

Current Problems and Issues with Black Body Load

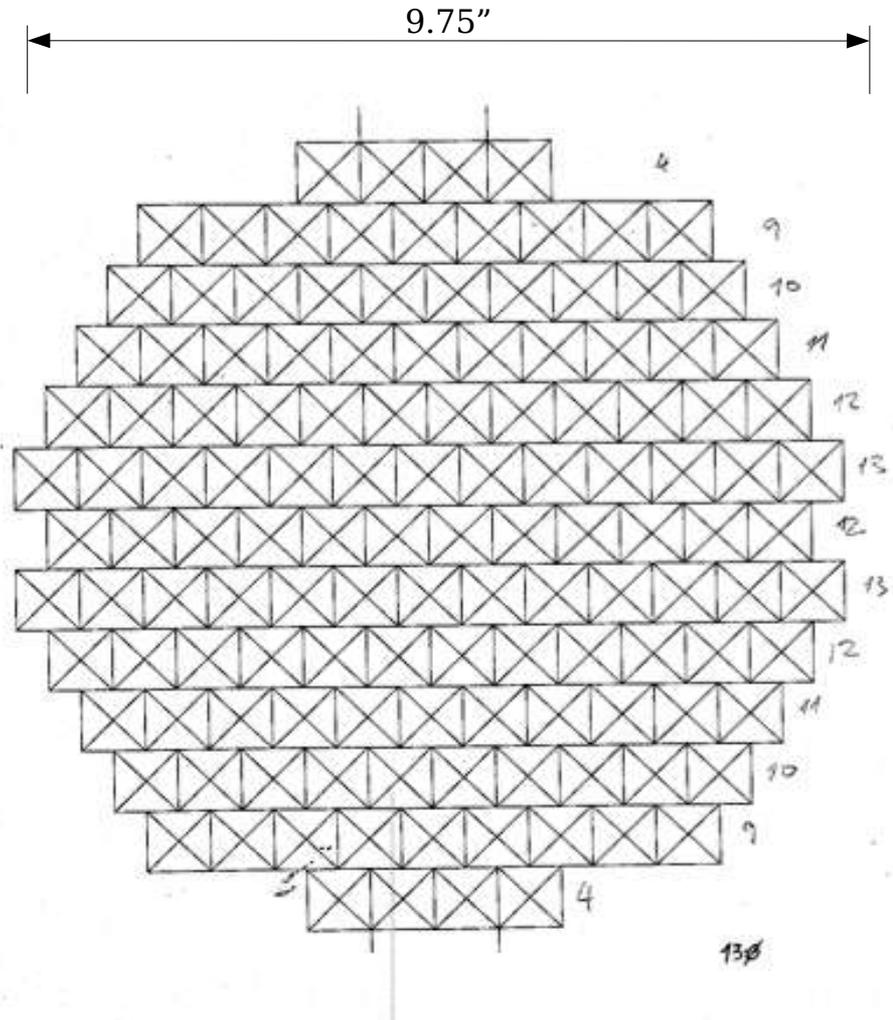
- Summary of current design and flaws (pages 2 ,3,4)
- Cool Down Results from various attempts at improving the performance (pages 5,6)
- Consultation with Michele Limon
- Sent request to purchase/borrow Black Body from the UK. Emailed John Spencer of the STFC/ Rutherford Appleton Laboratory, but have not heard reply.
- Cold Head has trouble starting. It has to be sent back for repair.
- A new approach for making the black body (page 7).
- New Schedule (page 8)

Black Body Absorber Parameters

<u>Style</u>	<u>Comment</u>
Eccosorb CR-112	Follows Arcade-1 recipe*
Basic Unit Shape	Pyramidal Array
Pyramid Base Dimension	0.75" x 0.75"
Pyramid Height Dimension	2.25"

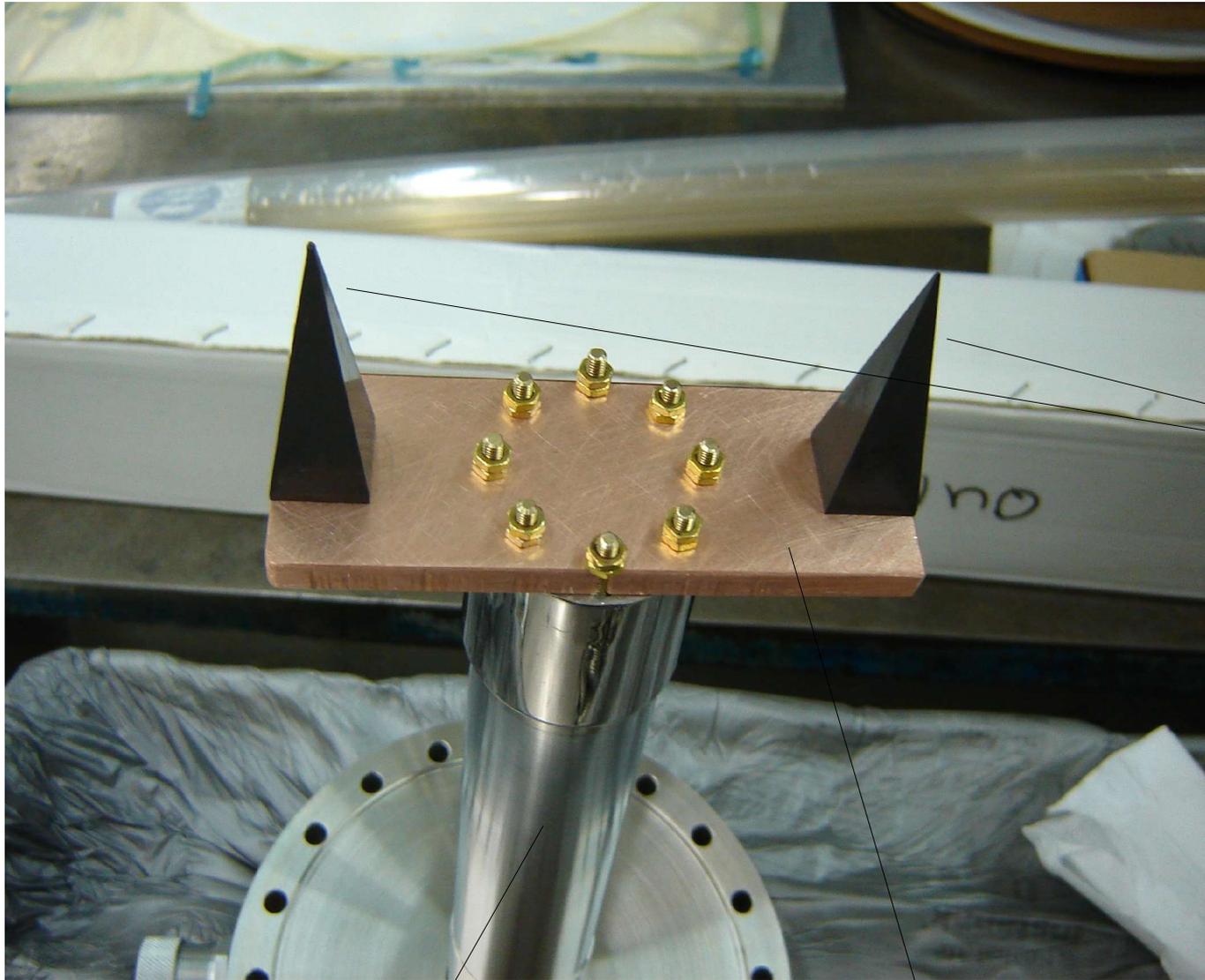


Pyramid Unit Shown with Thermometer



* Kogut, et al, Rev of Scien Instruments, Volume 75, N12, Dec 2004

Test Configuration for Commissioning of Cryocooler



Two Eccosorb CR-112
Pyramids
(including temperature
monitoring)

OFE Copper

Cold Head

Problems Encountered in test configuration

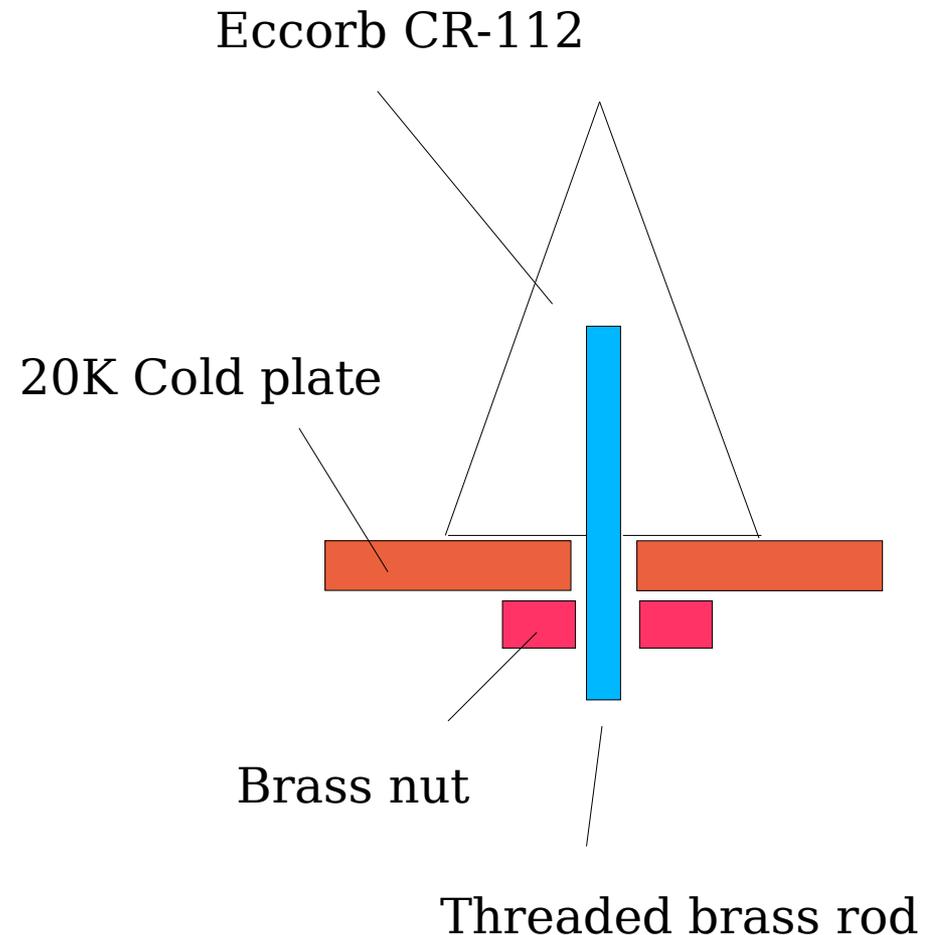
Cold-head easily reach 20K, but
pyramid core (near tip) reaches
only ~ 70K

Eccosorb CR-112 has low
thermal conductivity. I
didn't account for this.

Design flaw in current pyramid

Annoying problem with
thermometer mechanical
connection to black body

Debugging takes a long time
(2 cool downs per week)

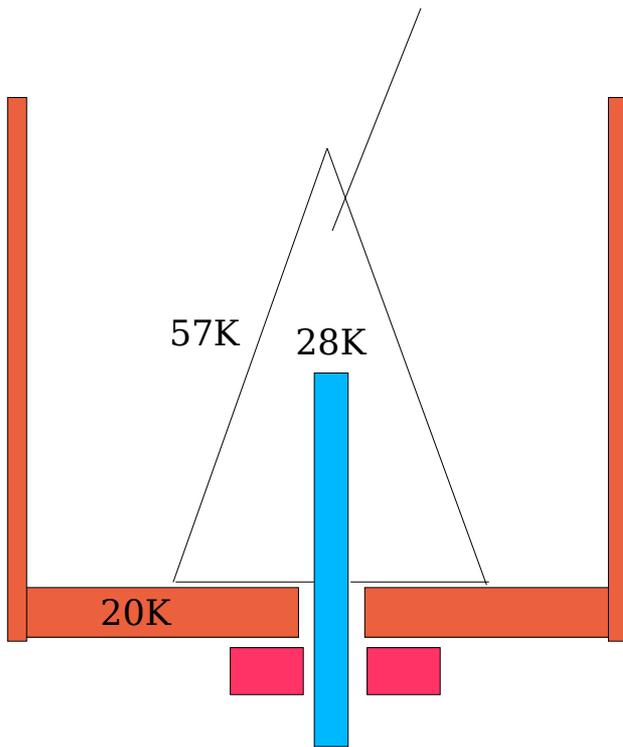


Flaw: Heat flows from brass rod to brass nut to
20K cold plate. Brass rod doesn't get cold
enough.

Brass rod doesn't extend far enough into tip

Attempts to Modify the Design

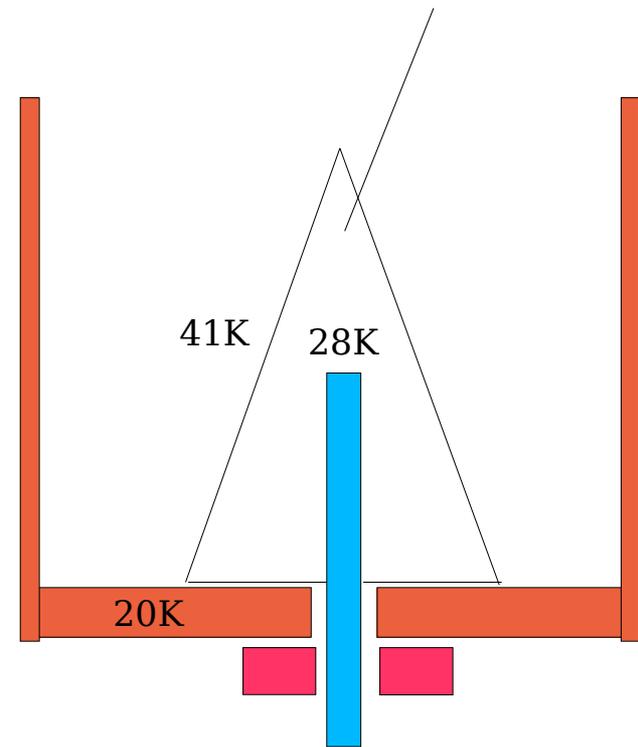
Eccosorb CR-112 pyramid (standard config)



Brass Rod and Nut soldered to the cold-plate. Brass rod is CASTED into the Eccosorb CR112

Test 1

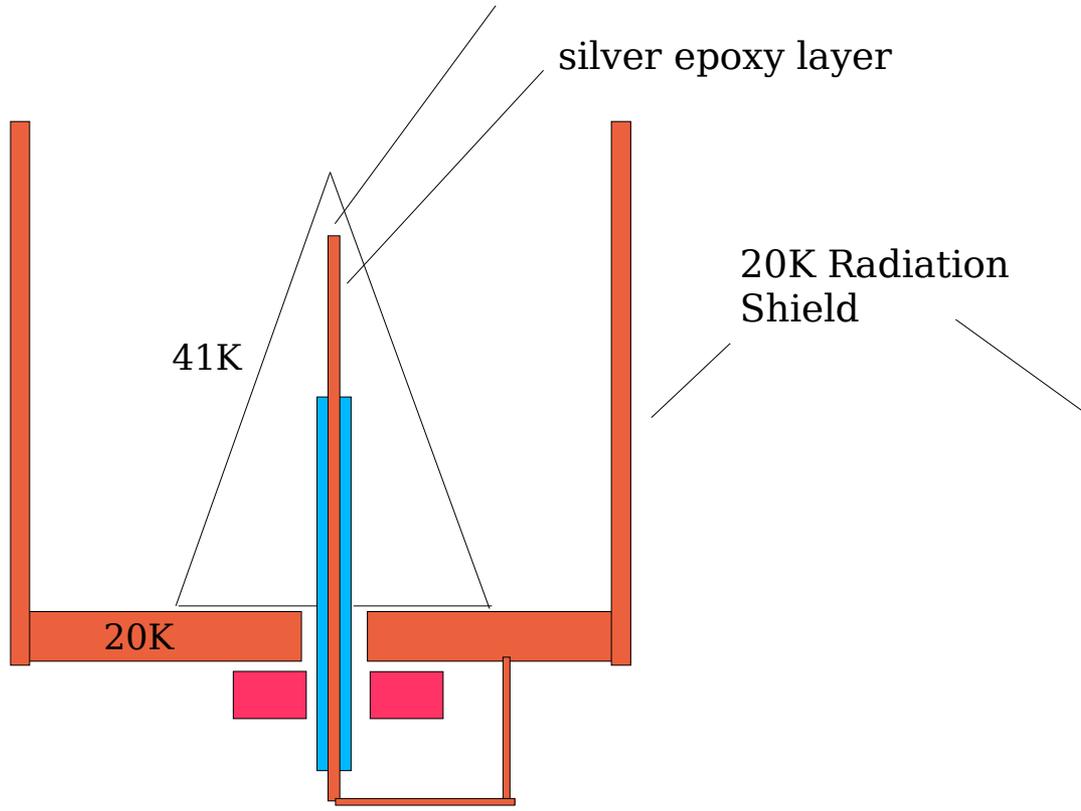
Aluminum pyramid



Brass Rod and Nut soldered to the cold-plate. Brass rod THREADED in Aluminum pyramid.

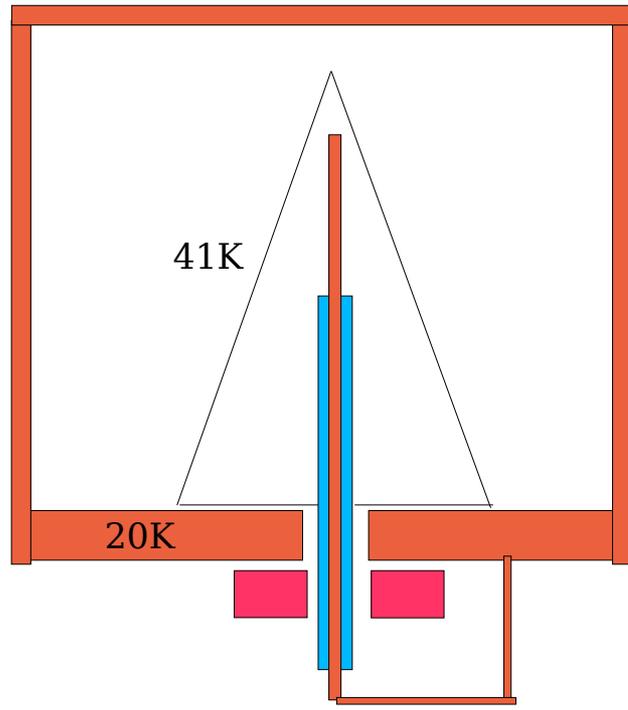
Test 2

Eccosorb CR-112 pyramid with **Copper Root Canal**



Copper root canal is soldered to cold head

Attempts to Modify the Design



Copper root canal is soldered to cold head

This configuration achieves the best result.

However, we are unsure if we can get a consistently good wetting of silver epoxy for all pyramids

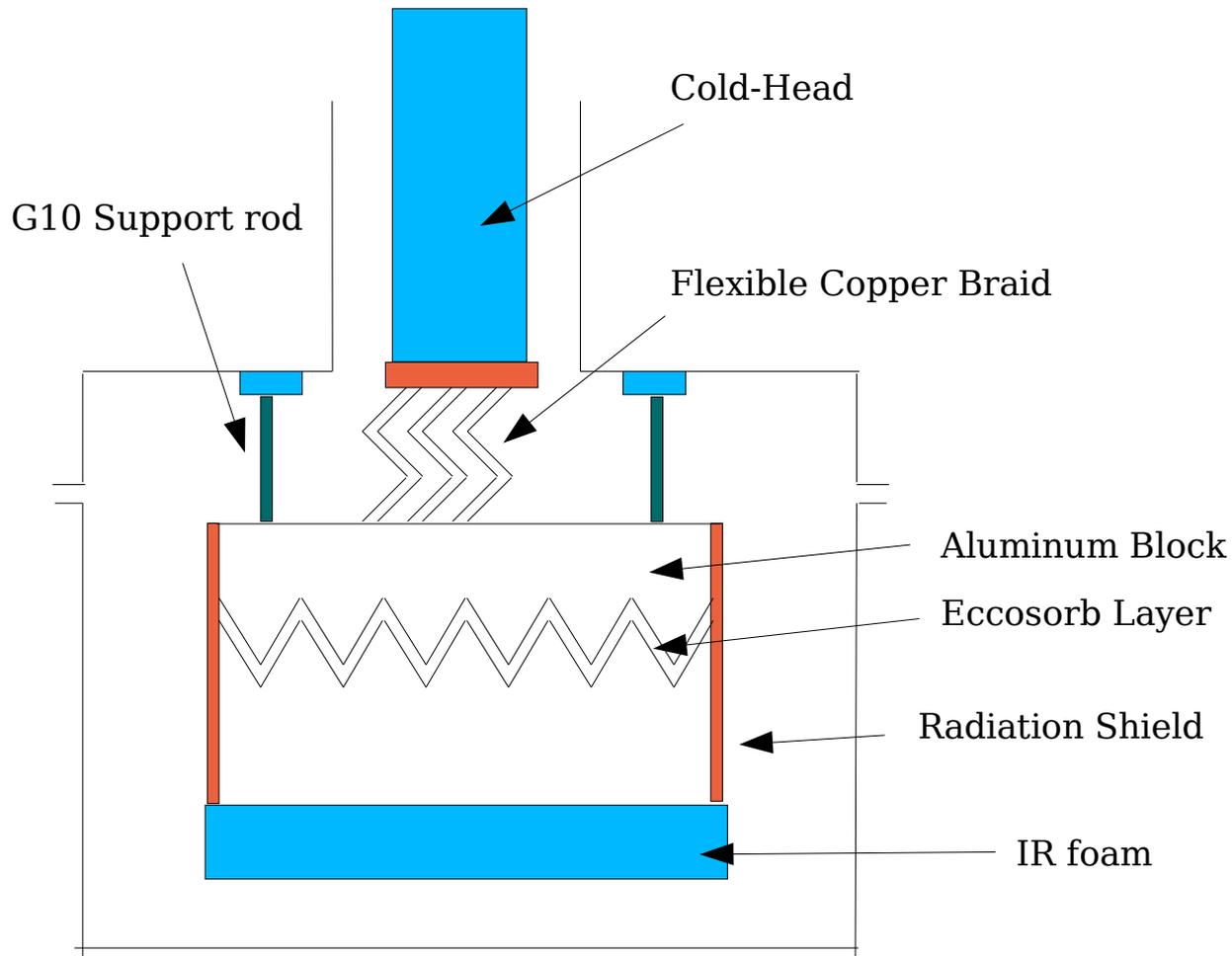
Test 3

With radiation shield totally enclosing the pyramid, we are still getting 41K.

This is very puzzling.

Test 4

Version 2
Dec-15-2008



New Design

Black Body will **machined** from a single block of Aluminum

Then coated with a thin Eccosorb-layer

Expected <1K temperature uniformity

New Schedule

Who	Step	When	Purpose
Butler	Perform another cool down with two pyramids totally enclosed by radiation shield, no foam	Dec 17-19	To prove that pyramid can get cooled to 20K if totally surrounded by 20K shield
Butler	Return Cold Head to Vendor for Repair	December	Cold head has trouble starting
Butler/Russ	Specify and Order Copper Braids	Dec 17-19	
Butler	Complete braided thermal link with cold head bolt pattern. Make support rods.	January	
Butler/Russ	Cool Down with 10" Diameter, 2.5" thick Uncut Aluminum Block, with cold shield, no foam	January	To prove that aluminum block gets sufficiently cold
Korienek	Prototype cutting 2.5" block aluminum array of 4 pyramids	January	To prove new technique for cutting pyramid pattern
Butler	Cast Eccosorb (or Steelcast) onto 4 pyramid array	January	To practice casting technique
Korienek	Cut pyramid pattern into 10" diameter Aluminum Block	January - February	
Korienek	Cut Down 4 pyramid Eccosorb-Aluminum array	February	To practice technique for cutting pyramid pattern in Eccosorb
Butler	Cool Down 10" Diameter Cut Aluminum disk	February	To verify Aluminum disk temperature before final casting.
Butler	Cast Eccosorb (or Steelcast) onto 10" diameter disk	February	
Korienek	Cut Down 10" Eccosorb-Aluminum disk	March	
Butler	Cool downs with final Eccosorb-Aluminum disk	March	