APPENDIX A

DETECTOR COMPONENTS

This appendix is a compilation of descriptions, positions and dimensions of many of the apparati in the T-864 particle detector. While the units used in describing the apparati will vary as a function of convenience, the coordinate system used will be exclusively the standard tracking coordinate system described in Chapter 1.

A.1 The Multiple Wire Proportional Chambers

A MWPC, as shown in Fig. A-1, consists of 128 wires spaced 0.1" apart. The $20\mu m$ gold-plated tungsten wires are sandwiched between two 24.4 μm aluminized mylar planes (0.19" apart) with the intervening area filled with an "inert" gas (80% Argon, 20% CO_2). Inlets allow the gas to be refreshed and the pressure to be kept constant (at one atmosphere). The MWPC frames have a margin 0.75" wide, roughly 15" square, and are constructed of layers of G-10, mylar and wires cemented and bolted together with nylon nuts and bolts. High-voltage applied between the wires and aluminized-mylar planes sensitizes the wires to ionization produced in the gas by the passage of charged particles. Electronic readout of the current through these wires enables detection of one coordinate (the position parallel to the wire is known only to within the length of a wire—15*cm*) of a charged particle passing through the MWPC.

The positions of the MWPC planes constitute the most important factor in tracking. If they are not known to extreme precision, errors in the least-squares fit can become unacceptably large. Fortunately, the positions can be determined very accurately via software methods. One previously used method took thousands of one-track events from real data and simultaneously minimized the goodness of fit of these tracks by adjusting the positions of the MWPC's via a LSF. The current procedure, developed and employed by Dr. Jenkins of Case Western Reserve University, uses sets of four "perfect" chambers to adjust parameters of the other chambers based upon data from one-track events. The results for doing this to various sets of perfect chambers are averaged to obtain a good overall parameter set. To describe the position of each chamber, four parameters are needed: the (x,y,z) coordinate of the center of the *0th* wire (where the first sensitive wire is wire 1) on the chamber and the angle of rotation of the chamber counterclockwise (looking from C0) about this point. The chamber positions, as reported 3/19/95, are displayed in Table A-2 in units of radians and inches.

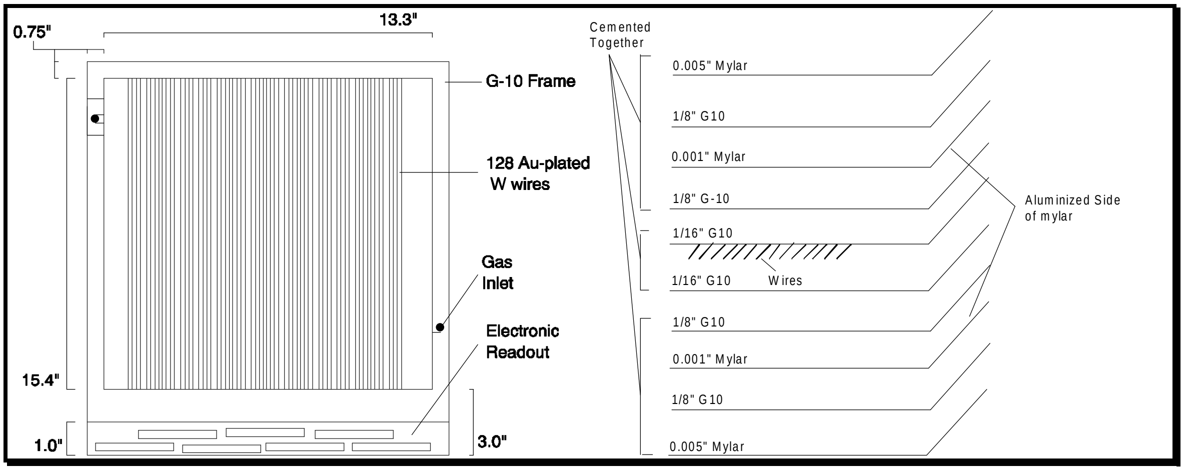

Figure A-1: MWPC Diagram

MWPC	Angle	X	Y	Z
1	-1.0477	3.23	11.849	132.65
2	-2.6107	11.972	9.215	136.53
3	-0.7886	1.675	11.045	140.65
4	-2.3572	10.755	10.889	144.53
5	-2.3554	10.506	11.239	163.59
6	-0.5289	1.152	9.405	167.59
7	-2.0917	10.552	11.886	171.59
8	0.7801	1.752	2.136	175.59
9	0.7874	1.68	2.368	194.53
10	-2.1169	10.376	12.193	198.41
11	-2.3591	11.156	11.49	202.28
12	0.5364	1.687	3.299	206.53
13	-2.3558	11.167	11.409	212.84
14	-2.5271	12.242	10.461	216.84
15	-2.358	12.24	11.516	221.09
16	0.9668	3.447	1.569	226.66
17	-2.3592	11.697	11.749	237.72
18	-2.2361	11.216	12.239	241.72
19	0.7847	2.616	2.686	245.84
20	-2.4771	12.387	11.188	249.72
21	-2.2556	11.497	12.241	256.15
22	0.7104	2.377	3.154	260.15
23	0.7801	2.779	2.82	264.4
24	0.7818	2.775	2.816	265.97

Table A-2: MWPC Positions

A.2 The Beam Pipe

The T-864 beam pipe, as displayed in Fig. 1-1, possesses two flares to minimize average particle interaction lengths. In Table A-3 the various parts of the TeV and the abort beam pipes are listed and their size and position are described; all units are in inches. The pipe diameter refers to the outer diameter of the pipe; the axis of the pipe refers to the offset from the beam axis in *(x,y)* at which the pipe segment is positioned. Pipe length describes the range of *z* over which the pipe exists and the thickness describes the thickness of the pipe.

Pipe	Axis of pipe		Pipe Length		Pipe
Diameter	X offset	Y Offset	From Z	To Z	Thickness
6	-1	1	-199.75	-60	0.0625
10	0	0	-60	40	0.25
20	3	3	40	120	0.25
2	0	0	120	140.375	0.03
2.5	0	0	140.375	170.375	0.03
3	0	0	170.375	200.375	0.03
3.5	0	0	200.375	230.375	0.03
4	0	0	230.375	260.275	0.03
2	0	0	260.375	307	0.03
2.5	-3.264	1.088	120	307	0.03

Table A-3: Beam pipe Segments

The various flanges, windows and holes are an integral part of the beam pipe. These sections hold all of the segments together in addition to providing additional material through which particles must pass. The positions of these objects, their inner and outer diameter and the *(x,y)* positions of their centers and their thicknesses are detailed in Table A-4.

	Diameter			Axis Offset		
Z Position	Inner	Outer	Thickness	X	Y	Description
-60	0	10	0.25	0	0	Plate connecting 10"-6" pipes
-60	0	6		-1	1	Hole for the 6" pipe
40	0	20	0.375	3	3	Plate connecting 10"-20" pipes
40	0	10		0	0	Hole for the 10" pipe
120	0	20	0.375	3	3	Plate connecting 10"-2" pipes
120	0	2		0	0	Hole for 2" TeV pipe
120	0	9	0.125	0.8891	0.8891	"The Window"
120	0	2		-3.264	1.088	Hole for the Abort pipe
140.375	2	2.5	0.03	0	0	30 degree flare from 2.5" - 3.0" pipes
170.375	2.5	3	0.03	0	0	30 degree flare from 2.5" - 3.0" pipes
200.375	3	3.5	0.03	0	0	30 degree flare from 3.0" - 3.5" pipes
230.375	3.5	4	0.03	0	0	30 degree flare from 3.5" - 4.0" pipes
260.375	2	4	0.03	0	0	30 degree flare from 4.0" - 2.0" pipes

Table A-4: Flanges, Holes and Windows

A.3 The Scintillator and Electromagnetic Calorimeter

The scintillation counters are approximately 0.5" thick plastic light guides located at various places throughout the detector. Their primary purposes are to measure the activity of an event in terms of energy deposition and to gather timing information. Because each scintillator slab consists of only a couple of large pixels, the information is not relevant to tracking; however, the fast response time of the counters makes them ideal for the basis of a trigger. The energy readout combined with timing information can be used to differentiate between high- and low-occupancy events as well as beam-gas, beam-halo, and beam-beam events. Various scintillator counters (nicknamed the alphabet counters) are positioned as shown in Table A-5. The *(x,y)* coordinate represents the center of the counter and the angle is the rotation counter-clockwise off the horizontal. All measurements are in inches. The "Pbar" counter is made up of eight small counters (each 6" wide) that are positioned so as to fully encircle and touch the 6" beam pipe. The position of PbC is also indicated in the following table for lack of a better place to describe it.

Position of Scintillator						
X	Y	Z	Angle	Width	Height	Name
3.75	-3.75	122.05	0 deg	5.5	5.5	A
5.03937	10.68898	180.315	45 deg	16	8	B
10.68898	5.03937	180.315	45 deg	16	8	B
5.129921	10.77953	189.3701	45 deg	16	8	C
10.77953	5.129921	189.3701	45 deg	16	8	C
6.669291	11.05118	280.315	41.7 deg	16	8	D
11.98819	5.330709	280.315	41.7 deg	16	8	D
-12.2047	-4.01575	322.0472	0 deg	12.99213	12.99213	Tiny
		-81.1024				PBar
5.38	5.5	184.8		5.5	5.5	PbC

Table A-5: Scintillator and PbC Position

The electromagnetic calorimeter consists of 12 “gamma counters” contributed by The University of Michigan and 20 calorimeters donated by Wayne State University. The Michigan calorimeters are each 3.8” square and about 25.5” long (including the phototube). They consist of 30 slices each of 4.88*mm* Pb and 6*mm* scintillator—27.2 radiation lengths thick in all. The WSU counters are 2” square and about 11.8” long (without the phototube).

These counters are positioned in two stacks. The main stack consists of sixteen WSU counters piled in a 4x4 array with the twelve Michigan counters surrounding them. This whole configuration is tipped at a 44.5^{o} angle to match the chambers, etc. The front face of the stack is at z=282”. The standard numbering of the counters and their relative positions is shown in Fig. A-6. Another stack of four WSU counters is placed beneath the beam pipe at z=272.5”.

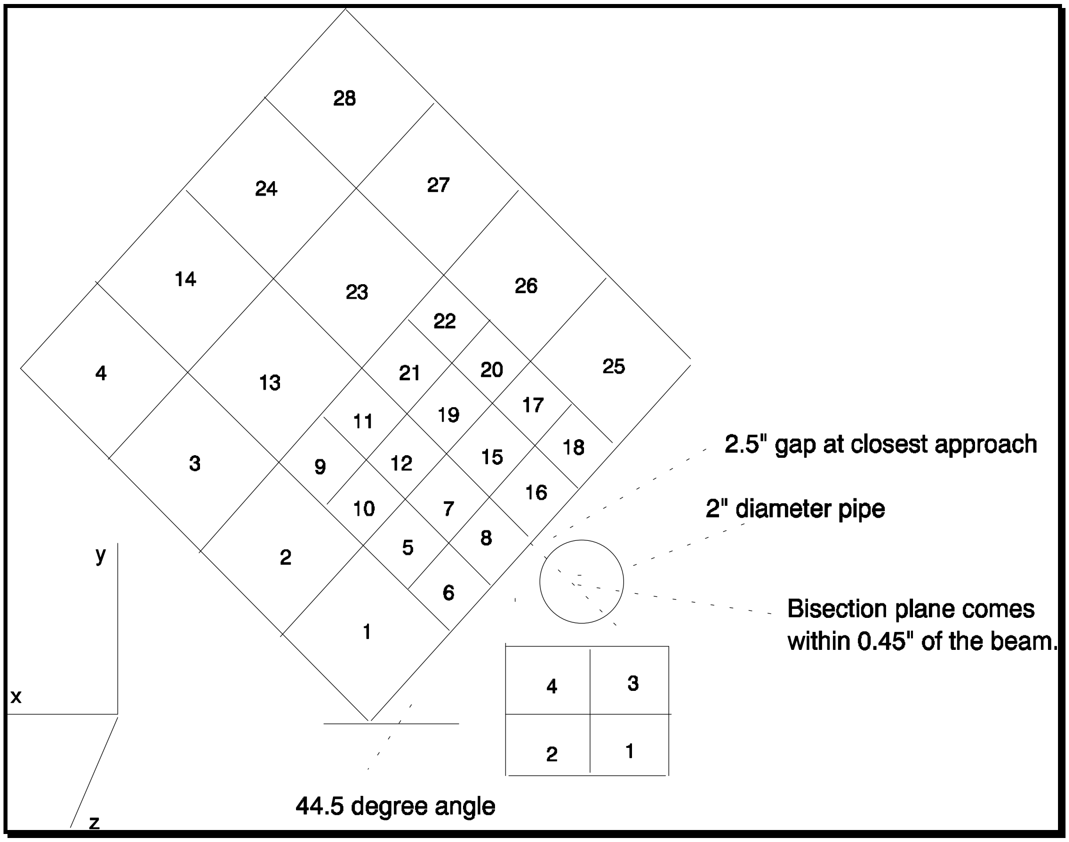

Fig. A-6: Ecal Diagram