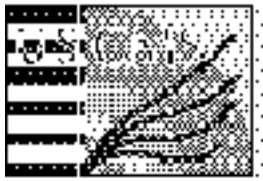


CMS Electronics Week

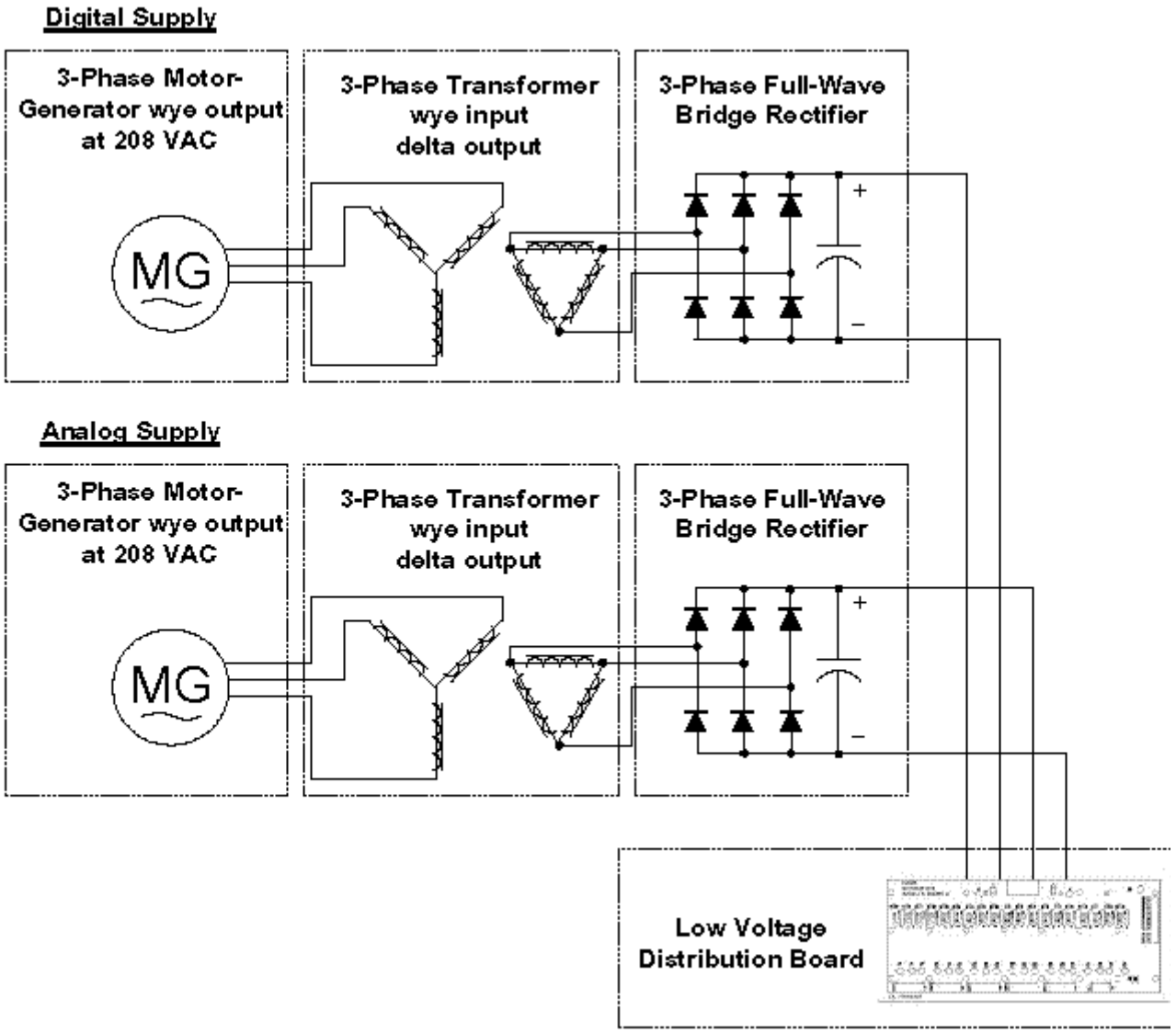
Plans for Production of CMS Low Voltage System

S. Lusin

University of Wisconsin

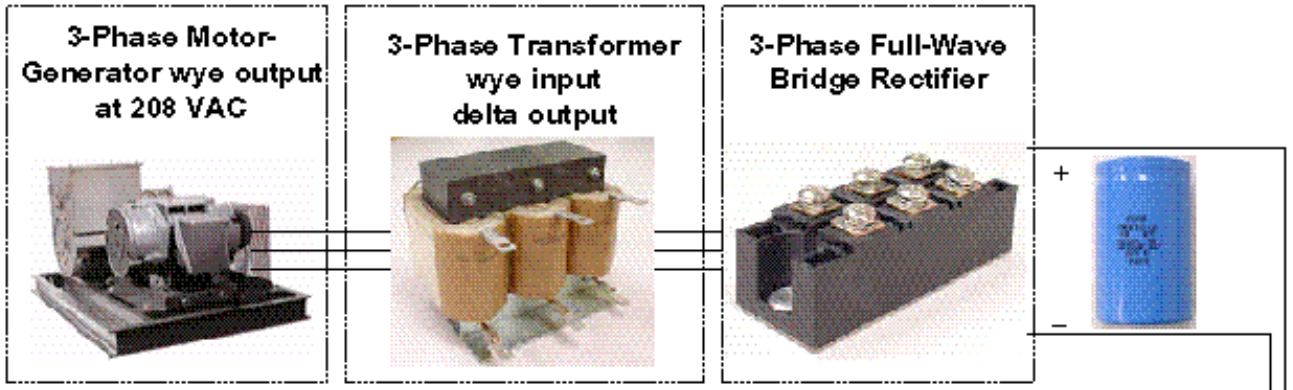
AC-DC Supply Overview

- 400 Hz AC would be supplied by motor-generators located i region of low magnetic field.
- Transformers would be mounted on the endcap walkways or in towers.
  - Transformer would be operated in a derated mode
  - May require some magnetic shielding
- Rectifiers and filters would be located at transformer

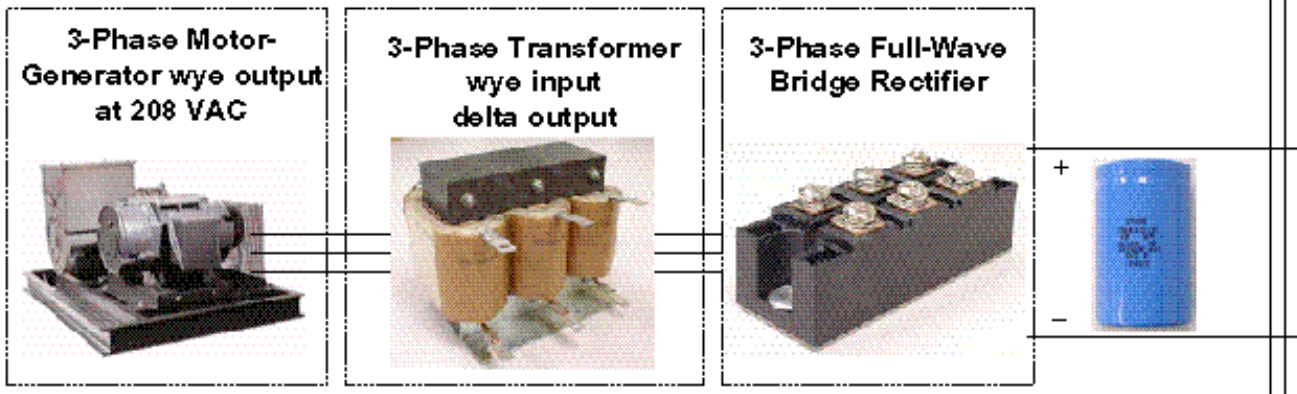


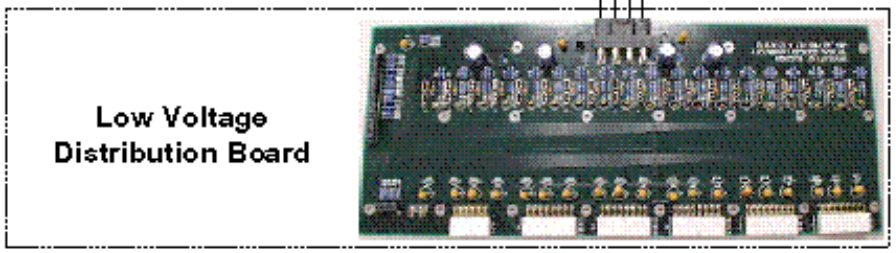
LV Supply Components

Digital Supply



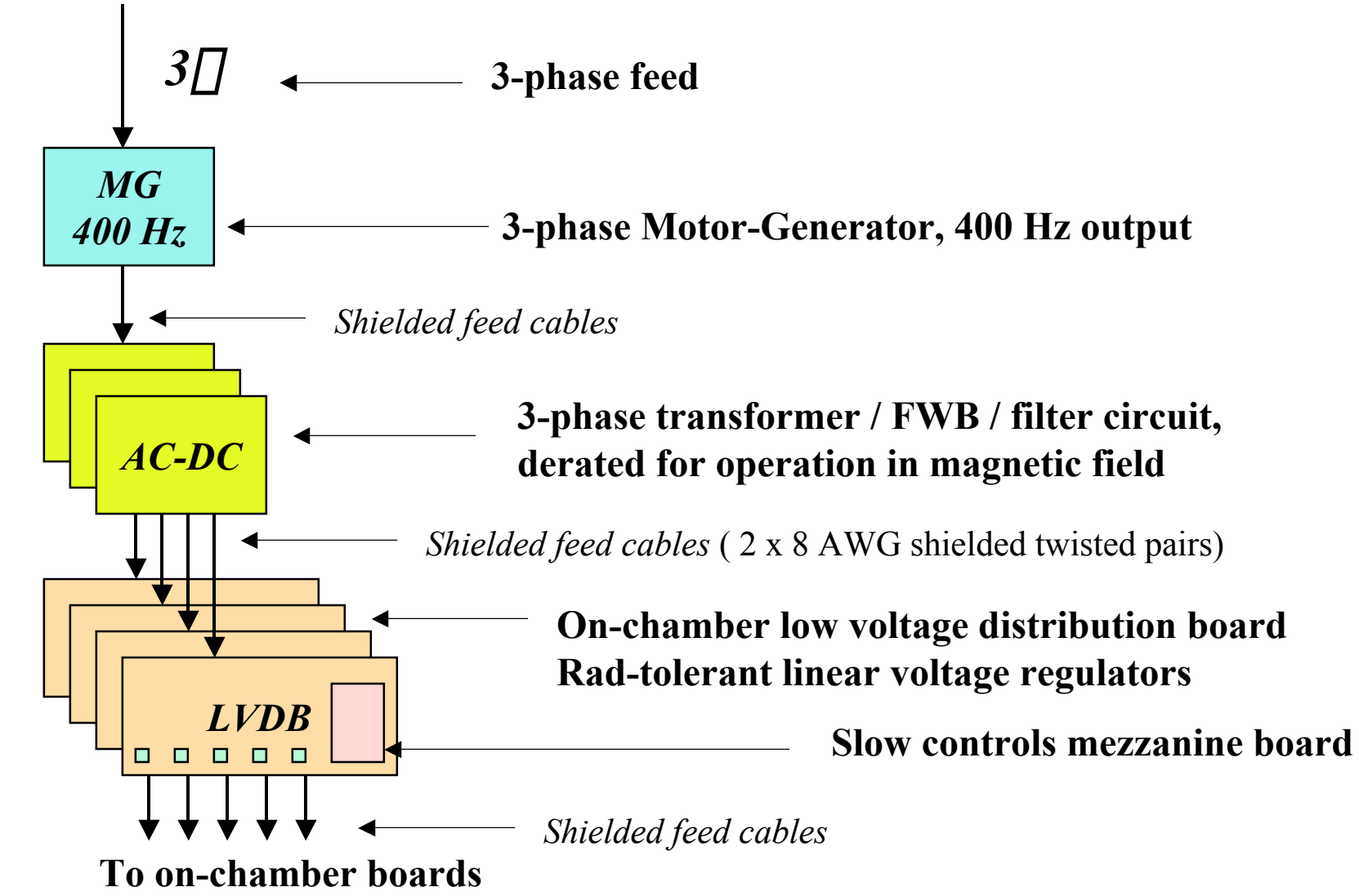
Analog Supply

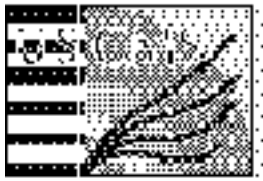




Regulation exists at the two ends of the system. Intermediate components are dumb and reliable.

AC-DC LV System Overview





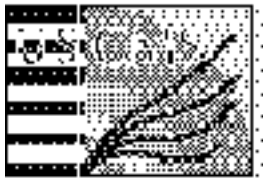
Issues: Power generation

MG Set is current baseline

- Main advantage is simplicity & reliability. What advantages might other options have?

Three-phase power is current baseline

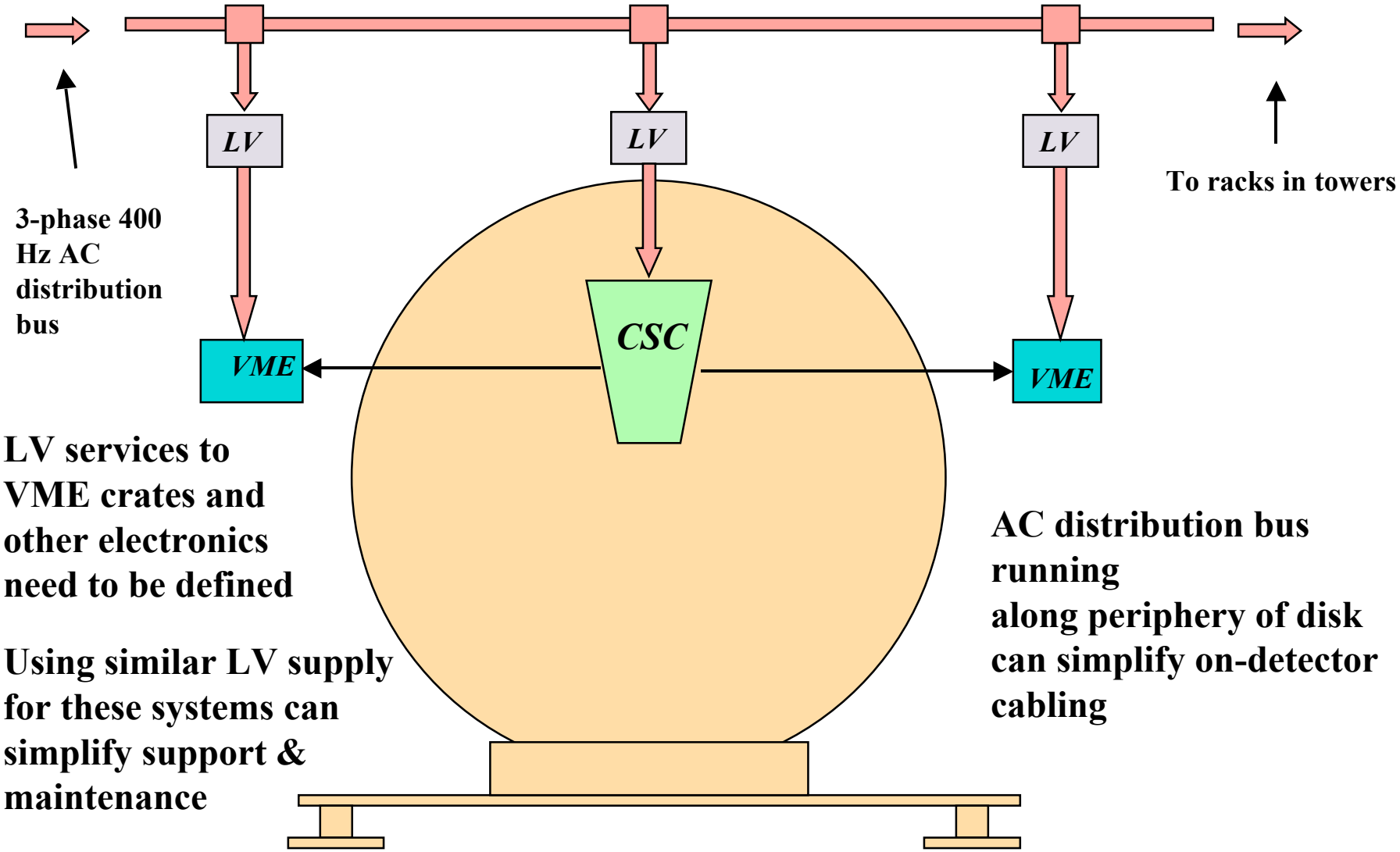
- Lower peak ripple currents
- Easier to filter
- But need to be scrupulous about load balance
- Where would service power come from?
- Is single-phase a contender?
  - Can provide utility power for services during access
  - Allows for toroidal cores on transformers. Can this give us any magnetic field advantages?
  - How much would filter capacitor MTBF degrade?
- Power factor correction?



Issues: Power Distribution

- This is overlap zone between LV system design and CERN general electrical services
- Need close involvement with CERN electrical groups early in design phase, LV system has to be co-developed with power distribution in cavern
- Safety evaluation, electrical code requirements are CERN-specific
- Fermilab engineers need to be familiarized with CERN requirements
- Aiming to create general-pupose power distribution system on detector periphery

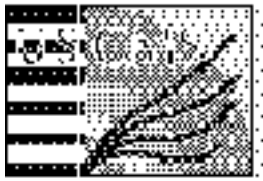
Low Voltage Services



LV services to VME crates and other electronics need to be defined

Using similar LV supply for these systems can simplify support & maintenance

AC distribution bus running along periphery of disk can simplify on-detector cabling



Issues: AC - DC Conversion

Need to incorporate subdetector-specific monitoring and controls

- Control may be simple cutoff from further upstream, out of magnetic field zone

Need better understanding of magnetic field

- What is equivalent magnetic field during tests?
- Need input from modeling & simulation
- Need validation from tests at magnetic field test facility

Cooling

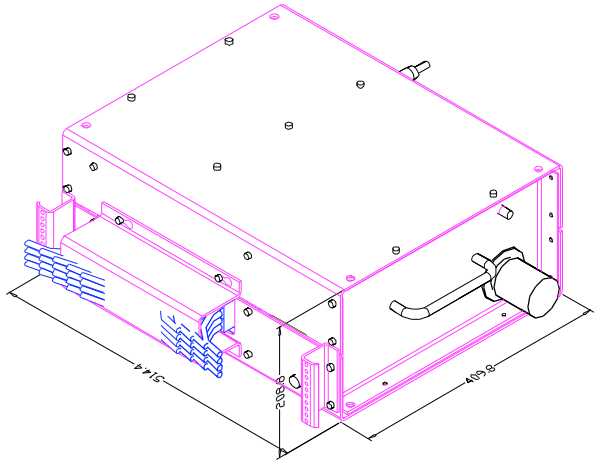
- Need integration with rest of detector services

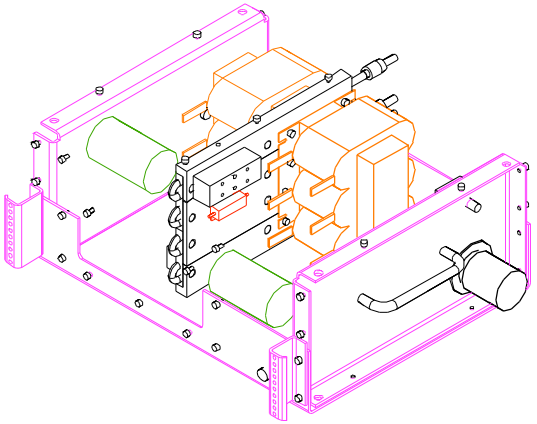
Installation, access & servicing

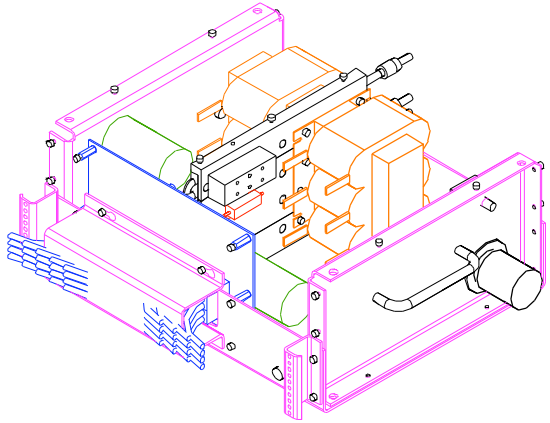
- Design for crane handling, module stacking, minimal fasteners

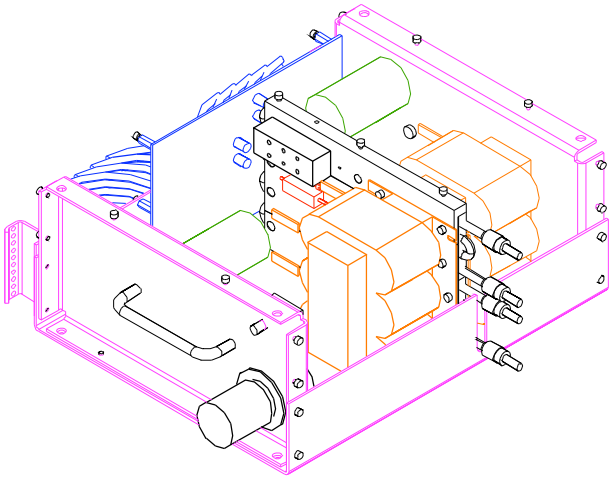
LV Power supply

Prototype enclosure design







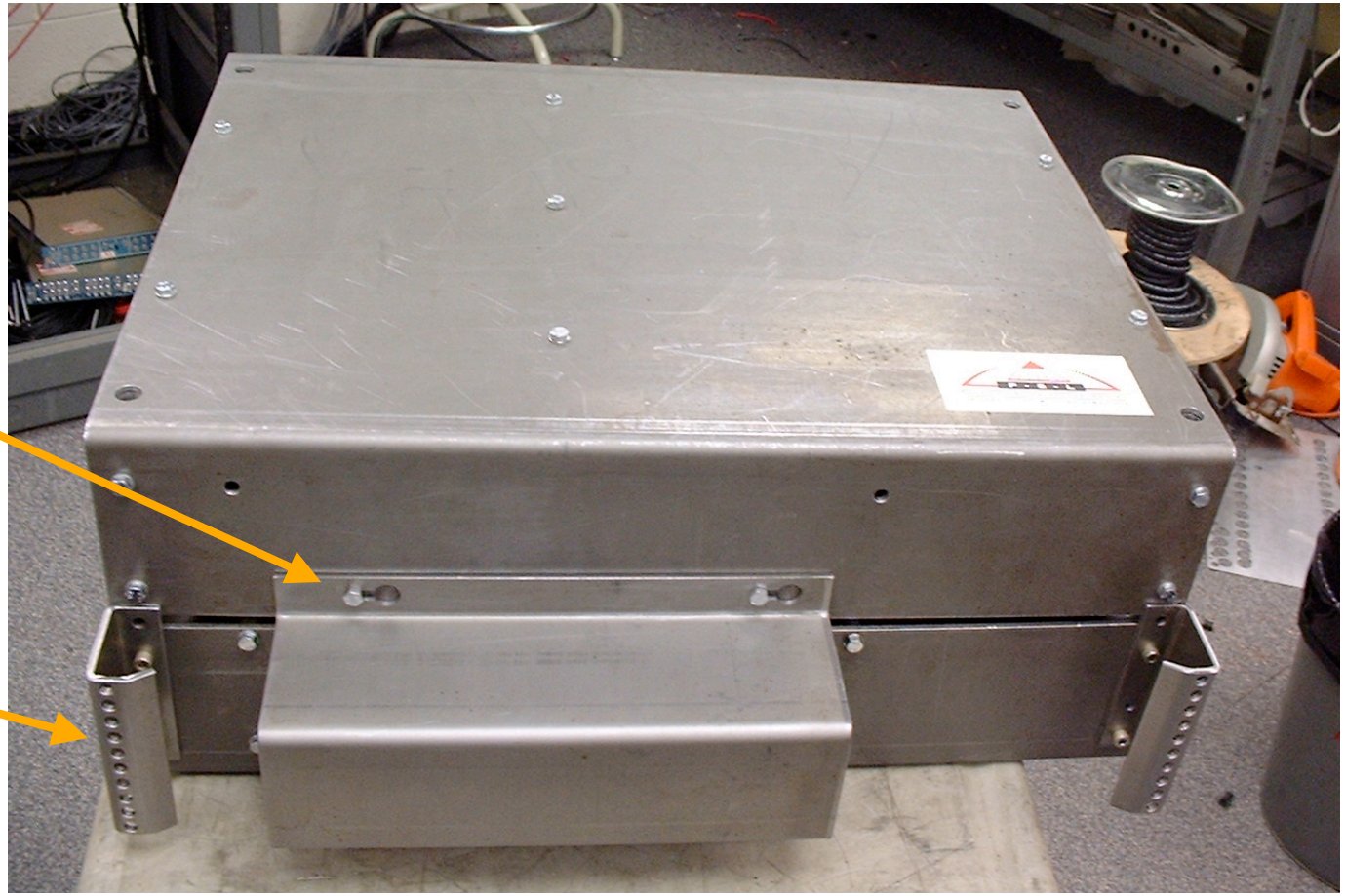


LV Power Supply, front

Shows clamshell construction, cable shield, strain reliefs.

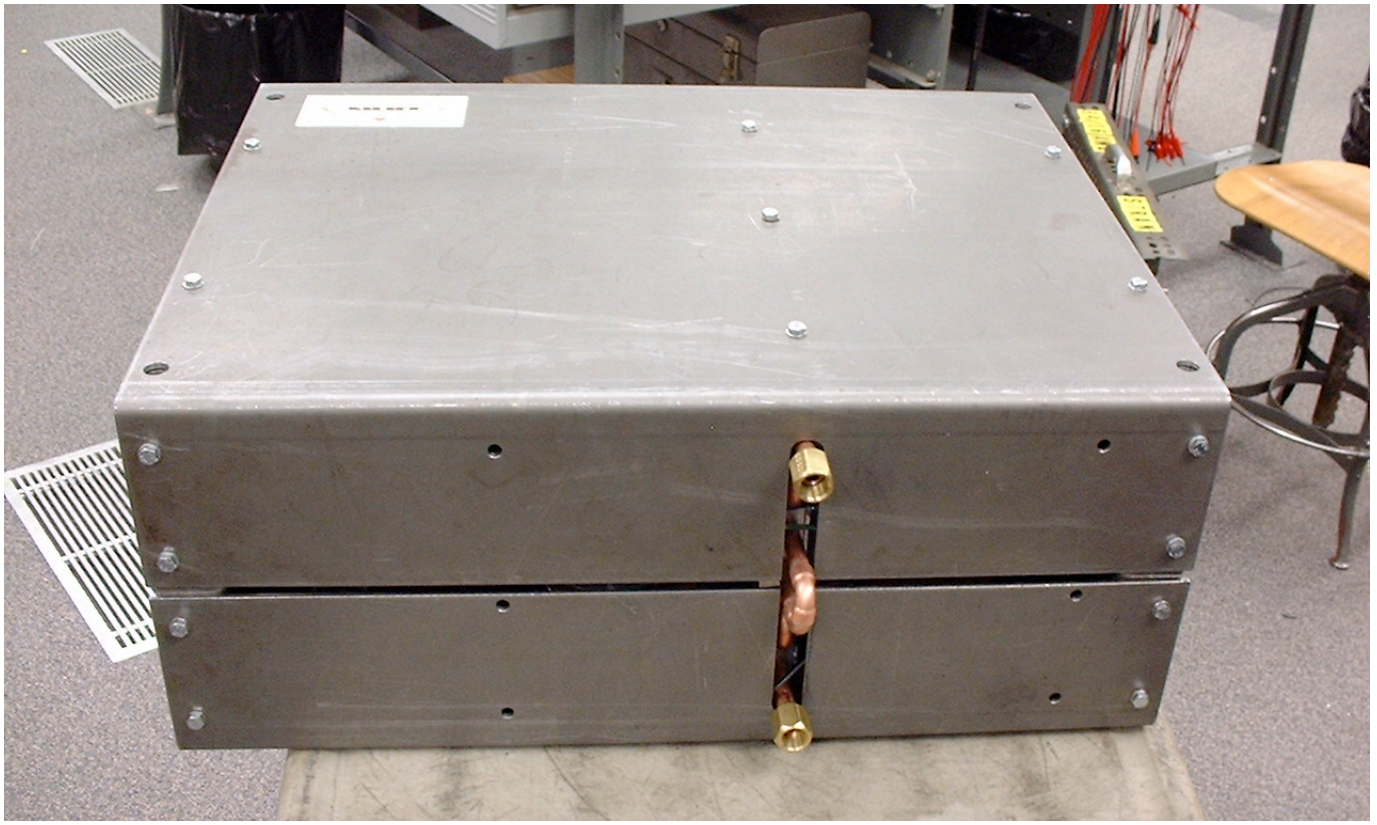
Keyhole screw mounts

Strain reliefs

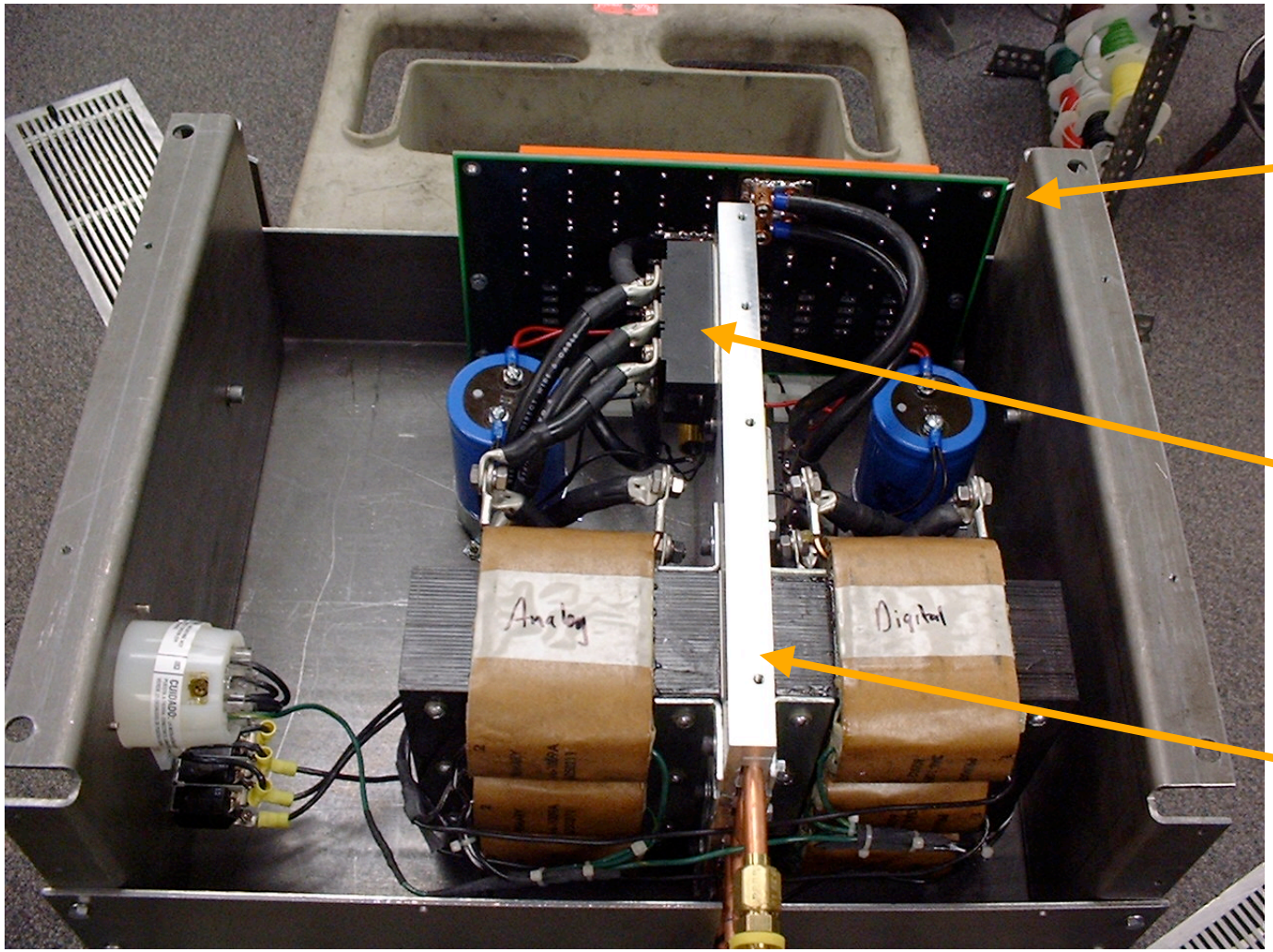


LV Power Supply, rear view

Shows cooling connections, uses flare fitting to hose-barb union (not shown)



LV Power Supply, plan view

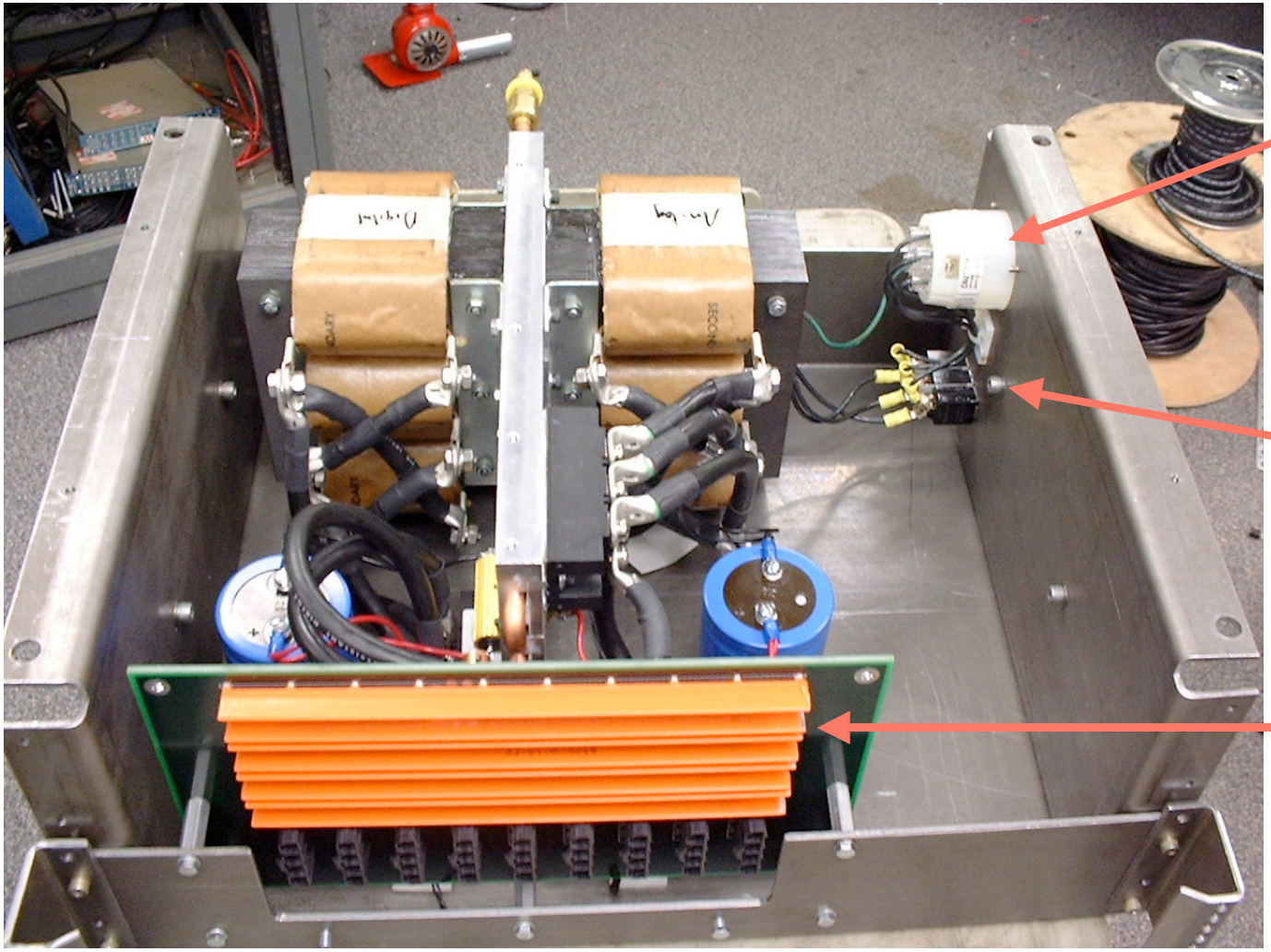


Distribution & connector board

3-phase bridge rectifier

Cooling plate

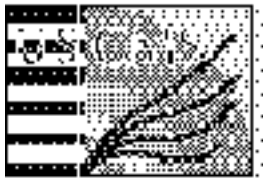
Connector board …



3-phase, 4-wire input connector

Thermal circuit breaker

Distribution bus bars



Voltage Regulation & LV Distribution

Local regulation is subdetector responsibilty

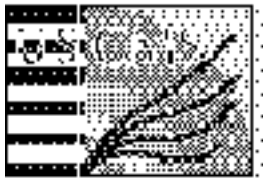
- But has to integrate into upstream LV system
- Need to coordinate with subdetectors at the design stage
  - Segmentation, headroom, choice of regulator …
- Integration issues have to be addressed at same time
  - Cabling, access, connector clearances, cooling …

Emphasis has been on supplying LV to detector front-end electronics

- But also need to address rack power & cooling

Not only sub-detectors need LV

- Alignment
- Gas system
- Controls & monitoring …



Commercial Power Systems

In general, industry does not support applications for exotic environments like ours, but ..

Several recent promising developments with commercial power systems

- LV supply module tested to 7 KG
- Water-cooled crate power supply with modest magnetic field tolerance
- Hope that progress and further development continues, will be happy to coordinate design approaches

Will evaluate commercial prototypes, provide feedback for manufacturers