

Define requirements for magnet system design

1.1. Working bore

1.2. Field on axis

1.3. Field uniformity along axis and within bore

1.4. Forces between neighbor-magnet systems

1.4.1. Normal

1.4.2. Off-normal

1.4.3. Emergency

1.5. Integration with other subsystems

1.5.1. Spatial constraints

1.5.2. Access requirements

1.5.3. Effects on operating environment

Beam dump

1.5.3.1.Target

1.6. Radiation environment

1.6.1.Heat loads

1.6.1.1.In resistive coils

1.6.1.2.In shielding

1.6.1.3.In superconducting coils

1.6.2.Dose/fluence

1.6.2.1.In resistive coils

1.6.2.2.In shielding

1.6.2.3.In superconducting coils

1.7. Shielding effectiveness

1.7.1.Of resistive coils

1.7.2.Of shielding

1.7.3.Of superconducting windings

1.8. Assembly and maintenance issues

1.8.1.Assembly and services gaps and tolerances

1.8.2.Component lifetimes

1.8.3.Remote maintenance requirements

1.8.4.Maintenance schedules

2. Establish magnet design criteria

2.1. Mechanical allowables (e.g.:)

2.1.1.Stress in structural components

2.1.2.Strain in insulation materials

2.1.3.Strain in superconductors

2.2. Local heating allowables (e.g.:)

2.2.1.Heat transfer to water

2.2.2.Temperature and pressure differentials in water flow path

2.2.3.Channel flow rates

2.2.4.Heat transfer to He

2.2.5.Temperature margin in He flow path

2.3. Radiation tolerance levels

2.3.1.Of structural components

2.3.2.Of copper in resistive windings

2.3.3.Of insulation in resistive windings

2.3.4.Of insulation in superconducting windings

2.3.5.Of superconductor in superconducting windings

2.3.6.Of copper in superconducting windings

2.4. Safety

2.4.1.Quench protection of superconducting magnets

2.4.2.Loss of coolant in resistive magnets

Fault forces

3. Describe and evaluate magnet design options

3.1. Fabrication and installation costs

3.1.1.Magnets

3.1.2. Shielding

3.1.3. Power supplies

3.1.4. Cooling systems

3.1.5. Cryogenic systems

3.2. Operating costs

3.2.1. Power requirements

3.2.1.1. Direct electrical

3.2.1.2. Water cooling

3.2.1.3. Cryogenics

3.2.2. Component–replacement/maintenance costs

3.3. Technical Risks