Diffuse model fitting

A. Strong, Dec. 2001

Fitting SPI data to *spatial* models

e.g. 1809 keV to CO, free–free, FIR, etc
    511 keV to sum of Gaussians
    continuum to HI+CO+inverse Compton+sources

Good method to produce spectra of diffuse emission
Alternative to imaging (e.g. spiskymax)
Many s/w components in common with other
imaging s/w (data, response)

Bayesian method:

advantages:
straightforward treatment of multiparameter problems
adopted for many current astrophysical analyses
large current literature, growing
expertise at nearby CIPS institute

spidiffit:
input:
SPI data
SPI response (IRF)
model skymaps (multichannel, from gensky)

output
fit parameters, error bars, distributions
corresponding skymaps with error−bar skymaps
(−> spectra of any sky region)

method: MCMC (Monte−Carlo Markov Chain)

spidiffit version 1

error analysis for multiparameter problems

errors on arbitrary combinations of parameters can be obtained

for arbitrary linear combination, covariance matrix sufficient
(e.g. error on total of components for a fitted skymap
-> spectra with errors)

MCMC: Metropolis–Hastings method implemented

see ADD for mathematical details

spidiffit: ADD and first version written

Tested on simulated GCDE surveys, works well

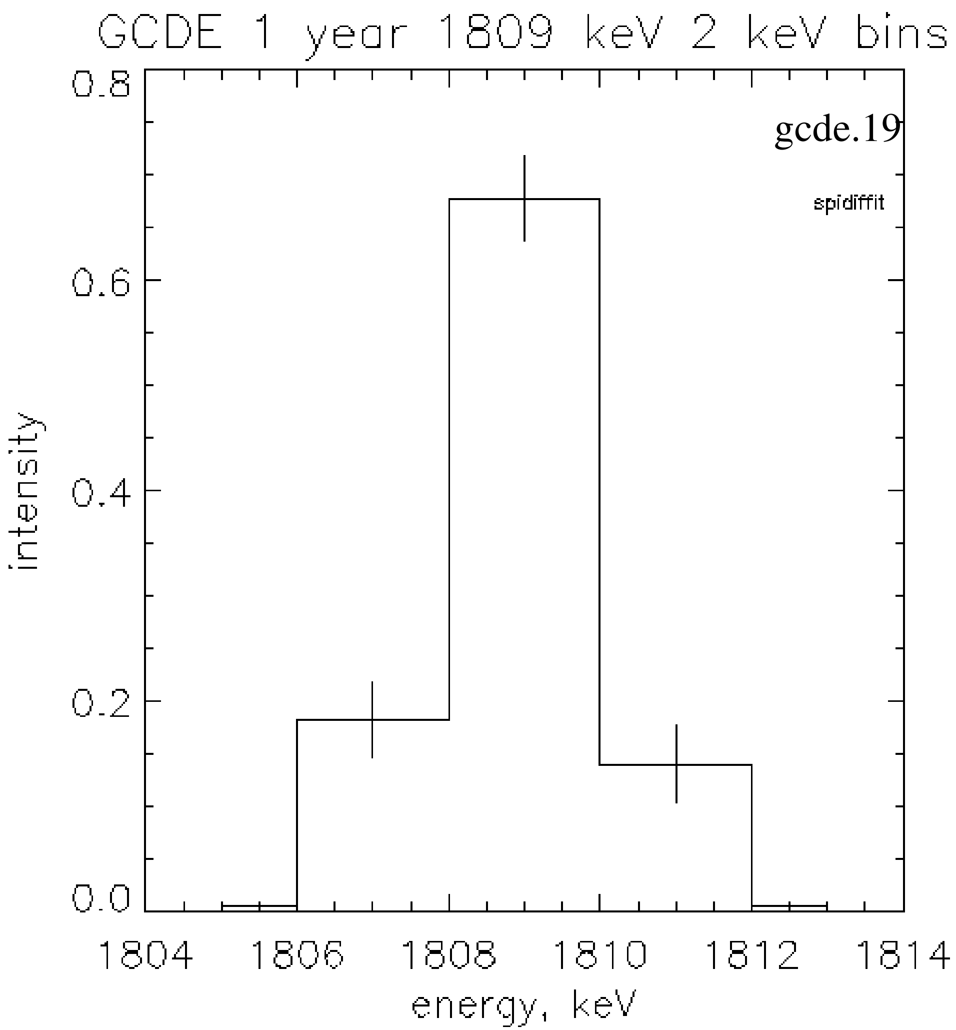
20 parameters: 1 model scaling, 19 detector background

model scaling is parameter of interest:
posterior marginalized over backgrounds

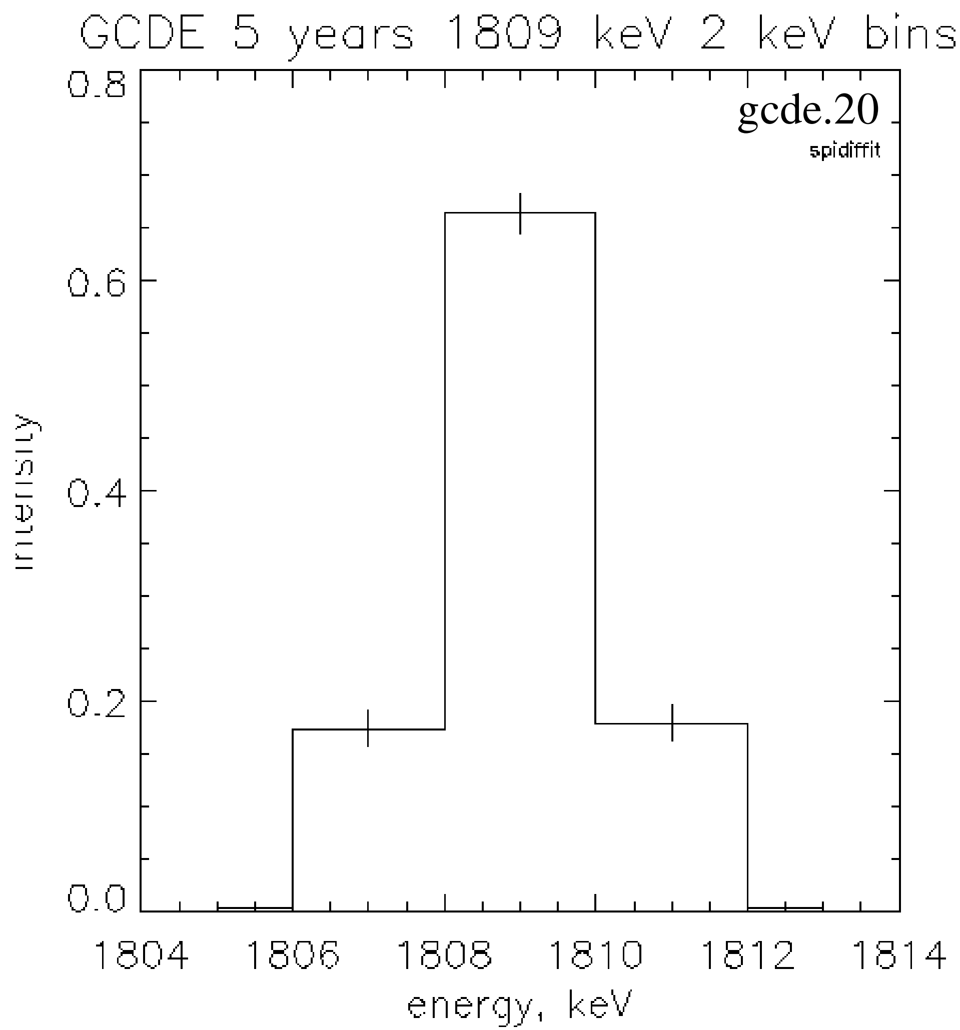
1809 keV 2.4 FWHM 240μm model scaled to COMPTEL maps

spidiffit, singles only

GCDE 1 year



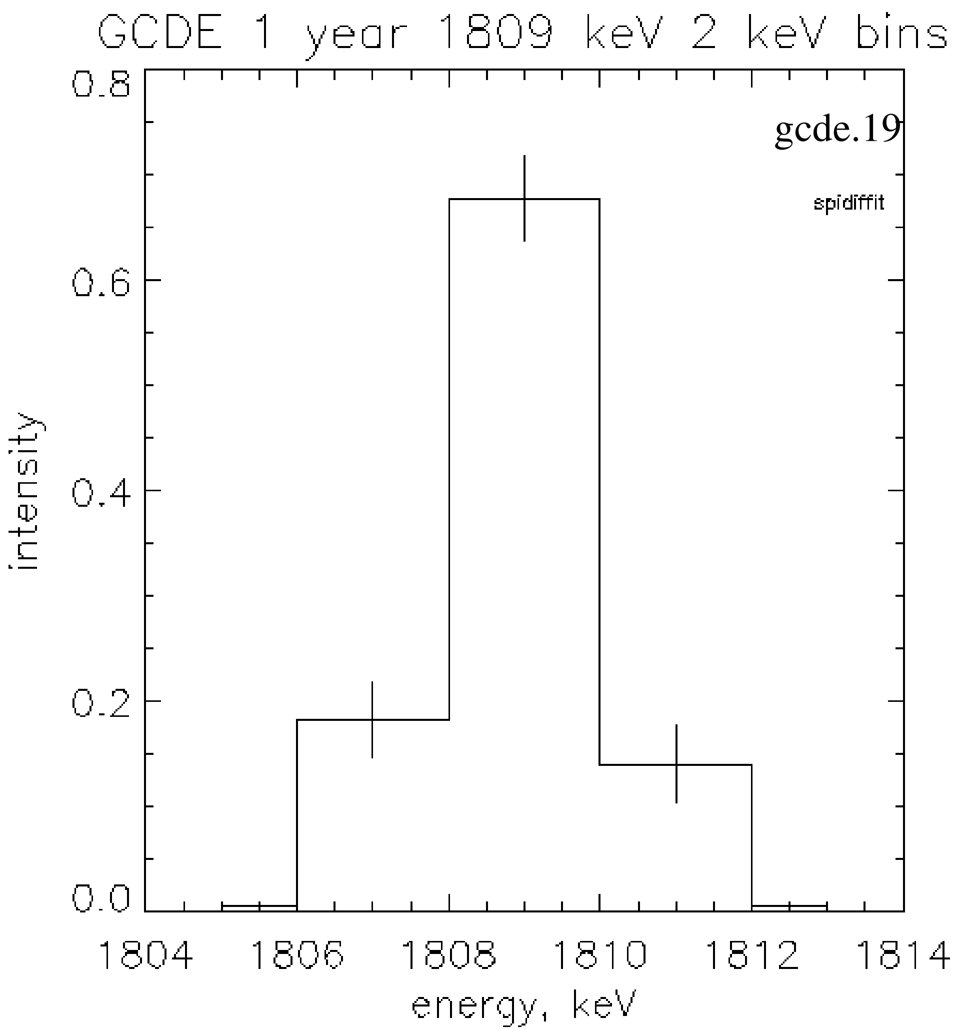
GCDE 5 years



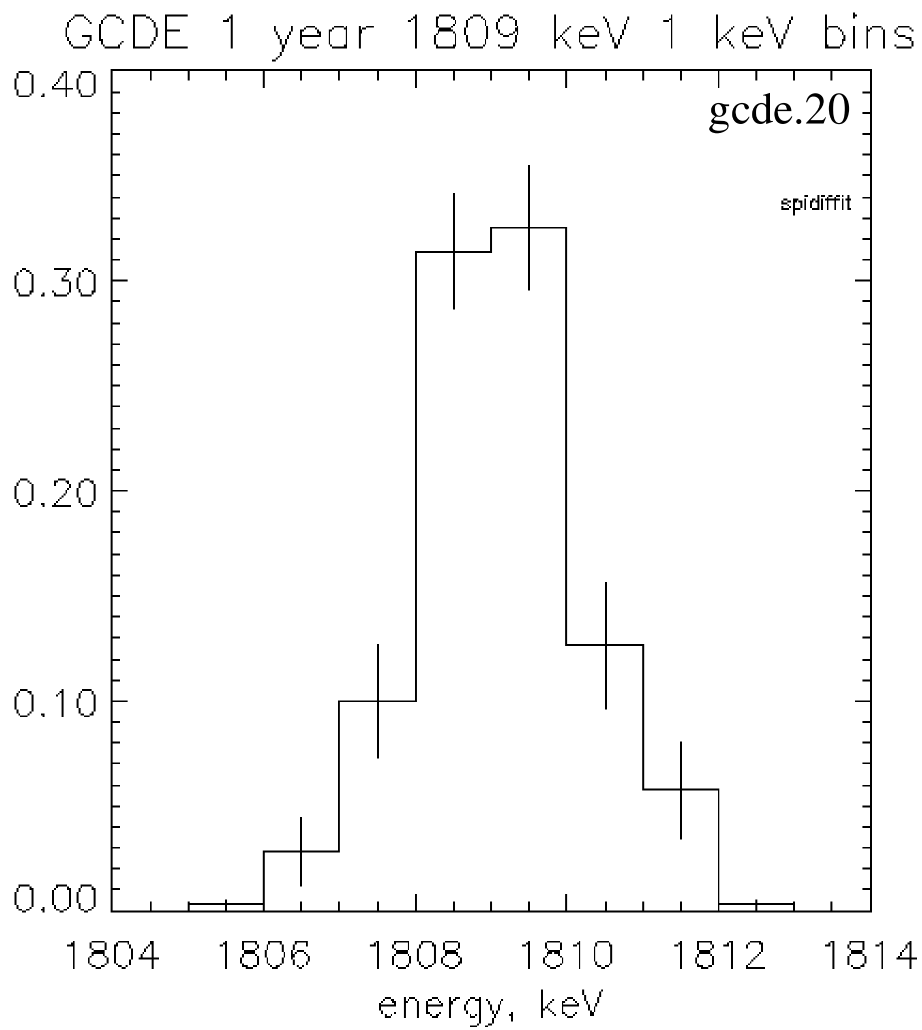
1809 keV 2.4 FWHM 240µm model scaled to COMPTEL maps

spidiffit, singles only

GCDE 1 year

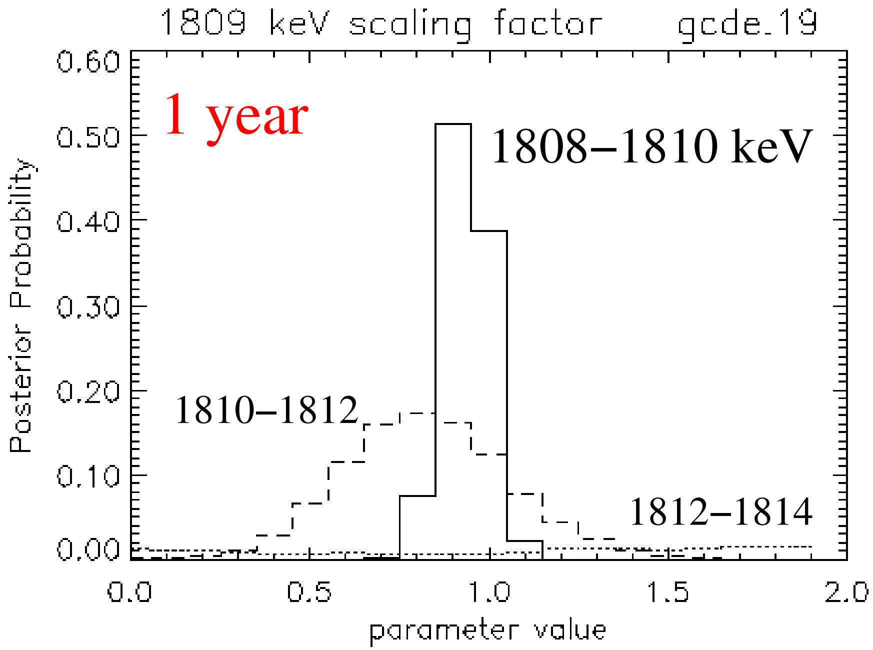


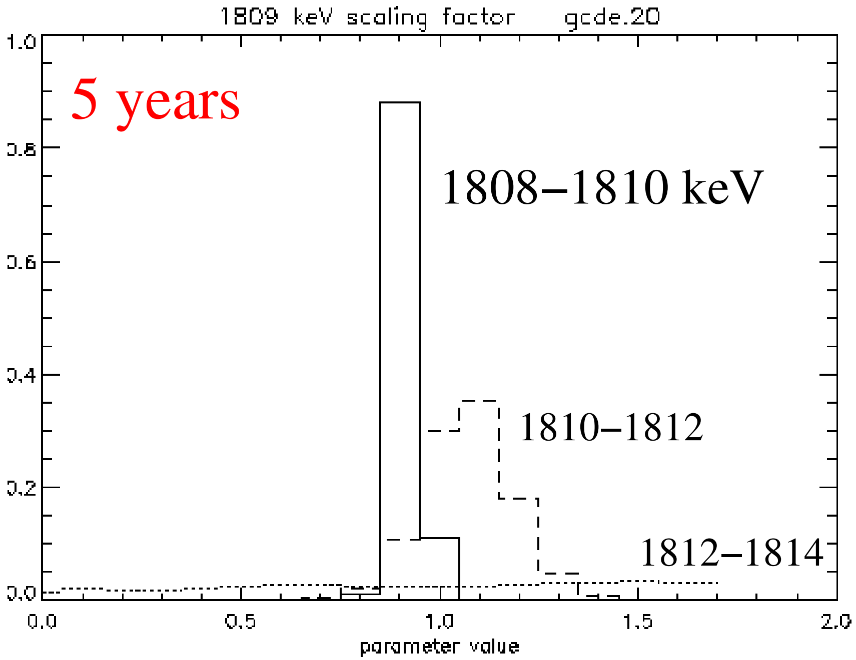
GCDE 1 years



GCDE 1809 keV 2.4 keV FWHM 240μm model

spidiffit parameter posterior distribution of scaling factor marginalized over background

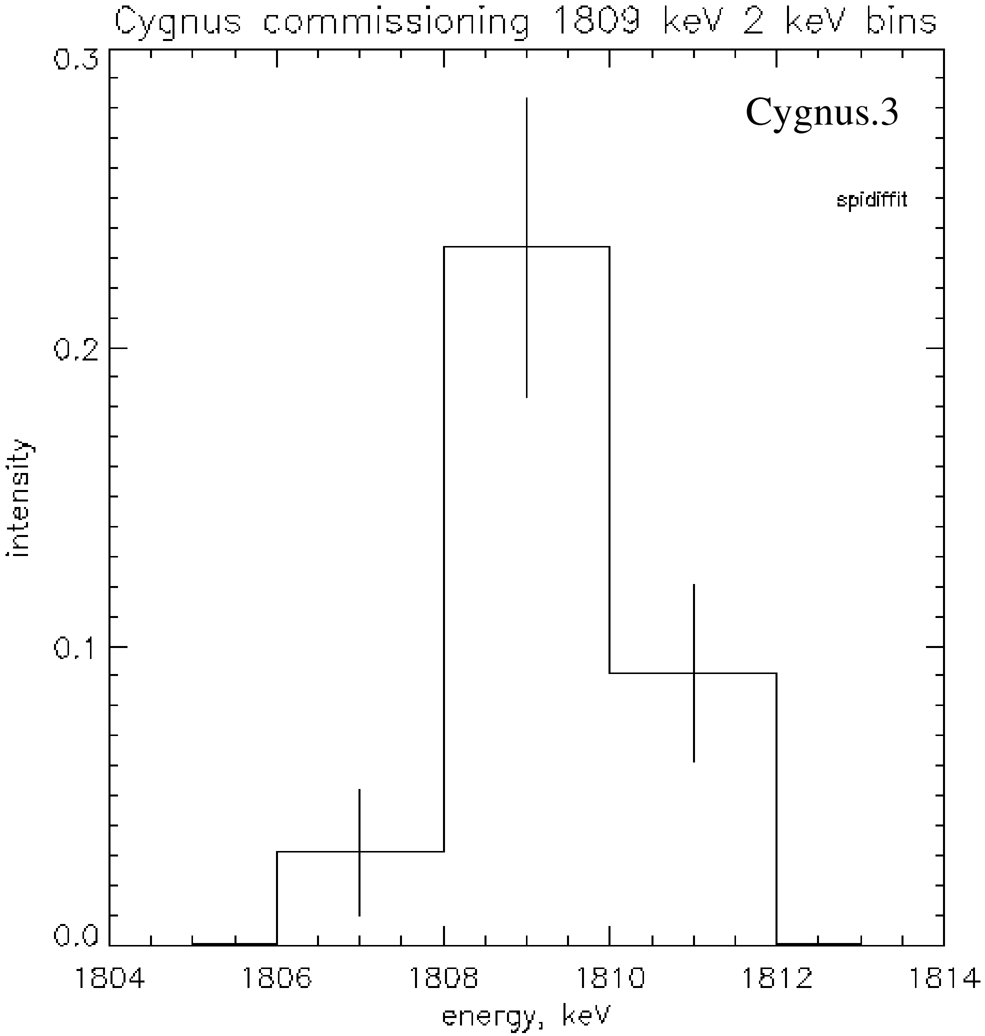




Commissioning phase = 0.9 Ms staring+3*0.27 Ms 5X5 +0.2 hex Ms

1809 keV 2.4 keV FWHM 240µm model

spidiffit



Pointings