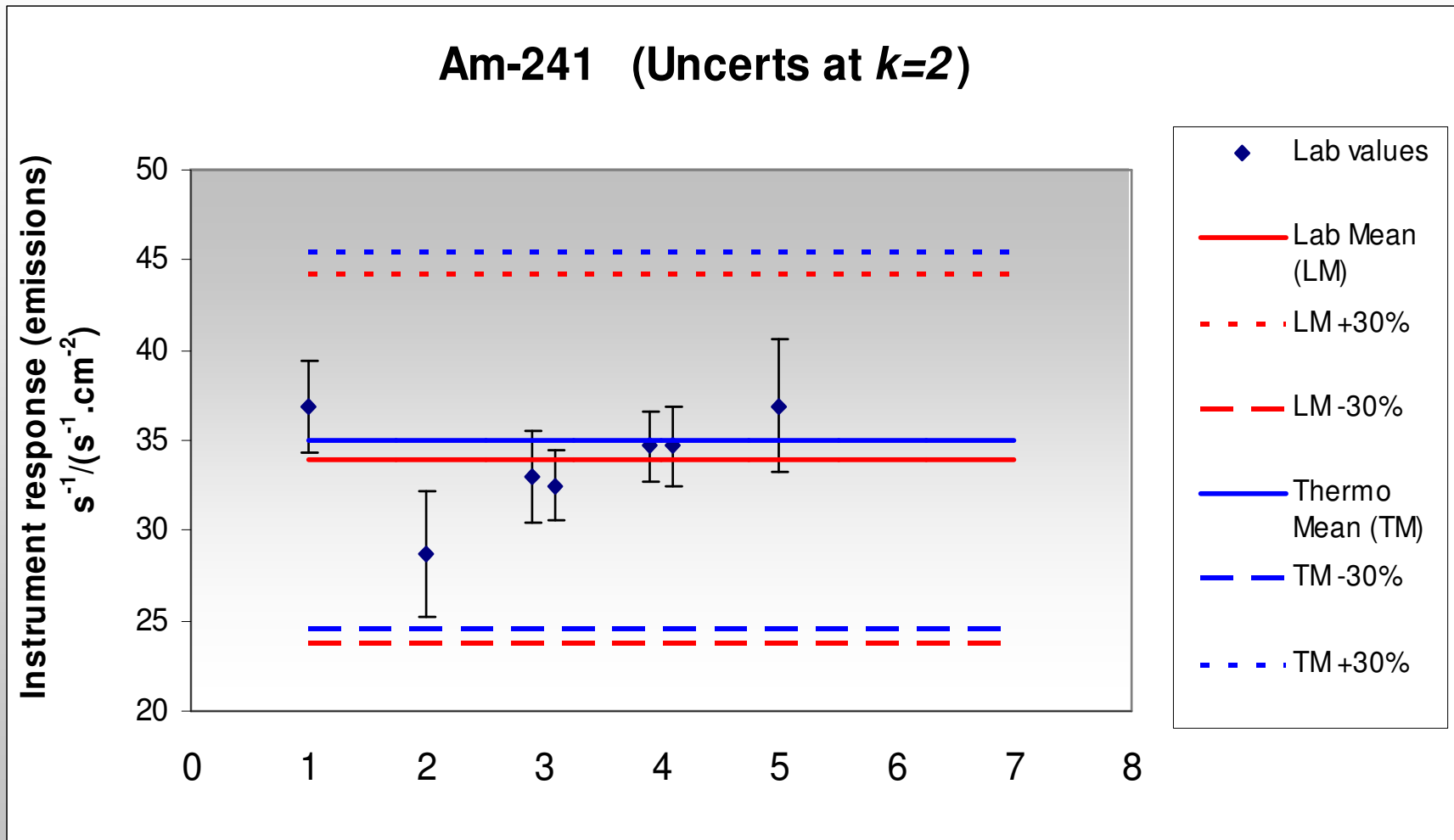
# BP19 results



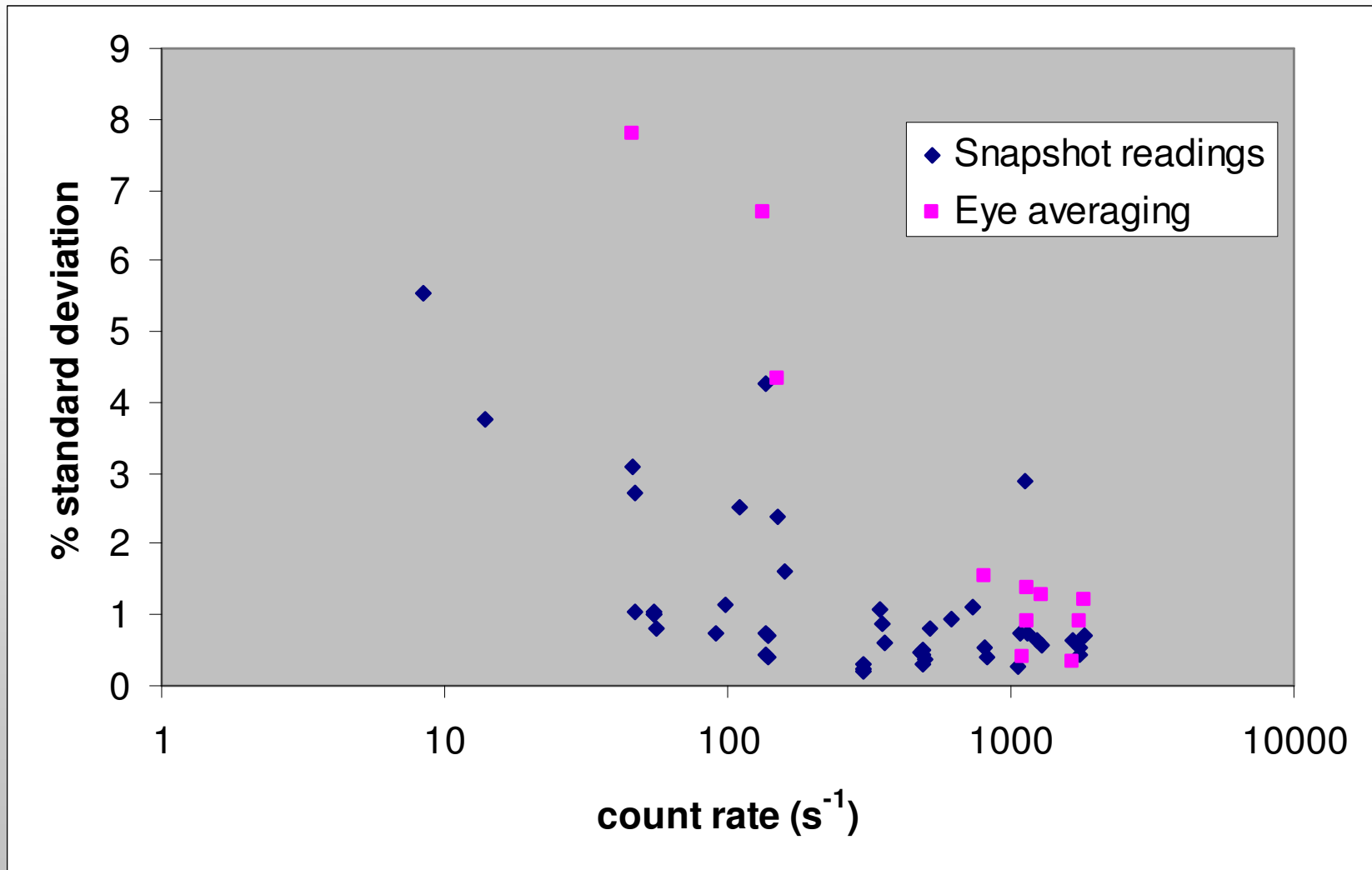
# BP19 results



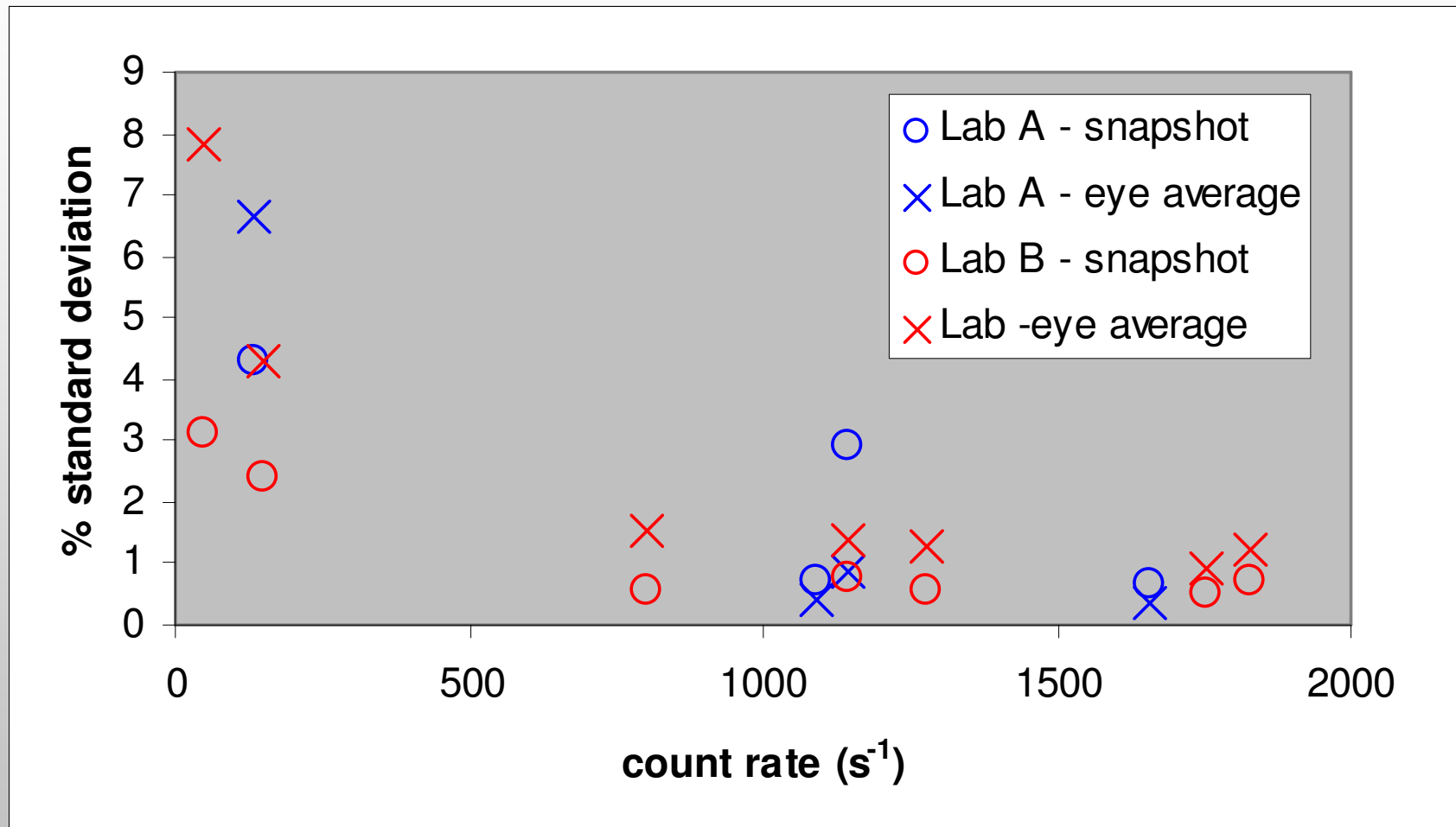
# AP5 results



# Comparison of reading standard deviations



# Comparison of reading standard deviations



# Schedule

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*10 July* - *meeting of UKAS labs*

*26 November* - *last measurements*

**Dec 07– Feb 08** - **complete collation of raw data and results**  
- **resolve obvious anomalies**

**Feb/Mar 08?** - **wash-up workshop**  
- **consider next comparison**

**Mar 08 →** - **implement/monitor improvements**

# Personal thoughts re improvements

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- **Improve communications/pre-planning of movements**
- **Reduce uncertainties**
  - **uniformity**
  - **assumptions about**
    - *source-detector separation*
    - *source area*
    - *.....*
  - **resolve differences/techniques between eye averaging and snapshots**
  - **calibration source activities**
  - *.....*
- **Ensure comparisons cover range of instruments, probe areas, ....**
- *.....*

# Personal thoughts (provisional) - this comparison

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- **UKAS labs have good, reproducible, robust measurement systems**
- **UKAS labs have good databanks for supporting data**
  - **traceability, calibration certificates, previous calibrations, source identification, .....**
- **Good agreement between UKAS labs**
  - **all compliant against “type test” data**
- **Uncertainty estimates/budgets are improving significantly**
- **Manufacturers’ type test data are not “robust”**
- **Problems related to:**
  - ***ad hoc/rapid* development of spreadsheets**
  - **eye averaging techniques**
  - **understanding uncertainties**