

# ***Fabrication Status of 57 MHz RFQ Prototype***

***Presented by: Sushil Sharma***  
*7/21/04*

*ANL Team:*  
*P. Ostroumov, N.E. Vinogradov*

*A. Barcikowski, F. DePaola, B. Rusthoven, S. Sharma*  
*H. Friedsam, W. Jansma*  
*W. Toter*

*and*  
*J. Rathke (AES), D. Schrage (LANL)*

**ARGONNE**  
NATIONAL LABORATORY



United States  
Department of Energy

The University of Chicago

ENTRANCE

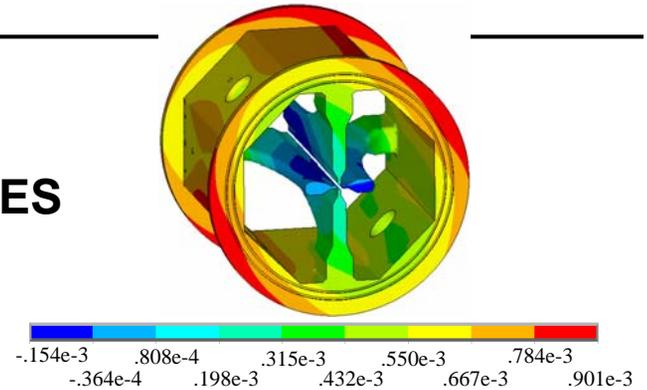
**Argonne National Laboratory**  
Operated by The University of Chicago  
for the U.S. Department of Energy



# Background

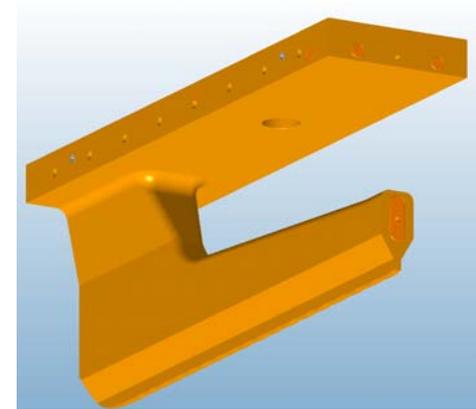
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- Detailed design drawings were developed based on a conceptual mechanical design by AES



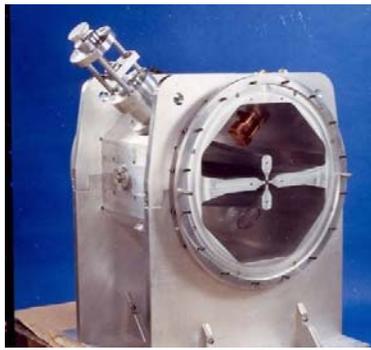
- Main design features:

- 4 vanes with large cut out – cooling, mechanical stability and alignment issues
- Large transverse dimension (0.51 m) – brazing issues
- Vane undulations – machining and tolerance issues



# Preliminary Fabrication & Testing

- An aluminum model was built to verify overall dimensions and tuning range.
- An OFE copper vane was fabricated to evaluate machining tolerances, brazing and gravity deflection. Vane undulations were machined
- Copper was tested for its oxygen content and blister tests were performed.
- Several braze samples were prepared to verify braze joints



Cold Al Model



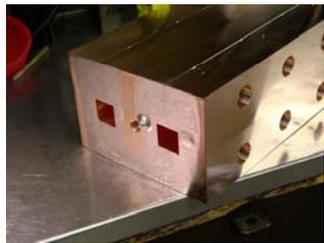
OFE Copper Vane



Vane Undulations



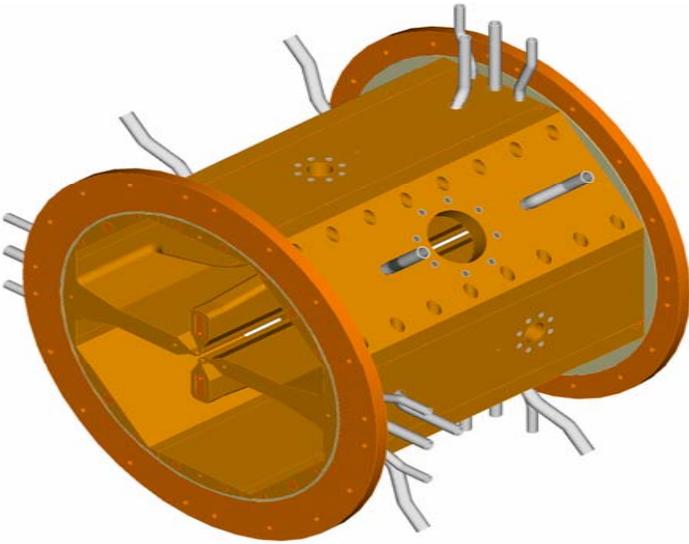
Blister Test



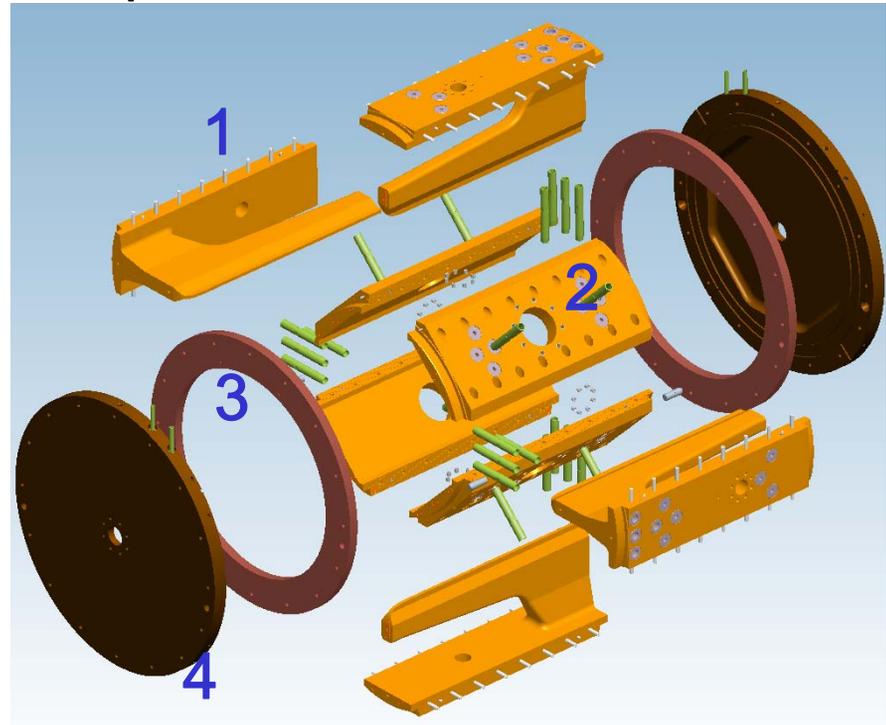
Braze Samples



# Main Components



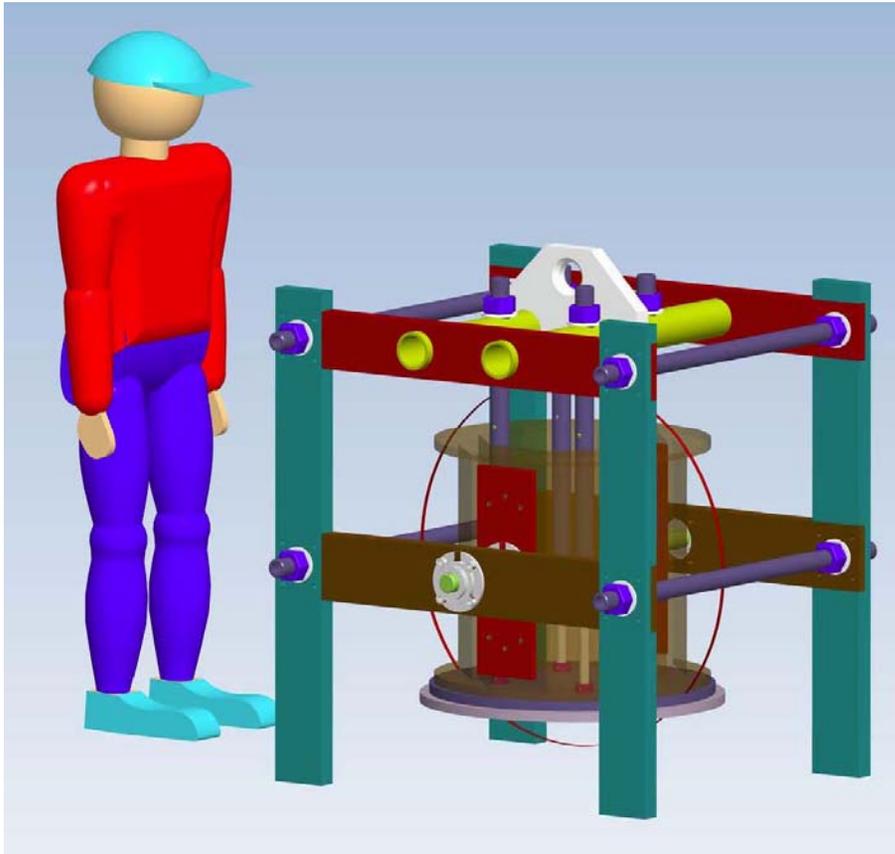
Exploded View – 57 MHz RFQ



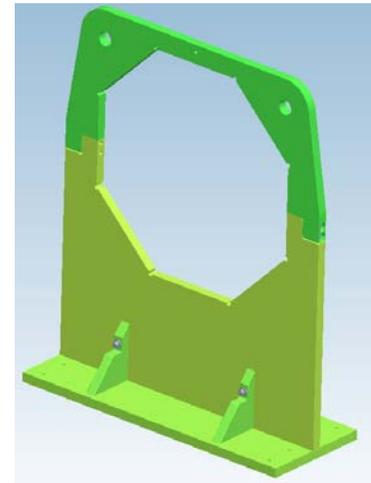
1. Vanes (4)
2. Quadrant Plates (4)
3. Body Flanges (2)
4. End Caps (2)

# Misc. Components in Progress

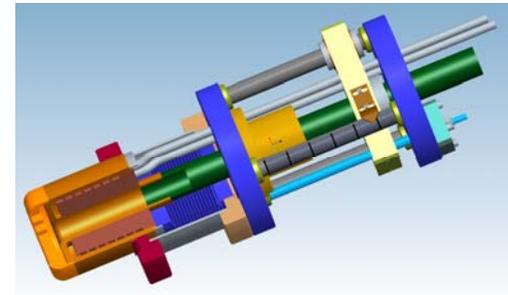
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Lifting Fixture



Support Plate



Tuner

# Complete Fabrication Schedule & Cost

ID	Task Name	Start	Finish	Cost	Money Spent to Date	March	April	May	June	July	August	Septe	Octobe	Novem	Decem	Januar	Febru					
1	57 MHZ Assembly	Wed 3/10/04	Wed 2/16/05	\$199,107.00	\$95,857.00	[Gantt bar]																
2	BRAZE TESTS	Wed 3/10/04	Mon 7/19/04	\$16,219.00	\$16,219.00	[Gantt bar]																
3	MATERIALS	Wed 3/10/04	Mon 3/22/04	\$3,700.00	\$3,700.00	[Gantt bar]																
4	MACHINE / BRAZE / EVALUATE	Mon 3/22/04	Mon 7/19/04	\$12,519.00	\$12,519.00	[Gantt bar]																
5	MISCELLANEOUS	Fri 4/16/04	Tue 5/25/04	\$4,615.00	\$4,615.00	[Gantt bar]																
6	MATERIAL CHEMICAL ANALYSIS	Fri 4/16/04	Tue 5/25/04	\$4,615.00	\$4,615.00	[Gantt bar]																
7	VANES	Fri 3/12/04	Thu 12/2/04	\$82,870.00	\$38,070.00	[Gantt bar]																
8	MATERIAL PURCHASE	Fri 3/12/04	Fri 4/16/04	\$24,750.00	\$24,750.00	[Gantt bar]																
9	PRE-BRAZE MACHINING	Thu 6/17/04	Wed 9/1/04	\$13,320.00	\$13,320.00	[Gantt bar]																
10	BRAZE PLUGS	Thu 9/2/04	Tue 9/21/04	\$4,800.00	\$0.00	[Gantt bar]																
11	FINISH MACHINING	Wed 9/22/04	Thu 12/2/04	\$40,000.00	\$0.00	[Gantt bar]																
12	QUADRANTS	Thu 3/11/04	Wed 11/10/04	\$38,032.00	\$13,232.00	[Gantt bar]																
13	MATERIAL PURCHASE	Thu 3/11/04	Mon 3/29/04	\$9,000.00	\$9,000.00	[Gantt bar]																
14	PRE-BRAZE MACHINING	Wed 4/28/04	Mon 7/19/04	\$4,232.00	\$4,232.00	[Gantt bar]																
15	BRAZE PLUGS	Tue 8/17/04	Wed 9/15/04	\$4,800.00	\$0.00	[Gantt bar]																
16	FINISH MACHINING	Thu 9/16/04	Wed 11/10/04	\$20,000.00	\$0.00	[Gantt bar]																
17	PLUGS / STUDS / TUBES	Tue 7/20/04	Mon 8/16/04	\$4,000.00	\$0.00	[Gantt bar]																
18	MATERIAL AND MACHINE COMPLETE	Tue 7/20/04	Mon 8/16/04	\$4,000.00	\$0.00	[Gantt bar]																
19	BODY FLANGES	Thu 3/11/04	Fri 8/6/04	\$12,475.00	\$8,475.00	[Gantt bar]																
20	MATERIAL	Thu 3/11/04	Fri 4/16/04	\$6,475.00	\$6,475.00	[Gantt bar]																
21	ROUGH MACHINING AND ANNEAL	Mon 5/24/04	Wed 7/14/04	\$2,000.00	\$2,000.00	[Gantt bar]																
22	FINISH MACHINING	Thu 7/15/04	Fri 8/6/04	\$4,000.00	\$0.00	[Gantt bar]																
23	END CAPS	Wed 6/2/04	Mon 8/9/04	\$10,746.00	\$10,746.00	[Gantt bar]																
24	MATERIAL AND MACHINE COMPLETE	Wed 6/2/04	Mon 8/9/04	\$10,746.00	\$10,746.00	[Gantt bar]																
25	LIFTING FIXTURE	Tue 7/20/04	Mon 8/16/04	\$10,150.00	\$0.00	[Gantt bar]																
26	MATERIAL AND MACHINE COMPLETE	Tue 7/20/04	Mon 8/16/04	\$10,150.00	\$0.00	[Gantt bar]																
27	HALF PERIOD ASSEMBLY	Fri 7/30/04	Wed 2/16/05	\$20,000.00	\$4,500.00	[Gantt bar]																
28	BRAZE ALLOY	Fri 7/30/04	Fri 7/30/04	\$4,500.00	\$4,500.00	[Gantt bar]																
29	PRE-BRAZE MACHINING	Fri 12/3/04	Thu 12/16/04	\$3,000.00	\$0.00	[Gantt bar]																
30	BRAZE ASSEMBLY	Fri 12/17/04	Mon 1/17/05	\$5,000.00	\$0.00	[Gantt bar]																
31	FINISH MACHINING	Tue 1/18/05	Wed 2/16/05	\$7,500.00	\$0.00	[Gantt bar]																

Project: 57 mhz project schedule  
Date: Tue 7/20/04

Task: [Blue bar] Progress: [Black bar] Summary: [Black bar with arrow] External Tasks: [Grey bar] Deadline: [Green arrow]

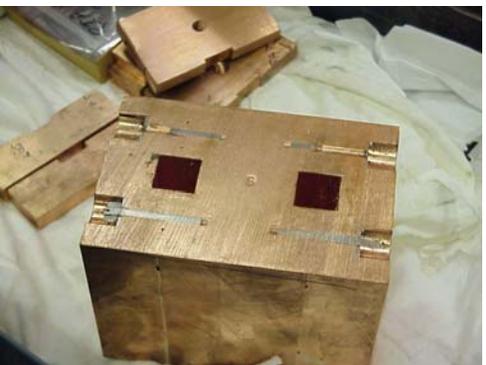
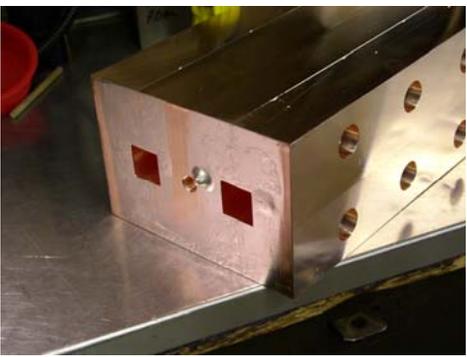
Split: [Dotted bar] Milestone: [Black diamond] Project Summary: [Grey bar with arrow] External Milestone: [Black diamond]



## 57 MHz RFQ Fabrication Status

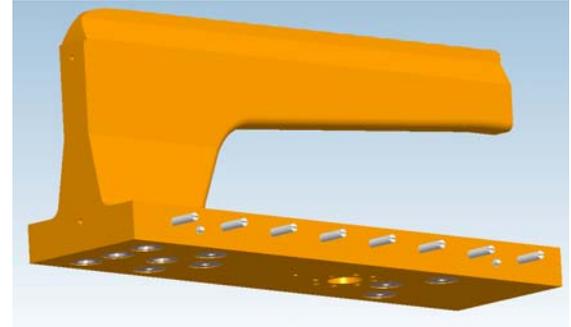
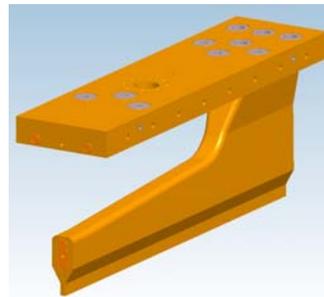
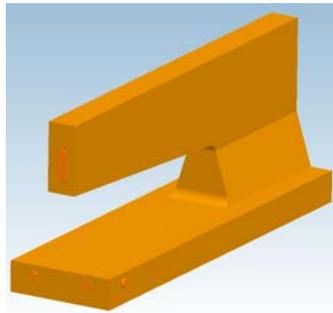
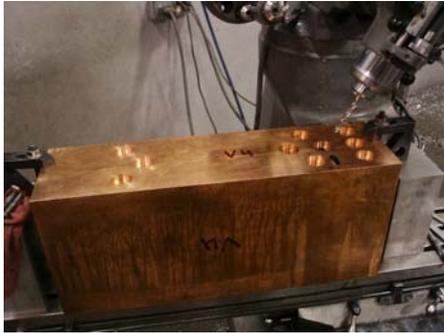
# Braze Testing

Task Name	Start	Finish	Cost	Money Spent to Date	March	April	May	June	July
BRAZE TESTS	Wed 3/10/04	Mon 7/19/04	\$16,219.00	\$16,219.00	[Gantt bar spanning March to July]				
MATERIALS	Wed 3/10/04	Mon 3/22/04	\$3,700.00	\$3,700.00	[Gantt bar in March]				
MACHINE / BRAZE / EVALUATE	Mon 3/22/04	Mon 7/19/04	\$12,519.00	\$12,519.00	[Gantt bar from late March to July]				



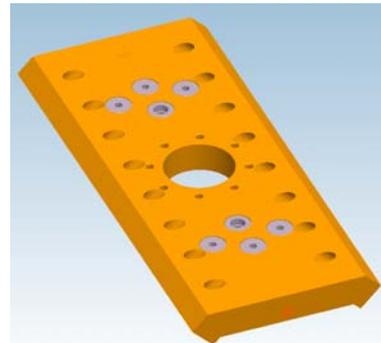
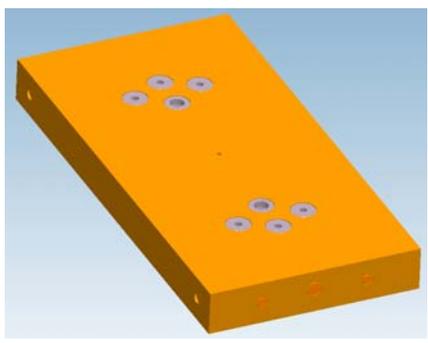
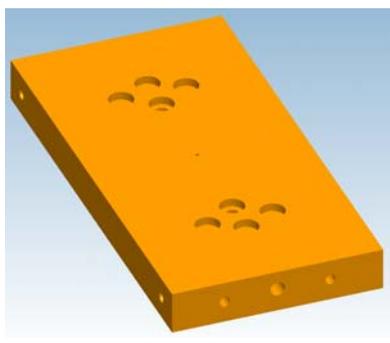
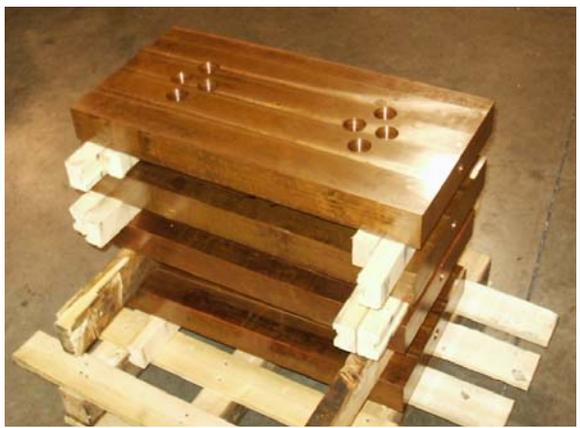
# Vanes

Task Name	Start	Finish	Cost	Money Spent to Date	March	April	May	June	July	August	Septe	Octobe	Novem	D				
VANES	Fri 3/12/04	Thu 12/2/04	\$82,870.00	\$38,070.00	[Gantt Chart: A thick black bar spans from March to November, with a green vertical line at July.]													
MATERIAL PURCHASE	Fri 3/12/04	Fri 4/16/04	\$24,750.00	\$24,750.00	[Gantt Chart: A blue bar from March to April, connected to the main bar.]													
PRE-BRAZE MACHINING	Thu 6/17/04	Wed 9/1/04	\$13,320.00	\$13,320.00	[Gantt Chart: A blue bar from June to August, connected to the main bar.]													
BRAZE PLUGS	Thu 9/2/04	Tue 9/21/04	\$4,800.00	\$0.00	[Gantt Chart: A blue bar from September to September, connected to the main bar.]													
FINISH MACHINING	Wed 9/22/04	Thu 12/2/04	\$40,000.00	\$0.00	[Gantt Chart: A blue bar from October to November, connected to the main bar.]													



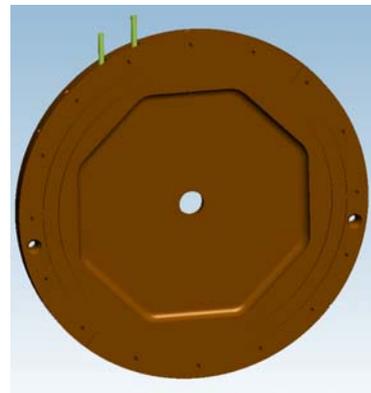
# Quadrant Plates

Task Name	Start	Finish	Cost	Money Spent to Date	March	April	May	June	July	August	Septe	Octobe	Nov				
<b>QUADRANTS</b>	<b>Thu 3/11/04</b>	<b>Wed 11/10/04</b>	<b>\$38,032.00</b>	<b>\$13,232.00</b>	▶												
MATERIAL PURCHASE	Thu 3/11/04	Mon 3/29/04	\$9,000.00	\$9,000.00	█												
PRE-BRAZE MACHINING	Wed 4/28/04	Mon 7/19/04	\$4,232.00	\$4,232.00			█	█	█								
BRAZE PLUGS	Tue 8/17/04	Wed 9/15/04	\$4,800.00	\$0.00							█						
FINISH MACHINING	Thu 9/16/04	Wed 11/10/04	\$20,000.00	\$0.00								█	█				

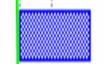


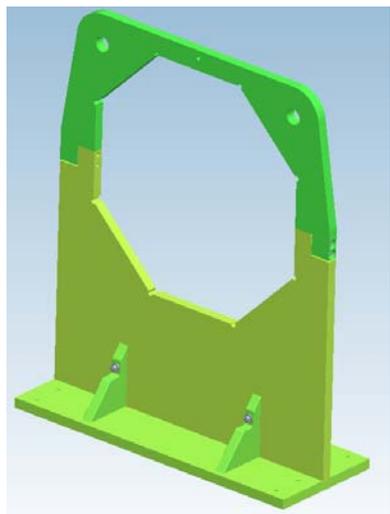
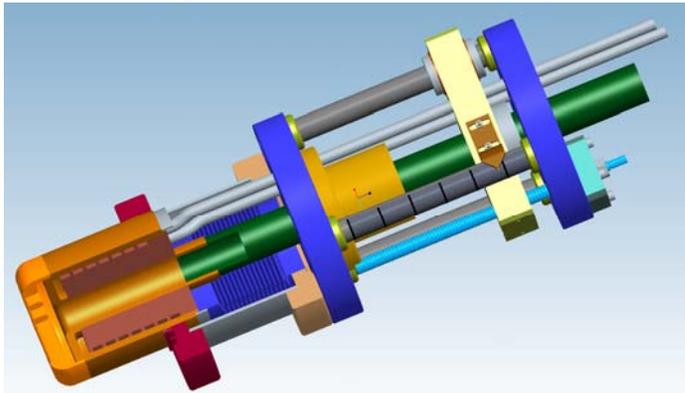
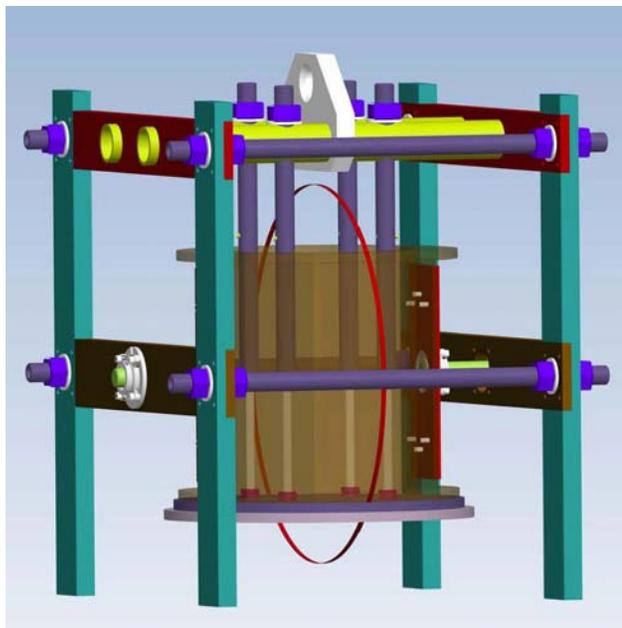
# Body Flanges & End Caps

Task Name	Start	Finish	Cost	Money Spent to Date	March	April	May	June	July	Aug
<b>BODY FLANGES</b>	Thu 3/11/04	Fri 8/6/04	\$12,475.00	\$8,475.00	▶					
MATERIAL	Thu 3/11/04	Fri 4/16/04	\$6,475.00	\$6,475.00	█					
ROUGH MACHINING AND ANNEAL	Mon 5/24/04	Wed 7/14/04	\$2,000.00	\$2,000.00			█			
FINISH MACHINING	Thu 7/15/04	Fri 8/6/04	\$4,000.00	\$0.00					█	
<b>END CAPS</b>	Wed 6/2/04	Mon 8/9/04	\$10,746.00	\$10,746.00			▶			
MATERIAL AND MACHINE COMPLETE	Wed 6/2/04	Mon 8/9/04	\$10,746.00	\$10,746.00				█	█	



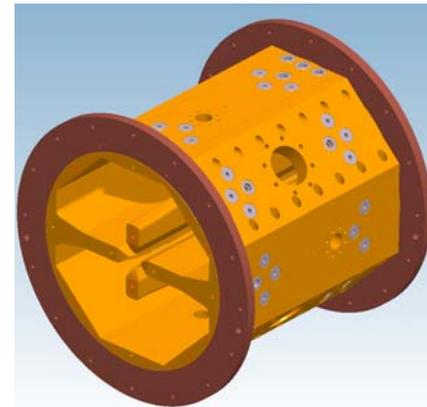
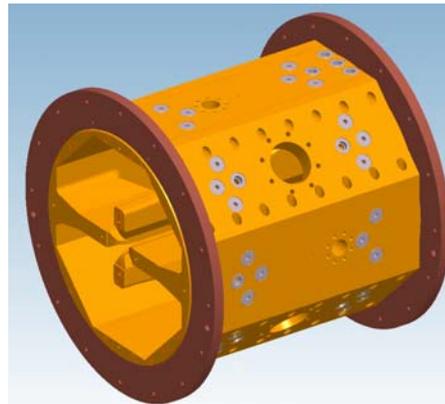
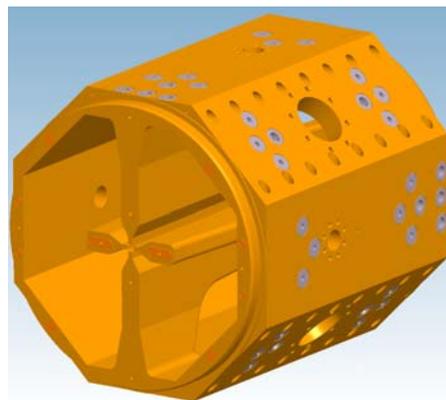
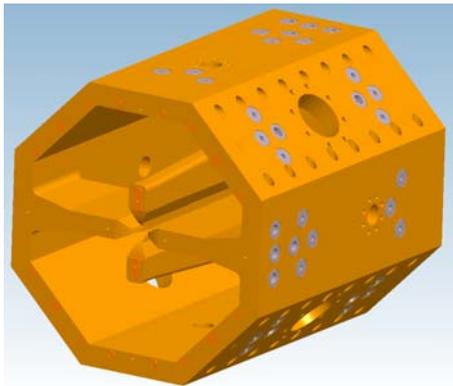
# Misc. Components in Progress

Task Name	Start	Finish	Cost	Money Spent to Date	March	April	May	June	July	August
LIFTING FIXTURE	Tue 7/20/04	Mon 8/16/04	\$10,150.00	\$0.00						
MATERIAL AND MACHINE COMPLETE	Tue 7/20/04	Mon 8/16/04	\$10,150.00	\$0.00						



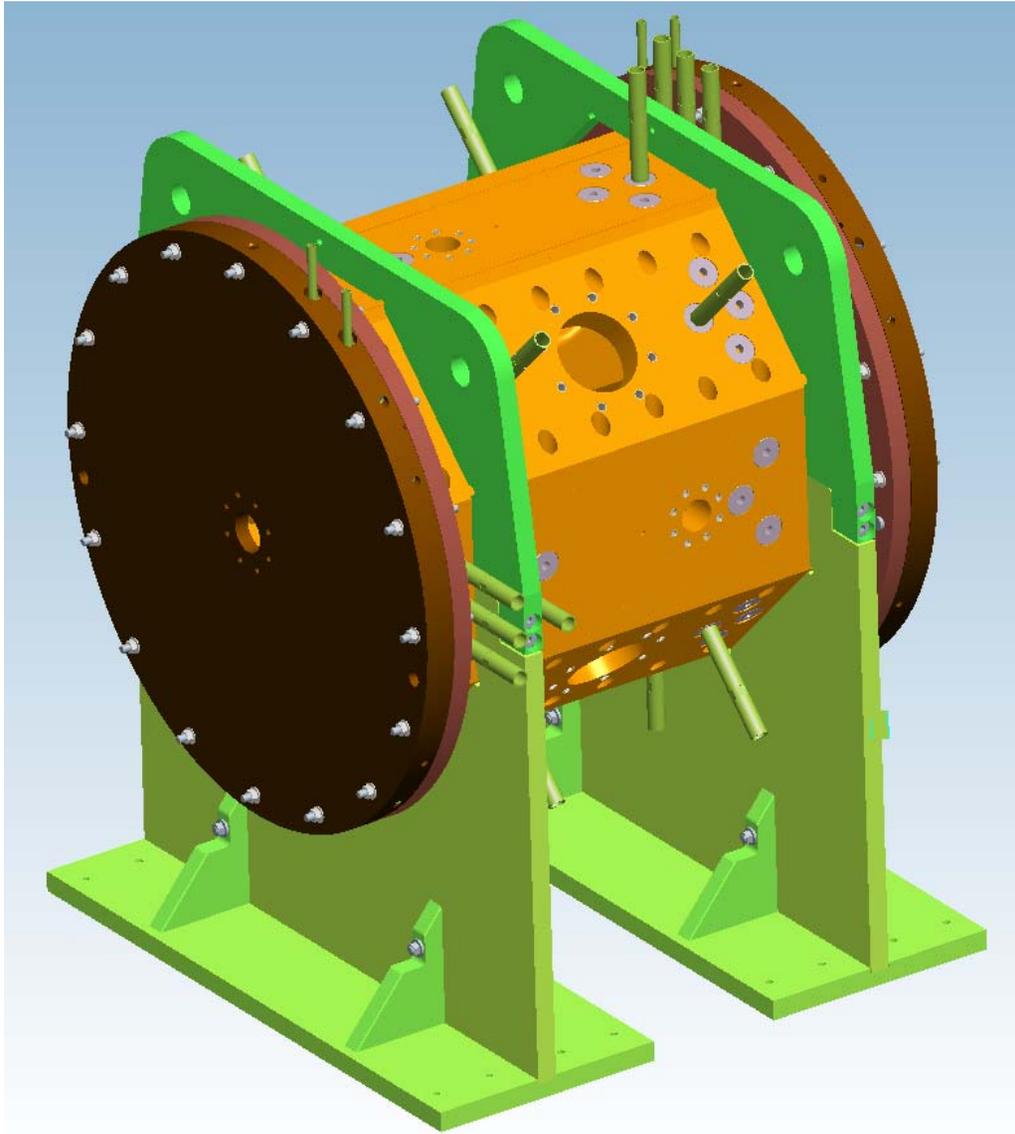
# Assembly

Task Name	Start	Finish	Cost	Money Spent to Date	March	April	May	June	July	August	Septe	Octobe	Novem	Decem	Januar	Febru
HALF PERIOD ASSEMBLY	Fri 7/30/04	Wed 2/16/05	\$20,000.00	\$4,500.00						▶						
BRAZE ALLOY	Fri 7/30/04	Fri 7/30/04	\$4,500.00	\$4,500.00												
PRE-BRAZE MACHINING	Fri 12/3/04	Thu 12/16/04	\$3,000.00	\$0.00												
BRAZE ASSEMBLY	Fri 12/17/04	Mon 1/17/05	\$5,000.00	\$0.00												
FINISH MACHINING	Tue 1/18/05	Wed 2/16/05	\$7,500.00	\$0.00												



# *Completed Assembly*

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# Competitive Bidding to Minimize Cost

## 57 MHZ RFQ STRUCTURE - COMPETITIVE BIDS

	VENDOR #1	VENDOR #2	VENDOR #3	VENDOR #4	VENDOR #5	VENDOR #6
VANES PRE-BRAZE MACHINING	\$13,320.00	\$16,872.00				
QUADRANTS PRE-BRAZE MACHINING	\$4,232.00	\$6,516.00				
END CAPS MATERIAL & MACHINE COMPLETE	\$10,746.00	\$17,133.44	\$19,494.00			
PLUGS / STUDS / TUBES, MATERIAL & MACHINE COMPLETE	\$5,025.20	\$3,061.16		\$3,746.90		
LIFTING FIXTURE MATERIAL & MACHINE COMPLETE			\$10,205.00		\$10,150.00	\$16,996.00
VENDOR #1 - KREIS TOOL						
VENDOR #2 - HI-TECH MANUFACTURING						
VENDOR #3 - WALCO TOOL						
VENDOR #4 - IMPERIAL MACHINE						
VENDOR #5 - AJR INDUSTRIES						
VENDOR #6 - WILSON TOOL						

# Summary

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- **Committed to Date:** **\$95,857**
- **Estimated Total to Complete Assembly:** **\$103,250**
  - Misc. Components in Progress
    - *Tuners*
    - *Support Stand*
    - *Drive Loop*
    - *Vacuum Components*
- **Scheduled completing date:** **Feb. 2005**
  - Includes in Progress Items
- **Total Cost for Assembly:** **\$199,107**
  - Does not include Misc. Components in Progress