Current Status of C-GFT

(Chinese Ground Follow-up Telescope)

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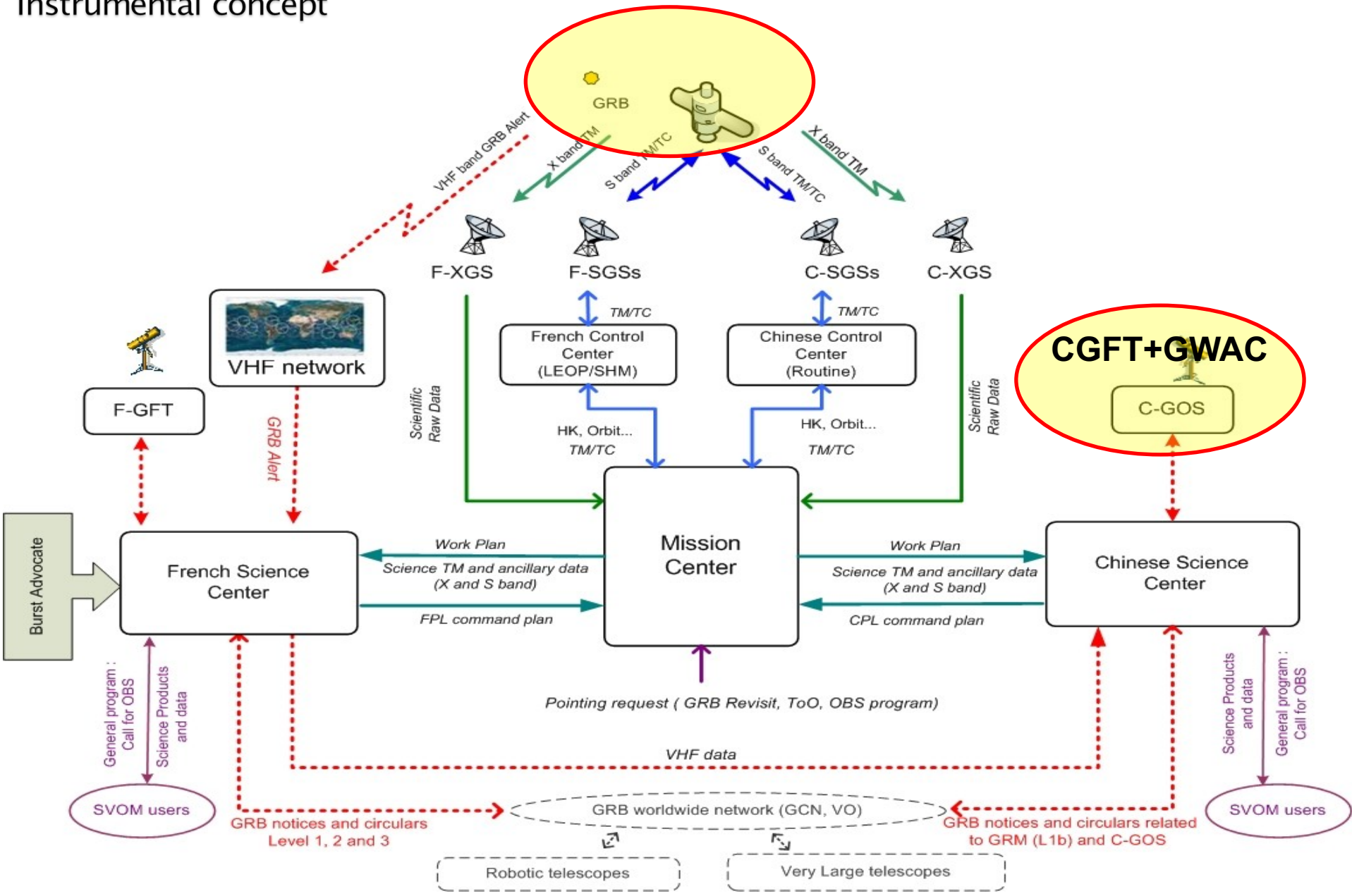
On behalf of SVOM@NAOC

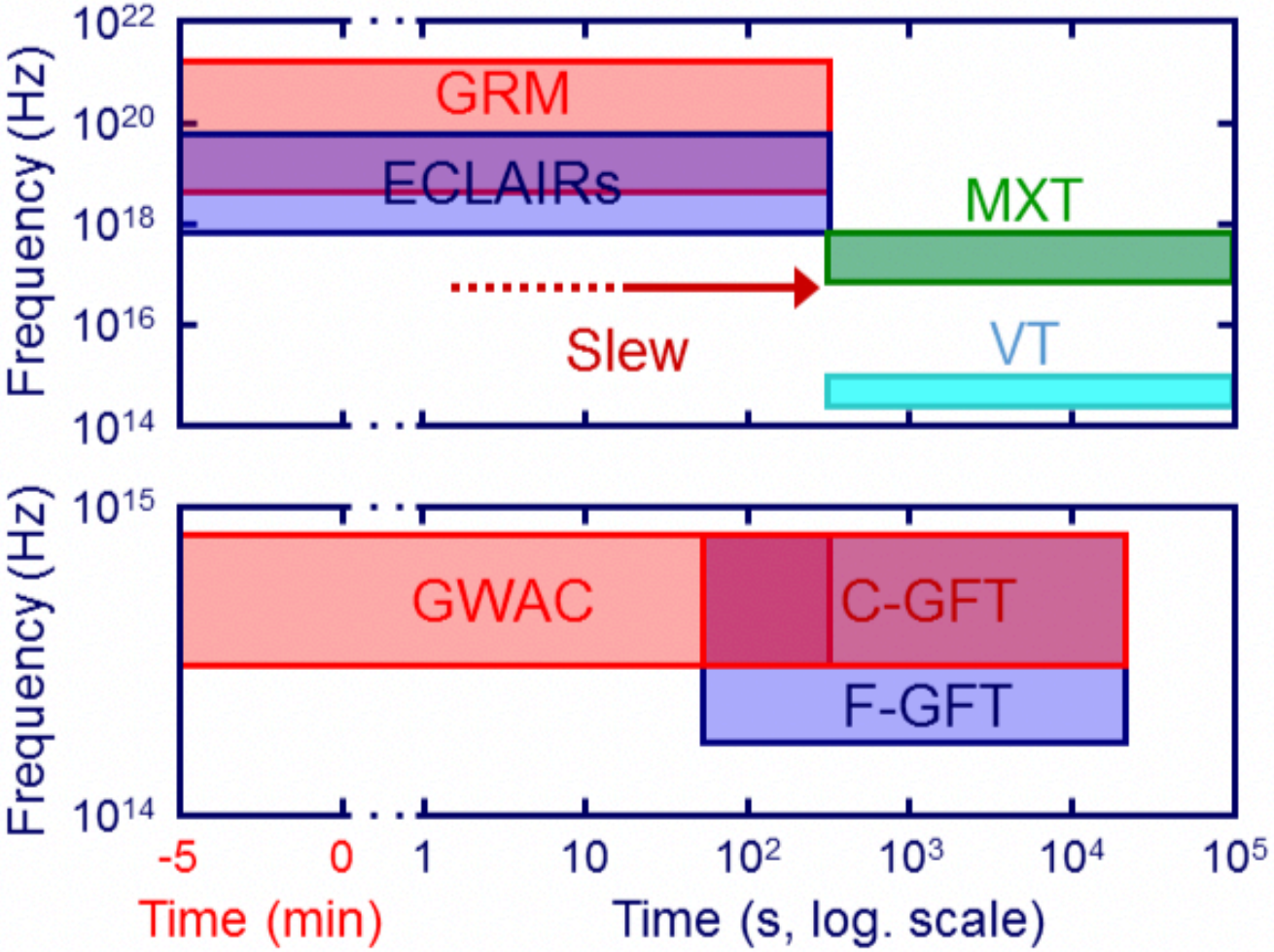
2018.05.17 @Les Houches

Outlines

- Instrumental concept
- Scientific products of C-GFT
- Progress in new C-GFT
- Expected scientific performance
- Prepare for O3

Instrumental concept





Observation time sequence

In 5 mins to report localization

Burst detected time=0, see white paper 2016.

◆Instrumental concept

- Main characteristics of CGFT (From requirements)

Parameter	Value
Energy range	400-9500 nm
Field of View	21' x 21'
Aperture(diameter)	1 m
Channels	3 channels of g,r,i
Detector	3 CCD camera mounted
Sensitivity (AB mag, 5 sigma)	Mag(r) = 19 @100s (new Moon)
Localization accuracy	0.5 arcsec
Observation rate	>20% burst triggered by ECLAIRs

◆ Scientific products of CGFT

1. online products:

GRB (OT) position, magnitude, color index (redshift indicator), Finding Chart;

.OR. Upperlimit in case of no GRB afterglow detection

Note: There is not only one candidate of GRB/OT provided by CGFT since larger error box of ECLAIRs. Weight and position will be provided together.

2. Offline products:

Refined light curve, temporal slope, SED, photo-Z

Astrometric calibrated images of three channels in time series.

◆Instrumental concept

- Modification of CGFT observation site

  The old one is occupied by quantum communication project.
  Requirements is same as before.

Old: @Xinglong observatory

- ~130 Km to Beijing

New: @Jilin observatory

- ~920 Km to Beijing

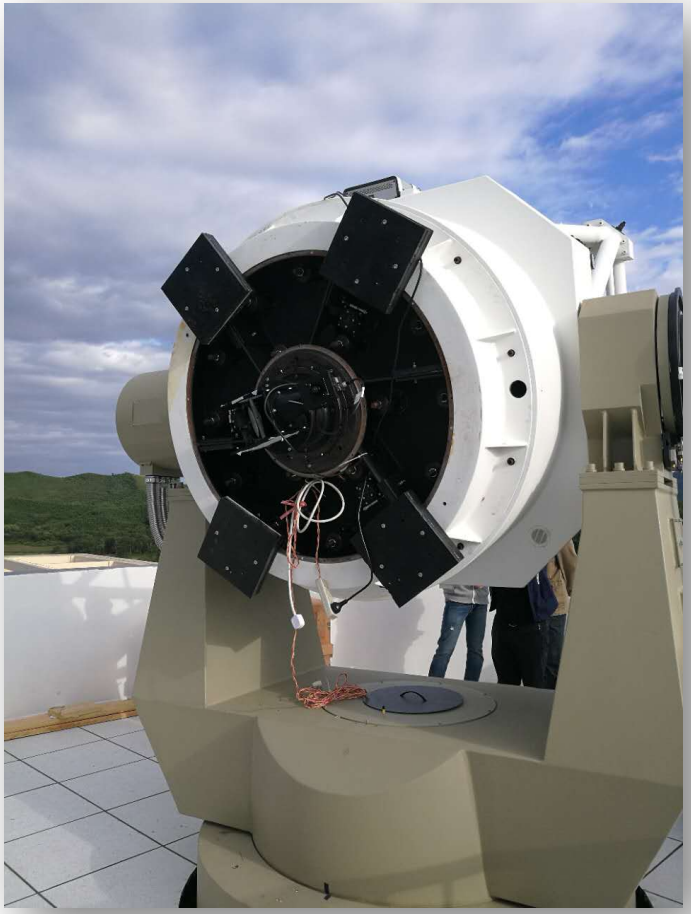
Sites @map:

Xinglong

Longitude: 117d 34 m 30s
Latitude. : 40 d 23 m 36s
Altitude. : 960 m

Jilin

Longitude: 126d 19m 49.66s
Latitude. : 43d 49m 27.76s
Altitude. : 320 m



Cassegrain Focus

Primary Focus

Aperture = 1.2 m

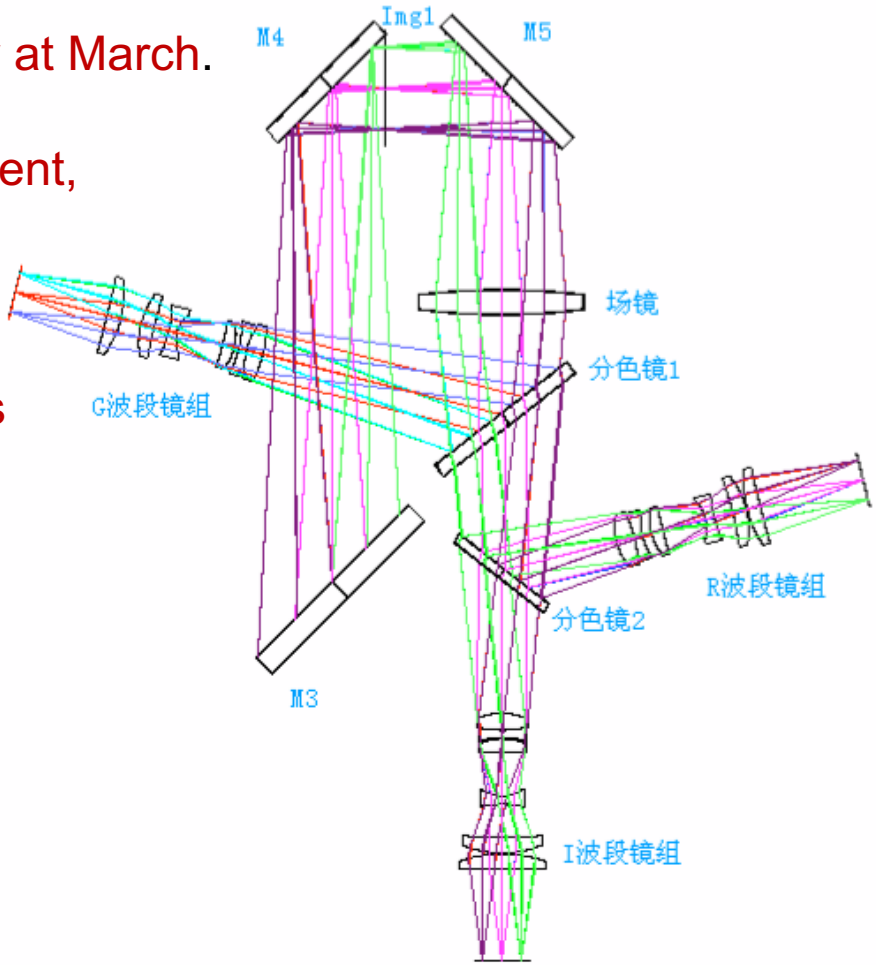
◆Instrumental concept

- Compare with Xinglong telescope

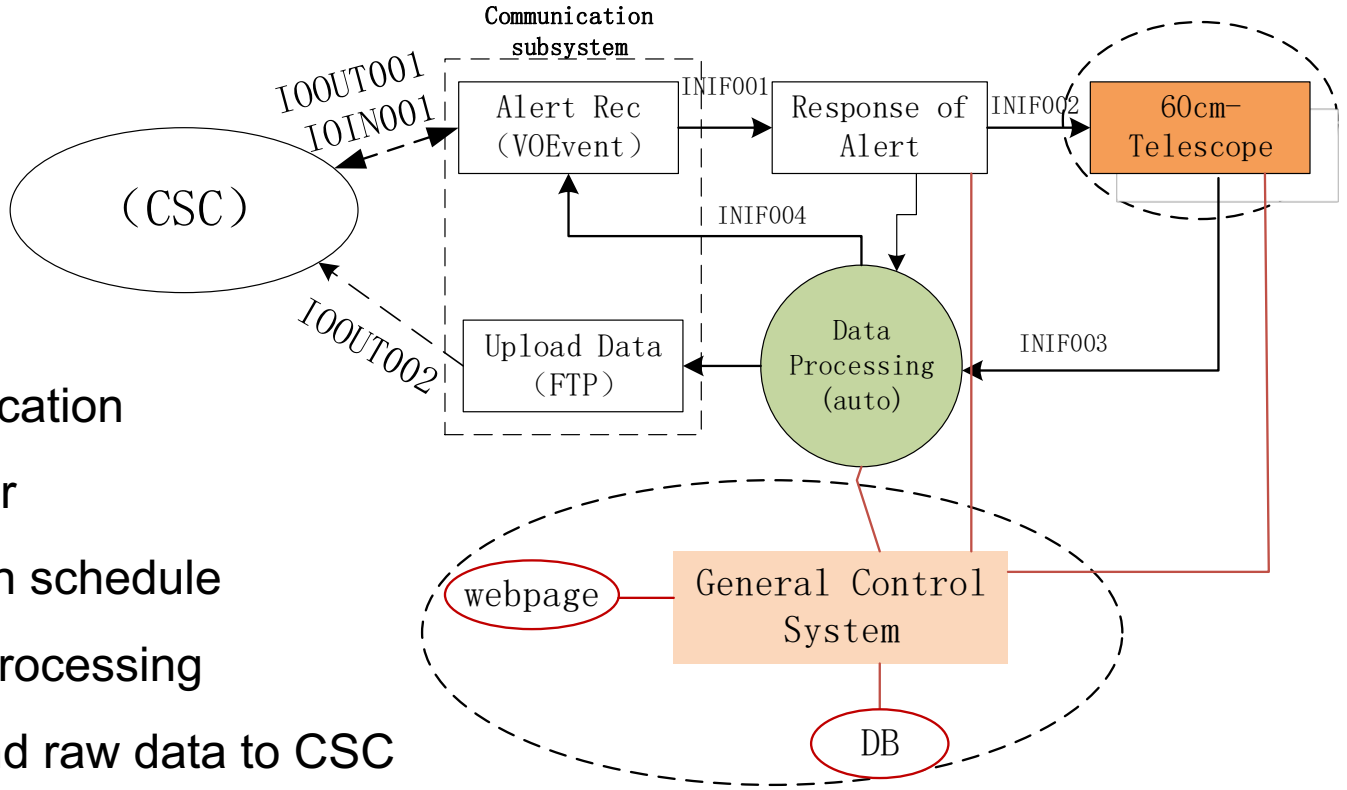
		Xinglong	Jilin
Tel	aperture	1.0 m	1.2 m
	3-channels (Cassegrain focus)	g,r,I 2kx2kCCD FOV=21'X21'	g,r,I 2kx2k CCD 21'X21'
	Primary Focus	None	4kX4k CCD FOV=1.5degX1.5deg
Site	seeing	Median ~1.5"	~same ?
	Observation nights	60%	~same ?
Available Observation time		Share with other project	Only SVOM

◆ Progress in new CGFT

- ✓ The 3 channels : under development, expected to be mounted at the end of this year.
- ✓ Design of the 3 channels: finished review at March.
- ✓ Robotic control system: under development, completed before Oct.
- ✓ Primary focus Camera(4kx4k): start to adjustment observation at the end of this month.



✓ C-GFT prototype data processing system ： reviewed last July.

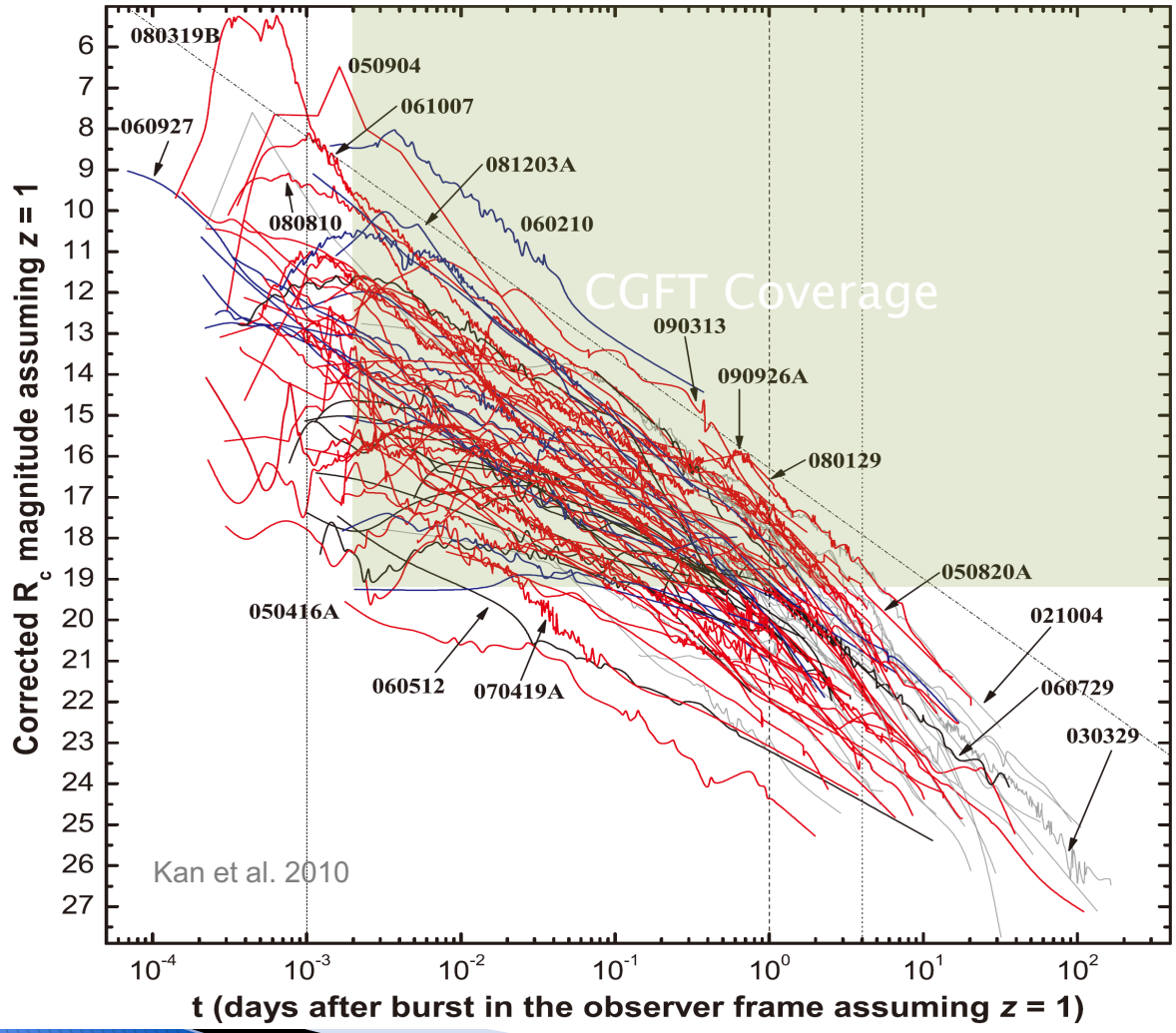


- Trigger communication
- Response trigger
- Make observation schedule
- Automatic data processing
- Return results and raw data to CSC

Test on communication between 60cm telescope@Xinglong and CSC@Beijing.

◆ Expected scientific performances

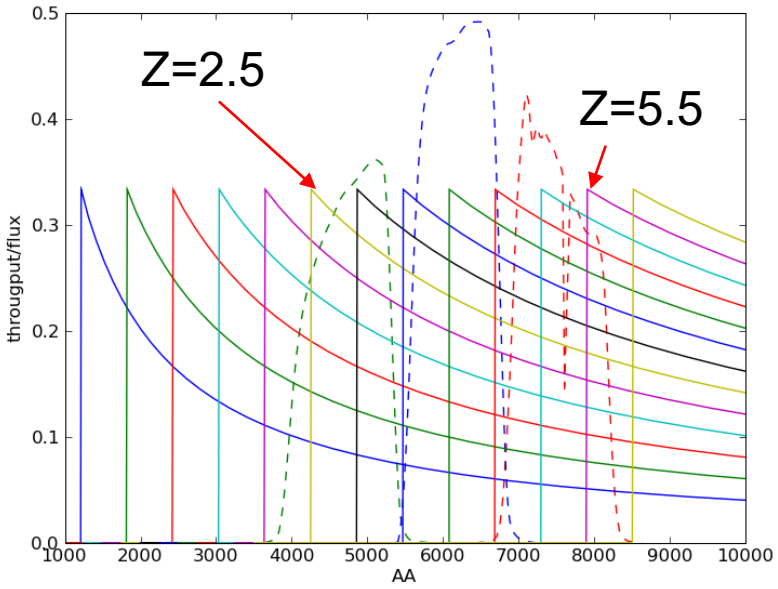
- C-GFT sensitivity in GRB afterglow obs.



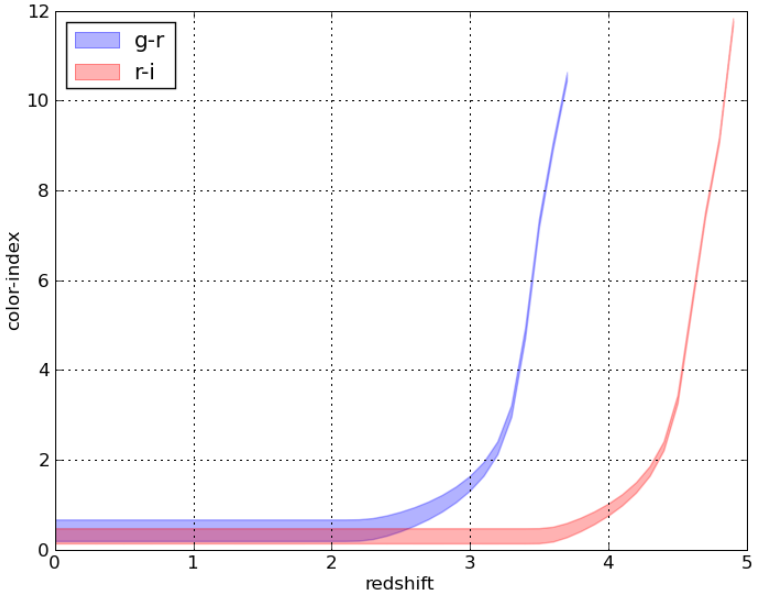
◆ Expected scientific performances

- Redshift indicator measurement on CGFT

  (simple estimation: details, refer to Kruhler et al. A&A, 2012)



GRB spectrum with index=-1



photoZ on GRB of index in (-1.4—0.2)

Prepare for O3: what can C-GFT do at O3?

In-press at Living Reviews, now posted at arXiv:1304.0670v5 :

Epoch			2015–2016	2016–2017	2018–2019	2020+	2024+
Planned run duration			4 months	9 months	12 months	(per year)	(per year)
Expected burst range/Mpc		LIGO	40–60	60–75	75–90	105	105
		Virgo	—	20–40	40–50	40–70	80
		KAGRA	—	—	—	—	100
Expected BNS range/Mpc		LIGO	40–80	80–120	120–170	190	190
		Virgo	—	20–65	65–85	65–115	125
		KAGRA	—	—	—	—	140
Achieved BNS range/Mpc		LIGO	60–80	60–100	—	—	—
		Virgo	—	25–30	—	—	—
		KAGRA	—	—	—	—	—
Estimated BNS detections			0.05–1	0.2–4.5	1–50	4–80	11–180
Actual BNS detections			0	1	—	—	—
90% CR	% within	5 deg^2	<1	1–5	1–4	3–7	23–30
		20 deg^2	<1	7–14	12–21	14–22	65–73
	median/deg^2		460–530	230–320	120–180	110–180	9–12
Searched area	% within	5 deg^2	4–6	15–21	20–26	23–29	62–67
		20 deg^2	14–17	33–41	42–50	44–52	87–90

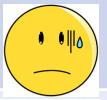
Acceptable : ~80 fields, coverage 90% CR, (180 sqDeg)

See Nicolas's talk

◆ Prepare for O3: what can C-GFT do at O3?

- Compare with Swope (the first found optical counterpart of GW170817)

  ** Only consider the primary focus camera of C-GFT.*

	Swope	C-GFT	
GW-localization	31deg^2@90% (GW170817)	180deg^2@90% (median)	
FOV	27.9'x27.8'	1.5degx1.5deg	
Aperture	1 m	1.2m	
Fields to cover localization	~143	~80	

* C-GFT has advantages in GW optical counterpart search, but there are challenges to data processing.

Table S1: Observation Schedule (Coulter D.A. et al. 2017)

Galaxy	R.A.	Decl.	Probability	Observation Number		
				Swope	LDSS-3	FourStar
NGC 4830	12:57:27.9	-19:41:28	0.086207	1	2	1
NGC 4970	13:07:33.7	-24:00:31	0.083333	11	3	9
NGC 4763	12:53:27.2	-17:00:18	0.077519	13	4	2
IC 3799	12:48:59.7	-14:23:56	0.073529	5	5	3
PGC 044234	12:57:00.5	-17:19:13	0.044248	2	6	4
NGC 4756	12:52:52.6	-15:24:48	0.037037	4	7	5
PGC 043424	12:50:04.7	-14:44:00	0.034014	5	8	6
ESO 575-G029	12:55:59.7	-19:16:07	0.028818	1	9	
ESO 508-G010	13:07:37.8	-23:34:43	0.027855	11	10	
PGC 043664	12:52:25.6	-15:31:02	0.026316	4	1	7
ESO 508-G019	13:09:51.7	-24:14:22	0.025773	10	11	
NGC 4993	**13:09:47.7**	**-23:23:01**	**0.021463**	**9**	**12**	**11**
IC 4197	13:08:04.3	-23:47:49	0.021368	11		
ESO 508-G024	13:10:45.9	-23:51:56	0.020243	12		

CGFT may find this early with its wide FOV.

◆ Prepare for O3: what is needed to do for C-GFT in O3?

- ✓ Make optimized observation strategy: Pointing priority.
- ✓ Search candidates from large FOV fields: No reference.
- ✓ Robotic observation and automatic data processing: Fast & feasible.
- ✓ New telescope & new observation site: need time to adjust.

  Unexpected problems?

We have collaboration team: GRANDMA

For details, please see Damien's presentation!

Expected to be ready for everything before the end of this year.

Thank you for your attention