ELECTROSTATIC stationary analysis. THERMAL transient, non-linear analyses

STRIKE PURPOSES
ITER Requirements: Uniformity ≤ ±10 %
Measure of: Impedance in the vacuum chamber
Beam divergence Measurement of: Beamlet deflection
Stripping losses in SPIDER

STRIKE REQUIREMENTS
ITER Requirements: Uniformity ≤ ±10 %
Measure of: Power deposition
Beam divergence Measurement of: Beamlet deflection

Preliminary specifications and feasibility study

Electrostatic analysis
Modelled system: (0.396/2)×(0.16/2) orthogonal, (0.396/2)x(0.32/2) angled panels
Material: CARBON FRP (FRP)

Beam characteristic
Beam parameters:
- Linear energy transfer L = 600 MeV/nucleon
- Beam: protons for hadrontherapy
- Beam divergence: θ = 0.02 mrad
- Beam energy: 15 Bev
- Beam current: 10 A
- Beam intensity: 10^15 particles/s

SPIDER

Beam divergence
Beamlet definition
- Beamlet divergence: θ = 0.02 mrad
- Beam energy: 15 Bev
- Beam current: 10 A
- Beam intensity: 10^15 particles/s

NBI

Beamlet definition
- Beamlet divergence: θ = 0.02 mrad
- Beam energy: 15 Bev
- Beam current: 10 A
- Beam intensity: 10^15 particles/s

Assessment of calorimeter position

Beam characteristic: Gaussian distribution
Modelled system: (0.396/2)x(0.396/2) orthogonal, MFC1-A

Comparison with ANSYS: successful

Measurement of divergence
Modelled system: a quarter of a beamlet group (0.396/2)x(0.396/2)
Material: CARBON FRP (FRP)

Conclusion: indications of the divergence can be obtained

Thermal simulation with radiation

Beam characteristic: Gaussian shaped beams, with peak heat flux 20 MW/m², half-
width θ = 0.02 mrad and divergence α = 3 mrad
Simulated cases: 0.02m thickness, MFC1-A
(1) after flux application, on all the faces are thermally insulated
(2) after flux application, all the faces are thermally insulated at all times the face opposite the one hit by the beam radiates towards a surface at 300 K, four consecutive 5 s load applications
(3) after flux application, all the faces are thermally insulated at all times the face opposite the one hit by the beam radiates towards a surface at 300 K, three consecutive 10 s load applications

Conclusion: on the basis of COMSOL results, decision taken about:
- No active cooling
- Tiles electrically insulated
- 2 axial distances
- 1000 s pulse duration

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References