

Link Box Euro Specification

Revisions

When	Who	What
2003.01.02	MK, KP	
2003.03.11	MK	RE1/1 mechanics, Second data link on MLB in RE1/1,
2003.06.30	MK	After 2003 synch tests, Euro LBx
2004.10.30	MK	After 2004 synch tests, Euro LBx only

General remarks

1. PACT link system is built of Link Boards (LB) and Control Boards (CB) located in Link Boxes (LBx).
2. Link Box (LBx) is a mechanical enclosure housing LBs and CBs.

Two types of the LBx exists:

- 6U Euro crate – barrel and endcap (except RE11) – LBx (124 are needed),
It houses up to 16 LBs and 2 CBs (Fig.1). (18 locations are needed for interconnection reasons – see barrel RB4 and RB10!).
LB, CB dimension are 220 x 233 mm². LB is build in two versions
 - Master LB (MLB). MLB receives partially compressed data from two neighboring SLBs (see below) and sends fully compressed data to the trigger data optical link,
 - Slave LB (SLB). SLB sends partially compressed data to MLB.

Each MLB/SLB receives data from 6 FEB data cables.

CB controls (via LVDS I2C) 8 FEB I2C distribution boxes.

In/out Cconnectors are allowed on the front and back panel.

LBx back plane (Fig. 2) is build of :

- FEB data connectors,
- FEB I2C connectors,
- LV supply.

LBx front panel (Fig. 3) is build of :

- control bus ,
- I2C signal bus,
- TTC opto receiver and TTC signal distribution.

Optical connectors (trigger data) and CCU signals are located directly on the front side of the LB or CB.

- special Link Box for endcap RE11 (LBx/RE11) (24 are needed).
LBx/RE11 houses six LB/RE11 and one CB/RE11.
It is described separately

Master Link Board (MLB) Specification

MLB:

1. MLB interfaces (logical)

- a) FEB Data (6) (external to RPC) (96 strip signals - LVDS),
- b) Control bus (internal to/from CB) (40 signals - LVDS),
- c) Slave data (2) (internal from SLB) (20 signals - TTL),
- d) CSC data (external to CSC) (**only in Endcaps**) (20 signals - LVDS),
- e) Trigger (external to Trigger board) (optical),
- f) TTC pulse (internal from frontplane) (electrical) (1 signal - PECL),
- g) LV Supply (internal from backplane),
- h) I2C signals (internal from frontplane) (2 signals),
- i) Jtag (internal on board).

**FEB1 - 6 - connector Scotchflex 40 pin
data – in, 16*2 LVDS, 32 pins
test pulses – out, 4*2 LVDS, 8 pins**

2. MLB interfaces (physical):

- a) Back plane Connector P1, 40 pin - FEB1,
- b) Back plane Connector P2, 40 pin - FEB2,
- c) Back plane Connector P3, 40 pin - FEB3,
- d) Back plane Connector P4, 40 pin - FEB4,
- e) Back plane Connector P5, 50 pin - FEB5 + LV,
- f) Back plane Connector P6, 50 pin - FEB6 + LV,
- g) Front plane Connector P7 Hpack, 2mm, 125 pin
 - i. Slave data1 (20 pins),
 - ii. Slave data2 (20 pins),
 - iii. Control bus (40 pins),
 - iv. TTC pulse (2 pins),
 - v. I2C signals (2 pins),
- h) Front Connector P8, CSC data, connector 40 pin (Scotchflex),
- i) Front Connector P9, Trigger, connector LC (optical),
- j) On board connector, Jtag, 10 pin connector.

**CSC - 1 - connector Scotchflex 40 pin
data – out, 12*2 LVDS, 24 pins
BXN – out, 3*2 LVDS, 6 pins
GND – 2*1, 2 pins (optionally)**

3. MLB dimension: 233(6U) * 220 mm²;

4. MLB Power consumption:

- i. +3.3V – 1A,
- ii. +2.5V – 0,25A,
- iii. +1.8V – 0,35A.

5. Number of MLB's

- a) Barrel - 300,
- b) Endcap - without RE2bis (with RE5=RE2bis) - 288 (384).

Slave Link Board (SLB) Specification

SLB:

1. SLB interfaces (logical)

- a) FEB Data (6) (external to RPC) (96 strip signals - LVDS),
- b) Control bus (internal to/from CB) (40 signals - LVDS),
- c) Slave data (1) (internal to MLB) (20 signals - TTL),
- d) CSC data (external to CSC) (**only in Endcaps**) (20 signals - LVDS),
- e) TTC pulse (internal from frontplane) (electrical) (1 signal - PECL),
- f) LV Supply (internal from backplane),
- g) I2C signals (internal from frontplane) (2 signals),
- h) Jtag (internal on board).

**FEB1 - 6 - connector Scotchflex 40 pin
data – in, 16*2 LVDS, 32 pins
test pulses – out, 4*2 LVDS, 8 pins**

2. SLB interfaces (physical):

- a) Back plane Connector P1, 40 pin - FEB1,
- b) Back plane Connector P2, 40 pin - FEB2,
- c) Back plane Connector P3, 40 pin - FEB3,
- d) Back plane Connector P4, 40 pin - FEB4,
- e) Back plane Connector P5, 50 pin - FEB5 + LV,
- f) Back plane Connector P6, 50 pin - FEB6 + LV,
- g) Front plane Connector P7 Hpack, 2mm, 125 pin
 - i. Slave data1 (20 pins),
 - ii. Slave data2 (20 pins),
 - iii. Control bus (40 pins),
 - iv. TTC pulse (2 pins),
 - v. I2C signals (2 pins),
- h) Front Connector P8, CSC data, connector 40 pin (Scotchflex),
- i) Front Connector P9, Trigger, connector LC (optical),
- j) On board connector, Jtag, 10 pin connector.

**CSC - 1 - connector Scotchflex 40 pin
data – out, 12*2 LVDS, 24 pins
BXN – out, 3*2 LVDS, 6 pins
GND – 2*1, 2 pins (optionally)**

3. SLB dimension: 233(6U) * 220 mm²;

4. SLB Power consumption:

- i. +3.3V – 0.9A,
- ii. +2.5V – 0,25A,
- iii. +1.8V – 0,35A.

5. Number of SLBs:

- a) Barrel - 500,
- b) Endcaps - without RE2bis (with RE5=RE2bis) - 480 (624).

Control Board Specification

CB

1. CB interfaces (logical):
 - a) FEB I2C (8) (external to RPC) (6 LVDS signals),
 - b) Control bus (internal to/from LB) (40 signals),
 - c) TTC pulse (8) (internal to LB) (electrical) (2 signals),
 - d) DCS (2) (external to other CB) (electrical) (20 signals),
 - e) LV Supply (internal from front plane),
 - f) Jtag (internal on board);

2. CB Interfaces (physical):
 - a) Back plane Connector P1, 10 pin – FEB_I2C1,
 - b) Back plane Connector P2, 10 pin – FEB_I2C2,
 - c) Back plane Connector P3, 10 pin – FEB_I2C3,
 - d) Back plane Connector P4, 10 pin – FEB_I2C4,
 - e) Back plane Connector P5, 10 pin – FEB_I2C5,
 - f) Back plane Connector P6, 10 pin – FEB_I2C6,
 - g) Back plane Connector P7, 20 pin – FEB_I2C7 + LV,
 - h) Back plane Connector P8, 20 pin – FEB_I2C8 + LV,
 - i) Front plane Connector P9, 10 pin – CCU_in,
 - j) Front plane Connector P10, 10 pin – CCU_out,
 - k) Front plane Connector P11 Hpack, 2mm, 125 pin
 - i. Control bus (40 pins),
 - ii. TTC pulse (16 pins),
 - iii. I2C signals (2 pins),
 - i. LV Supply (+5V) (4 pins),
 - l) On board connector, Jtag, 10 pin connector,

3. CB dimension: 233(6U) * 220 mm;

4. CB Power consumption:
 - i. +3.3V – 1.6A,
 - ii. +2.5V – 0,3A,
 - iii. +1.8V – 0,2A.

5. Number of CBs – 216 (248).

Opto module Specification

OP:

OP is a mechanical module where opto MU adapter and single fibers – ribbon fiber fanout is mounted. It houses also the spare amount of ribbon. One OP module is needed per redundant chain (one OP per 6 Lbox on detector side).

OP dimension is 6Ux 220cm. It is 1 slot large. (see photo).

Link Box Specification

Link box it is the standard 6Ux 220cm Euro crate (Fig1,2).

Box can be filled by up to 21 modules:

1. Link boards (LB) - up to 16 modules,
2. Control Boards (CB) – 2 modules,
3. Opto module (OP) – one module in selected boxes.

LB, CB and OP are described above.

On the back side of the Link box custom backplane is mounted.

Custom backplane closes the crate from the back side. It is standard 6U Euro crate high and 20 slot large. (most left crate slot is free- can be used to OP connections).

On the rear side of the backplane following connectors are located (Fig 3, 6):

1. FEB data (for up to 6*16 cables),
2. I2C (for up to 8*2 cables),
3. LV (for 2*3 cables).

Front side backplane connectors are used to pass these signals to LBs and CBs.

Prior to LBs, and CBs module installation all detector cables and low voltage cables should be located on the back side of the backplane.

On the front side of the Link box two identical frontplanes connect the groups of the 9LBs and CB (Fig 1, 3). The frontplane makes (Fig 4, 5):

1. the slave -> master LB interconnections,
2. CB <-> LBs bus interconnection,
3. TTC signal distribution (length of tracks are equalized),
4. LV supply for TTC opto receiver.

On the front side of the Link box smaller amount of LBs, CBs connectors are located:

1. trigger fiber (from MLB only, up to 6 fibres),
2. CSC connector (on LB, up to 16 cables but only in RE+-1 endcap),
3. DCS fibers (on CB to OP, up to 8 fibres per Lbox),
4. DCS cables (on CB, up to 8 cables per Lbox),
5. TTC fiber (from frontplane, 2 fibers per crate).

Figures 7 to 11 show Lbox occupancy for different detector areas.

Number of LBx's needed

1. barrel - 60 (12 per wheel),
2. endcap - 48 (with RE5 - 64).

Figures

Fig. 1 Lbox EURO Front view

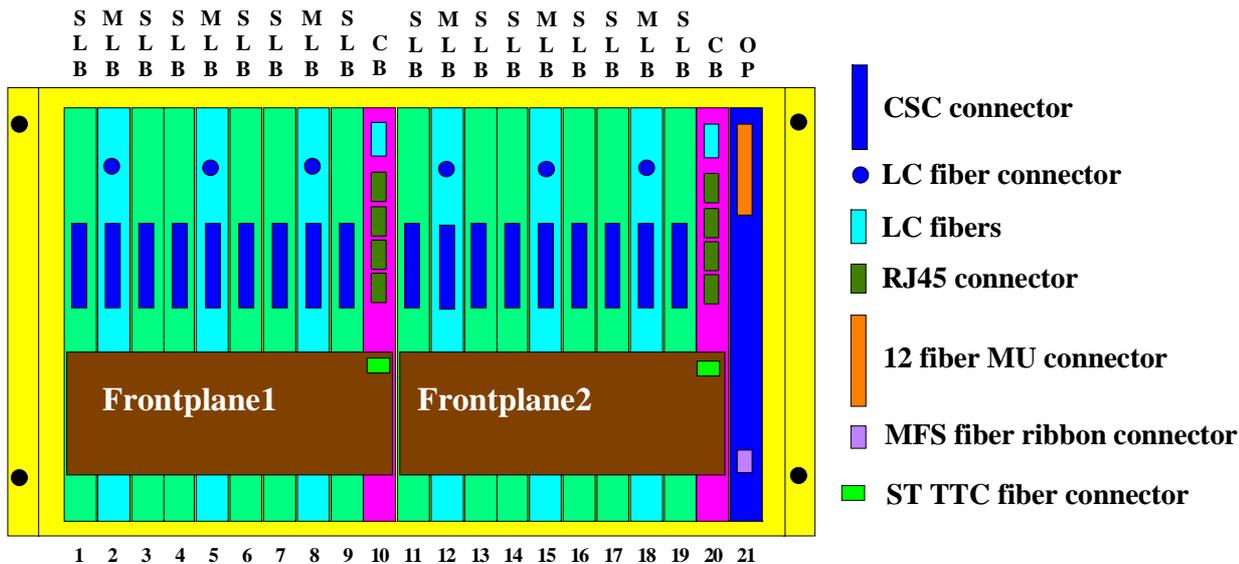


Fig. 2 Lbox EURO Rear view

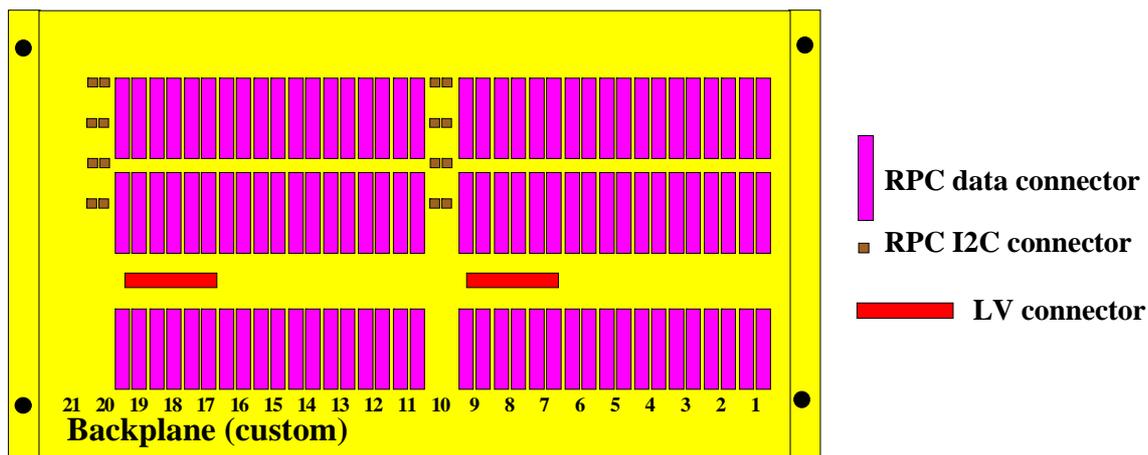
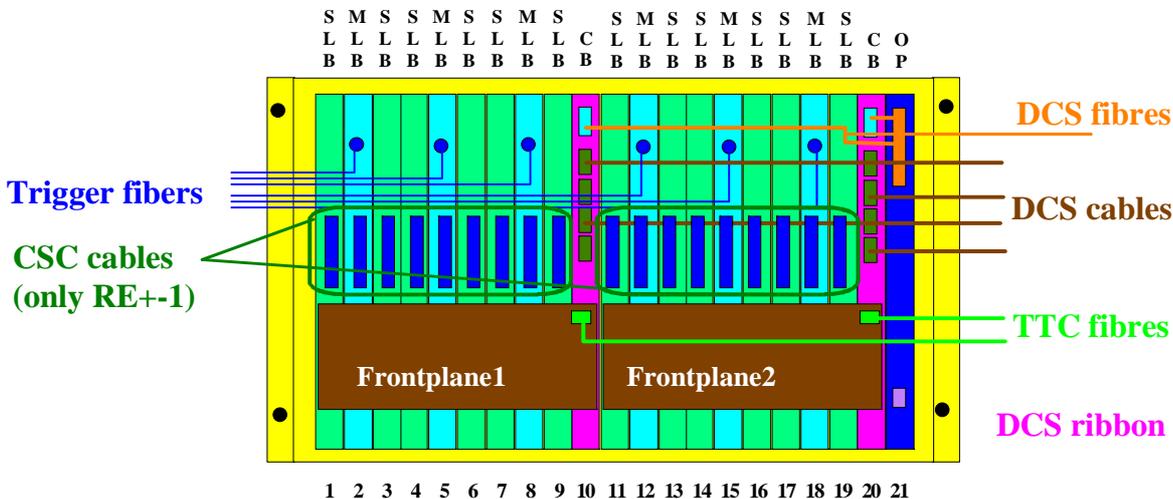


Fig. 3 Lbox EURO - Cables - Front view



Figures

Fig. 4 Lbox EURO – Cables – Rear View

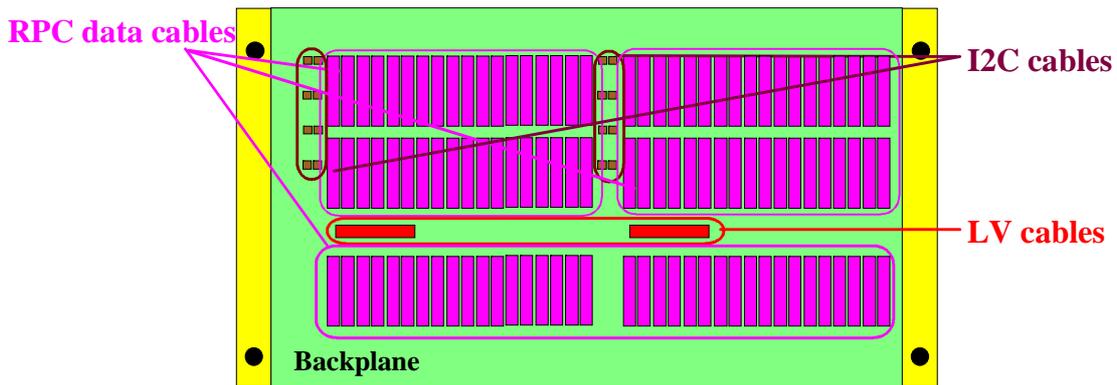


Fig. 5 Lbox EURO - Frontplanes

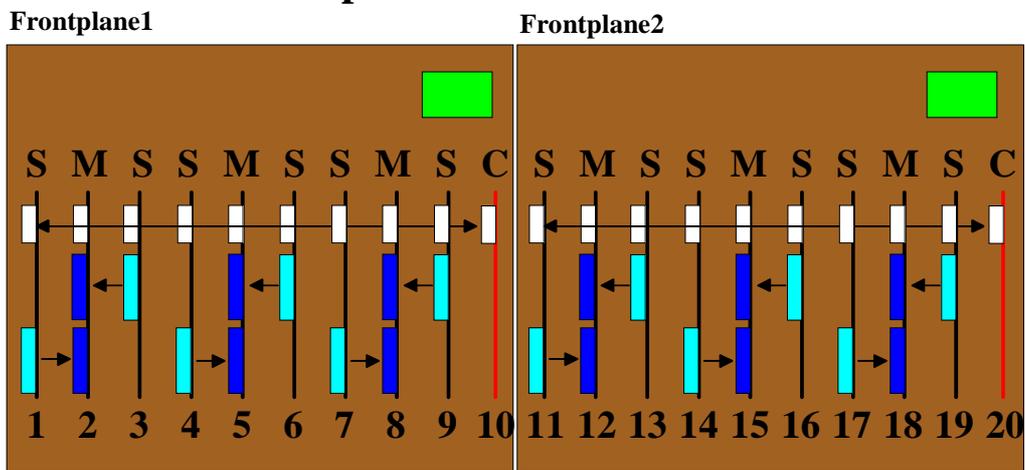
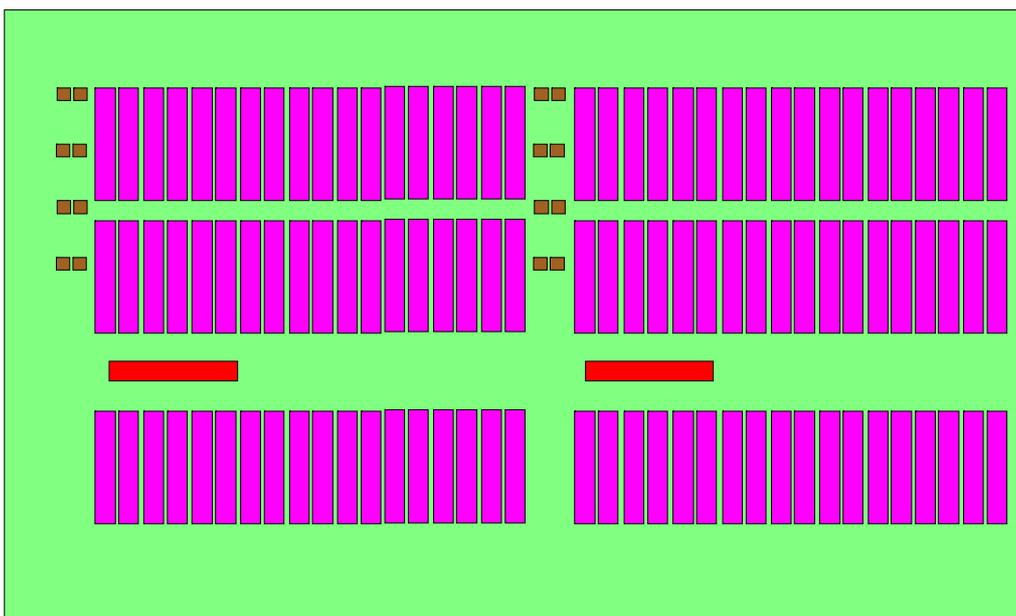


Fig. 6 Lbox EURO Backplane



Figures

Fig. 7 Lbox EURO – Barrel – RB4, RB10

RB4, RB10 - 10 boxes

$$5*(1MLB+2SLB) \Rightarrow 15LB + 2CB$$

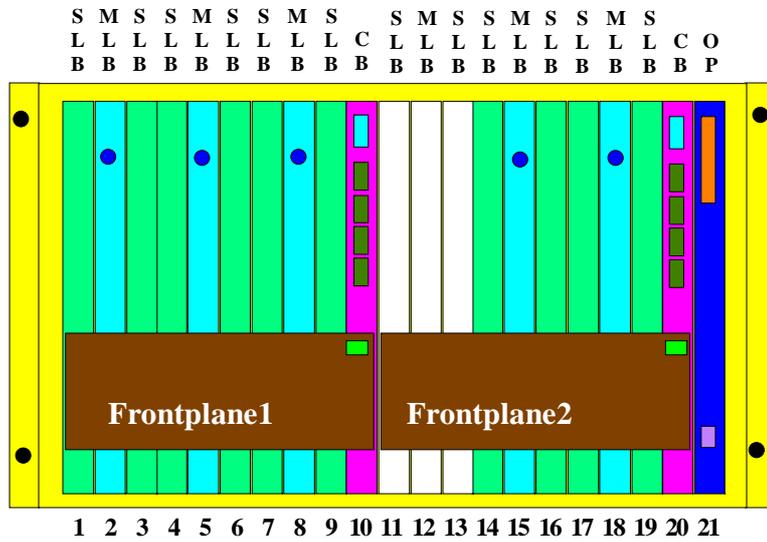
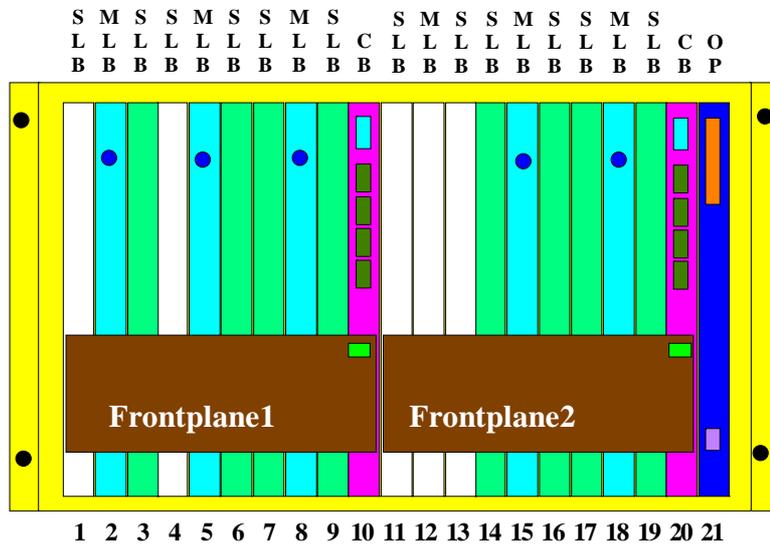


Fig. 8 Lbox EURO – Barrel – RB other than 4,10

RB other than 4, 10 - 50 boxes

$$3*(MLB+2SLB) + 2*(MLB+SLB) \Rightarrow 13LB + 2CB$$



Figures

Fig. 9 Lbox EURO – Endcap – RE1 and RE2

RE1/2,RE1/3 +RE2 (30 deg) - 24 boxes
 $4*(MLB+2SLB)+2*(MLB+SLB)\Rightarrow 6MLB+10SLB+2CB$
 $\Rightarrow 144MLB+240SLB+48CB$

For <1.6

RE1/2,RE1/3 +RE2 (30 deg) - 24 boxes
 $4*(MLB+2SLB)\Rightarrow 4MLB+8SLB+2CB$
 $=96MLB+192SLB+48CB$

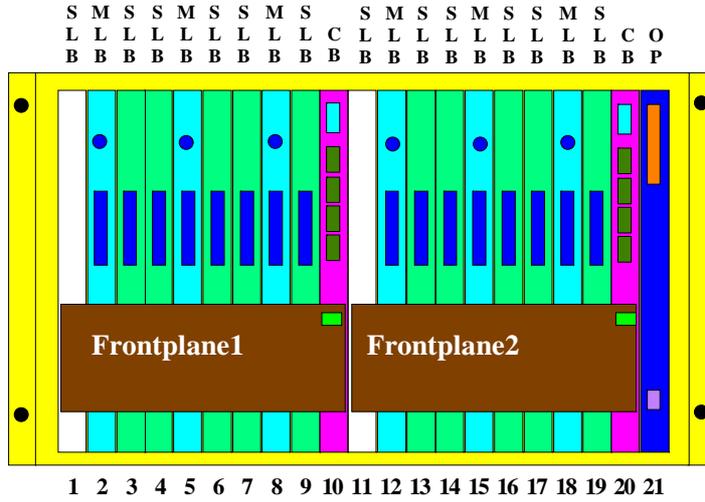
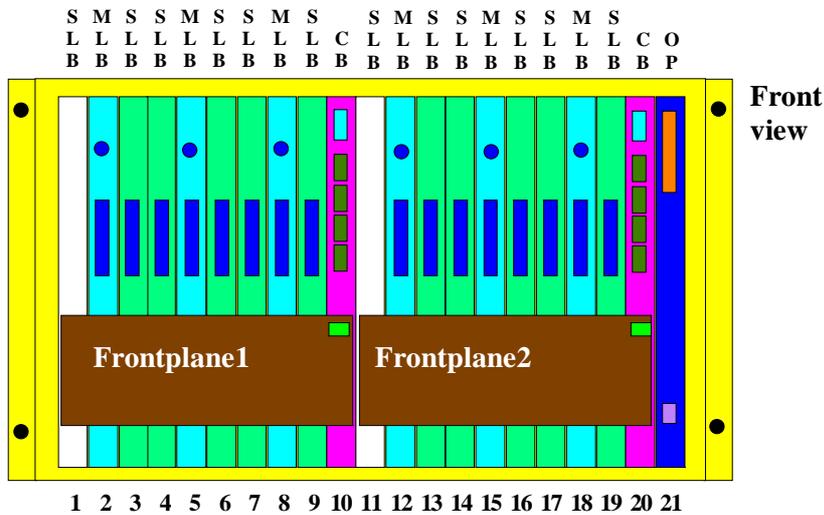


Fig. 10 Lbox EURO – Endcap – RE3 and RE4

RE3 (60 deg) - 12 boxes = RE4 (60 deg) - 12 boxes
 $4*(MLB+2SLB)+2*(MLB+SLB)\Rightarrow 6MLB+10SLB+2CB$
 $\Rightarrow 72MLB+120SLB+24CB$

For <1.6

RE3 (60 deg) - 12 boxes = RE4 (60 deg) - 12 boxes
 $4*(MLB+2SLB)\Rightarrow 4MLB+8SLB+2CB$
 $=48MLB+96SLB+24CB$



Figures

Fig. 11 Lbox EURO – Endcap – RE5

RE5 (RE2bis) (~45 deg) on YE1 (YE-1) - 16 boxes *

$$3*(MLB+2SLB)+3*(MLB+SLB) \Rightarrow 6MLB+9SLB+2CB$$

$$=96MLB+144SLB+32CB$$

For <1.6

RE5 (RE2bis) (~45 deg) on YE1 (YE-1) - 16 boxes *

$$3*(MLB+2SLB) \Rightarrow 3MLB+6SLB+2CB$$

$$=48MLB+96SLB+32CB$$

