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## Inter-laboratory test for gas concentrations measurements of the R3C network's calorimetric chambers

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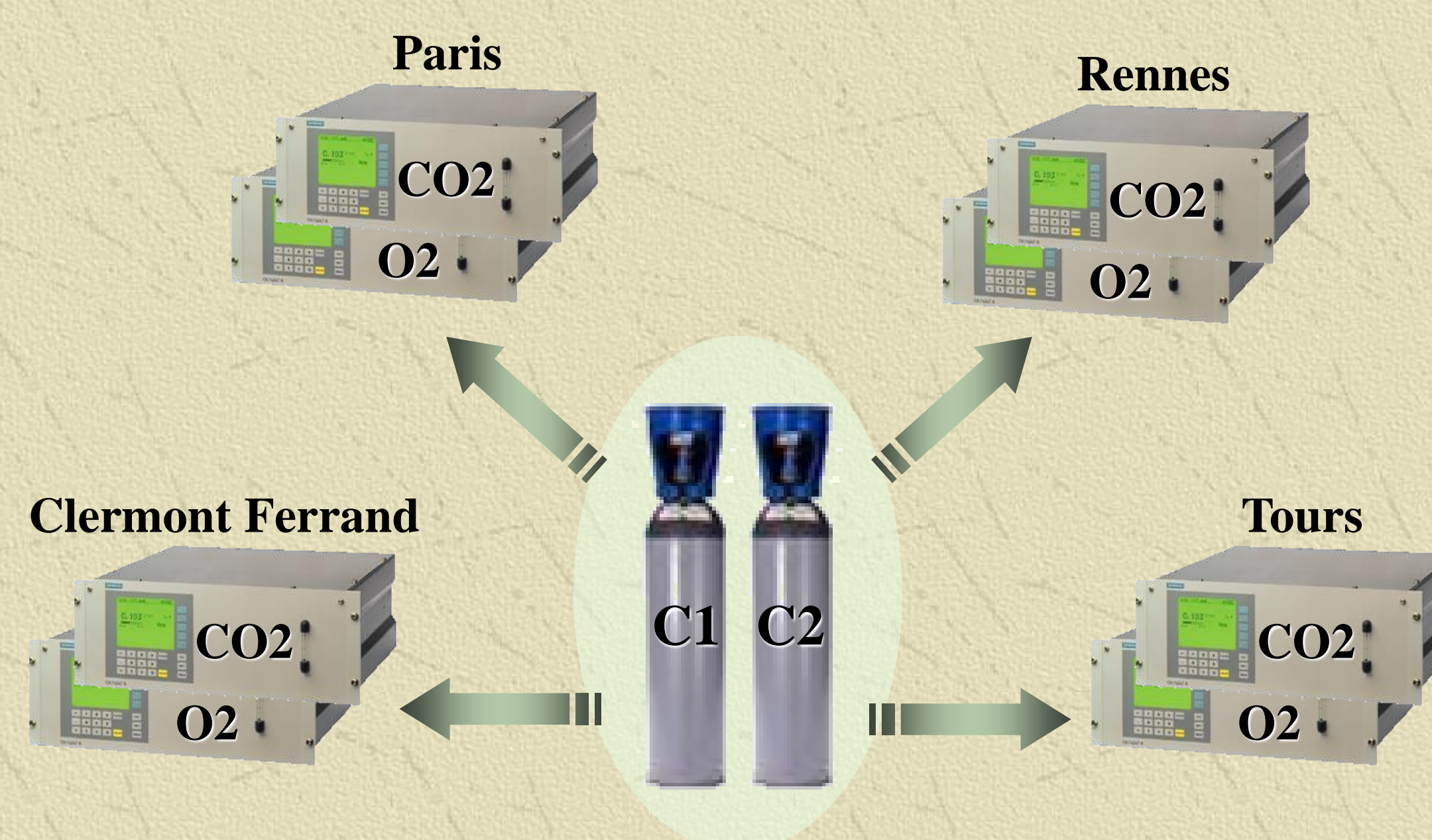
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**Introduction :** Four sites (Clermont Ferrand, Paris, Rennes, and Tours) involved in the R3C (Réseau de Compétence en Chambre Calorimétrique) network have facilities to determine energy expenditure (EE) by indirect calorimetry. EE is computed from the measurements of the O<sub>2</sub> and CO<sub>2</sub> concentration changes in calorimetric chamber (CC) during the stay of a volunteer or an animal (depending on the site). To obtain reliable values, gas analyzers have to be calibrated using standard gases. As the precision we need for these gases is not available in the gas trade, each site built its own standard gas and control it with its previous standard. Then the values of the standard gases may progressively drift for each site. Moreover such a drift could impact on EE calculation.

The **objective** was to obtain from each site the measurements of the O<sub>2</sub> and CO<sub>2</sub> concentrations in the same gases mixtures and to examine the degree of concordance/discordance between the four sites and their consequences on EE calculations. This represents a necessary control before multicentric studies involving EE measurements could be carried out.

**Design of the study :** Each site is equipped with a couple of analyzers (O<sub>2</sub> and CO<sub>2</sub>). 2 cylinders (C1 and C2) were filled with 2 different mixtures of gas to obtain appreciative concentrations about 20.200 % and 20.600 % (O<sub>2</sub>), and 0.800 % and 0.400 % (CO<sub>2</sub>), respectively for C1 and C2. Both cylinders moved from one site to another. From 5 non-consecutive measurements on each site, we obtain the real mean values for O<sub>2</sub> and CO<sub>2</sub> concentrations of C1, and the same for C2.



## Results

Figure 1

Fig 1 presents the results obtained for O<sub>2</sub>. Compared to the mean values, the differences ranged from 0.2 to 4.4% for C1 and from 0.2 to 2.7% for C2. The SD was 3.2 and 2.0% for C1 and C2 respectively.

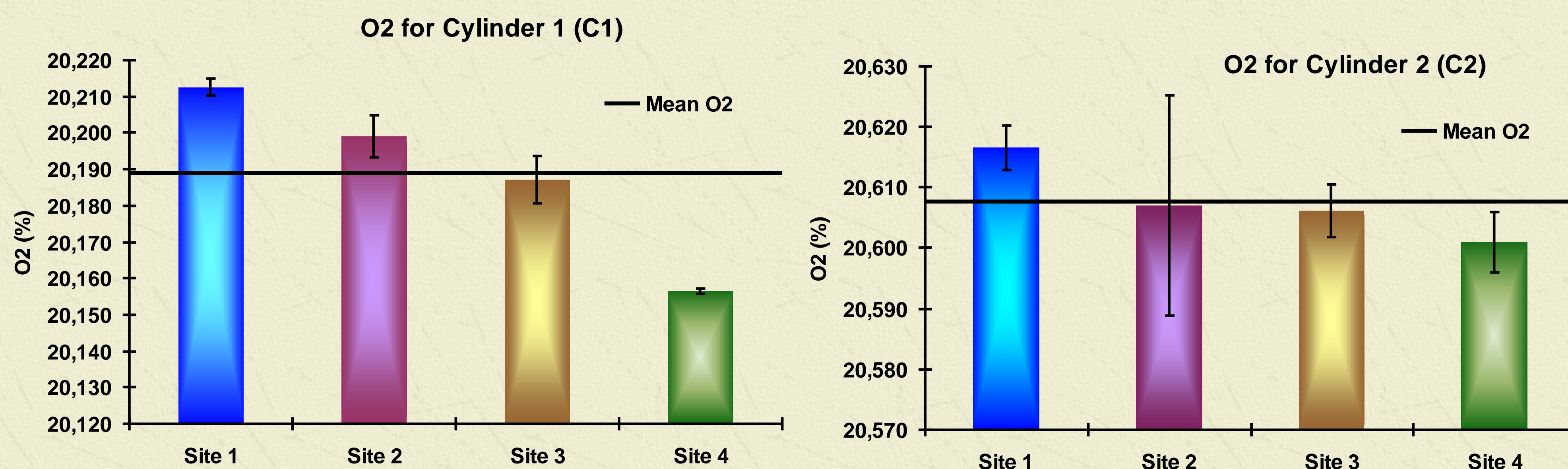


Figure 2

Fig 2 presents the results obtained for CO<sub>2</sub>. Compared to the mean values the differences ranged from 0.6 to 2.6% for C1 and from 0.1 to 3.9% for C2 with a SD of 2.2 and 2.8% for C1 and C2 respectively.

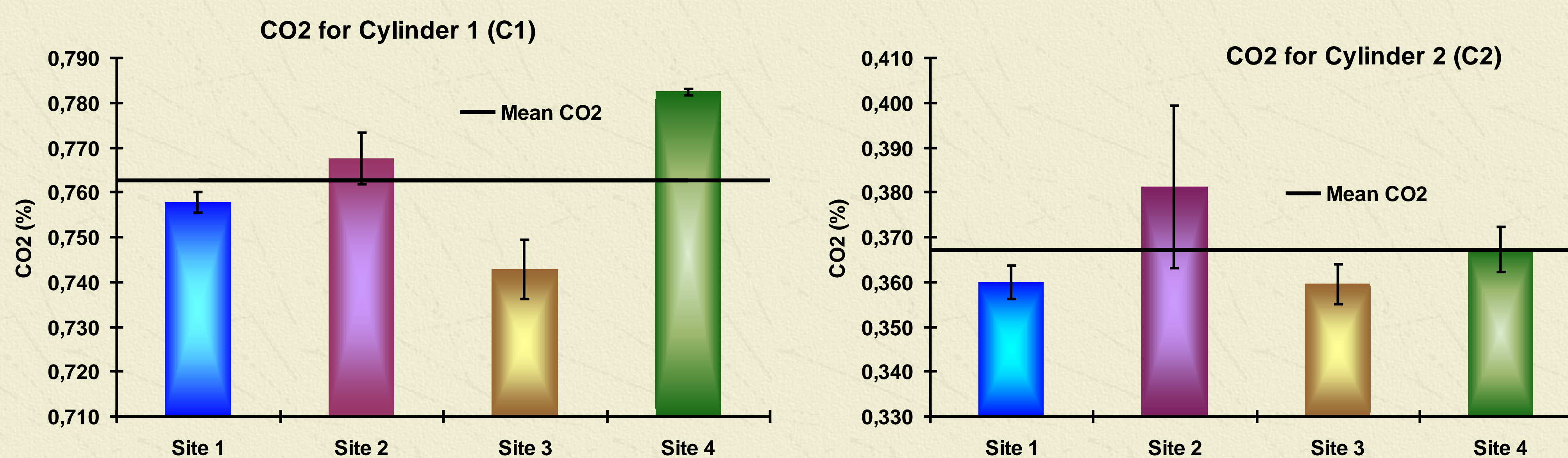
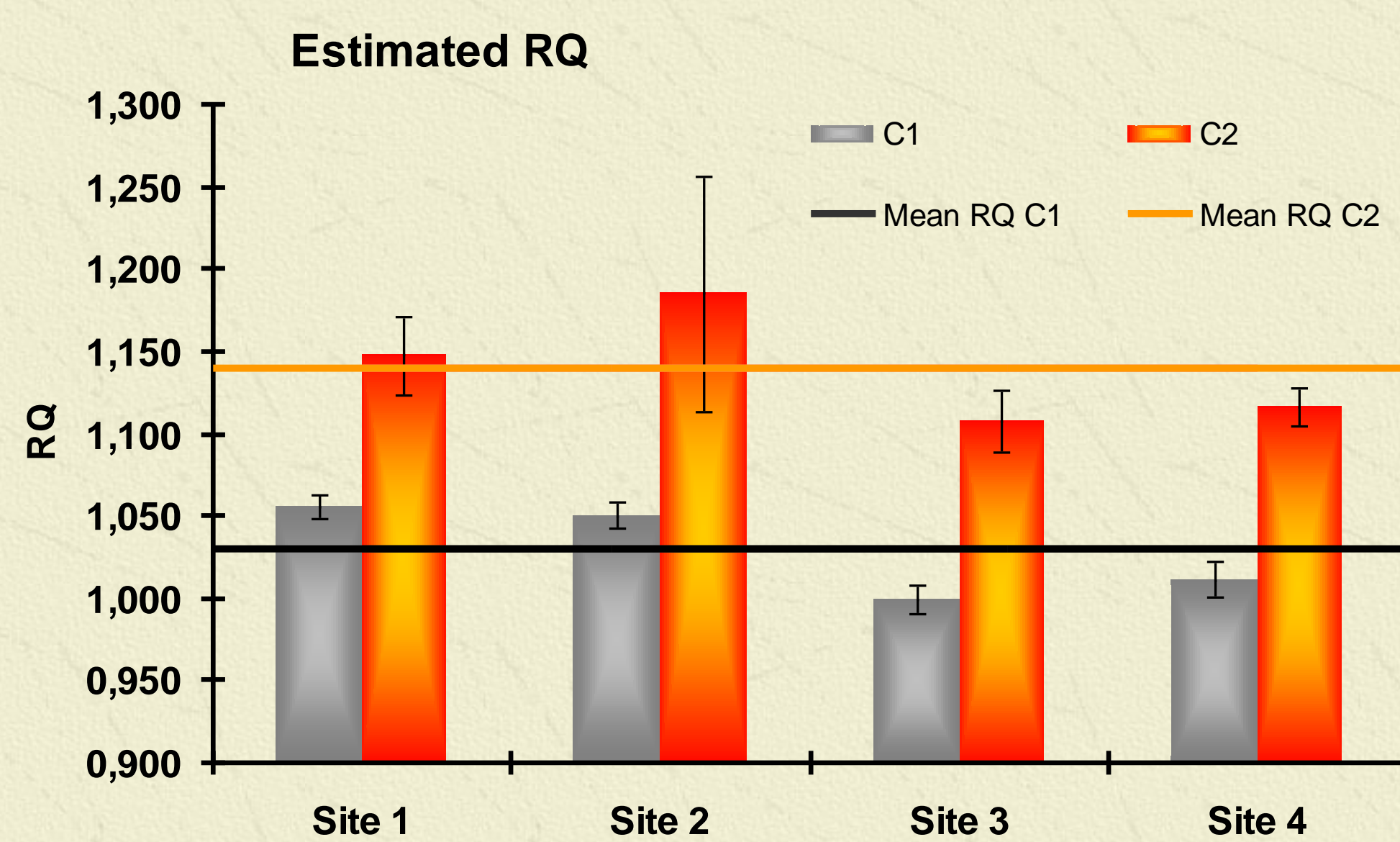


Figure 3

The results obtained for the respiratory quotient (RQ) are shown in Fig 3. The differences between sites were  $0.016 \pm 0.040$  for C1 and  $0.018 \pm 0.051$  for C2 respectively.



### Example of consequences on EE

If drift = 2% (O<sub>2</sub> and CO<sub>2</sub>)



Error on EE is about 1.6 %

**Conclusions :** The results underscore that differences of measurement exist between the 4 sites of the R3C network involved in this test. From this inter-laboratory test first approach, we can quantify differences of O<sub>2</sub> and CO<sub>2</sub> concentration measurements between the sites. We can take these differences into account, even if they are low, in order to manage multi-sites and epidemiologic studies providing comparable results of EE, after correction if necessary. The setting of correcting methods and the writing of a rigorous inter-laboratory test procedure, are the next steps of this work.