BESII+BESIII

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☞ Achievements and difficulties

- BESII performance and J/ψ data taking (Dr. T. Hu, X.Y. Shen)
- Software, computing system (Dr. C.C. Zhang, Z.P. Mao)
- Physics analysis and publications (Dr. X.C. Lou)
- Team

☞ Futures

- Data taking with BESII
- BESIII
- Collaboration

☞ Summary

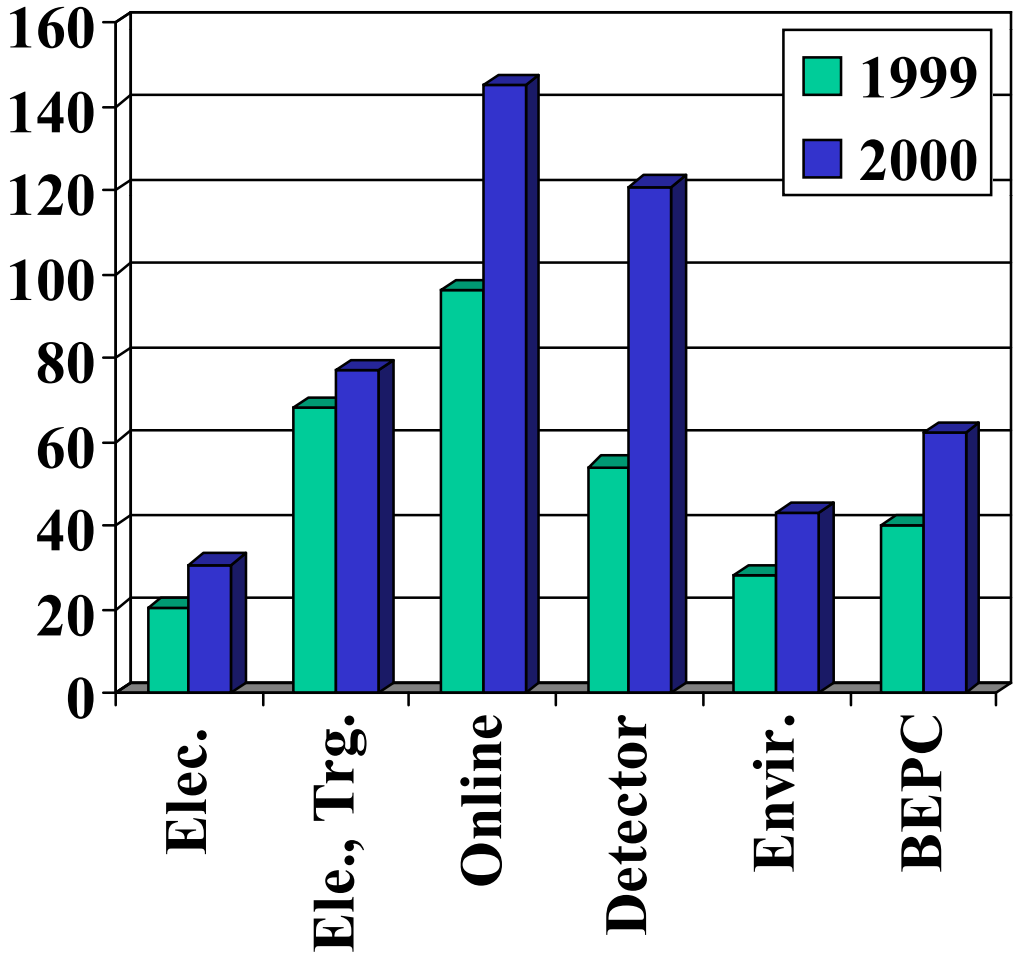
☞ Achievements

- BESII performance and J/ψ data taking
  - No disaster occurred during 6 months running
  - Performance stable
  - 22 M J/ψ events with good quality was collected and reconstructed

BESII Subsystem Status

System	VC	MDC	BSC	BTOF	Moun	DAQ	L.M.	Gas
Status	☺	☹	😐	☺	😐	☹	☹	☺
Problem		3 feedthr.	2 wires broken		Elect.	Trg. elect., aging Online network Software	Poor contact	

Number of Malfunctions



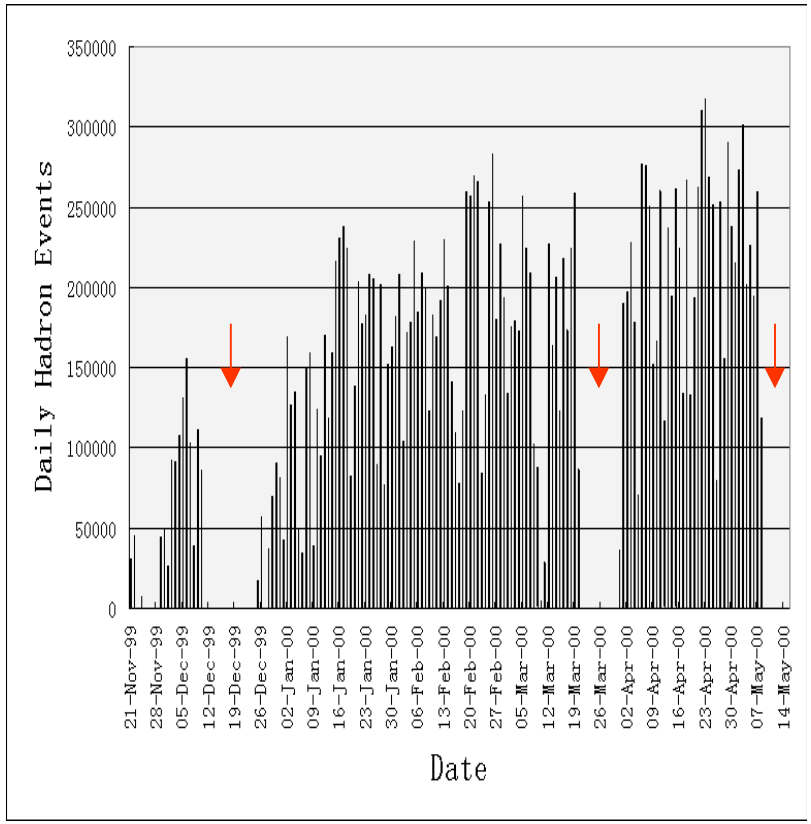
Beam Time Efficiency

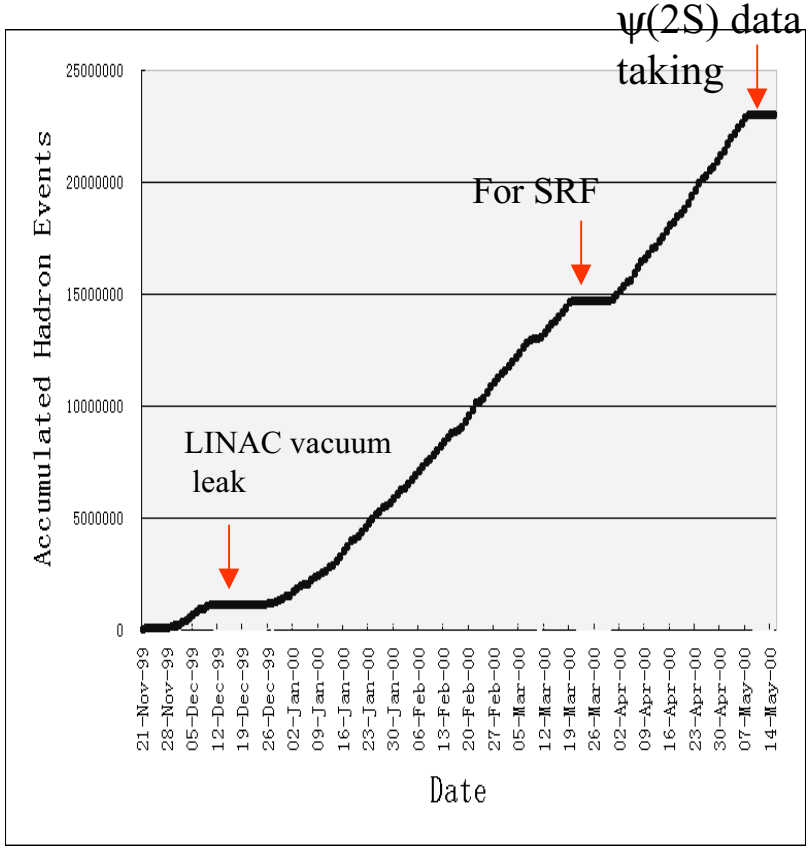
R≡ pure data taking time / total beam time

Year	1999	2000
R(%)	44	53

BESII J/ψ Data Taking History

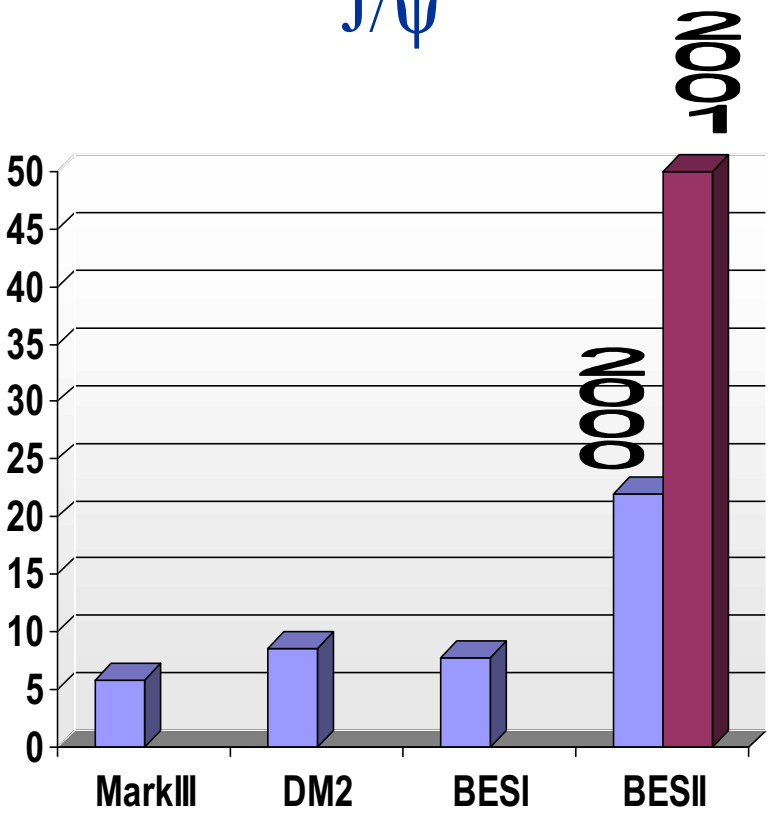
(17/11/1999-15/05/2000)



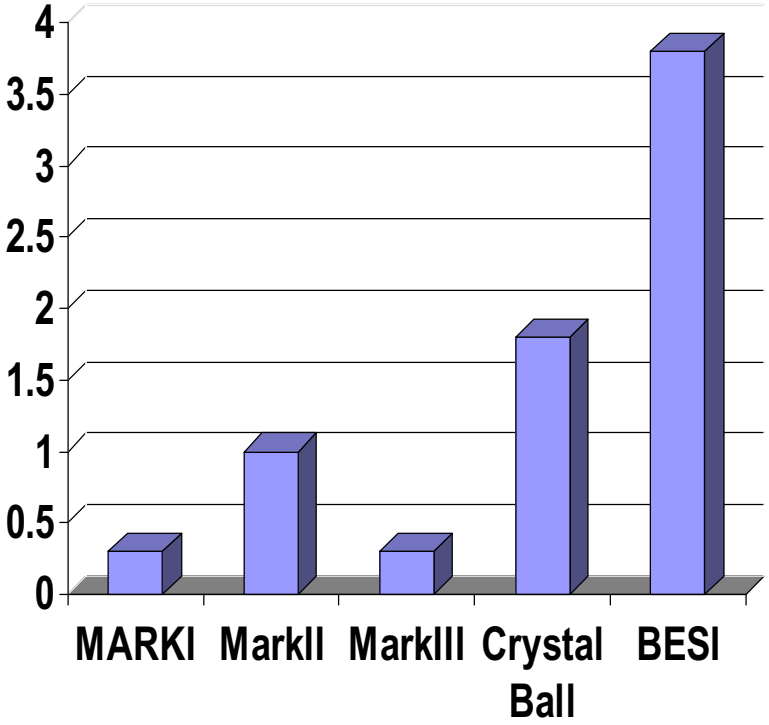


World J/ψ and ψ(2S) Samples ($\times 10^6$)

J/ψ



ψ(2S)



- Software and computing system

Version 102 frozen, Telesis improved, MDC trk finding and fitting to be improved(Zepu with Bill at SLAC)

a) New HP workstation:

HP9000/J5000

CPU ~60 (dual) SPCint95

2 GB RAM

7 × 18 GB HD

2 tape drivers

b) PC farm

Server: PIII 500 (dual);

256 MB SDRAM;17 GB SCSI HD + 6×36 GB Raid (Mode 5)

+

5 PIII500 PC's with 64 MB SDRAM

13 GB HD each

Will serve for the future data analysis and data reconstruction

- Physics analysis and publications (Dr. X. C. Lou)

1) R scan

First scan with 6 energy points:

PRL 84(2000)594

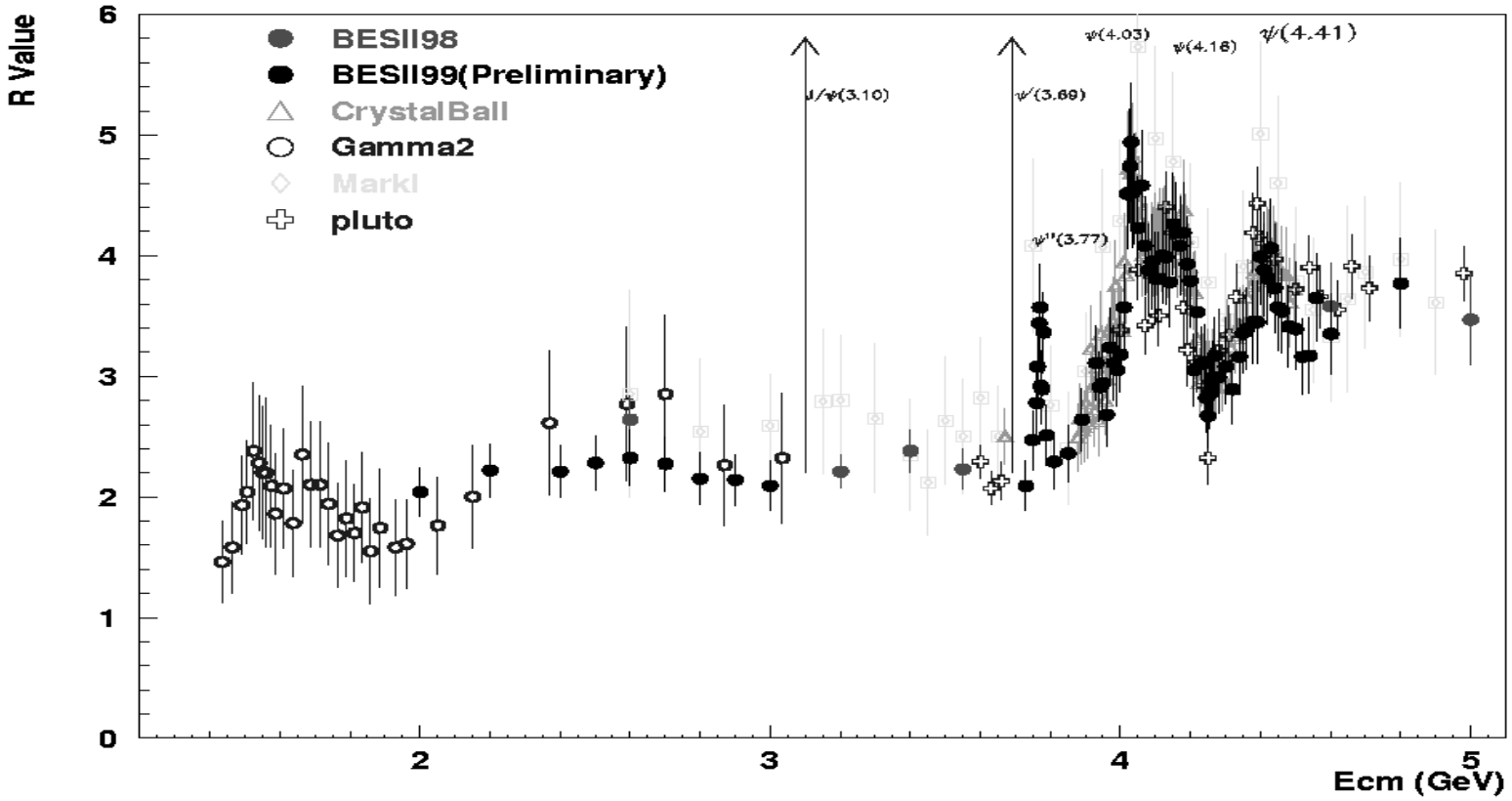
Second scan with 85 energy points:
Preliminary R values at 8 pts reported at LP99 and Hadron99;
All 85 pts will be presented at BES2K, and then summer int. conf. (e.g. ICHEP2K)

Final paper to be submitted in autumn or winter

Hadronic event shape analysis will then follow

E.M. form factor measurement Memo?

R Values in 2-5 GeV



2) J/ψ physics (BESI data)

a) Light hadron spectroscopy and glueball searches with PWA

$J/\psi \to \gamma\eta\pi^+\pi^-$	PLB 446(1999)356
$\gamma\pi^+\pi^-\ \pi^+\pi^-$	PLB 472(2000)207
$\gamma K^+K^-\ \pi^+\pi^-$	PLB 446(2000)200
$\gamma K^{\pm}K_S^-\ \pi^{\mp}$	PLB 476(2000)25
$\gamma\eta_c$ ($M\eta_c$ and $\Gamma\eta_c$) ↳ $\pi^+\pi^-\pi^+\pi^-$, $\pi^+\pi^-K^+K^-$ $K^+K^-\pi^0$, $\phi\phi$, $K^{\pm}K_S^-\ \pi^{\mp}$	Submitted to PRD
$\gamma\ \pi^+\pi^-$	Memo
ppbar η	Memo
$\gamma\ \gamma V$ (V=φ, ρ)	Memo (No PWA used)

b) New physics searches (preliminary)

$J/\psi \to e\mu$, DX	Waiting for memo

3) $\psi(2S)$ physics

$\psi(2S) \rightarrow AP = b_1\pi$, $K_1 Kbar$	PRL 83(1999)1918
$\gamma\chi_c$	PRD 60(1999)
↳hadron	
$J/\psi + \pi^+\pi^-$ (soft)	Accepted by PRD
ω/ϕ X	Passed BES referees
$\tau^+\tau^-$	Draft
5 γ's	Draft
$\pi^0 h_c$	
↳ $J/\psi + \pi^+\pi^-$	Memo
J/ψ + neutral	1 Memo, two more analysis
Resonance parameters	In progress
Total # of $N_{\psi(2s)}$	1 memo, one more analysis

4) D and Ds

$D^0 \to K^{0bar}\pi^+\pi^-$, $K^{0bar}K^+K^-$ BES referee review

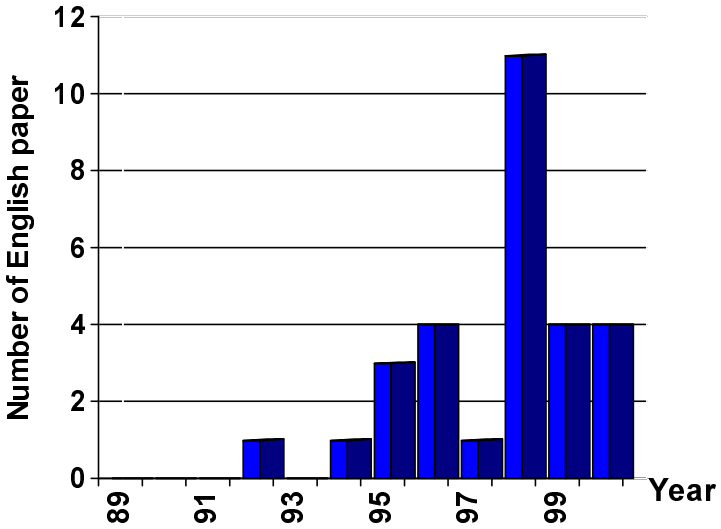
Br: $D_s \to K^{0*}X$ Waiting for memo

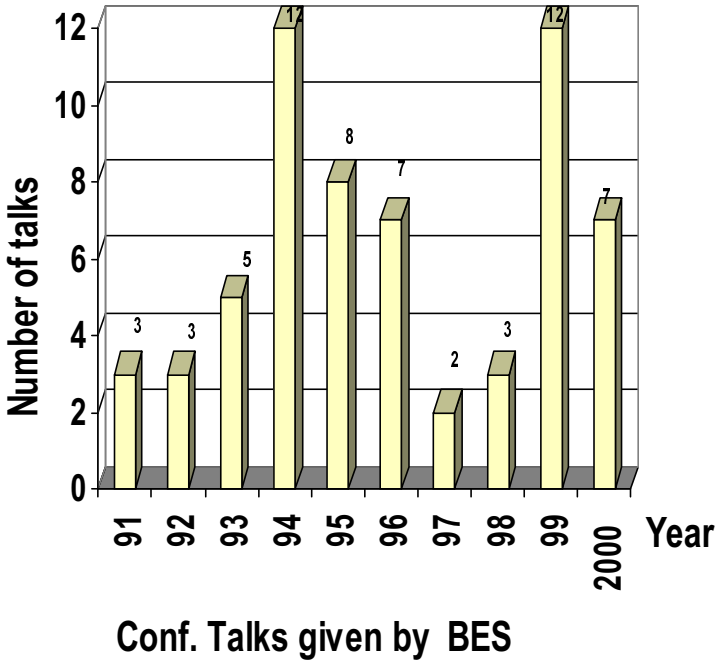
M_{Ds}: $D_s \to \phi\pi$, K^*K, K_sK, $K_0K\pi\pi$ Waiting for memo

5) BESII

Upgrade of BES: submitted to NIM

BES Publications and Conf. Talks





Conf. Talks given by BES

- Team

a) BES is continue losing young talents due to the killing of BTCF and too low income

b) Some young physicists are growing up

c) Urgent to train hardware experts, BESIII is an good opportunity

☞ Futures

- What data should we take with BESII after 50 M J/ψ?

1) E_{cm}= 3.77 GeV (1 year, ~40 pb^{-1})
2) More ψ(2S) (2 years, 18-20 M)
3) Large sample(10K) at the continuum e.g. 3.55 GeV (~14 days)
4) ψ(3770) resonance parameters measurement (~ 7 days)

Do you have any proposals?

BESIII

- Status of BESII
- What are BEPCII and BESIII
- Principal Tasks for BESIII

Current Status of BESII

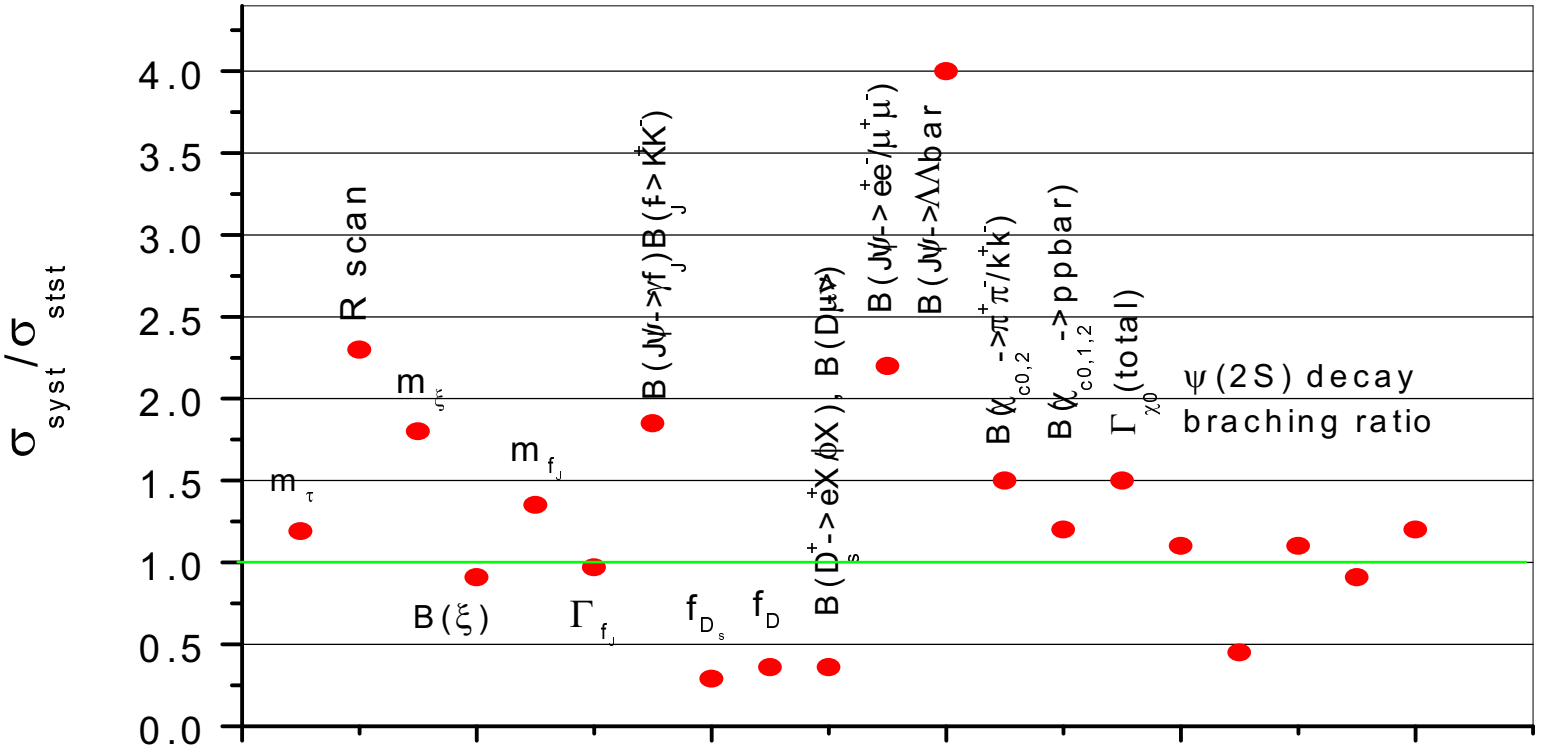
- 20 year's old technologies, not good enough PID, poor for γ's, small acceptance
- Doing good and important physics is limited
- Seriously suffering aging problem
- Unable to match BEPCII

Data Collected with BESI and BESII

E_{cm} (GeV)	Physics	BES Data	Other Lab. Data
3.10	J/ψ	7.8×10^6	8.6×10^6
3.69	ψ(2S)	3.7×10^6	1.8×10^6
4.03	τ	1.0×10^5	LEP
4.03	D_S, D	22.3 pb^{-1}	CLEO
3.55 m_τ scan	m_τ	5 pb^{-1}	
2-5 R scan	R value, α_{QED}, $(g-2)_\mu$	6+85 points	γγ2, MarkI Crystal Ball Pluto……
3.1	J/ψ	2.2×10^7	

Statistical and Systematic Uncertainties at BESI and BESII

$\sigma_{syst} > \sigma_{stat}$ for most of the measurements
$\rightarrow$ detector needs to be improved



What is BEPCII?

Machine

Original: L~10^{32} /(cm^2s) at E_{cm}=4.0 GeV

Now: $L_{BEPCII} = (5\sim10)\ L_{BEPC}$ at E_{cm}=???

Require

- Shorter bunch length (~5 cm↘ ~2 cm)
- Smaller energy spread (not much to gain)
- Lower background (will be worse than BEPC)

Measures

- Multi-bunch train (4~6 bunches, pretzel orbit)
- mini-β: ↘ impedance, ↗RF frequency &HV (200↗500 MHz); insert magnets close to collision point

What is BEPCII?

Detector

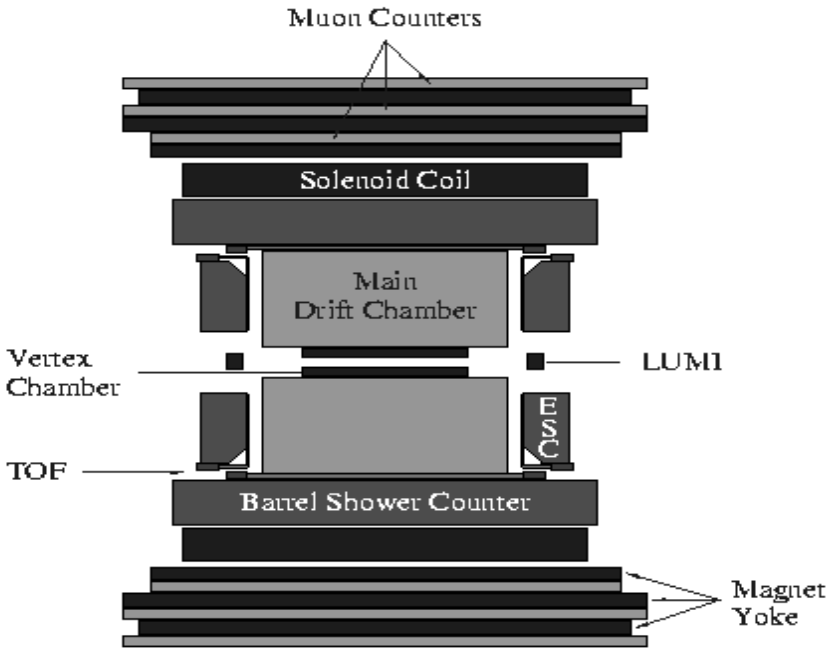
$$\sigma_{exp}^2 = \sigma_{stat}^2 + \sigma_{syst}^2$$

$L_{BEPCII} = (5\sim10)\, L_{BEPC}$, detector parameters needs a factor of 2-3 improvement.

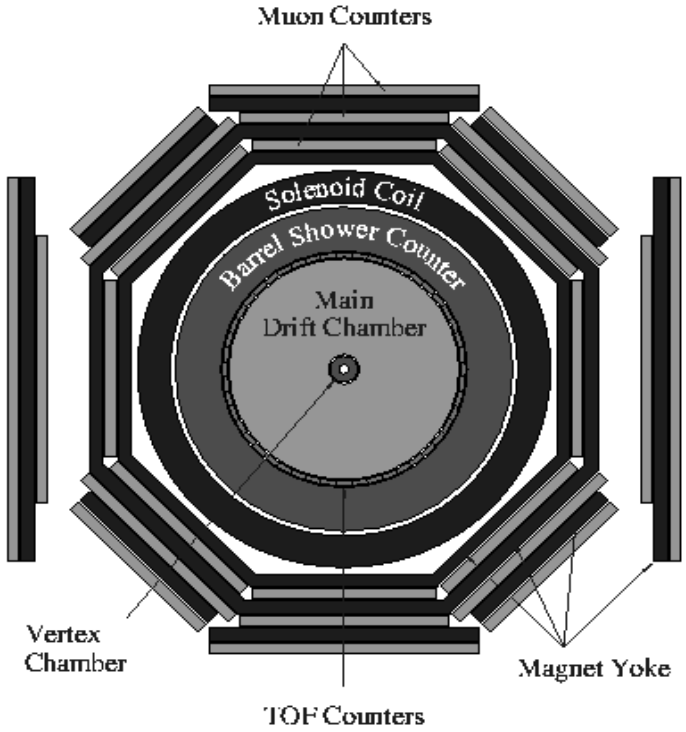
Two options:

1) A completely new generation detector (~200 M CNY)
   - My best favor
   - Unstable staffs are not interested in
   - Too expensive, and therefore unrealistic?

2) BESIII - significantly upgrade BESII (~150 M CYN)



Side view of the BES detector



End view of the BES detector

Principal Tasks for BESIII

- New barrel electromagnetic calorimeter (BEMC)
- Openable endcaps(door only in the first step)
- MDCIII (Al wires, or He gas?)
- New DAQ system adapting multi-bunch train
- All corresponding electronics
- New luminosity monitor (L.M.)
- New barrel time-of-flight (TOF)
- New vertex chamber (VC)
- New μ counter
- PC farm for data reconstruction and analysis
- Detector simulation based on GEANT3

$\rightarrow$ Almost each subsystem has to be upgraded in the end!

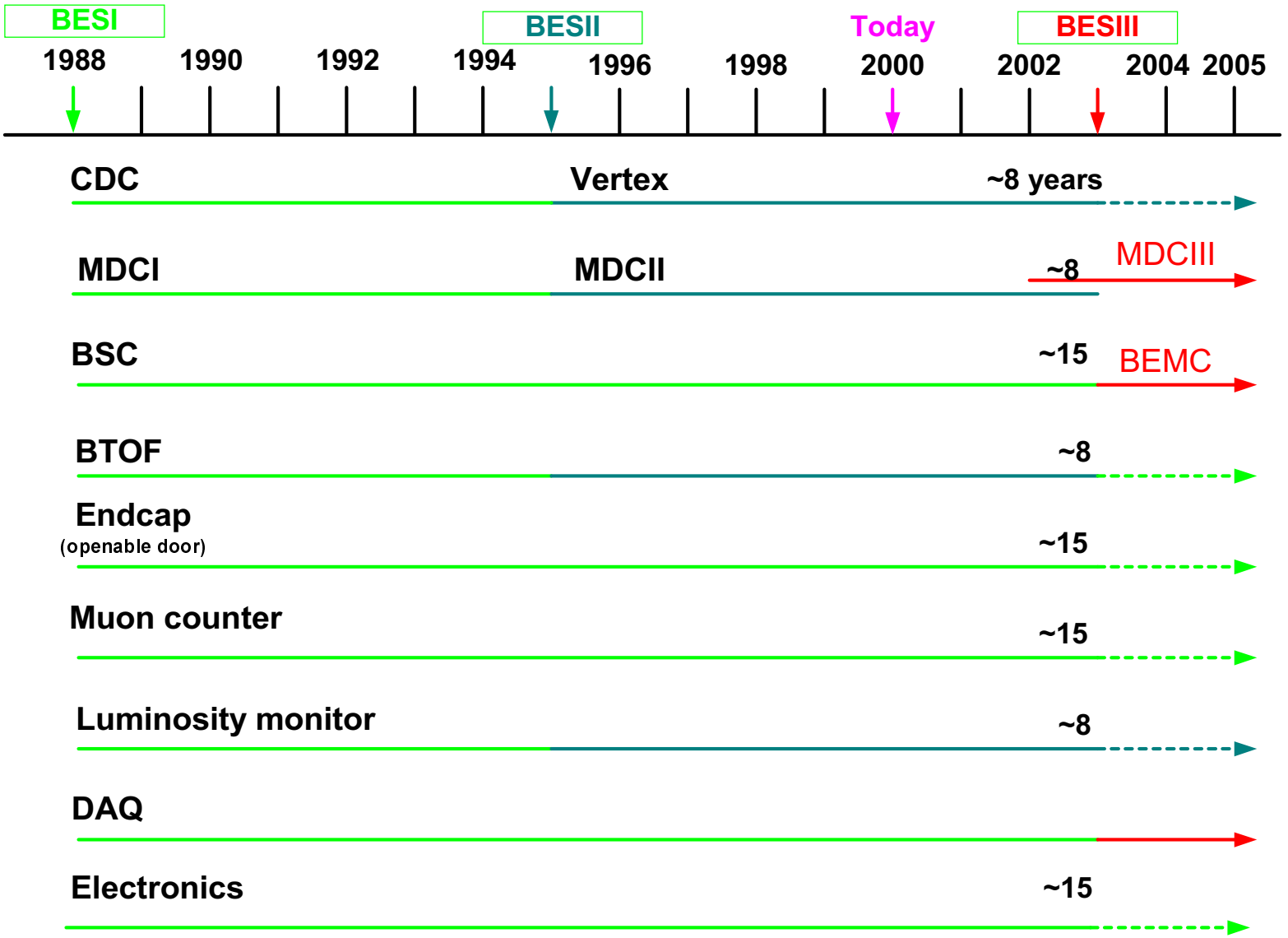
Major Detector Parameters

Detector	Major para.	BESI	BESII	BESIII
VC	$\sigma_{x,y}$ (μm)	200	100	BESII
MDC	σ_{xy} (μm)	200-250	190-220	MDCIII (Al+He?)
	$\Delta p/p$ (%)	1.76 $\sqrt{(1+p^2)}$	1.78 $\sqrt{(1+p^2)}$	BESII
	$\sigma_{dE/dx}$ (%)	7.9	8.4	
BTOF	σ_T (ps)	375	180	~(120-150)
	L_{atten} (m)	1.0-1.2	3.5-5.5	
BSC	$\Delta E/\sqrt{E}$ (%)	23.8	22	<10
	σ_z (cm)	4.5	4.5	<4
	σ_ϕ(mrad)	7.9	7.9	<8
ETOF	σ_T (ps)		720	openable
ESC	$\Delta E/\sqrt{E}$ (%)	24.4	22.1	endcaps
μ counter	σ_z (cm)	5.5	5.5	Better coverage
DAQ	dead time (ms)	20	8	?

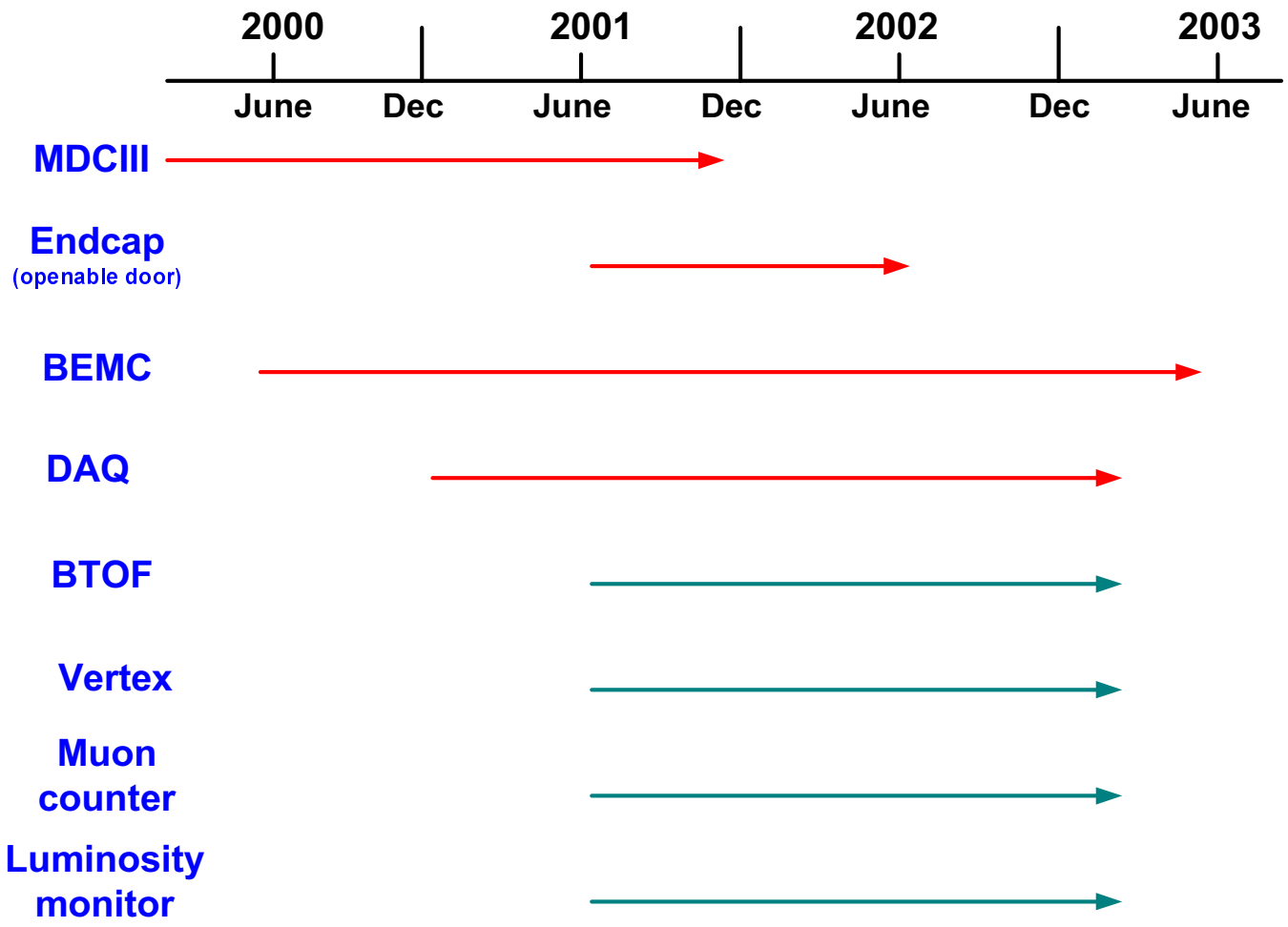
BESIII Type, Parameters and Cost Estimation

Item	Type	Parameter	Nominal value	Cost (M CNY)	Assumed by
MDCIII	Al wires, He gas MDCII cell structure	σ_{xy} (μm) $\Delta p/p$ (%) $\sigma_{dE/dx}$ (%)	~190-220 $1.78\sqrt{(1+p^2)}$ 7.8	10 (paid)	US+IHEP
BEMC	Scintillating fiber+P_b+glue (KLOE type)	$\Delta E/\sqrt{E}$ (%) σ_z (cm) σ_ϕ(mrad)	< 10 <4 <8	80	IHEP+?
End door	Openable			2	IHEP
DAQ	?	Dead time(ms)		3	IHEP+?
L.M.	?	$\Delta L/L$(%)	5	1.5	?
VC	Straw tube	$\sigma_{x,y}$ (μm)	100	2(?)	?
BTOF	Plastic sci. (96 pieces)	σ_T (ps)	120-150	10	?
μ counter	Increase coverage (?)	σ_z (cm)	5.5(?)	3(?)	?
Electronics				?	IHEP+

The Detector Age Issue



BESIII Construction Time Schedule

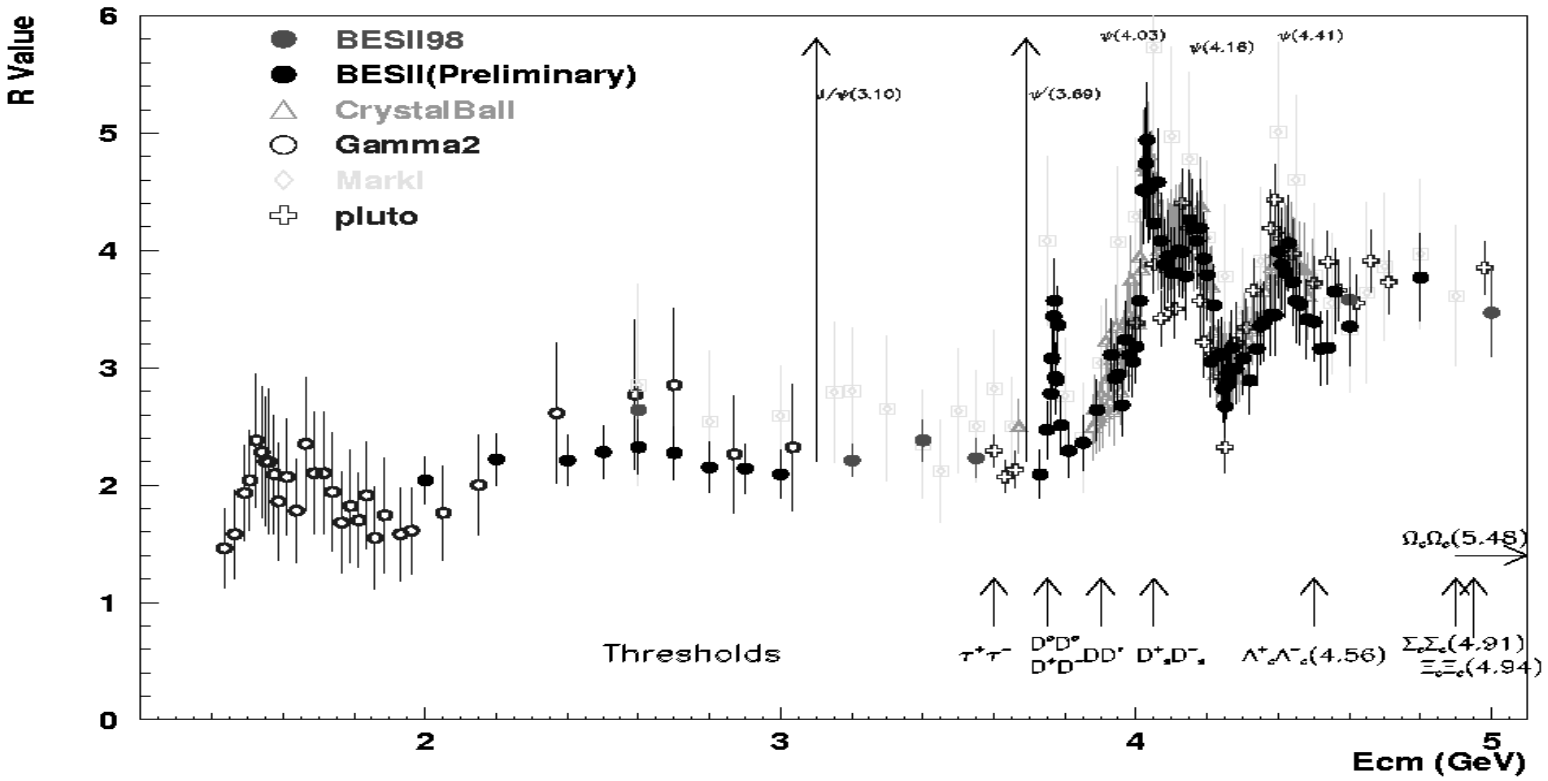


Physics Futures of the BEPC Energy Region

- Produce two of all three families of the quarks and all three lepton families
- Rich of resonances, charmonum and charmed mesons
- Threshold characteristics
- Transition between perturbative and non-perturbative QCD
- Gluenic matter and glueball

Physics Features in BEPC Energy Region

- Rich of resonances
- Thresholds characteristics
- Transition region between resonance and smooth perturbative



Physics Program at BESIII

- Light hadron spectroscopy, charmed mesons and tau at the thresholds

  a) Precision measurement of the decay Br for J/ψ, $\psi(2S)$, ψ'', D, Ds and some of their decay products (e.g. η_c, χ_{cJ}); Study of N^*, Λ^*, Σ^*, Ξ^*...

  b) Improving the measurement of f_D, f_{Ds}, ν_τ, m_τ

- Hadron production mechanism, low energy QCD

  Precision R values, $e^+e^- \rightarrow$ V, T, Baryon pairs, ambiguous' structures

Physics Program at BESIII

- Searches

  $^1P_1$, η_c', glueball, hybrids, exotics states

- New physics

  Possibility of probing rare decay and CP violation from the decays of J/ψ and ψ(2S)

Concluding Remarks

- BES at BEPC: a few generations' effort; 12 years painstaking, sacrifice and 12 years success
- Needs a good detector—BESIII to match BEPCII
  - Aging problem (electronics, BSC, μ counter, trigger)
  - Necessity from physics point of view
    better PID, γ detection and acceptance
  - Adapt BEPCII (trigger, L.M., electronics, end door)
- BEPCII with a good detector, a new era for IHEP
  - Needs much determination, effort, strength
  - A strong team and a good int. collab.
  - An effective and modern management

Wishes

An other 12 years of

- great effort with sacrifice, painstaking, success, contribution; without class and power struggle
- great concern and strong support from central government and CAS
- strong support from the hep community
- distinguished hep lab. in the world

and for anther a few generations, of which the youth are waiting for another Mr. X.P. Deng!

Advice to ?

- Green book for BTCF ☹← killed and reshuffled
  Don't produce any green book in China!

- Red book for BEPCII ☺ ← will be approved
  - Physics goals
  - Machine
  - Detector
  - Budget
  - Schedule

All needs a class of talents and a strong team ← key issue all over the world, particularly urgent for IHEP

The BES Collaboration (international)

The BES Collaboration (Domestic)

☞ Summary→ kindly invite you to make it

- BESII

  Painstaking, Survived and is making progress MDCIII, R scan, 22 M J/ψ

☹ 😐 ☺ then?

- BESIII

☺ 😐 ☹ or ☹ 😐 ☺