ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Photo-z, DESDM and DB

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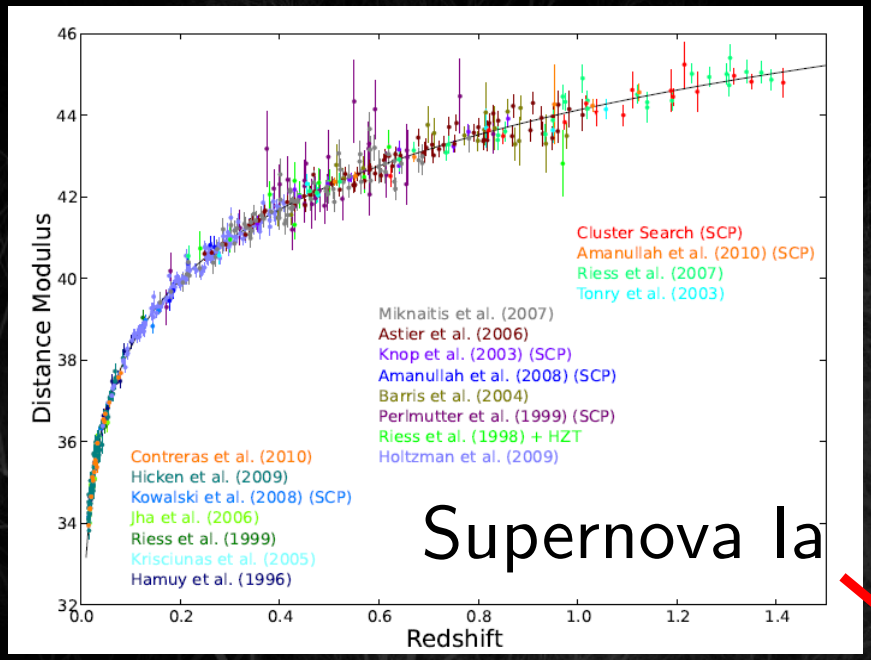
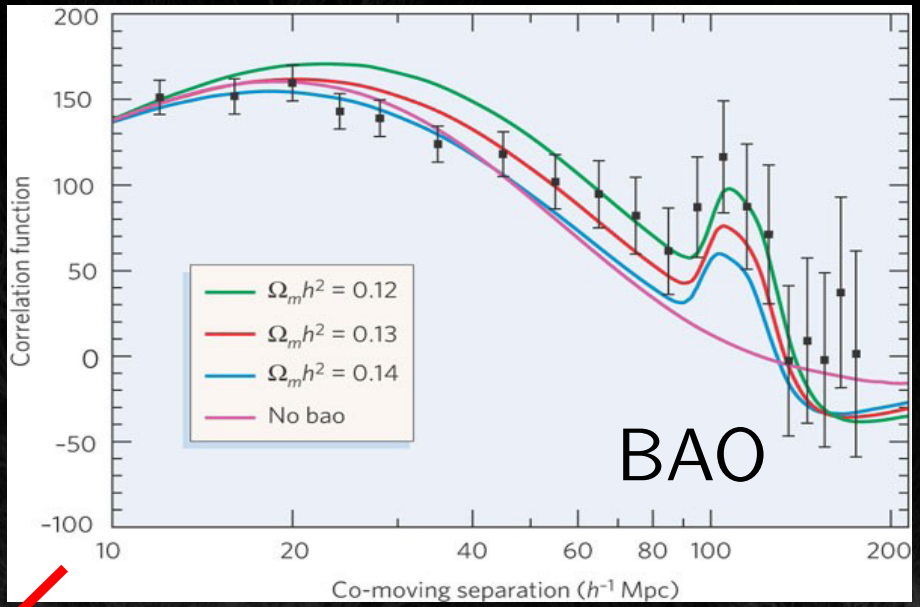
NCSA/Department of Astronomy
University of Illinois at Urbana-Champaign

DECam Community Science Workshop
March 11^{th} - 13^{th}, 2015

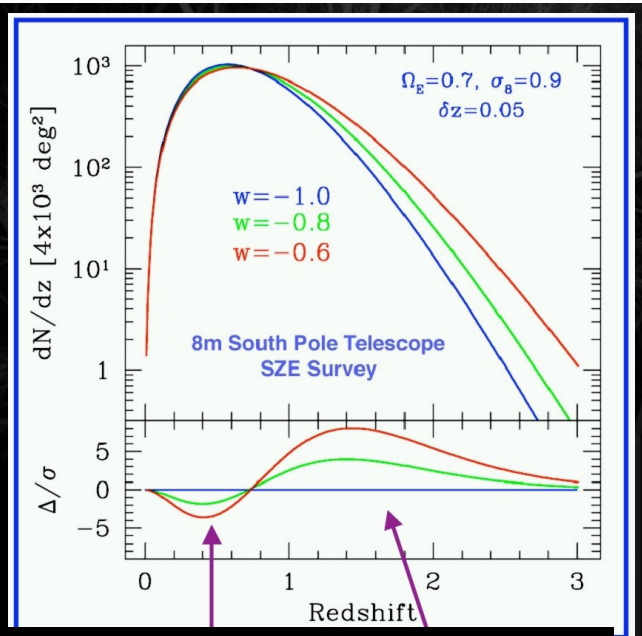
Observational Probes of Dark Energy



Supernova Ia



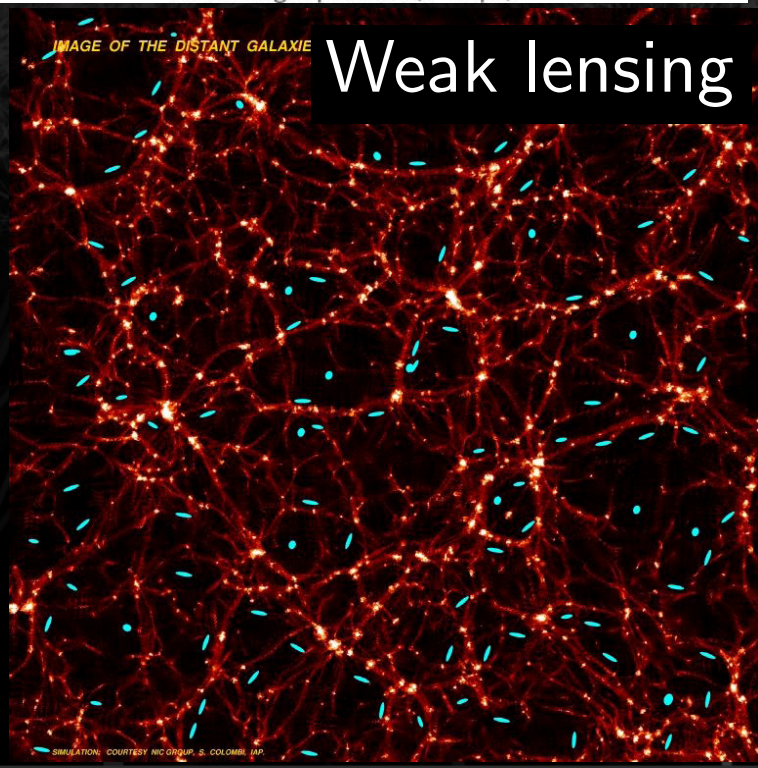
BAO



Cluster abundance

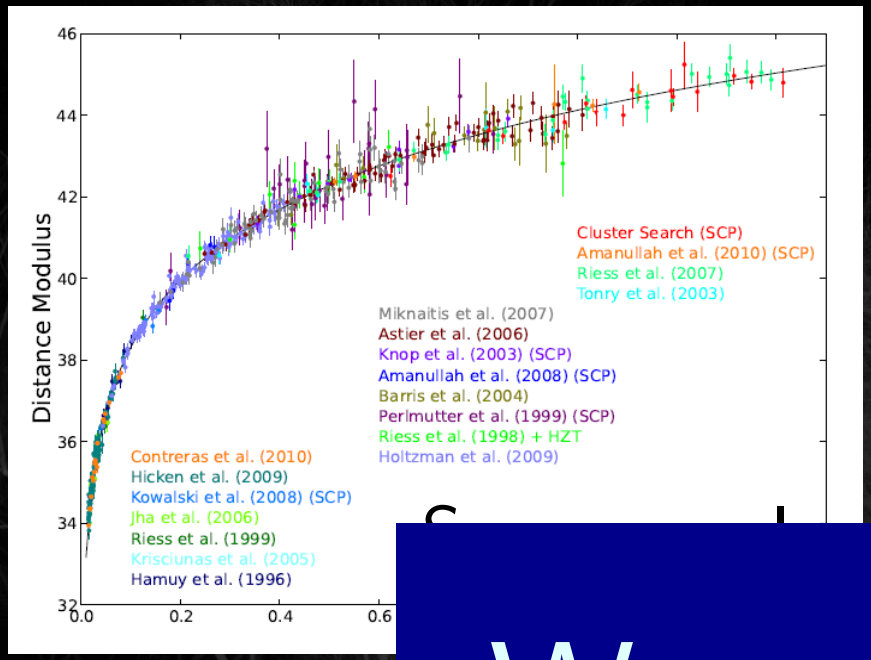
Geometry

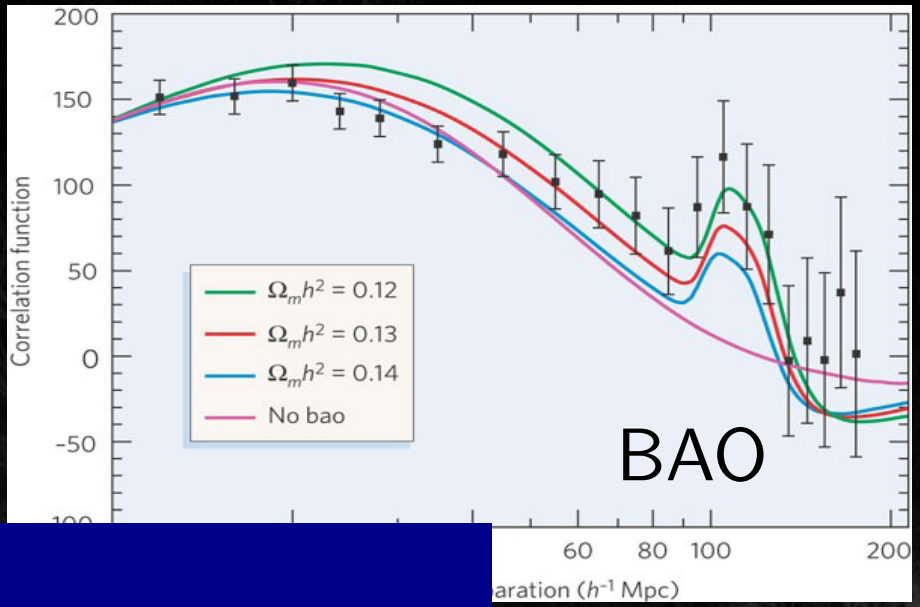
Growth of structure



Weak lensing

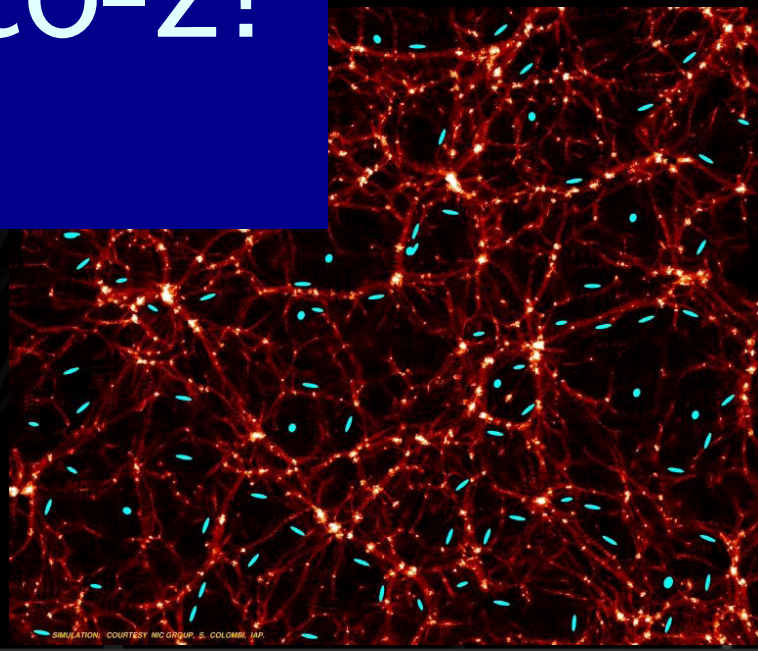
Observational Probes of Dark Energy

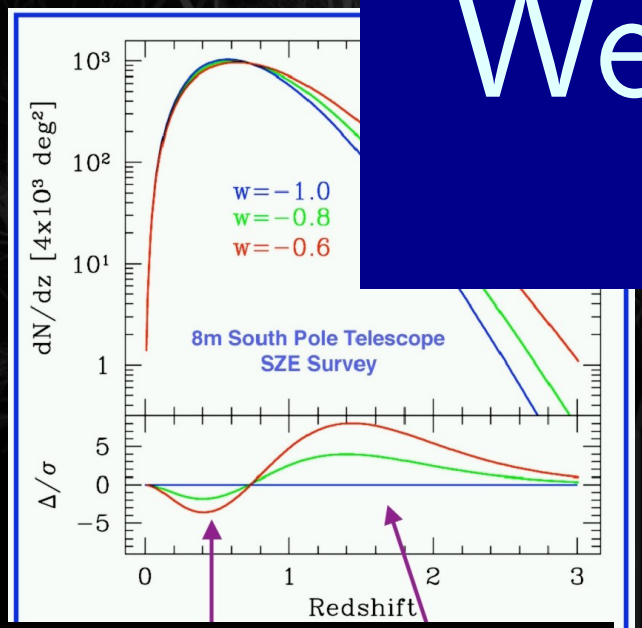




We need photo-z!

Weak lensing





Cluster abundance

Growth of structure

Photo-z for DES SV data

Monthly Notices
of the
ROYAL ASTRONOMICAL SOCIETY

MNRAS **445,** 1482–1506 (2014) doi:10.1093/mnras/stu1836

Photometric redshift analysis in the Dark Energy Survey Science Verification data

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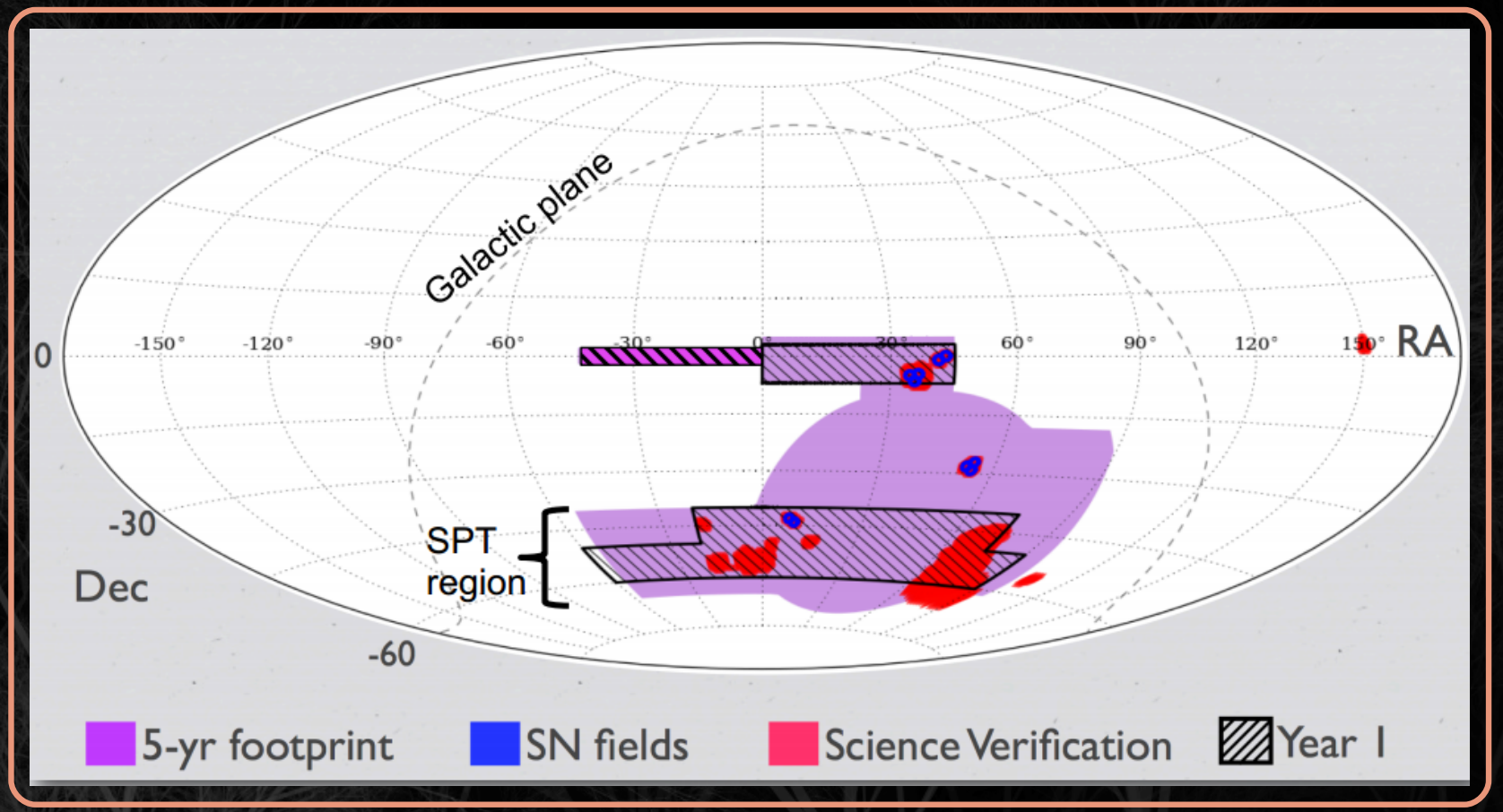
Affiliations are listed at the end of the paper

Sanchez et al. (2015). First published paper using DES data!

Photo-z for DES SV data



- DES Science Verification data
- Photo-z code comparison and analysis
- Good benchmark results for future releases

Spectroscopic data

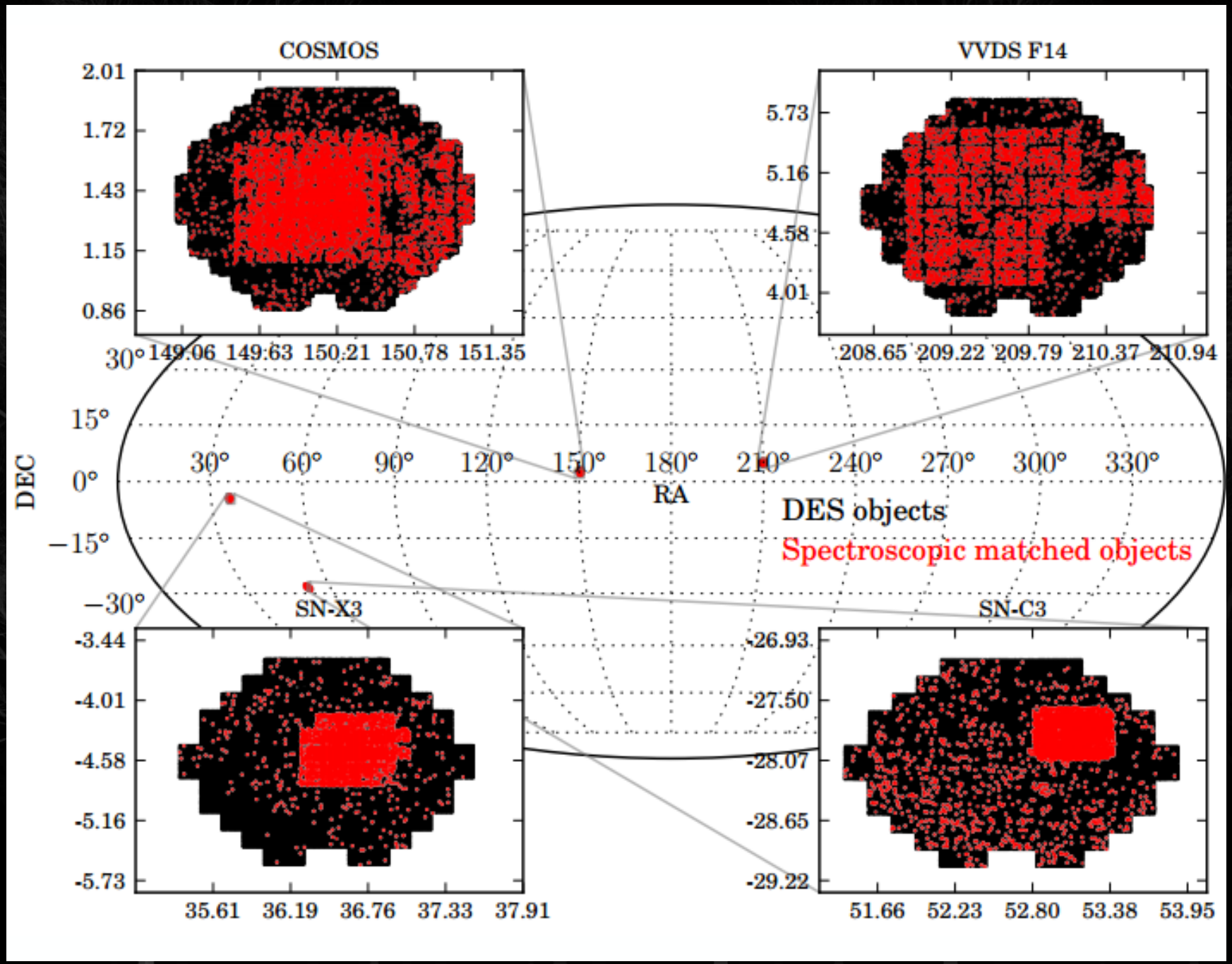
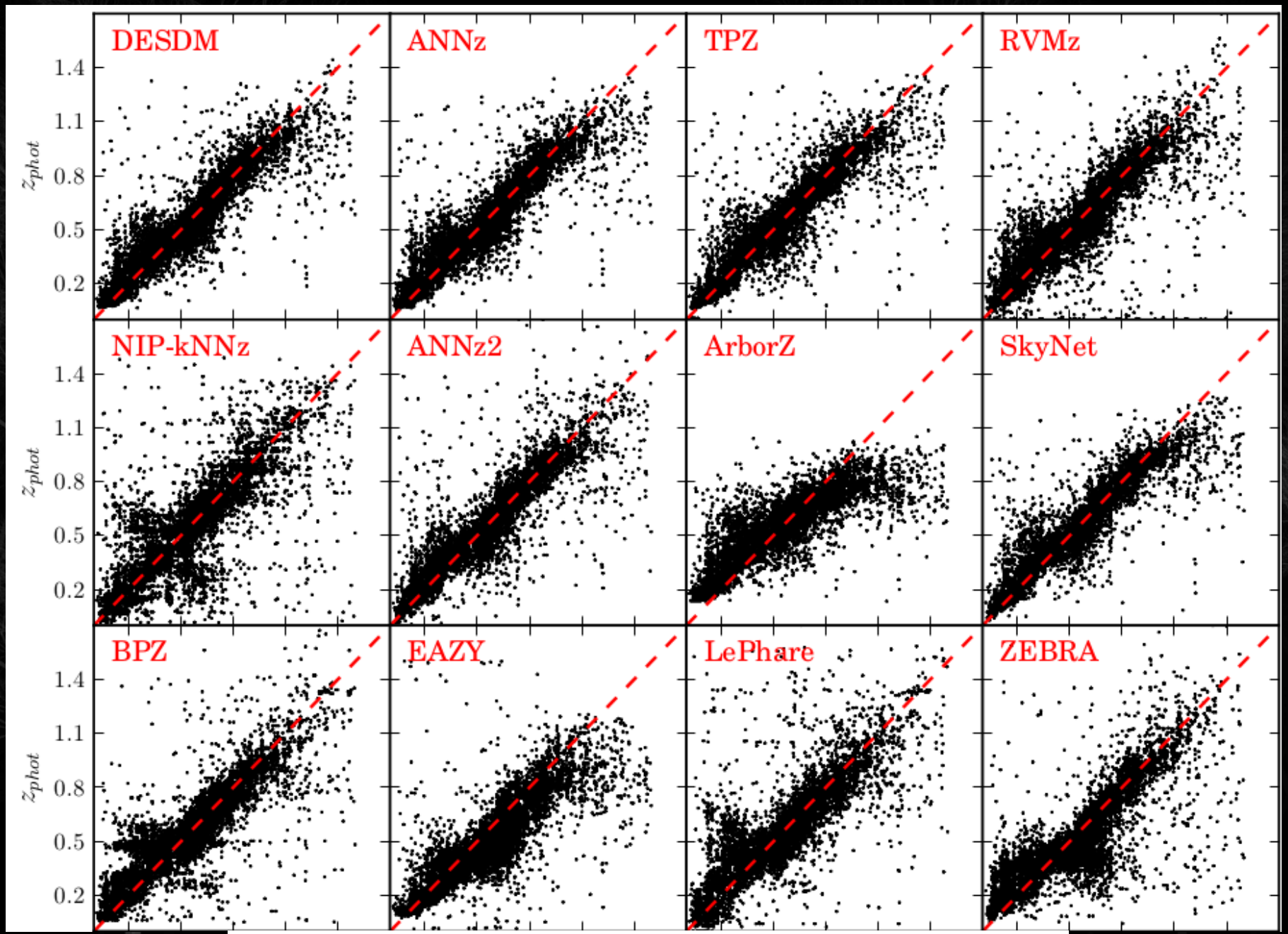


Photo-z PDF application: DES SV data



Sanchéz, Carrasco Kind, et al. 2014 (MNRAS, 445, 1482)

Photo-z for DES SV data

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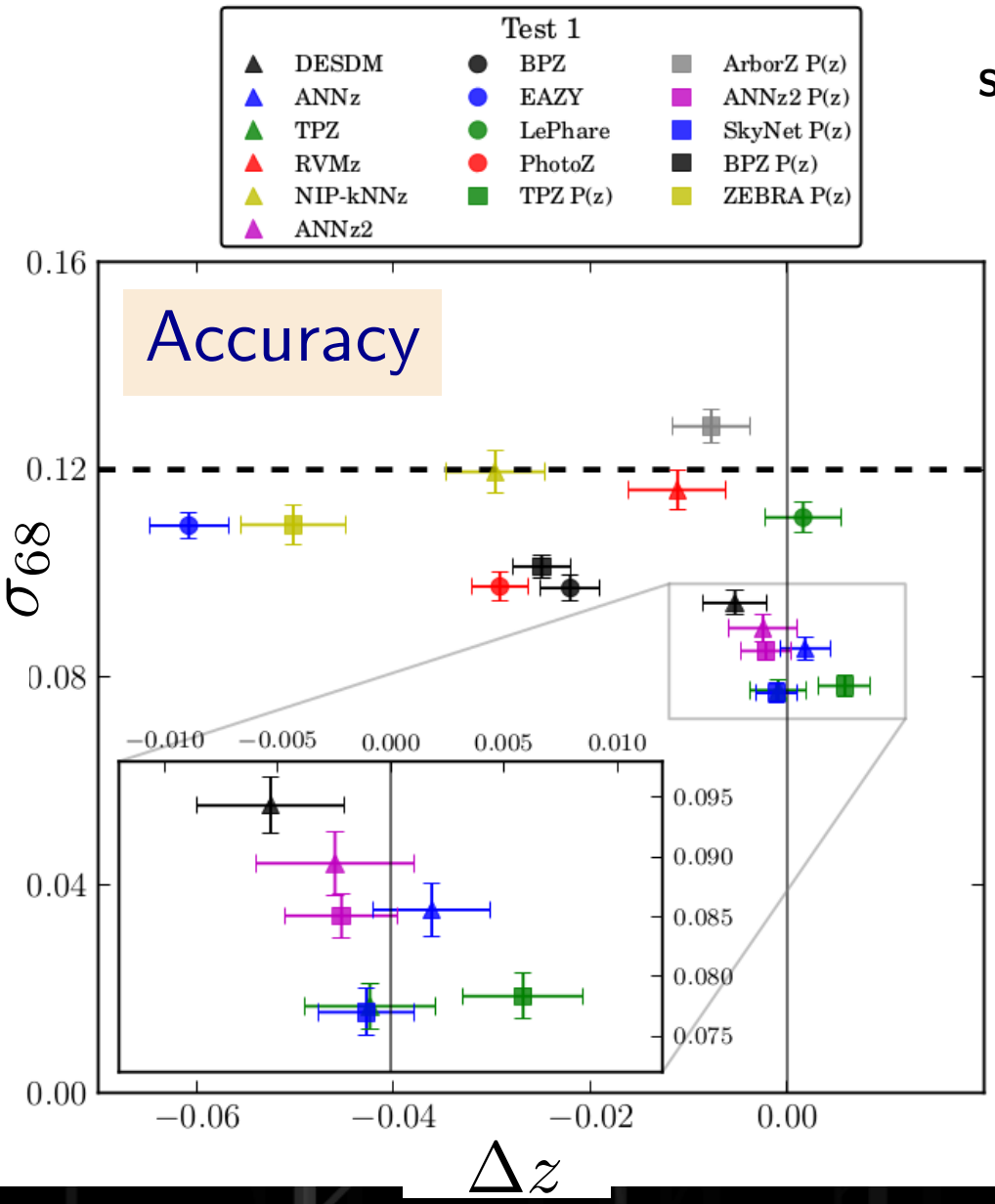
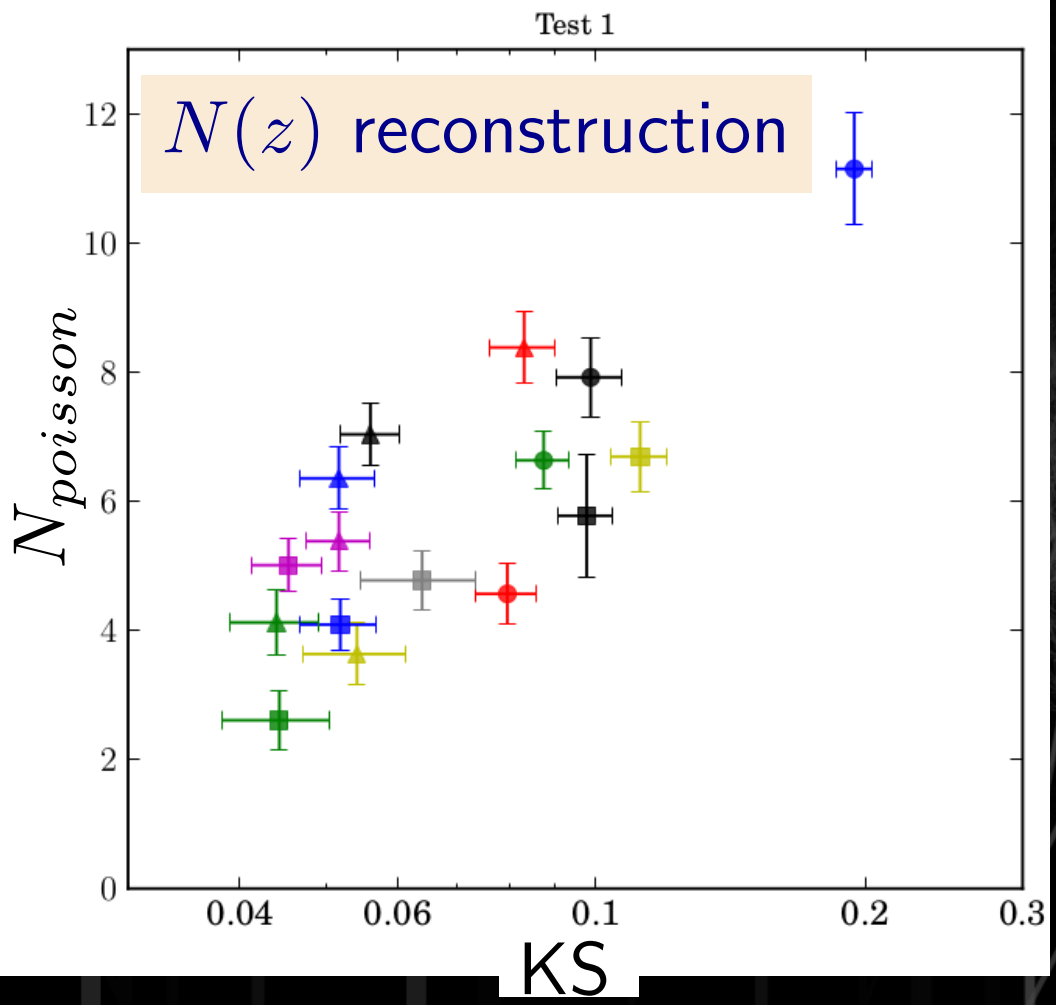
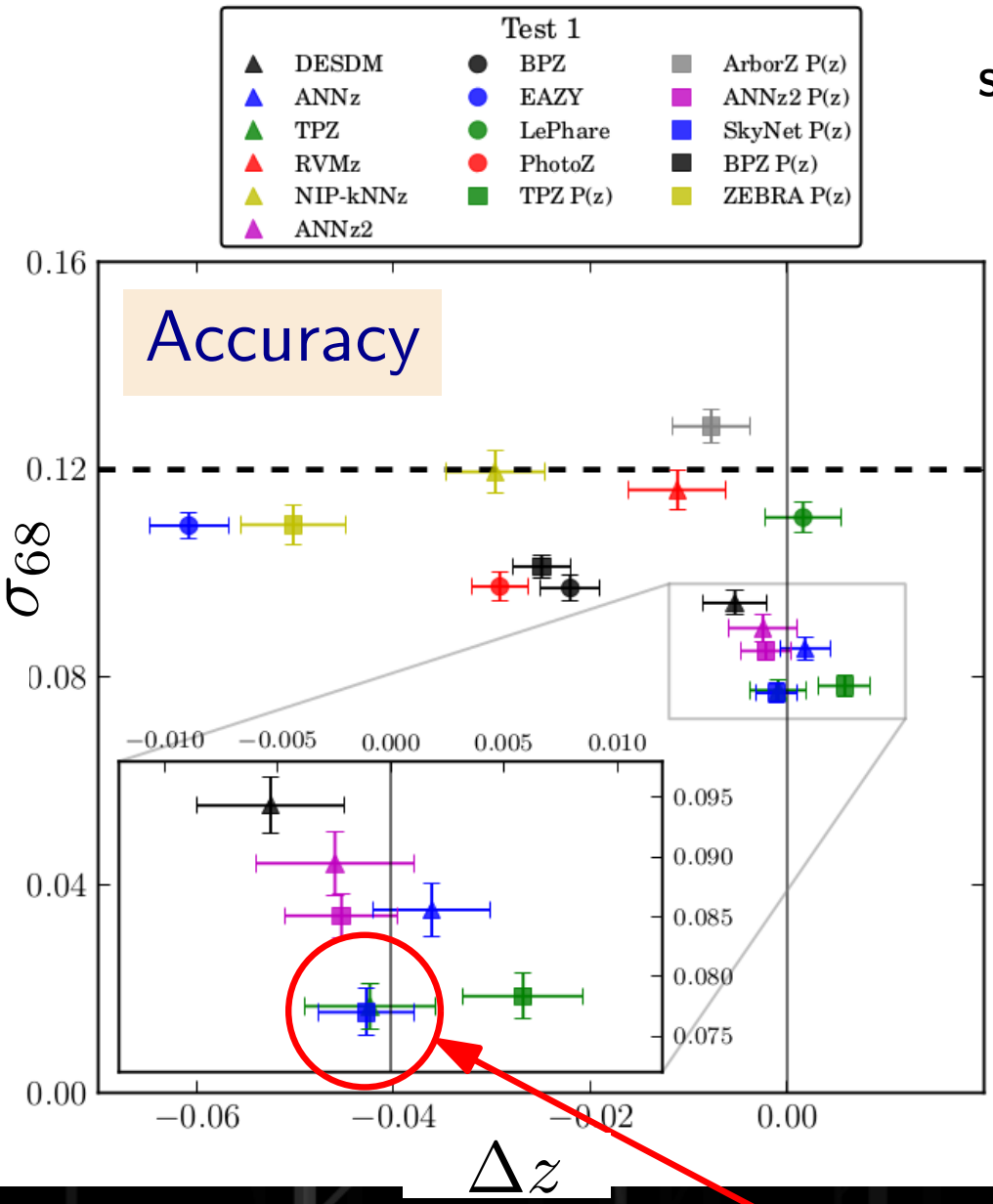


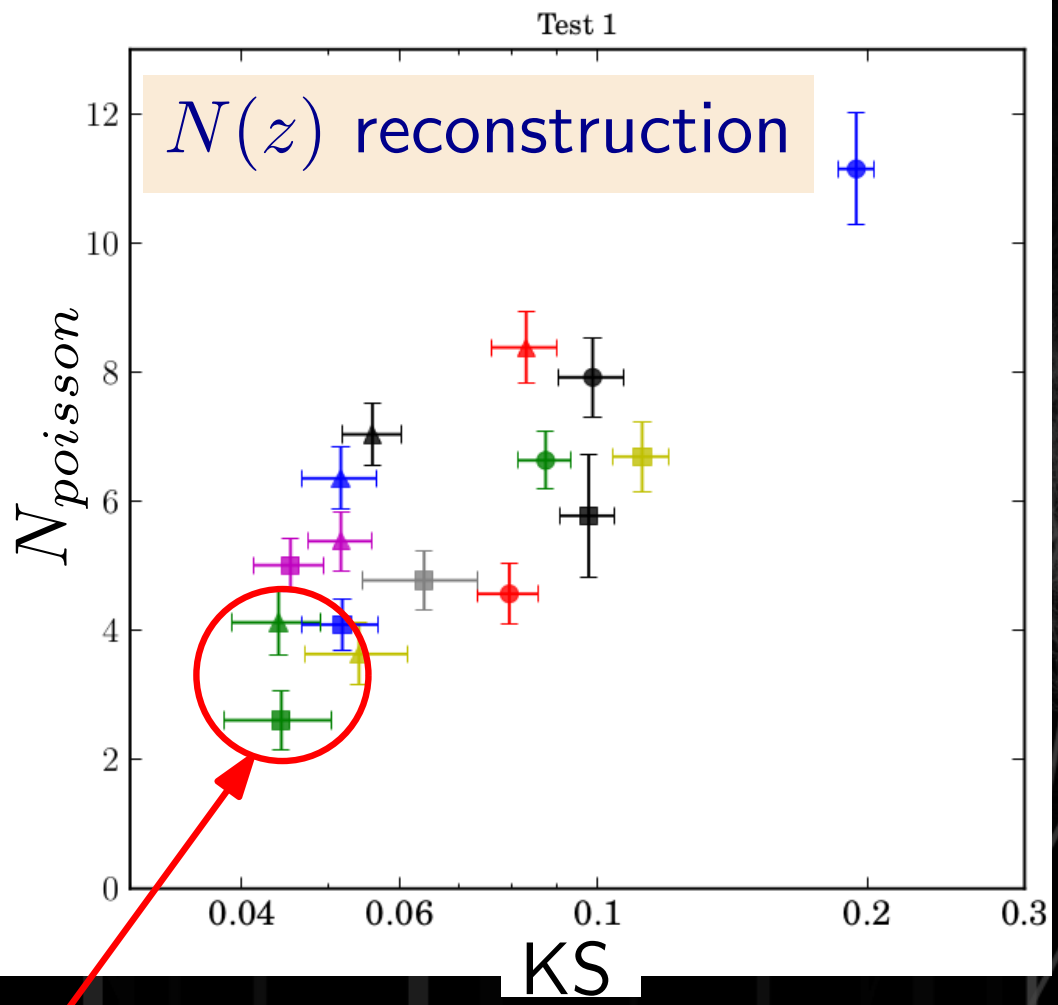


13 photo-z codes comparison

Photo-z for DES SV data

Sanchéz, Carrasco Kind, et al. 2014 (MNRAS, 445, 1482)





TPZ

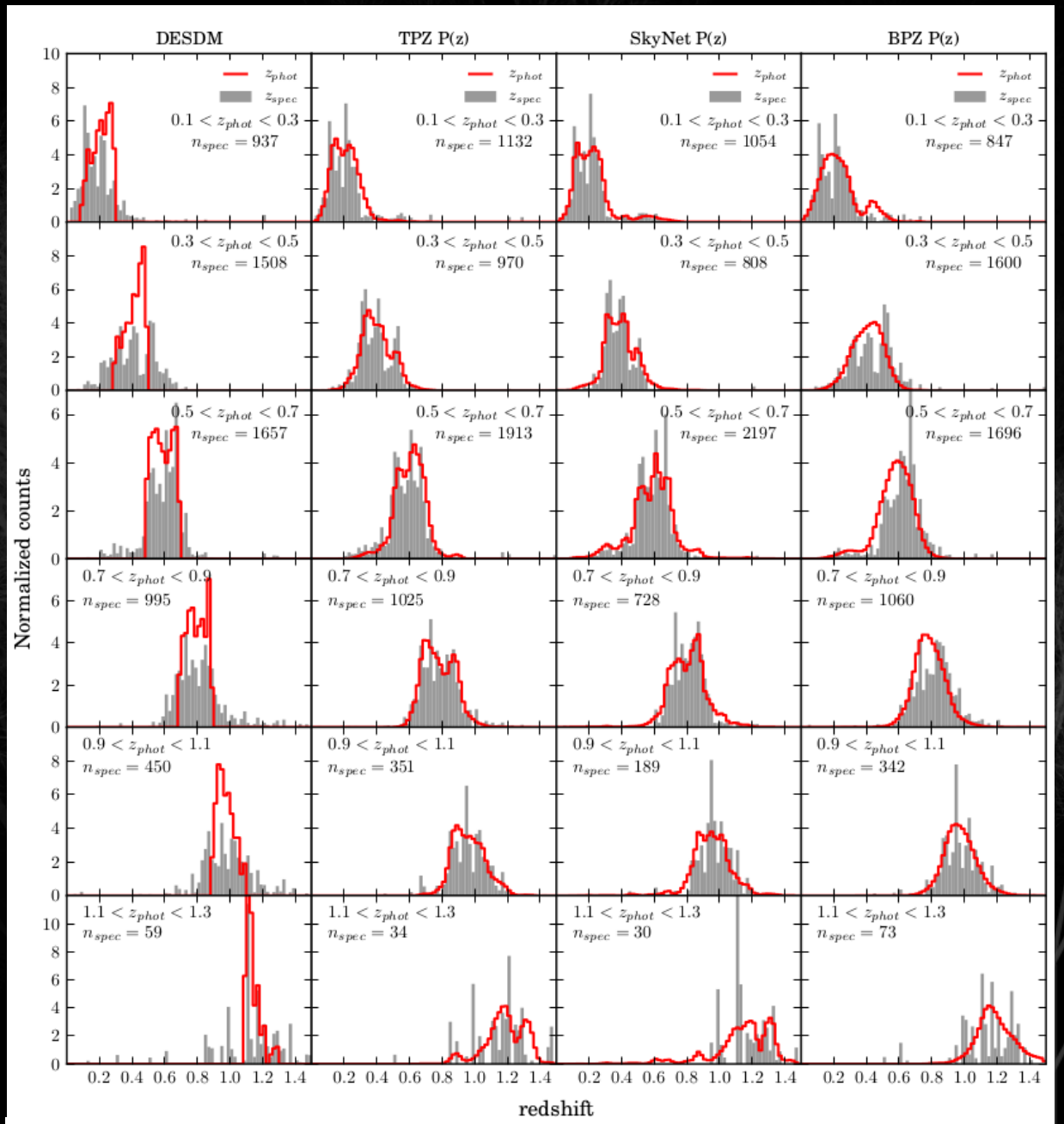
Photo-z for DES SV data

4 codes recommendation

Default, 2 training and 1 template

PDF methods are better for $N(z)$

Combination methods! (not used here)



Sanchéz, Carrasco Kind, et al. 2014 (MNRAS, submitted)

Main results

- Most methods meet DES requirements
- ML and template methods working together
- OzDES spectra and other surveys will reduce error
- Good benchmark results

Photo-z PDF representation and storage in DES DB

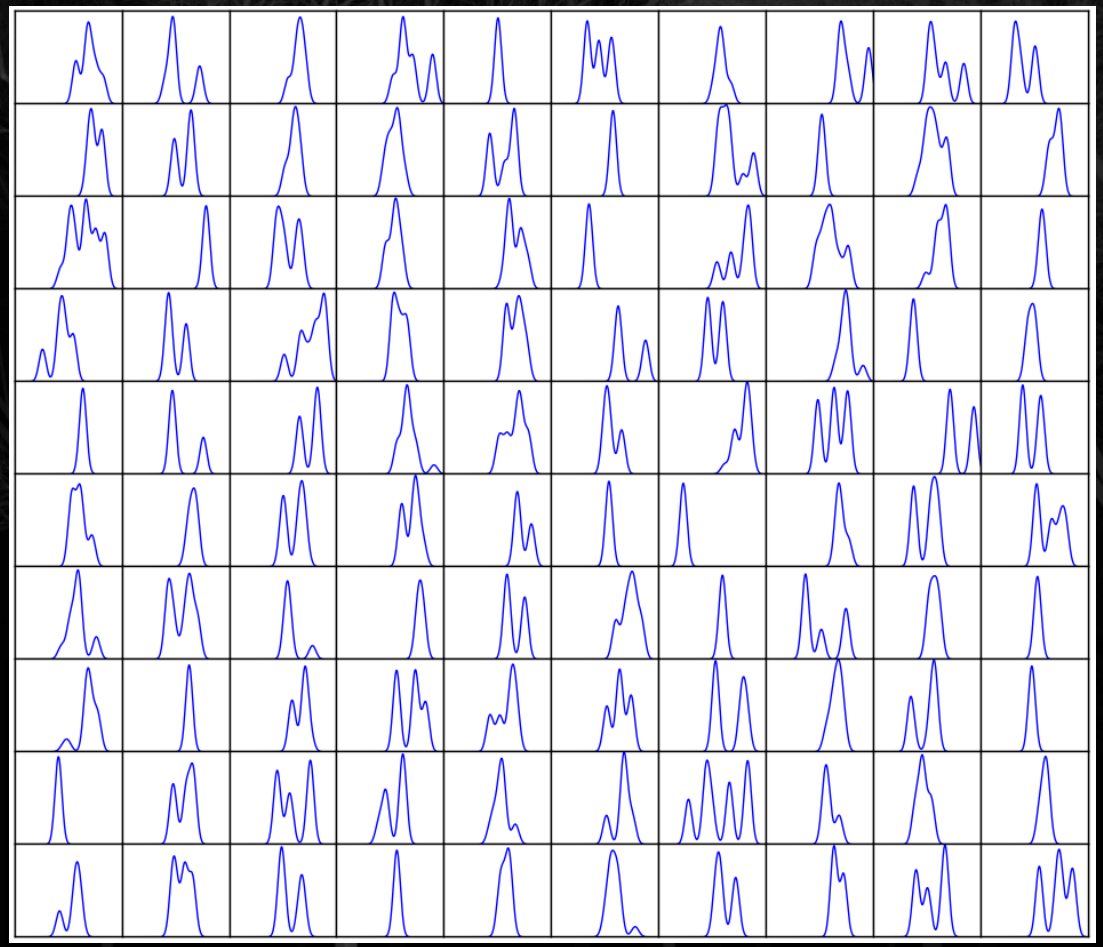


Photo-z PDF storage: Strategies

Single Gaussian fit

Multi-Gaussan fit

Monte Carlo sampling

Sparse representation techniques

Reduce number of points while increasing accuracy

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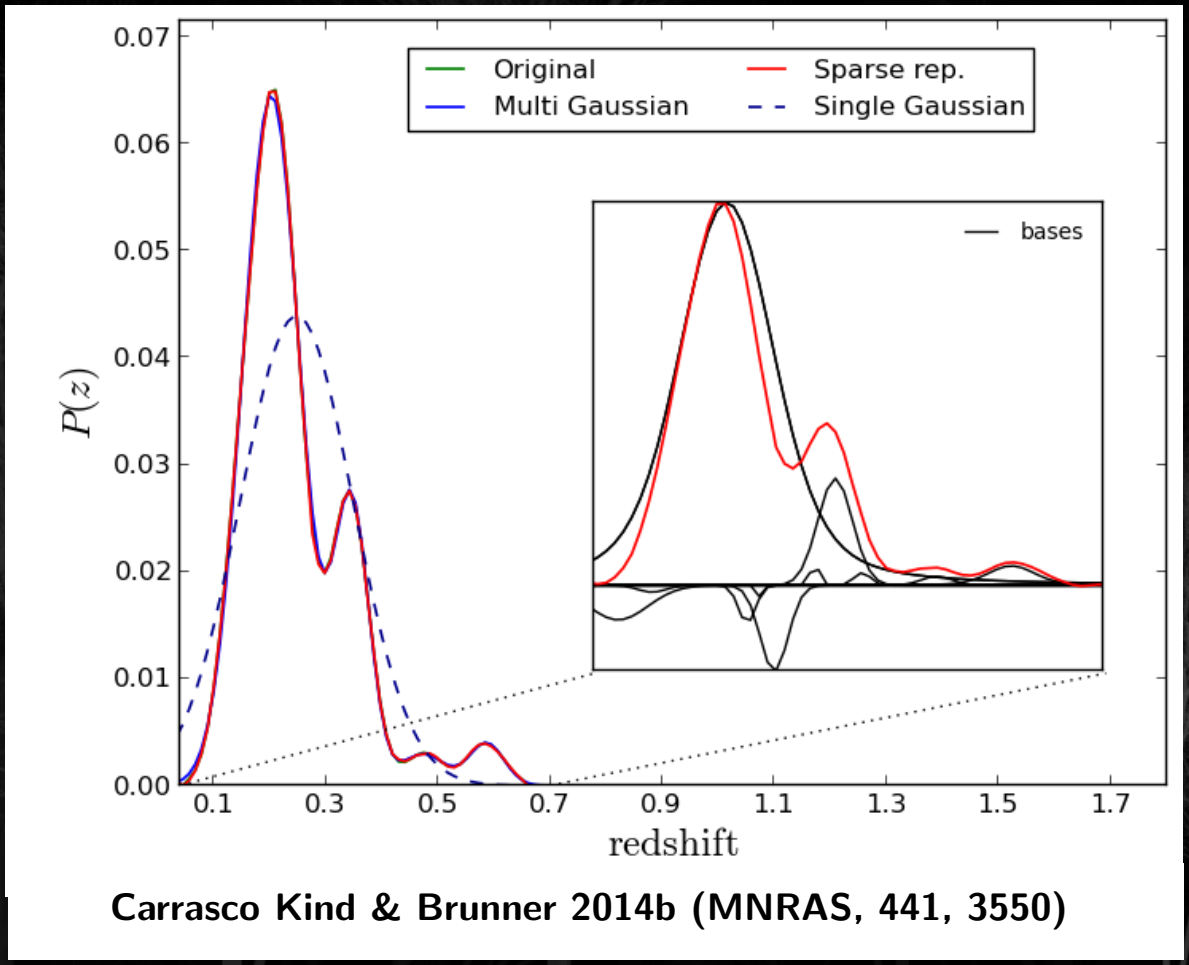


Carrasco Kind & Brunner 2014b (MNRAS, 441, 3550)

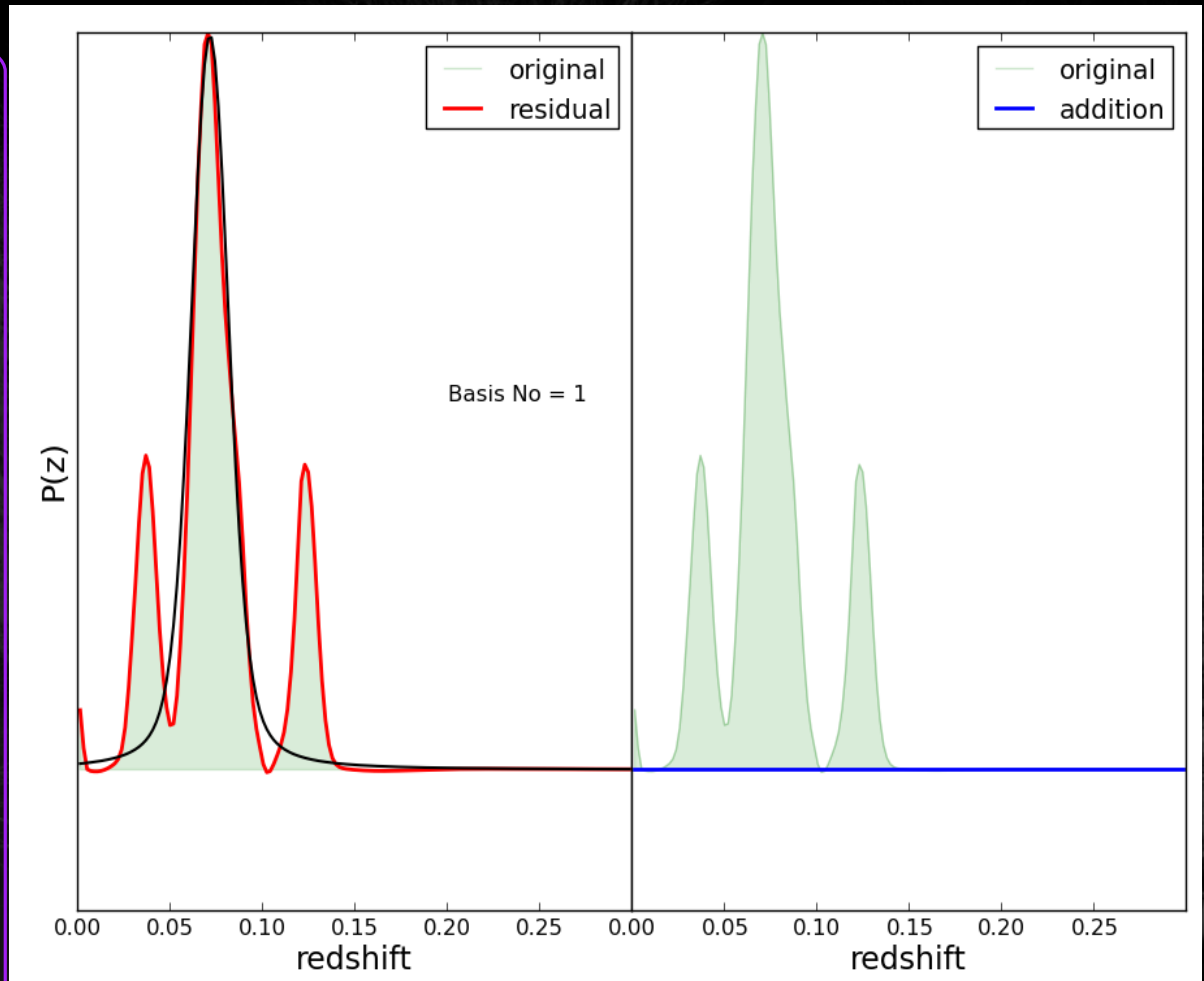
Photo-z PDF storage: Sparse representation

Use Gaussian and Voigt profiles as bases, need $N^2_{\rm original}$ bases

With only 10-20 bases achieve 99.9 % accuracy

Use 32-bits integer per basis, compression

Store Multiple PDFs



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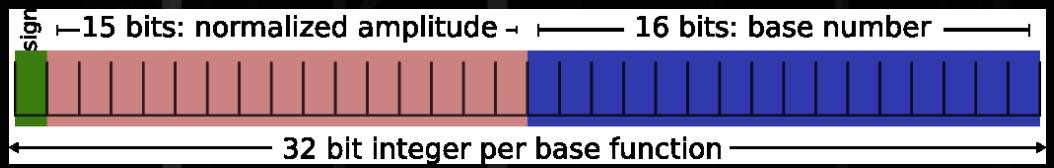

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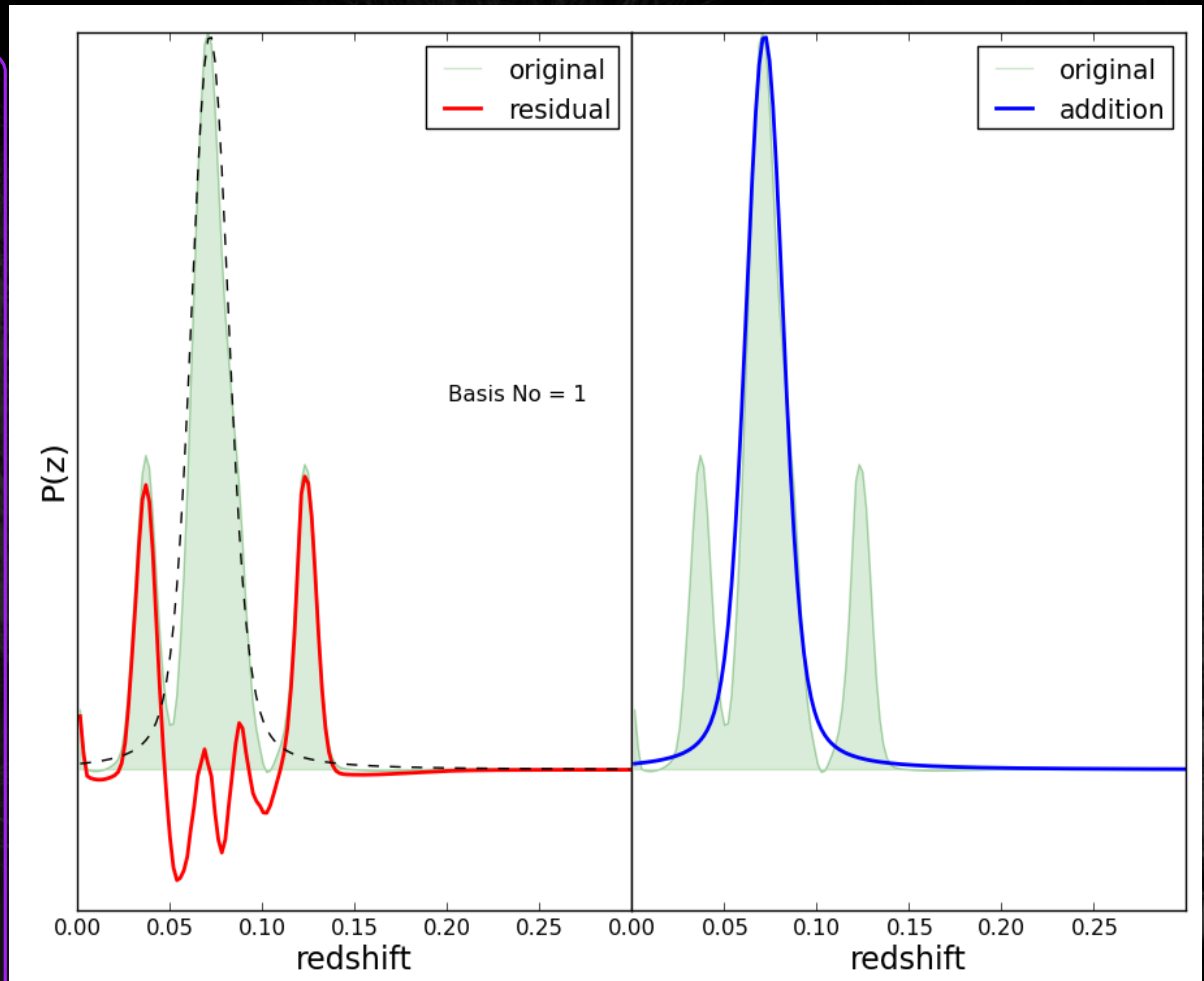

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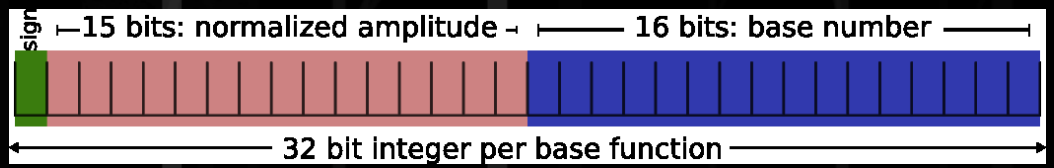

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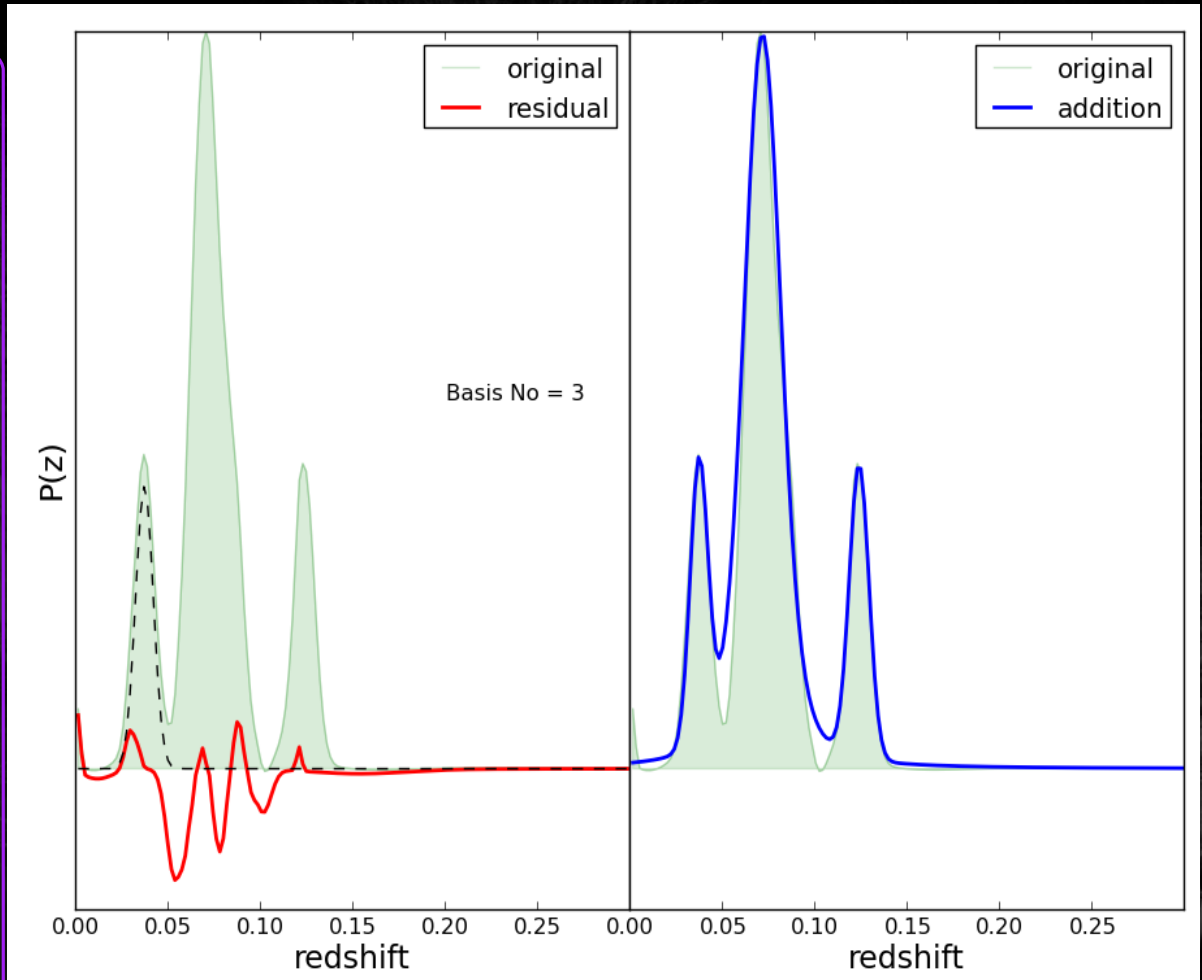

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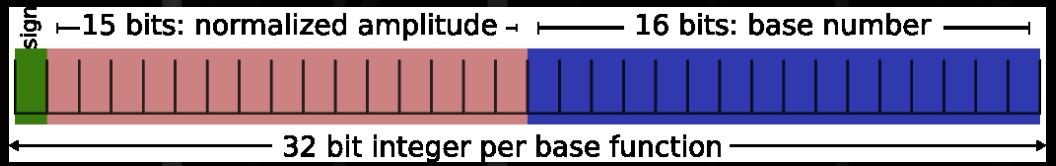

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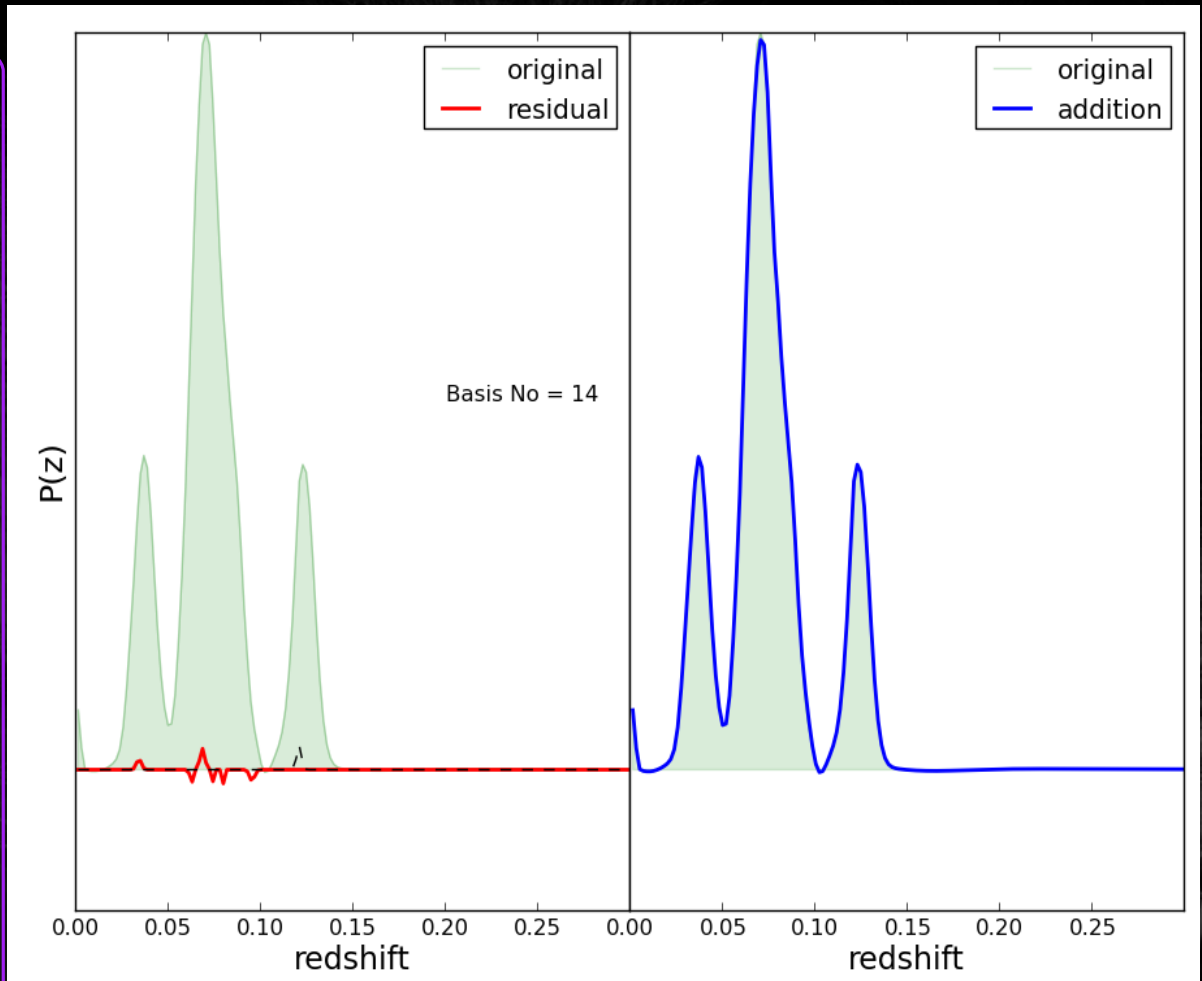

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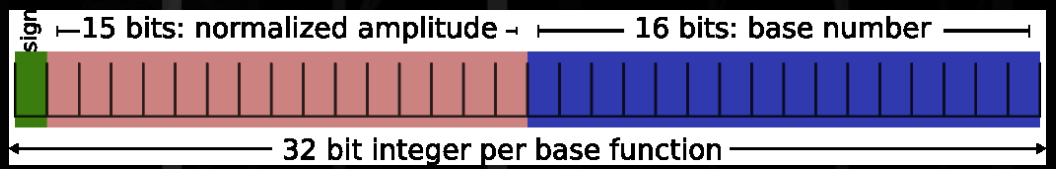
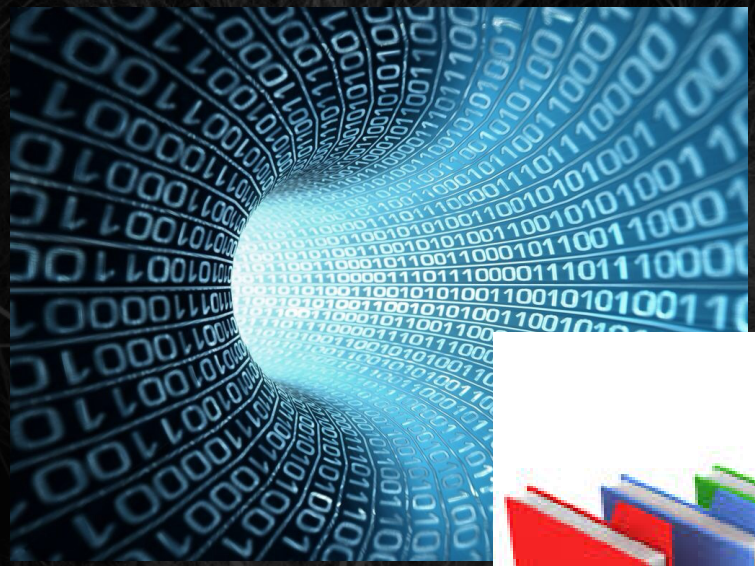
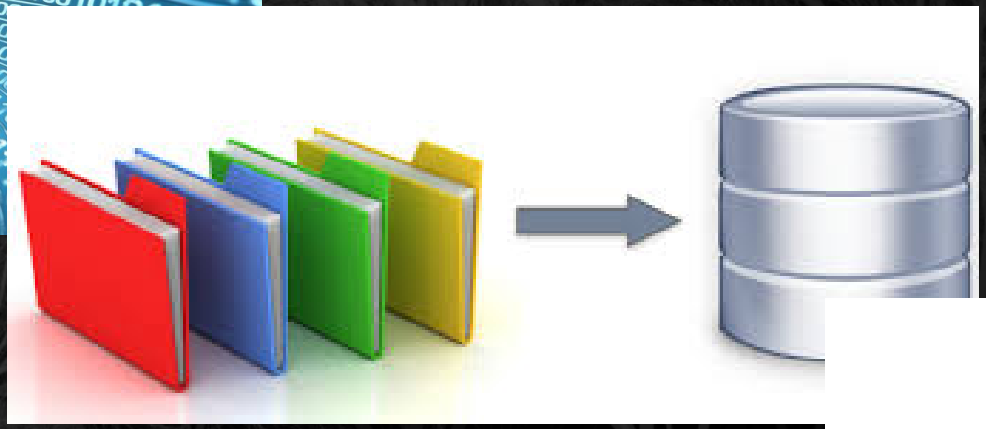


How can we do it?





Getting some PDFs from DB

```
query="""
select COADD_OBJECTS_ID,TPZ from
PHOTOZ_PDF_SVA1_GOLD where rownum < 6"""
cc=cursor.execute(query)
#Handling and plot
df=ea.to_pandas(cc)
for i in xrange(5):
    cid=df.COADD_OBJECTS_ID.values[i]
    plt.plot(zbins,df.TPZ.values[i],
    lw=2,label=cid)
plt.xlabel('redshift',fontsize=17)
plt.ylabel('P(z)',fontsize=17)
plt.legend(loc=0, title='COADD_OBJECTS_ID')
```

Getting some PDFs from DB

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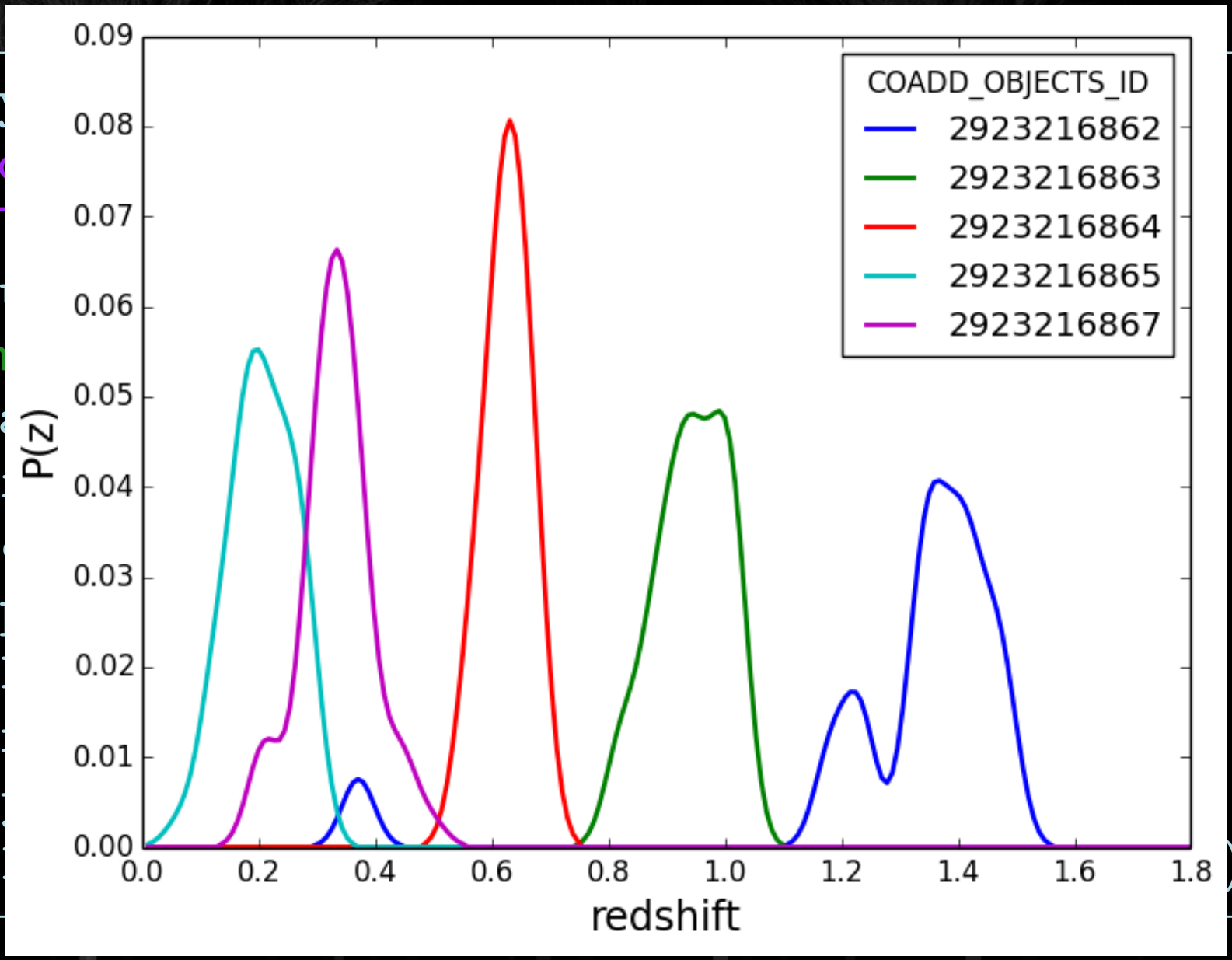

Now using Sparse rep.

```
query="""
select COADD_OBJECTS_ID,PHZ.GET_PDF(TPZ) as
TPZ from PHOTOZ_SPARSE_SVA1_GOLD
where rownum < 6"""
cc=cursor.execute(query)
#Handling and plot
df=ea.to_pandas(cc)
for i in xrange(5):
    cid=df.COADD_OBJECTS_ID.values[i]
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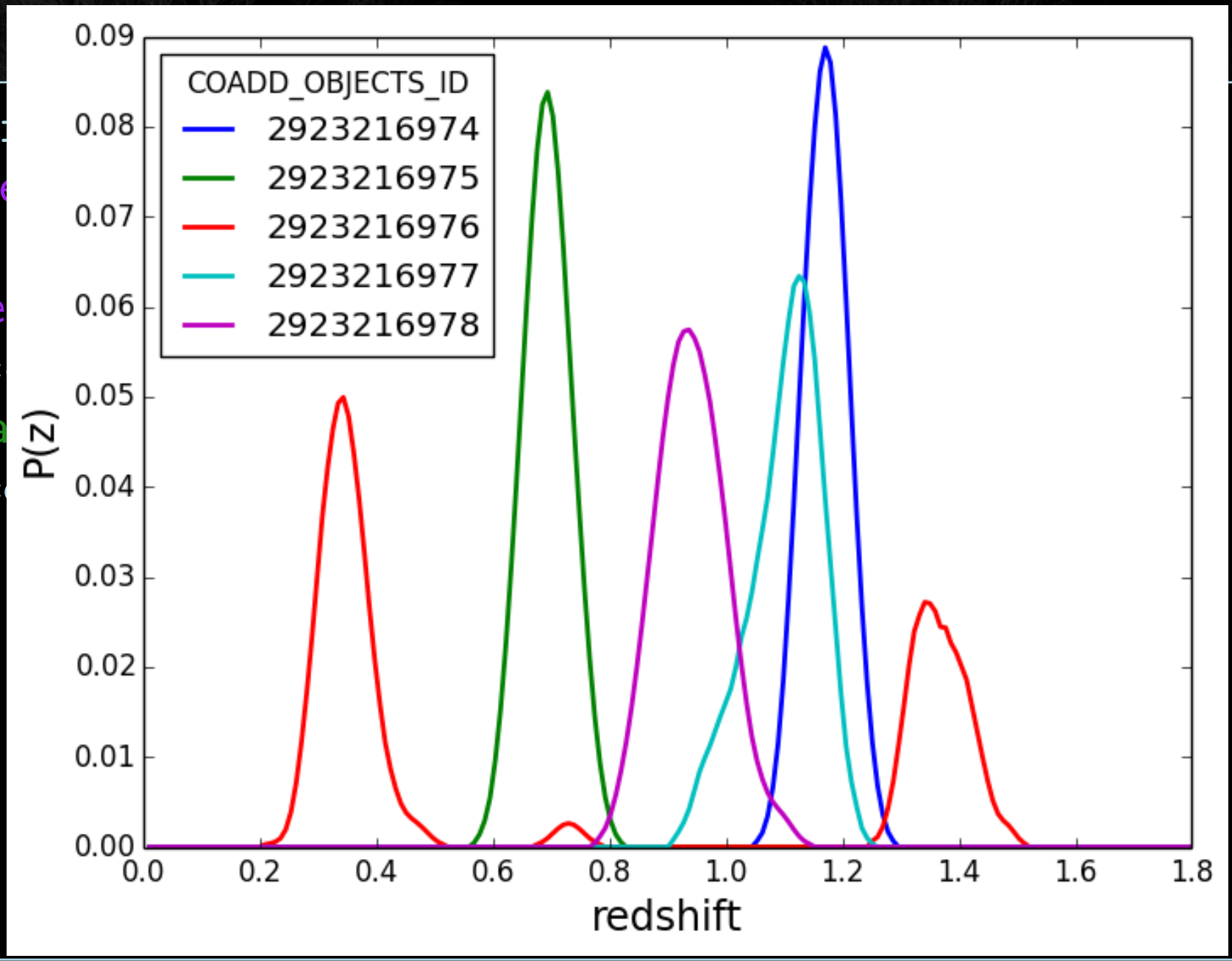

Getting metrics on the fly

```
query="""
Select PHZ.MEAN(tpz) mean, PHZ.MEDIAN(tpz)
median from PHOTOZ_PDF_SVA1_GOLD
where rownum < 1000"""
cc=cursor.execute(query)
df=ea.to_pandas(cc)
plt.plot(df.MEAN,df.MEDIAN,'ko')
plt.xlabel('PDF mean',fontsize=17)
plt.ylabel('PDF median',fontsize=17)
```

Getting metrics on the fly

```
query="""
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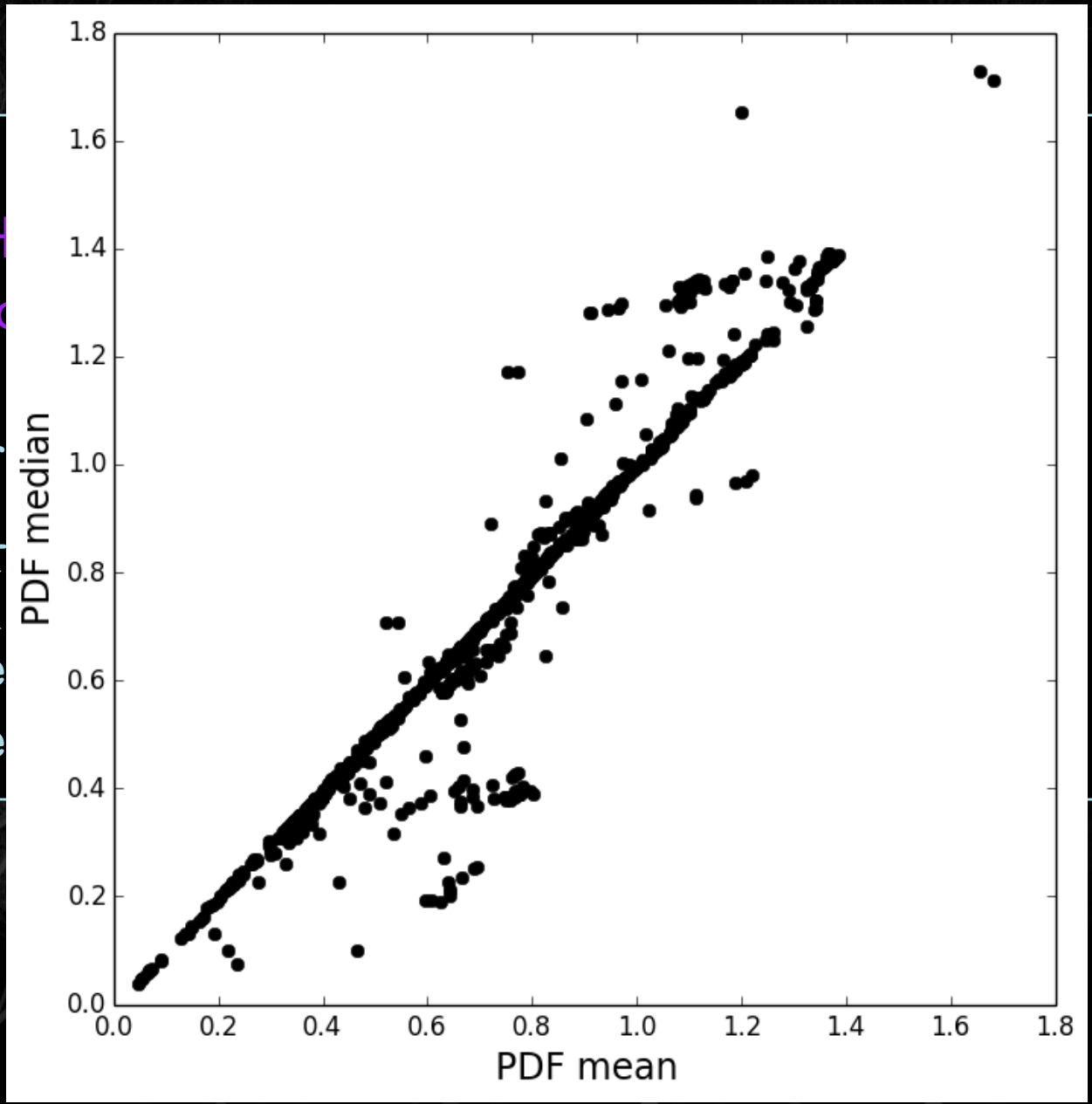

Stacking PDFs in DB cluster!

```
query="""
Select NZ(PHZ.TOTABLE(tpz)) as NZ from
PHOTOZ_PDF_SVA1_GOLD where
PHZ.MEAN(tpz) BETWEEN 0.1 and 0.4
and rownum < 100000"""
cc=cursor.execute(query)
df=ea.to_pandas(cc)
plt.fill_between(zbins,df.NZ.values[0],
     facecolor='blue',alpha=0.7)
plt.xlabel('redshift',fontsize=17)
plt.ylabel('N(z)',fontsize=17)
```

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```
query="""
Select NZ(PHZ.TOTABLE(tpz)) as NZ from
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```
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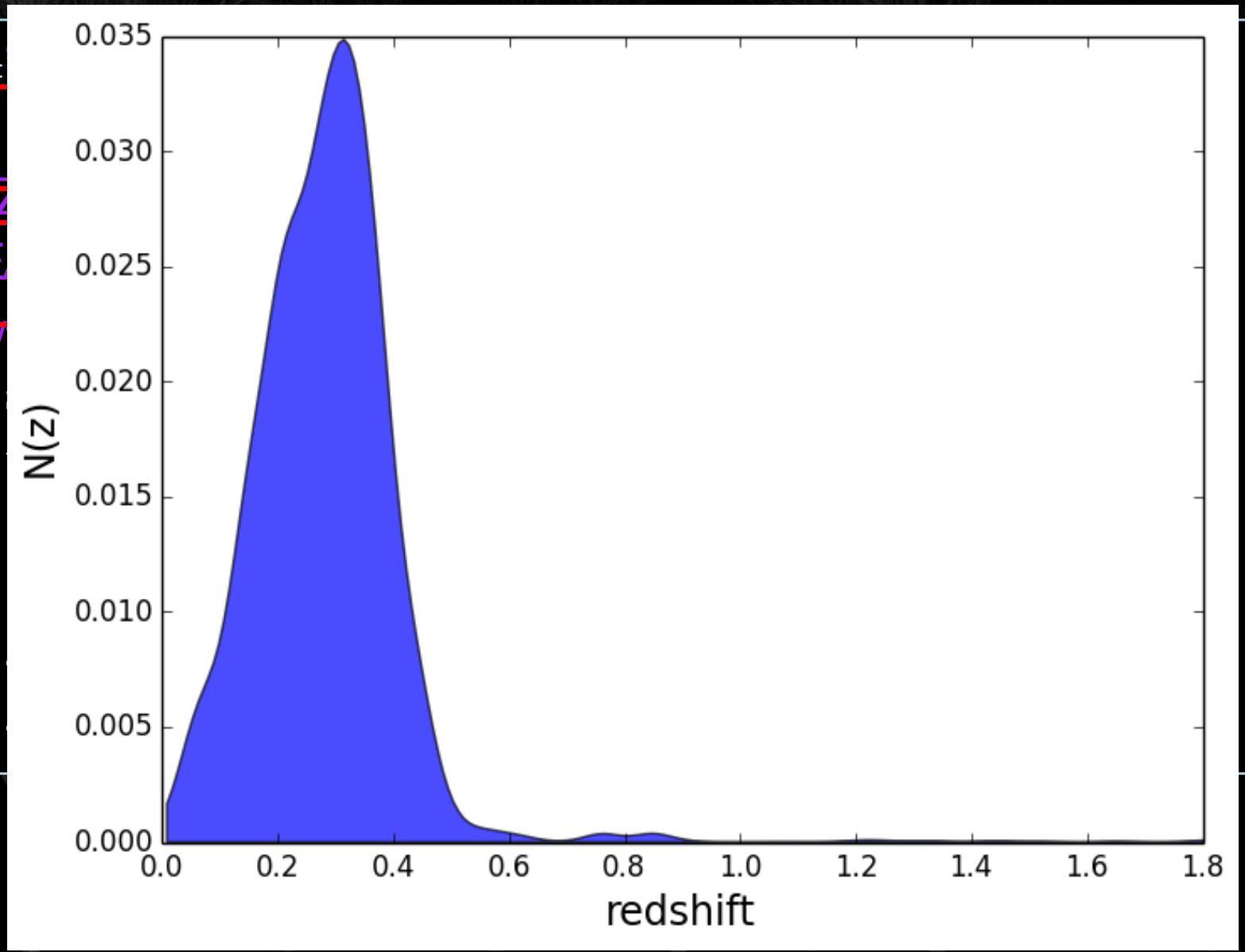

Conclusions

- Photo-z in DECam look good!
- Stay tuned for DES papers
- Photo-z PDF just one example!
- First time doing science wit queries
- Bring analysis (software) to DB!

THANKS!

Questions?

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mcarras2@ncsa.illinois.edu
http://matias-ck.com/
https://github.com/mgckind

EXTRA SLIDES