

THE LOFAR TRANSIENTS PIPELINE

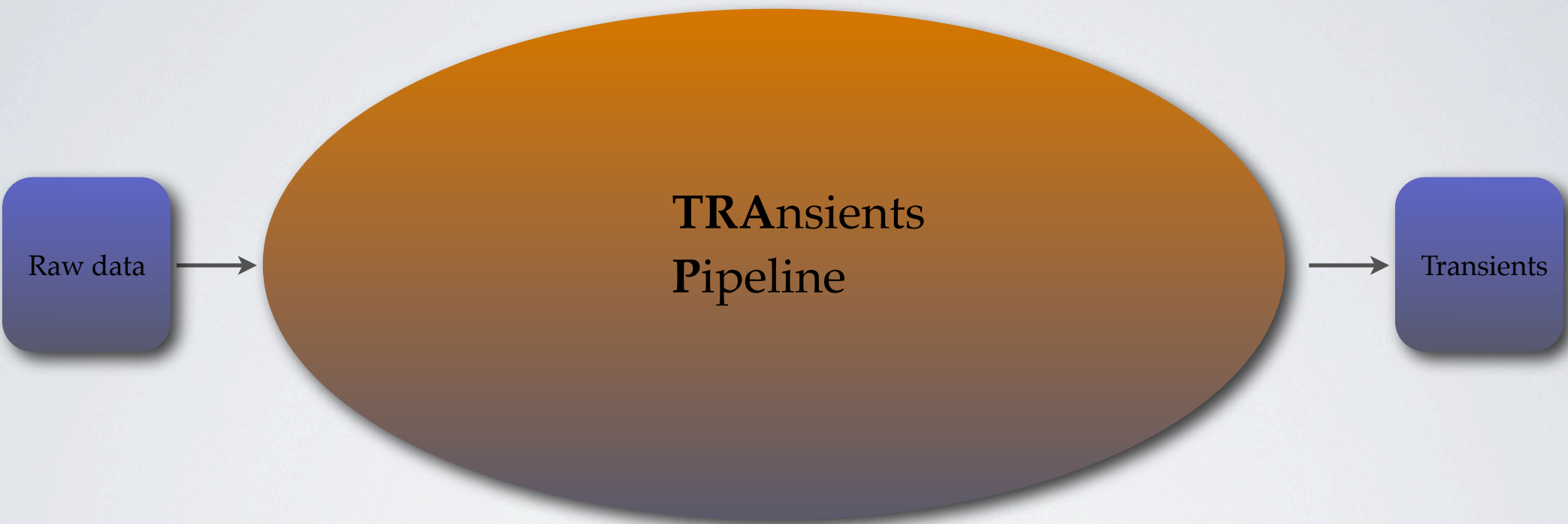
RESULTS AND STATUS

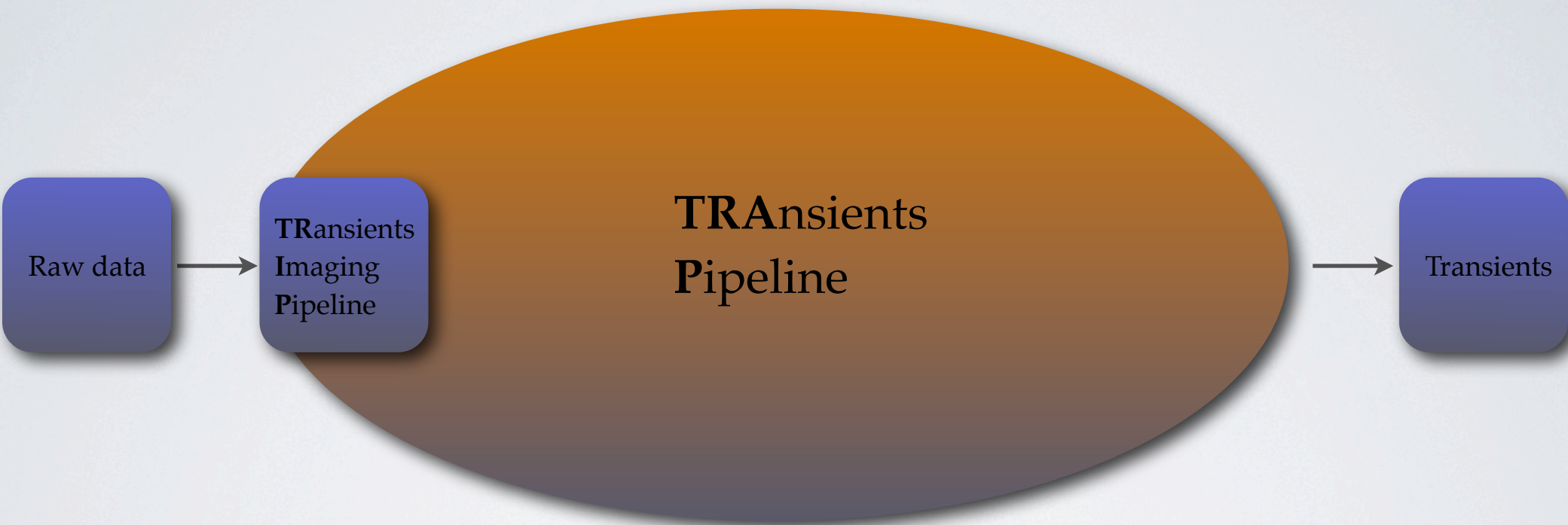
Evert Rol

LOFAR Transients Key project

Raw data

Transients



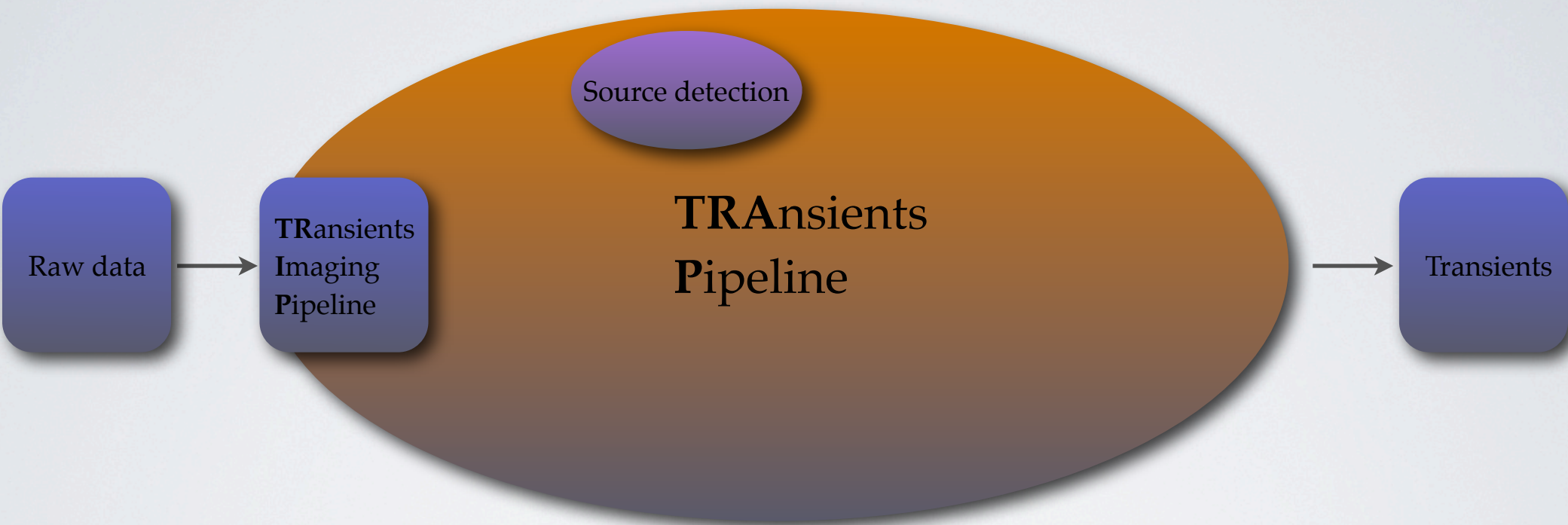


Raw data

TRAnsients
Imaging
Pipeline

TRAnsients
Pipeline

Transients



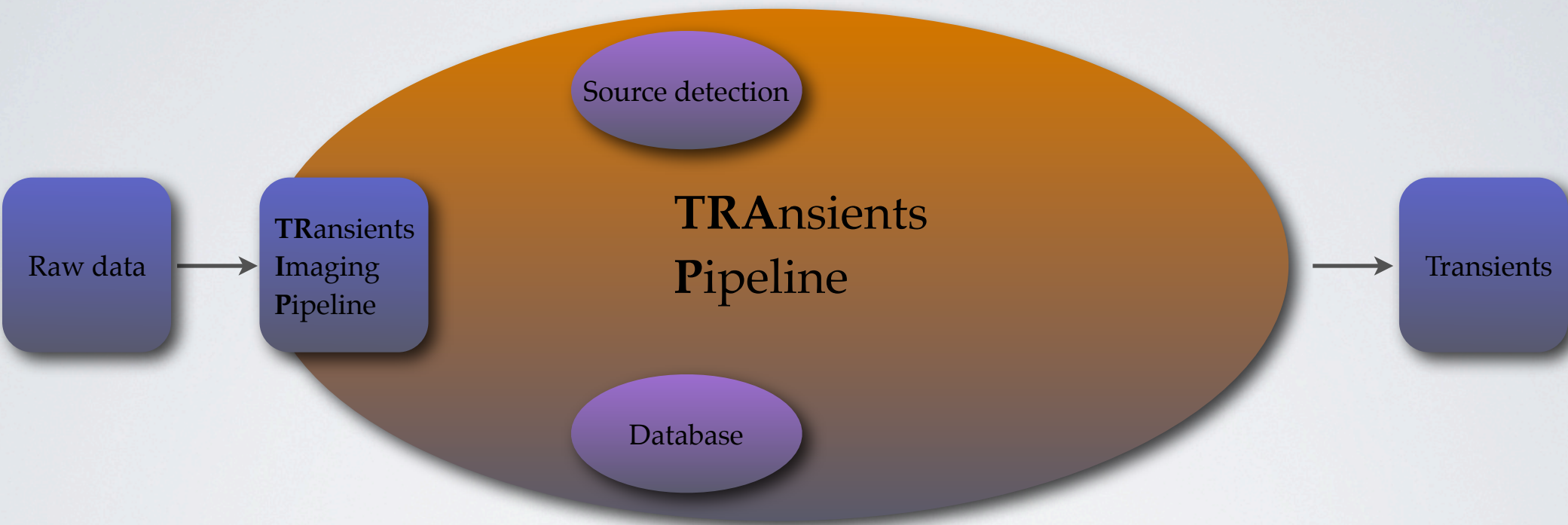
Raw data

TRAnsients
Imaging
Pipeline

Source detection

TRAnsients
Pipeline

Transients



Raw data

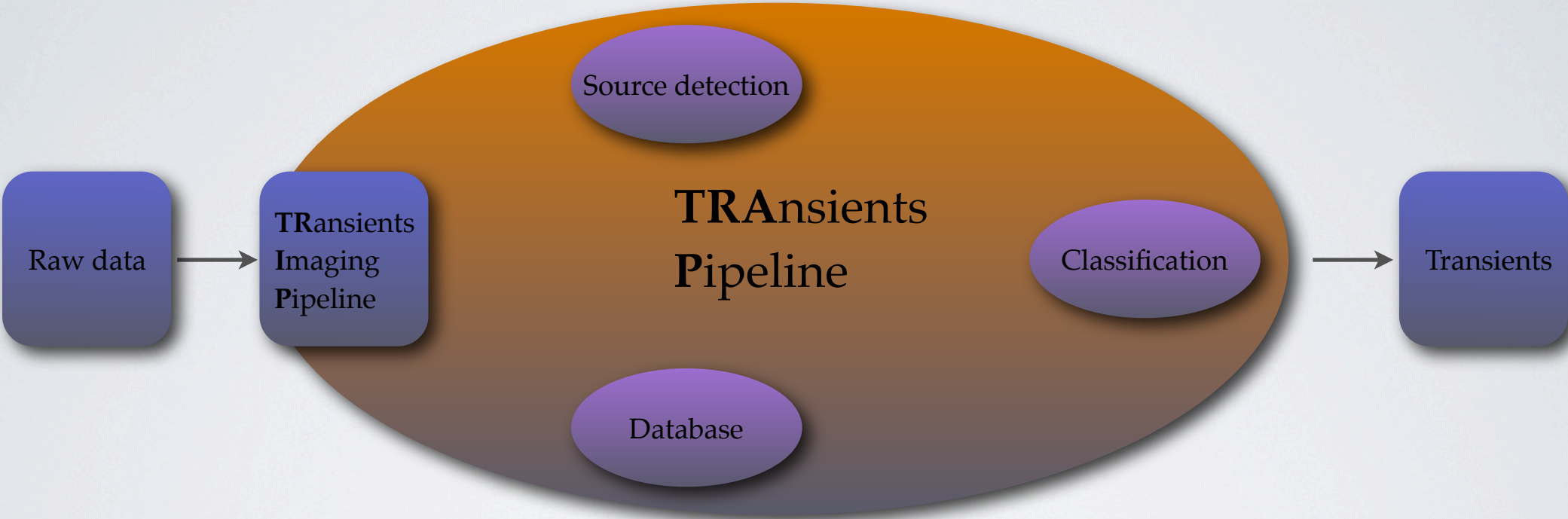
TRAnsients
Imaging
Pipeline

Source detection

TRAnsients
Pipeline

Database

Transients



Raw data

TRansients
Imaging
Pipeline

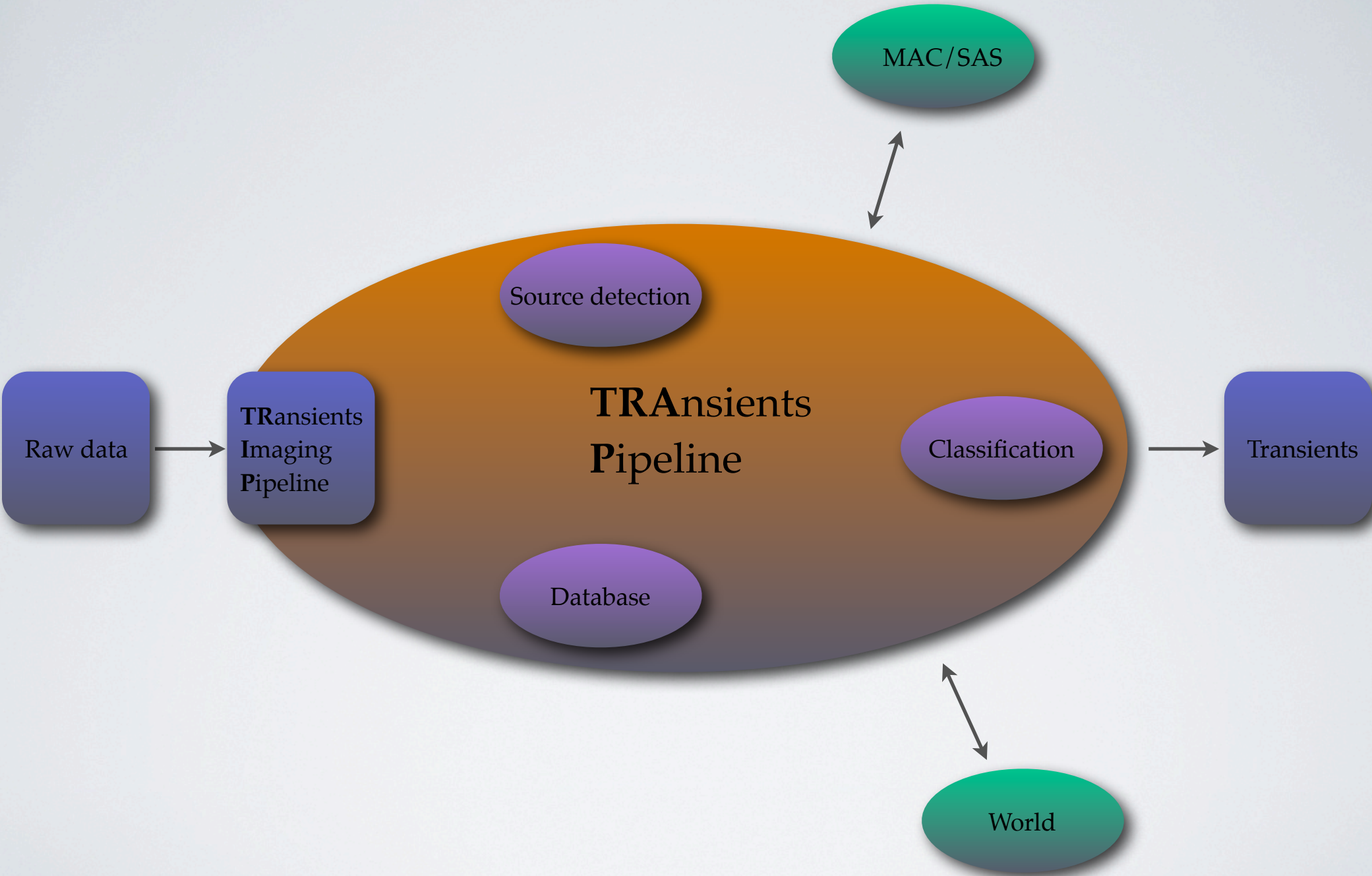
Source detection

TRansients
Pipeline

Database

Classification

Transients



TRANSIENTS IMAGING PIPELINE

TRANSIENTS IMAGING PIPELINE

- Standard imaging procedure

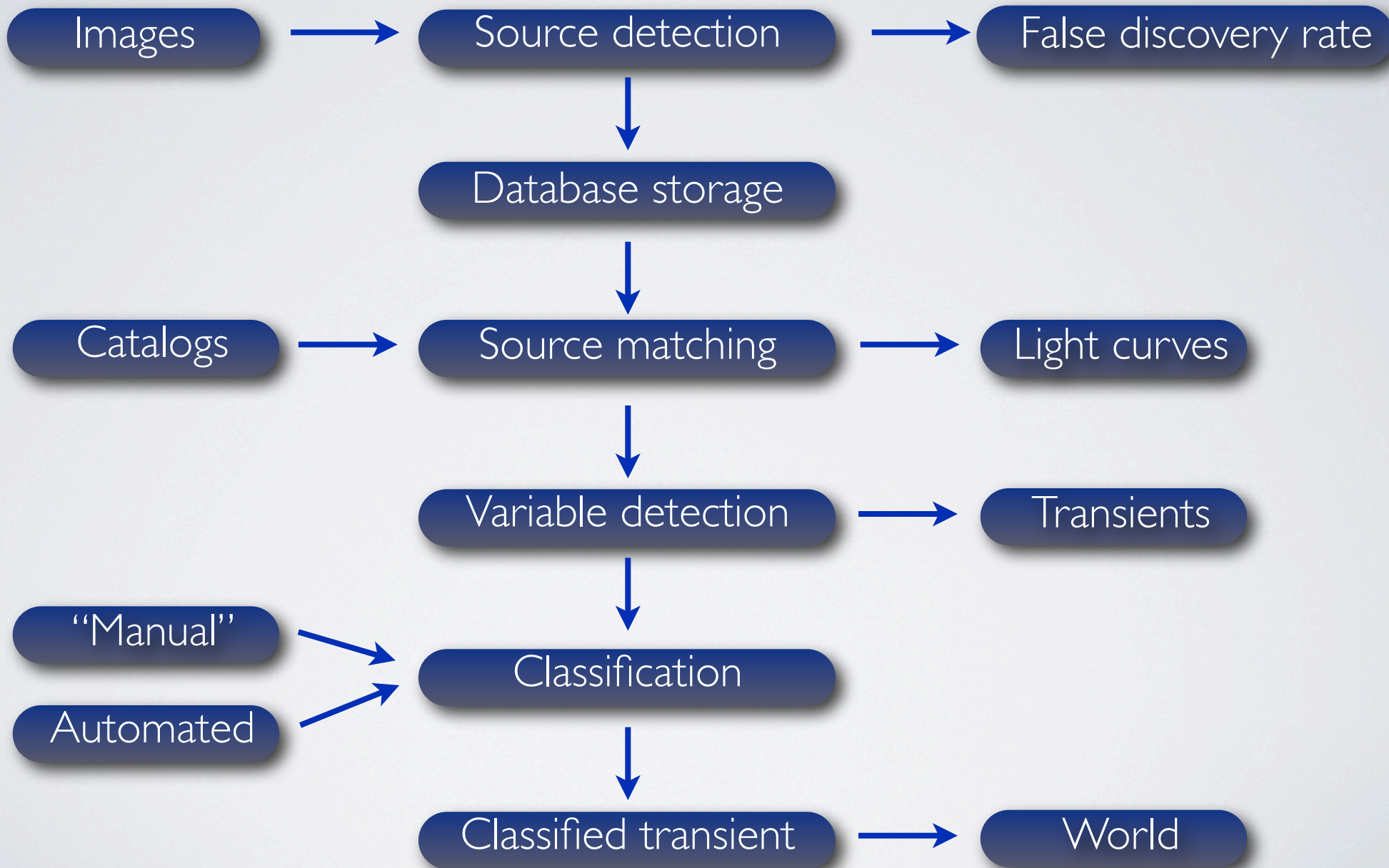
TRANSIENTS IMAGING PIPELINE

- Standard imaging procedure
- Optimised for transients
 - Avoid flagging fast transients
 - re-arrange subbands
 - prepare final images for TRAP

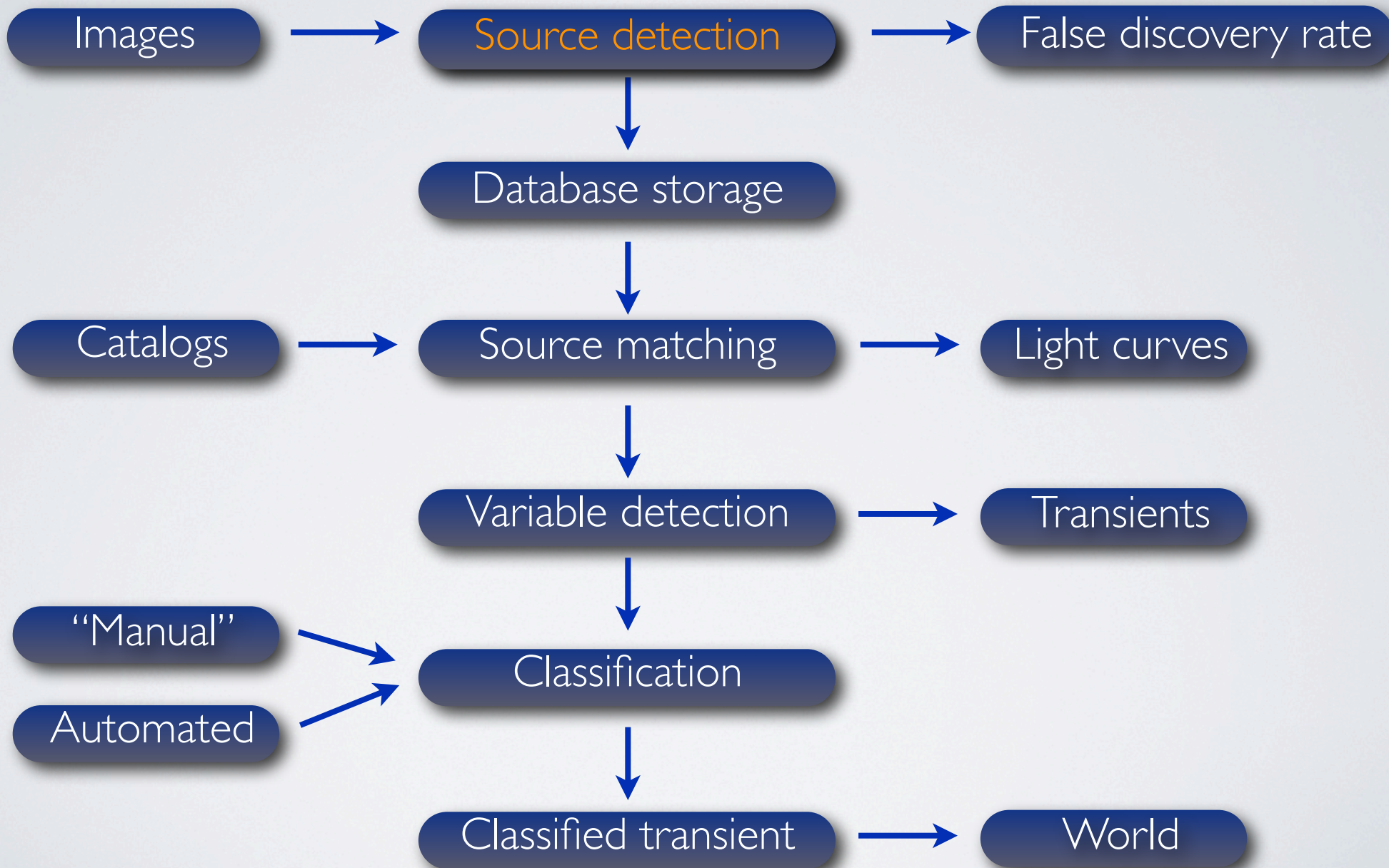
TRANSIENTS IMAGING PIPELINE

- Standard imaging procedure
- Optimised for transients
 - Avoid flagging fast transients
 - re-arrange subbands
 - prepare final images for TRAP
- Time slicing

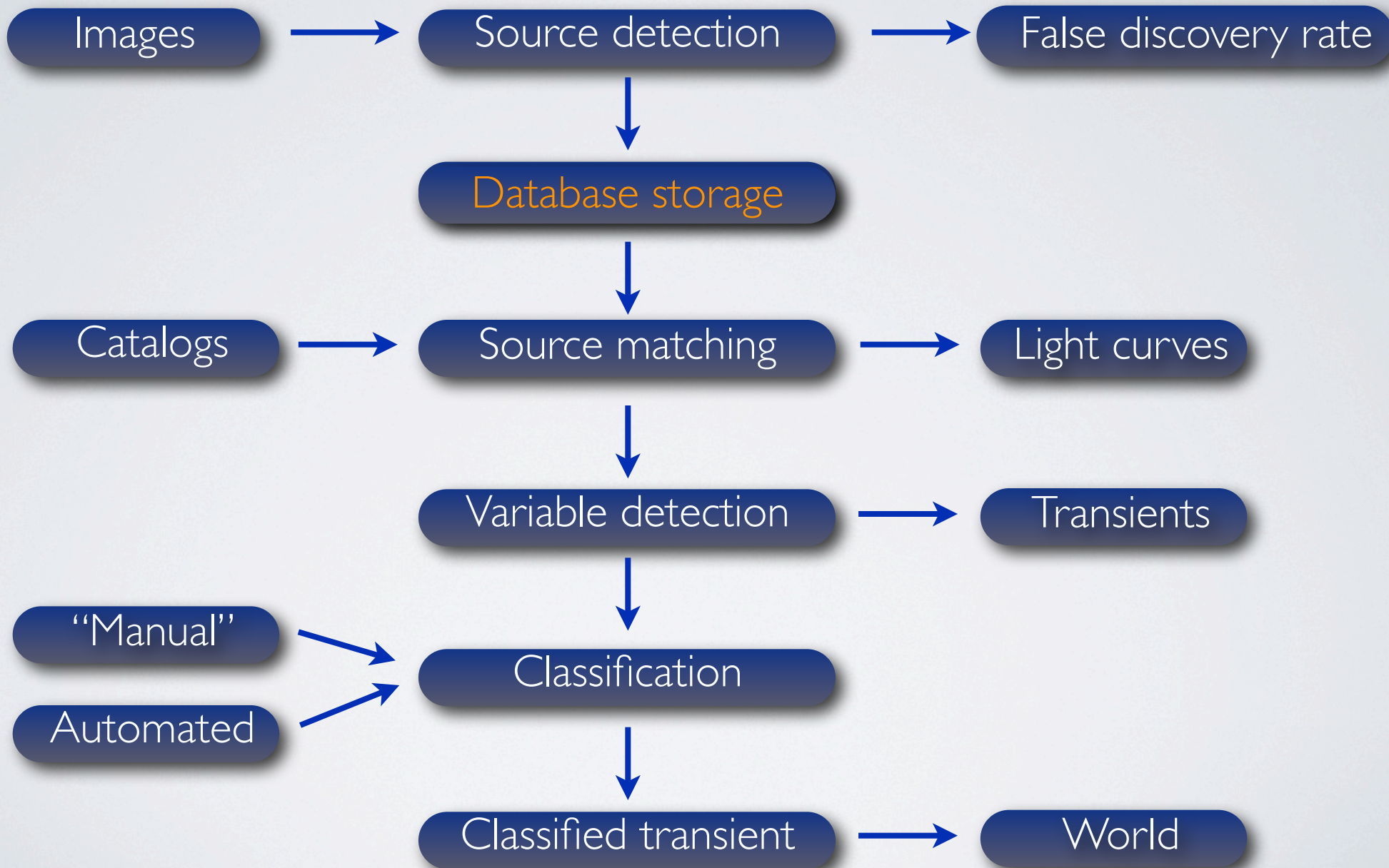
TRANSIENTS PIPELINE



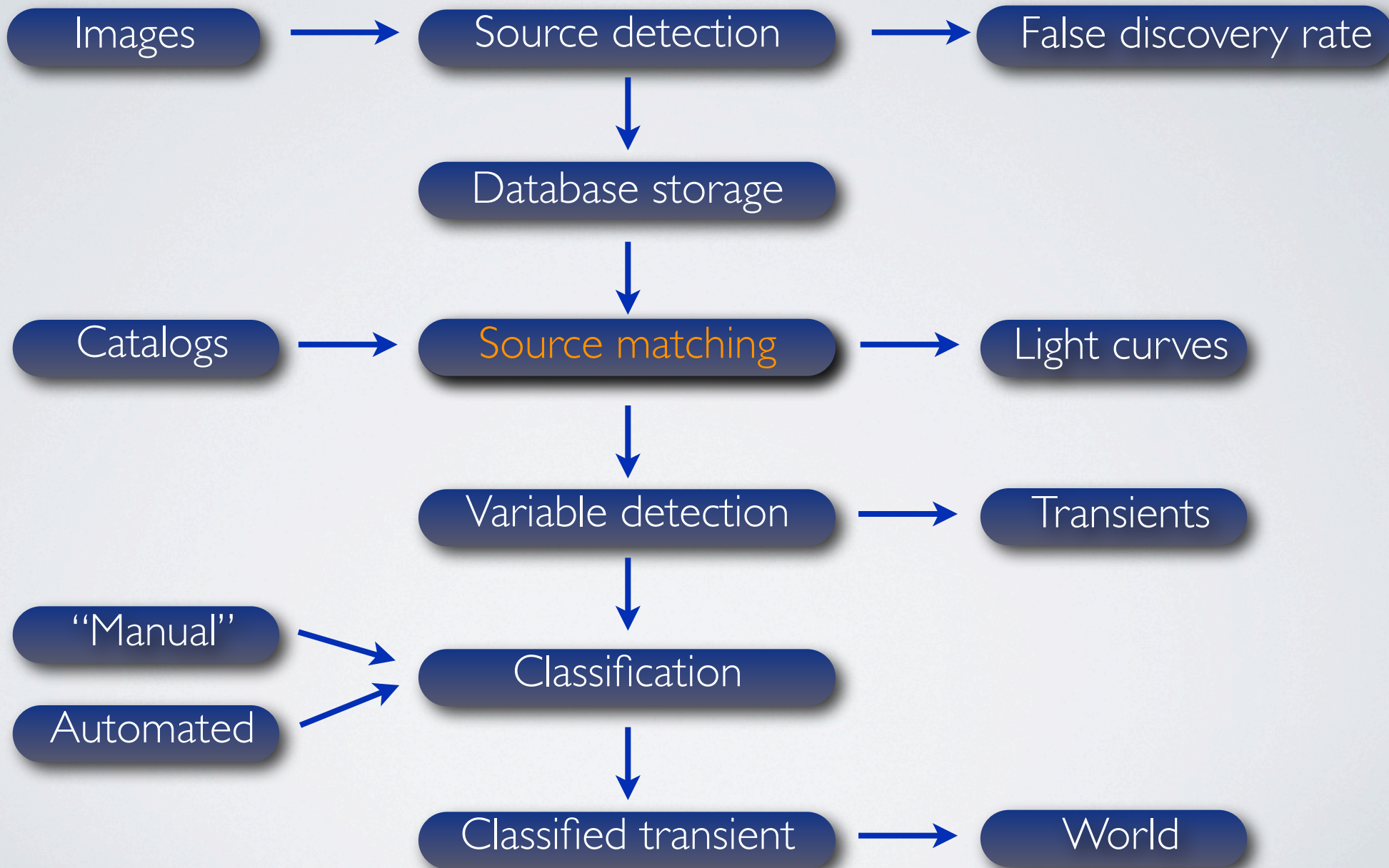
TRANSIENTS PIPELINE



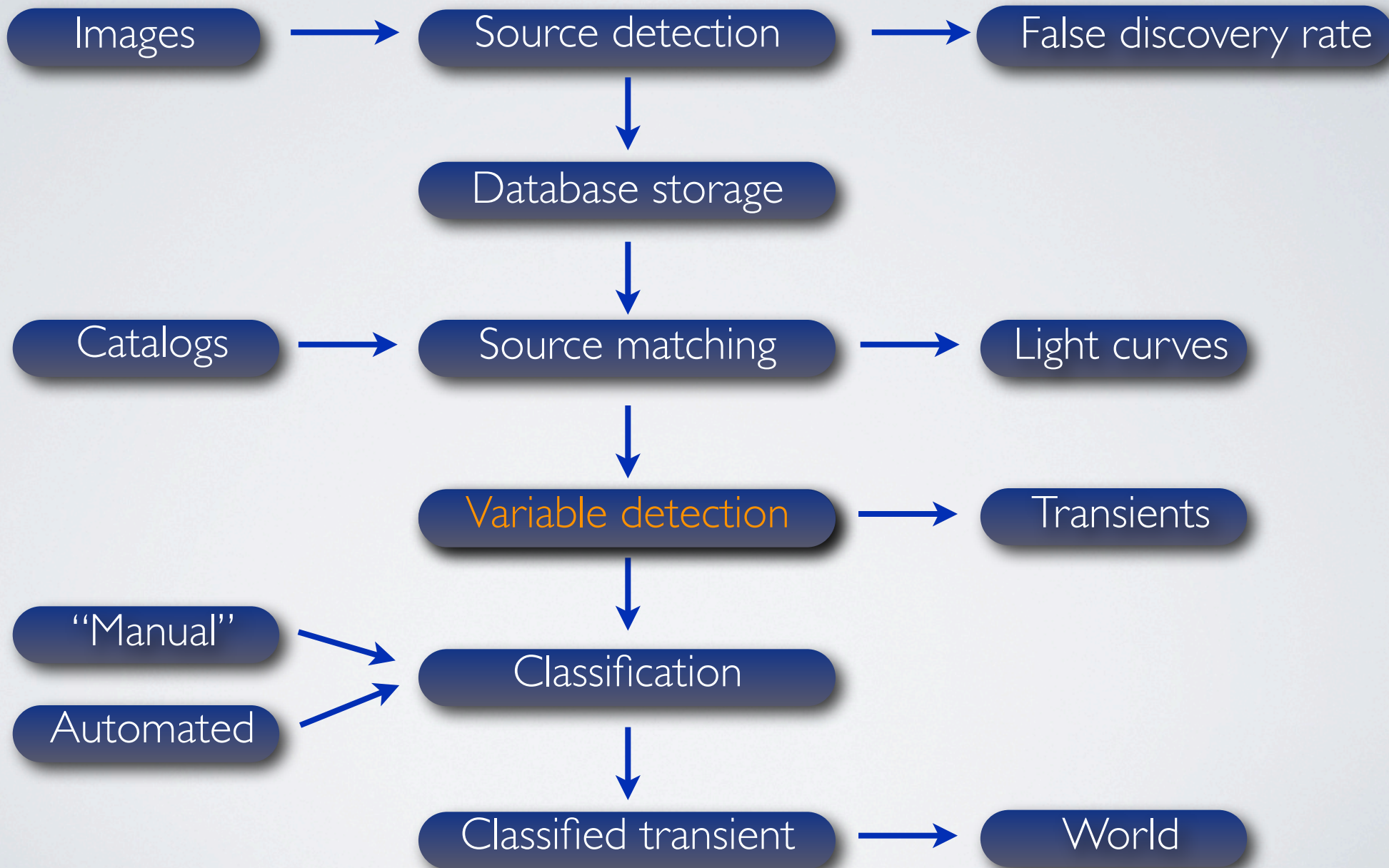
TRANSIENTS PIPELINE



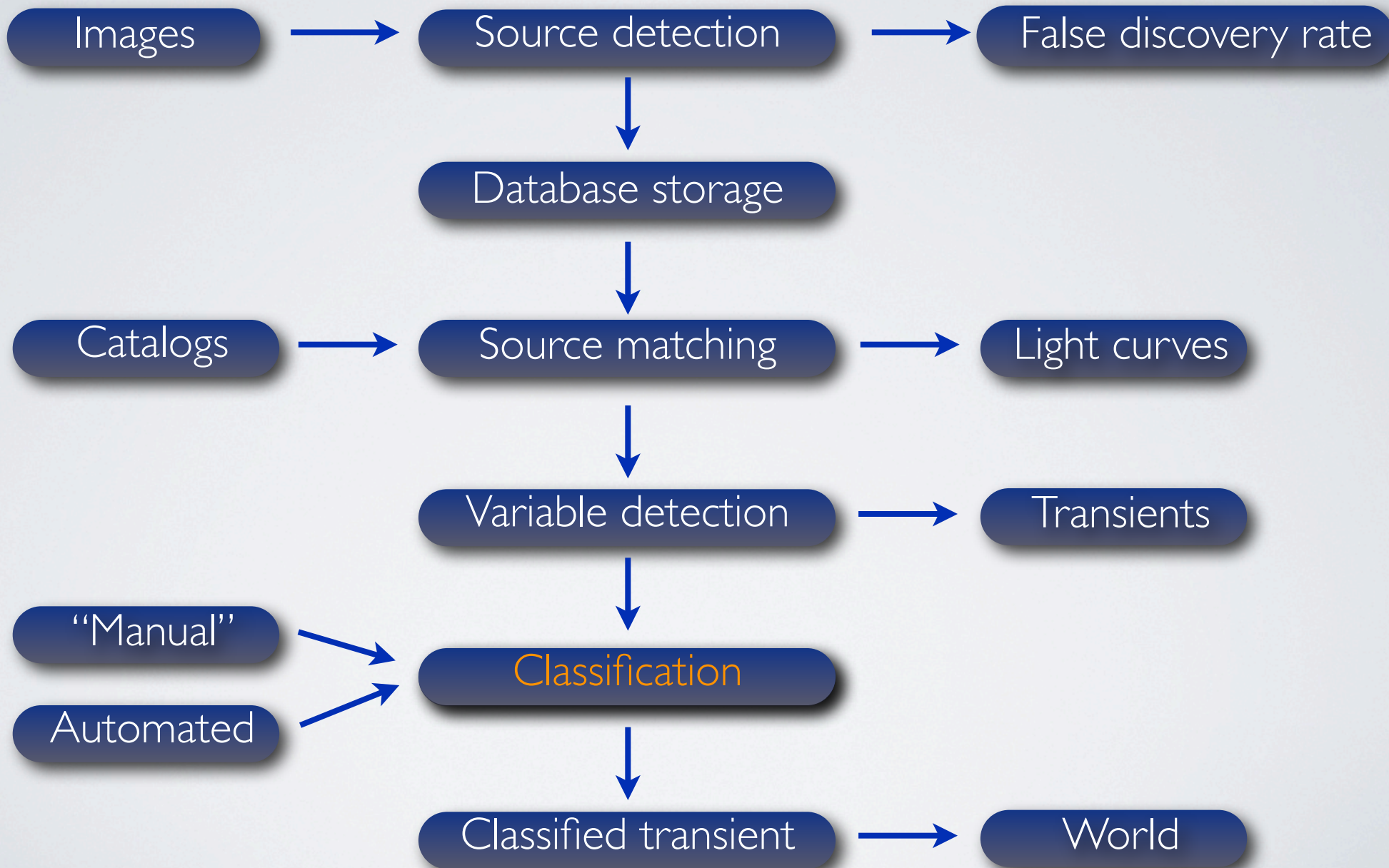
TRANSIENTS PIPELINE



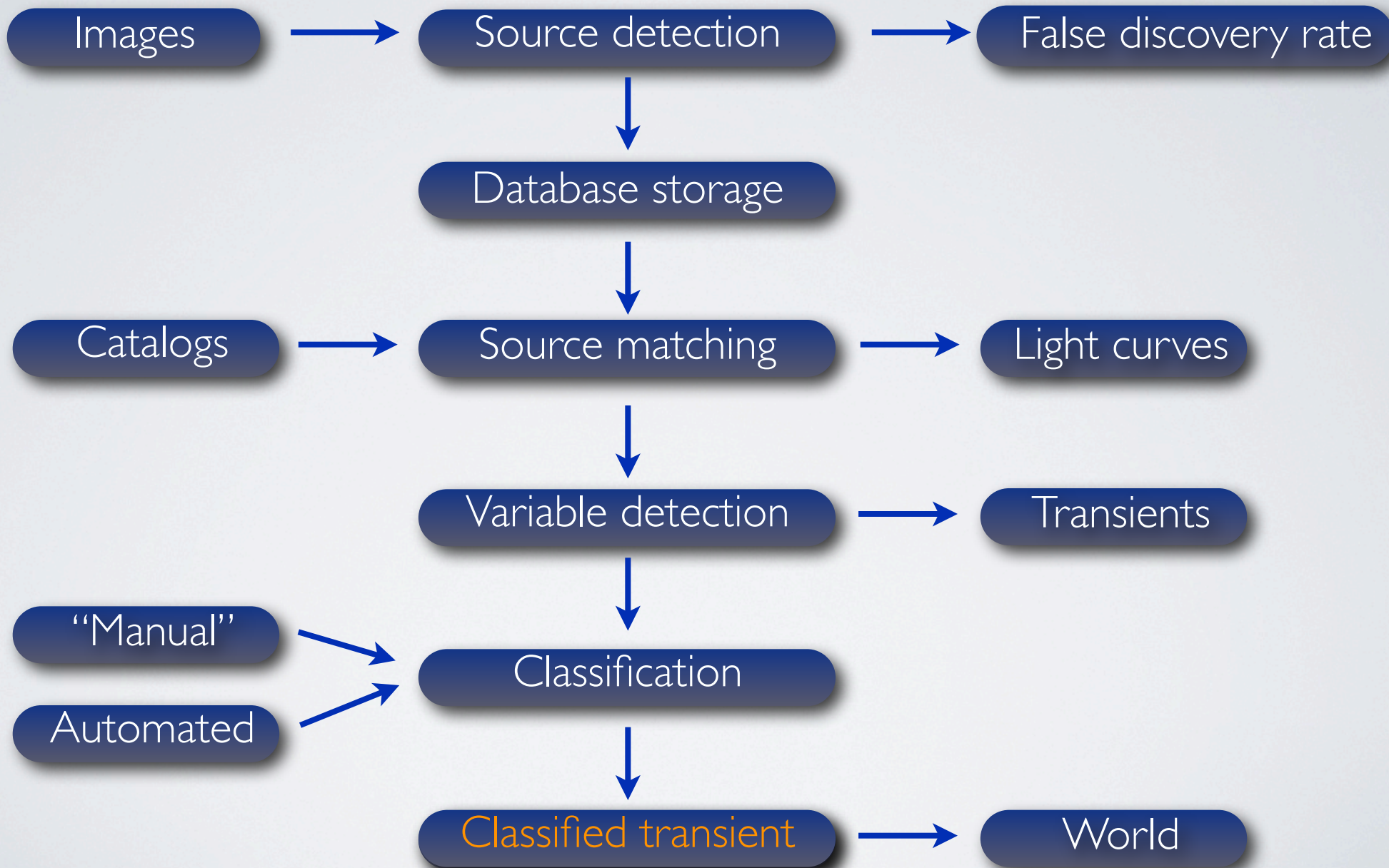
TRANSIENTS PIPELINE



TRANSIENTS PIPELINE



TRANSIENTS PIPELINE



SOURCE FINDING

SOURCE FINDING

- Optimised for transient finding
 - Fast enough for 1 second images

SOURCE FINDING

- Optimised for transient finding
 - Fast enough for 1 second images
- False detection algorithm
 - Some statistics on detected transients

DATABASE

DATABASE

- MonetDB, developed by CWI
 - column store: faster when accessing data from millions of records

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 - column store: faster when accessing data from millions of records
- A lot of the heavily lifting is done **inside the database**
 - Source matching
 - Variability search

CLASSIFICATION

CLASSIFICATION

- Manual decision tree
 - Good to pick out those sources you care for

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- Manual decision tree
 - Good to pick out those sources you care for
- Automated classification
 - Development ongoing
 - Lack of training data set

TRAP STATUS

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- A simple run, from source extraction to classification: 20 seconds

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- Finds transients, but reliability depends on images

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- Finds transients, but reliability depends on images
- In principle, light curves are available!

TRAP STATUS

NEAR FUTURE

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- Monitoring list of interesting sources

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NEAR FUTURE

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- Pick up first detection of new source

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- Notify people about new transients (email, VO events)

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NEAR FUTURE

- Monitoring list of interesting sources
- Pick up first detection of new source
- Notify people about new transients (email, VO events)
- Quality control

TRAP STATUS

LONGER TERM

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LONGER TERM

- Spectral information

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- Polarisation information

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LONGER TERM

- Spectral information
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- MAC/SAS integration

TRAP STATUS

LONGER TERM

- Spectral information
- Polarisation information
- MAC/SAS integration
- Automated classification

RESULTS

(THOSE LIGHT CURVES)

RESULTS

(THOSE LIGHT CURVES)

[HTTP://HEASTRO2.SCIENCE.UVA.NL:8888/SEARCH/](http://heastro2.science.uva.nl:8888/search/)

LOFAR transients database

Datasets

id	description	in name	Reprocessing step #	Processing finished	Number of transients
21	None	L2010_20850	0	2011-09-08T14:06:51	10
22	None	L2010_20850	1	2011-09-08T14:08:18	10
23	None	L2010_20850	2	2011-09-08T14:21:25	10
24	None	L2010_21641	0	2011-09-08T22:28:57	0
25	None	L2010_21641	1	2011-09-09T09:21:09	1
26	None	L2010_21641	2	2011-09-09T12:03:53	1

Dataset #21, L2010_20850

Properties

description: None
 Reprocessing step: 0
 processing finished: 2011-09-08T14:06:51

Images

id	start time	integration time (seconds)	band	effective frequency (Hz)	bandwidth (Hz)	Location
18	2010-08-13T10:00:00	3600.0	20	163.18 MHz	48.24 MHz	/home/evert/scratch/bell/L09851_227sbs.fits
19	2010-08-20T10:00:00	3600.0	20	163.18 MHz	48.24 MHz	/home/evert/scratch/bell/L09936_227sbs.fits
20	2010-08-21T10:00:00	3600.0	20	163.18 MHz	48.24 MHz	/home/evert/scratch/bell/L09948_227sbs.fits
21	2010-08-27T10:00:00	3600.0	20	163.18 MHz	48.24 MHz	/home/evert/scratch/bell/L20033_227sbs.fits
22	2010-09-25T10:00:00	3600.0	20	163.18 MHz	48.24 MHz	/home/evert/scratch/bell/L20613_227sbs.fits

Transients

ID	source ID	significance level	# of points	lightcurve start time
35	269	1.0	5	1970-01-01T00:00:00
36	270	1.0	5	2010-08-27T10:00:00
28	272	1.0	5	1970-01-01T00:00:00
32	274	1.0	5	1970-01-01T00:00:00
29	275	1.0	5	2010-08-13T10:00:00
30	277	1.0	5	2010-08-13T10:00:00
37	280	1.0	5	2010-08-27T10:00:00
33	285	1.0	5	1970-01-01T00:00:00
31	287	1.0	5	1970-01-01T00:00:00
34	290	1.0	5	2010-08-21T10:00:00

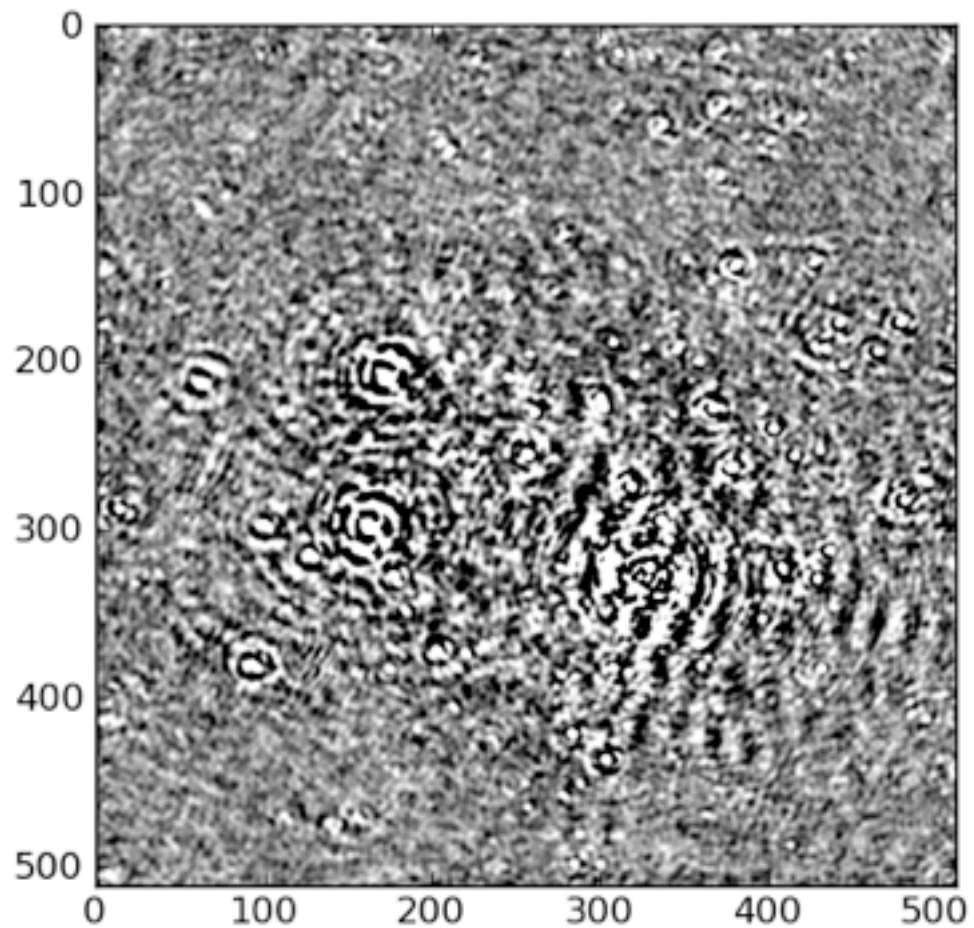
Sources

View [all 33 unique sources](#) for this dataset

Properties

Start time: 2010-08-27T10:00:00
Integration time: 1
Band: 20
Effective frequency: 163.18 MHz
Bandwidth: 48.24 MHz
Dataset #: [21](#)

Quick view



Dataset #21, L2010_20850

Properties

description: None
 Reprocessing step: 0
 processing finished: 2011-09-08T14:06:51

Images

id	start time	integration time (seconds)	band	effective frequency (Hz)	bandwidth (Hz)	Location
18	2010-08-13T10:00:00	3600.0	20	163.18 MHz	48.24 MHz	/home/evert/scratch/bell/L09851_227sbs.fits
19	2010-08-20T10:00:00	3600.0	20	163.18 MHz	48.24 MHz	/home/evert/scratch/bell/L09936_227sbs.fits
20	2010-08-21T10:00:00	3600.0	20	163.18 MHz	48.24 MHz	/home/evert/scratch/bell/L09948_227sbs.fits
21	2010-08-27T10:00:00	3600.0	20	163.18 MHz	48.24 MHz	/home/evert/scratch/bell/L20033_227sbs.fits
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Transients

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32	274	1.0	5	1970-01-01T00:00:00
29	275	1.0	5	2010-08-13T10:00:00
30	277	1.0	5	2010-08-13T10:00:00
37	280	1.0	5	2010-08-27T10:00:00
33	285	1.0	5	1970-01-01T00:00:00
31	287	1.0	5	1970-01-01T00:00:00
34	290	1.0	5	2010-08-21T10:00:00

Sources

View [all 33 unique sources](#) for this dataset

Unique sources in dataset #21

ID	image (first detected)	# of associations	RA	declination	detection level	flux (Jy)
266	18	5	55.442 +/- 10.478	55.940 +/- 5.846	16.112	0.840 +/- 0.053
267	18	2	54.826 +/- 11.766	57.039 +/- 5.731	14.280	0.653 +/- 0.046
268	18	2	54.469 +/- 10.273	56.896 +/- 7.052	12.536	0.616 +/- 0.048
269	18	5	54.100 +/- 2.546	53.659 +/- 1.642	52.536	9.532 +/- 0.174
270	18	5	54.011 +/- 6.280	52.451 +/- 5.520	19.990	1.236 +/- 0.062
271	18	3	53.857 +/- 68.673	55.074 +/- 16.188	11.913	0.717 +/- 0.060
272	18	5	53.770 +/- 6.453	55.817 +/- 4.986	20.154	1.660 +/- 0.080
273	18	3	53.537 +/- 10.162	56.213 +/- 6.287	13.953	0.958 +/- 0.066
274	18	5	53.230 +/- 3.811	54.592 +/- 2.498	31.937	2.962 +/- 0.089
275	18	5	53.068 +/- 3.605	55.933 +/- 2.449	34.065	3.224 +/- 0.091
276	18	4	52.858 +/- 7.551	55.276 +/- 4.945	16.570	2.242 +/- 0.131
277	18	5	52.672 +/- 4.768	57.076 +/- 3.183	23.278	1.718 +/- 0.066
278	18	2	52.650 +/- 8.357	51.889 +/- 5.941	13.563	0.806 +/- 0.057
279	18	3	52.467 +/- 10.050	55.469 +/- 5.770	13.965	2.463 +/- 0.172
280	18	5	52.447 +/- 1.890	53.552 +/- 1.304	72.240	12.502 +/- 0.179
281	18	5	52.460 +/- 8.531	52.866 +/- 7.148	14.180	1.112 +/- 0.076
282	18	4	52.177 +/- 8.433	53.493 +/- 7.593	13.705	2.210 +/- 0.159
283	18	4	52.082 +/- 8.644	56.579 +/- 5.955	12.687	0.956 +/- 0.068
284	18	5	52.128 +/- 9.582	53.161 +/- 7.325	12.583	1.381 +/- 0.106
285	18	5	52.029 +/- 2.878	55.164 +/- 1.654	45.911	11.903 +/- 0.247
286	18	5	51.920 +/- 4.103	55.387 +/- 2.763	26.008	7.241 +/- 0.249
287	18	5	51.877 +/- 6.132	56.265 +/- 2.989	23.660	2.501 +/- 0.096
288	18	2	51.884 +/- 39.619	53.704 +/- 13.833	10.329	0.991 +/- 0.115
289	18	5	51.041 +/- 7.878	53.975 +/- 6.799	13.223	1.192 +/- 0.083
290	18	5	50.948 +/- 4.915	52.763 +/- 3.814	26.597	1.558 +/- 0.060
291	18	4	50.034 +/- 8.583	54.848 +/- 6.118	14.197	1.048 +/- 0.070
292	18	5	49.724 +/- 6.168	55.060 +/- 4.046	17.785	1.530 +/- 0.076
293	19	2	57.797 +/- 25.981	51.655 +/- 4.215	10.100	0.501 +/- 0.050
331	21	1	55.739 +/- 14.216	54.804 +/- 9.956	10.953	0.371 +/- 0.034
339	21	2	53.715 +/- 12.526	54.635 +/- 7.770	12.251	0.823 +/- 0.067

Unique sources in dataset #21

ID	image (first detected)	# of associations	RA	declination	detection level	flux (Jy)
280	18	5	52.447 +/- 1.890	53.552 +/- 1.304	72.240	12.502 +/- 0.179
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274	18	5	53.230 +/- 3.811	54.592 +/- 2.498	31.937	2.962 +/- 0.089
287	18	5	51.877 +/- 6.132	56.265 +/- 2.989	23.660	2.501 +/- 0.096
279	18	3	52.467 +/- 10.050	55.469 +/- 5.770	13.965	2.463 +/- 0.172
276	18	4	52.858 +/- 7.551	55.276 +/- 4.945	16.570	2.242 +/- 0.131
282	18	4	52.177 +/- 8.433	53.493 +/- 7.593	13.705	2.210 +/- 0.159
277	18	5	52.672 +/- 4.768	57.076 +/- 3.183	23.278	1.718 +/- 0.066
272	18	5	53.770 +/- 6.453	55.817 +/- 4.986	20.154	1.660 +/- 0.080
290	18	5	50.948 +/- 4.915	52.763 +/- 3.814	26.597	1.558 +/- 0.060
292	18	5	49.724 +/- 6.168	55.060 +/- 4.046	17.785	1.530 +/- 0.076
284	18	5	52.128 +/- 9.582	53.161 +/- 7.325	12.583	1.381 +/- 0.106
270	18	5	54.011 +/- 6.280	52.451 +/- 5.520	19.990	1.236 +/- 0.062
289	18	5	51.041 +/- 7.878	53.975 +/- 6.799	13.223	1.192 +/- 0.083
281	18	5	52.460 +/- 8.531	52.866 +/- 7.148	14.180	1.112 +/- 0.076
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278	18	2	52.650 +/- 8.357	51.889 +/- 5.941	13.563	0.806 +/- 0.057
359	21	2	50.767 +/- 12.145	55.132 +/- 9.415	10.253	0.795 +/- 0.075
356	21	1	51.745 +/- 13.957	56.496 +/- 7.603	10.551	0.722 +/- 0.069
271	18	3	53.857 +/- 68.673	55.074 +/- 16.188	11.913	0.717 +/- 0.060
267	18	2	54.826 +/- 11.766	57.039 +/- 5.731	14.280	0.653 +/- 0.046
268	18	2	54.469 +/- 10.273	56.896 +/- 7.052	12.536	0.616 +/- 0.048

Dataset #21, L2010_20850

Properties

description: None
 Reprocessing step: 0
 processing finished: 2011-09-08T14:06:51

Images

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20	2010-08-21T10:00:00	3600.0	20	163.18 MHz	48.24 MHz	/home/evert/scratch/bell/L09948_227sbs.fits
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Transients

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35	269	1.0	5	1970-01-01T00:00:00
36	270	1.0	5	2010-08-27T10:00:00
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30	277	1.0	5	2010-08-13T10:00:00
37	280	1.0	5	2010-08-27T10:00:00
33	285	1.0	5	1970-01-01T00:00:00
31	287	1.0	5	1970-01-01T00:00:00
34	290	1.0	5	2010-08-21T10:00:00

Sources

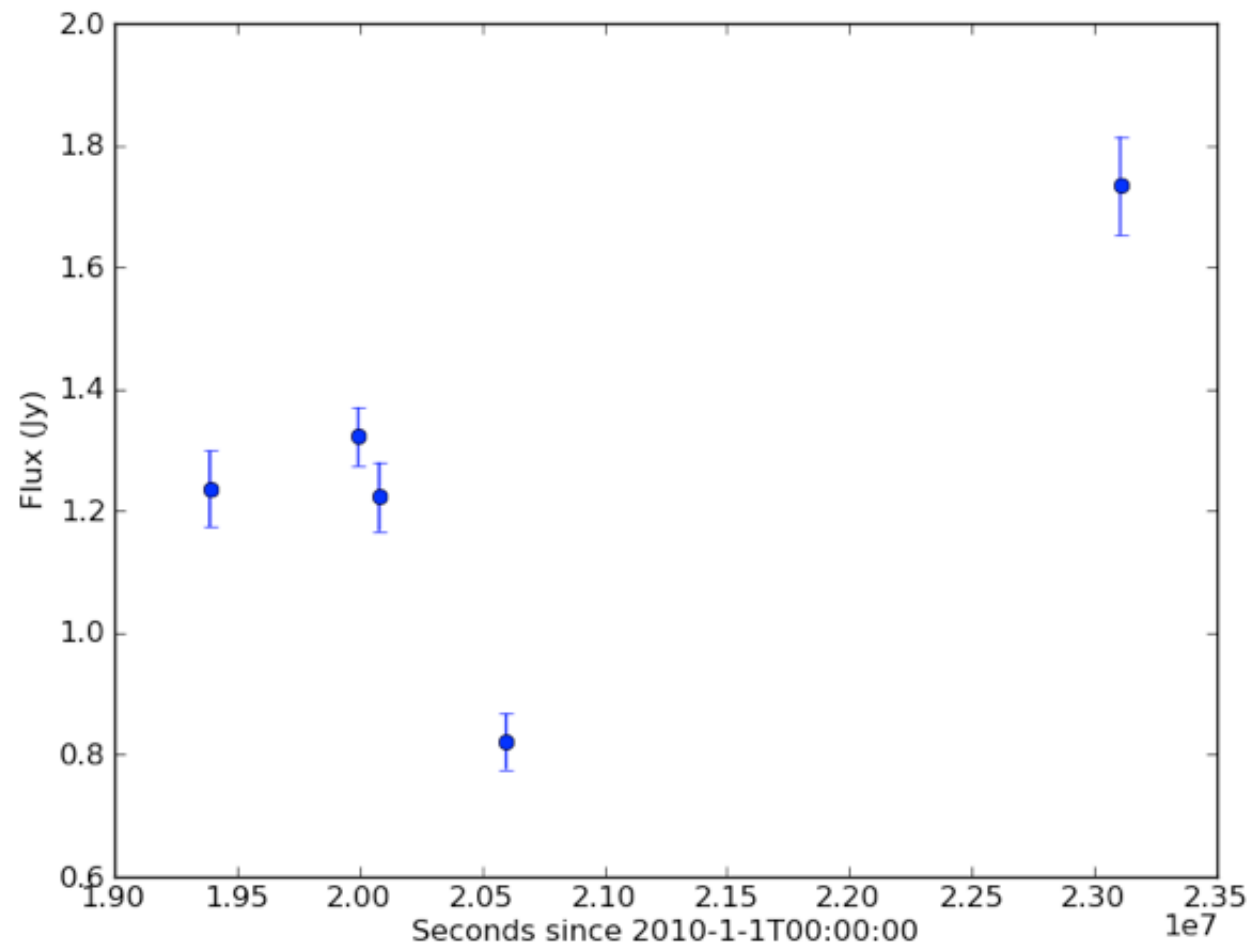
View [all 33 unique sources](#) for this dataset

Transient #36

Properties

source ID: [270](#)
status: 0
significance level: 1.0
start time: 2010-08-27T10:00:00
image id: [18](#)
dataset id: [21](#)

Lightcurve

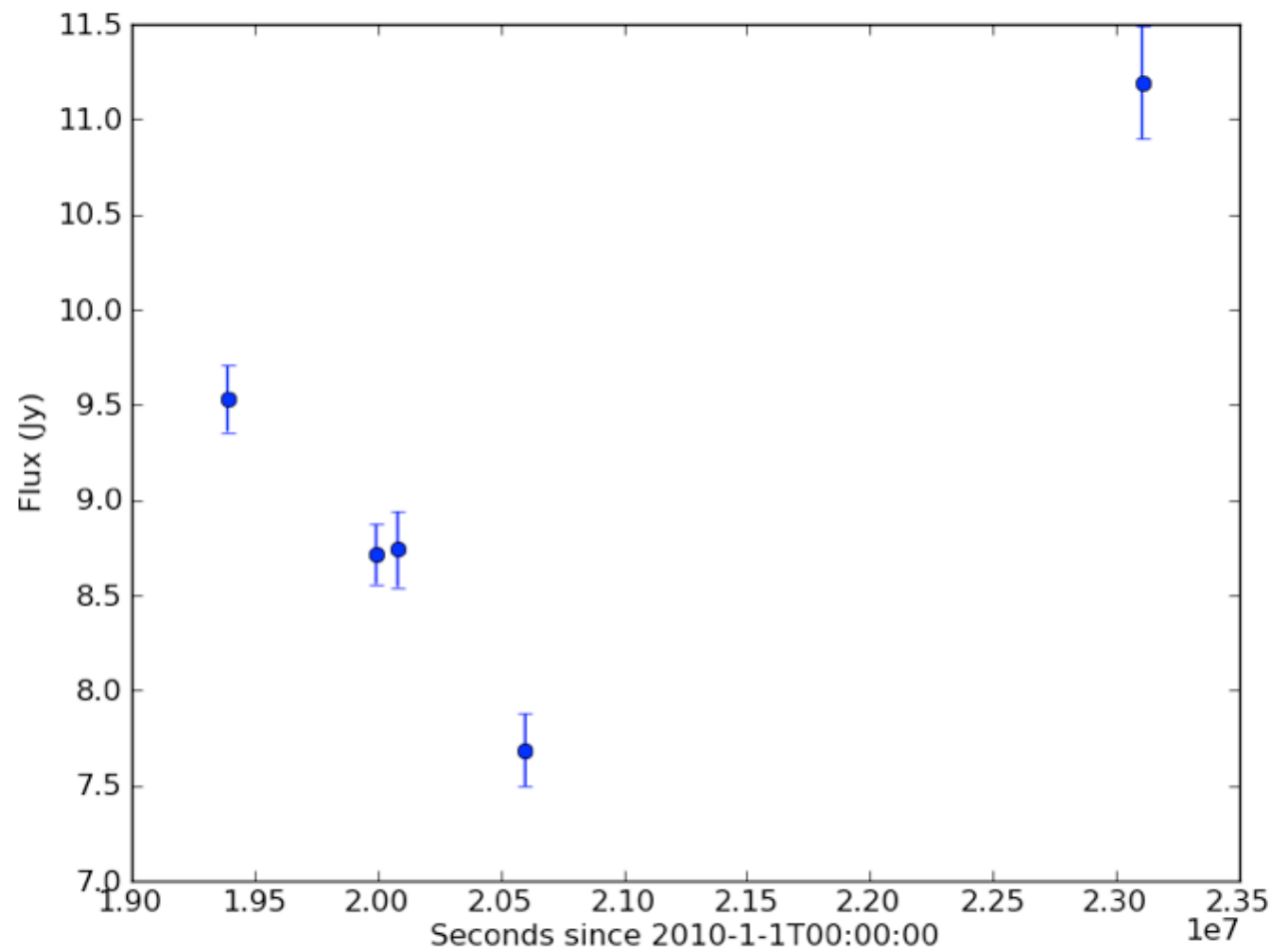


Transient #35

Properties

source ID: [269](#)
status: 0
significance level: 1.0
start time: 1970-01-01T00:00:00
image id: [18](#)
dataset id: [21](#)

Lightcurve



THE LOFAR TRANSIENTS PIPELINE

THE LOFAR TRANSIENTS PIPELINE

WE HOPE YOU HEAR FROM US SOON!