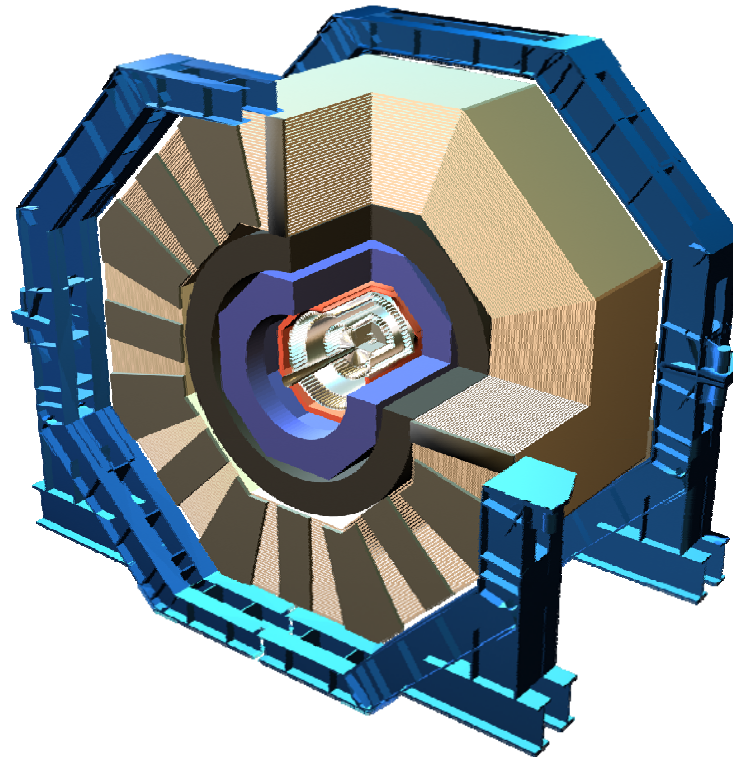




Solenoid/Flux Return Design: Status and Issues

Kurt Krempetz

Fermilab





Baseline Solenoid Design

- 5 Tesla
- 5m diameter clear bore
- 5m Long
- 6 Layers
- Stored Energy 1.4 GJ
- Possible Integrated Dipole
- Details in two reports;
 - A 5 tesla Solenoid for SiD
 - A Detector Integrated Dipole for the Silicon Detector at the International Linear Collider



Return Flux

- Octagonal Barrels and Endcaps
 - Steel plates
 - 10 cm thick (with 5 cm gaps for muon chambers)
 - 23 layers
 - Barrel: $R = 3.428\text{m}$ to 6.828m ; 5.6m long
 - Endcaps: $Z = 2.847\text{m}$ to 6.247m
 - Estimated Total Weight~ 6,000 tons



CMS Parameters

CMS

- 4Tesla
- 5.9m diameter clear bore
- 13m Long
- 4 Layers
- Stored Energy 2.8 GJ

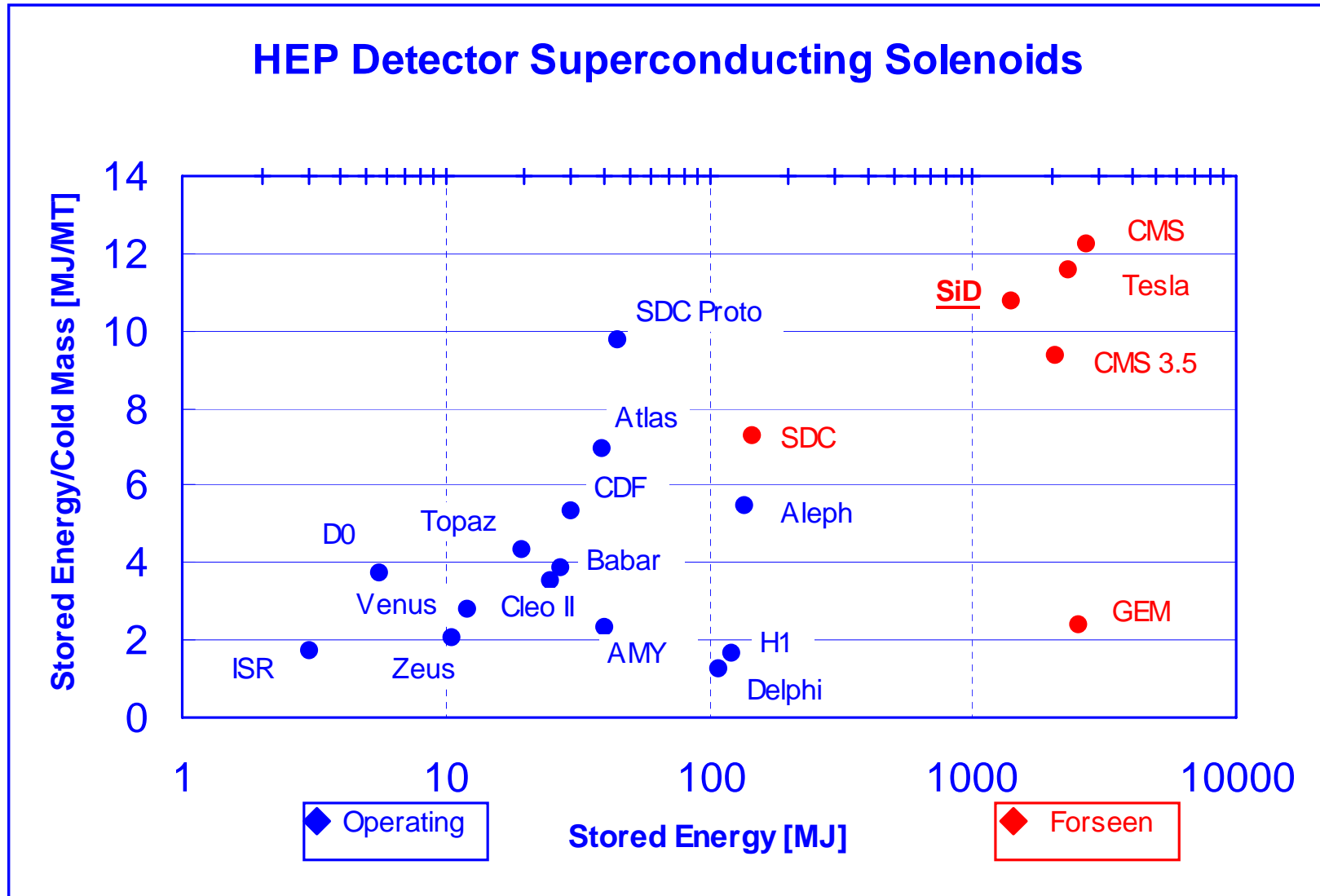
SID

- 5Tesla
- 5m
- 5m
- 6 layers
- 1.4 GJ

CMS Solenoid has been successfully tested to 4 Tesla!



HEP Solenoid History





SiD/CMS Comparisons

Quantity	SiD	CMS
Von Mises Stress in High-Purity Al	22.4 MPa	22 MPa
Von Mises Stress in Structural Al	165 Mpa	145 MPa
Von Mises Stress in Rutherford Cable	132 MPa	128 MPa
Maximum Radial Displacement	5.9mm	~5mm
Maximum Axial Displacement	2.9mm	~3.5mm
Maximum Shear Stress in Insulation	22.6 MPa	21 MPa



SiD/CMS Comparisons

Quantity	SiD	CMS
Radial Decentering	38 kN/mm	38 kN/mm
Axial Decentering	230 kN/mm	85 kN/mm



Moving Forward

Understanding SiD/CMS Differences

- Higher Field
 - Superconductor Studies
- More Layers
 - Cold Mass Stiffness Studies
 - Thermal Studies
- Larger Axial Decentering
 - Support Studies



Moving Forward

Vacuum Vessel/Transfer Line/Feed Can Baseline

- Vacuum Vessel
 - Preliminary Design
 - Material
- Transfer Line
 - Preliminary Design
 - Material
 - Route out of Detector
- Feed Cans
 - Preliminary Design
 - Materials
 - Placement



Moving Forward Solenoid Coil

- Understanding Vendor Involvement/Options
- Gathering Detailed Specifications
 - Loads being supported from the Solenoid
 - Refrigeration Loads
 - External Solenoid Support

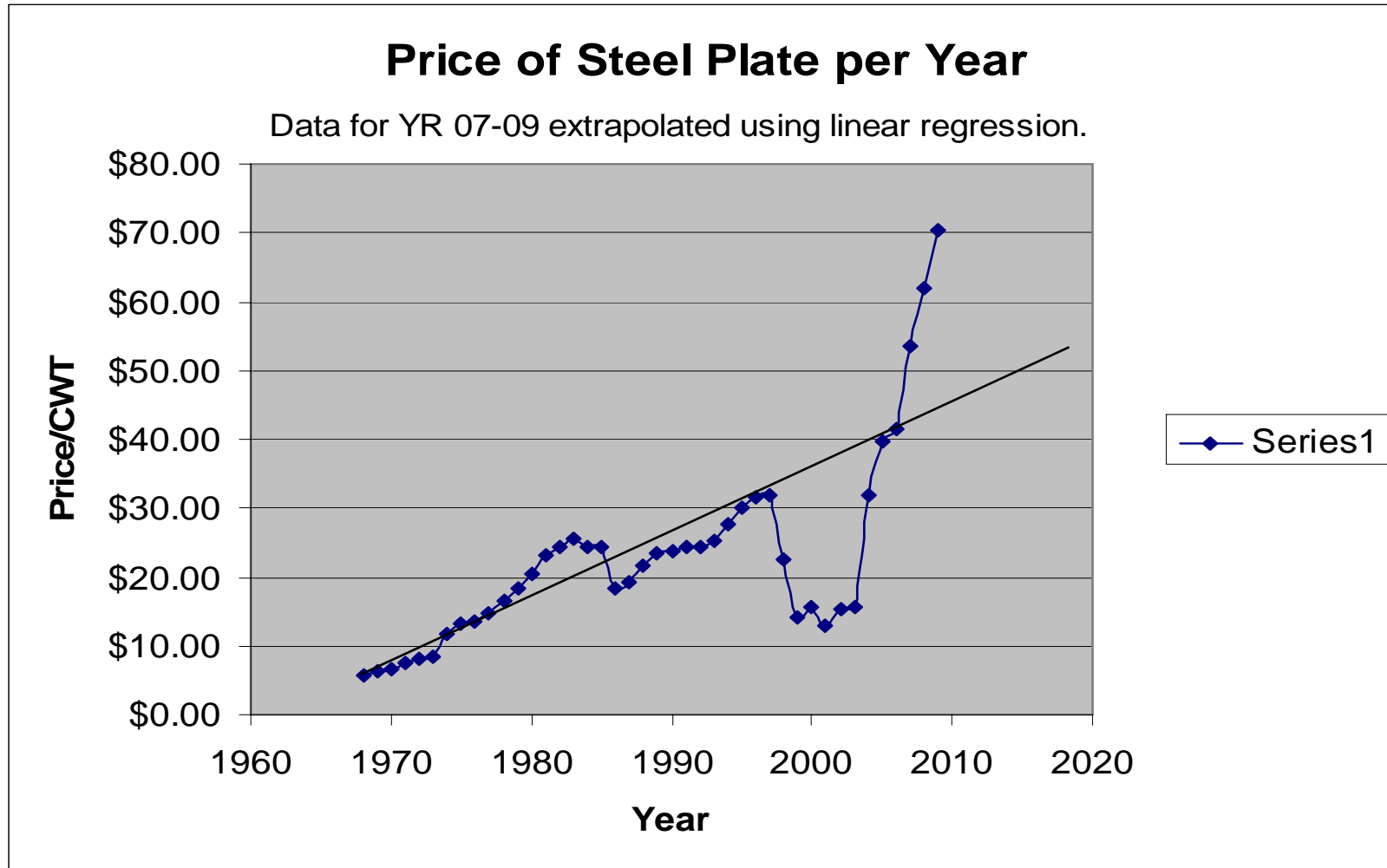


Moving Forward Iron Yoke

- Understanding Vendor Involvement/Options
- Gathering Detailed Specifications
 - Loads being supported, magnet loads, etc
 - Motion System requirements
 - Routing of Cable, Cryogenics, Power, Air, etc.
 - Clearances required



Iron Yoke





Conclusions

- A lot of work ahead
- Good/Productive process can be made especially when detailed specifications are determined.