

# Halogen-free laminates for PCBs

## 0- Legal requirements :

- at CERN      **Safety Instruction No 41**
- in Europe      still no law,  
but a proposed directive
- elsewhere      a law in Sweden ?  
strong implication in Sw and Jp

# Halogen-free laminates for PCBs

1- Available materials : FR-4 type :

- **HITACHI** MCL-RO-67G
  - **ISOLA** Duraver E-CU 156
  - **PARK-NELCO** N4000-2 EF
  - + **POLYCLAD** PCL-HF-541, -571
  - + **MATSUSHITA** R1566
  - **TOSHIBA** TLD-152
- + polyimides + Isoval (FR5) + Permaglass (CEM3) ...

# Halogen-free laminates for PCBs

2- Suppliers announce good electrical properties (similar to FR-4).

Only Cu adhesion might be weaker.

(see previous report)

3- Results of fire tests are satisfactory

(see Jonathan's report)

# Halogen-free laminates for PCBs

## 4- Experience in industry :

- Portable Computers by Toshiba
- Portable phones by Nokia (Hitachi)
- other in Sweden ?

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## 5- Circuit-makers claiming to use 0-hal :

- Adv. Mat. Co, ITEQ Corp. (USA)
- **AC+, CEM, SOS électr., TECHCI R-A (F)**
- **AIK Laminate (De), AT&S (A)**
- **Elektrotryck AG (S)**
- **MAS (It + Be)** (= Matsushita Avionic Systems ? )
- **Park-Nelco-Dielectra, Scotland EI (UK)**
- **SPS (Bulgaria)**
- Taconic Int., Leaf Techno (Ireland)
- Sony, Toshiba, Hitachi (Jp)

# Halogen-free laminates for PCBs

## 6- Experience with FR-4 at CERN :

- 6.1. 4-layer ~16x24 and 10x22 cm protos (“naked”) made by EST-DEM for a “first check” using the **ISOLA** and **HITACHI** materials  
aspect : OK  
electrical test (connections) : OK

# Halogen-free laminates for PCBs

## 6- Experience with FR-4 at CERN :

6.2. 2-layer ~ 48x60 cm proto

made by EST-DEM for ALICE Muon ARM  
using the **Park-NELCO** material

aspect, dimensions : OK

electrical test : to be done...

# Halogen-free laminates for PCBs

## 6- Experience with FR-4 at CERN :

- 6.3. 4-layer ~10x10 cm proto for ATLAS  
made by SPS (Bulgaria)  
using the **ISOLA** material  
  
aspect : not yet delivered  
electrical test : to come...  
price : + 13% compared to FR-4

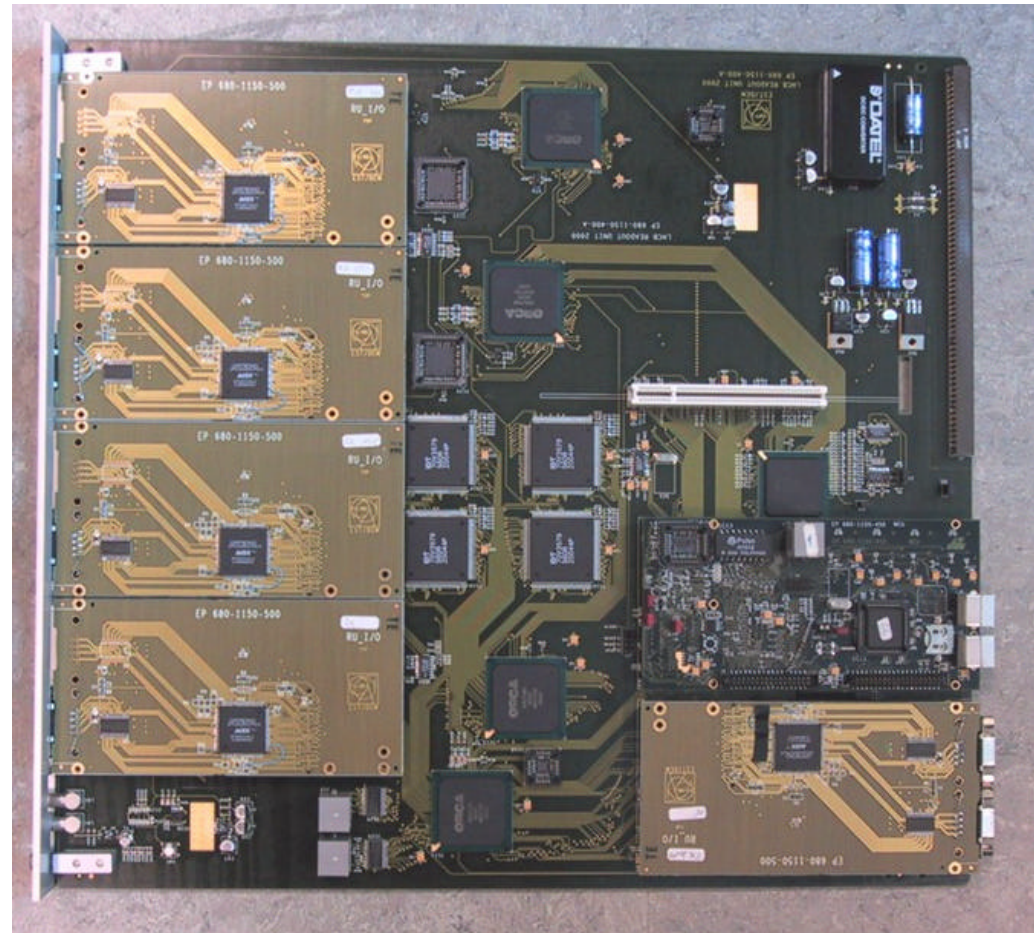
# Halogen-free laminates for PCBs

## 6- Experience with FR-4 at CERN :

- 6.4. 8-layer ~37x40 cm (9U) proto for LHCB  
made by Electrotryck (S)  
using the Matsushita (**NAIS**) material
- aspect : OK  
full electrical test : OK (high-frequency)  
price : **x 2** compared to FR-4 !

# Halogen-free laminates for PCBs

9U module  
(8-layer, 37x40cm)  
made by  
Electrotryck (Sw)  
with the R-1566  
halogen-free  
laminate from  
Matsushita (NAIS)  
for LHCb



# Halogen-free laminates for PCBs

## 7- Any other experience at CERN ?

- Some users do not even ask for 0-halogen in their call-for-tenders !
- To DO-13903 (6-layer VME modules), **CEM** (F), **Scotland El.** (UK), and **Leaf Techno.** (Ir) have offer 0-hal for only 3% more !!

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## 8- Conclusions :

- Benefit for the environment
- Lower disposal price (taxes)
- Better fire behaviour
- Good electrical (incl. HF) behaviour
- Prototypes are OK, but **ageing** (?)
- Still problems of **availability** ?
- Slight higher **price** (from + 3% to x 2)