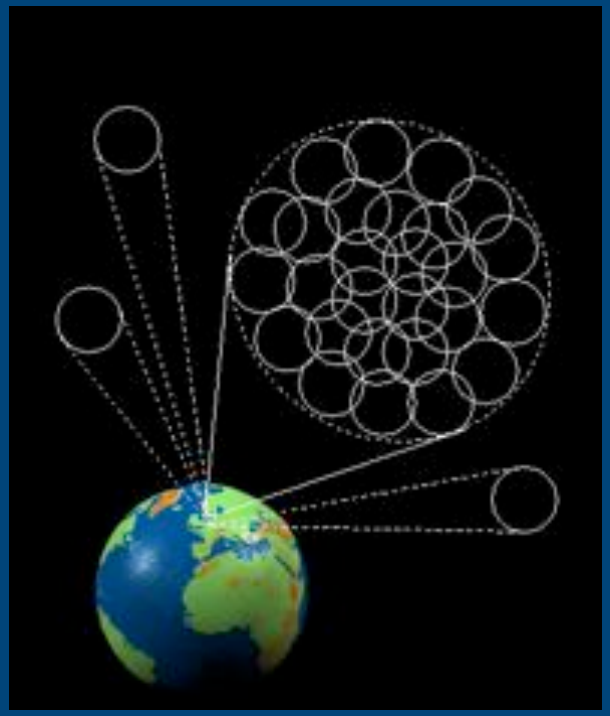
TKP Database Techniques



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LSM, Dwingeloo, 2010-02-24

Outline

TKP pipeline

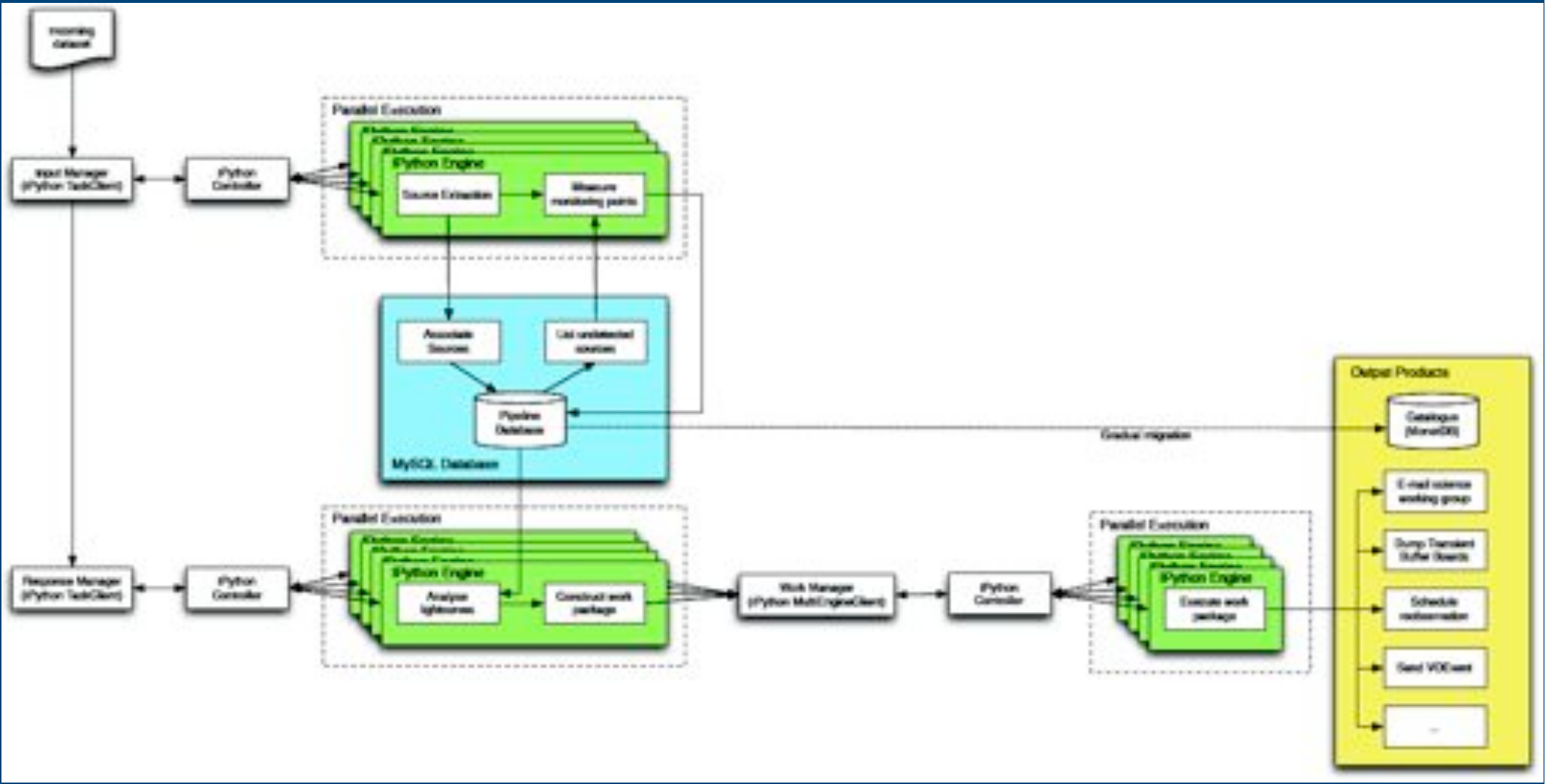
Databases

MonetDB

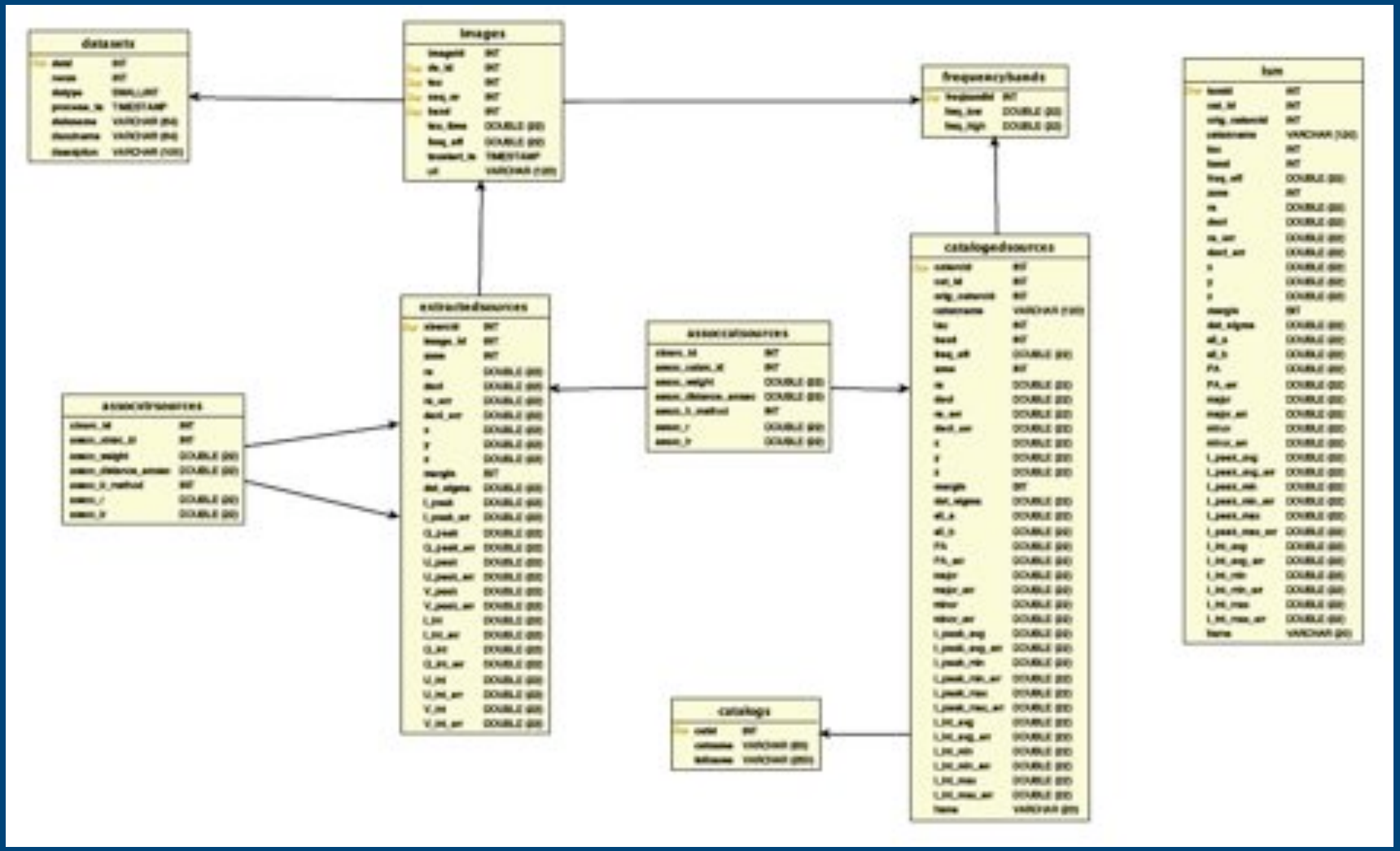
Source Association
Variability Index

Simulated images / WENSS-NVSS / GRB030329

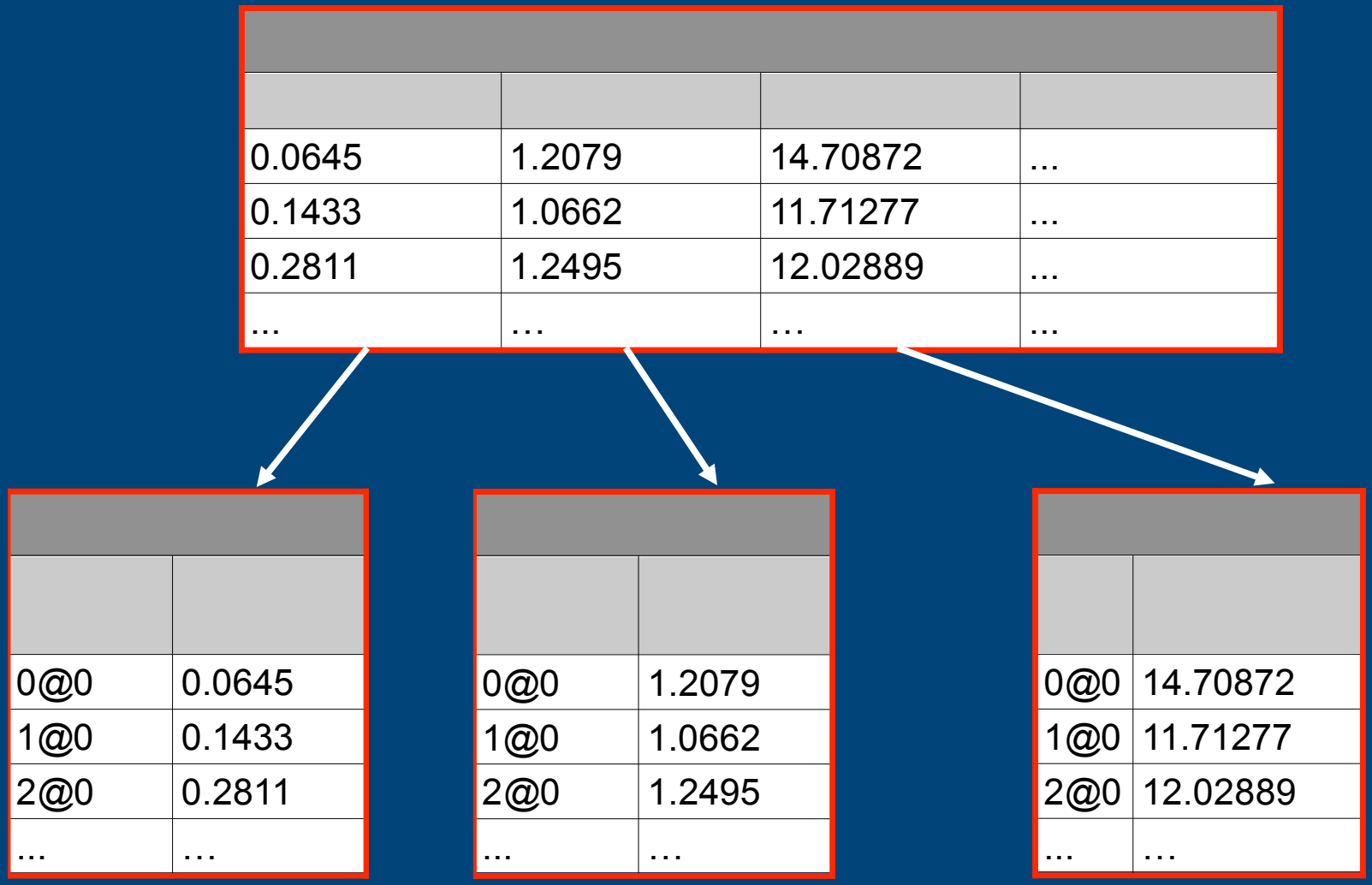
Transients Key Project Pipeline



Database schema



MonetDB – a column oriented DB



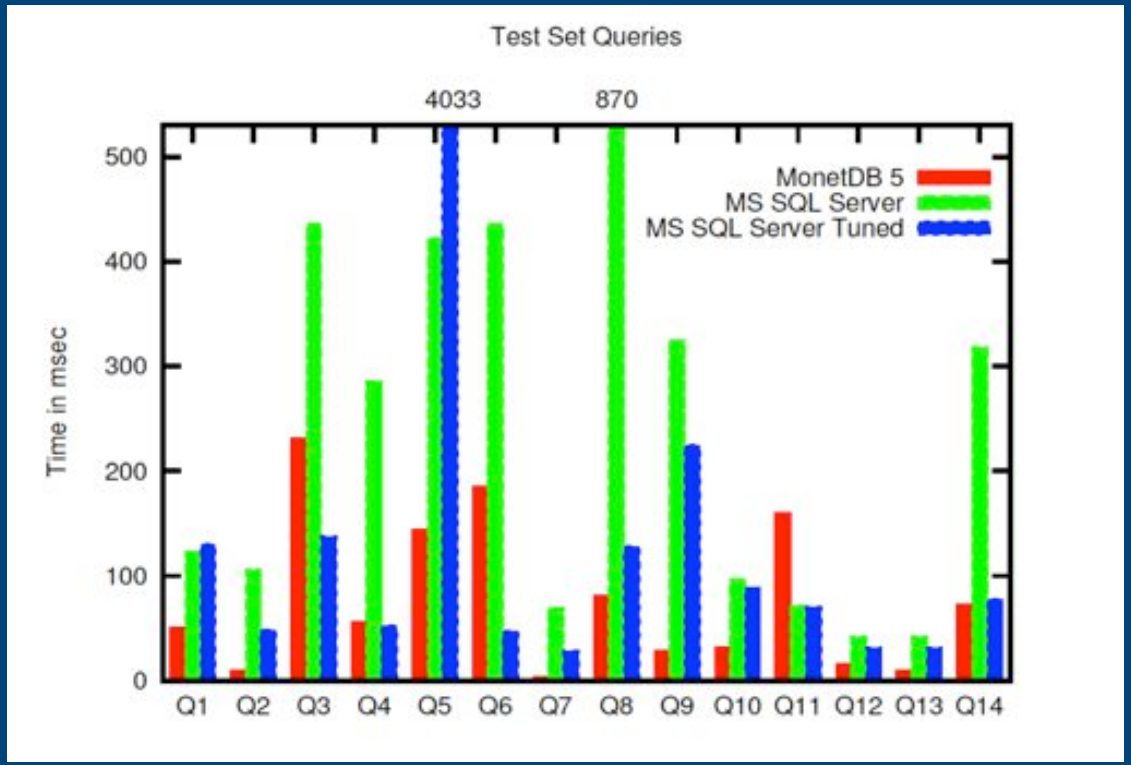
0.0645	1.2079	14.70872	...
0.1433	1.0662	11.71277	...
0.2811	1.2495	12.02889	...
...	…	…	...

0@0	0.0645
1@0	0.1433
2@0	0.2811
...	…

0@0	1.2079
1@0	1.0662
2@0	1.2495
...	…

0@0	14.70872
1@0	11.71277
2@0	12.02889
...	…

SDSS SkyServer ported to MonetDB



Ivanova et al. (2007)

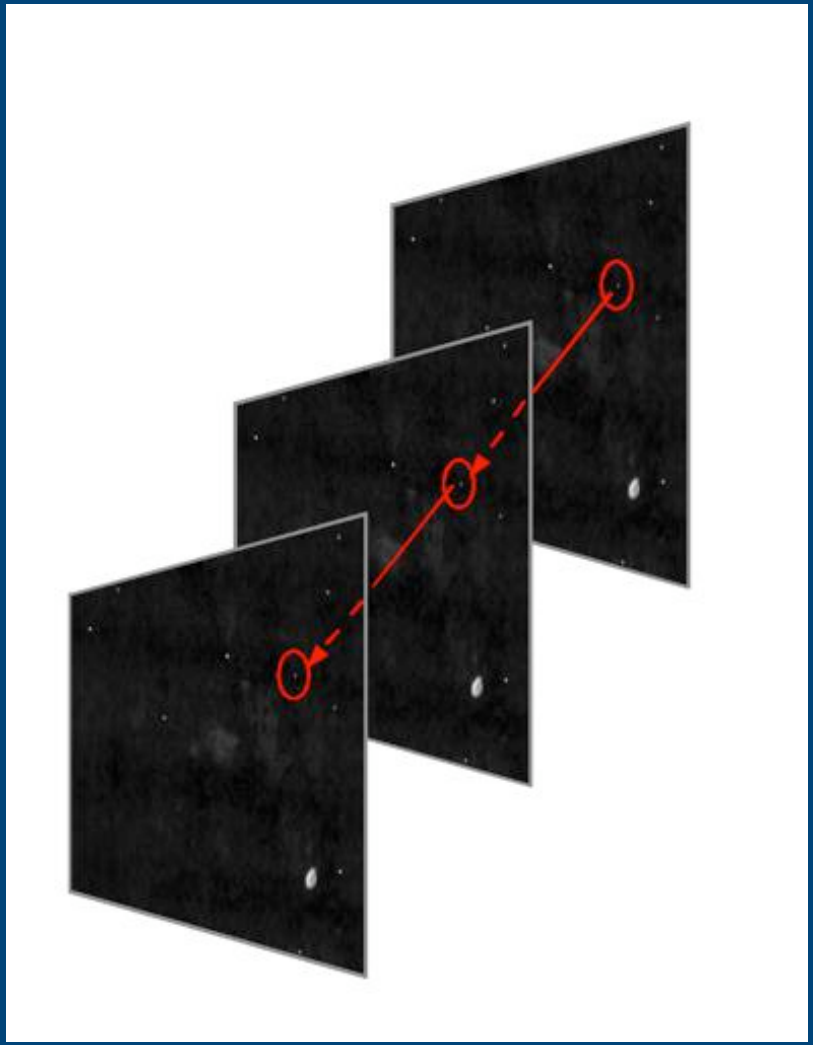
Source Association

Store all sources

Find candidate pairs in search area

Probability
- true (Rayleigh)
- chance (Poisson)

$LR_{ij} = \exp(-r_{ij}/2)/2\pi\sigma_\alpha\sigma_\delta n_L$

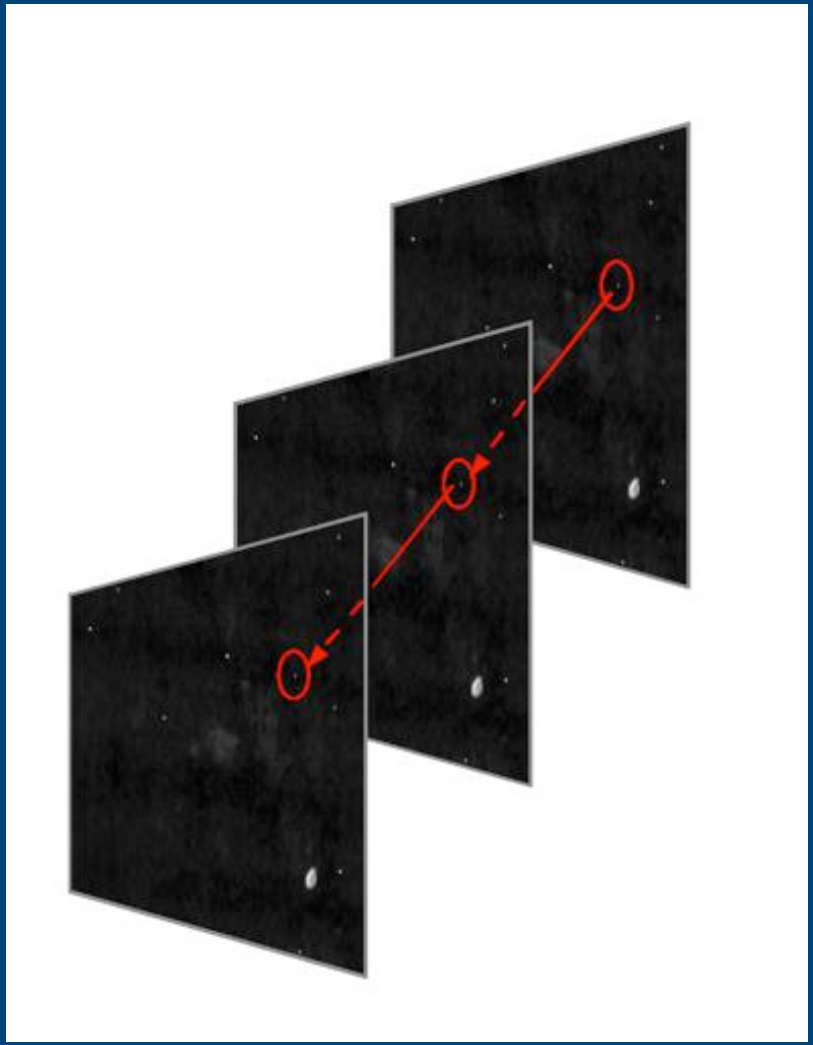


Variability Index

- Analyze associations

$$\frac{s}{\overline{I_\nu}} = \frac{\sqrt{\frac{N}{N-1}\left(\overline{I_\nu^2} - \overline{I_\nu}^2\right)}}{\overline{I_\nu}}$$

- Aggregate functions
  - group by
  - average/std
  - summarization

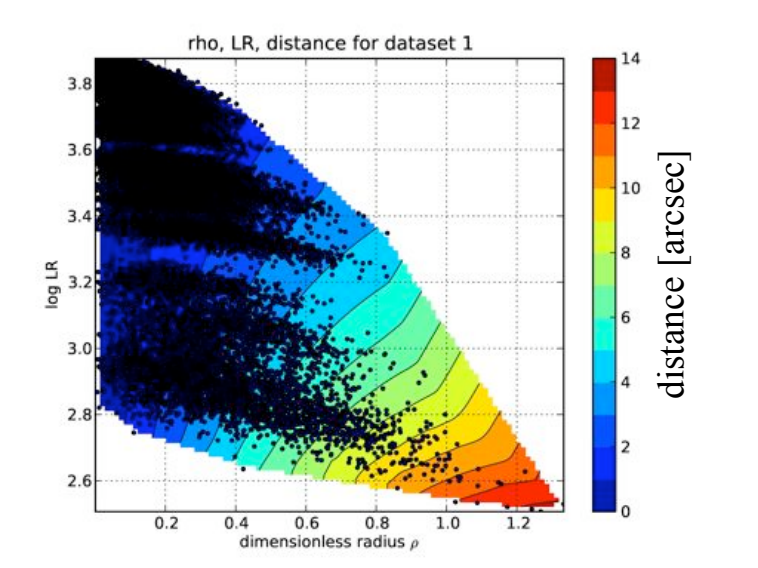


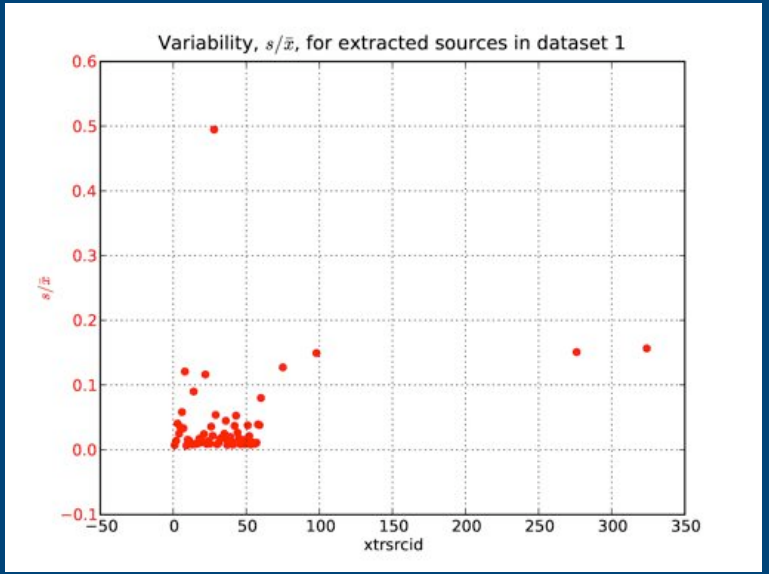
Process simulated Images

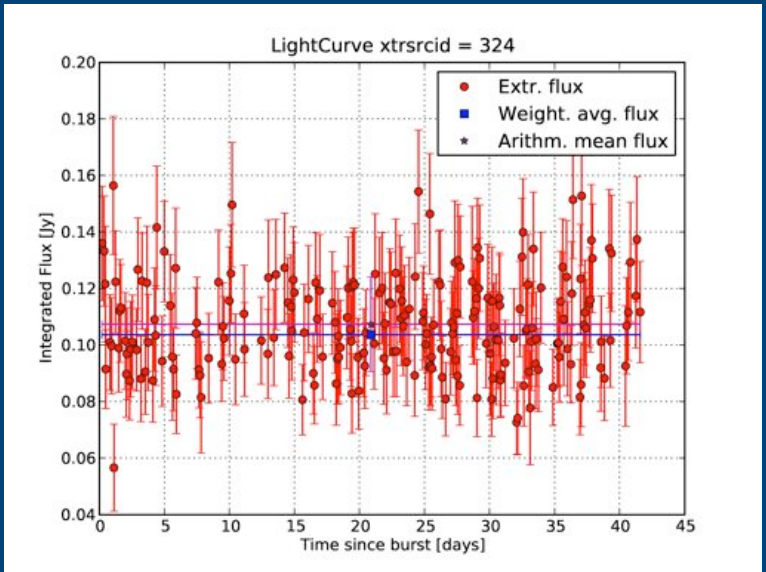
1000 Noise maps
- from VLA 325 MHz
- ~ 1 × 1 degrees
- avg 10 mJy/bm

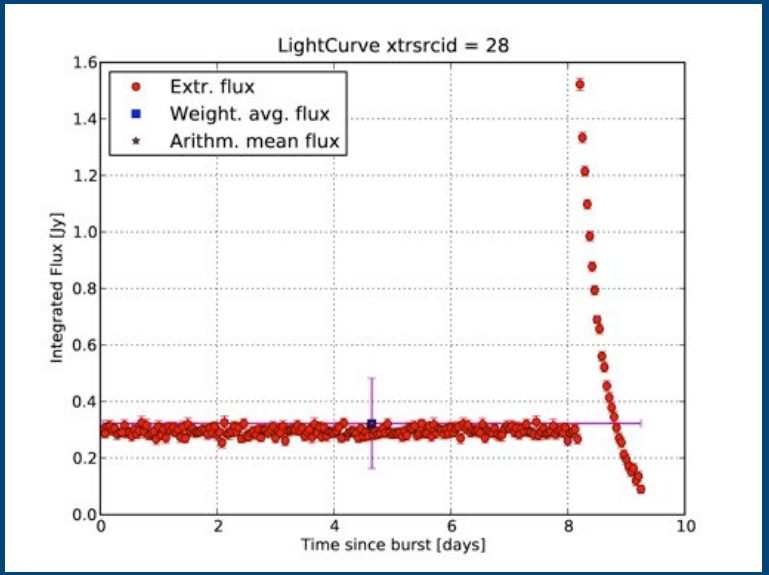
1000 images
- $\Delta t = 1$ hr
- 64 sources per image on rectangular grid
- (30 mJy – 3 Jy) ± 0.5 mJy

1 transient substituted at some time/image


rho, LR, distance for dataset 1
log LR
dimensionless radius ρ
distance [arcsec]


Variability, $s/\bar{x}$, for extracted sources in dataset 1
$s/\bar{x}$
xtrsrcid


LightCurve xtrsrcid = 324
Extr. flux
Weight. avg. flux
Arithm. mean flux
Integrated Flux [Jy]
Time since burst [days]


LightCurve xtrsrcid = 28
Extr. flux
Weight. avg. flux
Arithm. mean flux
Integrated Flux [Jy]
Time since burst [days]

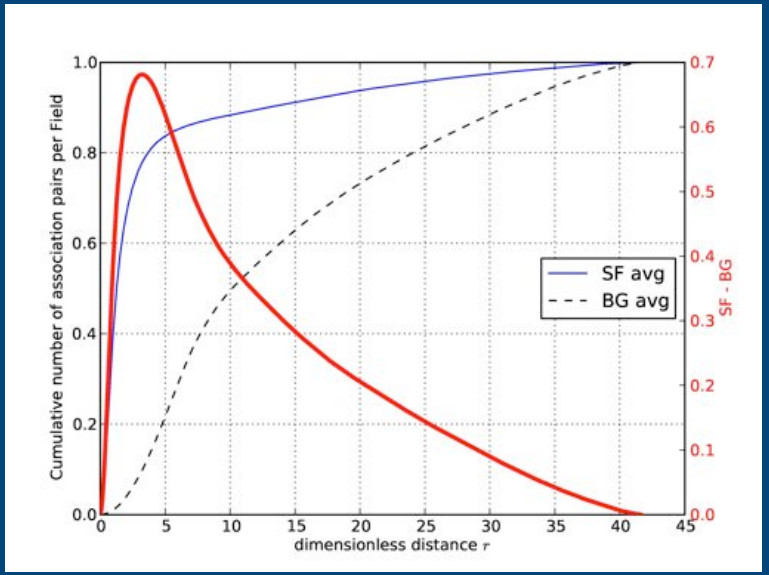
Process WENSS – NVSS sources

Source Field
- 229,420 WENSS source

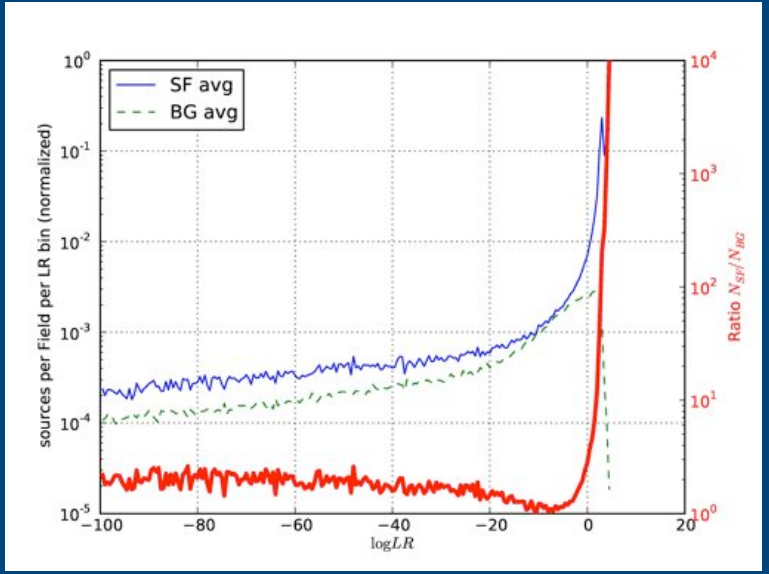
Background Field
- 3 × 3 square lattice
- centres offset by 180 arcsec
- 1,835,360 sources

Process in TKP pipeline
- Source Association
- Spectral indices

cumulative distribution of dimensionless positional difference for Source and Background Fields



Distribution of log LR for Source and Background Fields

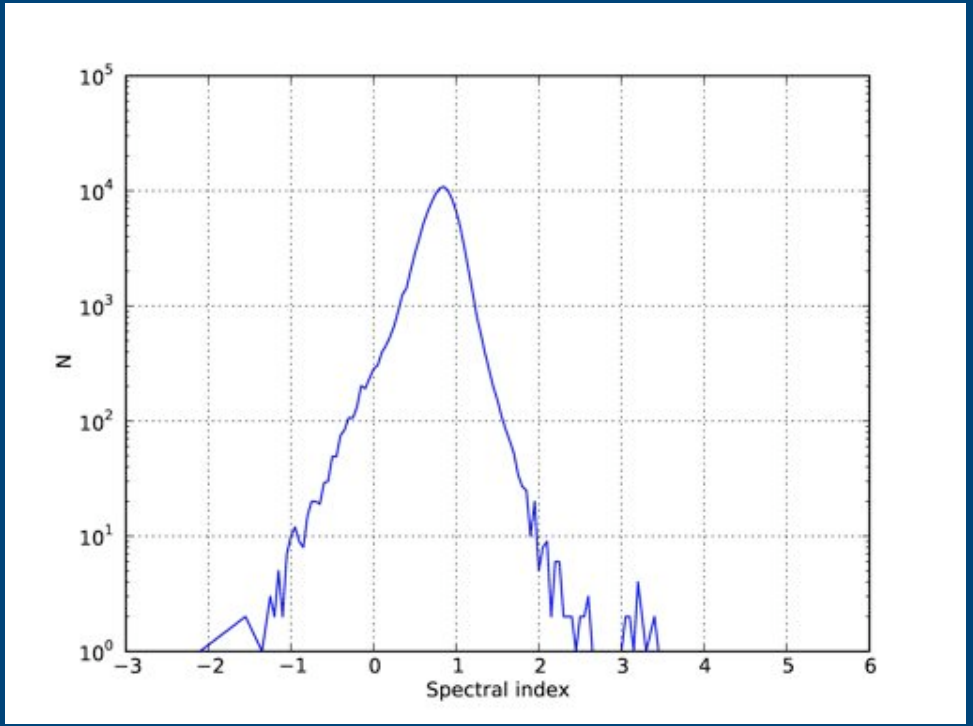


Spectral Index WENSS-NVSS assocs

select log LR > 3

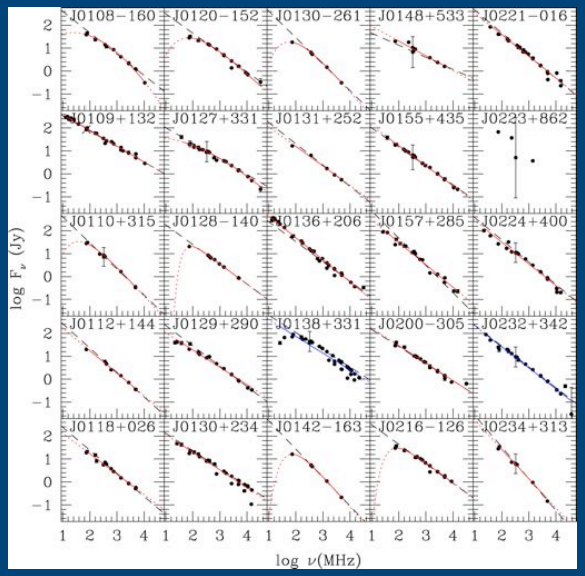
106,039 sources

S_ν propto $\nu^{-\alpha}$

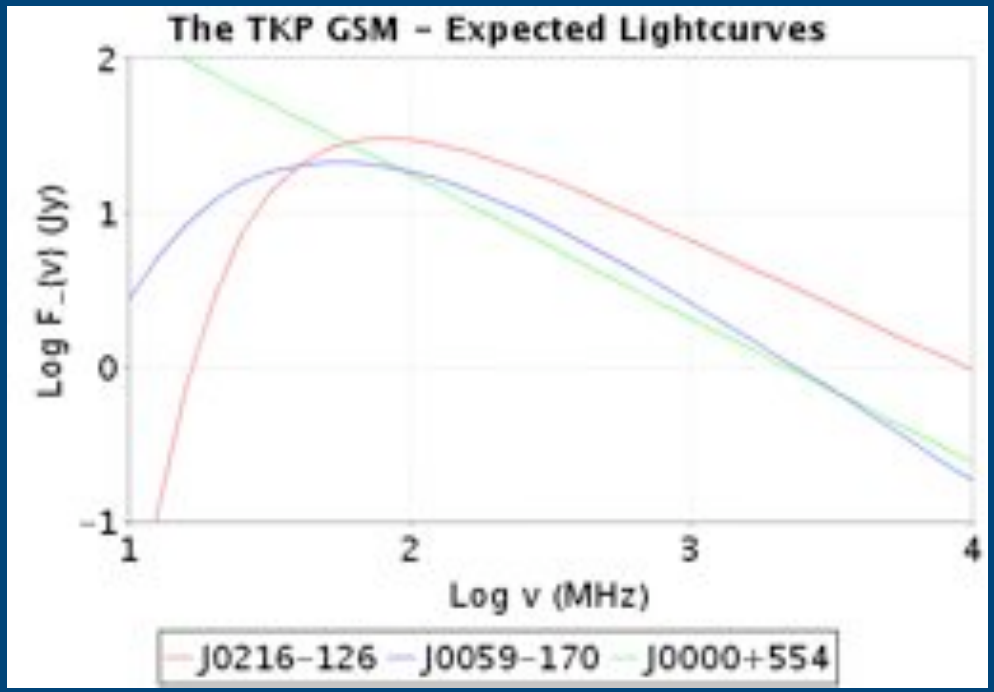


Helmboldt sources and fluxes

```
SELECT alpha_gt_300 * LOG10(@nu/74) + LOG10(f_ext) AS 'linear: log F_{nu} (Jy)'
      ,CASE WHEN param_a IS NULL
            THEN NULL
            ELSE param_a +
                 IFNULL(param_b, 0) * LOG10(@nu/74) +
                 IFNULL(param_c, 0) * EXP(IFNULL(param_d, 0) * LOG10(@nu/74))
            END AS 'Kuehr: log F_{nu} (Jy)'
  FROM sources src
      ,spectralparameters sp
 WHERE spectral_params_id = spectral_paramsid
   AND src_name = @src_name
```



Helmboldt et al. (2008)



GRB030329 FoV

WSRT observations between 2003 – 2007

350 MHz – 8400 MHz
- FWHM 2.6° – 0.1°

TKP pipeline

GRB030329 FoV 1400MHz assocs