

LOFAR Transient Detection Pipeline



LOFAR

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Agenda

- Transient detection
- Pipeline layout
- Software



LOFAR

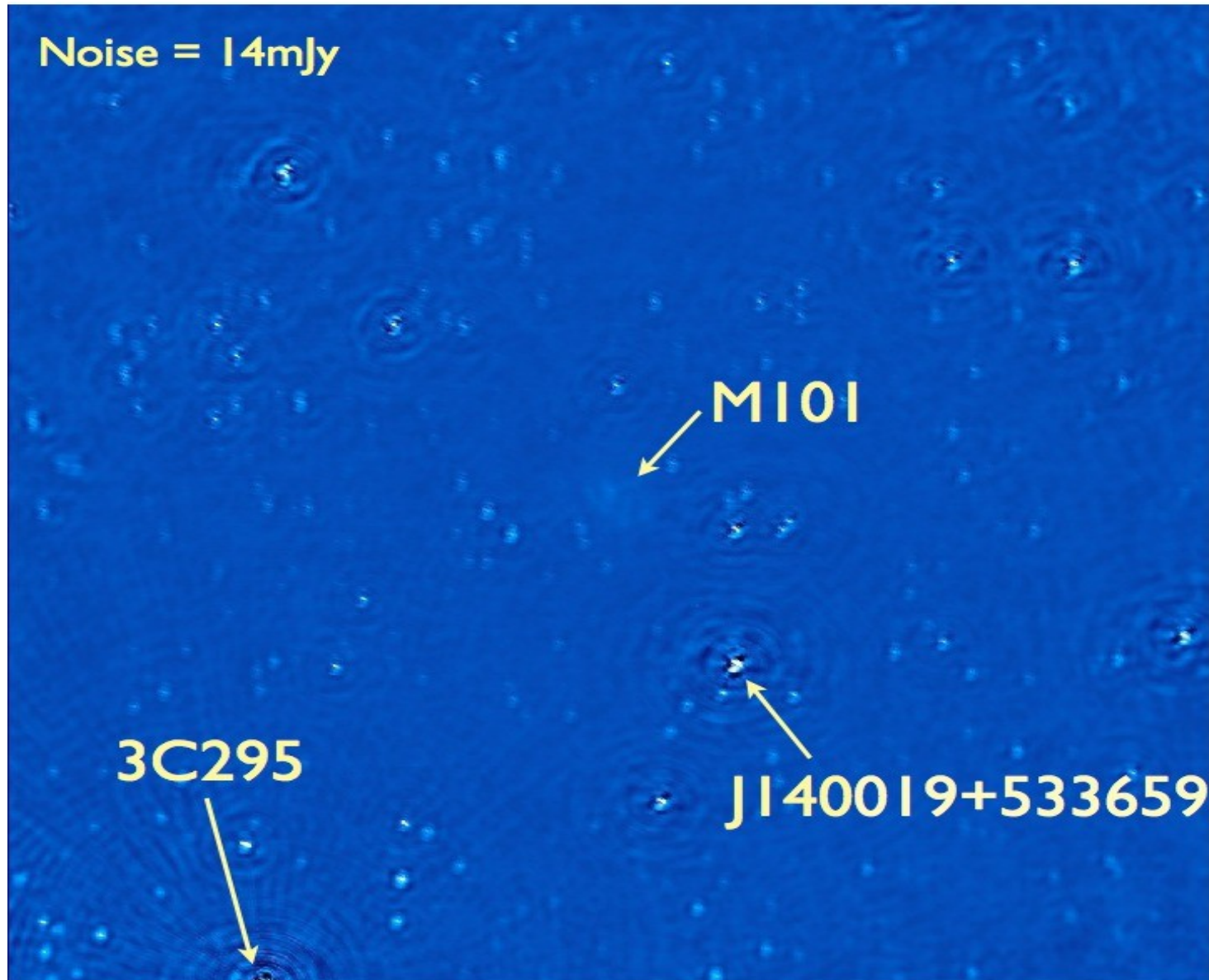


Transients Detection



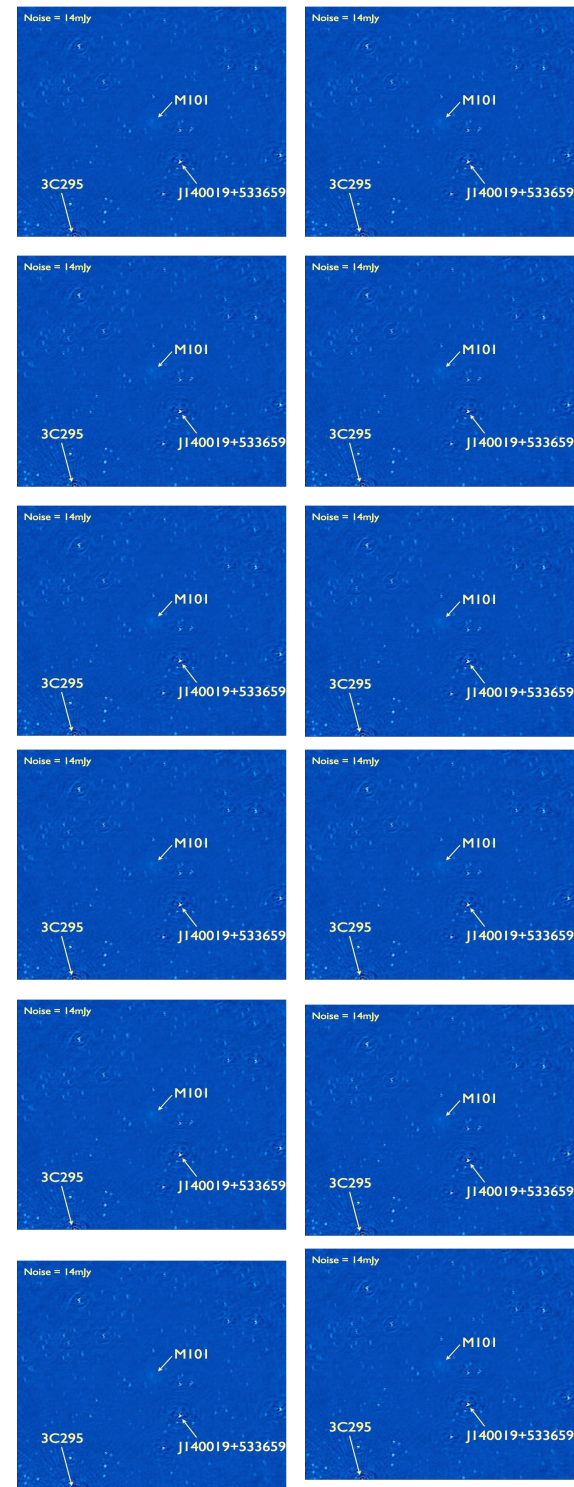
- Static sources are boring
- Transient – something that changes
- Huge amount of data – automation

Image data

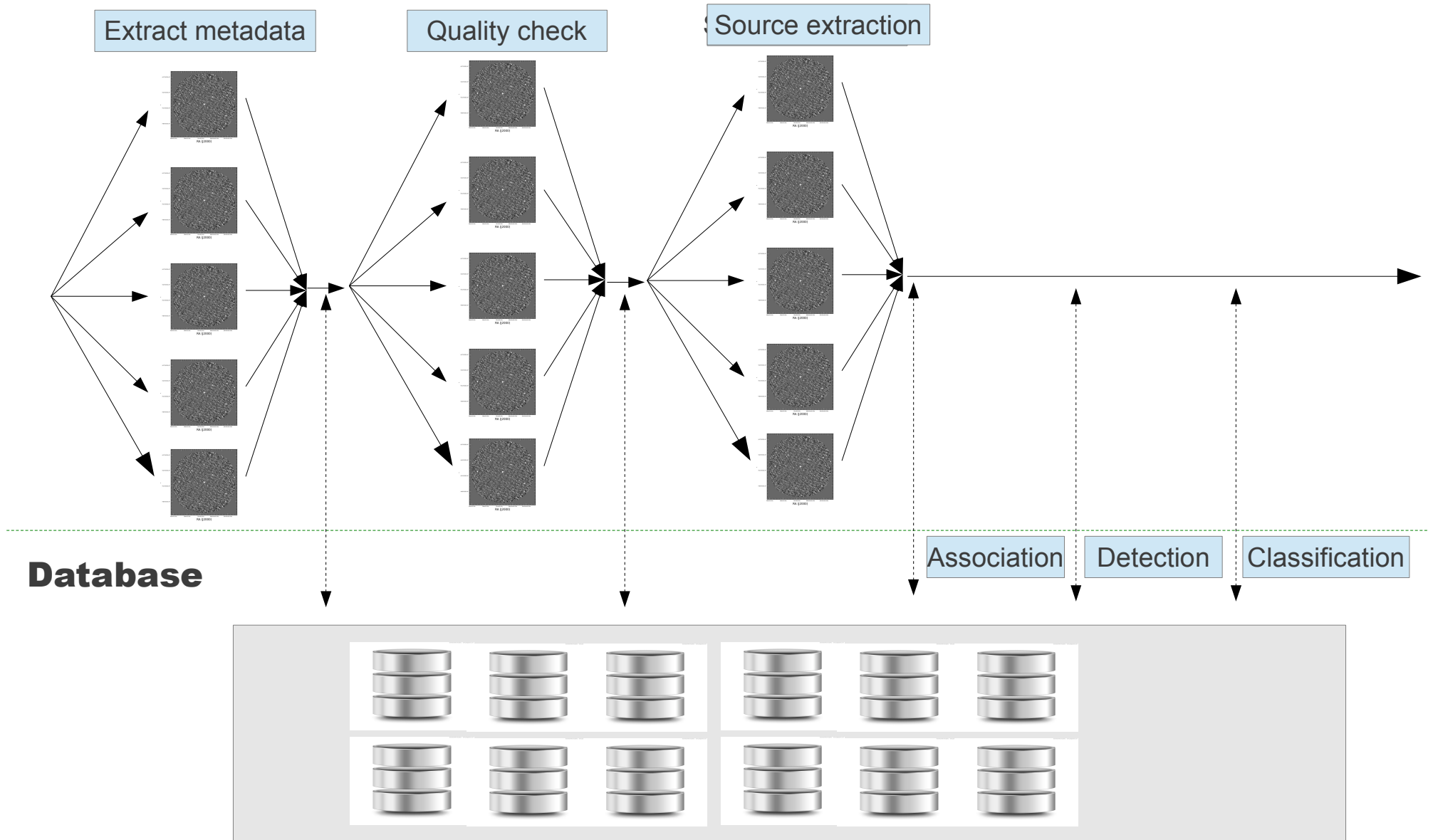


The data

- 1 datacube per second
- 10 frequency bands
- In the future 10 images per second
- In the future 4 different polarization
- Non stop



Transient detection Pipeline





- The glue
- Distributing computation
- Image processing
- Statistics
- Source extraction
- Database interactions

Distributed Computation

- Home made library
- SSH based

- Difficult to debug
- Difficult to profile
- Doing research on Celery and Hadoop

Database

- Move calculation to the data
- Highly structured
- Independent data
- Naturally separable by sky coordinates

- ~100 TB/year
- 10.000 insert/second

MonetDB



- Relational
- Column store DB
- Fast
- Auto tuning!
- Developers next door (CWI)

Challenges

- Debugging queries
- MonetDB still in active development

```

INSERT INTO tempbasesources
(xtrsrc_id
,datapoints
,l_peak_sum
,l_peak_sq_sum
,weight_peak_sum
,weight_l_peak_sum
,weight_l_peak_sq_sum
)
SELECT b0.xtrsrc_id
,b0.datapoints
+ 1 AS datapoints
,b0.l_peak_sum
+ x0.l_peak AS i_peak_sum
,b0.l_peak_sq_sum
+ x0.l_peak * x0.l_peak AS i_peak_sq_sum
,b0.weight_peak_sum
+ 1 / (x0.l_peak_err * x0.l_peak_err) AS weight_peak_sum
,b0.weight_l_peak_sum
+ x0.l_peak / (x0.l_peak_err * x0.l_peak_err)
AS weight_i_peak_sum
,b0.weight_l_peak_sq_sum
+ x0.l_peak * x0.l_peak / (x0.l_peak_err * x0.l_peak_err)
AS weight_i_peak_sq_sum
FROM basesources b0
,extractedsources x0
WHERE x0.image_id = @imageid
AND b0.zone BETWEEN CAST(FLOOR((x0.decl - @theta) / x0.zoneheight
) AS INTEGER)
AND CAST(FLOOR((x0.decl + @theta) / x0.zoneheight
) AS INTEGER)
AND ASIN(SQRT((x0.x - b0.x)*(x0.x - b0.x)
+(x0.y - b0.y)*(x0.y - b0.y)
+(x0.z - b0.z)*(x0.z - b0.z)
) / 2
)
/
SQRT(x0.ra_err * x0.ra_err + b0.ra_err * b0.ra_err
+x0.decl_err * x0.decl_err + b0.decl_err * b0.decl_err)
< @assoc_r;

```

MonetDB and Python

- We maintain the MonetDB Python API
- <http://pypi.python.org/pypi/python-monetdb/>
- Problems? Ask me :)

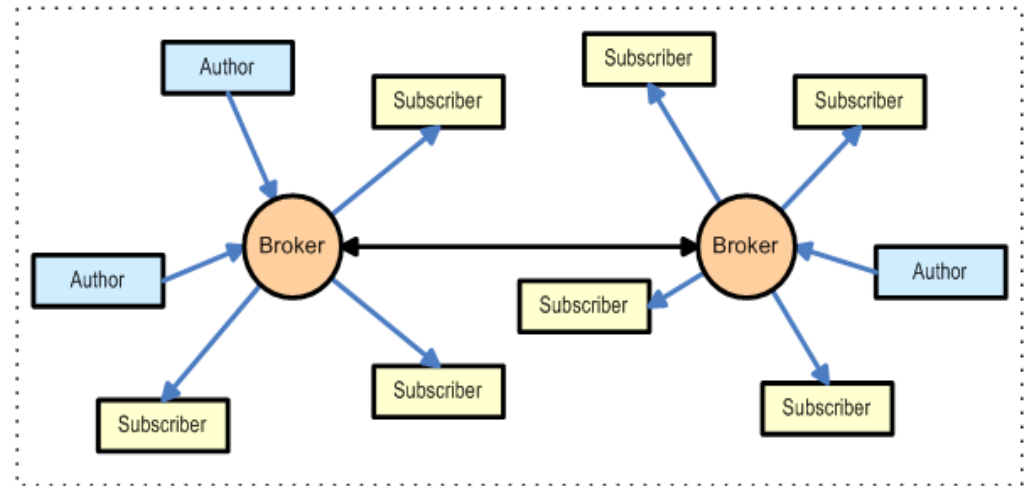
Djonet



- MonetDB backend for Django
- <https://github.com/gijzelaerr/djonet>
- brew install monetdb
- pip install python-monetdb djonet
- Contributions are welcome!

VO events

- Standardized language
- Report observations of astronomical events



- Hey world, check this supernova out over there
- <http://comet.transientskp.org>

Visualisation

- Web interface
- Django!
- Not public (yet)

Dataset #15, L30582

Properties

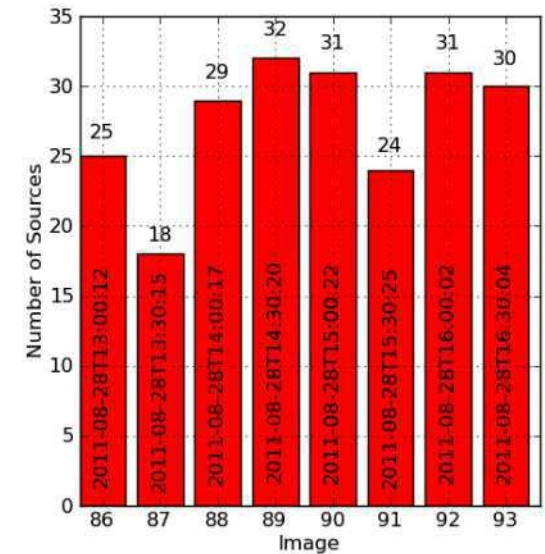
description: None
Reprocessing step: 9
processing finished: 2012-04-24T12:46:59

Details

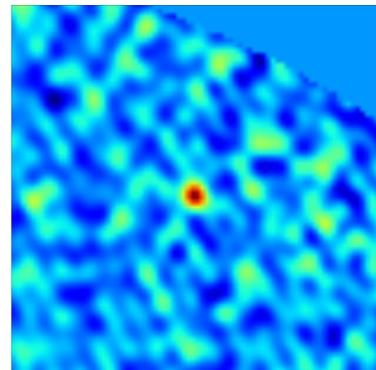
- 11 detected transients
- 8 available images
- 61 unique sources
- 220 total detected sources
- Monitoring list

Quality control checks

Number of sources per image



ID	Date (UTC)	Integration time (s)	Flux (mJy)	Flux error (mJy)	Thumbnail
8727	2011-12-24T04:03:00	29070754.5784	10579.196	1290.034	
8740	2011-12-24T04:18:00	29070754.5784	8326.059	1547.875	
8967	2011-12-24T04:33:00	29070754.5784	6087.607	1416.403	
8766	2011-12-24T04:48:00	29070754.5784	7418.521	1409.684	
8780	2011-12-24T05:03:00	29070754.5784	7441.110	1292.688	
8796	2011-12-24T05:18:00	29070754.5784	6807.511	1286.727	
8810	2011-12-24T05:33:00	29070754.5784	6785.535	1248.815	
8822	2011-12-24T05:48:00	29070754.5784	10492.151	1532.072	
8838	2011-12-24T06:03:00	29070754.5784	9571.644	1363.617	
8856	2011-12-24T06:18:00	29070754.5784	12100.066	1583.704	
8870	2011-12-24T06:33:00	29070754.5784	10402.404	2093.548	
8885	2011-12-24T06:48:00	29070754.5784	9255.653	1394.475	
8903	2011-12-24T07:03:00	29070754.5784	10805.948	1851.099	
8944	2011-12-24T07:18:00	29070754.5784	4022.222	1455.724	



csv format

More

- <http://www.transientskp.org/>
- <http://www.lofar.org/>
- <http://www.aartfaac.org/>

Questions?