Construction and Commissioning of BEPCII

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On behalf of the BEPCII Team

Particle Accelerator Conference

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Construction and Commissioning of BEPCII

- Introduction
- Construction
- Commissioning

(1) Introduction

- From BEPC to BEPCII
- Luminosity strategy
- Milestones

1.1 From BEPC to BEPCII

Natural extension, remains a dual-purpose facility

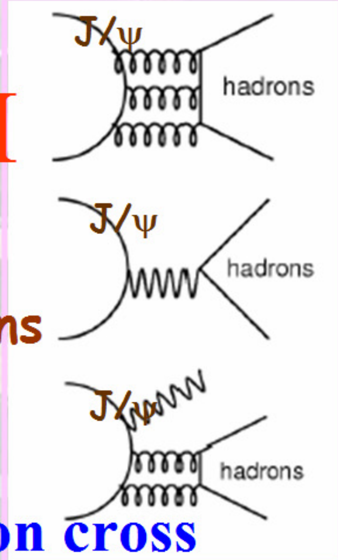
- **Charm and τ physics**
  - **Precision measurement of CKM matrix elements**
  - **Precision test of Standard Model**
  - **QCD and hadron production**
  - **Light hadron spectroscopy**
  - **Charmonium physics**
  - **Search for new physics/new particles ……**
- **Synchrotron radiation research**

  Serve as a platform of multi-discipline researches with improved performance.

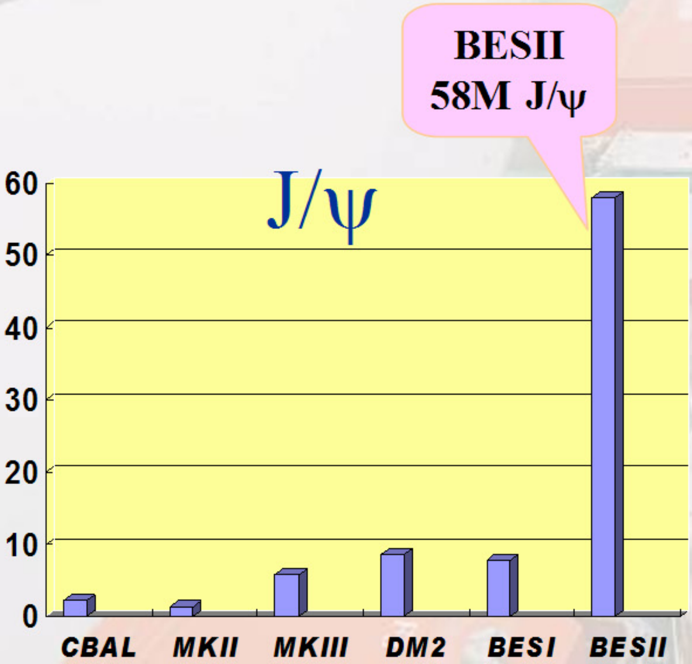
Physics results with BESII

Taking J/ψ decays as example

Ideal place to search for new types of hadrons



World J/ψ Samples ($\times 10^6$)

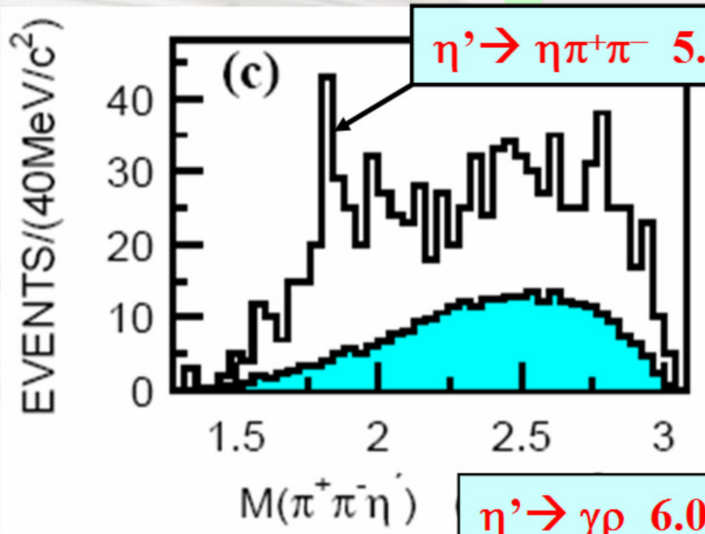


- **Gluon rich**
- **Very high production cross section**
- **Higher BR to hadrons than that of ψ' ("12% rule").**
- **Larger phase space to 1-3 GeV hadrons than that of Υ**
- **Clean background environment compared with hadron collision experiments, e.g., "J^P, I" filter**

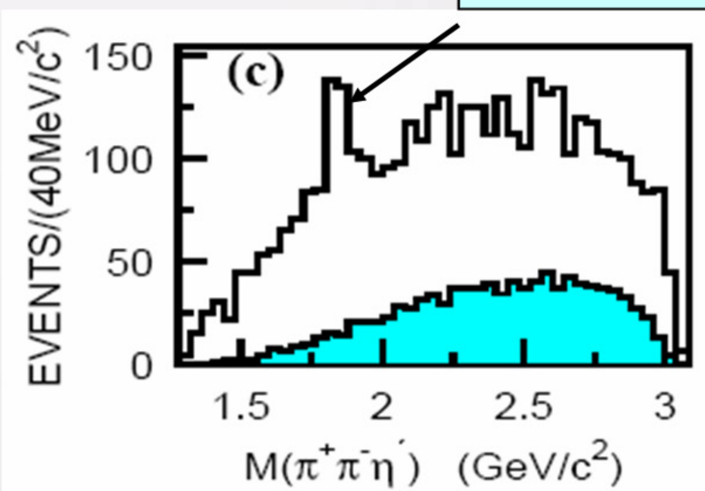
Observation of X(1835) in $J/\psi \to \gamma\eta'\pi^+\pi^-$

Phys. Rev. Lett. 95, 262001 (2005)

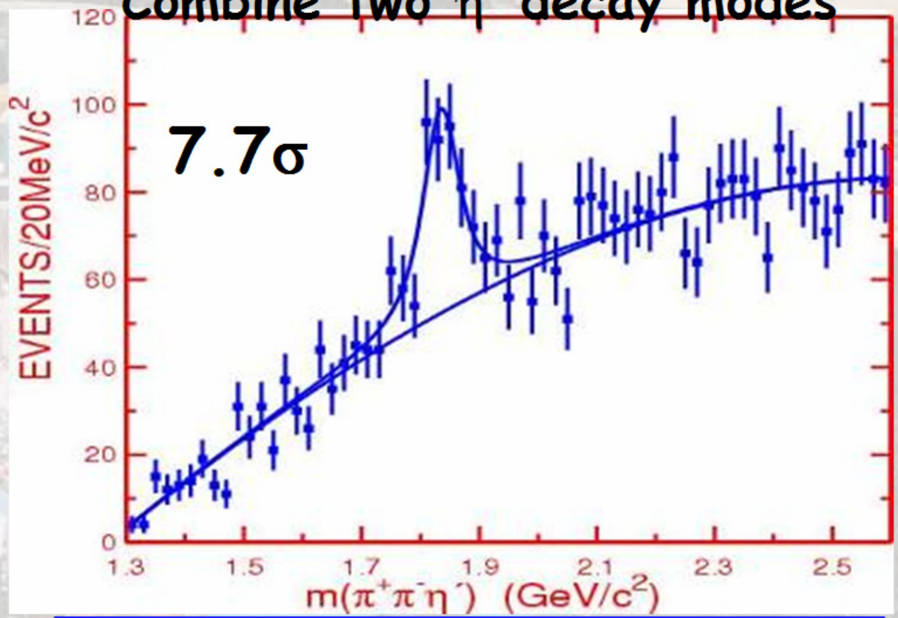
$\eta' \to \eta\pi^+\pi^-$ 5.1 σ



$\eta' \to \gamma\rho$ 6.0 σ



Combine two η′ decay modes



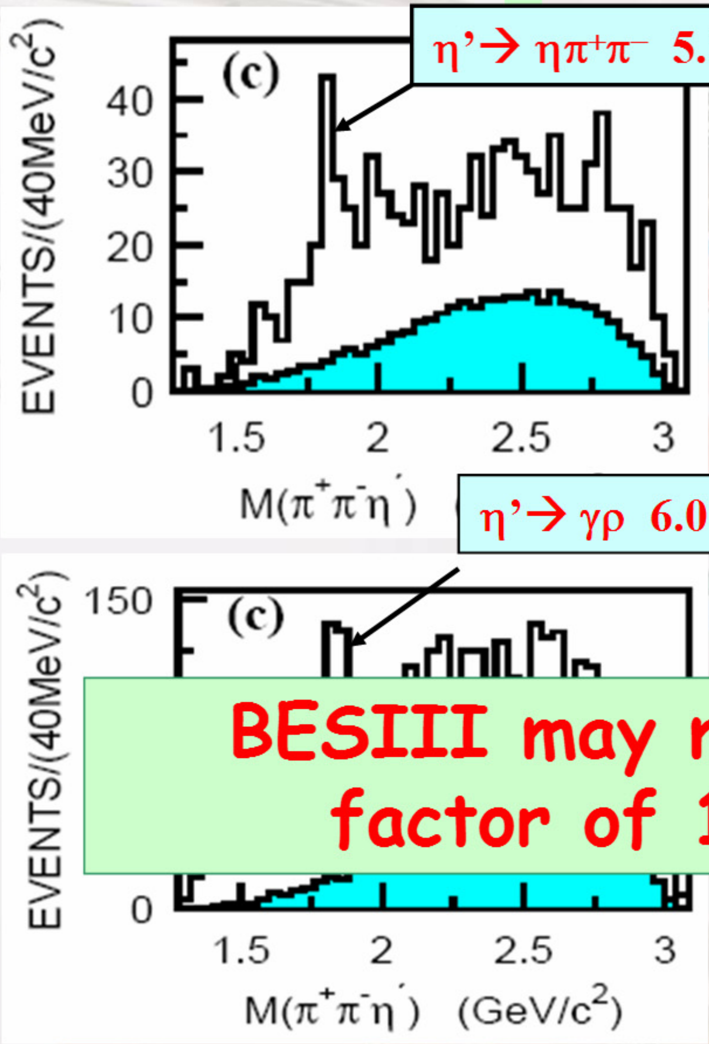
$$N_{obs} = 264 \pm 54$$

$$M = 1833.7 \pm 6.1 \pm 2.7 \text{ MeV/c}^2$$

$$\Gamma = 67.7 \pm 20.3 \pm 7.7 \text{ MeV/c}^2$$

$$B(J/\psi \to \gamma X)B(X \to \pi^+\pi^-\eta') = (2.2 \pm 0.4 \pm 0.4) \times 10^{-4}$$

Observation of X(1835) in $J/\psi \rightarrow \gamma\eta'\pi^+\pi^-$



Phys. Rev. Lett. 95, 262001 (2005)

Combine two η' decay modes

BESIII may measure its J^{PC} with a factor of 100 more statistics

$$M = 1833.7 \pm 6.1 \pm 2.7 \text{ MeV/c}^2$$

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$$B(J/\psi \rightarrow \gamma X)B(X \rightarrow \pi^+\pi^-\eta') = (2.2 \pm 0.4 \pm 0.4) \times 10^{-4}$$

BESIII Data acquisition plan

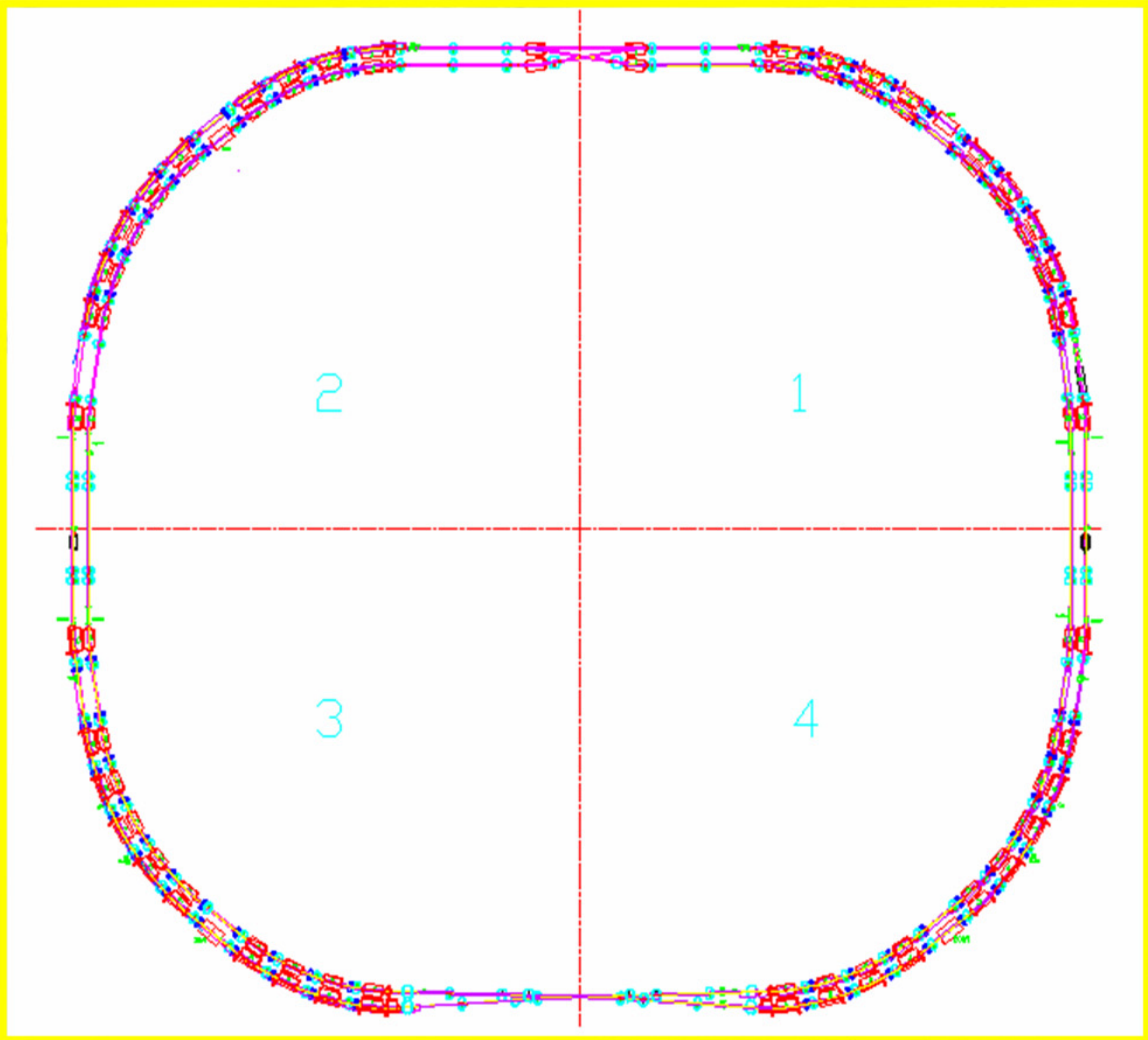
Physics Channel	Energy (GeV)	Luminosity (10^{33} $cm^{-2}s^{-1}$)	Events/year
J/ψ	3.097	0.6	1.0×10^{10}
τ	3.67	1.0	1.2×10^{7}
ψ’	3.686	1.0	3.0×10^{9}
D*	3.77	1.0	2.5×10^{7}
Ds	4.03	0.6	1.0×10^{6}
Ds	4.14	0.6	2.0×10^{6}

The BEPCII Accelerators

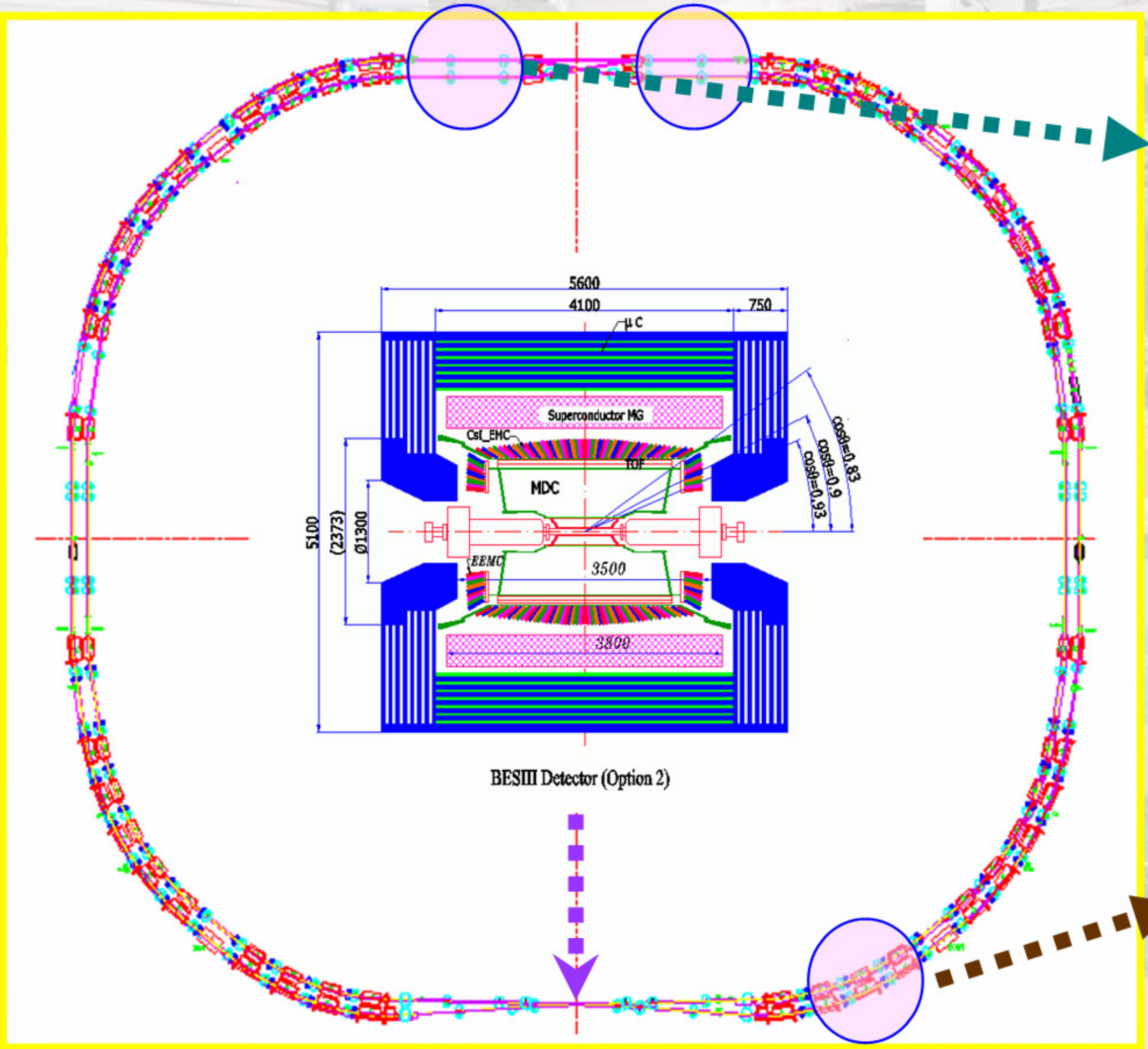
The BEPCII serves the purposes of both high energy physics experiments and synchrotron radiation applications.

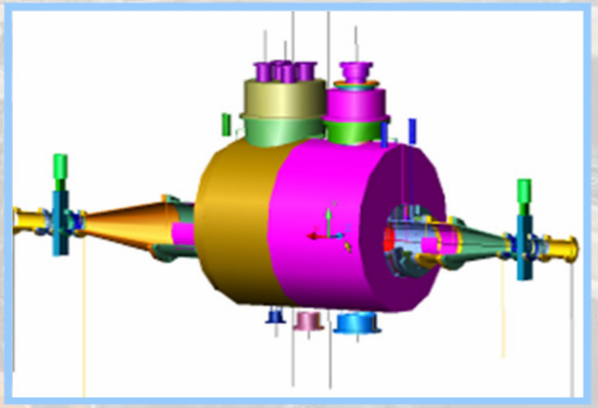
Beam energy range	1–2.1 GeV
Optimized beam energy	1.89GeV
Luminosity @ 1.89 GeV	1×10^{33} $cm^{-2}s^{-1}$
Injection from linac	Full energy injection: E_{inj}=1.55–1.89GeV Positron injection rate > 50 mA/min
Dedicated SR operation	250 mA @ 2.5 GeV

BEPCII: ***double–ring collider in τ-charm region***

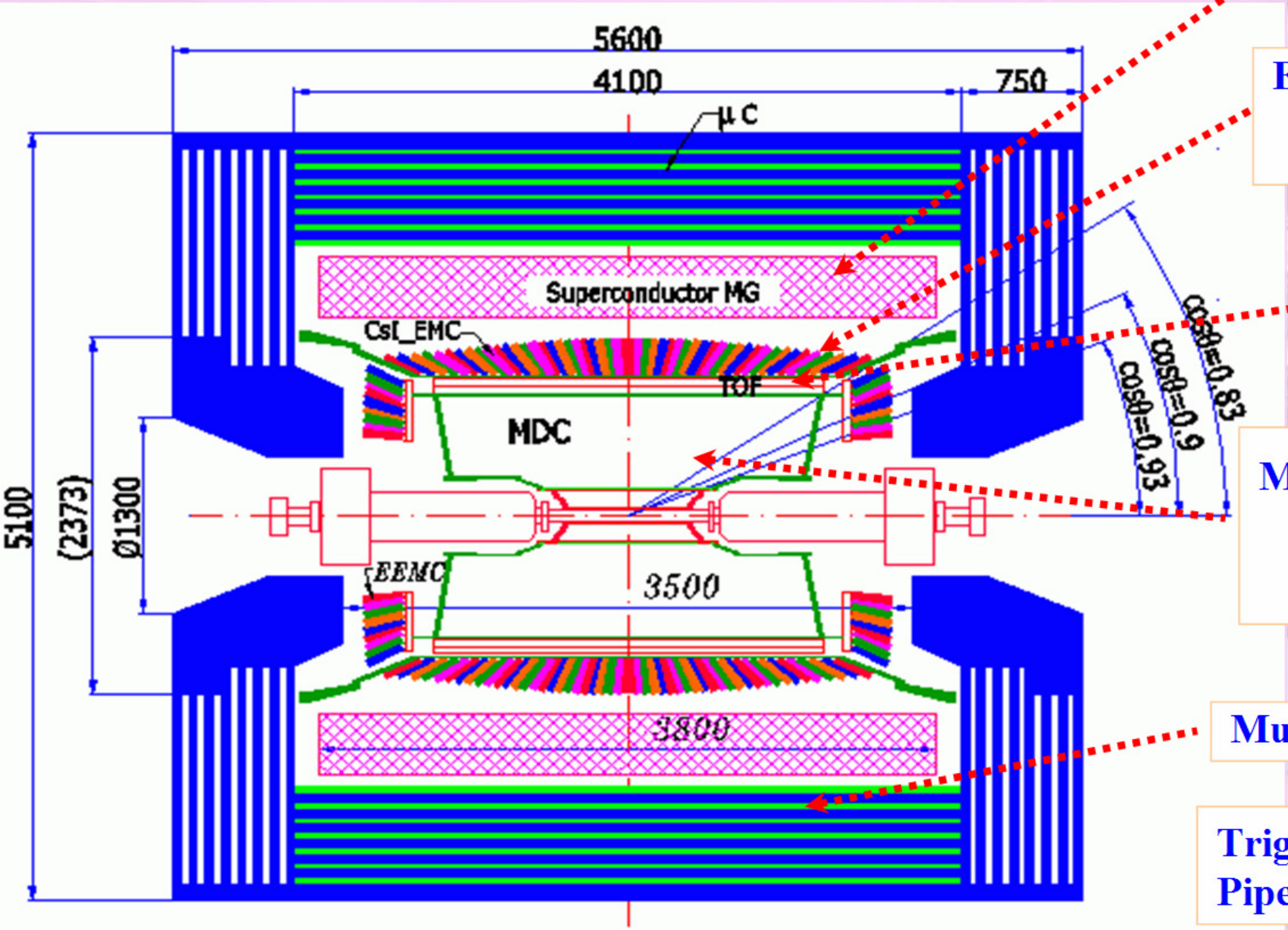


BEPCII: *double–ring collider in τ-charm region*





BESIII Detector



Magnet: 1 T Super conducting

EMCAL: CsI crystal
ΔE/E = 2.2% @1 GeV
σz = 0.5 cm/√E

TOF:
σT = 100 ps Barrel
110 ps Endcap

MDC: small cell & He gas
σ_{xy}=130 μm
s_p/p = 0.5% @1GeV
dE/dx=6%

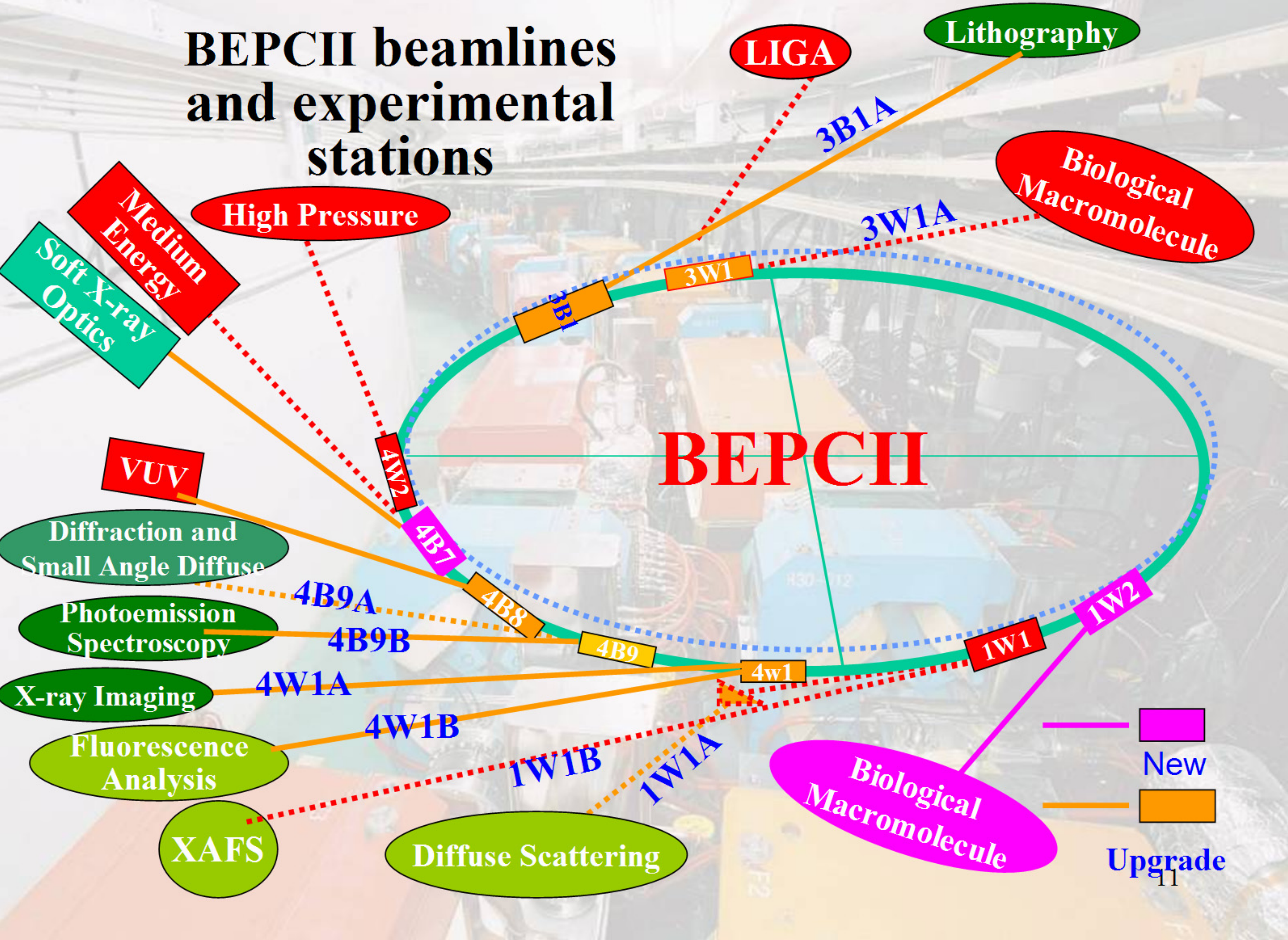
Muon ID: 9 layer RPC

Trigger: Tracks & Showers
Pipelined; Latency = 2.4 ms

Data Acquisition:
Event rate = 3 kHz
Thruput ~ 50 MB/s

- **Adapt to high event rate of BEPCII:**
  10^{33}cm^{-2} s^{-1} and bunch spacing 8ns
- **Reduce sys. errors to match high statistics**
  Photon measurement, PID…
- **Increase acceptance**

BEPCII beamlines and experimental stations



1.2 Strategy of luminosity upgrade

DR: multy-bunch k_{bmax}~400, k_b=1 → 93

Choose large ε_x & optimum param.: I_b=9.75mA, ξ_y=0.04

$$L(\mathrm{cm}^{-2}\mathrm{s}^{-1}) = 2.17\times 10^{34}(1+R)\xi_y \frac{E(GeV)k_b I_b(A)}{\beta_y^*(cm)}$$

Micro-β: β_y^* =5cm → 1.5 cm
SC insertion quads

Reduce impedance +SC RF
σ_z =5cm → <1.5cm

$(L_{BEPCII}/ L_{BEPC})_{D.R.}$=(5.5/1.5) ×93 × 9.8/35=96

L_{BEPC}=1.0×10 ^{31} cm^{-2}s^{-1} → L_{BEPCII} =1×10 ^{33} cm^{-2}s^{-1}

1.3 Milestones


May 2004


Sep. 2004


July 2005


July 2005

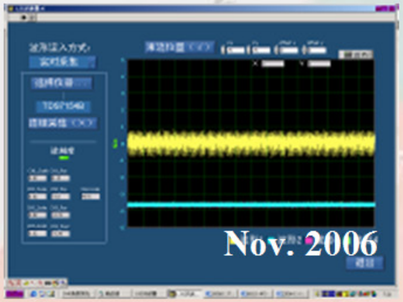
January 2004	Construction started
May. 4, 2004	Dismount of 8 linac sections started
Dec. 1, 2004	Linac delivered e^- beams for BEPC
July 4, 2005	BEPC ring dismount started
Mar. 2, 2006	BEPCII ring installation started
Nov. 13, 2006	Phase 1 commissioning started
Aug. 3, 2007	Shutdown for installation of IR-SCQ's
Oct. 24, 2007	Phase 2 commissioning started
Mar.28, 2008	Shutdown for installation of detector
June 22, 2008	Phase 3 commissioning started


Oct. 2005


May 2006


Oct. 2006


Oct. 2006


Nov. 2006


Nov. 2006.


Oct. 2007


May 2008

(2) Construction

- Main parameters
- The injector linac
- The storage rings

2.1 Main Parameters

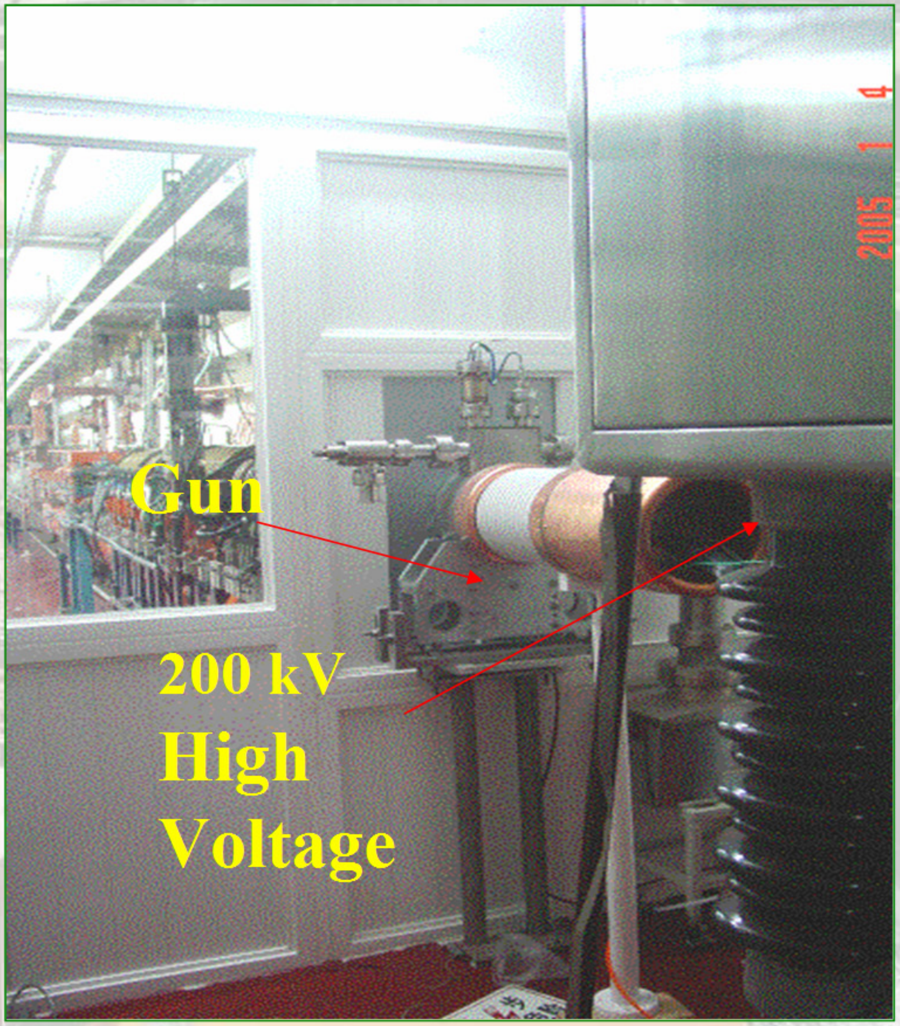
Parameters		Unit	BEPCII	BEPC
Operation energy (E)		GeV	1.0–2.1	1.0–2.5
Injection energy (E_{inj})		GeV	1.55–1.89	1.3
Circumference (C)		m	237.5	240.4
β^*-function at IP (β_x^*/β_y^*)		cm	100/1.5	120/5
Tunes ($\nu_x/\nu_y/\nu_s$)			6.53/5.58/0.034	5.8/6.7/0.02
Hor. natural emittance (ε_{x0})		mm·mr	0.14 @1.89 GeV	0.39 @1.89 GeV
Damping time ($\tau_x/\tau_y/\tau_e$)			25/25/12.5 @1.89 GeV	28/28/14@1.89 GeV
RF frequency (f_{rf})		MHz	499.8	199.533
RF voltage per ring (V_{rf})		MV	1.5	0.6–1.6
Bunch number (N_b)			93	2×1
Bunch spacing		m	2.4	240.4
Beam current	Colliding	mA	910 @1.89 GeV	~2×35 @1.89 GeV
	SR		250 @ 2.5GeV	130
Bunch length (cm) σ_l		cm	~1.5	~5
Impedance $\|Z/n\|_0$		Ω	~ 0.2	~4
Crossing angle		mrad	±11	0
Vert. beam-beam param. ξ_y			0.04	0.04
Beam lifetime		hrs.	2.7	6–8
luminosity@1.89 GeV		$10^{31}cm^{-2}s^{-1}$	100	1

2.2 The Injector Linac

- **Basic requirement:**
  - **Higher intensity: e^+ injection rate ≥ 50 mA/min.;**
  - **Full energy injection with E=1.55 ~ 1.89 GeV;**
- **To enhance the current and energy of the electron beam bombarding the target and to reduce the beam spot;**
- **To design and produce a new positron source and to improve its focusing;**
- **To increase the repetition rate from present 12.5 Hz to 50 Hz.**
- **To apply multi-bunch injection (f_{RF}/f_{Linac}=7/40);**

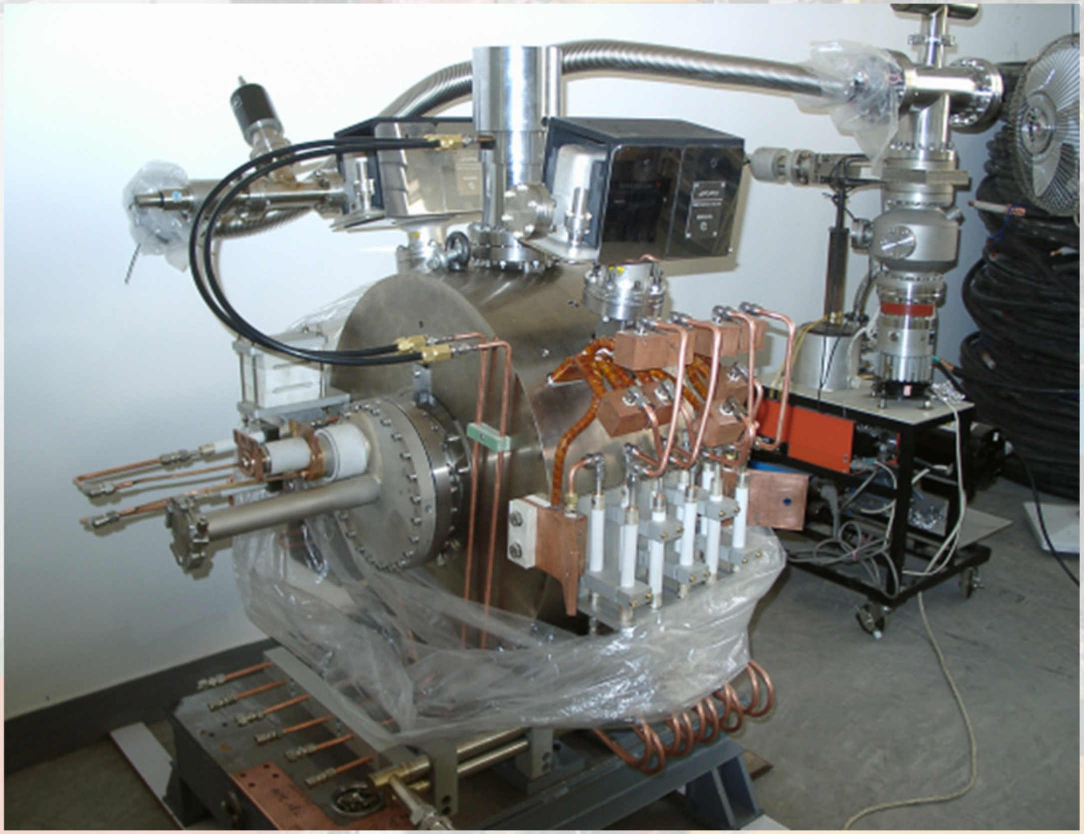
New Electron Gun

Parameters	Unit	BEPCII
Cathode		EIMAC Y796
Beam current Pulse length	A ns	10 1 (FWHM)
Emittance (norm.)	µm	14
Accelerating voltage	kV	120~200 Pulse / 3 µ s
Heater volt. /current	V/A	6 ~ 8 / 5 ~ 7.5
Grid voltage	V	0~250
Grid pulse	V	-300 ~ -700
Bias voltage	V	+150 ~ +300
Operating Mode		1 or 2 Bunches
Repetition Rate	Hz	50



New Positron Source

A flux concentrator is employed to have a large e^+ acceptance:
L = 10 cm , B = 5.3 T ↘ 0.50 T, Φ = 7 mm → 52 mm.

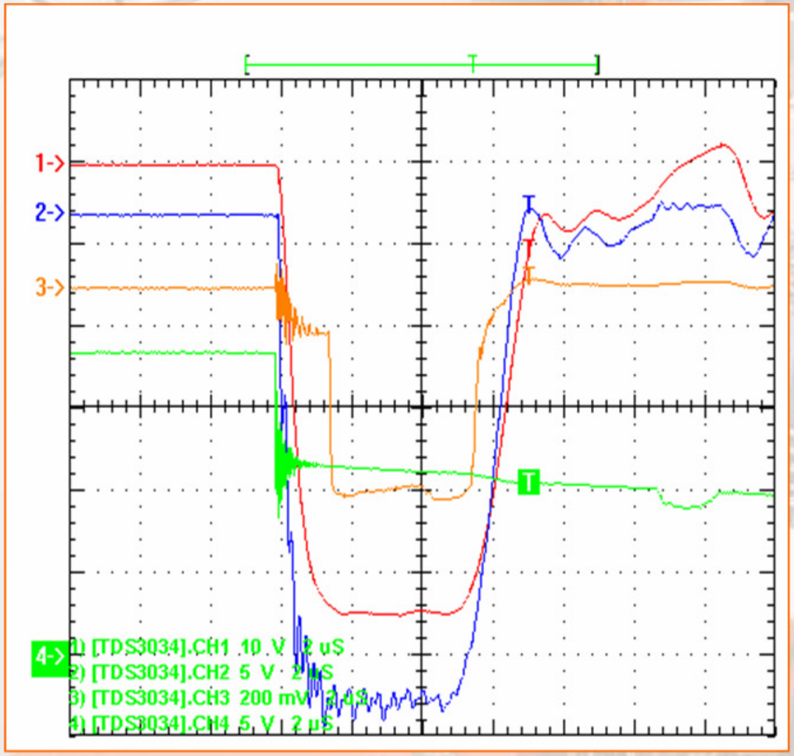


New RF Power Sourse

50MW new klystrons

New modulators with high power 320 kV × 360 A.

High voltage stability ≤ ±0.15%



Performance of the injector linac

Parameters		Design	Accept test	BEPC
Energy (GeV)		1.89	1.89	1.30-1.55
Current (mA)	e+	37	66	~5
	e-	500	550	300
Emittance (1σ) (mm-mrad)	e+	0.40	0.35 ~ 0.27	----
	e-	0.10	0.097~0.079	----
Energy spread (1σ) (%)	e+	0.50	0.371	~0.80
	e-	0.50	0.295	~0.80
Energy stability (%)	±0.15		±(0.050 ~ 0.035)	----
Orbit stability (mm)	±0.30		±(0.119 ~0.058)	----
Repeatation rate	50		50	12.5
e^+ inj. rate (mA/min.)	50		61.5	1 ~ 3

2.3 Storage Rings

- RF System
- Injection Kickers
- Magnet System
- Power Supply
- Vacuum System
- Beam Diagnosis
- Control System
- Cryogenics
- Interaction Region
- Installation

RF System

RF Frequency	f_{rf}	499.8 MHz
RF Voltage	V_{rf}	1.5 MV
Q Value		$>5\times10^8$@2MV
Number of cavities	N_{rfc}	2×1
SR loss per turn @ 1.89 GeV	U_{rf}	123 keV/ring
Total RF loss @ 1.89 GeV	P_b	124 kW/ring
Power of RF transmitters	P_{rf}	2× 250 kW

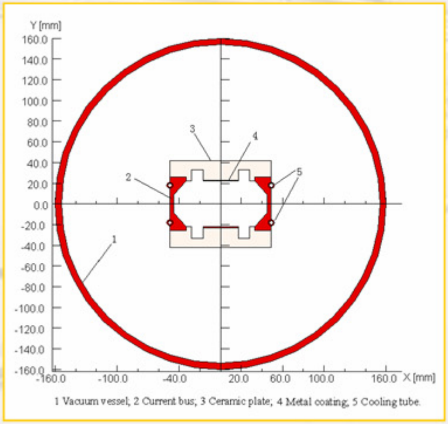
Magnet System

Magnet type	Number
Dipole (Leff.=1.4135m)	40+1
Dipole (Leff.= 1.2277m)	2
Dipole (Leff.= 1.0339m)	2
Weak dipole (Leff.=1.0321m)	2
Weak dipole (Leff.=0.7453m)	2
Quadrupole	88+2
Old quadrupoles with modified coils	28
160Q quadrupole (Old)	6
Sextupole	72+1
Vertical corrector	48+1
Special vertical corrector	6
Quadrupole of the SR mode	1
Skew quadrupole	4+4
70B dipole (Old)	40+4
Octupole (Old)	2
Total	356

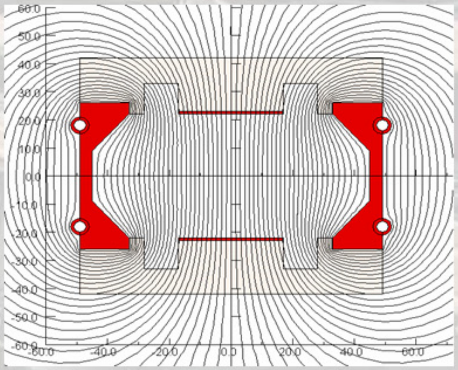
Power Supplies

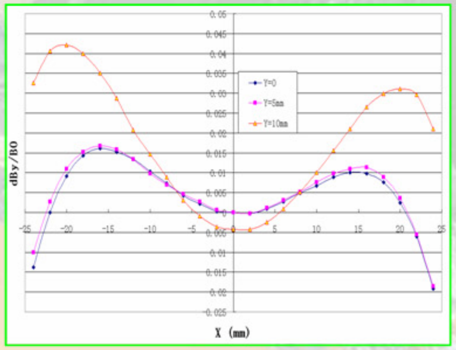
P.S.	No.	Design Stability	Tested Stability
Q & S	165	1×10^{-4}	4×10^{-5}
OQ2,OQ3, IQ2, IQ3	16	1×10^{-4}	5×10^{-5}
B	4	1×10^{-4}	5×10^{-5}
BH,BV	144	1×10^{-4}	4×10^{-5}
T.Q	34	1×10^{-4}	4×10^{-5}
T.B	2	1×10^{-4}	4×10^{-5}
SC magnets	16	1×10^{-4}	1×10^{-4}
Q1a,Q1b,ISPB	3	1×10^{-4}	1×10^{-4}

Injection Kickers



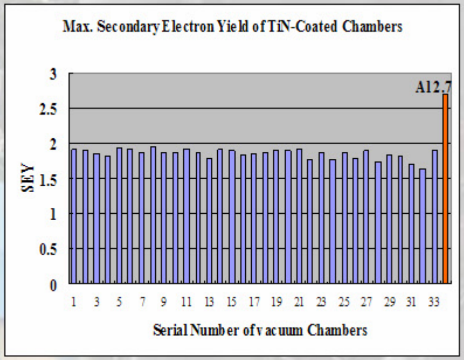
Number of Kickers	4
Length	1.9m
Integral field	200Gs·m
Aperture	90mm×38mm
Good field region	±20mm
Field uniformity	±1%
The pulse repetition	50Hz
Stability of current	1%
Waveform	Half-sine wave
Pulse Width	600ns
Time jitter	<5ns
impedance	<0.025Ω

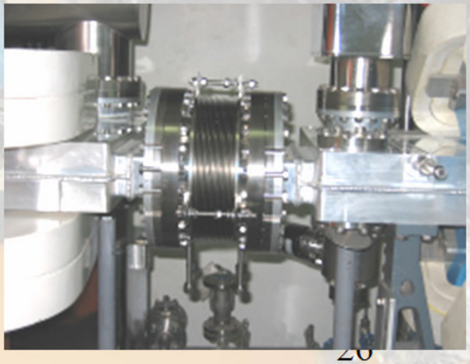




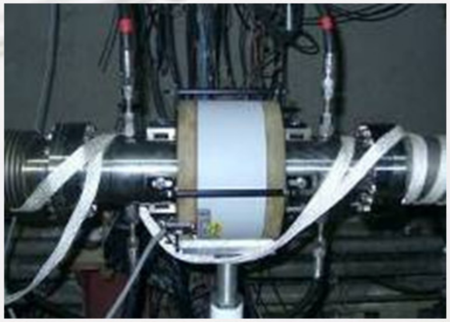
Vacuum System

- The design dynamic vacuum pressure are 8×10^{-9} Torr in the arc and 5×10^{-10} Torr in the IR.
- Antechambers are chosen for both e^+ and e^- rings.
- 80 arc chambers,120 straight section chambers; 175 discrete photon absorbers 180 RF shielded bellows
- TiN coating for e+ ring chambers to reduce SEY

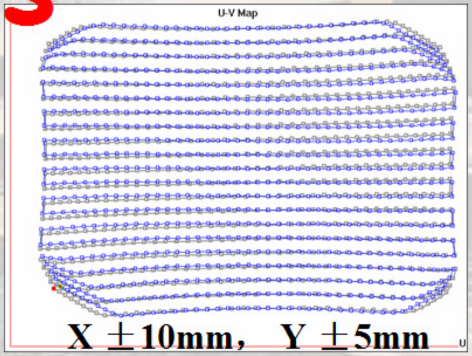


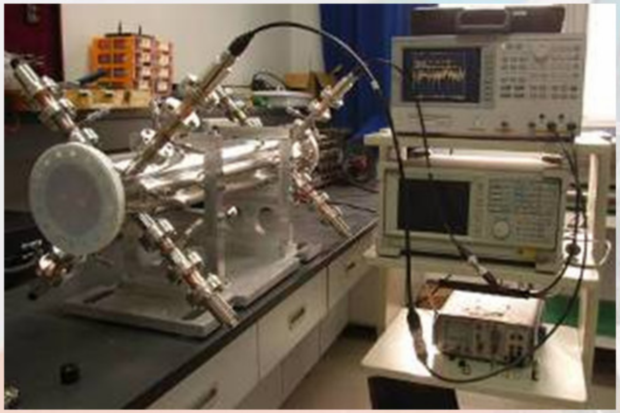


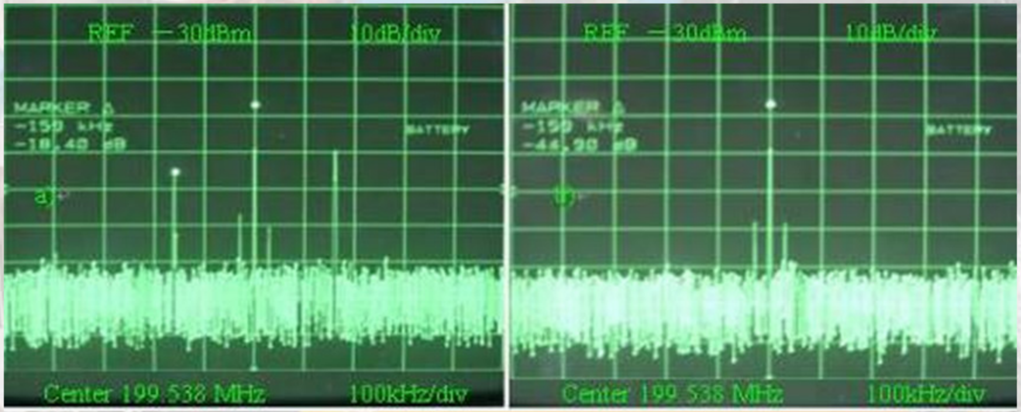
Beam Diagnosis



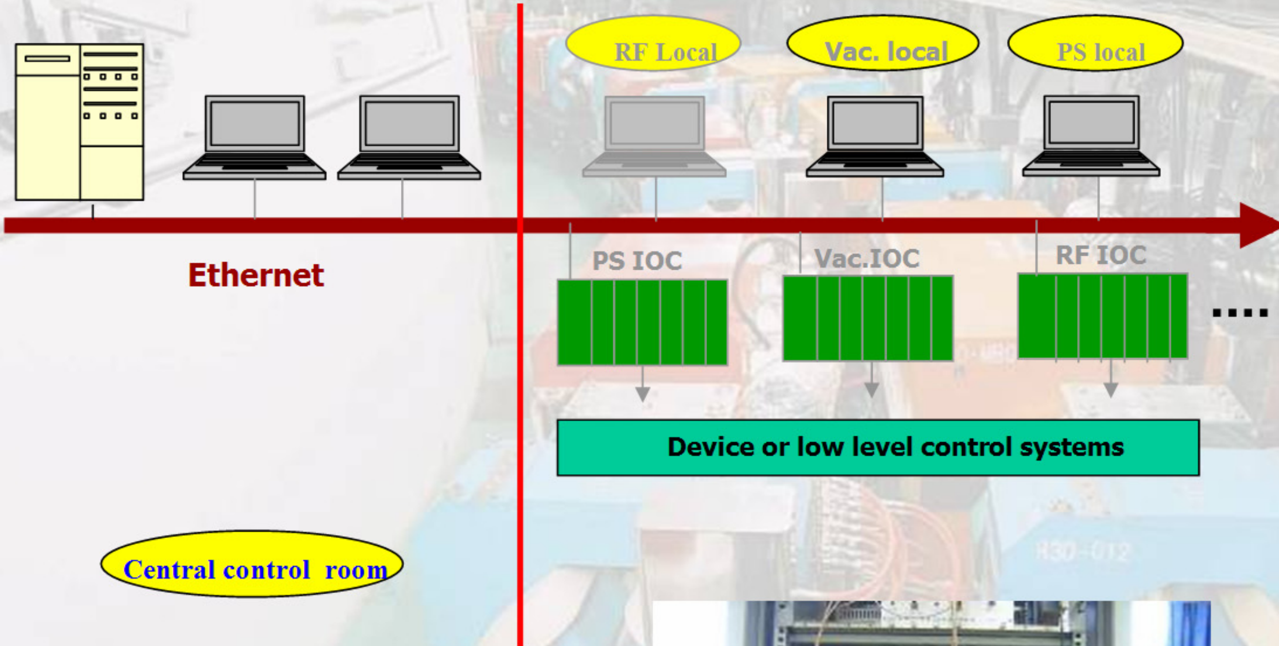
- Beam Position Monitor
- Bunch Current Monitor
- SR monitor
- DCCT
- Transverse Feedback
- Tune measurement
- Beam Loss Monitor



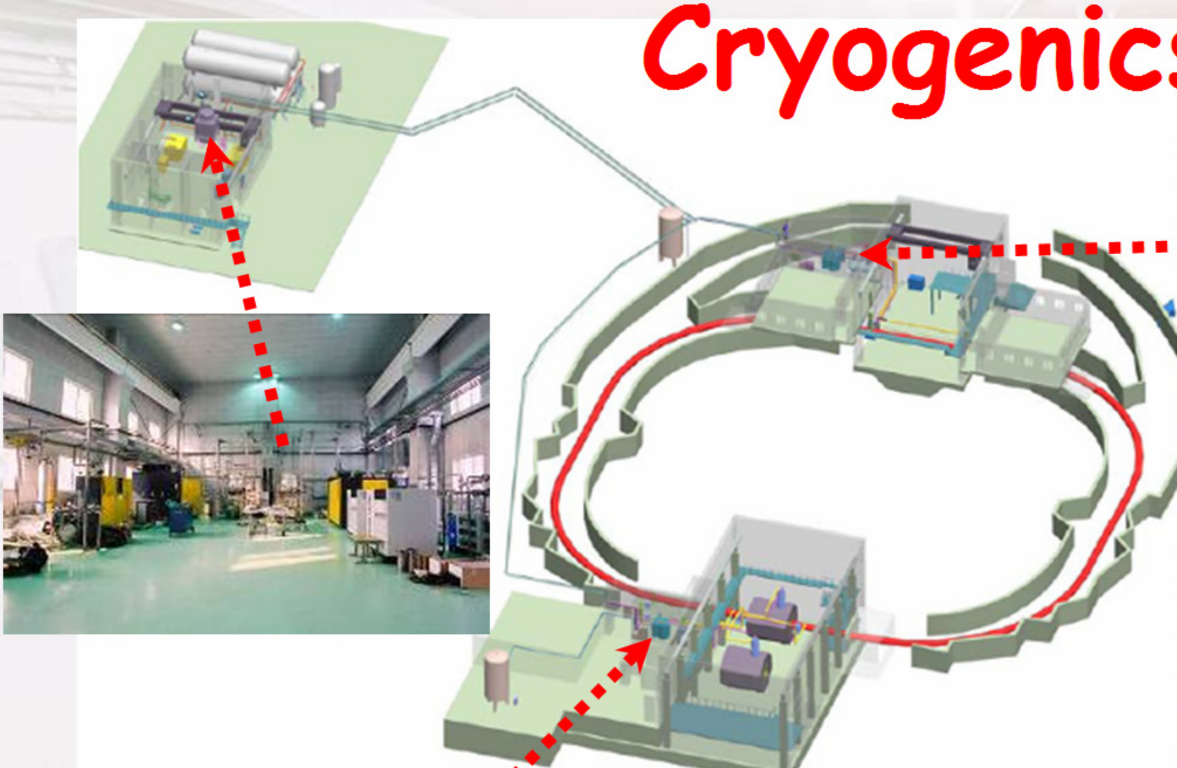


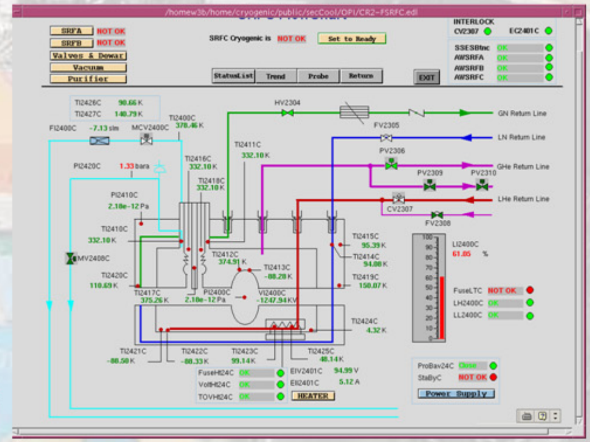


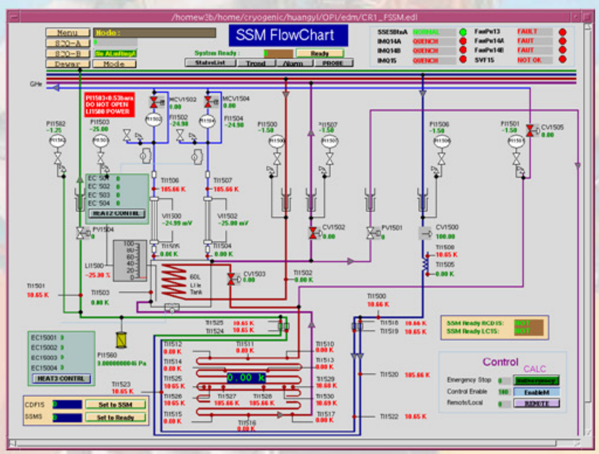
Control System

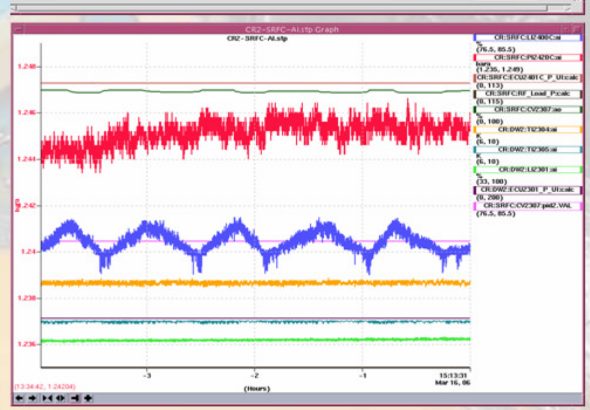


Cryogenics



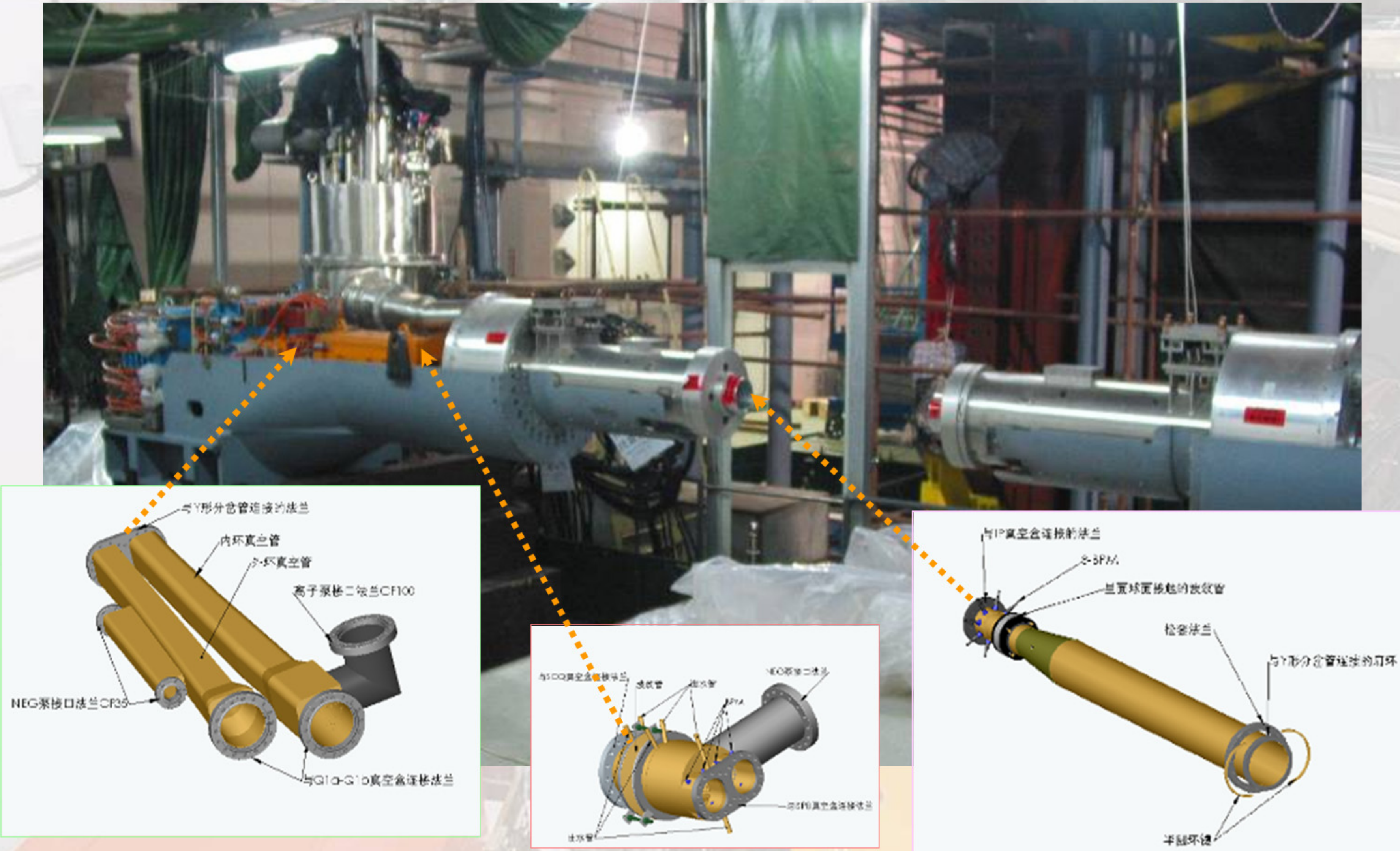

SRFC Cryogenic is NOT OK
Set to Ready
GN Return Line
LN Return Line
GHe Return Line
LHe Return Line


SSM FlowChart
Control

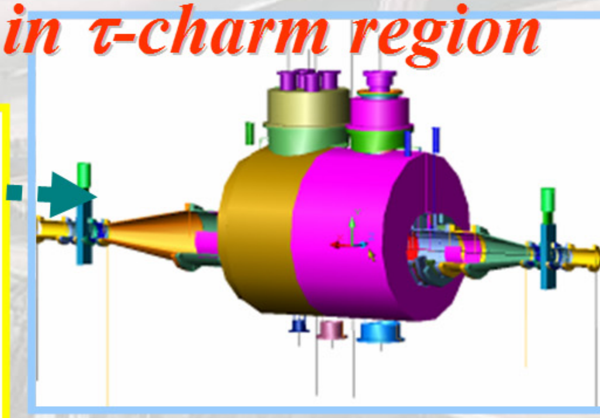

CR2-SRFC-AI.stp Graph

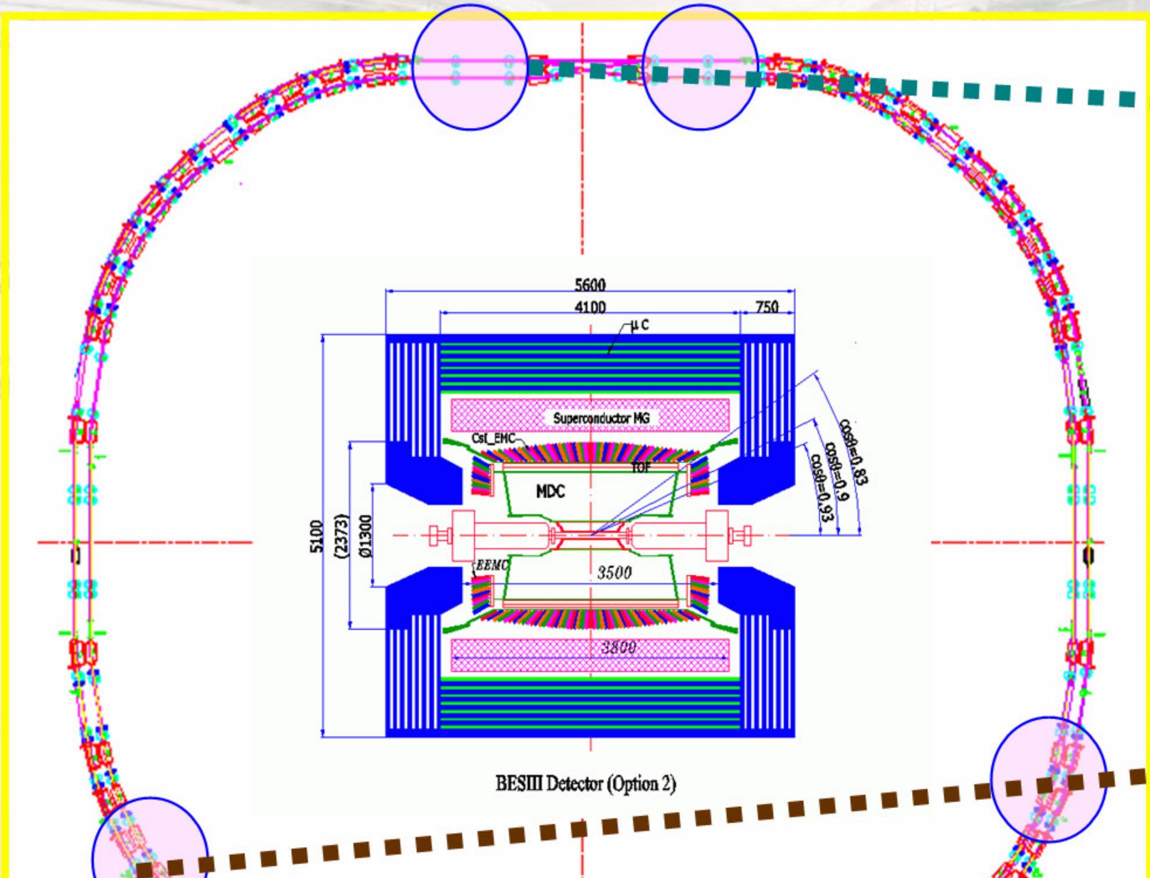
Interaction Region

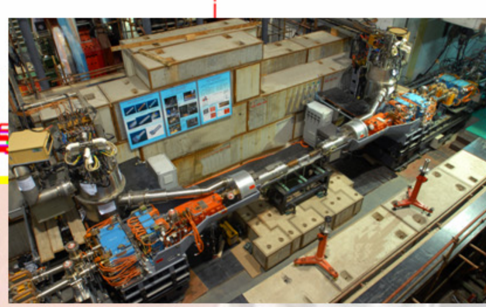
Interaction Region



BEPCII: *a double-ring e^--e^+ collider in τ-charm region*







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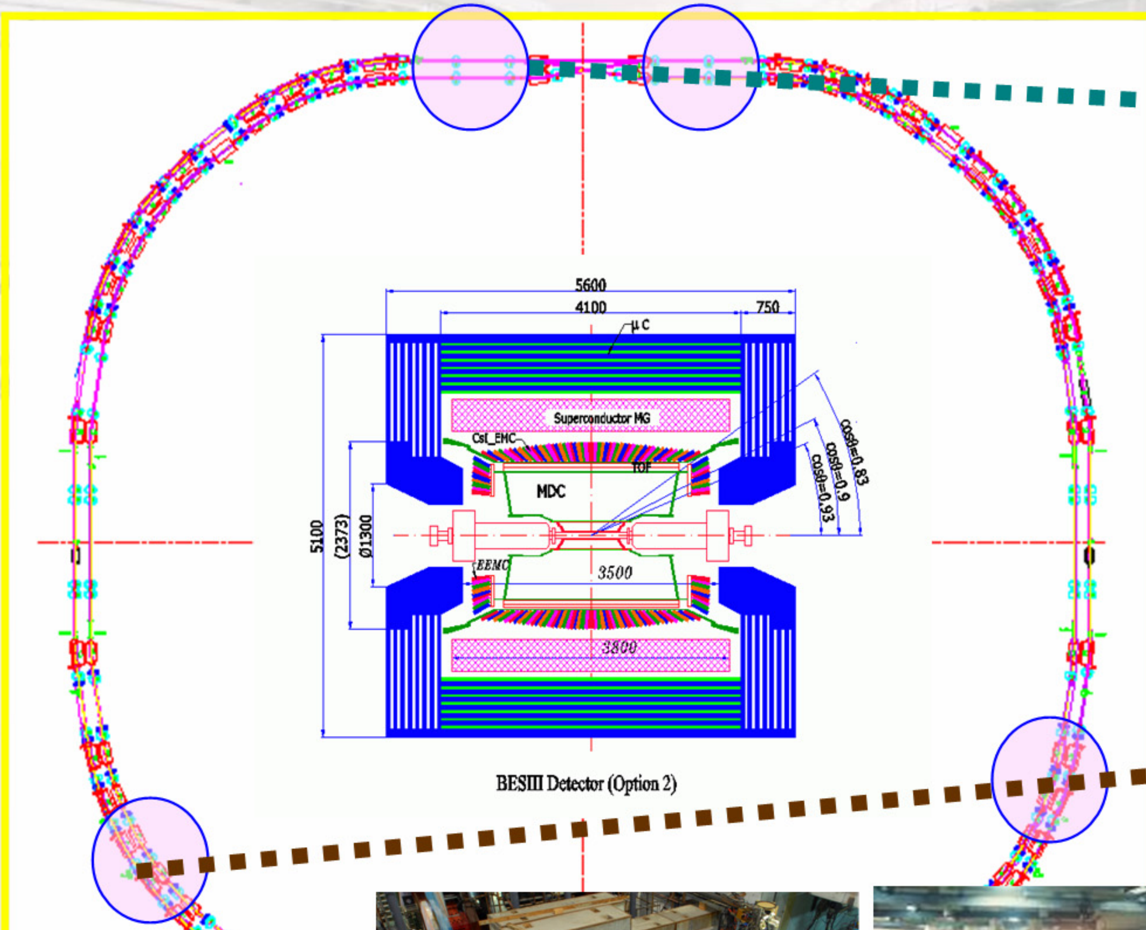
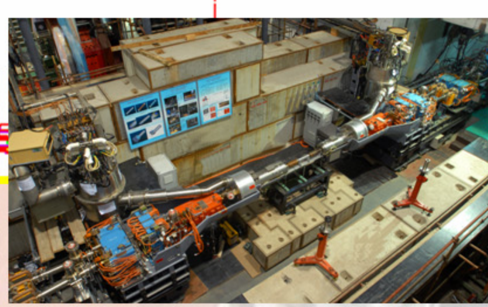
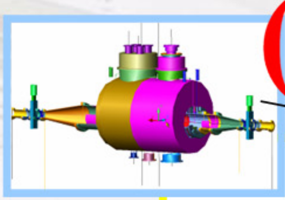
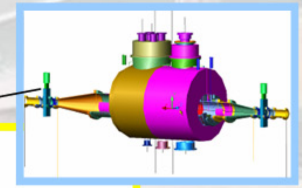
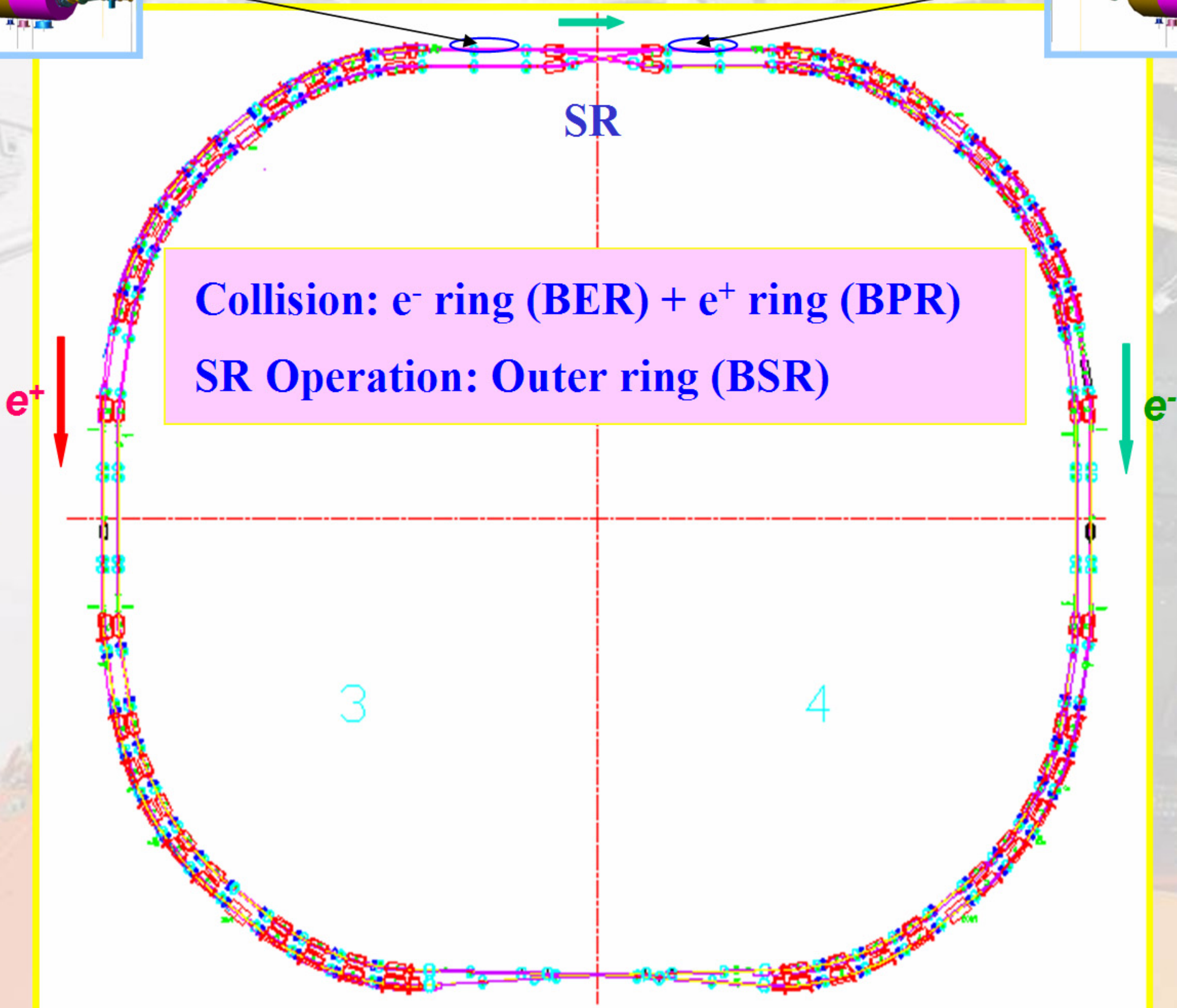




(3) Commissioning



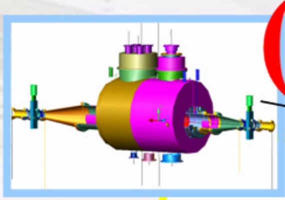


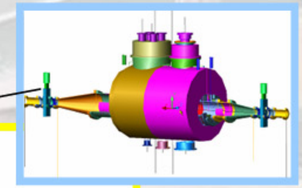


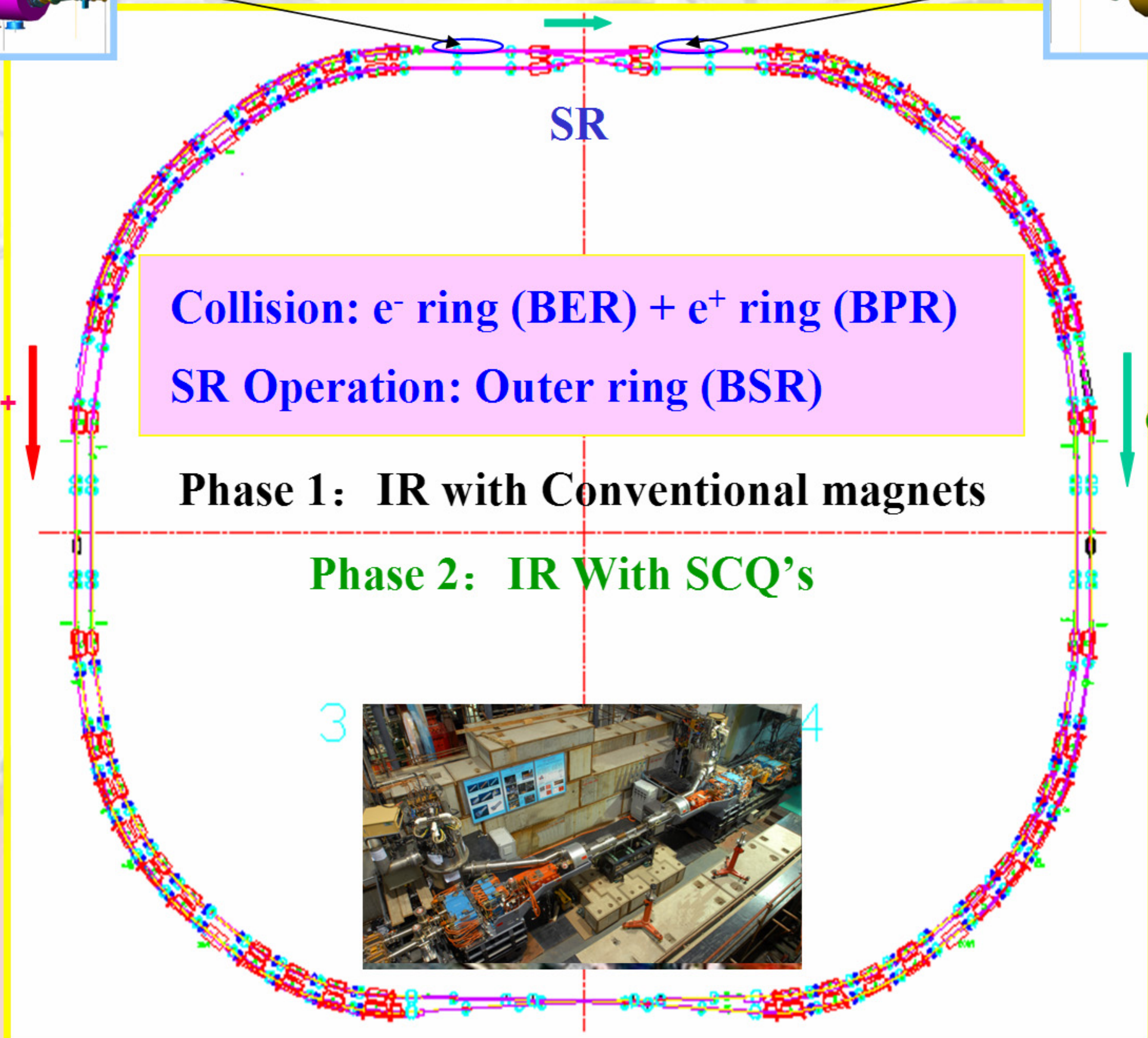
Collision: e⁻ ring (BER) + e⁺ ring (BPR)

SR Operation: Outer ring (BSR)

(3) Commissioning







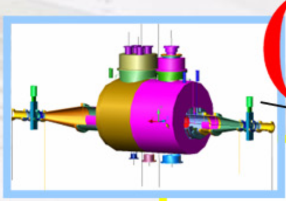
Collision: e⁻ ring (BER) + e⁺ ring (BPR)

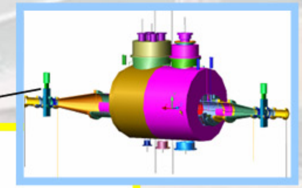
SR Operation: Outer ring (BSR)

Phase 1：IR with Conventional magnets

Phase 2：IR With SCQ's

(3) Commissioning





Collision: e^- ring (BER) + e^+ ring (BPR)

SR Operation: Outer ring (BSR)

Phase 1： IR with Conventional magnets

Phase 2： IR With SCQ's

Phsse 3： BEPCII + BESIII

Commissioning of BEPCII

2006 Oct. Installation completed with NIM-IR

2006 Nov 18 First beam stored
2007 Mar 26 First collision
2007 May 14 Luminosity (as BEPC)

Phase 1
reports on APAC07, PAC07

2007 Oct. Installation completed with SIM-IR

2007 Oct. 24 First beam stored
2007 Nov. 18 First collision
2008 Jan. 29 Luminosity $>1\times10^{32}cm^{-2}s^{-1}$

Phase 2
reports on EPAC08

2008 June. Installation completed with BESIII in the IR

July 19, 2008 First event detected with BESIII
April 8, 2009 Luminosity reached $2.3\times10^{32}cm^{-2}s^{-1}$
April 14, 2009 BESIII collected 100M $\psi(2S)$ events

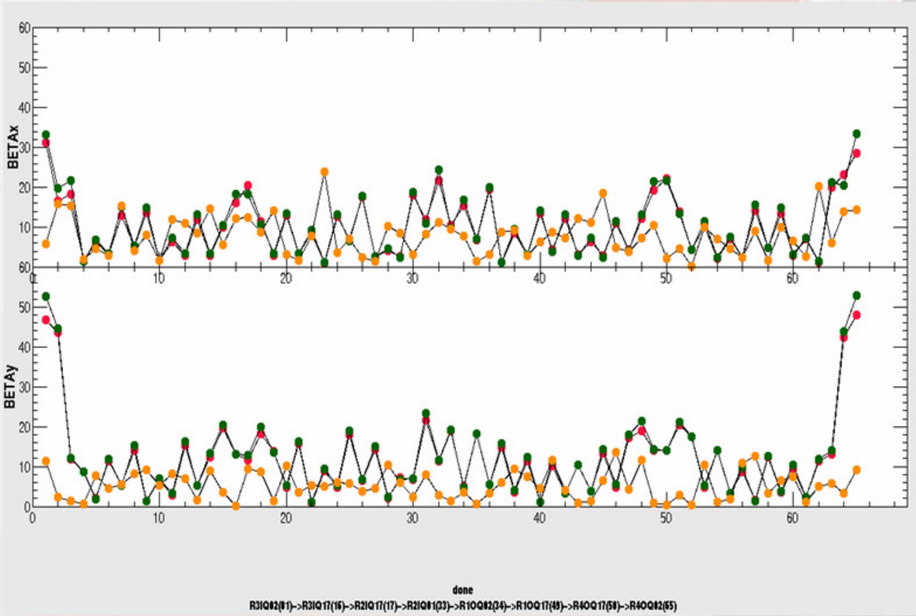
Phase 3
reports on PAC09

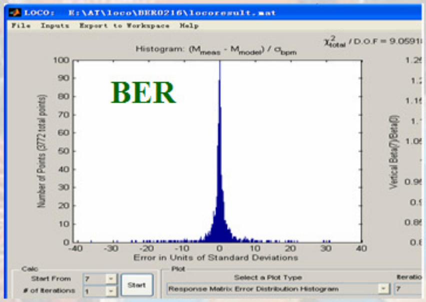
Commissioning

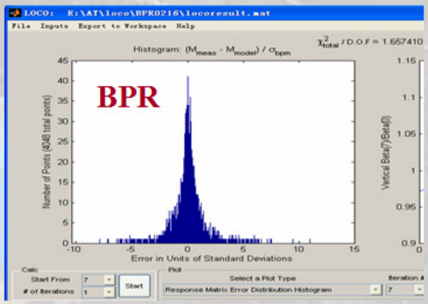
- Optics and injection
- Single Beam Performance
- Single-bunch collision
- Multi-bunch collision
- Operation for SR and HEP

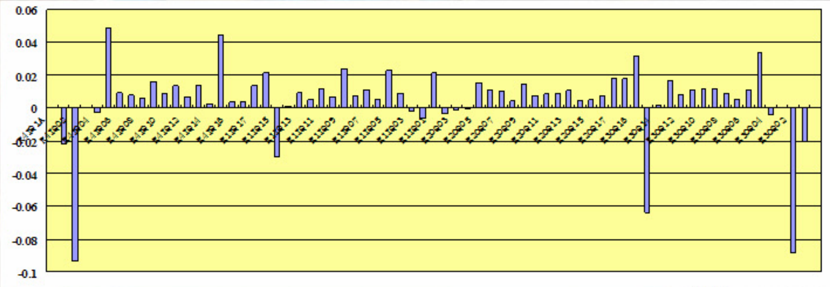
3.1 Optics and injection

- Measured beam optics functions are in good agreement with theoretical prediction with discrepancy within ±10% at most quadrupoles,
- Difference between measured and design tunes $\Delta\nu_{x,y}$<0.01
- Quadrupole strengths systematically 1~2% lower than design set:
  - Quadrupole and sextupole near to each other
  - fringe filed effect.
  - Other origin of these errors is still pursued.



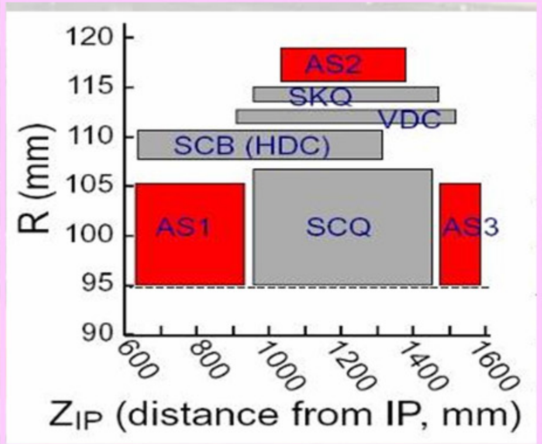


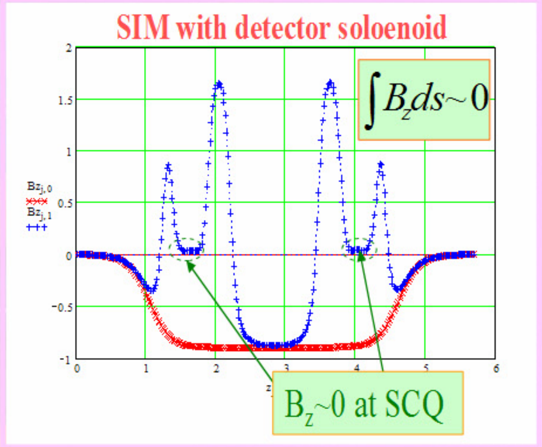




Detector solenoid compensation

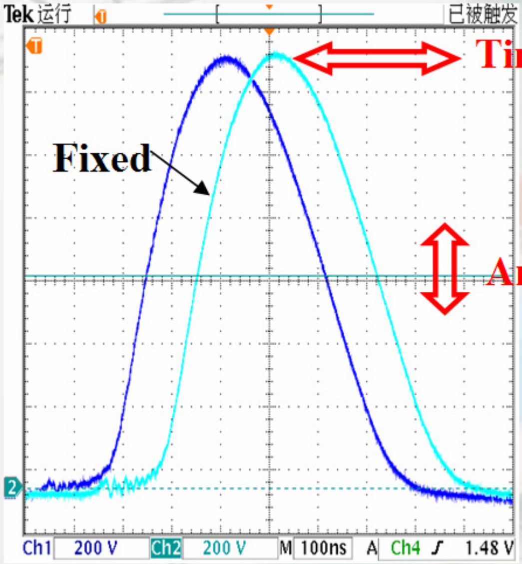
- **Three anti-solenoids (AS1~3) and a skew quadrupole was designed in the package of coils for the SIM.**
- **The combined magnetic field measurement of the SIM's and the SSM was done in July 2007.**
- **The integral $\int Bz\,dz$ is nearly zero.**
- **The measured coupling < 1%.**
- **The strength of SCQ was reduced 0.32% to compensate the additional focusing and thus the β-functions can be well restored.**

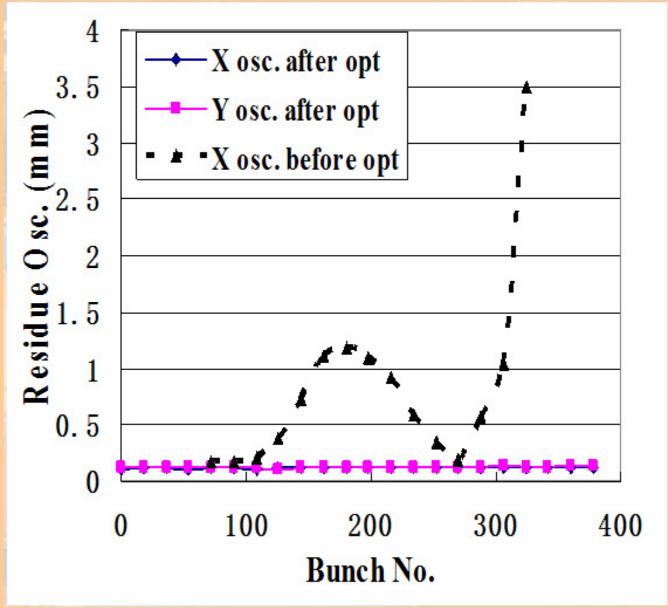




Injection

To reduce the residual orbit oscillation of stored beams during injection =>set the right timing and amplitude of the two kickers.





=>For timing: fix k1, scan k2 ; do in turn for k2

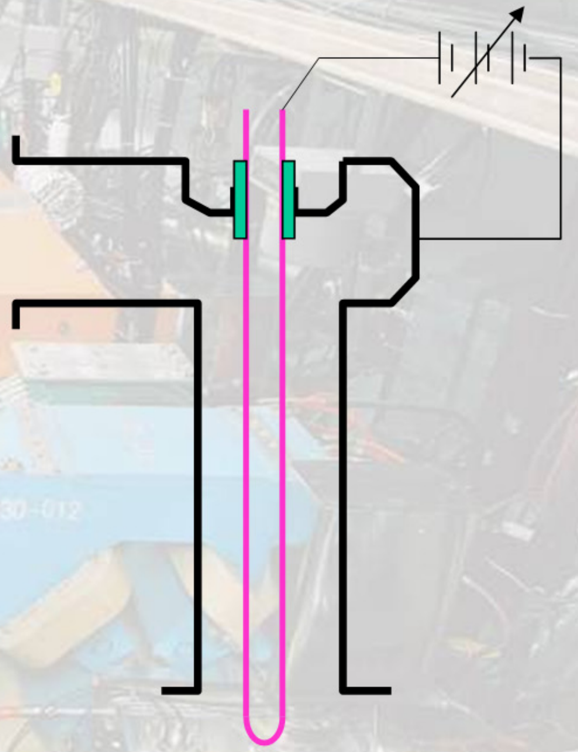
=>For amp: fix k1 or k2 amp, scan the other

⇒ **After optimization with on bunch, the residual orbit oscillation of all the other bunches during injection reduced to around 0.1mm/0.1σ_x.**

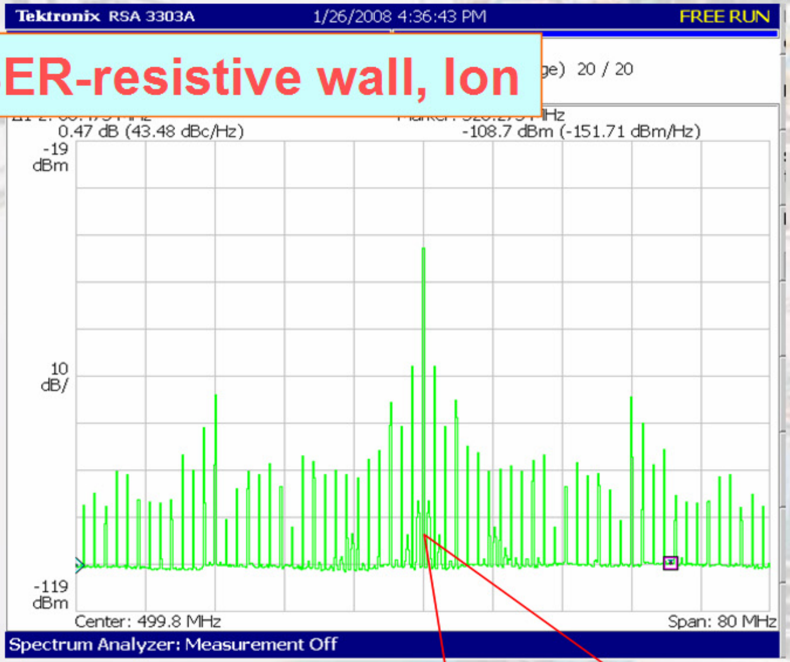
⇒ **Injection on collision possible.**

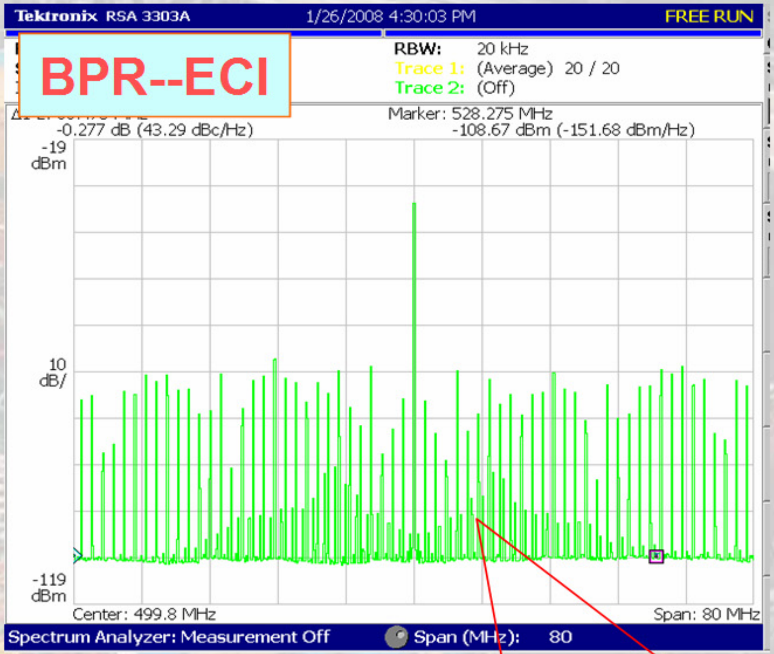
RF tuning to increase the beam current

- When the beam current in BER exceeded 100mA, the SC cavity (SCC) tripped often due to its arc interlock of window and following vacuum pressure raised quickly.
- To overcome the problem, a DC bias voltage was used on the power coupler of the SC cavity to suppress the multi-pacting effect.
- For longitudinal stable: LLRF tuning when with current.



3.1 Single Beam Performance



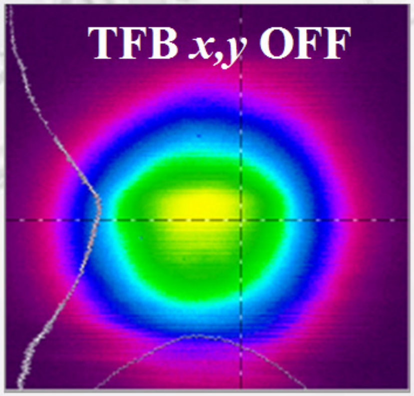


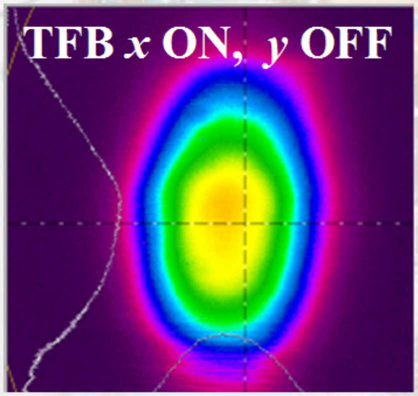
Sidebands of the electron beam with 99 bunch uniform filling, spacing 4 buckets, beam current 40mA.

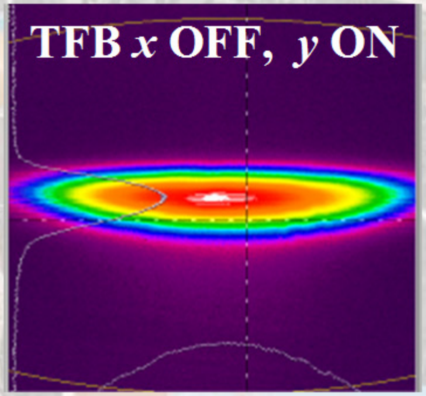
Sidebands of the positron beam with 99 bunch uniform filling, spacing 4 buckets, beam current 40mA.

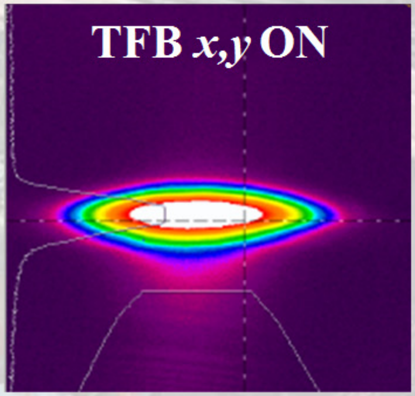
Transverse Feedback System

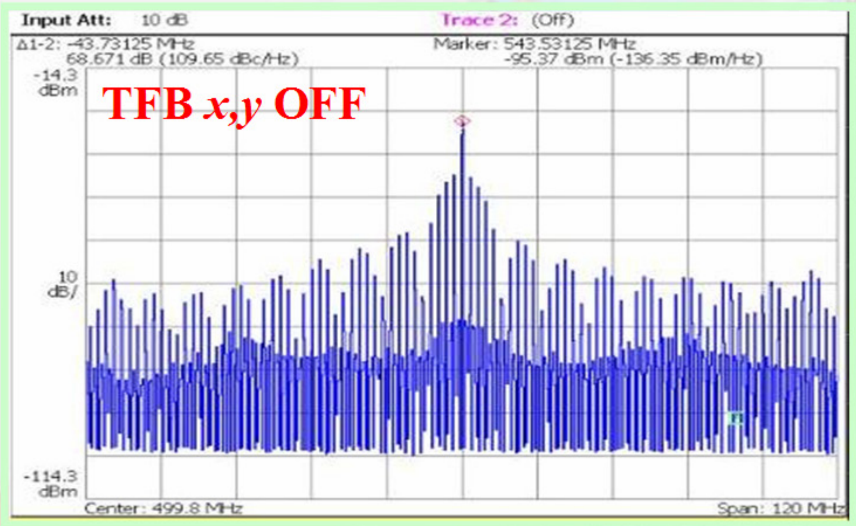
Couple bunch instabilities can be cured with the analog TFB system, the sidebands of in both BER and BPR can be well suppressed

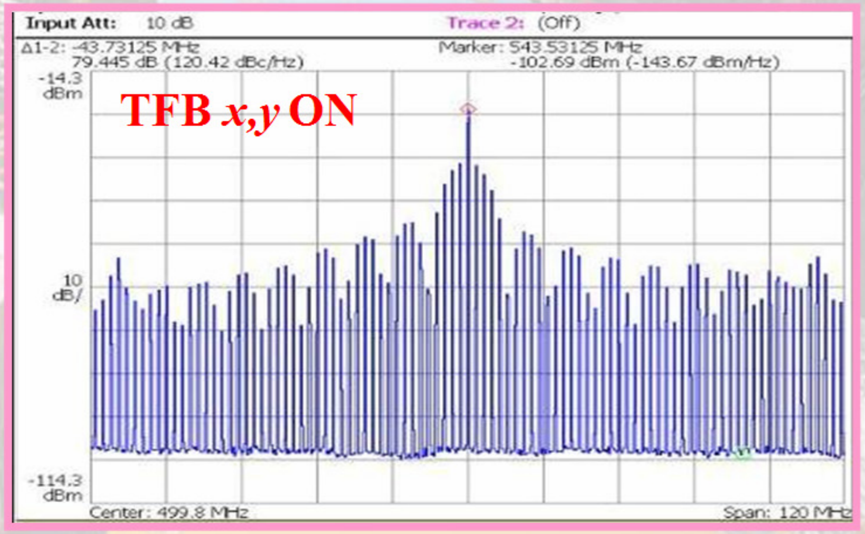




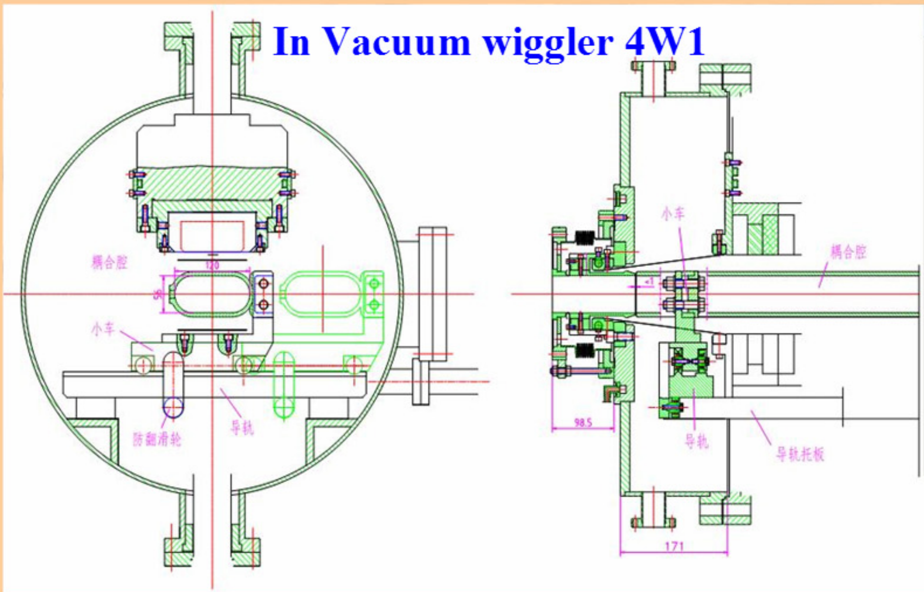




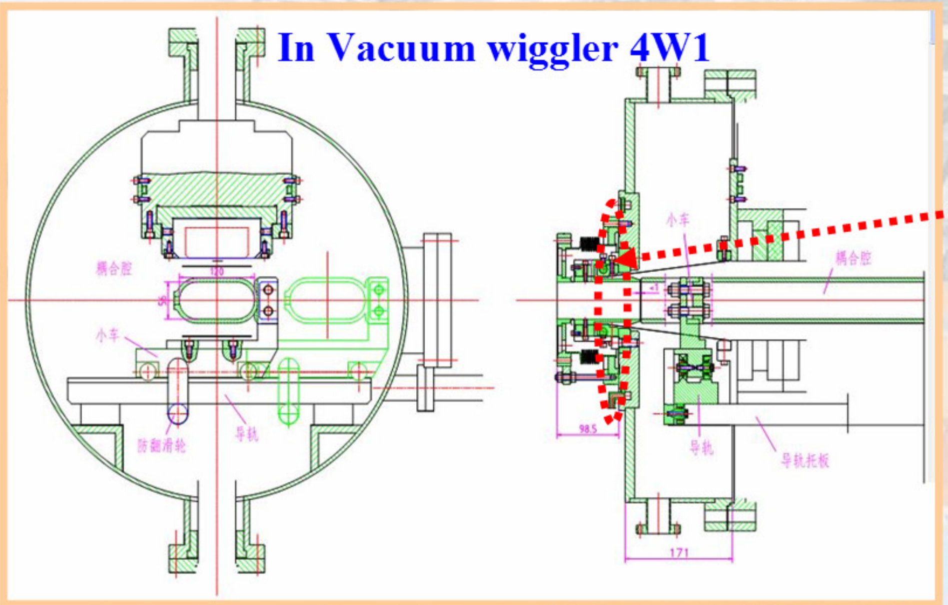


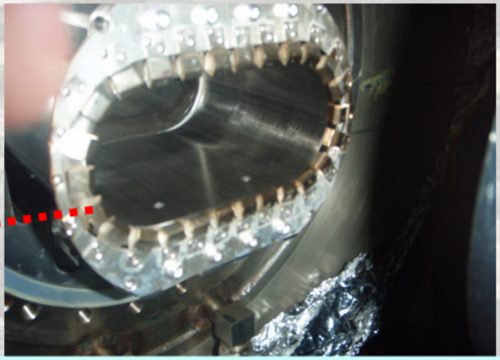


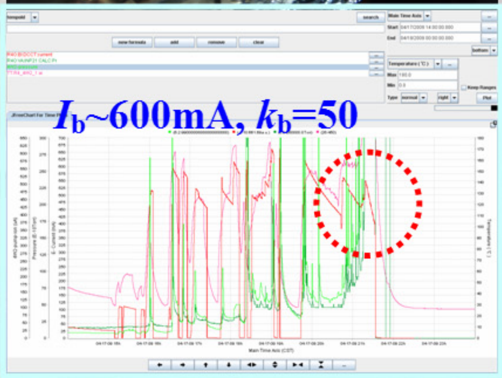
High current issues



High current issues

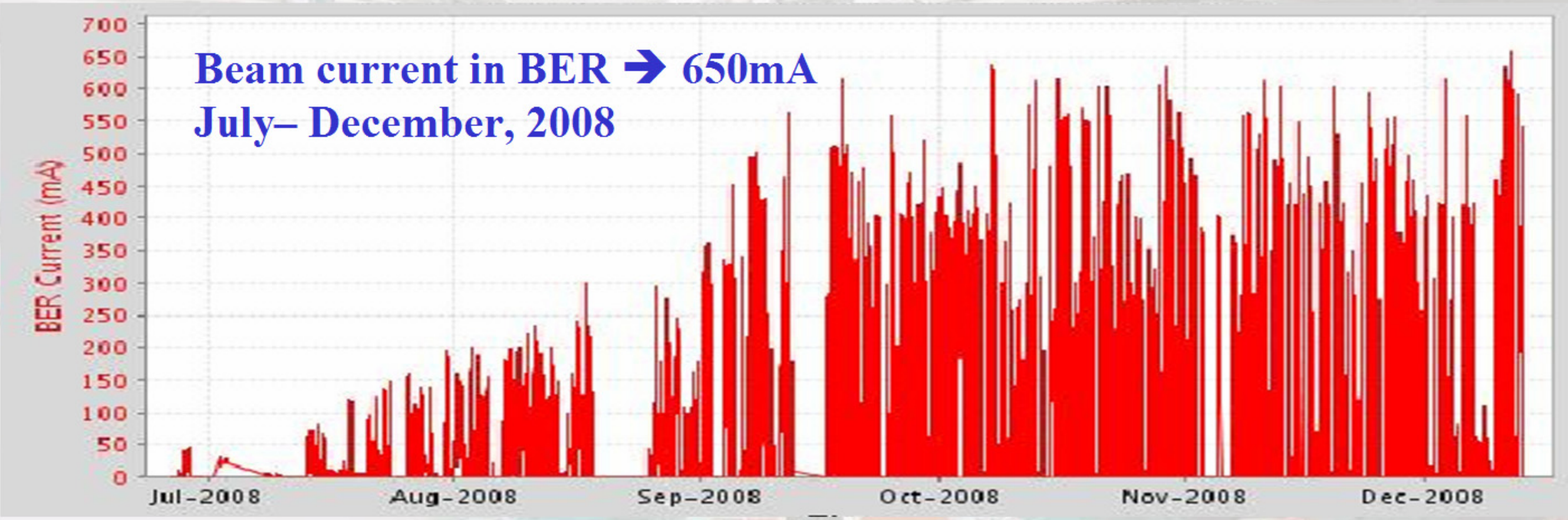


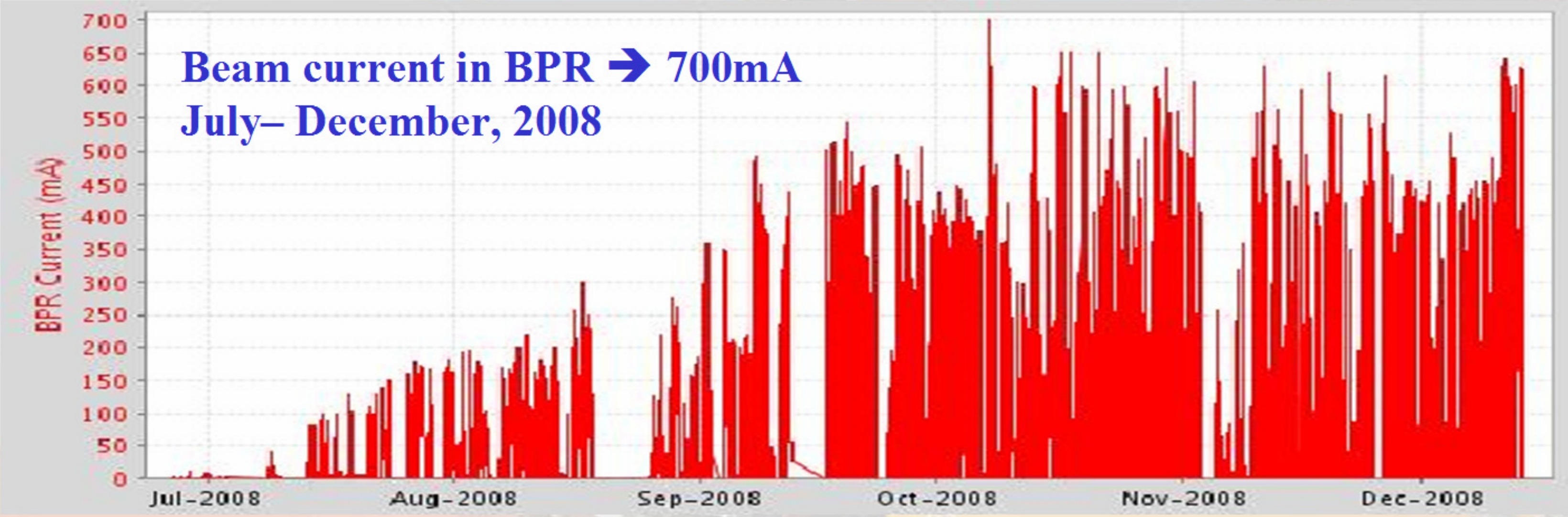




- The bellow was repaired;
- Vacuum and temperature have been in monitoring;

History of beam current growth



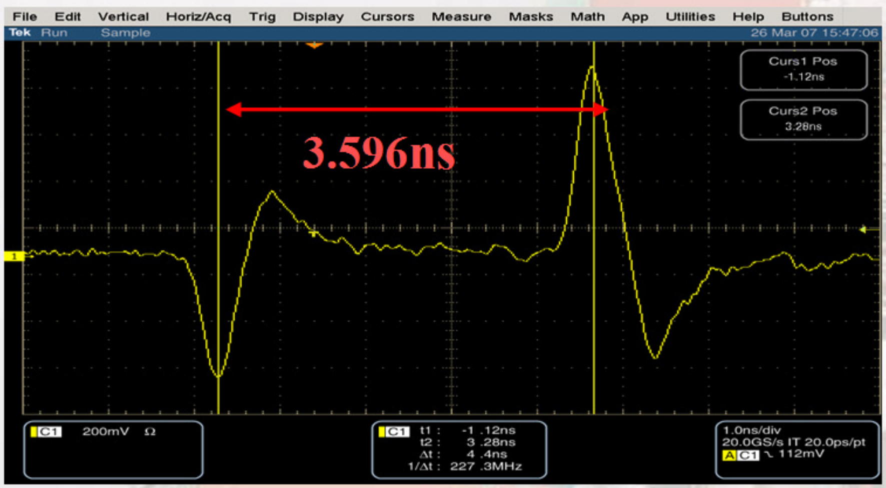


3.3 Single-bunch collision

IP bunch size: σ_z=1.5cm (50ps)
transverse: σ_x=0.5mm, σ_y=5μm

Collision in long.

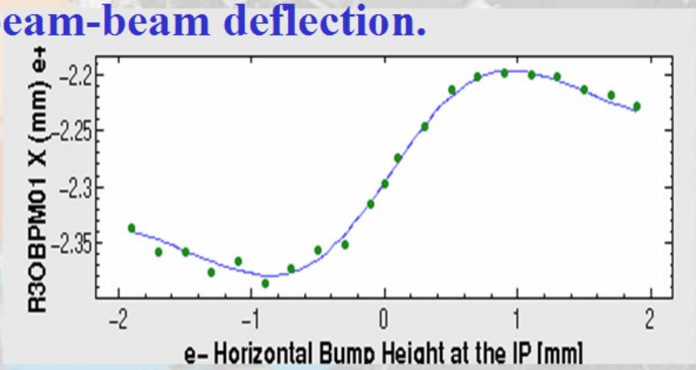
Adjust RF phase=> Two bunch reach IP at same time (deviation <10ps)

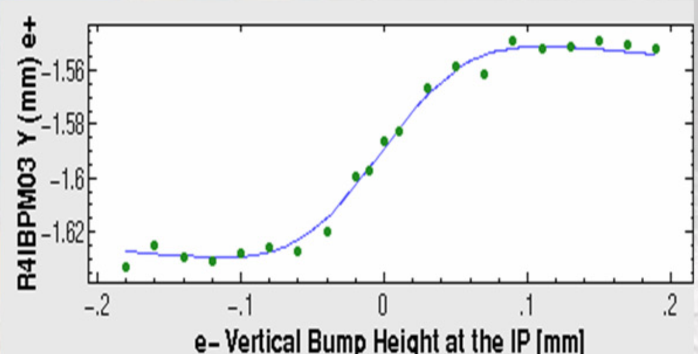


e+ and e- signals on
R4CBPM00 (0.539m to IP)

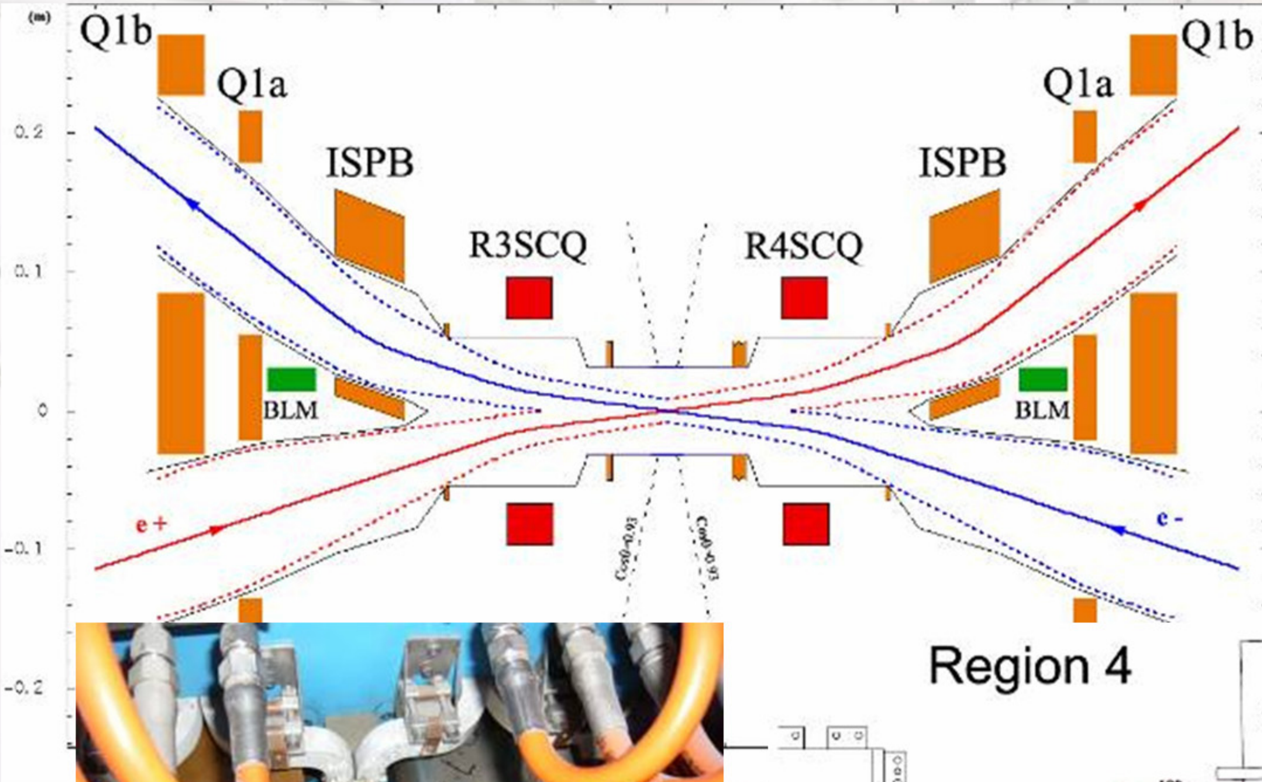
Transverse Scan

Adjust an orbit bump (step in 10/1.0 μm) around the IP in one ring, while observing the beam orbit variation in the other ring due to the beam-beam deflection.





Luminosity monitor



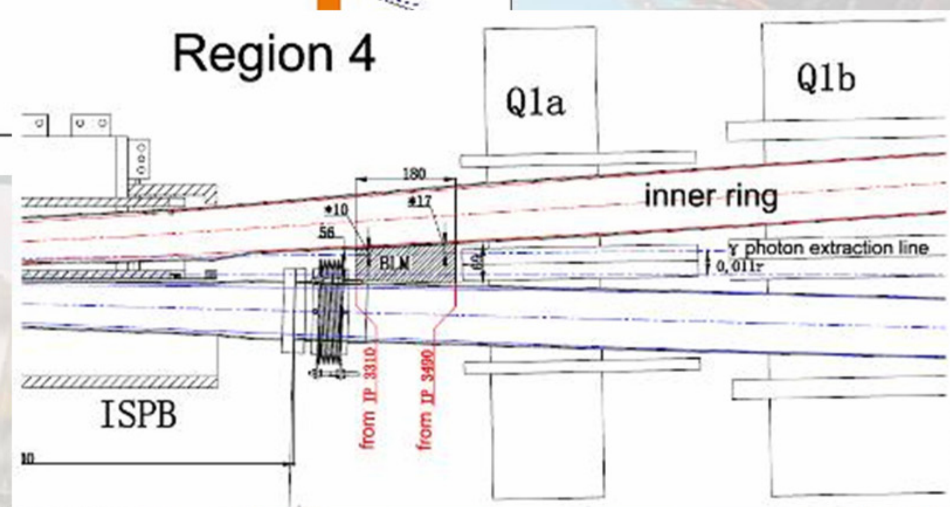
Zero degree Radiative bhabha process

$$e^+ + e^- \rightarrow e^+ + e^- + \gamma$$

R=3mm aperture

Time res. 0.21ns

=> Bunch luminosity



Tune Scan

To find the best working point for high specific luminosity $L/(I^{+}\times I^{-})$ around the designed one by beam-beam simulation.

BPR	5.55	5.56	5.57	5.58	5.59	5.6	5.61	5.62	5.63	5.64	5.65
6.52	t差	t差	t差	t差	76.92		丢束	t差	127.3	139.2	166.0
6.53	108.6	119.3	98.8	105.4	89.7	198.6	164.9	139	99.2	84.3	81.1
6.54	105.7	160.8	164.8	182.4	118.5	168.7	172.5	129.9	137.8	131.8	142.8
6.55	82.1	101.6	109.4	96.7	125.6	150.3	117.3	161.4	157.9	149.2	155.7
6.56	74.2	79.0	139.4	147.0	118.5	139.7	161.7	134.1	139.3	141.6	146.2
6.57	112.9	96.1	77.1	87.2	132.5	133.4	151.2	148.4	143.4	131.8	164.8
6.58	93.5	e+ blow up			185.2	102.4	114.3	128.5	171.0	136.0	146
6.59	113.1	101.9	158.9	75.2		110.5	113.7		140.4	t差	

BER	5.55	5.56	5.57	5.58	5.59	5.6	5.61	5.62	5.63	5.64	5.65
6.52											
6.53	131.8	167.2	141.9	111.7	139.1	146.2	145.6			207.1	214.1
6.54	t差 119	109	139.5	164.5	156.5 145.2					218.5	224.2
6.55	60.1	106.3	93.1	99.2	123	143.4	142.7			205.6	215.2
6.56		丢束	丢束	132.1	165.5				205.8	198.6	丢束
6.57	75.2	143.3	134	116.2	94.1	111.1	122.5	164.4	166.9	170.7	t差
6.58											
6.59	131.9	171.8	163.2	93.0	118.2	丢束	90.1				

Design: BPR and BER: 6.54/5.59

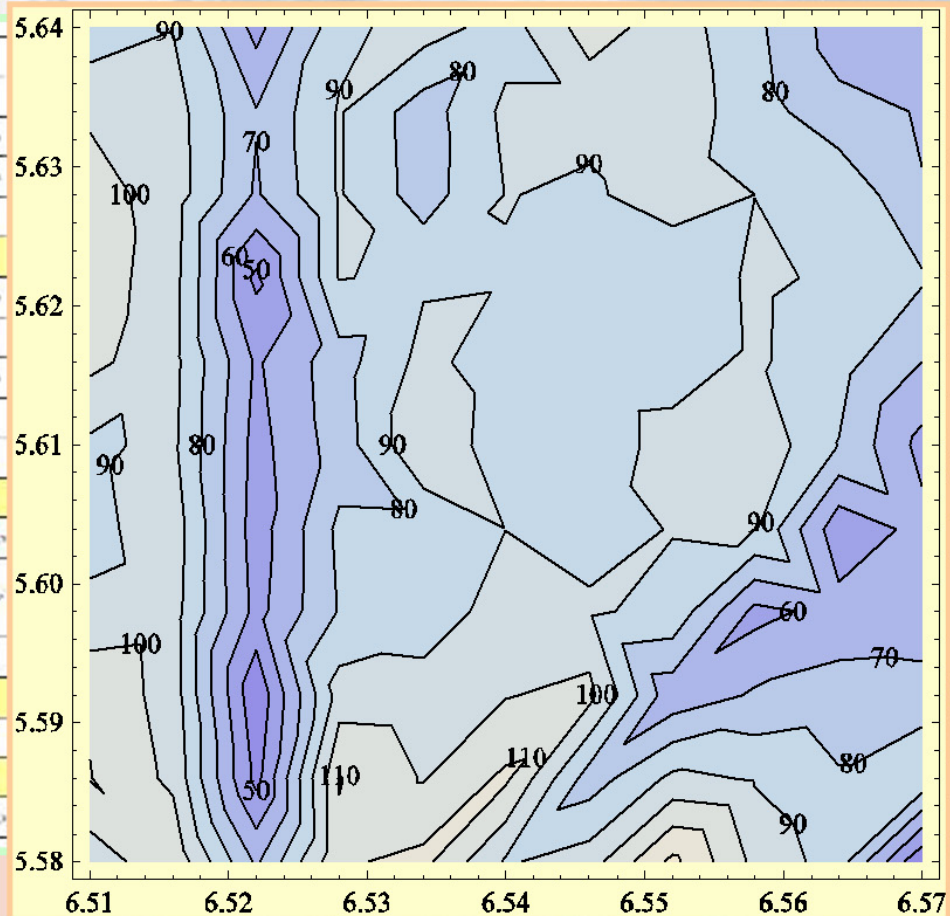
Scan result: BPR: 6.545/5.610 BER: 6.540/5.640

Tune Scan

To find the best working point for high specific luminosity $L/(I^{+}\times I^{-})$ around the designed one by beam-beam simulation.

BPR	5.55	5.63	5.64	5.65
6.52	t 差	127.3	139.2	166.0
6.53	108.6	99.2	84.3	81.1
6.54	105.7	137.8	131.8	142.8
6.55	82.1	157.9	149.2	155.7
6.56	74.2	139.3	141.6	146.2
6.57	112.9	143.4	131.8	164.8
6.58	93.5	171.0	136.0	146
6.59	113.1	140.4	t 差	

BER	5.55	5.63	5.64	5.65
6.52				
6.53	131.8		207.1	214.1
6.54	t 差 119		218.5	224.2
6.55	60.1		[illegible]	[illegible]
6.56		205.8	198.6	丢束
6.57	75.2	166.9	170.7	t 差
6.58				
6.59	131.9			



Design:

Scan result: BPR: 6.545/5.610 BER: 6.540/5.640

Optimization for Single bunch collision

- **Global optimization**

✓ ***x-y* coupling: adjusting the local vertical orbit at one sextupole**

=>1% coupling gives the best specific luminosity.

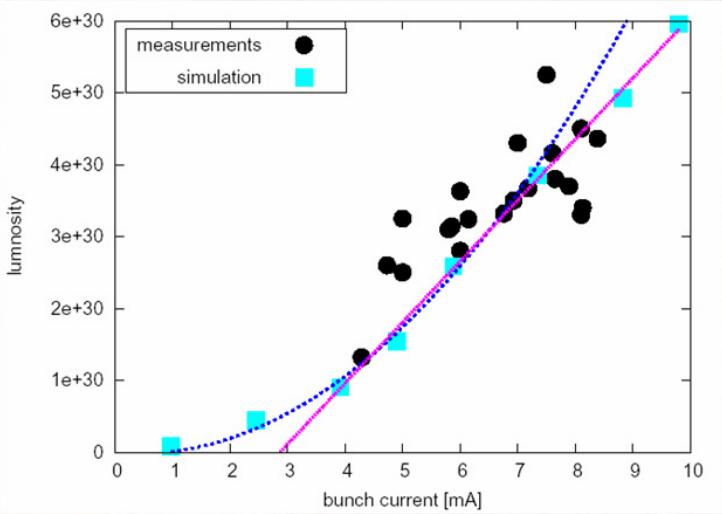
✓ **$D_y^* < 10$mm**

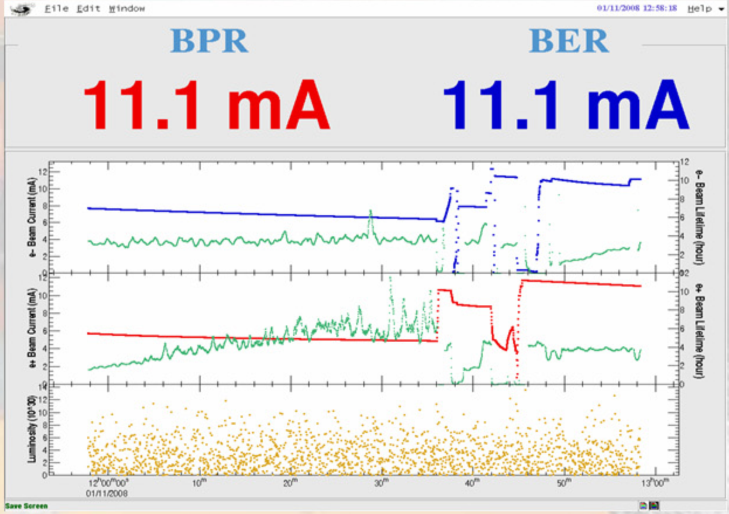
=>contribution to the beam size at IP can be neglected.

- **Local optics at the IP**

Coupling and β_y^* waist were also adjusted to optimize the luminosity.

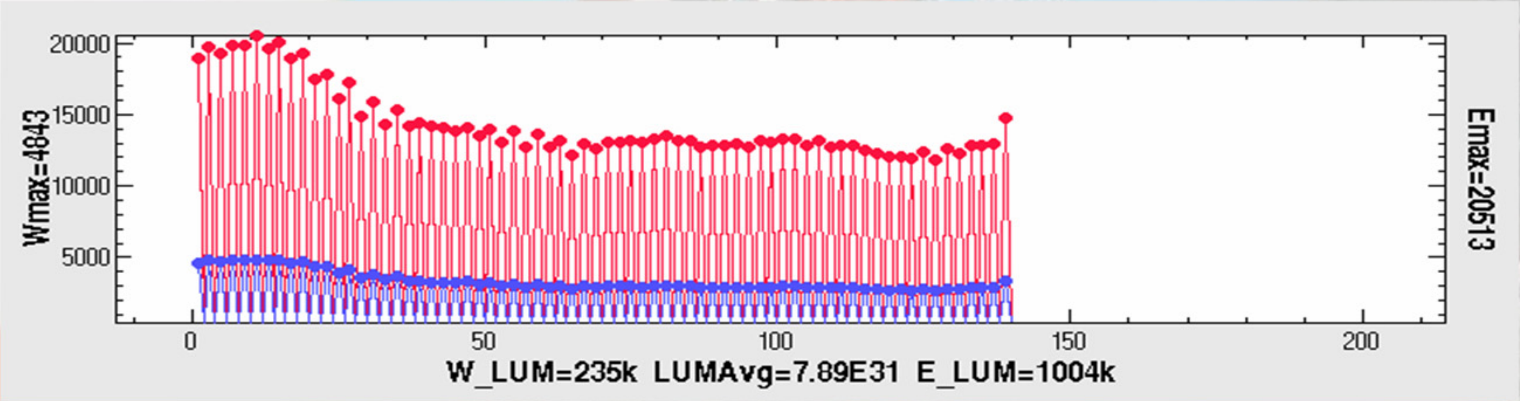
11mA×11mA was reached, more than the design of 9.8mA.



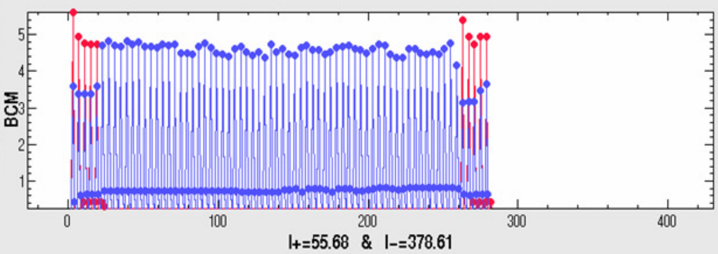


3.4 Multi-bunch collision

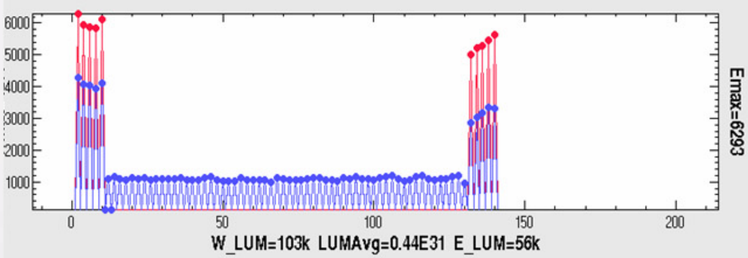
- Multi-bunch collision was practiced in two ways, one with relative high bunch current but small number of bunch.
- It was found that the luminosity for each pair of colliding bunches decreases along the bunch train
- The luminosity does not increase proportional to the bunch number.

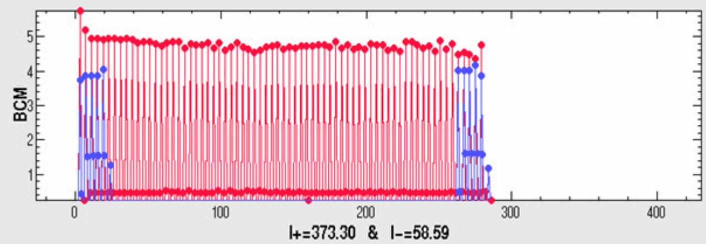


Comparison of a long e^+(e^-) bunch colliding with two short e^-(e^+) bunches in head and tail

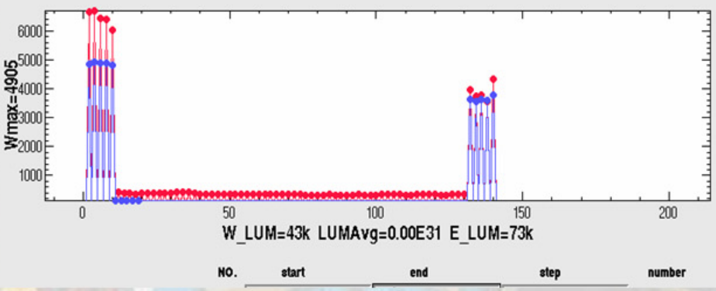


70 e^- vs. 10 e^+ bunches



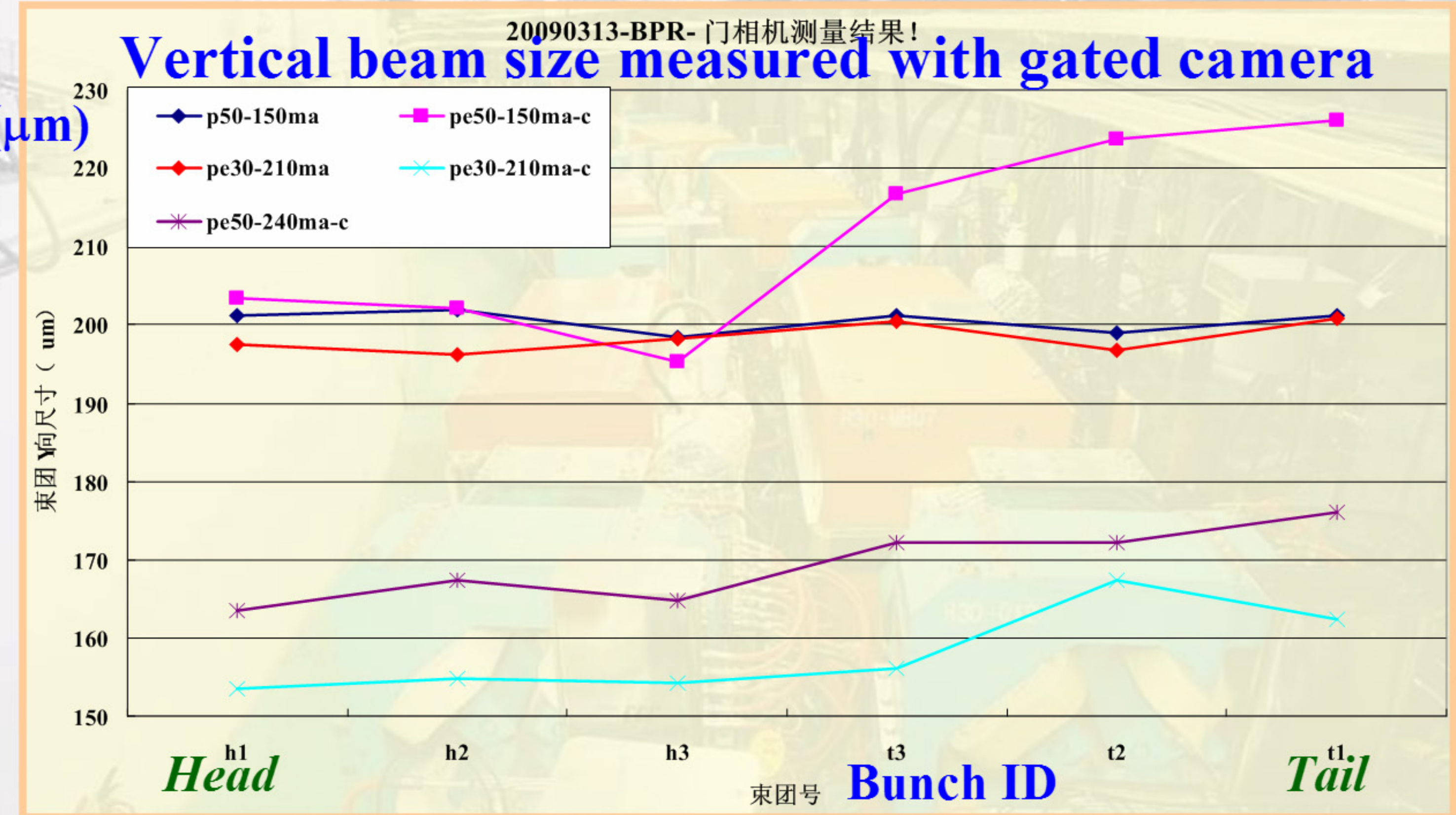


70 e^+ vs. 10 e^- bunches



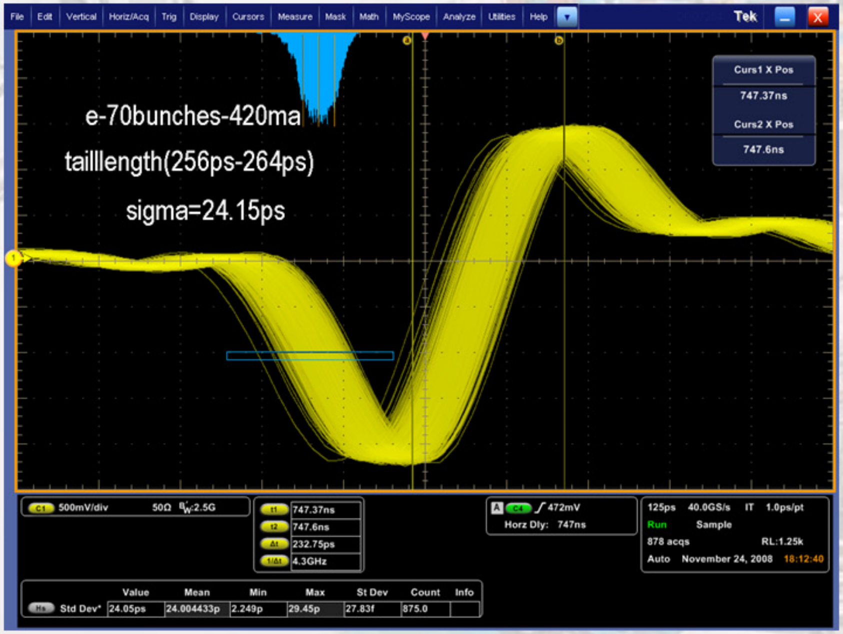
The problem was caused by e^+ beams!

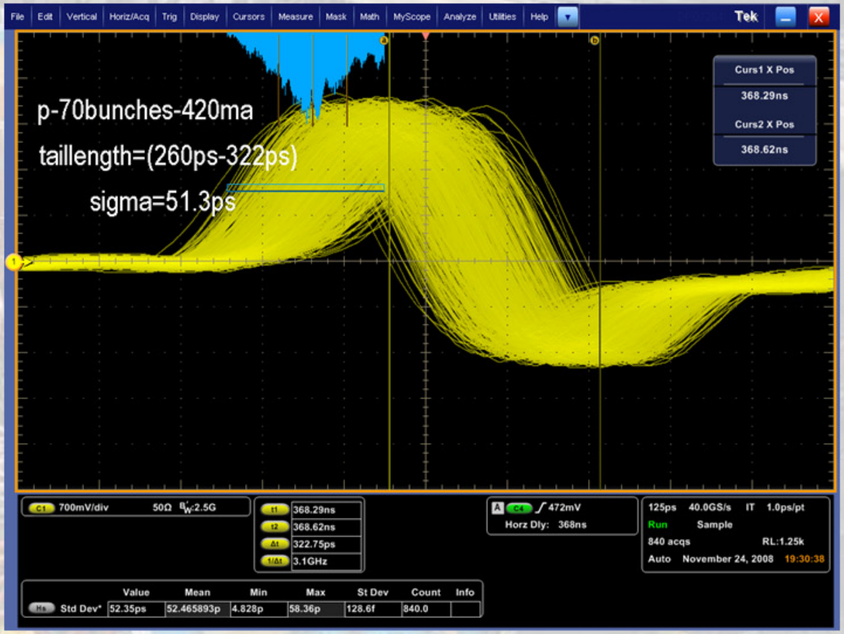
Is this caused by ECI?



It seems not caused by the electron cloud similar to other machines such as KEKB and PEPII.

Longitudinal oscillation of bunch train tail

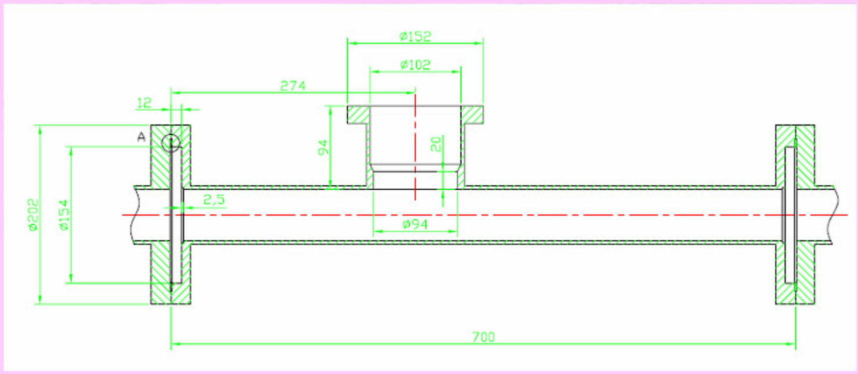


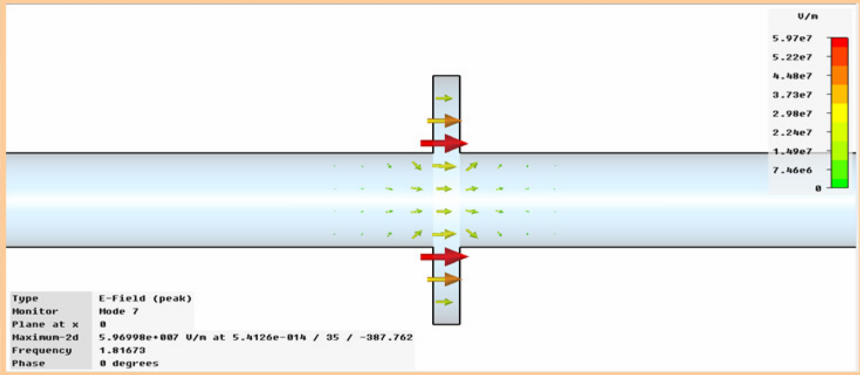


Electron bunches **Positron bunches**

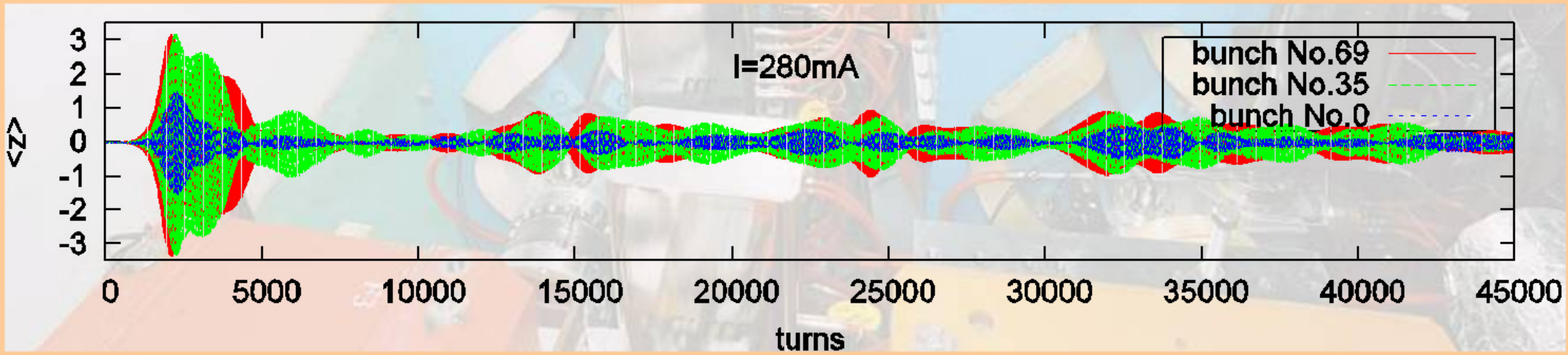
HOM of two screen monitors

Temporarily used for positron injection

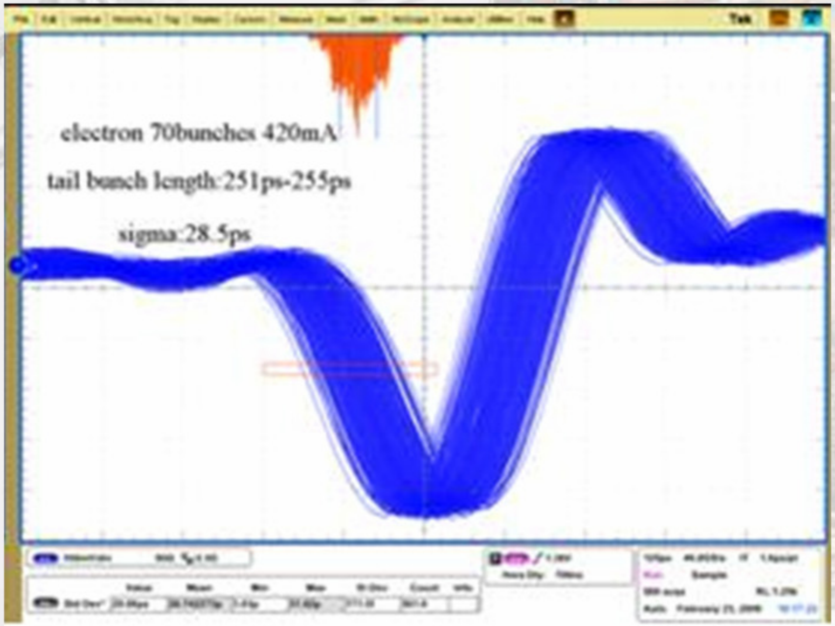


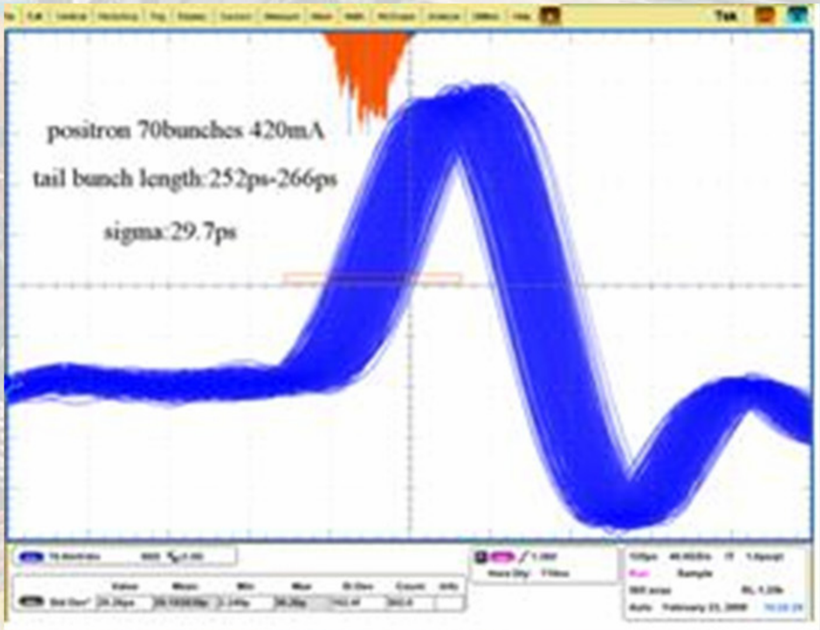


f_{res}= 1.8 GHz, R_s=80,000Ω , τ~ 200ns <T_0=800ns



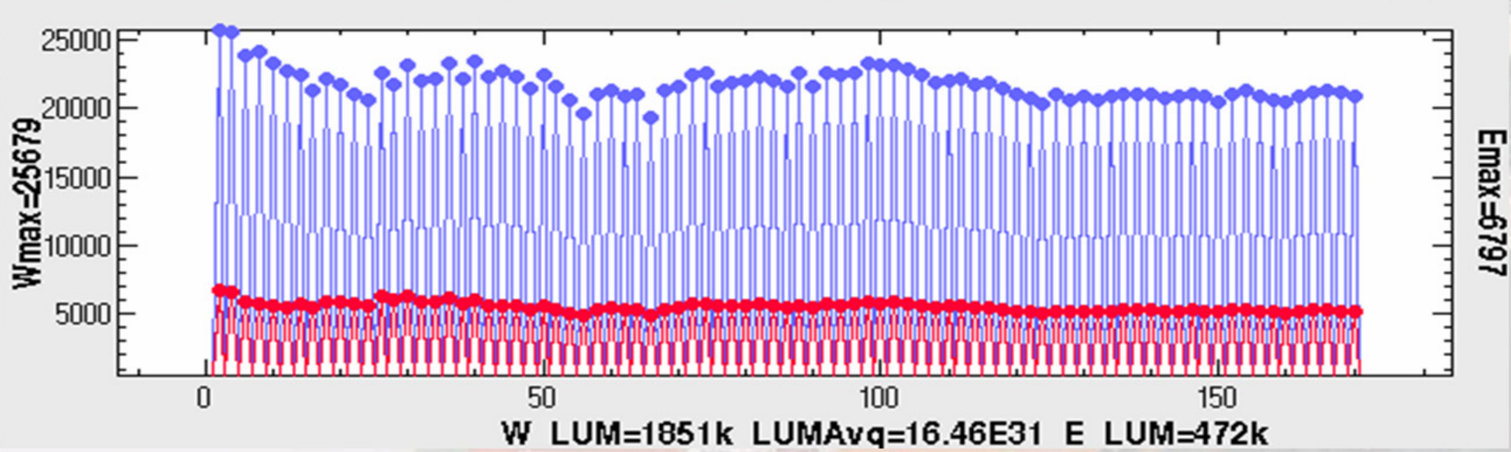
Longitudinal oscillation of bunch train tail after the SM's removed

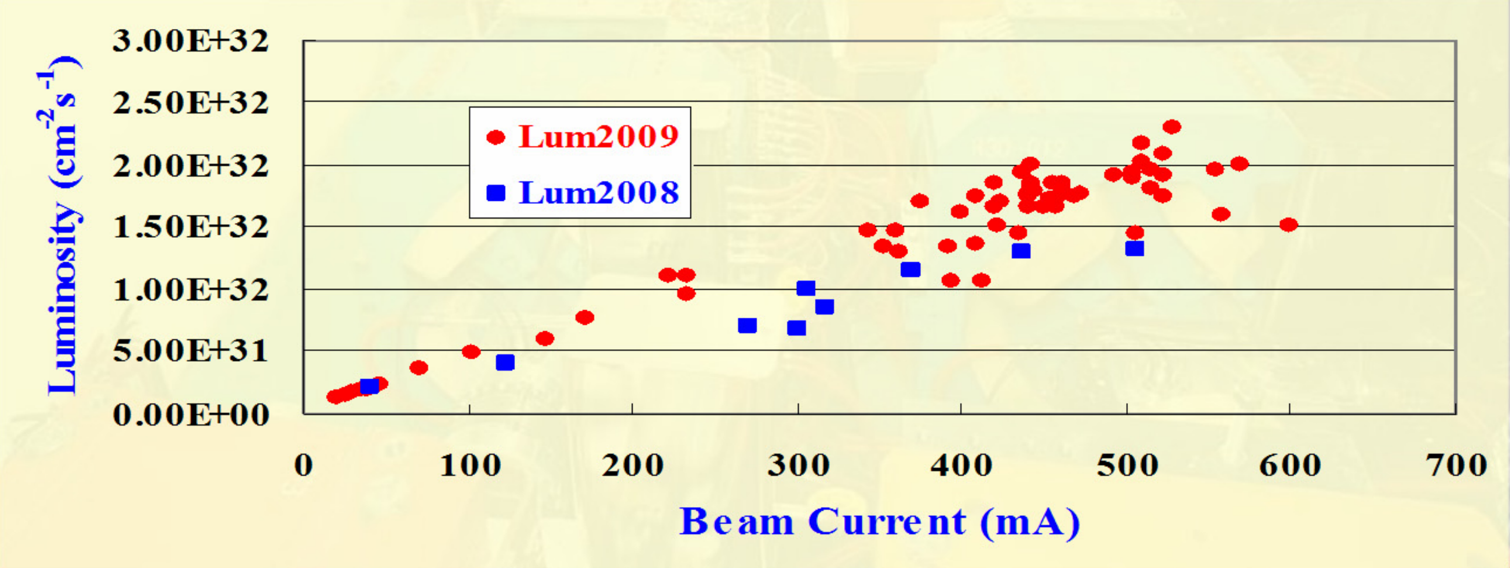




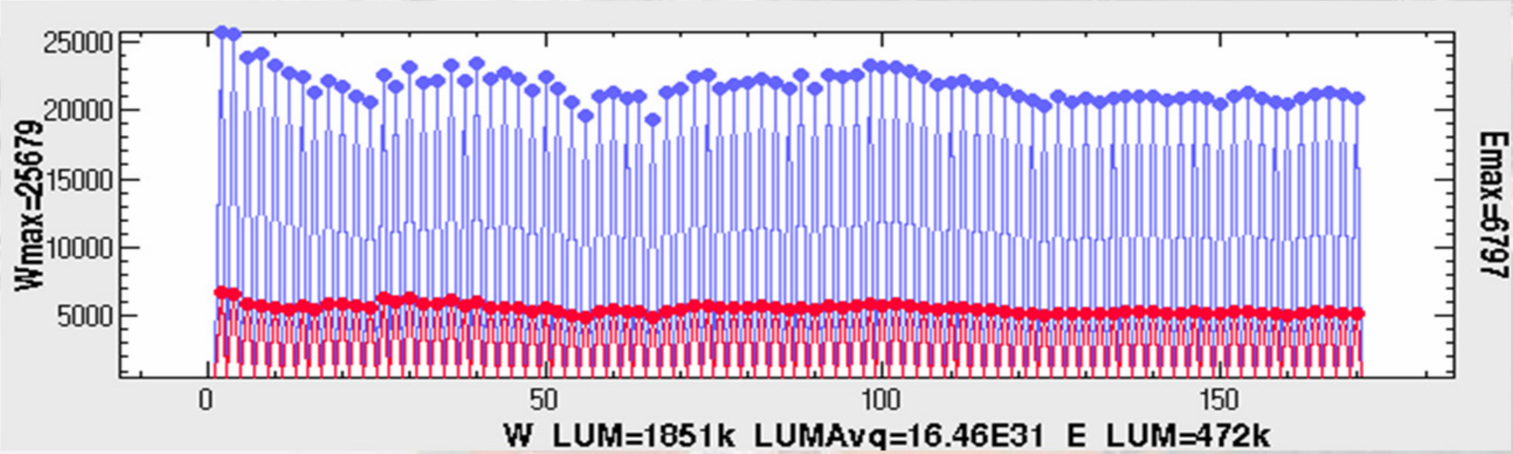
Electron bunches **Positron bunches**

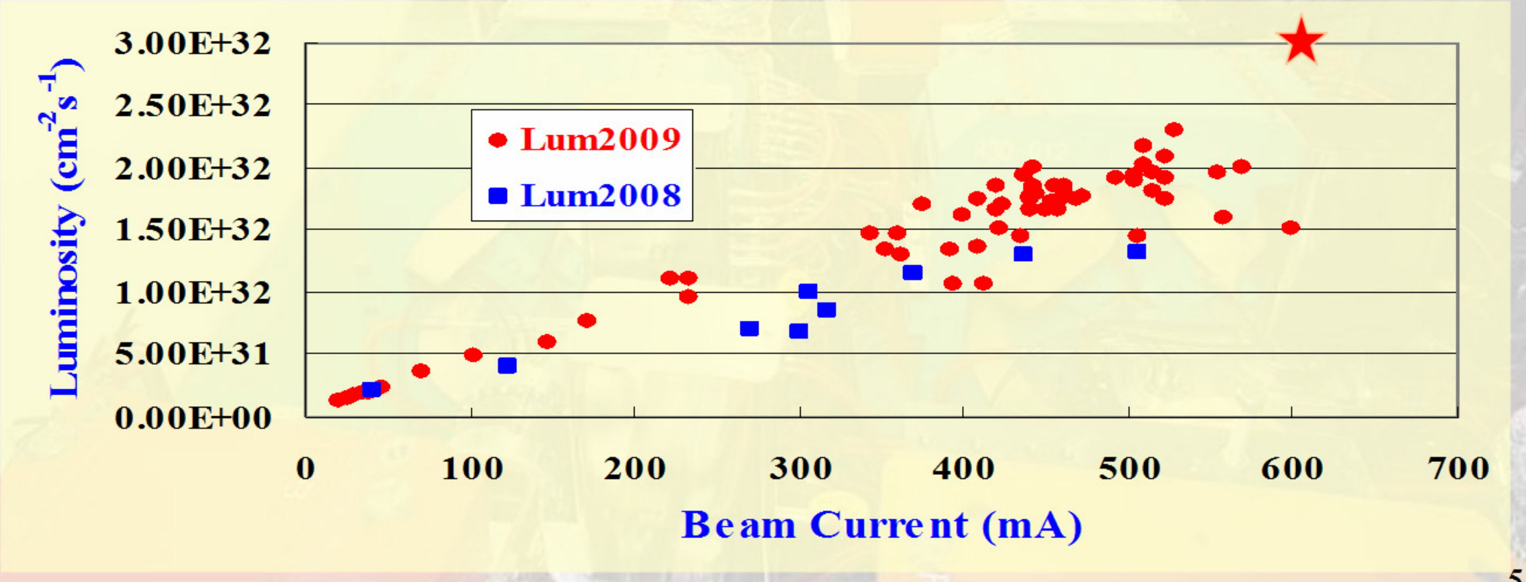
Luminosity after the SM's removed





Luminosity after the SM's removed



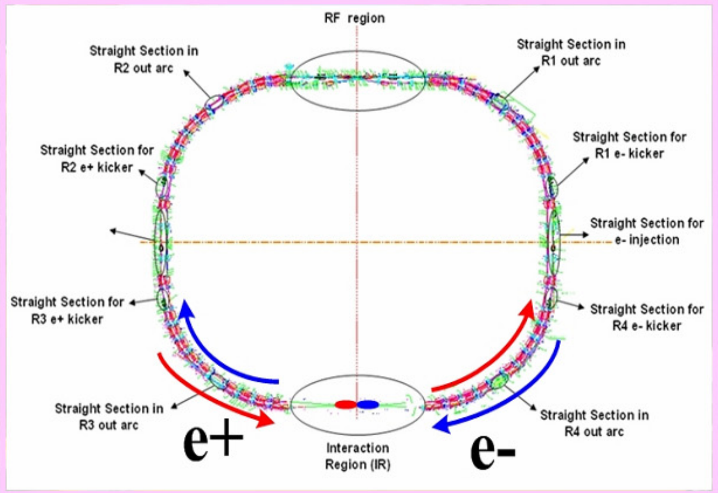


Main parameters achieved in collision

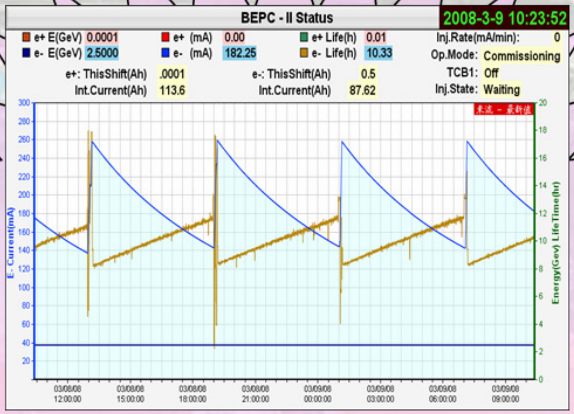
Parameters	Design	Achieved	
		BER	BPR
Energy (GeV)	1.89	1.89	1.89
Beam current. (mA)	910	650	700
Bunch current. (mA)	9.8	>10	>10
Bunch number	93	93	93
RF voltage	1.5	1.6	1.6
Tunes (ν_x/ν_y)	6.54/5.59	6.54/5.61	6.54/5.61
ν_s @ V_{RF}= 1.5MV	0.033	0.032	0.032
β_x^*/β_y^* (m)	1.0/0.015	~1.0/0.016	~1.0/0.016
Injection rate (mA/min)	200 e^-/50 e^+	>200	>50
L (10^{33}cm^{-2}s^{-1})	1.0	0.23	

Background

- Optimization has been done to reduce the dose rate in the IR during injection to protect the BESIII detector.
- Detector noise was significantly improved by filters of power supplies and BPM's, shielding accelerator components and better ground.
- To reduce the backgrounds during steady runs for data taking, collimators were used.
- For higher beam operation, it still needs further study on the aperture limit to improve the beam lifetime and to reduce the beam loss to generate background.



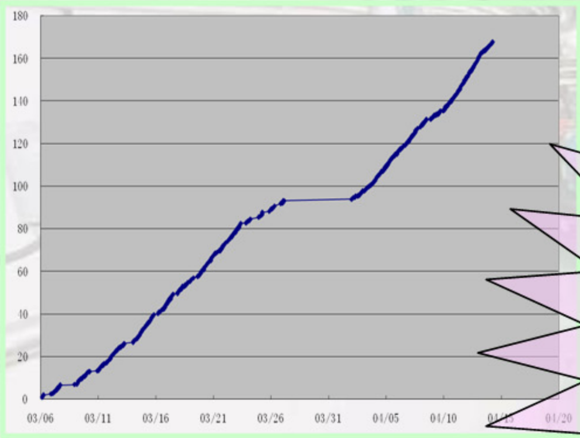
3.5 Operation for SR and HEP

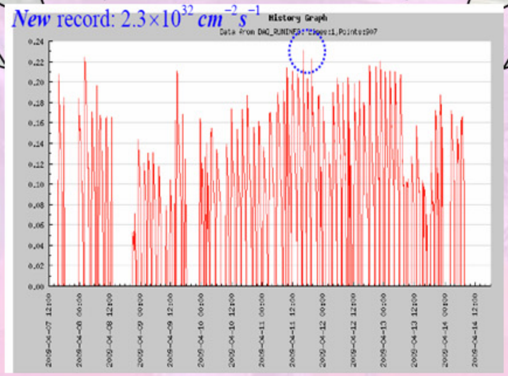


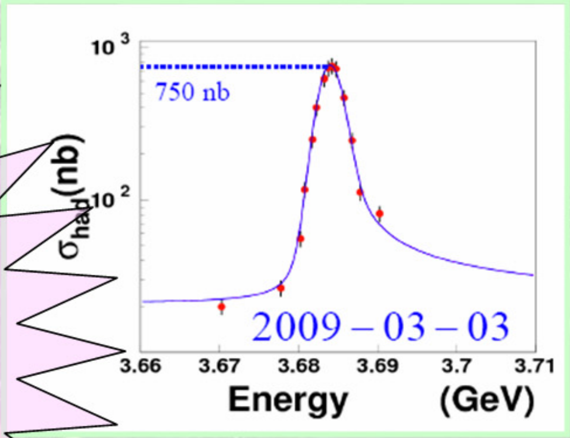
2.5 GeV, 250 mA, 10hrs.

~ 300 users

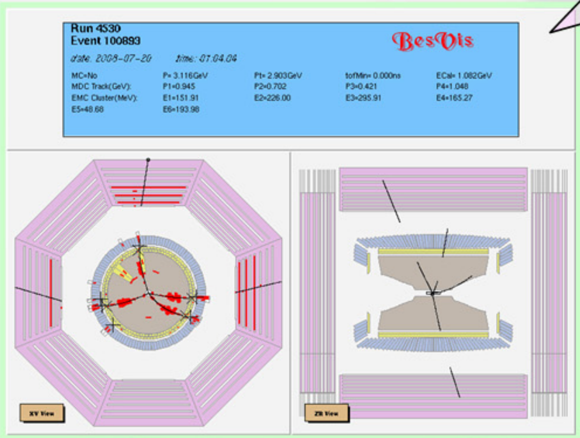
Operation for HEP



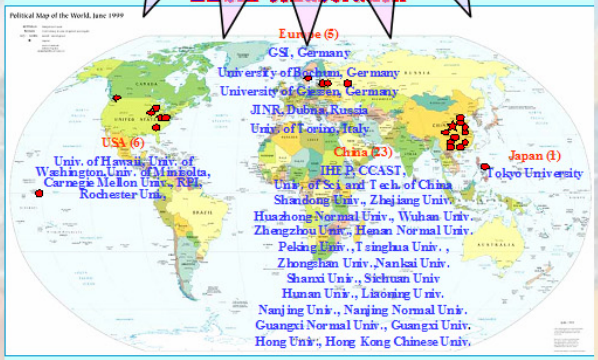




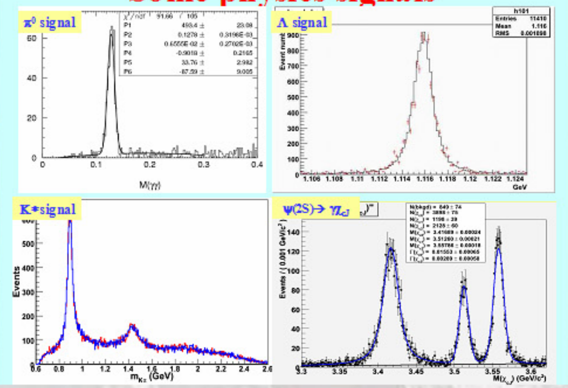
1.84 GeV, 2× 550 mA,
L>2×10^{32}cm^{-2}s^{-1}, 100M ψ(2S)



BESIII collaboration



Some physics signals



Summary

- The construction of BEPCII completed;
- The commissioning has been carried out progressively and alternatively together with operations for both high energy physics and synchrotron radiation.