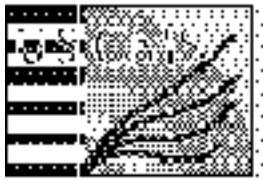


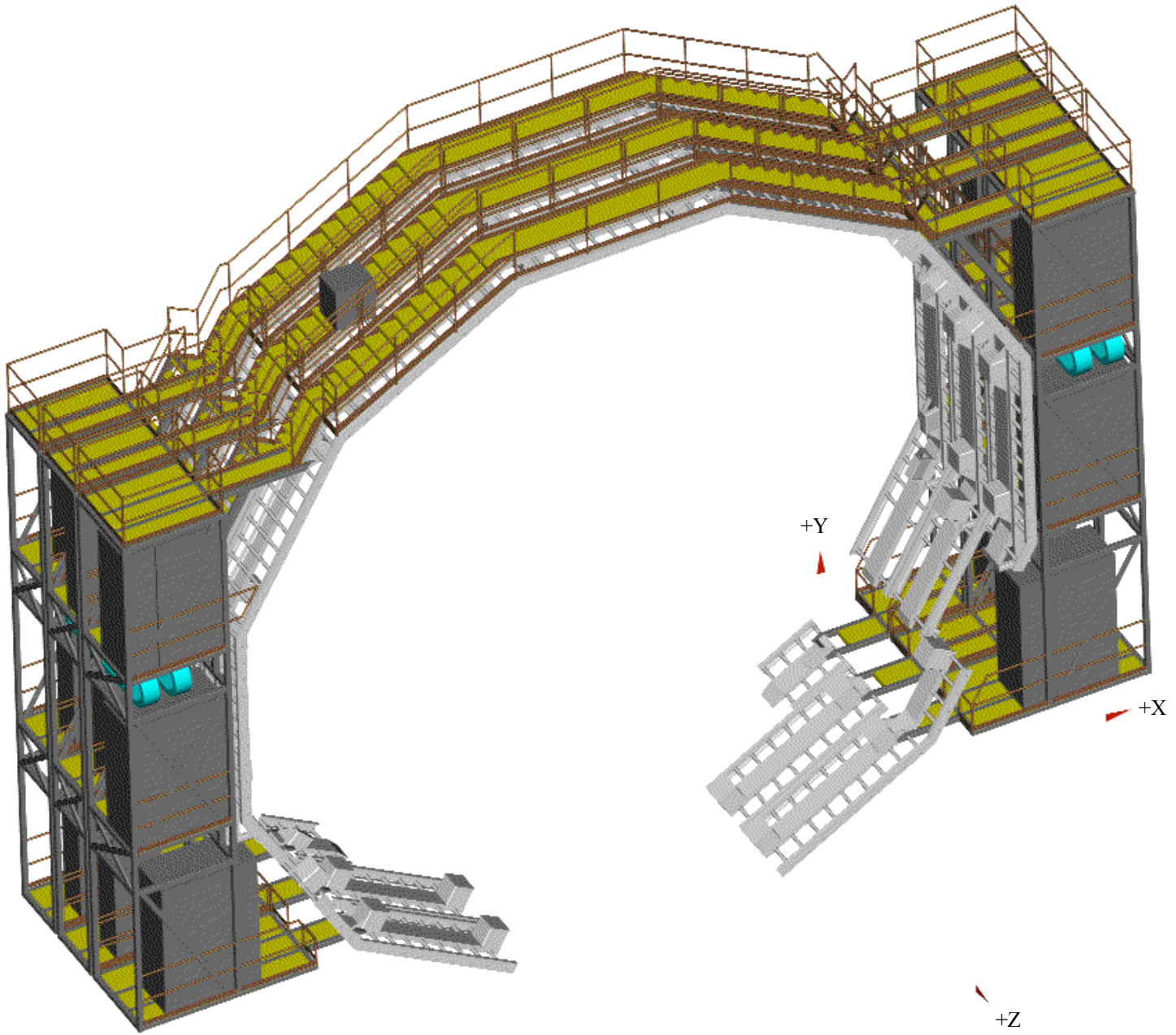
CMS Electronics Week

The EMU Low Voltage System

S. Lusin

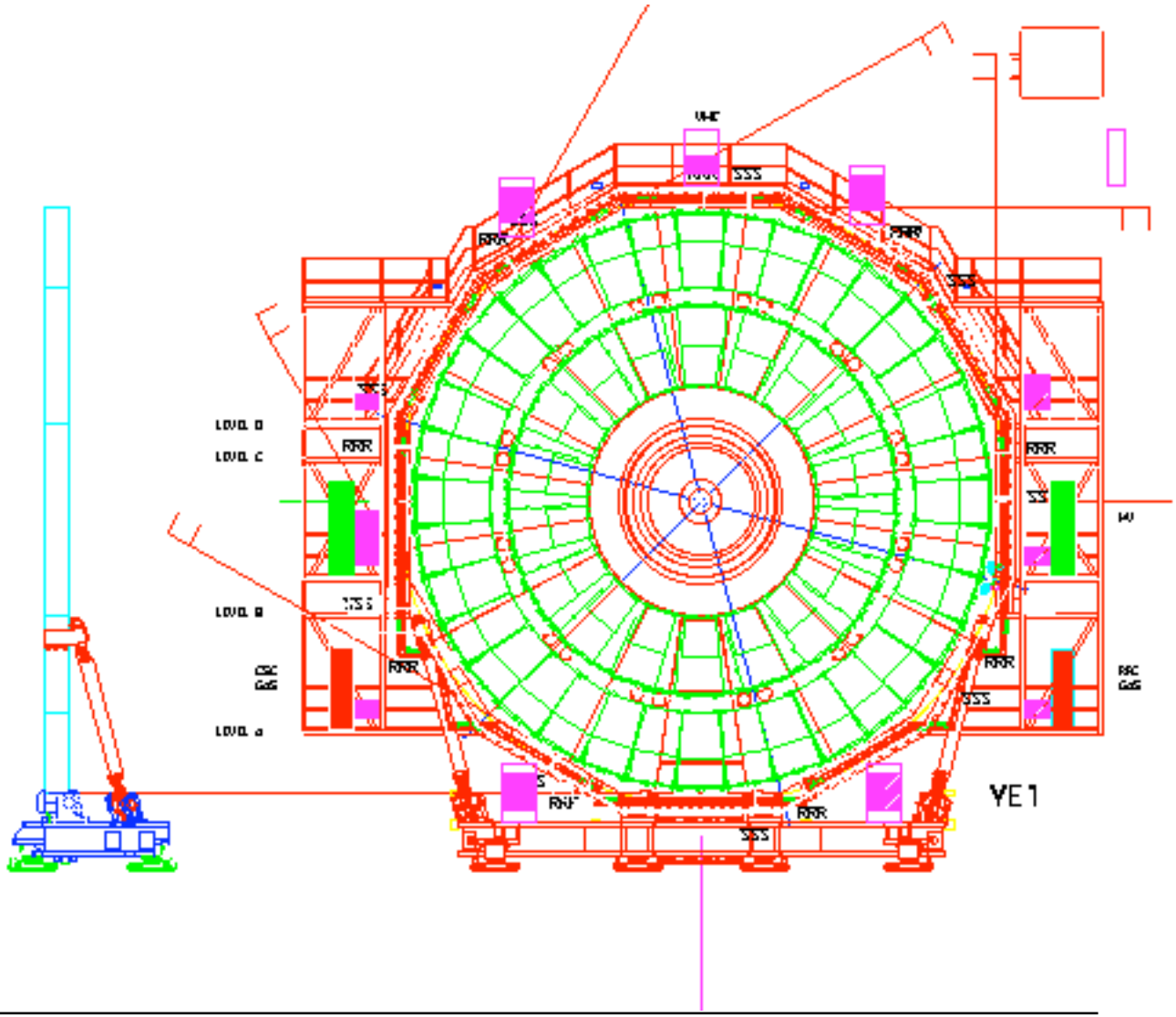
University of Wisconsin

EMU LV supplies will be mounted in towers or on walkways on periphery of endcap iron

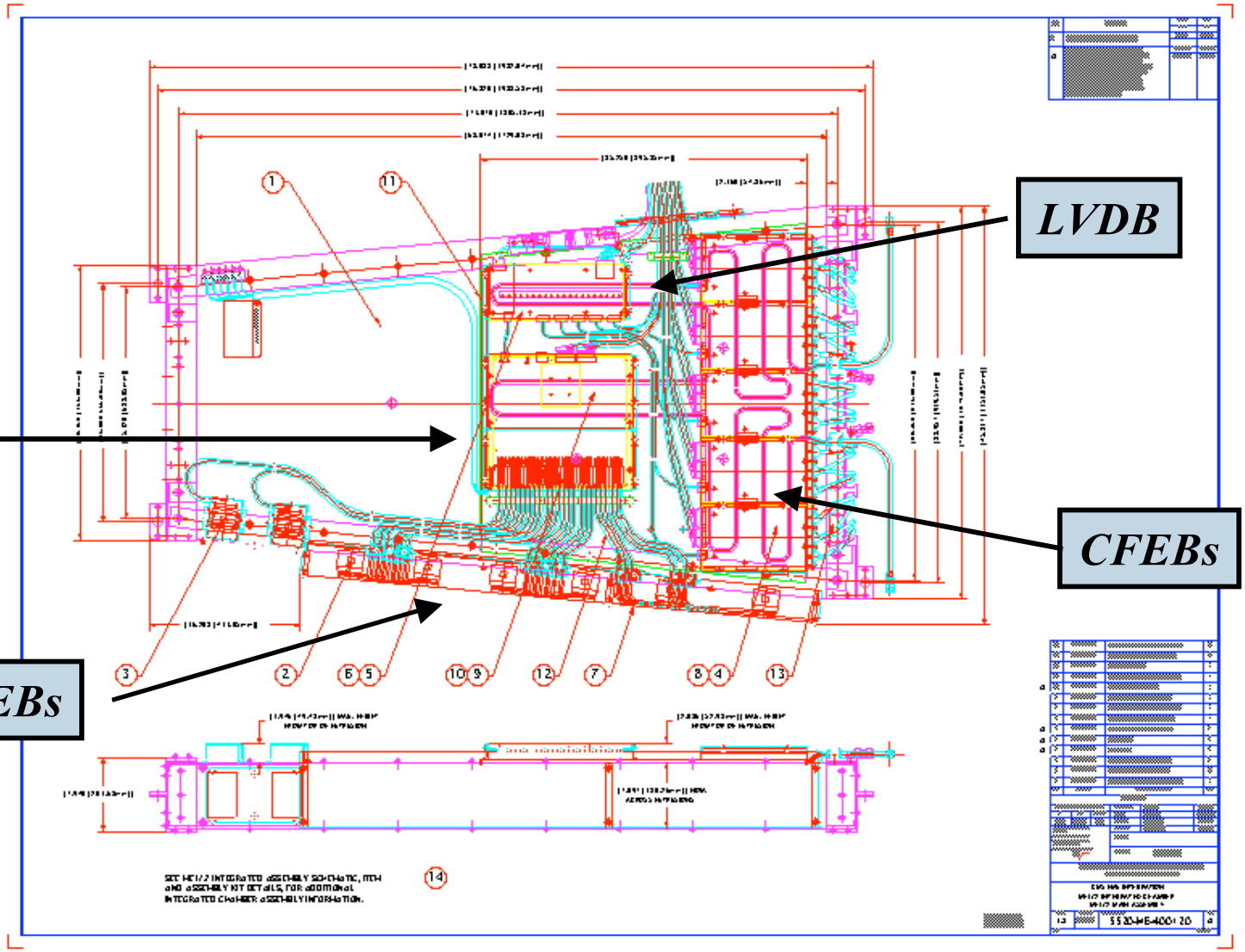


LV Supply Placement

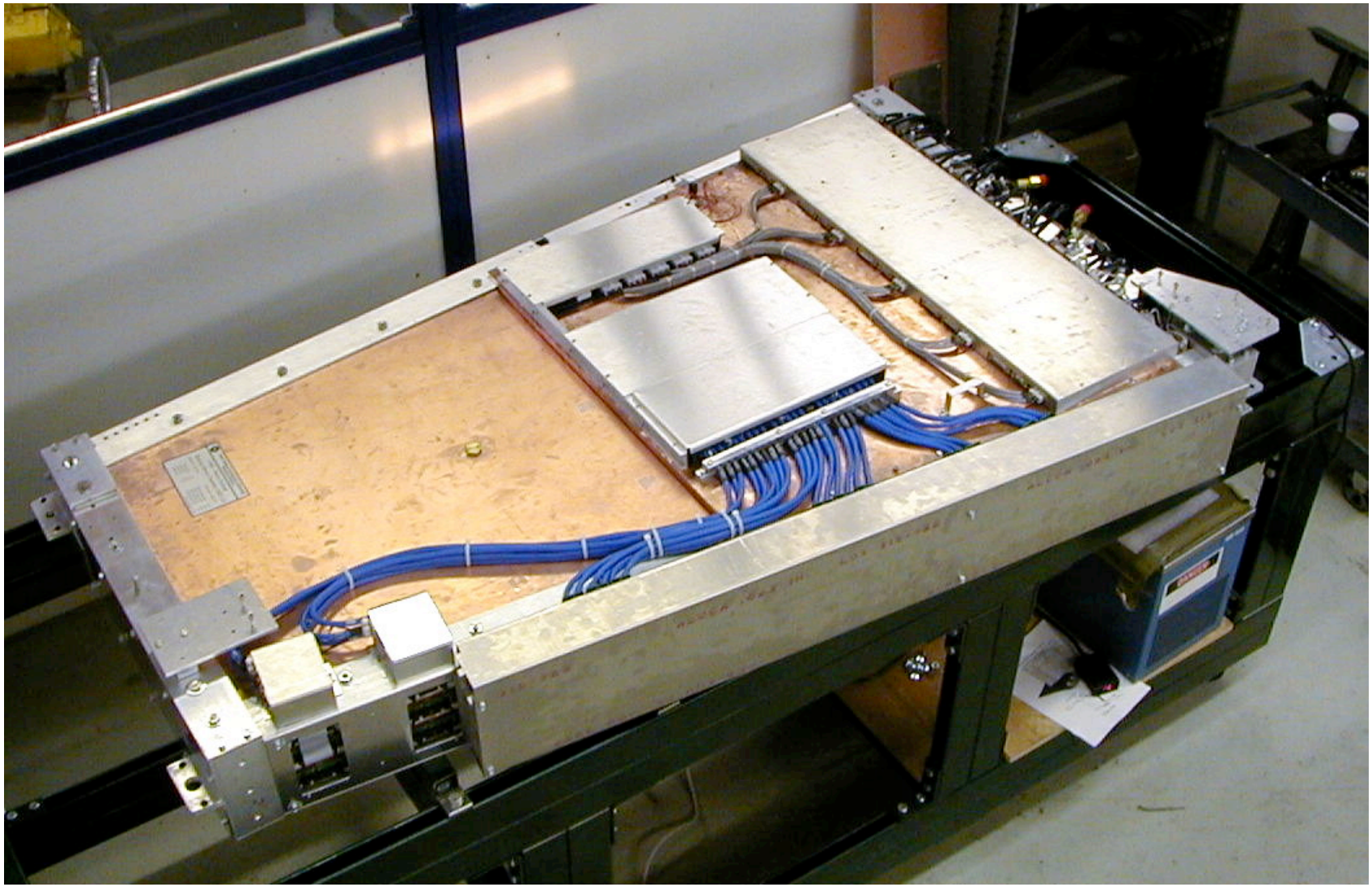
- YE +1 Disk shown
- YE1 is most difficult case for global integration
- LV supply boxes for CSCs feed 60-degree sectors
- 1 sector = ~ 1.2 kVA



EMU CSC Electronics



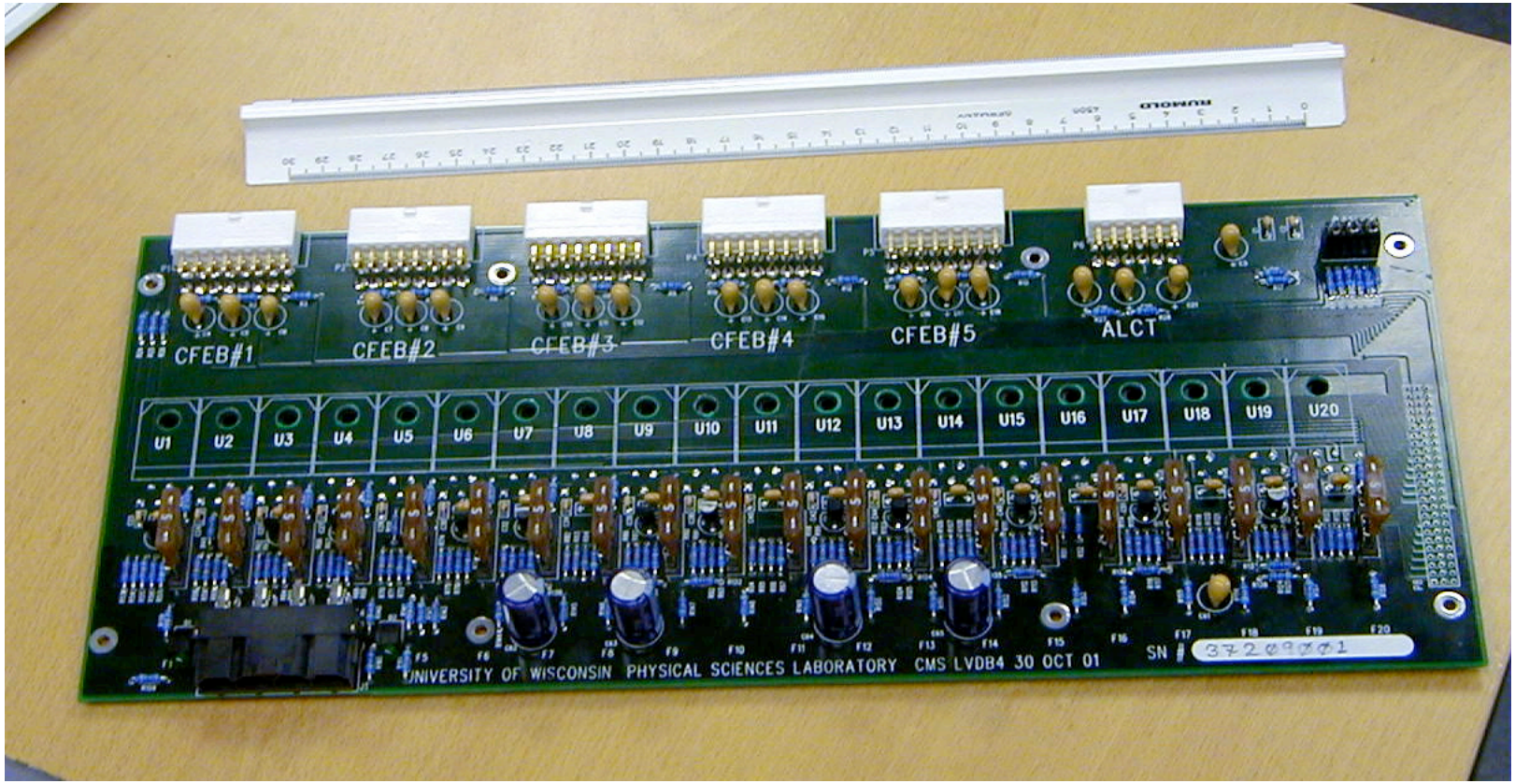
ME 1/2 CSC Prototype



LV Distribution Board

LVDB designed around 10A COTS regulators manufactured by Sharp Electronics

Accepts mezzanine board for control & monitoring

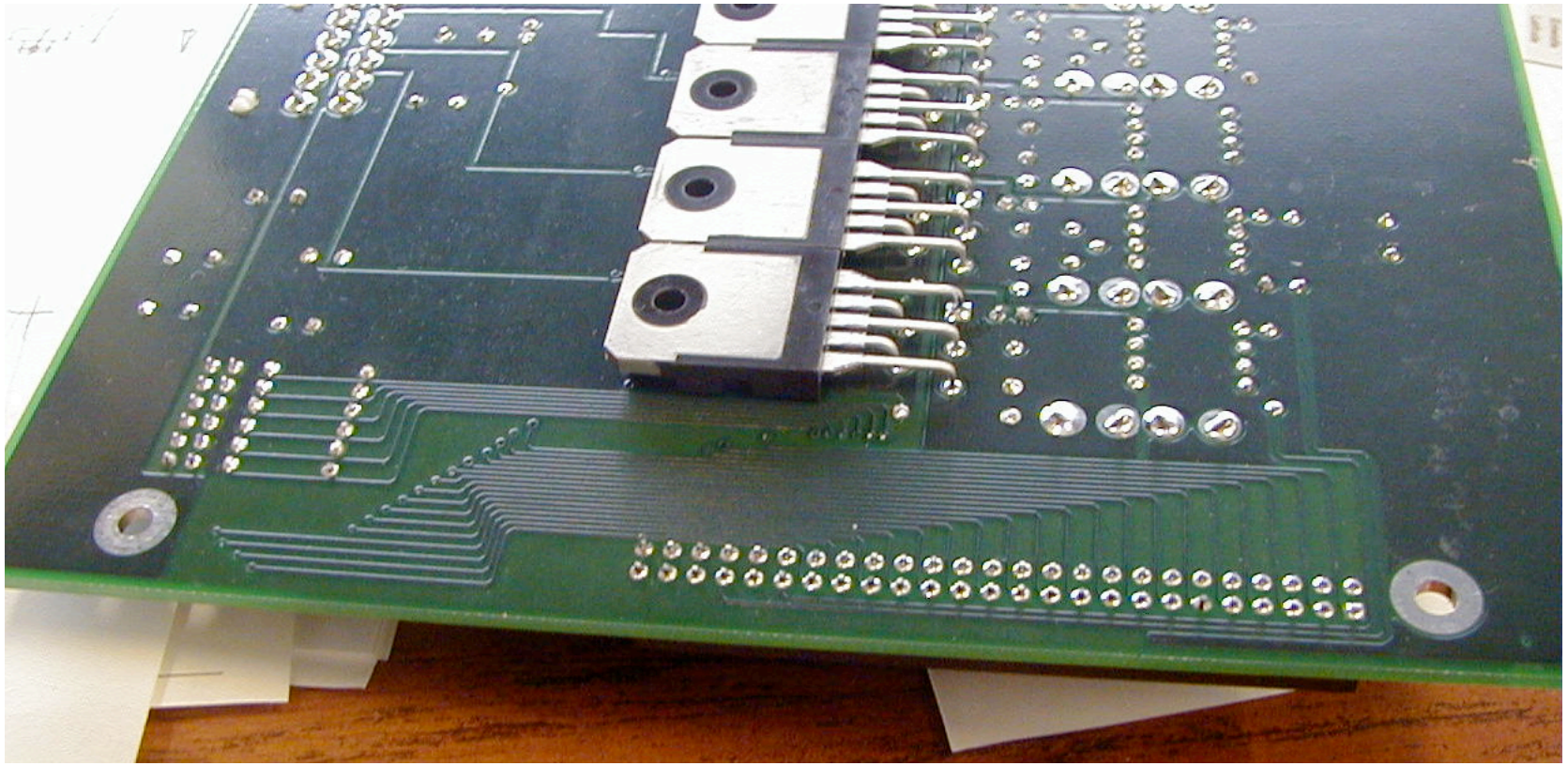


LVDB Regulators

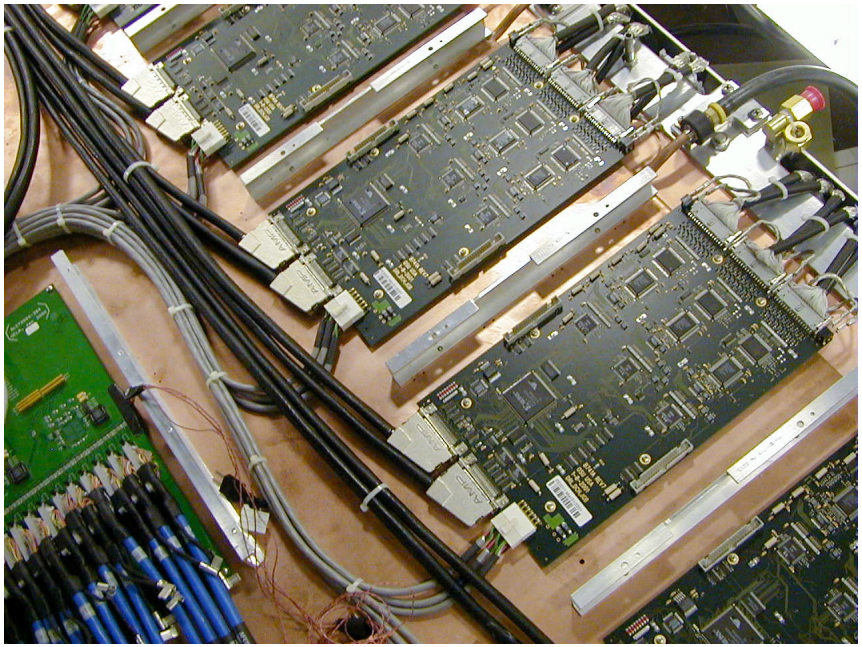
Regulators mount underneath distribution board

Thermal coupling to cooling plate via silicone pad

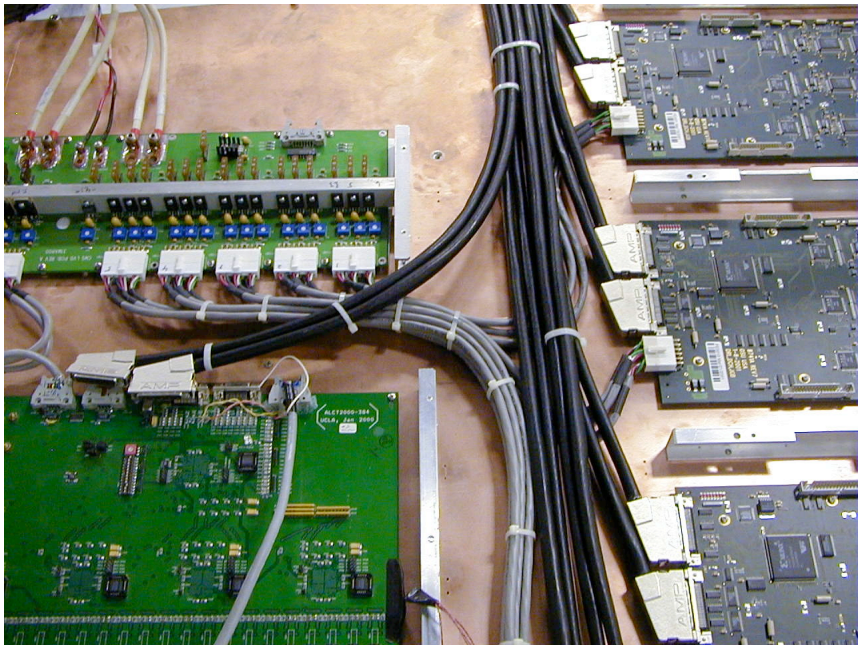
Each regulator individually screwed to plate, legs provide compliance



Staying in the Envelope

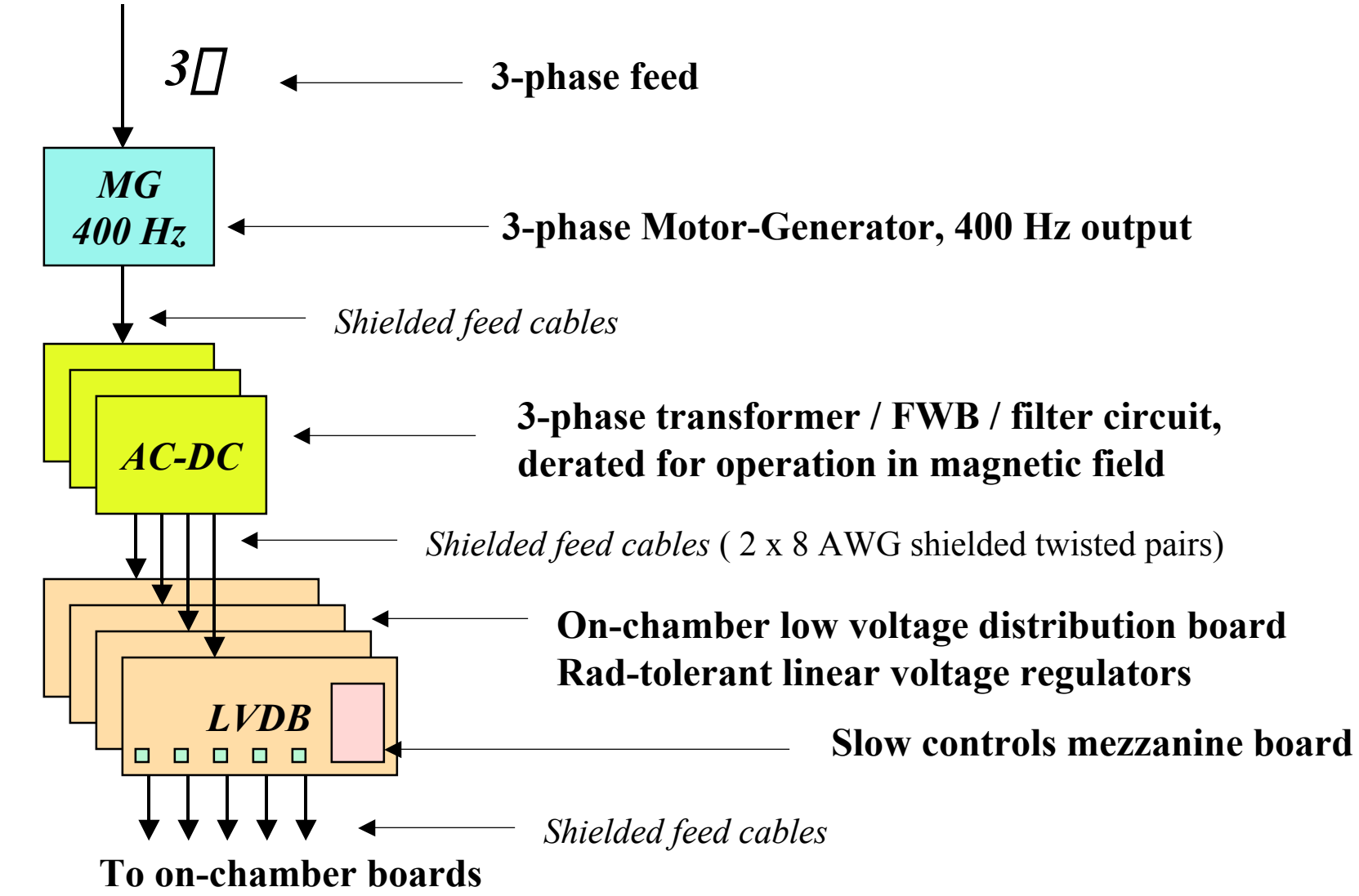


Readout cables for cathode front-end boards



Crossover for anode trigger board readout, low voltage supply harness

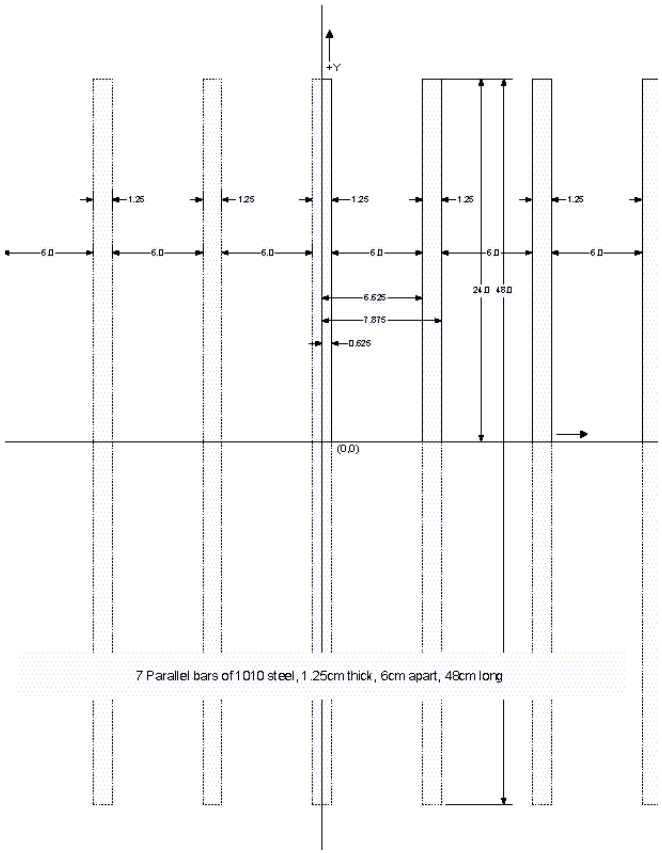
AC-DC LV System Overview



Magnetic shielding model

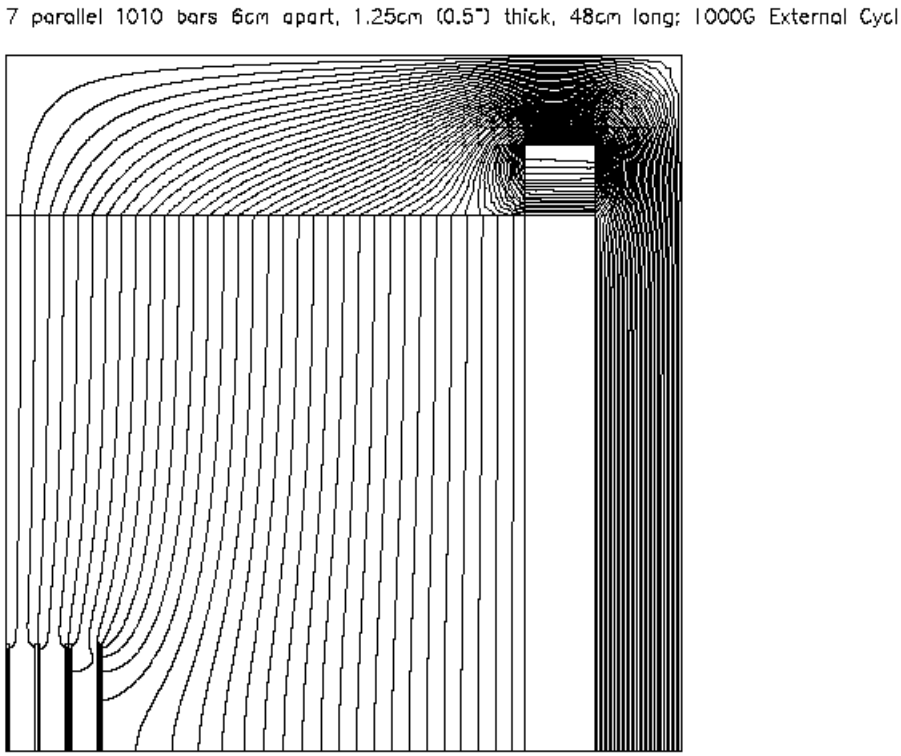
Poisson model

- Seven 1/2” thick plates
- Six gaps for Vicor boards

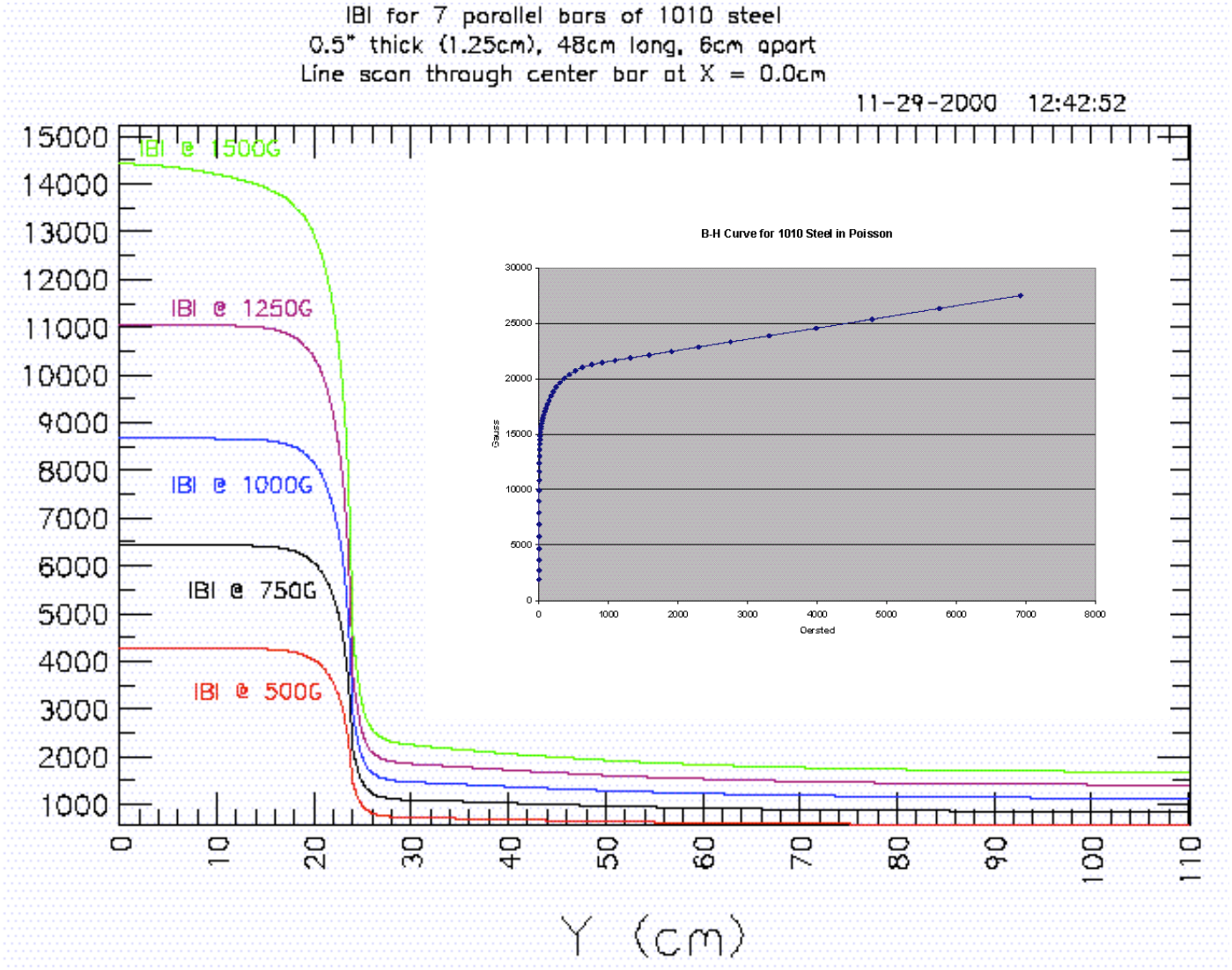


Field in region of shielding plates

- Outer gap exposed to

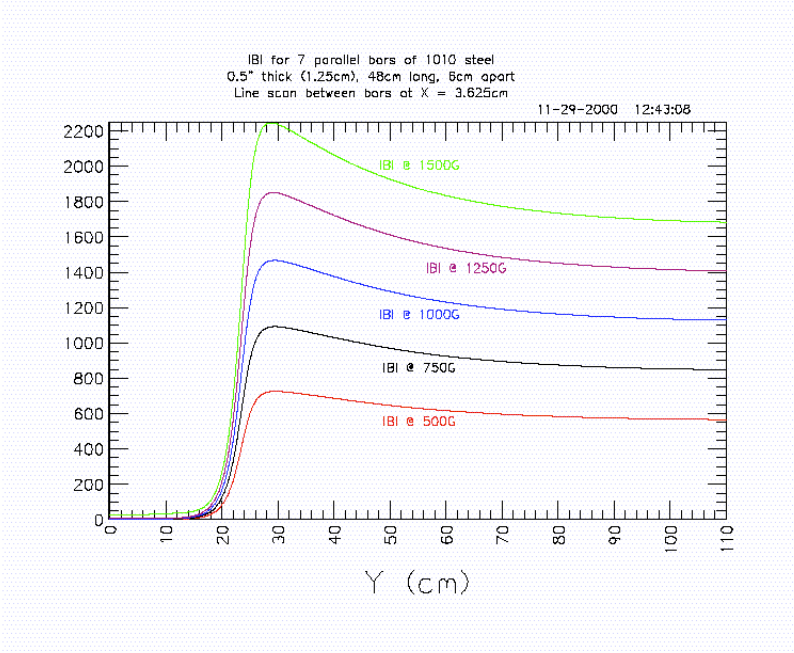


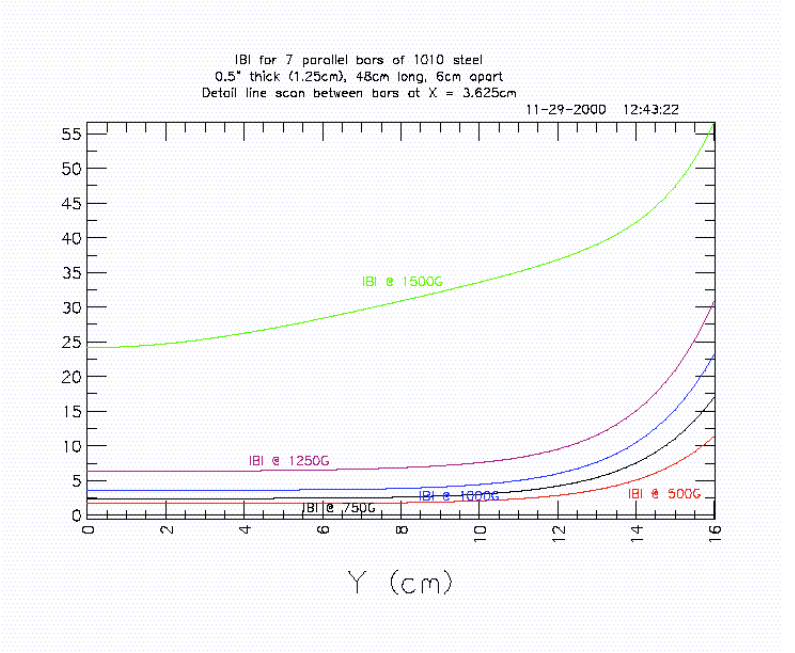
Field in shielding plates ...



Field in gap …

Scanning up along line through center of innermost gap





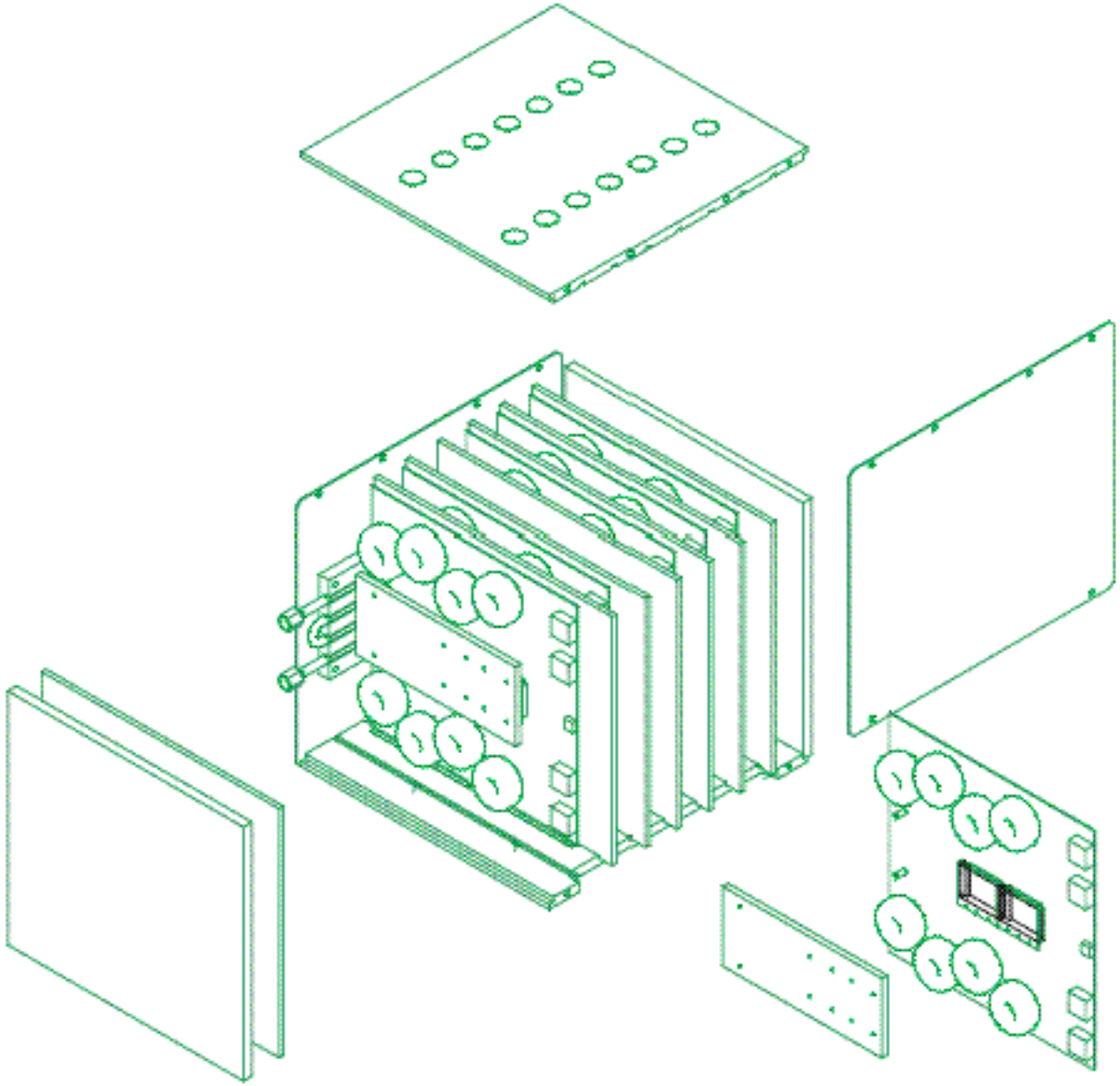
Field in sensitive zone is within operational limits for Vicor

Vicor Magnetic Shield

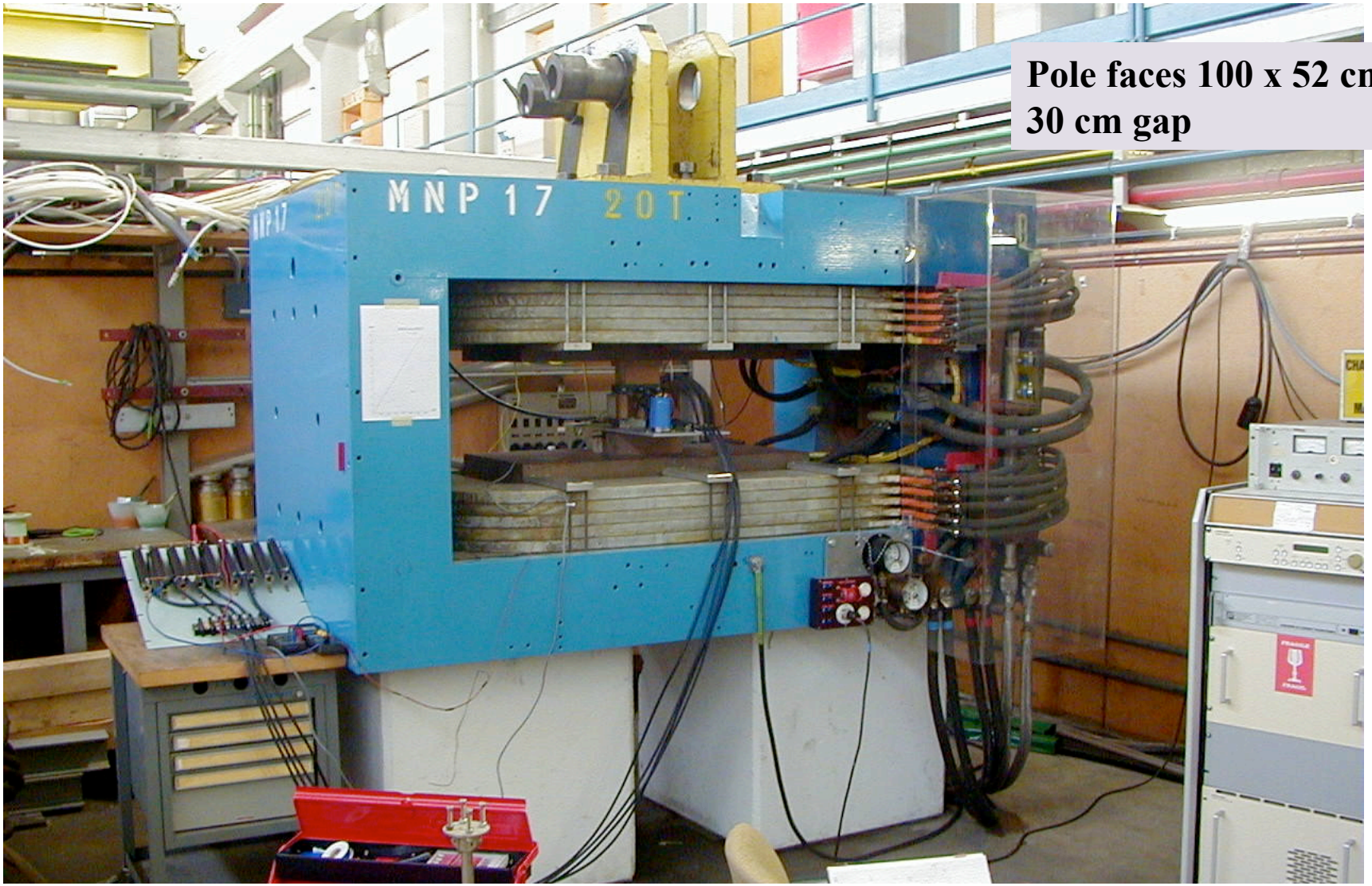
Drawings for pr
magnetic shi
design compl

DC-DC convert
cooling is inc

Cost of steel is
issue, will ne
seek optimal



AC Tests, Test Magnet

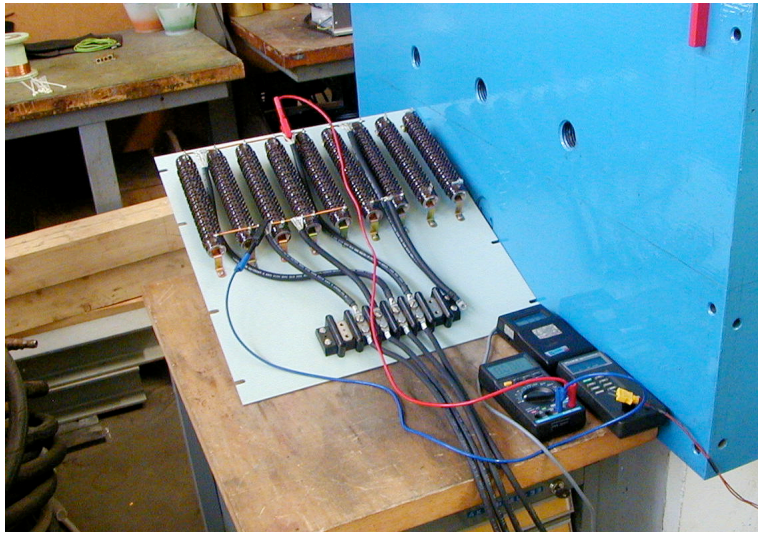


Pole faces 100 x 52 cm, 30 cm gap

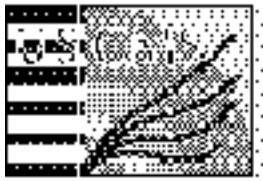
Transformer test setup

Transformer in magnet, core ~7cm away from each pole face to prevent magnet iron from acting as part of transformer magnetic circuit

Gaussmeter probe location



0.1 Ohm load, 5 kW

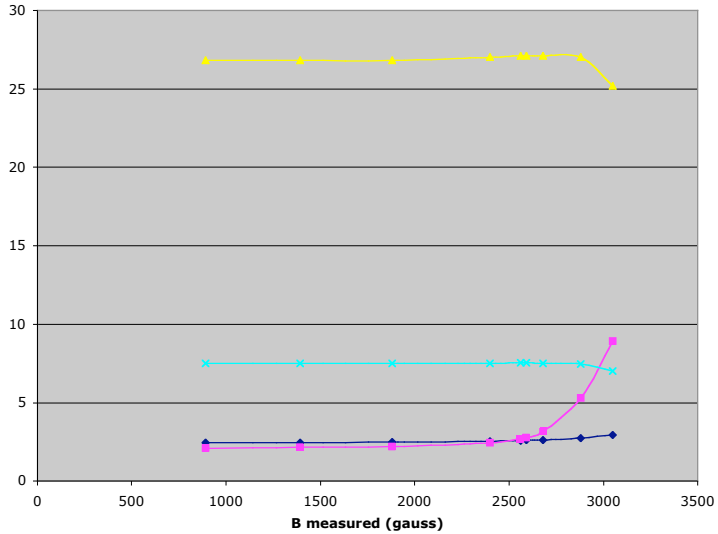


Magnetic Field Test Results

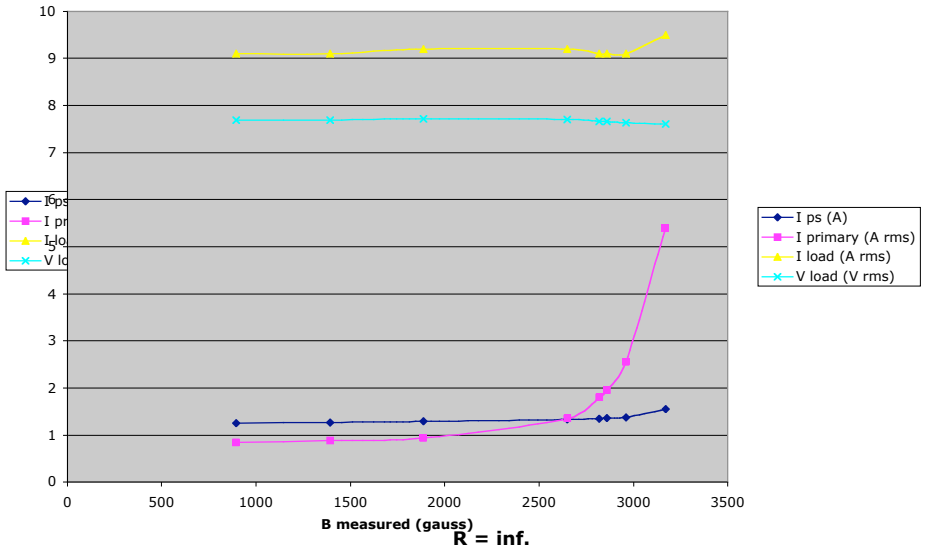
Magnet current	B nominal	B local	Load voltage	Primary current
32.5 A	0.50 kG	0.93 kG	7.26 V	14.0 A (p-p)
49.9	0.75	1.39	7.27	15.0
66.6	1.25	2.51	7.26	15.0
88.7	1.30	2.66	7.27	15.5
89.8	1.35	2.68	7.26	15.5
93.1	1.40	2.78	7.20	17.0
99.8	1.50	2.97	6.93	24.2
106.4	1.60	3.16	6.18	34.0

Testing AC Characteristics

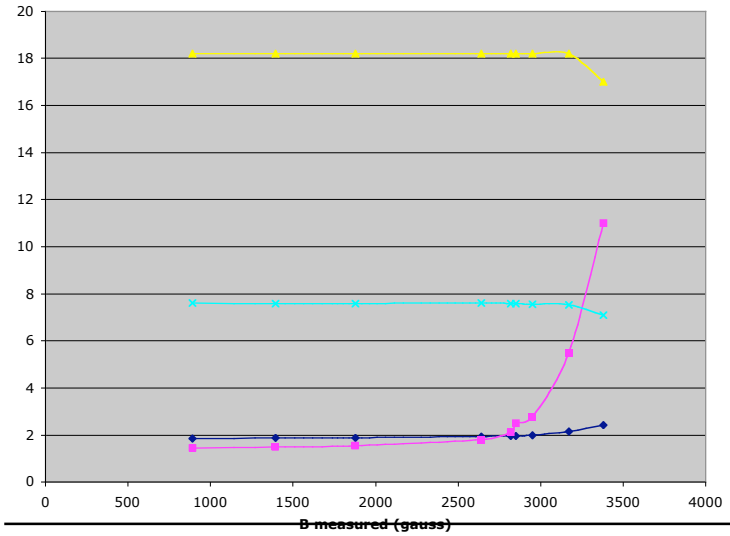
R = 0.166 ohm



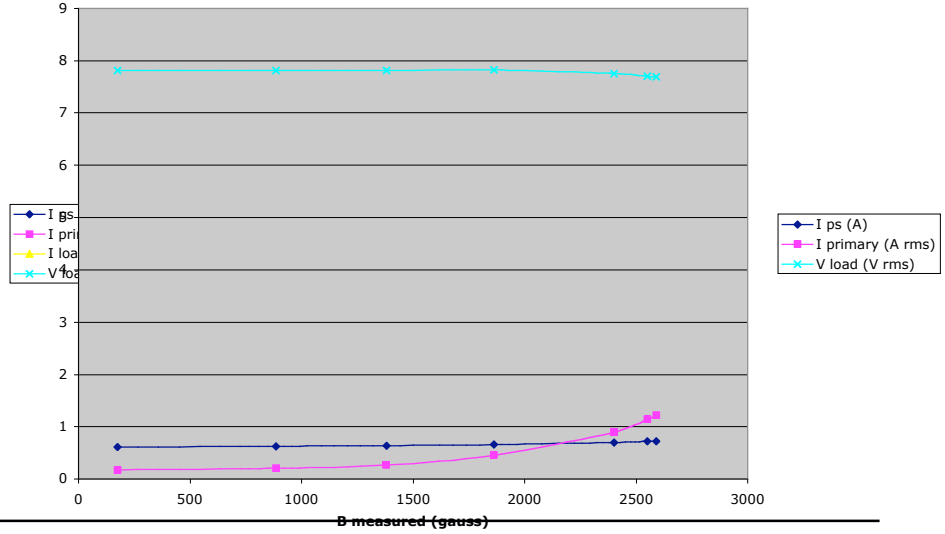
R= 0.5 ohm



R = 0.25 ohm

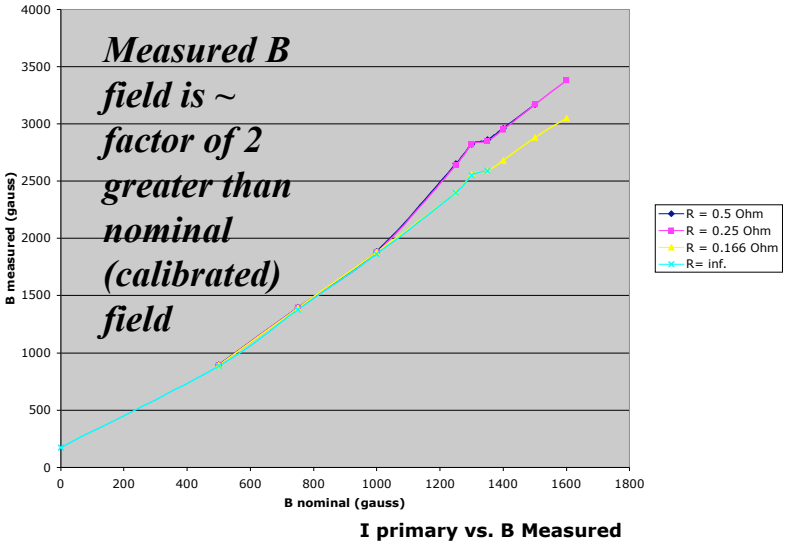


R = inf.



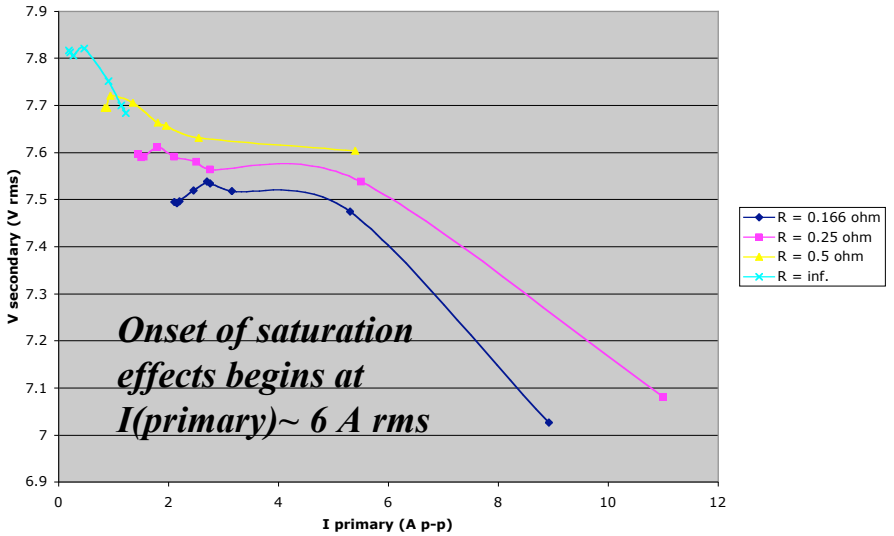
Mag. Test Summary

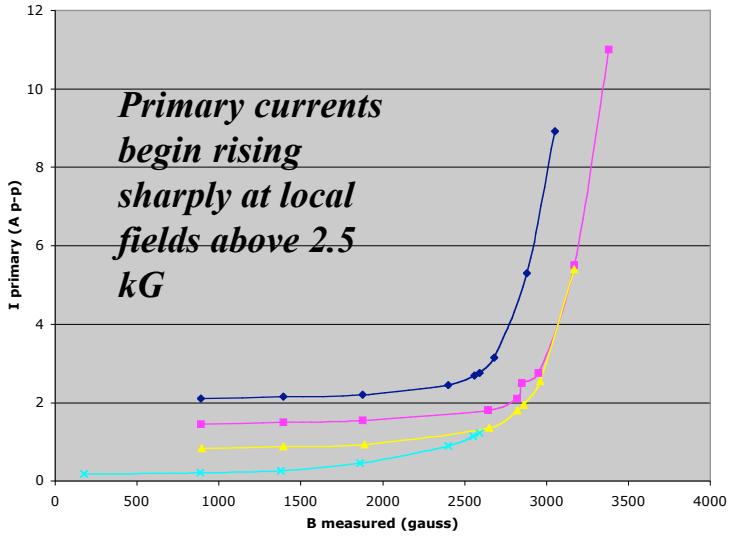
B field at transformer



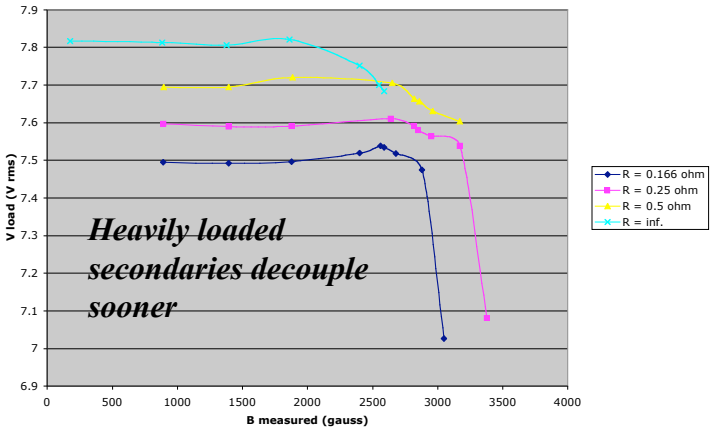
I primary vs. B Measured

V sec. vs. I prim.



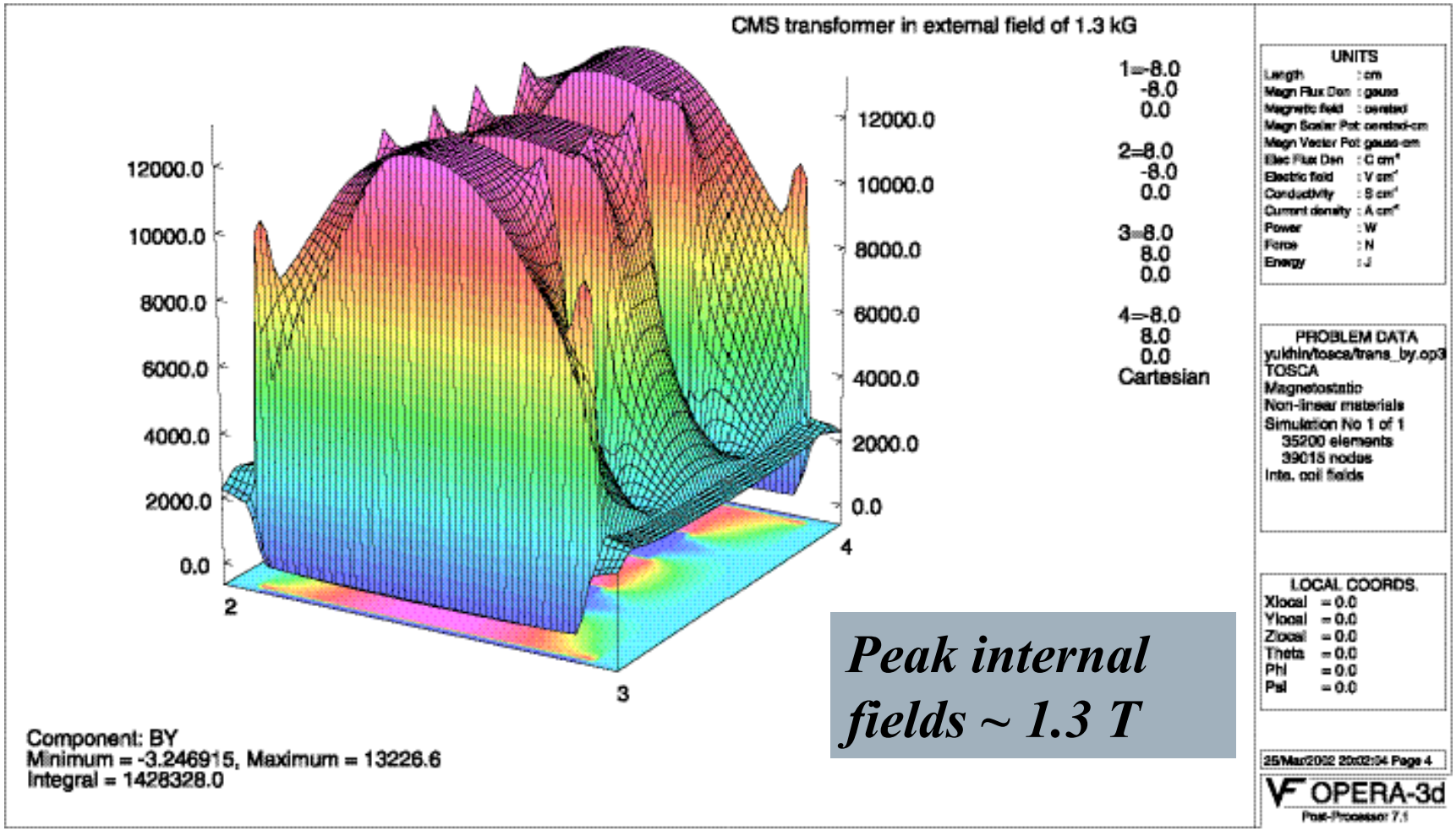


V secondary vs. B measured



Magnetic FEA for 1.3 kG

Field directed along axis of windings:



Mag Field Test: Conclusions

- Results of magnetic field tests of AC-DC converter demonstrate that operation of transformer-based LV system in an ambient field of 1.3 kG is possible
  - May be able to optimize transformer core design to operate directly on disk periphery without additional magnetic shielding
  - Should be able to take advantage of transformer orientation to increase magnetic field tolerance
- In principle, the prototype 3-phase transformer we tested could be used as is for the EMU low voltage system