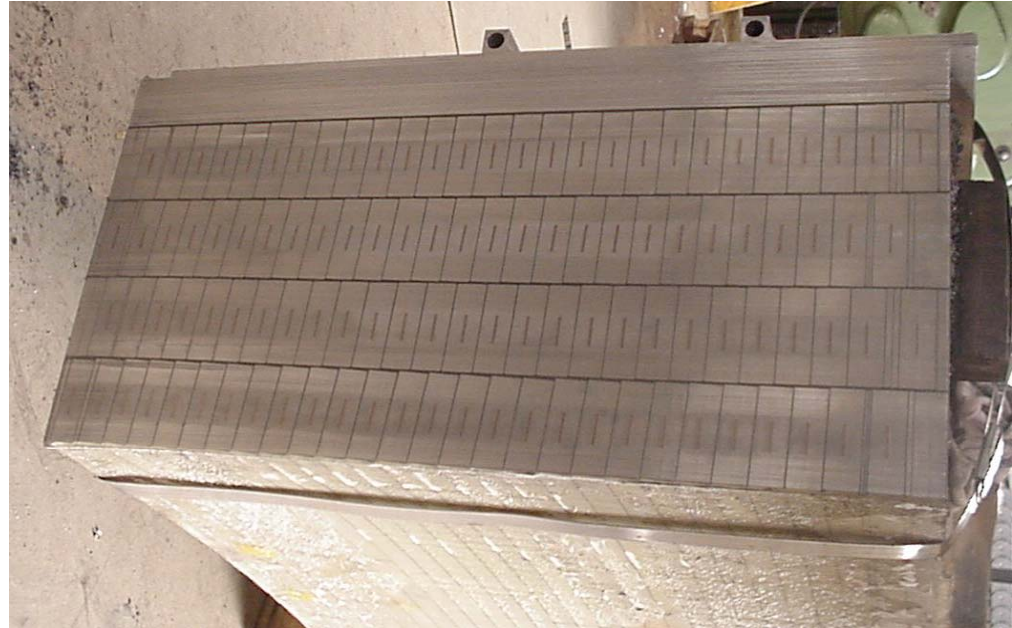


*SID
SUPERCONDUCTING
MAGNET /
SUPERCONDUCTING
CABLE*

Wes Craddock
Boulder, Colorado
18 September 2008

September 19, 2008



CMS WINDING PACK

Wes Craddock

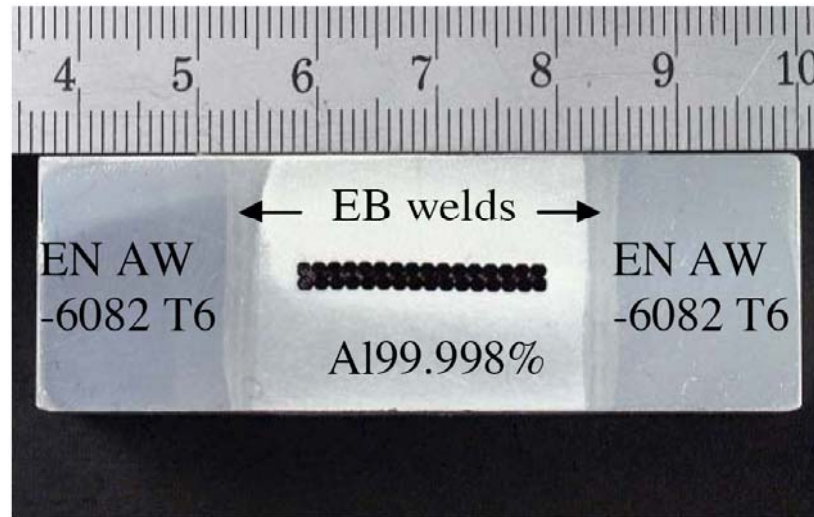
GENERAL STATUS

- A Workable Conceptual Solenoid Design Was Completed a Couple of Years Ago by Rich Smith and Bob Wands (FNAL)
- This Design Using the CMS Conductor is Still the Baseline
- Bob Wands has Continued to Work on Fringe Fields
- Wes Craddock is Pursuing Alternative Conductor Designs
- John Weisend is Pursing the Cryogenic Aspects
- Need more mechanical design/fabrication work for the LOI

WORK NEEDED FOR THE LOI

- Conductor/Outer mandrel winding scheme
- FEM work emphasizing conductor stress
- FEM Conductor stability at the higher field
- Quench propagation and energy extraction
- Conductor package thermal cooling
- Size and placement of the cryo chimney(s)
- Mechanical design of vacuum shell, current leads, thermal shields, cooling tubes, liquefier interface, etc.
- Power supply, dump breaker&resistor, and instrumentation

CMS CONDUCTOR REPLACEMENT



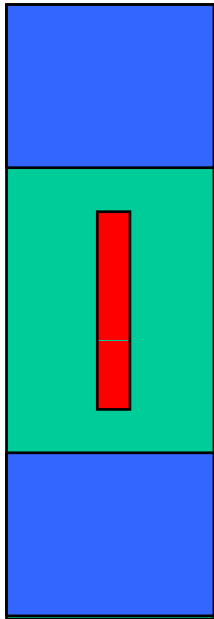
- The CMS conductor is costly and difficult
- Since CMS other conductors have been proposed and used (e.g. ATLAS Al-0.1% Ni alloy)
- Total conductor volume probably cannot be reduced by much since we are at the CMS state of the art 12 kJ/kg limit.

CONDUCTOR REPLACEMENT MOTIVATION

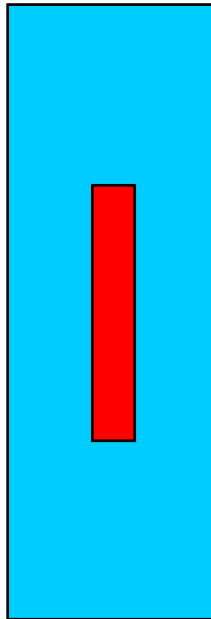
- The CMS conductor requires difficult on site ebeam welding
- There is great incentive to produce a cheaper/ “easier” conductor
- The replacement conductor should be also easier to wind
- An advanced design could be used in other projects such as high field MRI magnets

SiD CONDUCTOR OPTIONS

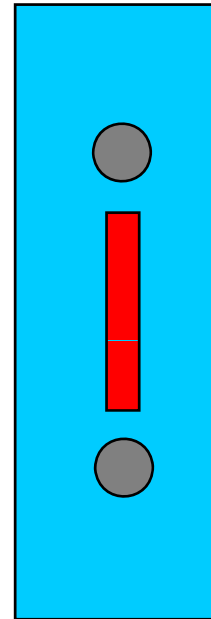
**CMS
CONDUCTOR**



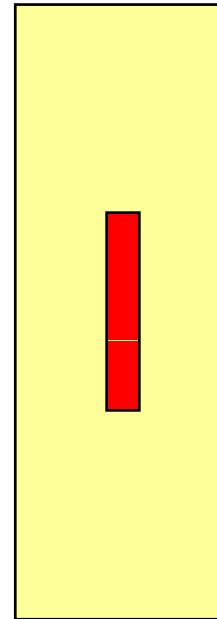
Option 1








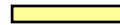
Option 2



Option 3



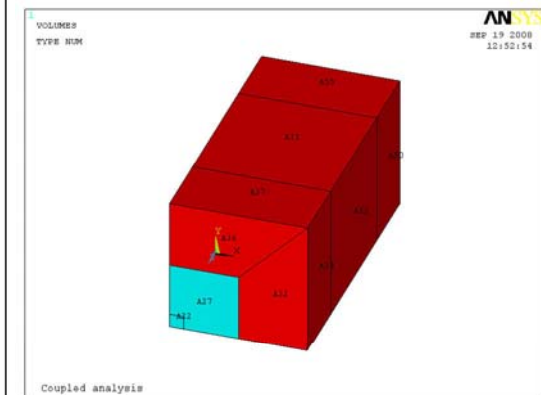
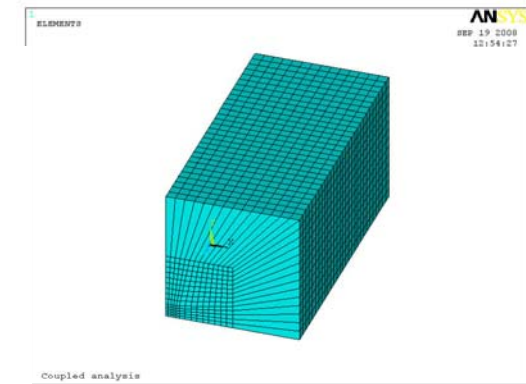
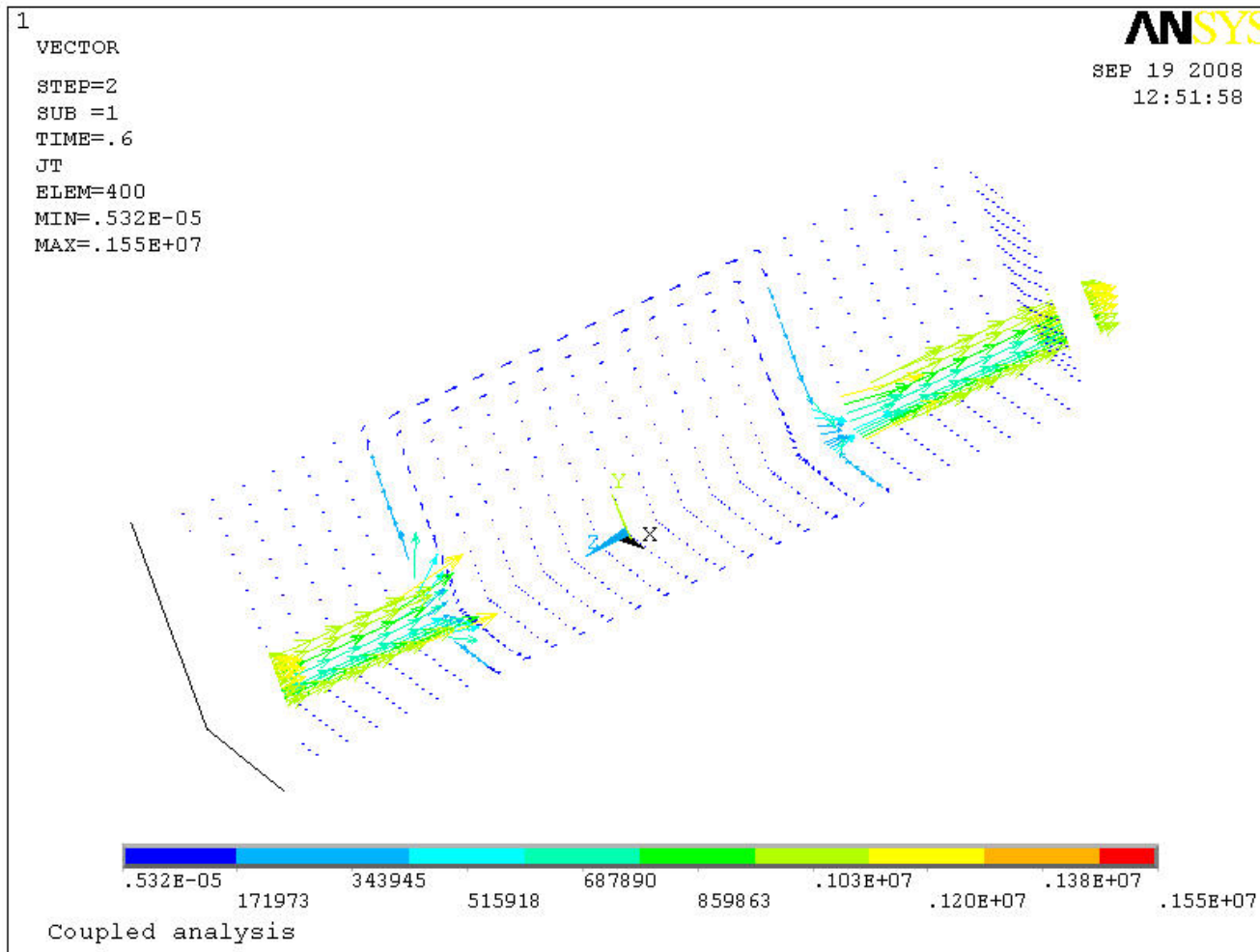
-  Ultra High Purity Al
-  6082 T6 Al
-  Superconducting Cable

-  Al – 0.1 % Ni
-  Stainless steel cable
-  Aluminum/matrix composite

CONDUCTOR WORK IN PROGRESS

- Investigation of dilute aluminum alloys
- Nothing much yet on aluminum matrix materials
- ANSYS structural and winding stress analysis
- ANSYS coupled transient electromagnetic/thermal analysis
(Since SiD is at a higher field/stress than CMS, the quench stability must be at least as good as CMS)
- A meeting is being planned with Ted Hartwig and Peter McIntyre (Texas A&M) and Bob Dawles from the Alcoa R&D center. Ted Hartwig is an expert in dilute aluminum alloys and equal angle area extrusion. Alcoa is interested in expanding their high purity aluminum business

ANSYS STABILITY TEST MODEL



FUTURE CONDUCTOR WORK

- Choose preliminary alternative(s) to CMS in one month
- Visit/Contact companies and universities
 - Materials properties & manufacture support
 - Extrusion capabilities
 - Aluminum cold working
 - Try to get DOE SBIR interest
- Incorporate the latest best NbTi Jc properties into the SiD conductor design
- Use ANSYS stability model to get first pass quench safety
 - Overall quench propagation, quench back, magnetic and thermal quench initiation

