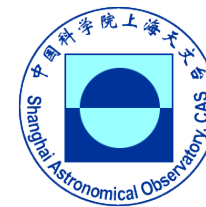


On the role of Tianma radio telescope for improving celestial reference frames

Fengchun Shu, Jinqing Wang,
Wu Jiang, Guangli Wang, Zhiqiang Shen

Shanghai Astronomical Observatory

The 22nd EVGA Meeting, Sao Miguel, May 18, 2015



Tianma Radio Telescope

- ❑ A shaped Cassegrain antenna comprised of a 65-meter diameter main reflector
- ❑ Active surface control system
- ❑ The whole supporting track employed seamless welding technique
- ❑ Frequency bands:
 - L(1.6GHz)、C(5GHz)、Ku(15GHz)、K(22GHz)、Q(43GHz)
 - S/X (2.2/8.4GHz)
 - X/Ka
- ❑ DIBAS, CDAS, DBBC2
- ❑ Total weight: 2640 T



Dual band receivers

S/X receiver

2.2-2.4, 8.2-9 GHz

December 2012 installed



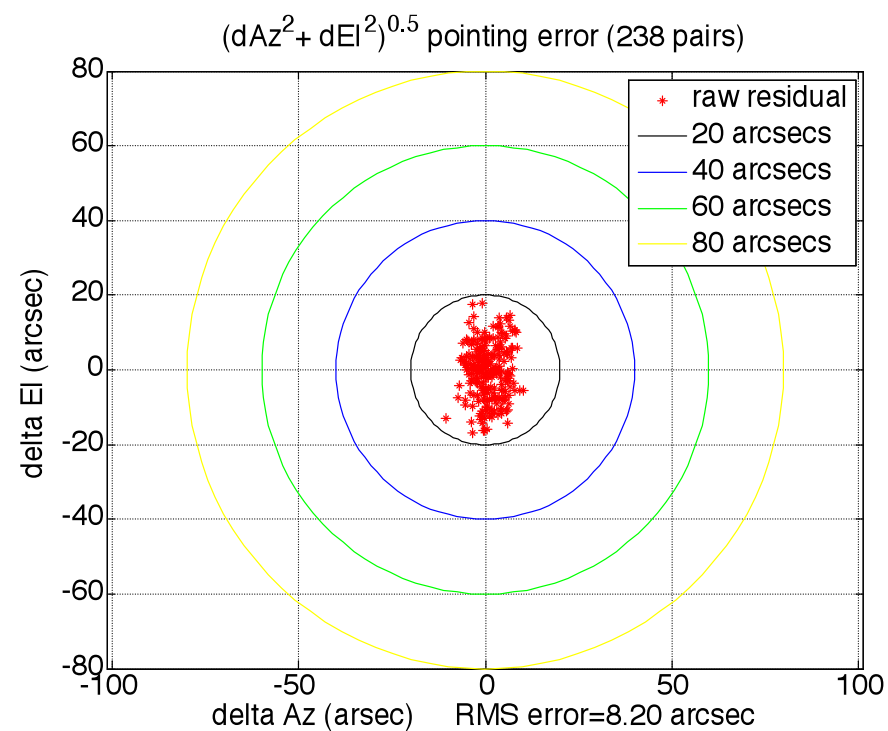
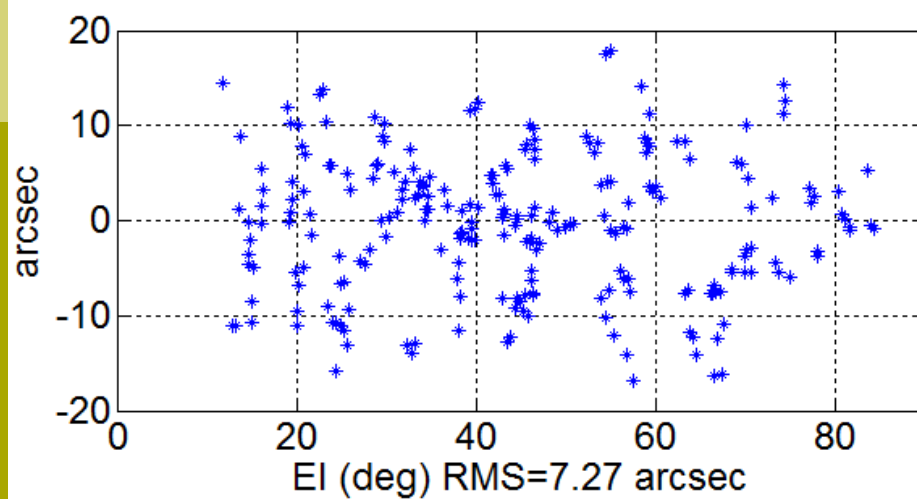
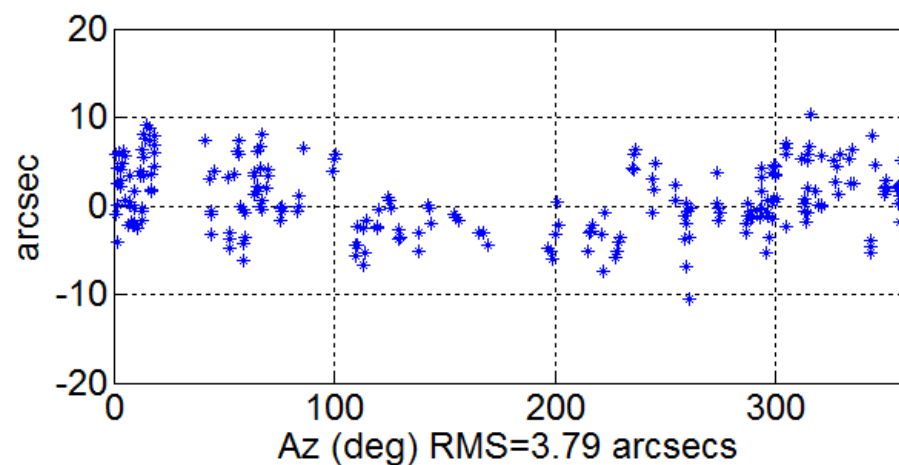
X/Ka receiver

8-9, 30-34 GHz

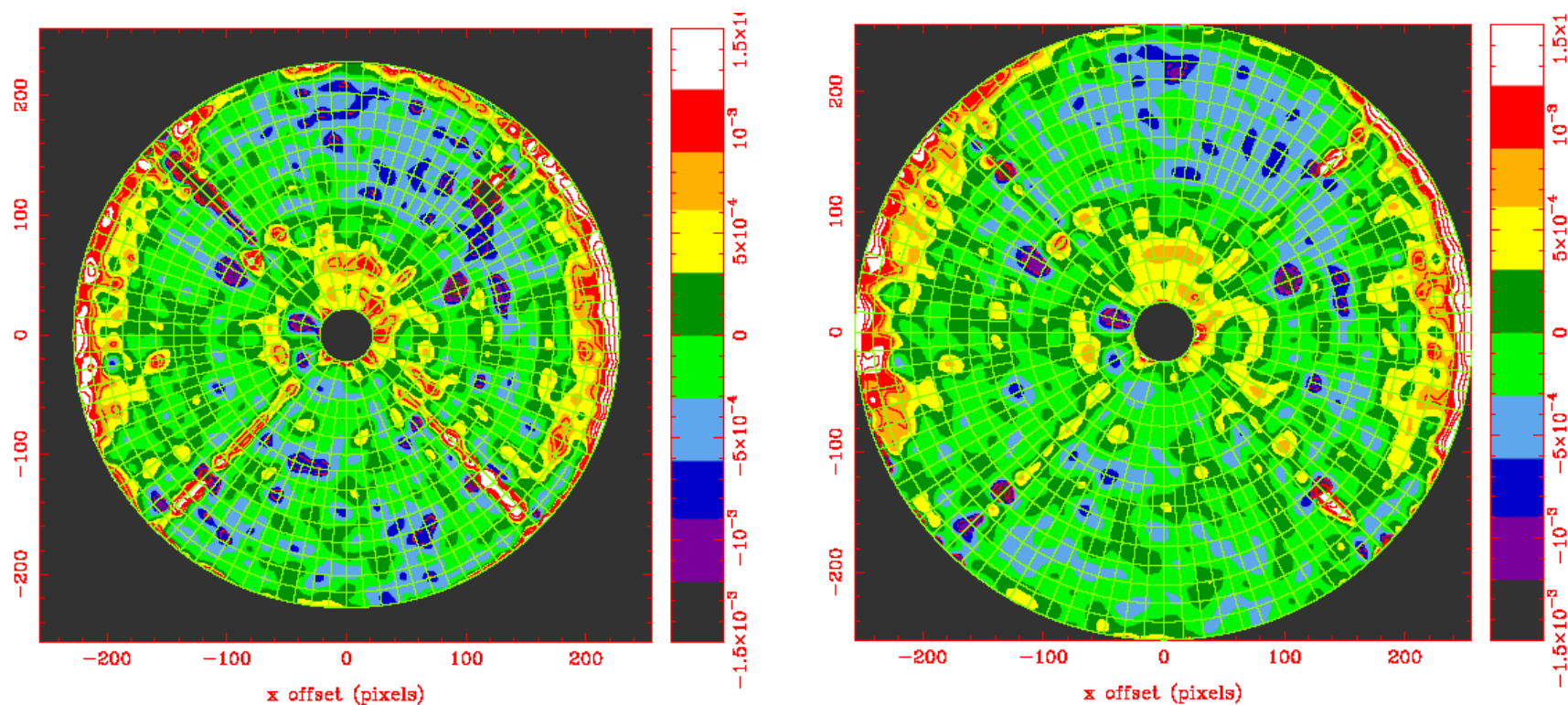
March 2015 installed



Antenna pointing errors

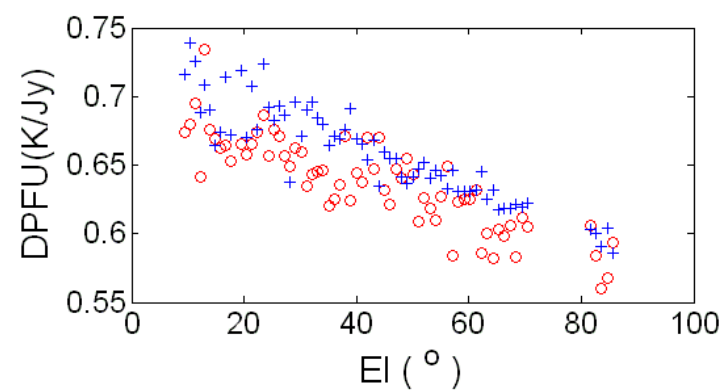
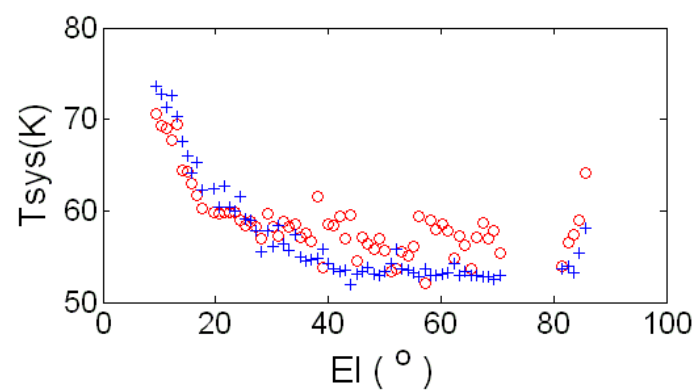
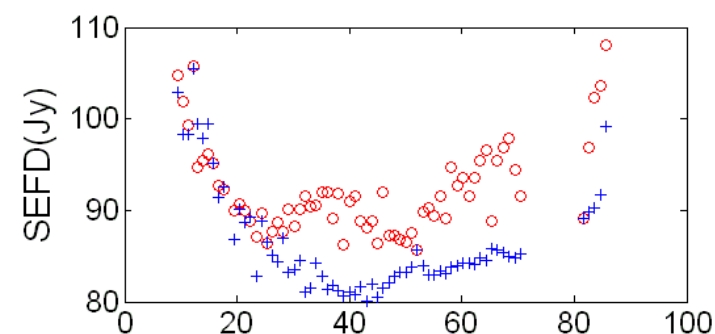
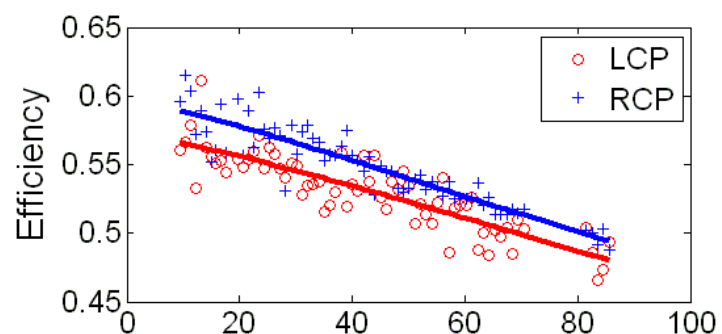


Antenna holography measurement

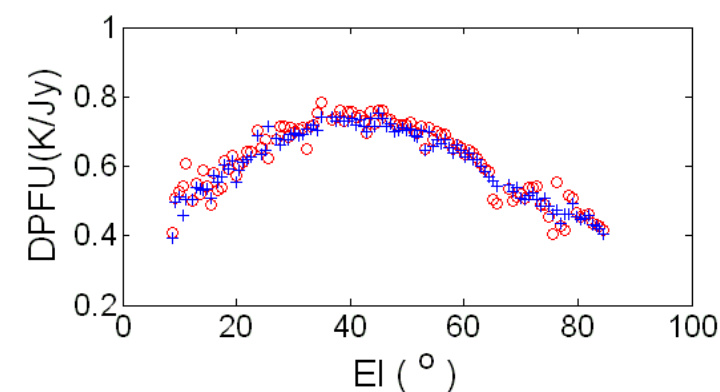
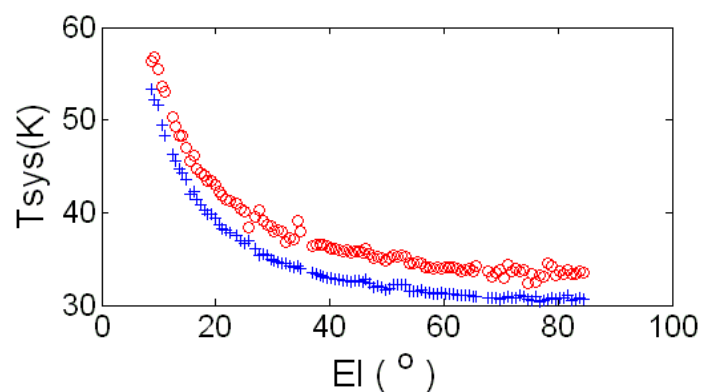
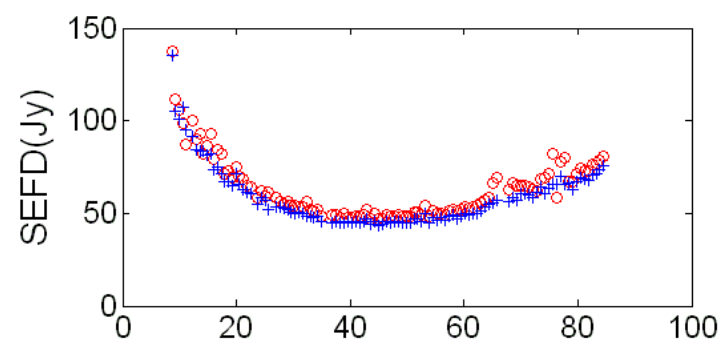
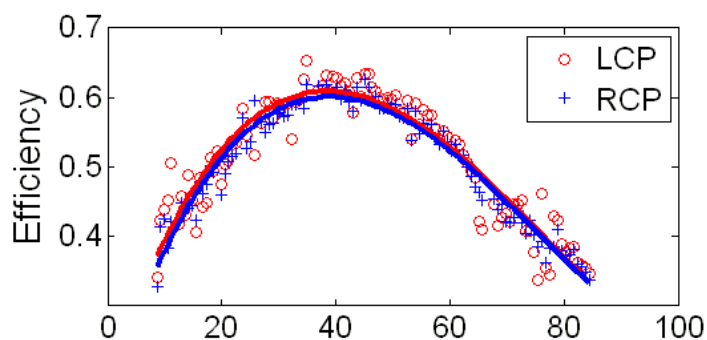


aperture surface RMS error: 0.56mm

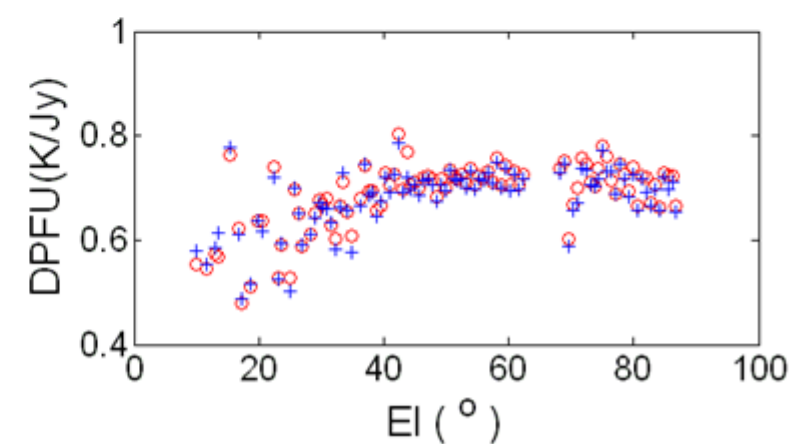
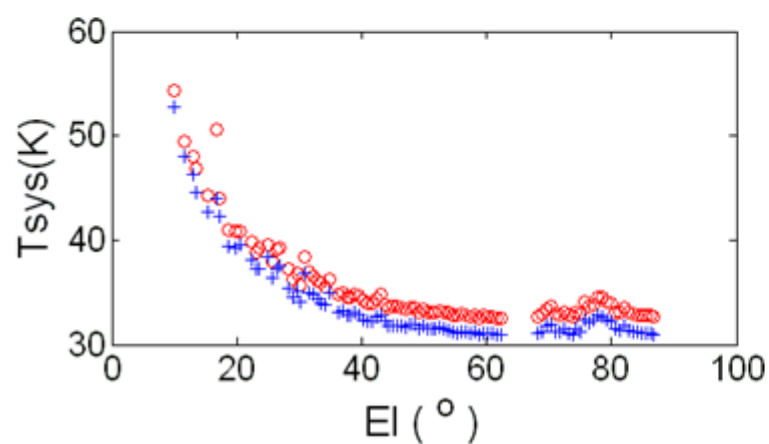
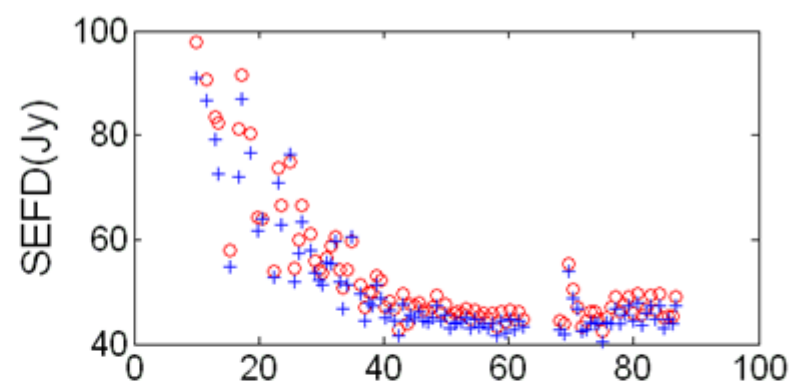
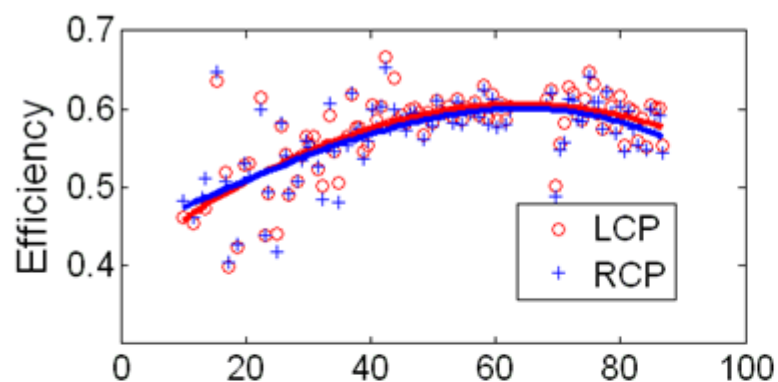
S-band 2.265GHz (Sub-reflector model disabled)

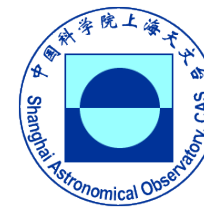


X-band 8.4 GHz (Sub-reflector model disabled)



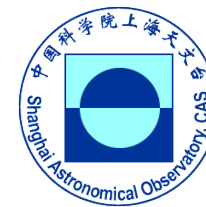
X-band 8.75 GHz (Sub-reflector model enabled)



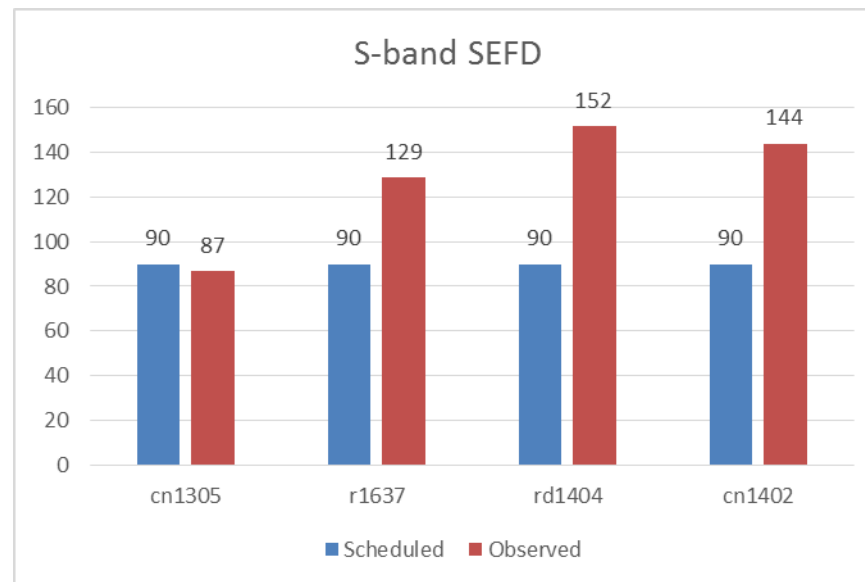
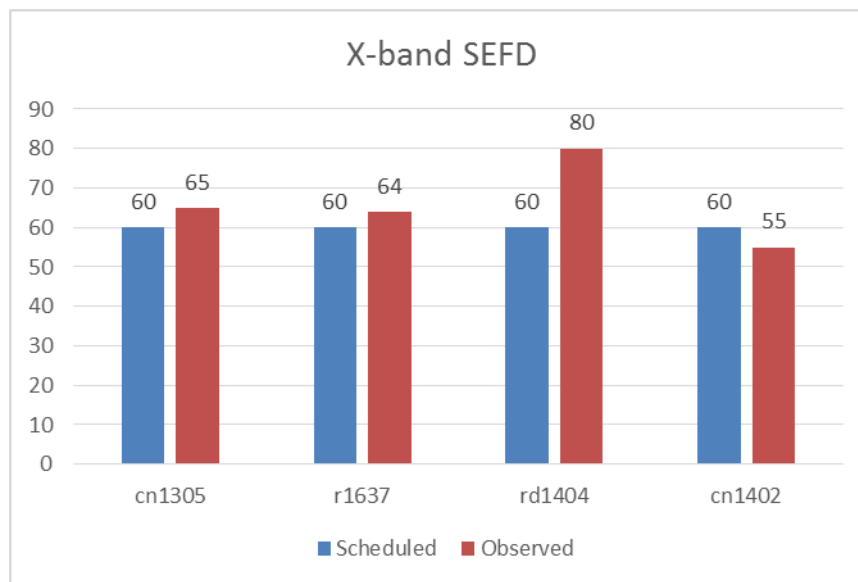


First 4 geodetic/astrometric experiments

Date	Code	UT Range	Stations	Frequency	Data rate	Channels	Sampling
(yyyy-mm-dd)		(hh:mm--hh:mm)			(Mbps)		(bits)
2013-11-21	cn1305	13:00--13:00(+1)	ShKmUrT6	S/X	256	16	1
2014-05-27	r1637	17:00--17:00(+1)	ShT6+IVS	S/X	256	16	1
2014-06-11	rd1404	18:00--18:00(+1)	T6+IVS	S/X	512	16	2
2014-10-18	cn1402	07:00--07:00(+1)	ShKmUrT6	S/X	256	16	1



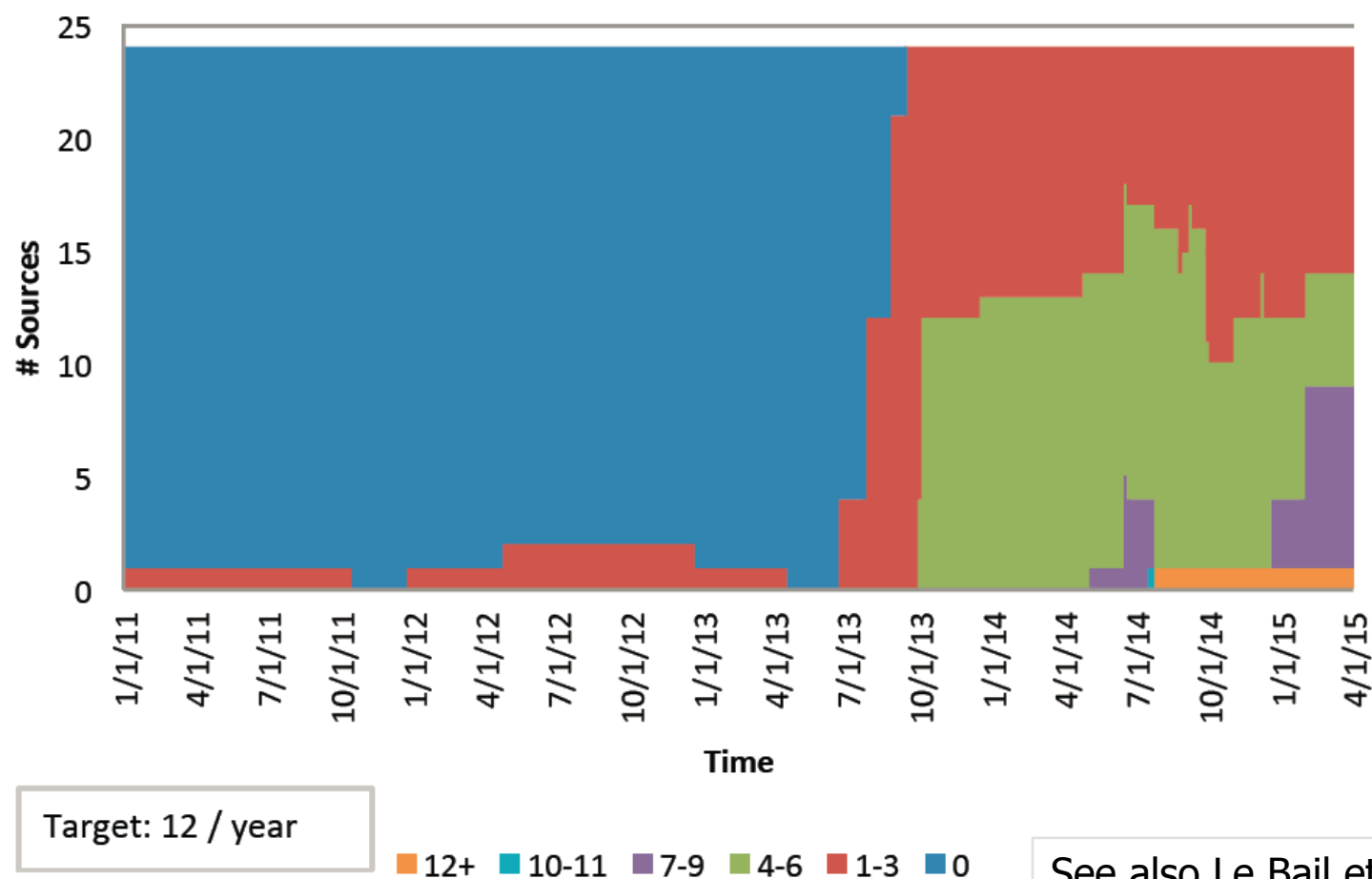
Observed SEFD of Tianma65



- Effelsberg: SEFD = 25@X-band, 100@S-band
- Parkes: SEFD = 150@X-band, 150@S-band

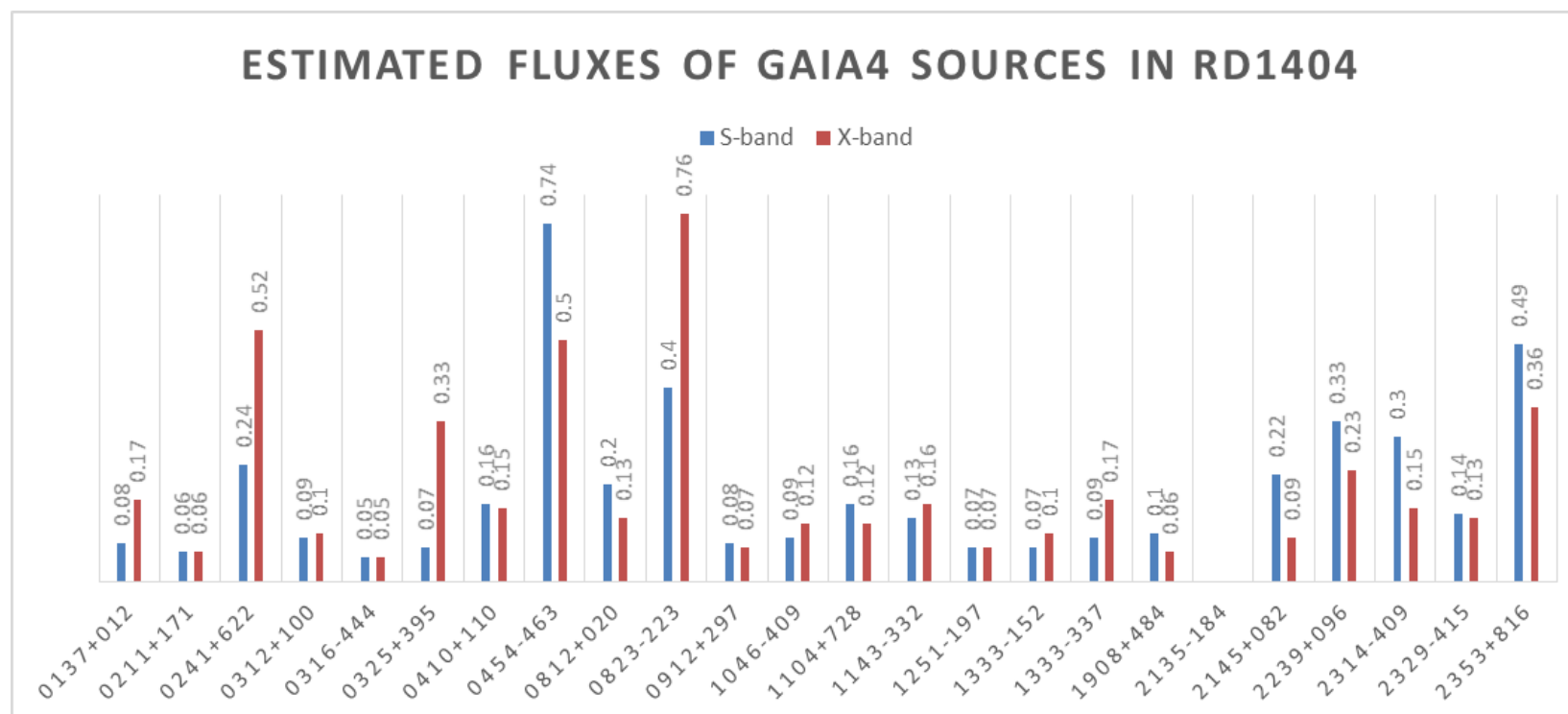
Observed sessions for GAIA4 sources

Gaia4 Sources (24)

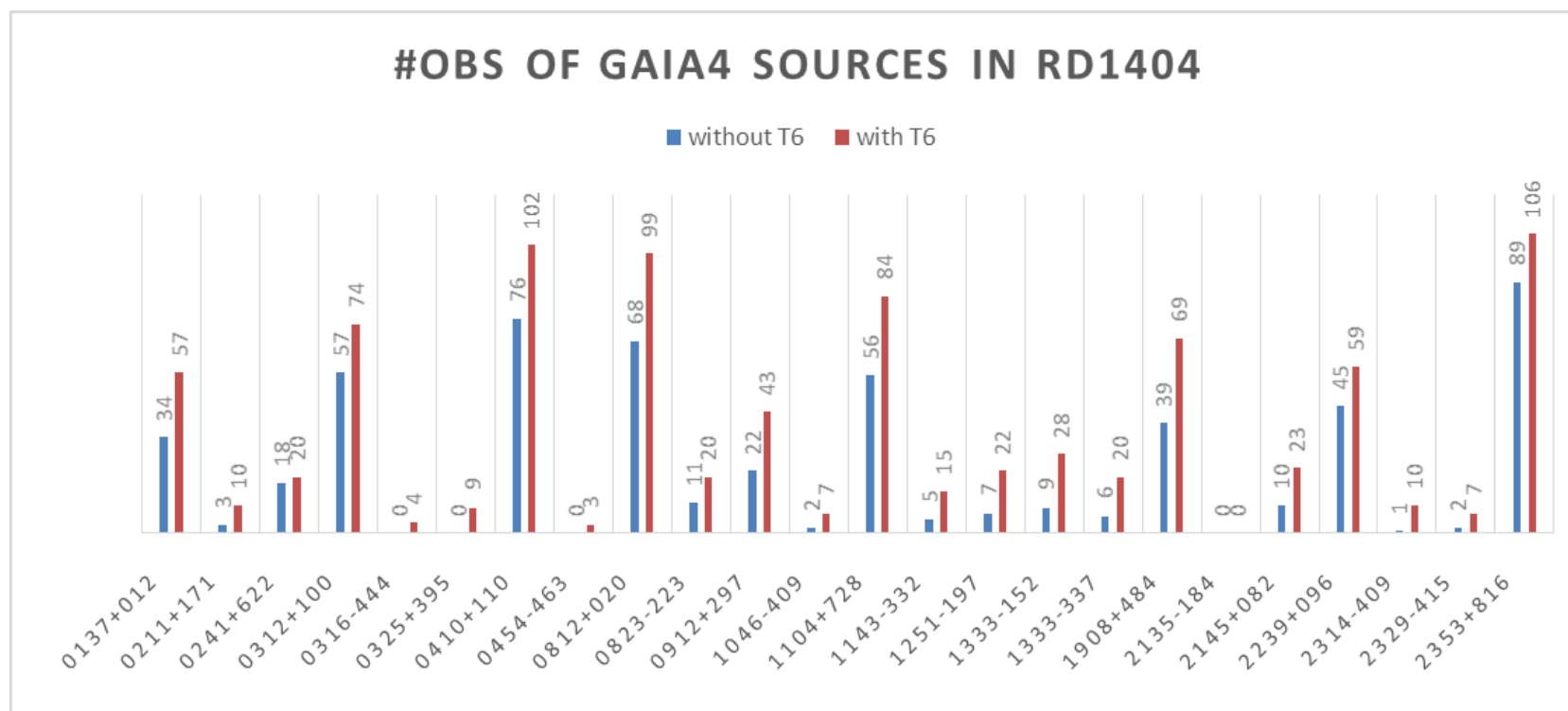


See also Le Bail et al. this meeting

Fluxes of 24 GAIA4 sources



Contribution of Tianma65 to GAIA4 sources

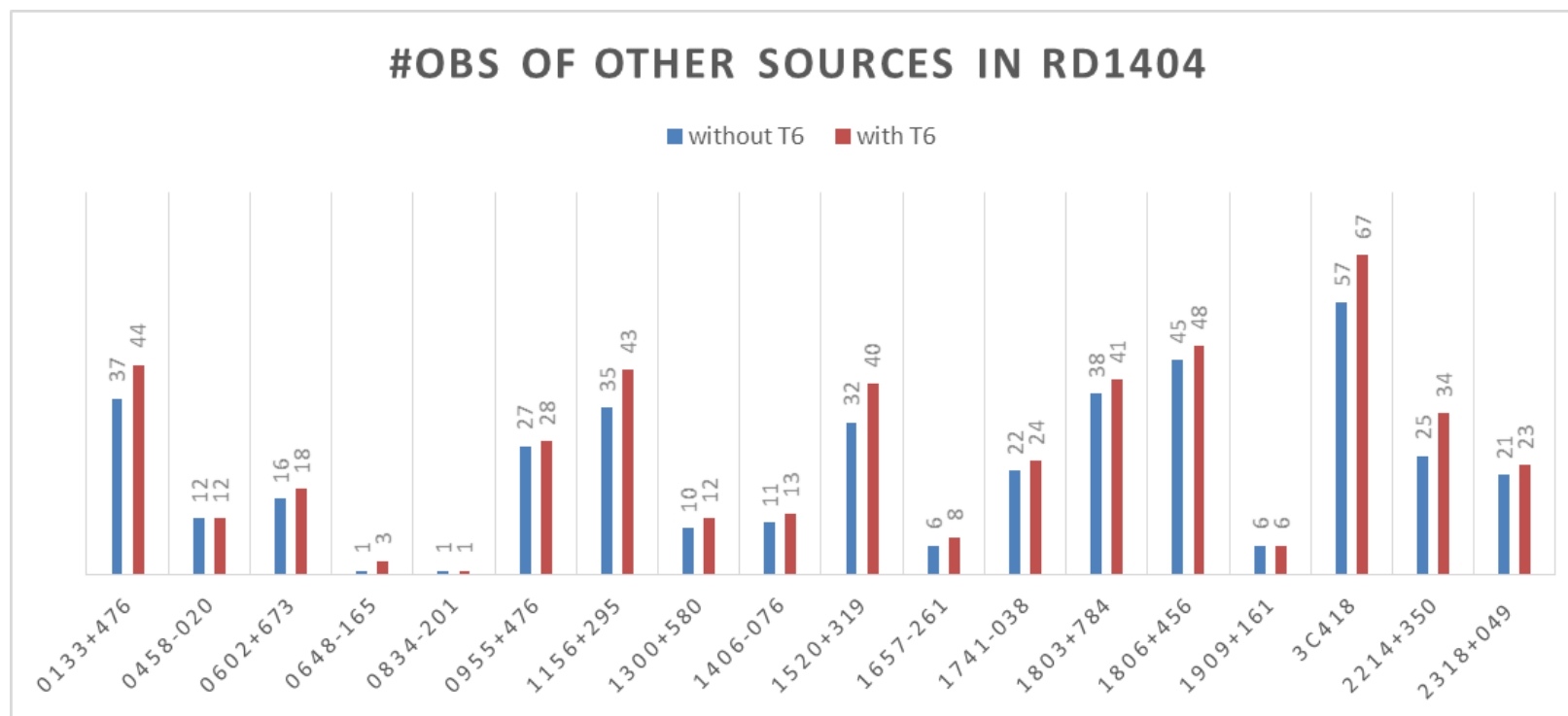


560 vs 891 total observations

59% increased by adding Tianma65

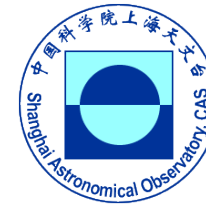
Data from David Gordon

Contribution of Tianma65 to other sources



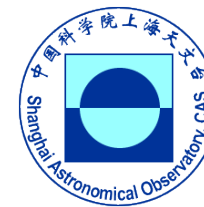
402 vs 465 total observations

16% increased by adding Tianma65



Recent observing status

- ❑ After half a year of maintenance, the first astrometric session participated by Tianma65 is AOV003.
- ❑ A few more sessions including Tianma65 are scheduled to monitor GAIA4 sources this year.
- ❑ We are conducting 2Gbps data rate observations, possibly include Tianma65 and a few international stations in the future.



Observations with 1/2Gbps data rate

Date (yyyy-mm-dd)	UT Range (hh:mm--hh:mm)	Stations	Frequency	Data rate (Mbps)	Channels	Sampling (bits)
2010-09-09	02:00--06:00	ShBjKmUr	S/X	1024	16	1
2011-01-14	02:00--04:00	ShBjKmUr	S/X	1024	16	1
2011-06-21	22:30--10:30	ShKmUr	X	2048	16	2
2011-07-07	06:00--08:00	ShKmUr	X	2048	16	2
2011-10-10	07:00--13:00	ShKmUr	X	2048	16	2
2012-01-12	04:00--06:00	ShKmUr	S/X	1024	16	1
2012-09-19	11:00--14:00	ShKmUr	S/X	1024	16	1
2013-06-20	06:00--06:00	ShKmUr	S/X	1024	16	1
2014-08-06	13:25--17:30	ShT6	X	2048	16	2
2014-11-26	11:30--18:30	ShBjKmUr	S/X	2048	16	2
2014-12-18	01:00--03:00	UrKv	X	2048	16	2
2015-02-13	05:00--05:00	ShKmUr	X	2048	16	2
2015-02-14	06:00--04:15	ShKmUr	X	2048	16	2
2015-04-23	05:00--04:30	ShKmUrKv	X	2048	16	2
2015-04-24	06:00--04:10	ShKmUrKv	X	2048	16	2

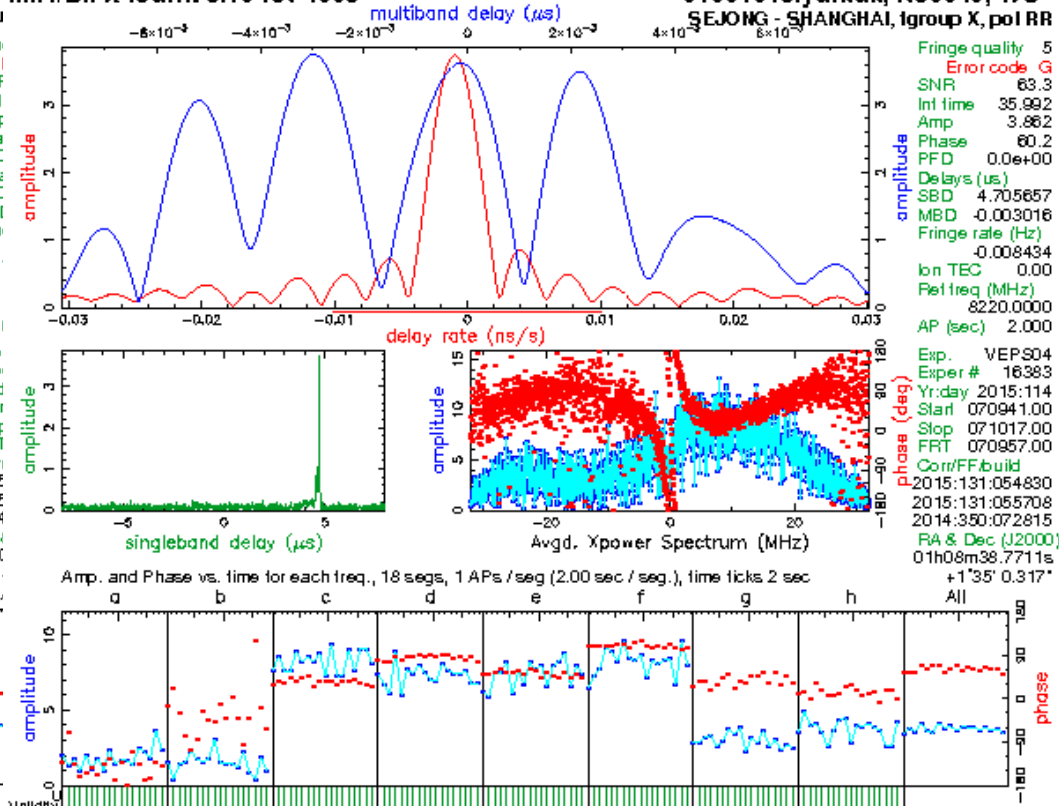
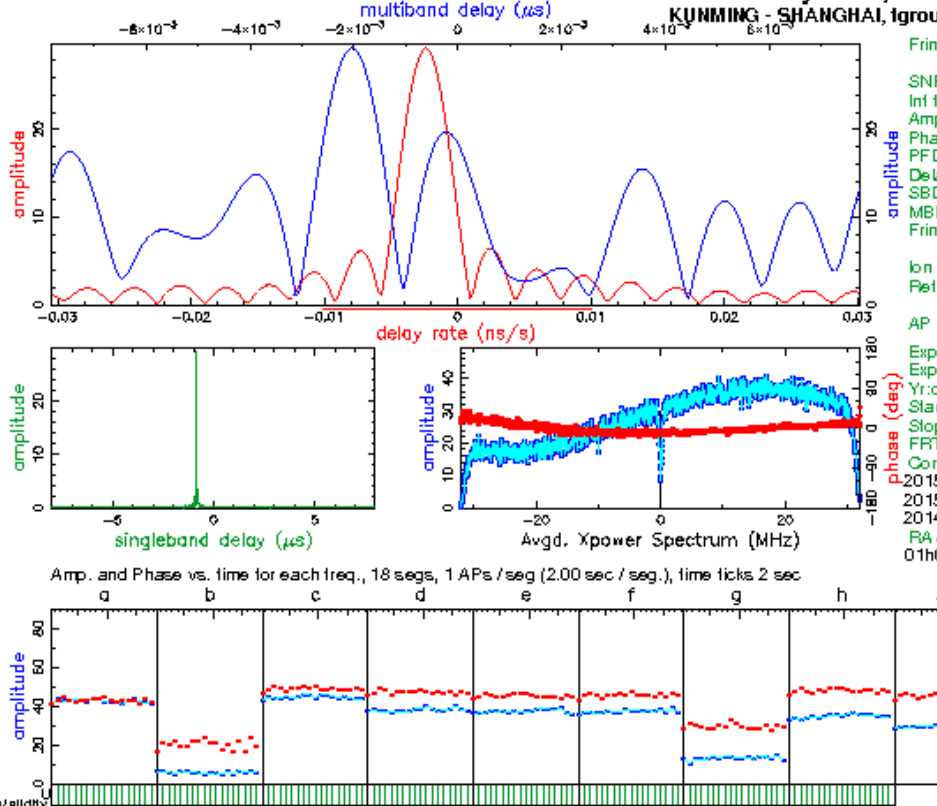
* Kv: 1bit available with maximum 1Gbps data rate

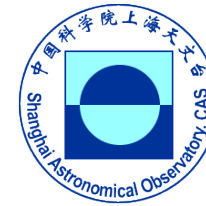
Wide band fringes to Sejong

Mk4/DIFX fourfit 3.10 rev 1009

0106+013.ydrxux, No00040, WC

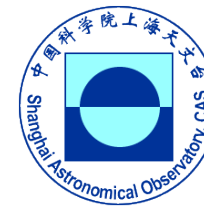
0106+013.ydrxux, No0040, WC





Summary

- ❑ Tianma65 has been operational for absolute astrometric VLBI with expected performance.
- ❑ 1/2Gbps data rate recording can help to form a more sensitive network than before, with participation of Tianma65, which will contribute to improving celestial reference frames.
- ❑ How to make the best use of Tianma65 for astrometry is still a topic of discussion, for its observing time will be limited due to many competitive scientific proposals.



Thank you!