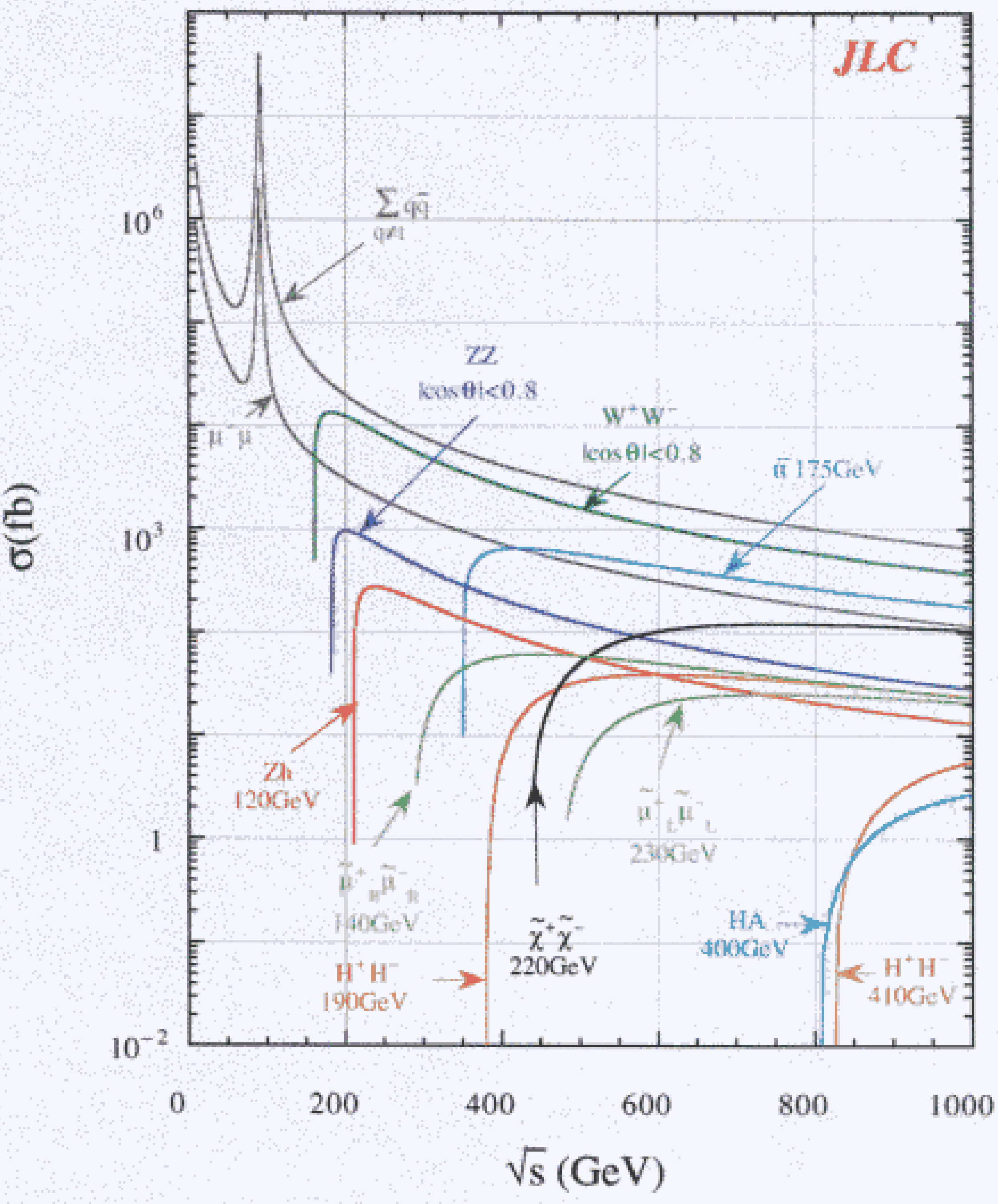
Asian Activities

Takayuki Matsui
KEK
September 22-25, 2000, DESY, Hamburg



JLC
ZZ
|cosθ|<0.8
W+W-
|cosθ|<0.8
tt̄ 175GeV
Zh
120GeV
140GeV
H+H-
190GeV
χ̃+χ̃-
220GeV
230GeV
HA
400GeV
H+H-
410GeV
σ(fb)
10^6
10^3
1
10^-2
0
200
400
600
800
1000
√s (GeV)

Physics Targets of the e^+e^- linear collider

1000 fb^{-1} (5 years)

Higgs ~ 0.3 M events

$m_{Higgs} < 215$ GeV (95% CL)

Top ~ 0.5 M events

$m_{Top} = 174.3 \pm 5.1$ GeV

W/Z ~ 10 M events

Further Precision Electroweak Tests

SUSY ~ 50 K events

Suggested by $\sin^2\theta_w$

K. Yokoya.

250GeV (CM) Hi-Lum Parameters of JLC

		A	X	Y
Luminosity	$10^{34}/\mathrm{cm}^2\mathrm{s}$	0.44	0.79	1.31
Nominal Lum.[3)]	$10^{34}/\mathrm{cm}^2\mathrm{s}$	0.32	0.54	0.88
Bunch Population	10^{10}	0.75	0.55	0.70
No. of bunches/pulse		95	190	190
Bunch separation	ns	2.8	1.4	1.4
Linac length/beam[7)]	km	2.50	2.65	2.86
AC power (2 linacs)	MW	56	60	65
Beam power/beam	MW	2.14	3.14	4.00
Loaded gradient[4)]	MV/m	57.6	54.2	50.2
Bunch length σ_z	μm	90	80	80
$\gamma\epsilon_x$ (DR exit)	10^{-6}m	3	3	3
$\gamma\epsilon_y$ (DR exit)	10^{-6}m	0.03	0.02	0.02
$\gamma\epsilon_x$ (IP)	10^{-6}m	4	4	4
$\gamma\epsilon_y$ (IP)	10^{-6}m	0.06	0.04	0.04
Cavity align. tol.[6)]	μm	19	23	17
β_x^*	mm	10	6	6
β_y^*	mm	0.1	0.1	0.1
IP beam size σ_x^*	nm	404	313	313
σ_y^*	nm	4.95	4.04	4.04
Diagonal angle σ_x^*/σ_z	mrad	4.49	3.92	3.92
Disruption param D_x		0.094	0.102	0.130
D_y		7.67	7.90	10.06
Pinch enh. H_D[5)]		1.38	1.45	1.49
Υ_{ave}		0.048	0.052	0.067
δ_{BS}	%	1.46	1.46	2.31
n_γ		0.80	0.76	0.97

Nominal Lum.: $f_{rep} n_b N^2 / 4\pi\sigma_x^*\sigma_y^*$

Linac length: Cavity L × 1.25

Cavity align. tol.: Transverse short-range wake

$E_b = 125$ GeV

http://acfahep.kek.jp/wg-meeting/199903/program/yokoya/

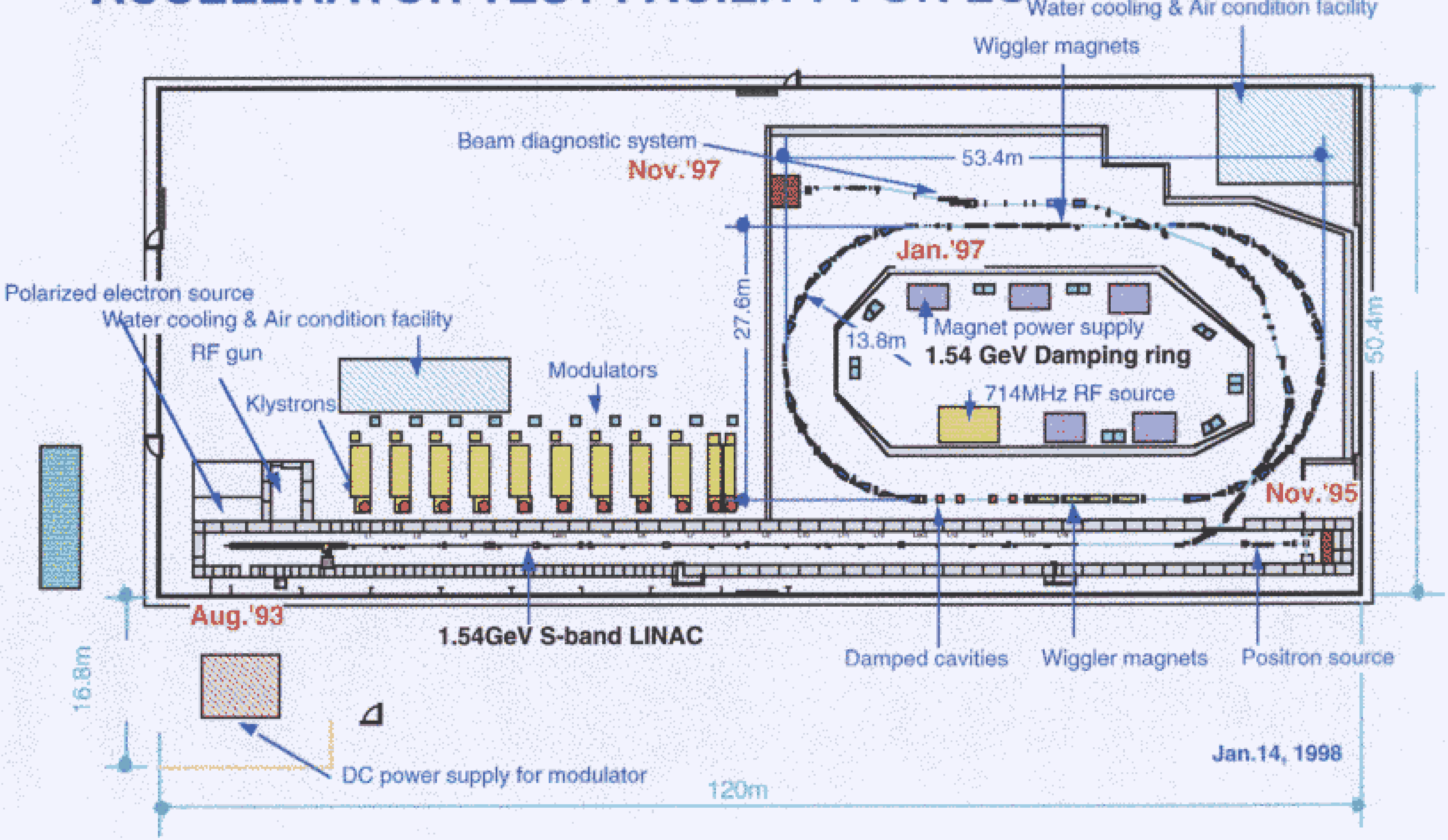
J. Urakawa et.al.

Beam Commissioning and Study
started since Jan. '97

International Collaboration with SLAC, DESY, BINP, PAL, IHEP(Beijing), CERN, INP, SEFT, and LBNL(9 Lab.)

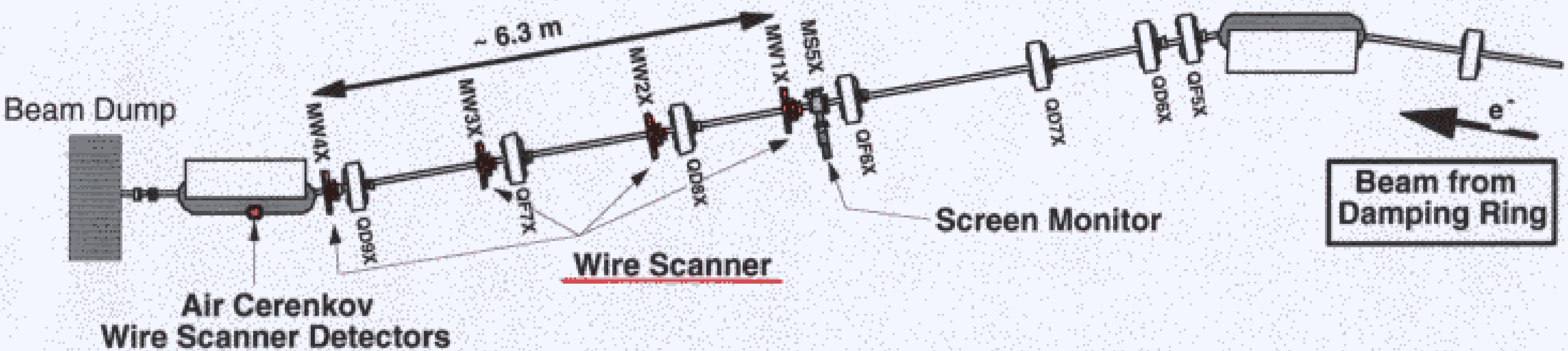
Collaboration in Japan
Tokyo Metropolitan University,
Kyoto University,
Tohoku University,
Tokyo Science University,
Tohoku Gakuin University,
Nagoya University,
Yokohama National University,
Toho University, Waseda University(9 Univ.)

ACCELERATOR TEST FACILITY FOR LC



ATF Linac

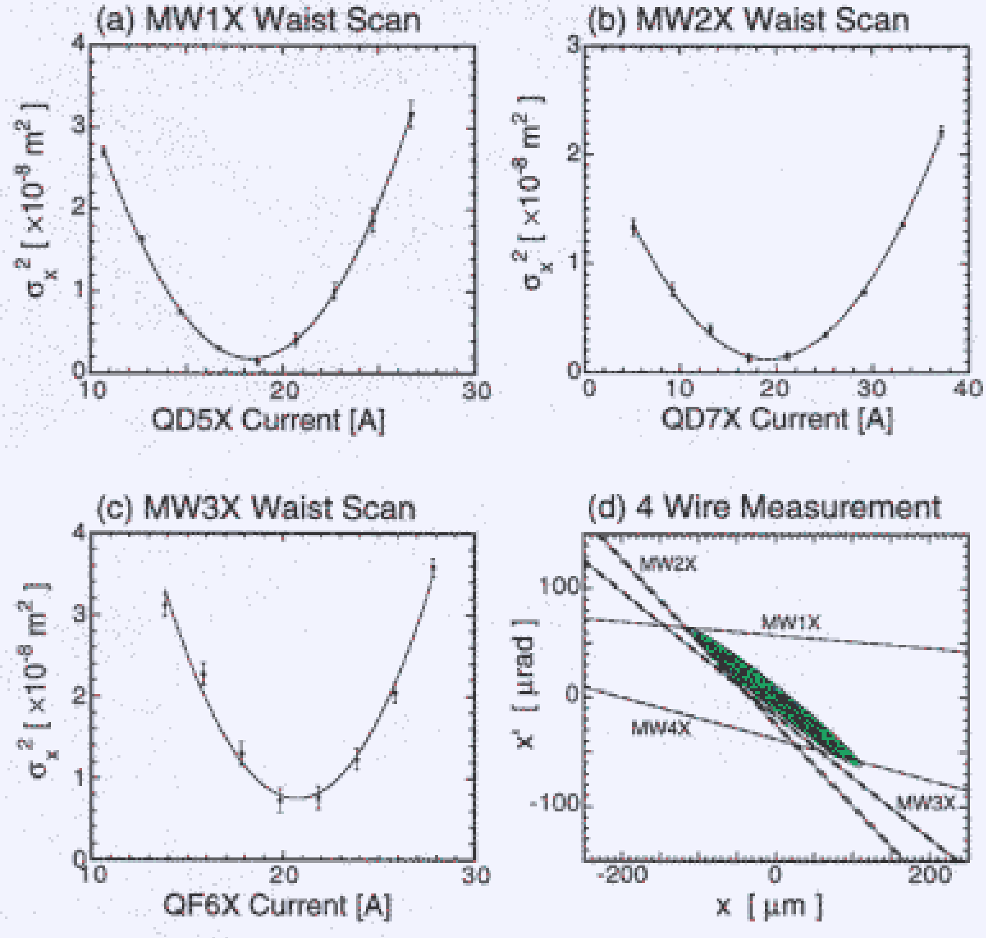
		[Goal]
Maximum Beam Energy	1.42 GeV	1.54 GeV
Maximum Gradient with Beam	28.7 MV/m	30 MV/m (Average)
Beam Intensity		
Single bunch	2.4×10^{10}	2.0×10^{10}
20 Multi-bunch	7.56×10^{10}	4.0×10^{11} (Total)
Energy Spread		
Single bunch	0.37% (1.0 % @ 2.4×10^{10})	< 0.38 %
20 Multi-bunch with ECS	0.37 %	< 0.38 % (FWHM)
Emittance $\gamma\varepsilon_x$ (at 80 MeV)		
Single bunch	2.5×10^{-4}	$< 3.0 \times 10^{-4}$
20 Multi-bunch	$\sim 7 \times 10^{-5}$	$< 3.0 \times 10^{-4}$ (rms)


Beam Dump
~ 6.3 m
MW4X
QD9X
MW3X
QF7X
MW2X
QD8X
MW1X
MS5X
QF6X
QD7X
QD6X
QF5X
e-
Beam from
Damping Ring
Screen Monitor
Wire Scanner
Air Cerenkov
Wire Scanner Detectors

T. Okugi et al.

Horizontal Emittance Evaluation

Two different methods are used for horizontal emittance evaluation. One is a waist scan method, and the other is a four wire method. The waist scan method is the method to evaluate a beam emittance by measuring a beam size with single wire scanner while changing strength of a quadrupole magnet located upstream of the wire scanner.The four wire method is the method to evaluate a beam emittance by measuring beam sizes with four wire scanners.



Method	Monitor	Emittance [nm]	B_{mag}
Waist Scan	MW1X	1.47 ± 0.06	1.03 ± 0.07
Waist Scan	MW2X	1.27 ± 0.06	1.00 ± 0.03
Waist Scan	MW3X	1.38 ± 0.05	1.02 ± 0.05
Four Wire	All Monitors	1.29 ± 0.11	1.06 ± 0.34
Average		1.37 ± 0.03	α_x:3.83 β_x:6.77

ε_x : 1.29 ± 0.11 $\times 10^{-9}$ radm 1.47 with intra-beam

ε_y : 4.11 ± 0.16 $\times 10^{-11}$ radm 1.47 ($\varepsilon_x \times 10^{-2}$)

T. Tauchi

ATF-2

Under consideration as the 2nd phase of the ATF international collabration.

1. Bunch Compression 1

< 1/10 by L-band cavity and chicane

(a) Longitudinal collimation: $< \pm 5\sigma_z$ at the main linac
$\pm 5\sigma_E$ in front of the cavity and $\pm 5\sigma_z$ at chicane

(b) Phase-amplitude modulation in the cavity
for multibunch longitudinal position shift

(c) Multiple chicanes
for the emittance growth due to coherent radiation

2. Final Focus

Raimondi's new optics at E_{beam}=1.3GeV

(a) Vertical beam size: σ_y^*=30nm
with σ_x^*/σ_y^*=100, $\Delta E/E < \pm 0.5\%$, L^*=4m and
the total length = 30m

The optics should be scaled at E_{beam}=250GeV.

(b) Instrumentation
Laser interferometer, laser wire and
BPMs for fast feedback etc.

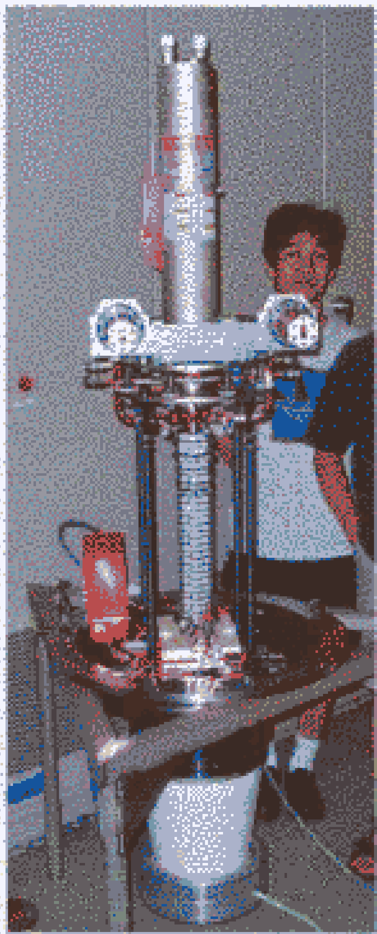
(c) Effect of Ground Motions

X-Band Klystron

- The periodic permanent magnet (PPM) klystrons are under development in the two-year/two-stage project with Toshiba.
- The goal is to produce 50MW output power at 1.5 μs pulse length at the first klystron and then to advance to 75MW at the second one.
  ~57 MW ~45% (200nsec)
- The high power testing of the Toshiba PPM-1 klystron is under way.
- Toshiba PPM-2 will have water cooling of PPM circuit to allow a higher repetition rate and may use a clamp-on PPM stack for cheaper and easier production.
- High power testing of Toshiba PPM-2 is scheduled to start in spring 2001.

	Toshiba PPM-1	*Toshiba PPM-2*
Peak power (MW)	>50	75
Beam voltage (kV)	480 - 500	480 - 500
Micro-perveance	0.8	0.8
Efficiency (%)	>50	60
Pulse length (μs)	1.5	1.5
Repetition rate (pps)	50	150
Bandwidth (MHz)	80 at -1 dB	80 at -1 dB
Cooling of PPM	Air	Water

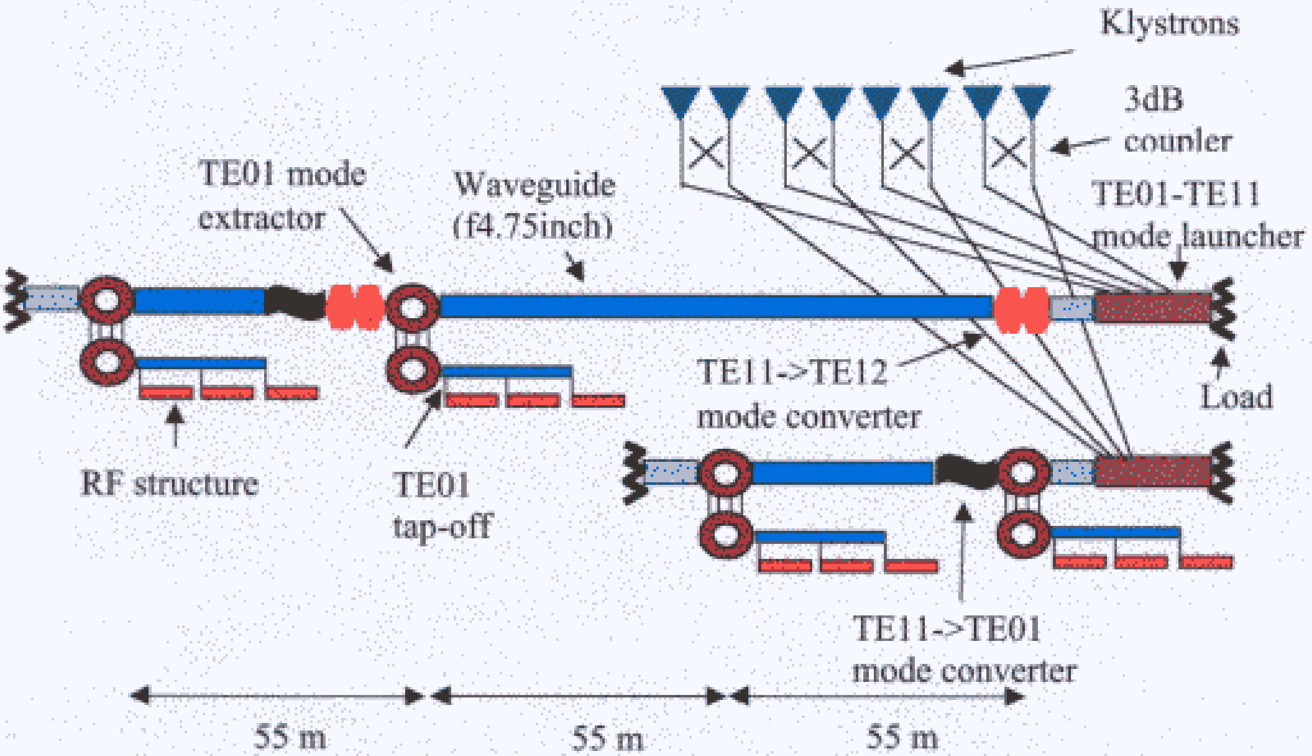
MAGIC simulation of Toshiba PPM-1 output cavity. The output power in this example is 74MW.



Toshiba PPM-1Klystron

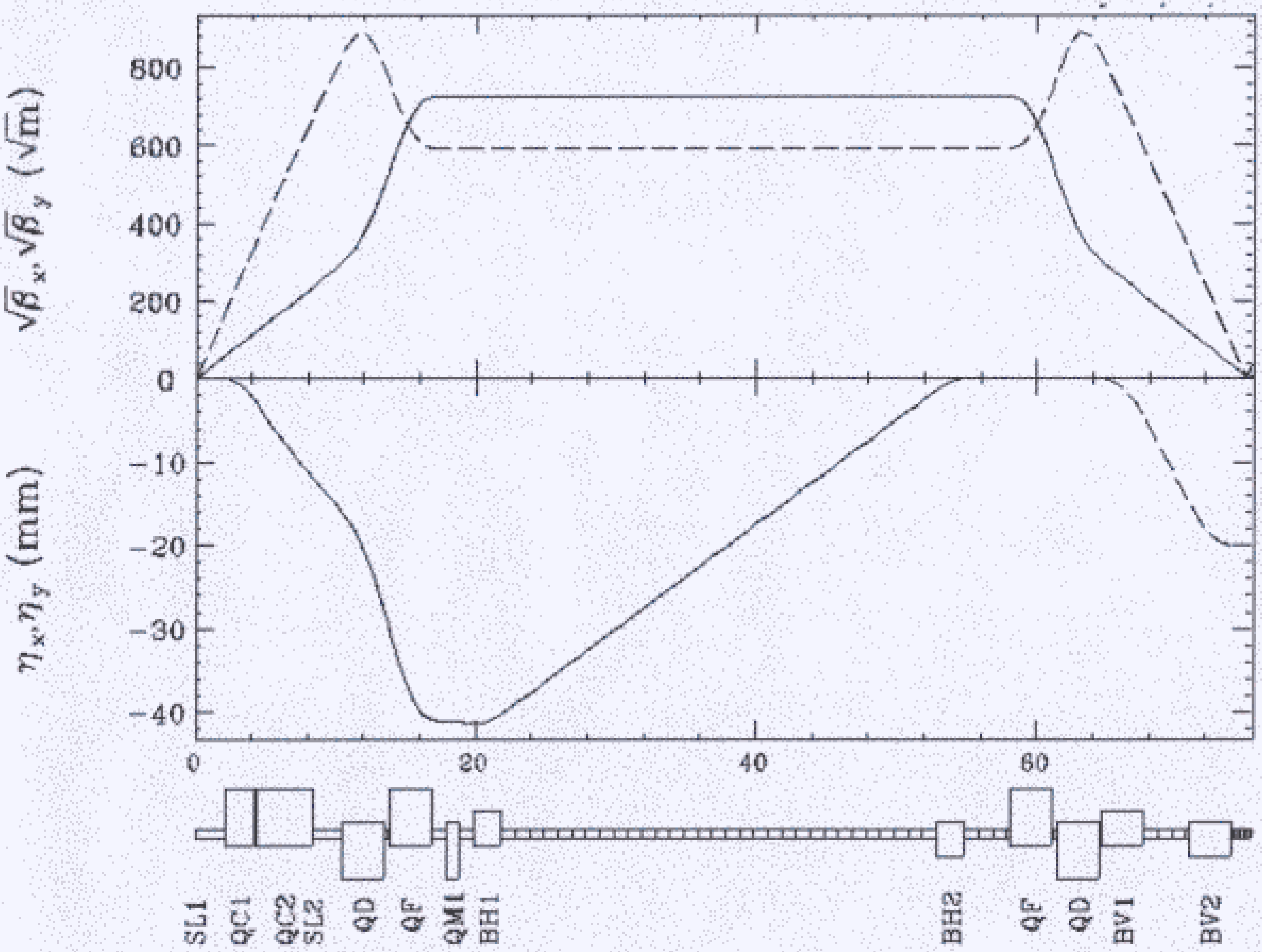
DLDS RF Power Distribution System

- KEK is developing the 2x2 DLDS to deliver RF power to four RF clusters.
- It consists of almost identical dual mode DLDS systems with long and short waveguide. Only two modes TE_{01} and TE_{12} or TE_{11} are used in each waveguide.
- The cold model testing proved that the present dual mode system can distribute RF power to two output ports with a good efficiency.
- Joint experiments with SLAC were performed at KEK on a delay line assembled in the ATF linac tunnel for stability of linearly polarized TE_{12} mode in a 55 m long waveguide.
- The results show that the TE_{12} mode is stable enough to be used in the dual mode DLDS.
- KEK is now developing a phase synchronization system with a beam using a beam pickup signal from the ATF linac.



Optics of Dump Line (30 June 2000)

K.Kubo

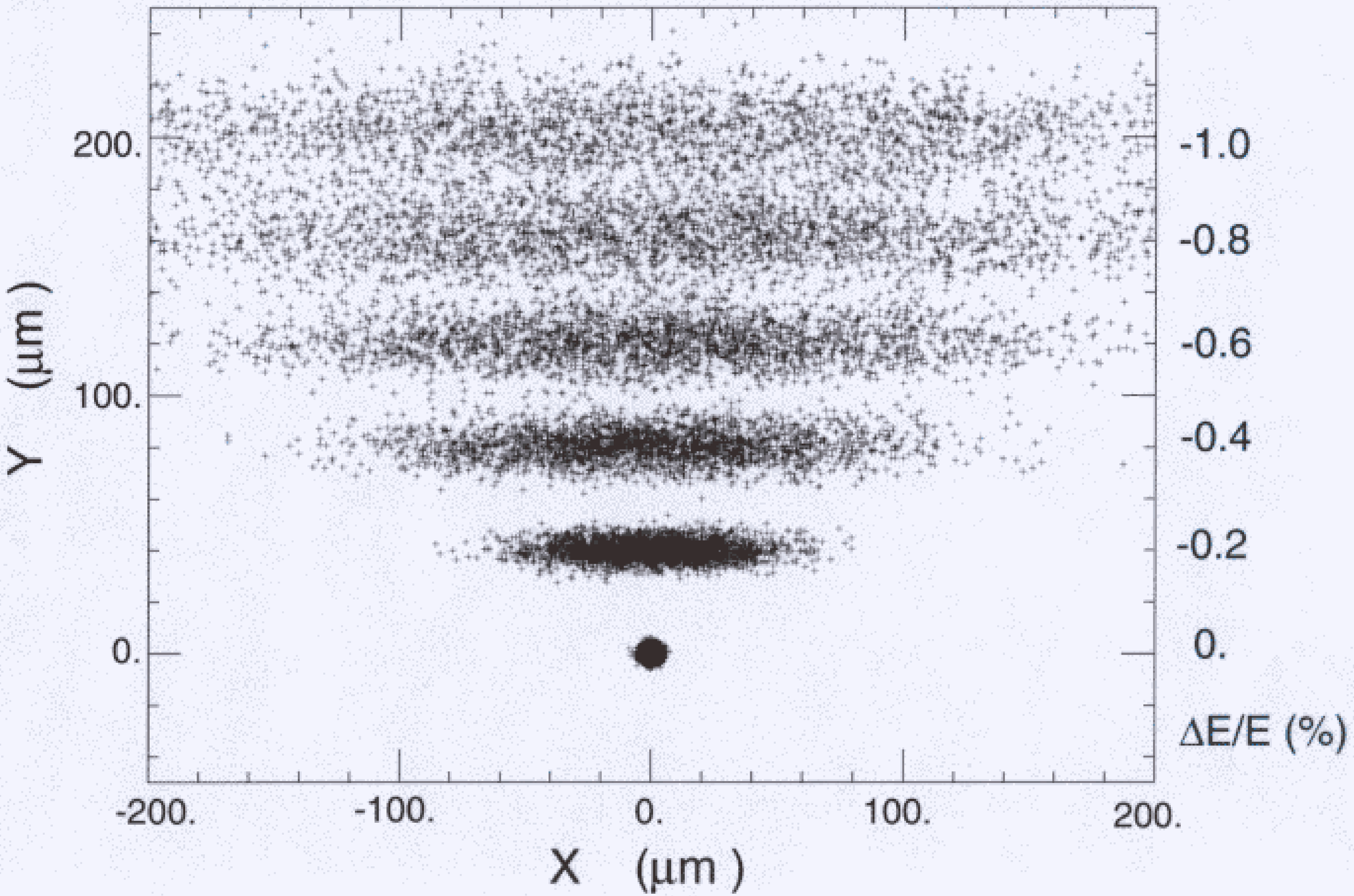


2nd focus point

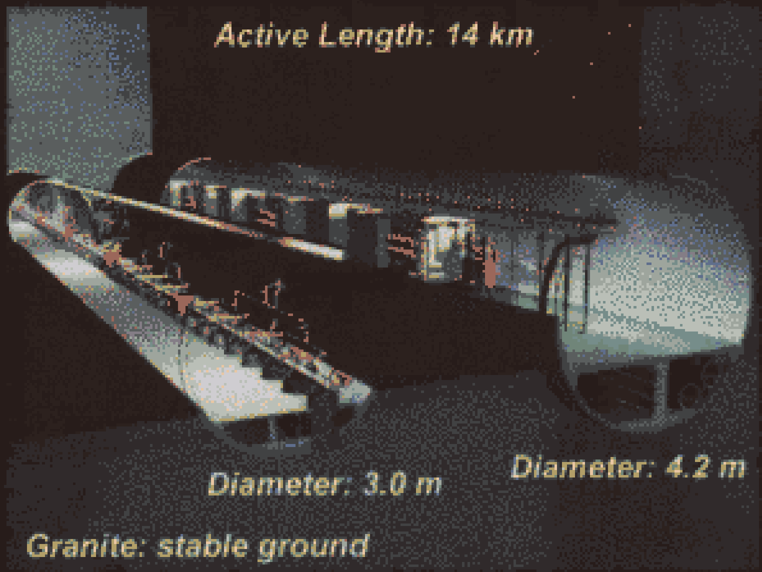
Measurements of
energy distribution
polarization

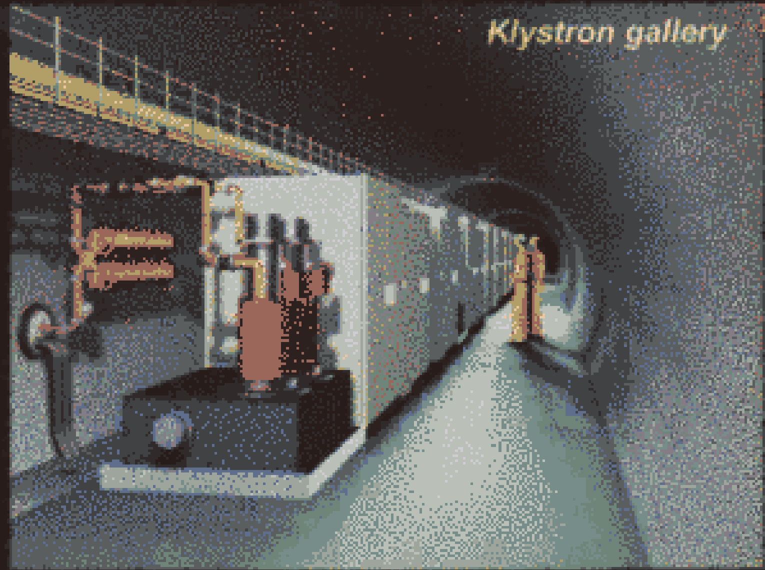
K.Kubo, Jan.2000

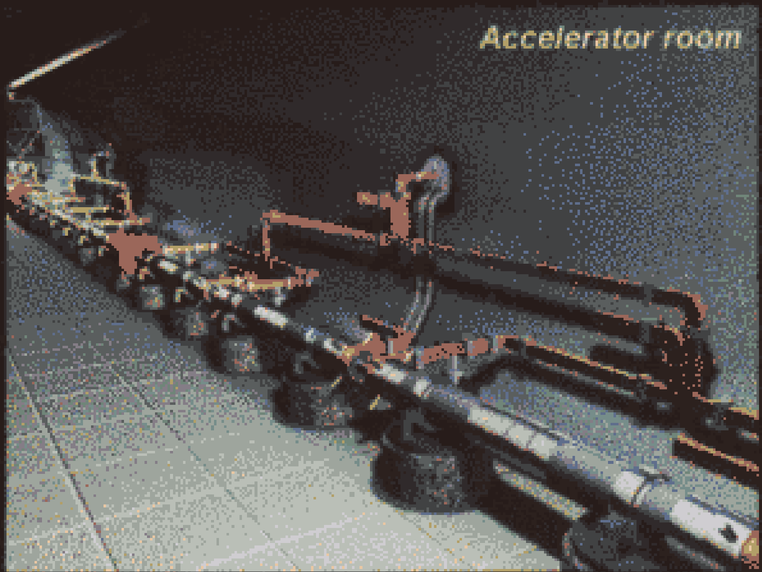
Vertical dispersion at 2nd IP in dump line

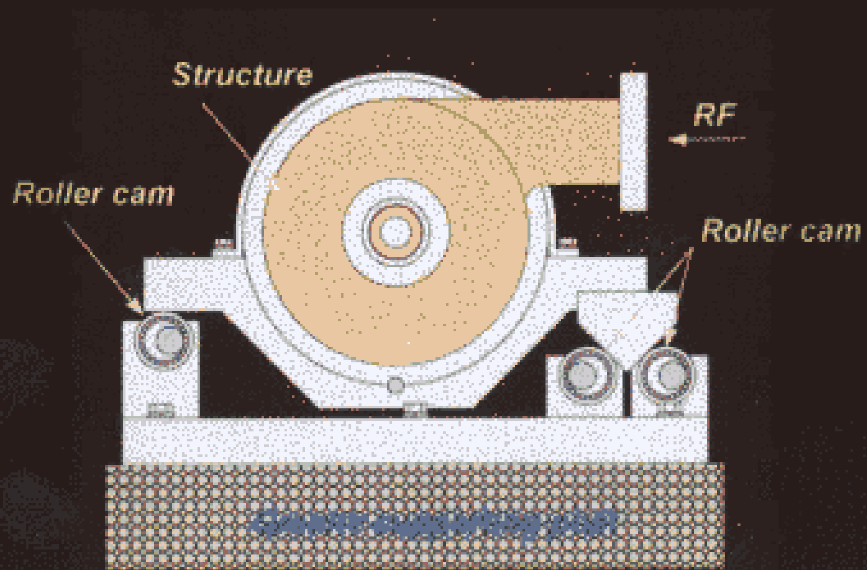


Overview of JLC Tunnel



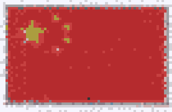




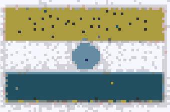


Working Group Institutions

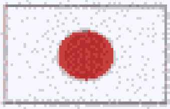
- Univ. of Melbourne



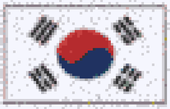
- Beijing Univ.
- Institute of Theoretical Physics, Academia Sinica
- Shandong Univ.
- Tsinghua Univ.
- Zhejiang Univ.



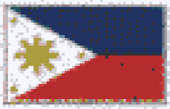
- Indian Institute of Science
- Physical Research Laboratory
- TIFR



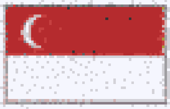
- Akita Keizaihoka Univ.
- Hiroshima Univ.
- KEK
- Kinki Univ.
- Kobe Univ.
- Kogakuin Univ.
- Konan Univ.
- Kyoto Univ.
- Miyagi Gakuin
- Nagoya Univ., N-lab.
- Nagoya Univ., Pol-lab.
- Niigata Univ.
- Niihama NCT
- Osaka City Univ.
- Osaka Univ.
- Saga Univ.
- Shinshu Univ.
- Tohoku Univ.
- Tohokugakuin Univ.
- Tokyo A&T
- Tokyo Metropolitan Univ.
- Toyama NCMT
- Univ. of Tokyo, ICEPP
- Univ. of Tsukuba



- Chonbuk Univ.
- KAIST
- KIAS
- Konkuk Univ.
- Korea Univ.
- Kyungpook National Univ.
- Seoul National Univ.
- Soongsil Univ.
- Yonsei Univ.

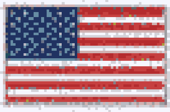


- Mindanao State Univ.
- Univ. of the Philippines

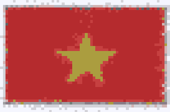


- National Univ. of Singapore

- Academia Sinica
- National Central Univ.
- National Taiwan Univ.



- UCLA
- Univ. of Hawaii



- Institute of Physics

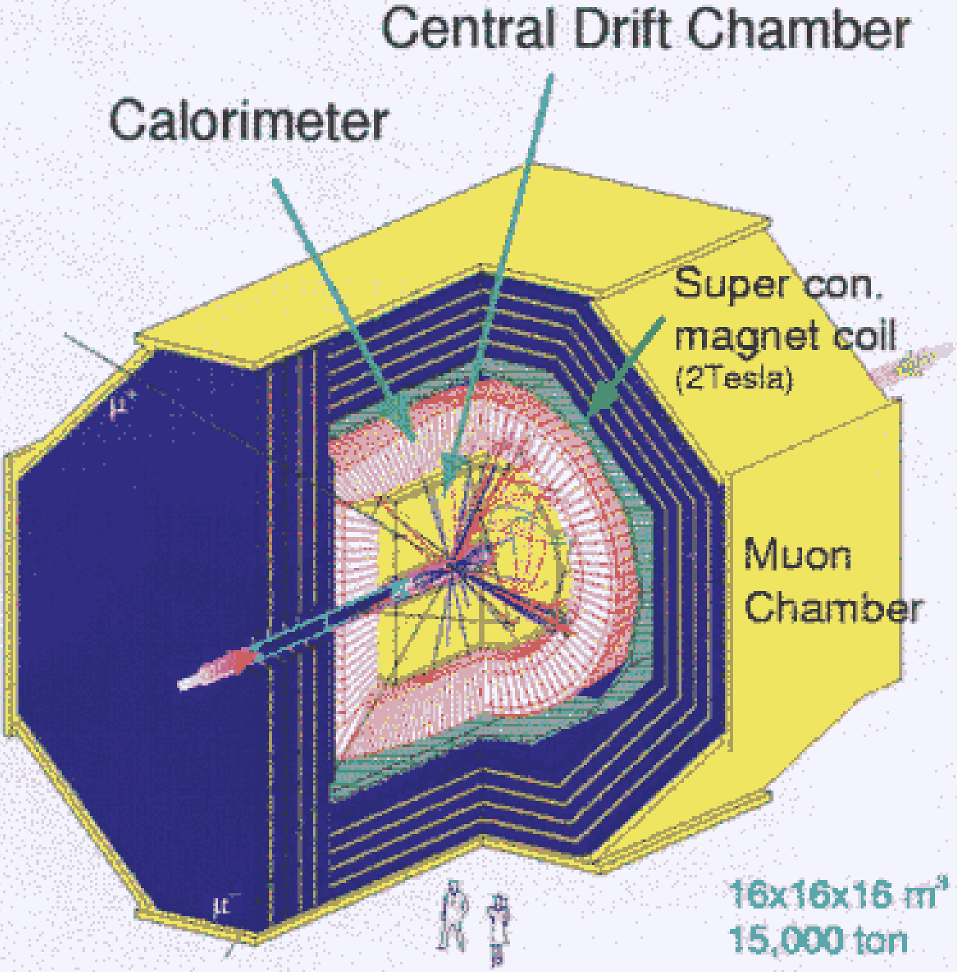

The Second ACFA Workshop on Physics/Detector at the Linear Collider

1. Outline of the JLC Detector

Original Design; Characterized by **large-volume jet-chamber**

for the best tracking performance

→ Medium magnetic field of **2 Tesla**



Important Features ;

- Whole Calorimeter inside of Super-conducting solenoid

→ The best **performance** and **hermeticity**

- Conical Mask to shield against beam-beam background

Recent Modification

Detailed background study showed that ...

2-Tesla is a little too weak to suppress beam-beam background to VTX/CDC

➡ Start **3 Tesla** Magnetic Field study

VTX-Layer#1 Background Situation @ $\sqrt{S}$=500GeV

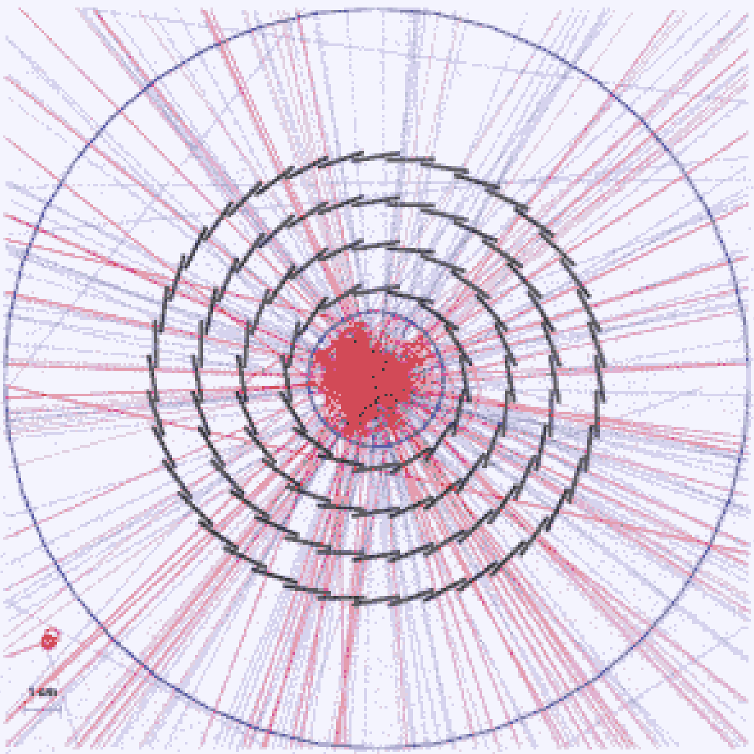
@2T ; 14,000 hits/crossing = 1.0 hits/mm^2/crossing

@3T ; 2,800 hits/crossing = 0.2 hits/mm^2/crossing

will be **3 times more** for high-luminosity option

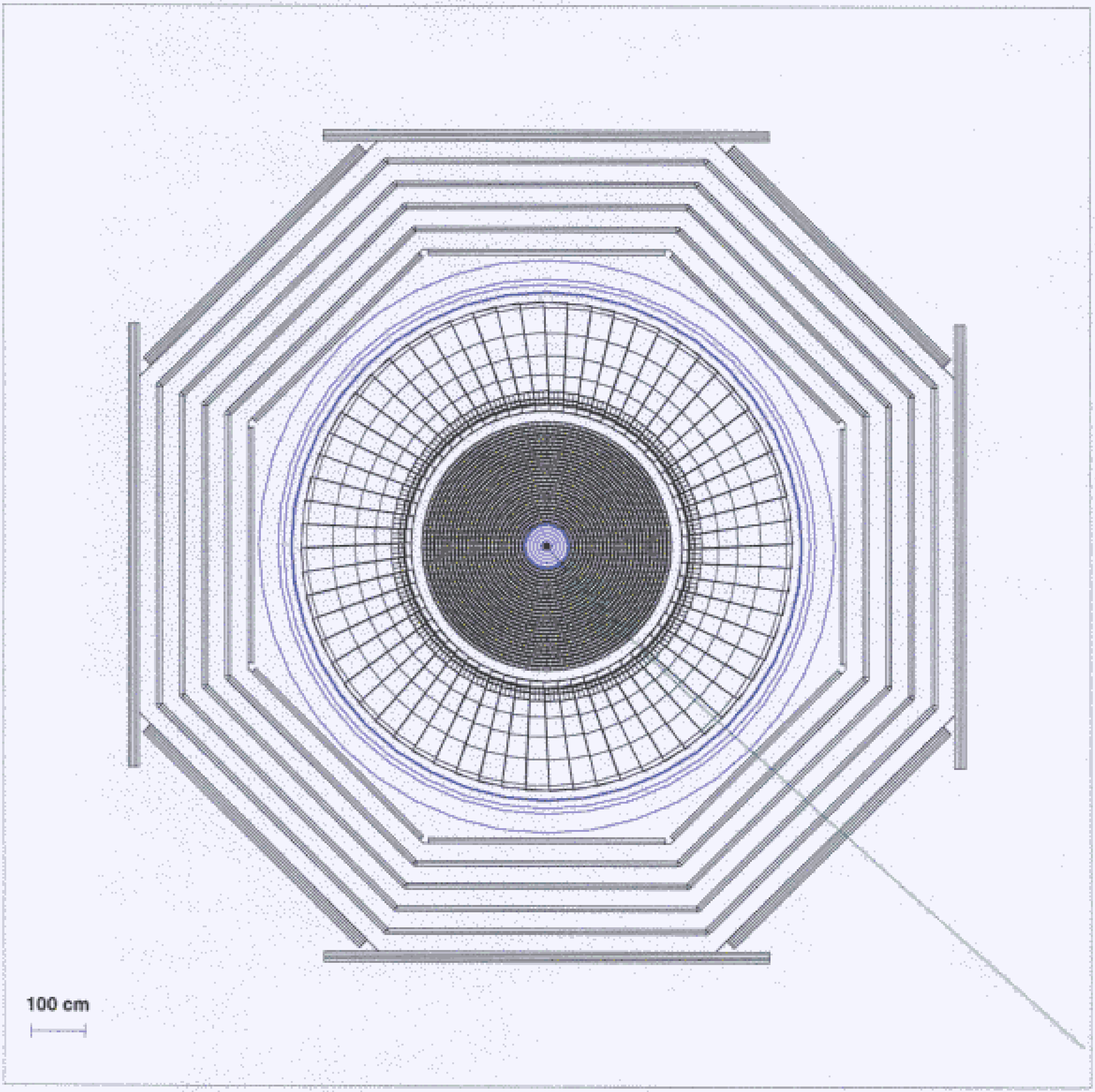
--> 2T is **RISKY**

while ... higgs production at $\sqrt{S}$=300GeV gives 140 hits @ Layer#1 = 1/100 of B.G.

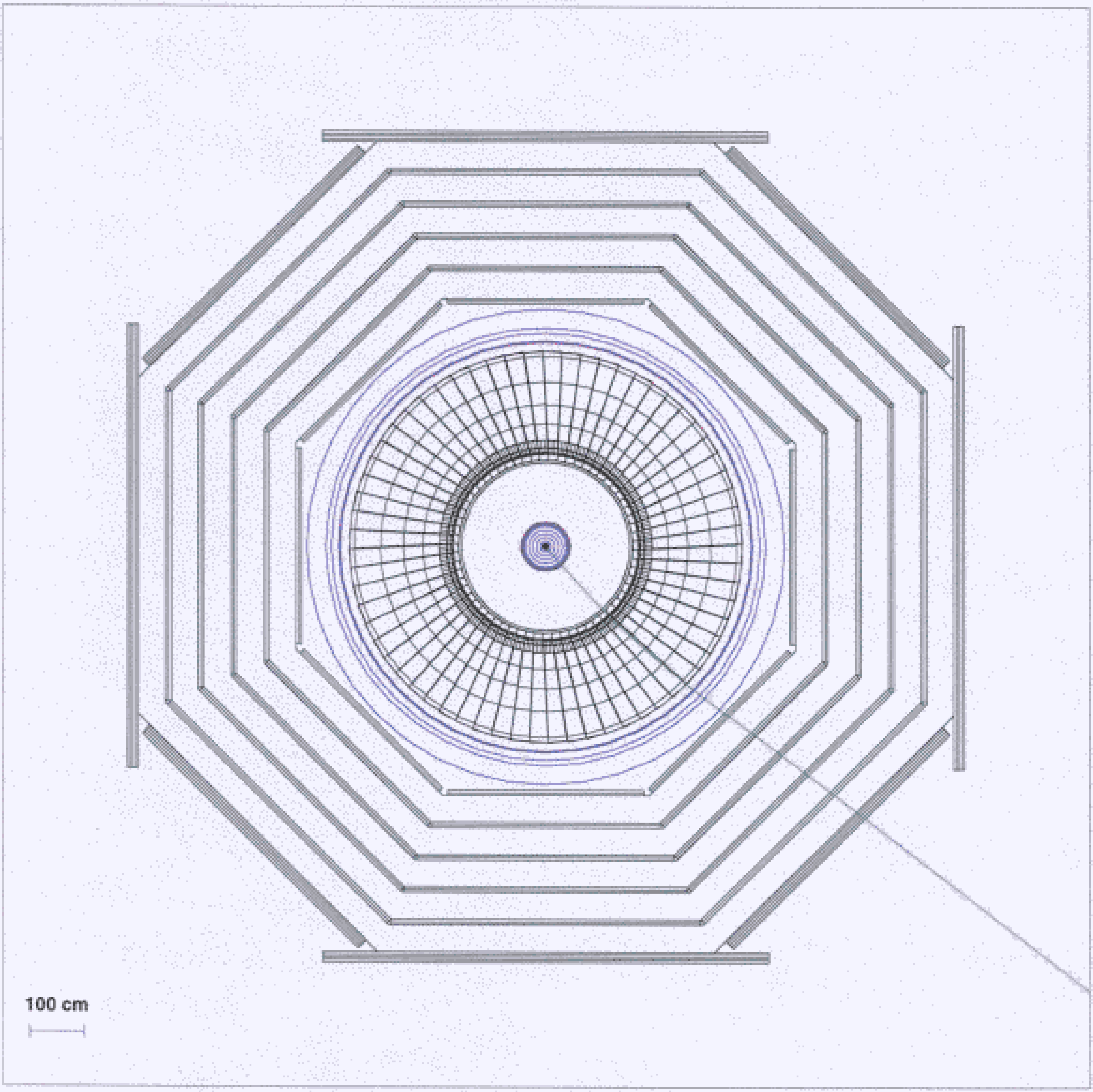


Beam-beam BG @$\sqrt{S}$=500GeV @3T

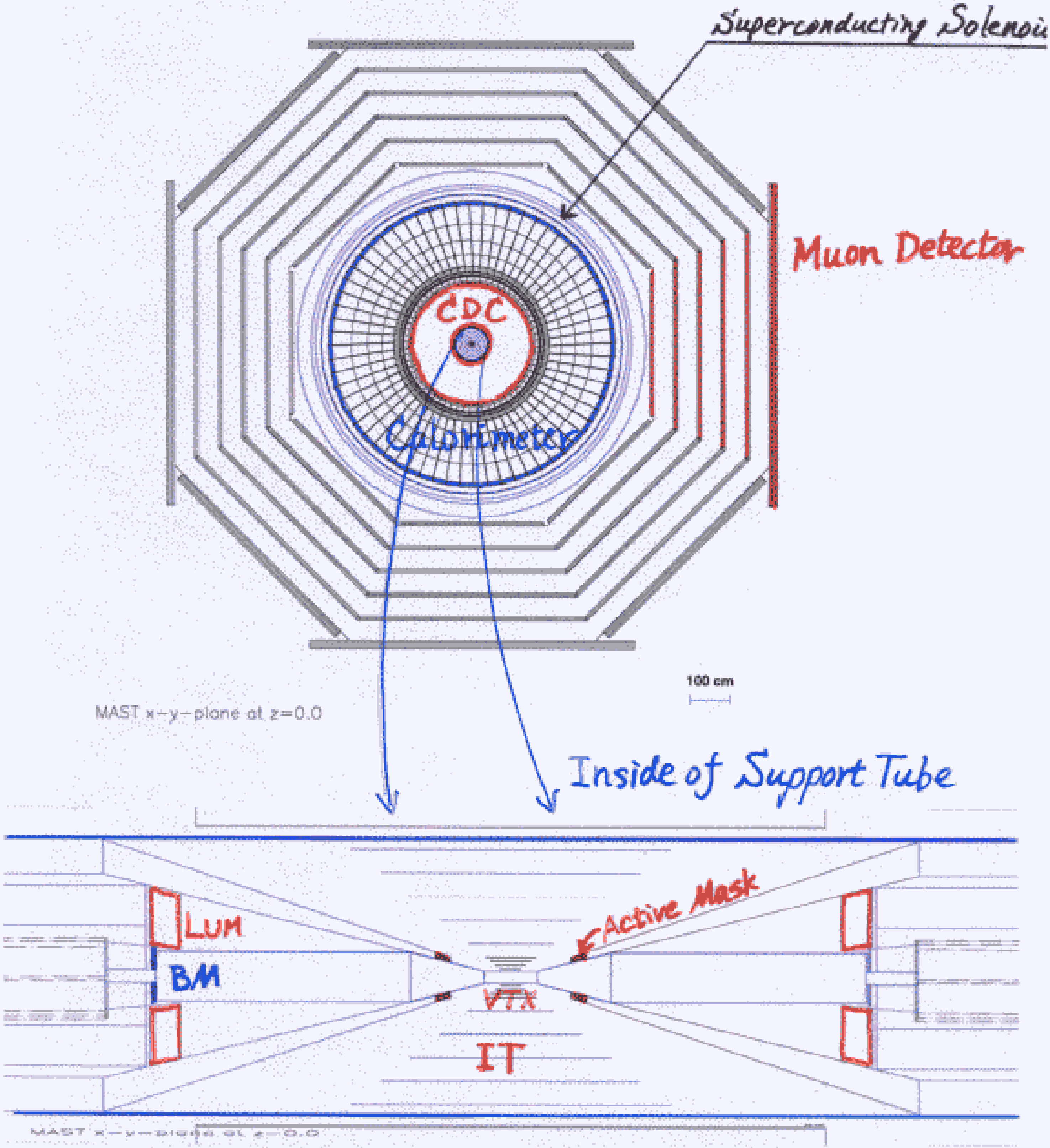
New 2T



New 3T



Layout of the JLC Detector



Detector Parameter Table

28-July-2000

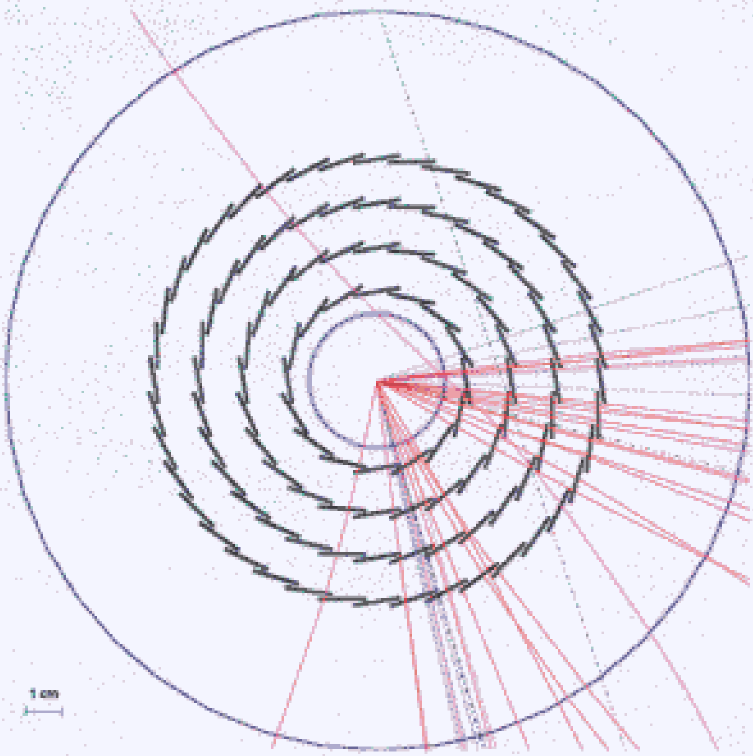
Detector	Type	OLD 2-Tesla Configuration	OLD 2-Tesla Performance	New 2-Tesla Configuration	New 2-Tesla Performance	New 3-Tesla Configuration	New 3-Tesla Performance
BM	active-pixel	NON	EXISTENT	θ = 11-48mrad	300μm-thick x 2 layers	pixel=100μm	Under Study
LUM	W/Si ?	NON	EXISTENT	θ = 50-150mrad	43Xo, 10sampling	Nr=32, Nϕ=16	Under Study
AM	W/Si-sandwich	NON	EXISTENT	θ = 150-200mrad	23Xo, 8sampling	Δr=2mm, Nϕ=32	Under Study
FST	CCD?Si-strip?	NON	EXISTENT		whether we need or not should be stied		
VTX	CCD	CCD-pixel=25μm 500μm-thick x 2layers r = 2.5&7.5cm cos(θ)<0.95	σ = 7.2μm $\delta^2 = 11.4^2 + (28.8/p)^2/\sin^3\theta$	CCD-pixel=25μm 300μm-thick x 4 layers r = 2.4, 3.6, 4.8, 6.0cm cos(θ) < 0.90	σ = 4.0μm $\delta^2 = 7.2^2 + (22.5/p)^2/\sin^3\theta$	CCD-pixel=25μm 300μm-thick x 4 layers r = 2.4, 3.6, 4.8, 6.0cm cos(θ) < 0.90	σ = 4.0μm $\delta^2 = 7.2^2 + (22.5/p)^2/\sin^3\theta$
IT	Si-strip	NON	EXISTENT	300μm-thick Si-strip 5 layers (r= 10 - 38cm) cos(θ) < 0.90	Under Study	300μm-thick Si-strip 5 layers (r= 10 - 38cm) cos(θ) < 0.90	Under Study
CDC	Small-Cell Jet Chamber	R=0.3-2.3m, L=4.6m Nsample = 100 cos(θ)<0.70 (20samples) cos(θ)<0.95 (full-sampl)	σ_x = 100μm σ_z = 2mm $\sigma_{Pt}/Pt = 1.1\times10^{-4}\,Pt \oplus 0.1\%$	R=0.45-2.3m, L=4.6m Nsample = 80 cos(θ)<0.70 (full-sample) cos(θ)<0.95 (20samples)	σ_x = 85μm σ_z = 1mm $\sigma_{Pt}/Pt = 1.1\times10^{-4}\,Pt \oplus 0.1\%$	R=45-155cm, L=3.1m Nsample = 50 cos(θ)<0.70 (full-sample)	σ_x = 85μm ? σ_z = 1mm under study, but ~ x2 worse than 2T
CAL	Compensated Pb/Sci-sandwich	EM; 29Xo,10cmx10cm Had; 5.6λo, 20cmx20cm Si-pad x 1 layer; 1cmx1cm r=2.5-4m; cos(θ)<0.99	$\sigma/E = 15\%/\sqrt{E} + 1\%$ $\sigma/E = 40\%/\sqrt{E} + 2\%$ σ = 3mm	EM; 27Xo, 6cmx6cm Had; 6.5λo,18cmx18cm Scint.Strip x 2 doublets r=2.5-4.3m; cos(θ)<0.99	$\sigma/E = 15\%/\sqrt{E} + 1\%$ $\sigma/E = 40\%/\sqrt{E} + 2\%$ Under Study	EM; 27Xo, 4cmx4cm Had; 6.5λo,12cmx12cm Scint.Strip x 2 doublets r=1.6-3.4m; cos(θ)<0.99	$\sigma/E = 15\%/\sqrt{E} + 1\%$ $\sigma/E = 40\%/\sqrt{E} + 2\%$ Under Study
MU	SWDC or PRC ?	6 SuperLayers cos(θ) < 0.99	σ = 0.5mm	6 SuperLayers cos(θ) <0.998	Under Study	6 SuperLayers cos(θ) < 0.997	Under Study
Yoke		R = 5m-7.5m	Z = 5m-7.9m	R = 5.5m-7.5m	Z = 5m-7.9m	R = 4.5m-7.5m	Z = 3.9m-6.8m
QC		fat-yoke			slim-yoke	or Super-Conducting	

2 Vertex Detector

Important Parameters

Device Type	**CCD**
Pixel Size	**25μm**
Epitax. Thickness	20μm
Silicon Thickness	300μm
Number of layers	4 layers
@ 2.4, 3.6, 4.8, 6.0 cm	
Angular coverage	
	$\lvert\cos\theta\rvert < 0.90$

higgs production @$\sqrt{S}$=300GeV



Hit density = 1hit/mm^2/crossing => MUST be a PIXEL type.

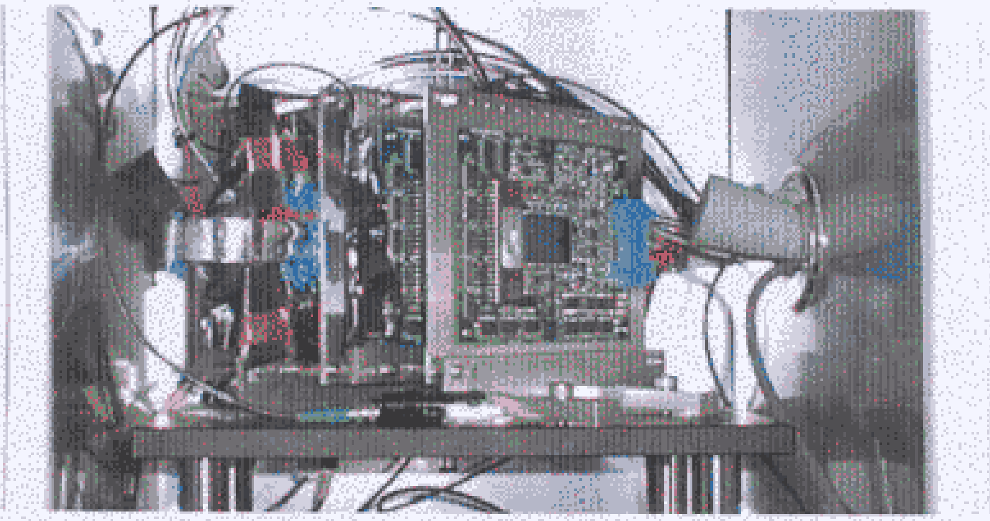
Required/Expected Performances

Readout speed	1 CCD/6msec or faster
Position resolution	4 μm
Impact parameter resolution	$\delta^2 = 7.2^2 + (22.5/p)^2/\sin^3\theta$

- Operational at Room Temperature
- Withstand the radiation damage by beam-beam background

Proof of Performance

Series of beam tests carried out at KEK.



Results

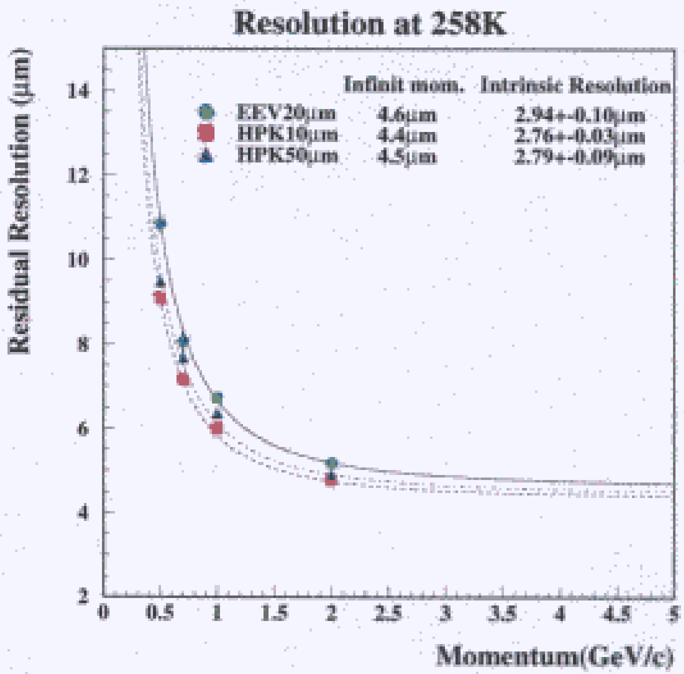
Position Resolution 2.8μm

S/N for MIPs 10 ~ 20

(3sec-read at room temp.)

Detction Inefficiency

~ 0.05%



Expected Performance of

$\delta^2 = 7.2^2 + (22.5/p)^2/\sin^3\theta$ can be achieved.

Radiation Damage

Bad Effect on
- Dark Current / Hot Pixel
- Charge Transfer Inefficiency

Estimated Dose at JLC @2T

1.5×10^{11} electrons/year/cm^2

1×10^{8} neutrons/year/cm^2 at the innermost VTX

Tested with

^{90}Sr (10mCi : e$^-$)

^{252}Cf (100μCi : n)

Proved Resistant upto

1×10^{12} electrons/cm^2

1.5×10^{10} neutrons/cm^2

x 10 more resistant at -100℃

Correcting Energy of e/n,

CCD is resistant upto

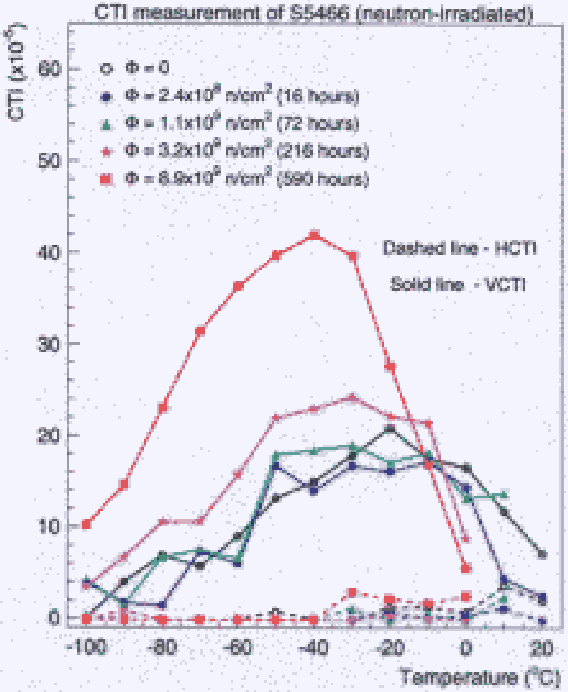
100year-operation for n

1year-operation for e$^-$

will be improved by

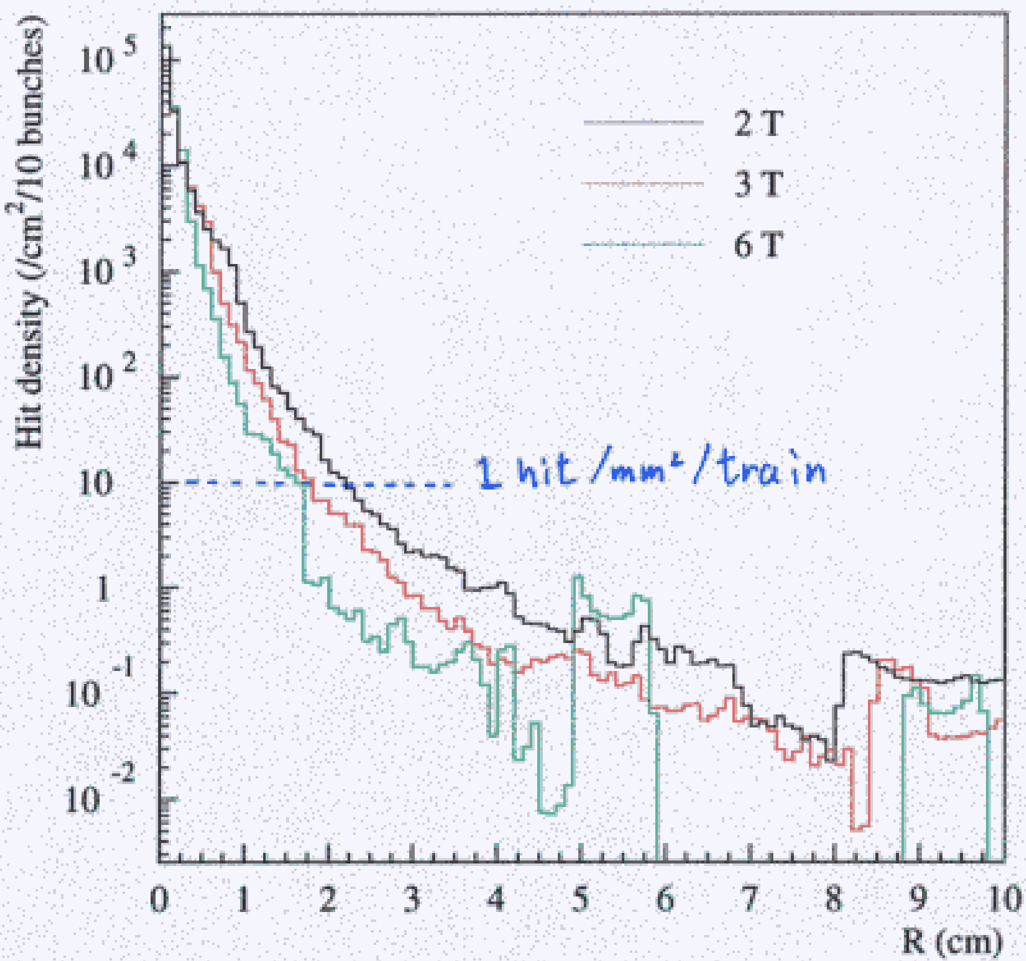
-100℃ operation

Dark Current Injection



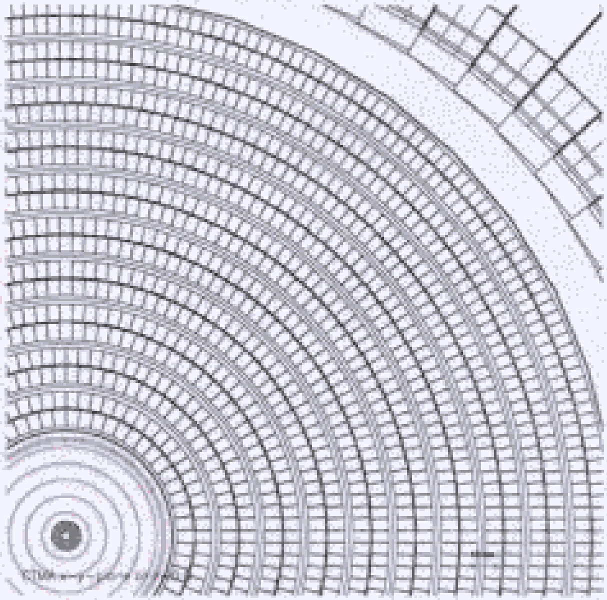
$e^{\pm}$ Background Hit Density

$\cos\theta < 0.9$



3. Trackers

Central Tracker ; Mini-cell Jet Chamber
Intermediate Tracker ; Si-strip
very Forward Tracker ; Silicon Disc
Endcap Tracker ; Do we need this ????



3.1 CDC

Important Parameters

	2T	or	3T
Wire Length	4.6m	or	3.1m
Inner Radius	45cm		45cm
Outer Radius	2.3m	or	1.55m
Number of Samples	80	or	50 ?
Angular Coverage	$\cos\theta < 0.70$ (full coverage)		
//	$\cos\theta < 0.95$ (20 samples)		
Gas (cool/slow)	$CO_2 + \text{iso-}C_4H_{10}$		

Required Performances

Position Resolution $\sigma_{r\phi} = 100\mu m$

$\sigma_z = \sim 1mm$

Momentum Resolution

$\sigma_{Pt} / Pt = 1 \times 10^{-4}\ Pt + 0.001$

2-track Separation ~ 1mm

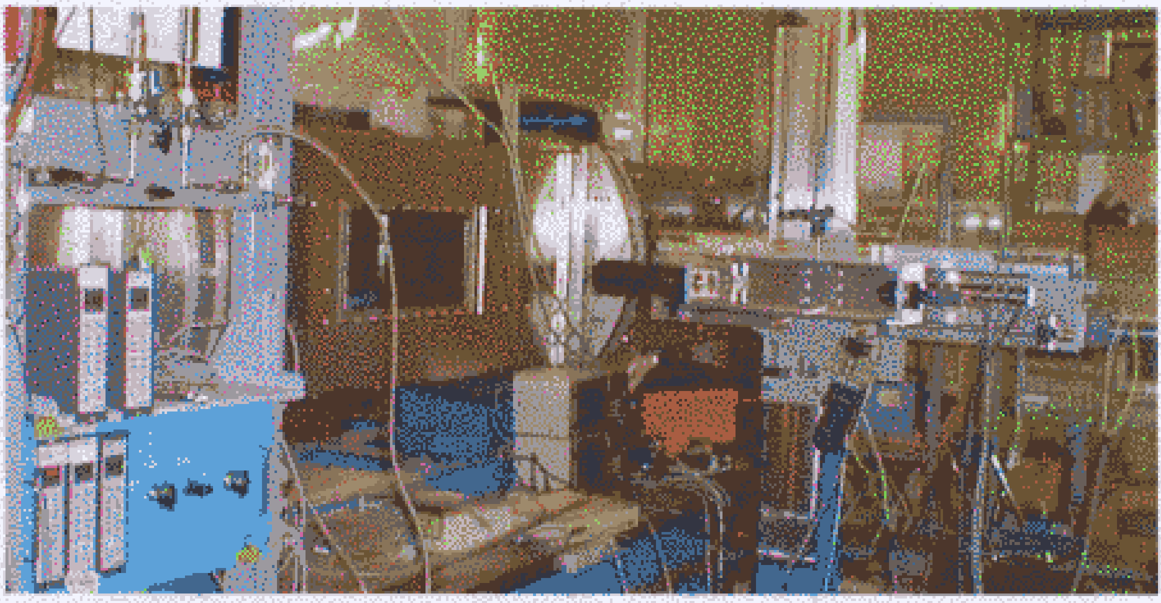
1) First Step to Design

Feasibility of 4.6m-long wire (2T-design was made first)

a) Stability and Contollability of the CELL structure against gravitational / electro-static forces

b) Long-term tension stability (**Creep**)

Made 4.6m-long test chamber with wire-position measurement system of **5μm** accuracy.



Result of 4.6m-wire test ;

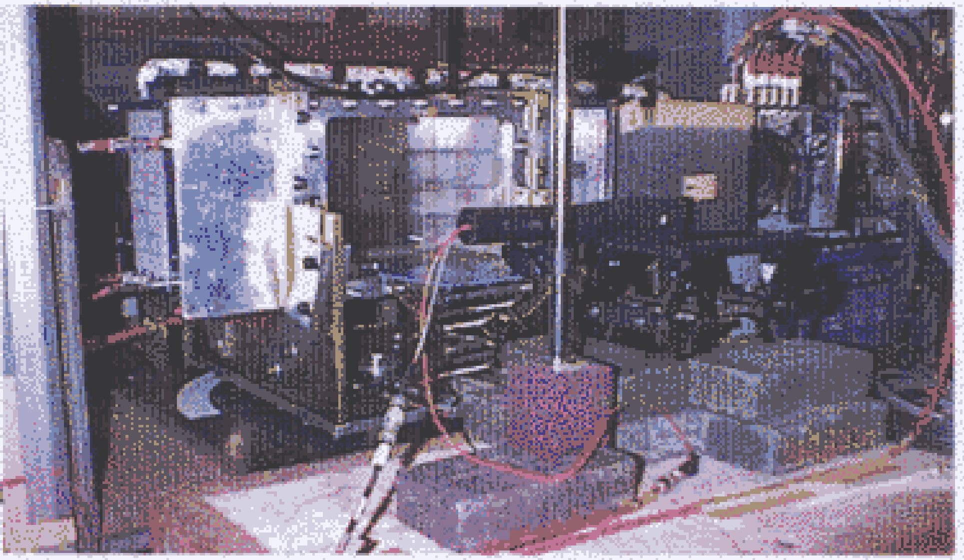
a) **~50μm agreement** with calculated design wire-position
Proved stability and reproductivity against HV On/Off

b) **Wire Creep observed.** Still measuring over a few years.

2) Proof of Performance

Basic Gas Properties
a) Gas Gain
b) Drift Velocity
c) Lorentz Angle

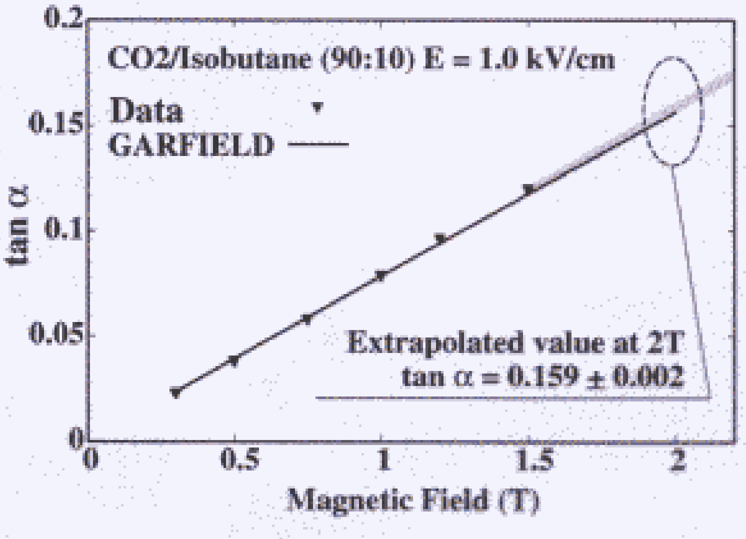
Performances
d) Position Resolution
e) 2-track Separation



A small chamber (baby chamber) is made for beam tests.

a) Gas Gain
- Uniformity for the Stereo-Cells ; No problem
- Saturation Observed.

May deteriorates 2-track separation.
Beam tests to be done.



c) Lorentz Angle Measurement

No problem for 2T

but

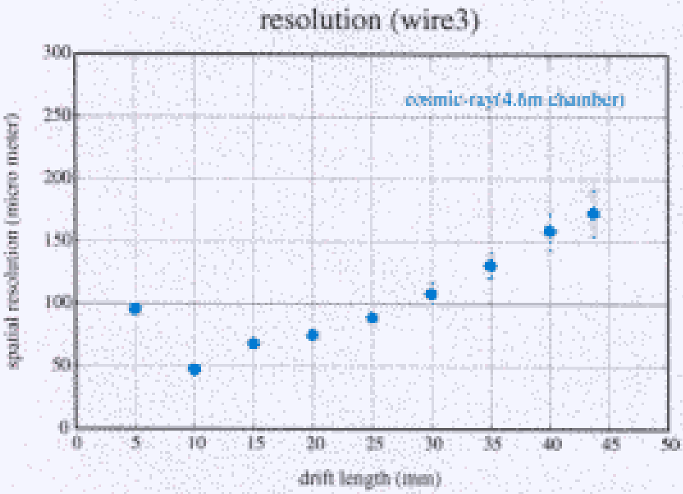
Extrapolation to 3T is too hard.
Further measurement is needed.

Cell design seems OK with the same gas without cell-tilt, but with shorter drift length.

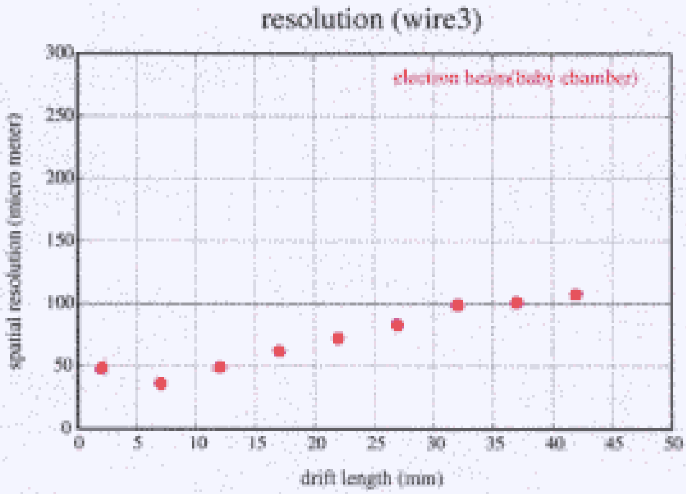
d) Position Resolution

4.6m-chamber with Cosmic Rays

Baby-chamber with Cosmic Ray and Electron Beam



4.6m-chamber with CosmicRay



baby chamber with electron beam

$\sigma_{r\phi}$ = 100μm is no problem.

85μm seems possible with precise control of gas purity.

e) 2-track Separation & dE/dx measurement

Beam Tests to be done in late September.

γ → target → e+e- pair → separated by B-field → Chamber

3.2 Intermediate Tracker

Purpose

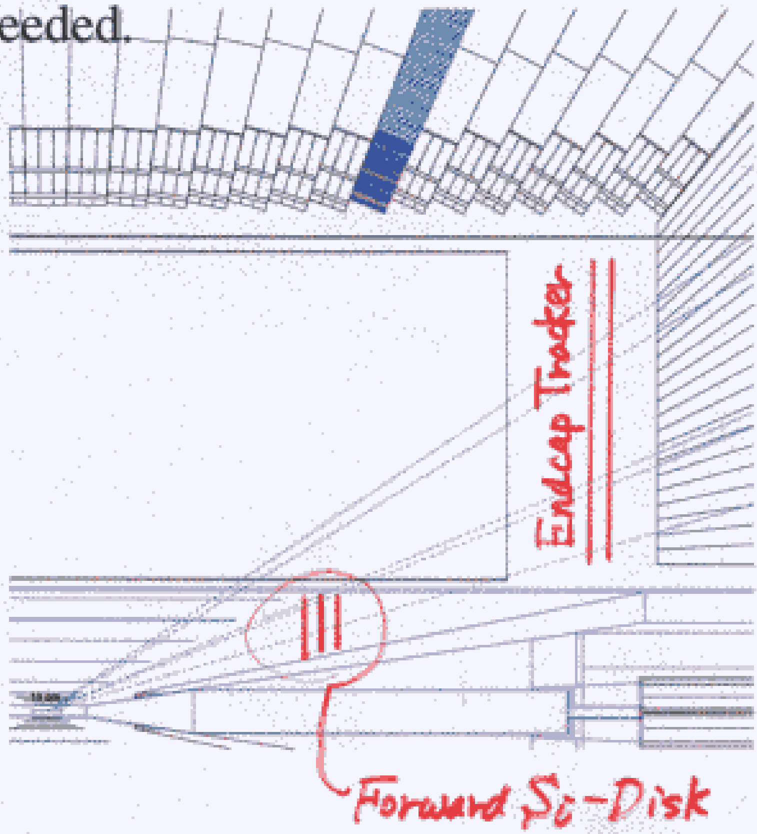
- **Linking from CDC track to VTX hits**
- Self-tracking even under very high background environment
- Improve momentum resolution

Assumed Parameters ;

Si-strip detector x 5-layers (r = 10cm ~ 38cm)

No detailed parameters designed yet.

==> Performance Study Needed.



3.3 Very Forward Tracker

3.4 Endcap Tracker

Purpose

- Tracking in forward region
- e/γ separation for Endcap Calorimeter hits

Assumed Parameters

VFT would be Silicon Disk (pad or strip or active pixel ???)

No design for Endcap Tracker at all.

Necessity itself must be studied first.

4. Calorimeter

1) Required Performance

Design Criteria in a de-coupled CAL parameter space

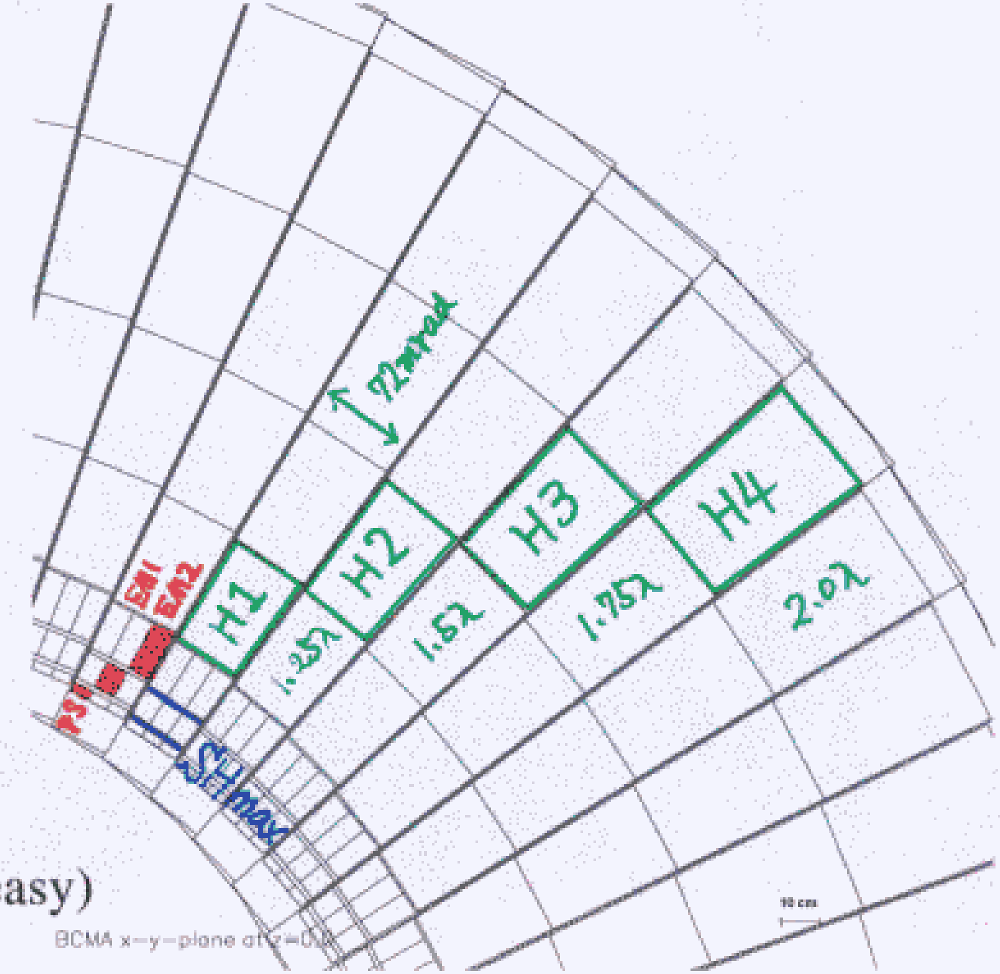
⇒ 2-jet mass resolution better than Γ_Z , Γ_W

⇒ $\sigma_E/E = 15\%/\sqrt{E} \oplus 1\%$ for EM

$\sigma_E/E = 40\%/\sqrt{E} \oplus 2\%$ for Hadron

⇒ Tile-Fiber Sampling Calorimeter
with Fine Granularity
with Hardware Compensation

Not software compensation
Not extremely fine granularity
(However finer longitudinal segmentation easy)



2) Basic Parameters of JLC calorimeter ; PreSH +SHmax +EMC +HCAL

	2T-case	3T-case	
Inner Radius	250cm	160cm	
Outer Radius	400cm	340cm	
Angular Coverage	$\lvert\cos\theta\rvert<0.99$	$\lvert\cos\theta\rvert<0.99$	
SHmax scheme	Sintillator Strip	Sintillator Strip	(option=Si-pad)
Thickness			
PreSH	$4X_o$	$4X_o$	
EMC	$23X_o$	$23X_o$	
HCAL	$6.5\lambda_o$	$6.5\lambda_o$	
Granurality			
EMC			
transverse	6cm x 6cm	4cm x 4cm	(24mrad in both case)
longitudinal	3 sections	3 sections	
HCAL			
transverse	18cm x 18cm	12cm x 12cm	(72mrad in both case)
longitudinal	4 sections	4 sections	

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3) Proof of Performance

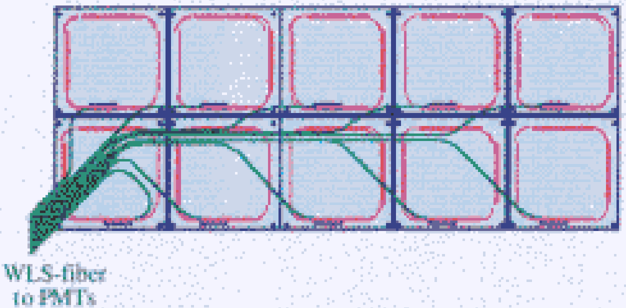
Beam tests done at KEK (1-4GeV) and at FNAL (10-200GeV) to prove ;

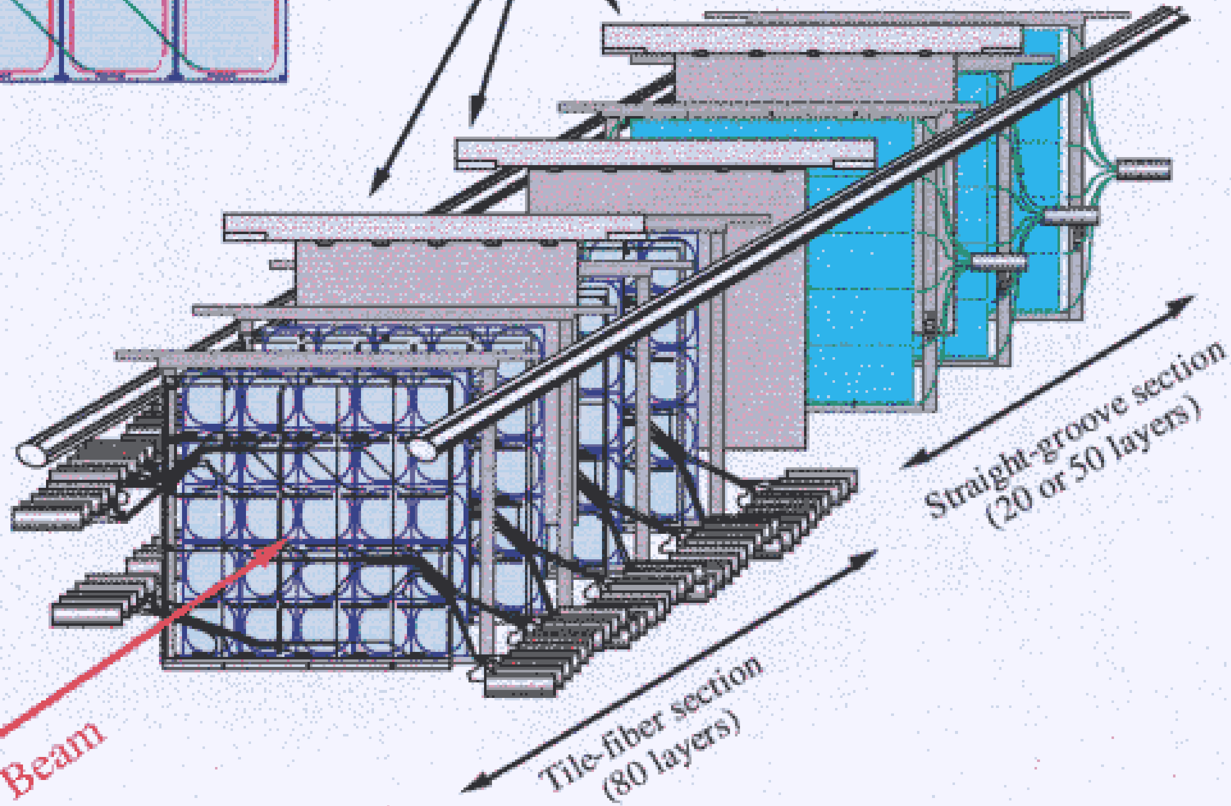
a) **Energy Resolution** / Gaussian Response / Hardware Compensation

b) **Linearity** / Dynamic Range

c) Tower Boundary Uniformity

d) e/π separation capability





Schematic View of Hadron Calorimeter test module with Tile/Fiber configuration

- 2mm-Sci + 8mm-Lead
- 130 layers in total
- 5 x 5 tower structure
- 20cm x 20cm cell size

a) Energy Resolution

Results of the beam test

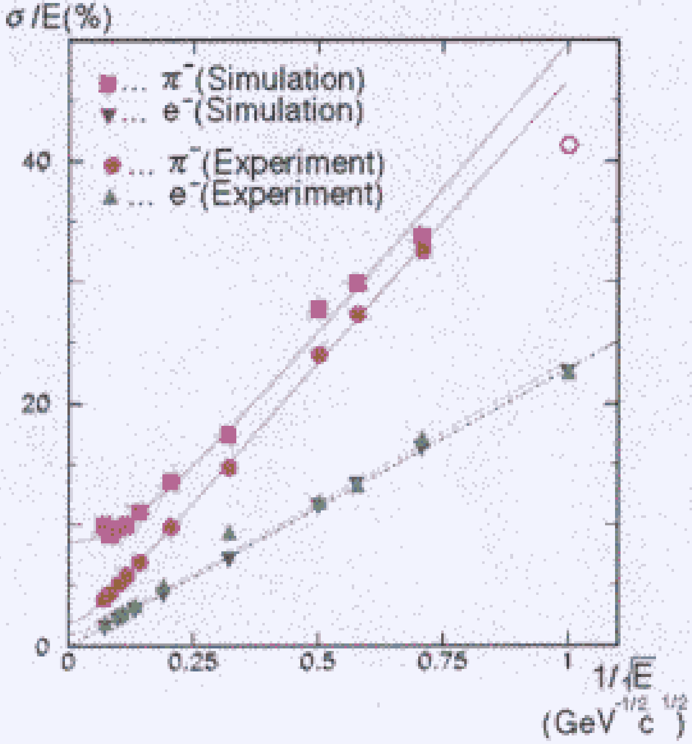
π ; $\sigma_E/E = 45.9\% + 1.5\%$

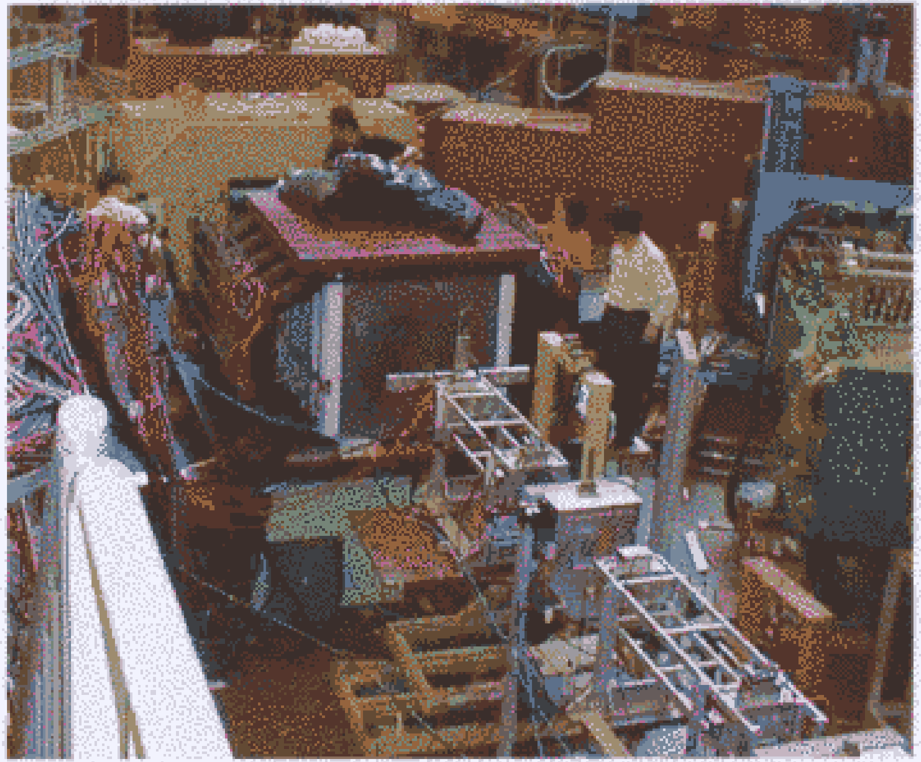
Worse than Design. Need Investigation

e- ; $\sigma_E/E = 23.4\% + 1.2\%$

O.K. because this is HCAL.

Energy Resolution





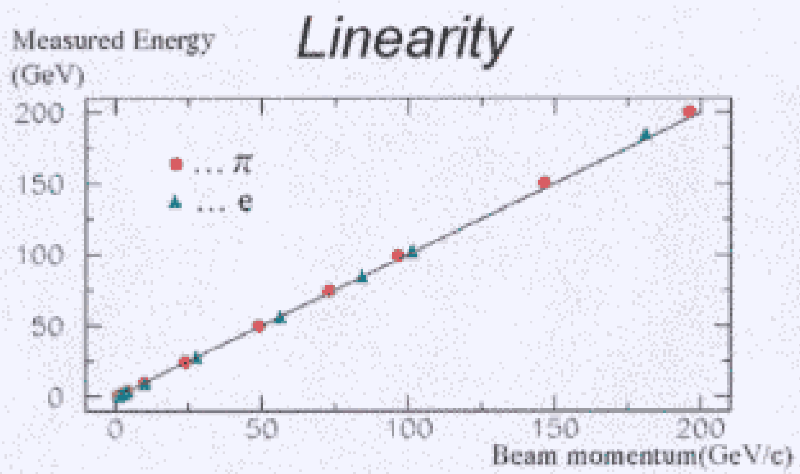
Comparison with Simulation (GEANT/GHEISHA)

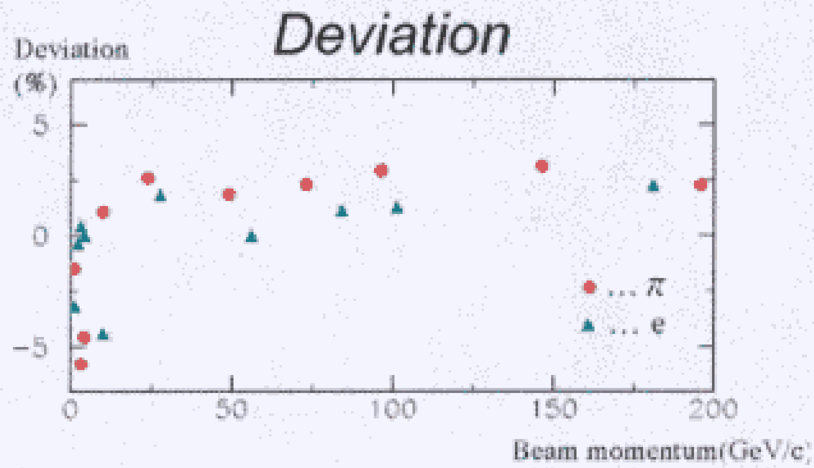
Large constant term in simulation data.

→Tuning of physics process needed.

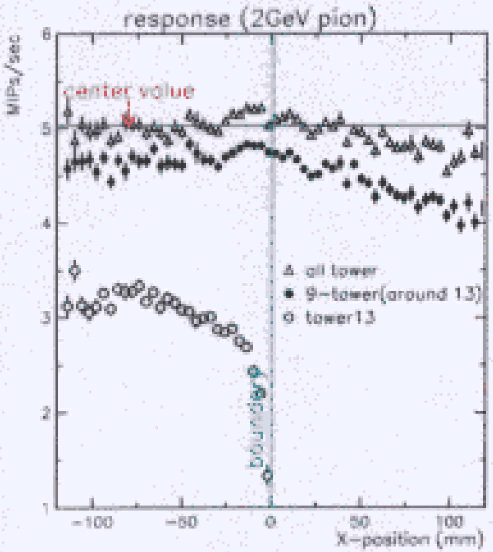
b) Linearity / Dynamic Range

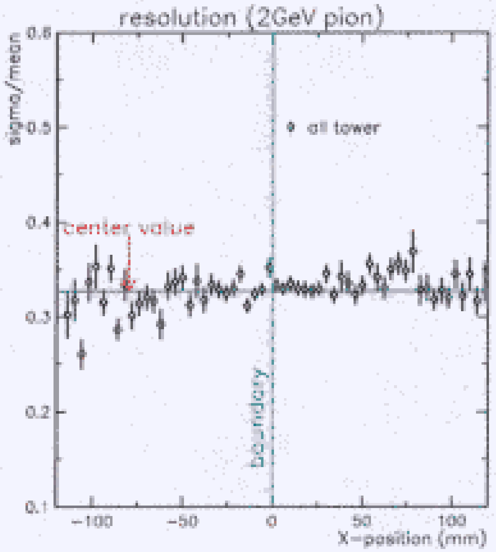
Nice Linearity thanks to Harware Compensation.





c) Tower Boundary Response





- No significant anomaly was observed at the tower boundary for pions.
- Slight anomaly was observed for electrons.

  EM module must be designed with more uniform response.

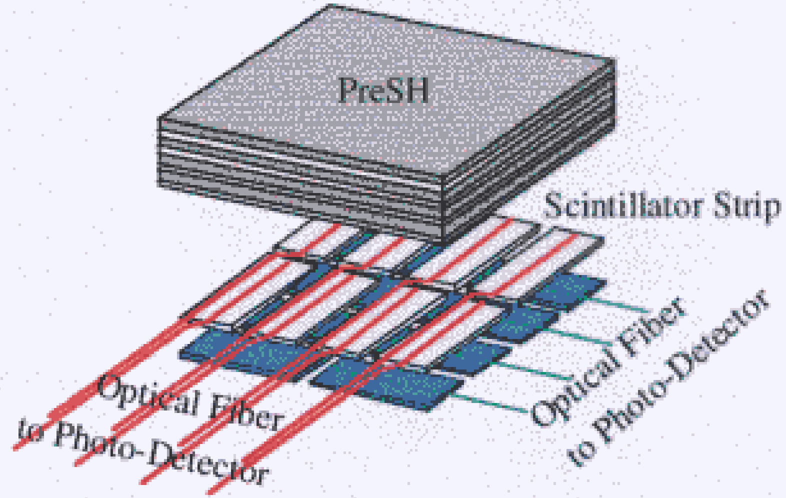
d) PreSH/SHmax and Photo-Detectors

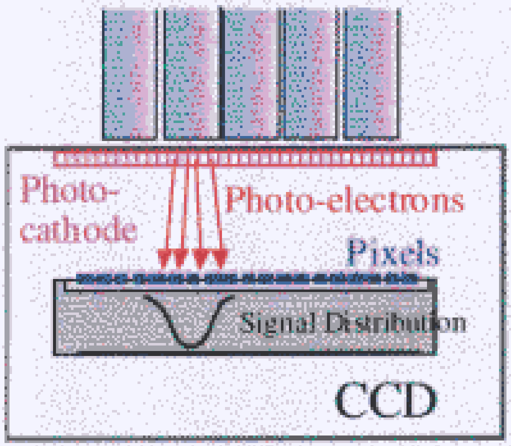
SHmax ; Si-pad array or Scint-Strip

Sci-Strip needs super-multichannel photo-detector.

MCHPD 61ch-HPD tests in progress

or **EBCCD** test-bench under preparation





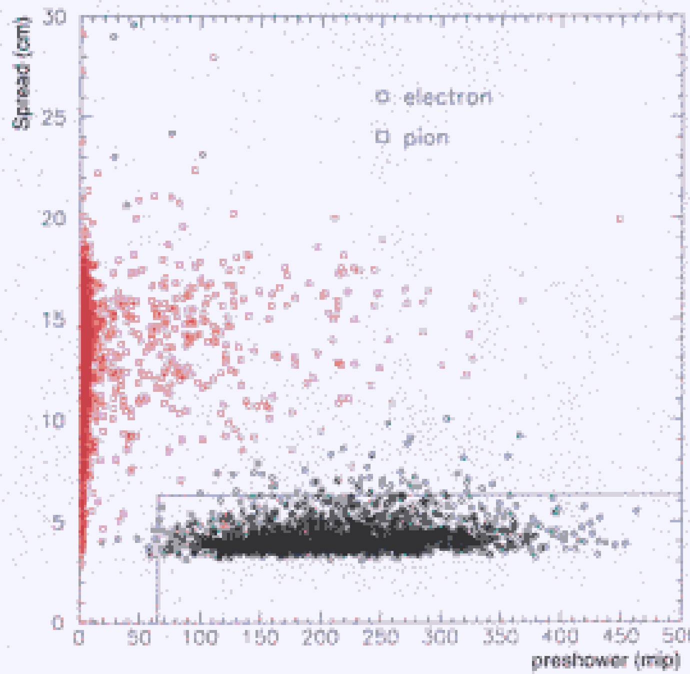
Principle of EBCCD

Combined performance of PreSH/SHmax/HCAL tested.

(Tested with MAPMTs)

- pion rejection ~1/1400
- with $\varepsilon_e \sim 98\%$

Quite Satisfactory



5) Muon Detector & Iron Structure

Important Parameters (under study)

- Number of Super-Layers

  Outside yoke 1 (RR' ZZ')

  Inside yoke 1 (RR' ZZ')

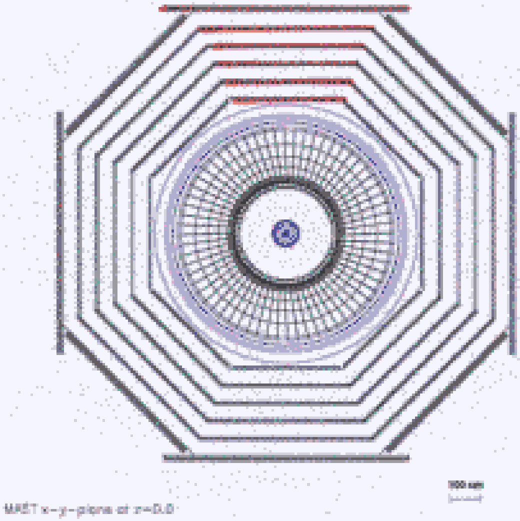
  Interleaved 4 (RZ)

- Position Resolution ~ a few mm

  (no need for momentum resolution)

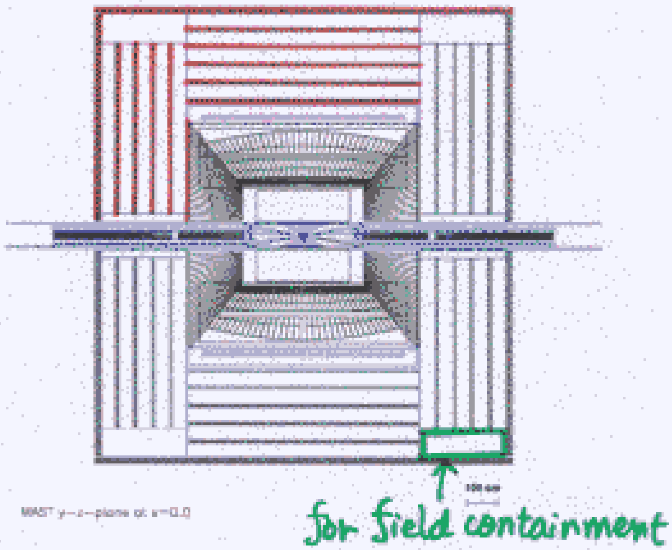
- Angular Coverage

  $|\cos\theta| < 0.997$



Detector Scheme not yet studied.

RPC or TGC or SWDC or ...



Thickness of Iron Yoke

(we want to reduce it)

- Mechanical Strength ; No Problem
- Magnetic Field Uniformity ; OK
- Leakage Magnetic Field ; Dominant Factor

  Reducing muon-slots at Endcap will reduce leakage field.

  Event analysis is needed.

The ACFA Joint Linear Collider Physics/Detector Working Group should prepare the report that is requested by ACFA.

By the end of this year

ACFA JLCWG:
Beijing (1998) → Seoul (1999)
→ Taipei (2000) Joint APPC/ACFA-JLC
→ ....

Many Activities and Outputs

The report should contain the present common view of the Linear collider physics/detector in our working group and should give a good start point for further R&D activities.

Phase-I Physics Potential
&
3-Tesla New Detector Model

Our studies will continue and the report will be updated according to the promotion stage of the JLC project.