

Workshop on Robotic Autonomous Observatories 2009

Making preliminary GRBs real-time astronomical reports

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Introduction

ToO Operations:

- GRB alert
- GRB Analysis and Evaluation of GRB
- ToO requests to relevant telescopes
- Follow-up observations.
- GCNs publications

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Introduction

Objective: “Optimise ToO”, Reducing time of analysis and evaluation.

Supported by all BOOTES projects

Previous Work

“Rapid Response Analysis of GRB Optical Afterglows”

Jensen B.L

Phd Thesis

- Copenhagen Rapid Alert: CRA
- Copenhagen Rapid Response: CRR

Specification

- *Input (GCN server socket ---> rts2)*
 - Type of alert (2HETE, 2INTEGRAL, 3SWIFT)
 - Grb ra, dec
 - Grb timespan
 - Error
 - Grb id

Specification

- *Output*

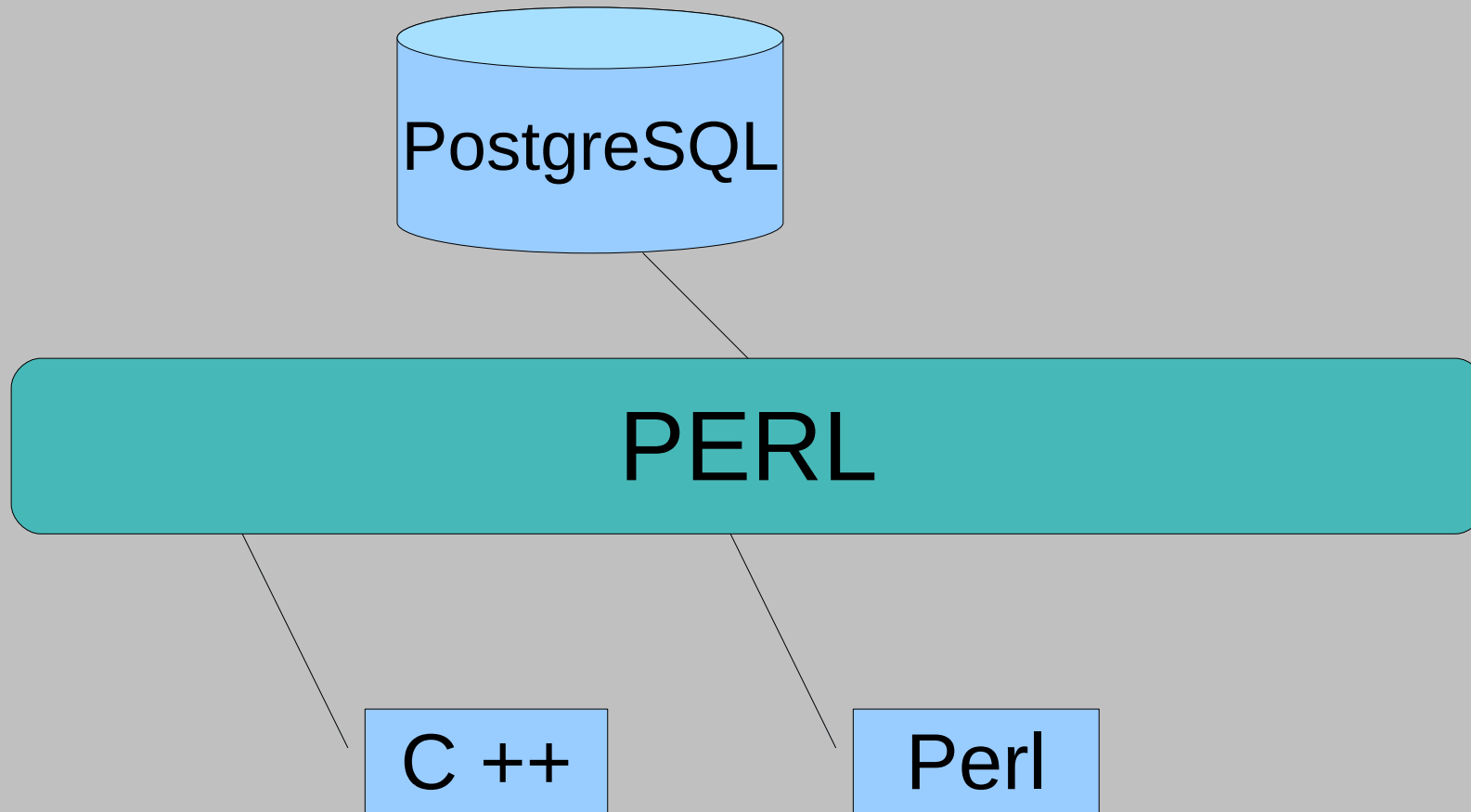
- *sms*

- Grb title (type)
- Ra, dec
- UT grb time
- Grb date

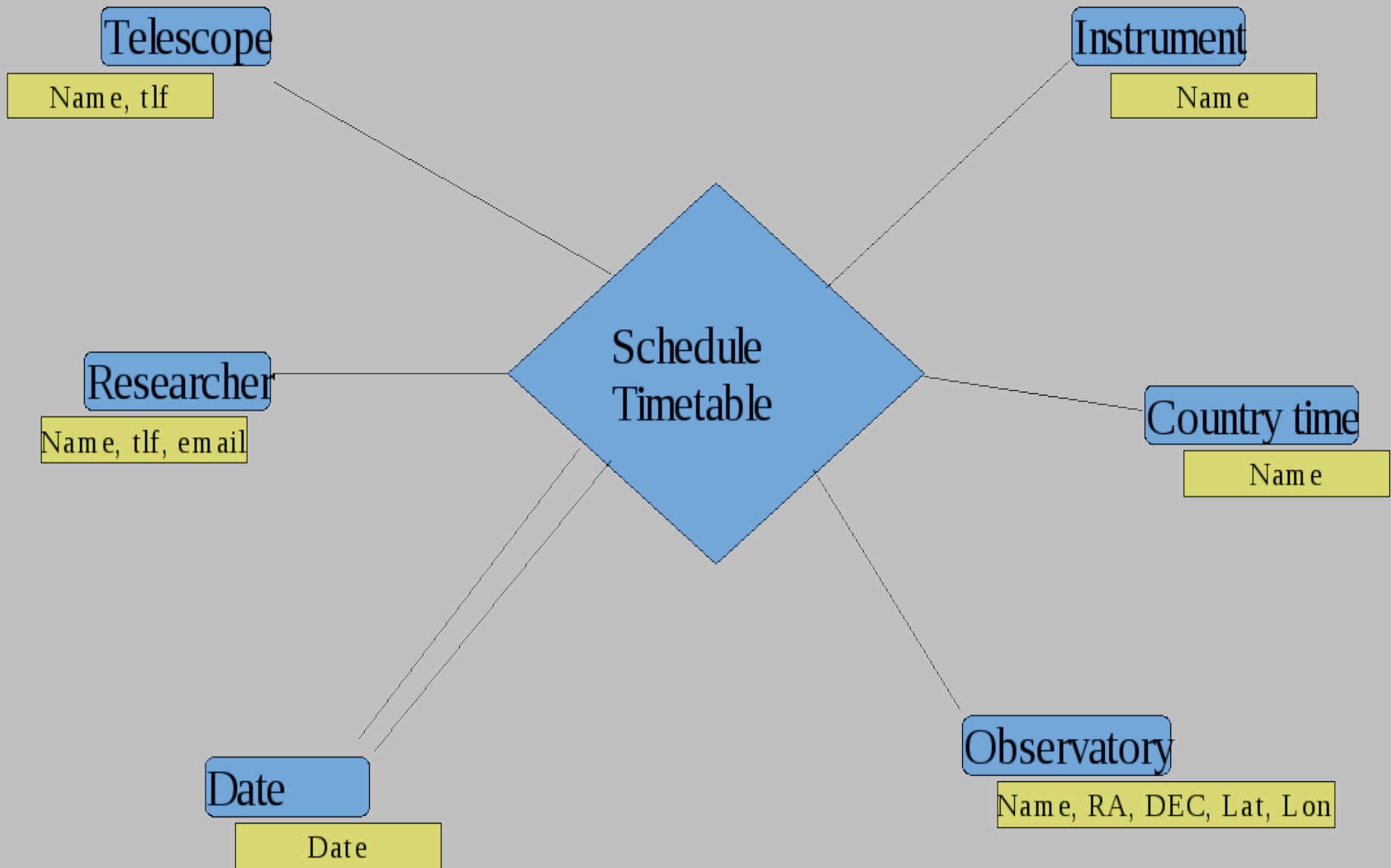
- *Web , email:*

- title
- timespan
- Time elapsed grb-report
- Galactic coord
- dust maps
- Moon, sun ra, dec, distance to grb
- Obs, tel, inst, etc.
- Elevation graphs, visibility plots
- Dss fits/jpeg images (red, ir, blue)

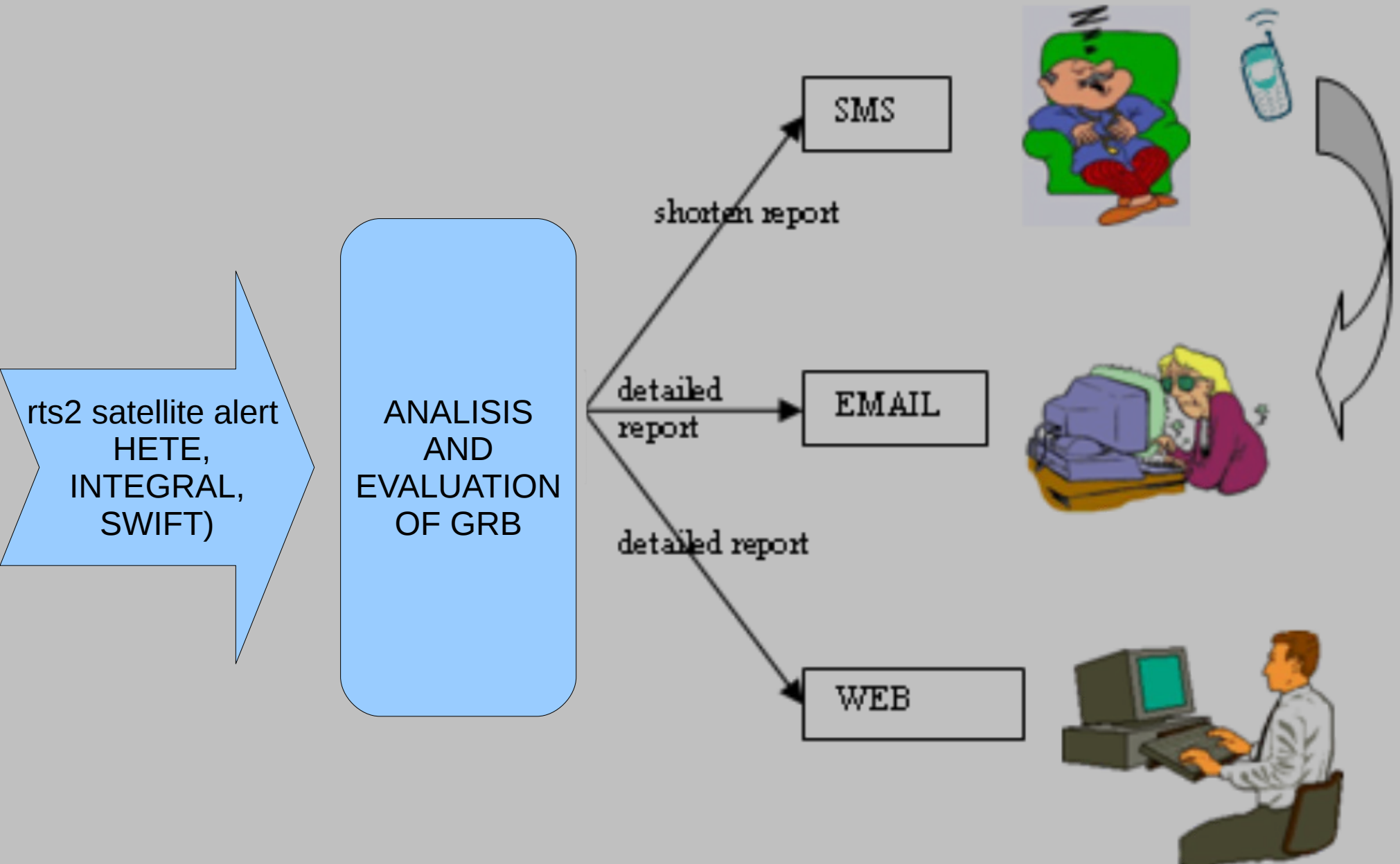
Design and Implementation



Design and Implementation



Working



Examples (15/05/2009 352108)

TITLE: SWIFT_BAT_GRB_POSITION
TRIGGER NUM: 352108
GRB_RA: 10h 56m 41.0399998800s
GRB_DEC: +14d 27' 21.6000000000"
GRB_ERROR: 0.05 [arcmin radius, statistical only]
GRB_TIME: 04:45:09 UT
GRB_DATE: 2009/05/15
GAL_COORDS: 232.49312,60.44090 [deg] lat,lon of the burst
SUN_DIST: 105.325721
MOON_DIST: 140.806949
T_INF: 2009/5/15 4:45:23 (UT) (creacion del informe)
GRB_TIME-T_INF: 0/0/0 0:0:14
MOON_PHASE: 0.70 (en el momento que se produjo el GRB)
DUST MAP: E(B-V)=0.02092
Au = 0.10
Ab = 0.09
Av = 0.07
Ar = 0.05
Ai = 0.03
Aj = 0.02
Ah = 0.01
Ak = 0.01

OBSERVATORIO	TELESCOPIO	INSTRUMENTO	T_OBSERV	INVESTIGADOR	TLF
CALAR_ALTO	3_5	OMEGA2000	SPAIN	Villar	950-63_25_82
CALAR_ALTO	2_2	FOCES	NOSPAIN	GEHREN	950-63_25_71
LA_PALMA	TNG	—	—	—	922-40_55_35

Examples (15/05/2009 352108)

OBSERVATORIO UT AZIMUTH ALTURA(grb) AZIMUTH ALTURA(sol)
(LA FECHA ES EN LA QUE SE PRODUJO EL GRB)

LA_PALMA	15:00:00	260.17	12.42	75.37	62.59
LA_PALMA	16:00:00	266.93	25.52	85.86	49.59
LA_PALMA	17:00:00	274.28	38.70	93.24	36.41
LA_PALMA	18:00:00	283.63	51.72	99.66	23.32
LA_PALMA	19:00:00	298.47	64.05	105.98	10.60
LA_PALMA	20:00:00	329.79	73.74	112.92	-1.83
LA_PALMA	21:00:00	24.79	74.42	121.01	-13.58
LA_PALMA	22:00:00	59.17	65.34	130.95	-24.26
LA_PALMA	23:00:00	75.09	53.15	143.41	-33.14
LA_PALMA	0:00:00	84.26	41.03	159.20	-39.75
LA_PALMA	1:00:00	91.84	27.86	177.60	-42.38
LA_PALMA	2:00:00	98.63	14.74	196.53	-40.74
LA_PALMA	3:00:00	105.50	1.85	213.17	-35.15

Examples (15/05/2009 352108)

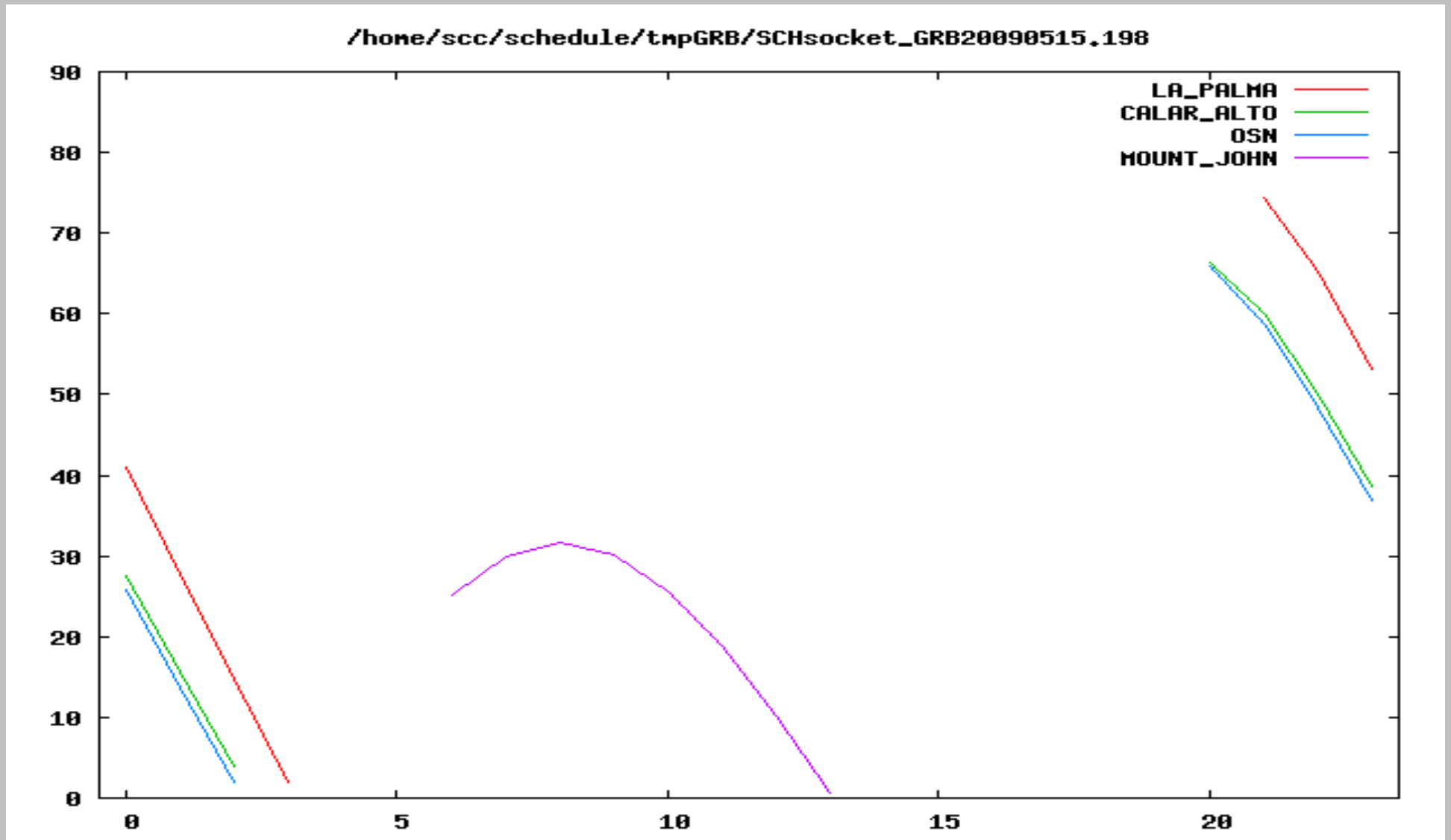
CALAR_ALTO	13:00:00	253.51	2.25	36.54	68.25
CALAR_ALTO	14:00:00	262.28	13.95	61.63	59.11
CALAR_ALTO	15:00:00	271.17	25.90	76.45	48.04
CALAR_ALTO	16:00:00	281.09	37.79	87.14	36.20
CALAR_ALTO	17:00:00	293.63	49.22	96.09	24.24
CALAR_ALTO	18:00:00	311.79	59.33	104.52	12.48
CALAR_ALTO	19:00:00	340.34	66.12	113.10	1.26
CALAR_ALTO	20:00:00	17.04	66.41	122.64	-9.32
CALAR_ALTO	21:00:00	46.49	59.99	133.63	-18.73
CALAR_ALTO	22:00:00	65.26	50.04	146.60	-26.42
CALAR_ALTO	23:00:00	78.08	38.67	161.57	-31.60
CALAR_ALTO	0:00:00	87.53	27.58	178.35	-33.94
CALAR_ALTO	1:00:00	96.49	15.62	195.14	-32.53
CALAR_ALTO	2:00:00	105.24	3.87	210.70	-27.84

Examples (15/05/2009 352108)

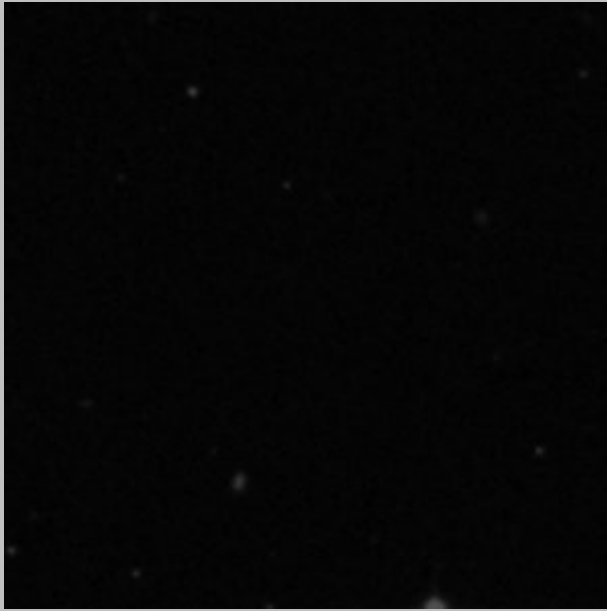
OSN	13:00:00	254.87	3.99	41.69	67.20
OSN	14:00:00	263.58	15.77	64.62	57.53
OSN	15:00:00	272.52	27.75	78.45	46.27
OSN	16:00:00	282.67	39.64	88.70	34.36
OSN	17:00:00	295.78	50.97	97.46	22.39
OSN	18:00:00	315.20	60.78	105.85	10.65
OSN	19:00:00	345.70	66.82	114.50	-0.49
OSN	20:00:00	22.50	65.93	124.20	-10.95
OSN	21:00:00	50.16	58.72	135.45	-20.16
OSN	22:00:00	67.68	48.41	148.75	-27.54
OSN	23:00:00	79.88	36.89	164.04	-32.30
OSN	0:00:00	89.04	25.74	181.00	-34.11
OSN	1:00:00	97.88	13.77	197.69	-32.16
OSN	2:00:00	106.62	2.05	212.96	-27.00

MOUNT_JOHN	4:00:00	238.93	9.65	130.84	11.45
MOUNT_JOHN	5:00:00	226.82	18.28	119.70	2.70
MOUNT_JOHN	6:00:00	213.03	25.23	109.41	-7.14
MOUNT_JOHN	7:00:00	197.43	29.85	99.53	-17.61
MOUNT_JOHN	8:00:00	180.60	31.56	89.53	-28.29
MOUNT_JOHN	9:00:00	163.71	30.07	78.30	-39.04
MOUNT_JOHN	10:00:00	148.00	25.64	64.47	-49.30
MOUNT_JOHN	11:00:00	134.08	18.83	45.51	-58.19
MOUNT_JOHN	12:00:00	121.87	10.30	18.65	-63.95
MOUNT_JOHN	13:00:00	110.93	0.61	345.66	-64.38

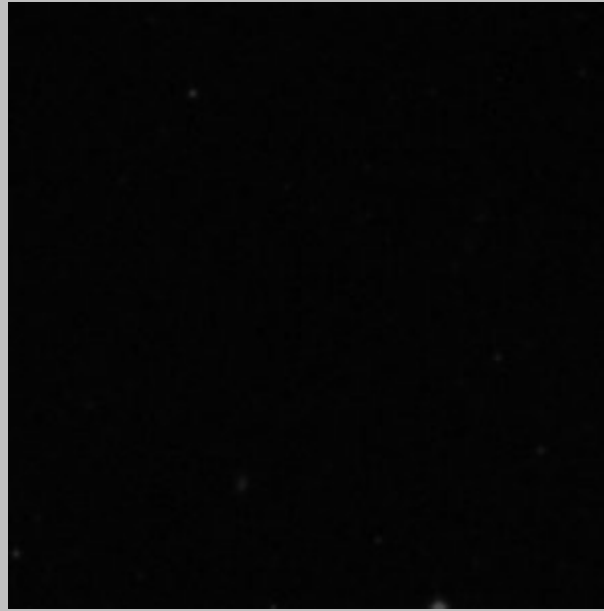
Examples (15/05/2009 352108)



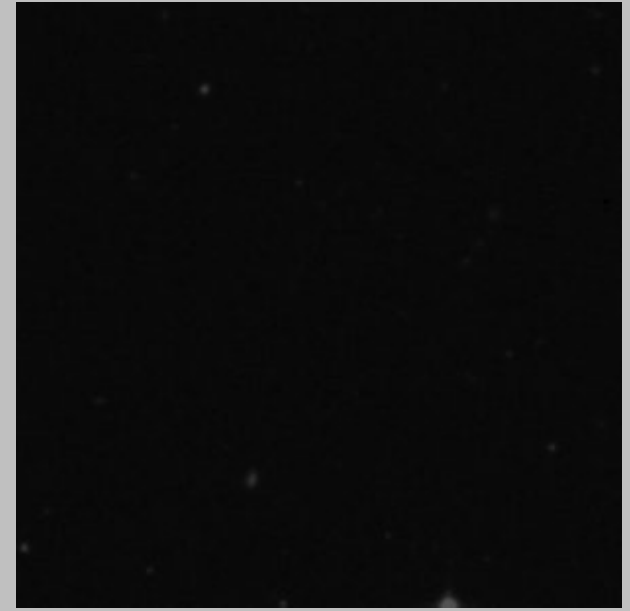
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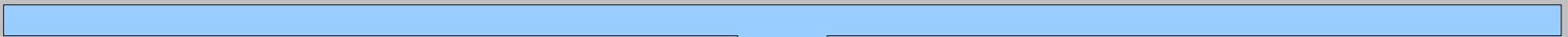
BLUE



IR



RED



JPEG & FITS

SMS : SB105641s+142721_04:45,15/05

Conclusions

- Successful ToO system.
- Reduce time required for evaluating ToO feasibility.
- Rapid GRB report response, minimum delay from alert to ToO-activation.
- Easy access to all relevant information
- Reject unsuitable alerts.