

LBNL TPC R&D Studies

Mike Ronan

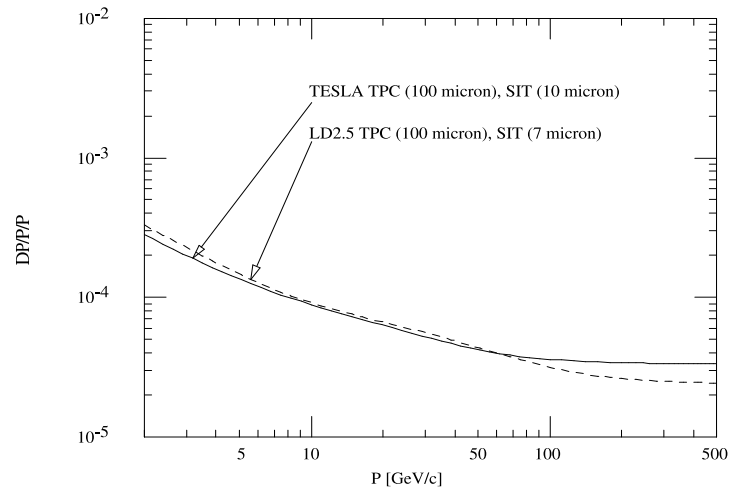
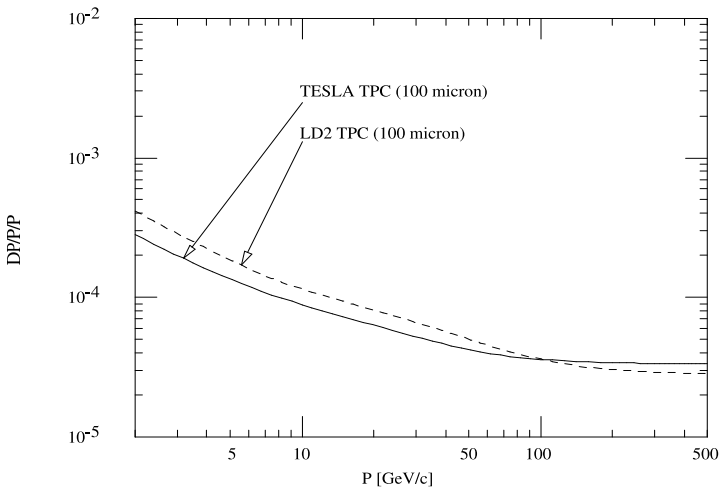
Lawrence Berkeley National Laboratory

Amsterdam 2003 ECFA/DESY Workshop

Outline

- LC-TPC Performance Studies
 - Tracking Resolution Studies
 - Background Studies
- TPC R&D Activities & Plans
 - MicroMEGAS-TPC R&D Studies
 - GEM-TPC R&D Studies
 - Generic TPC R&D Plans
 - JTPC R&D Planning
 - TPC R&D Software Developments
 - ...
- Time Projection Chamber Symposium
- TPC R&D Meeting
- Concluding Remarks
 - Interesting TPC R&D plans
 - Continuing TPC design studies

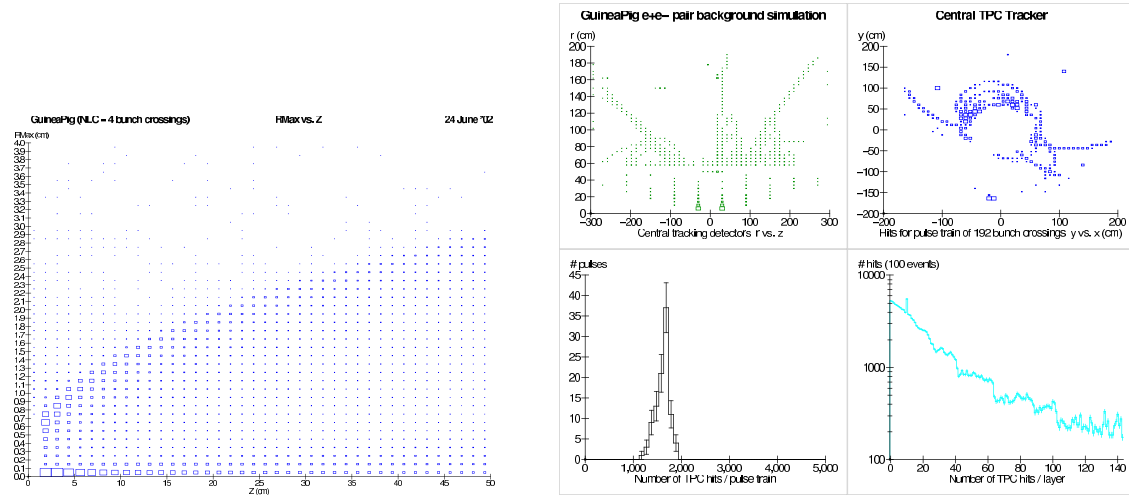
Comparison of American and TESLA TPC designs



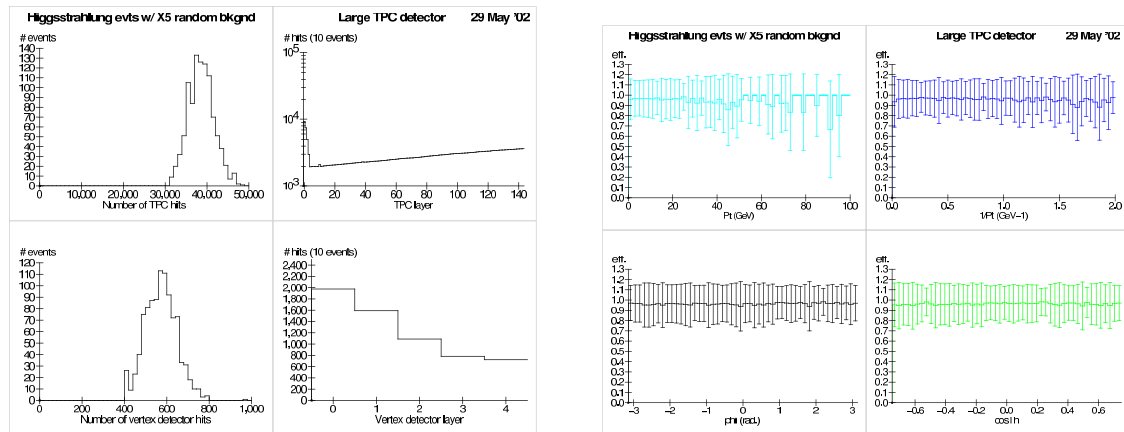
Momentum resolution (dp/p^2) vs. momentum (GeV)

a.) TESLA TPC has better low momentum resolution because of small inner radius and higher segmentation. b.) Here, the American TPC Detector design assumes the same anode pad size as in the TESLA TPC design.

Background Studies



(a) Position of maximum radius reached vs. z for all e^+e^- pair backgrounds; and (b) Background tracker hit distributions: r - z view of hits in central tracking detectors including TPC, intermediate tracker and forward disks, a x - y view of TPC hits only, number of TPC background hits / pulse train and number of hits at each layer of the TPC.



(a) Tracker hit distributions: number of TPC hits/event, TPC layer hit distribution for 10 events, number of Vertex detector hits/event, and Vertex detector layer hit distribution; and (b) Tracking efficiency vs. different kinematic variables: P_t (GeV), $1/P_t$ (GeV⁻¹), ϕ (radians) and $\cos(\theta)$ within central tracking region.

Generic TPC R&D Plans

LBNL, BNL

E. Anderssen, F. Bieser, M. Ronan, N. Smirnov, H. Wieman & C. Woody

Study TPC design options for a future Linear Collider (LC) and the Relativistic Heavy Ion Collider (RHIC)

- Work with new commercial GEM detectors.
- Learn how to fabricate MicroMEGAS type detectors.
- Build a mini-TPC for cosmic ray and beam tests.
- Develop common prototype tracking and analysis software.
- Use next generation Front-End (FEE) electronics and readout system.

Just-in-Time Projection Chamber Planning

LBNL, KEK, Tsukuba

E. Anderssen, F. Bieser, N. Khalatyan, T. Matsuda & M. Ronan

TPC with fast timing designed for warm machine and nano-second bunch spacing

Recent discussions at KEK and Arlington, Texas:

- Build a mini-JTPC for cosmic ray and beam tests.
- Work with American/Japanese industry to build GEM & MicroMEGAS type detectors.
- Develop common prototype tracking and analysis software.
- Use next generation Front-End (FEE) electronics and readout system.
- Study timing and positive ion feedback properties.

TPC R&D Software Development

MIDAS DAQ Software

LBL, U. Montreal, TRIUMF, Victoria

- Develop VxWorks microprocessor DAQ code
- Develop MIDAS TPC R&D online system

CLEO Tracking Software

LBL, Cornell

- Interface Cornell Tracking software to Java
- Interface LCD SIO files to FORTRAN commons

Time Projection Chamber Symposium



Date: Friday, 17 October 2003

Location: Lawrence Berkeley National Laboratory (LBNL)

Hosts: LBNL Physics and Nuclear Science Divisions,
and the U.S. Department of Energy (DOE)

Program Outline

Areas of TPC Applications

- **e+e- Annihilation Studies**
- **Heavy Ion Physics**
- **Double Beta Decay Experiments**
- **Neutrino Physics Experiments**
- **Rare Event Detection**

New Developments / Current R&D

- **Micro-Pattern Gas Detector (MPGD) Readout Technologies**
- **High-density, Low-mass Electronics**

New Ideas Forum

- **New Techniques**
- **New TPC Applications**

Linear Collider TPC R&D Meeting



Date: Saturday - Sunday, 18-19 October 2003

Location: Lawrence Berkeley National Laboratory (LBNL)

Host: LBNL Physics Division and the Department of Energy (DOE)

Organizing Committee

T. Matsuda, KEK
M. Ronan, LBNL
R. Settles, DESY/MPI

Concluding Remarks

- Interesting TPC R&D plans
 - Micropattern Gas Detectors(MPGD's)
 - Gas properties
 - Alternative readout schemes
 - High-density readout electronics
 - High magnetic field cosmic / beam testing

- Continuing TPC design studies
 - Required LC-TPC performance studies
 - U.S. reference designs
 - Machine background studies