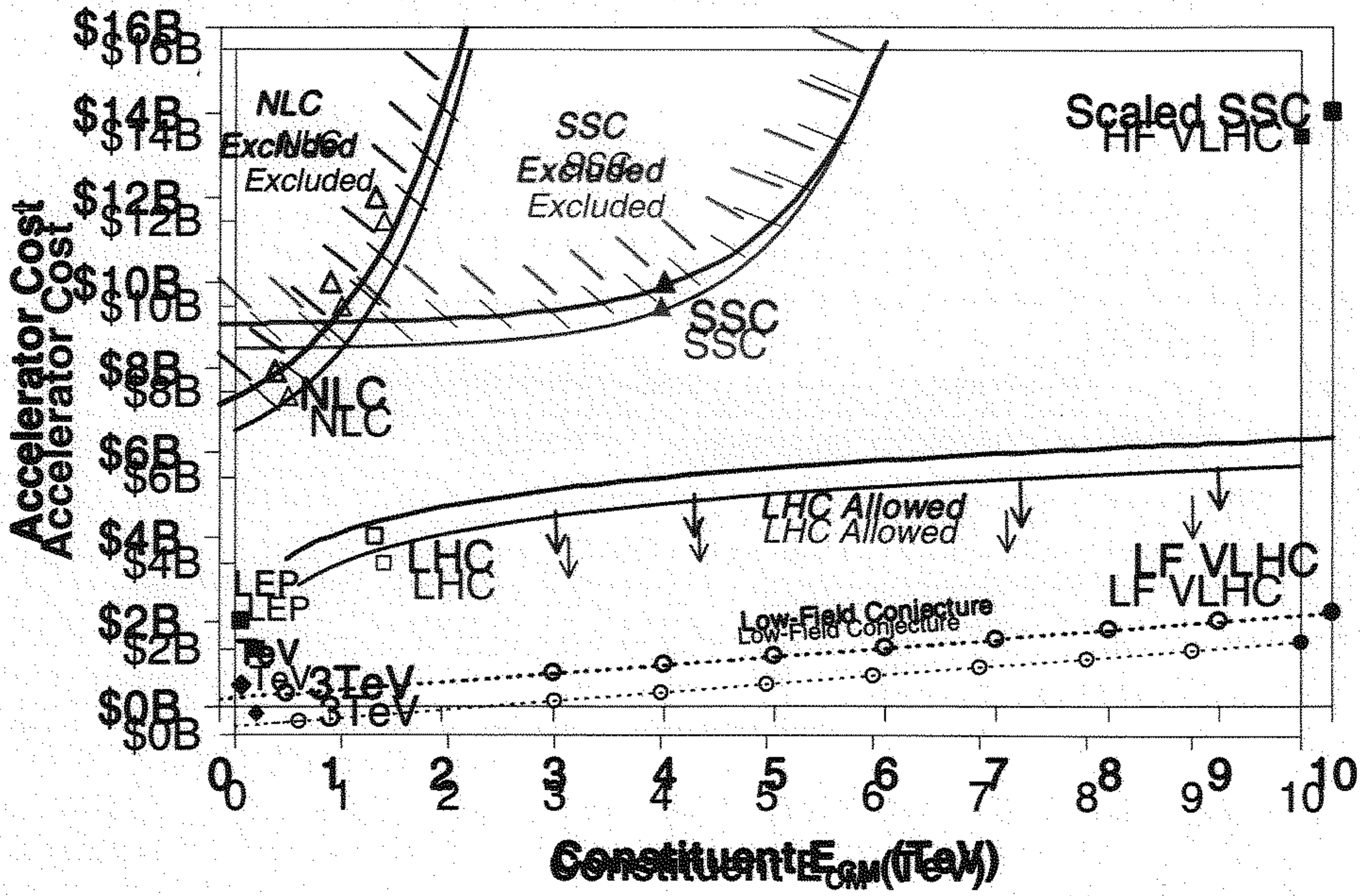
15 FOSTER

3 TeV Machine Design Study

- A 3 TeV "rapid cycling" superconducting synchrotron.
- Based on Superferric "Transmission line" magnets.
- Goal of Design Study:

<u>Document cost for 3 TeV</u> ~ Main Injector
< \$100M/TeV

Accelerator Cost vs. E_{CM}



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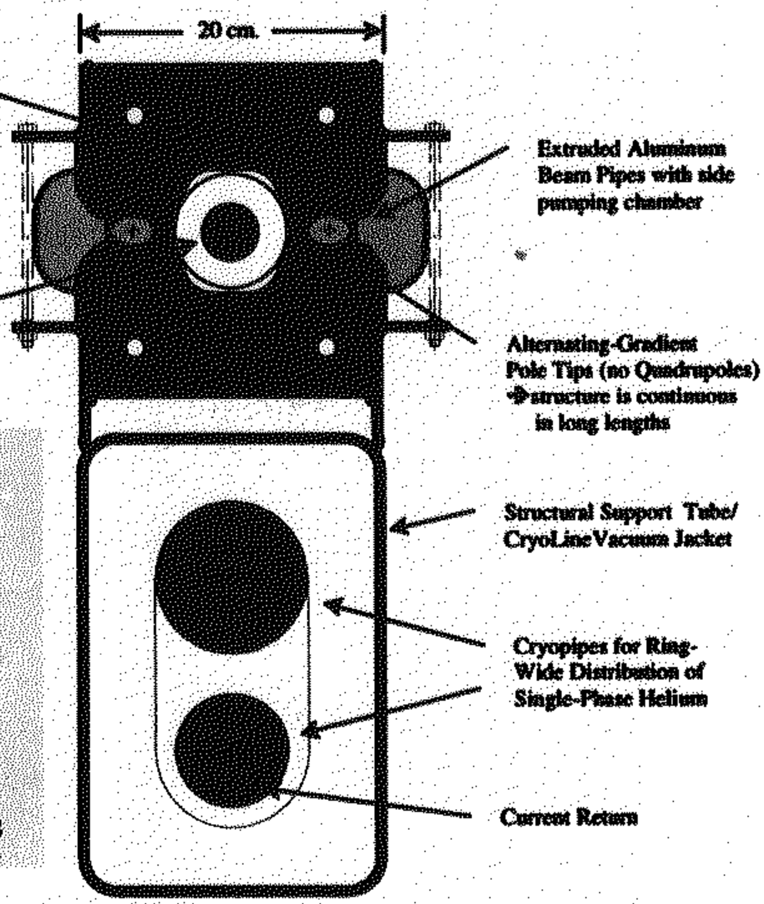
Transmission Line Magnet



KEY FEATURES:

- Simple Cryogenic System
- Small Superconductor Usage
- Small Cold Mass
- Low Heat Leak
- Continuous in Long Lengths
- No Quads or Spool Pieces
- Warm Bore Vacuum System
- Standard Construction Methods

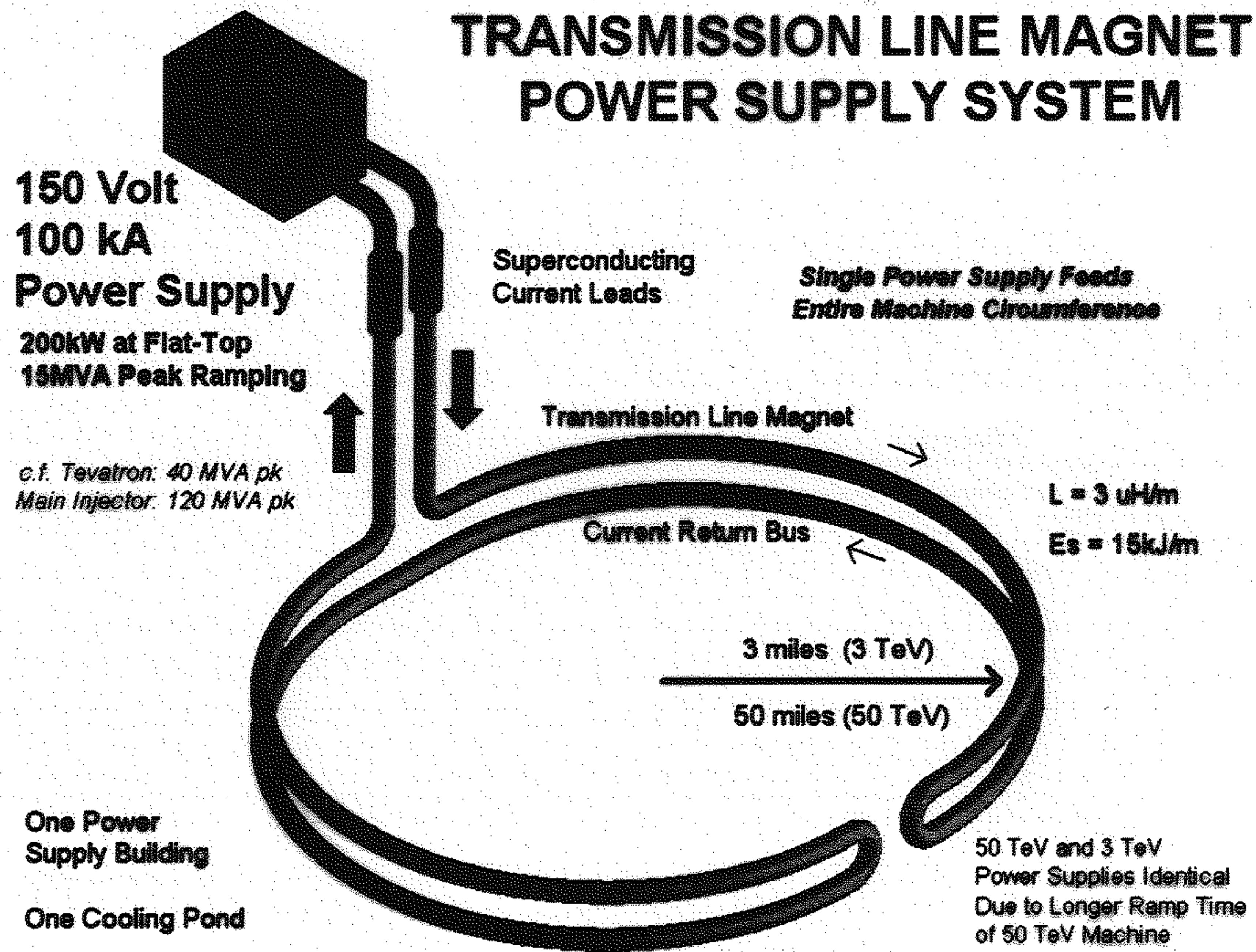
Motivation:

Magnet Parts cost ~\$1k/m → \$500M / 100 TeV E_{CM}

Cryo Wall Power ~100W/m → 50MW / 100 TeV E_{CM}

Technology Exists Today

TRANSMISSION LINE MAGNET POWER SUPPLY SYSTEM



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Strategic Purpose(s) of 3 TeV Machine:

- Serves as VLHC Injector
- Demonstrate technology and cost goals
- Convince people that tunneling off-site is non-threatening

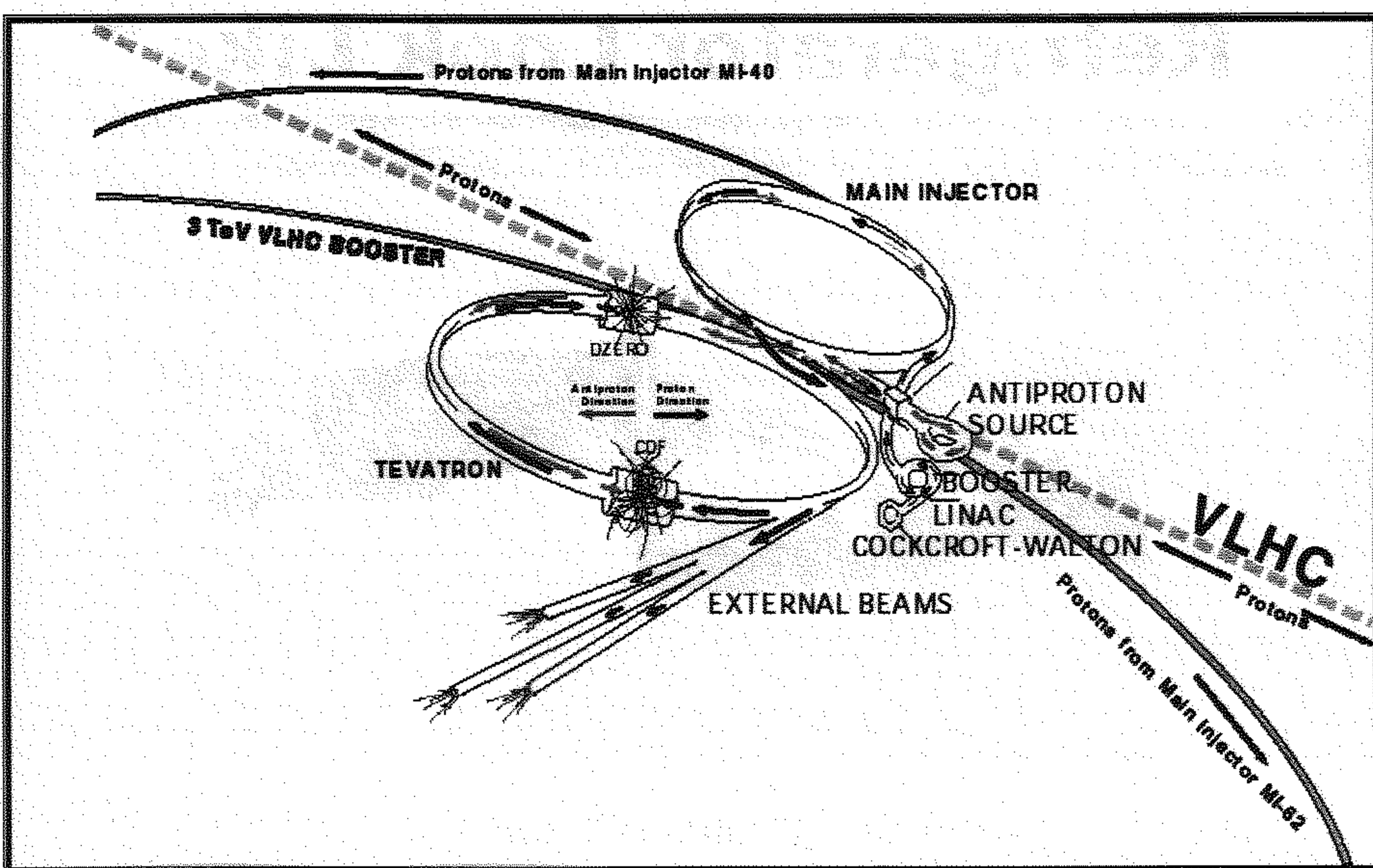
Tactical Missions (Bridge Program)

- COLLIDER
  - Hadronic B-factory (collider)
  - Low-angle experiments
- FIXED TARGET
  - Photoproduction
  - *Hyperons*
  - ν_τ
  - Polarization, gas jets…
  - …

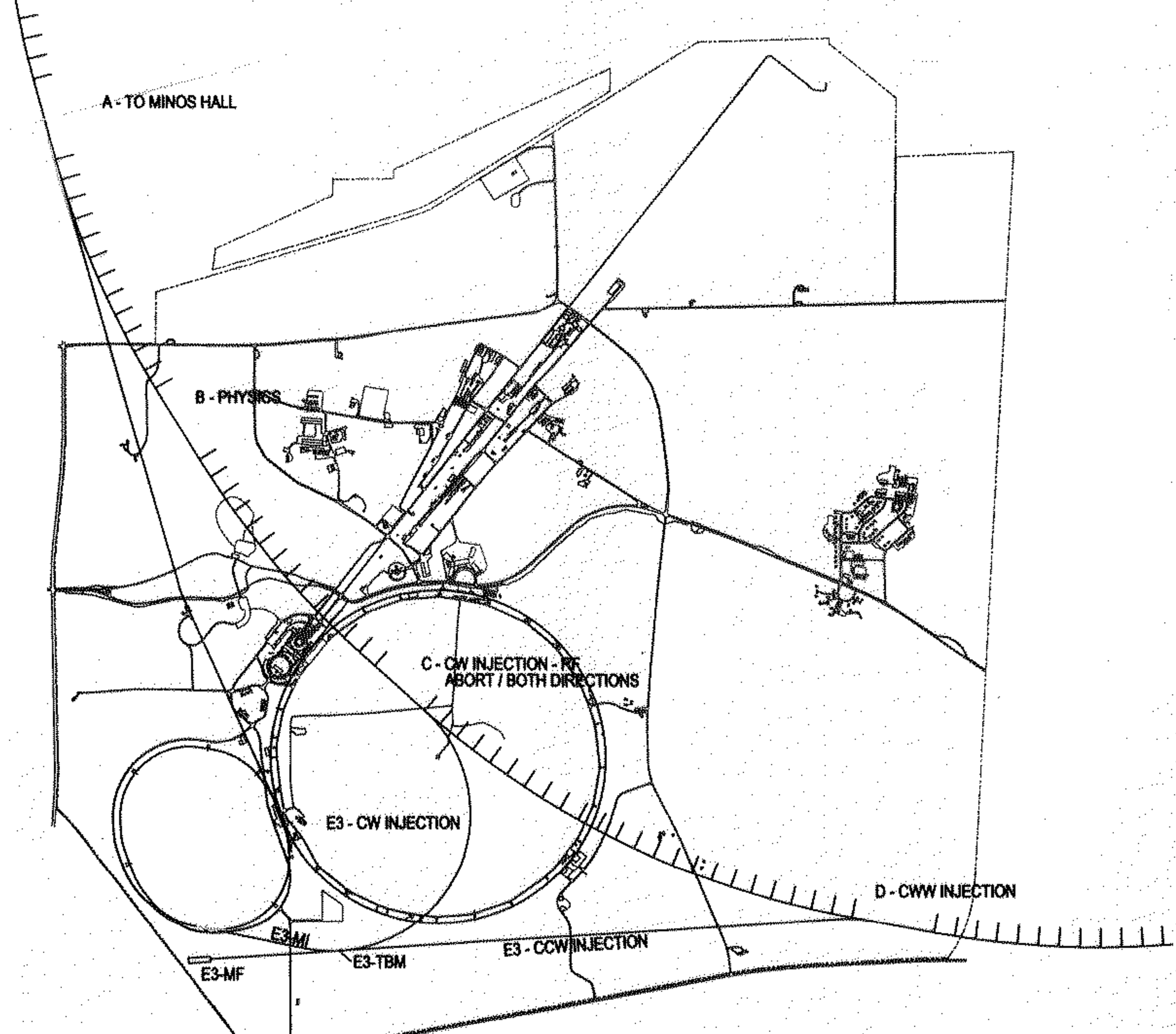
3 TeV Machine Capabilities

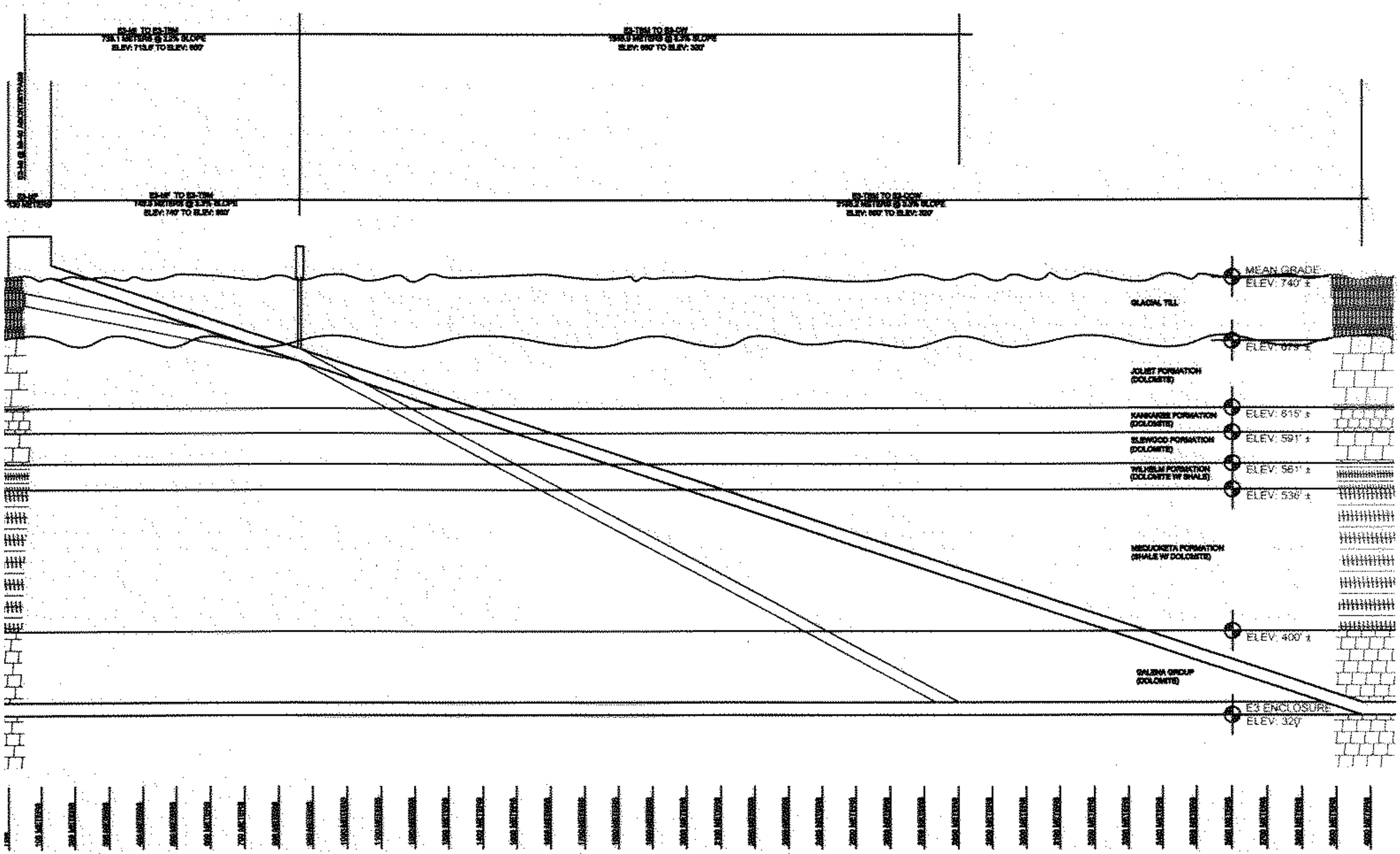
- Multi-TeV Fixed Target will be unique capability in LHC Era
- Superferric magnets (warm iron) can ramp rapidly and hold flat top indefinitely
- Machine Ramp will be RF-power limited
  → few x Tevatron average beam power)
- Physics Mission Cheapest if it can be confined to a few small underground halls
- Possible siting of fixed-target facilities taking advantage of NUMI access shaft

VLHC at Fermilab

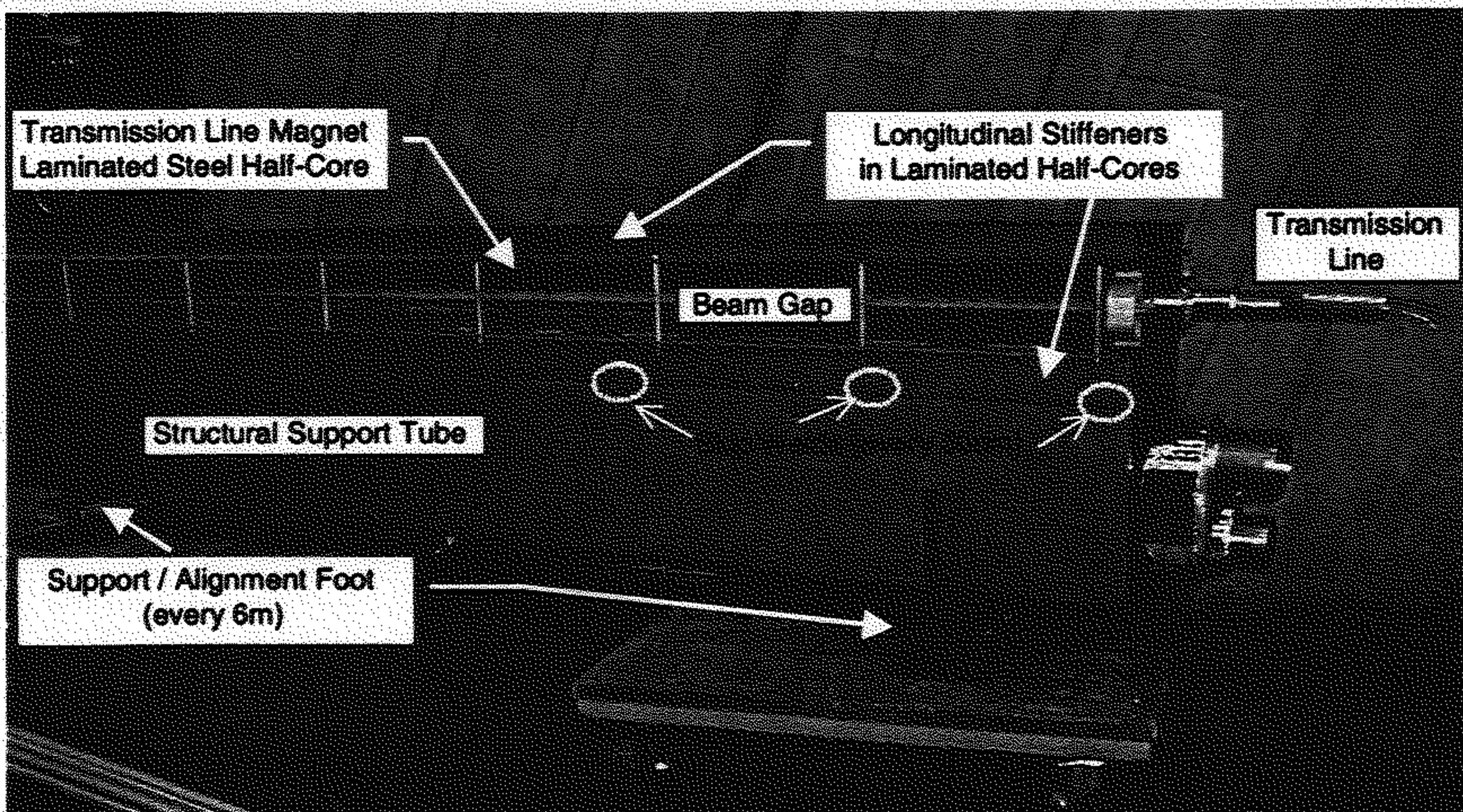


E3 BEAMLINE STUDIES
93% - 37,750 METER CIRCUMFERENCE
E3-08-31-01

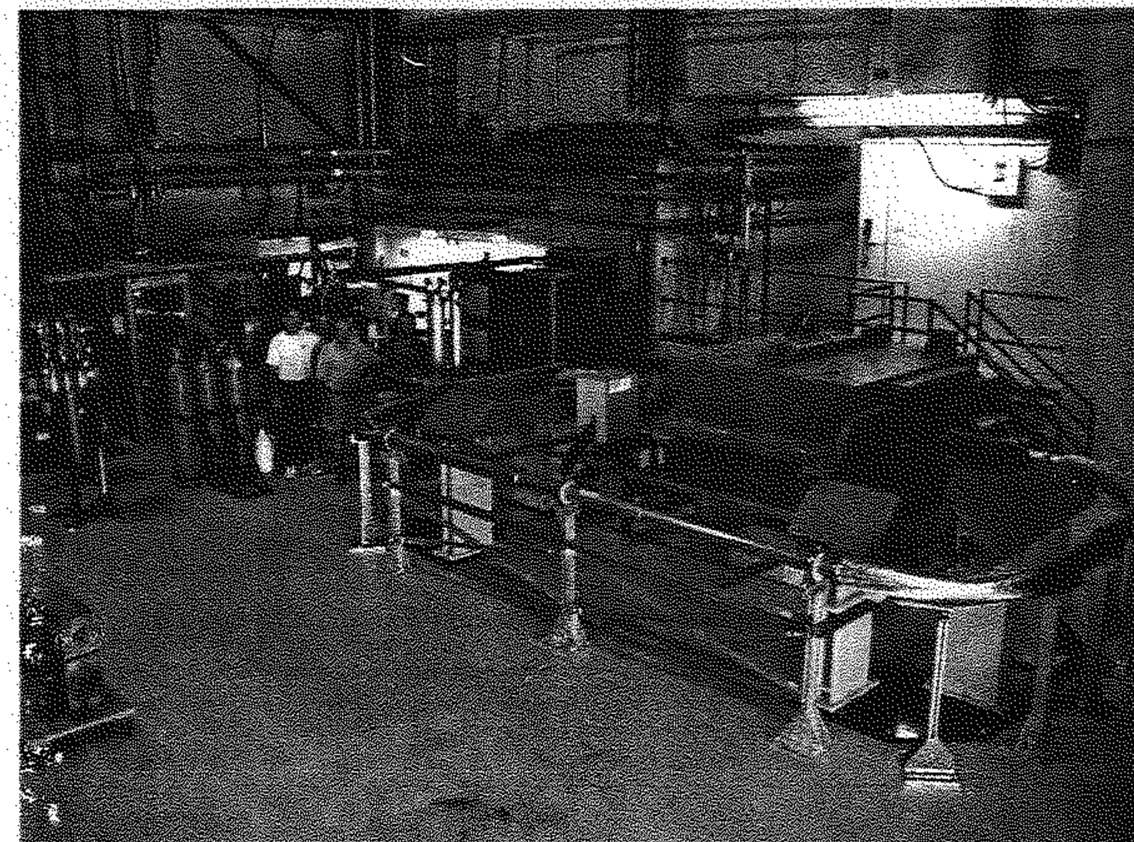



MEAN GRADE
ELEV: 740' ±
GLACIAL TILL
JOLIET FORMATION
(DOLOMITE)
ELEV: 615' ±
KANKAKEE FORMATION
(DOLOMITE)
ELEV: 591' ±
ELWOOD FORMATION
(DOLOMITE)
ELEV: 561' ±
WILHELM FORMATION
(DOLOMITE W/ SHALE)
ELEV: 536' ±
MAQUOKETA FORMATION
(SHALE W/ DOLOMITE)
ELEV: 400' ±
GALENA GROUP
(DOLOMITE)
E3 ENCLOSURE
ELEV: 320'

Components of the Transmission Line Magnet



100kA Transmission Line 17 meter Test Loop



Henryk Piekarz, Phil Schlabach, Phil Gallo of FNAL Tech Div.

Inductive Coupling to avoid 100kA Current Leads

4m Section is Replaceable for studying design variants.

Use as “flux-pump” to power long magnets.

Conclusions

There *will* be a VLHC.

There *will* be a (largely unused) multi-TeV rapid-cycling injector to this machine.

Multi-TeV fixed target will be an option.

This could happen soon, at Fermilab, if we convince the powers that be that this is the route to the energy frontier.

Put on your thinking caps and dream cheap dreams.

Should $\bar{p}p \rightarrow \bar{\Lambda}\Lambda$ be revived?

Daniel M. Kaplan
Illinois Institute of Technology

Sept. 29, 1999

Brief History:

- PS185 at LEAR proposed 1981, begins 1984
- $\bar{p}p \rightarrow \bar{\Lambda}\Lambda$ proposed for CP: Donoghue, Holstein, Valencia, He, Pakvasa 1986
- CERN Hyperon CP study group: technique feasible $\rightarrow 10^{-4}$ statistics, 10^{-5} systematics
- Hsueh and Rapidis propose new $\bar{p}$ storage ring at Fermilab 1992 $\rightarrow$ rejected
- LEAR shut down 1996, PS185 ends
- PS185 publishes world's best limit to date:

$$A_{\Lambda} = 0.013 \pm 0.022$$

P. D. Barnes *et al.*, Phys. Rev. C **54**, 1877 (1996)

sections and polar-
·e characteristic of
ese matters are dis-

5 data very close to
taking has recently
n unexpected struc-
t $\epsilon\sim1$ MeV excita-
l higher-momentum
g analyzed (Bröders
1]).
$\bar{\Lambda}\Lambda$ transition have
[15–42]. These de-
ies: (1) the strange-
hannel exchange of
originates from the
the subsequent pro-
ed by four "specta-
cused on quark de-
]), and (3) model-
ntum data that are
mposition [34–36].
ute here, it may be
ing reaction mecha-
o been done in the
anomaly [5] in the
.
xpected to be short
essary to create the
pectation that quark
K-meson exchanges
However, given the
ions, we expect that
be of major signifi-
rstanding of absorp-
more about the de-
In order to deal with
ly coupled channels
-channel techniques
data.
tistics measurements

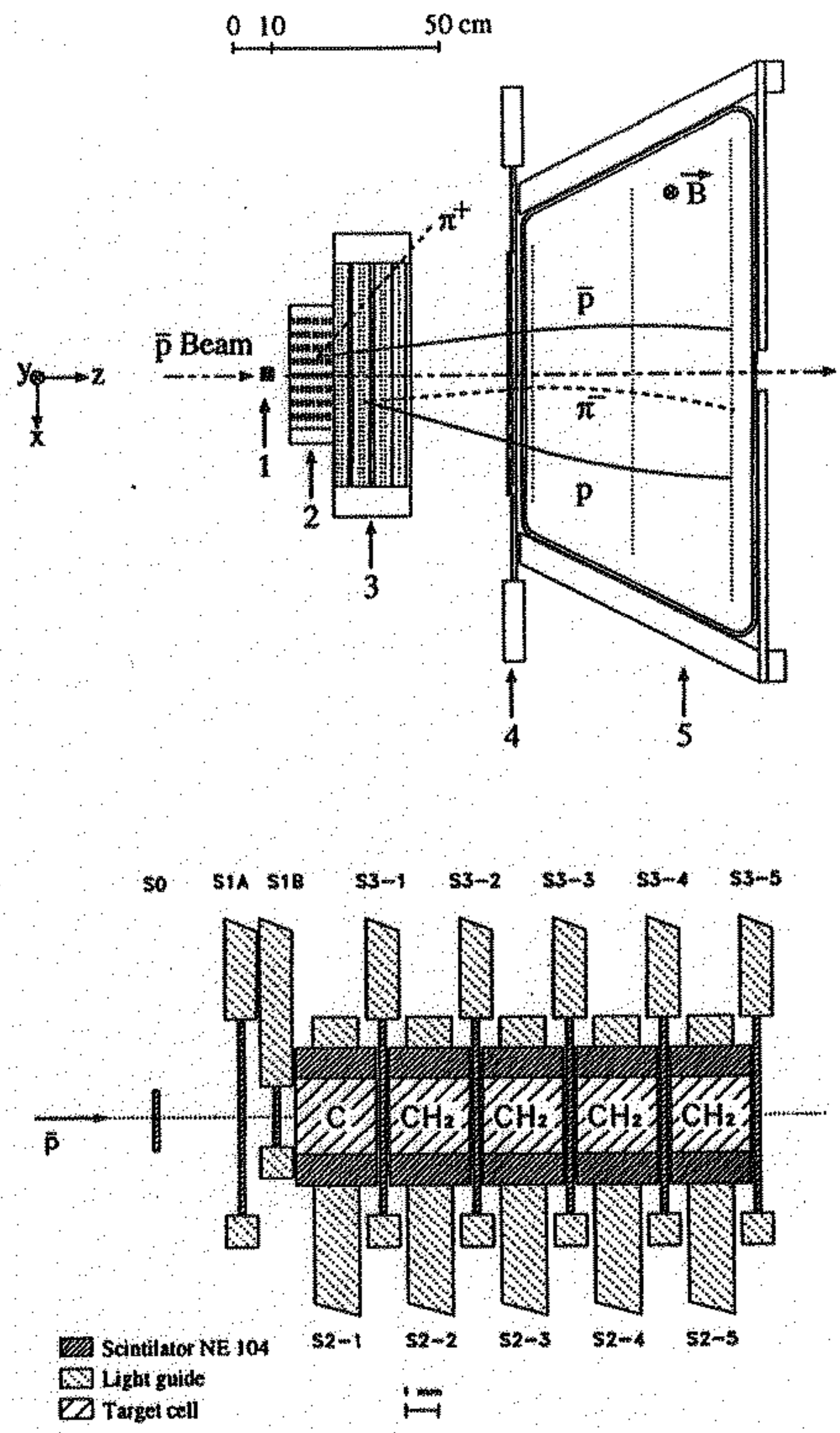


FIG. 1. Overview of the PS185 detector system. (1) segmented neutral trigger target, (2) multiwire proportional chambers (MWPC's), (3) multiwire drift chambers (MWDC's), (4) scintillator hodoscope, and (5) solenoid "baryon indentifier" with drift chambers. The lower part of the figure shows a detail of the segmented target.

state spin observables [43]. The experimental setup, shown

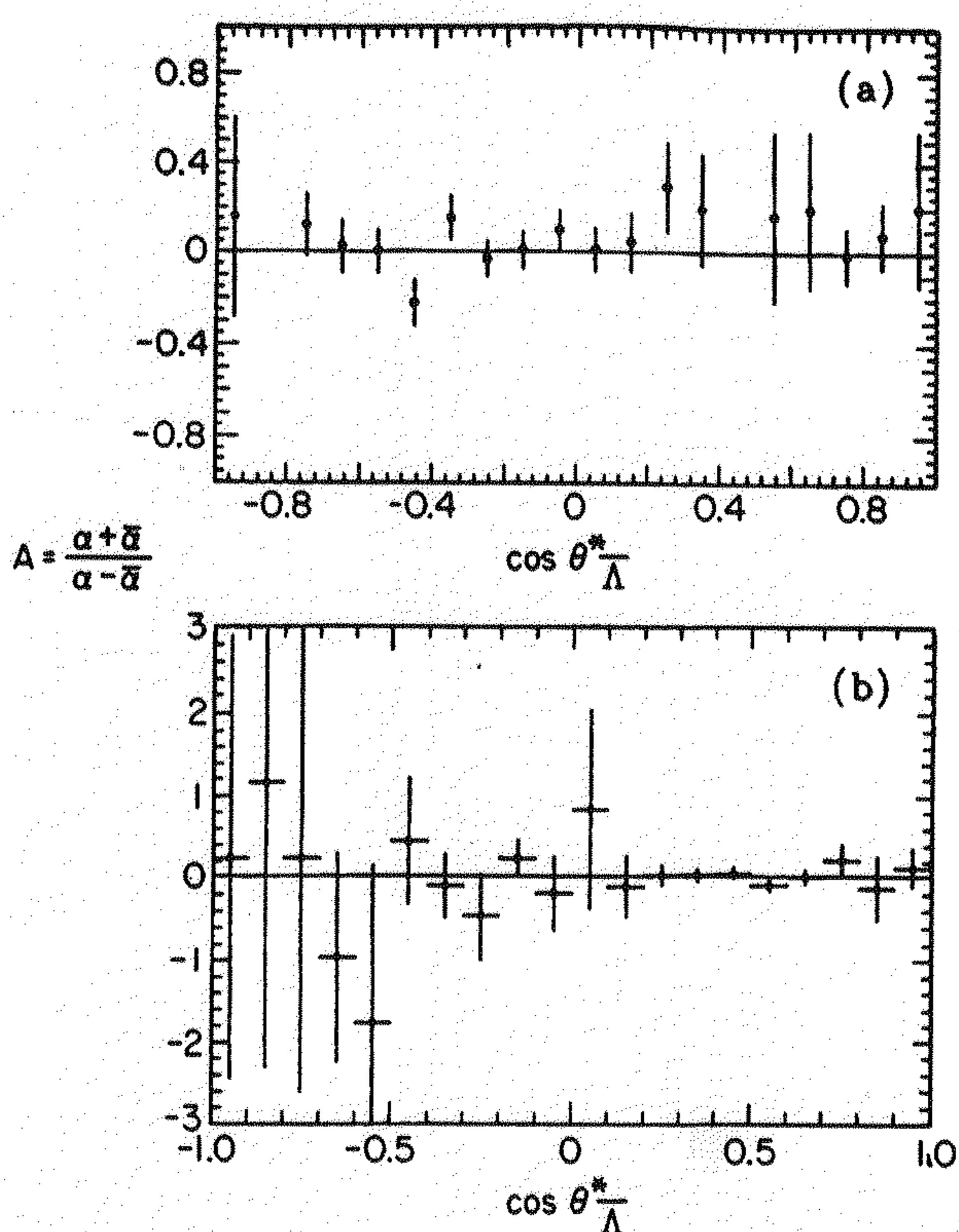


FIG. 7. Angular distributions of the ratio $A = \langle(\alpha+\overline{\alpha})\rangle / \langle(\alpha-\overline{\alpha})\rangle$. The top panel shows data at 1.642 GeV/c and the bottom one shows data at 1.918 GeV/c.

CP Reach in p pbar -> Λ Λ-bar

	L /cm^2/s	pbar/hr	tgt density A/cm^2	N_pbar/s	I_pbar mA	N_pbar	days @50%	events	CP reach
P859:	1.6E+32	5.8E+10	1.0E+14	1.6E+18	0.26	8.0E+11	88	2.3E+09	1.0E-04
	1.0E+33	3.6E+11	3.0E+14	3.3E+18	0.53	1.7E+12	365	5.9E+10	2.0E-05
xP859:		6.3						26	5.1

$\bar{p}$ source upgrade?

- Main injector $\rightarrow$ ~100 kW of 150-GeV beam on $\bar{p}$ production target from ~10 kW of 8-GeV Booster beam

- Proton source upgrade $\rightarrow$ 4 MW at 16 GeV proposed for a Muon Collider

- Neutrino Factory 6-month study: 1 MW at 16 GeV

$\Rightarrow$ **Is $\times$10 in $\bar{p}$/s feasible?**

"The Recycler changes everything!"

-J. Peoples

$\rightarrow$ **Who else would be a customer?**