BEAM TRANSPORT

KIKUCHI M. MAC'95/6/08

Contents

1. Design Considerations

- Parameters on incoming beam
- Requirements

  Energy acceptance 0.5%

  Separate lines for e^+ and e^- beams

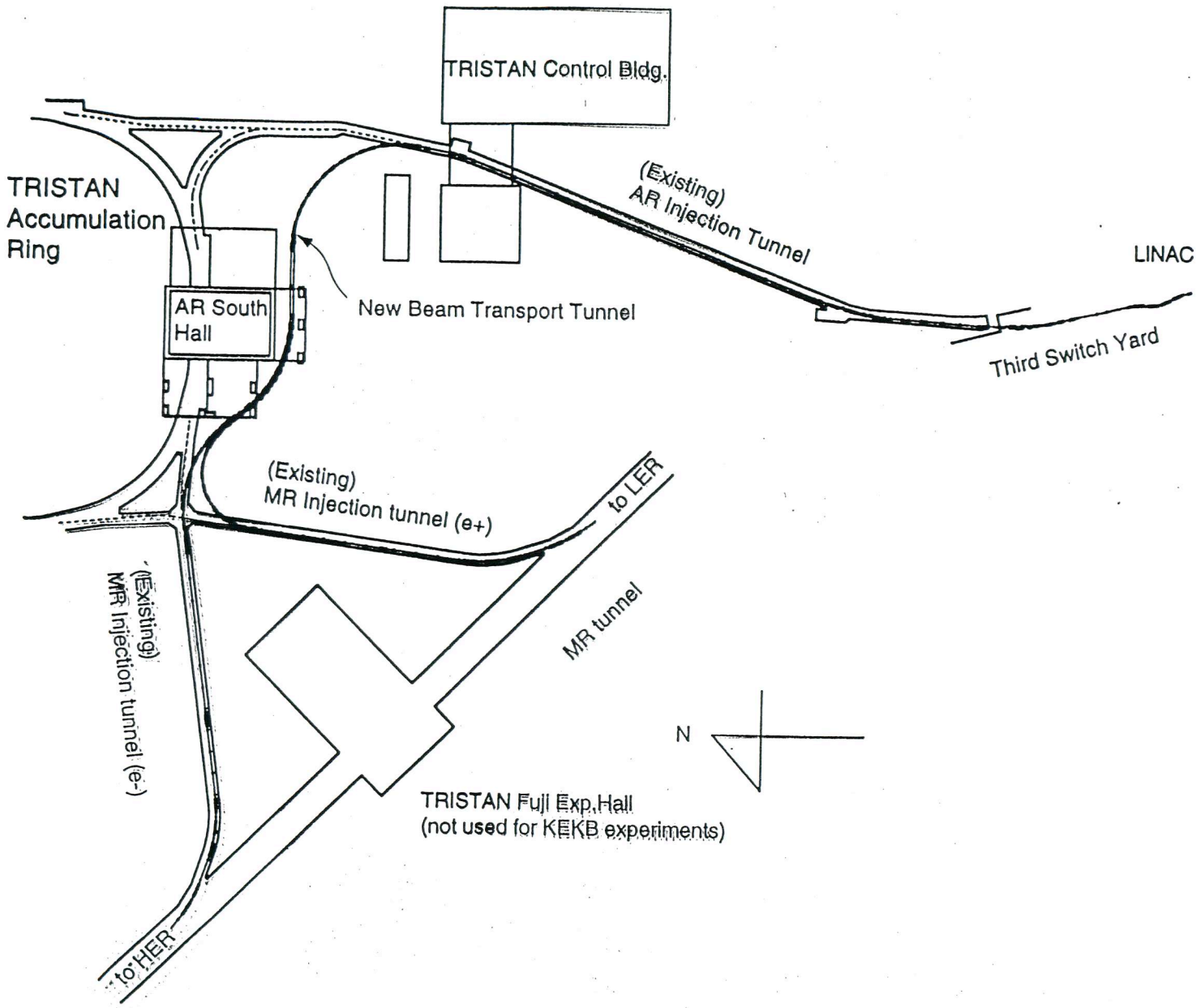
  $R_{56} < 4$ m

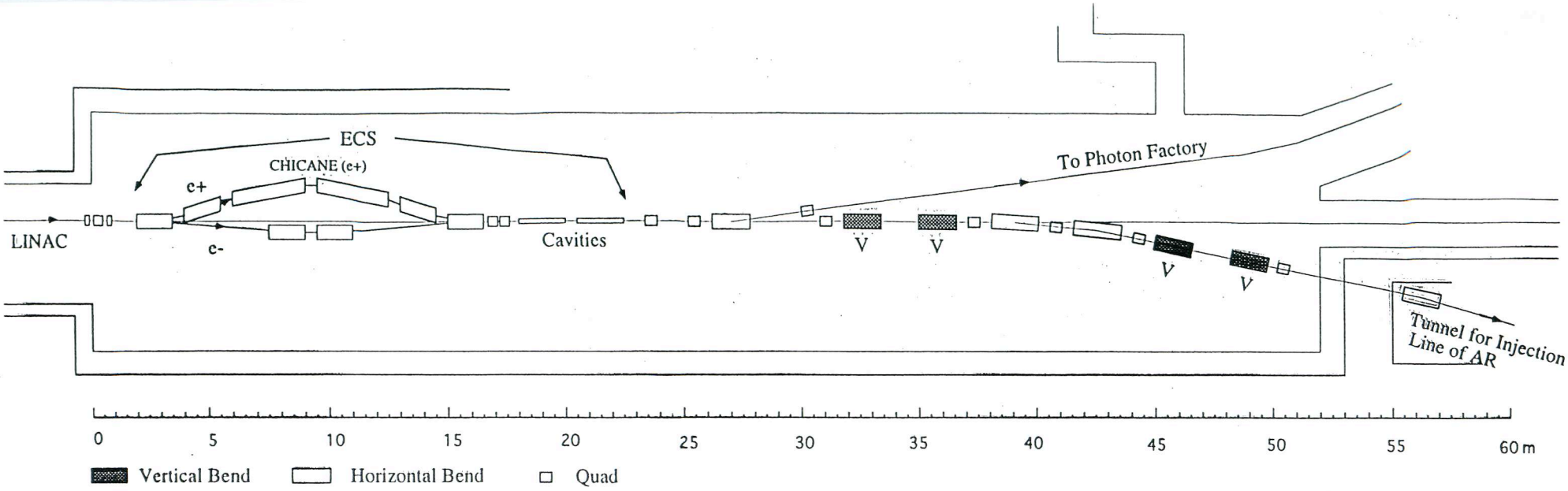
2. Routing

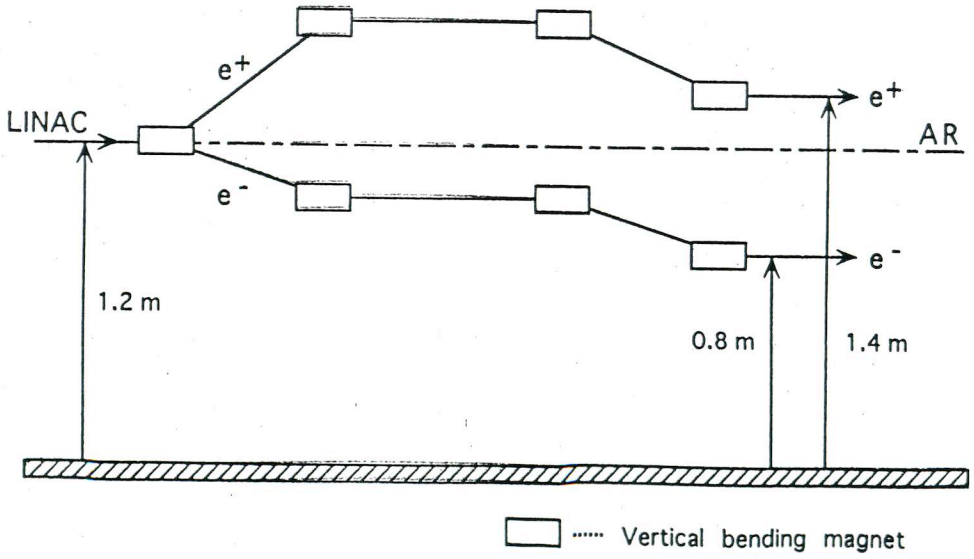
	e^-	e^+
Maximum energy [GeV]	8.4	3.7
Emittance(2σ) [m]	6.4×10^{-8}	8.8×10^{-7}
Energy Spread(2σ) [%]	±0.3	±0.5
with ECS		±0.25
Bunch length (σ_z) [mm]	1.5	1.5
with ECS		3.0
Time jitter $\Delta z_{max}/c$ (ps)	±30	±30
Momentum acceptance of Rings [%]	0.5†	0.5†

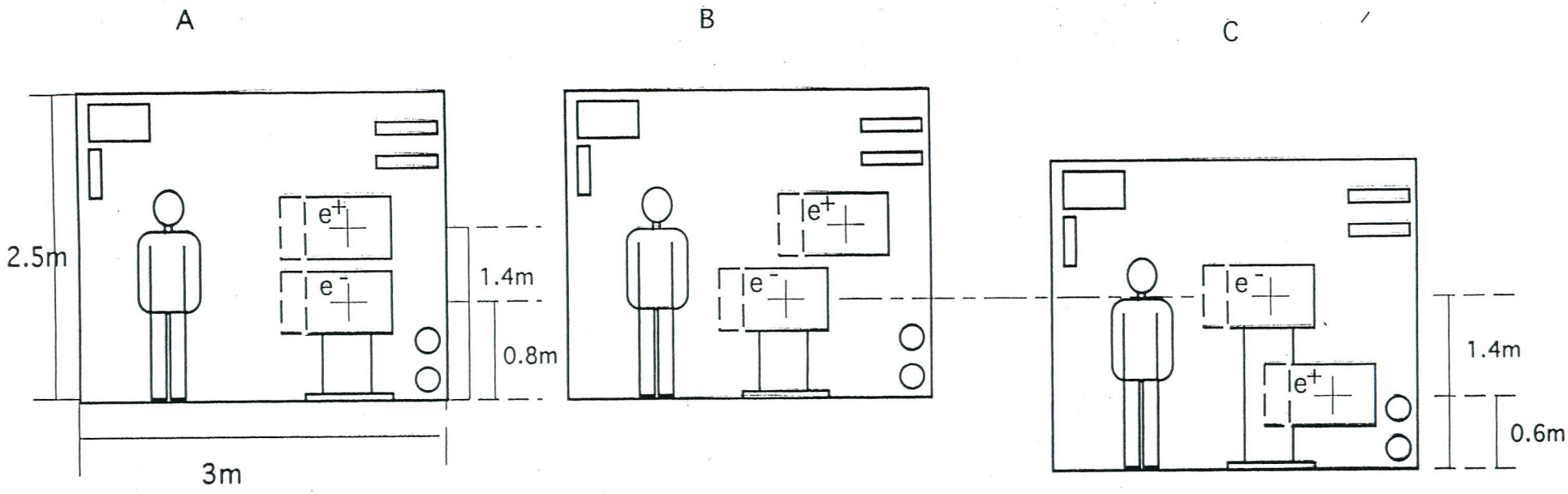
† 30 to 50 % degradation are assumed compared to the ideal case.

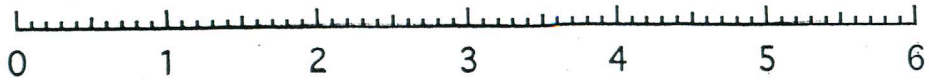
Table 12.5: Parameters relevant to the beam transport system. In the table, "ECS" means the energy compressor system for the positrons in the early part of the beam transport. See the text for details.


TRISTAN Control Bldg.
TRISTAN
Accumulation
Ring
(Existing)
AR Injection Tunnel
LINAC
AR South
Hall
New Beam Transport Tunnel
Third Switch Yard
(Existing)
MR Injection tunnel (e+)
to LER
(Existing)
MR Injection tunnel (e-)
MR tunnel
N
TRISTAN Fuji Exp.Hall
(not used for KEKB experiments)
to HER


ECS
CHICANE (e+)
e+
e-
LINAC
Cavities
To Photon Factory
V
V
V
V
Tunnel for Injection
Line of AR
0
5
10
15
20
25
30
35
40
45
50
55
60 m
Vertical Bend
Horizontal Bend
Quad


LINAC
e+
e-
e+
e-
AR
1.2 m
0.8 m
1.4 m
Vertical bending magnet


A
B
C
2.5m
1.4m
0.8m
3m
e+
e-
e+
e-
e-
e+
1.4m
0.6m


0
1
2
3
4
5
6

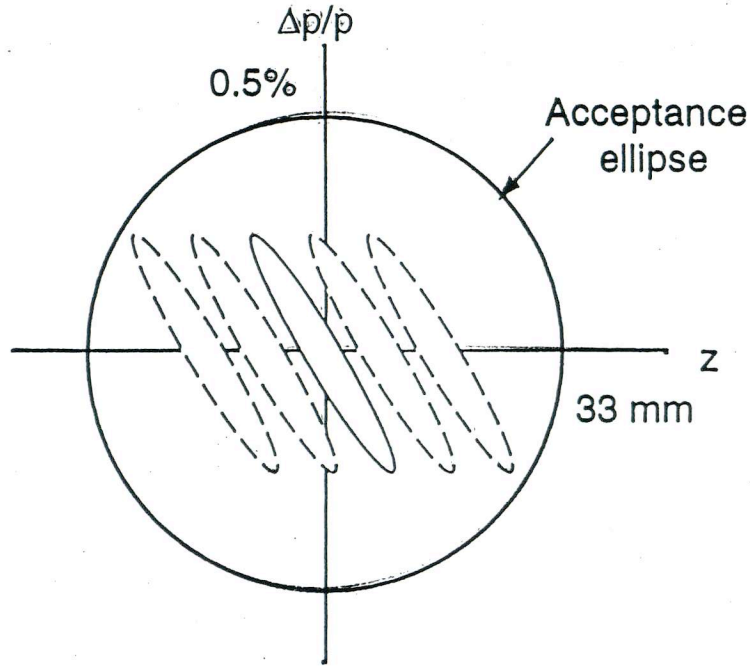


Figure 12.28: Acceptance of the LER and incoming beam. The large circle indicates the acceptance ellipse in the longitudinal plane of the LER. The rotated ellipse with thick line represents the incoming positron beam with ECS, while ellipses with broken lines indicates incoming beams with a timing jitter. The outermost ellipse corresponds to the maximum allowable jitter. The R_{56} is assumed to be 4 m.

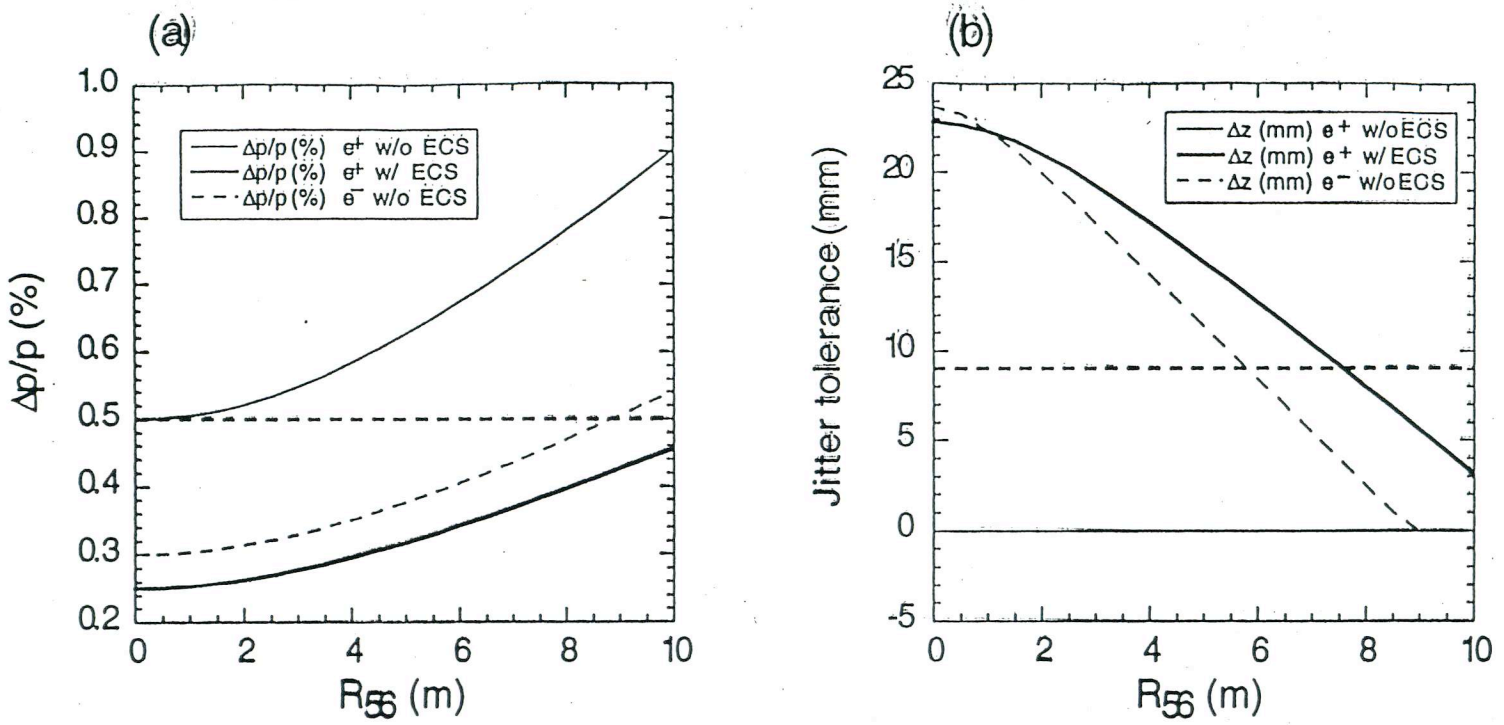


Figure 12.29: (a) Largest amplitude of energy oscillation as a function of R_{56}. Double broken line shows the momentum acceptance of 0.5 %.(b) the timing jitter tolerances as a function of R_{56}. Double broken line shows the tolerance of 9 mm (30 ps).

3. Constraints to R_{56} and the tolerance of timing jitter

If $\Delta p/p=0.25\%$, $R_{56}=5m$ --> $\Delta z=12.5mm$
:not negligible for the enegy acceptance of the KEKB rings!

- Timing jitter tolelance of 30ps demands:
  e^+ w/o ECS --> no solution
  e^+ w/ ECS --> $R_{56} < 7.5$ m
  e^- w/ ECS --> $R_{56} < 6$ m
- Design: $R_{56} < 4$ m for both beam lines.

4. Summary

- Route is fixed.
  Rough scheme is fixed.
- Constarinrs on energy acceptance and R_{56} component of transfer matrix.
- Designs on optics, Instrumentation, and tuning scheme are going on.