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CRACK PARAMETERS

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One of the important variables in the design of the end cap calorimeter is the number of angular divisions that should be made in the face of the calorimeter array. While it would be ideal to have no such divisions, they are unavoidable because the maximum size for uranium sheets is less than the diameter of the array. These divisions create regions which are either partially or totally devoid of absorber and readout. It is the purpose of this note to analyze the effects of different parameters on the size of these cracks.

This analysis assumes wedge shaped structures of significant depth(i.e. > 20% of the total depth). For such modules there are five variables which affect the size of a crack. They are:

- 1.The clearance between modules. The extent to which the module wall and the array extend into this region depends on the tolerances on the manufacture of the module. All of the module construction techniques currently under consideration have very tight tolerances (e.g. 2 mils). Therefore, this region is assumed to be void of solid material. In the C.C this region is thought to be .090 inches wide.

- 2.The thickness of the module walls. The wall thickness depends on which module is discussed. Design thicknesses range from .078 inches in the C.C. modules to .150 inches in the E.C leakage modules. Because tight tolerances are assumed on the construction of the modules the skin is assumed to be perfectly flat.

- 3.The dimension tolerance on the uranium width. The effect of the dimension tolerance varies depending on the location of the module. Modules near the 3 o'clock and 9 o'clock position will see a gray zone equal to the dimension tolerance at the top of each module. There will be a solid black zone at the bottom of each module. This results from gravity pulling the uranium plates down to touch the lower wall of the module. Modules near the 6 o'clock and 12

o'clock region will see a gray zone equal to the dimension tolerance at both edges of a module since there are no plans for a mechanism to insure their alignment along one wall.

4.The straightness tolerance on the plate edges. The straightness tolerance creates a gray zone equal to its width along each side of a module.

5.The region of reduced signal pickup. The extent of this region is not yet well understood. The current design requires an area along the edge of the module which does not have resistive coat. The width of this region has not been determined. Some portion of this region should still collect all of the signal. The size of this region is not known, either.

As an example we can use the tolerances currently achieved for the Harvard plates at Rocky Flats. The width tolerance requested was +0.000, -0.020 inches. Rocky Flats is delivering plates with a width tolerance of +0.000, -0.040 inch. There is no tolerance on the straightness of the datum edge. If we assume that .010 inch of the .040 inch tolerance is do to straightness variation then we can determine the crack sizes for a C.C. E.M. module.

The gray area is the sum of:

1.The intermodular clear space	.090 inch
2.The module walls	.156 inch
3.The width tolerance	.060 inch
4.The straightness tolerance	.020 inch
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5.Total	.326 inch

This is .070 inches less than the crack modeled in Raja's Monte Carlos.

Preliminary Data on 1.7% Ni Plates

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Introduction

On October 11, 1985 Fermilab received twelve plates from the rolling mill at Rocky Flats, Colorado. The plates were sheared 24in.x24in. and were rolled to three thicknesses. Five of the plates were nominally 1.5mm thick, three were 2mm, and four were 5mm thick.

Surface Quality

All of the plates showed some degree of oxidation. Most showed some iridescence though some had turned gray black. All of the plates showed some pitting. Some pits were over .030in. deep. The extent of the pitting varied from small sections to entire plates. Flaking was also noted on some plates. In general the surface quality was worse than that seen on pure DU plates.

Edges

Seven of the plates displayed cracking at the edges. the cracking varied in length, depth, and attitude. Some cracks were very thin, did not extend through the thickness of the plate, and did not extend away from the edge very far. Other cracks were wide enough to see through, extended at shallow angles from the surface through the plate, and ran several inches from the edge. Nothing of this sort has been seen in pure DU plate.

The shearing of the edges was of inferior quality. While the edges were very square (Maximum deviation from a square corner was $.2^\circ$), the tolerance on the length of the sides was $\pm 1/8$ in. The tolerance seemed independent of thickness, at least over this range of thicknesses. Also many edges had a large bur.

Thickness

Thickness variations were pronounced for most of the plates. The thickness varied more than .007in. for most of the plates. The absolute variation was the same for all three thicknesses. No improvement was seen with increasing plate thickness. Also, the 1.5mm plates are consistently thinner in one direction. Only two plates are within a $\pm .003$ in. tolerance.

Flatness

All of the plates are warped. The extent of warping appears to be independent of thickness. The average plate has a warp of .3in. The worst plate is a 5mm plate with a .949in. warp. No attempt has been made to measure the wave length of the warping. Most of the warps are two dimensional. The worst pure DU plate we have is better than the best 1.7% Ni plate.

Conclusions

This material is terrible.