



AHELP for CIAO 3.4

## chisquare

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### Synopsis

Chi-square statistic.

### Description

The chi-square statistic is

$$\chi^2 = \sum_i [ [ N(i,S) - B(i,x,pB) - S(i,x,pS) ]^2 / \sigma(i)^2 ]$$

where  $N(i,S)$  is the total number of observed counts in bin  $i$  of the on-source region;  $B(i,x,pB)$  is the number of predicted background model counts in bin  $i$  of the on-source region (zero for background-subtracted data), rescaled from bin  $i$  of the off-source region, and computed as a function of the model argument  $x(i)$  (e.g., energy or time) and set of background model parameter values  $pB$ ;  $S(i,x,pS)$  is the number of predicted source model counts in bin  $i$ , as a function of the model argument  $x(i)$  and set of source model parameter values  $pS$ ; and  $\sigma(i)$  is the error in bin  $i$ .

The options for assigning  $\sigma(i)$  are described in the documentation for CHI DVAR (CHIDVAR), CHI GEHRELS (CHIGEHRELS), CHI MVAR (CHIMVAR), and CHI PRIMINI (CHIPRIMINI). In each of these files,  $N(i,B)$  is the total number of observed counts in bin  $i$  of the off-source region;  $A(B)$  is the off-source 'area,' which could be the size of the region from which the background is extracted, or the length of a background time segment, or a product of the two, etc.; and  $A(S)$  is the on-source 'area.'

In the analysis of PHA data,  $A(B)$  is the product of the BACKSCAL and EXPTIME FITS header keyword values, provided in the file containing the background data.  $A(S)$  is computed similarly, from keyword values in the source data file.

Note that in the current version of Sherpa, it is assumed that there is a one-to-one mapping between a given background region bin and a given source region bin. For instance, in the analysis of PHA data, it is assumed that the input background counts spectrum is binned in exactly the same way as the input source counts spectrum, and any filter applied to the source spectrum automatically applied to the background spectrum. This means that currently, the user cannot, e.g., specify arbitrary background and source regions in two dimensions and get correct results. This will be changed in a future version of Sherpa.

(However, this limitation only applies when analyzing background data that have been entered with the BACK command. One can always enter the background as a separate dataset and jointly fit the source and background

regions.)

## Bugs

See the [Sherpa bug pages](#) online for an up-to-date listing of known bugs.

## See Also

*sherpa*

[bayes](#), [cash](#), [chicvar](#), [chidvar](#), [chigehrels](#), [chimvar](#), [chiprimini](#), [cstat](#), [get\\_stat\\_expr](#), [statistic](#), [truncate](#),  
[userstat](#)

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URL:  
<http://cxc.harvard.edu/ciao3.4/chisquare.html>  
Last modified: December 2006