Discussion for the LP endplate

D. P. Peterson       Cornell University, Laboratory for Accelerator-based ScienceS and Education

See also:  http://w4.lns.cornell.edu/~dpp/linearCollider/LargePrototype.html

This project is supported by
the US National Science Foundation (LEPP cooperative agreement)
and an LCDRD consortium grant
Changed to 9.4mm to center band 5 at 28.0mm.
Endplate/band geometry (3GEM+G) 2007-10-21

3mm stay clear

D. Peterson, “LC-TPC LP endplate”, LC-TPC group meeting at ALCPG07, 21-October-2007
Changed to 3.2 mm board
Endplates drawings were prepared for sending to vendors and preliminary quotes 2007-10-19.

Missing:
- gas holes
- skirt holes
- fun holes

The missing items will not significantly affect evaluation by potential vendors.
Endplate Drawings, 2007-10-20

Technical questions, including clarifications and proposals for exceptions, are to be directed to:
Dan Peterson
Senior Physicist, Laboratory for Elementary Particle Physics, Cornell University
607-255-8784
dpp@lepp.cornell.edu

D. Peterson, “LC-TPC LP endplate”, LC-TPC group meeting at ALCPG07, 21-October-2007
This sheet shows profile dimensions. "Outside", "Inside", and "Profile" views are shown.
Specification for holes in the flange area.

Dowel holes 'B' have tolerance +/- 0.002 inch within a frame defined by the hole locations B1, B11, B21, B31.
NOTE: This is the Bounding Box. It is not a part for construction. It is an abstract geometrical shape, located on the Endplate, within which the module and all mountings for the module are defined.

* This dimensions includes the encapsulation case, offset of the radii of curvature needed to keep the model adaptive.

D. Peterson, “LC-TPC LP endplate”, LC-TPC group meeting at ALCPG07, 21-October-2007
This shows the locations of seven (7) replications of the Bounding Box on the Endplate.
This shows the details of features that are placed within each Bounding Box.
This sheet shows dowel holes that are defined within the Bounding Box. Global locations are shown here for reference and certification measurements.

Dowel hole locations and cut-out features have tolerance +/- 0.001 inch within the Bounding Box.
Dowel hole locations have tolerance +/- 0.002 within a frame defined by holes B1, B11, B21, B31.
Note: This sheet shows certification measurements. These measurements are locally defined within the Bounding Box.

SCALE 1:1
OUTSIDE

Dowel hole locations and cut-out features have tolerance ±0.001 inch within the Bounding Box. Dowel hole locations have tolerance ±0.002 within a frame defined by holes B1, B11, B21, B31.

SCALE 1:1
INSIDE
While the endplate drawings are being sent to outside vendors, a series of module back-frames will be made in the Cornell shop.

a total of 4 back-frames,

2 for Micromegas, pad board 3.2mm,

2 for GEM

I need up-to-date information on the need of GEM. Currently I planned for 18mm of material: 2mm pad board, 3x 2mm GEM, 10mm Gate. In the absence of firm numbers, I am producing back-frames for 8mm material. (They can be re-machined, but they may warp.)

This will be the full process:
75μm oversize
liquid N₂ stress relief
25μm oversize
liquid N₂ stress relief
final cut
Endplate Drawings, 2007-10-20

D. Peterson, "LC-TPC LP endplate", LC-TPC group meeting at ALCPG07, 21-October-2007
Stress relief test piece

This shows the first in a series of “stress relief test pieces”.

This has been cut with a center opening of 30cm wide. The “mullions” are the same size as proposed in the endplate drawing: 18mm at the widest width, 14mm in depth.

This is the first baseline part, with no stress relief.

It has been fully measured on a CMM. The mullion position is distorted upward by 500μm (0.020inch).

The part was revised to have the strengthening section as shown in the current endplate.
Stress relief test piece

A close-up of the part shown in the previous slide.
Motivation:
A position tolerance of $<25\mu m$ is needed for the modules to decouple the calibration of the magnetic field from the position calibration of the modules.

I am trying to provide, at delivery, $<25\mu m$ position tolerance of the mullions. The endplate will then be evaluated after some service time to determine the ability to maintain this tolerance.

The program:
6 plates are being made to the revised drawing. A multi-step production is used:
1) machine to 1000 $\mu m$ oversize
2) machine to 750 $\mu m$ oversize,
3) stress relief
4) machine to 250 $\mu m$ oversize,
5) stress relief
6) machine to drawing dimensions

Stress relief processes:
2 plates - (3)heat to 325F, (5)heat to 650F
2 plates - rapid cooling to liquid $N_2$
2 plates - ultrasonic cleaner, 6 hours
Coordinate Measuring machine (CMM), 2007-05-25

D. Peterson, “LC-TPC LP endplate”, LC-TPC group meeting at ALCPG07, 21-October-2007
Example of measurement after the 2nd machining.

Units are milli-inch.
0.001 inch = 25.5 μm

This is the Z view.

There is a 30 μm bowing in z-x.

There is a twist about x from left to right of 25 μm.
Example of measurement after the 2\textsuperscript{nd} machining.

Units are milli-inch.
0.001 inch = 25.5 \(\mu\text{m}\)

This is the y view.

There is a 30 \(\mu\text{m}\) bowing in y of the indicated mullion.
Endplate loading 2007-08-17

A test piece was loaded with 5 kg, 2.6 millibar

The center of the longest span deflected by 7 μm.
Gas Seal test, 2007-08-21

Test of the o-ring seal.

It can be mounted either way.

- model of mullion
- back-frame
- clamping bracket

2007-08-21

improved box seal
improved module seal
test of blank plate

D. Peterson, “LC-TPC LP endplate”, LC-TPC group meeting at ALCPG07, 21-October-2007
After 1 week, pressure changed from 20.1 inch water (~40 millibar) to 13 inch water

Calculate: leak rate through module seal = 0.13 cc/hour

(After another 8 weeks, the pressure has dropped to ~ 8 inch water, a much lower leak rate. The seal does not require pressure.)
Bolt size: (I propose 8mm, DESY proposes 5mm)

The proposed self tapping insert will require more
a larger insert hole, limiting mounting screws to 5mm.

I have ordered parts, as used in the gas seal test,
with (5mm x 0.8mm) and (6mm x 1mm) threads.
Tests of torque to make the seal will follow.
decisions

O-rings

4 surface contact

2 surface contact

Figure 1.1  How an O ring works. (a) As installed. (b) Under pressure. (From The Parker O-Ring Handbook, courtesy of Parker Seal Group.)
schedule

I will know more about the schedule after first discussions with vendors.