

Use of XSPEC for XRISM (part II)

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General comments (yesterday)

Coming attractions (yesterday)

Handling the Resolve response matrix (yesterday)

Parallelization

Simultaneous fitting of Resolve and Xtend

Parallelization

Run the program multiple times
(note that PyXspec runs a single instance of xspec)

Multiple processes with their own memory copy

Multiple processes with common memory

XSPEC parallel command and PyXspec Xset.parallel create multiple processes with separate copies of memory. The operating system chooses how to distribute them over CPUs.

leven	partial derivatives wrt fit parameters
error	parameters
steppar	sections of grid
goodness	simulations
walkers	Goodman-Weare MCMC walkers

Cannot be stacked.

```
XSPEC12> xset APECMULTITHREAD yes
```

Parallelizes over temperatures within a model built on apec. Uses C++ threads for multiple processes with common memory.

```
vector<thread> threads;
for (size_t it=0; it<interpTindex.size(); it++) {
    tempFluxArray[it].resize(fluxArray.size());
    tempFluxArray[it] = 0.0;
    threads.push_back(thread([this, it, interpTindex, Zinput, abundZ,
                             interplonFrac, sourceFrameEnergy, isCEI,
                             minLineflux, &tempFluxArray, &tempMaxLineflux]() {
        calcLineSpectrumForTemperature(interpTindex[it], Zinput, abundZ,
                                       interplonFrac[it], sourceFrameEnergy, isCEI, minLineflux,
                                       tempFluxArray[it], tempMaxLineflux[it]);
    }));
}

for (auto& t : threads) t.join();
```

(Code generated with assistance from Google Bard)

Combining high res and low res data: A Toy Case

High resolution detector with FWHM 5 eV

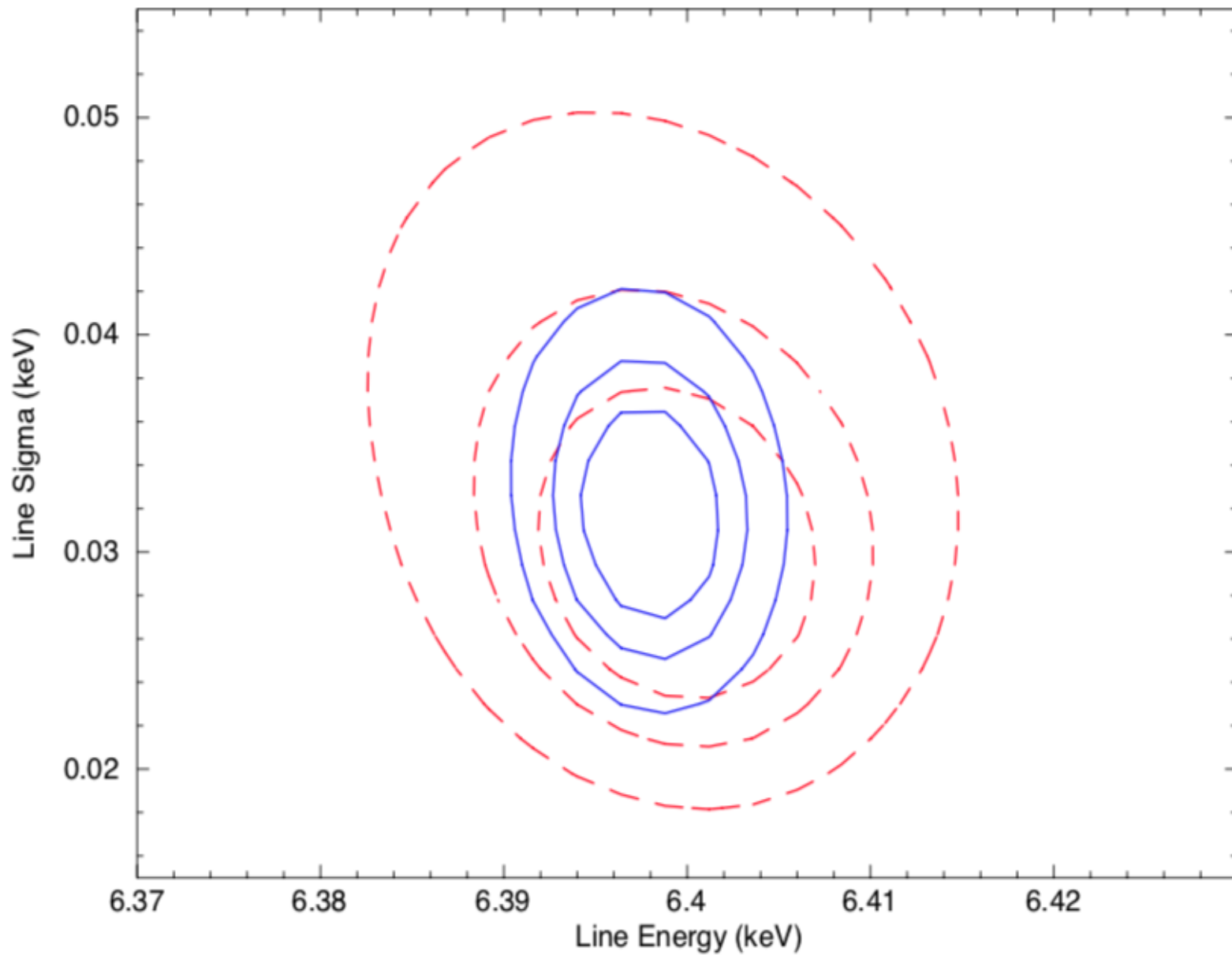
Low resolution detector with FWHM 100 eV and 10x the effective area of high resolution detector

Single gaussian line and power-law background.

Look at cases of 30 eV sigma line and 5 eV sigma line.

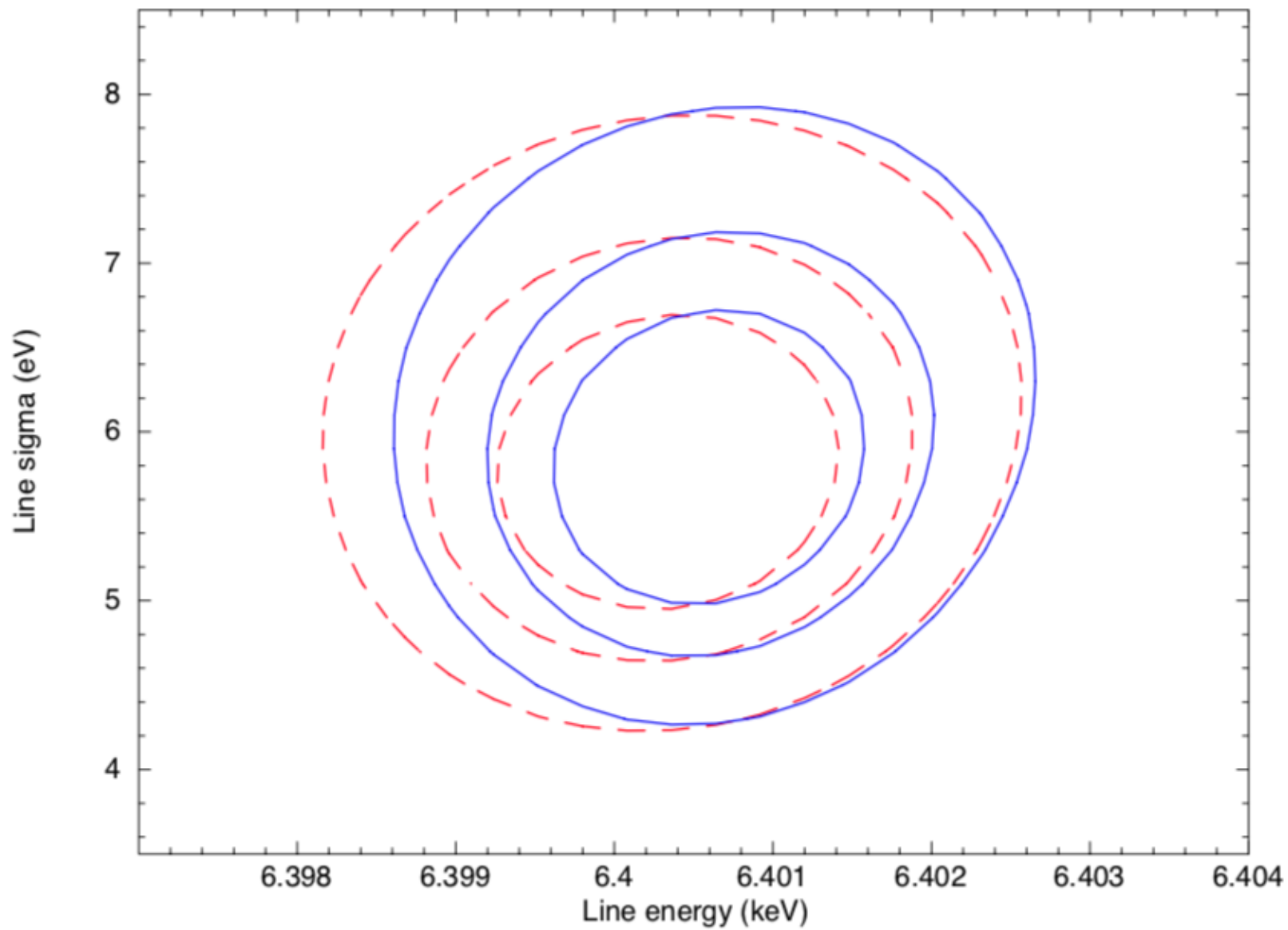
30 eV sigma line

Confidence contours
High resolution only and both



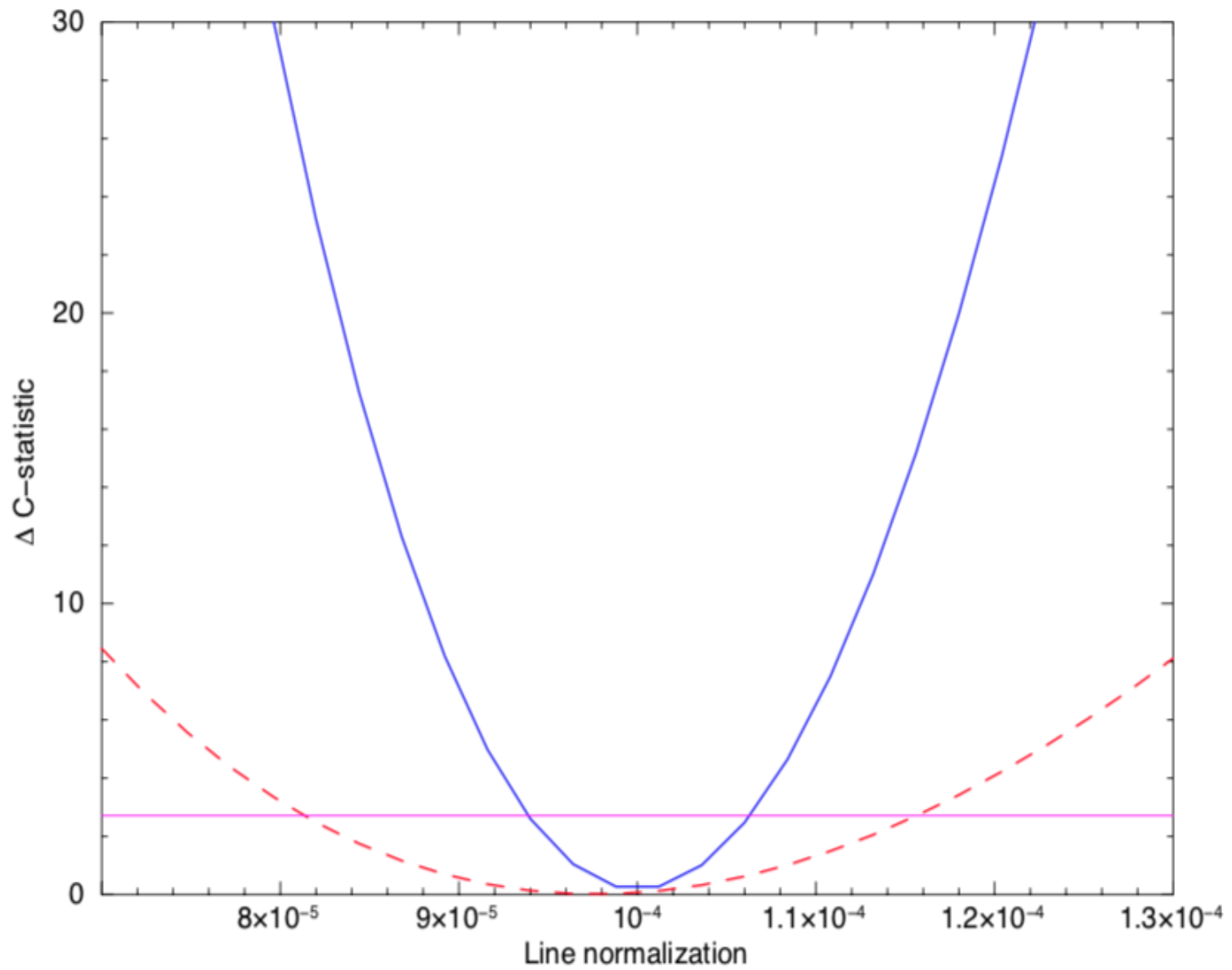
5 eV sigma line

Confidence contours
High resolution only and both



5 eV sigma line

High resolution only and both



Combining high res and low res data: What could possibly go wrong?

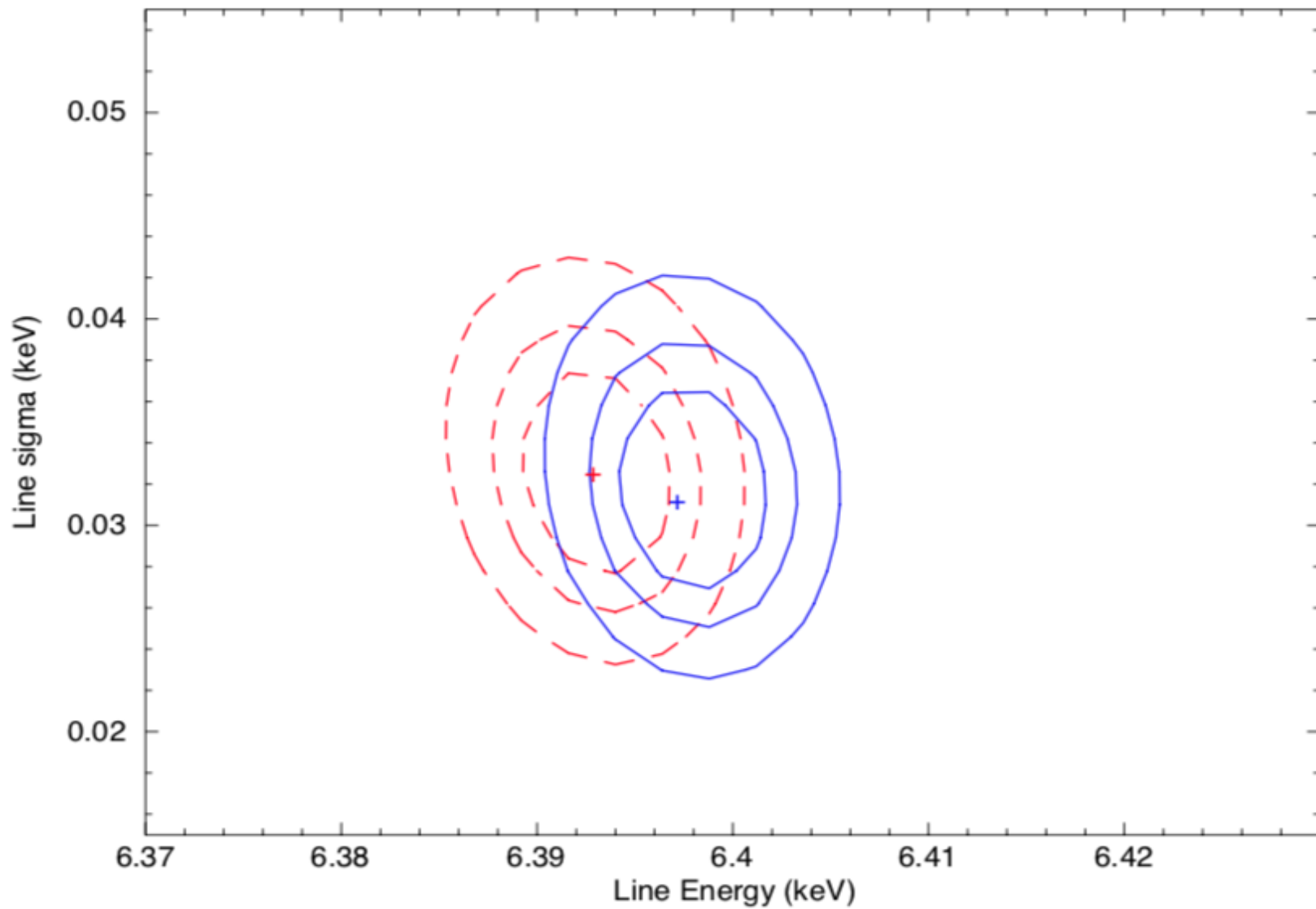
If the model is correct the greater number of counts in the low res data could drive the fit to a local minimum which doesn't work for the high res data. - Probably best to fit the high res data first.

If the model is incorrect then the fit may end up in a global minimum which doesn't work for the high res data. Find a better model.

If the low res data has calibration problems then the fit may not work for the high res data and the parameters may be wrong.

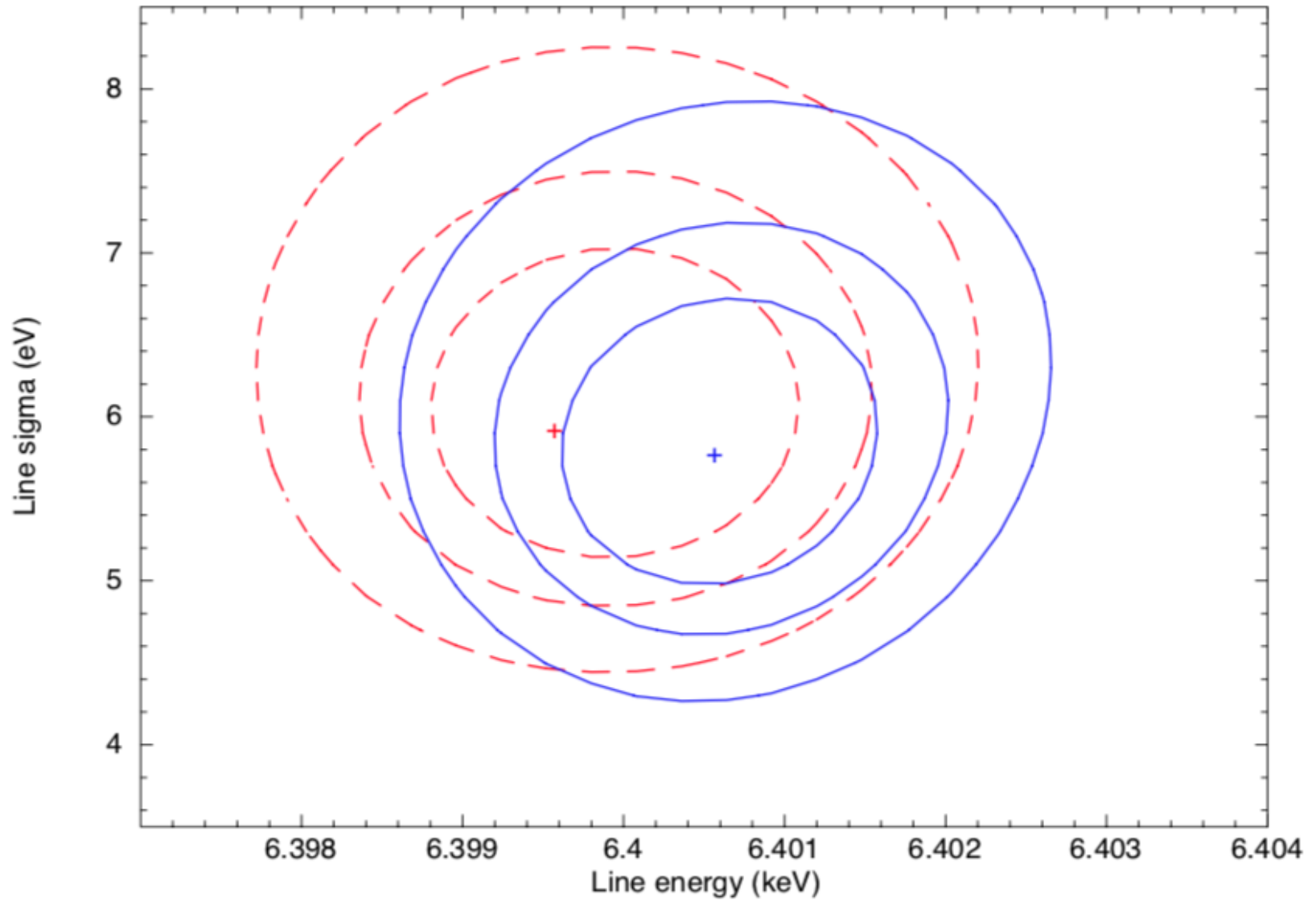
30 eV sigma line

Confidence contours
Original and with 0.1% gain shift for low resolution



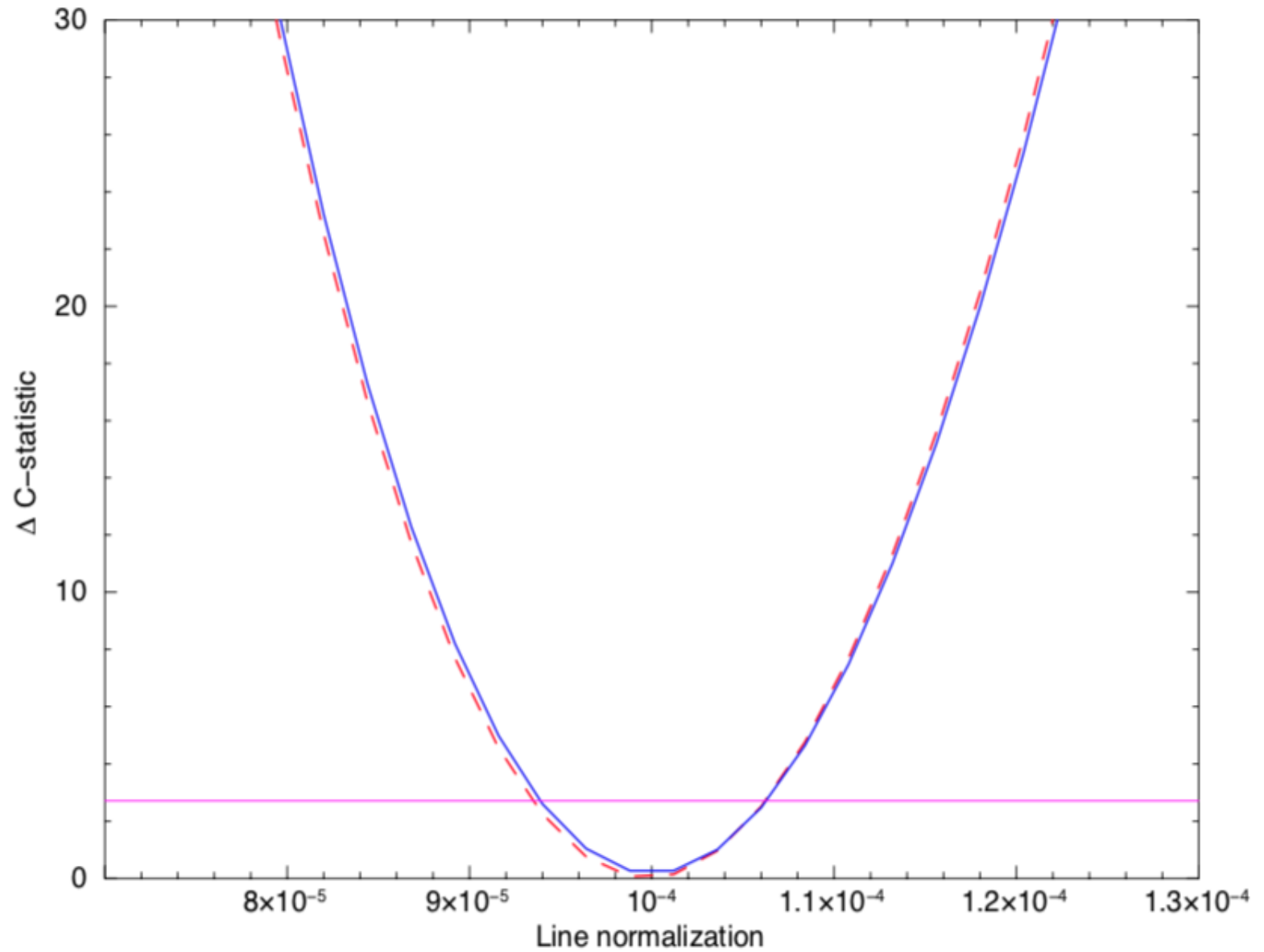
5 eV sigma line

Confidence contours
Original and with 0.1% gain shift for low resolution



5 eV sigma line

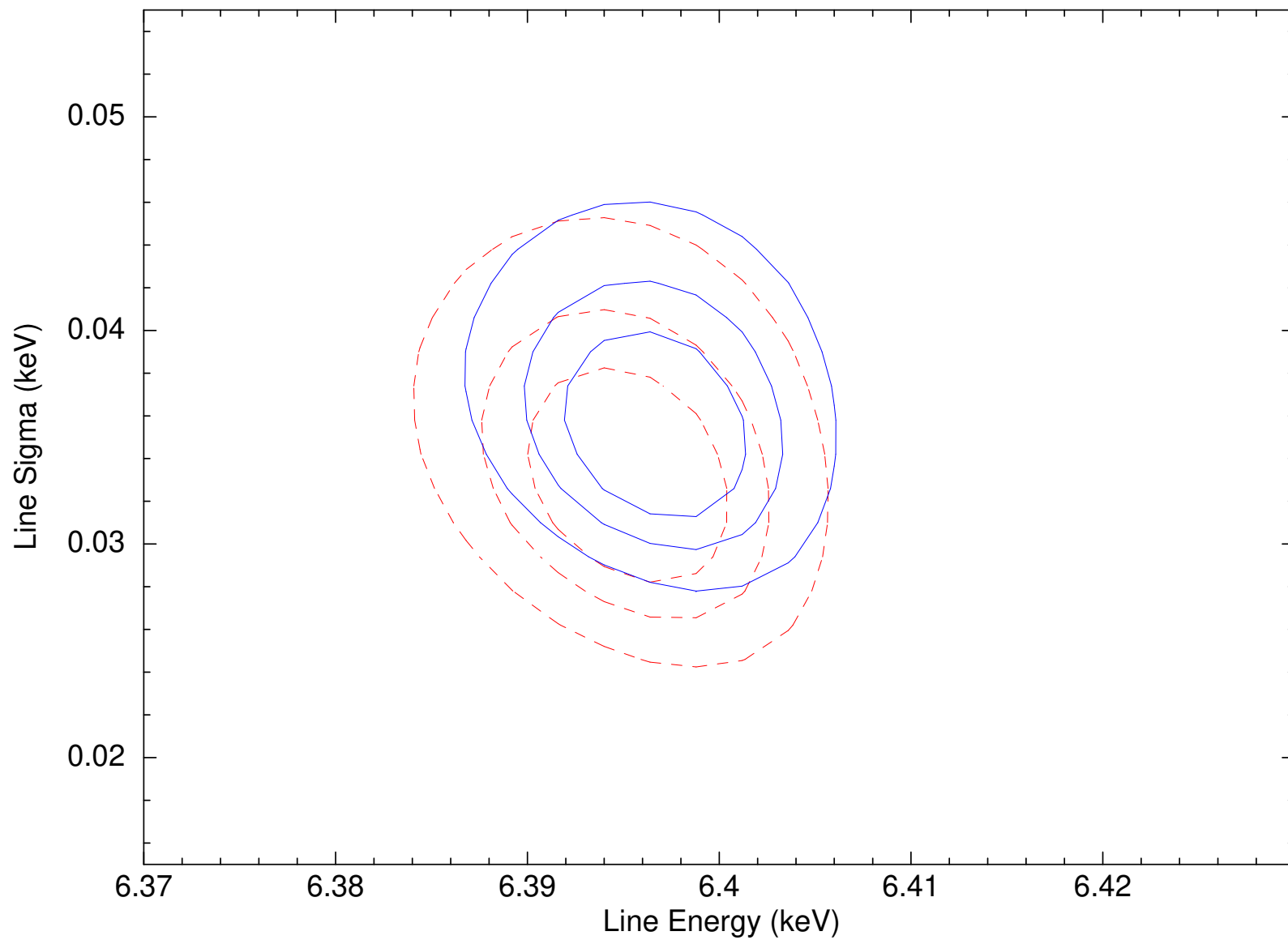
Original and with 0.1% gain shift for low resolution



Now let's do this with actual Resolve and Xtend responses (grâce à Francois).

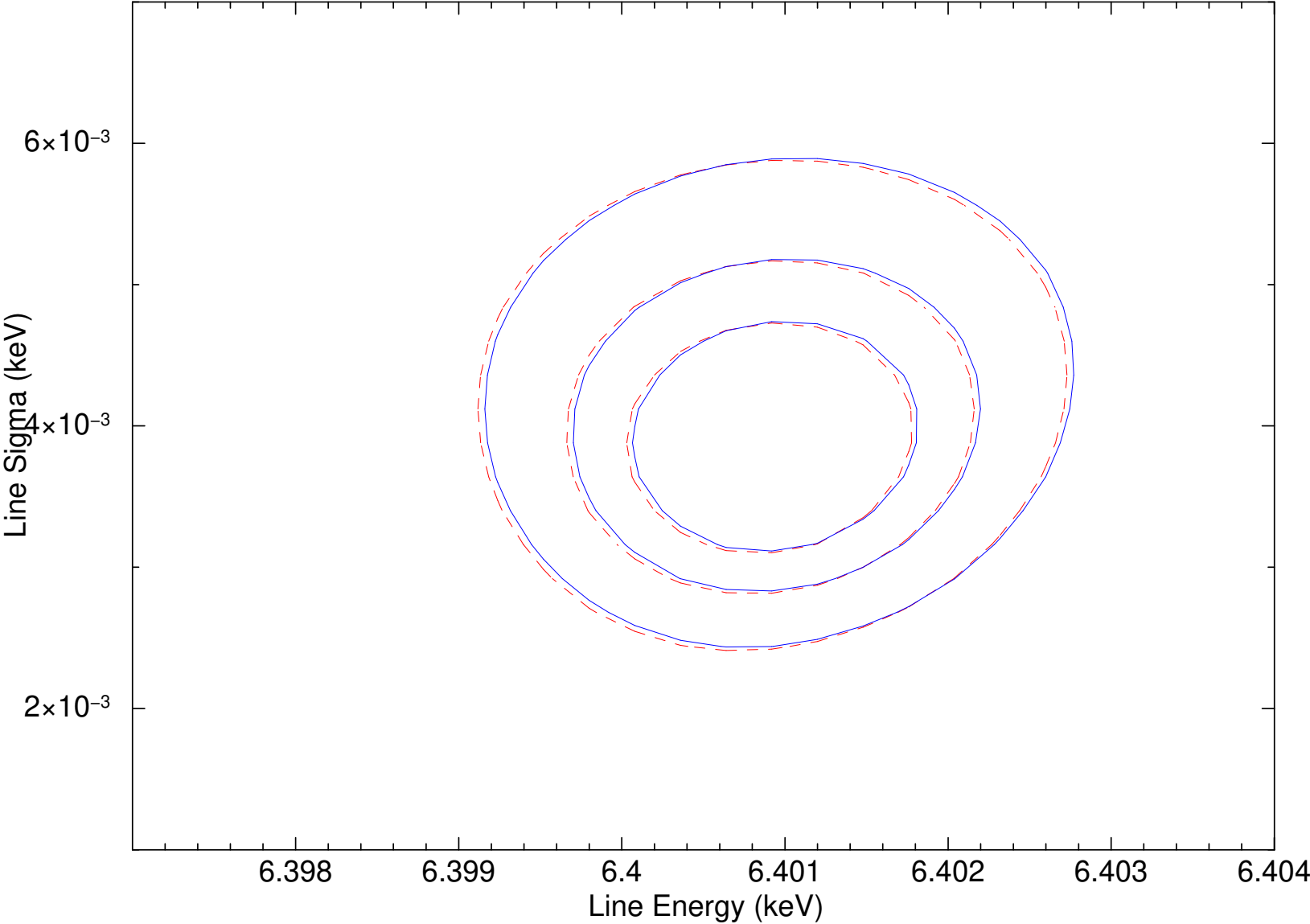
30eV width line

Confidence contours
Resolve only and both



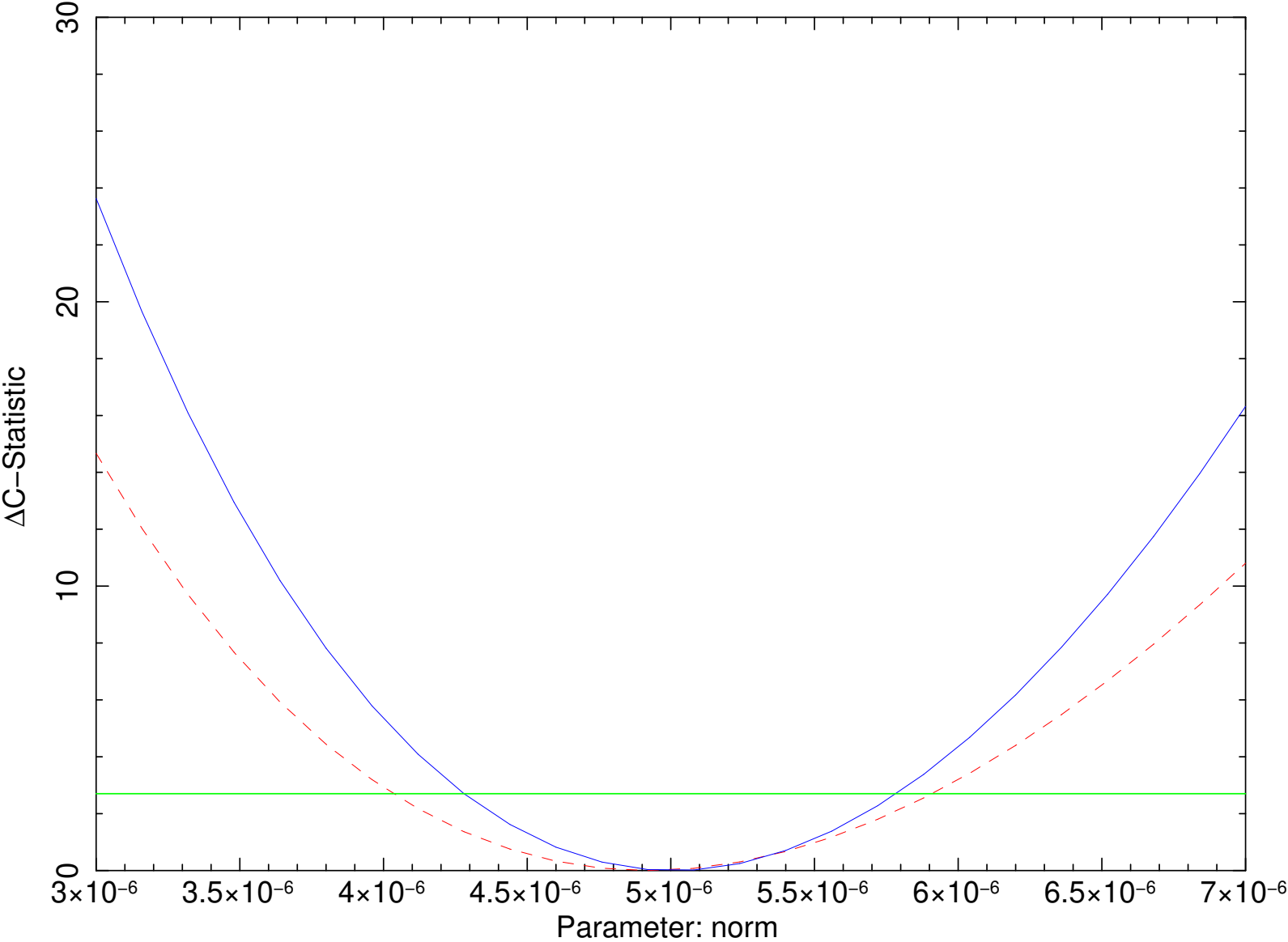
5eV width line

Confidence contours
Resolve and both



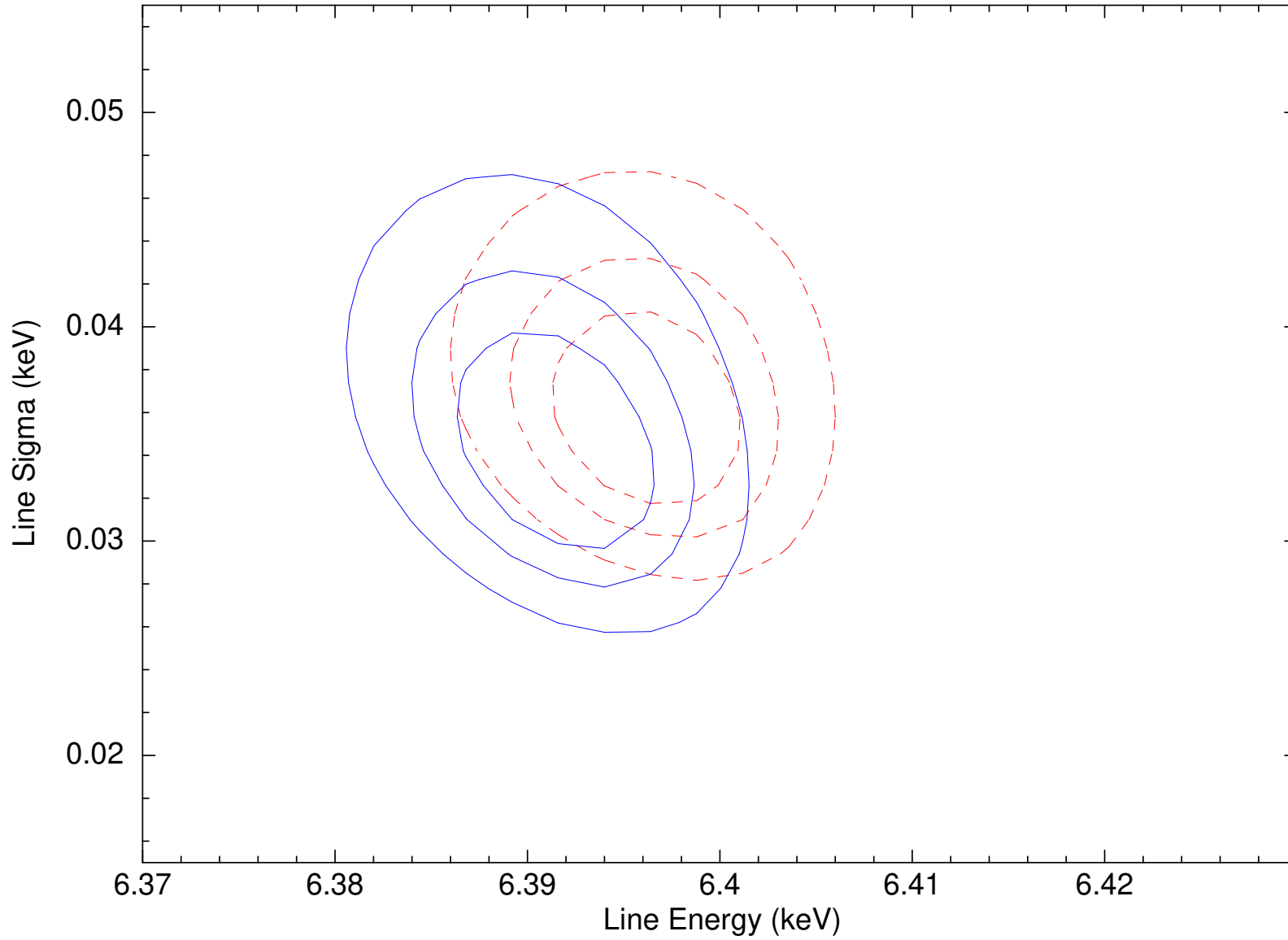
5eV width line

Resolve and both



30eV width line

Confidence contours
Both and both with Xtend gain shift



5eV width line

Confidence contours
Both and both with Xtend gain-shifted

