

Technical protocol for a BIPM ongoing key comparison in dosimetry

This short technical protocol produced by the BIPM specifies in general the procedure to be followed for comparisons in dosimetry. It should be read in conjunction with the *Guidelines for BIPM ongoing key comparisons*, with reference to the standards as given in the list of references.

It is important to remember, however, that the purpose of a key comparison is to compare the standards as realized in the participating institutes, not to require each participant to adopt precisely the same conditions of realization. The protocol, therefore, specifies the procedures necessary for the comparison, but not the procedures used for the realization of the standards being compared.

This protocol covers the general procedure for the key comparisons, BIPM.RI(I)-K1, BIPM.RI(I)-K2, BIPM.RI(I)-K3, BIPM.RI(I)-K4, BIPM.RI(I)-K5 and BIPM.RI(I)-K7. The key comparisons BIPM.RI(I)-K6 and BIPM.RI(I)-K8 have separate protocols as they presently use BIPM transfer instruments at the NMI site.

Comparison of standards

1. The BIPM will measure the air kerma or absorbed dose to water using the NMI standard in the BIPM reference beams and compare the results with those measured by the BIPM standards.
2. The NMI standard to be used in the comparison must be fully described and the measurement method equation should be fully detailed so as to document the traceability to the SI for the quantity being compared.
3. Publications referring to the NMI standard and in particular any correction factors to be applied should be provided by the NMI.
4. A full uncertainty budget should be provided by the NMI, preferably in advance of the comparison. Uncertainties are evaluated at a level of one standard uncertainty.
5. The comparisons, BIPM.RI(I)-K1, BIPM.RI(I)-K2 and BIPM.RI(I)-K5 are normally made using the NMI primary standards at the BIPM; BIPM.RI(I)-K3, BIPM.RI(I)-K4 and BIPM.RI(I)-K7 are normally made using transfer standards. Note that for BIPM.RI(I)-K4, the NMI standard to be used must be waterproofed, either by itself or by using a waterproof sleeve or holder.
6. The reference conditions for the comparison are those agreed by the CCRI(I); see also [6].
7. The BIPM standards are used regularly to assure the stability of the key comparison reference value.
8. The BIPM correction factors and uncertainty budgets are given in [6].

Transfer standards

9. Where NMI transfer standards are used, a detailed description of the devices: manufacturer, type, serial number, size, weight, packaging, etc. and technical data needed for their operation must be supplied prior to the comparison; a form is provided by the BIPM to supply this information.
10. If a transfer standard is sent unaccompanied to the BIPM, advice on handling the transfer standard, including unpacking and subsequent packing and return shipping to the participating institute should be provided; this should include a complete list of the contents of the package and the weight and size of the whole package.

Measurement procedure

11. The NMI is expected to ensure that their standard is in perfect working order prior to the comparison and to make all the arrangements for its safe transport.
12. When the comparison uses one or more NMI transfer standards, these should have a demonstrated stability through repeated calibrations at the NMI prior to the comparison at the BIPM and again after the comparison visit. The calibration coefficients of the transfer standards should be given to the BIPM on arrival.
13. The measurements for each comparison at the BIPM can normally be made over five working days. In some cases, comparisons can be run in parallel but confirmation of this is needed prior to the comparisons taking place.
14. A representative of the NMI should be present during the comparison to oversee the safe handling and use of the NMI standard, monitor the measurements and discuss the results.

Comparison result

15. When a primary standard has been used, the comparison result is obtained as soon as the comparison measurements are completed and analysed.
16. When a transfer standard has been used, the NMI will normally need to check the calibration coefficients of the transfer standard on return to the NMI before the outcome of the comparison is discussed.
17. The post-comparison results should be sent to the BIPM within 4 weeks of the comparison measurements. This is important to identify any problems particularly with the use of a transfer standard during the comparison.
18. The comparison report is prepared for publication as described in the *Guidelines*.

Instrumentation transport

19. Before transporting instruments to the BIPM, the appropriate administrative documents should be completed by the NMI. These are sent by the BIPM as soon as the comparison dates are arranged.
20. In general each participating institute is responsible for its own costs regarding the measurements, transportation and any customs charges as well as any damage that may occur within its country.
21. If the NMI wishes to insure its standards, then it is the responsibility of the NMI to do so. The BIPM does not normally provide insurance cover.

Chronological References

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- [4] Allisy P.J., Burns D.T., Andreo P., International framework of traceability for radiation dosimetry quantities, [*Metrologia*, 2009, **46\(2\)**, S1-S8](#)
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- [6] Allisy-Roberts P.J., Burns D.T., Kessler C., Measuring conditions and uncertainties for the comparison and calibration of national dosimetric standards at the BIPM, [*Rapport BIPM-2011/04*](#), 21 pp
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- [9] Allisy-Roberts P.J., Burns D.T., Summary of the BIPM.RI(I)-K4 comparison for absorbed dose to water in ^{60}Co gamma radiation, [*Metrologia*, 2005, **42**, *Tech. Suppl.*, 06002](#)
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- [12] Burns D.T., Degrees of equivalence for the key comparison BIPM.RI(I)-K2 between national primary standards for low-energy x-rays, [*Metrologia*, 2003, **40**, *Tech. Suppl.*, 06031](#)
- [13] Burns D.T., Degrees of equivalence for the key comparison BIPM.RI(I)-K3 between national primary standards for medium-energy x-rays, [*Metrologia*, 2003, **40**, *Tech. Suppl.*, 06036](#)
- [14] Boutillon M., Allisy-Roberts P.J., Measurement of air kerma and ambient dose equivalent in a ^{137}Cs beam, 1996, [*Rapport BIPM-96/7*](#), 12 pp.
- [15] Boutillon M. and Niatel M.-TA., Study of a graphite cavity chamber for absolute measurements of ^{60}Co gamma rays, 1973, [*Metrologia*, **9**, 139-146](#).