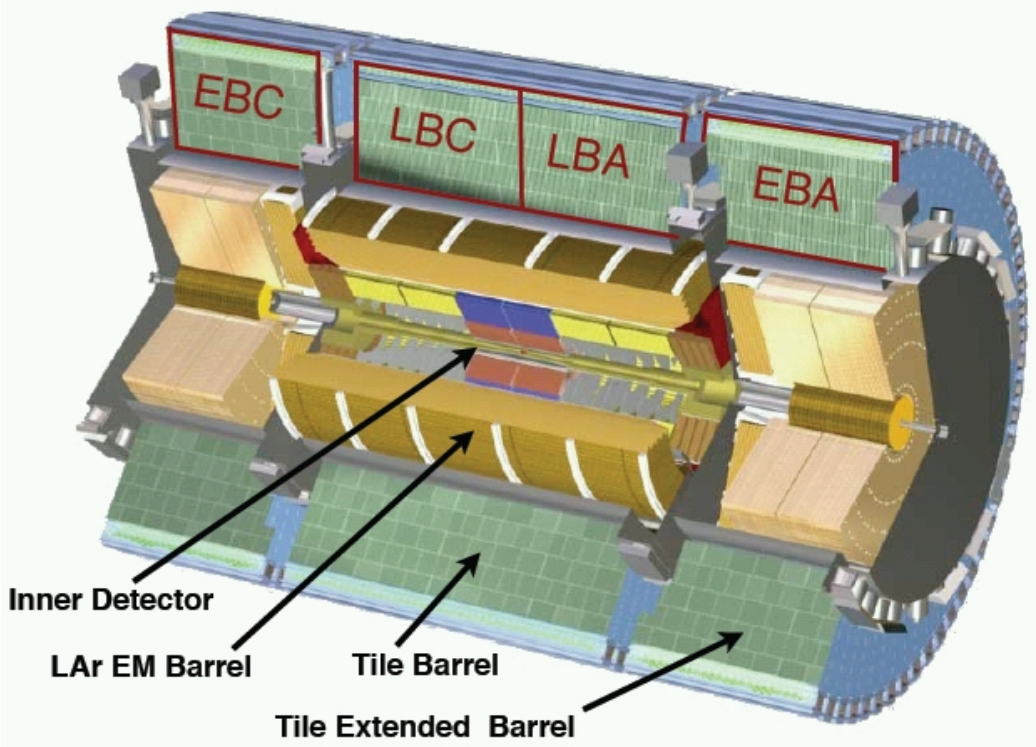


TileCal Power Supply System Maintenance LVPS & HVS1

B. Palan / FZU Prague

Tue 11 Dec 2007

LVPS Meeting

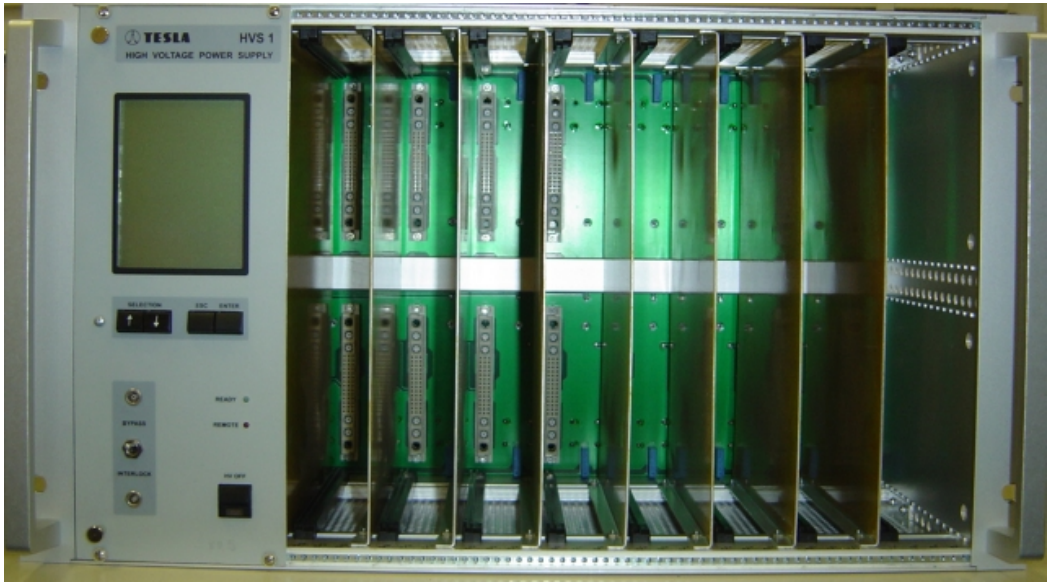
LVPS & HVS1 Maintenance

Continuous technical & engineering support and service to maintain all TileCal power supply systems (LVPS & HVS1) 100% functional for physics experiments during 10 years of operation.

USA15 control room Access any time Safe but supervised area		**ATLAS PIT cavern** Radiation, magnetic field Very Limited access 1-2 times/year
16	**High Voltage System for PMTs** **TESLA HVS1** (16x16= 256 of 830VDC channels)	
24 64 4	**Low Voltage PS** **TESLA HPS1 (3 x 200VDC PS)** (64 channels, 6 x HPS1 per partition) **AUX Boards control card** (1x per 4 LVBOXes, 16 per partition) **DSS - LVPS Interlock board** (1 per partition)	8 200V and AUX Star Boxes  256 LVBOXes 

HVS1 Maintenance (1)

TESLA HVS1 16ch -830V/-950VDC PS for photomultipliers



Motherboard chassis for 8 cards (16 channels)

2ch HV card

One HVS1 unit is supplying 16 drawers.
Remote control by MODBUS protocol (RS422), in Scada/PVSS.
Interlocked by DSS-LVPS Interlock card, switched ON when LVPS ON.
Used only during cosmic tests in 2004 - 2007.

HVS1 Maintenance (2)

Qty: 16x HVS1 chassis, 128x 2ch HV cards installed in USA15
Spares: 2 chassis (one in 512, one Prague), 8 x 2ch HV cards (6%)

Produced by TESLA-CZ in 2001/02. No more support from them.
Tested with 16 HV dummy-loads in Prague during 2003.
Possible maintenance support from FZU/Prague.

Testing/Burnin place with 16 HV dummy-loads in Prague.

Found problems during operation:

-Chassis — 3 broken PS protection fuses 1.5A/250V
-2ch HV card — 4 broken output HV fuses 100mA/1000V
8 damaged TRACO DC/DC 1W converters

Critical components are TRACO converters
- datasheet isolation I/O 3kV
- problems/damages in 1kV

Possible improvements for easier maintenance:
-add pcb fuses on each 2ch HV card
-only one 2ch card OFF when problem, not all 16ch.

HPS1 Maintenance (1)

TESLA HPS1 200VDC PS for LVPS boxes

3ch x 200VDC /7.5A/1.7kW
Remote control by MODBUS protocol (RS422) in PVSS.

One 200V channel supplies four LVBOXes.

Only few units tested with 3 dummy-loads in Prague in 2005-7.
Interlocked by DSS-LVPS Interlock card, switched ON to start LVPS boxes.
Some units extensively used in 2006, 2007.

HPS1 Maintenance (2)

Qty: **24x HPS1, 72 x 200VDC channels installed in USA15**
Spares: **2ch per partition of 64 drawers (12.5%), no other units avail.**

Produced by TESLA-CZ in 2005-7. Time limited support from them.
Only few units tested with 3 dummy-loads in Prague during 2005-7.
Proposed maintenance support from FZU/Prague.

Testing place with 3 dummy-loads in Prague and at CERN.

Found problems during operation:

-Control SW		**caused by HW, reprogrammed all new ATMEL firmware**
-Hardware	**min 10**	**Vout channel cards broken in 2006**
	min 10	**broken power diodes in DC/DC conv (new D)**
	min 6	**broken output fuses 20A/500V**
-Noise/interference		**found 17MHz conducted current noise, ferrites + LC filter (not yet solved)**

Need close supervision, especially after power cut.

AUX Board Maintenance (1)

Custom made auxiliary power and control board for 4 LVBOxes

V2.4 with modified ELMB FirmWare
It supplies 4LVBOXes with
Startup pulse, ELMB chip
Power, ELMB_MB inside LVBOX

CanBus communication with SW
Control in SCADA/PVSS.

Interlocked by DSS-LVPS Interlock card, switches ON LVPS.
Extensively used during commissioning tests in 2006/2007.

AUX Board Maintenance (2)

Qty: 64x units, 256 channels installed in USA15
Spares: 20 AUX Boards v2.4 (31%)

Custom design produced in 2006-07.
Each installed board qualified on AUX_Board tester at CERN.

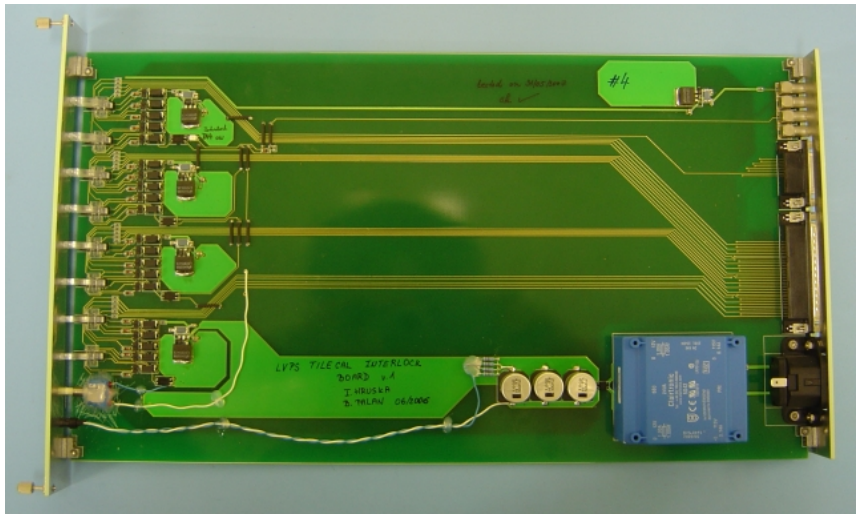
<u>Found problems during operation:</u>

6 AUX boards returned from PIT
various reasons, Startup power DC/DC converters, Transformers channel fuses, channel output transils etc.
6 transformers, 2 overheated themselves (Clairtronic)

Need close supervision and maintenance, specially after power cut.

DSS-LVPS Interlock Board Maintenance

Custom made interlock and control board for 64 LVBOXes



One card is interlocking/enabling
- **64x LVBOXes**
- **16x Aux Boards**
- **6x HPS1 200V PSs**
- **4x HVS1 800V PSs**

DSS signal from cooling system ON/OFF LVPS

Qty: 4x units, each for 64 drawers installed in USA15
Spares: 1 unit (25%)

Custom design produced in 2006.
No special tester made. Basic and simple electronics.

<u>Found problems during operation:</u>
No major problems.

No special attention but supervision after electricity power cut.

200V and AUX Star Boxes Maintenance

Custom made distribution boxes of 200V and AUX signals around calorimeter

One card is interlocking/enabling
- 4pcs on main barrel
- 4pcs on extended barrels

Passive interconnections only.

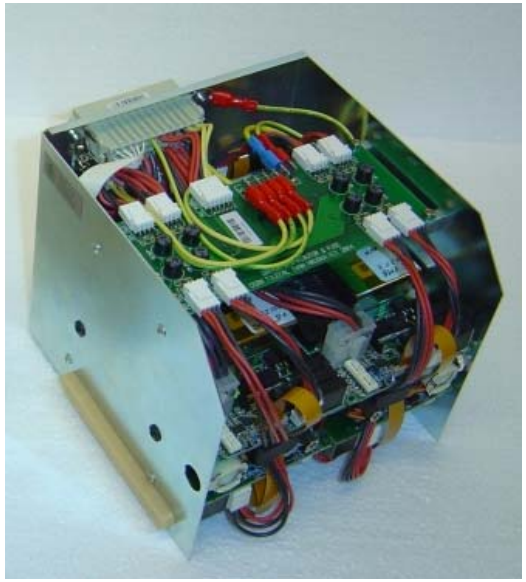
But limited access, and irradiated.

No required maintenance, only passive interconnections between LVBOxes and USA15 Instruments (HPS1, AUX Boards). Functionality verified during commissioning.

May show problems towards the end of maintenance (aging of screwed pins, contact resistance)

LVBOX Maintenance (1)

Custom made DC/DC power supply for TileCal drawers



Inside

8 Bricks, DC/DC modules, 1 x 3.3V, 3 x 15V, 4 x 5V (2048pcs)
ELMB Motherboard – canbus remote control

4 boxes creates one power branch supplied by one 200V channel supply, and one AUX board.

Radiation tolerant up to 20krad TID, 2.15E+12 n/cm^2 neutron fluency, Able to work up to 200gauss mag.field.

v.6.5.4 final modifications, 300kHz SW Freq., OVP on each brick, OCP, startup sequence in 3 groups, HV or DIG side safe shdn, ELMB power cycle non-influence.

ELMB_MB v6.5.3 five V levels sense line measurements improved

LVBOX Maintenance (2)

Qty: 256 (v6.5.4) installed in the ATLAS PIT, limited access
Spares: 44 boxes (17%)

Custom produced at CERN in 2007.
All production testers, QA long term qualification at b512.
Bricks - pinfield tester, burnin tester
ELMB_MB – tester
LVBOXes – QA station

Each qualified box has run during min 3 hours.

<u>Found problems during operation:</u>
-34 returned boxes (January – November 2007) stopped working
- **Bad assembly, modification, failed components**

-27 redo calibration

Limited access (1-2 per year), operative change of failed boxes,
Special attention (radioactive) during repair.

LVPS & HPS1 Maintenance Center

Proposed Bld175 (also as TileCal drawer repair center)

Move equipment from 512 -> 175 after production (Feb-April 08)
Install all required testers

Brick	**- Pinfield tester, Burnin station**
ELMB_MB	**- tester**
AUX Board	**- tester**
LVBOX	**- QA station with 3 dummy loads and 2 drawers**

Bring together all applied necessary crimping tools, screws, spare active/passive electronic components, spare cables, etc.
Be able to repair any LVPS/HVS1 components

Brick, ELMB_MB, Fuse_board, AUX board, HPS1, HVS1..

What about CanBus power supplies maintenance?