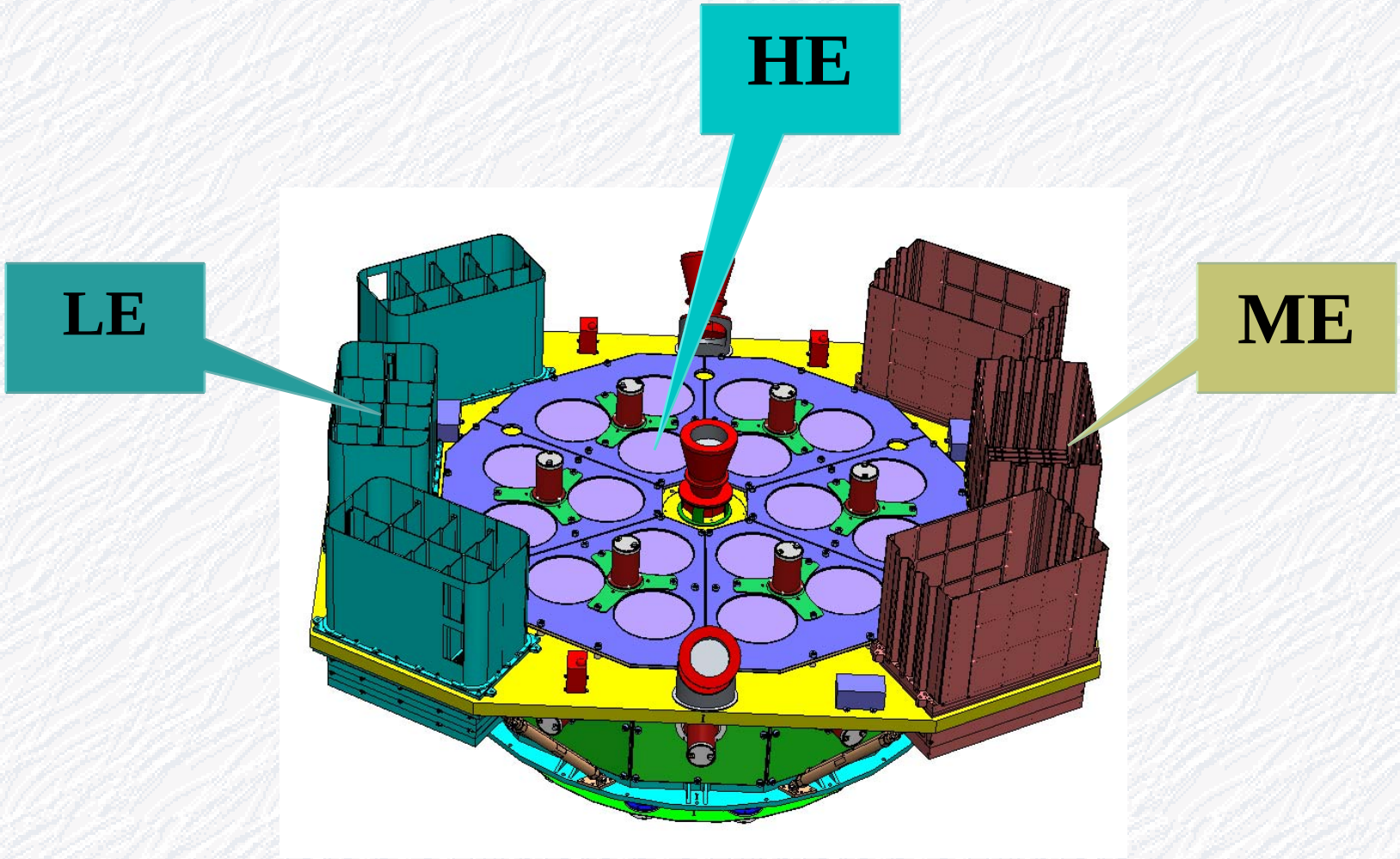
HXMT/HE development and calibration status

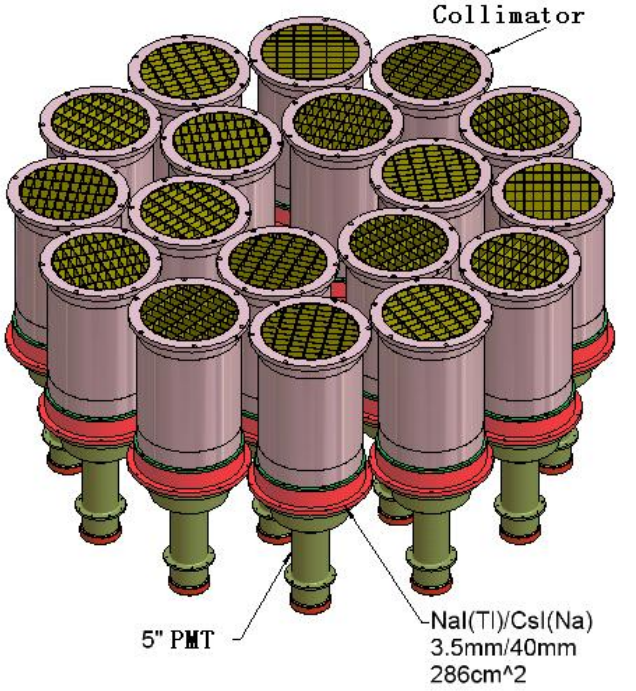
Liu Congzhan
IHEP,China

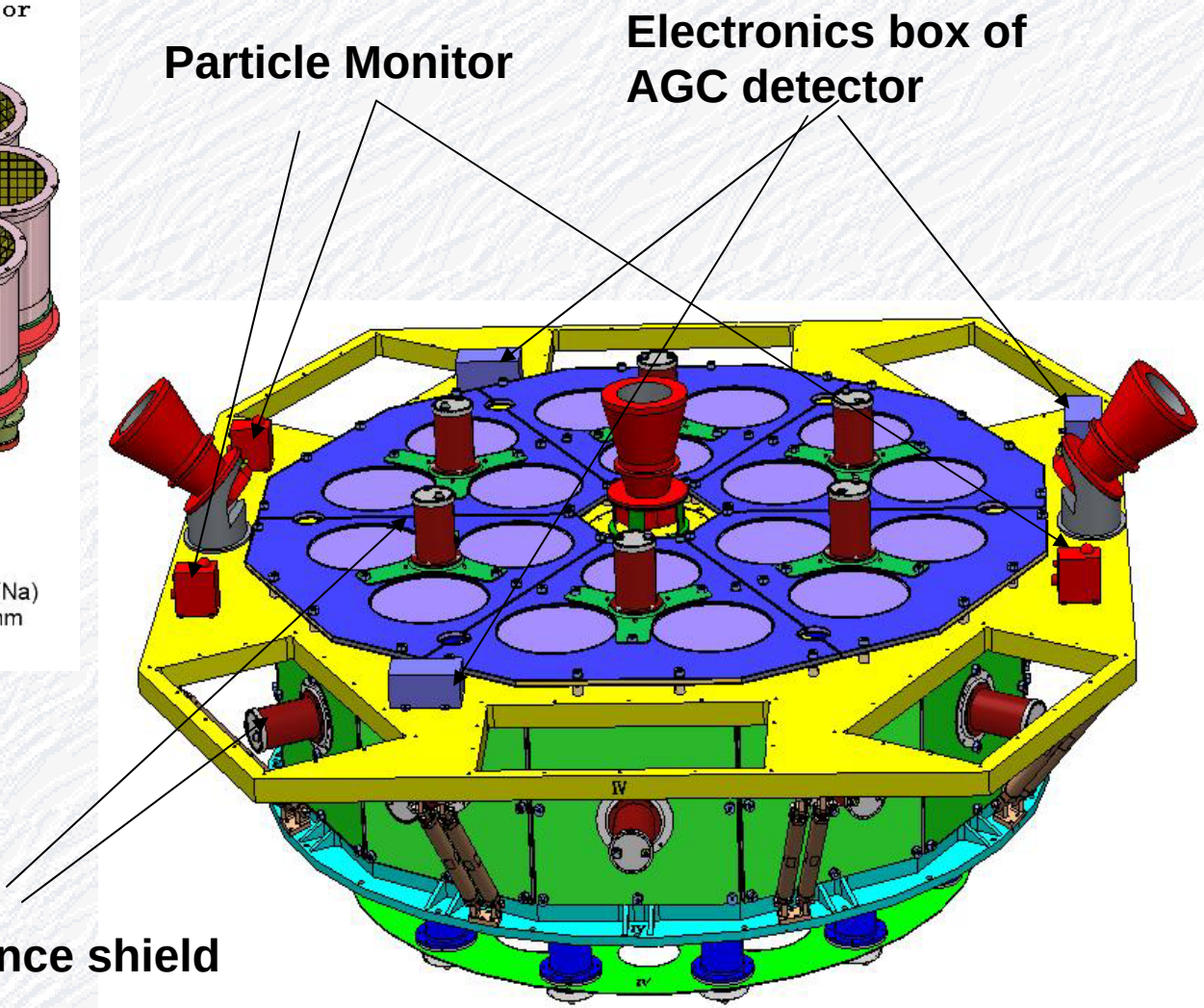
On Behalf of HXMT/HE Team

Overview



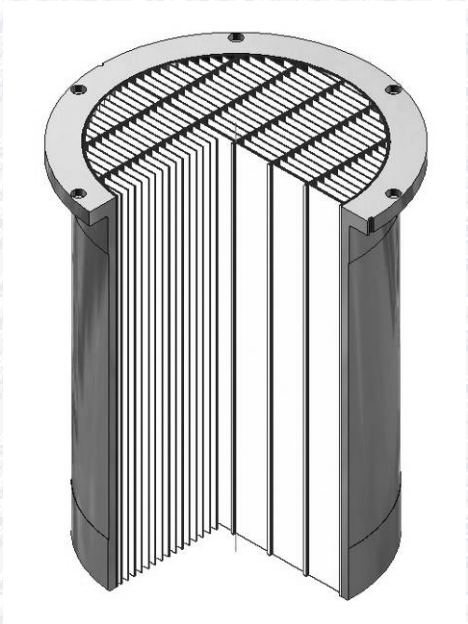
Overview

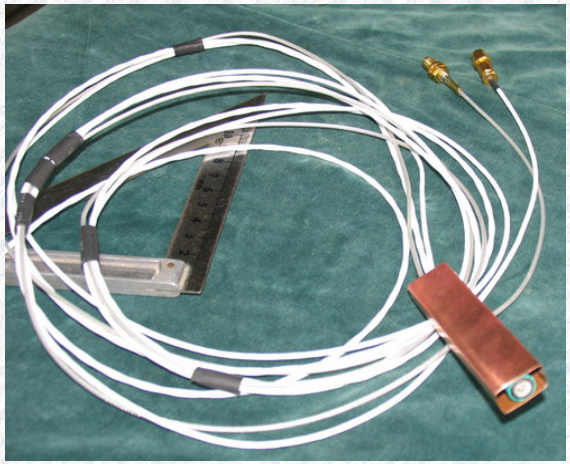

Collimator
5" PMT
NaI(Tl)/CsI(Na)
3.5mm/40mm
286cm^2

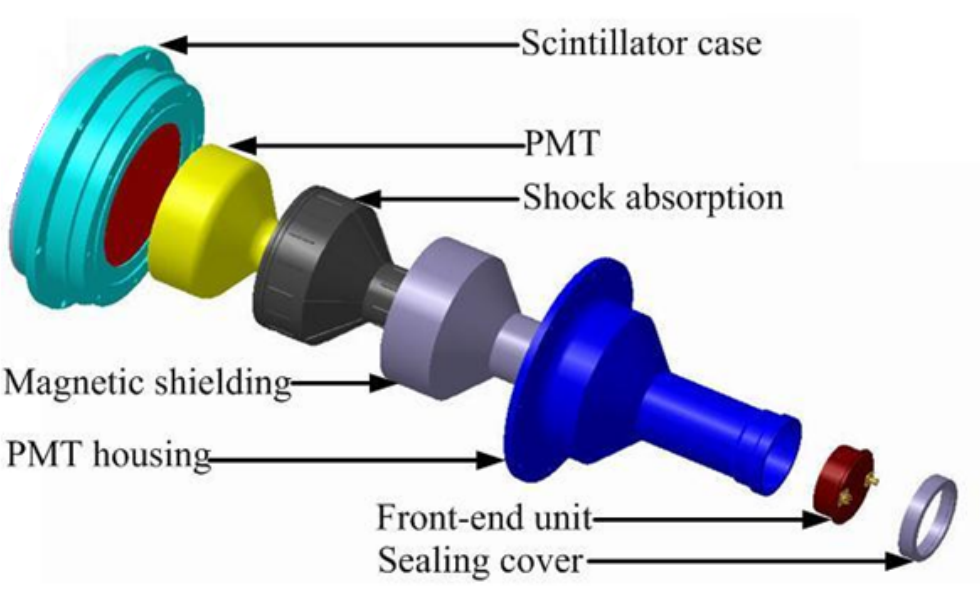

Particle Monitor
Electronics box of
AGC detector
Anticoincidence shield

Phoswich Detector Unit

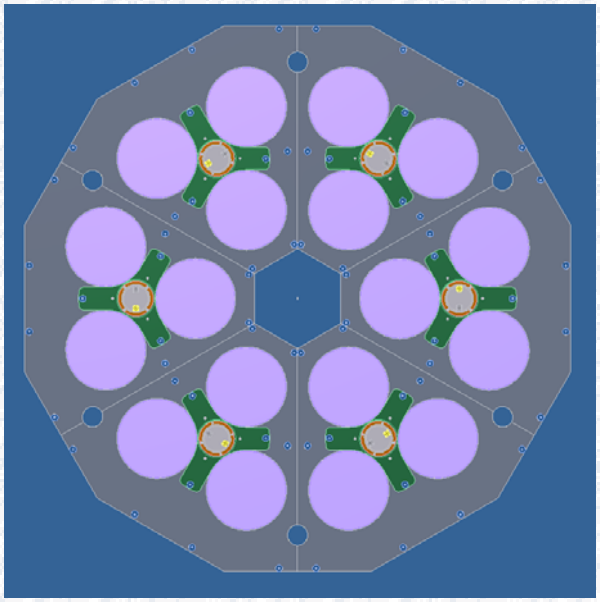
Collimator

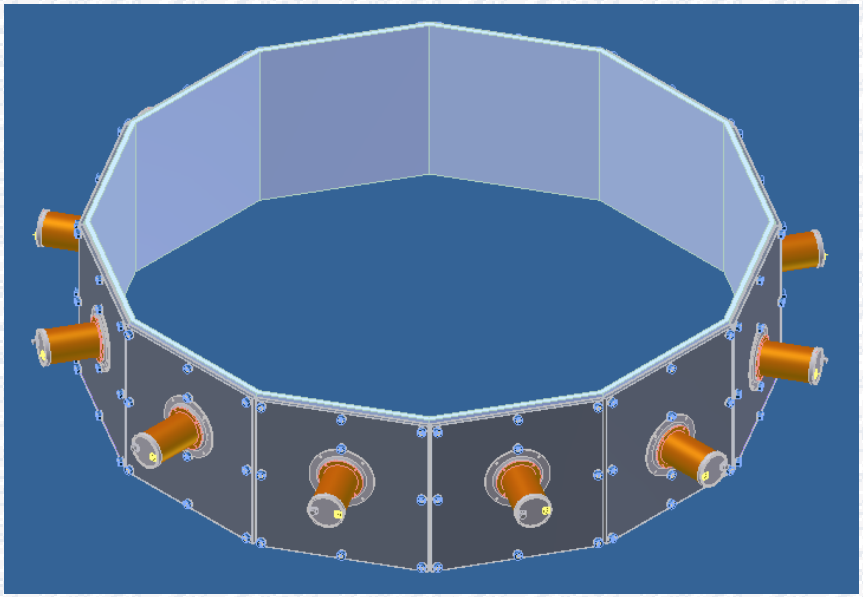






Anticoincidence Shield Detectors





6 Top slabs

12 Lateral slabs

Key Characteristics

Phoswich	**NaI(Tl)/CsI(Na)**
Energy Range	**20-250 keV**
Field of View (FWHM)	**1.1°×5.7° (15 units), 5.7°×5.7° (2 units); 1.1°×5.7° (Blind, 1 unit)**
Geometrical detector area	**~ 5000 cm^2**
Spectral Resolution	**< 19%@60 keV**
Time Resolution	**< 25 μs**

Prototype models of these units have been implemented.

A very preliminary calibration requirement document has been completed.

Calibration Items

On-ground Calibration

	items	symbols	methods
Energy Response	Channel-Energy Relation	*E-I*	Radioactive sources(~10 lines, 10keV~300keV) Synchrotron radiation(0.2keV~50keV)
	Spec. Resolution	*FWHM-E*	
	Response Matrix	*RMF-E*	
Effective Area	Effective Area	*A-E*	
Collimator Response	Field of View	*PSF*	Radioactive sources(^{241}Am, etc.) (for high energy band) optical image (for low energy band)
	Alignment	*Ad*	
Timing	Dead-time	*Td*	Radioactive sources(^{241}Am)
	Time resolution		Relative timing/absolute timing
Shield Anticoincidence Detector	Threshold Energy	*Thres-E*	Accelerator (p, e) Cosmic ray μ
	Dead-time	*Td*	
	Detection Efficiency	*eff*	

On-ground Calibration

AGC Detector	Detection Efficiency	*eff*	Radioactive sources(^{241}Am)
Particle Monitor	Threshold Energy	*ThresE*	Accelerator
	Detection Efficiency	*eff*	Accelerator (p, e)
Temperature Response	Temperature effect to noise level (spurious signal)	*Bg-T*	Environment simulation facility
	Temperature effect to instrument response	*E(I，T）*	Radioactive sources(~10 lines, 10keV~511keV) Environment simulation facility
		R(E,T)	
		RMF(E,T)	
Charged Particle	Effect for dead-time	*Td*	Accelerator

On-ground Calibration

- Temperature Dependence
  - Thermal-vacuum environment
  - Different temperature

  - Overall the calibration items

In-Orbit Calibration

	items	symbols	methods
Energy Response	Channel-Energy Relations	*E-I*	60keV: AGC calibration source(^{241}Am) K x-rays from Collimators
	Spectral Resolution	*FWHM-E*	
	Response Matrix	*RMF-E*	
Effective Area	Effective Area	*A-E*	point observation of Crab (etc.)
Collimator Response	Field of View	*PSF*	Slow scan across Crab in orthogonal directions
	Alignment	*Ad*	
Timing	Dead-time	*Td*	point observation of Crab (etc.)

On-ground Calibration Plan and Facilities

On-ground calibration

Levels:

- **Unit Level : Performance Test**
  - **Collimator, Phoswich Unit, Electronic Unit,**
  - **Automatic gain control (AGC) Detector**
  - **Particle Monitor (PM) Detector,**
  - **Anticoincidence shield (AC) Detector**
- **Module Level : before integration**
  - **Phoswich unit + AGC + collimator + Flight Electronic**
  - **++ shield assembly**
- **HE Level : after integration**
  - **Integrated HE, pre-launched**

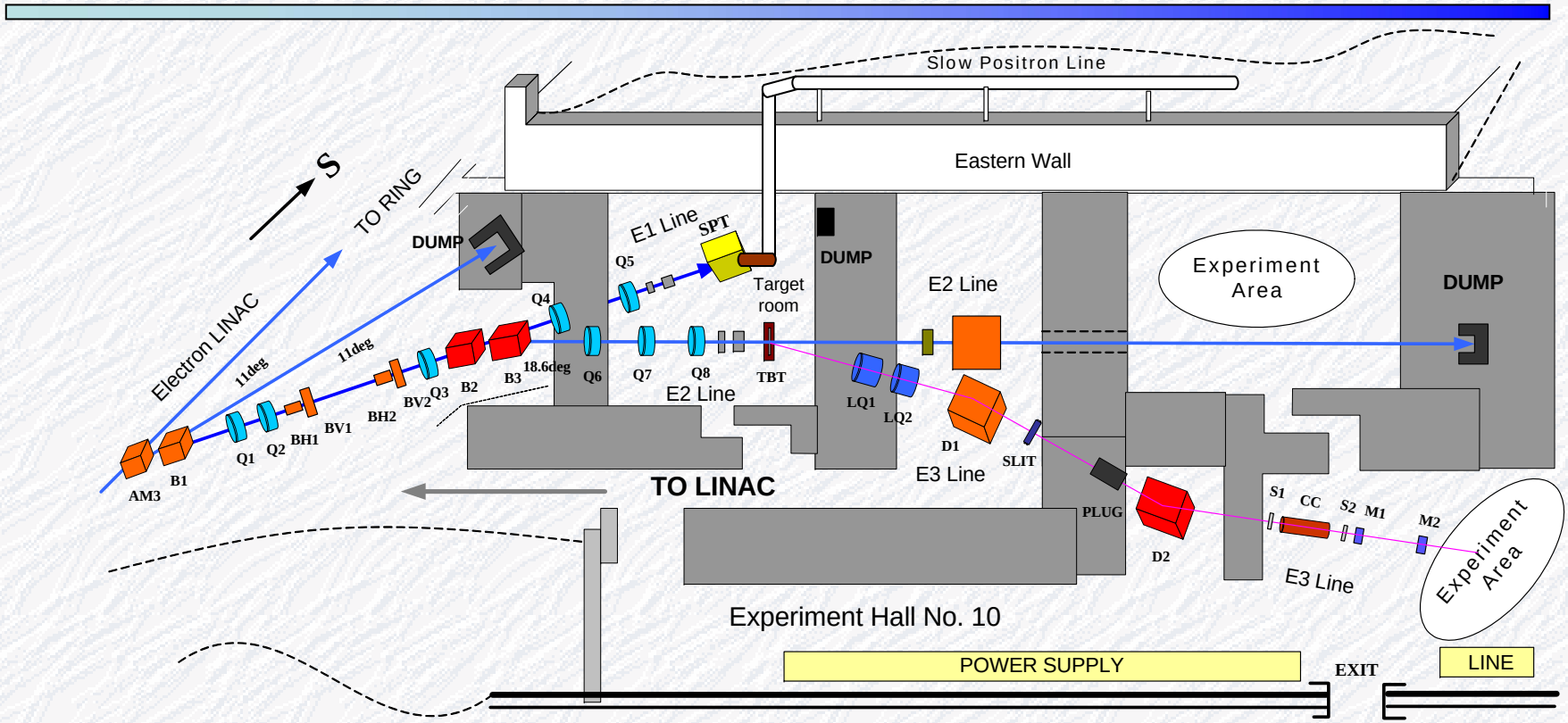
Calibration Sources

- Radioactive sources
  - About 10 lines 10 ~ 300 keV
- Accelerator: proton,400MeV~1.2GeV
- X-ray source facility
- Synchrotron radiation: hard to get available time

Radioactive Sources in Lab

Nuclide	Half-life	Line Energies/keV (No.)
^{241}Am	433y	26.3 (3) 59.54 (8)
^{57}Co	271d	122 (10) 136.5 (11)
^{109}Cd	453d	88 (9) 24.9 (2) 22 (1)
^{137}Cs	30y	32 (5) 36.6 (7)
^{203}Hg	46.6d	279.2 (12)
^{125}I	59d	27.3 (4) 35.5 (6)

accelerator



AM3、B1、B2、B3 Bending Magnets,
BH1、BH2、BV1、BV2 Dipole Corrector
Q1、Q2、Q3、Q4、Q5、Q6、Q7、Q8、LQ1、LQ2 Quadrupole
SPT: SLOW POSITRON TARGET; TBT: TEST BEAM TARGET; S1、S2、Scintillator, M1、M2 Multi-wire Proportional Chanber
CC : Cherenkov

IHEP BEPC-LINAC
THE CONFIGURATION OF TEST BEAM

X-ray Facility