IHEP Benchmark WL and plans

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BESIII Experiment at BEPCII

Satellite view of BEPCII /BESIII

LINAC

South

BESIII detector

2004: start BEPCII construction
2008: test run of BEPCII
2009-now: BECPII/BESIII
              data taking

5600
4100
750
μ C
Superconductor MG
CsI_EMC
TOF
MDC
cosθ=0.83
cosθ=0.9
cosθ=0.93
5100
(2373)
Ø1300
EEMC
3500
3800

文本框: Beam energy: 1.0-2.3 GeV
Luminosity: ~1×1033 cm-2s-1
Optimum energy: 1.89 GeV
No. of bunches: 93
Bunch length: 1.5 cm
Circumference: 237 m

BESIII Detector (Option 2)

Beam energy: **1.0-2.3 GeV**

Luminosity: **~1×10^{33} cm^{-2}s^{-1}**

Optimum energy: **1.89 GeV**

No. of bunches: **93**

Bunch length: **1.5 cm**

Circumference: **237 m**

BESIII detector:

Main Drift Chamber

Time of Flight

CsI Calorimeter

Muon Chamber

1T SC Magnet

The JUNO Experiment

- **The Jiangmen Underground Neutrino Observatory (JUNO):**
  - Neutrino detected by Inverse Beta Decay (IBD);
  - Baseline: ~53 km from 2 nuclear power plants sites (26 GWth in 2020);
  - 20 kilotons high light yield and high transparency liquid scintillator;
 - >75% PMT photocathode coverage;
- **Goals of JUNO:**
  - Main: to determine the neutrino mass hierarchy at 3-4σ sensitivity within 6 years by <3% energy resolution @ 1 MeV;
  - Other: solar oscillation parameters, supernova neutrino, geo-neutrino, etc.
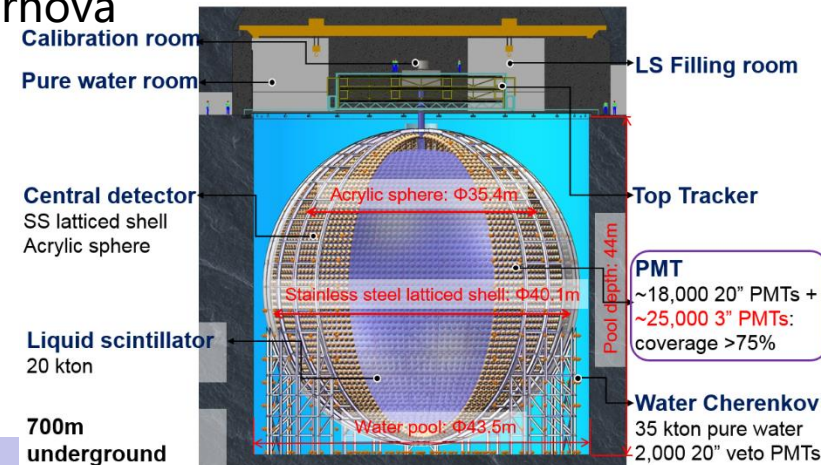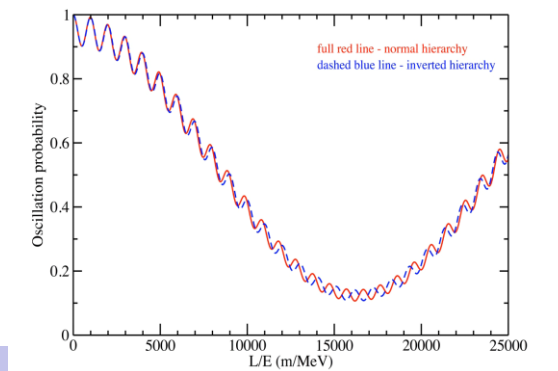
JUNO Computing

- **JUNO Distributed Computing system was built on DIRAC**
  - Handles heterogeneous and distributed resources
  - Provides workload management (WM) and data management (DM)

JUNO Data centers roles
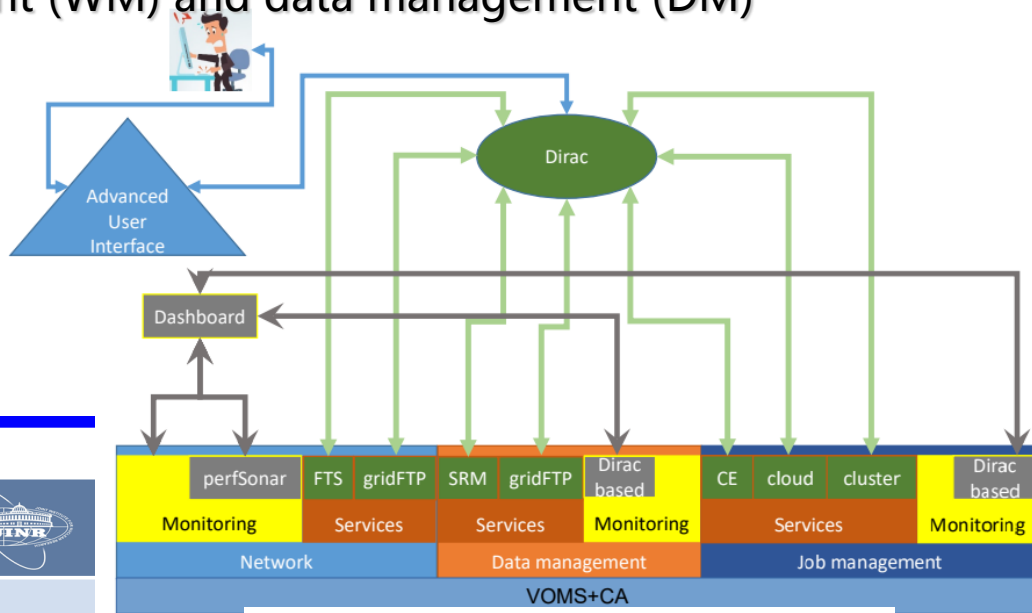
	IHEP	CCIN2P3	INFN CNAF	MSU	JINR (DUBNA)
Main storage			Secondary storage		Secondary storage
Data quality					
First reconstruction			Secondary reconstruction		Secondary reconstruction
Analysis	Analysis	Analysis	Analysis	Analysis	Analysis
Simulation	Simulation	Simulation	Simulation	Simulation	Simulation

Country	Institute	Country	Institute	Country	Institute
Armenia	Yerevan Physics Institute	China	IMP-CAS	Germany	U. Mainz
Belgium	Universite libre de Bruxelles	China	SYSU	Germany	U. Tuebingen
Brazil	PUC	China	Tsinghua U.	Italy	INFN Catania
Brazil	UEL	China	UCAS	Italy	INFN di Frascati
Chile	PCUC	China	USTC	Italy	INFN-Ferrara
Chile	UTFSM	China	U. of South China	Italy	INFN-Milano
China	BISEE	China	Wu Yi U.	Italy	INFN-Milano Bicocca
China	Beijing Normal U.	China	Wuhan U.	Italy	INFN-Padova
China	CAGS	China	Xi'an JT U.	Italy	INFN-Perugia
China	ChongQing University	China	Xiamen University	Italy	INFN-Roma 3
China	CIAE	China	Zhengzhou U.	Latvia	IECS
China	DGUT	China	NUDT	Pakistan	PINSTECH (PAEC)
China	ECUST	China	CUG-Beijing	Russia	INR Moscow
China	Guangxi U.	China	ECUT-Nanchang City	Russia	JINR
China	Harbin Institute of Technology	Czech R.	Charles University	Russia	MSU
China	IHEP	Finland	University of Jyvaskyla	Slovakia	FMPI CU
China	Jilin U.	France	LAL Orsay	Taiwan-China	National Chiao-Tung U.
China	Jinan U.	France	CENBG Bordeaux	Taiwan-China	National Taiwan U.
China	Nanjing U.	France	CPPM Marseille	Taiwan-China	National United U.
China	Nankai U.	France	IPHC Strasbourg	Thailand	NARIT
China	NCEPU	France	Subatech Nantes	Thailand	PPRLCU
China	Pekin U.	Germany	FZJ-ZEA	Thailand	SUT
China	Shandong U.	Germany	RWTH Aachen U.	USA	UMD1
China	Shanghai JT U.	Germany	TUM	USA	UMD2
China	IGG-Beijing	Germany	U. Hamburg	USA	UC Irvine
China	IGG-Wuhan	Germany	FZJ-IKP		

77 members

HEPS : High Energy Photon Source

- **New light source in China — High energy, high brightness**

- **Located in Beijing - about 80KM from IHEP**

- **Officially approved in Dec. 2017, the construction was started at the end of 2018 and will be completed in 2024**

- **The whole project will be finished in mid-2025 after commissioning**

A new photon science research center at the northern China
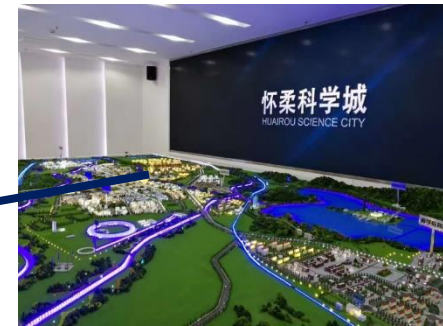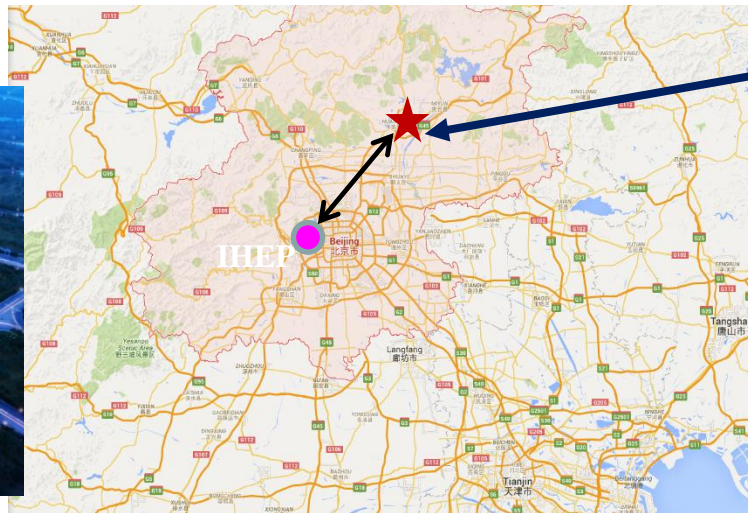
·Main parameters	Unit	Value
Beam energy	GeV	6
Circumference	m	1360.4
Emittance	pm·rad	< 60
Brightness	phs/s/mm^2/mrad^2/0.1%BW	>10^{22}
Beam current	mA	200
Injection		Top-up

HEPS Computing

- Simulation / For accelerator design
- Online / For beamlines
- Offline / For users and in-house scientists
- (Data Reconstruction, Analysis …)

Computing Overview

System Design : Capability

Items	Performance		
Machine Room	Space: 600 ㎡ Racks: 30(100)		14 beamlines phase I >90 beamlines phase II
GPN	1Gbps/10Gbps		
DCN	10Gbps/100Gbps		
Storage	30 PB Disk XXPB Tape		Tape storage will be provided according to the funding
Computing	CPU: 90 TFLOPS GPU:365 TFLOPS	2500 CPU Cores 48 GPU NVIDIA Tesla V100	
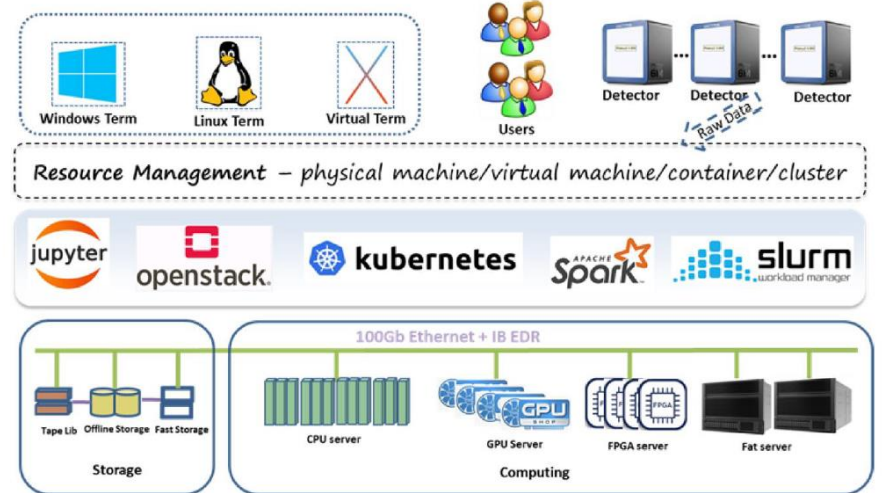
Requirement of Benchmark

- Global computing: JUNO, BESIII, CEPC,... .
- HEPS and BESIII need both CPU and GPU.
- Job type: SIM, GEN, REC, Analysis
- To address the computing needs for experiments.
- Unify the site pledged with different hardware.

What we have for WL

- **BES**
  - Simulation and Event Generation
  - Reconstruction
  - Analysis (not for benchmark)
- **JUNO**
  - Sim, Gen, Rec

```
[root@raqws007 zoujh]# cat benchmark/runCVMFS.sh
#!/bin/bash

#version=$1
version="7.0.5-Slc6Centos7Compat"
cmthome="/cvmfs/bes3.ihep.ac.cn/bes3sw/cmthome/cmthome-$version"

if [ ! -d $cmthome ]; then
    echo "Error: invalid version $version"
    exit
fi

rundir=`cat /proc/sys/kernel/random/uuid`

mkdir $rundir

pushd $rundir
    source $cmthome/setupCMT.sh
    cp -r  $cmthome/requirements .
    cmt config
    source setup.sh
    source $BesArea/TestRelease/TestRelease-*/cmt/setup.sh

    cp $TESTRELEASEROOT/run/rhopi.dec .

    boss.exe $TESTRELEASEROOT/run/jobOptions_sim.txt
popd
```
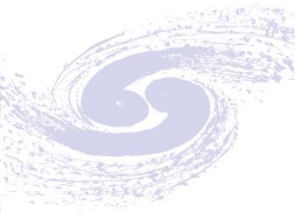
```
[root@ccopt benchmark]# cat /cvmfs/bes3.ihep.ac.cn/bes3sw/Boss/7.0.6/TestRelea
sim.txt
//DENG Zi-yan 2008-03-17

#include "$OFFLINEEVENTLOOPMGRROOT/share/OfflineEventLoopMgr_Option.txt"

//*************job options for generator (KKMC)***************
#include "$KKMCROOT/share/jobOptions_KKMC.txt"
KKMC.CMSEnergy = 3.097;
KKMC.BeamEnergySpread=0.0008;
KKMC.NumberOfEventPrinted=1;
KKMC.GenerateJPsi=true;

//*************job options for EvtGen***************
#include "$BESEVTGENROOT/share/BesEvtGen.txt"
EvtDecay.userDecayTableName = "rhopi.dec";

//*************job options for random number*********************
BesRndmGenSvc.RndmSeed = 100;

//*************job options for detector simulation*****************
#include "$BESSIMROOT/share/G4Svc_BesSim.txt"

//configure for calibration constants
#include "$CALIBSVCROOT/share/calibConfig_sim.txt"

// run ID
RealizationSvc.RunIdList = {-9989};

#include "$ROOTIOROOT/share/jobOptions_Digi2Root.txt"
RootCnvSvc.digiRootOutputFile = "rhopi.rtraw";

// OUTPUT PRINTOUT LEVEL
// Set output level threshold (2=DEBUG, 3=INFO, 4=WARNING, 5=ERROR, 6=FATAL )
MessageSvc.OutputLevel  = 5;

// Number of events to be processed (default is 10)
ApplicationMgr.EvtMax = 50;
```

```
    jobOptions_sim_db.txt         rec_data.txt
1 /cvmfs/bes3.ihep.ac.cn/bes3sw/Boss/7.0.6/Tes

  67 Oct 22 16:55 CVS
1384 Oct 22  2010 HelloWorldOptions.txt
 678 Sep 27  2009 jobOptions_ana_pipijpsi.txt
 666 Sep 27  2009 jobOptions_ana_rhopi.txt
1707 Aug 19  2017 jobOptions_rec_data.txt
1651 Aug 19  2017 jobOptions_rec_recdata.txt
1784 Aug 19  2017 jobOptions_rec.txt
1328 Jan 19  2020 jobOptions_sim_db.txt
1143 Nov 30  2009 jobOptions_sim_psip.txt
1133 Nov 30  2009 jobOptions_sim.txt
 156 Aug 26  2009 pipijpsi.dec
1614 Aug 19  2017 rec_data.txt
1902 Aug 19  2017 rec_mc.txt
 184 Dec 10  2010 rhopi.dec
```

Next Step

- Packaging and Containerize the workloads.
- Test and certify.
- Need instructions and documents.

Thanks