Rack Power distribution

At the 8/14/25 ePIC DAQ meeting we had the discussion about form factors for electronics.

- VME-like or some other standard (ATCA or mTCA) – do we need shelf management?
- Custom standalone “boxes” tailored for the electronics they hold?
- Central (meaning per rack) DC power, or individual power supplies?

Some rule-of-thumb numbers –

- You can typically fit 4 6U crates into a rack
- You need space for fan trays, patch panels, and rack management
- Physicists should generally refrain from dissipating more than ~25KW per rack (special back-door water-cooled computer racks can go to 60KW – that’s because the internal airflow is optimized).

Crates can be expensive

The argument around here is that there is usually a stash of existing [VME] crates available – good argument as long as they haven't reached their EOL

We have no investment AFAIK in ATCA or derivatives – the LHC experiments paid big money just for the convenience of shelf management features (not using the backplane, really)

Crates with good power supplies are expensive – the difference between a "normal" VME and a VIPA-standard crate with cleaner power etc can be a factor of >2

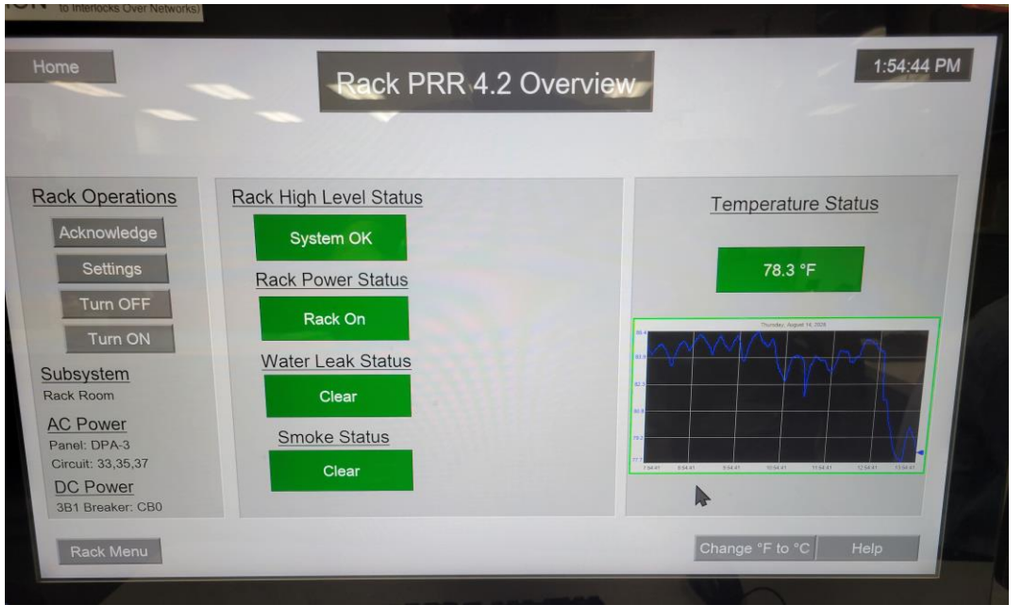
In general, backplanes are expensive – if you only need power, it's a consideration

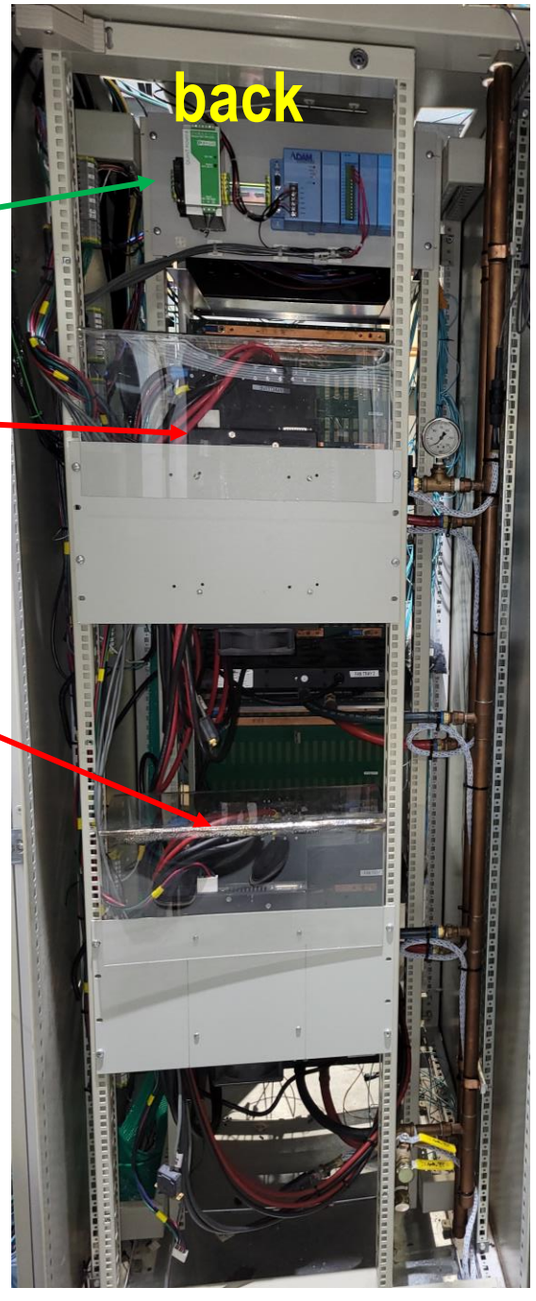
sPHENIX racks

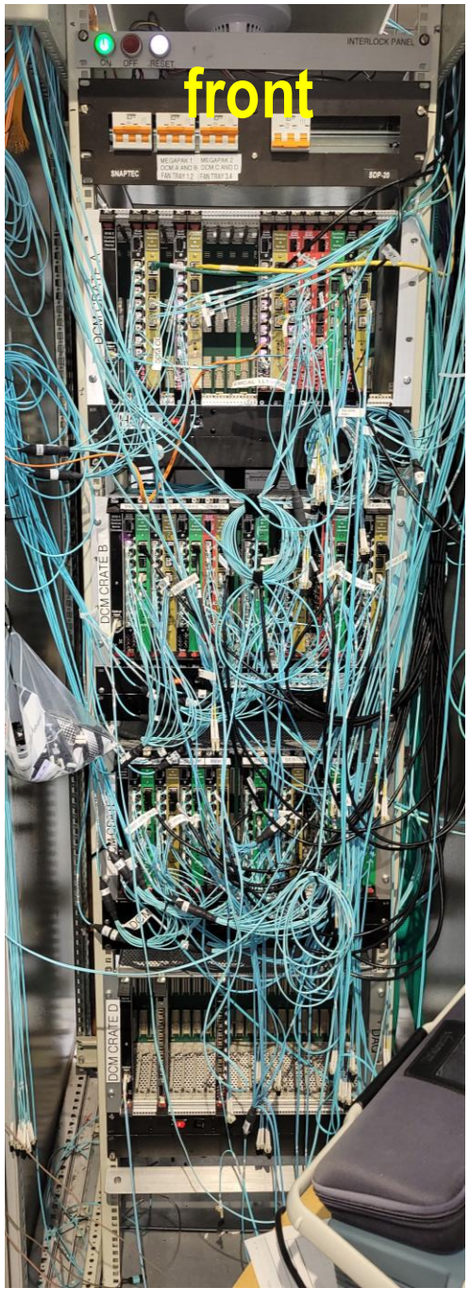
Our standard racks have centralized DC power

The racks are centrally controlled with a controller that also embeds safety systems (smoke, temperature, etc)

We use Vicor “MegaPacks”

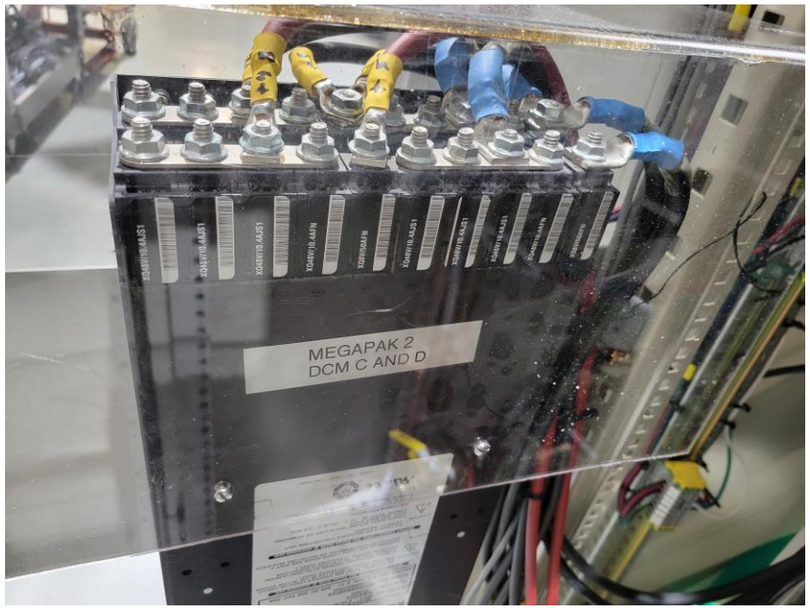


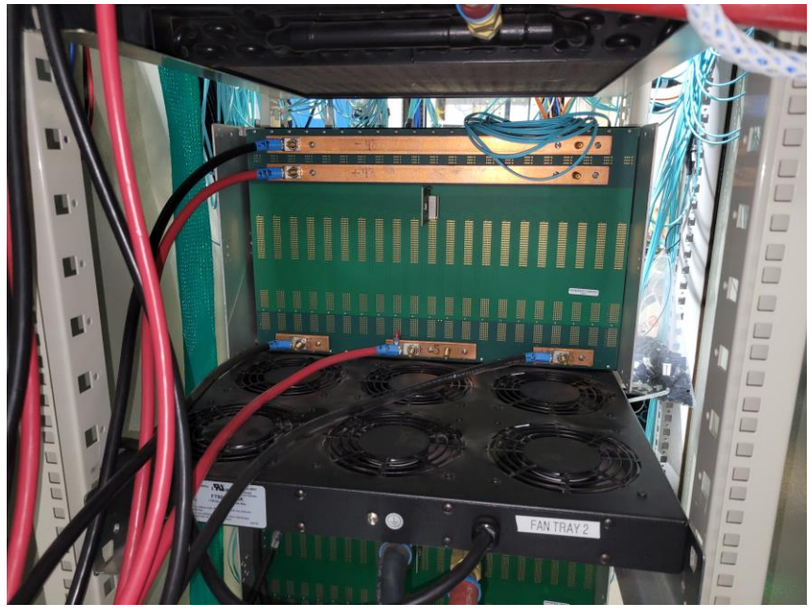


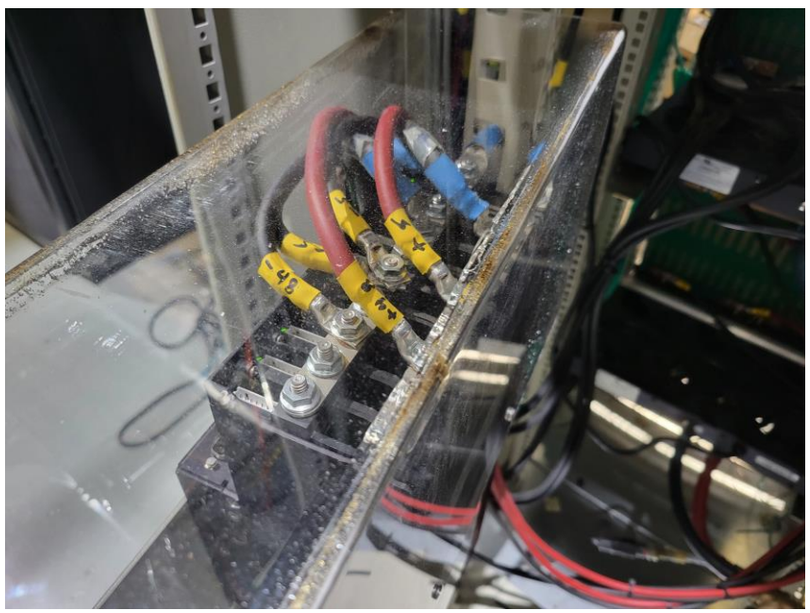


Megapacks

Here one pack powers two crates (high power usage). The MegaPack provides the various DC levels (+-12V, 5V, etc etc)







BTW, those look like VME backplanes but are really custom. The good stuff runs on the “P0” lines.

Noise considerations

No switching power supply is without noise. We don't have a direct comparison for most systems since we always used the MegaPacks

Some switching noise will still travel along the wires, but distance helps

Case in point: the early versions of our "GTU" had a chassis with an internal power supply (left)

There is a SPI-based register setting that would fail about once in 30 settings due to noise on the traces

We then wired it to external DC power (right), and the problem was gone.