Particle And Astrophysical Xenon Experiment

Status and Plans of the PandaX Experiment at CJPL

Li ZHAO

Shanghai Jiao Tong University

(on behalf of PandaX collaboration)

Shanghai Jiao Tong University
Shanghai Institute of Applied Physics
Shandong University
Peking University
Yalong River Hydropower Development Company

University of Michigan
University of Maryland

August 21st, 2013

http://pandax.physics.sjtu.edu.cn/

Outline

1)Where is CJPL?;

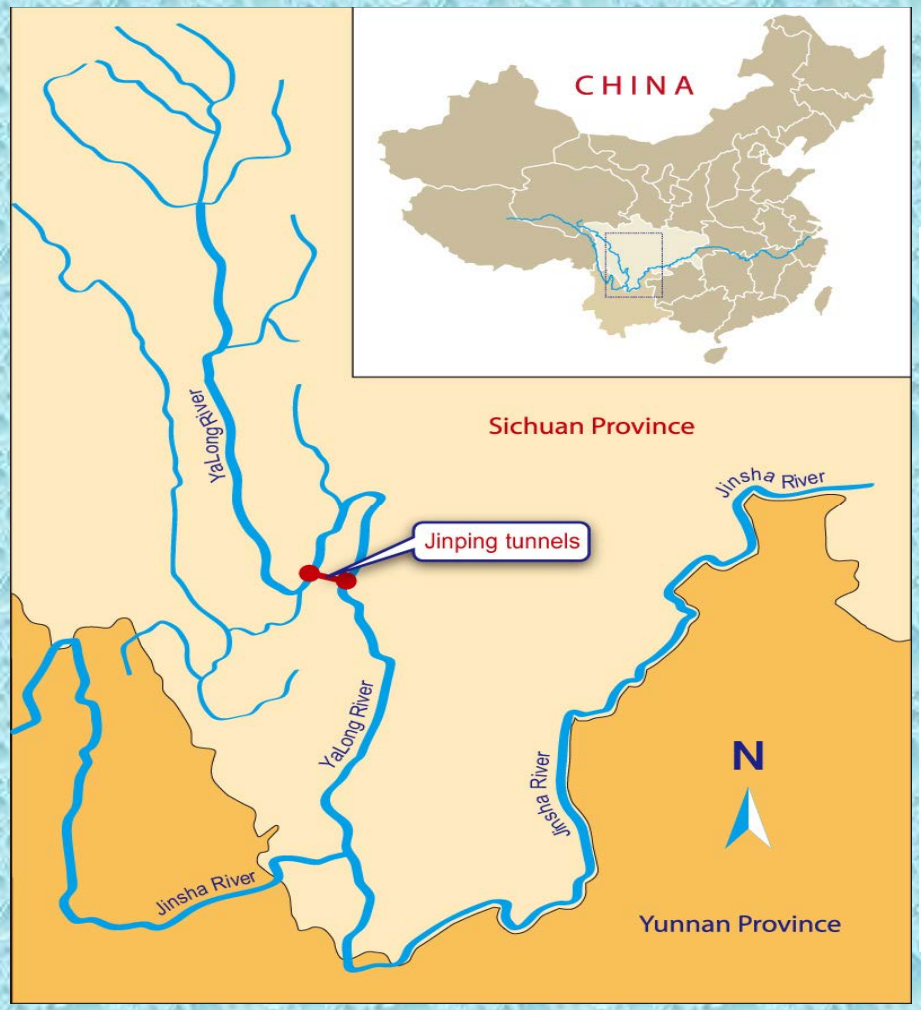
2)Why? Advantage;

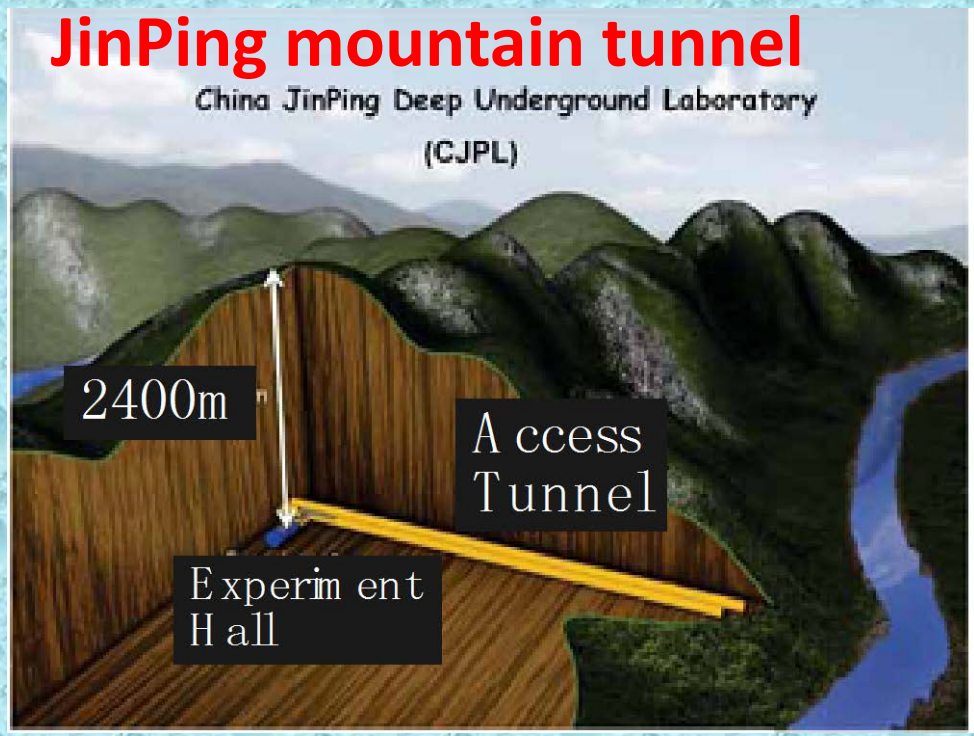
3)Where is PandaX Experiment?

4)The status of PandaX;

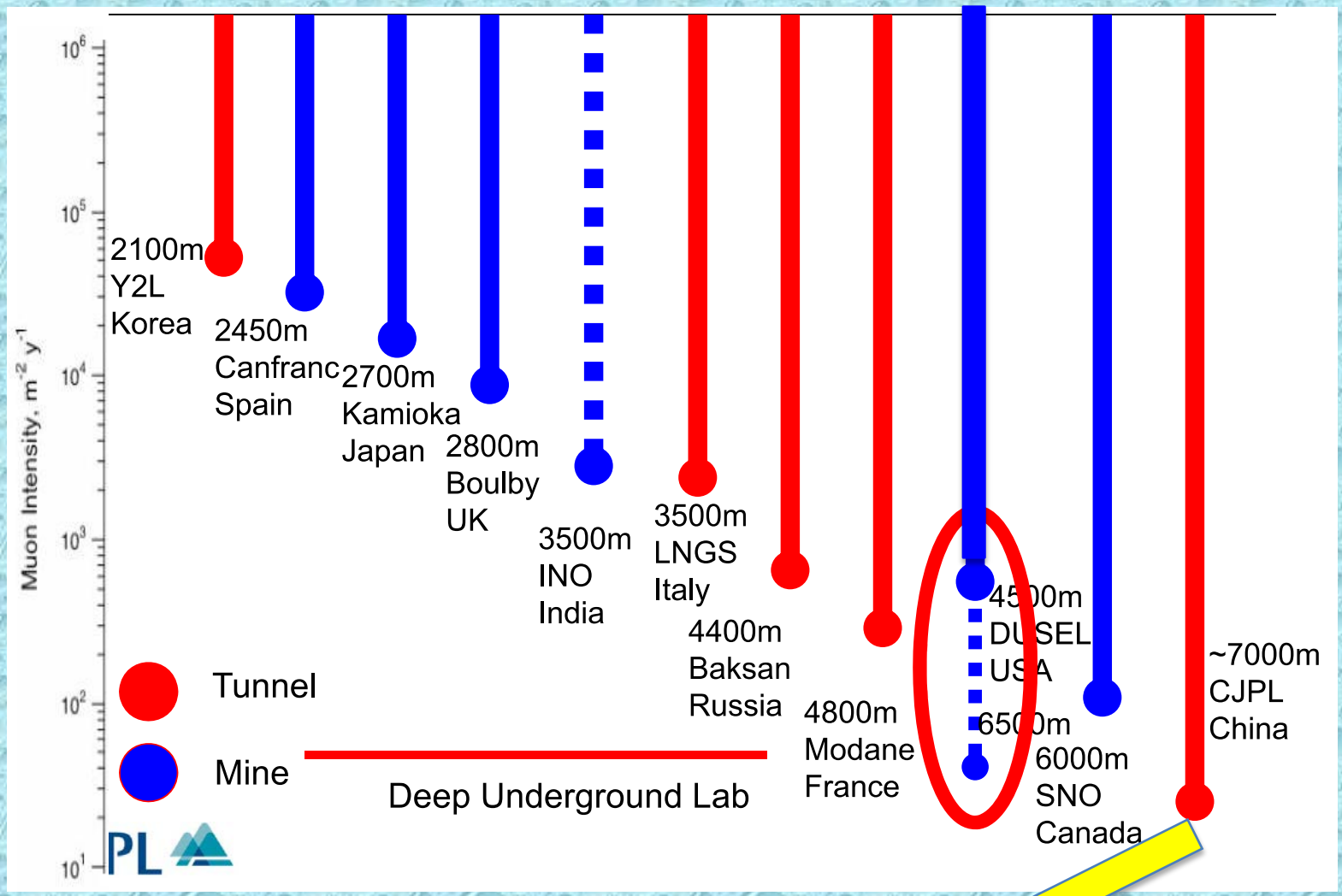
5)Plans of PandaX;

1 Where is CJPL?



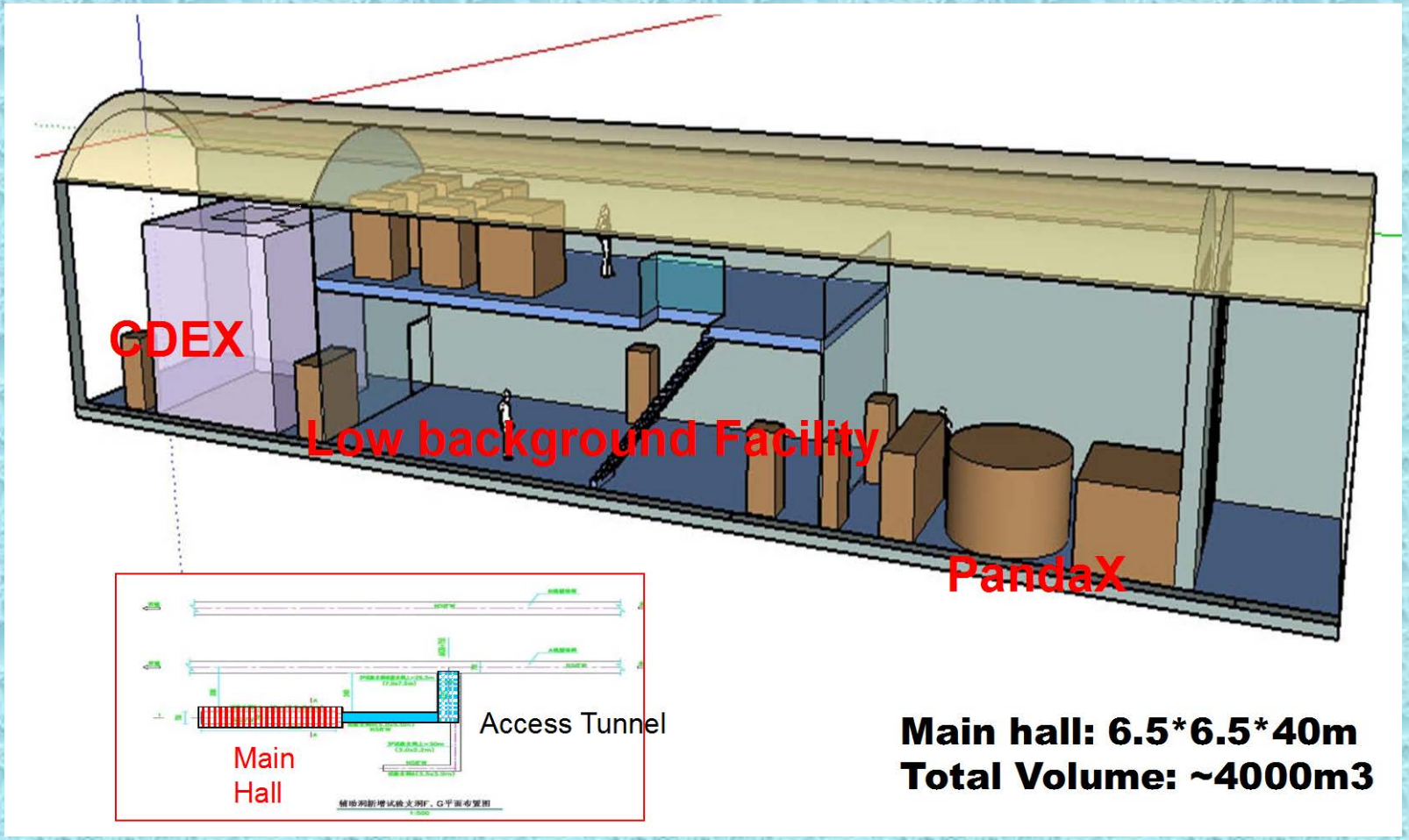


2 Why? advantage

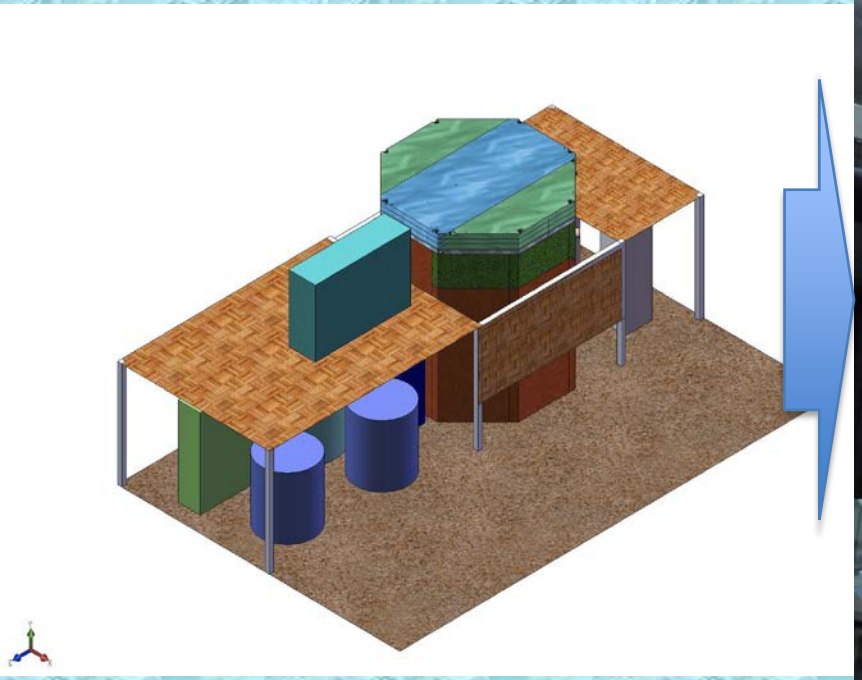


Measured muon flux: 60 muons/year/m²

3.1 Where is PandaX Experiment?

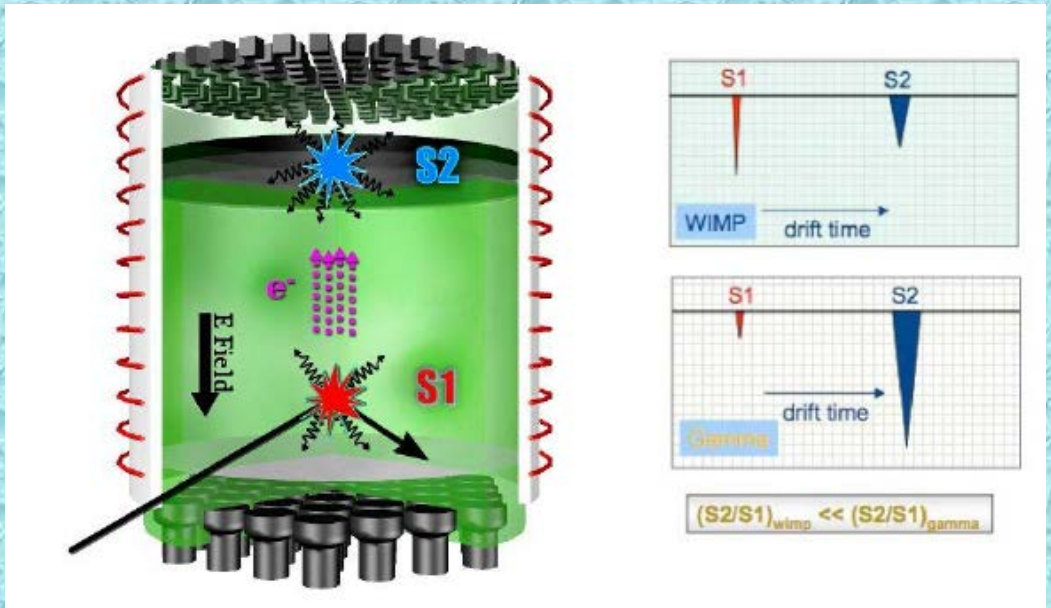


3.2 Picture of PandaX Experiment

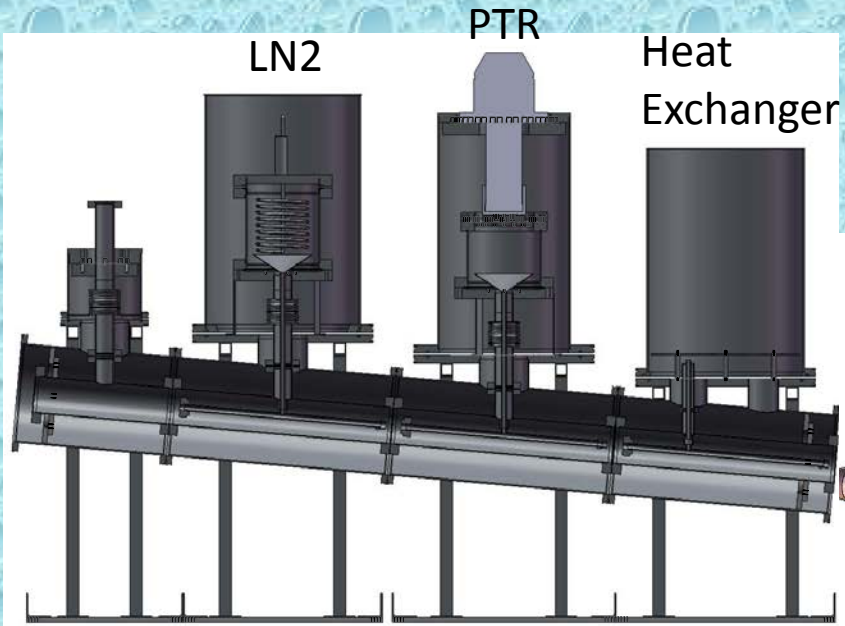


4 The PandaX Experiment

- A two-phase xenon experiment for dark matter direct detection (WIMPs)
- Plans: reach a ton-scale target detector in two stages
  - Stage-1a: 25 kg fiducial mass
  - Stage-1b: 300Kg fiducial mass
  - Stage-2: 1.4 ton fiducial mass

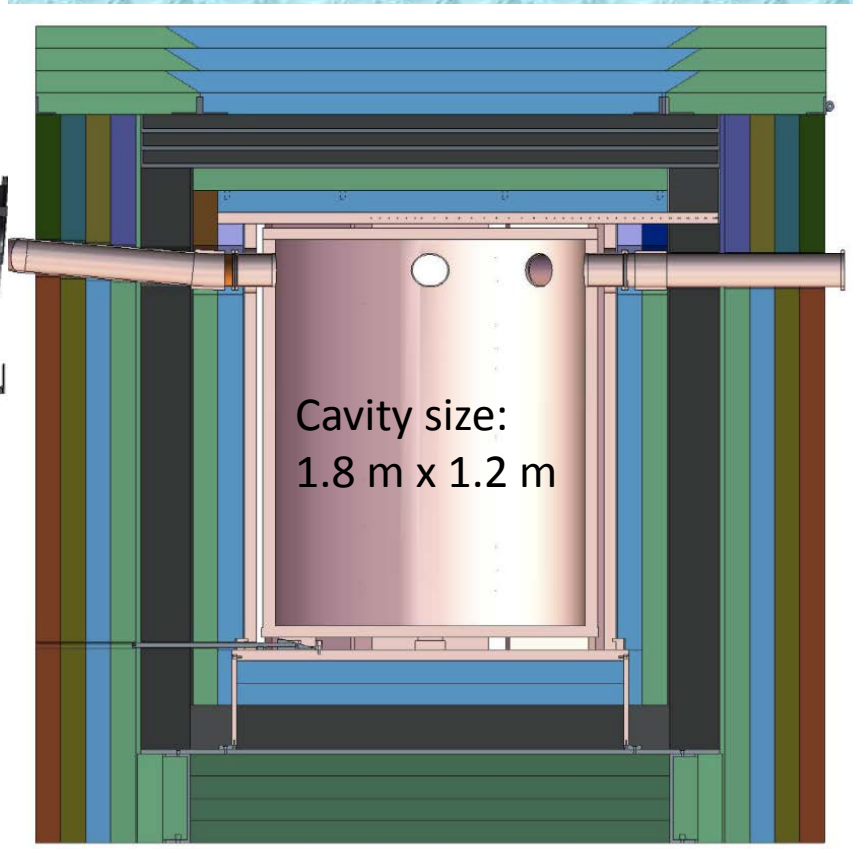


4.1 The shielding, cryogenics, copper vacuum vessel



Cryogenic System

Shield



Cooling power(PTR): about 180W,
Liquefying rate: around 70Kg/day

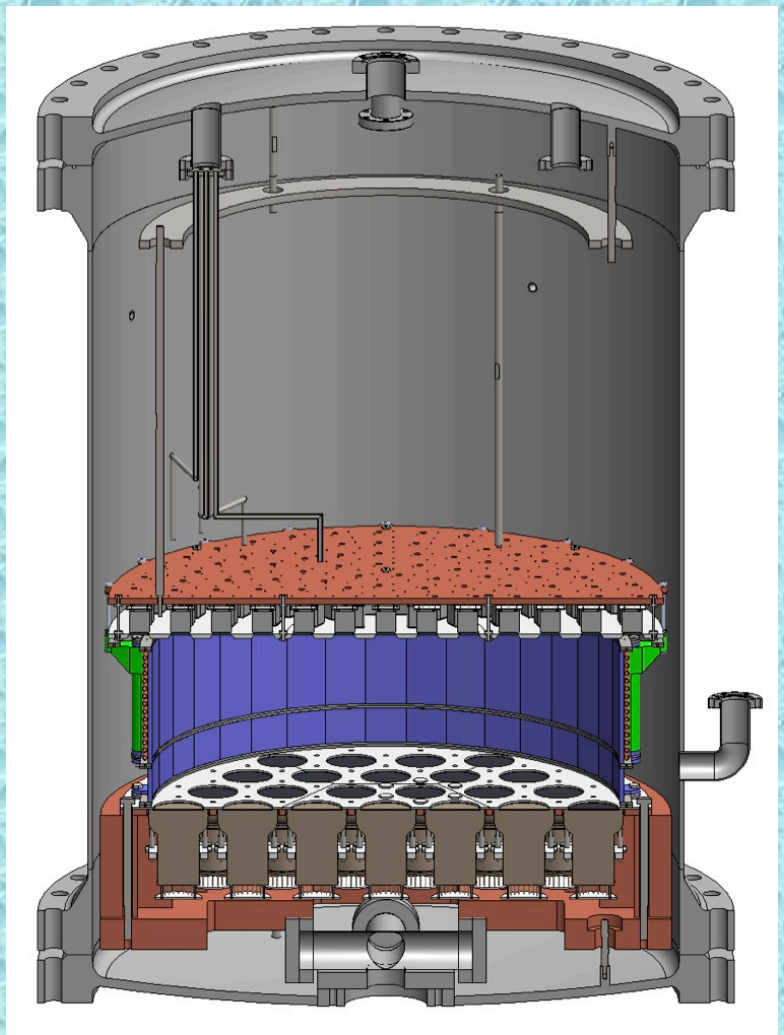
4.2 Real picture of The shielding, cryogenics, copper vacuum vessel

4.3The gas system(storage): gas line, bottles

4.4 Kr removal system started operation at SJTU

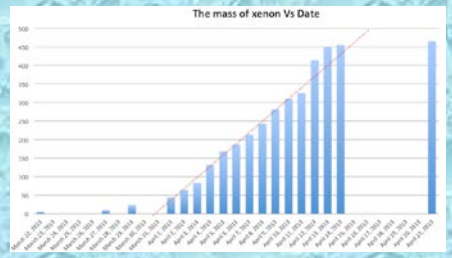
450 kg xenon has been distilled in the Kr column

4.5 Stage-1a: design and goals

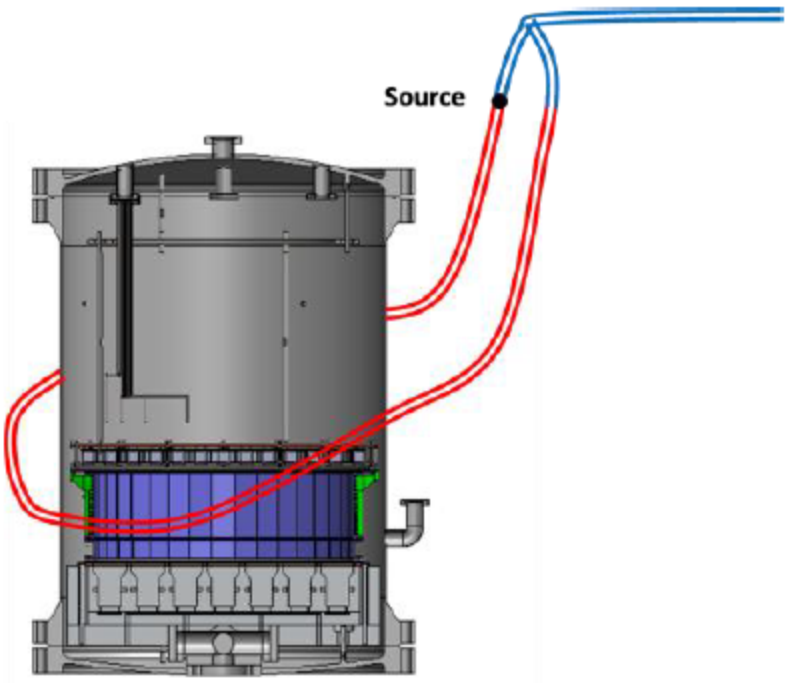


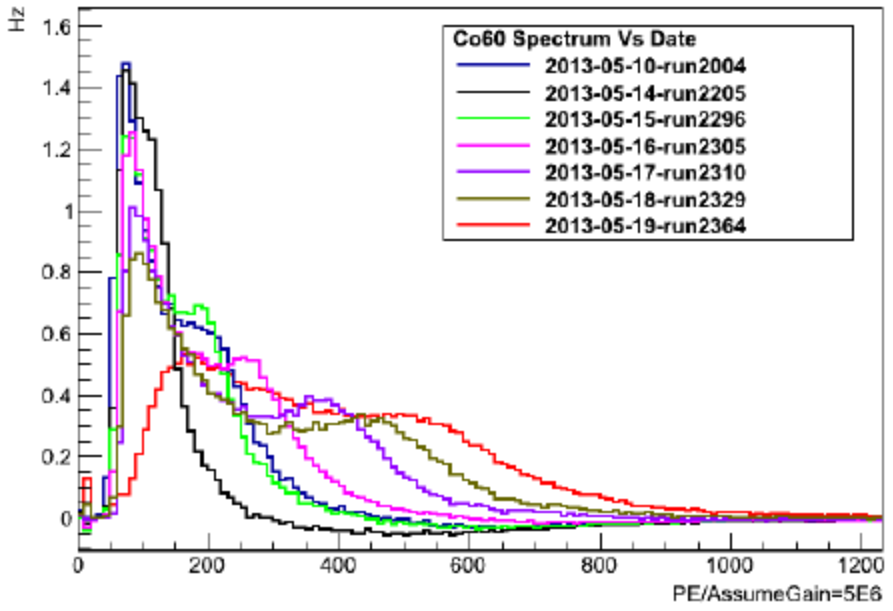
- **Design:**
  - TPC diameter/length: 60/15 cm
  - Target Xe mass: 125 kg
  - Expected fiducial mass: 25 kg
  - Top PMT: 143 R8520
  - Bottom PMT: 37 R11410
- **Goals:**
  - Low threshold for light WIMPs
  - Demonstrate high voltage/field
  - Demonstrate efficient Xe purification and low Kr-concentration

4.6 Stage 1a: current status



- **464Kg** Xenon has been liquefied and recuperate safely;
- Bottom PMTs in LX are tested with DAQ;
- The purifier is tested;

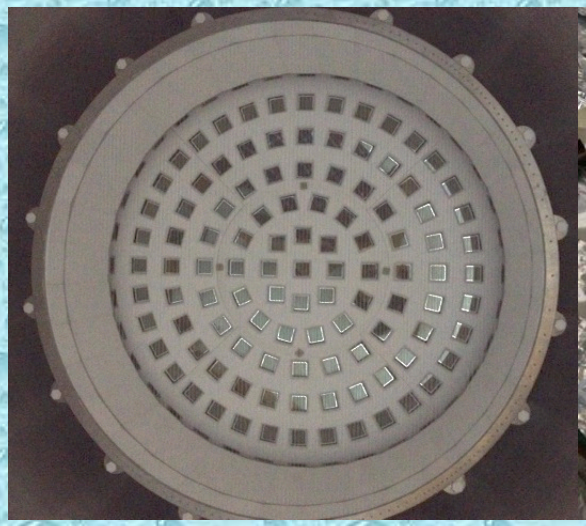


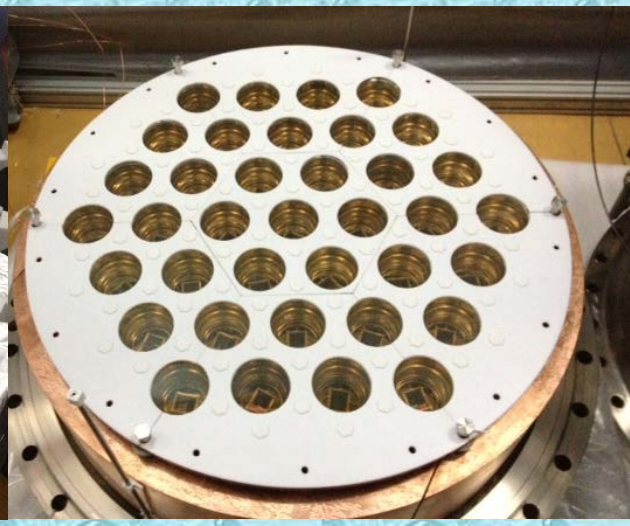


4.7 Stage 1a: current status

- **in final stage of integration underground**
- **commissioning and operation in 2013**

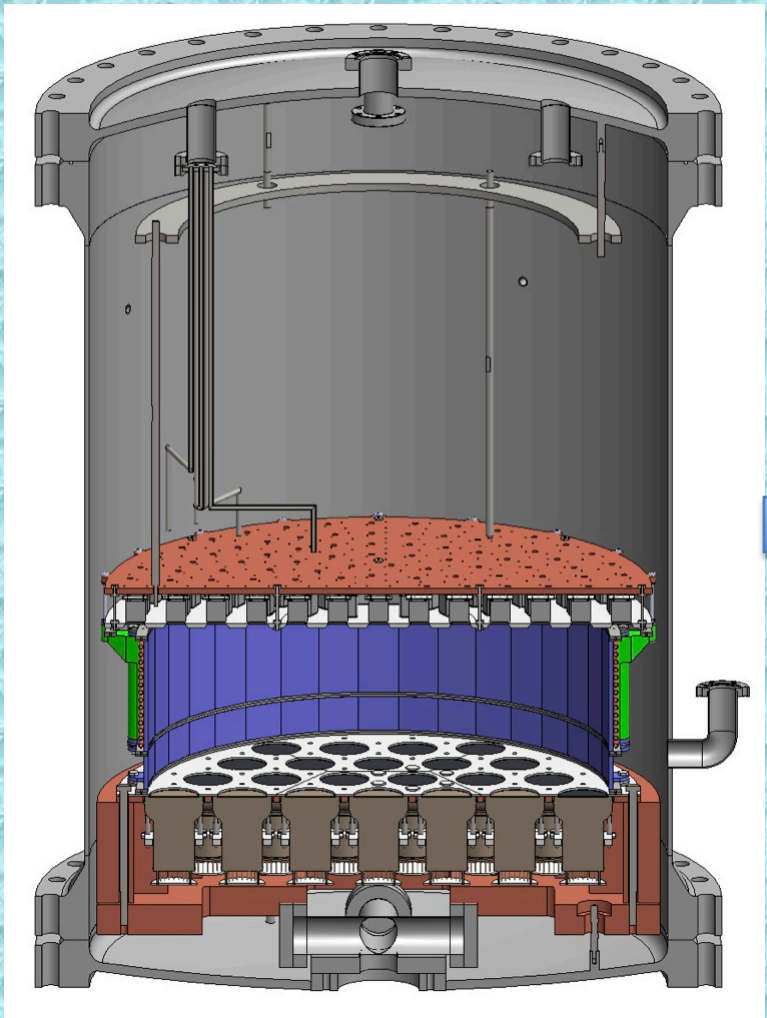
- Planned exposure: 25-kg x 60-days
- Expected bkg (dominated by ERs from Vessel and PMTs): 0.3 (after ER rejection based on S2/S1)
- Expected threshold/NR acceptance: 1.5 keVee/35%
- Expected sensitivity (SI): 1e-43 cm^2 at 10 GeV with 25-kg x 60 days exposure



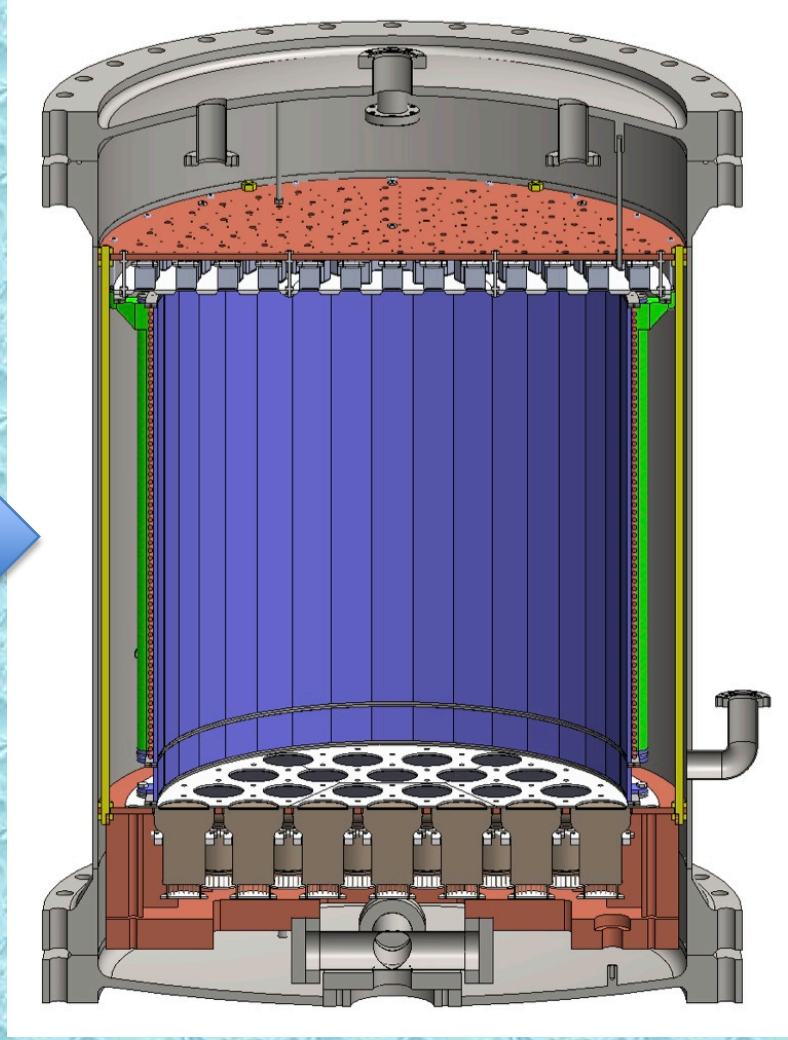


5 Plans:

Two steps for Stage-1: same detector vessel and PMT arrays. Only need to increase the TPC height.

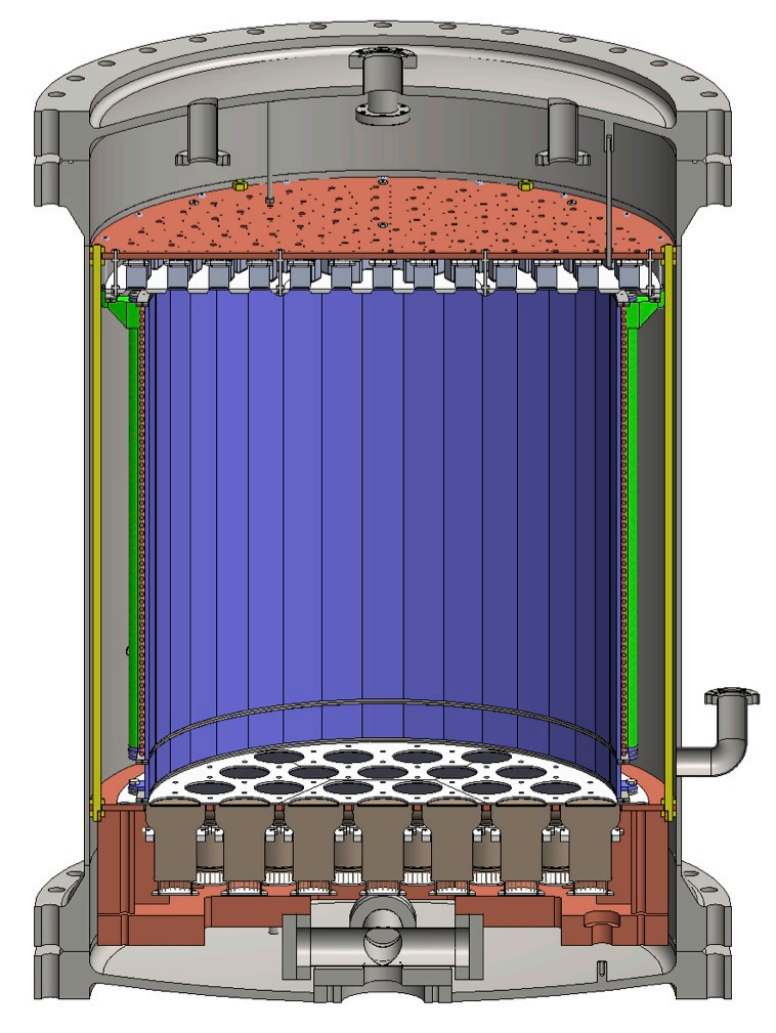


Stage-1a (125 kg target)



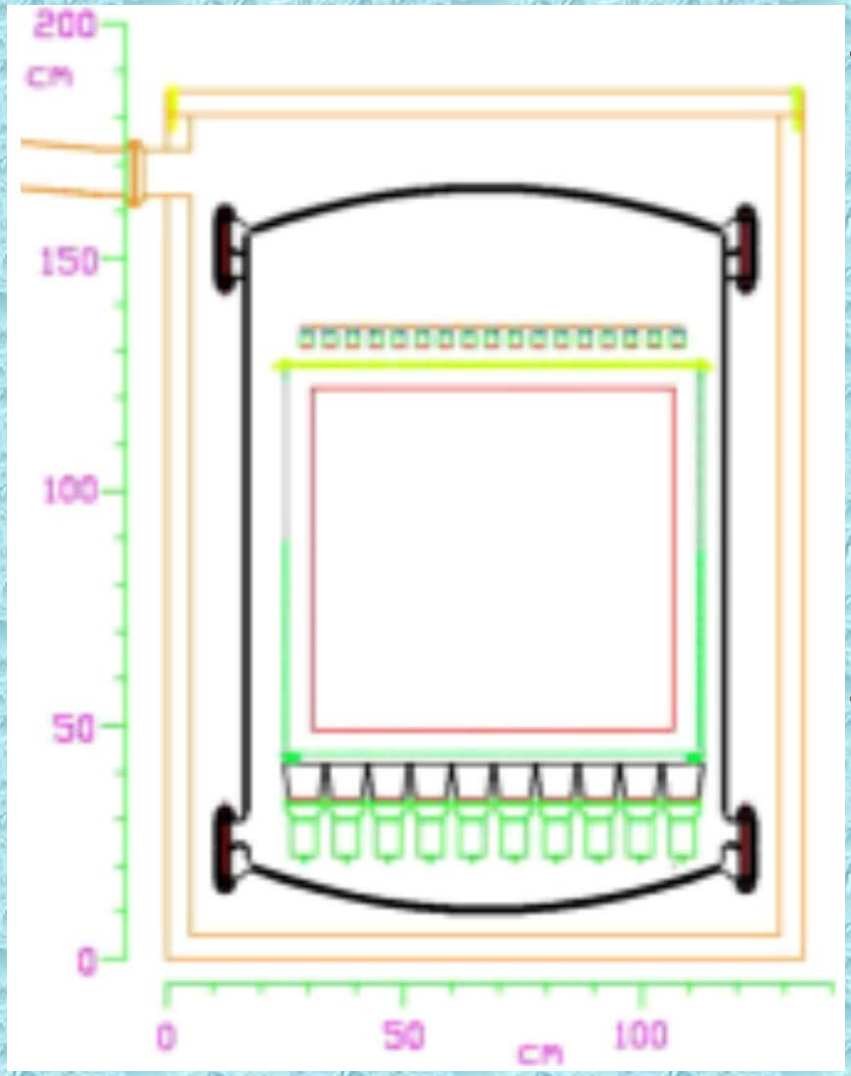
Stage-1b (500 kg target)

5.1 Stage-1b: design and plans



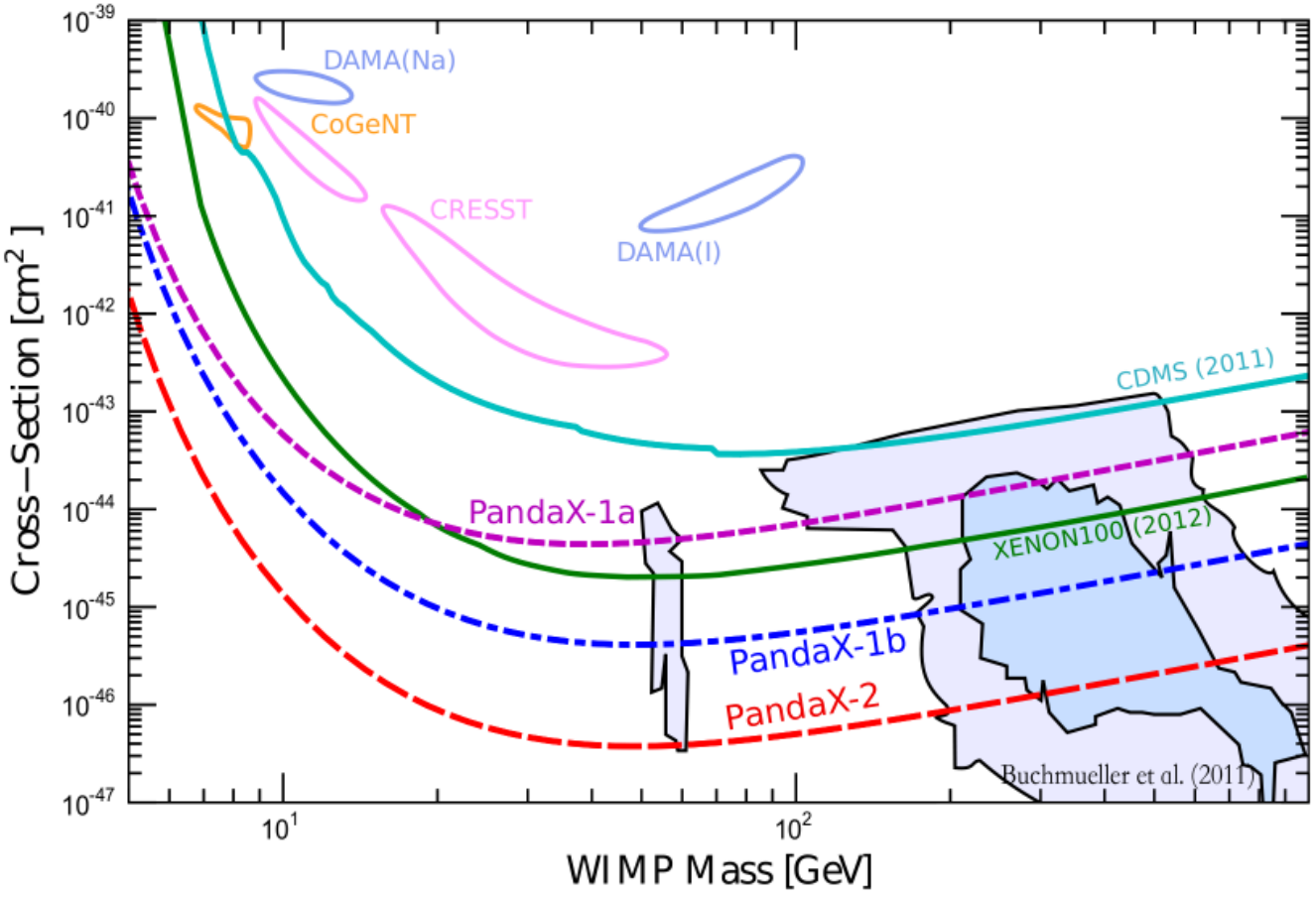
- Design:
  - TPC diameter/length: 60/60 cm
  - Target Xe mass: 500 kg
  - Expected Fiducial mass: 300 kg
  - PMTs: same as stage-1a
- Plans:
  - Construction: 2013
  - Commissioning/Operation: 2014
  - Sensitivity reach: 4e-46 cm^2 at 100 GeV with a 300 kg x 180 days exposure

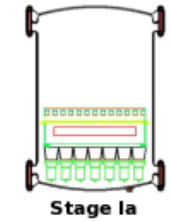
5.2 Stage-2: design and plans



- Design:
  - New low activity inner vessel
  - TPC diameter/length: 100/100 cm
  - Target Xe mass: 2.4 ton
  - Expected Fiducial mass: 1.4 ton
  - Top PMTs: R8520 or R11410
  - Bottom PMTs: 121 R11410
- Plans:
  - Start construction in 2014 (funding driven)
  - Commissioning/operation: 2015-2017
  - Sensitivity reach: 3e-47 cm^2 at 100 GeV with a 600,000 kg-day exposure

5.3 Estimated results





Thanks a lot