Advanced TOPCAT & STILTS

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WHICH ONE TO USE?

TOPCAT

- Easier to learn.
- Interactive.
- Good for exploring data.

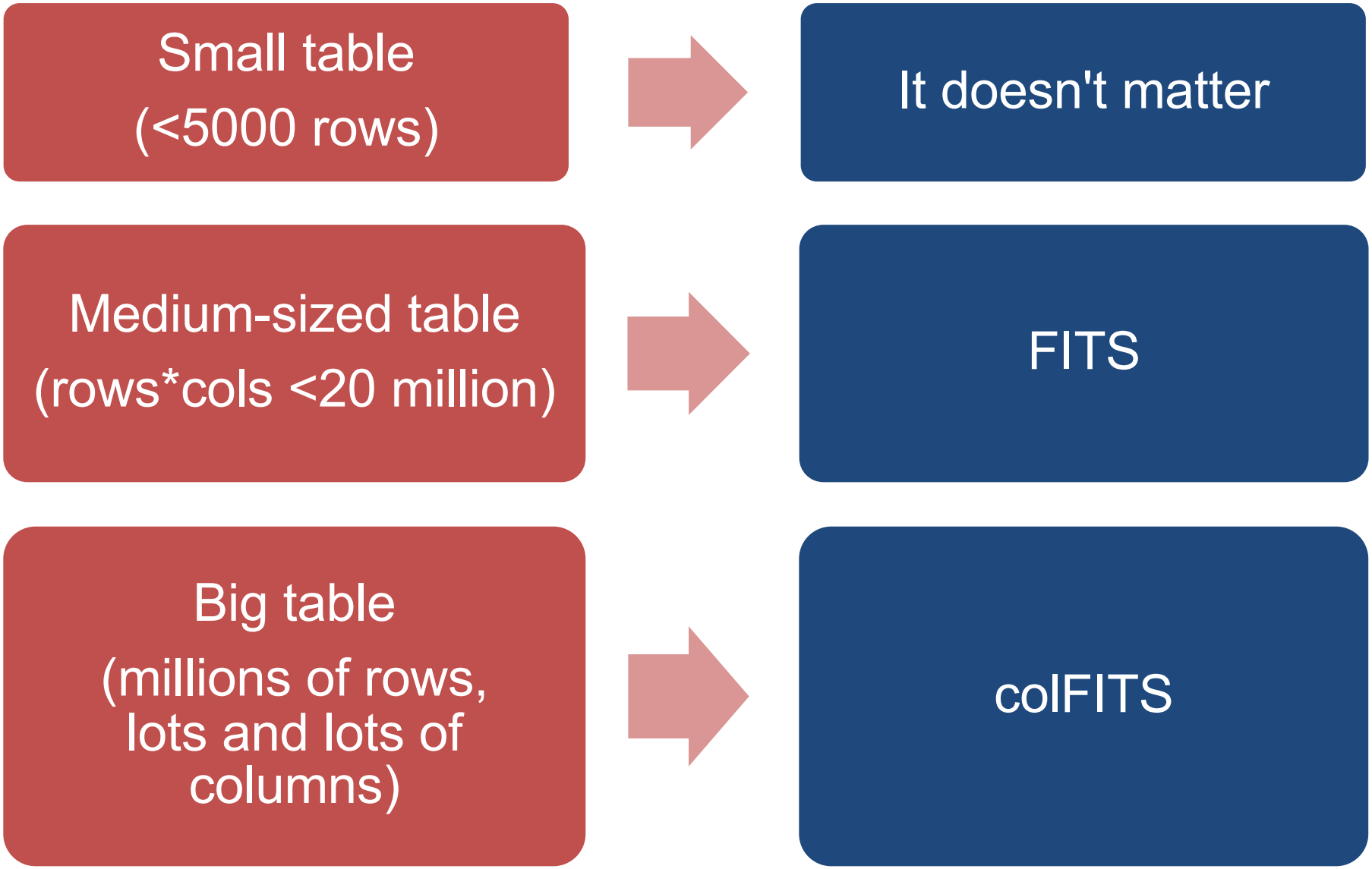
STILTS

- Can be scripted.
- Better por reproducible work.
- Steeper learning curve.

TABLE FORMATS

INPUT FORMATS	OUTPUT FORMATS
FITS	FITS
Column-oriented FITS	Column-oriented FITS
VOTable	VOTable
ECSV	ECSV
Feather	CDF
ASCII	Feather
IPAC	ASCII
CSV	Text
GBIN	IPAC
Tab-separated table	CSV
SQL Database Queries	Tab-separated table
World Data Center	SQL table
	HTML
	LaTeX
	Mirage

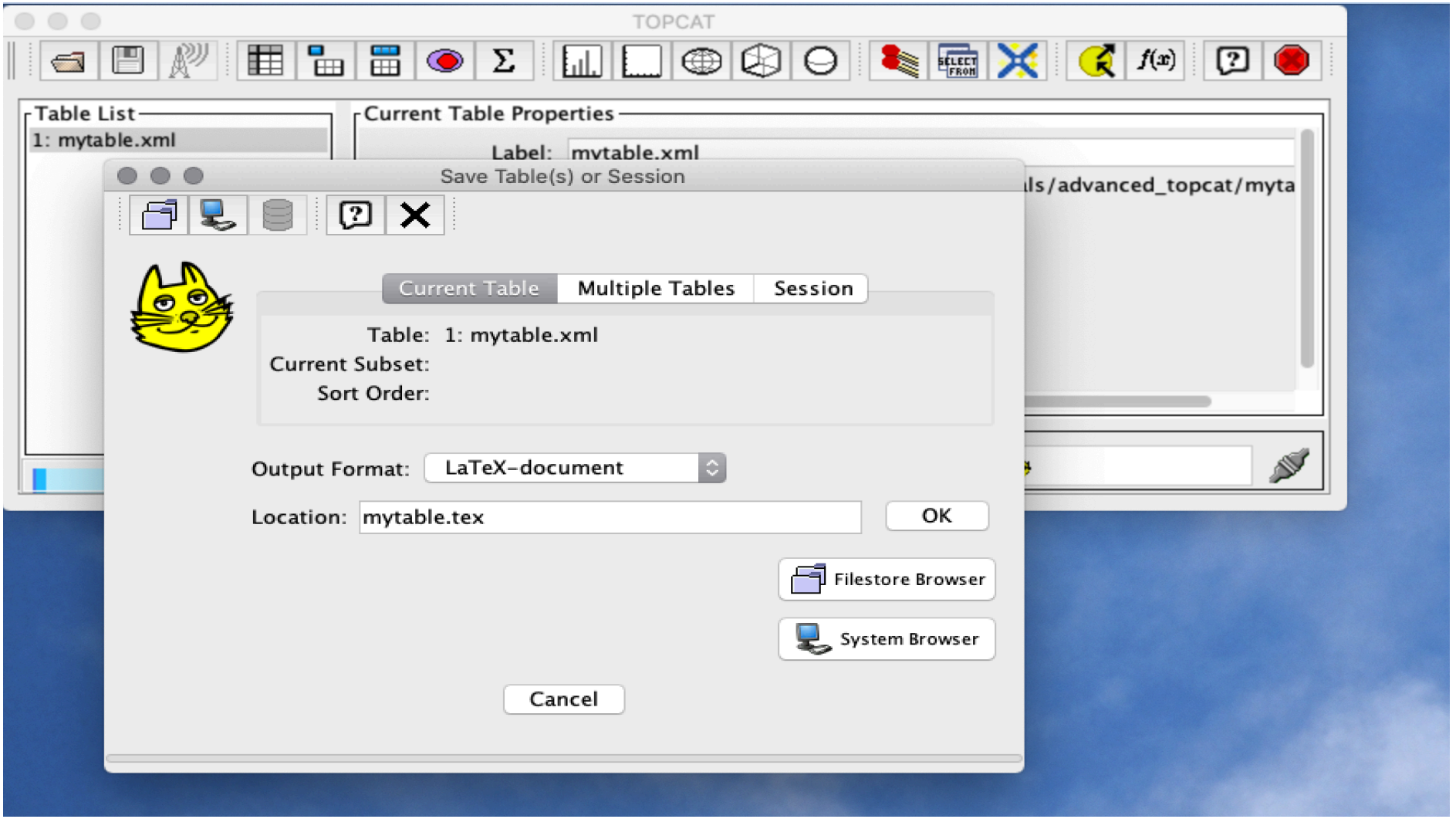
WHAT IS THE BEST FORMAT?



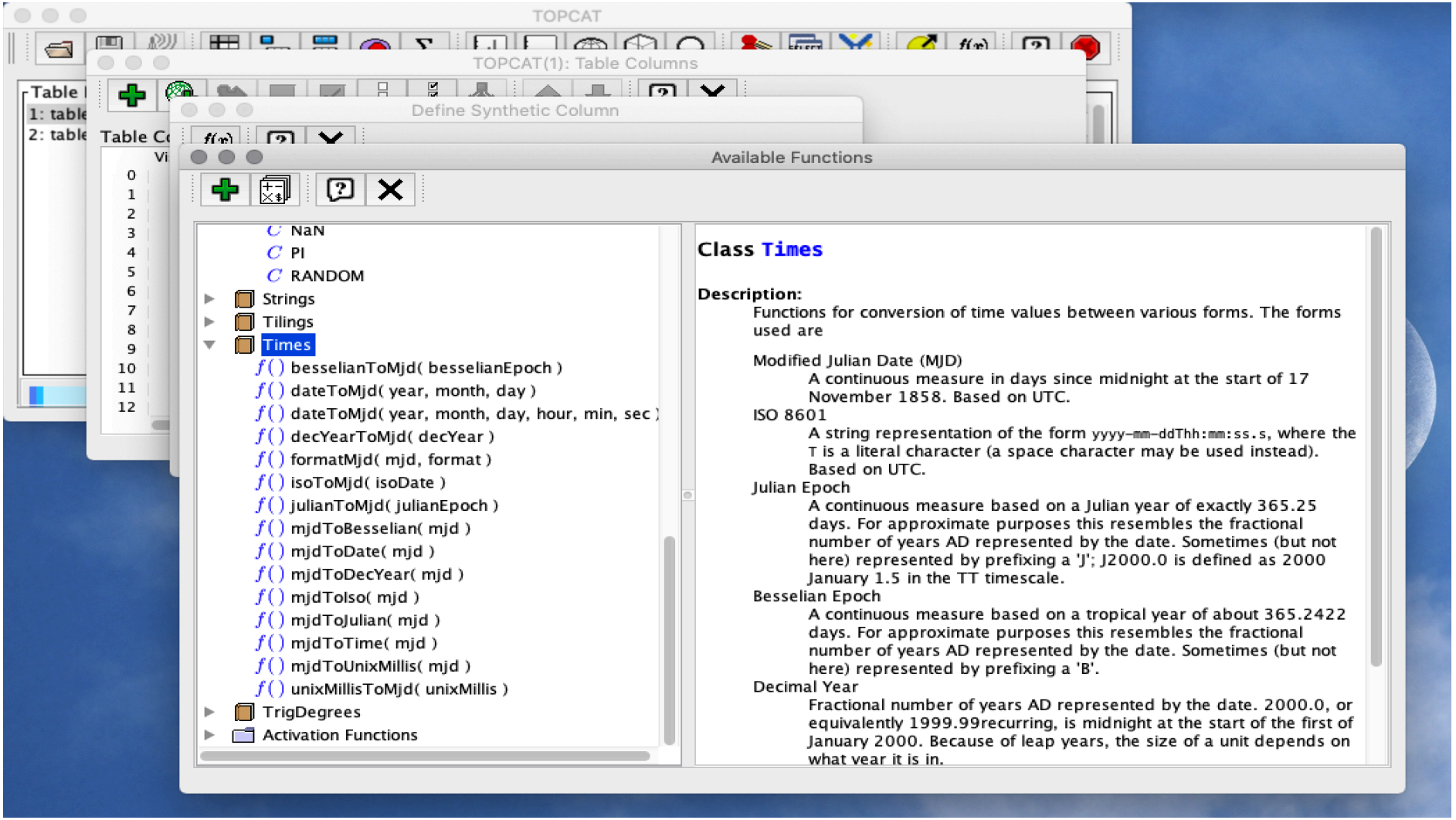
FORMAT CONVERSION WITH STILTS

```
stilts tpipe in=mytable.csv ifmt=csv out=mytable.fits ofmt=fits
```

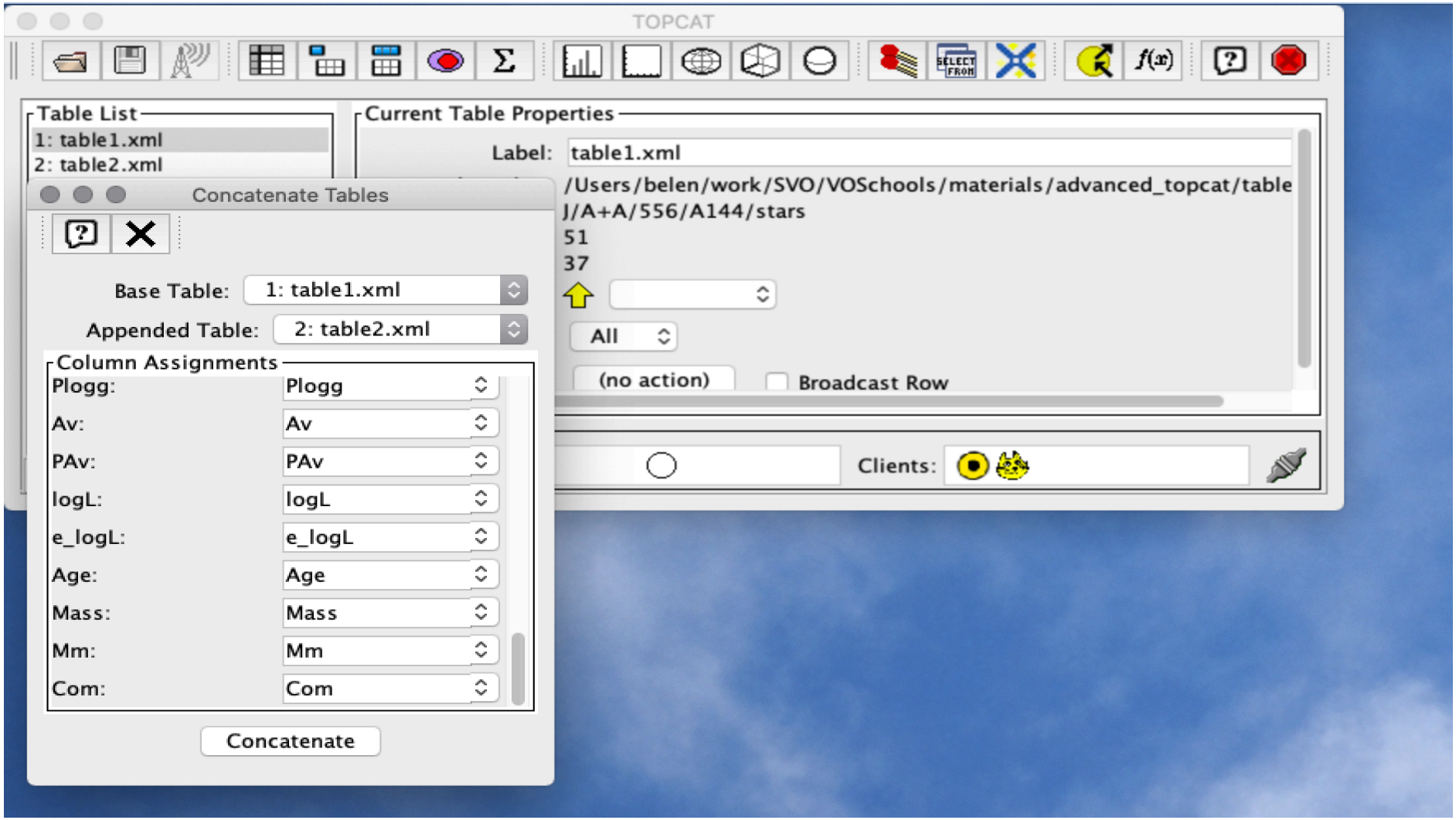
FROM TOPCAT TO PAPER!



FUNCTIONS IN TOPCAT



CONCATENATING TABLES



TOPCAT: Only two tables at a time.

CONCATENATING TABLES

```
stilts tcat ifmt=ascii in=t1.txt in=t2.txt in=t3.txt out=table.txt
```

```
stilts tcat ifmt=ascii in="t1.txt t2.txt t3.txt" out=table.txt
```

```
stilts tcat ifmt=ascii in=@tablelist.lis out=table.txt
```

STILTS: Multiple tables, same format and columns.

CONCATENATING TABLES

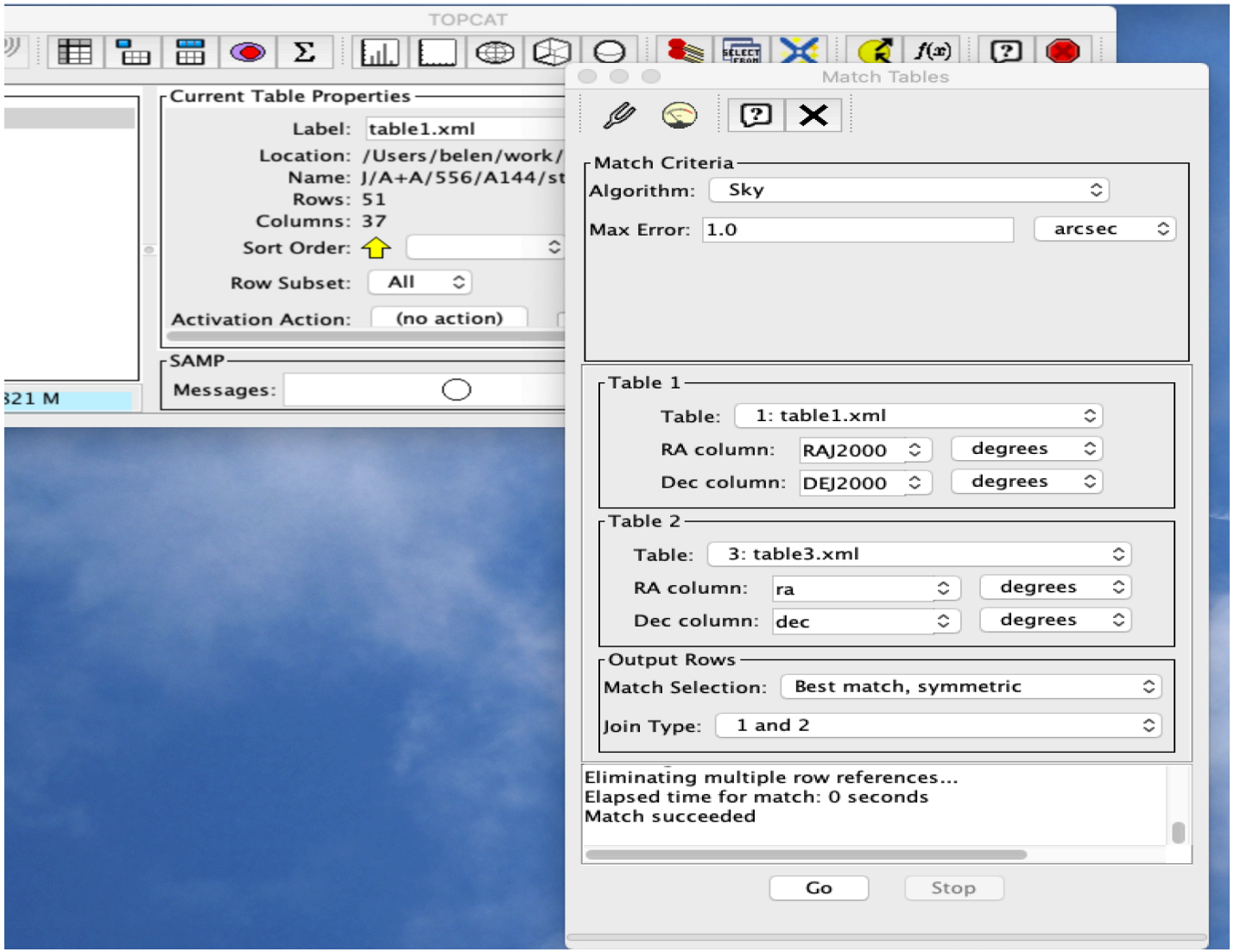
```
stilts tcatn nin=2 in1=survey.vot.gz ifmt2=csv in2=more_data.csv  \
           icmd1='addskycoords fk5 galactic RA2000 DEC2000 GLON GLAT' \
           icmd1='keepcols "OBJ_ID GLON GLAT" ' \
           icmd2='keepcols "ident gal_lon gal_lat" ' \
           loccol=FILENAME omode=topcat
```

STILTS: Multiple tables, different format and columns.

CROSS-MATCHING TABLES

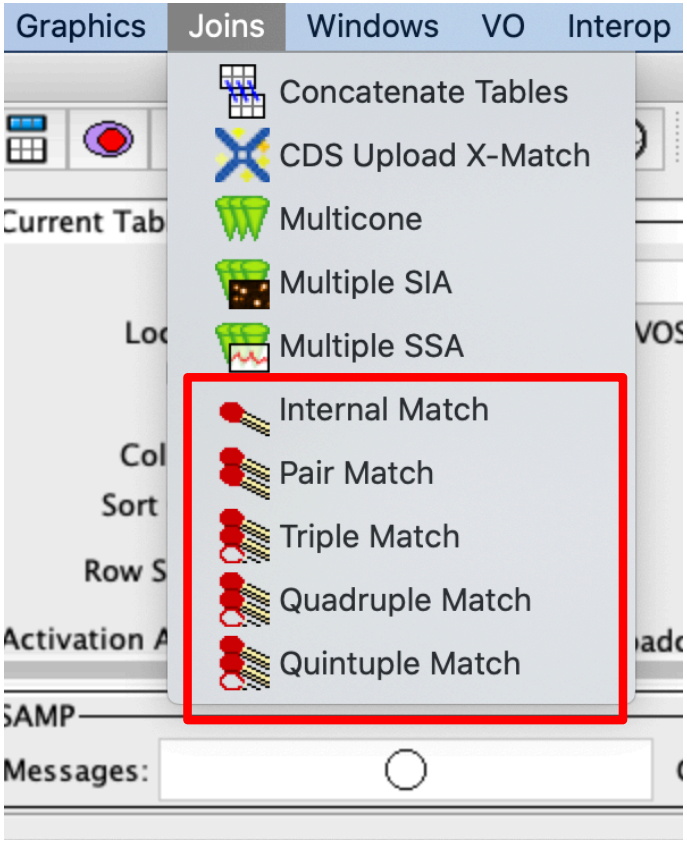
```
stilts tskymatch \
       in1=tycho-pleiades.fits ra1=RAJ2000 dec1=DEJ2000 \
       in2=2mass-pleiades.fits ra2=RAJ2000 dec2=DEJ2000 \
       join=1and2 find=best error=1 out=tycho-2mass.fits
```

CROSS-MATCHING TABLES



CROSS-MATCHING TABLES

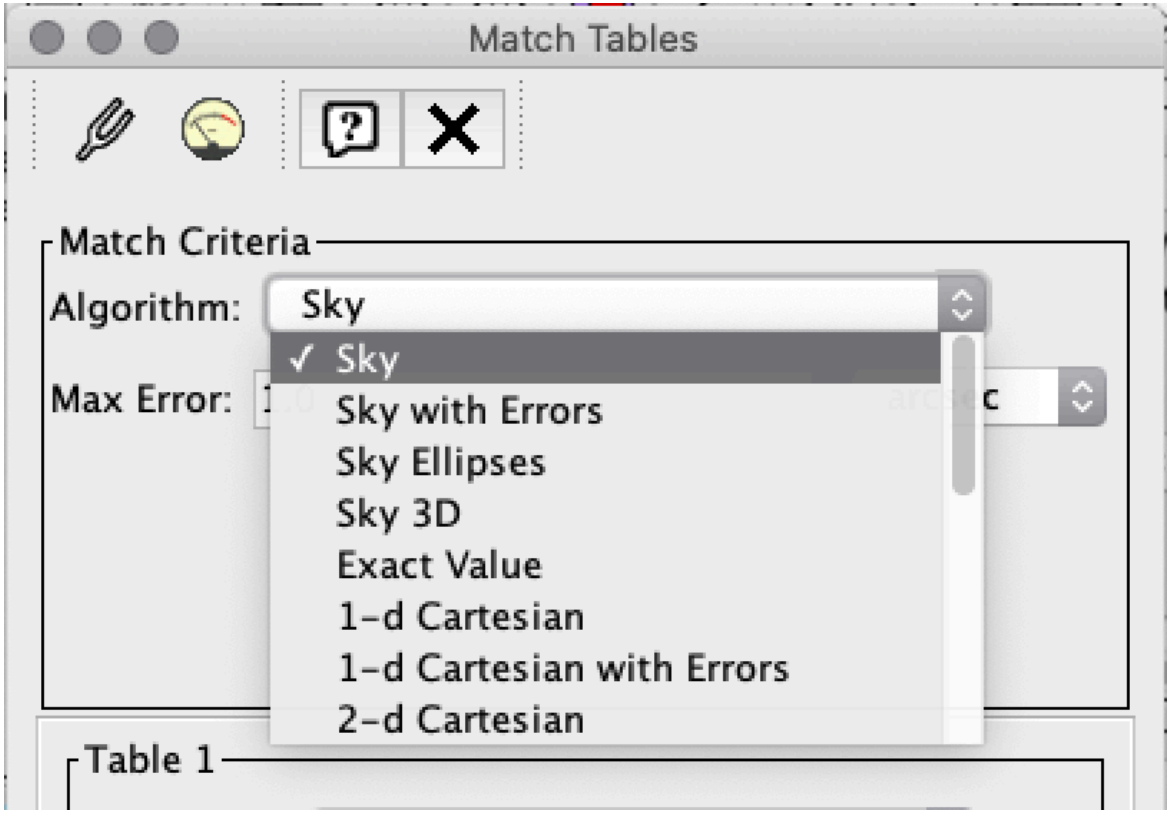
Things to keep in mind



Lots of different match types.

CROSS-MATCHING TABLES

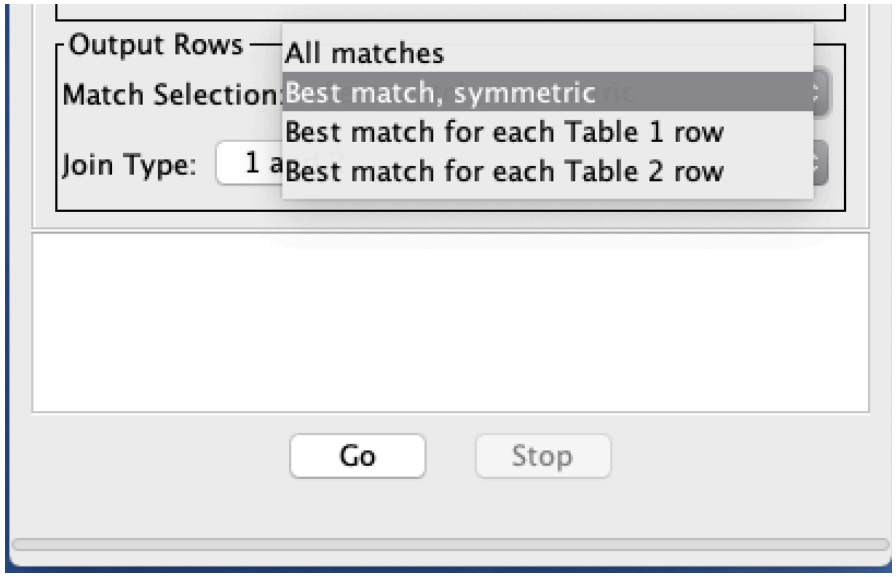
Things to keep in mind

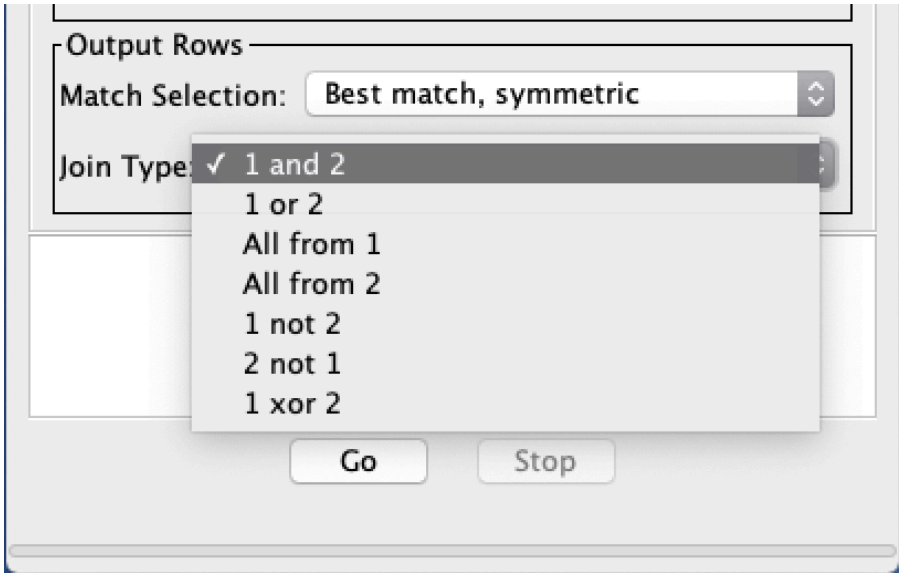


Lots of different match algorithms.

CROSS-MATCHING TABLES

Things to keep in mind





Different output options.

CROSS-MATCHING TABLES

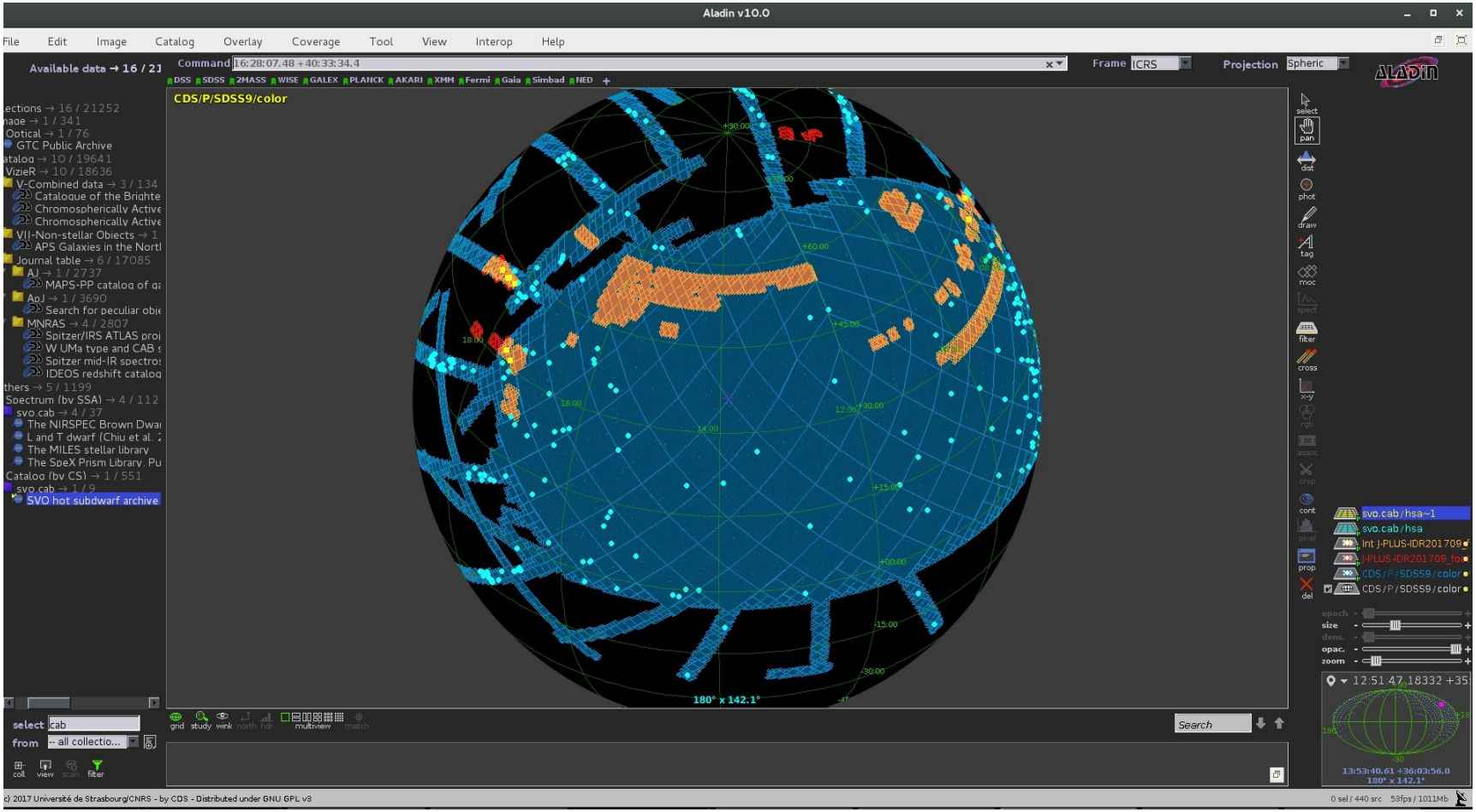
Things to keep in mind

For large tables, you may run out of memory!

…or use the *java -disk* option.

CROSS-MATCHING WITH A LARGE CATALOGUE

OPTION 1: Filter by MOC & cross-match



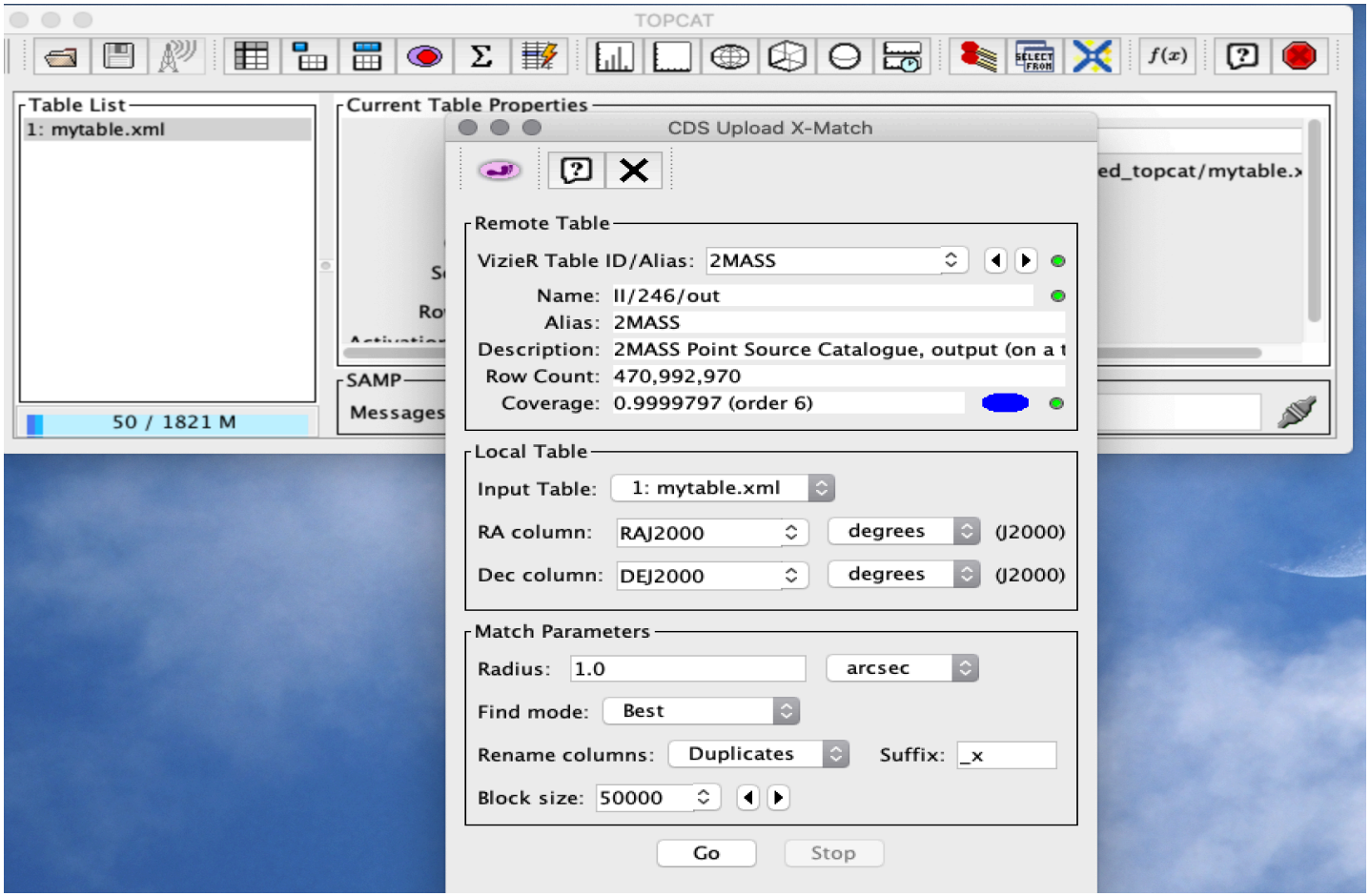
CROSS-MATCHING WITH A LARGE CATALOGUE

OPTION 1: Filter by MOC & cross-match

Pros	Cons
• Reduced table for cross-match	• Two steps

CROSS-MATCHING WITH A LARGE CATALOGUE

OPTION 2: CDS Upload X-match



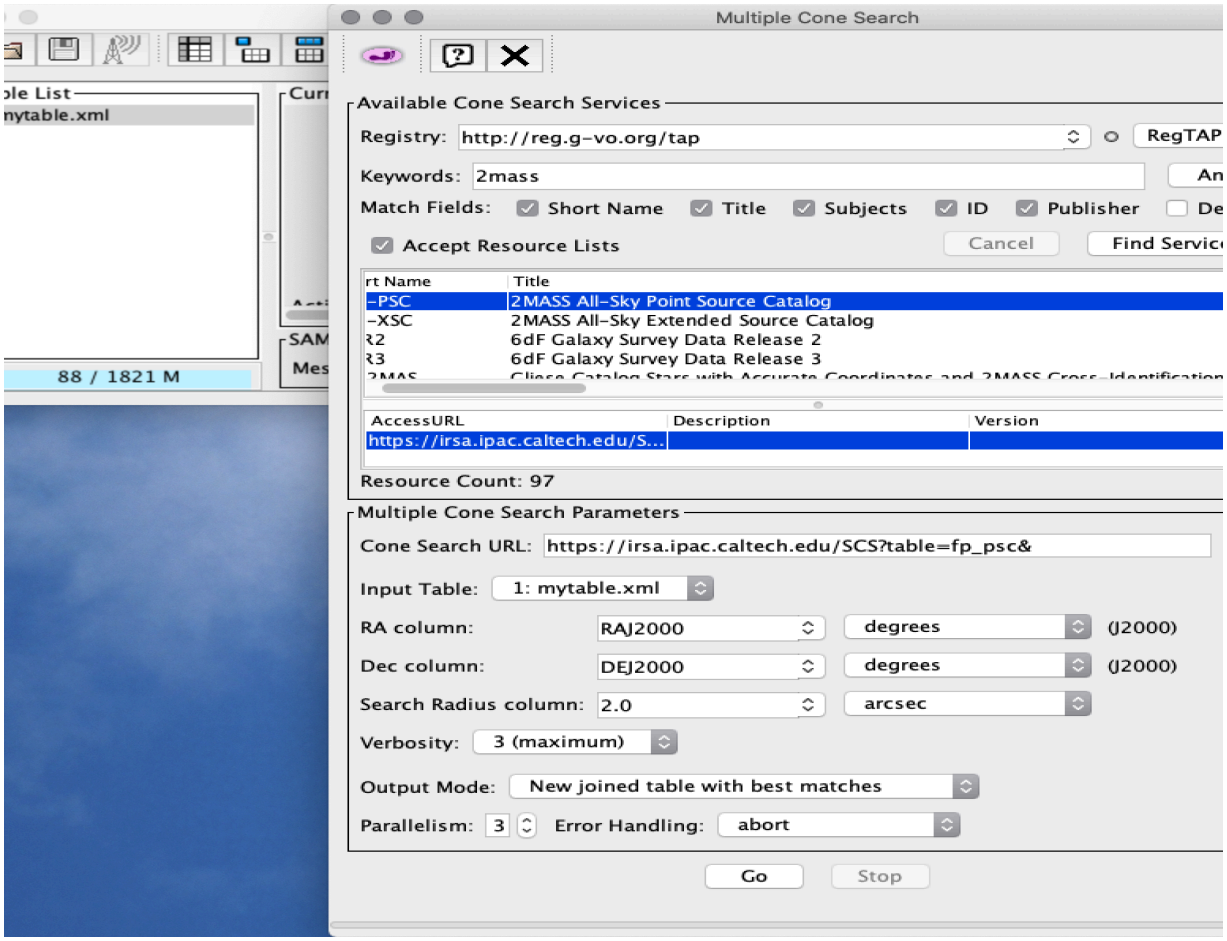
CROSS-MATCHING WITH A LARGE CATALOGUE

OPTION 2: CDS Upload X-match

Pros	Cons
• Efficiency	• Only CDS catalogues • Only default columns

CROSS-MATCHING WITH A LARGE CATALOGUE

OPTION 3: Multicone



CROSS-MATCHING WITH A LARGE CATALOGUE

OPTION 3: Multicone

Pros	Cons
• Many services • All columns	• Slow

CROSS-MATCHING TWO LARGE CATALOGUES

OPTION 1: CDS X-match Service

CROSS-MATCHING TWO LARGE CATALOGUES

OPTION 1: CDS X-match Service

Pros	Cons
• User space	• No filtering • Large outputs

CROSS-MATCHING TWO LARGE CATALOGUES

OPTION 2: STILTS

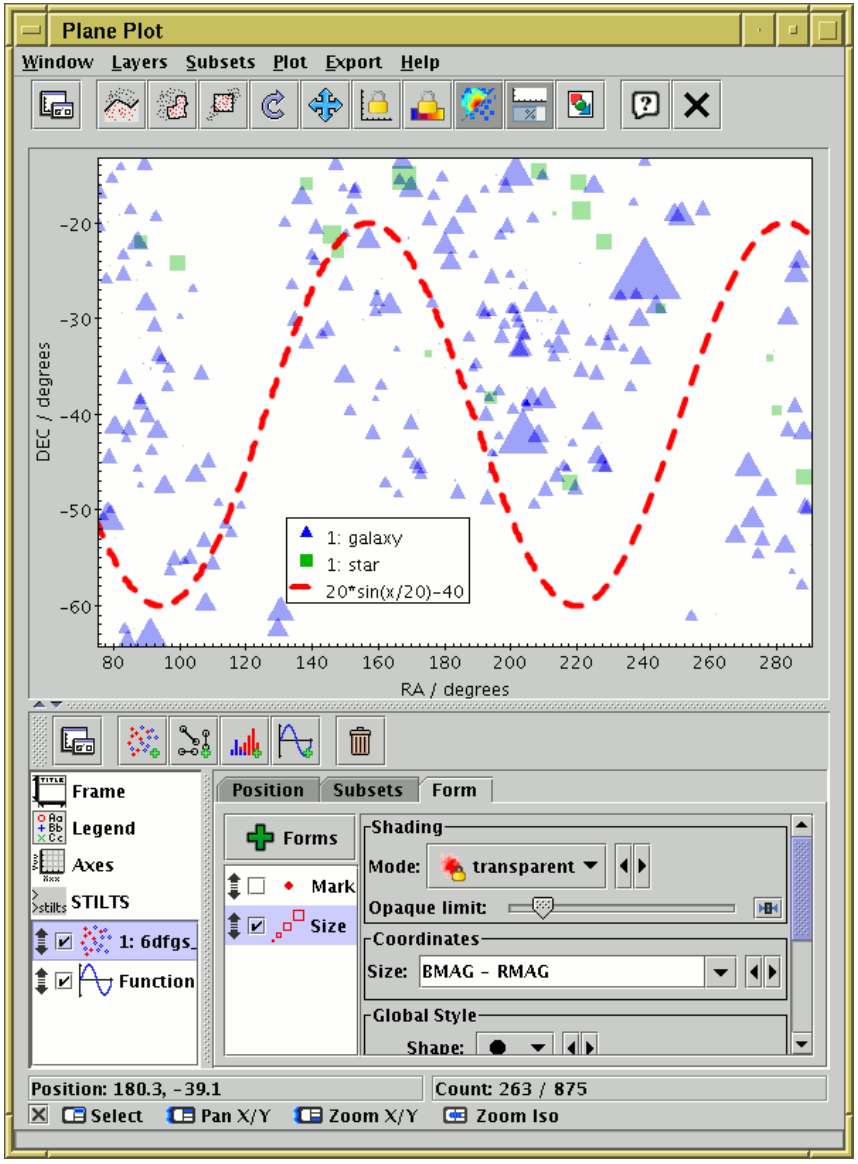
```
stilts tskymatch ifmt1=votable in1=2mass.xml ra1=RAJ2000 dec1=DEJ2000 \
                 ifmt2=votable in2=sdss.xml ra2=RAJ2000 dec2=DEJ2000 \
                 error=10 find=all out=cross.xml ofmt=votable

stilts tpipe ifmt=votable in=cross.xml \
             cmd="select zmag>12 && zmag<19.5 && rmag-kmag>(zmag+0.5)/2.5
             && (rmag-kmag)<(zmag+10.5)/2.5 && e_kmag>0" \
             out=rmkz.xml ofmt=votable
```

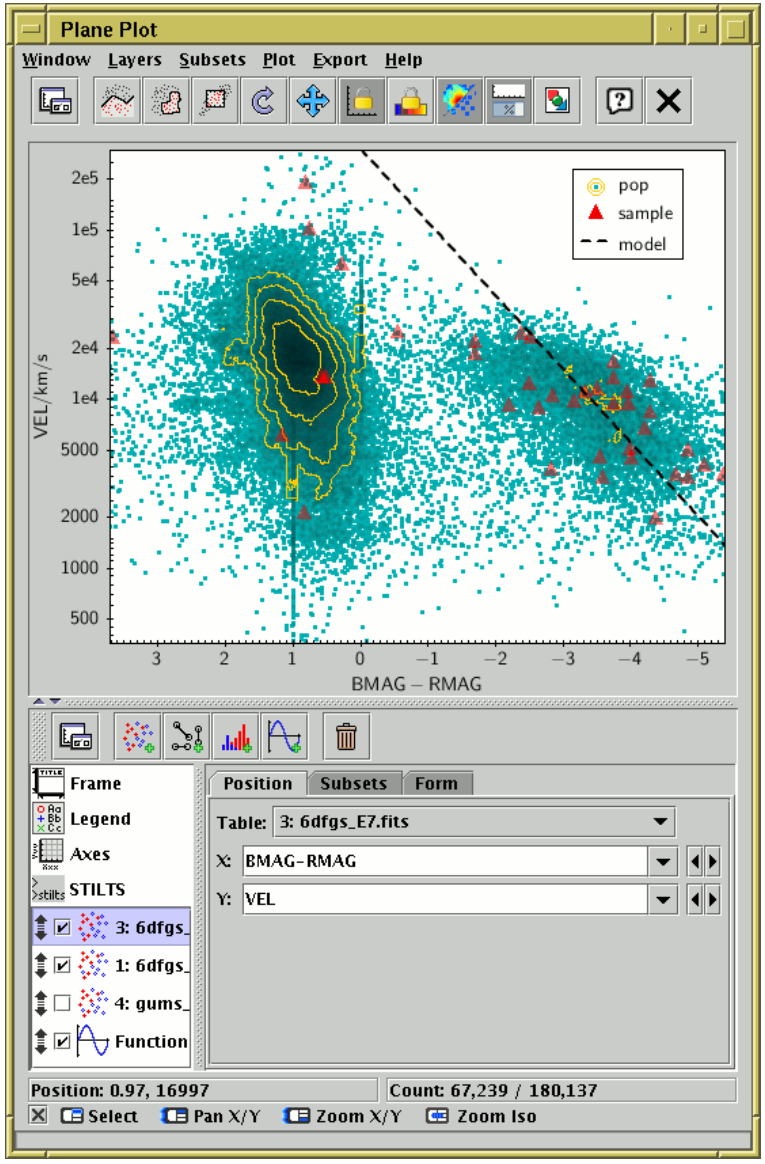
CROSS-MATCHING TWO LARGE CATALOGUES

OPTION 2: STILTS

Pros	Cons
• Filtering • Reproducible	• May need to split the catalogues into smaller tables for efficient processing.

DATA VISUALIZATION IN TOPCAT





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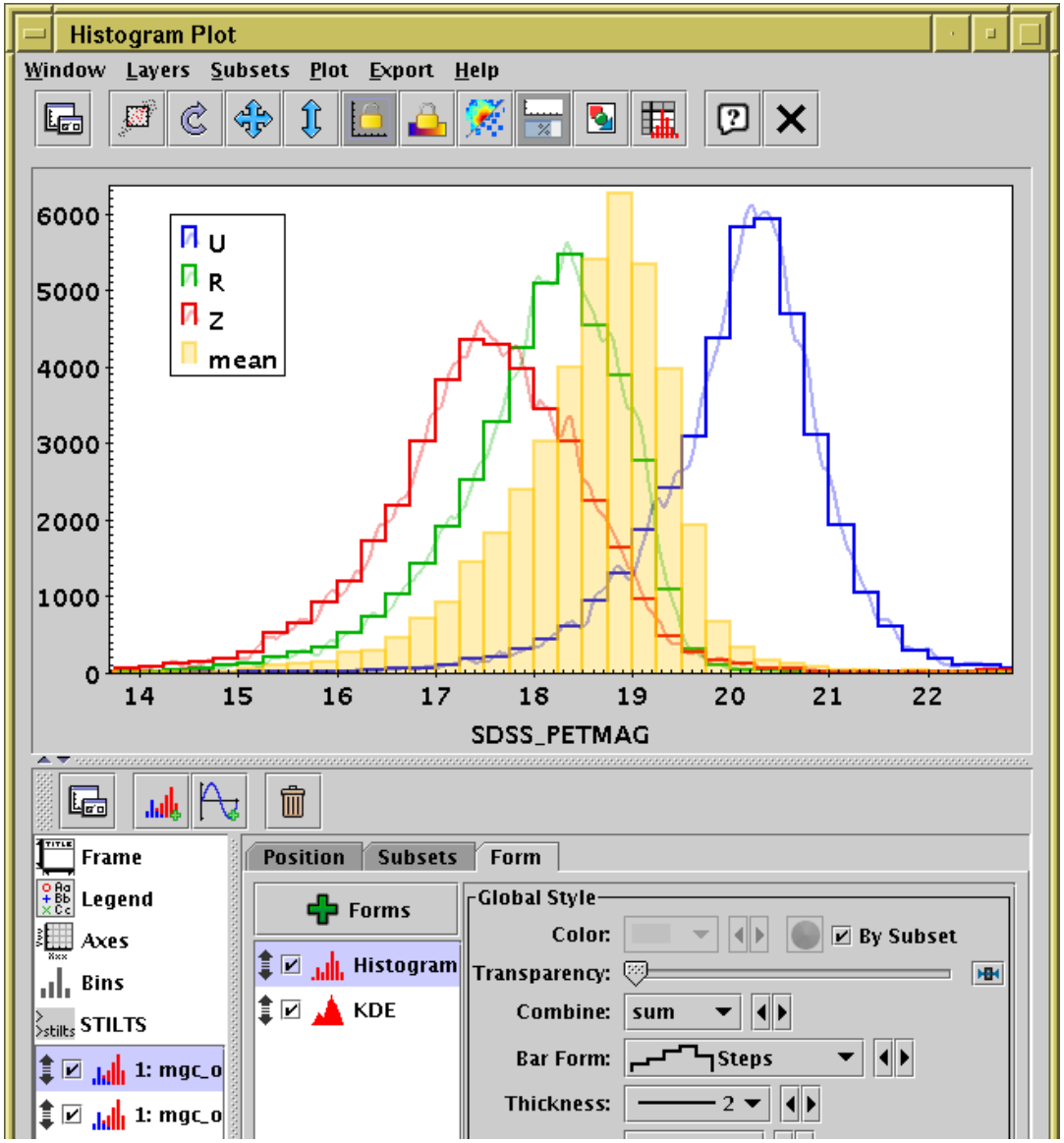

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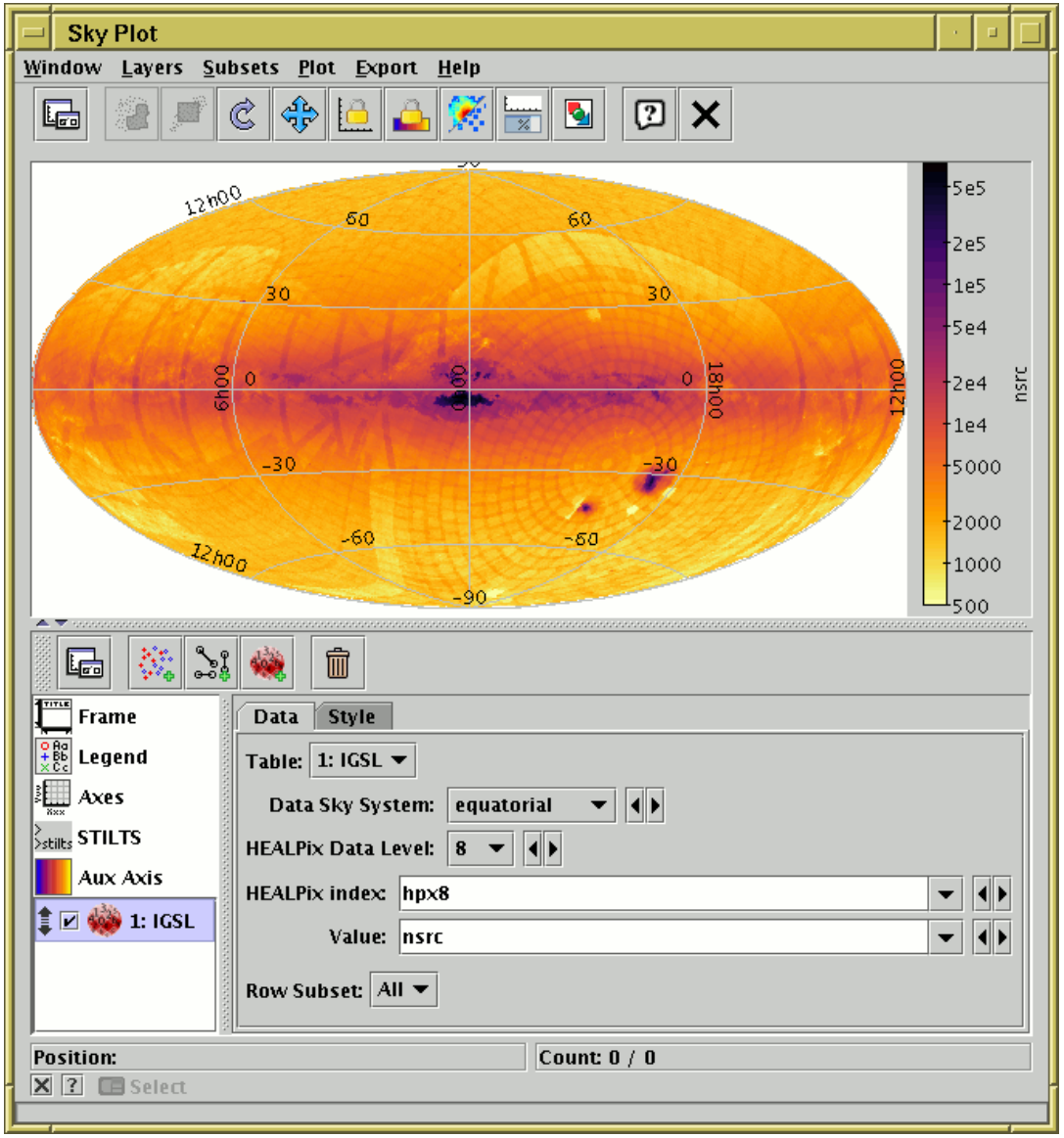

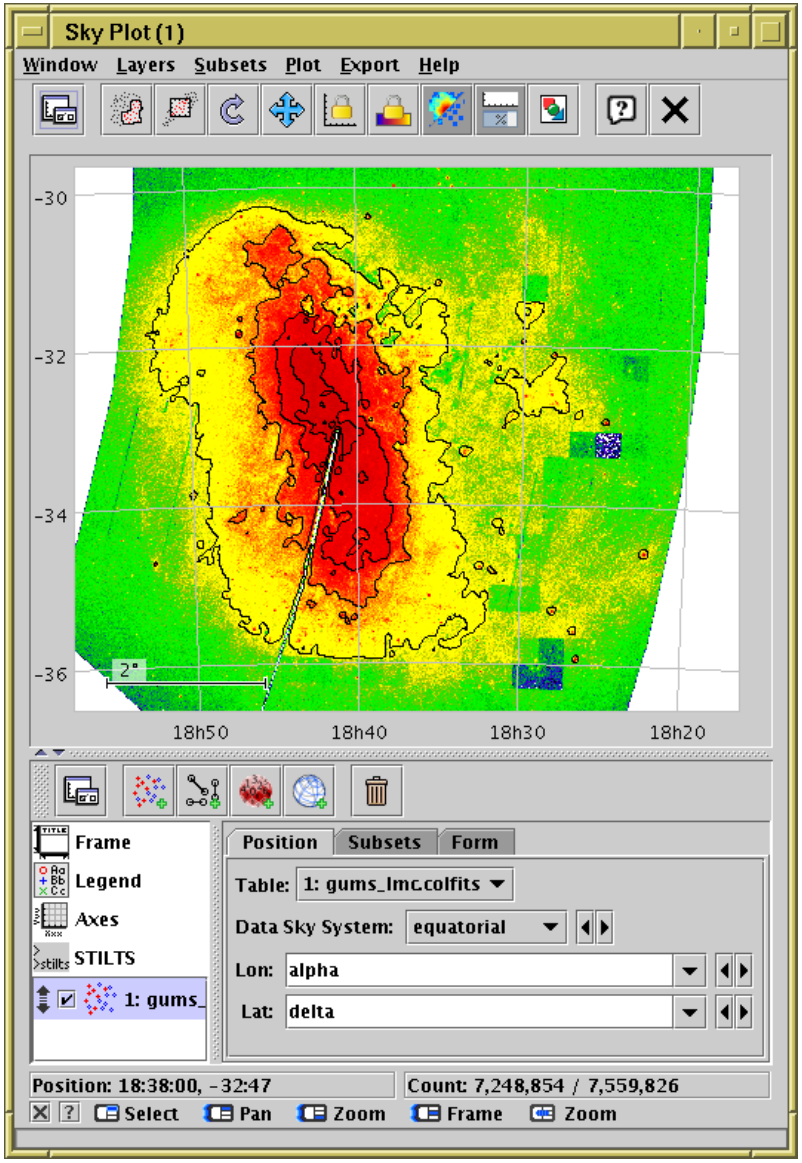

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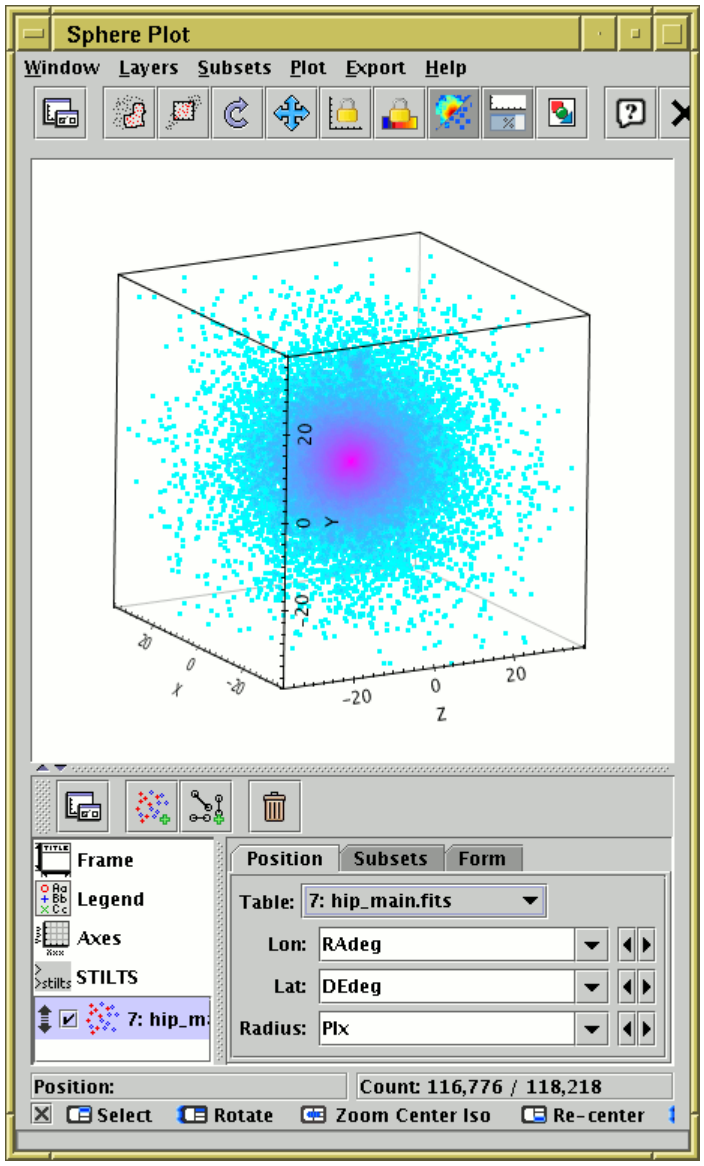

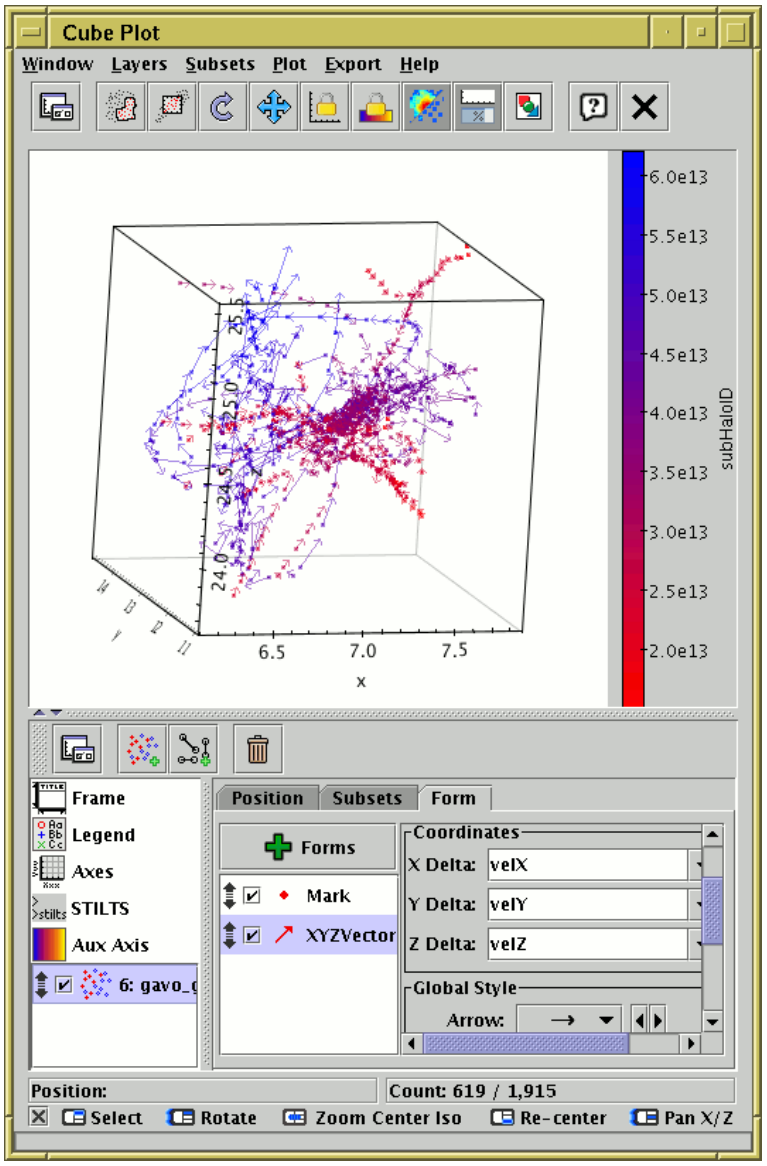

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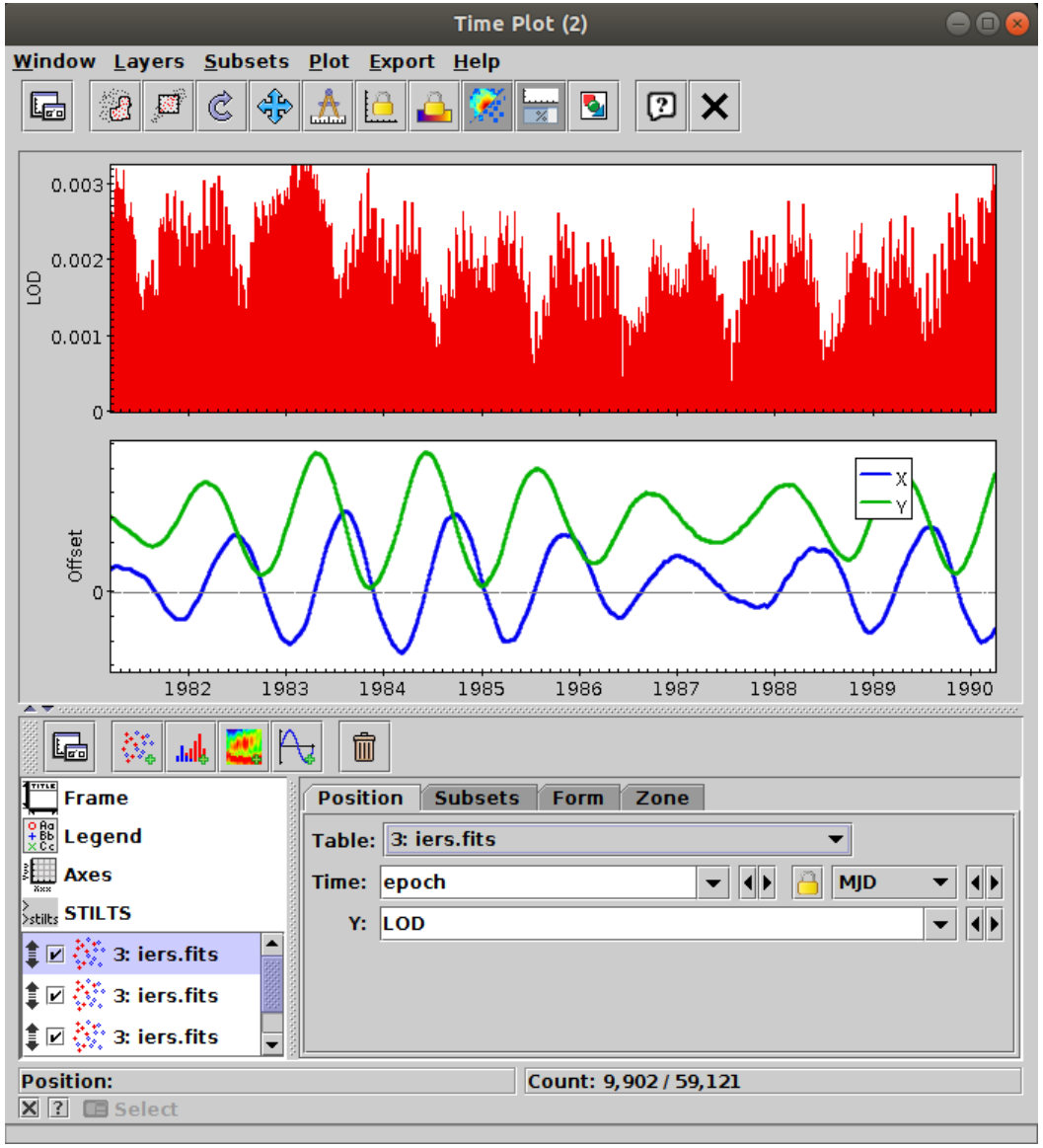

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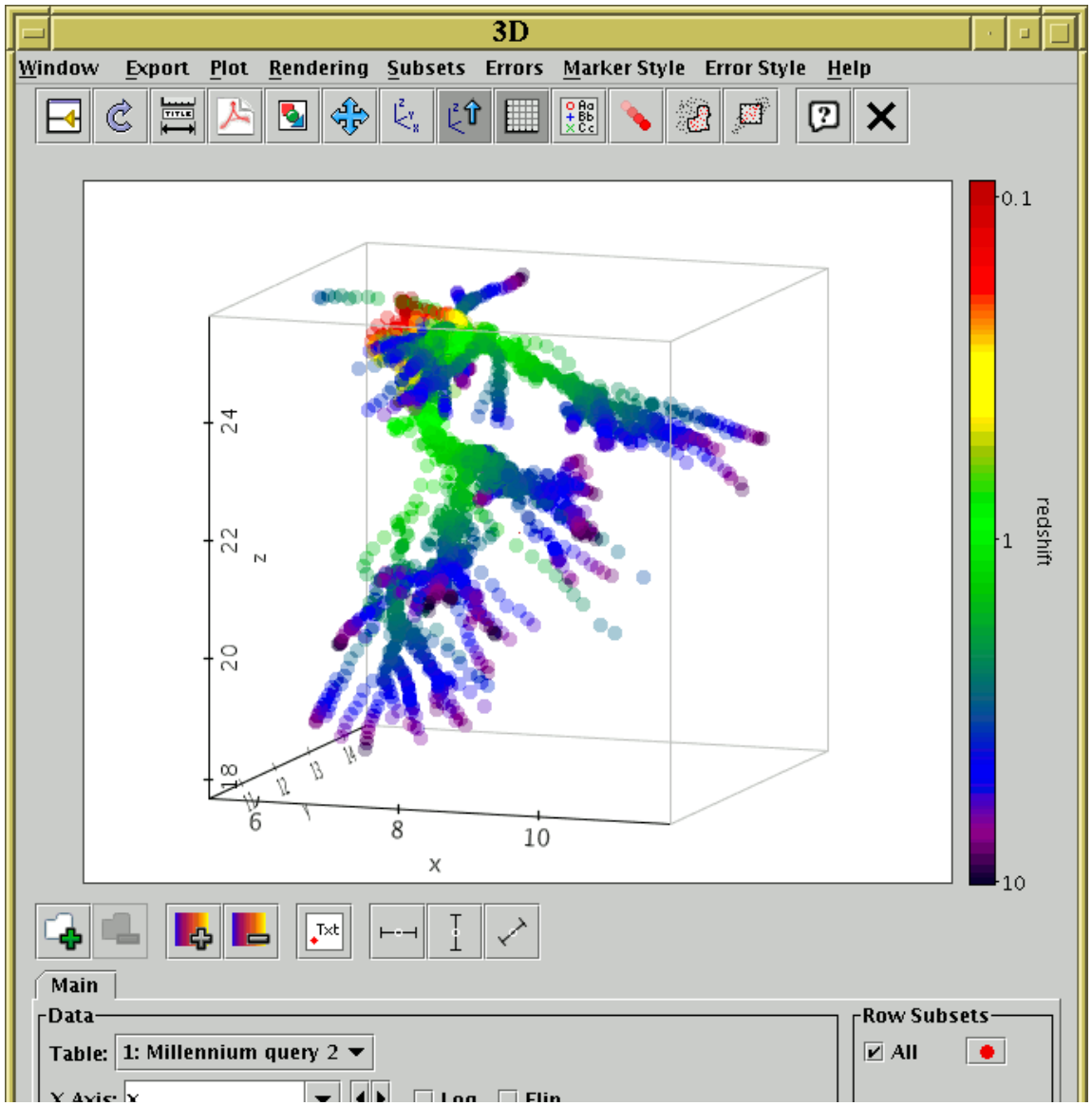
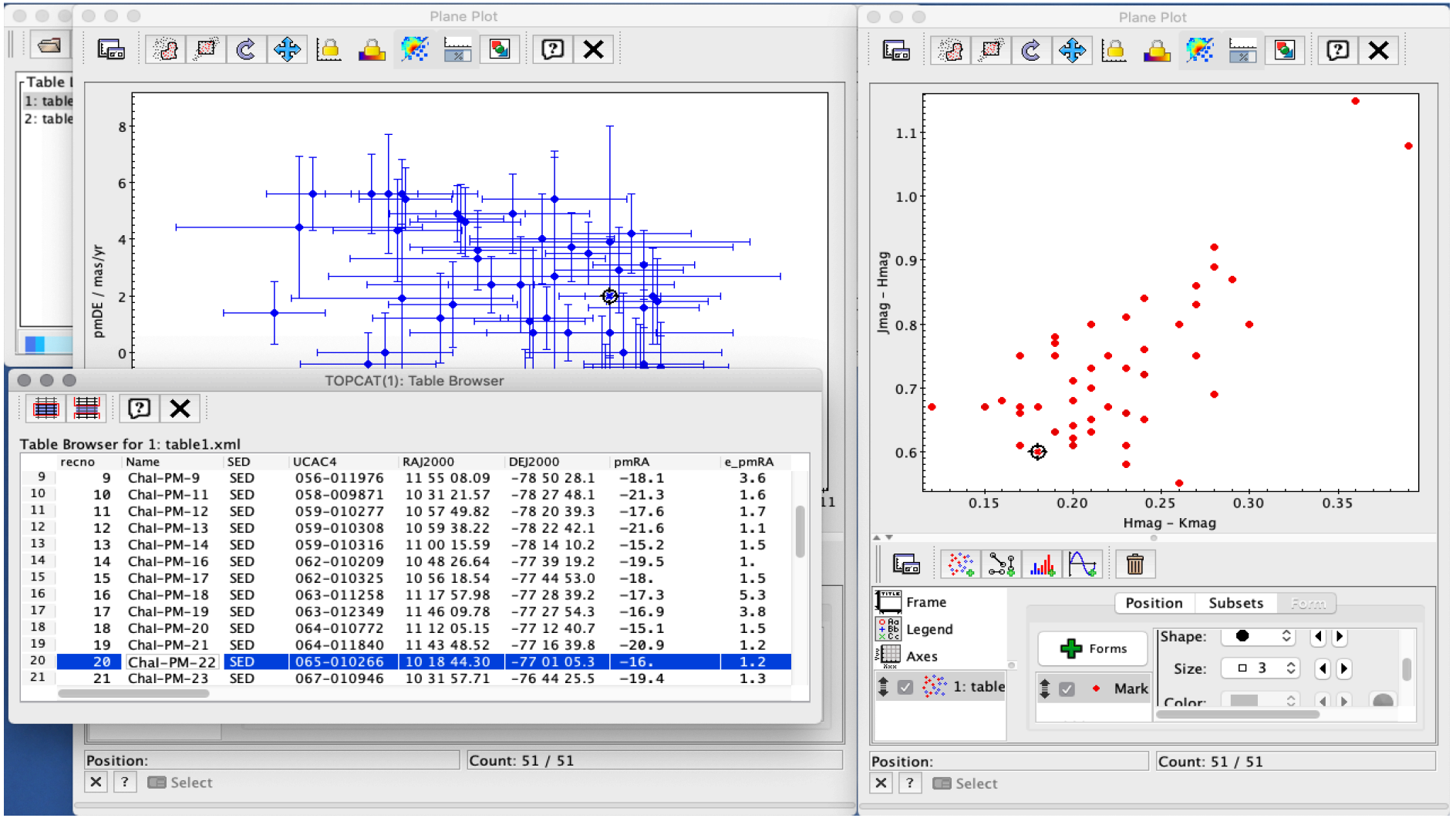
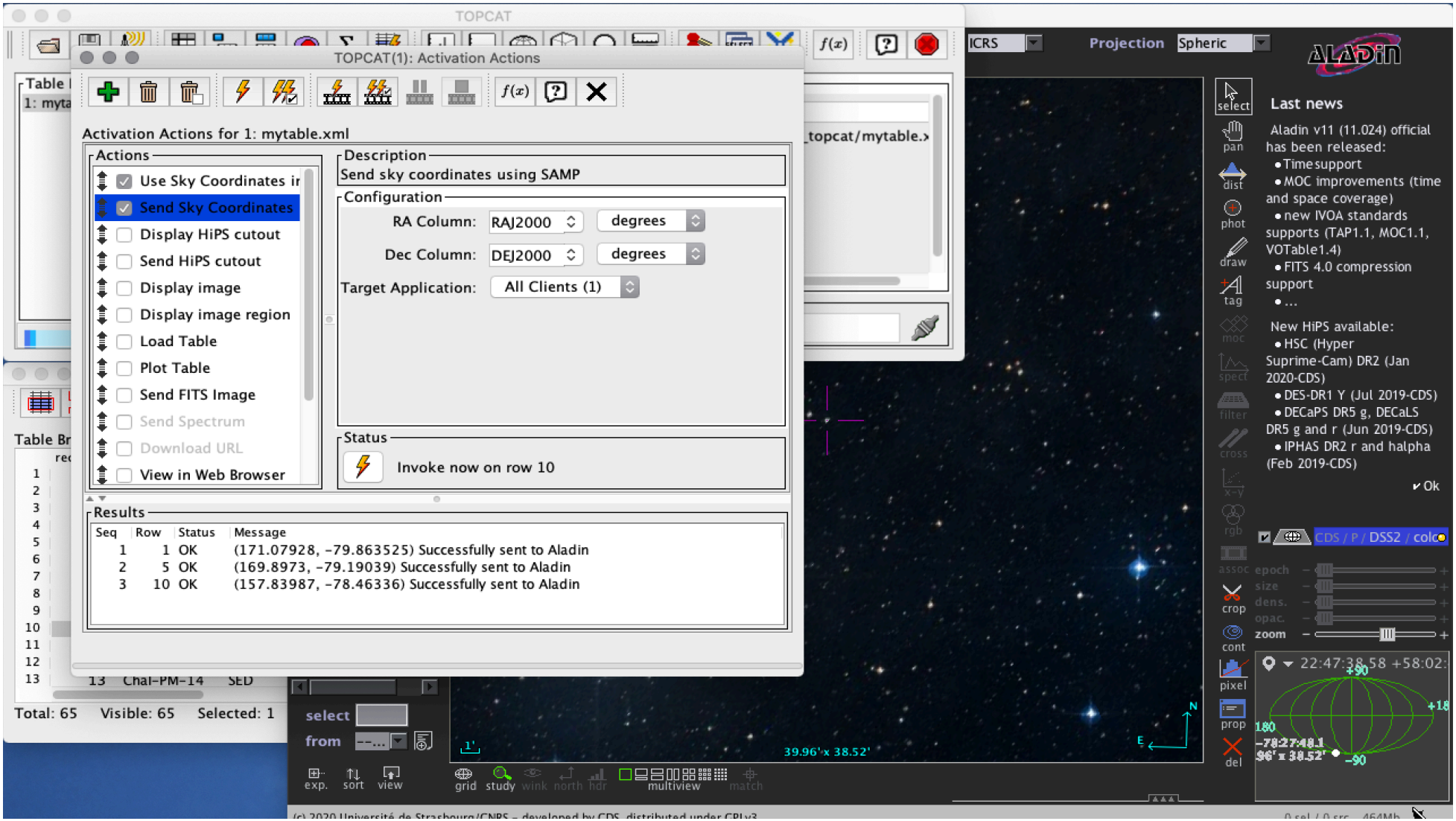


LINKED VIEWS IN TOPCAT



ACTIVATION ACTIONS IN TOPCAT



TO KNOW MORE

- TOPCAT v4.7.2: http://www.star.bris.ac.uk/~mbt/topcat/sun253/sun253.html
- STILTS v3.2.2: http://www.star.bris.ac.uk/~mbt/stilts/sun256/sun256.html

- TOPCAT/STILTS advanced tutorial: http://andromeda.star.bris.ac.uk/topcat/tutorial-asterics1/
- TOPCAT virtual lesson (in Spanish): https://youtu.be/IJ3qeIiOOGY