

**Welcome to
ILCWS2010 and ILC10**

**Introduction of
Institute of High Energy Physics**

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Outline

- Introduction
- BEPC/BEPCII
- Daya Bay reactor neutrino experiment
- Particle astrophysics
 - Yanbgjing cosmic ray observatory
 - Space program
- Multiple discipline research
- Chinese Spallation Neutron Source
- Medium and long term plan
- Close remarks: cooperation with JLAB

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Institute of High Energy Physics

- Institute of Modern Physics: established at 1950
- Institute of High Energy Physics: independent Institute for Particle physics at 1973
 - Comprehensive and largest fundamental research center in China
 - 1250 employees, 2/3 of them are physicists and engineers,
 - 450 PhD Students and postdoctors
- Goal of IHEP: multiple discipline research center based on large scientific facilities.

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Major research fields at IHEP

- **Particle physics:**
 - Charm physics @ BEPC
 - LHC exp.
 - Yangbajing cosmic ray observatory
 - particle astrophysics
 - ν physics: Daya Bay reactor ν exp.
- **Accelerator technology and applications**
 - High Lumi. e+e- collider: BEPCII
 - High power proton accelerator
- **Radiation technologies and multidiscipline**
 - Synchrotron radiation source and applications
 - Spallation neutron source and application
 - Multiple discipline research: biology, nano-sciences, energy, environment.....

Beijing Electron Positron Collider (BEPC) at IHEP

BEPC: constructed 1984-1988

$E_{\text{beam}} \sim 1-2.5 \text{ GeV}$

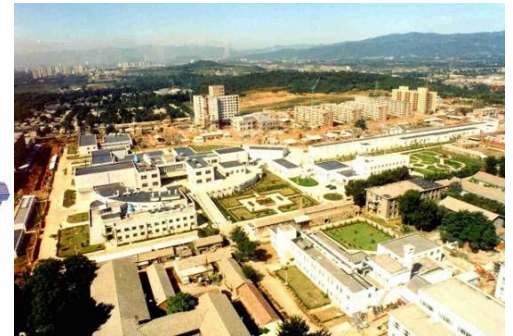
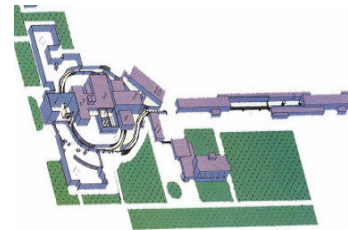
BESI: run from 1989-1998

BESII: run from 1999-2004

BEPCII upgraded 2004-2008

$E_{\text{beam}} \sim 1-2.3 \text{ GeV}$

BESIII: run from 2008



With BES I and BES II data:

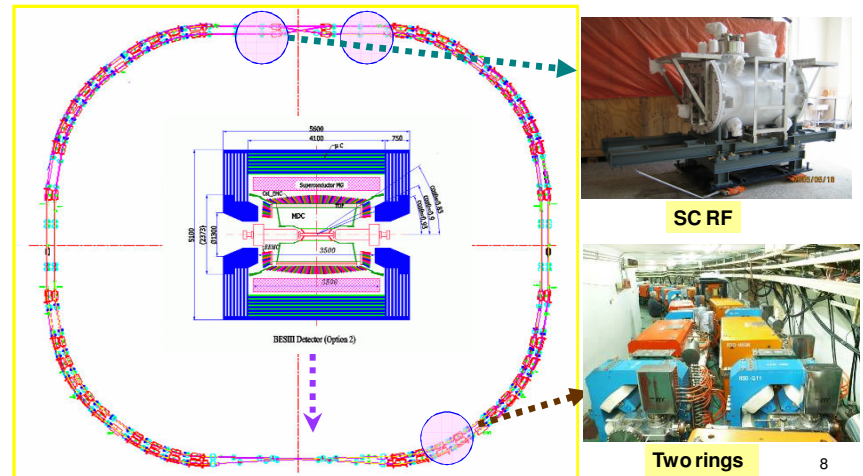
- precision measurement of τ mass: **10 times improved**. Lepton universality!
- R measurements improve uncertainties by a factor of 2-3 ($\Delta R/R \sim 6\%$). **Great impact to $M_H \cdot \alpha(M_Z^2)$, $g-2$**
- Some new particles X(1835) observed. Hard to be interpreted as conventional hadrons. ppbar bound state?

Precision measurement requires high statistics and small sys. errors →
Major upgrade: BEPCII / BESIII (2004-2008)

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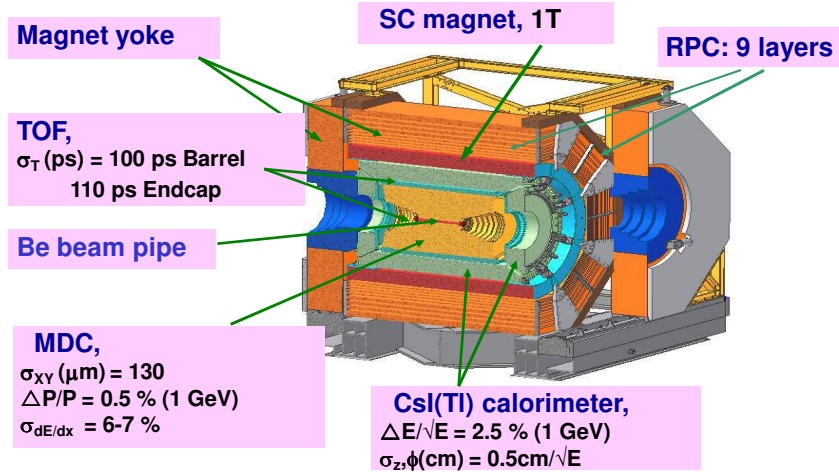
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BEPCII: a high luminosity double-ring collider



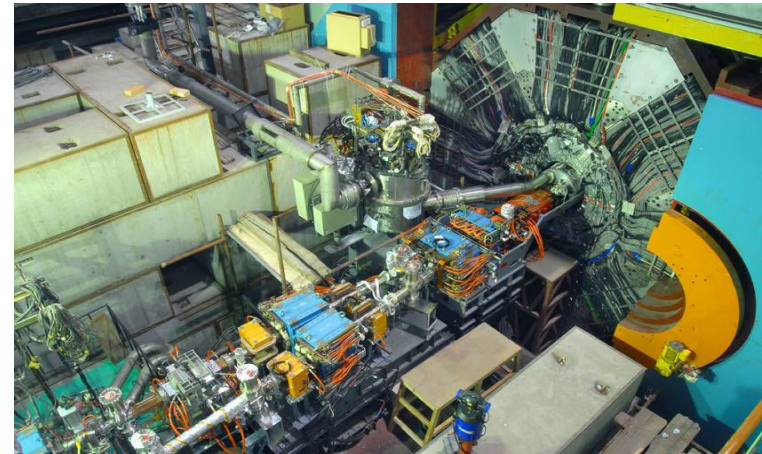
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The BESIII Detector



Joint Commissioning

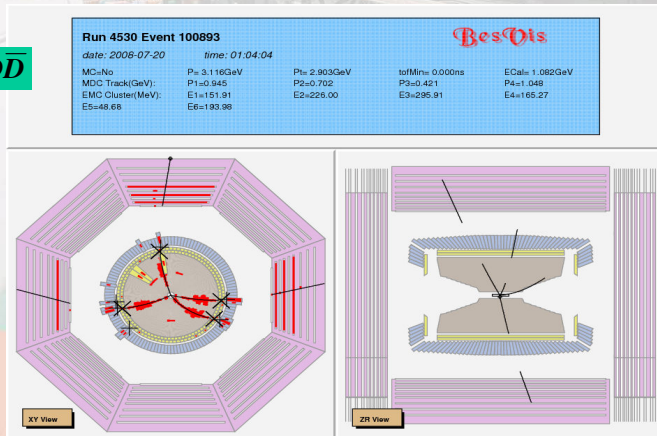
- BESIII detector moved into the IR in May
- Joint commissioning started 22 June.



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- First physics event was detected at BESIII in July 19, 2008.
- MDC noise problem was solved.
- 10M ψ' events collected for calibration

$\psi(3770) \rightarrow D\bar{D}$



BESIII reached design goals on schedule within the budget

- Linac: positron injection rate improved by > factor of 15
- BESIII performance reached the design goals.
- Synchrotron radiation running hard X-ray flux increased by a factor of 10
- luminosity of storage ring reached $3.2 \times 10^{32} \text{cm}^{-2} \text{s}^{-1}$ May 2009. a factor of 32 improvement
- BESIII passed the assessment of the funding agency July 17, 2009.
- By summer 2009, 120M Ψ' events and 200M J/Ψ collected/

Main parameters achieved in collision mode

parameters	design	Achieved	
		BER	BPR
Energy (GeV)	1.89	1.89	1.89
Beam curr. (mA)	910	650	700
Bunch curr. (mA)	9.8	>10	>10
Bunch number	93	93	93
RF voltage	1.5	1.5	1.5
* v_s @ 1.5MV	0.033	0.032	0.032
β_x^*/β_y^* (m)	1.0/0.015	~1.0/0.016	~1.0/0.016
Inj. Rate (mA/min)	200 e ⁻ /50 e ⁺	>200	>50
Lum. ($\times 10^{33}\text{cm}^{-2}\text{s}^{-1}$)	1	0.33	

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Preliminary physics results

- Confirm BESII results
 - threshold enhancement γppbar , $\gamma\omega\phi$, X(1835), ...
- Improved measurements
 - h_c , η_c , χ_{cJ} , ...
- New observations
 - χ_{cJ} decays
 - h_c decays
 - Light hadrons, ...
- 3 papers accepted and 4 submitted

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Physics at BEPCII/BESIII

- Precision measurement of CKM matrix elements
- Precision test of Standard Model
- QCD and hadron production
- Light hadron spectroscopy
- Charmonium production/decays
- Search for new physics/new particles

Physics	Energy (GeV)	Peak Luminosity ($10^{33} \text{ cm}^{-2}\text{s}^{-1}$)	Events/year	Existing data
J/ ψ	3.097	0.6	10×10^9	60×10^6 (BESII)
τ	3.67(?)	1.0	12×10^6	--
ψ'	3.686	1.0	3×10^9	27×10^6 (CLEOc) 14×10^6 (BESII)
D	3.77	1.0	3×10^6	5×10^6 (CLEOc)
Ds	4.03	0.6	1×10^6	4×10^3 (BESI)
Ds	4.17	0.6	3×10^6	0.3×10^6 (CLEOc)
R scan	3.0-4.6	0.6(?) - 1.0	--	--

Precision measurement of ν mixing θ_{13} : Daya Bay reactor ν experiment

- Daya Bay nuclear power plant: 4 reactor cores, 11.6 GW
2 more in 2011 for a total of 17.4 GW
- Mountains near by, easy to construct a lab with enough overburden to shield cosmic-ray backgrounds
- 90% tunnel construction finished. Begin data taking with the Near-Far configuration later 2011
- Expect to reach sensitivity of 0.01 with 3 years of running.



Experimental layout



- Identical detector at near and far site to perform relative measurement in order to cancel reactor related systematic error
- Experimental halls are connected by 3000m tunnel
- Signal rate :
~1200/day Near
~350/day Far
- Backgrounds :
B/S ~0.4% Near
B/S ~0.2% Far

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LHC Experiments

1. **CMS** (IHEP, Peking Univ.)
 - 1/3 of CSC at muon end caps (IHEP)
 - RPC of barrel muon (Beijing Univ.)
 - Physics and MC
2. **Atlas** (IHEP, USTC, Shandong Univ., Nanjing Univ.)
 - Drift Monitor chambers (IHEP)
 - TGC (Shandong Univ.)
 - Physics and MC
3. **LCG: Tier 2**
4. **LHCb:** (Tsinghua Univ.)
5. **Alice:** (Huazhong Normal Univ., CIAE)

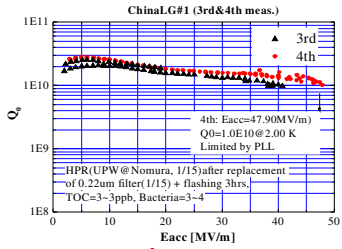
ILC R&D Activities

- SC cavities (also for next generation light source)
 - Dumping ring design
 - Positron source
 - detector R&D (IHEP and Tsinghua Univ....)
- Other R&D:**
- works for EXFEL also very useful for ILC R&D
 - BEPCII spare cavity (500 MHz)

At meantime, Chinese accelerator teams are heavily loaded with the domestic programs. China will be more active in R&D of ILC in near future.

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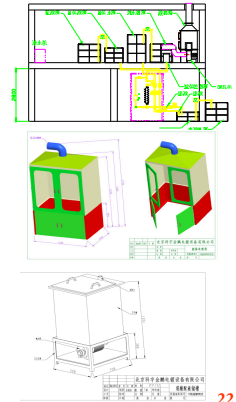
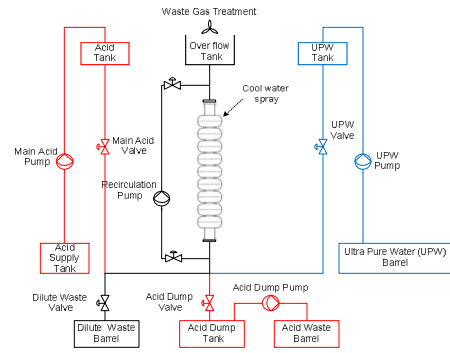
ILC cavity made by Chinese single crystal (collaborating with KEK Saito group)



47.9 MV/m (after EP)

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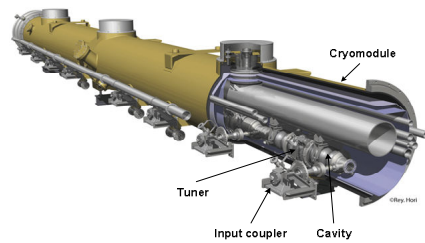
Chemical Polishing Facility (installed at IHEP)



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SCRF Test Facility is proposed

1.3 GHz SCRF Accelerating Unit and Horizontal Test Stand for ILC, ERL and XFEL

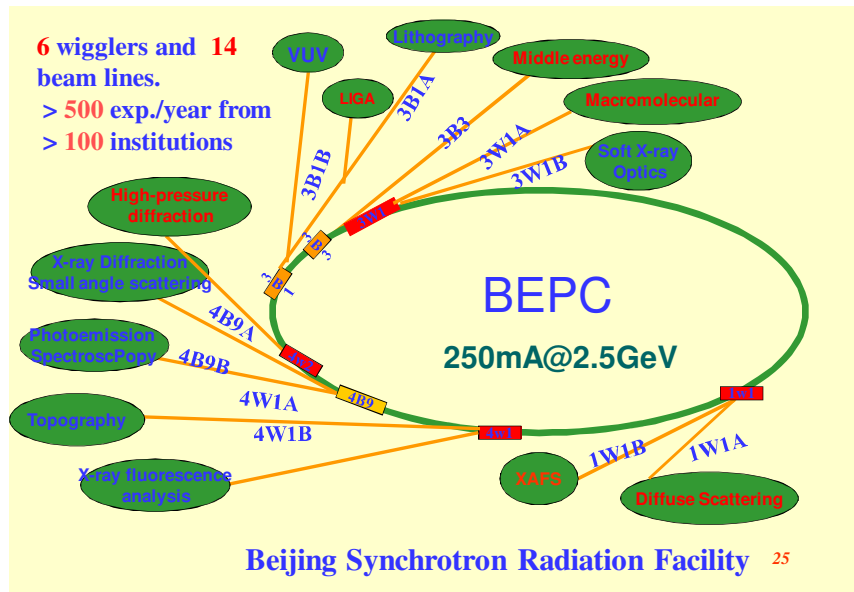


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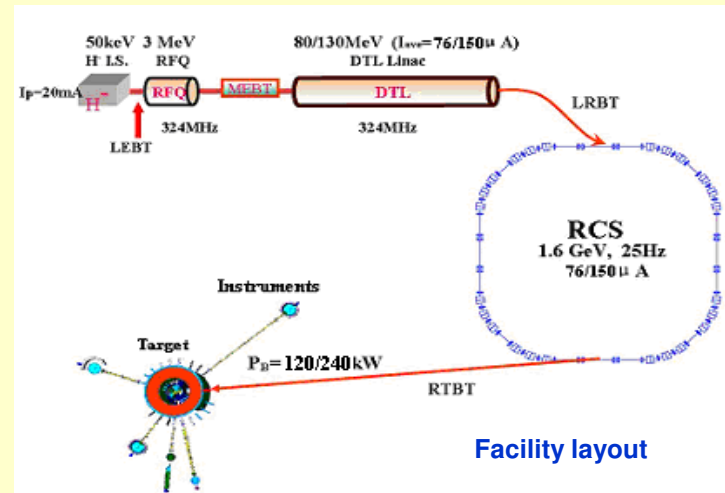
Multiple discipline research

- **Large Facilities:**
 - BSRF
 - CSNS
 - High current slow positron source
 - Beijing Advance Light Source (under discussion)
- **Research fields:**
 - Biology effects of nano-materials
 - Nuclear image and application
 - Protein structure and function
 - Environment studies with nuclear methods
 - Nano-material science
 -

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Chinese Spallation Neutron Source (CSNS)



Status of CSNS

- **Proposal approved.**
- **Feasibility study report approved.**
- **Preliminary designs are ready, reviews are underway.**
- **IHEP is in charge of the project with cooperation with Inst. of Physics.**
- **CSNS will be a branch of IHEP**
- **Budget: 1.4B RMB + the fund (0.5B) & the free land from the local governments**
- **Construction and commissioning: 6.5 year**
- **Major project for machine team and detector team after BEPCII/BESIII**
- **Design and R&D are going smoothly. many prototypes are under test.**

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Chinese Particle Physics projects in medium and long term plan

- **Charm physics @ BEPCII: next 8 years or more**
- **Intl. collaborations: LHC exp., ILC...**
- **Particle Astrophysics exp. at Space**
 - **Modulated hard X-ray telescope satellite**
 - **SVOM**
 - **Polar @ Chinese Spacelab.: polarization of γ burst**
- **Cosmic ray measurement**
 - **Yangbajing Cosmic ray Observatory: LHAASO**
- **Neutrino experiments:**
 - **Daya Bay Reactor neutrino exp.:**
- **Deep underground Lab.: dark matter search**
- **South pole Dome A: 4m telescope (under discussion)**

Chinese Particle Physics Medium and Long Term Plan (cont.)

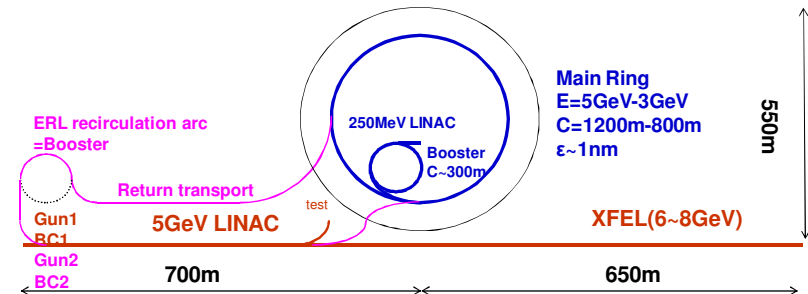
- High power proton Accelerator:
 - Chinese Spallation Neutron Source
 - Accelerator Driven Subcritical system
- Beijing Advance Light Source ERL + XFEL

IHEP extends research fields, to protein structure, nano-science, material science...

→ Multiple discipline research center

Beijing Advanced Photon Complex

Phase I: Low emittance Synchrotron Radiation source BAPS ,
5GeV, 100-200mA, 1nm.rad, 2013-2018
Phase II: X-ray FEL (BXFEL)0.15 nm, 6-8 GeV, 2017-2022
Phase III: X-ray Energy Recovery LINAC source, BXERL, 2022-



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Thank you for attention !

Wish the workshop with great success

Pleasant Stay in Beijing !