

APPENDIX II: Consistency of two means: the t-test.

In the two sets of measurements,  $n_1$  of  $x_1$  and  $n_2$  of  $x_2$ , are consistent (i.e. they agree within about the sum of their standard deviations) and are pooled, the best estimate of the standard deviation of the parent population, of which the  $n_1+n_2$  measurements are a compound random sample, is

$$\sigma_{x_1+x_2} = \left[ \frac{\sum_{i=1}^{n_1} x_i^2 - \left(\sum_{i=1}^{n_1} x_i\right)^2/n_1 + \sum_{i=1}^{n_2} y_i^2 - \left(\sum_{i=1}^{n_2} y_i\right)^2/n_2}{(n_1-1) + (n_2-1)} \right]^{1/2}$$

where  $n_1+n_2-2$  is the number of degrees of freedom (which range from 40 to 250 in this work). As a working parameter in this t-test, we write

$$t \equiv \frac{\bar{x}_1 - \bar{x}_2}{\sigma_{(x_1 + x_2)}} \times \left( \frac{n_1 n_2}{n_1 + n_2} \right)^{1/2}$$