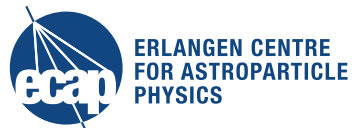


Covariance matrix + butterfly plots in ctools

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ctools coding sprint
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Confidence regions/ covariance matrix information

- analysis: fitting of a model → **ctlike**



- clike.log ← curvature matrix (not helpful)
- model-xml file ← error information

- **no direct access to covariance matrix**
- **no access to error ellipses/conf. regions**
- **no handle on correlation of parameters and related uncertainties**

This is important information which should be provided

What to provide, how to provide?

- covariance matrix, e.g. fits file, structured information (flag)
- likelihood profiles → which parameters? output format?
→ very much related to cterror I think...

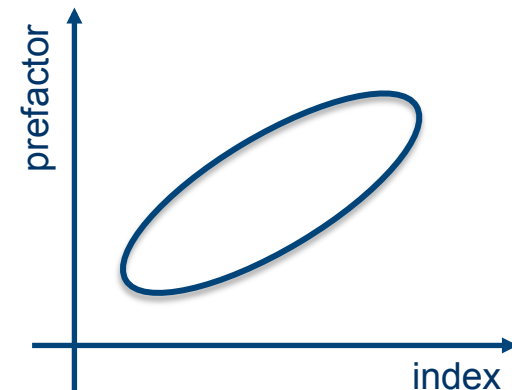
ctbutterfly - confidence bands for spectrum plots

Purpose

- calculate confidence band around best fit model, according to a specified confidence level (e.g. 68%)

Status

- **only working for pure power law**
 - from covariance matrix calculate error ellipse
 - for discrete energy values 'walk around the ellipse'
 - take min/max (envelopes)



→ this needs some kind of generalization to get confidence bands for arbitrary spectral models

ctbutterfly - confidence bands for spectrum plots

Possible solution, which works easily for arbitrary spectral models:

→ Gaussian error propagation to obtain confidence band:

$$\Delta F = \text{grad } F \begin{bmatrix} \text{cov.} \end{bmatrix} \text{grad } F$$

covariance matrix

- widely used implementation
- not too complicated to implement
- easily applicable to arbitrary spectral models