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# IHEP, Beijing, Test Beam Facility Status and Plans

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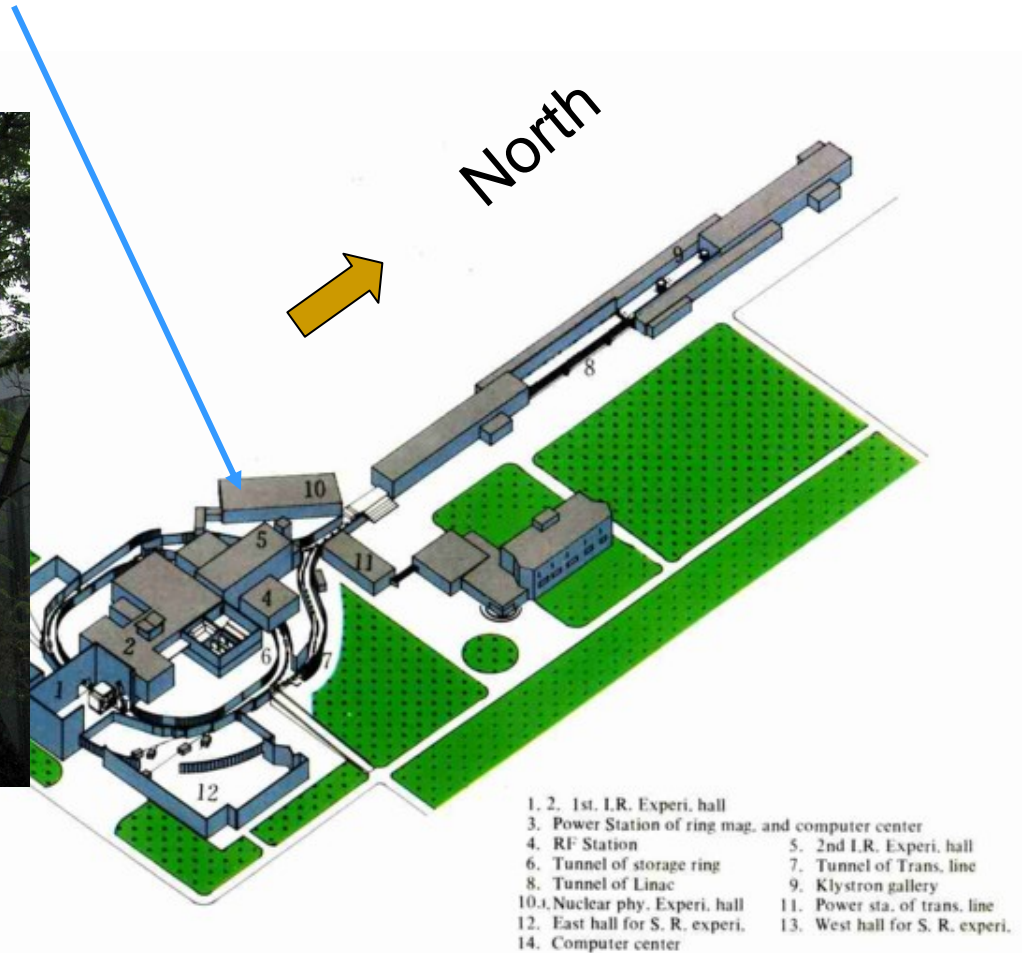
Test Beam Group

<http://www.ihep.ac.cn/facility/testbeam/index-English.htm>

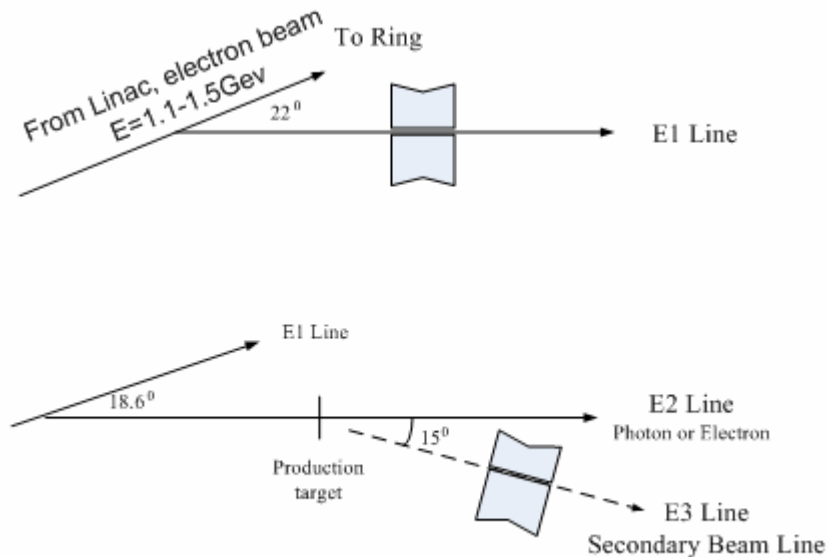
Institute of High Energy Physics  
Chinese Academy of Science



# Location of Beijing Test Beam Facility is in hall 10 of BEPC

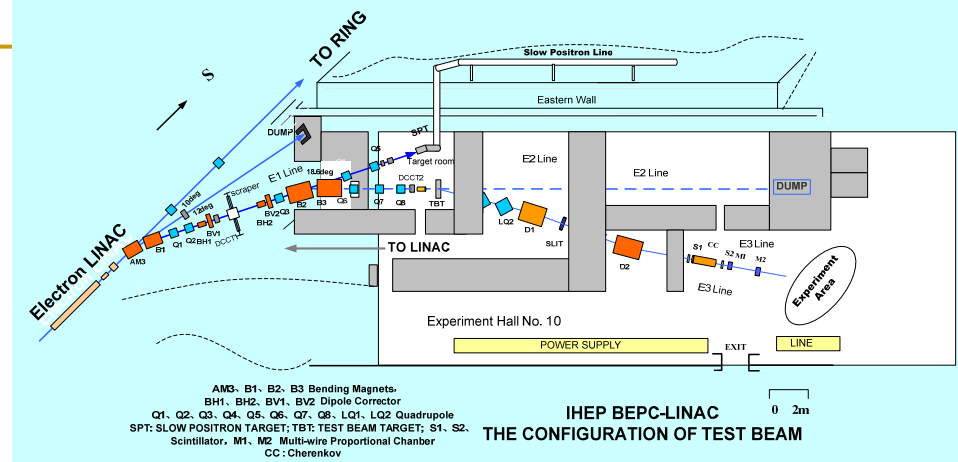


# A brief introduction of the Test Beam



- The Linac beam which has a bend of  $22^\circ$  into the Hall 10. As above the fig. that is an E1 Line.
- Two dipole magnets were inserted to the E1 line that beam was bend  $18.6^\circ$  again, and than come into the E2 line.
- The E3 line is a secondary beam line which is produced by electron impinging target. Particles that are a fixed angular acceptance of  $15^\circ$  enter a spectrometer and are transported to beam test area.

# Basic Equipments in Hall 10



- The facility was equipped in Hall 10 there is an area of 540m<sup>2</sup>, the crane has a capability of 10 Tons.
- As shown the figure, the E1 and E2 electron beam line which is 20m and 29m long respectively. The E3 line provided with a spectrometer and that is 23m long.

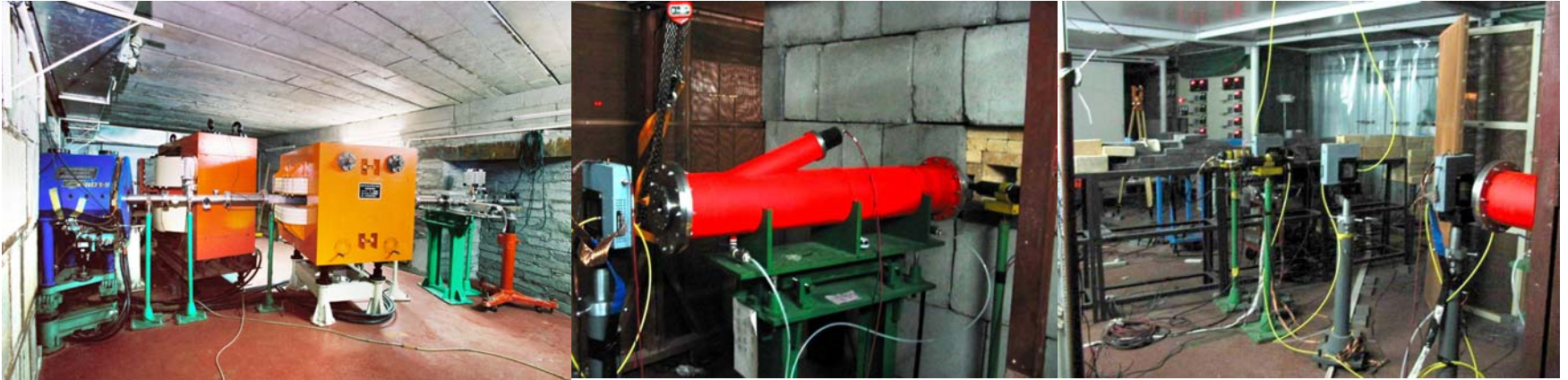


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The magnetic spectrometer on E3 line which has a structure of 2Q2D, its momentum resolution is 1% and has two running modes to detect both negatively and positively charged particles. In the spectrometer the detectors contain a Cherenkov counter, TOF counters and MWPC.

- **Cherenkov Counter**

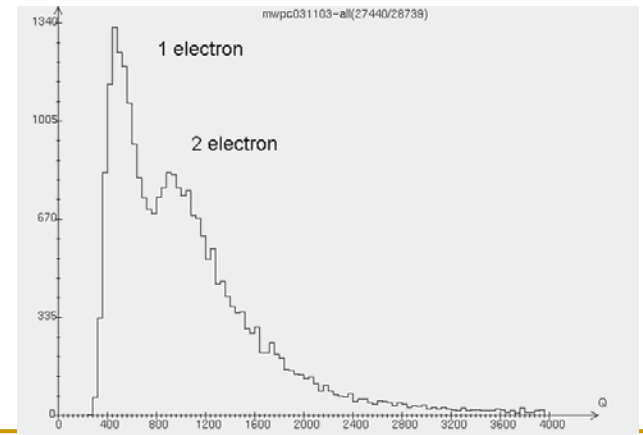
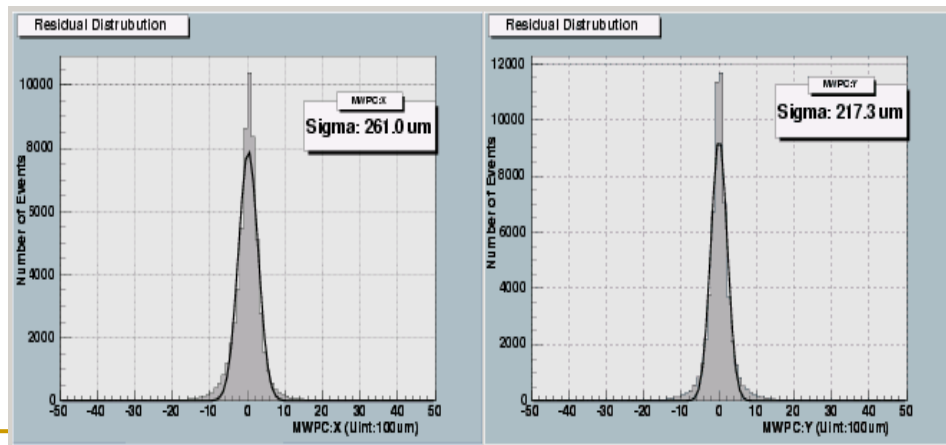
The CO<sub>2</sub> gas Cherenkov counter provided an identification of electrons and pions. An efficiency of the selection has reached 99%.

- **three Scintillator Counters**

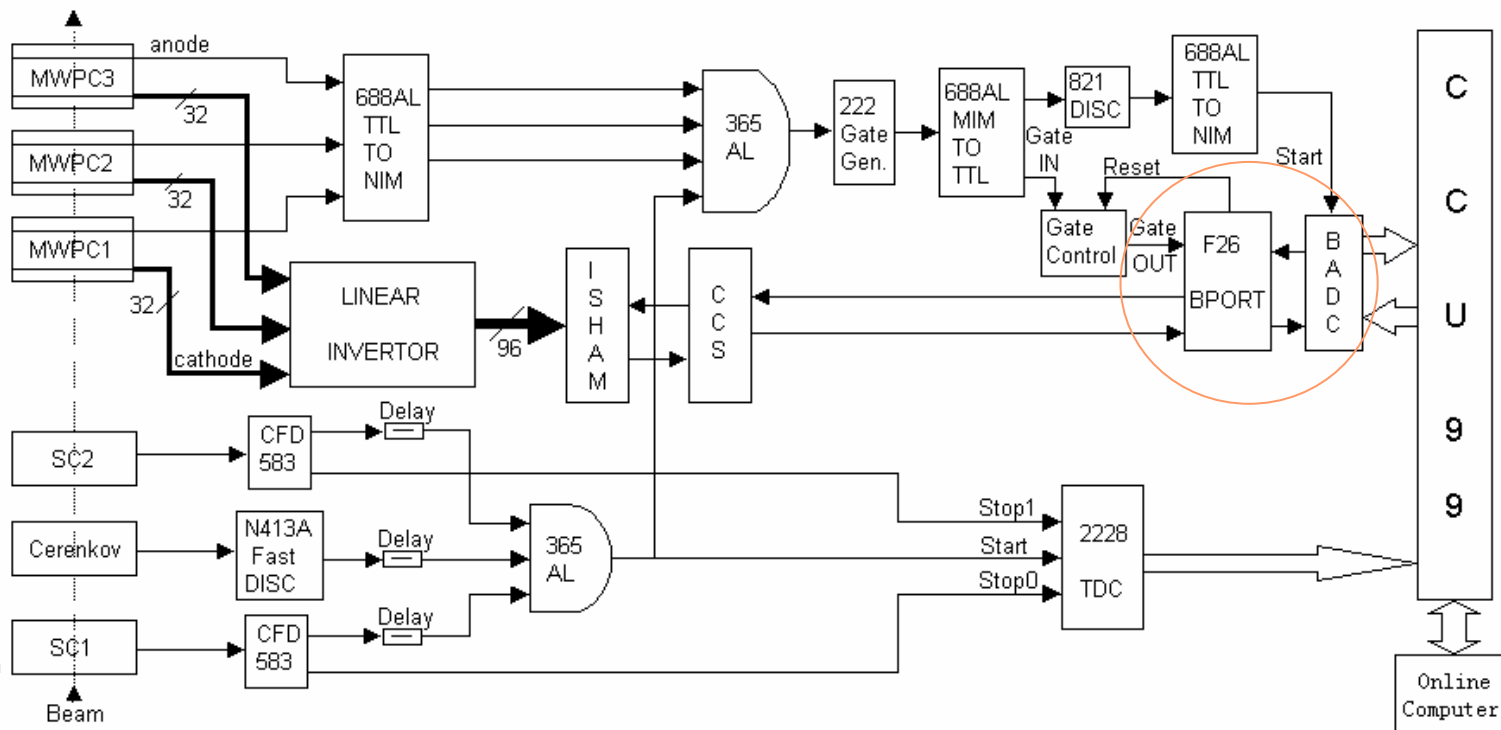
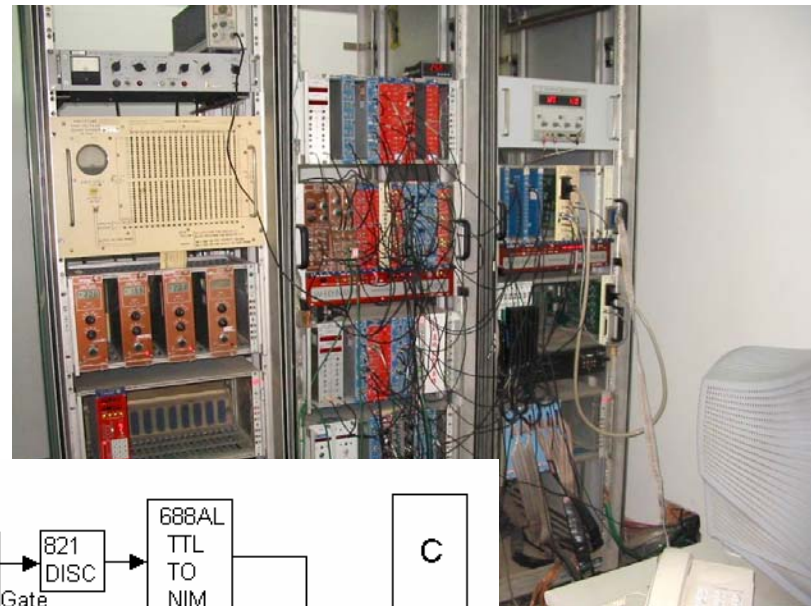
Time of Flight of particles was measured for identifying pions and protons. The time resolution is 200ps.

- **Three Multi-wire Proportional Chambers (MWPC)**

Each chamber has one anode side and 2 cathode sides with 32 induced stripes, the stripe is width of 4.2mm. The position resolution is less than 300micro-m. The dE/dx resolution is about 50%.

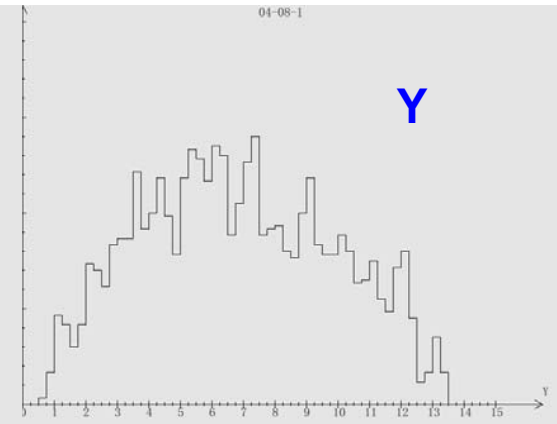
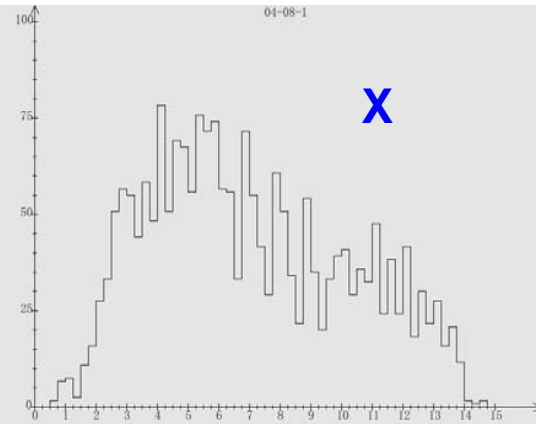
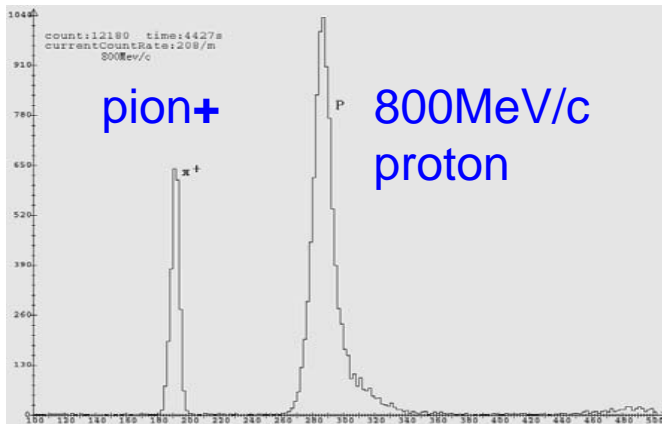
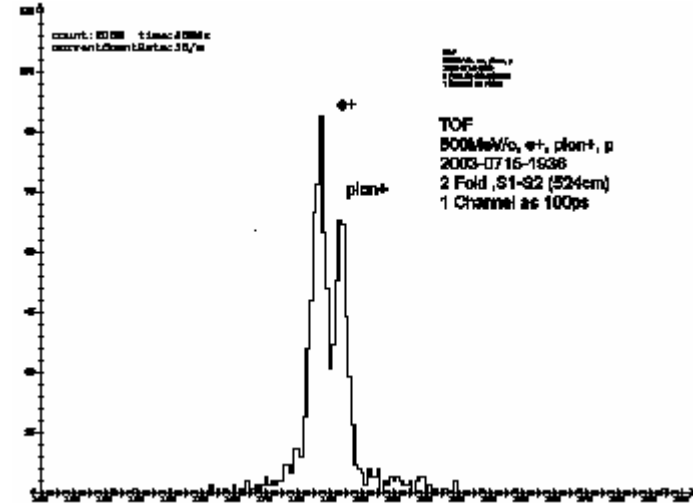


- The electronics include the discriminators, the triggers, the coincidence sets and the digital converter, the main frame is shown in this fig.
- The BADC was retired from BES (in 2005). Originally, the BADC –TRANSIAC MODEL 7001 designed by SLAC and produced by TRANSIAC Co. (in 1985).



## On-Line:

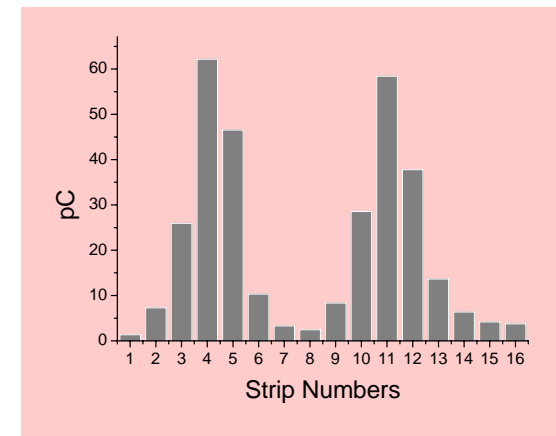
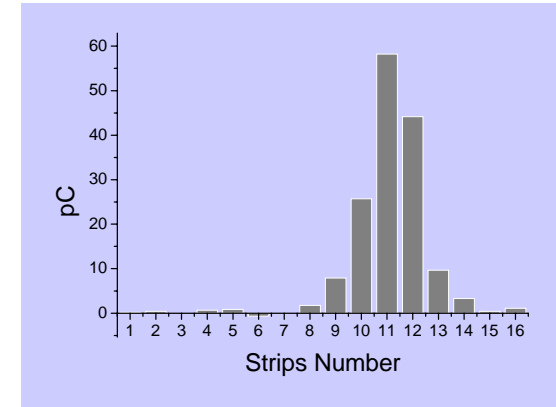
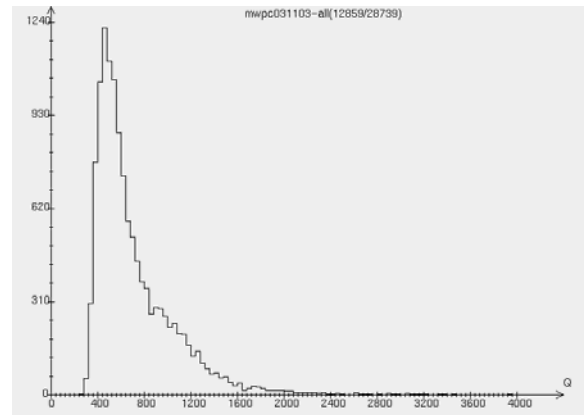
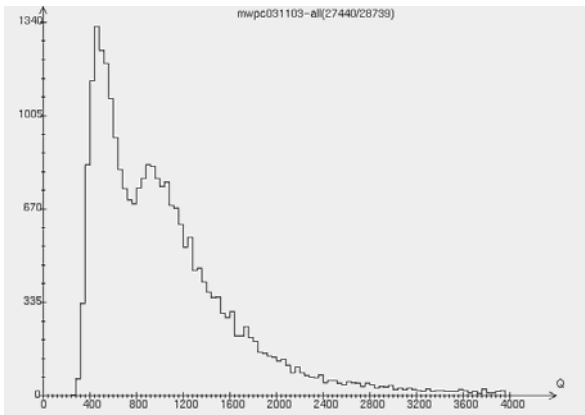
- Electronics Calibration,
- Read the data from CAMAC system.
- Show histograms in real-time on locale terminal and a remote, as a TOF spectrum and beam profiles.
- To save the raw-data once per 100 events.





## Off-line analysis:

- To adjust the efficiency of MWPC's cathodes, and to select induced strips as single particle on charges distribution.
- To calculate hit coordinates and reconstruct the tracks of single particle.
- Draw out the  $dE/dx$  distribution for cutting multi-particle again.





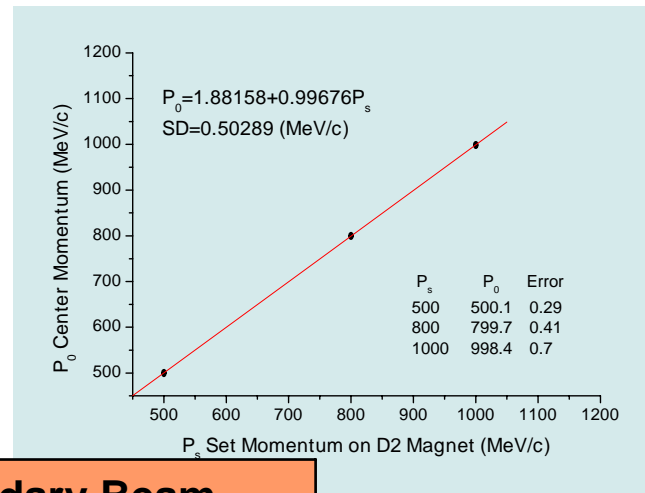
# Operation Parameters

## @ Primary electron beam from LINAC:

Intensity:  $10^{10}$ e/bunch, Energy: 1.1-1.5GeV,

## @ Secondary beam: $e^{\pm}$ , $\pi^{\pm}$ , p

- Target material : Carbon, Beryllium
- Derivative angle: fixed forward orientation of  $15^{\circ}$
- Momentum resolution and its linear errors is 1% and 0.5MeV/c respectively.



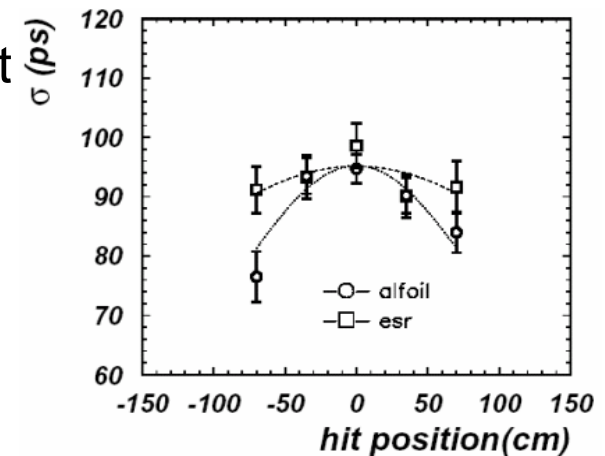
| Parameter        | Primary electron beam (E1 and E2 Beam Line) | Secondary Beam (E3 Beam Line)                     |
|------------------|---|---|
| Charge/Bunch     | $1.0 \times 10^{10}$                        | Single and multi-particle                         |
| Energy           | 1.1-1.5 GeV                                 | 0.4-1.2GeV/c                                      |
| Energy Spread    | < 1%  | 1%  |
| Kind of Particle | $e^{\pm}$                                   | $e^{\pm}$ , $\pi^{\pm}$ , p                       |
| Bunch width (ns) | 1.2   |   |
| Bunch rate (Hz)  | 25  | 1.5-2 (single particle);<br>7-8 ( multi-particle) |

Table 1



# First running for the TOF detector in 2004

- The energy 800MeV electron beam was employed for the time resolution measurement of the TOF prototype.
- Its main parameters:  
5×6cm<sup>2</sup> cross section, 2.3m length,  
the scintillator materials is EJ 200,  
the time resolution is reached 90ps~94ps.



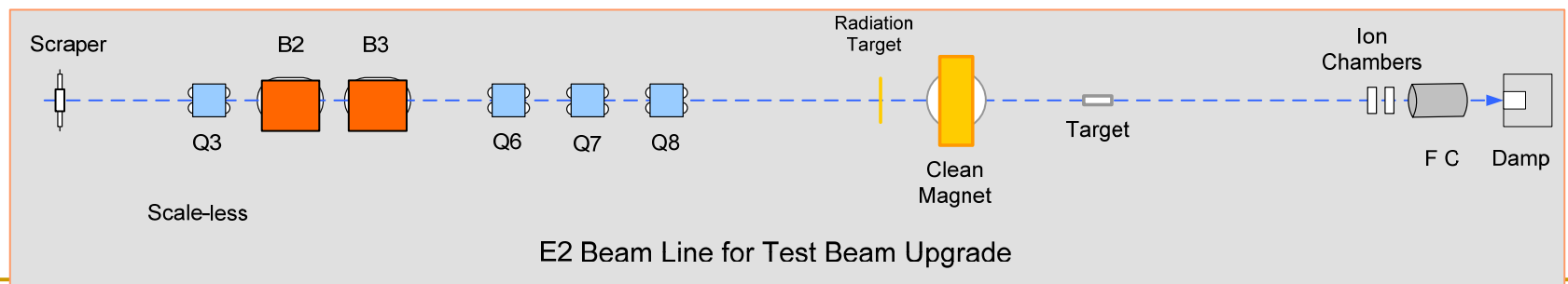


BESIII sub-detectors beam test was included:

- The TOF detector tested some packing sheets of scintillator.
- EMC energy resolution and its shower core-position measurement.
- The MDC whole length prototype tested its electronics threshold voltages and its noise suppression.
- And the RPC acquired some data for the efficiency measurement under high background,
- The associated test of electronics (DAQ) was performed for simulating a possible interferences of BESIII's detectors operation together.

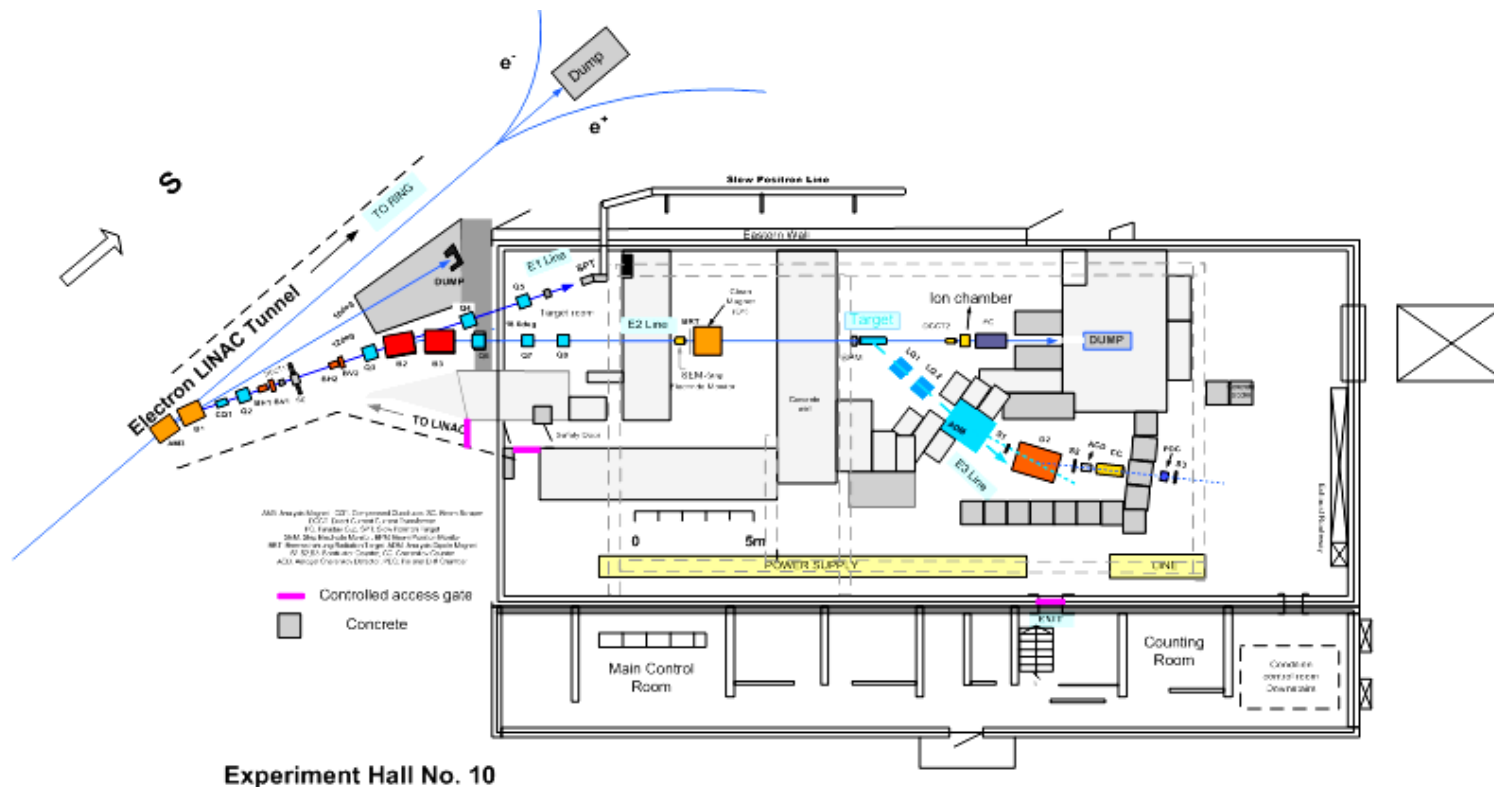
## ■ An alteration of E2 Line

- (1) To extend the vacuum pipes of E2 line, this scheme is put forward that will enable to equip double target for reduce particle multiplicity, and that is requested by operation flexible. As the follow fig, the real bremsstrahlung photons will be generated by the electrons impinging on a copper radiation target, located 550cm upstream from a production target.
- (2) Ion-chambers and Faraday Cup which use to measure the intensity of photons or electrons.
- (3) The electron beam strike the production target directly instead of photon beam that will be available for hadrons.
- (4) To degrade the beam intensity on E2 Line for special application that will use a beam scraper, located 8m upstream from the B2. The intensity of  $10^{6-10}$  e/bunch is achievable on the E2 line.



## ■ A New E3 Line in Hall 10

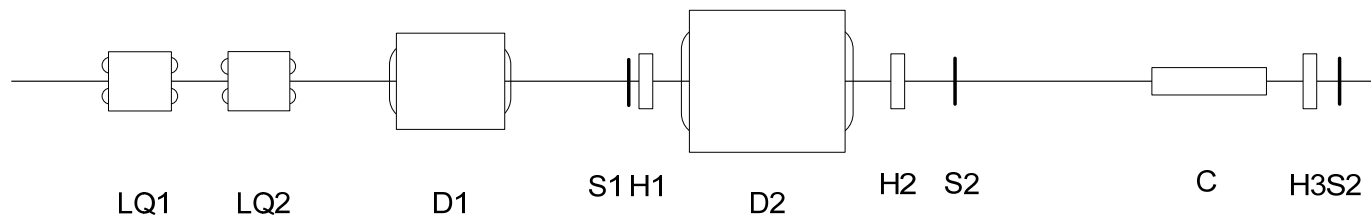
The new E3 line will enhance Pion's intensity that the spectrometer will be shortened from 23m to 15m long, and also, that will extend the experiment area. The configuration was shown in the following picture.



## ■ The New Spectrometer Configuration

As shown in follow picture, the 1.2GeV/c spectrometer which were consisted of two dipole and two quadrupole magnets, three sets of hodoscopes H1-H3, three triggers S1-S3 and a renewed Cherenkov counter.

The hodoscopes will be used reconstruction of particle trajectory so the momentum resolution will be improved more.



| ID | Task Name   | Start      | Finish     | Duration | 2007 |  |  |  |  |  |  |  |  |  |  |  | 2008 |  |  |  |  |  |  |  |  |  |  |  |
|----|---|------------|------------|----------|------|--|--|--|--|--|--|--|--|--|--|--|------|--|--|--|--|--|--|--|--|--|--|--|
|    |   |            |            |          |      |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |  |  |  |  |  |  |  |  |
| 1  | Quartz scintillator fiber target test                           | 2007-1-10  | 2007-1-15  | .8w      |      |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |  |  |  |  |  |  |  |  |
| 2  | Calibration of Faraday Cup                                      | 2007-1-10  | 2007-1-31  | 3.2w     |      |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |  |  |  |  |  |  |  |  |
| 3  | Background measurement for EMC                                  | 2007-2-1   | 2007-2-16  | 2.4w     |      |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |  |  |  |  |  |  |  |  |
| 4  | Yangbajing Air-shower Core detector test                        | 2007-2-19  | 2007-4-6   | 7w       |      |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |  |  |  |  |  |  |  |  |
| 5  | GEM detector test (IHEP-EPC)                                    | 2007-4-9   | 2007-4-16  | 1.2w     |      |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |  |  |  |  |  |  |  |  |
| 6  | GEM detector test (Tsinghua University)                         | 2007-4-17  | 2007-4-25  | 1.4w     |      |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |  |  |  |  |  |  |  |  |
| 7  | MRPC(for USTC)  | 2007-4-25  | 2007-5-15  | 3w       |      |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |  |  |  |  |  |  |  |  |
| 8  | Test Beam Update  | 2007-5-16  | 2007-11-16 | 26.6w    |      |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |  |  |  |  |  |  |  |  |
| 9  | A experiment of electron scattering                             | 2007-11-19 | 2008-2-28  | 14.8w    |      |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |  |  |  |  |  |  |  |  |
| 10 | Test Beam running (Parasitical model running) for open duration | 2008-3-3   | 2008-12-31 | 43.6w    |      |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |  |  |  |  |  |  |  |  |

- In 2007 years, the main running is a calibration of Yangbajing Air-shower Core detectors and an experiment of the Electron Scattering. A period of shutdown is six month for the test beam upgrade.
- 10th item in the table: from March 2008y ---, the test beam haven't a certain schedule for any detectors.



# Summary

- The Beijing testbeam commit oneself to beam test of BESIII's sub-detectors in 2003y-2005y.
- There are some modifications and upgrade that was asked by detectors beam test.
- The plan that is proposed which had submitted to an authority for some required supports.



# Thanks