

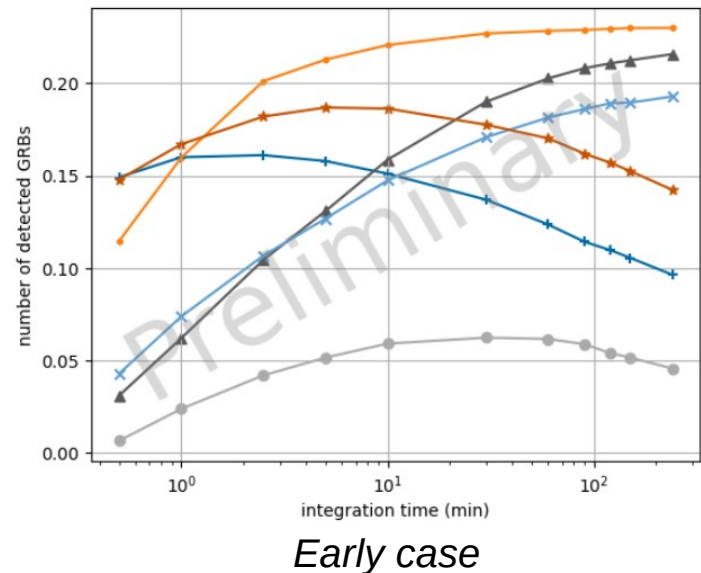
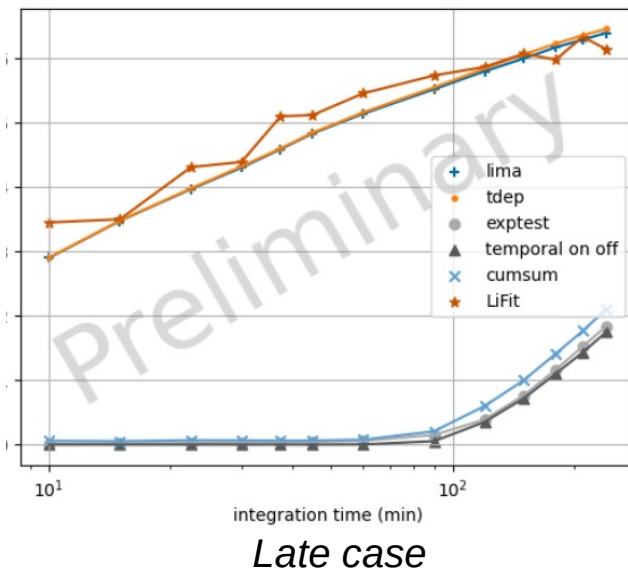
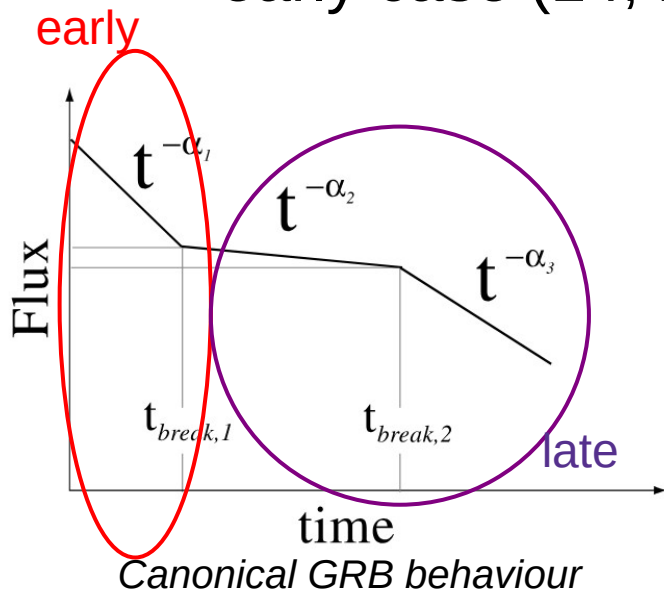
05/06/2025

**- Gammapy meeting -**  
Time-dependent methods  
GRB Classification

# Update on time dependent methods

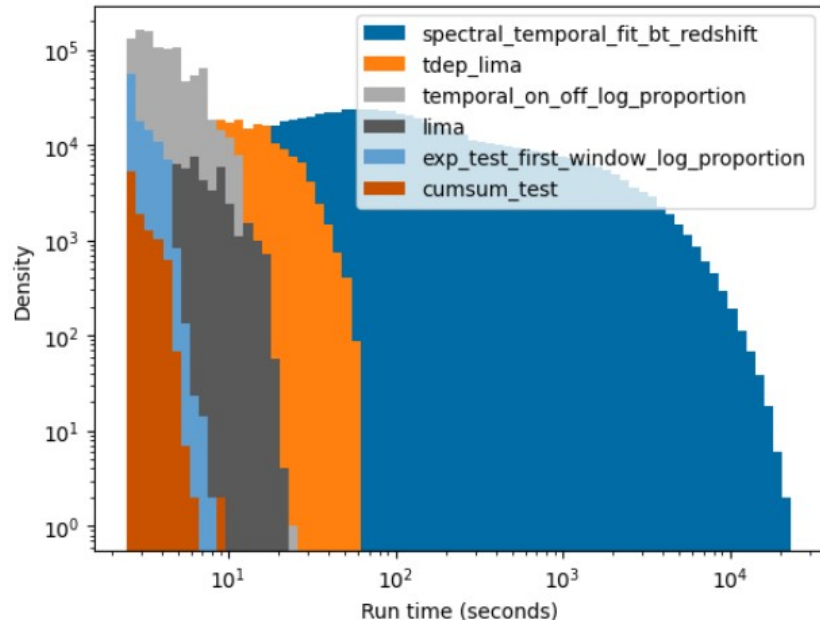
Simulating 2 cases:

- late case (28,000 simulations)
- early case (14,400 simulations)



# Update on time dependent methods

## Method run time



*Distribution of run time for each method*

Use in RTA?

# Update on time dependent methods

## Issues

- LiFit fitting
- FAR
- method to choose significance result

# Update on time dependent methods

## Issues

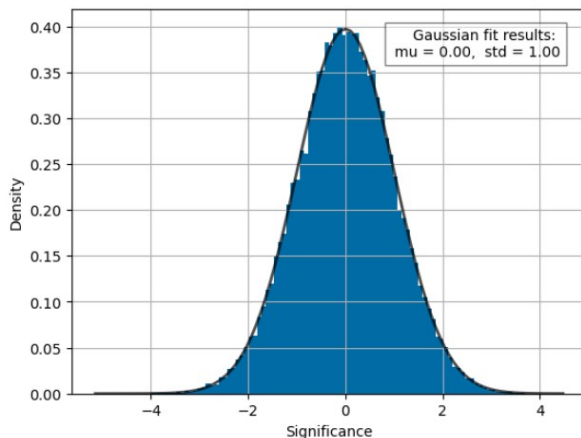
→ LiFit fitting: fit fails in ~50 % of the cases

# Update on time dependent methods

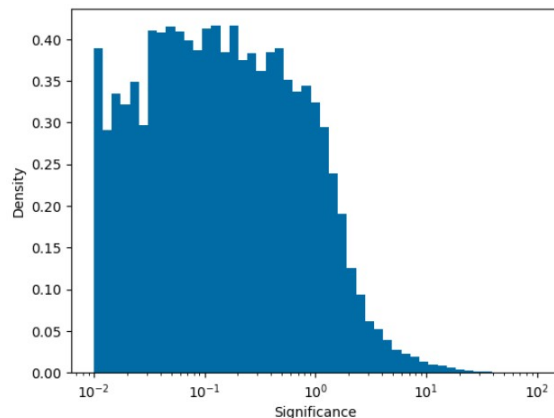
## Issues

→ FAR: criteria used for LST meeting >10 %

	method	falseAlertRate
0	lima	0.000000
1	tdep_lima	0.000000
2	cumsum_test	0.001752
3	cumsum_first_window_linear_proportion	0.534655
4	cumsum_first_window_log_proportion	0.414972
5	cumsum_first_window_fixed	0.396873
6	exp_test_global	0.000000
7	exp_test_first_window_linear_proportion	0.136498
8	exp_test_first_window_log_proportion	0.158221
9	temporal_on_off_fixed	0.090510
10	temporal_on_off_log_proportion	0.114560
11	temporal_on_off_linear_proportion	0.104368
12	spectral_temporal_fit_bt	0.052952



*Distribution of significance computed with Li&Ma in the case of only background*



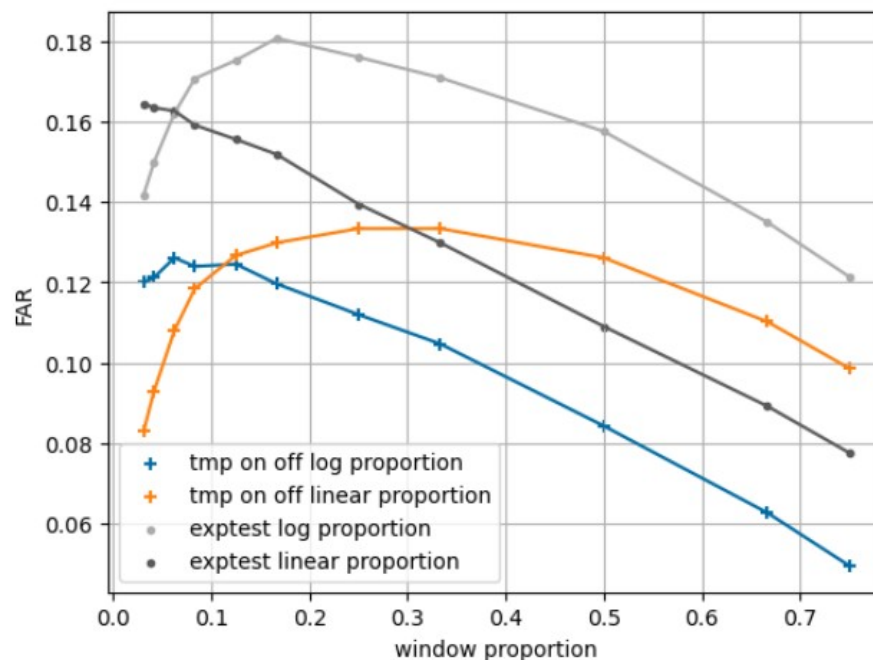
*Distribution of significance computed with temporal on off fixed in the case of only background*

# Update on time dependent methods

## Issues

→ FAR

	method	falseAlertRate
0	lima	0.000000
1	tdep_lima	0.000000
2	cumsum_test	0.001752
3	cumsum_first_window_linear_proportion	0.534655
4	cumsum_first_window_log_proportion	0.414972
5	cumsum_first_window_fixed	0.396873
6	exp_test_global	0.000000
7	exp_test_first_window_linear_proportion	0.136498
8	exp_test_first_window_log_proportion	0.158221
9	temporal_on_off_fixed	0.090510
10	temporal_on_off_log_proportion	0.114560
11	temporal_on_off_linear_proportion	0.104368
12	spectral_temporal_fit_bt	0.052952

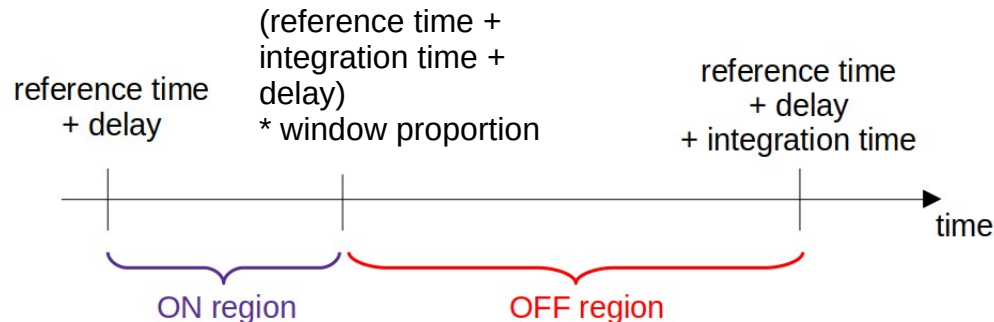


*Evolution of the FAR, depending on the window proportion*

# Update on time dependent methods

## Issues

- method to choose significance result,  
cases: cumusm, tmp on off, exptest
  - variant of the method that minimizes the FAR?
  - window proportion that minimizes the FAR?



*Example of tmp on off method with window prop*



# Update on time dependent methods

## Issues

- method to choose significance result,  
case: tdep LiMa, needs to assume tmp index
  - test several hypothesis (*and correct per trial*)
  - fix one depending on the case => RTA
  - use x-ray light curve => Offline analysis

# Matching databases

LST-1 database

VS

Swift, Fermi-GBM, MAXI, INTEGRAL, SVOM, EP databases  
(+ GRBWeb catalog)

up to the 04/04/2025

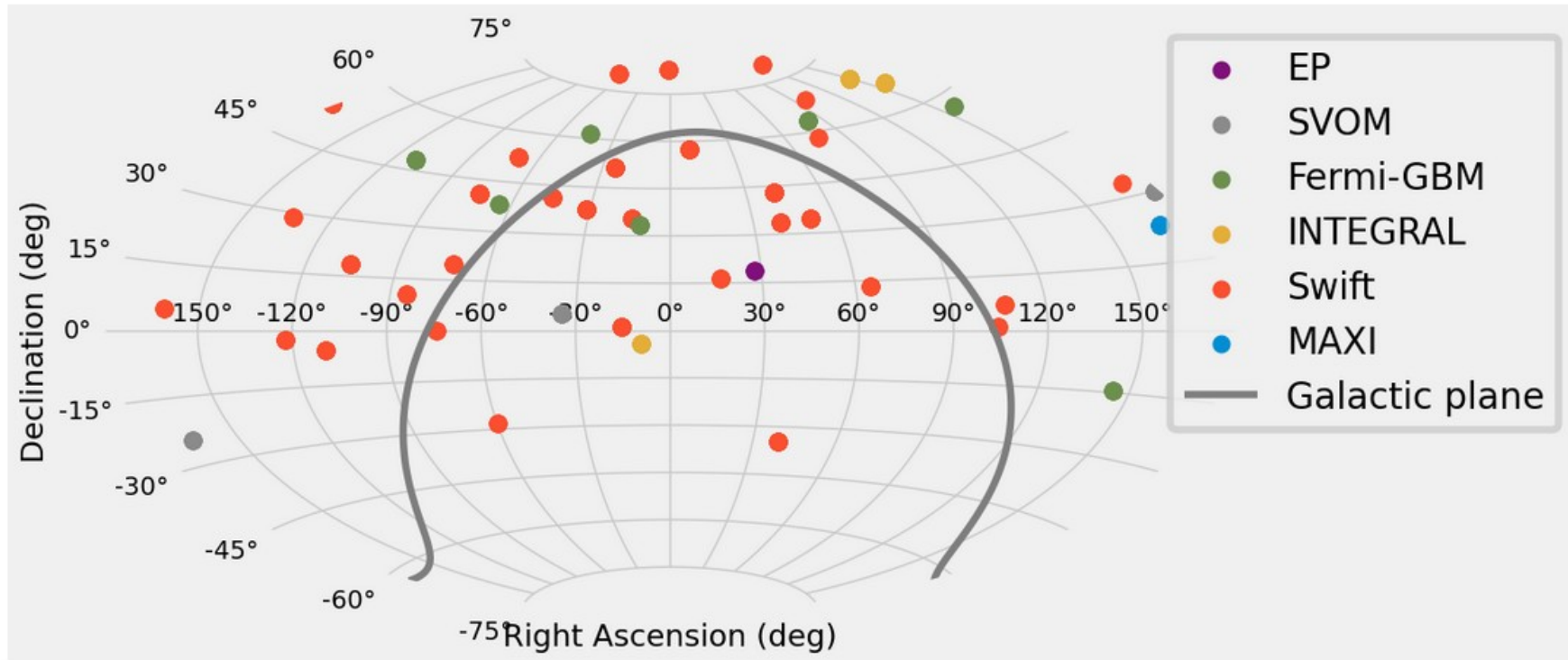
# Matching databases

## Use archival alerts from Astro-COLIBRI

```
{'alert_type': '',
 'archive': {'sb25033102_0': '2025-03-31T09:23:30'
             'sb25033102_1': '2025-03-31T09:24:47'},
 'archive_id': 'sb25033102_1',
 'assoc': '',
 'broker': '',
 'broker_attributes': {},
 'classification': '',
 'comment': 'false trigger due to nearby SCO X-1',
 'confidential_observatory': '',
 'constellation': 'Sagittarius',
 'dec': -18.527,
 'discoverer_internal_name': 'sb25033102',
 'distance': 'None',
 'distance_error': 'None',
 'dm': '',
 'energy': 'None',
 'energy_time_url': '',
 'err': 0.09133333,
 'event_display_url': '',
 'event_url': '',
 'extinction_ebv': 0.1418994516134262,
 'far': 'None',
 'follow_up': [],
 'gw_BBH': 'None',
 'gw_BNS': 'None',
 'gw_MassGap': 'None',
 'gw_NSBH': 'None',
 'gw_Noise': 'None',
 'gw_hasNS': 'None',
 'gw_hasSSM': 'None',
 'gw_pipeline': '',
 'image_urls': 'None',
 'instrument': 'ECLAIRS',
 'instrument': 'ECLAIRS',
 'ivorn': '',
 'ivorn_history': [],
 'ivorn_time': '',
 'last_modified': '2025-03-31T09:24:47',
 'latest_lc_url': '',
 'lc_url': '',
 'longterm_lc_url': '',
 'map_areas': {},
 'observatory': 'svom',
 'photometry': {},
 'pkt_ser_num': 'None',
 'ra': 289.235,
 'redshift': 'None',
 'reference': '',
 'sed_url': '',
 'signalness': 'None',
 'significance': 'None',
 'simbad_link': '',
 'slew': 0.0,
 'source_name': 'retracted',
 'sun_distance': 82.036,
 'time': '2025-03-31T02:04:18',
 'timestamp': 1743386658000.0,
 'transient_flux': 'None',
 'transient_flux_error': 'None',
 'transient_flux_units': '',
 'trigger_id': 'sb25033102',
 'type': 'burst',
 'unistellar_deeplink': '',
 'url': 'https://gc.nasa.gov/circulars/39965',
 'url_name': 'GCN #39965'}
```

# Matching databases

Add to Edna plot SVOM and EP GRBs:



# Ranking GRBs

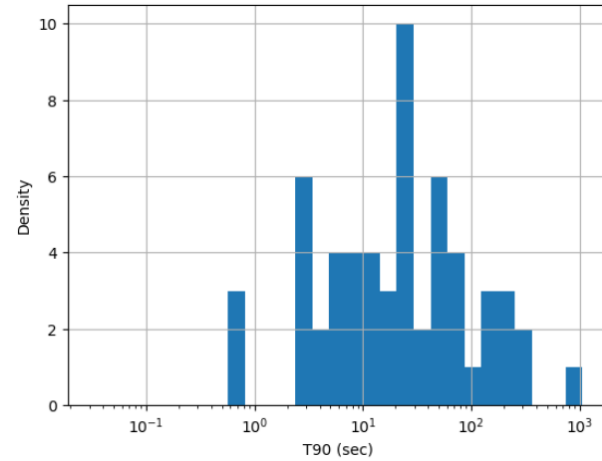
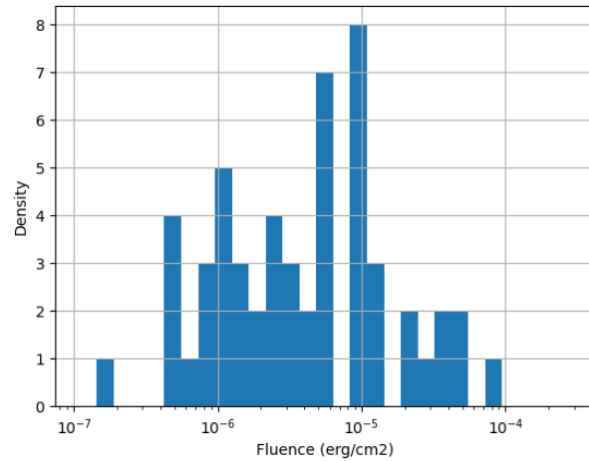
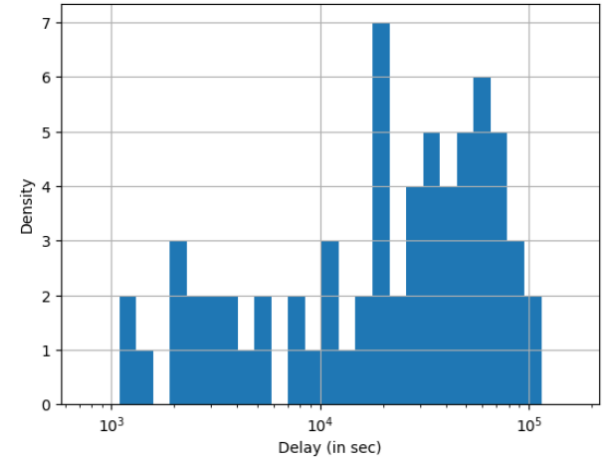
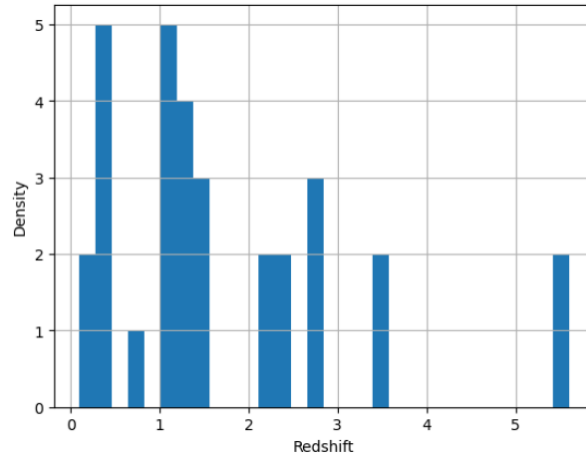
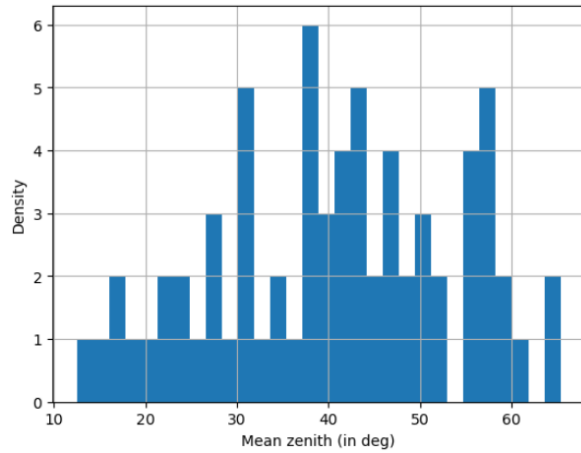
Database :

- from the beginning of LST-1 observation to the 04/04/2025
- 46 GRBs // 69 'clusters' (criteria:  $> 15\text{min}$  of delay)

Criteria:

- redshift
- delay
- mean zenith
- fluence
- T90

# Ranking GRBs



# Ranking GRBs

GRB_name	mean_zenith	zenith_evolution	delay	redshift	mwI	t90	fluence	mean_grade
230812790	27.161166	-3.633128	10375.809521	0.3600	2	3.264	2.798700e-04	7.537088
250129A	26.549170	0.000000	1247.416079	2.1510	1	262.250	5.000000e-06	7.513578
250129A	24.254797	0.399668	2380.280663	2.1510	1	262.250	5.000000e-06	7.376182
201216C	16.051574	-3.675516	77613.505778	1.1000	3	48.000	4.500000e-05	7.047484
230812790	38.568549	-2.847897	15118.476162	0.3600	2	3.264	2.798700e-04	7.023068
221009A	43.447605	-12.019097	112328.732742	0.1510	1	1068.400	7.400000e-05	6.951637
240529A	40.005712	5.963643	2081.440314	2.6950	1	160.670	2.100000e-05	6.951601
230812790	48.524016	0.000000	19385.816594	0.3600	2	3.264	2.798700e-04	6.601124
201216C	22.918674	-6.245816	166206.470549	1.1000	3	48.000	4.500000e-05	6.559638
230812790	57.336720	-3.395836	21419.878027	0.3600	2	3.264	2.798700e-04	6.267744