Astrometry.net Uncertainties

After doing a plate solution, astrometry.net creates several files. The two important ones for our purposes are:

> new-image.fits   (original image with new header containing position information)
> corr.fits   (correspondences between image and reference stars)

To gauge the uncertainties of the plate solution, we will use the corr.fits file. First, download the two files to some location, then cd to that location. Then read the data as follows:

```
from astropy.io import fits
%pylab
img = fits.open('new-image.fits')[0].data
tbl = fits.open('corr.fits')[1].data
```

The uncertainties can be determined from the differences between the measured locations (tbl.index_x and tbl.index_y) and the expected locations (tbl.field_x and tbl.field_y). The root-mean-square (rms) error for the entire set of stars, in pixels, is:

```
rmserr = sqrt(mean((tbl.index_x-tbl.field_x)**2 + (tbl.index_y - tbl.field_y)**2))
```

To get the error in arcsec, this must be multiplied by the pixel size, in arcsec. It is interesting to get a graphical impression of these errors:

```
bgnd = mean(tbl.BACKGROUND)
imshow(img,cmap='gray',vmin=0.5*bgnd,vmax=2*bgnd,interpolation='nearest')
axis('equal')
for i in range(len(tbl.FLUX)):
    plot(tbl.index_x[i]-1,tbl.index_y[i]-1,'go',markersize=log(tbl.FLUX[i]/10.))
    plot(tbl.field_x[i]-1,tbl.field_y[i]-1,'bo',markersize=log(tbl.FLUX[i]/10.))
```

You can then zoom in to see symbols overplotted onto your stars. The green symbols are supposed to be the measured positions, and the blue symbols are the expected positions.