# SSR1 Superconducting Resonator

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### SSR1 & PXIE



# SSR1 Main Components

- Niobium Cavity
- Helium Vessel made from SS316L
- Oryomodule at 2K
- 325MHz Operating Frequency







### Frequency Tuner

- Actuation System
- Main Arms
- Fulcrum







# My Contribution

### Main Arms Stiffness Analysis



## Simulation Description

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Simulation Done Using ANSYS

Measure Stiffness

Deforming the Main Arm with an Applied Force

Linear Elastic Analysis (Elastic Zone)

Hooke's Law: k=F/x

# Symmetry Plane

### Why Create a Symmetry Plane?

Reduces The Physical Size of The Model
Reduces The Simulation Time
Makes The Model More Stable for Static Analysis By Removing a Degree of Freedom

# Symmetry Plane



### Degree of Freedom



### Constraints

# 0 Displacement y-axis



# 0 Displacement x-axis



### Mesh Selection

### Selected Mesh

### Contains 16,558 number of elements



Sunday, August 4, 13

### Mesh Selection

#### Mesh Refinement

Convergence Study





### Force

#### 200N Force Simulation.

#### IOON Force was placed because of symmetry.



### Results

Max Directional Deformation=0.0059436mm
Deformation in Elastic Zone
Hooke's Law: k=F/x
Stiffness: k=33.6kN/mm (previous prototype k=30kN/mm)

### Deformation at Os

A: Static Structural Directional Deformation Type: Directional Deformation(Y Axis) Unit: mm Plane6 Time: 0 7/29/2013 10:45 AM				ANSYS R14.5
0.0059436 Max 0.0052665 0.0045894 0.0032353 0.0025582 0.0018811 0.001204 0.00052691 -0.00015019 Min				
	0.00	100.00	200.00 (mm)	Y
	50.00	150.00	,	

### Final Deformation



# Bellows Experiment

### Experiment Details

Experiment in Elastic Region
Measure The Stiffness
Adding Weights On Top of The Bellows
Measure The Directional Deformation
Calculate The Stiffness Using Hooke's Law: k=F/x

# Equipment

Weights Approx. 7.6kg(x9)

Dial Indicators (x3)

Bellows





# Experiment Layout





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- 3 Blocks=223.67N
- 6 Blocks=447.16N
- 9 Blocks=670.65N



#### Results





Maximum Stiffness=588.235N/mm All Data Stiffness=526.316N/mm Minimum Stiffness=454.545N/mm Estimated Stiffness=526.316±67N/mm

### Antenna Flange

#### Aluminum 6062

 Welding Processes of the Helium Vessel

Detects Shrinkage

Measures Temperature

Purges the Helium Vessel with Argon



### Antenna Flange Sketch



# Antenna Flange Mounted on Helium Vessel





## Tuner Stand Prototype

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## Tuner Stand Prototype









### Conclusion & Future Work

Reasonable Results From Simulations and Test
Improving Bellows Experiment
Improving The Tuner Stand Design

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