

## **Calibration of Quadrupole Magnets via Response Matrix Fitting, L. FARVACQUE and R. NAGAOKA,**

ESRF - A precise knowledge of the mapping between current and field of the quadrupoles is essential for the operation of the new generation light sources, whose low emittance optics is generally highly sensitive to fine tuning. On top of possible uncertainties in the basic field measurements, the final assembly of magnets could produce unknown interferences, whose cumulative contributions could significantly influence the calibration. To obtain an accurate effective calibration, the determination of the quadrupole strengths is attempted directly with beam by fitting the model response matrix to the measured, as the BPMs have the relative accuracy down to microns. As the response matrix involves steerers that introduce another uncertainty, the steerer calibration is incorporated altogether in the fitting. Averaging is made over the matrix to reduce the quadrupole degree of freedom to families. To be able to survey the current dependence of the calibration, the response matrix is measured over different optics and at different energies. The results suggested a trend that a residual saturation effect must be added on the original calibration. The obtained precision, in terms of tunes, is roughly one degree per cell in both planes, nearly over the whole operating range.