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As part of our efforts to harness mathematic to make our planet smarter, and in particular more instrumented, one ought to consider optimal setting of measurement sensors and even more generally any other controllable parameters of the apparatus and process (e.g. regularization). While design for well-posed problems has been extensively studied in past years, very little attention has been devoted to its ill-posed counterpart. This stands in contrast to the fact that we challenge more and more of real-life problems are of such nature. In this talk we shall describe some of the intrinsic difficulties associated with ill-posed inverse problems, lay out a coherent mathematical formulation to address them and finally demonstrate the importance of design for both medical and geophysical imaging problems. (Received September 23, 2009)