The Evolution from the L1/S1 to the L2/S2 Tracker

Bruce Schumm
Santa Cruz Institute for Particle Physics
and the
University of California, Santa Cruz

Presented at:

Berkeley 2000 Linear Collider Workshop
Berkeley, California
March 29, 2000

Issues Driving the Changes

Major

- Refined VTX design (S & L)
- Inclusion of Forward Disks (L only; S already there)
- Central Tracker Inner Radius (L only)
- Intermediate Tracking (L only)
- Smaller Radius Beampipe (L $\rightarrow$ S = 1 cm)

Minor

- Thinner Beampipe (S & L $\rightarrow$ 0.5 mm Be; 0.14% X0)
- Masking & Tolerances (100 mrad + 1cm clearance)
- VTX Cryogenic Containment (S & L; 0.77% X0)

New Optimization Tool

Billior error matrix routine LCDTRK.F has been upgraded to allow mixed r-ϕ and r-z systems (issue for L detector disks)

http://www.slac.stanford.edu/ schumm/lcdtrk19991014.tar.gz

is a gzipped, tarred file containing:

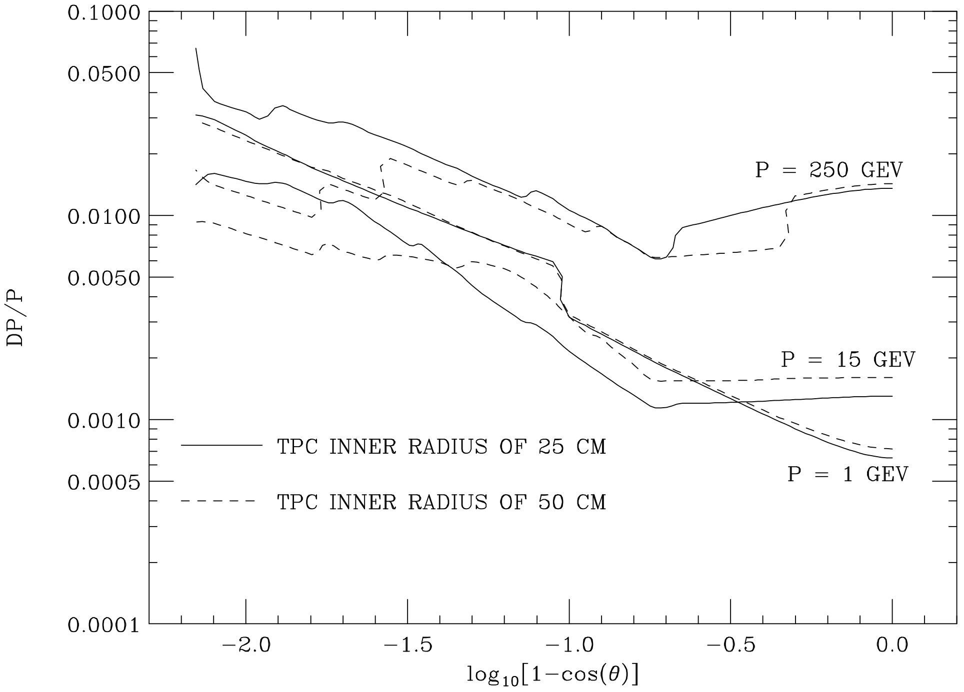
lcdtrk.f	Fortran Code
lcdtrk.txt	Documentation
des_small_1099.input	S2 Specification File
des_large_1099.input	L2 Specification File

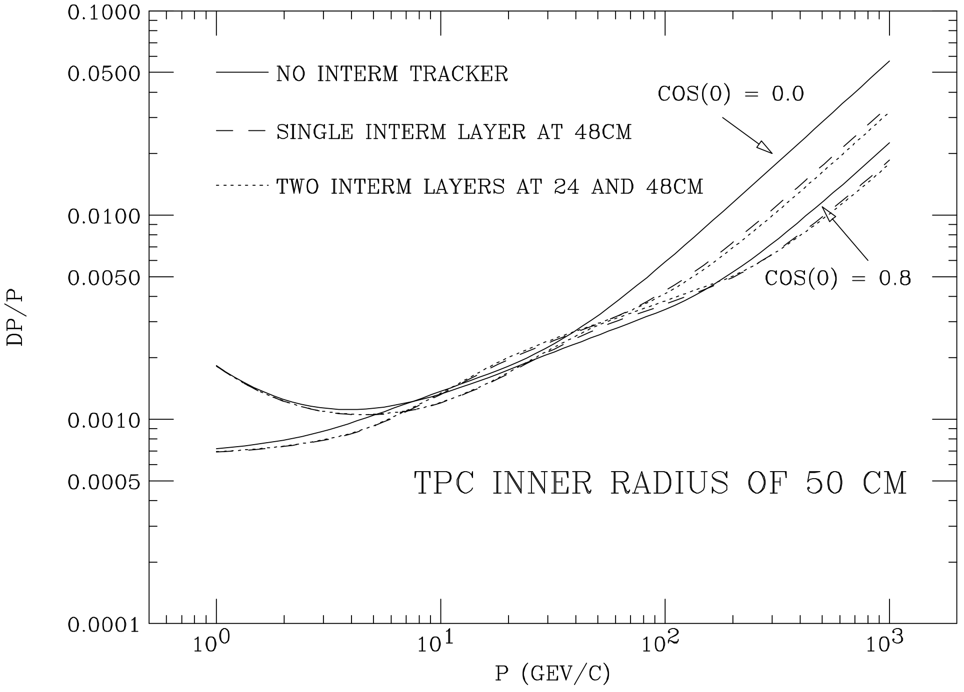
L Detector Re-optimization

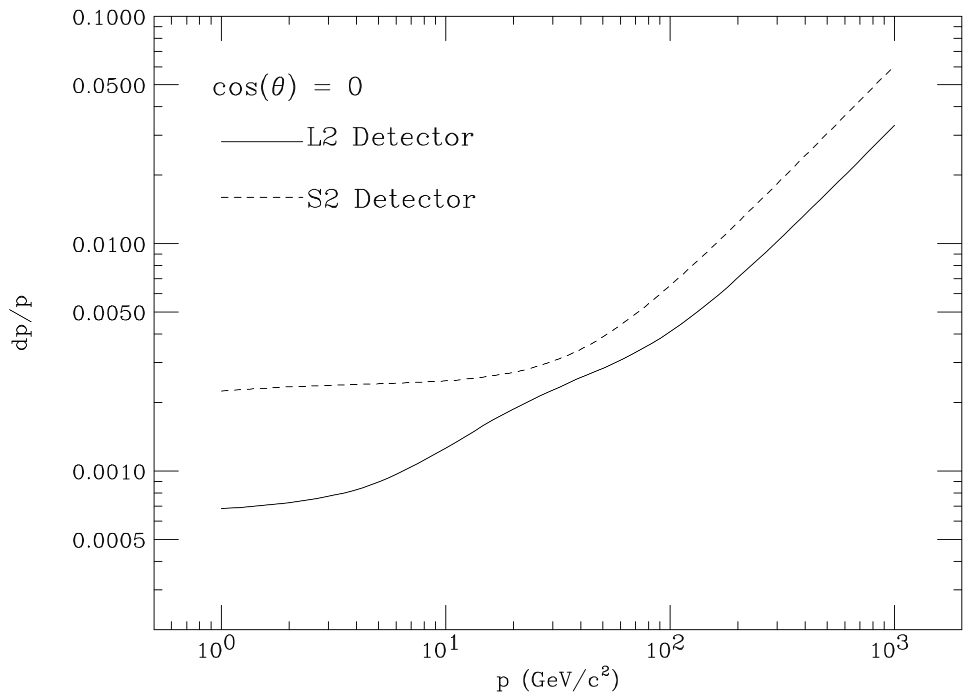
The inclusion of forward disks and intermediate tracking had a substantial impacat on the L detctor design.

The L detector was re-optimized as follows:

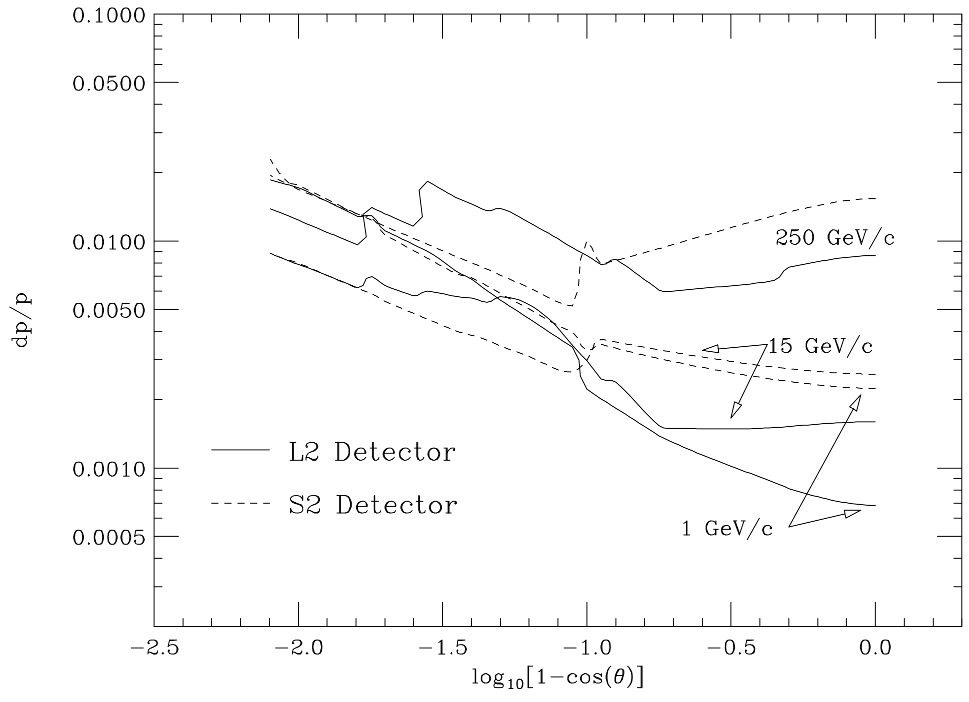
- Include 5 disk layers between $30 < z < 270$ cm.
- Explore 25 and 50 cm inner radius (with disks extending out to inner radius) $\Rightarrow$ Choose 50 cm
- Explore zero, one (48 cm),and two (24 cm and 48cm) intermediate tracking layers $\Rightarrow$ Choose one layer out to first disk (nothing beyond)


0.1000
0.0500
0.0100
0.0050
0.0010
0.0005
0.0001
DP/P
P = 250 GEV
P = 15 GEV
P = 1 GEV
TPC INNER RADIUS OF 25 CM
TPC INNER RADIUS OF 50 CM
−2.0
−1.5
−1.0
−0.5
0.0
$\log_{10}[1-\cos(\theta)]$

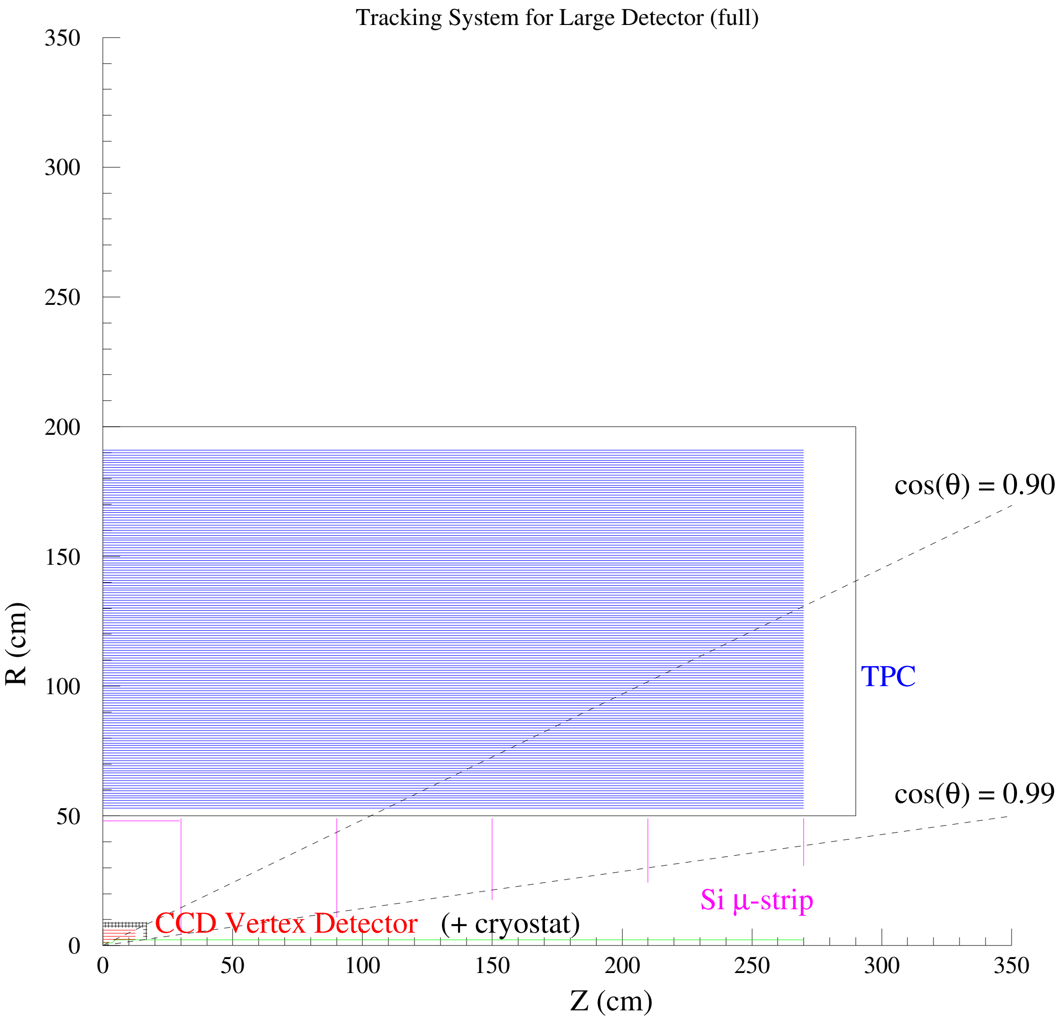

0.1000
0.0500
0.0100
0.0050
0.0010
0.0005
0.0001
DP/P
NO INTERM TRACKER
SINGLE INTERM LAYER AT 48CM
TWO INTERM LAYERS AT 24 AND 48CM
COS(0) = 0.0
COS(0) = 0.8
TPC INNER RADIUS OF 50 CM
10^0
10^1
10^2
10^3
P (GEV/C)



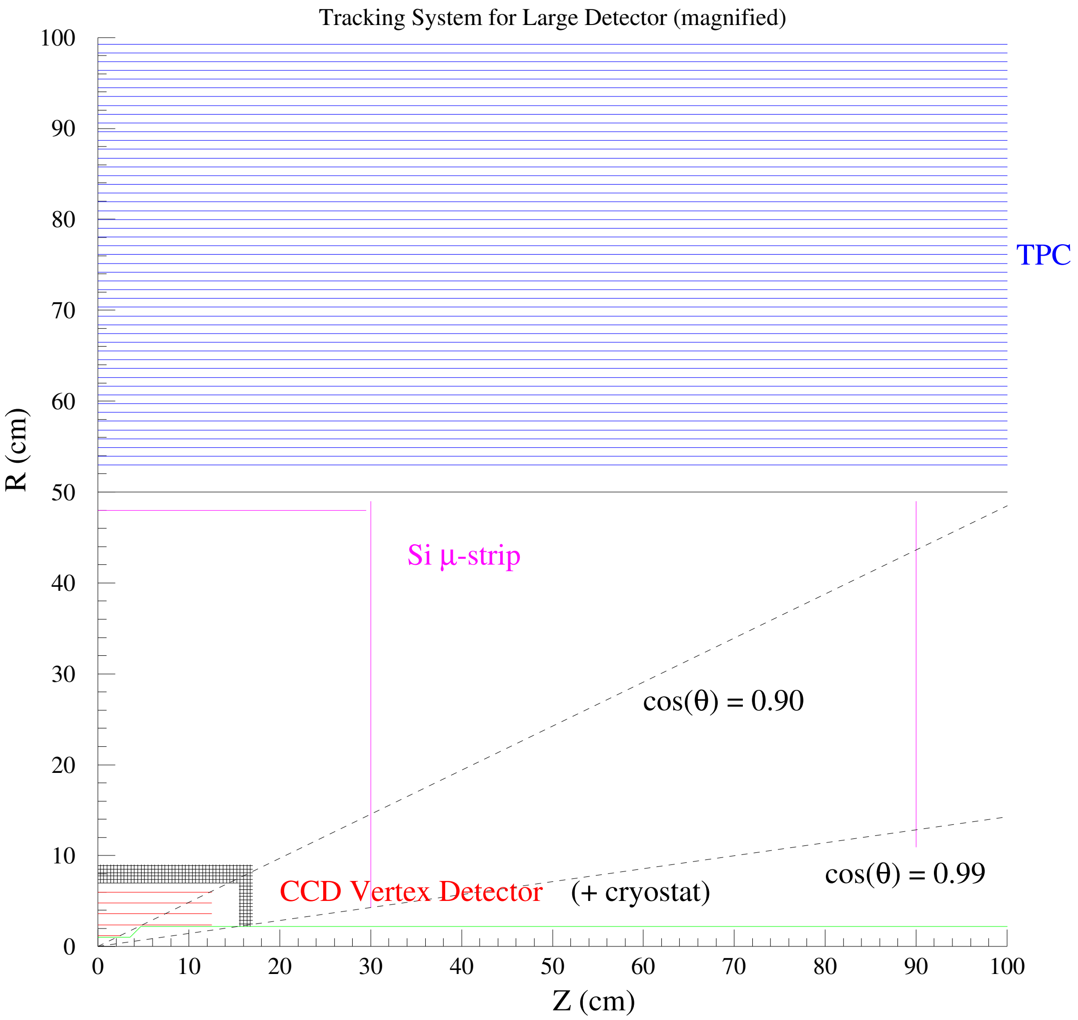
cos(θ) = 0
L2 Detector
S2 Detector
dp/p
p (GeV/c²)



250 GeV/c
15 GeV/c
1 GeV/c
L2 Detector
S2 Detector
dp/p
log₁₀[1−cos(θ)]



Tracking System for Large Detector (full)
350
300
250
200
150
100
50
0
R (cm)
cos(θ) = 0.90
TPC
cos(θ) = 0.99
Si μ-strip
CCD Vertex Detector
(+ cryostat)
0
50
100
150
200
250
300
350
Z (cm)


Tracking System for Large Detector (magnified)
R (cm)
Z (cm)
TPC
Si μ-strip
cos(θ) = 0.90
cos(θ) = 0.99
CCD Vertex Detector
(+ cryostat)
0
10
20
30
40
50
60
70
80
90
100

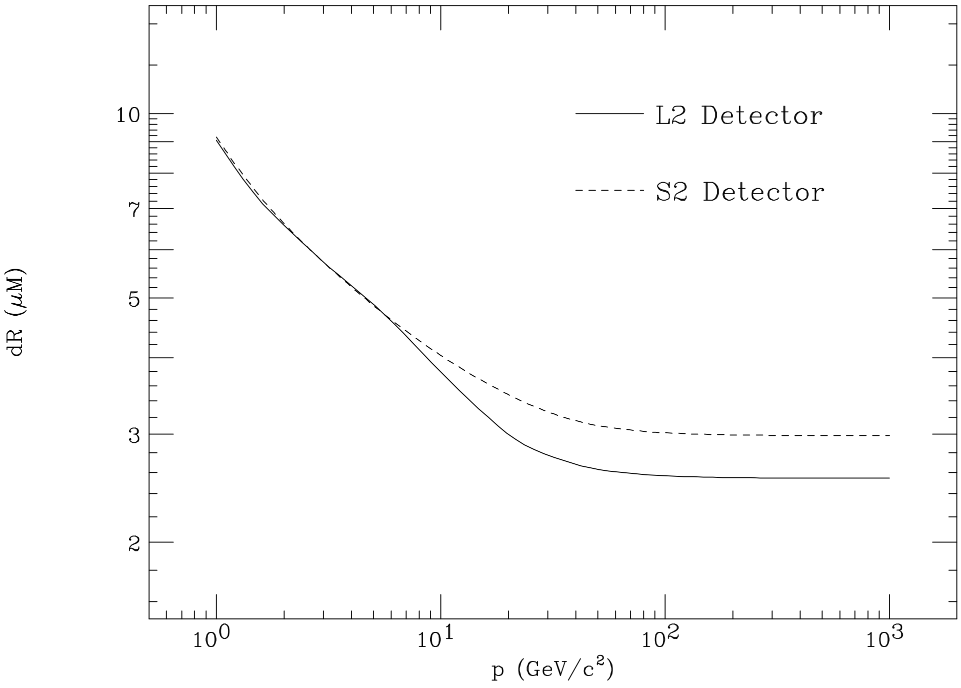
MAJOR ISSUE: L/S BEAMPIPE RADIUS

Europeans ('L'-like option only) devised masking scheme to allow $r_{pipe} \rightarrow 1.0$ cm (from 2.5 cm).

We adopted this approach (why not?)

Impact parameter resolution now $better$ for L detector than S!

Has anyone thought similarly as carefully about S detector beampipe?



L2 Detector
S2 Detector
dR (μM)
10
7
5
3
2
10^0
10^1
10^2
10^3
p (GeV/c^2)