



**Particle Physics Division
Mechanical Department Engineering Note**

Number: MD-ENG-190

Date: 24 June 2009

Project Internal Reference: none.

Project: NOvA FHEP

Title: Bookend Drilling for FHEP Strain gauge installation

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Reviewer(s):

Key Words: FHEP, Bookend, Strain gauge

Applicable Codes: none

Abstract Summary:

Plan is to install strain gauges or dial indicators on the FHEP vertical modules for measuring strain or deflection of the FHEP vertical modules after filling. These measurements will be compared to the FEA results created by Ang Lee.

All Holes $\frac{3}{8}$ " \varnothing

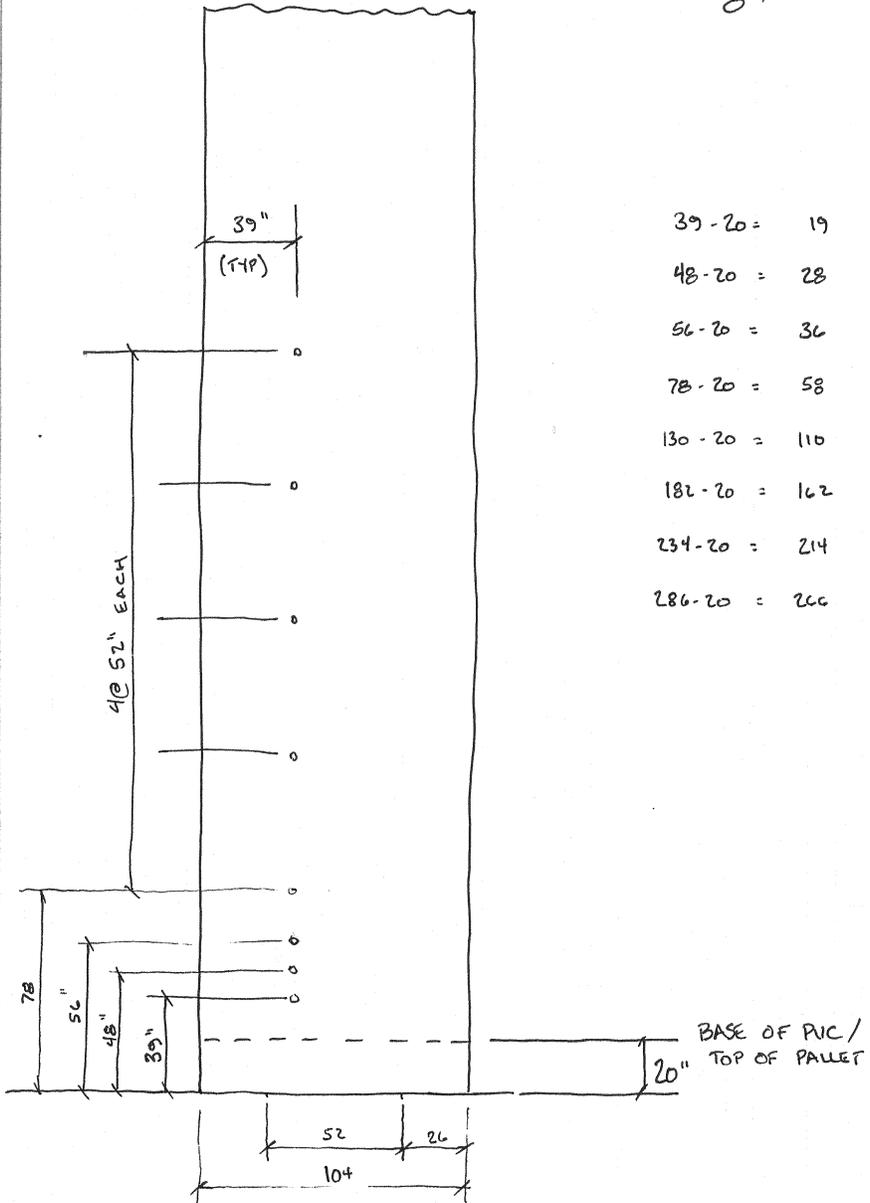
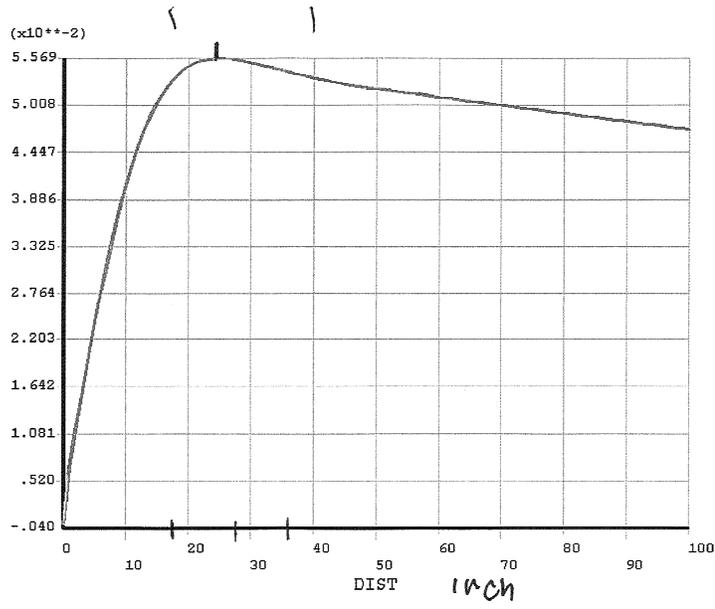


Figure 1, Hole locations

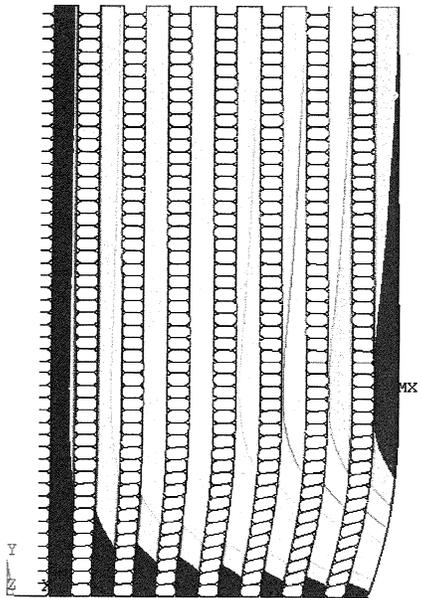
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side/web=4.5mm/3 mm for verticalonly ,e=146000 MPa

Amc Lee's Plot of Vertical Cell
Deflection AS A FUNCTION OF
HEIGHT.

Figure 2, Deflection as a function of distance up from the bottom of a vertical module.



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09:36:45
NODAL SOLUTION
STEP=1
SUB =1
TIME=1
UX          (AVG)
RSYS=0
PowerGraphics
EFACET=1
AVRES=Mat
DMX =.473804
SMN =-.001706
SMX =.055705
█          -.001706
█          .004673
█          .011052
█          .017431
█          .02381
█          .030189
█          .036568
█          .042947
█          .049326
█          .055705

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side/web=4.5mm/3 mm for verticalonly ,e=146000 MPa

Figure 3, Excerpt of Ang's Solid Model Results