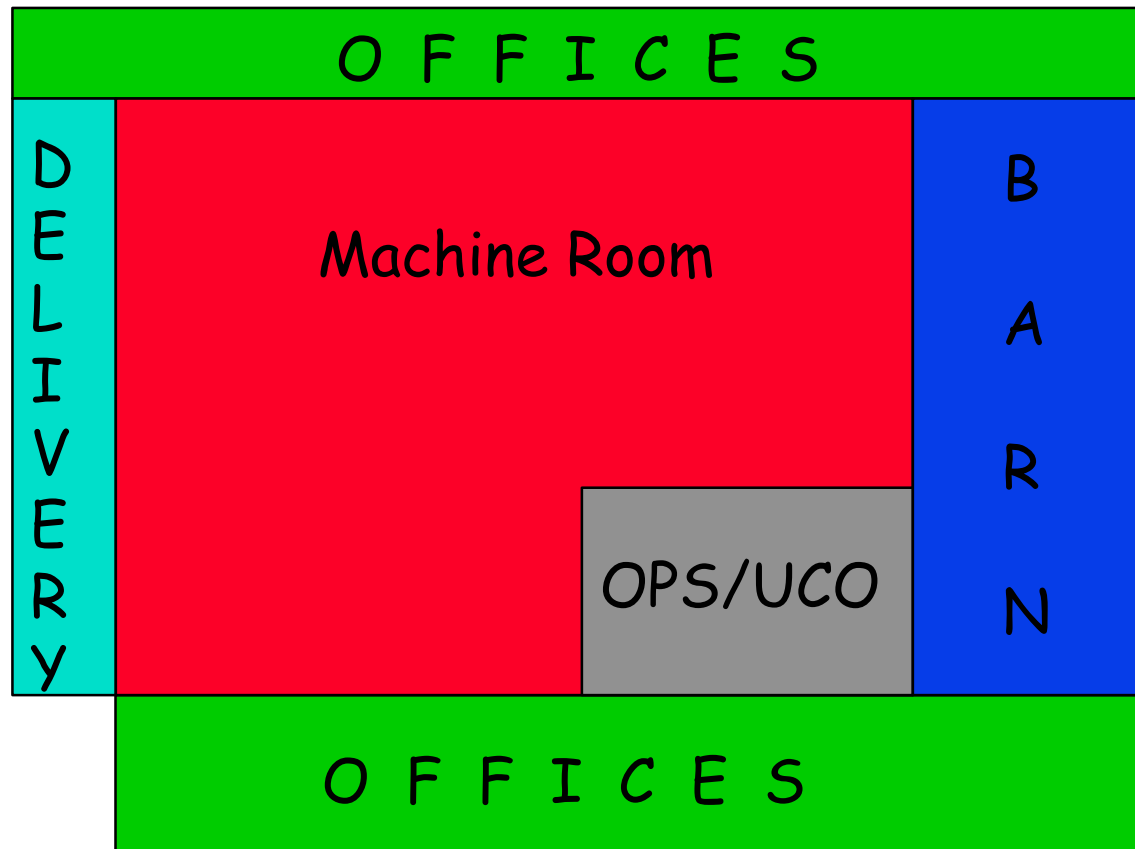

Transforming B513 into a Computer Centre for the LHC Era

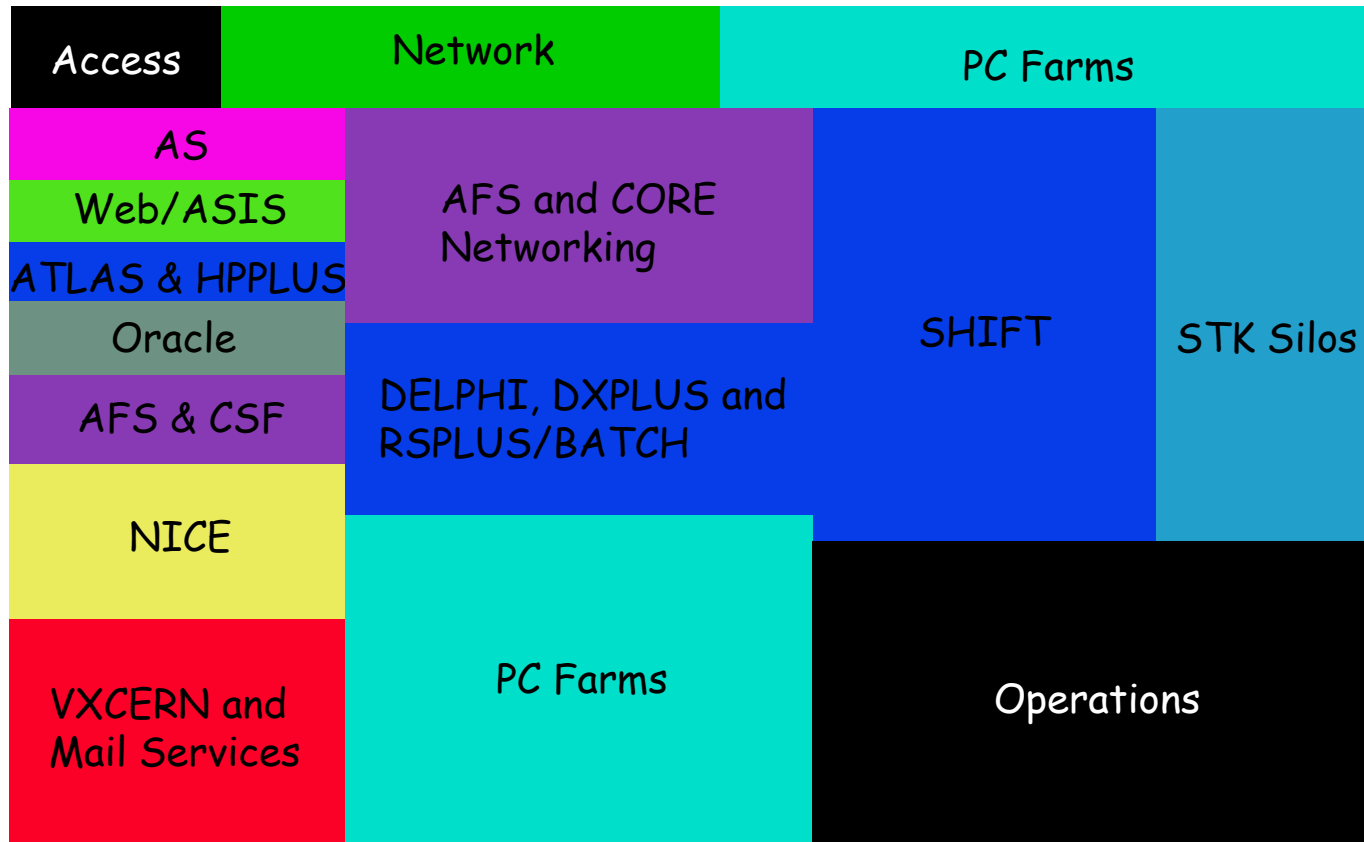


Tony Cass — Tony.Cass@cern.ch

B513 Ground Floor Layout



Machine Room Use Today



Total Floor Area: 1400m²



Tony Cass

What will we have in 2005?

✍ Computing farms

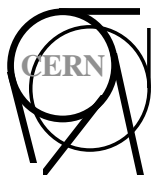
- For ATLAS, CMS, ALICE and LHCb
- For other experiments

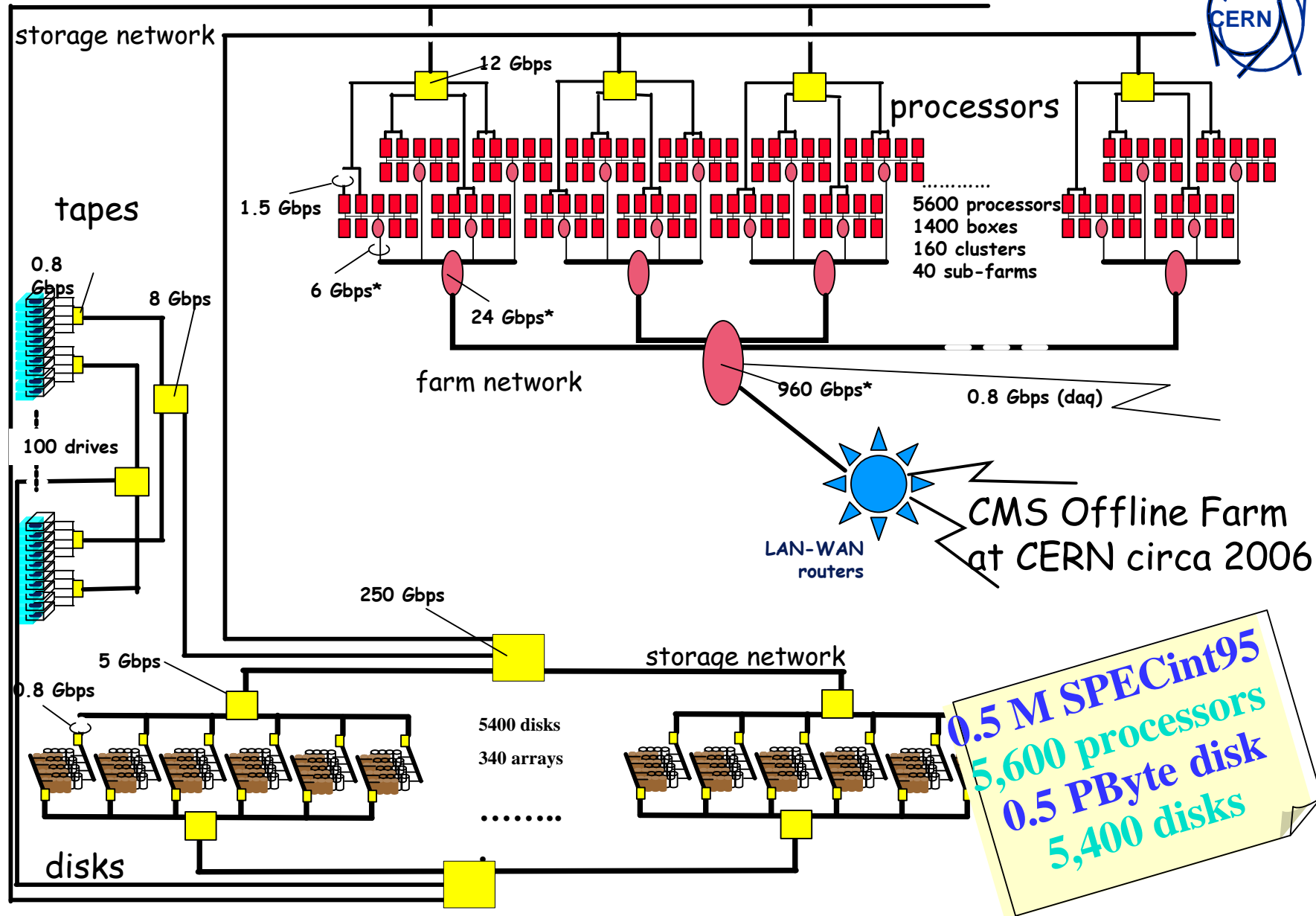
✍ Will still need

- Networking Infrastructure
- "Home Directory" servers
- Database Servers
- Administrative Servers

✍ What else?

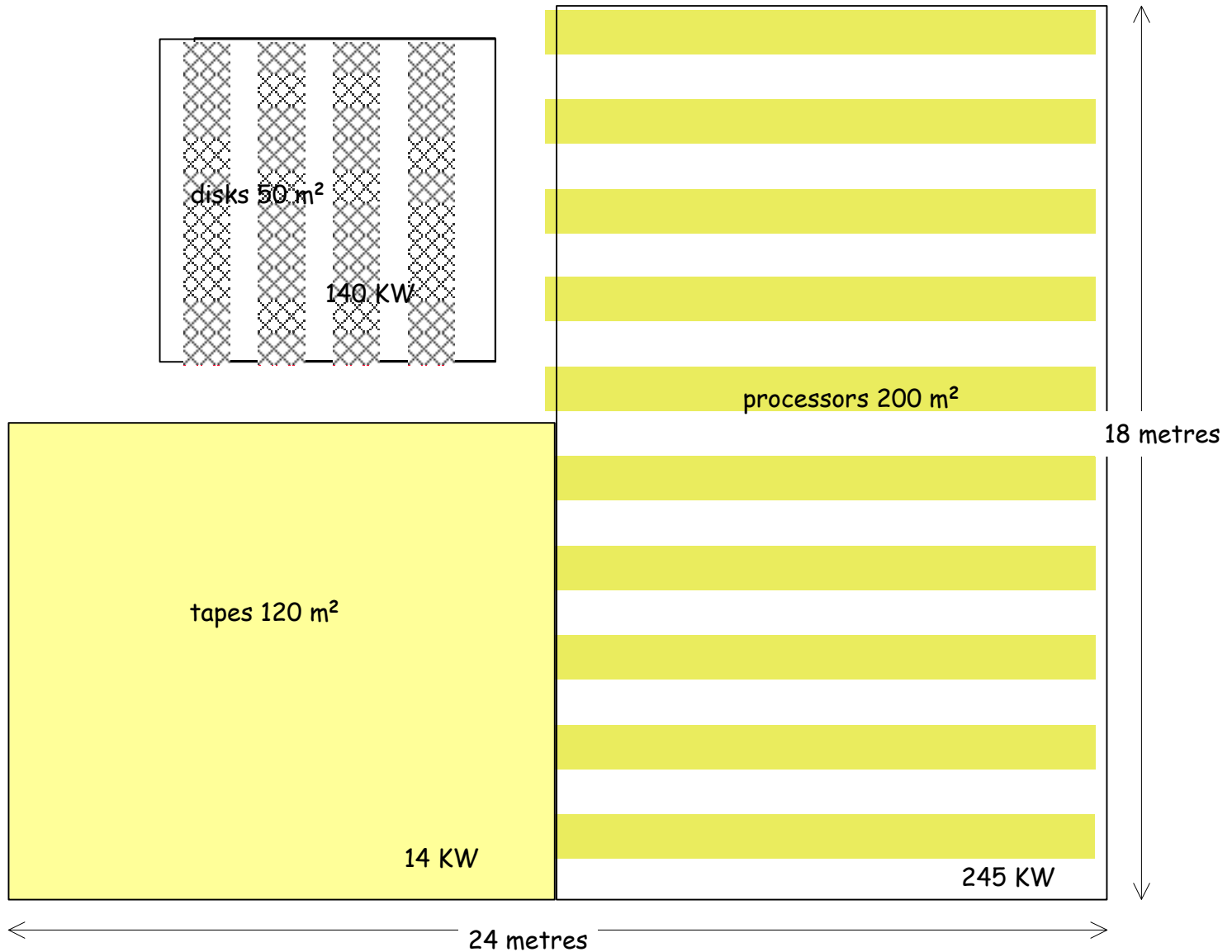
✍ What will an LHC Computing Farm look like?





Layout and power - CMS or ATLAS

totals
400 kWatts
370 m²



Space and Power Needed

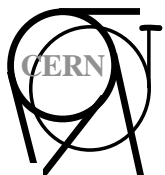
- ✍ Assume 5 Farms
 - 2000 m² floor space
 - 2MW power
- ✍ Plus same space as today for everything else.
- ✍ Space available in B513:

Computer Room	1,400m ²
Vault	1,050m ²
MG Room	200m ²
Barn	650m ²



Electricity Supply

- ✍ Transformers in B513 limit supply to 2MW
 - Replacing these would be expensive!
- ✍ 2MW can be distributed to machine room but
 - most services do not have an independent supply:
 - » power lines run "vertically" but
 - » services are arranged "horizontally"
 - Emergency Power Off tests are required each year
- ✍ How much work is required to fix these problems?
 - Remove Emergency Power Off? (only Local Power Off required)
 - Rearrange services "vertically"?
- ✍ See later for a discussion of fire detection.



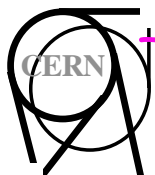
UPS

✍ Installed in 1992

- Consists of 3 modules, each rated at 400kVA, a 4th is available but no batteries are installed.
- Autonomy is 10 minutes at rated load, but around 30 minutes with current load.
- Battery life is 8 years... Replacement is indicated **now** (some corrosion visible); cost estimated at 220K.
 - » But could survive with just two modules... 150K or 80K for cheap batteries with 5 year life.

✍ What autonomy is required in 2005?

- Auto transfer between Swiss/French supplies in operation since January this year (**only!**).
 - » Do we need more than 5-10 minutes autonomy?
- Are the Swiss and French supplies really independent?



+ 2MW diesel backup would require a dedicated installation for IT

Air Conditioning — Total Load

✍ 2MW power means 2MW of heat to remove!

✍ But also need to remember

B513 offices and B31 500kW

The Sun heats the machine room as well 200kW

Equipment overhead 500kW

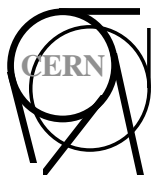
✍ Total cooling load of 3.2MW compared to capacity of 2.4MW today

- Need to add new water chiller on roof. Space is available but this will cost at least 350KCHF



Air Conditioning — Where to cool?

- ✍ The cooling capacity for the combined machine room and barn area could be increased from 1.6MW to 2.1MW.
 - This requires increasing the
 - » air flow and the
 - » temperature difference between incoming and outgoing air.
- ✍ We can install up to 500kW cooling in the vault.
 - Total capacity is limited by ceiling height.
 - Installation would cost ~600KCHF
 - » and take 1 year from giving the go-ahead to ST.
- ✍ MG room capacity should be reduced to 140kW
 - Combine with vault cooling to reduce equipment space?



Fire Detection

- ✍ We have one Very Early Smoke Detection (VESDA) system which samples air extracted from the machine room.
 - A second unit should be installed for redundancy.
- ✍ Localised fire detection linked to automatic cut of electricity supply is possible. Do we want this?
 - Does it require work to general power distribution or can we use the local distribution boxes (and circuit breakers) we are now putting on each rack?
 - We should not use closed racks, though, as this creates problems for cooling.



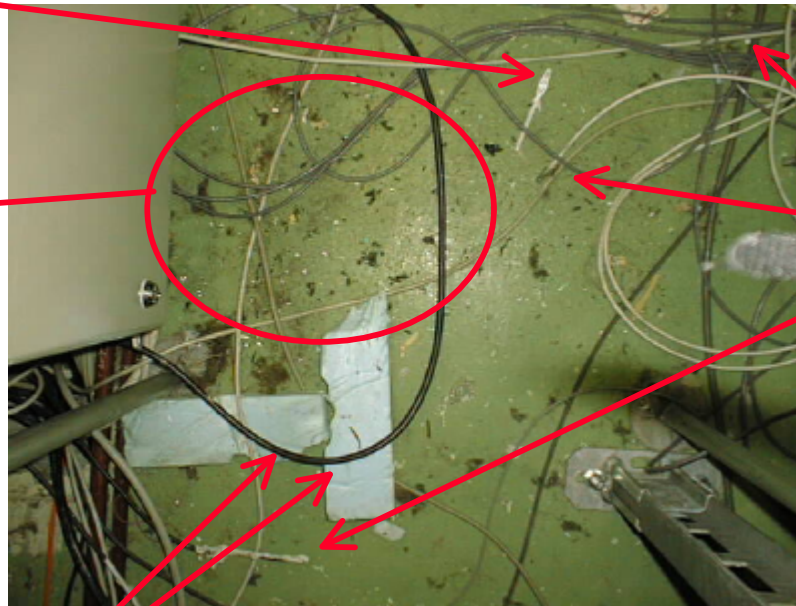
✍ Fire detection in the false floor void should be improved.

The False Floor — I

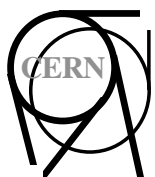
- ✍ The state of the false floor void is **unacceptable!**

Coffee stirrer

30 years of dust accumulation



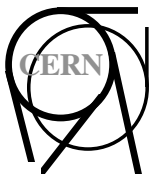
Cable ends



General Rubbish

The False Floor — II

- ✍ In addition to all the rubbish, there are many cables that should be removed. Particular problems are
 - the many obsolete FDDI fibres arriving at the backbone area, and
 - the mess in the old CS/2 area—which is where we are planning to install many PCs...
- ✍ There are no more shutdowns. Can cables be removed
 - at any time?
 - outside “accelerator operation and conference season” periods?and at what risk to services?
- ✍ **What powered equipment is installed in the void?**



Between 2000 and 2005

- ✍ The planned LHC Testbed would lead to
 - 200 PCs being installed at the end of 2000
 - 300 more PCs being installed at the end of 2001 and
 - 1000 more PCs being installed at the end of 2002.
- ✍ At current packing densities, the testbed requires some 25m² this year, 40m² in 2001 and 135m² in 2002.
 - But this doesn't include space for any extra silos...
- ✍ Fortunately, the PC area will shrink as screens are removed so we can probably cope for 2000/2001.
 - But this assumes no-one else wants more space!
- ✍ On current plans, LEP equipment isn't going to be removed until the end of 2003.
 - This, particularly the disks, occupies a fair bit of space.



Racking Options and Density

- ✍ **Air-conditioning** considerations **exclude a mezzanine floor** in the machine room.
- ✍ Today's racks are ~2m high. Packing density would double if we used taller racks. However,
 - this isn't true for tape robotics,
 - access considerations probably require wider gangways,
 - such racks must be placed under the air extraction ducts (which run "vertically"), and
 - standard 19" racks are not 4m tall.
- ✍ PC density could be increased by moving to 1U systems or special solutions but
 - standard 19" racks are not 4m tall,
 - special solutions limit potential suppliers and flexibility, and
 - what are the cost implications?
 - » $10,000\text{PCs} * 100\text{CHF/PC} = 1\text{MCHF}$



Anything else?

- ✍ Anything we've forgotten?
- ✍ When will we know exactly which bits of LHC computing equipment will be installed where?
- ✍ Will other people want to install equipment in the Computer Centre? "Other people" means both
 - other CERN Divisions and
 - experiments.



Conclusions

- ✍ Either the Barn or the Vault must be converted for use as a machine room area.
- ✍ Additional chilled water capacity is required at a cost of at least 350KCHF.
- ✍ UPS:
 - Existing batteries must be replaced very soon.
 - A solution providing 10minutes autonomy for 2MW is required by 2005.
- ✍ Fire detection should be improved.
 - Automatic power off on localised smoke detection is probably desirable.



How to get there from here?

✍ **Either the Vault or the Barn **must** be equipped as a machine room area **during 2001**.**

- Converting the barn would be cheaper but requires moving PC, Mac and Printer workshops, offices for WMDData staff and EP labs.

✍ **Space has to be managed.**

- We need carefully thought out plans for service evolution and equipment installation and removal schedules.
 - » Precision at box level not possible, but what is planning for, e.g., SL/LEP machine databases? And LHC?



Questions to be answered

- ✍ What are your space needs? How will they change?
- ✍ Can we afford to pay for flexibility?
 - Converting the vault now (and using the barn later) would cost ~1MCHF but would provide much greater flexibility than just using the machine room and barn.
- ✍ Can we manage without flexibility?
 - Equipment has been moved around to clear space in the past. Do we want to do this in future?
 - » Can we? There are no Christmas Shutdowns any more.

