# Errors in all variables

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**Abstract**

In the absence of a global plasma model describing energy confinement in fusion devices, scaling laws are a well established by-pass. Being decorated with a scaling exponent all machine variables which have an influence on the confinement enter such a scaling law on input. But not only the quantity on output, i.e. the confined energy, is the result of a measurement process and carries an uncertainty, also most of the machine variables have to be measured during the experiment and are therefore known only within a certain error margin. One possibility to incorporate these uncertainties of the variables is to make use of the error propagation law which leads to an increase in the standard deviation of the response variable [1]. We present a Bayesian approach, however, which takes care of both the uncertainties in the dependent and the independent variables. To start with we consider the estimation of the coefficients ($a$, $b$) of a straight line in two dimensions, $y = ax + b$. Following this we go on to the case of a model function which is nonlinear in its variables, but linear in the parameters. Here we consider the simple case of a parabola, $y = ax^2 + bx + c$. Finally we come back to the original problem of determining the exponents of a scaling law, where in logarithmic form the scaling exponents are linear coefficients of nonlinear (i.e. logarithmic) variables.
The physics results will be presented on a separate poster.

References:

[1] R. Preuss, V. Dose and W. von der Linden, Nucl. Fusion **39**, 849 (1999).

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