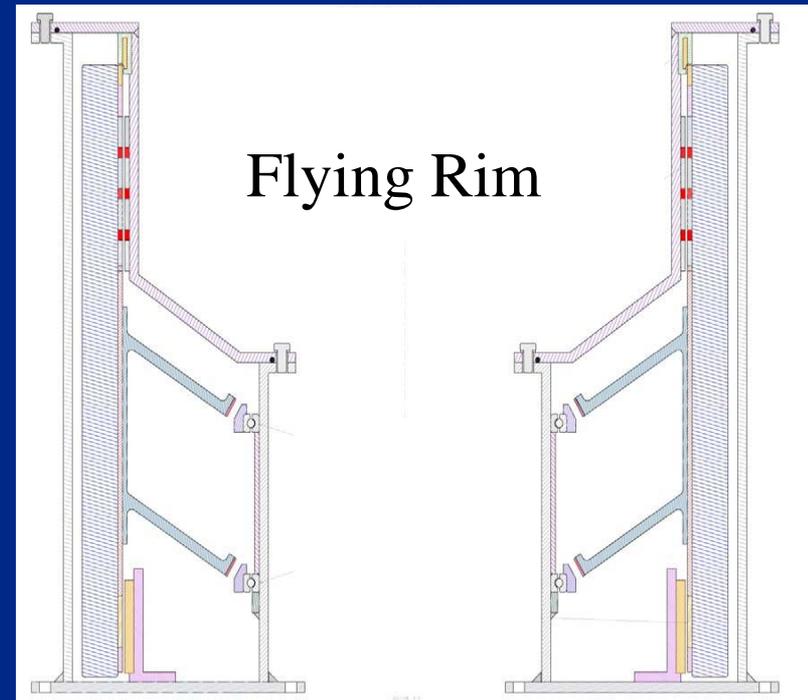


Development of a 100 kWh/100 kW Flywheel Energy Storage Module

- 100KWh - 1/8 cost / KWh vs. current State of the Art
- Bonded Magnetic Bearings on Rim ID
- No Shaft / Hub (which limits surface speed)
- Flexible Motor Magnets on Rim ID
- Develop Touch-down System for Earthquake

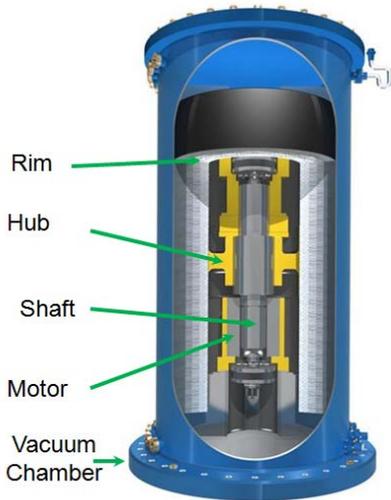


Development of a 100 kWh/100 kW Flywheel Energy Storage Module

Current State of the Art Flywheel

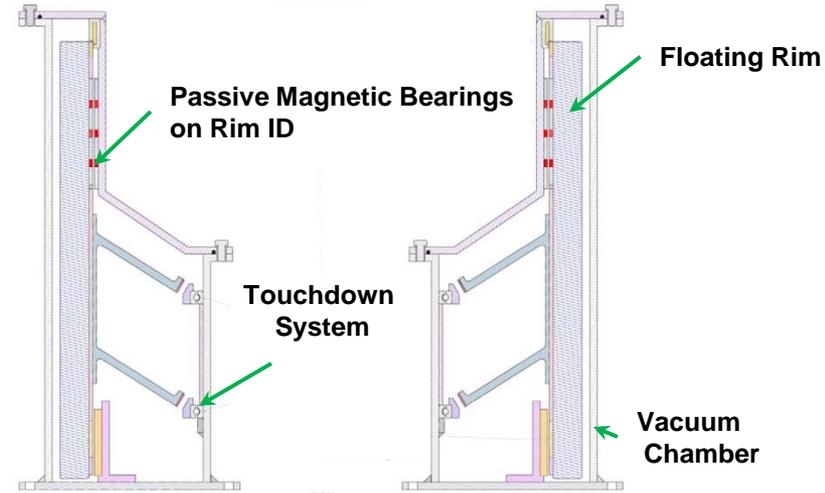
High Speed, Low Cost, Composite Ring with Bore-Mounted Magnetics

25 KWh – 100KW



- Eliminate Shaft and Hub
 - Levitate on Passive Magnetic Bearings
 - Increase Rim Tip Speed
- ➔
- Larger Diameter Thinner Rim Stores More Energy
 - 4 X increase in Stored Energy with only 60% Increase in Weight

100 KWh – 100KW



Limitations of Existing Flywheel

- 15 Minutes of storage
- Limited to Frequency Regulation Application
- Rim Speed (Stored Energy) Limited by Hub Strain and Shaft Dynamics

Program Objectives

- 1 Hour of Storage
- 1/8 the Cost per unit of Stored Energy
- Reduced Parasitic Losses
- Additional Applications Possible
 - ✓ Wind and Solar Ramping
 - ✓ Wind Firming
 - ✓ Peak Shaving – Demand Limiting

Program Challenges

- Development of flexible magnets on Rim ID
- Touchdown System for Earthquake Survival
- Process Development of larger Rim

