Current and future astronomy in mainland China

Observational Facilities

Existing facilities

On-going ground based telescopes

Space projects

Other international space projects

Particle Astrophysics

Site Survey

China-VO

Future plan (under discussions)

Research activities

Conclusion: Some concerns

Observational Facilities

Existing (ground-based) main facilities (Optical / IR)

NAOC

2.16 m reflectoe

60/90cm Schmidt

1.2 m IR telescope

85 cm Reflector

60 cm Reflector

1 m telescope (new)

(Solar Instruments not included)

YNO

1m reflector

60cm reflector

2.4 m reflector (new)

PMO

1m f/1.8 Schmidt (new)

SAO

1.56 m reflector

Observational Facilities

Existing (ground-based) main facilities (Radio)

NAOC

Meter- band synthesis

(17 x 9m)

50 m (s – x band)

(for lunar exploration)

50 m (cm – band)

(reduced FAST)

YNO

40 m (s – x band)

PMO

13.7 m mm band

sub-mm portable

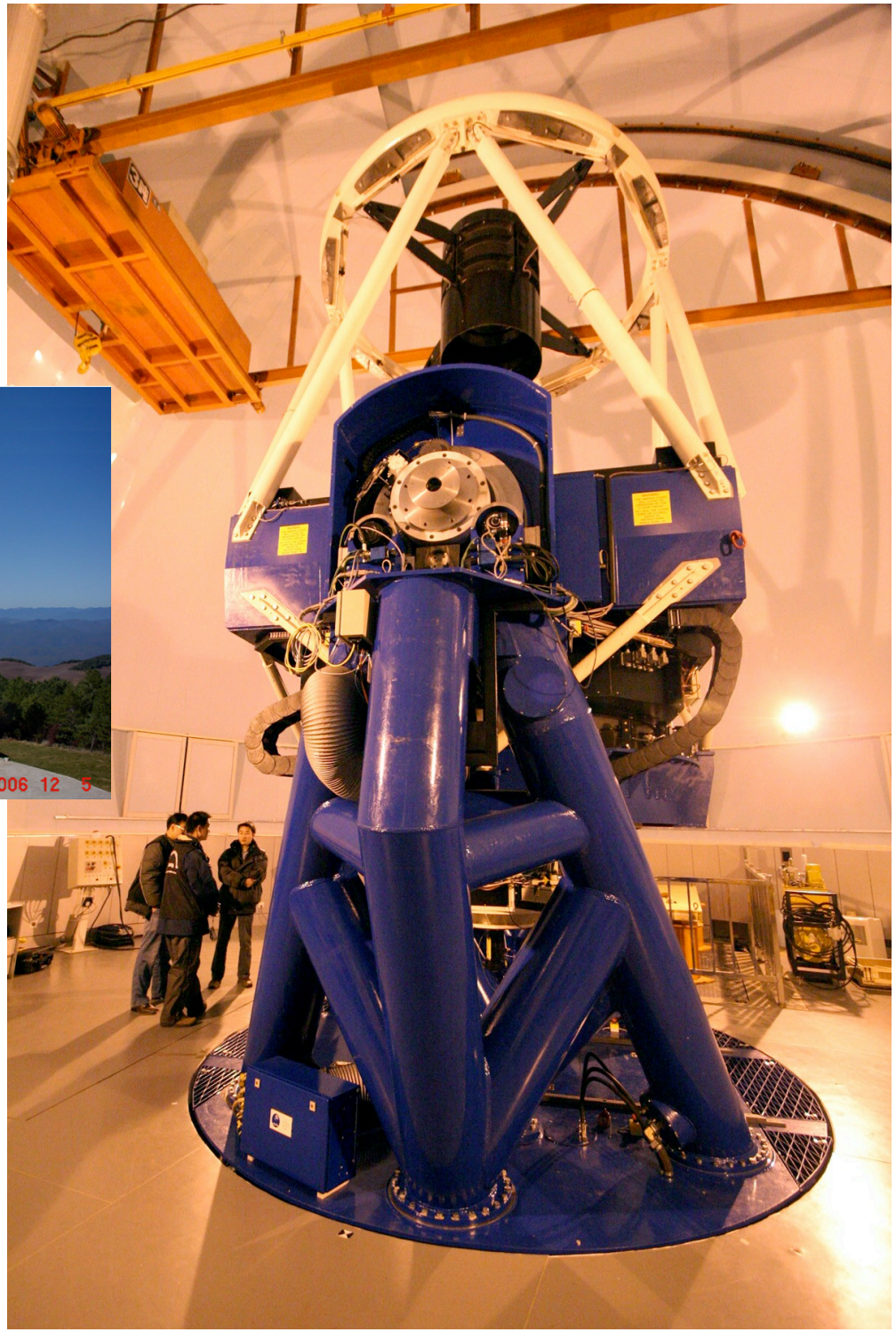
SAO/UAO

VLBI net 2x25m


NAOC
Urumqi Obs.
Changchun Obs.
NAOC
Delingha
Purple Mountain Obs.
Shanghai Obs.
Yunnan Obs.

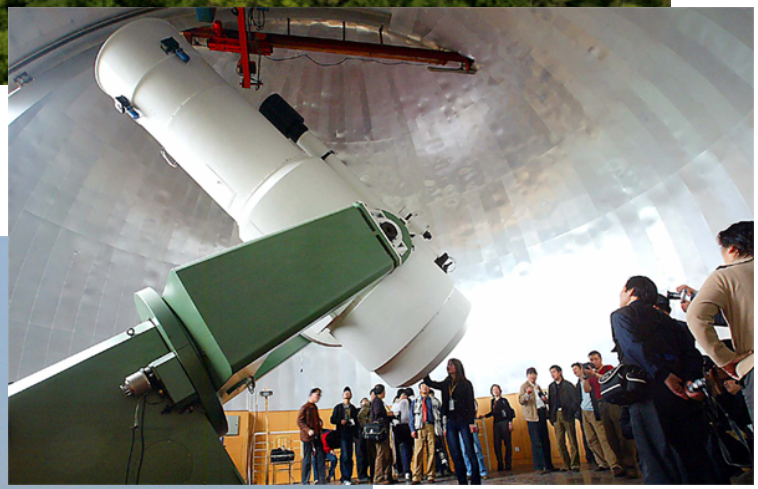
YNO 2.4m

(new)



Purple Mountain 1m f/1.8 Schmidt

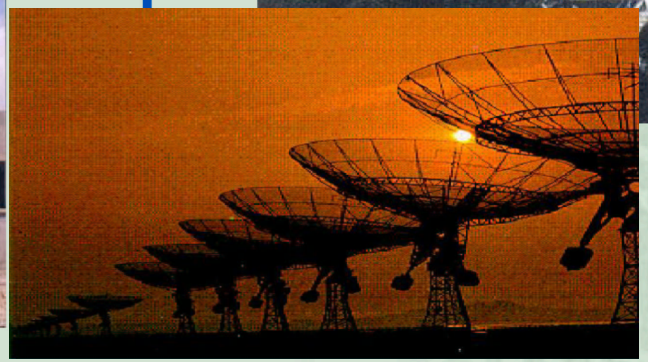
盱眙天体力学观测基地 New



- 视　　场：20‘×20’
- 曝光时间：10s

Radio Telescope Bases

Nanshan (25m)



1. Chinese VLBI Network

1993 (25m)

2006 (50m)

1987 (25m)

2006

2006 (40m)

Observational Facilities

On going ground projects (at various stage)

LAMOST (full system first light : 2008)

FAST (approved)

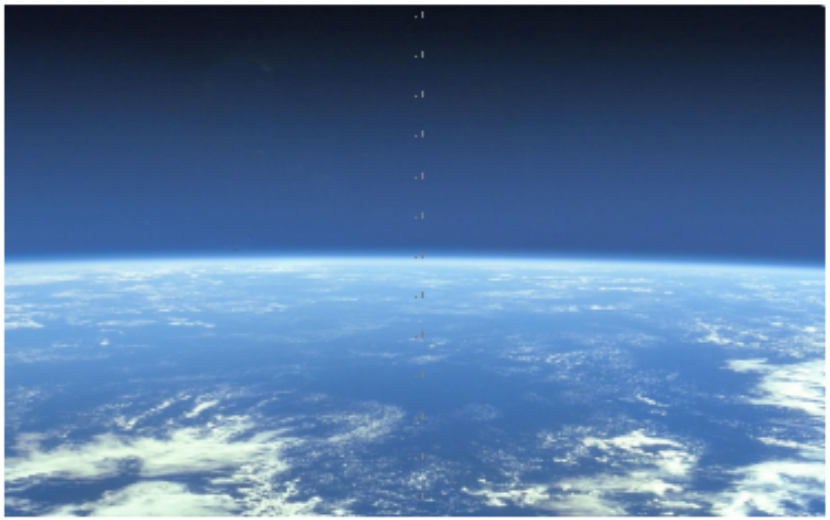
21CMA

Observational Facilities

Space projects (at various stage)

China National Space Administration

“十一五”空间科学发展规划



国防科工委

2007 年 1 月

目　　录

Observational Facilities

Space projects

Lunar Exploration

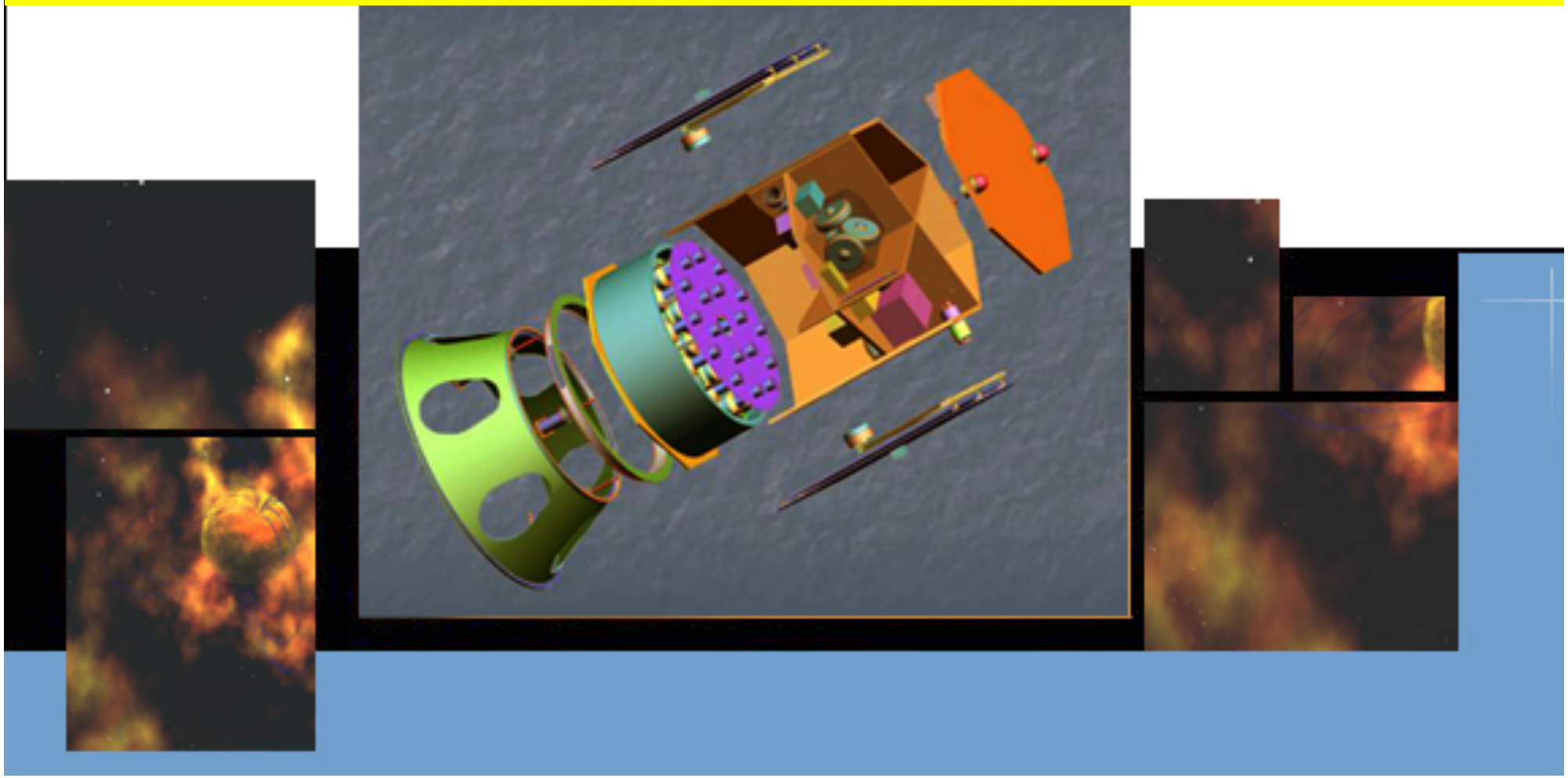
HXMT

International

Mars project (with Russia)

WSO (World Space Observatory)

HXMT(Hard X-Ray Modulation Telescope)



Mapping the Universe at 20kev-200kev band with high special resolution

Scheduled for launch time at 2010

Observational Facilities

other International Project

SVOM (Space Variable Objet Monitor) (with France)

SPIRE (ESA IR Space Observatory)

ALMA

The Sino-French GRB Satellite Mission SVOM

A Sino-French joint GRB satellite mission called SVOM has been approved by both governments. The scientific instruments onboard

a hard X-ray detector (CXG) for GRB trigger and localization,

a gamma-ray monitor (GRM),

a 50cm visual telescope (VT),

a soft X-ray camera (SXC).

Besides routine discoveries of about 80-100 GRBs per year,

main scientific objectives:

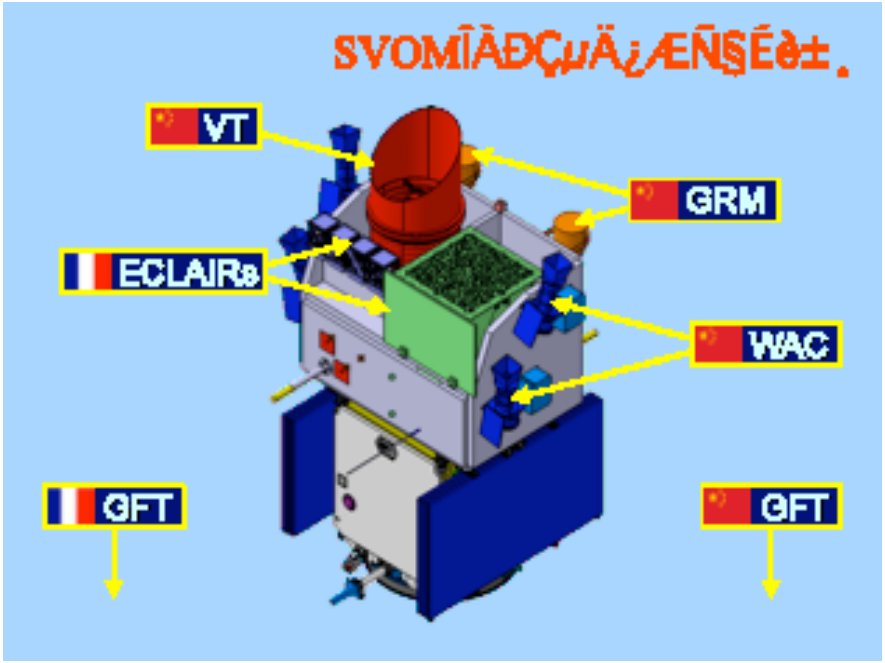
searching for high-redshift GRBs,

measuring spectral parameters of GRBs like E_peak,

obtaining well-sampled optical light curves of afterglows, catching prompt optical flashes, etc.

The satellite is scheduled to be launched in 2011 or 2012.

SVOM

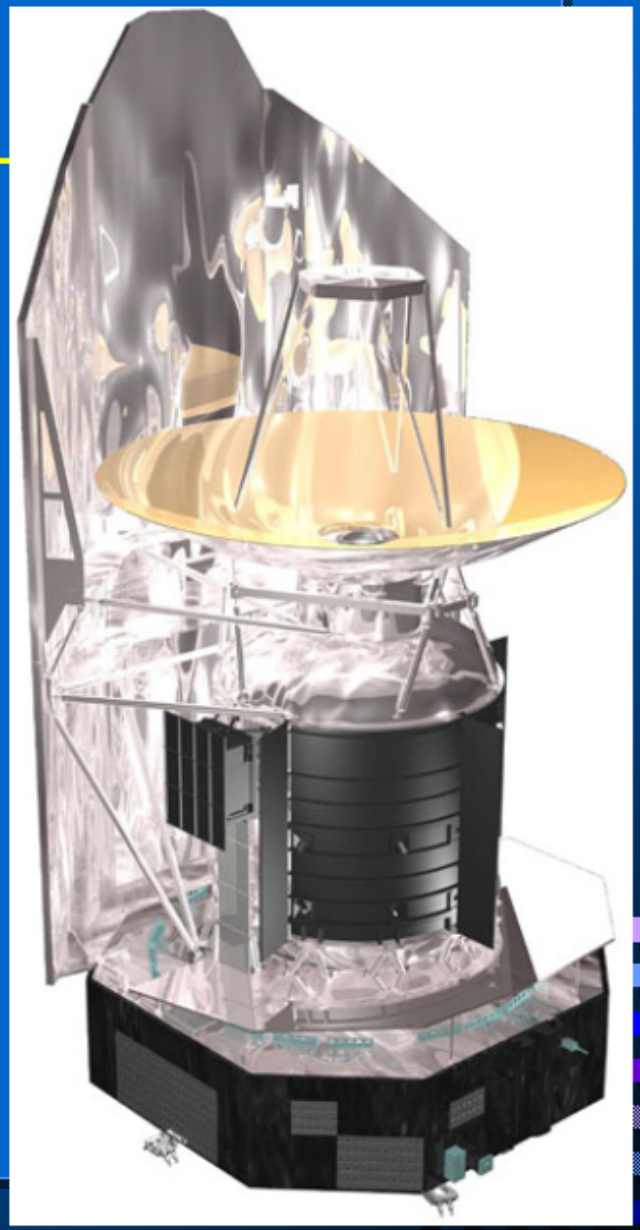


- Trigger on 200GRB's per year
- X, Gamma, Visible on satellite
- Location in <10 sec to <10 arc min
  - 50% of the cases <1 arc min for ground follow up
- Allow for 75% cases red shift and spectroscopy follow up

- On board visible cameras under study
  - WAC V 40 degx 40 deg 15 mag in 10 sec
  - VIRT K 10arc min x 10 20 mag in 300 sec
  - Observe « prompt » emission before and after GRB

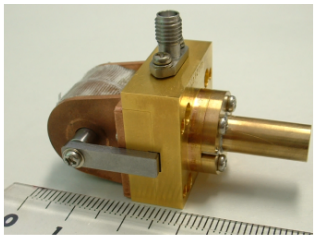
Participation of ESA's Herschel Infrared Space Observatory

- Herschel is a 3.5m diameter telescope to be launched to the L2 orbit in 2008
- Observatory type mission
- NAOC has contributed to the SPIRE instrument since September 2005 in its Instrument Control Center.
- China is a formal partner of the SPIRE instrument team.



Collaborative R&D for ALMA Band-8

Photo of band-8 SIS mixer



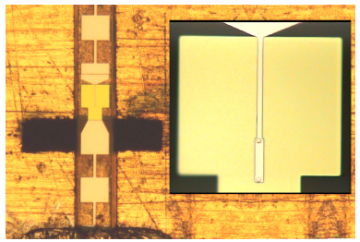
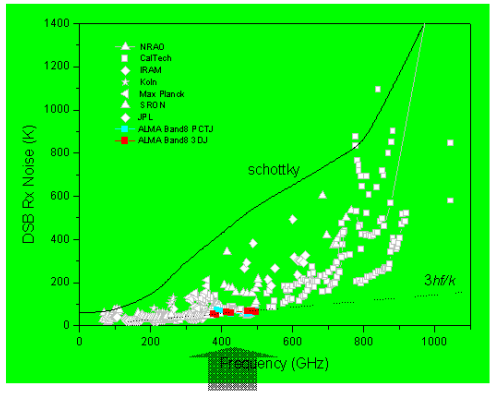


Photo of Nb SIS junctions for band-8

Comparison of the performance of SIS mixers



Best noise performance ever achieved in this band

NAOJ

ALMA Band 8
385-500 GHz Cartridge

National Astronomical Observatory of Japan
Purple Mountain Observatory, NAOC, China

ALMA

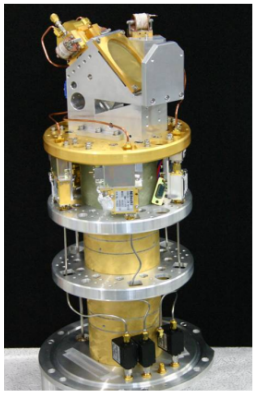
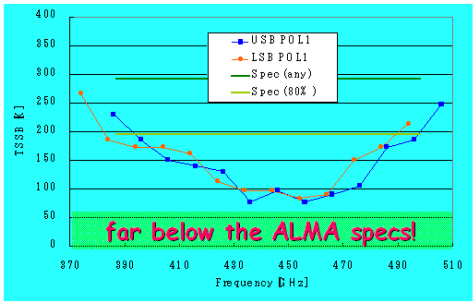


Photo of band-8 cartridge



Collaborative R&D for ALMA Band-10

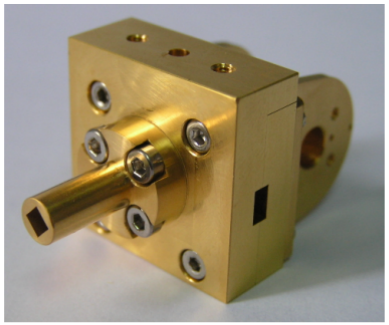
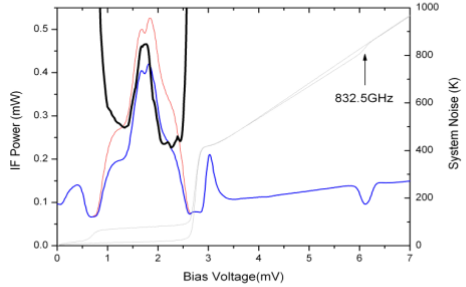
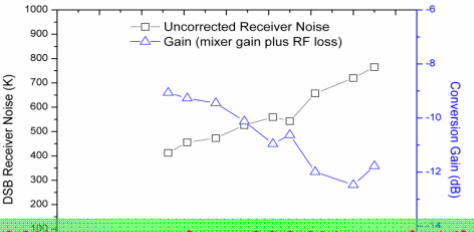


Photo of the 1st band-10 waveguide mixer block (designed/ordered by PMO)





400K measured at 830GHz with Nb SIS junctions, a very good start!

Collaborative R&D for ALMA Band-10 (cont'd)

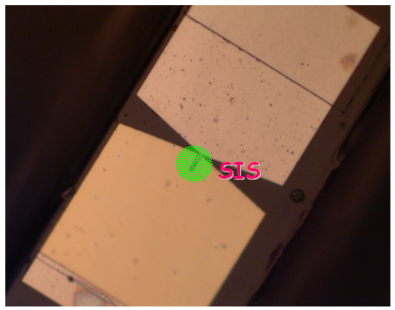
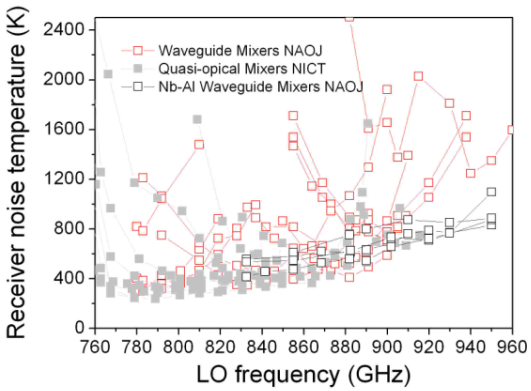


Photo of an NbN SIS junction (designed at PMO, fabricated at NiCT)



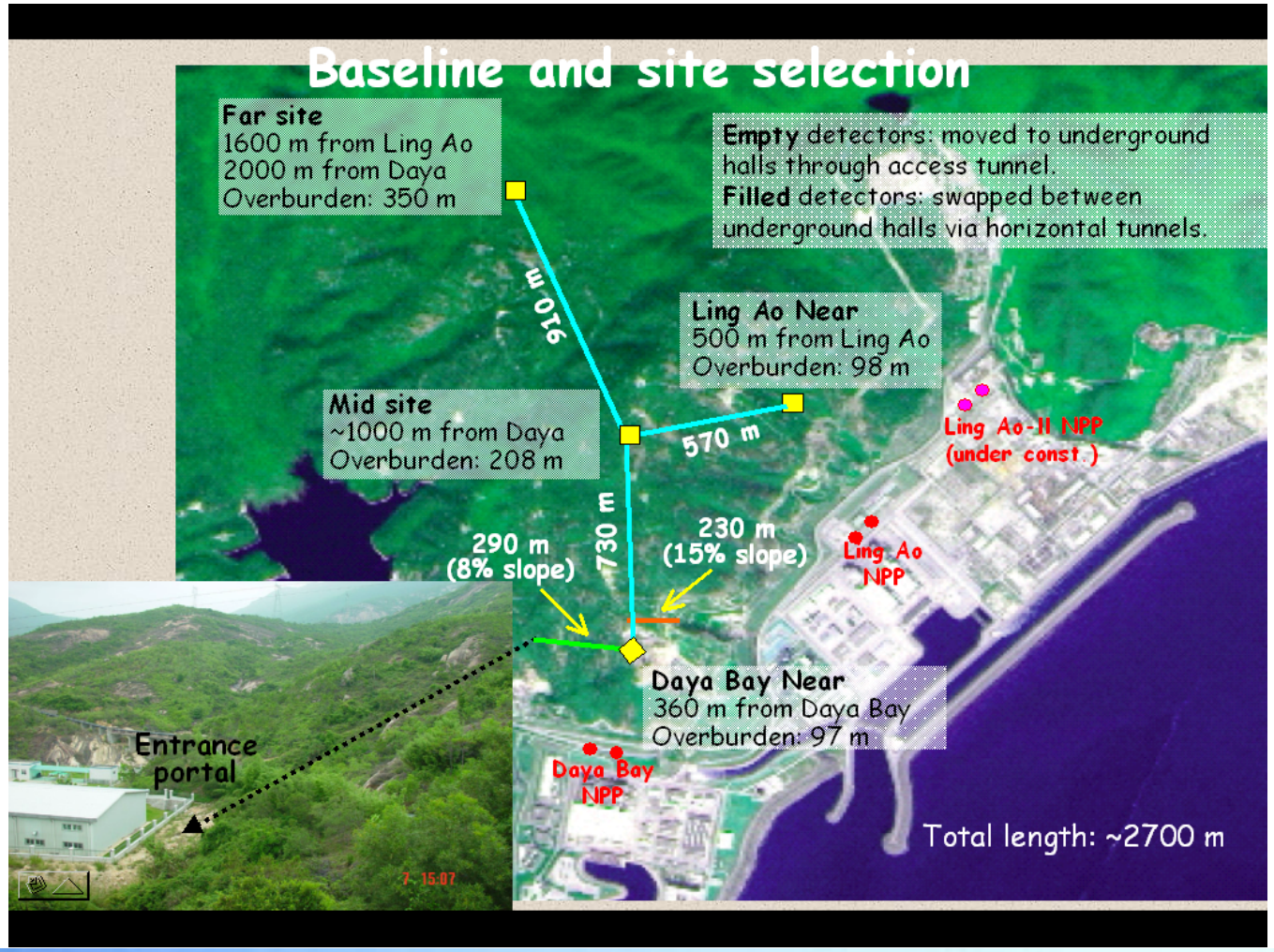
Approaching the requirement of noise temperature, but with small bandwidth

Particle Astrophysics

- 1990’s, set up of the Tibet/Yangbajing ASγexperiment
- 1998-, AMS01 permanent magnet and AMS02 ECAL
- 1999-2000, L3+Cosmic-ray experiment
- 2001, Tibet/Yangbajing ARGO experiment
- 2006-, Approval of the Daya Bay Neutrino oscillation experiment
- 2006-, CRTNT: high energy neutrino experiment

Daya Bay

θ_{13}: The Last Unknown Neutrino Mixing Angle

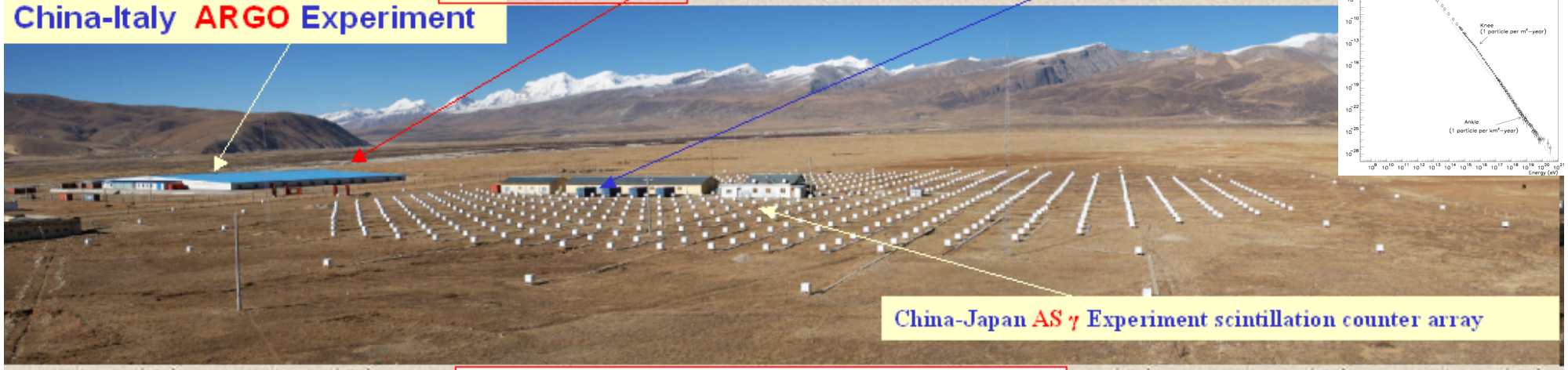


Asγ,ARGO (High Duty cycle, Large F.O.V)

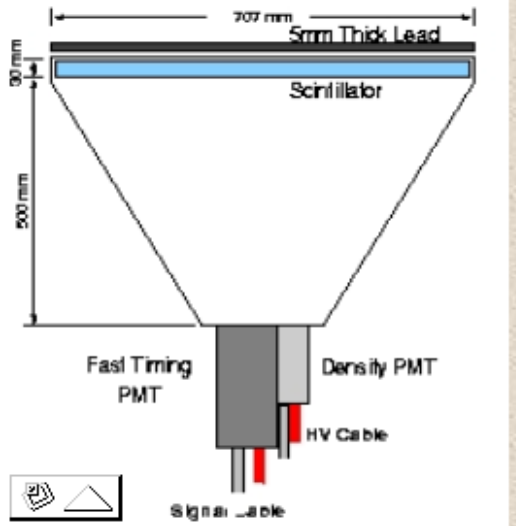
~100 GeV

~TeV

China-Italy ARGO Experiment



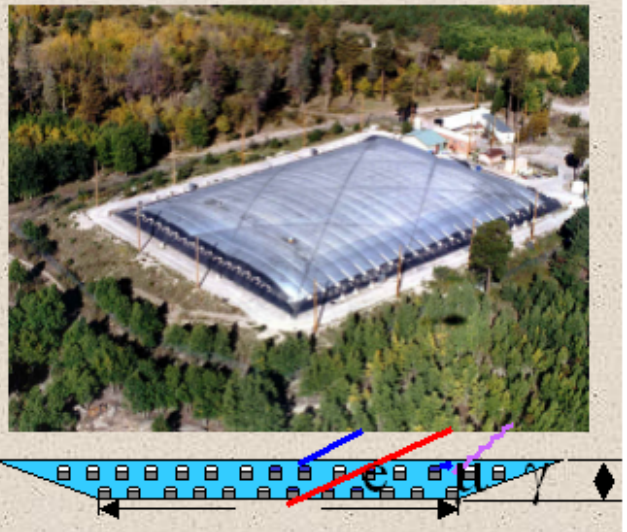
AS γ scintillation counter



ARGO hall, floored by RPC.
Fully installed in July 2006.

Tibet - YBJ

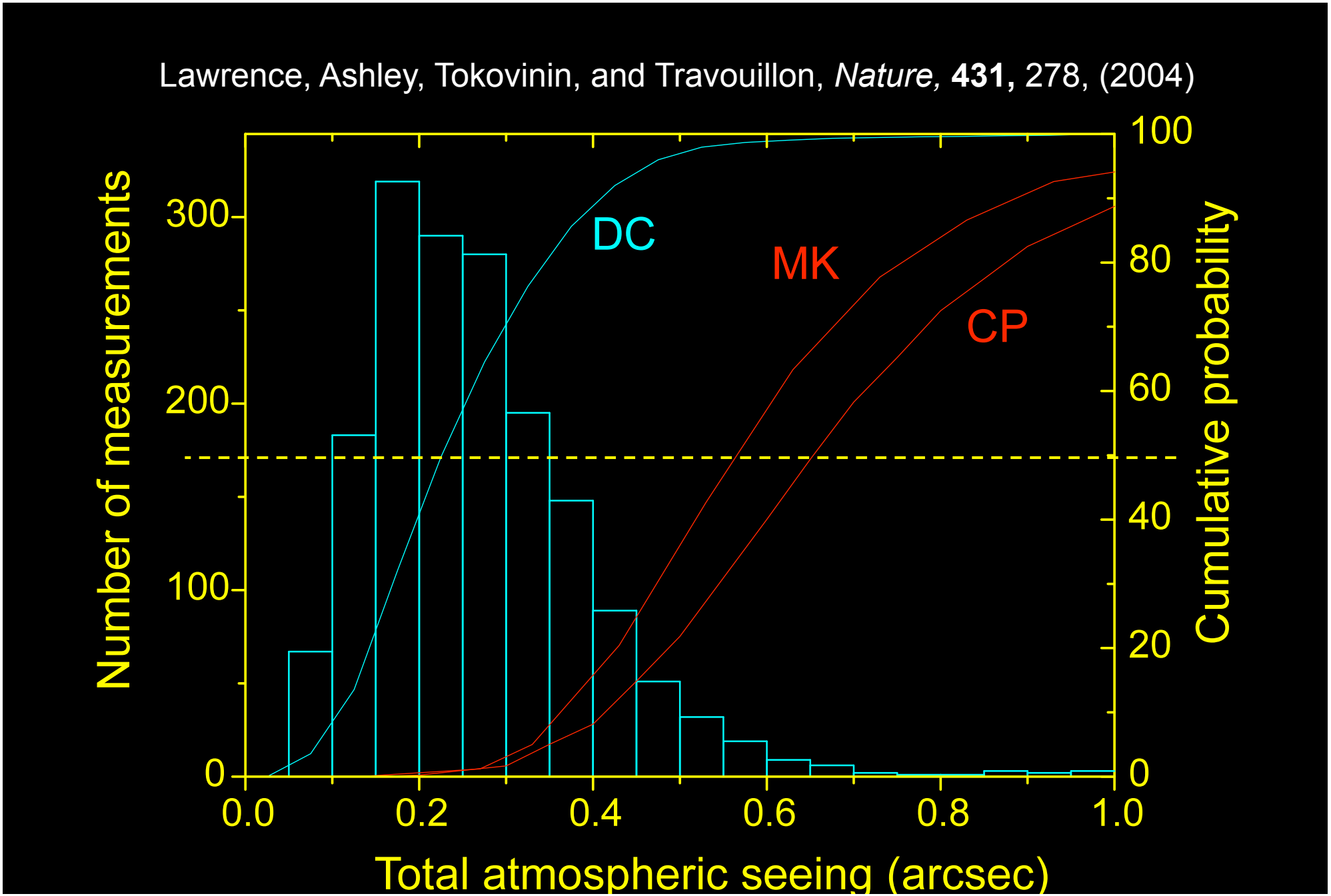
MILAGRO,Jemez（2630M）



Site Survey

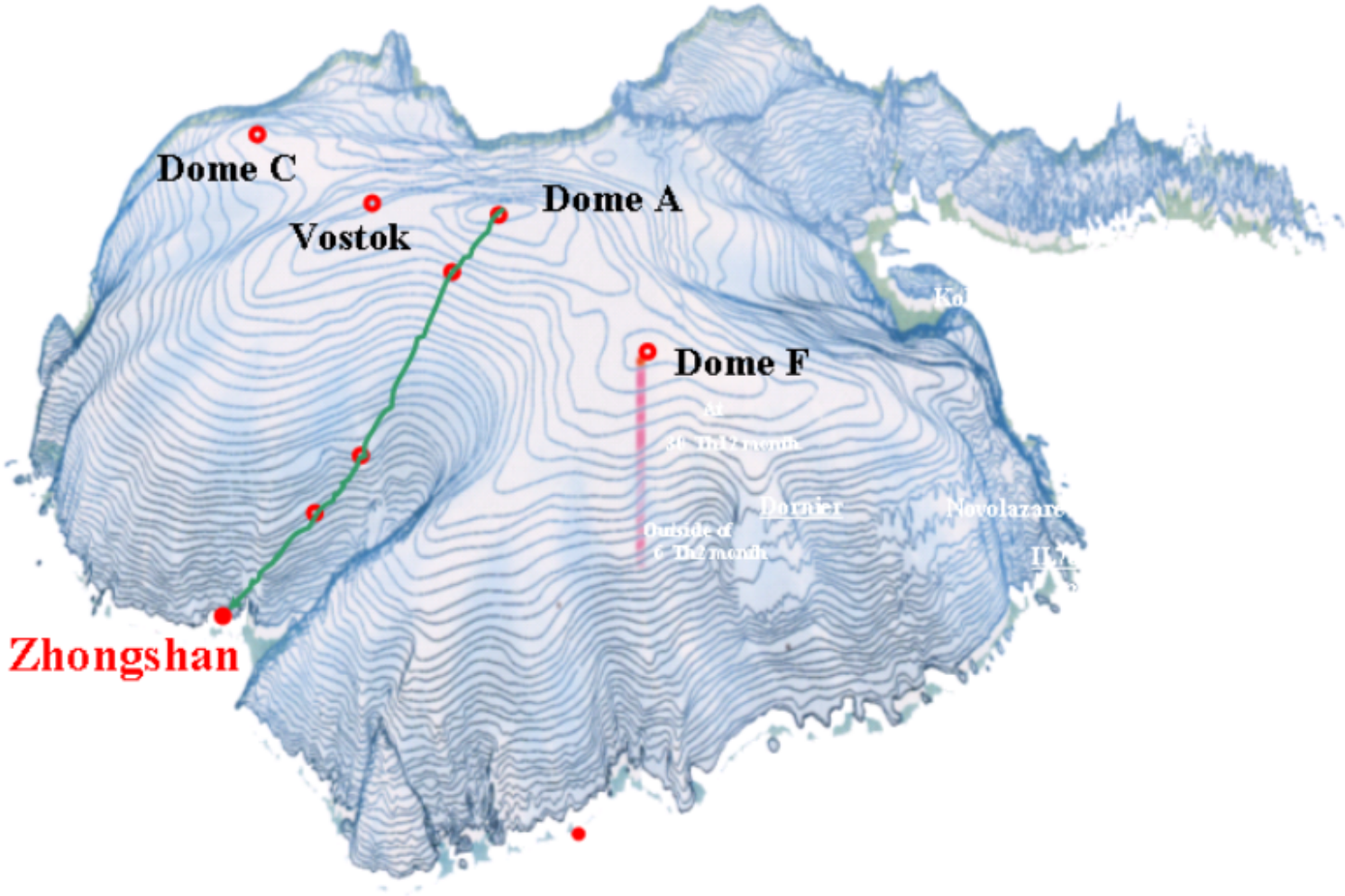
Western part of China

Antarctic region : Dome A



Antarctic site survey

Site Survey in Antarctica -Dome A



Dome A – the summit of the Antarctic icecap

Yuansheng Li, 2005

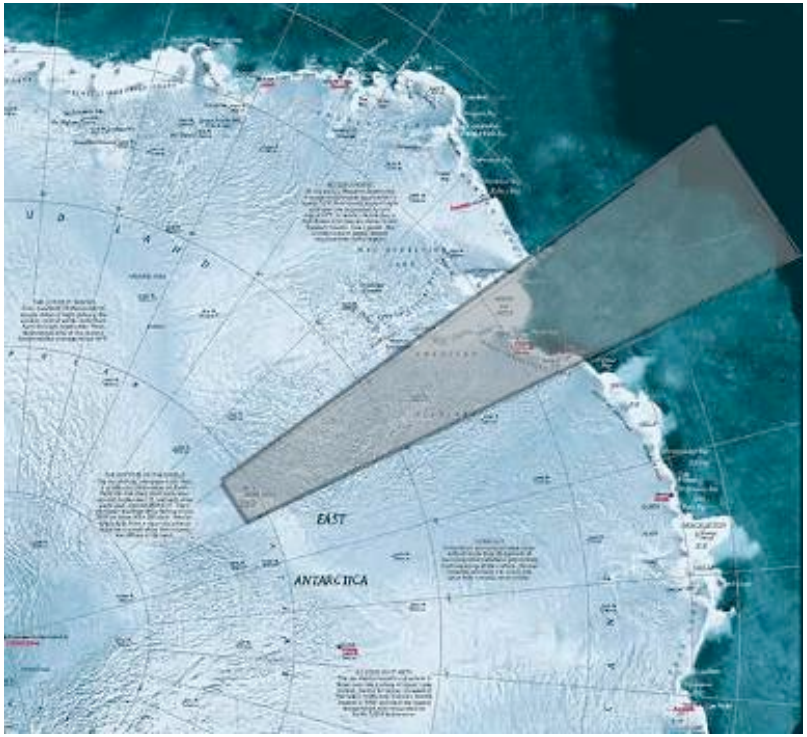
What is PANDA?

The Prydz Bay, Amery Ice Shelf and Dome A Observatories

Short Form Title : PANDA

The geographic locations

(60°～80°E, south of 53°S)

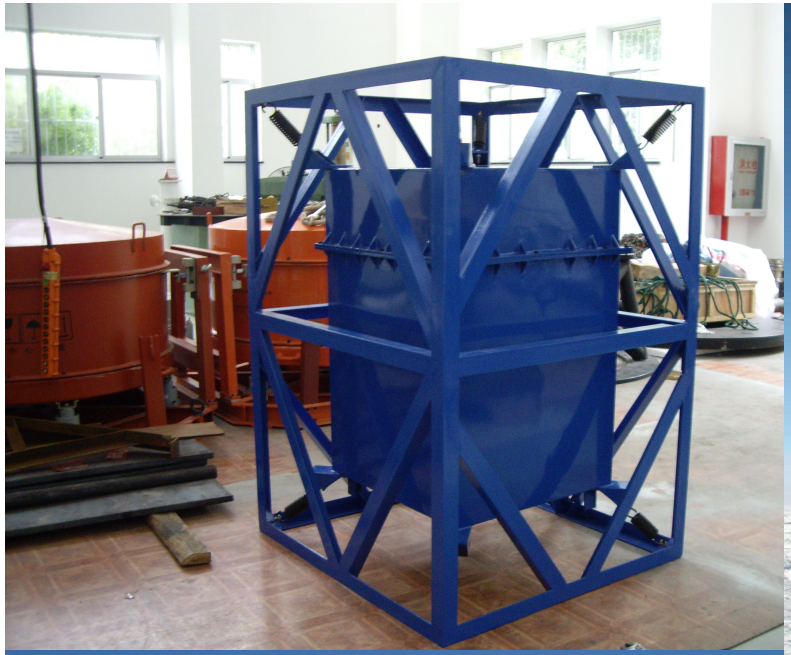


Main research areas

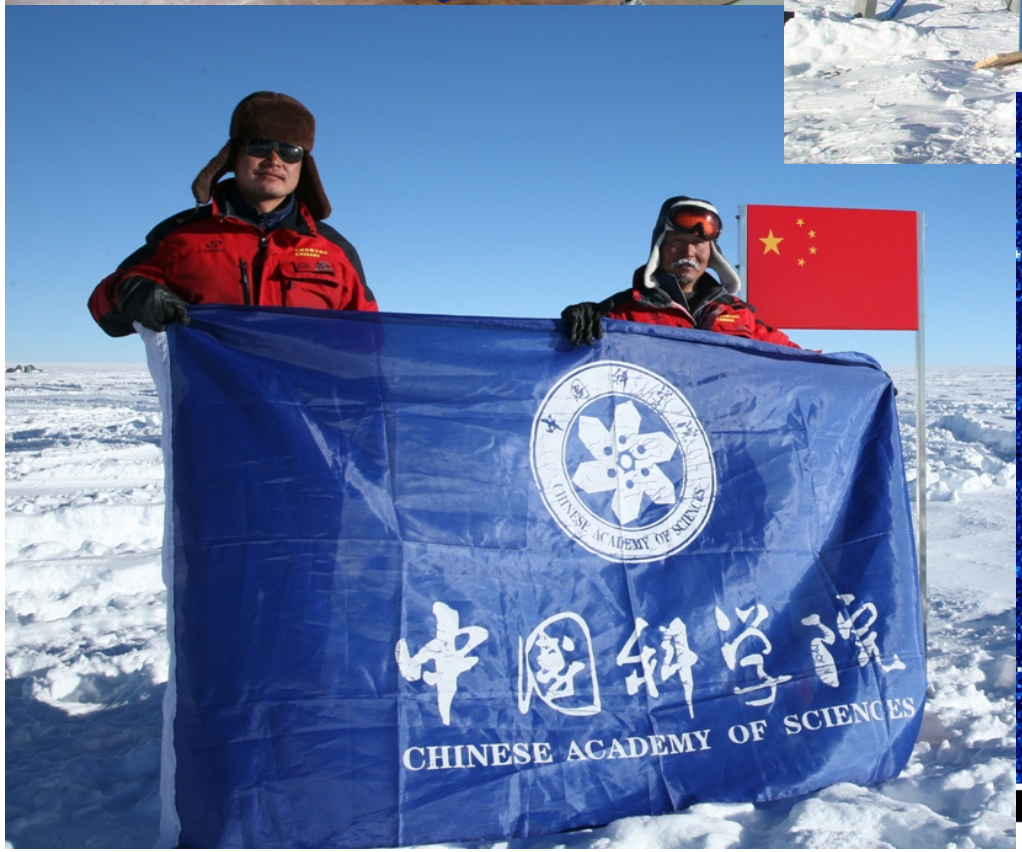
- ◆ Prydz Bay
- ◆ Amery Ice Shelf
- ◆ Zhongshan Station
- ◆ Lambert Basin
- ◆Zhongshan-Dome A transect
- ◆ Dome A

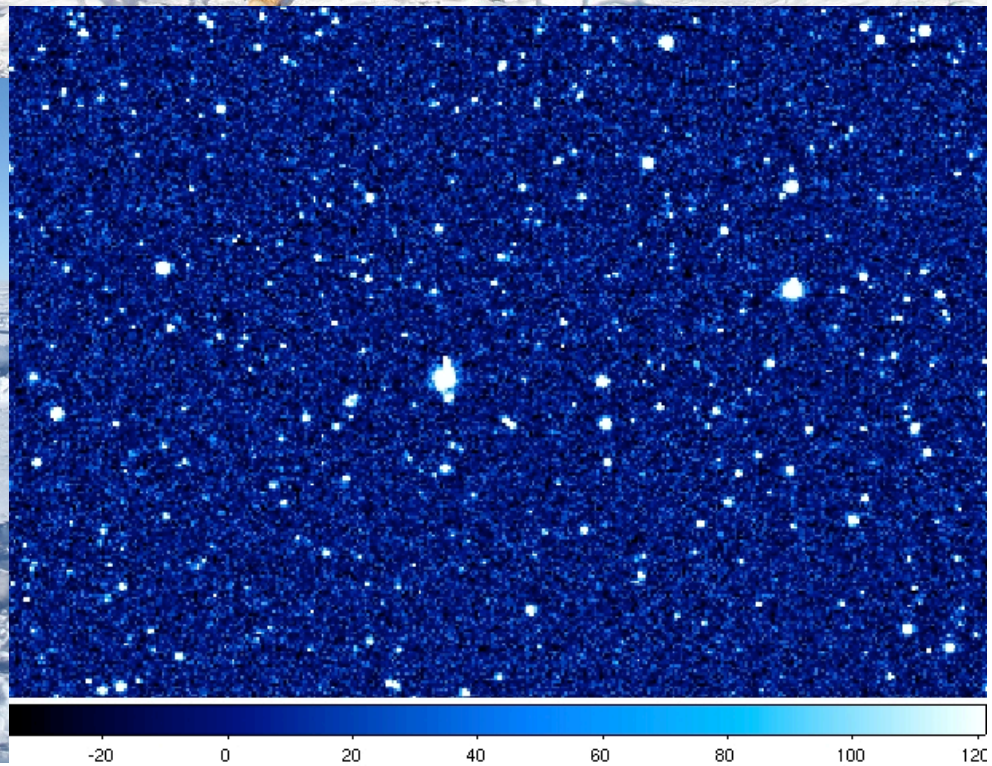
4x15cm telescopes

- 4 telescopes with diameter 15cm, 1Kx1K CCD each, 5x5 square degrees view, all point to the south pole (near the zenith).
- With g, r, i and none filters, without any mechanical moveable instrument.
- Constant observation for more than 4 months, take pictures every 20s.




CSTAR
Chinese Center for Antarctic Astronomy
2007


CHINESE ACADEMY OF SCIENCES
中国科学院
CHINESE ACADEMY OF SCIENCES


-20
0
20
40
60
80
100
120

China Virtual Observatory

VOFilter an XML filter for OpenOffice to load IVOA VOTable file into its Calc application;

SkyMouse a smart interface for astronomical on-line resources and services;

VO-DAS a uniform access interface for catalog, spectra and images under grid environments;

FitHAS an easy-of-use FITS archive management tool.

china - VO science and applications

China-VO Platform

- Uniform Access to On-line Astronomical Resources and Services
- VO-ready Projects and Facilities
- VO-based Astronomical Research Activities
- VO-based Public Education

Research Activity

Cosmology: early stage; inflation; cosmic string; dark energy; dark matter; gravitational weak lensing; dark age and first light; particle astrophysics, ……

(PKU, NAOC, PMO, USTC, BNU, IHEP, ITP….)

Galaxies: origin / formation /evolution of structure/galaxies; numerical simulation; normal galaxies; cluster of galaxies; dynamics of galaxy,

(SHAO, PKU, NAOC,USTC, ….)

High energy astrophysics: AGN; BH; GRB; X-ray; accretion disc; pulsar……,

(NJU, THU, IHEP, PKU, SHAO, NAOC, USTC, PMO, XU, GU, YNO, ……)

Stellar Astrophysics: structure and evolution; binary stars; variable stars; chemical abundances; star formation; galactic astrometry, …….

(YNO, NAOC, NJU, PMO,

Research Activity

ISM /IGM: QSO absorption lines; PN; SRN; molecule clouds,

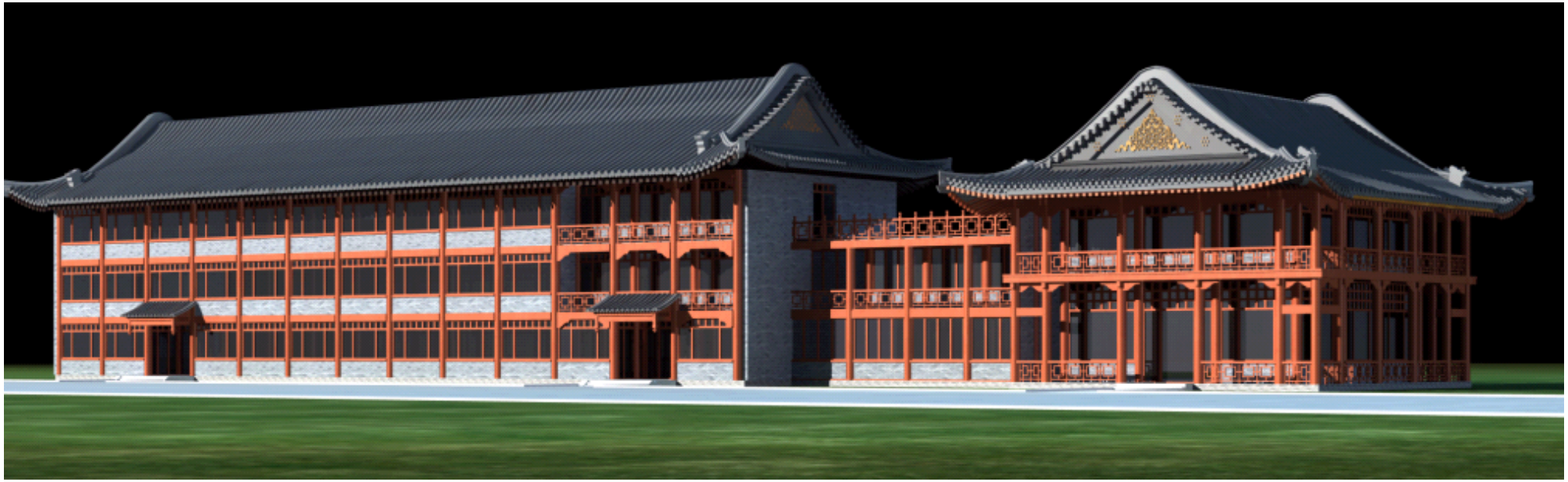
(PMO, PKU, BNU,….

Solar system: planet; luna exploration; extra-solar planet;

(PMO, PKU, NAOC, NJU,

Solar Physics:…..

Kavli Institute for Astronomy and Astrophysics (KIAA) at Peking University (2006.6)



Director : D.N.C. Lin (UCSC)

Associate Director : Xiaowei Liu

Research sources

National Development and Reform Commission(NDRC)

Ministry of Science and Technology (MOST)

Chinese Academy of Sciences (CAS)

National Natural Science Foundation of China (NSFC)

Chinese National Space Administration (CNSA)

Ministry of Education (MOE)

Education in Astronomy

Undergraduate level

Nanjing University

Peking University

University of Sci. & Tech.

Education in Astronomy

graduate level

Chinese Academy of Sciences

Nanjing University

Peking University

University of Sci. & Tech.

Tsinghua University

Beijing Normal University

etc

Future Plane

(discussion / suggestion)

Driven by:

Scientific opportunity driven

wavelength band driven

People driven

International collaboration driven

Site driven

Future Plane

(discussion / suggestion)

EAO (East-Asia Observatory

Antactic Observatory

Join international large ground/space project

Asian Optical Telescope Array
AOTA @ Tibet
--- Time sequence of Telescope construction

1st 8m Tel on the site ~ 2016?

2nd 30m Tel

2m Tel for site evaluation ~ 2012?

1st 30m Tel
~ 2020?

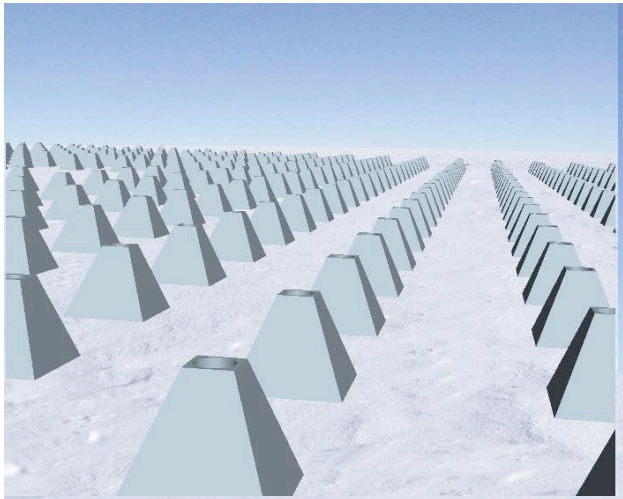
30m Tels more … ~ 2025?

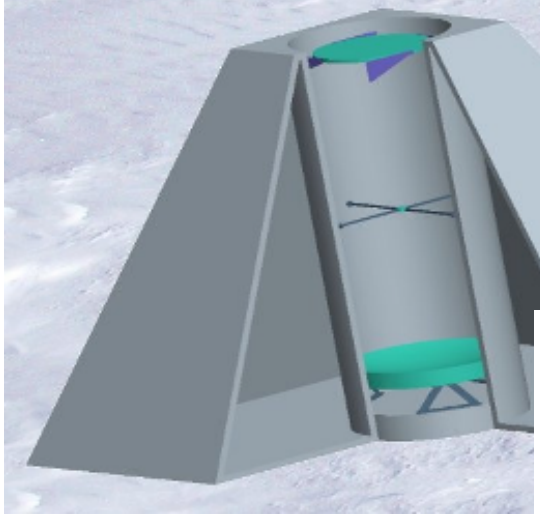
8m Tels more … ~ 2025?

launch Interferometry
~ 2030?

Antarctic Observatory

XIAN— eXtreme Imaging Array Network

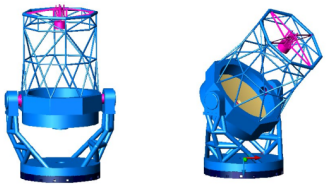




For Antarctic Dome A

4-8meter wide field telescope

4m = 10m LSST



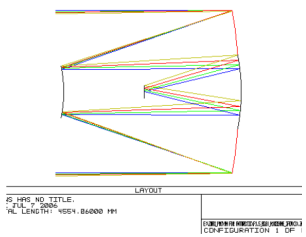
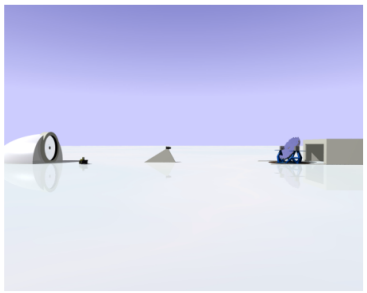
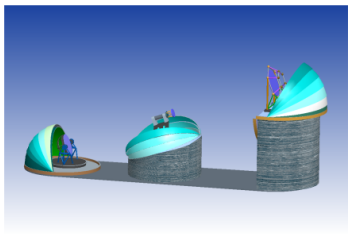


图4 (b) 4米望远镜机架及支撑效果图

LAMOST type telescopes



(Will Saunders , AAO,2004)

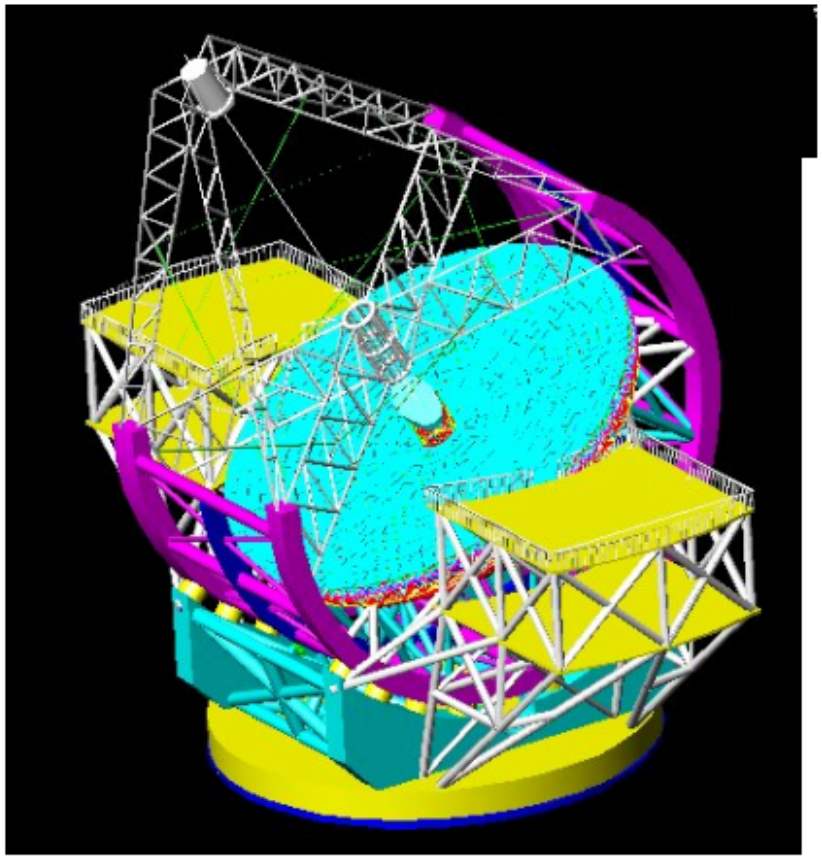


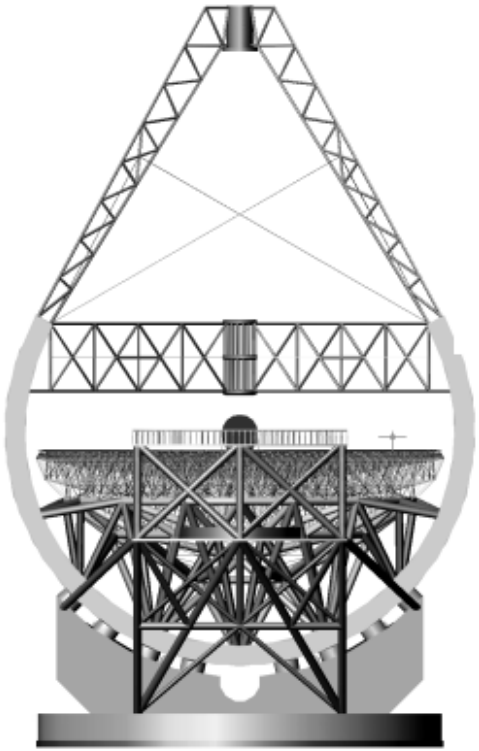
δ \ 2w	0°		1.5°		3°	
	50%	80%	50%	80%	50%	80%
15°	0.01"	0.02"	0.10"	0.13"	0.21"	0.27"
30°	0.01"	0.02"	0.16"	0.20"	0.32"	0.41"
45°	0.01"	0.02"	0.22"	0.28"	0.44"	0.57"
60°	0.01"	0.02"	0.28"	0.37"	0.58"	0.75"
75°	0.01"	0.02"	0.37"	0.48"	0.76"	0.98"
90°	0.02"	0.03"	0.48"	0.63"	0.98"	1.27"

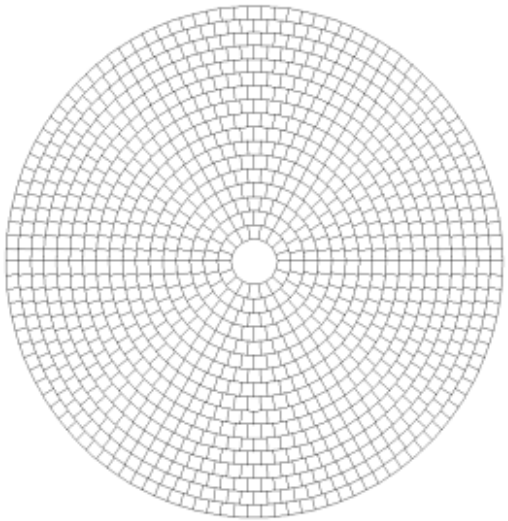
2m LAMOST for Southern sky survey

Preliminary study on Extremely Large Telescope
Chinese Future Giant Telescope- CFGT

Su, Wang & Cui, SPIE Vol. 5494,2004）

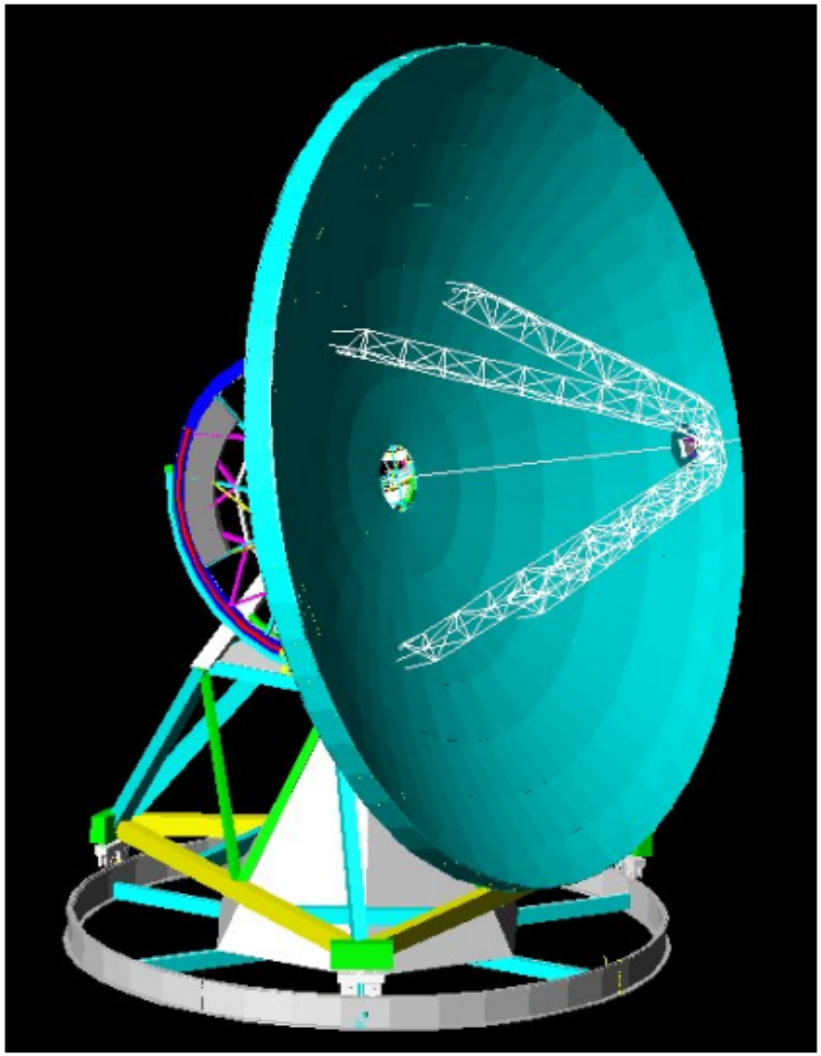






1122 sub-mirrors

30m active sub-mm telescope



- Complement with ALMA
- Good site in west China
- Active segments technology of optical telescope - NIAOT
- Superconduct receiver - PMO
- Get experience for optical telescope > 30m

Conclusion: Some concerns

The effort is too scatter. Need to concentrate the resources to do the best thing step by step !

Short of real academic (organization / individual interests free) atmosphere and system (evaluation, decision making…..) for :

- **establishing strategic and long term development plan**
- **evaluating mega-project**
- **promoting collaboration between different organization**

Conclusion: Some concerns

Short of advantages to attract / keep world class scientists to work in China

- **working condition**
- **academic atmosphere**
- **salary, …..**

KIAA will be the test bed.


Thank You !