Non-Accelerator Physics Experiments in IHEP Beijing

Hesheng Chen

Institute of High Energy Physics
Beijing 100039

Thank ICRR for very successful collaboration at Yangbajing Observatory for more than 20 years

Outline

- **Introduction to Institute of High Energy Physics**
- **Major activities in non-accelerator experiments.**
- **An idea about VLBL from JHF to Beijing**

Institute of High Energy Physics
Chinese Academy of Sciences

The largest and comprehensive fundamental research center in China

For :

- **High energy physics**
- **Accelerator technologies and applications**
- **Synchrotron radiation technologies and applications**

Major research fields in IHEP

1. Particle physics experiment

- **Beijing Spectrometer: Tau – Charm physics**

  Beijing Electron Positron Collider (2 - 5GeV)

  10^{31} cm $^{-2}$ s $^{-1}$ @ 3.77 GeV

  Upgrade: BEPCII 10^{33} cm $^{-2}$ s $^{-1}$ @ 3.77 GeV

  BES III new detector

- **Intl. collaboration of HEP experiments:**

  L3 & Aleph @ LEP/CERN

  CMS & Atlas @ LHC

  Belle @ KEKB, Babar @ PEPII

Bird's Eye View of BEPC

Major research fields in IHEP

– **Particle-Astrophysics experiments**

- **Yangbajing Cosmis ray observatory**
  - **Air shower array detector**
  - **RPC carpet detector**
- **L3 Cosmic ray measurement**
- **Alpha Magnetic Spectrometer**
- **γ ray burst detector.**
- **Hard X ray modulated telescope**
- **Scientific balloon**
- **Atsrophysics and data analysis**

Dedicated Division and Open Lab.

55 physicists and engineers/technicians +students

Major research fields in IHEP

2. Theoretical physics

- **Particle physics and field theory**
- **Intermediate and high energy nuclear physics**
- **Particle-astrophysics and cosmology**

3. Accelerator technology

- **high luminosity e^+e^- collider**
- **high power proton accelerator**
- **application of low energy accelerators**

4. Radiation technique and application

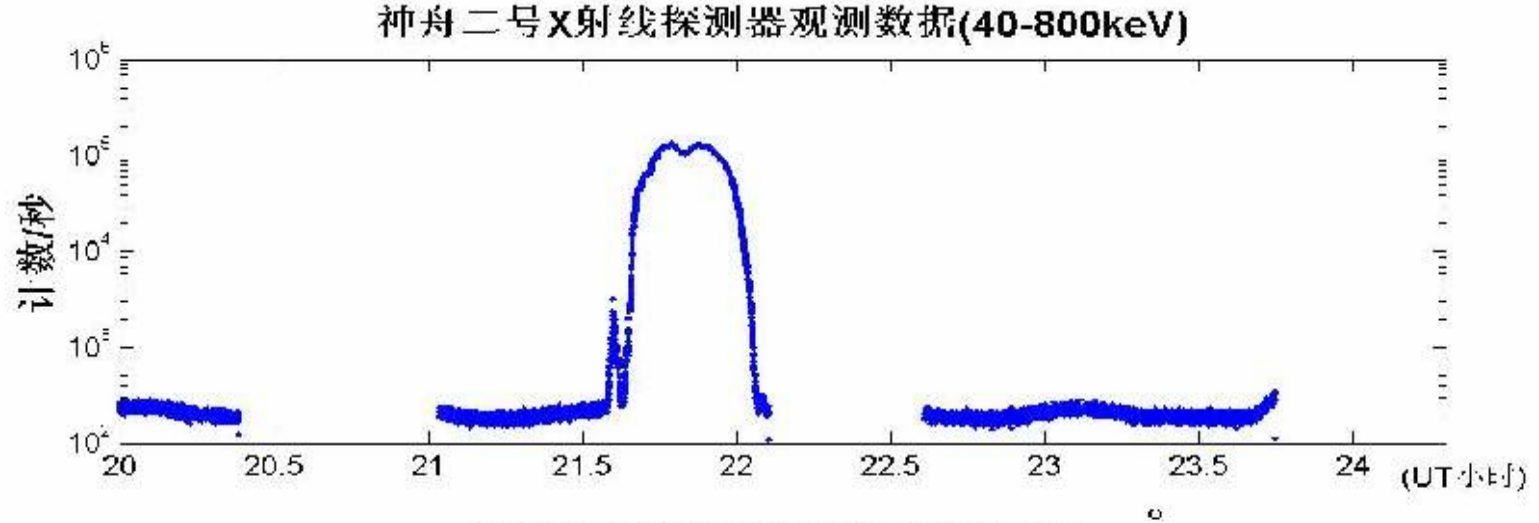
- **Synchrotron radiation**
- **Free electron laser**
- **Nuclear analysis techniques and its applications**

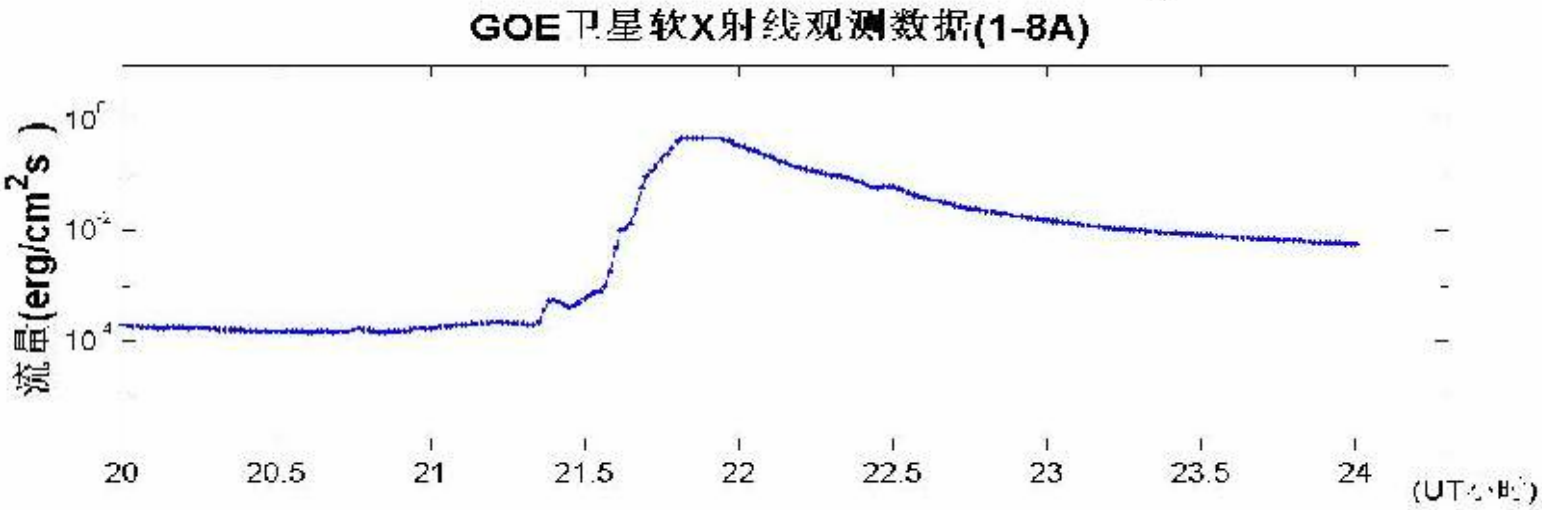
5. Nuclear detector and electronics

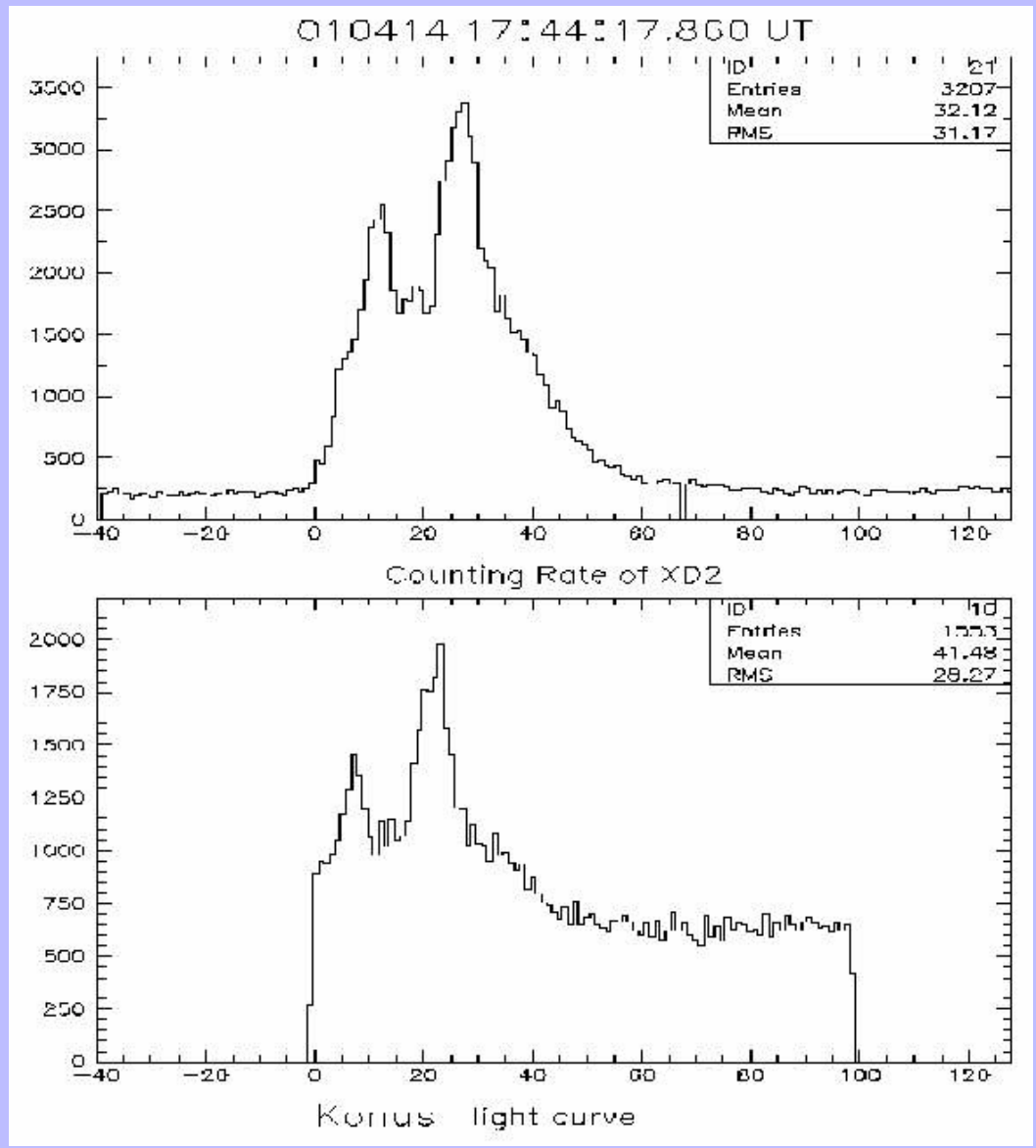
ARGO Experiment Area of YBJ Observatory

羊八井ARGO 实验区

γ-Ray burst detector in test flight of Chinese man-operated spacecraft

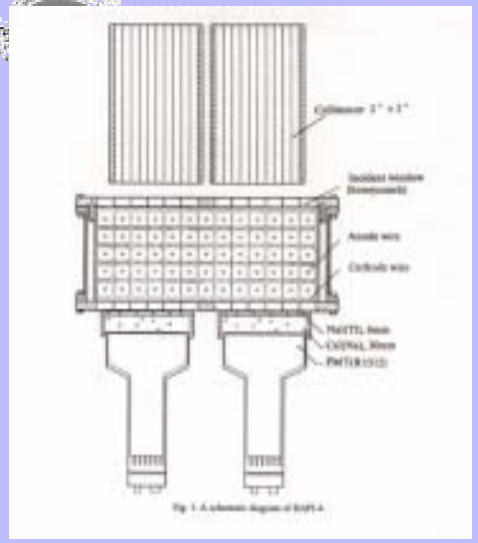

神舟二号X射线探测器观测数据(40-800keV)
计数/秒
20
20.5
21
21.5
22
22.5
23
23.5
24
(UT小时)

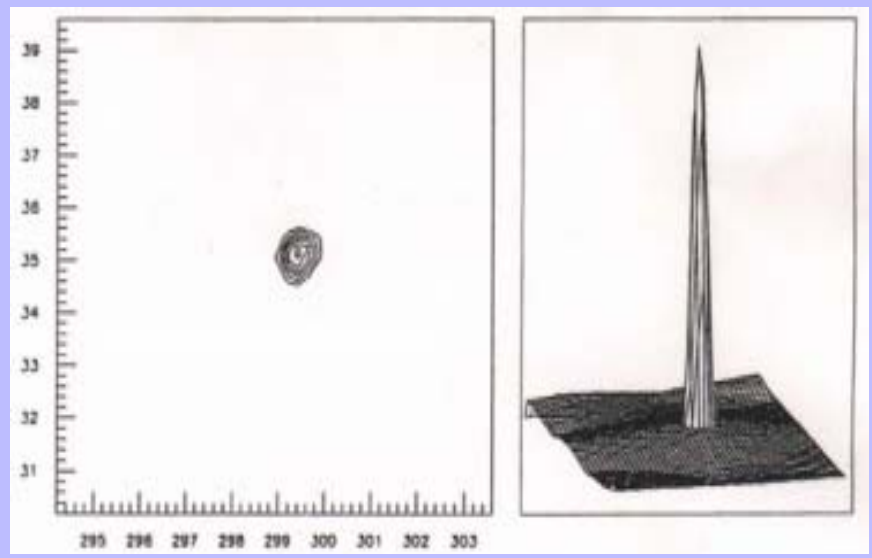

GOE卫星软X射线观测数据(1-8A)
流量(erg/cm2s)
20
20.5
21
21.5
22
22.5
23
23.5
24


010414 17:44:17.860 UT
ID 21
Entries 3207
Mean 32.12
RMS 31.17
3500
3000
2500
2000
1500
1000
500
0
−40
−20
0
20
40
60
80
100
120
Counting Rate of XD2
ID 10
Entries 1553
Mean 41.48
RMS 28.27
2000
1750
1500
1250
1000
750
500
250
0
−40
−20
0
20
40
60
80
100
120
Konus light curve

Scientific balloon (40K m^3 height 40km)

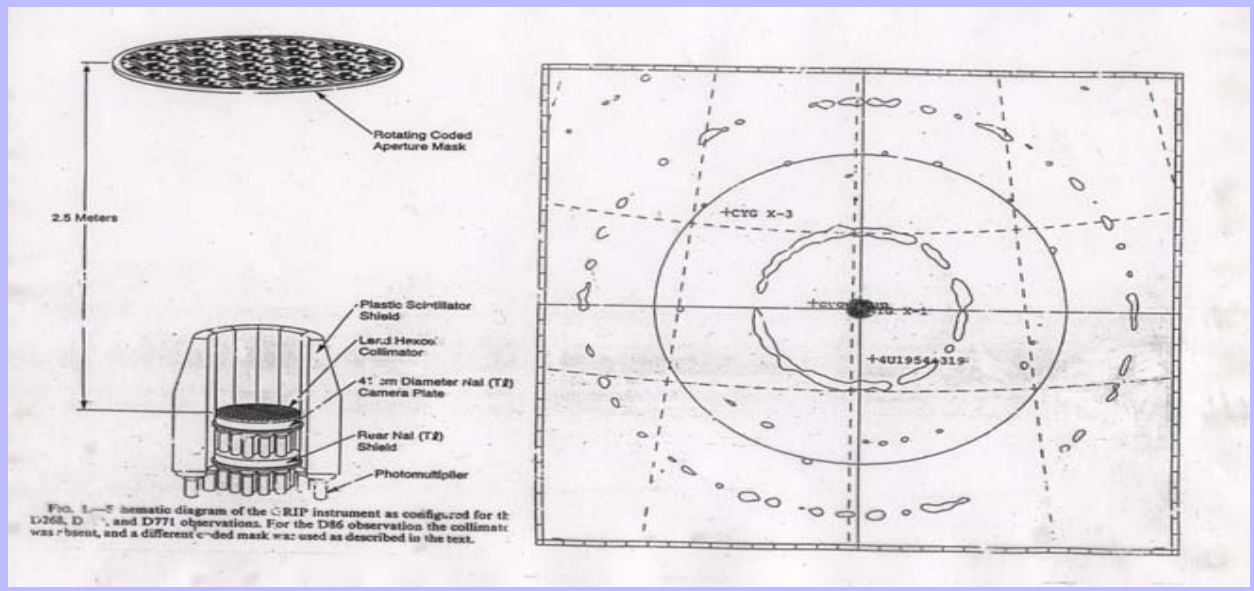
球載硬Ｘ射线望远镜ＨＡＰＩ－４





HAPI-4 / IHEP

1993. 9. 25



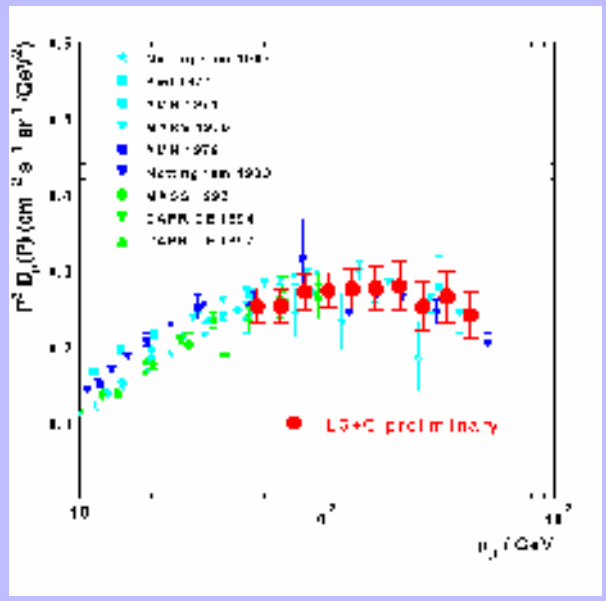
GRIP / Caltec

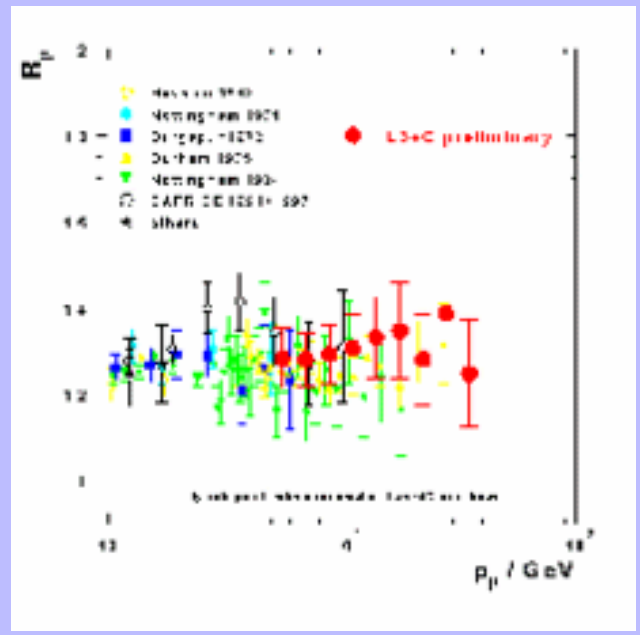
1993. 9. 20

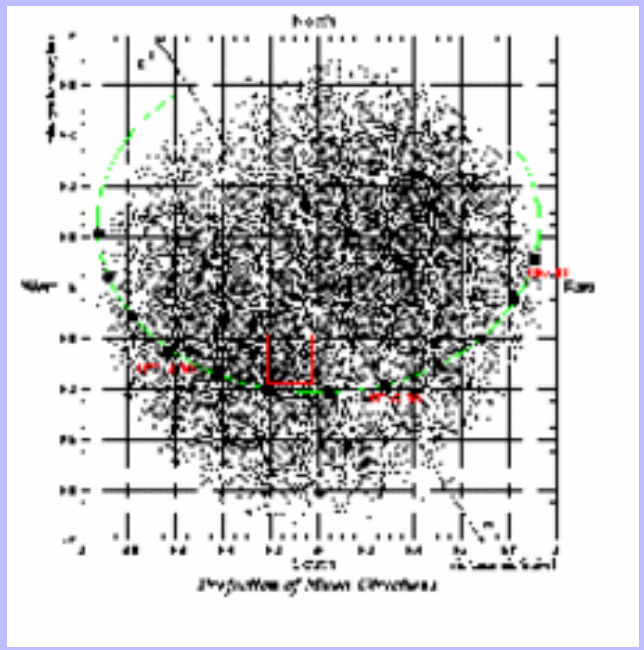
L3 Cosmic ray measurement

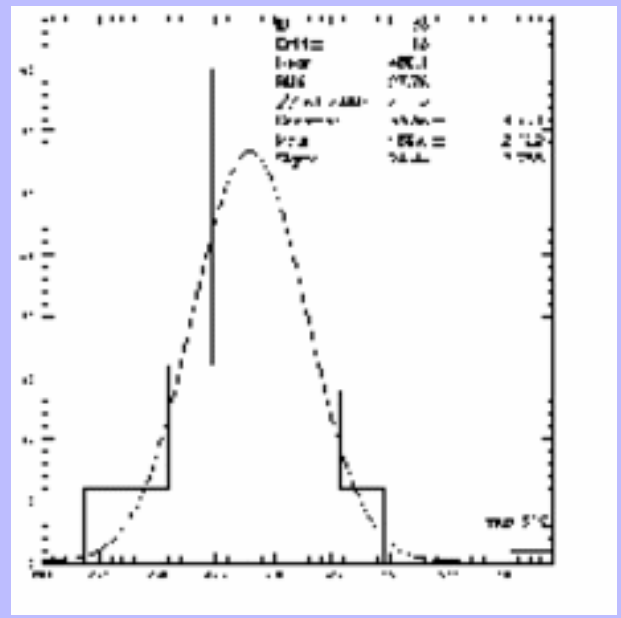
L3 Cosmic ray measurement

- Motivation:
  - Precision measurement of cosmic ray muon spectrum
  - Search for WIMP, e.g. Yunnan event
  - Sun and moon shadow
- Addition detector:
  - T0 counters: 200 m^2
  - independent trigger and DAQ
- Data taking 1998 – 2000: $2X10^9$ EVENTS

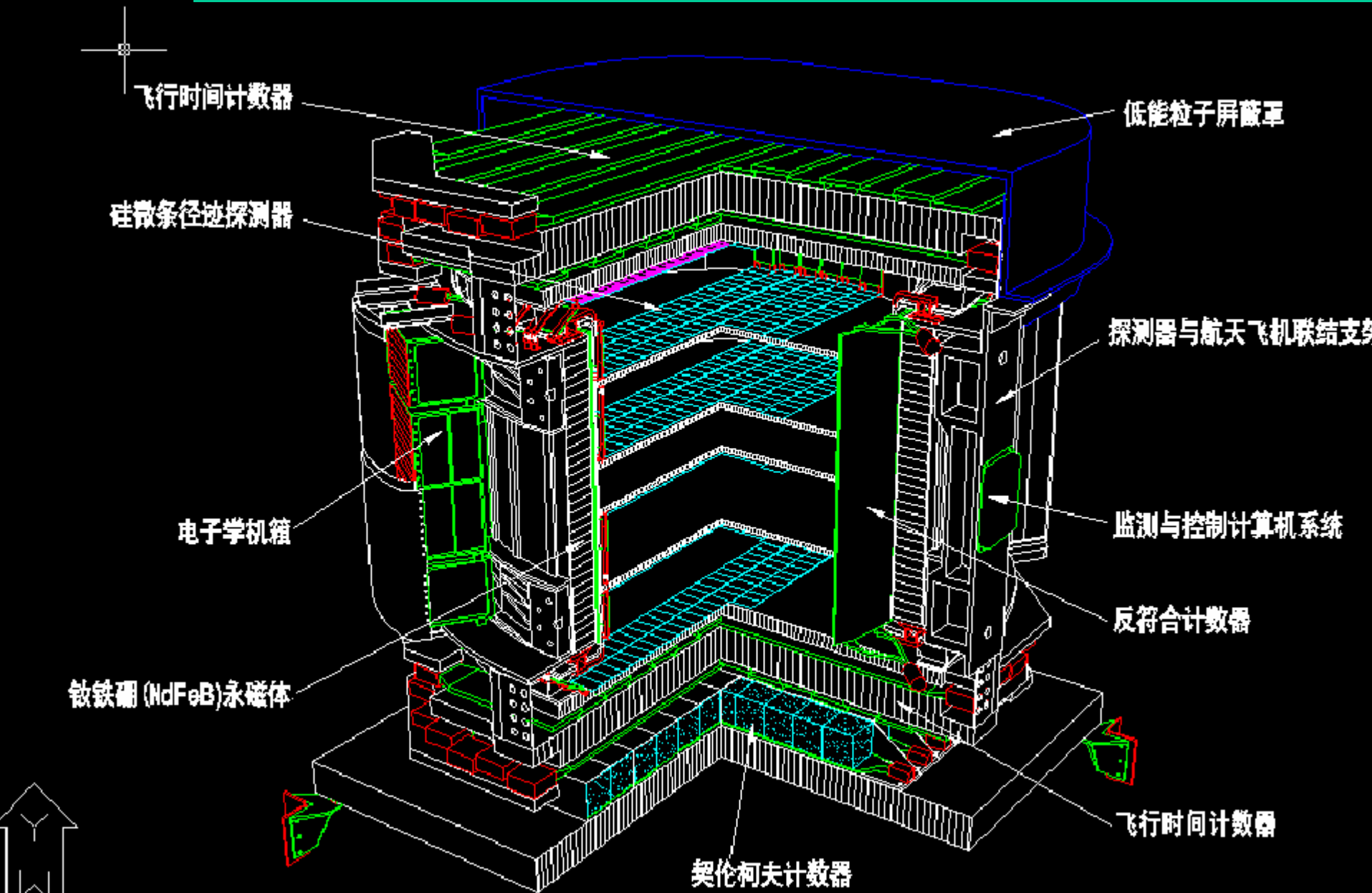

L3+C preliminary


L3+C preliminary



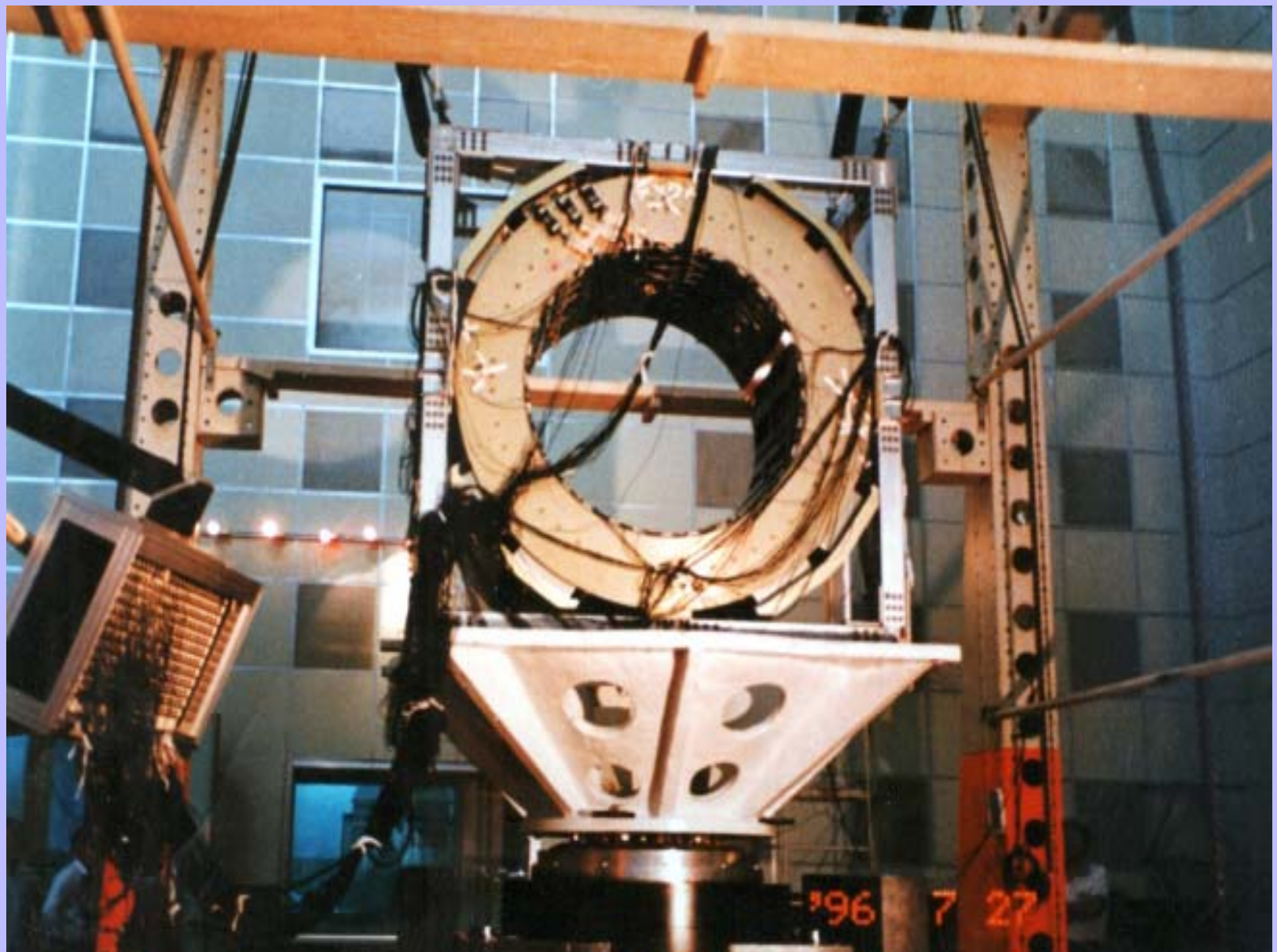


Alpha Magnetic Spectrometer (01)

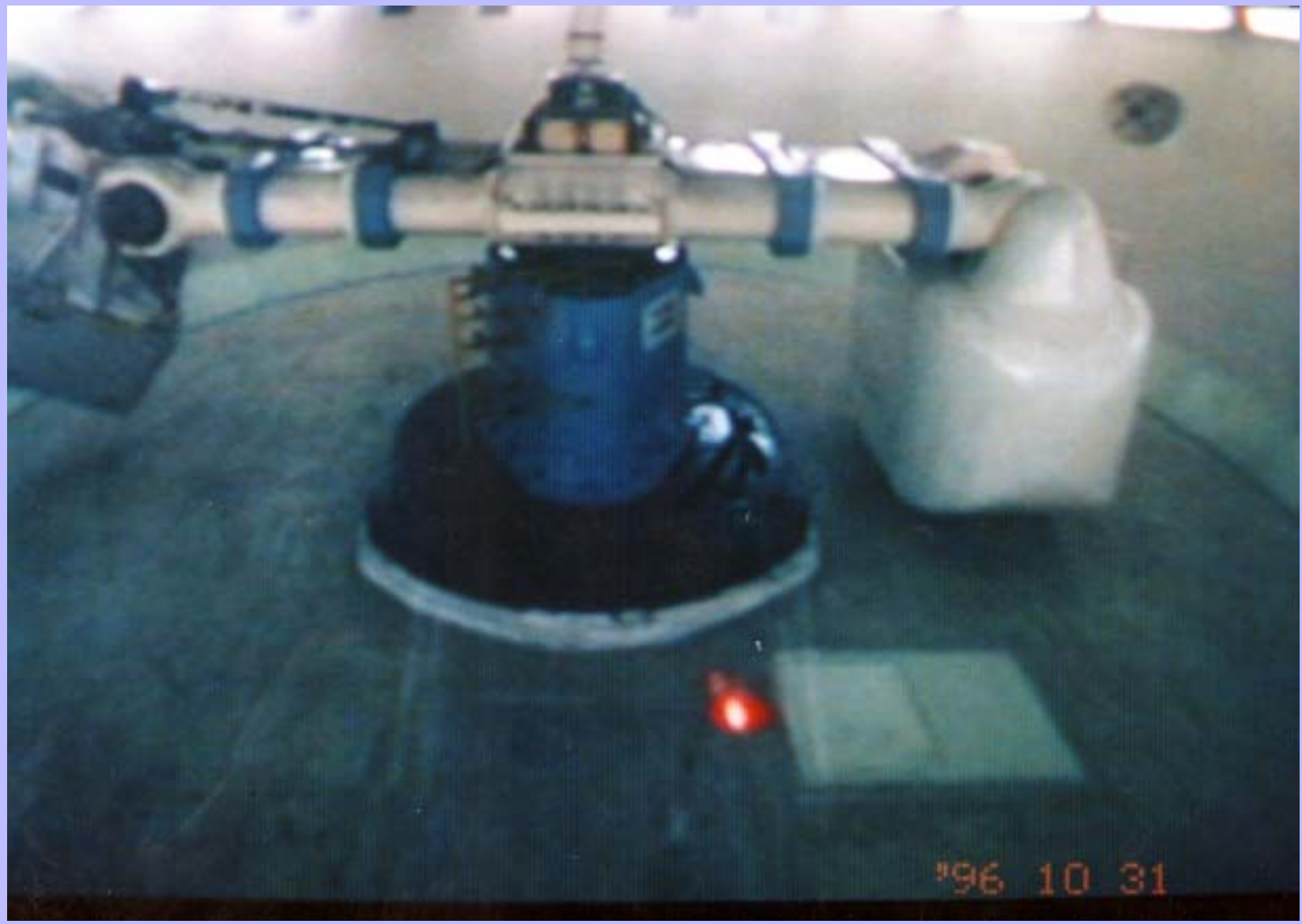


AMS01 magnet: First magnetic in Space

built and Space qualified in Beijing (95-97)



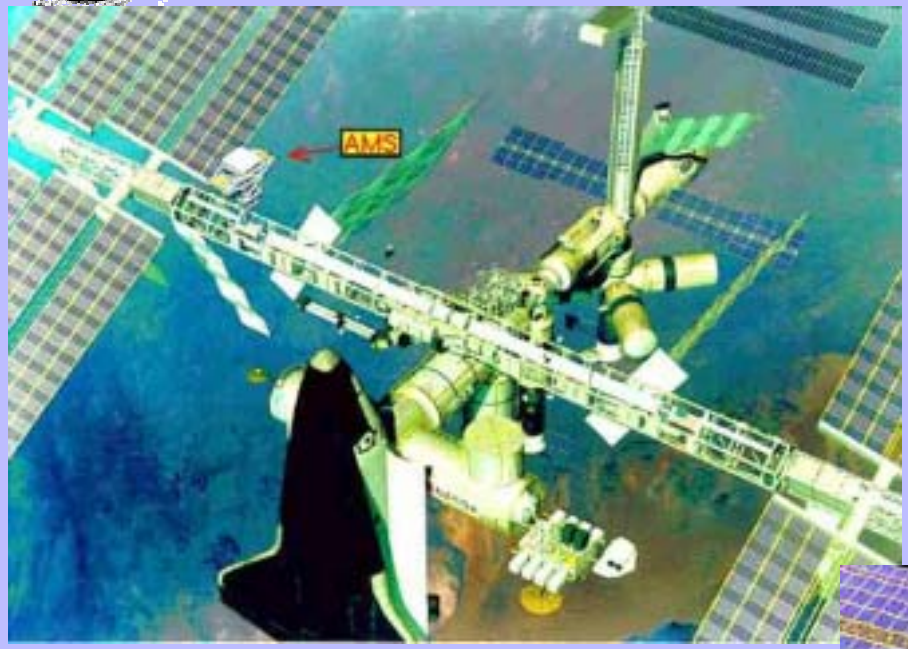
Centrifuge test with 19g



Physics results from AMS test flight

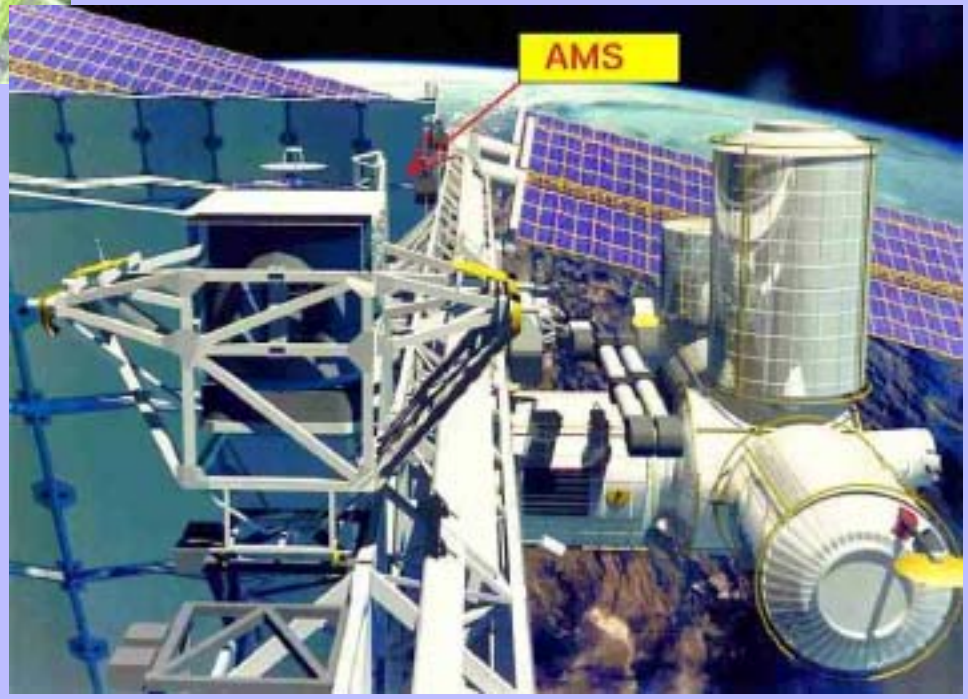
The test flight was carried out by Space shuttle Discovery June 2-12 1998.

- Second cosmic ray proton spectrum below geomagnetic cut
- e^+ / e^- is 4: 1 upto 1.5 Gev
- ^3He is dominated in He isotope below geomagnetic cut

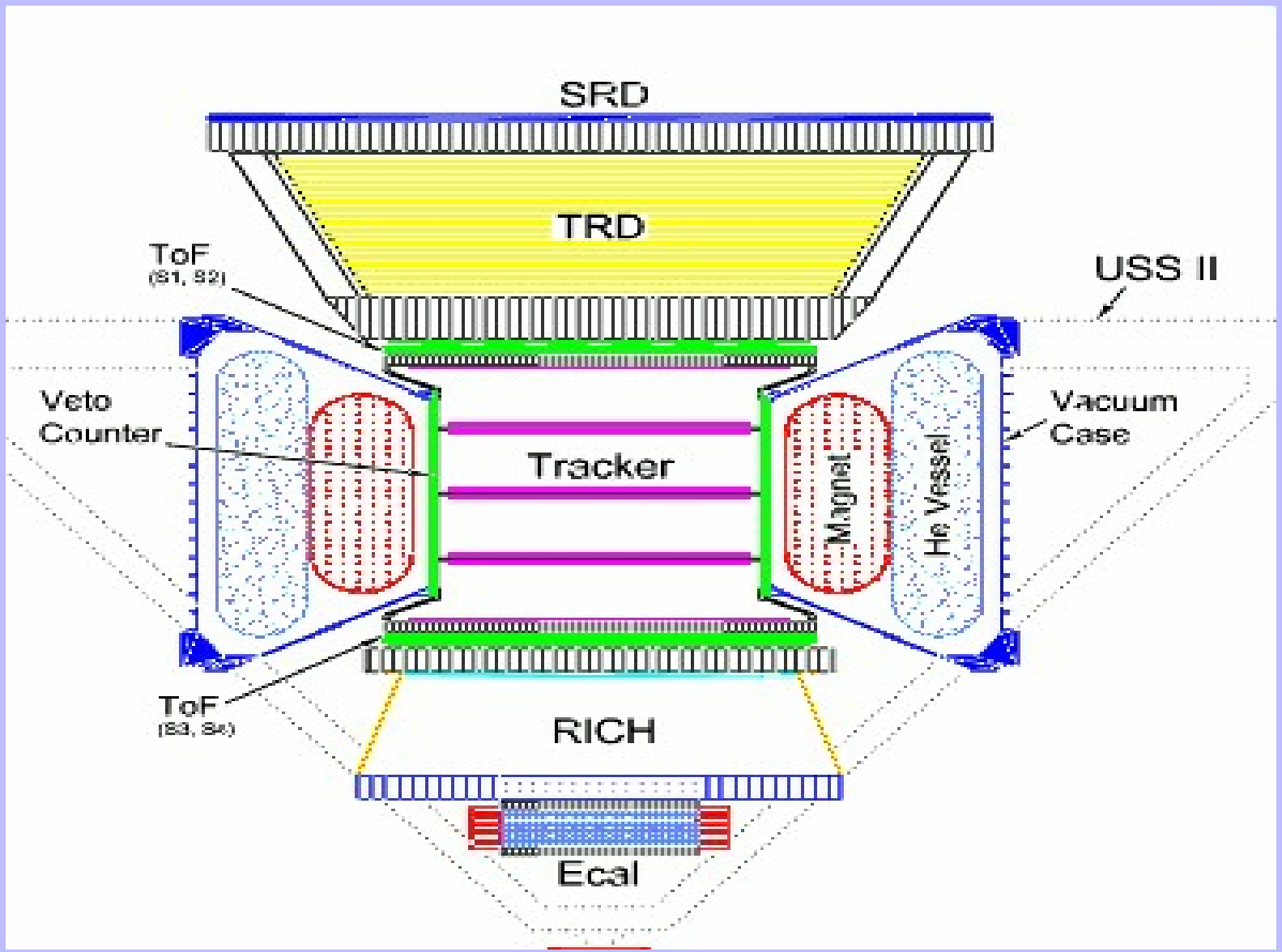


AMS02:

ISS 2005

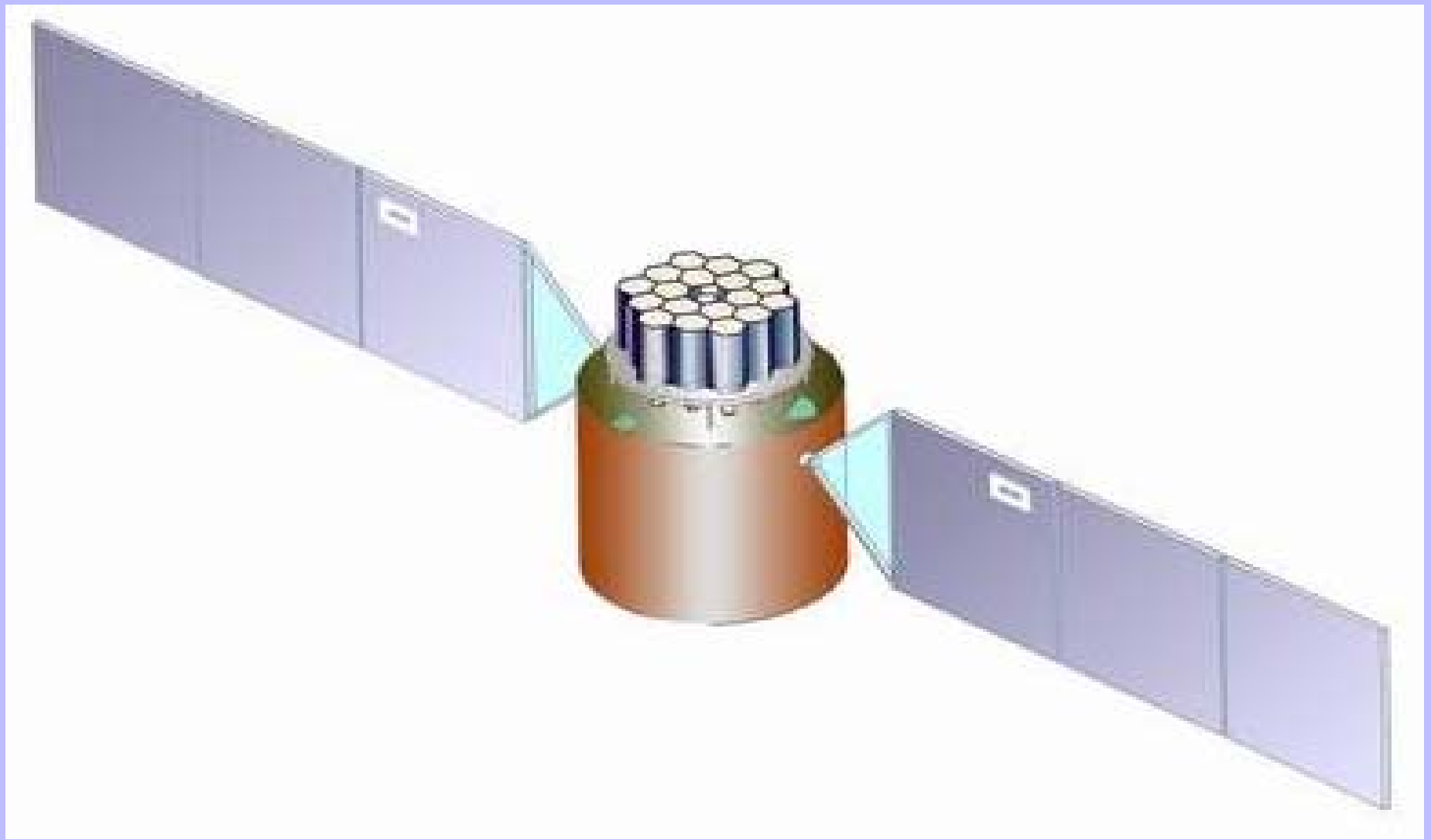


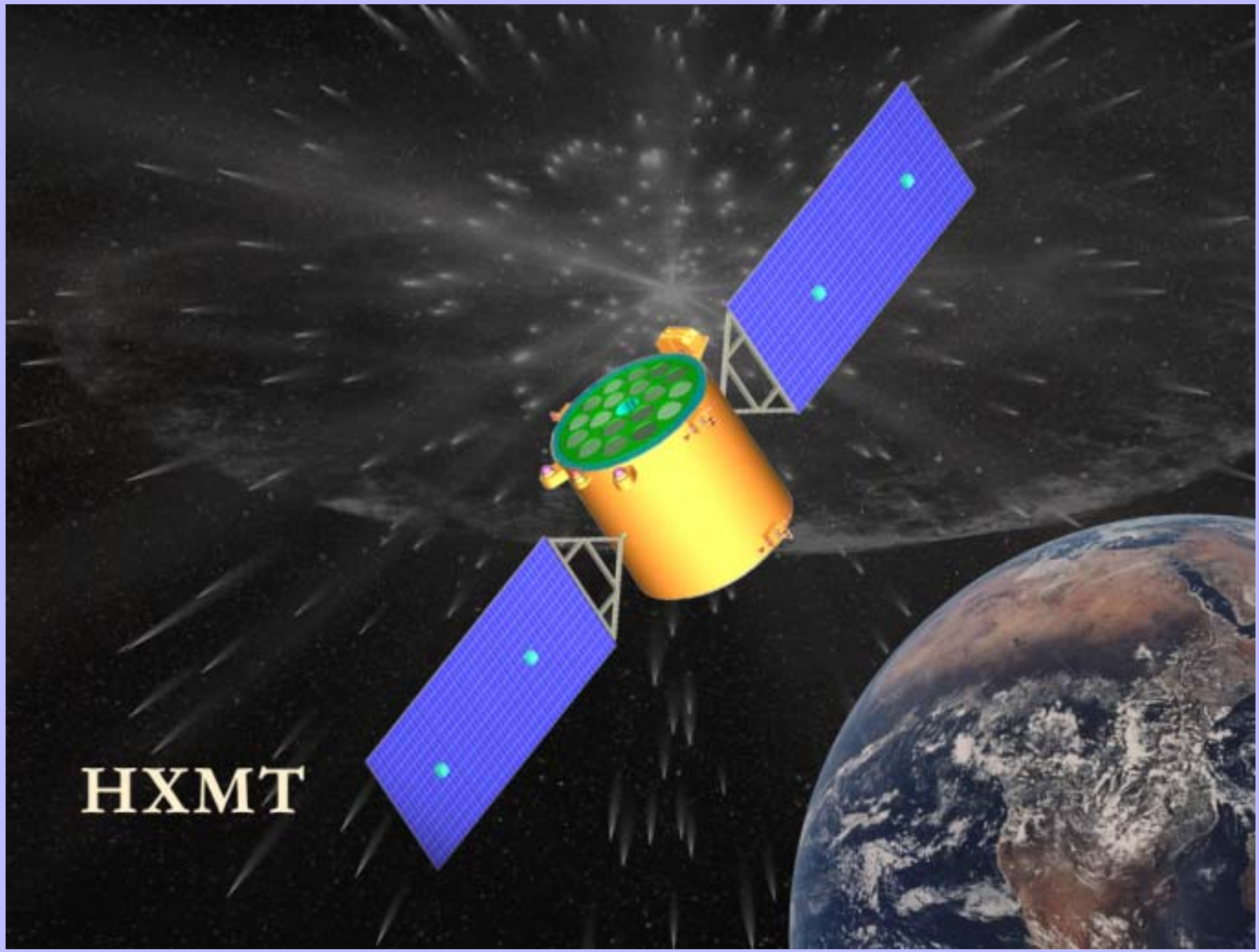
AMS02


SRD
TRD
ToF
(S1, S2)
USS II
Veto
Counter
Tracker
Magnet
He Vessel
Vacuum
Case
ToF
(S3, S4)
RICH
Ecal

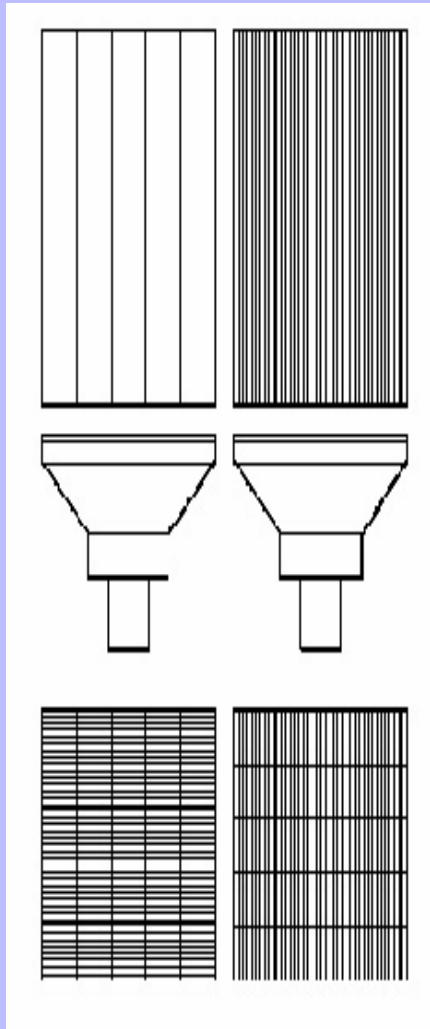
Prototype of E.M. Calorimeter of AMS02 built by IHEP, sent to CERN for beam test

The Hard X-ray Modulation Telescope (HXMT) Mission

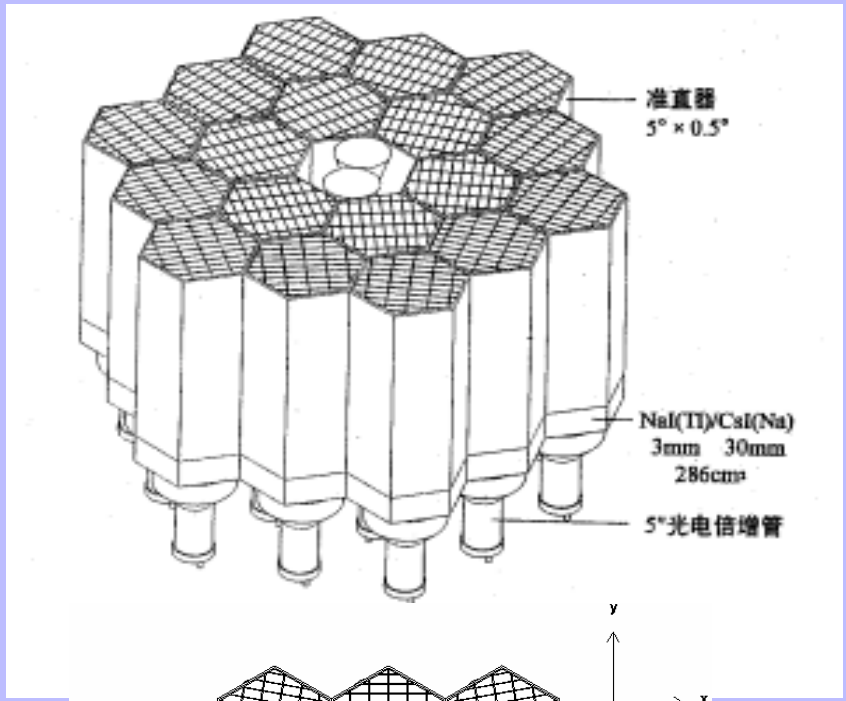


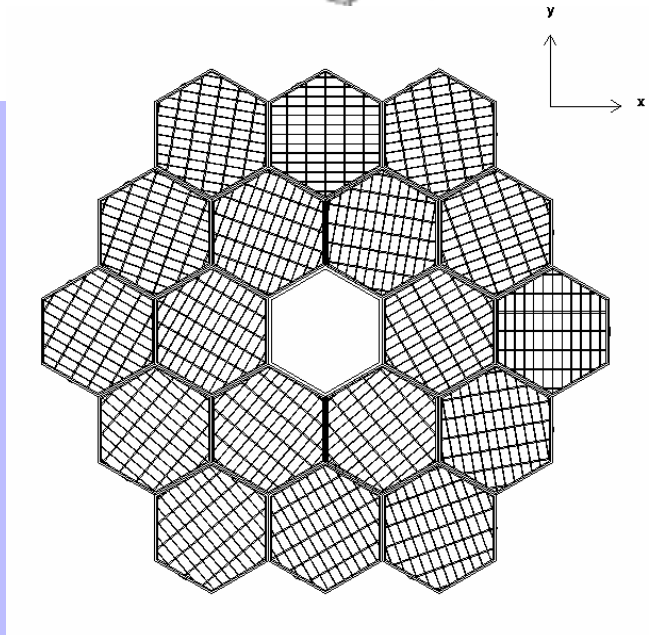

HXMT

The structure of the 18 detectors of HXMT

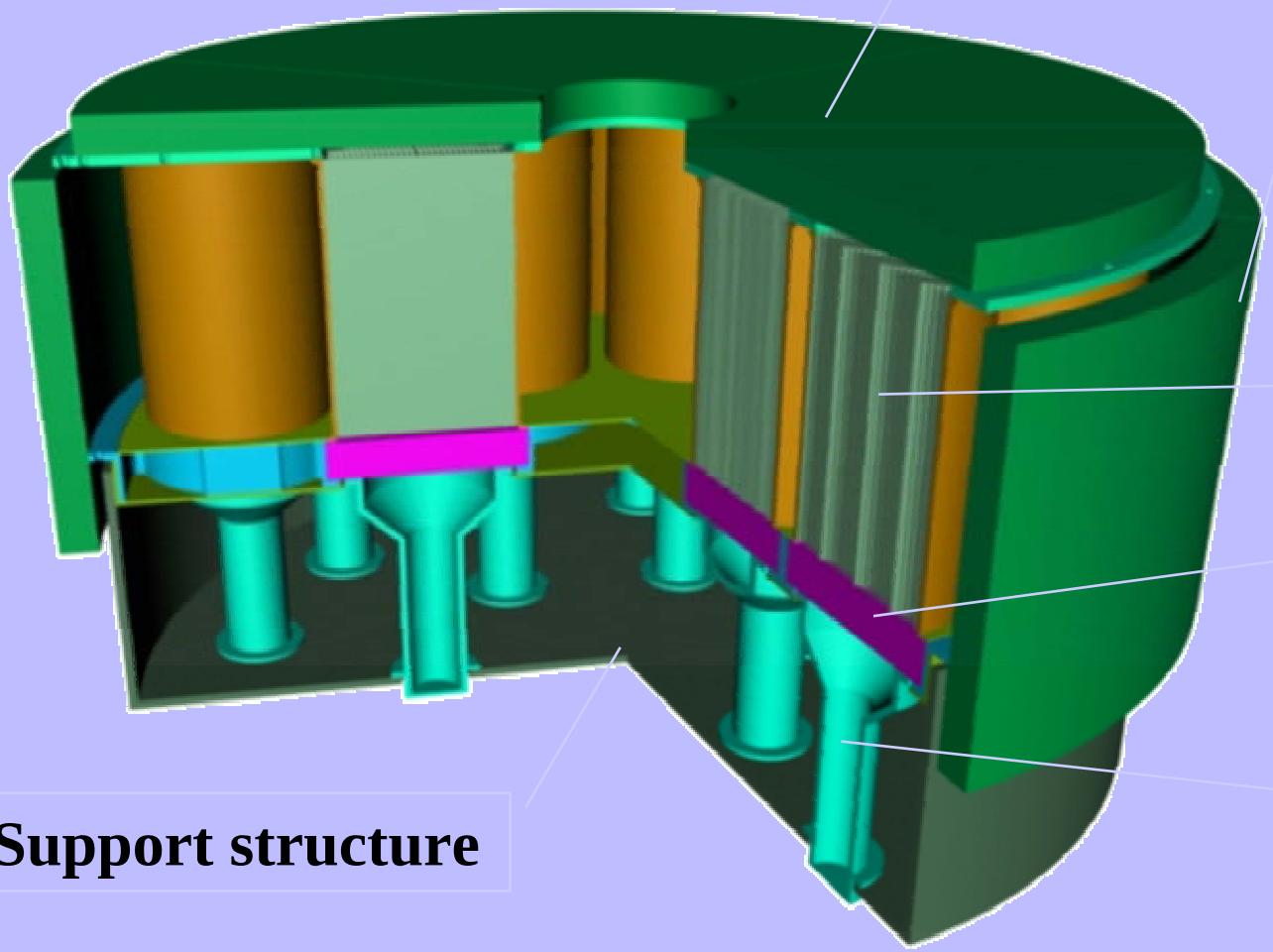


A detector unit

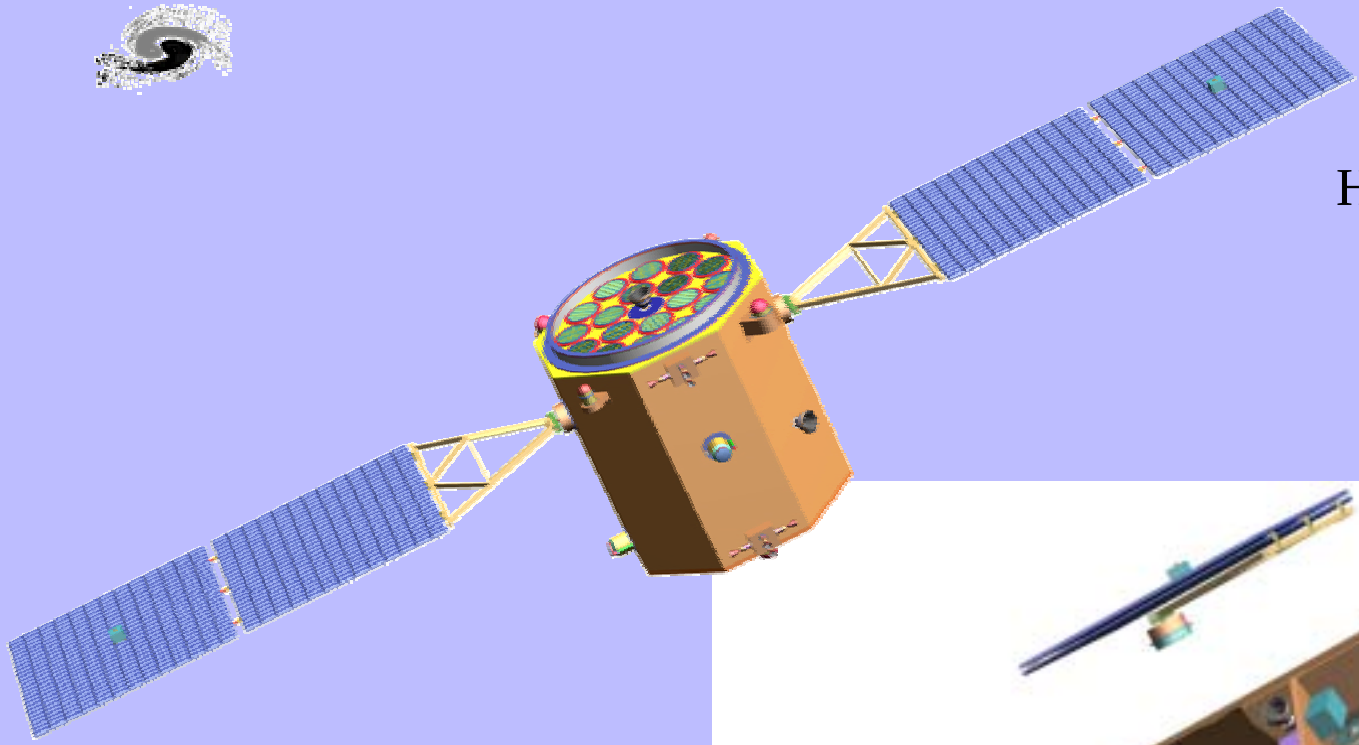


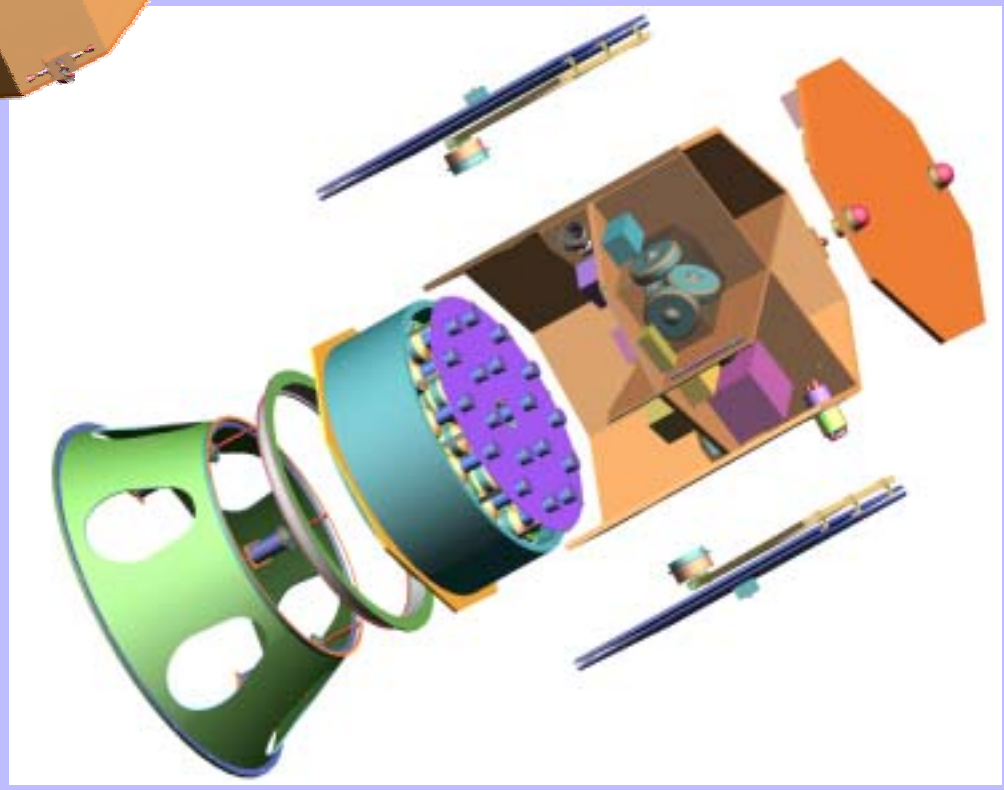


Hard X-ray Modulate Telescope

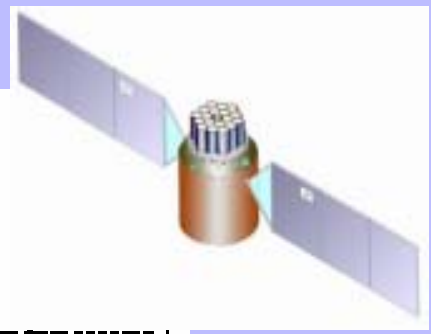


HXMT构型方案1



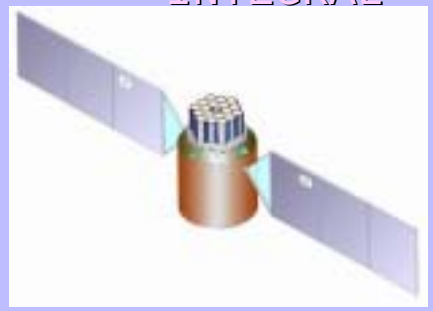


The key parameters of HXMT mission

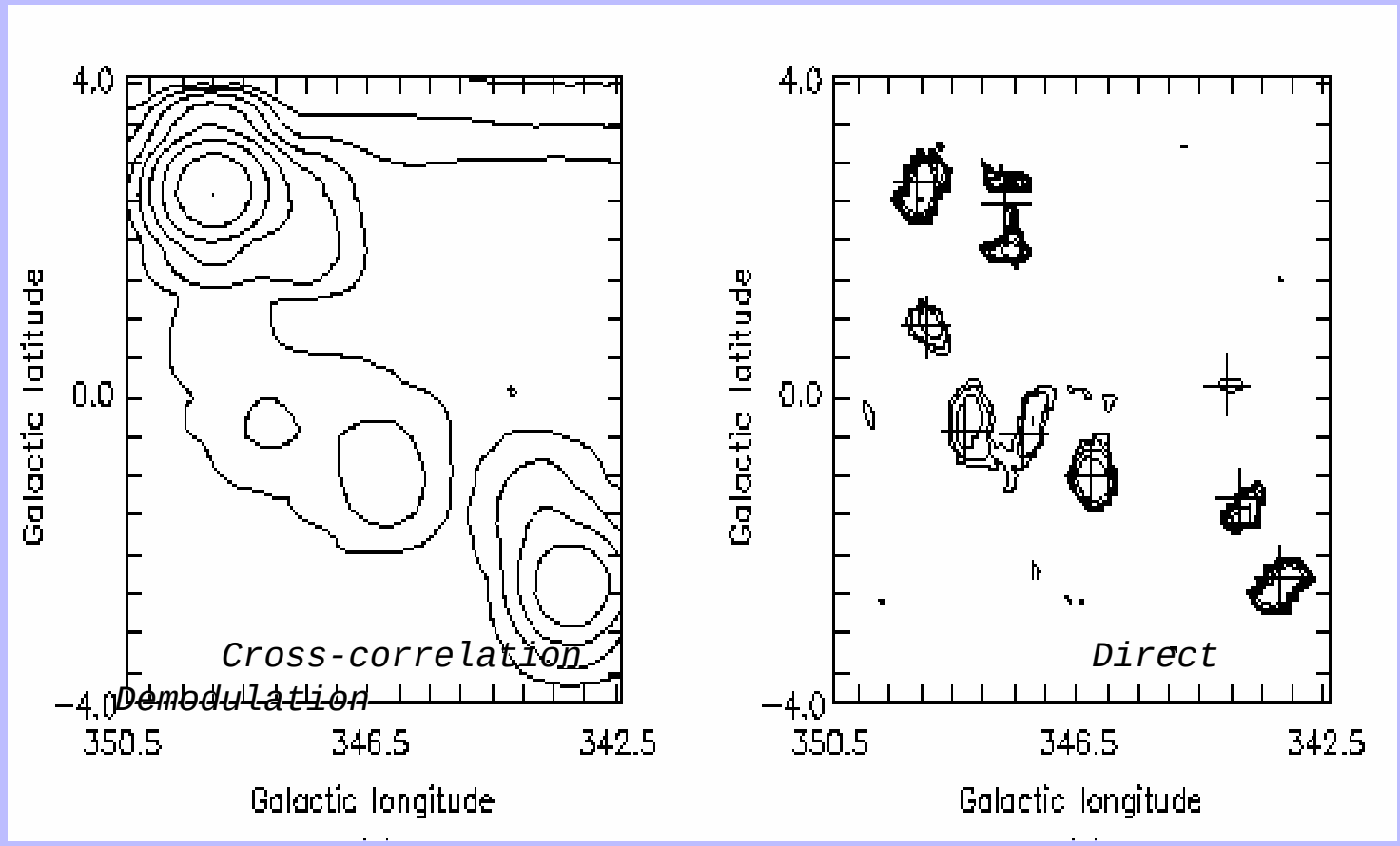


Energy Range	10–200 keV
Energy Resolution	$\sim$ 18% @ 60 keV
Angular Resolution	$\leq 10'$
Source Location (20σ source)	$\leq 1'$
Sensitivity	3×10^{-7} cm^{-2}s^{-1}keV^{-1} (continuum)
(3σ, in 10^5s @ 100keV)	1×10^{-5} cm^{-2}s^{-1} (narrow line)
Orbit	Altitude: $\sim$ 550 km circular
	Inclination: $\sim 43°$
Attitude	Three-axis stabilized
	Control precision: $\pm 0°.25$
	Measurement accuracy: $\pm 0°.01$
Data Rate	$\sim$ 30 kbps
Mass	Science instrument: $\sim$ 600 kg
	Total payload: $\sim$ 1400 kg
Nominal Mission Lifetime	2 years

Comparison between HXMT and INTEGRAL

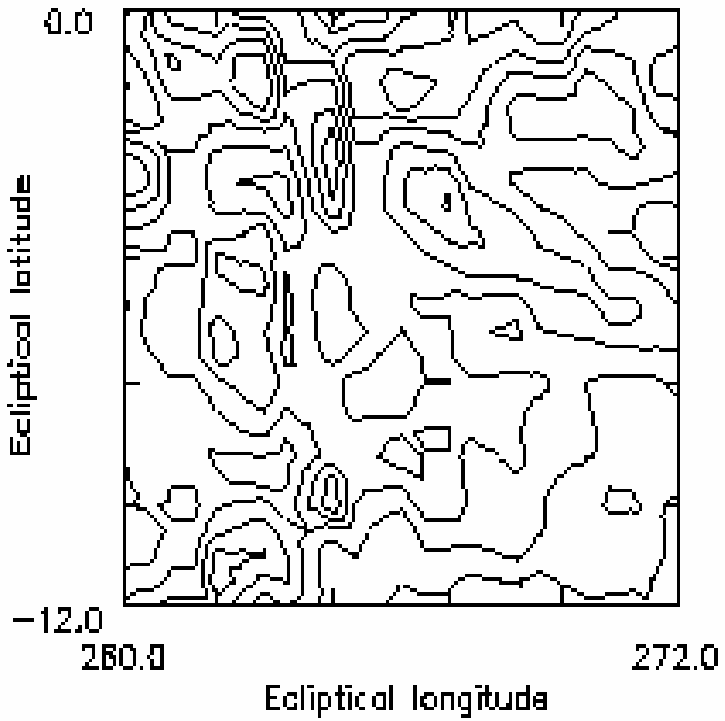


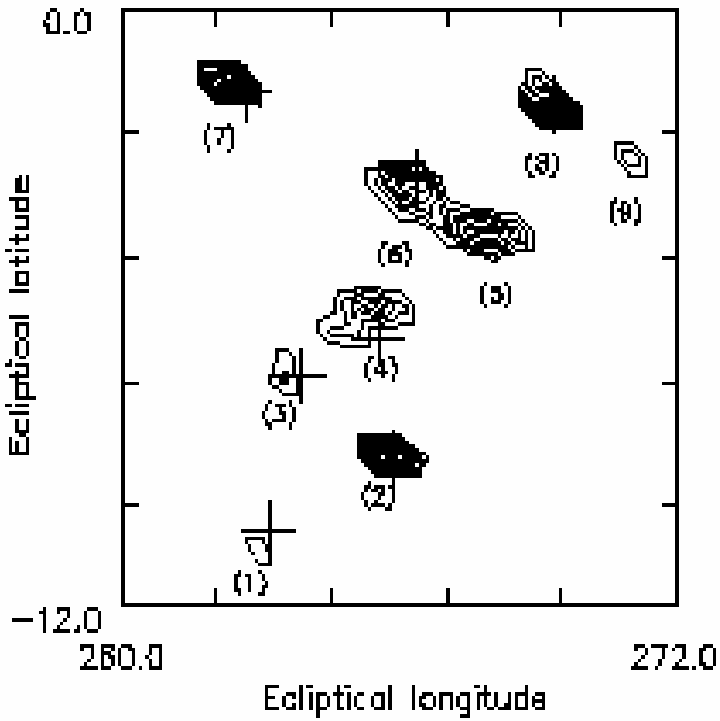
	HXMT	INTEGRAL
Angular Resolution	2’	15’
Source Location	0.2’	2’
Sensitivity (10^-7 / cm^2 S keV)	3	10
Observation Mode		
survey	yes	no
local imaging	yes	yes
pointing	yes	no



X-ray map from EXOSAT-ME slew observations

(from Lu et al. 1996, *Astron. Astrophys.Suppl.* **115**, 395)





Cross-correlation Demodulation ***Direct***

Hard X-ray map of the galactic center region from HEAO1-A4 survey

(from Lu et al. 1995, *Proc. CHEP'95*, 848)

Possible LBL ν Experiment in Beijing using JHF ν Beam

Results from Super-K and K2K indicate important breakthrough of particle physics

JHF and its ν beam to Super-K (295 km) will be approved soon

Minos and Opera : about 750 KM

LBL ν experiment with distance of 2000 - 4000 km is very interesting to study ν physics

We should promote an possible international collaboration of LBL ν experiment in Asia

Possible LBL ν Experiment JHF to Beijing

There is a good tunnel available in the north of Beijing: Aviation museum

- 20 km north of Beijing, near the highway to the great wall
- The tunnel is 560 m long, 34 meter wide, 13 meter height , 150 m rock on top
- Good infrastructure available
- 2200 km to JHF, 9.5^{o} dip angle
- Good distance for ν CP violation + many interesting physics

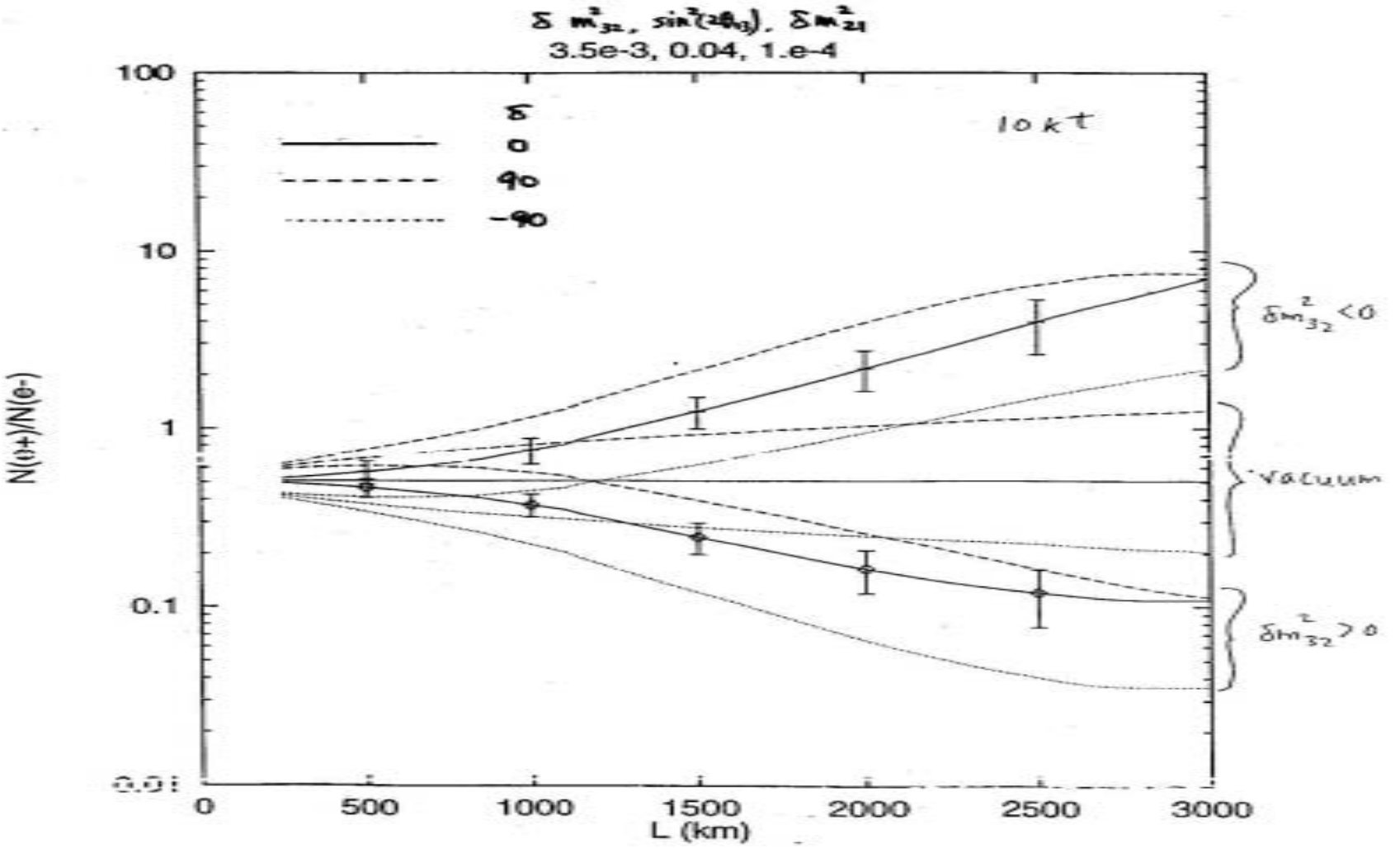
Aviation Museum

航空博物館外景

航空博物館大門

航空博物館隧道內景

Measurement of ν CP violation phase



How do push JHF-Beijing LBL ν Experiment

Its physics studied extensively joint by KEK and IHEP: very important physics

Discussion about the beam: it is much better to include such possibility in the design of JHF neutrino beam line.

Chinese NSF and CAS are interested in the idea, and express the intention to support the experiment.

The close discussion and cooperation between ICRR and IHEP are very important.


Thank
You !
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