

Status of CJPL & CDEX

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Tsinghua University

On behalf of CDEX Collaboration



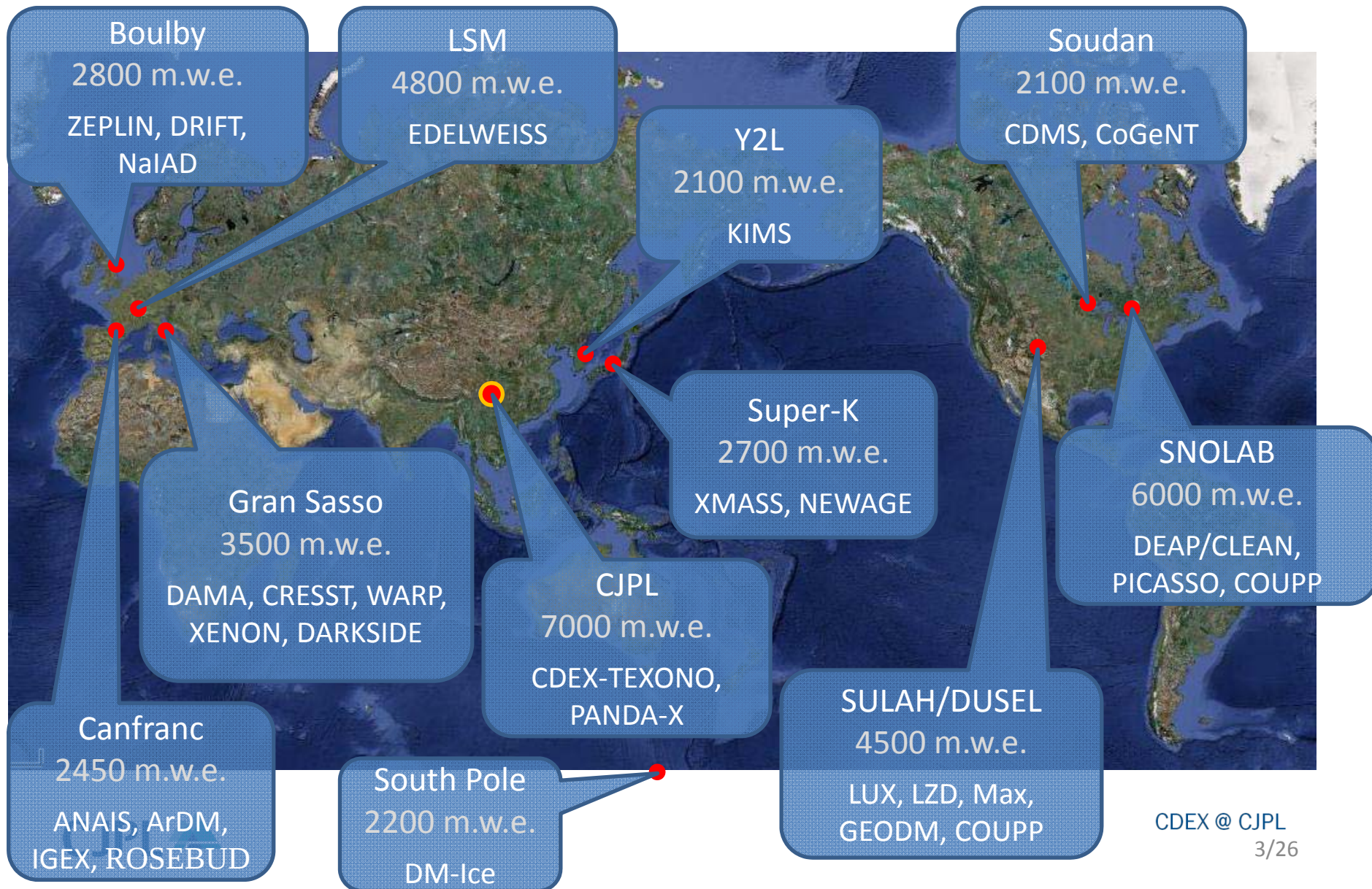
中国锦屏地下实验室
China Jinping Underground Laboratory

Outline:

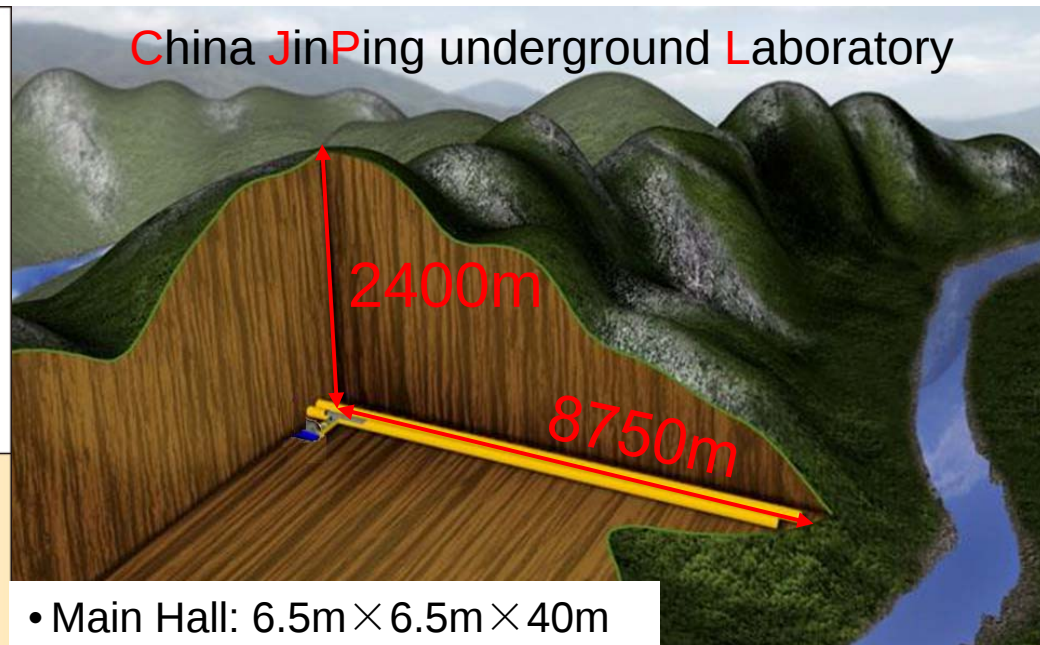
- CJPL
 - Introduction
 - Status
 - Future
- CDEX
 - History
 - Status
 - Future
- Summary



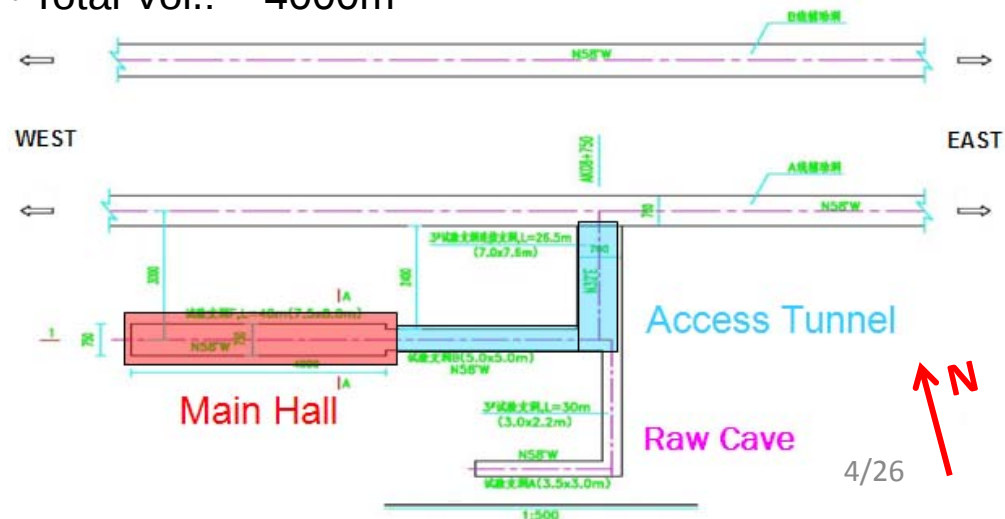
CJPL – Introduction



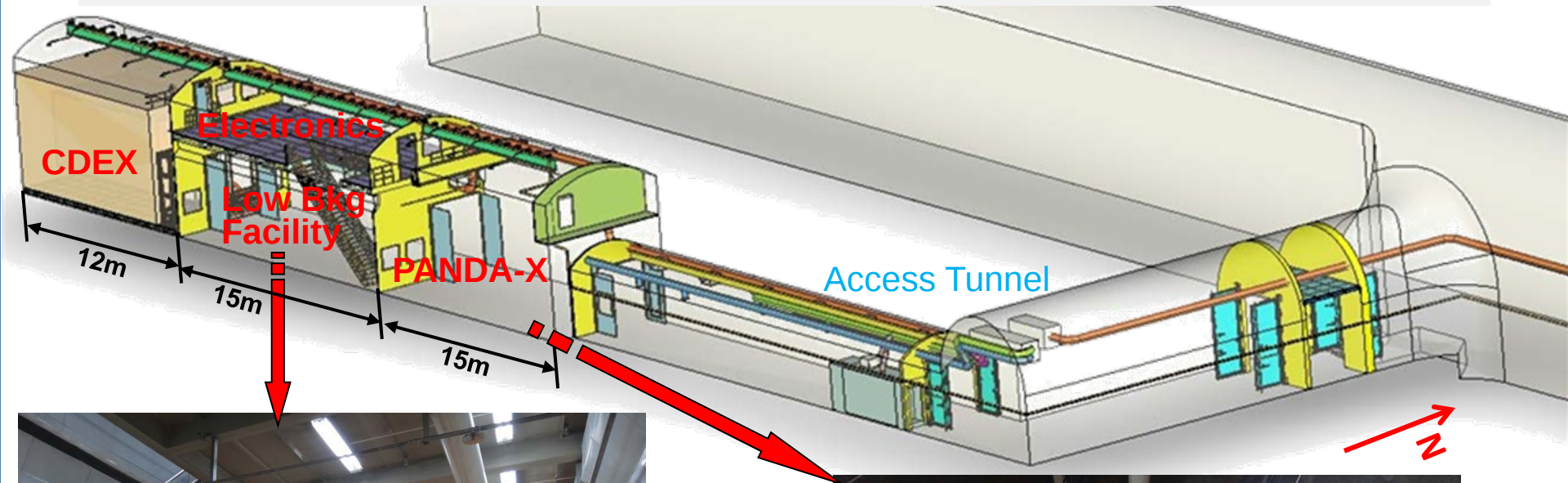
CJPL – Introduction - Site



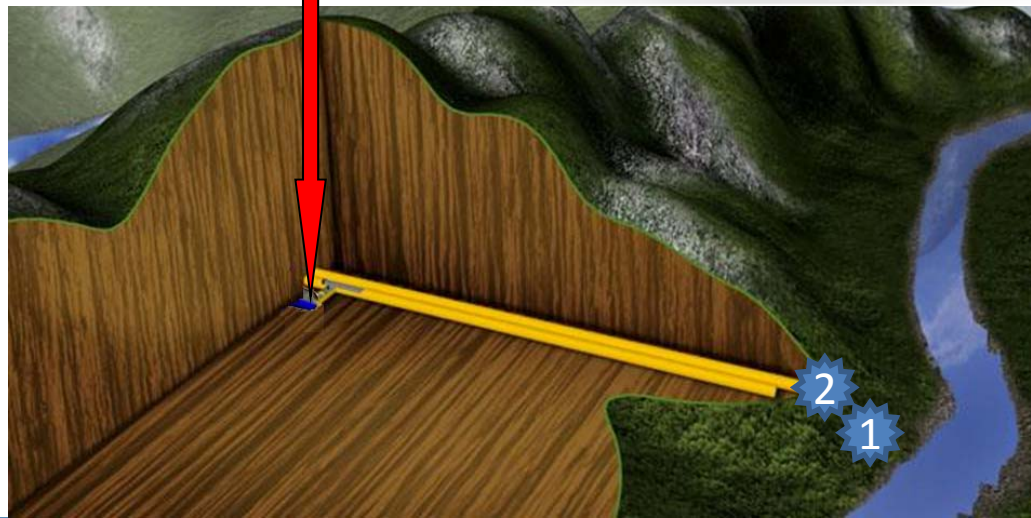
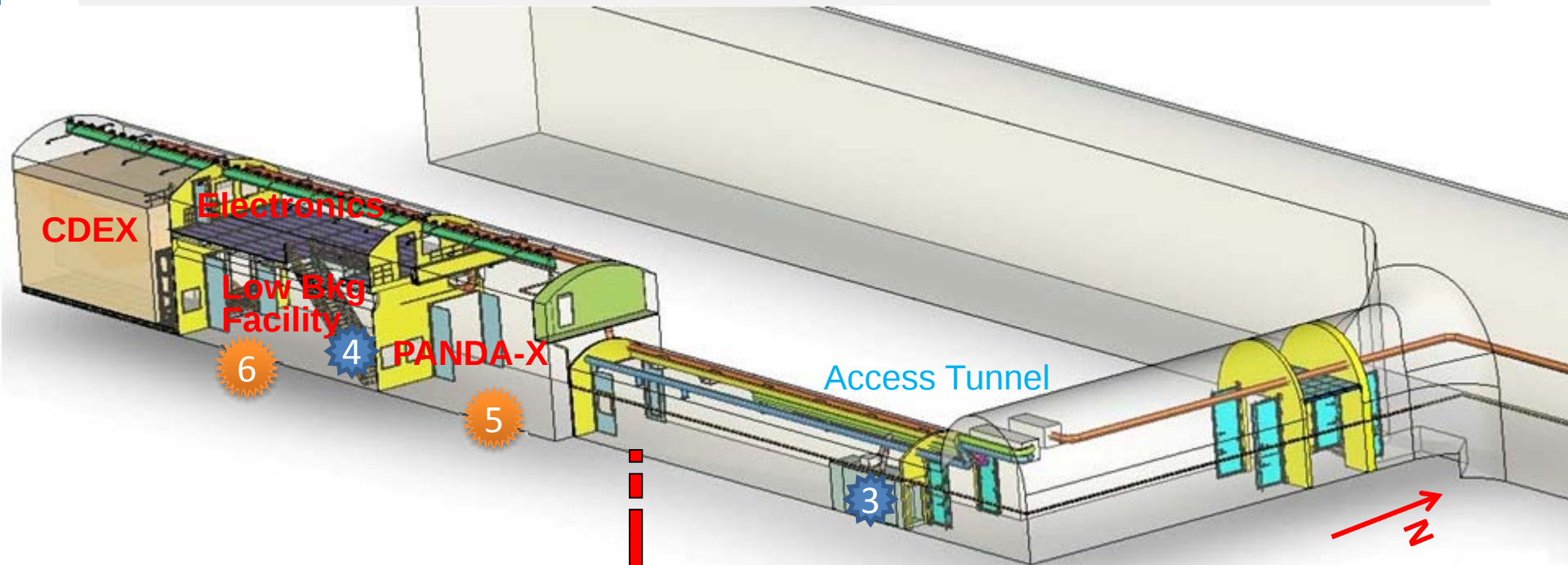
- Main Hall: $6.5\text{m} \times 6.5\text{m} \times 40\text{m}$
- Total Vol.: $\sim 4000\text{m}^3$



CJPL – Introduction - Layout



CJPL – Status



CJPL – Status - Ventilation System (2011)



CJPL – Status - Experiments

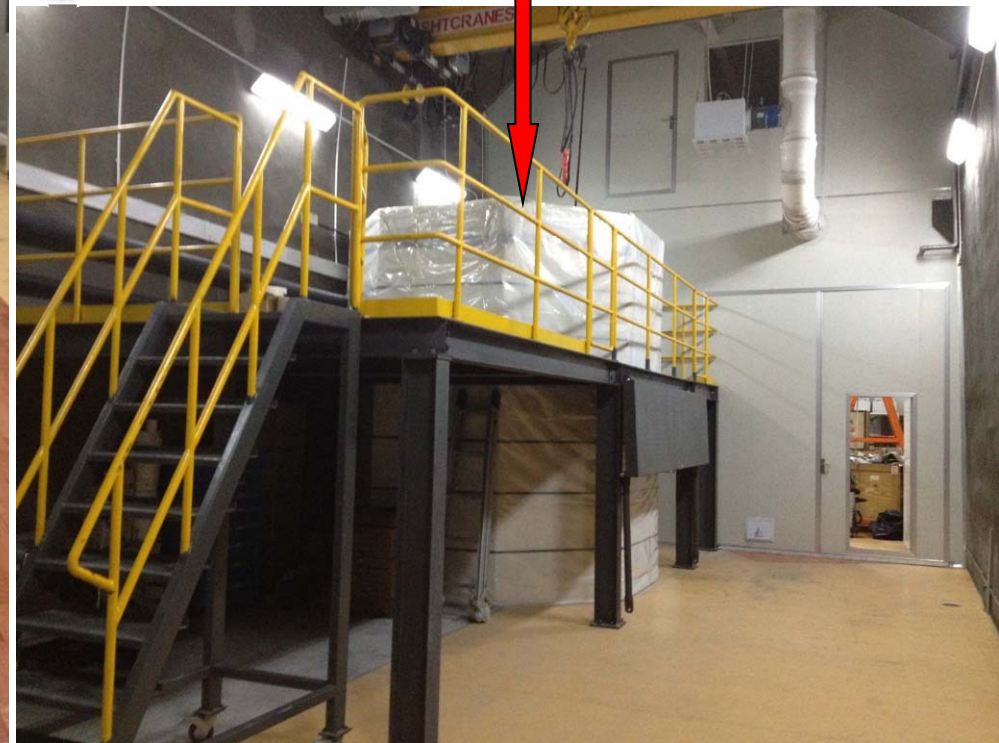


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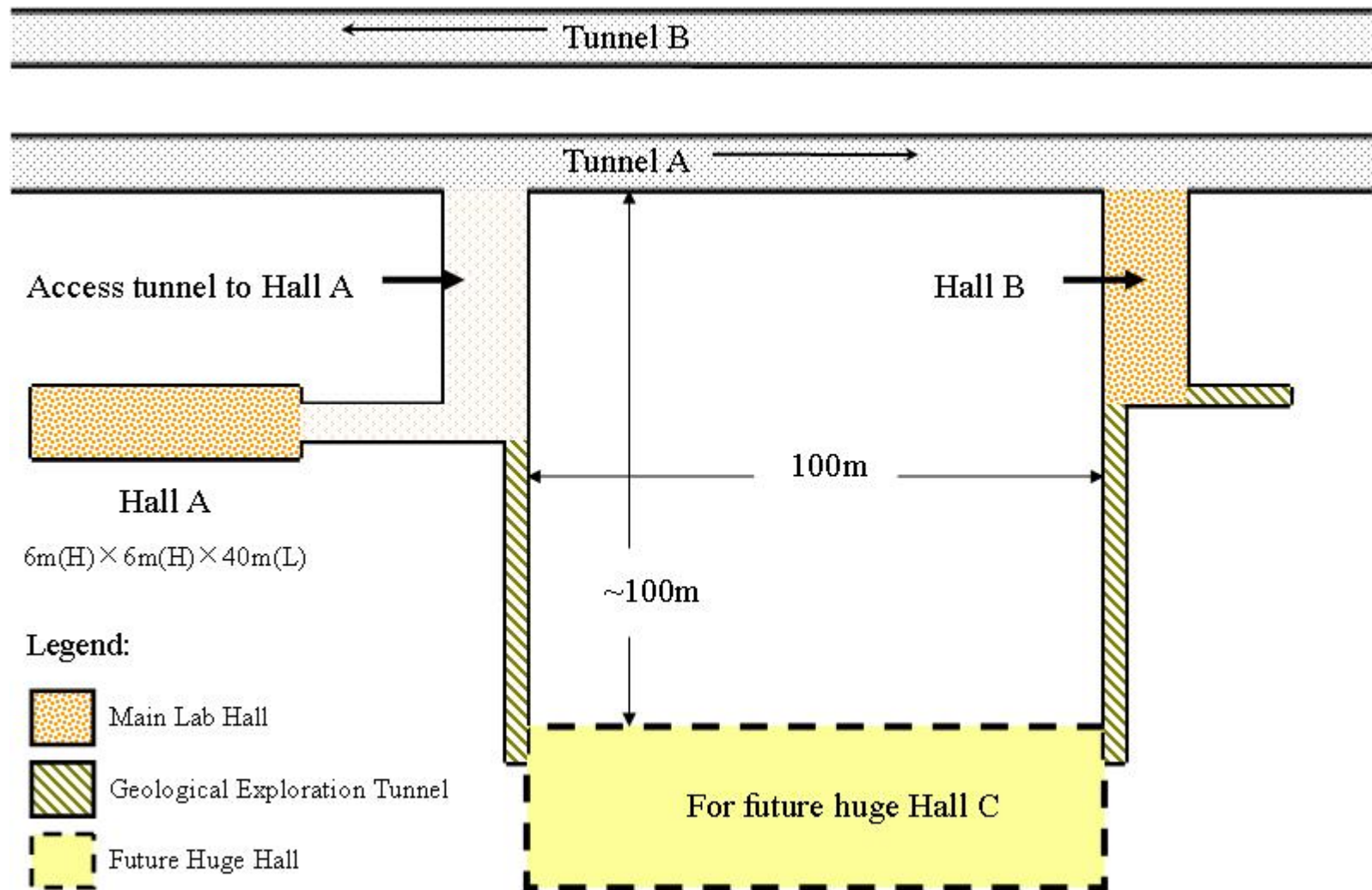
CDEX-1

5

PANDA-X



CJPL – Future



CDEX – History - Collaboration with TEXONO & KIMS

PHYSICAL REVIEW D **79**, 061101(R) (2009)

New limits on spin-independent and spin-dependent couplings of low-mass WIMP dark matter with a germanium detector at a threshold of 220 eV

S. T. Lin,¹ H. B. Li,¹ X. Li,² S. K. Lin,¹ H. T. Wong,^{1,*} M. Deniz,^{1,3} B. B. Fang,² D. He,² J. Li,^{2,4} C. W. Lin,¹ F. K. Lin,¹
X. C. Ruan,⁵ V. Singh,^{1,6} A. K. Soma,^{1,6} J. J. Wang,¹ Y. R. Wang,¹ S. C. Wu,¹ Q. Yue,² and Z. Y. Zhou⁵

(TEXONO Collaboration)

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²*Department of Engineering Physics, Tsinghua University, Beijing 100084, China*

³*Department of Physics, Middle East Technical University, Ankara 06531, Turkey*

⁴*Institute of High Energy Physics, Chinese Academy of Science, Beijing 100039, China*

⁵*Department of Nuclear Physics, Institute of Atomic Energy, Beijing 102413, China*

⁶*Department of Physics, Banaras Hindu University, Varanasi 221005, India*

(Received 10 December 2007; revised manuscript received 22 May 2008; published 12 March 2009)

Status of ULE-HPGe Detector Experiment for Dark Matter Search*

LI Xin¹ YUE Qian^{1,1)} LI Yuan-Jing¹ LI Jin¹ HE Dao¹
KIM S. K.² KWAK J. W.² WANG H. T.³

1 (Department of Engineering Physics, Tsinghua University, Beijing 100084, China)

2 (School of Physics, Seoul National University, Seoul 151-742, Korea)

3 (Institute of Physics, AS, Taipei 11529, China)

Experimental Study on the CsI(Tl) Crystal Anti-Compton

Detector for Dark Matter Search*

HE Dao¹ LI Yu-Lan¹ YUE Qian^{1,1)} LI Yuan-Jing¹ LI Jin¹ CHENG Jian-Ping¹
KWAK J W² KIM S K² LI Xin¹ WANG H T³

1 (Department of Engineering Physics, Tsinghua University, Beijing 100084, China)

2 (School of Physics, Seoul National University, Seoul 151-742, South Korea)

3 (Institute of Physics, AS, Taipei 11529, China)

Detection of WIMPs Using Low Threshold HPGe Detector

YUE Qian^{1,1)} CHENG Jian-Ping¹ LI Yuan-Jing¹ LI Jin^{1,2} WANG Zi-Jing³

2012

2009

2007

2007

2006

CDEX @ CJPL
2004^{10/26}
2002

CDEX – History - China Dark matter Experiment

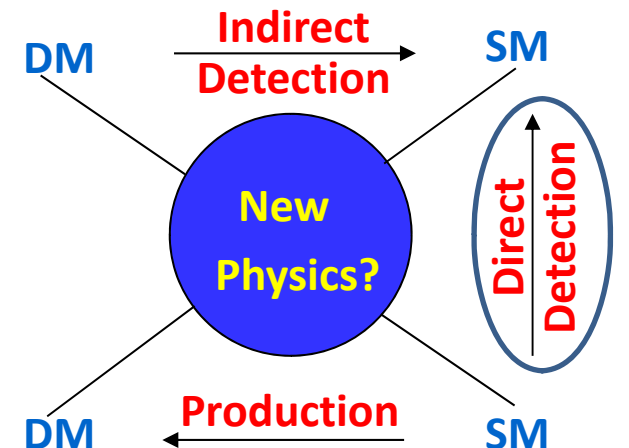
China Dark-matter EXperiment

- 2009.03, CDEX founded;
- 2009.05, MOU between THU & EHDC;
- 2010.12, CJPL opening;
- 2011 to date, CDEX-1 running...

CDEX Target:

Direct Search of Cold Dark Matter with O(10 kg) Ge detectors of Sub-keV Energy Sensitivity.

Goal: $O(0.1 \text{cpkcd})$, $< 300 \text{eV}$

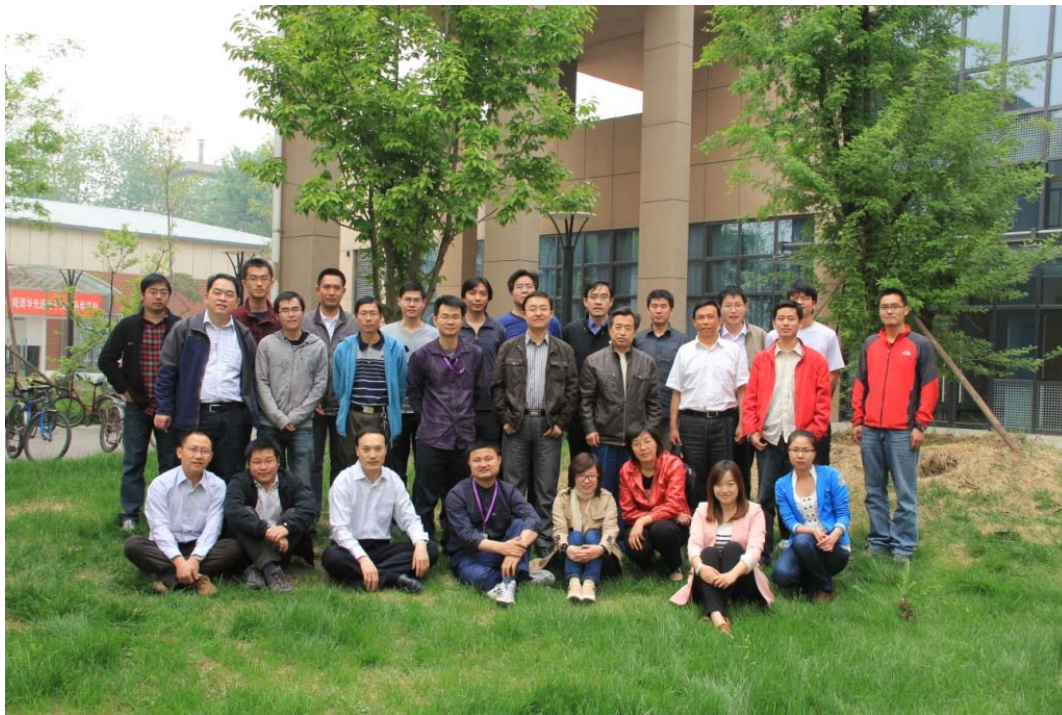


CDEX @ CJPL
11/26

CDEX – Status - Membership



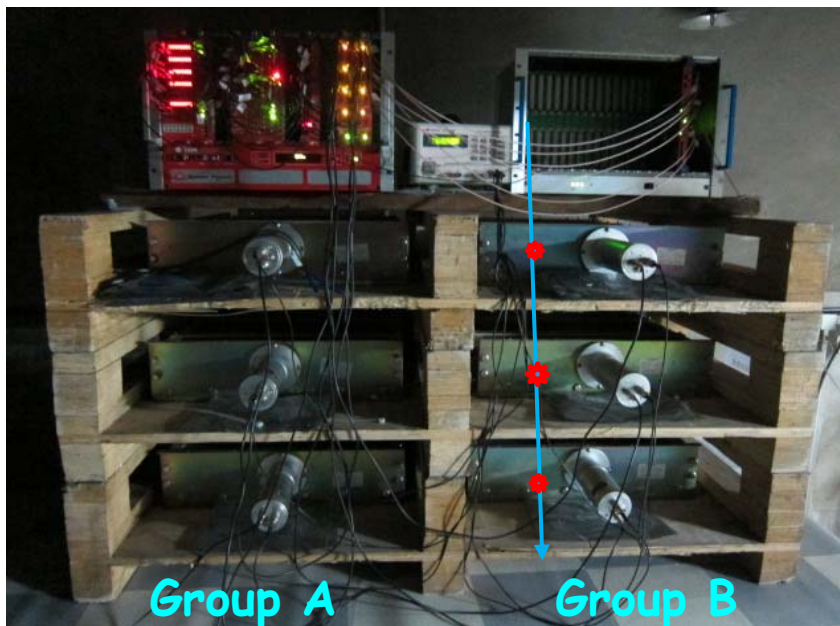
- Tsinghua University
- SiChuan University
- Nankai University
- China Institute of Atomic Energy
- Ertan Hydropower Development Company



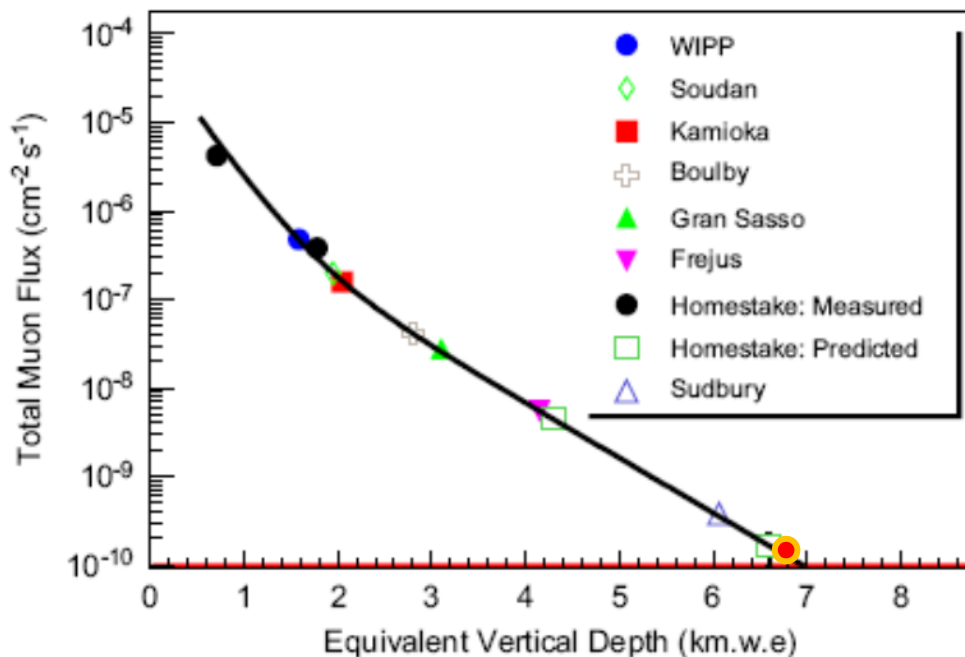
CDEX-TEXONO Collaboration



CDEX – Status - Bkg Measurement : CR



F.E. Gray, et al., NIMA638 (2011)



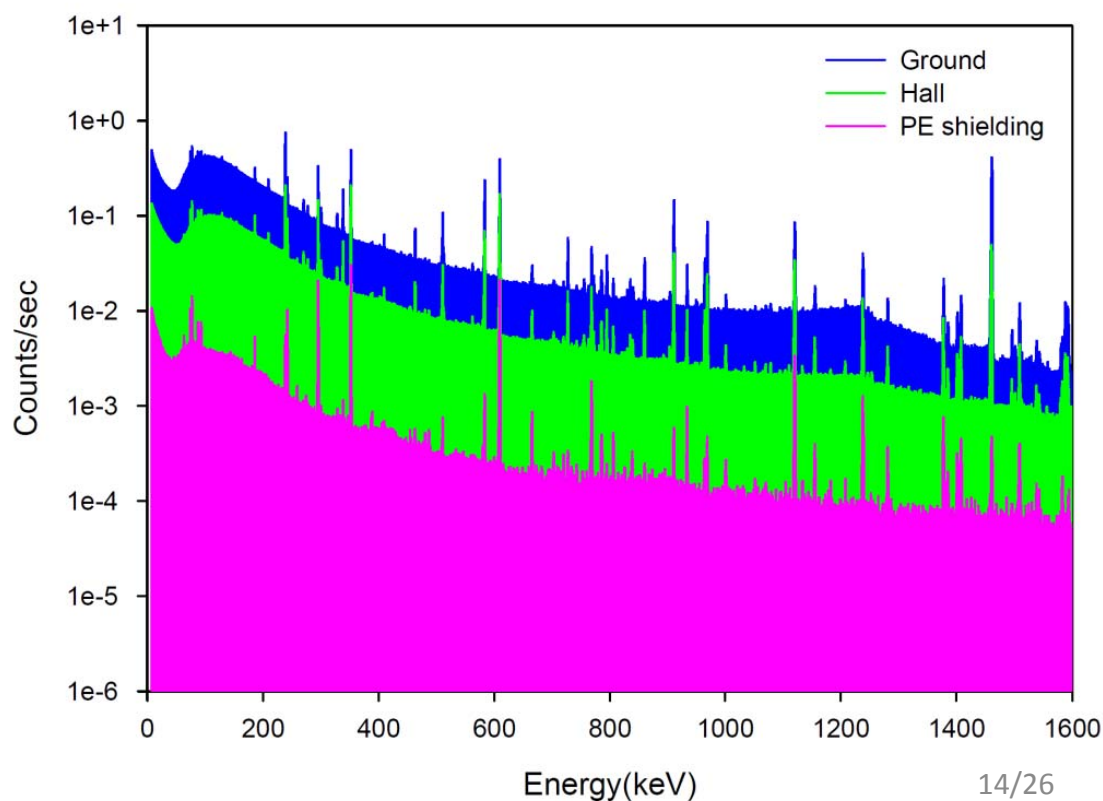
2 groups of 3-fold coincident Plastic Scintillators.

- 28 Cosmic Ray Events within 178 days.
- CR flux is $\sim 2 \times 10^{-10} \text{cm}^{-2} \text{s}^{-1}$, $\sim 10^{-8}$ of ground level.

CDEX – Status - Bkg Measurement : Gamma

CJPL Rock Bkg (Unit: Bq/kg)	K-40 (1461keV)	Ra-226 (609keV)	Th-232 (911keV)
CJPL Rock Sample	< 1.1	1.8 ± 0.2	< 0.27
Beijing Normal Ground Level	~ 600	~ 25	~ 50

Portable HPGe



CDEX – Status - Bkg Measurement : Thermal n

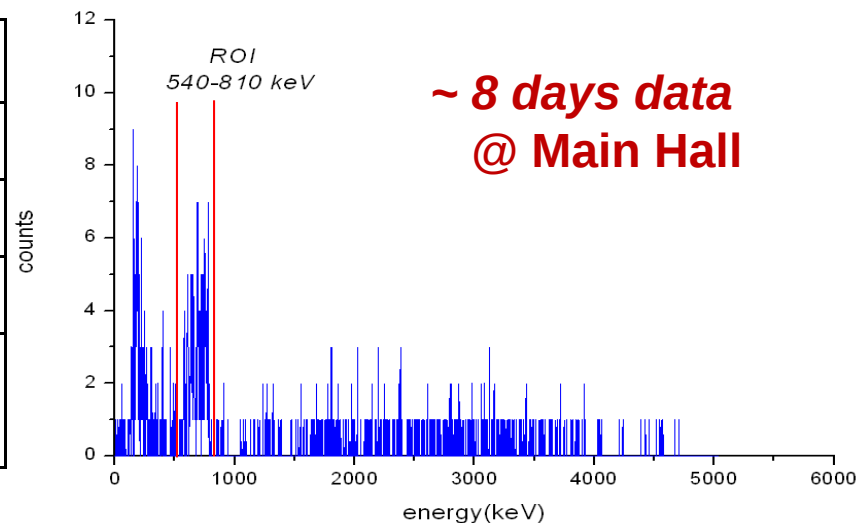
Home-made ^3He tube system:

- Pure OFHC tube wall;
- Readouts form both ends;
- Φ 25.4mm $\times$ 1m.



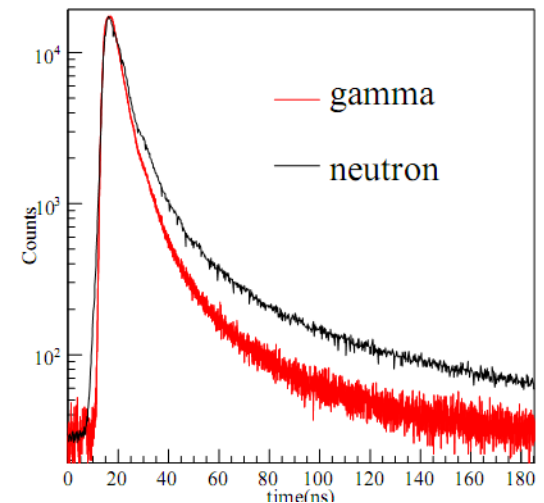
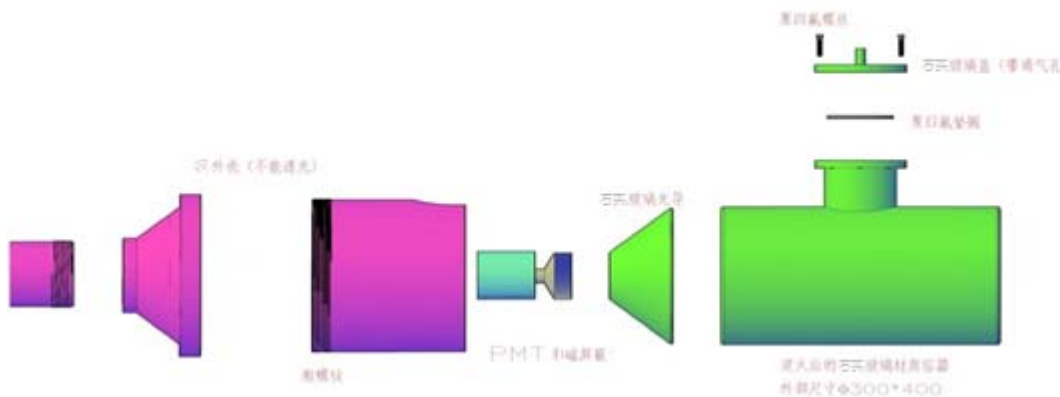
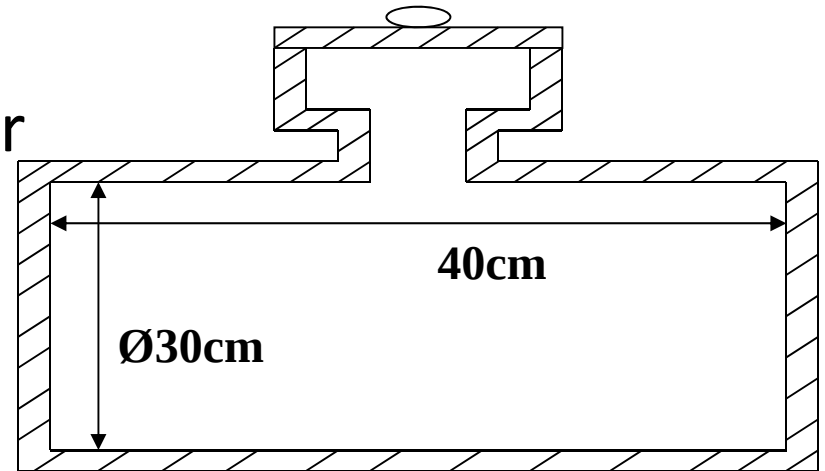
RATE	Main Hall	PE shielding
ROI (cpd)	34.11	3.71
α Bkg (cpd)	4.0	4.4
Thermal n (cpd)	~ 30	< 1
Thermal n flux ($\text{cm}^{-2}\text{s}^{-1}$)	4.34×10^{-6}	$< 1.45 \times 10^{-7}$

Reach the sensitivity limit of the detector.



CDEX – Status - Bkg Measurement : Fast n

- Gd-loaded liquid scintillator
- Quartz container (copper shell);
- 2 PMTs at both ends;
- Under testing...



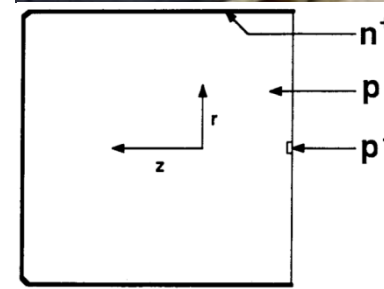
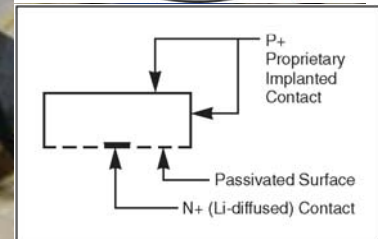
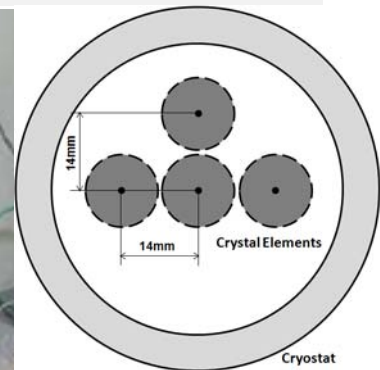
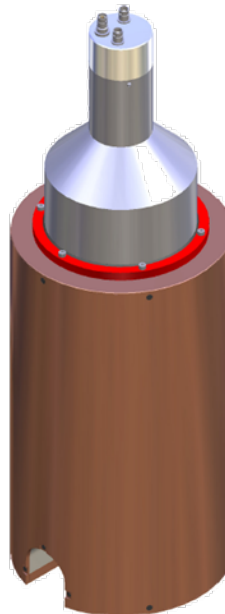
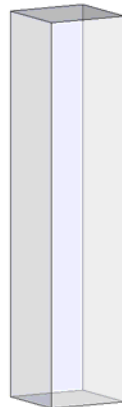
CDEX – Status - Low Bkg Facility

- Coaxial HPGe;
- Shielding:
 - ▣ 10cm PE;
 - ▣ 15cm Pb;
 - ▣ 5cm Cu;
 - ▣ N2 flushing inside.
- Select Low Bkg Materials.

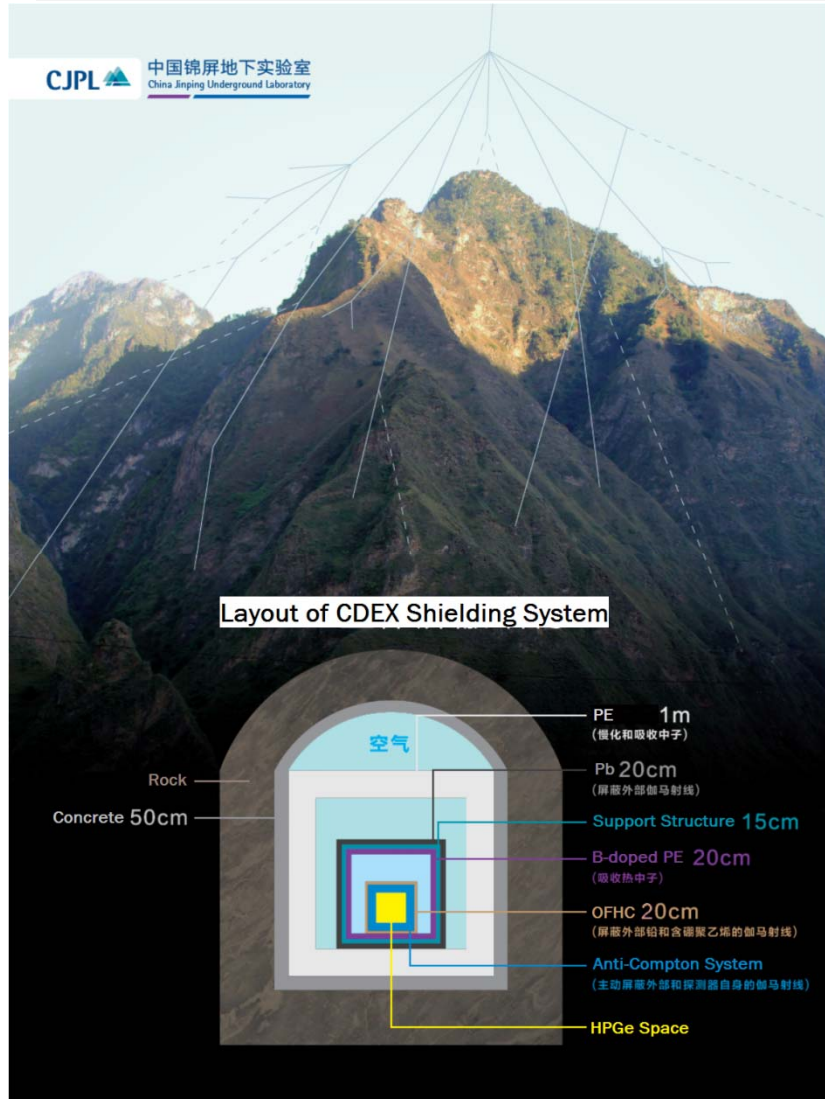


CDEX – Status - CDEX-1: Detectors

- 20g-ULEGe array;
(Ultra Low Energy Germanium)
- 1kg-PPCGe;
(P-type Point-Contact Germanium)
- CsI(Tl) crystal;
(Cuboid array)
- NaI(Tl) crystal;
(Well single)



CDEX – Status - CDEX-1: Shielding System



CDEX – Status - CDEX-1: Data Taking

- 20g-ULEGe: Data taking and data analysis now!
- 1kg-PPCGe: Data taking!

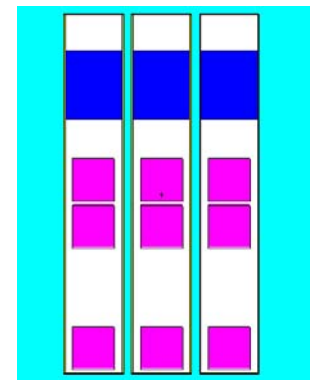
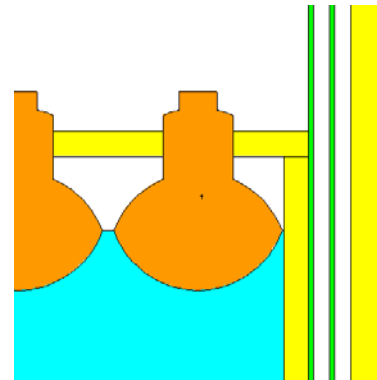
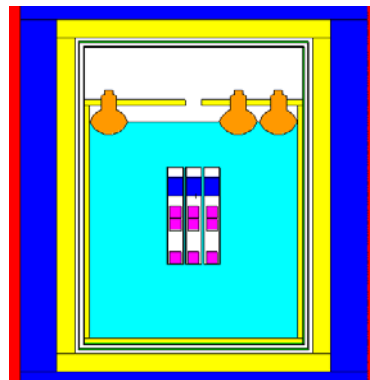
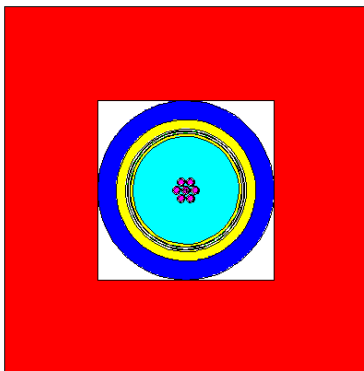


CDEX – Status - CDEX-10: Simulation

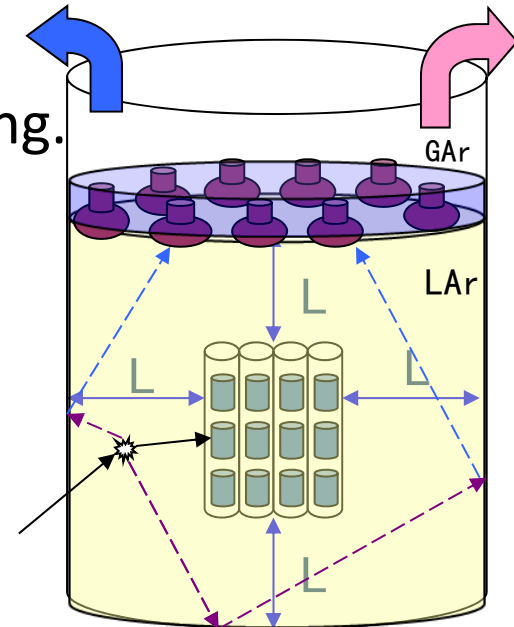
- LAr: Passive shielding + Active shielding.
- Ge: Encapsulated into Al vacuum tube for cooling.
Three PCGe in one tube.
- WLS: Transferring 128nm light to $\sim 420\text{nm}$ light.

Simulation

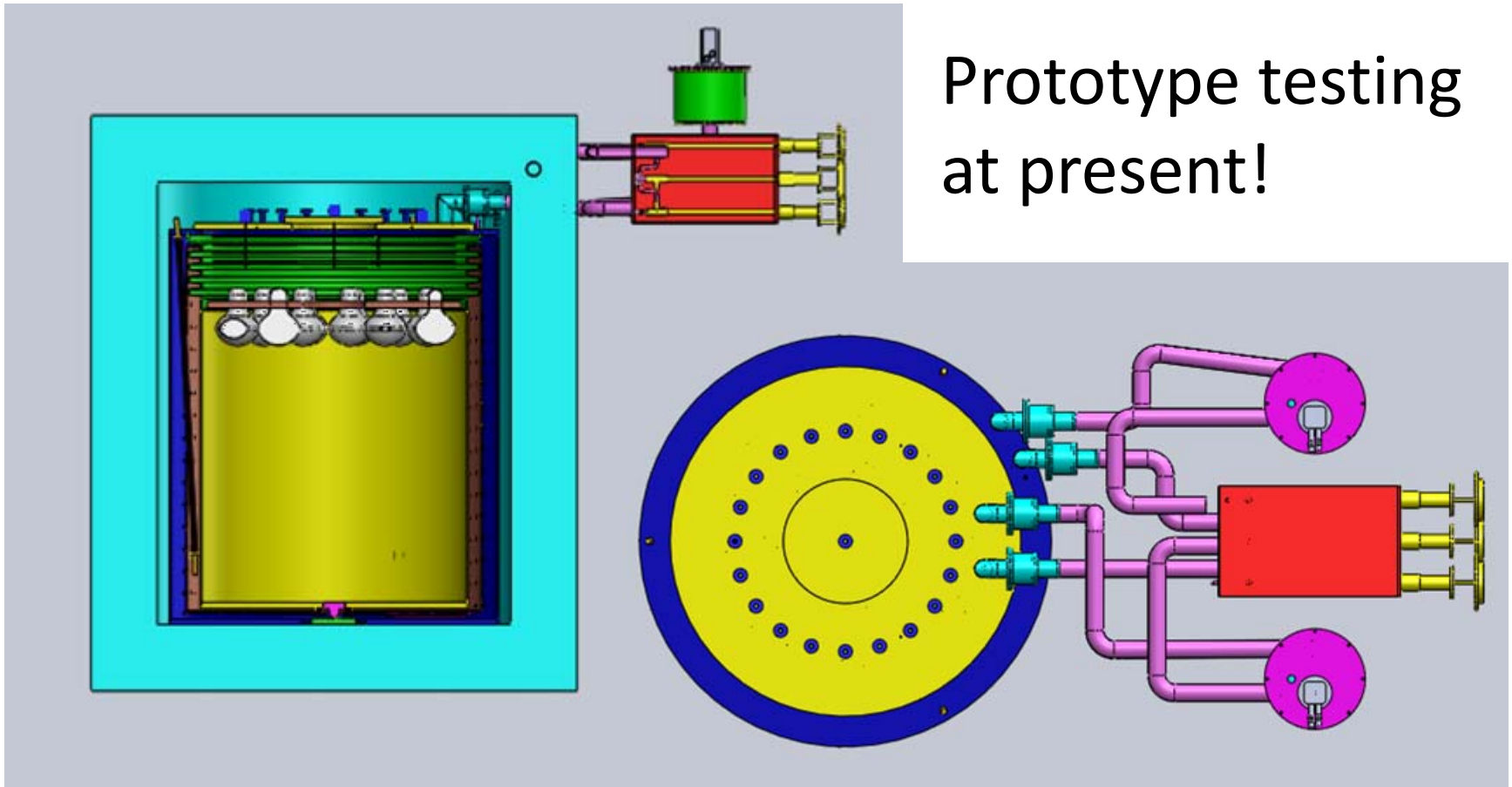
- Shielding: PE + Pb + Cu + SS + LAr;
- Detector: HPGe, LAr, PMT;



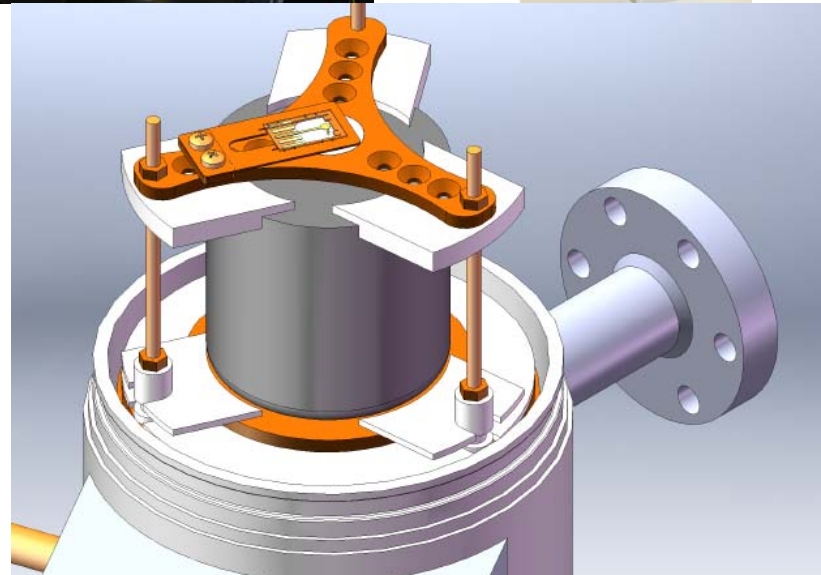
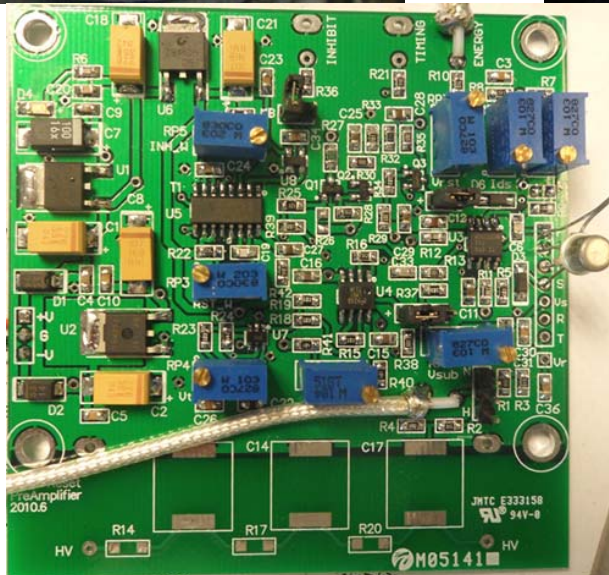
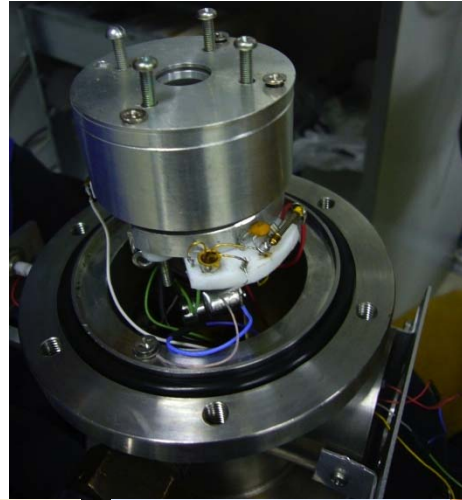
HV and Signals Cooling and Control



CDEX – Status - CDEX-10: Cryogenic System



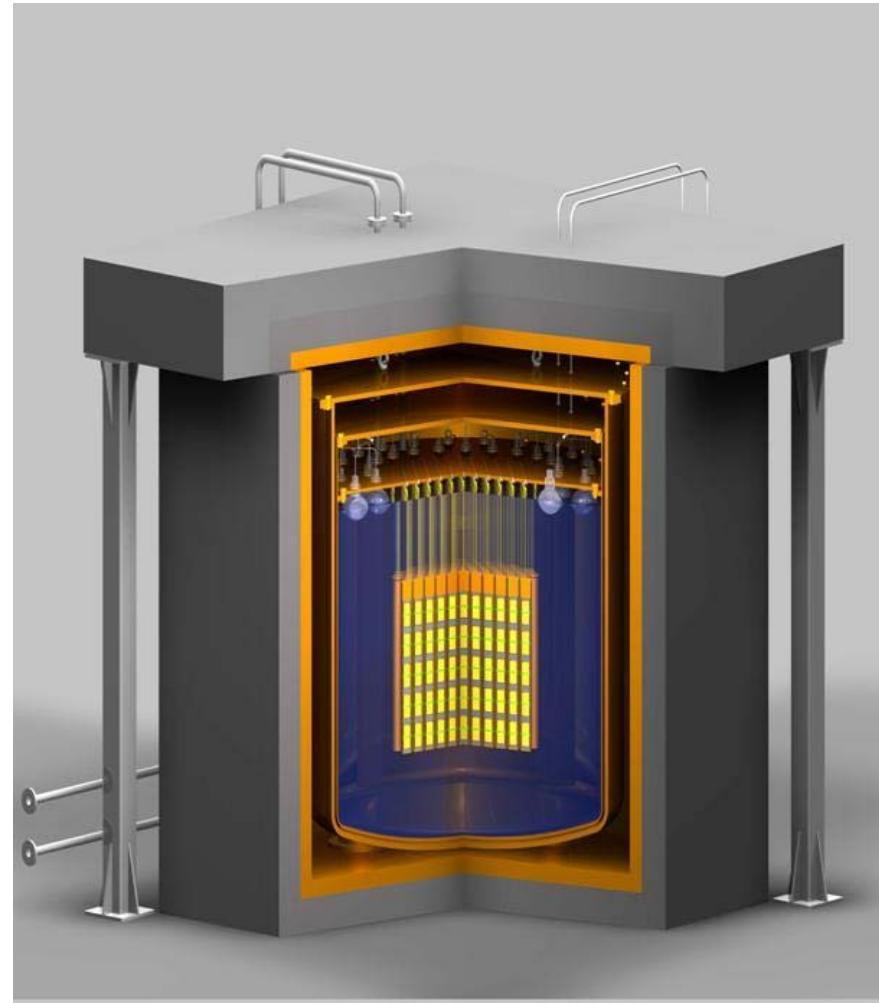
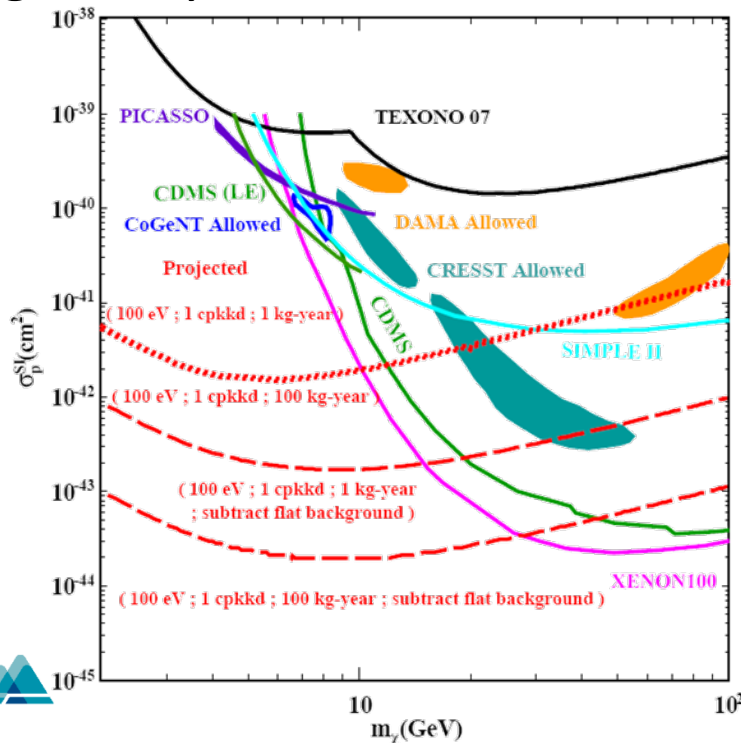
CDEX – Status - CDEX-10: R&D on Electronics



CDEX – Future - CDEX-1T Prospects

- New CJPL Halls;
- 10^3 Crystal Array;
- LAr Cooling and Shielding;
- New Design of Shielding and Cryogenic System;

• ...



Summary

➤ CJPL

- The deepest rock overburden Lab is running;
- New Ventilation System is blowing in fresh air.

➤ CDEX

- CR γ and n background is under measurement;
- First Low Background Facility has been testing;
- CDEX-1: both 20g & 1kg HPGe are taking data;
- CDEX-10: engineering design and prototype test.

Thanks for your
attention!



南無阿彌陀佛

看破放下自在隨緣念佛

真誠清淨平等正覺慈悲

