This is an exploration notebook of the spectroscopic reshifts in the 18'x18' area around the Musket Ball Cluster.

In [19]:
```
from __future__ import division
import tools
import CAT
import ds9tools
import cosmo
# improve the dpi of imbeded figures
matplotlib.rcParams['savefig.dpi'] = 120
```

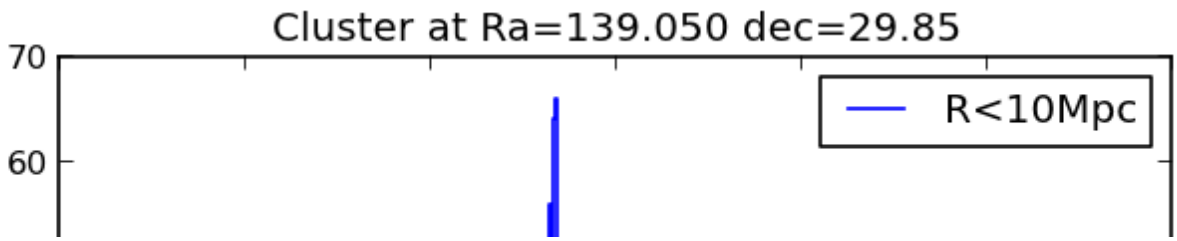
User Inputs

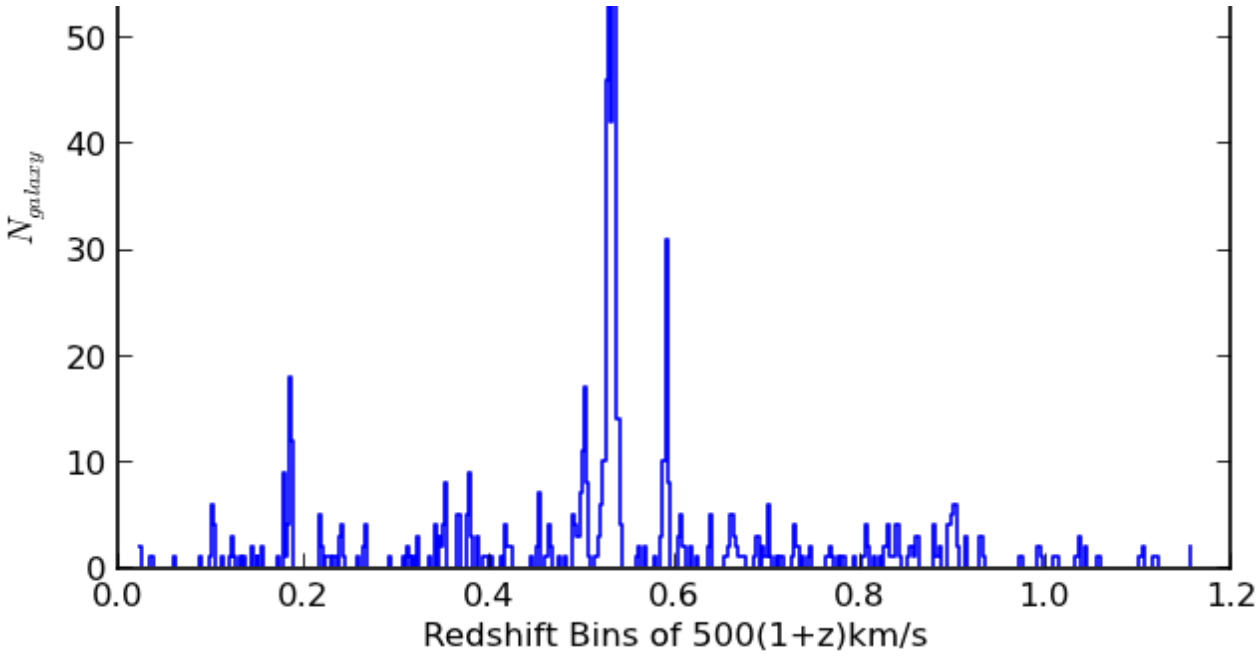
In [2]:
```
# redshift catalog
catalog = '/Users/dawson/SkyDrive/Research/Clusters/DLSCL09162953/Spec z/2013catalog/
# Approximate Cluster redshift range
z_range = (0.52,0.55) #same used for 2012 analysis
z_ttype = 'z'
# using trace coordinates since very percise spatial accuracy
# is not needed. Also don't need to worry about object image
# properties
ra_ttype = 'ra_trace'
dec_ttype = 'dec_trace'
# System center (approximate RA and Dec)
sys_center = (139.05,29.85)
# galaxy density centers for north and south subclusters
# see 2013 Subcluster Centers OneNote
north_center = (139.04767,29.865626)
south_center = (139.06686,29.82093)
```

Program

In [3]:
```
# read in the catalog
cat = tools.readcatalog(catalog,False)
key = tools.readheader(catalog)
# assign parameter arrays
ra = cat[:,key[ra_ttype]]
dec = cat[:,key[dec_ttype]]
z = cat[:,key[z_ttype]]
```

In [20]:
```
# Create a redshift histogram of all spectroscopic galaxies
CAT.zhist(catalog, (ra_ttype,dec_ttype,z_ttype), sys_center, zbinwidth=500, zrange=(0
```





In [5]:
```
# create region files for foreground, cluster and background spectroscopic galaxies
mask_z_fore = z < z_range[0]
mask_z_cluster = numpy.logical_and(z >= z_range[0], z <= z_range[1])
mask_z_back = z > z_range[1]
```

In [6]:
```
print '{0} foreground galaxies with spectroscopic redshift'.format(numpy.sum(mask_z_f
print '{0} cluster galaxies with spectroscopic redshift'.format(numpy.sum(mask_z_clus
print '{0} background galaxies with spectroscopic redshift'.format(numpy.sum(mask_z_b
```

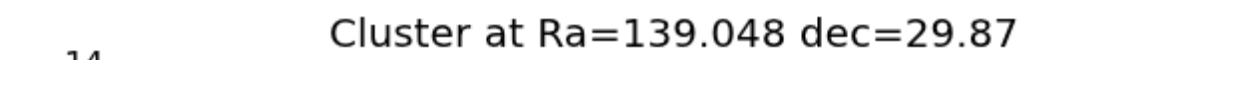
```
255 foreground galaxies with spectroscopic redshift
309 cluster galaxies with spectroscopic redshift
210 background galaxies with spectroscopic redshift
```

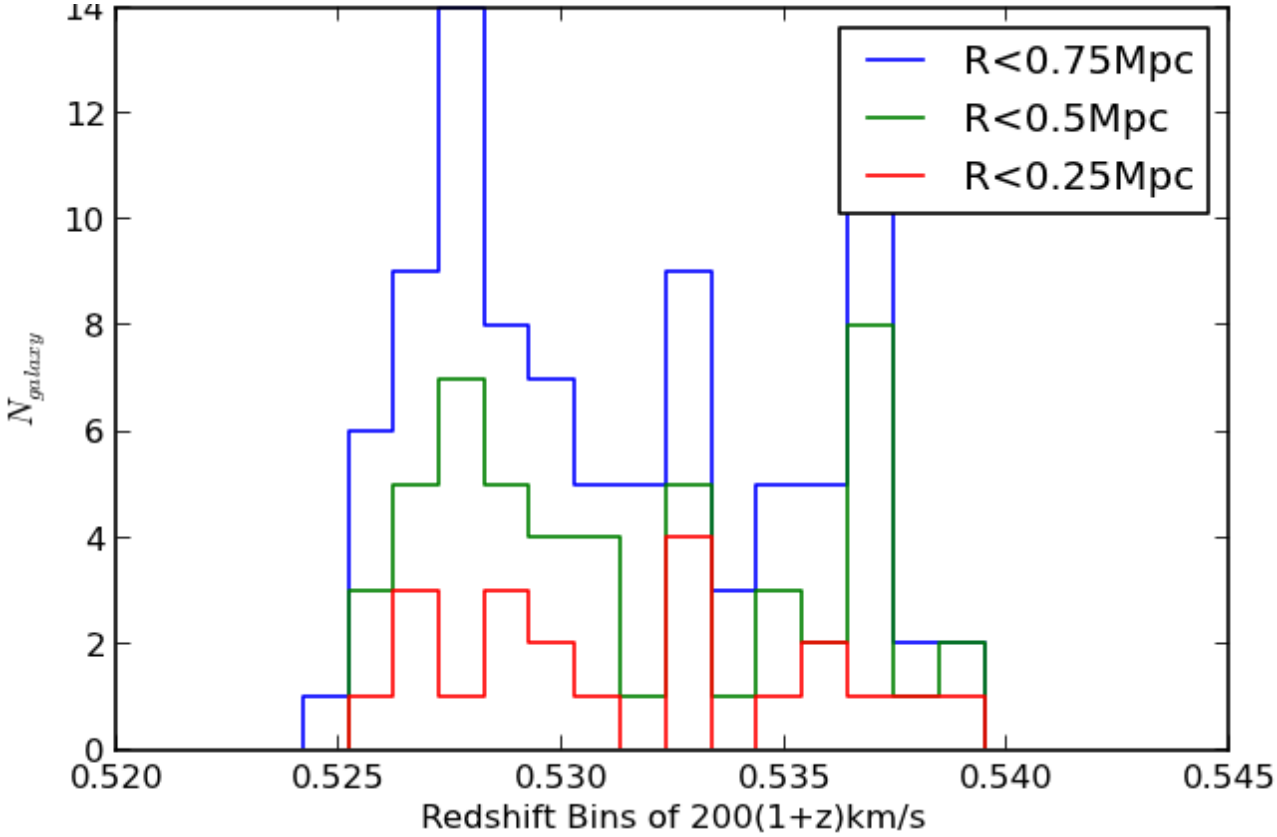
In [7]:
```
# parse the associated parameter arrays
ra_fore = ra[mask_z_fore]
dec_fore = dec[mask_z_fore]
z_fore = z[mask_z_fore]
ra_cluster = ra[mask_z_cluster]
dec_cluster = dec[mask_z_cluster]
z_cluster = z[mask_z_cluster]
ra_back = ra[mask_z_back]
dec_back = dec[mask_z_back]
z_back = z[mask_z_back]
```

Subcluster Redshift Histograms

North Subcluster

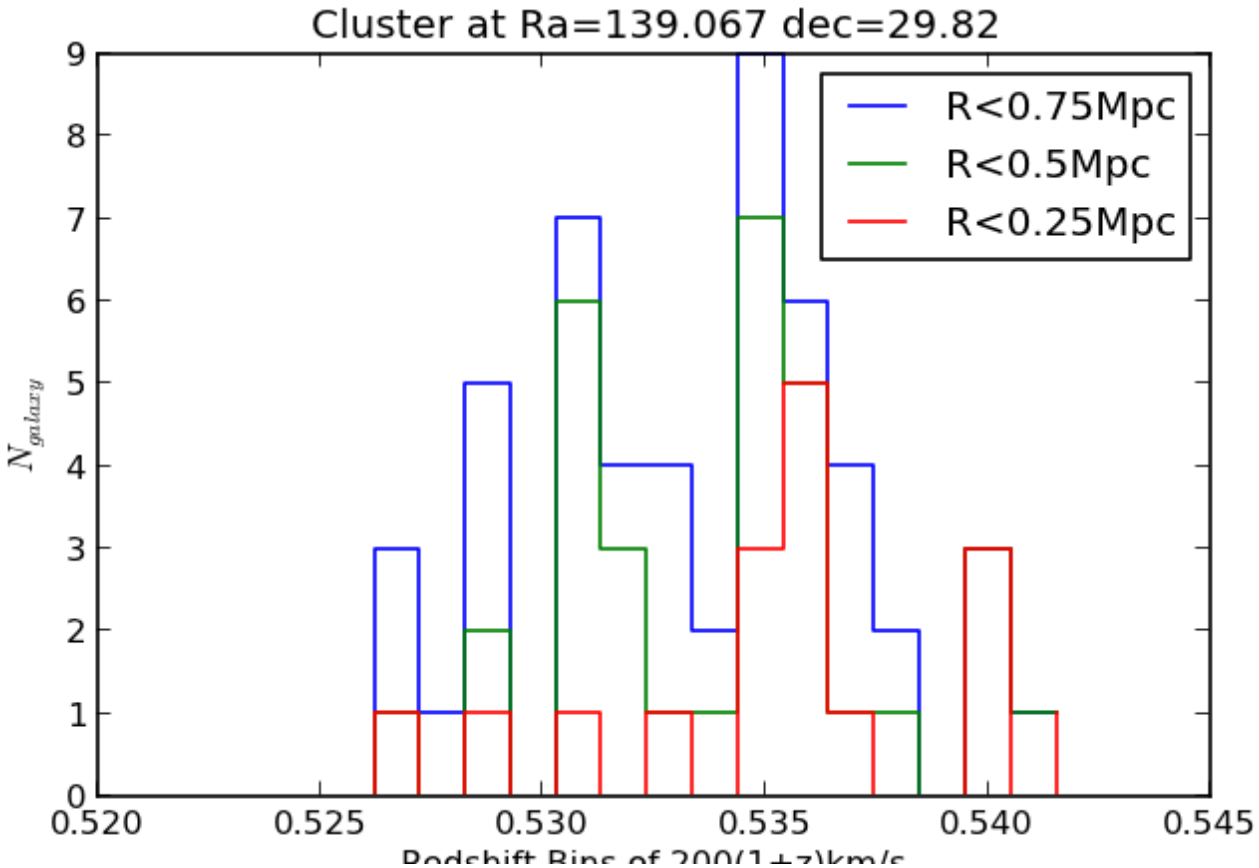
In [21]:
```
# Create a redshift histogram of north subcluster galaxies
CAT.zhist(catalog, (ra_ttype,dec_ttype,z_ttype), north_center, zbinwidth=200, zrange=
```





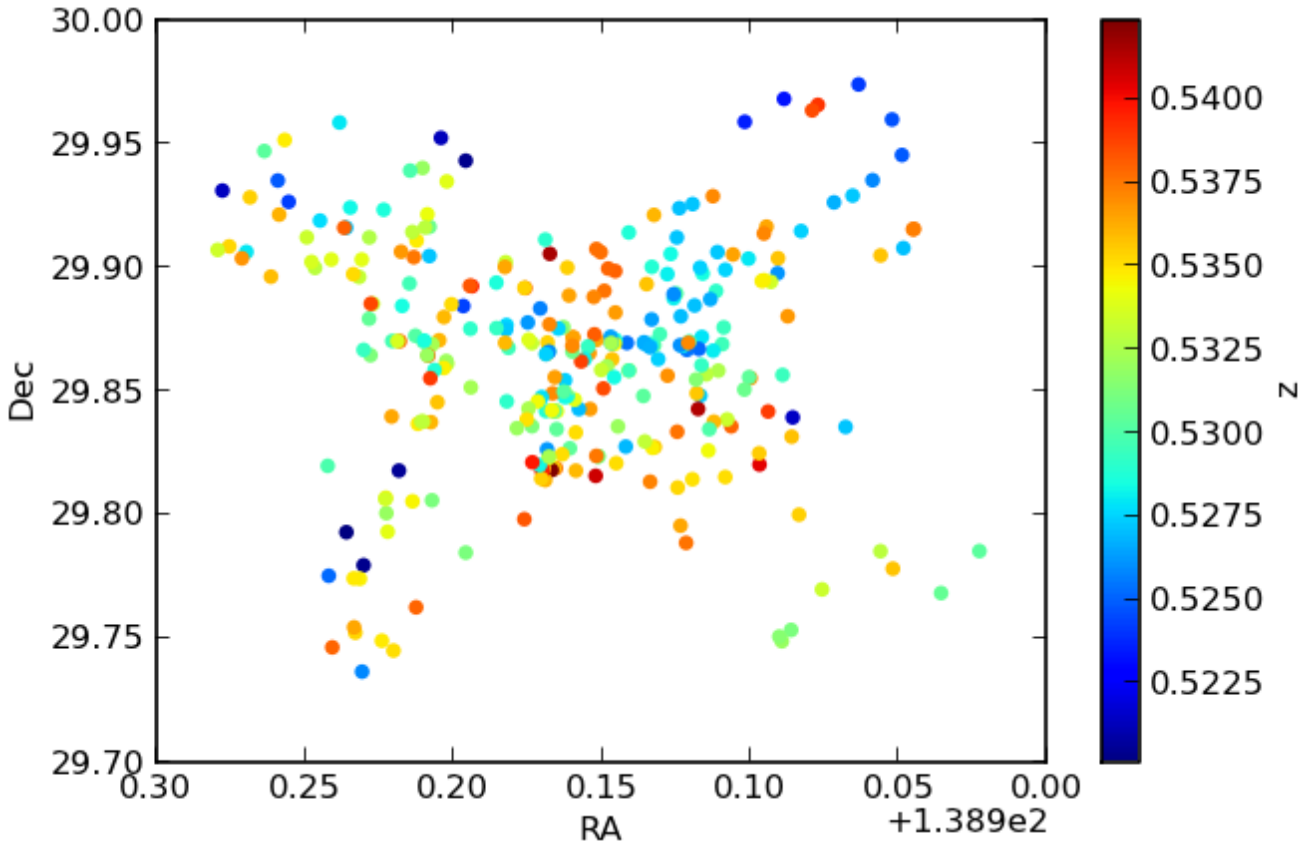
South Subcluster

In [22]:
```
# Create a redshift histogram of north subcluster galaxies
CAT.zhist(catalog, (ra_ttype,dec_ttype,z_ttype), south_center, zbinwidth=200, zrange=
```



Redshift bins of 200(1+z)km/s

In [23]:
```
# create a redshift map of the cluster redshifts
fig = pylab.figure()
pylab.scatter(ra_cluster,dec_cluster,s=20,c=z_cluster,marker='o',linewidths=0,alpha=5
xlim = pylab.xlim()
pylab.xlim((xlim[1],xlim[0]))
pylab.xlabel('RA')
pylab.ylabel('Dec')
cbar = pylab.colorbar()
cbar.set_label('z')
pylab.savefig('redshiftmap')
```



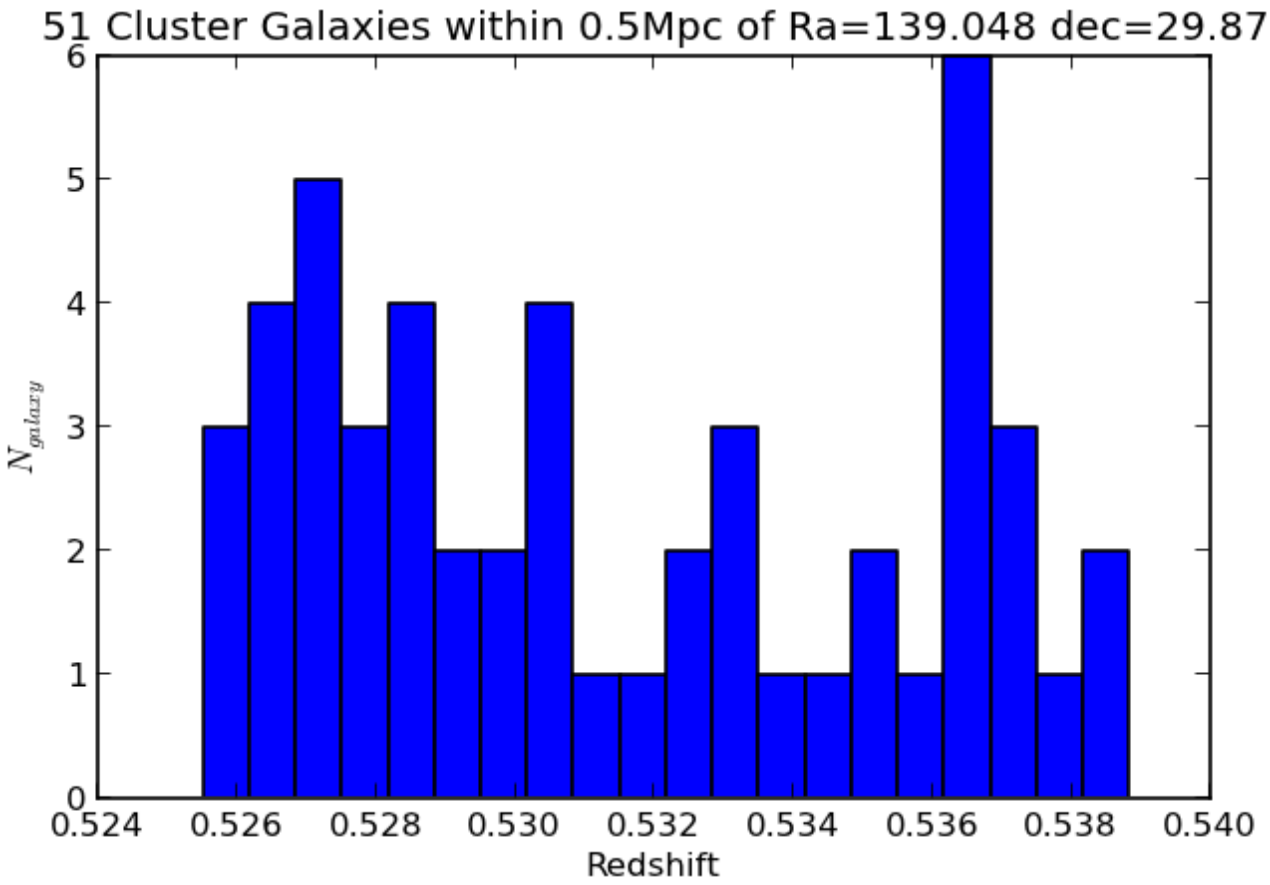
In [24]:
```
# create ds9 regions files
ds9tools.pointregions('foreground',ra_fore,dec_fore,style='circle',color='blue',size=
ds9tools.pointregions('cluster',ra_cluster,dec_cluster,style='diamond',color='green',
ds9tools.pointregions('background',ra_back,dec_back,style='circle',color='red',size=1
```

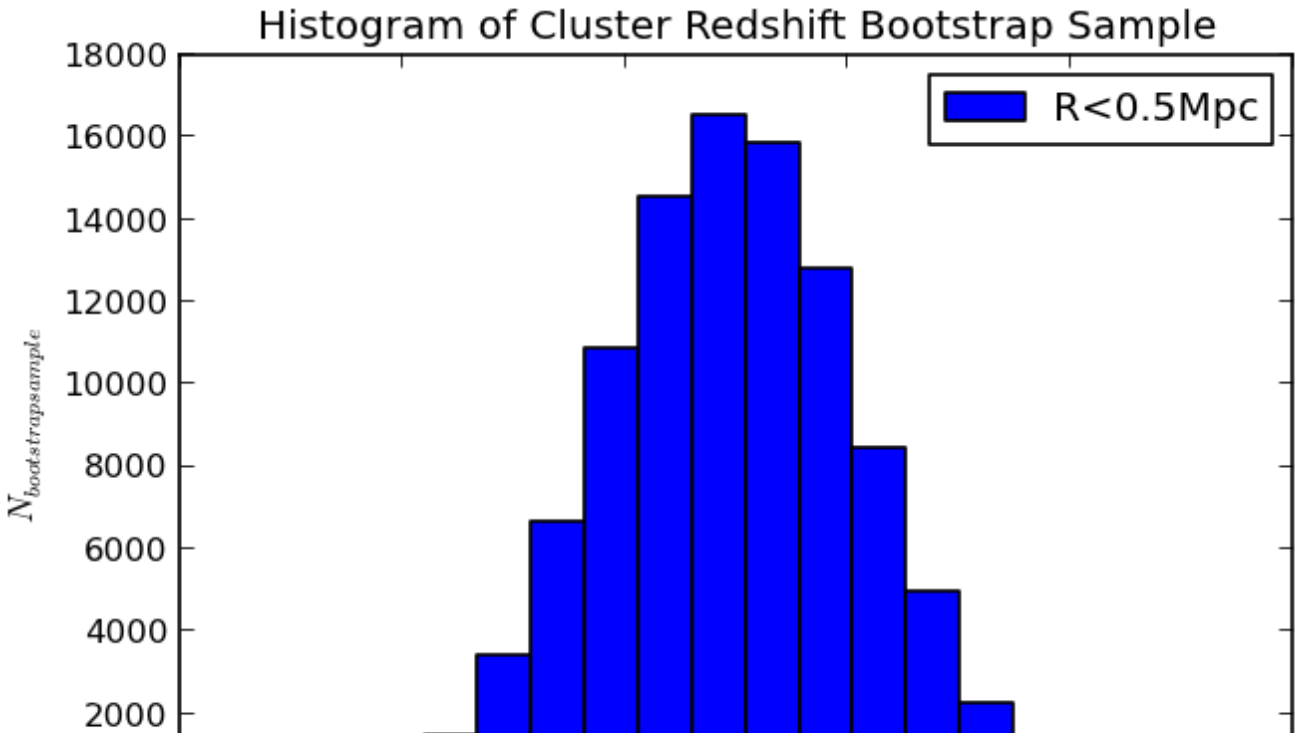
In [25]:
```
# create a distinction between the lower redshift cluster members
# and the higher redshift cluster members
mask_low = numpy.logical_and(z>=0.52,z<0.5335)
mask_high = numpy.logical_and(z>=0.5335,z<0.55)
ds9tools.pointregions('cluster_lowz',ra[mask_low],dec[mask_low],style='diamond',color
ds9tools.pointregions('cluster_highz',ra[mask_high],dec[mask_high],style='diamond',co
```

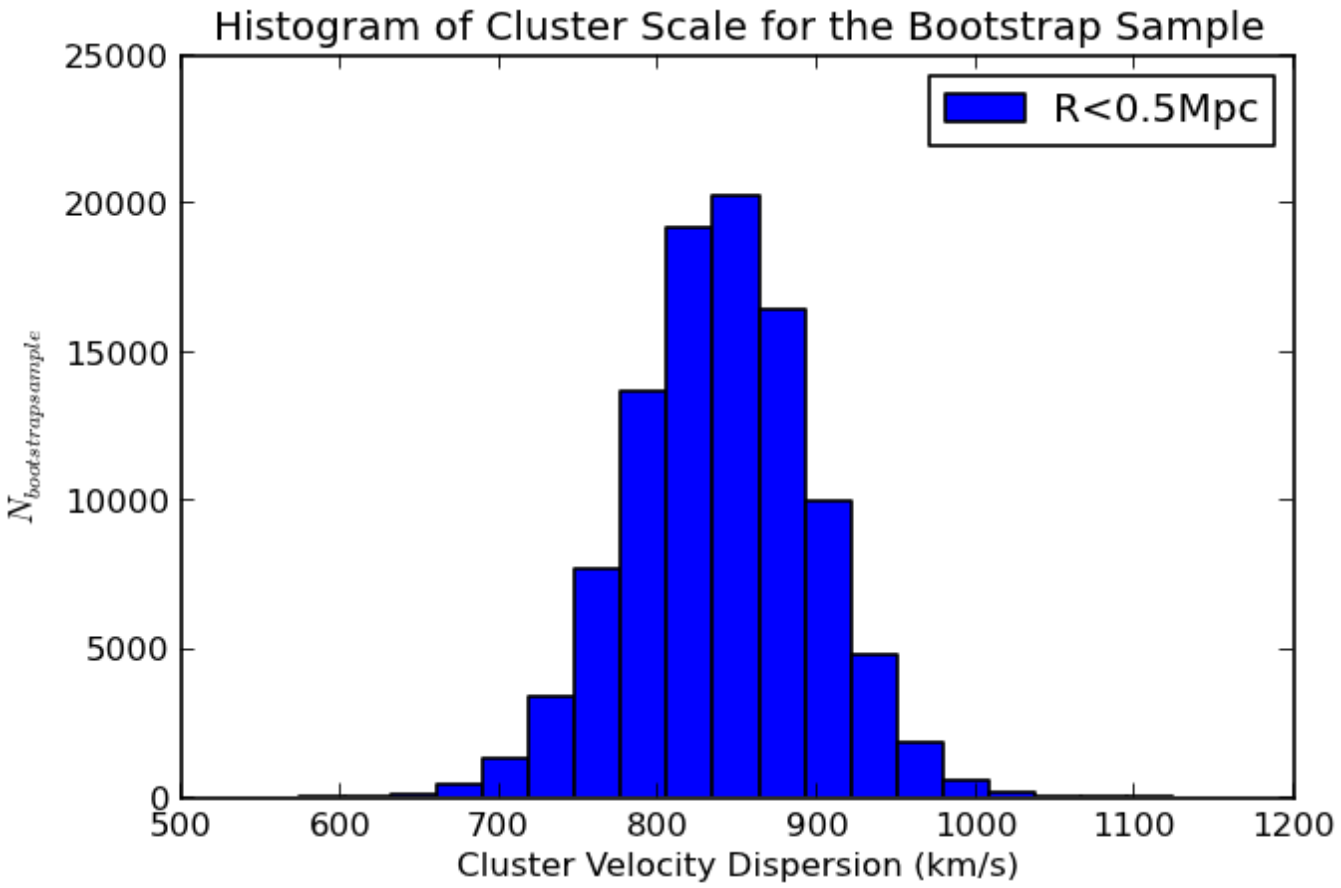
In [28]:
```
# estimate redshift and velocity dispersion of north subcluster
CAT.zVdisp(catalog, (ra_ttype,dec_ttype,z_ttype),north_center, zest=0.53,
vwidth=3000, radii=0.5, prefix='north', Nboot = 100000, N_sigma = 1, zbinwidth = 250,
h = 0.7, Om = 0.3, Ol = 0.7)
```

```
readcatalog: reading in /Users/dawson/SkyDrive/Research/Clusters/DLSCL09162953/Spec
```

```
z/2013catalog/RedshiftCatalog_pythonfmt.txt
readcatalog: read in /Users/dawson/SkyDrive/Research/Clusters/DLSCL09162953/Spec
z/2013catalog/RedshiftCatalog_pythonfmt.txt containing 774 rows and 20 columns of
data
Cluster central redshift estimate converged to 0.53148 after 2 iterations.
Cluster redshift results; upper and lower 1sigma confidence limits are quoted:
                Center  Lower   Upper   Units
For galaxies with r < 0.5 Mpc
Redshift        0.53148 0.53092 0.53206
Velocity Dispersion             854     811     923     km/s
```

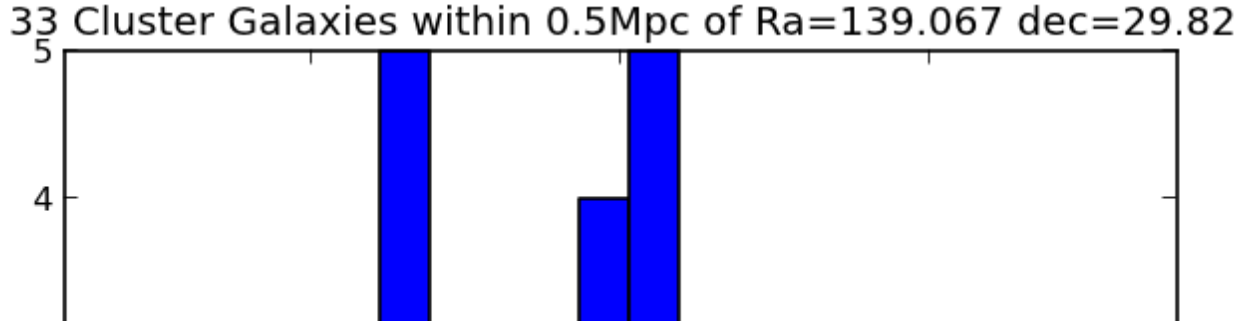


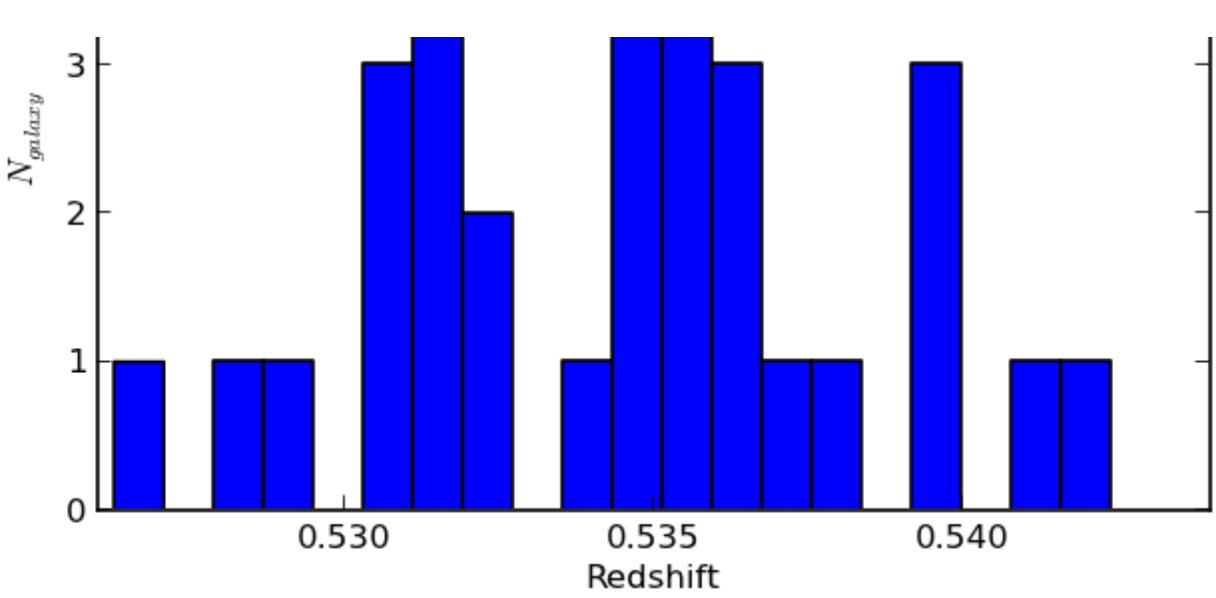


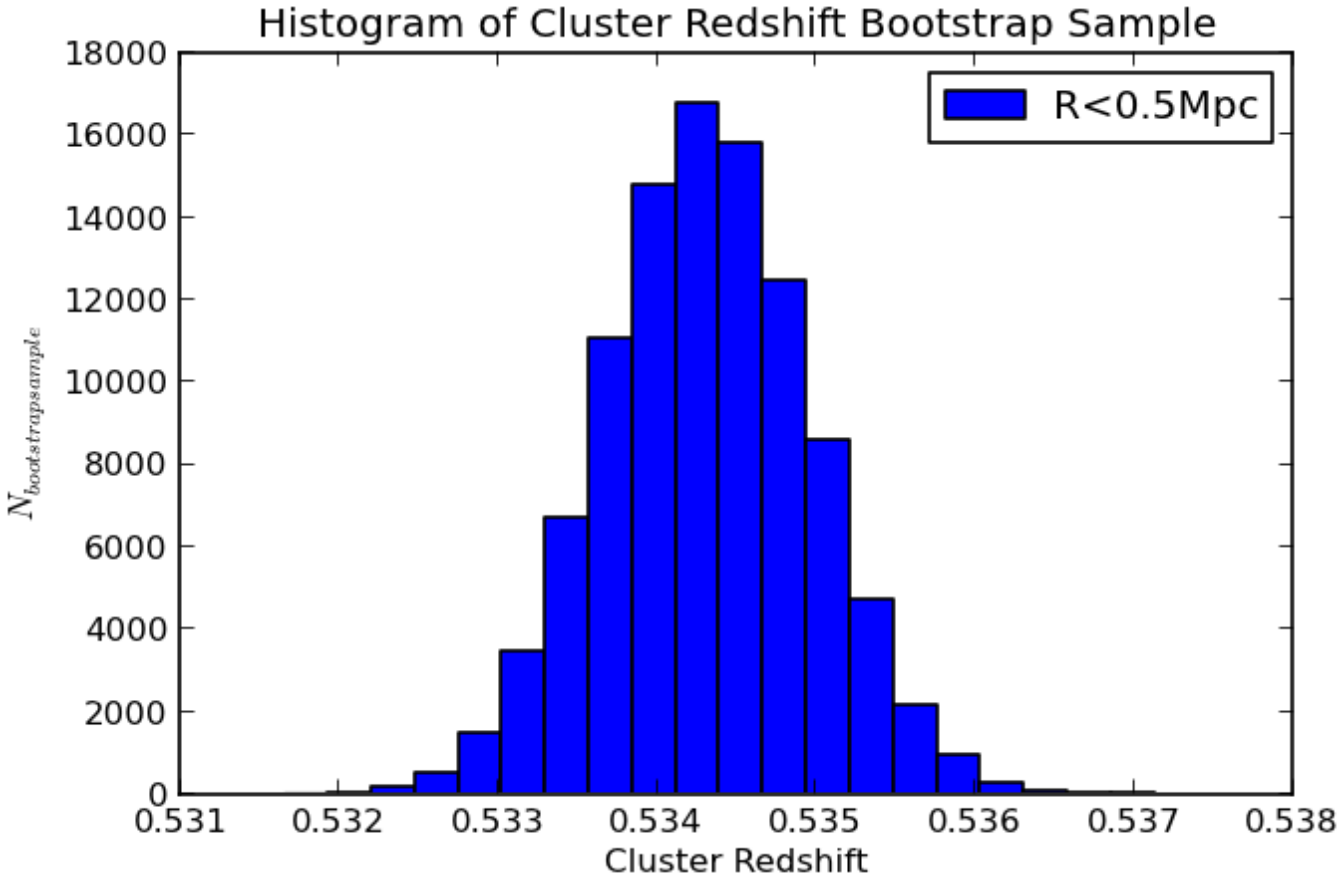


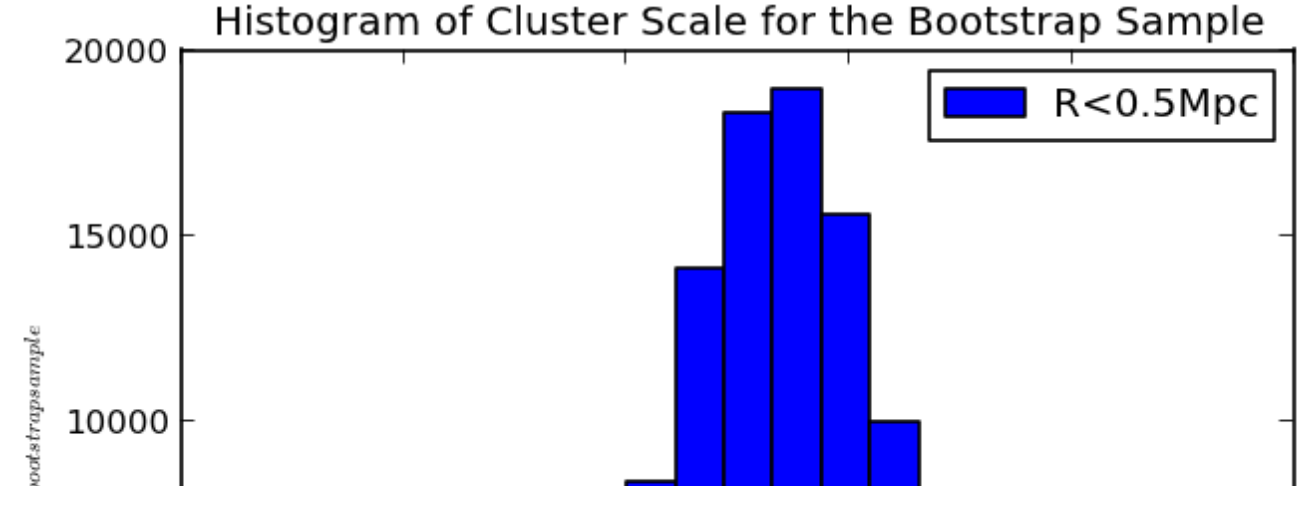
In [30]:
```
# estimate redshift and velocity dispersion of north subcluster
CAT.zVdisp(catalog, (ra_ttype,dec_ttype,z_ttype),south_center, zest=0.53,
vwidth=3000, radii=0.5, prefix='south', Nboot = 100000, N_sigma = 1, zbinwidth = 250,
h = 0.7, Om = 0.3, Ol = 0.7)
```

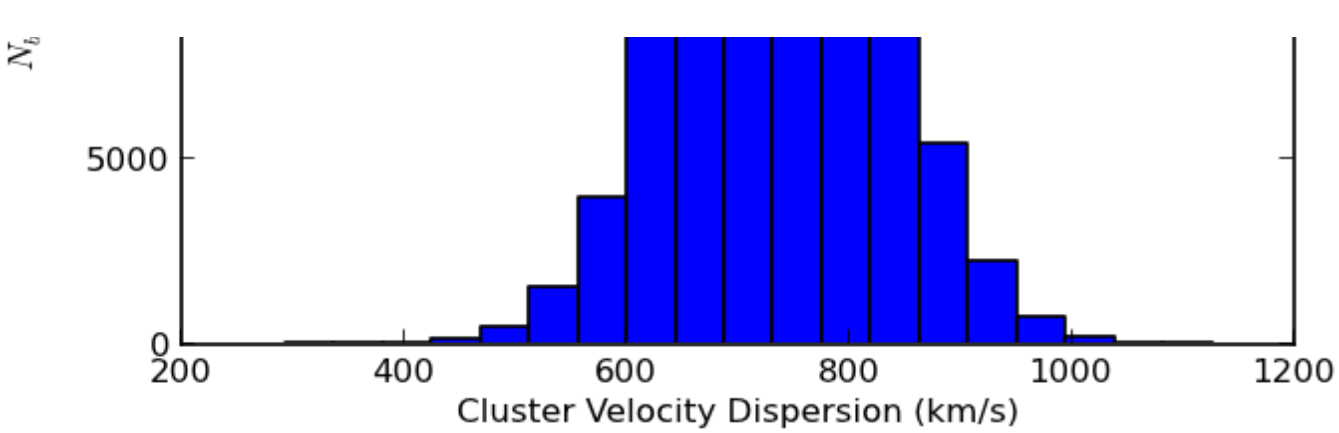
```
readcatalog: reading in /Users/dawson/SkyDrive/Research/Clusters/DLSCL09162953/Spec
z/2013catalog/RedshiftCatalog_pythonfmt.txt
readcatalog: read in /Users/dawson/SkyDrive/Research/Clusters/DLSCL09162953/Spec
z/2013catalog/RedshiftCatalog_pythonfmt.txt containing 774 rows and 20 columns of
data
Cluster central redshift estimate converged to 0.53431 after 2 iterations.
Cluster redshift results; upper and lower 1sigma confidence limits are quoted:
                Center  Lower   Upper   Units
For galaxies with r < 0.5 Mpc
Redshift        0.53431 0.53367 0.53497
Velocity Dispersion             761     692     873     km/s
```




N_{galaxy}
0
1
2
3
0.530
0.535
0.540
Redshift


Histogram of Cluster Redshift Bootstrap Sample
R<0.5Mpc
$N_{bootstrapsample}$
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
0.531
0.532
0.533
0.534
0.535
0.536
0.537
0.538
Cluster Redshift


Histogram of Cluster Scale for the Bootstrap Sample
R<0.5Mpc
10000
15000
20000



These results hardly vary from the results of Dawson et al. (2012), and are well within the previous errors that I don't see much use in redoing the analysis.

In [ ]: