

Beam-Diagnostic TPC (BDTPC)

Classification (subsystem)

Beam Diagnostics

Personnel and Institution(s) requesting funding

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Collaborators

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Project Leader

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Project Overview

Develop a new beam diagnostic tool based on a small Time Projection Chamber (Mini-TPC) for measuring beam tails. Comparisons between reconstructed background track origins and Monte Carlo beam-line simulations will provide insight on the size of beam tails and on resulting detector occupancies. Measurements made with different gases will provide sensitivity to different background sources, such as neutrons and heavily ionizing particles.

Broader Impact

A beam-diagnostic TPC tool could be used in many accelerator locations to study beam losses and the growth of beam tails. A reasonable goal would be to measure tails at the level of 10^{-3} to 10^{-4} ; that is, measure track backgrounds from the loss of 10^{6} to 10^7 beam particles for typical bunches with 10^{10} particles.

Results of Prior Research

Initial studies of Linear Collider detector backgrounds have been made, see [http://www-
ilc.lbl.gov/detector/talks/2005MDI-SLAC-BackgroundStudies.pdf](http://www-ilc.lbl.gov/detector/talks/2005MDI-SLAC-BackgroundStudies.pdf).

One of us (MTR) has had extensive experience in machine background simulations, operation of a high-rate TPC and detailed comparisons to Monte Carlo predictions, see above and “A mini-TPC for SLAC B-Factory Commissioning”, R. Cizeron et al, NIM A 419 (1998) 525, Proceedings of the Vienna Wire Chamber Conference, 1998, “Measurements of PEP-II Backgrounds with the Mini-TPC in the January 1998 Commissioning Run”, V.Lepeltier et al, BaBar Note #495, 28 May 1999, “Measurements of PEP-II Backgrounds with the Mini-TPC in the Autumn-Winter 1998-1999 Commissioning Run”, V.Lepeltier et al, BaBar Note #xxx, 10 Oct. 1999.

Facilities, Equipment and Other Resources

Existing TPC engineering designs will be used to specify the fabrication of a Mini-TPC for beam diagnostics. A commercial Micromegas mesh will be used for gas amplification. New highly-integrated front-end ALIRO electronics for the ALICE experiment at LHC will be used for analog and digital processing. A commercial VME read-out module (ROM), crate and power supplies will be purchased. Existing software tools will be used for data acquisition and analysis.

FY2005 Project Activities and Deliverables

A working Mini-TPC chamber will be run on cosmic ray tests.

FY2006 Project Activities and Deliverables

First beam testing of the Mini-TPC and preparations for beam diagnostic measurements.

FY2007 Project Activities and Deliverables

Detailed comparisons of Monte Carlo beam-line simulations and Mini-TPC measurements will be made.

Budget justification:

Lawrence Berkeley National Laboratory

LBNL will procure front-end and readout electronics for \$20K.

Indiana University will construct Mini-TPC chamber for \$10K.

Notre Dame University will assemble test apparatus \$15K.

Other miscellaneous expenses can be expected at a level not to exceed \$20K.

Three-year budget, in then-year K\$

Institution: Lawrence Berkeley National Laboratory

Item	FY2005	FY2006	FY2007	Total
Other Professionals	0	0	0	0
Graduate Students	0	0	0	0
Undergraduate Students	0	0	0	0
Total Salaries and Wages	0	0	0	0
Fringe Benefits	0	0	0	0
Total Salaries, Wages and Fringe Benefits	0	0	0	0
Equipment	20000	5000	5000	30000
Travel	0	0	0	0
Materials and Supplies	0	5000	5000	10000
Other direct costs	0	0	0	0
Institution 2 subcontract	10000	0	0	10000
Institution 3 subcontract	10000	5000	0	15000
Total direct costs	0	0	0	0
Indirect costs(1)	0	0	0	0
Total direct and indirect costs	50000	10000	5000	65000

(1) Includes xx% of first \$xx subcontract costs

Budget justification: Indiana University

Mini-TPC Chamber construction.

Three-year budget, in then-year K\$

Institution: Indiana University

Item	FY2005	FY2006	FY2007	Total
Other Professionals	0	0	0	0
Graduate Students	0	0	0	0
Undergraduate Students	0	0	0	0
Total Salaries and Wages	0	0	0	0
Fringe Benefits	0	0	0	0
Total Salaries, Wages and Fringe Benefits	0	0	0	0
Equipment	10000	0	0	10000
Travel	0	0	0	0
Materials and Supplies	0	0	0	0
Other direct costs	0	0	0	0
Total direct costs	0	0	0	0
Indirect costs	0	0	0	0
Total direct and indirect costs	10000	0	0	10000

Budget justification: Notre Dame University

Test apparatus.

Three-year budget, in then-year K\$**Institution:** Notre Dame University

Item	FY2005	FY2006	FY2007	Total
Other Professionals	0	0	0	0
Graduate Students	0	0	0	0
Undergraduate Students	0	0	0	0
Total Salaries and Wages	0	0	0	0
Fringe Benefits	0	0	0	0
Total Salaries, Wages and Fringe Benefits	0	0	0	0
Equipment	10000	5000	0	15000
Travel	0	0	0	0
Materials and Supplies	0	0	0	0
Other direct costs	0	0	0	0
Total direct costs	0	0	0	0
Indirect costs	0	0	0	0
Total direct and indirect costs	10000	5000	0	15000