

method: change the fitting method

Set the minimization method.

Syntax: **method** <algorithm> [<# of trials/evaluations> [<critical delta>]
[method-specific options]

where <algorithm> is the method in use and the other arguments are control values for the minimization. Their meanings are explained under the individual methods. Note that all but **leven** require the MINUIT library from CERN to be linked into XSPEC. If any of the MINUIT library methods are set, then the **error** command will use the MINUIT MINOS command to find the confidence regions.

XSPEC is required to calculate derivatives of the fit statistic with respect to the model parameters for both the **leven** and **migrad** methods. **leven** further requires second derivatives. By default, XSPEC calculates these using an analytic expression which assumes that partial 2nd derivatives of the model with respect to its parameters may be ignored. This may be changed by setting the USE_NUMERICAL_DIFFERENTIATION flag to “true” in the user’s startup Xspec.init initialization file. XSPEC will then calculate all derivatives numerically, which can be noticeably slower.

leven

method leven [<# of eval> [<crit delta>]]

The default XSPEC minimization method using the modified Levenberg-Marquardt based on the CURFIT routine from Bevington. <# of eval> is the number of trial vectors before the user is prompted to say whether they want to continue fitting. <crit delta> is the convergence criterion, which is the (absolute, not fractional) difference in fit statistic between successive iterations, less than which the fit is determined to have converged. <# of eval> and <crit delta> may also be changed through the **fit** command.

migrad

method migrad [<# of eval> [<crit delta>]]

The MINUIT MIGRAD method. <# of eval> is the number of function evaluations to perform before giving up and <crit delta> is the convergence criterion.

XSPEC12.0 includes version 94.1 of the CERN MINUIT library – dated August 1998. The manual for the library is included with the XSPEC12 documentation and can be accessed by

```
XSPEC12>help minuit
```

When minuit is used, the output from the fitting procedure is different from xspec’s normal behavior. It is written to the file mn_output.log in the current directory. For uncertainty calculations (the error command), XSPEC calls the equivalent MINUIT implementation (MNERRS).

Following the advice in section 5 of the MINUIT manual, instead of providing the full range of MINUIT methods, most of which are said to be inferior, we have chosen to give access to the robust **migrad** algorithm.

Advice

migrad uses only first derivatives of models, and part of its operation is to approximate the Hessian, or second derivative matrix. The Levenberg-Marquadt assumes that the model is twice [numerically] differentiable, and calculates the Hessian explicitly. Thus the latter is the method of choice for analytical models.

minim

method minim [<# of evaluations> [<critical delta>]]

The MINUIT MINIMIZE method, used MIGRAD unless it gets into trouble in which case it switches to SIMPLEX. <# of evaluations> is the number of function evaluations to perform before giving up and <critical delta> is the convergence criterion.

monte

method monte [<# of evaluations> [<critical delta>]]

The MINUIT SEEK method, a simple random sampling of parameter space (not recommended!). <# of evaluations> is the number of function evaluations to perform before giving up and <critical delta> is the convergence criterion.

simplex

method simplex [<# of evaluations> [<critical delta>]]

The MINUIT SIMPLEX method. <# of evaluations> is the number of function evaluations to perform before giving up and <critical delta> is the convergence criterion.