Local Station: the data read-out basic unit for ARGO-YBJ experiment

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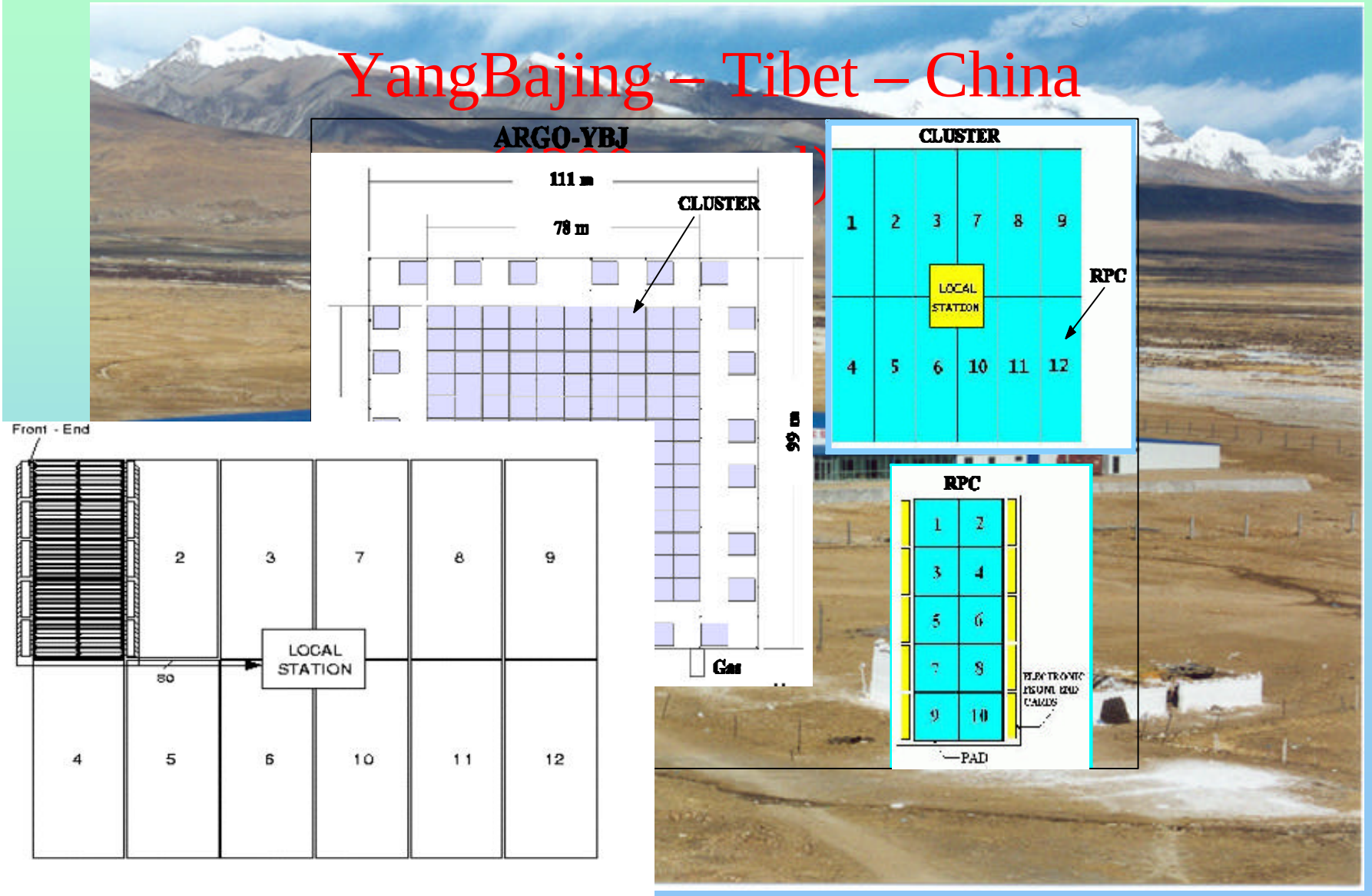
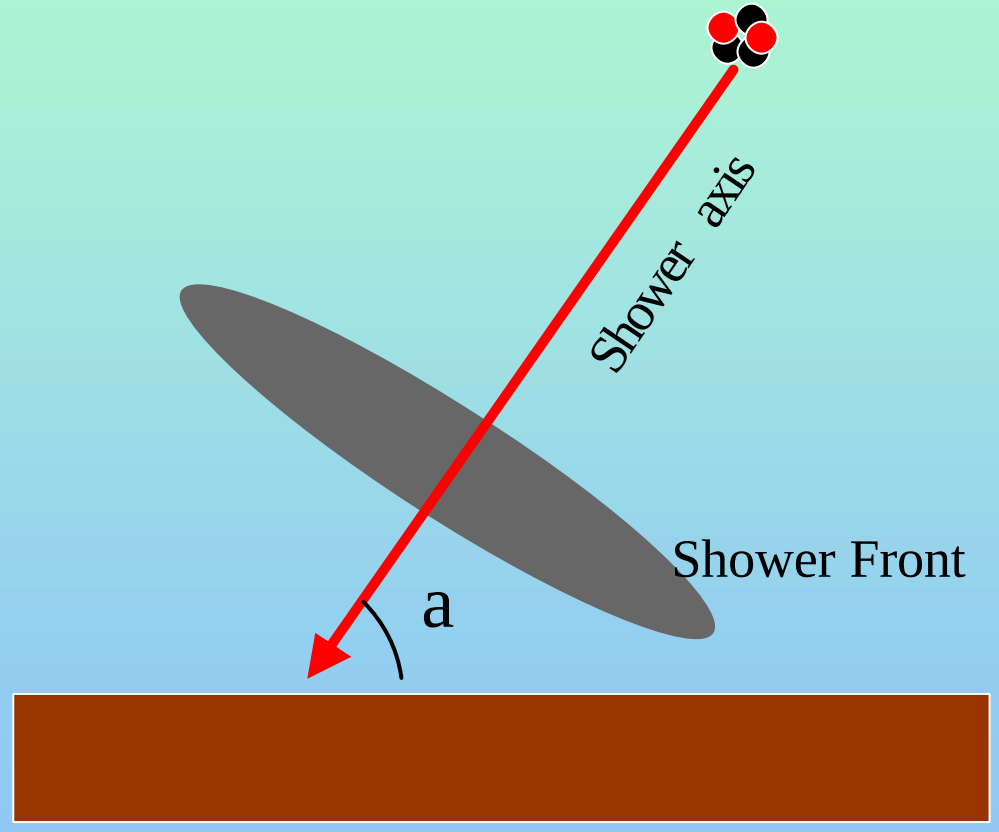
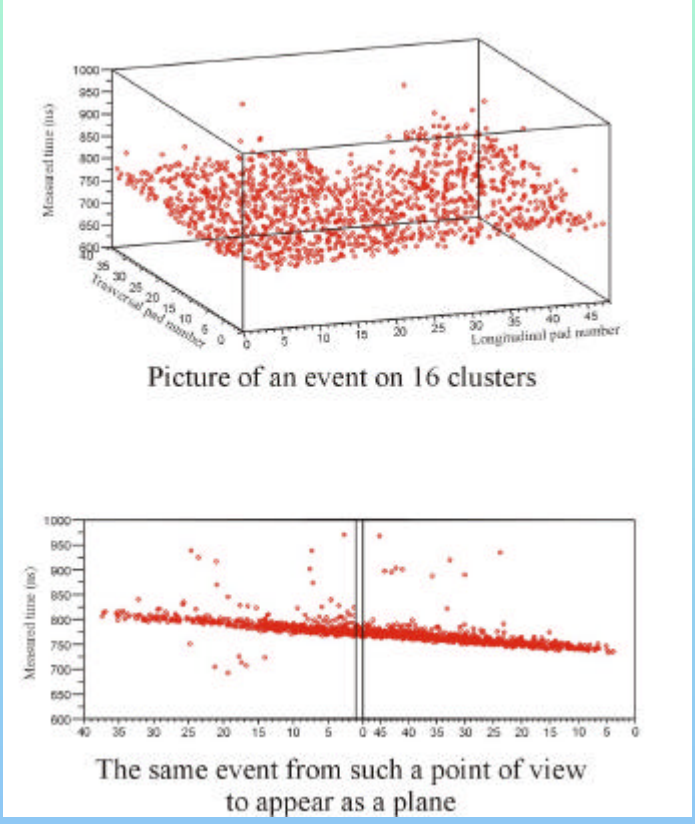
YangBajing – Tibet – China



Shower Development



Shower reconstruction



Picture of an event on 16 clusters

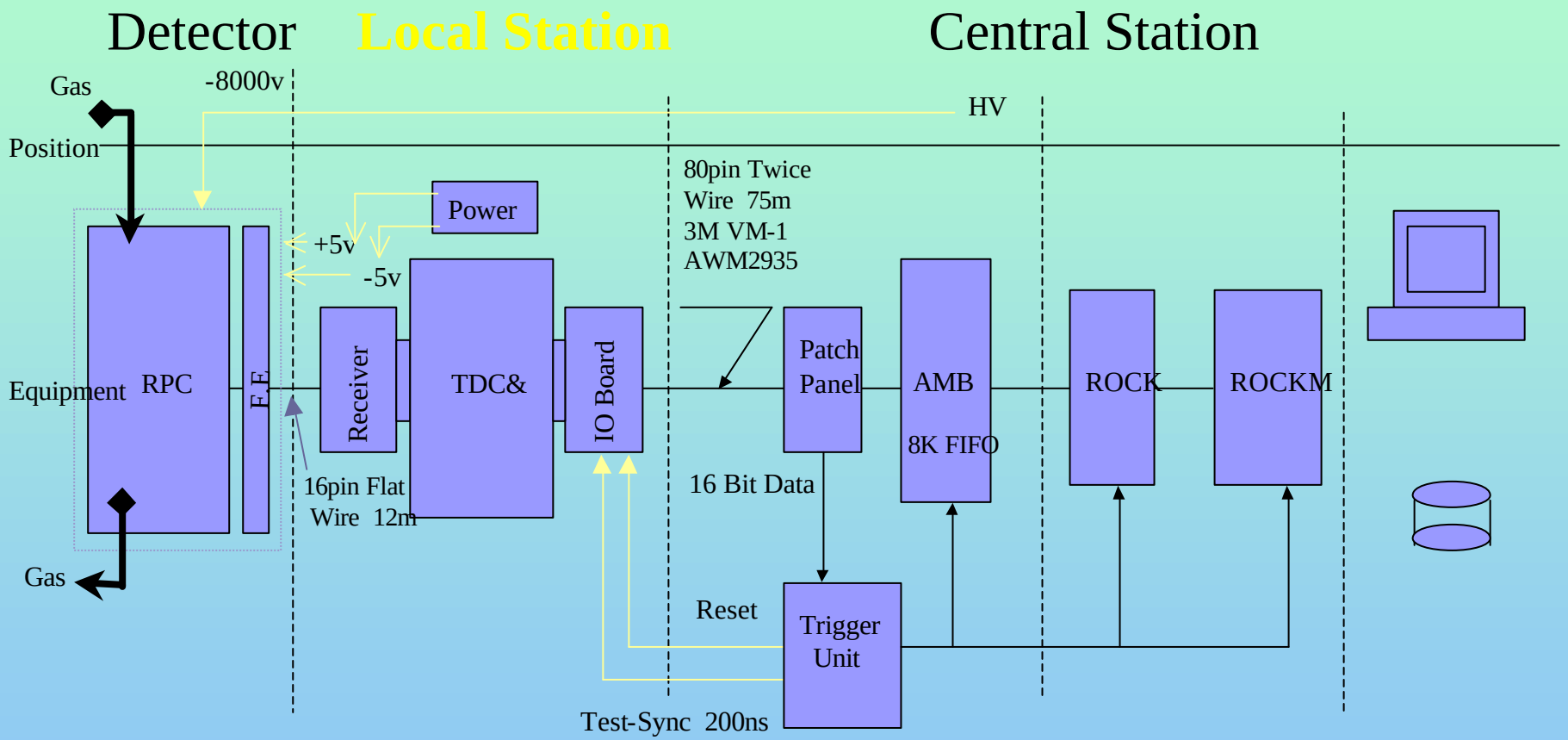
The same event from such a point of view to appear as a plane

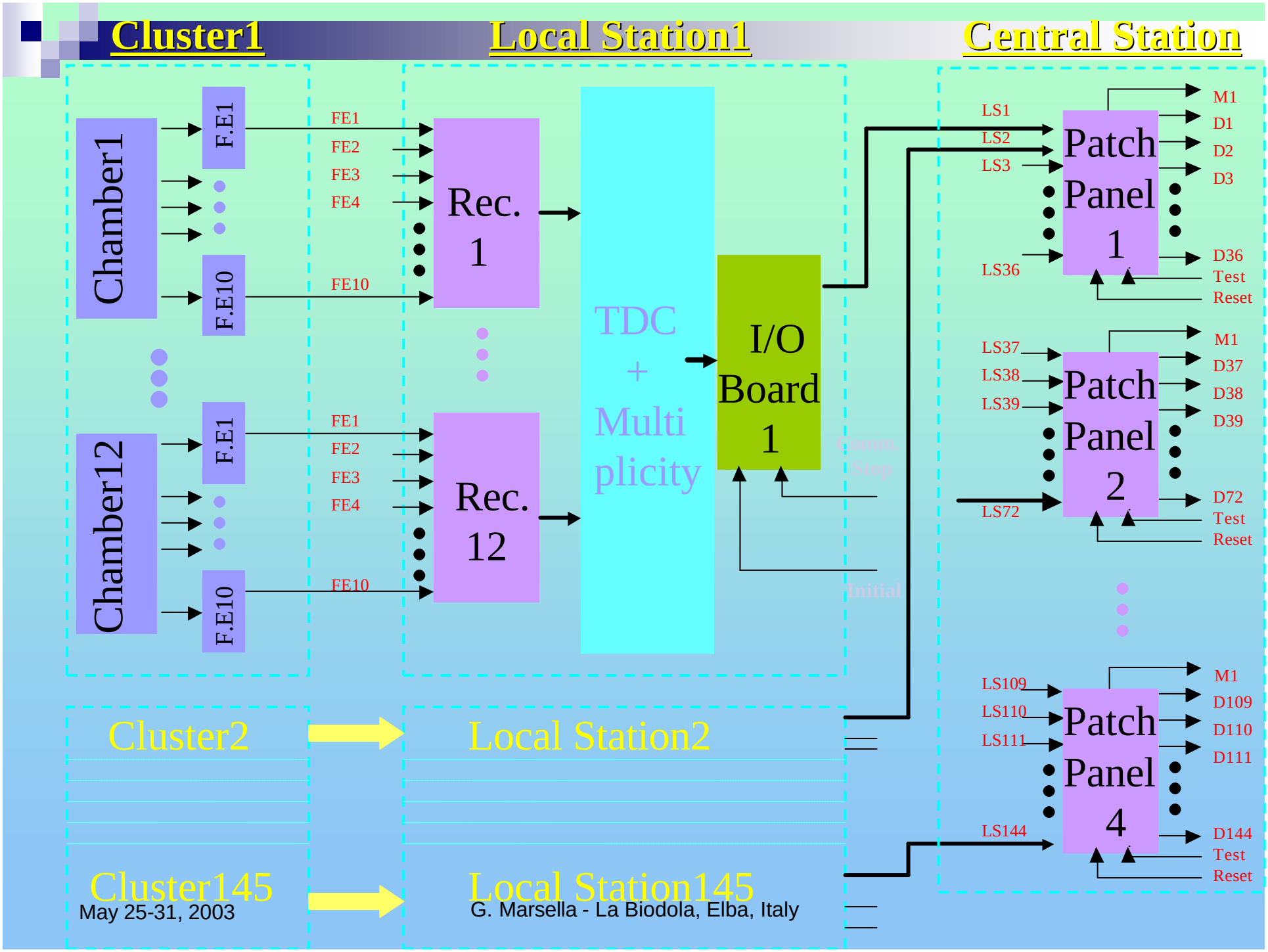
- Space – Time reconstruction
- 18480 pixels
- <1^{o} angular resolution => Good time resolution

YBJ-ARGO Channels

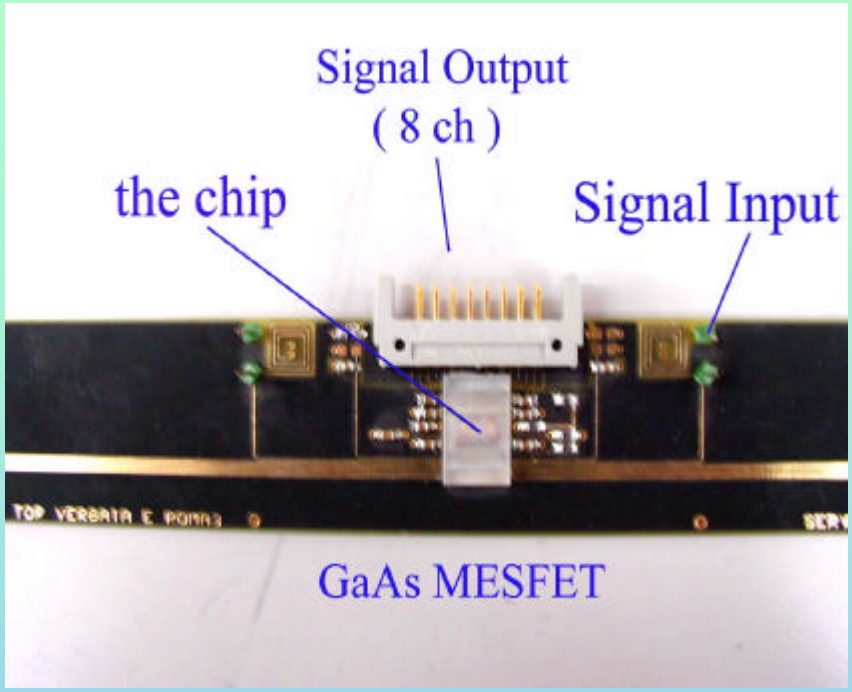
Strip	PAD	Chamber	Cluster
147840	18480	1848	154
1	8 Strip/PAD	10 **PAD /Chamber**	12 Chamber/Cluster

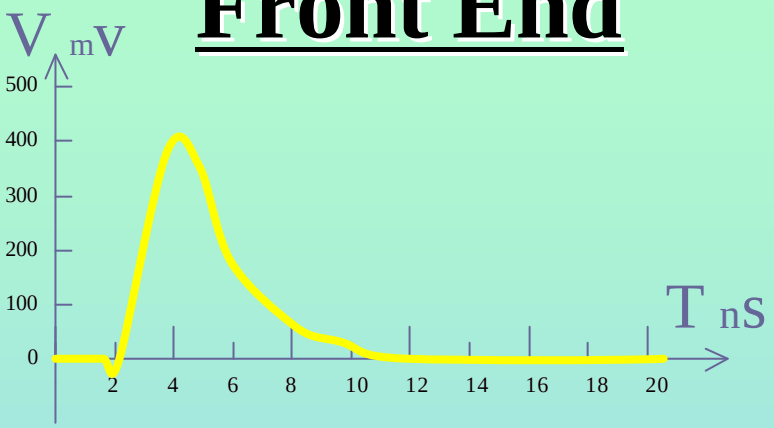
DAQ System


Detector
Local Station
Central Station
Gas
-8000v
HV
Position
80pin Twice
Wire 75m
3M VM-1
AWM2935
Power
+5v
-5v
Equipment
RPC
F.E.
Receiver
TDC&
IO Board
Patch
Panel
AMB
8K FIFO
ROCK
ROCKM
16pin Flat
Wire 12m
16 Bit Data
Gas
Reset
Trigger
Unit
Test-Sync 200ns


Cluster1
Local Station1
Central Station
Chamber1
Chamber12
F.E1
F.E10
FE1
FE2
FE3
FE4
FE10
Rec. 1
Rec. 12
TDC + Multi plicity
I/O Board 1
Comm. Stop
Initial
LS1
LS2
LS3
LS36
LS37
LS38
LS39
LS72
LS109
LS110
LS111
LS144
Patch Panel 1
Patch Panel 2
Patch Panel 4
M1
D1
D2
D3
D36
Test
Reset
D37
D38
D39
D72
D109
D110
D111
D144
Cluster2
Local Station2
Cluster145
Local Station145
May 25-31, 2003
G. Marsella - La Biodola, Elba, Italy

Front End





Vo = 300mV

t_r = 1~ 2ns

t_w = 10~20ns

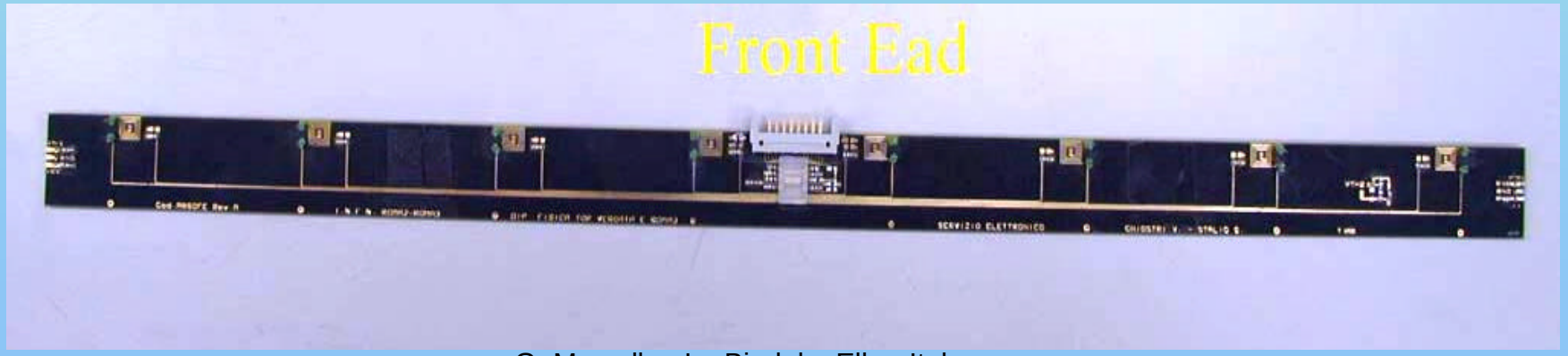
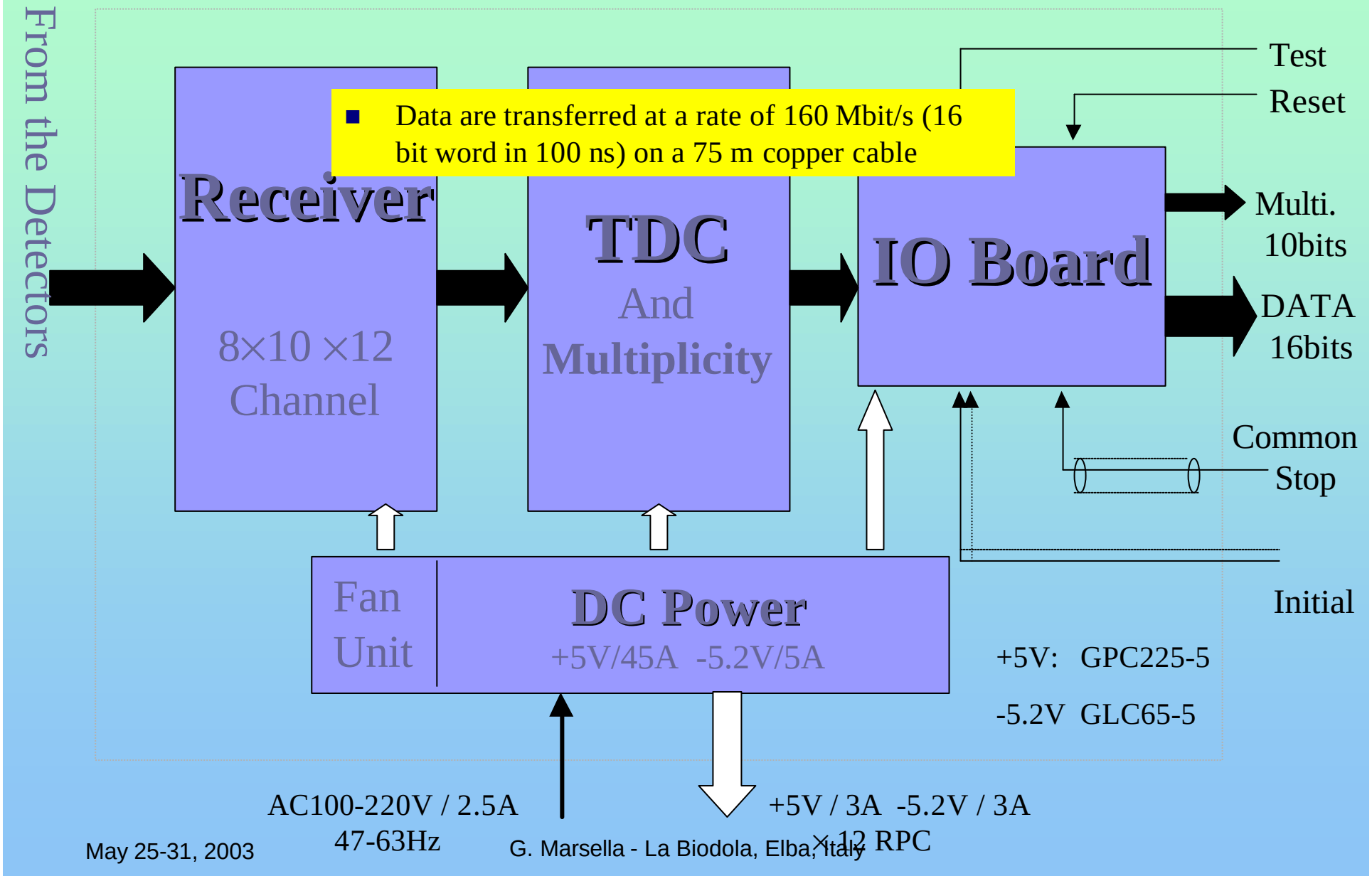
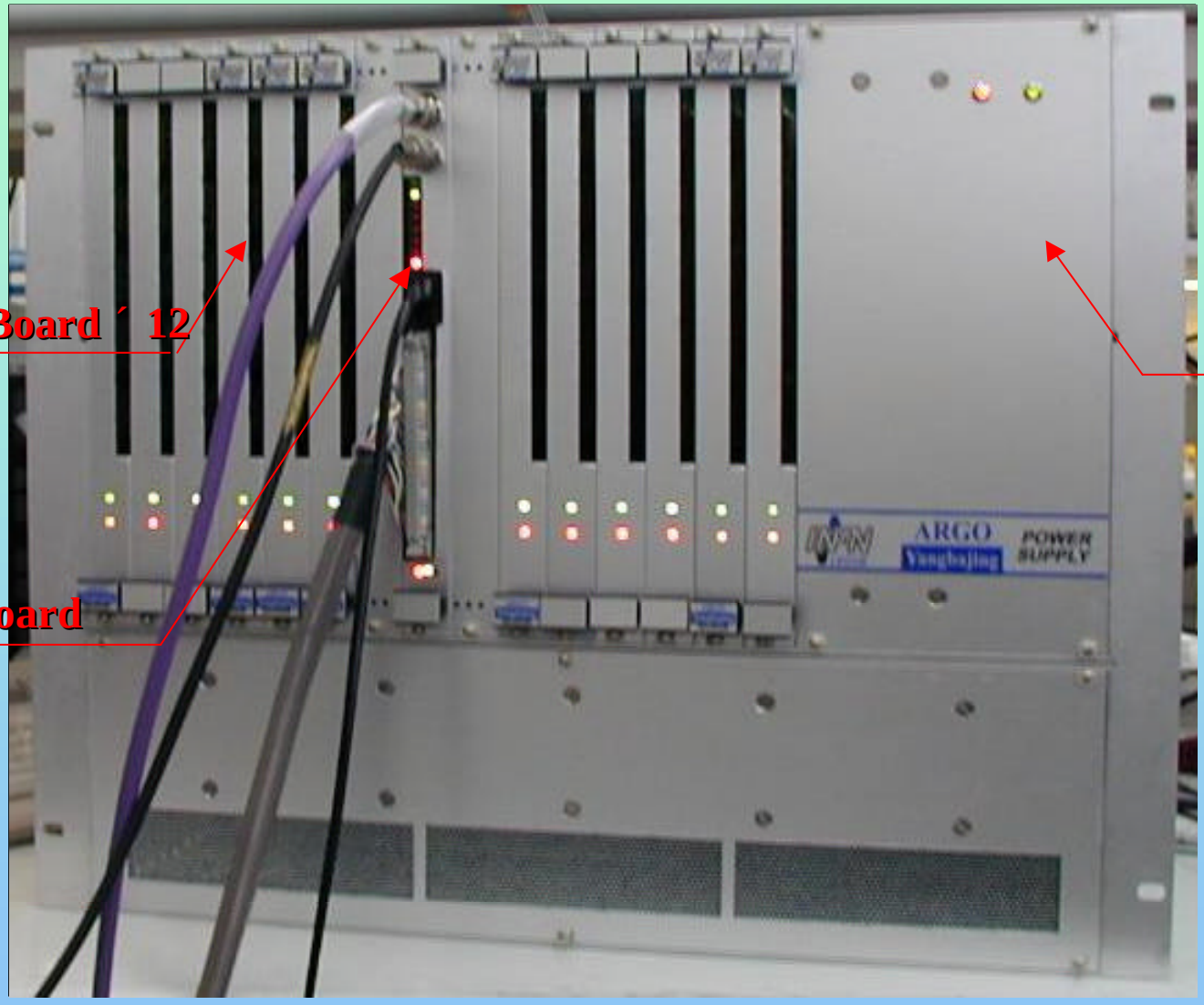


Diagram of LS



- Data are transferred at a rate of 160 Mbit/s (16 bit word in 100 ns) on a 75 m copper cable

Local Station



Local Station

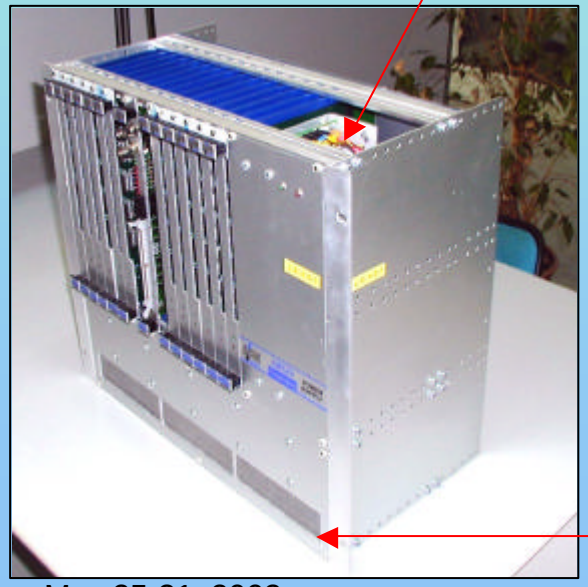
TYPE: GPC225-5 (CONDOR)
SUBCIDIARY INDUSTRIES
ASSEMBLED IN MEXICO

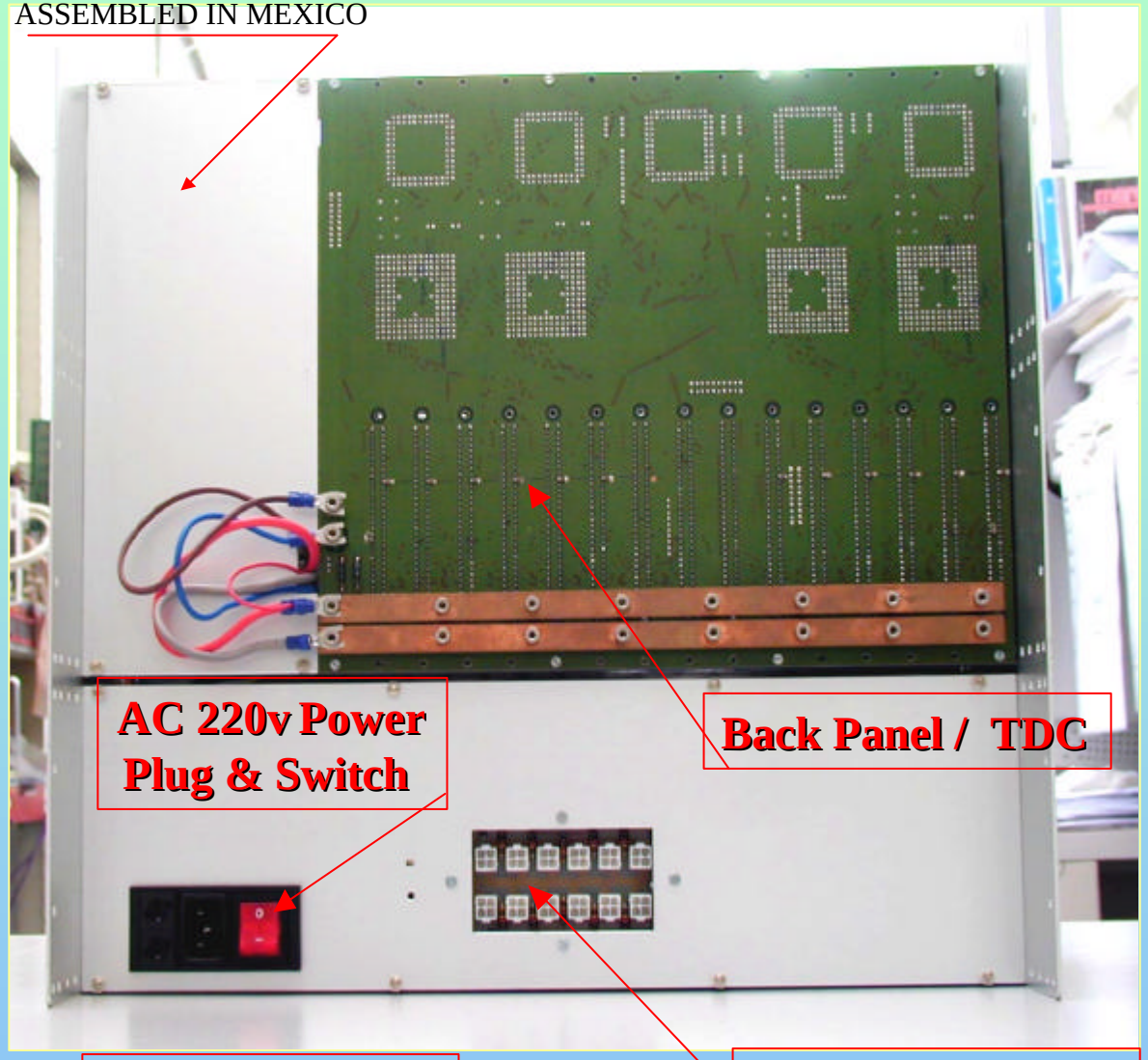
OUTPUT TB2

PIN	RATINGS
1,2,7,8	+5V / 45A
3,4,5,6	COMMON

+5V, -5.2V DC Power

225W WITH 26 CFM AIRFLOW





Receiver

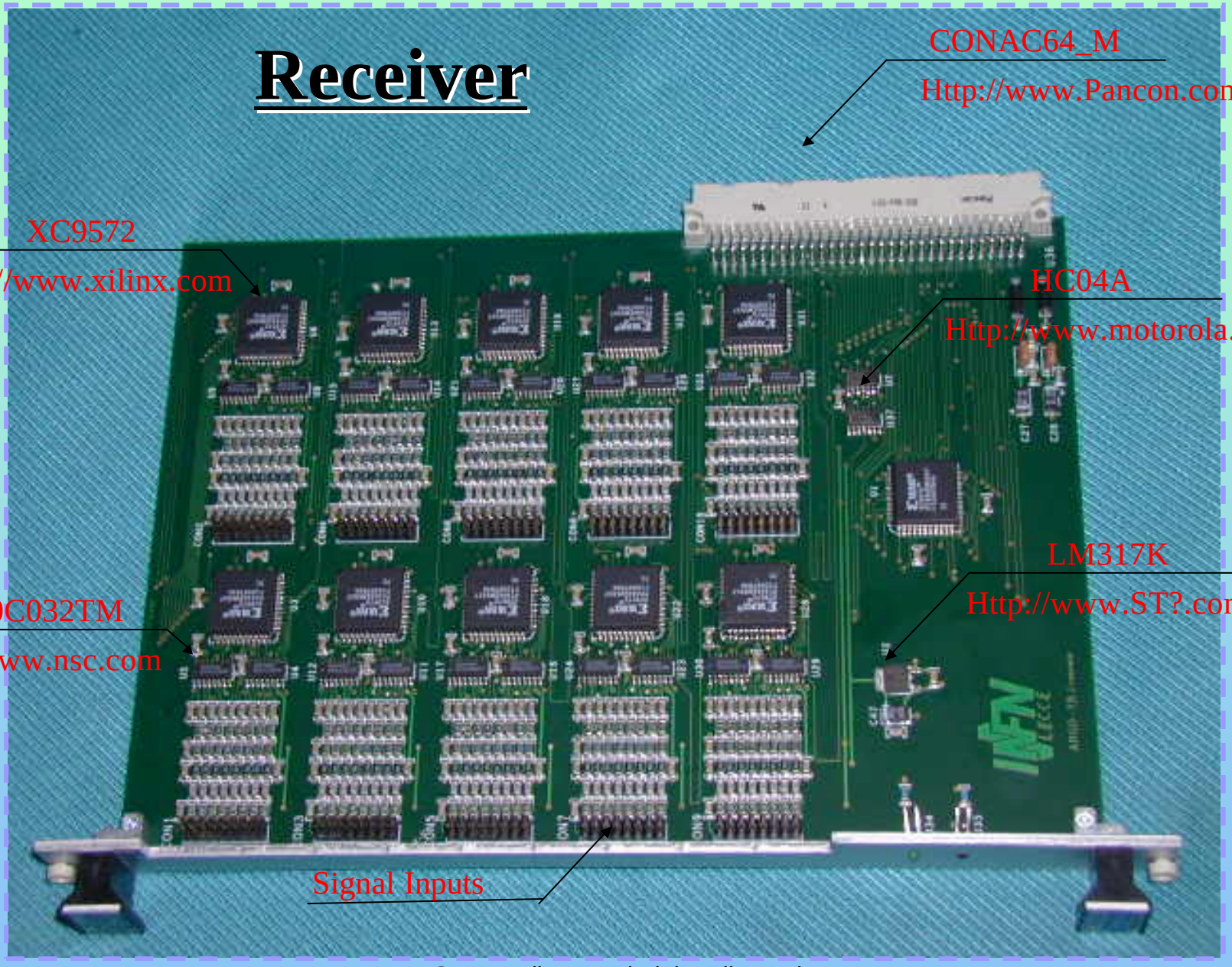

CONAC64_M
Http://www.Pancon.com
XC9572
Http://www.xilinx.com
HC04A
Http://www.motorola.com
LM317K
Http://www.ST?.com
DS90C032TM
Http://www.nsc.com
Signal Inputs

Diagram of Receiver (1)

XILINX®

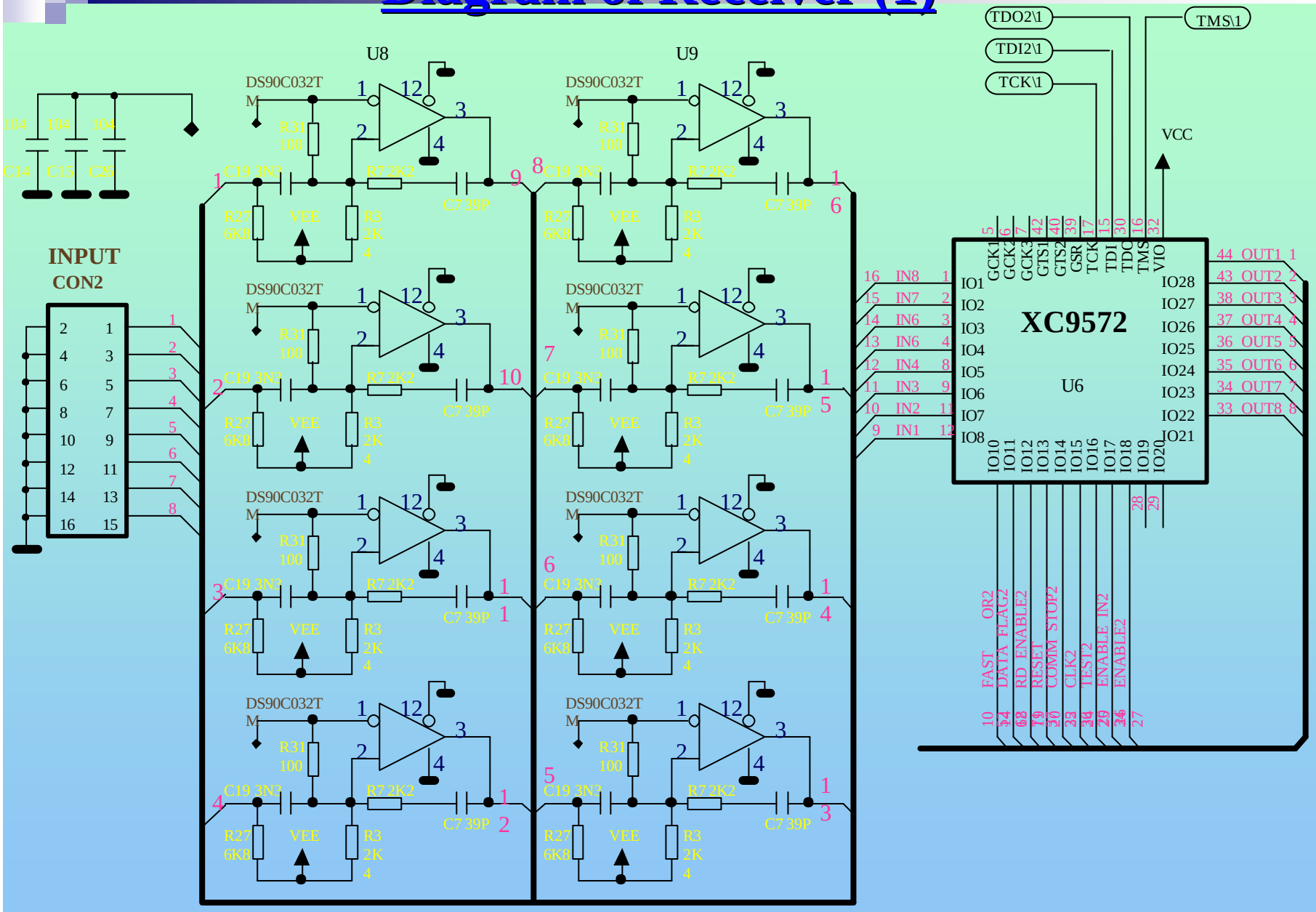
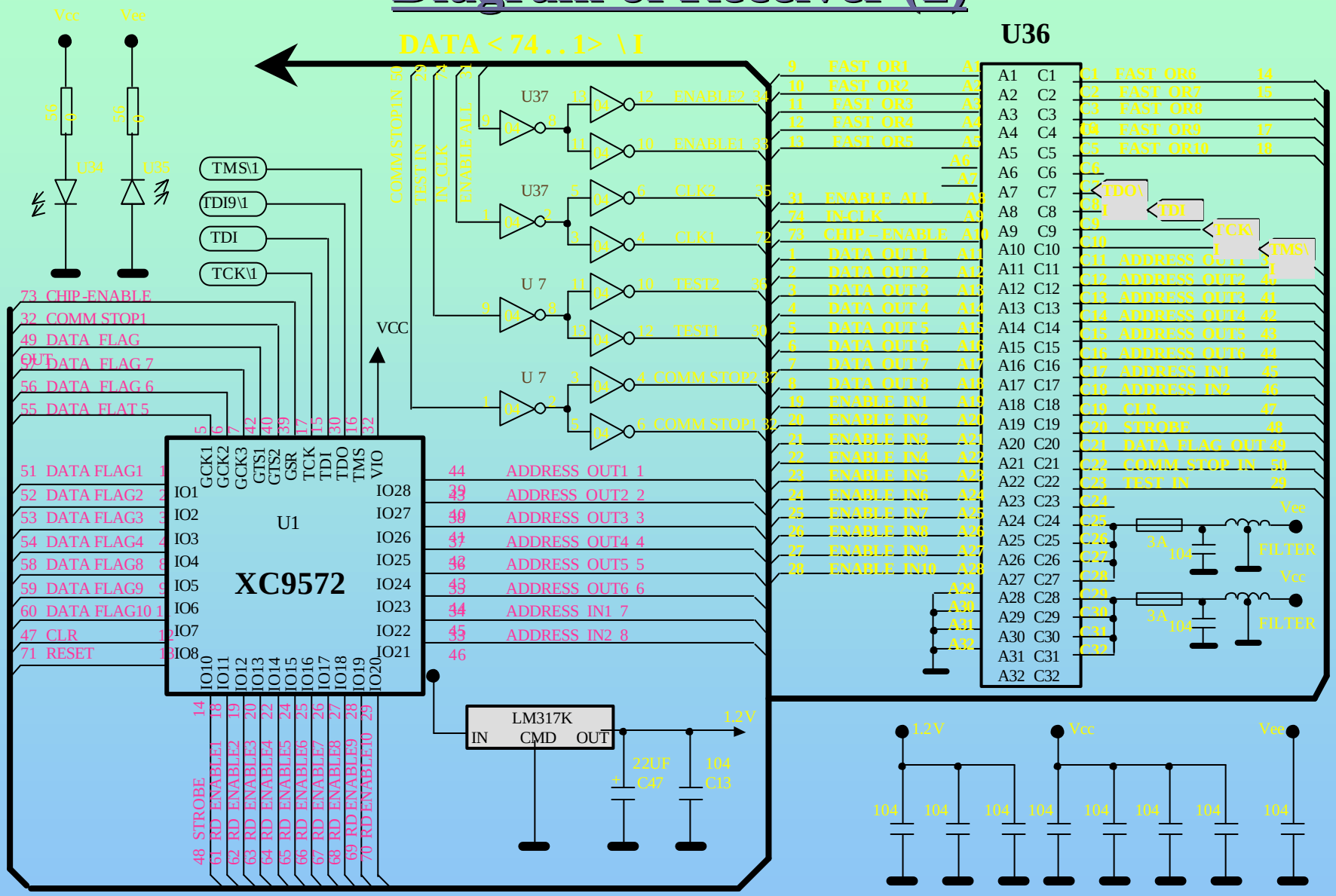
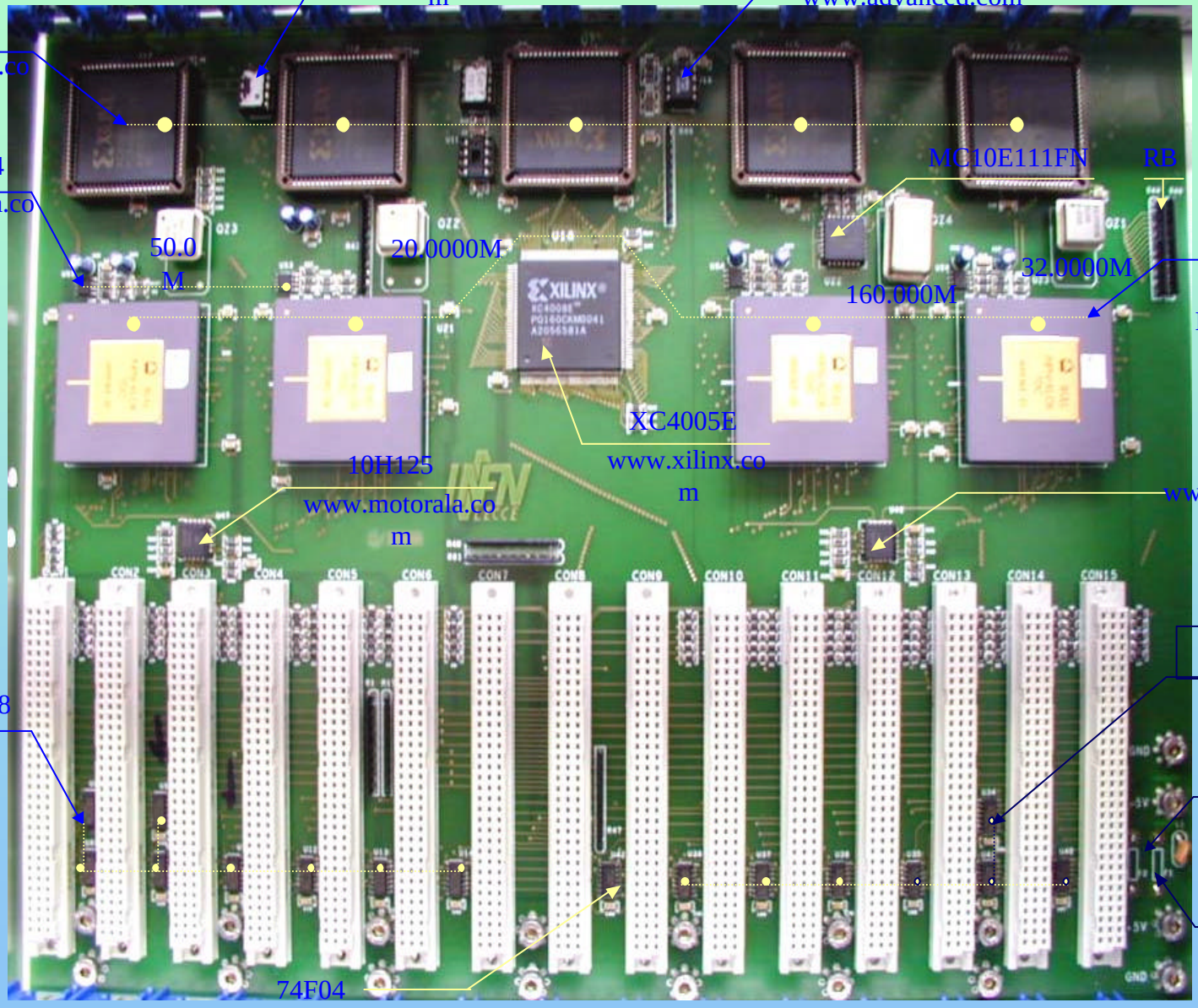


Diagram of Receiver (2)

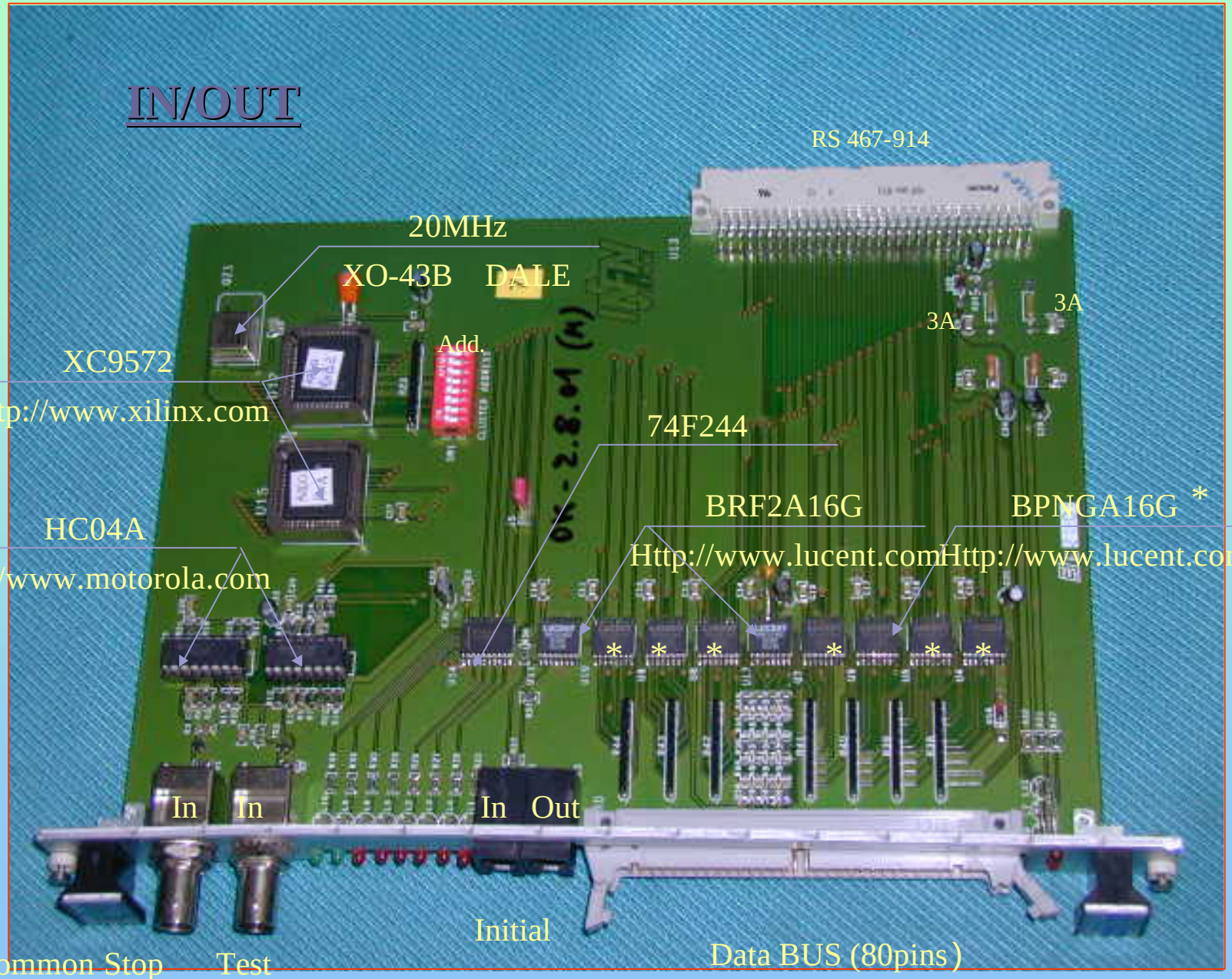
XILINX®



Back Panel / TDC



IN/OUT


RS 467-914
20MHz
XO-43B DALE
Add.
3A
3A
XC9572
Http://www.xilinx.com
74F244
BRF2A16G
Http://www.lucent.com
BPNGA16G *
Http://www.lucent.com
HC04A
Http://www.motorola.com
In
In
In
Out
Initial
Common Stop
Test
Data BUS (80pins)

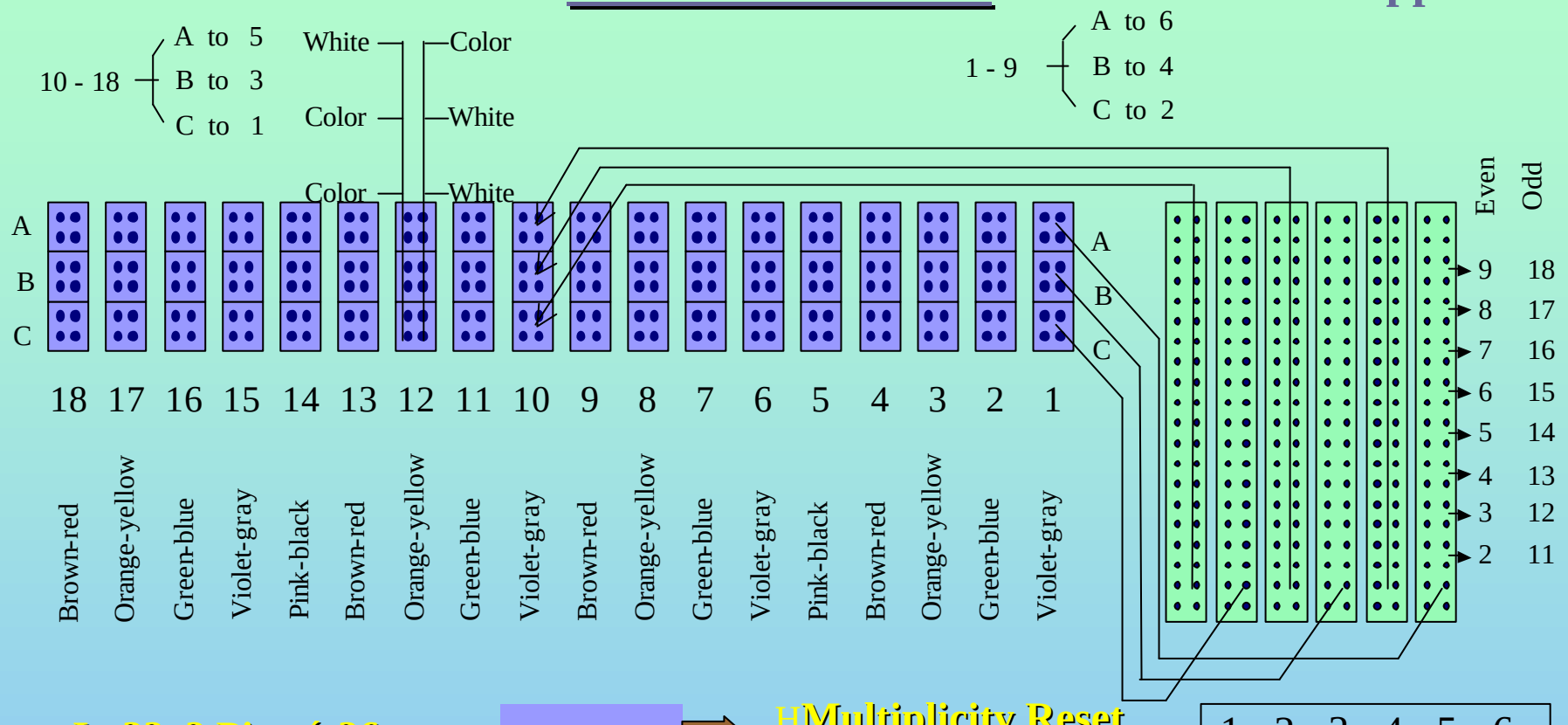
Data Structure

Local Station Data Format

START	0000	1010	1010	1010	0x0AAA
EV_NO. Created	0111	0000	XXXX	XXXX	0x70XX
EV_NO. TDC0	0100	0000	XXXX	XXXX	0x40XX
TDC_DATA	0010	0XXX	XXXX	XXXX	0x2XXX
TDC_ADR	0000	000X	XXXX	XXXX	0x00XX
EV_NO. TDC2	0101	0000	XXXX	XXXX	0x50XX
TDC_DATA	0011	0XXX	XXXX	XXXX	0x30XX
TDC_ADR	0001	000X	XXXX	XXXX	0x10XX
EV_NO. TDC3	0101	1000	XXXX	XXXX	0x58XX
TDC_DATA	0011	1XXX	XXXX	XXXX	0x3XXX
TDC_ADR	0001	100X	XXXX	XXXX	0x1XXX
TDC_DATA	0011	1XXX	XXXX	XXXX	0x3XXX
TDC_ADR	0001	100X	XXXX	XXXX	0x1XXX
STRIP	1XXX	XXXX	XXXX	XXXX	0xXXXX
STRIP	1XXX	XXXX	XXXX	XXXX	0xXXXX
STRIP	1XXX	XXXX	XXXX	XXXX	0xXXXX
STRIP	1XXX	XXXX	XXXX	XXXX	0xXXXX
STOP	0000	0101	0101	0101	0x0555
WORD_COUNT	0000	0000	0111	1111	0x007F
PARITY	1XXX	XXXX	XXXX	XXXX	0xXXXX

Patch Panel

upper



In 32x2 Pins ´ 36

16 bits Data
1 bits Test
2 bit Reset
6 bits 1-6Multiplicity
4 bits >7,16,32,64Multiplicity

Patch Panel

HMultiplicity Reset Test 6 pins x 36

1 2 3 4 5 6
C B A
Mul64 Mul16 Reset
Mul32 Mul7 Test

Data Out 20x2 Pins ´ 36

16 bits Data

L Multiplicity Out 6Pins ´ 36

6 bits Multiplicity × 3

Patch Panel

The Back

Data Bus from Local

The Face

Data Bus to Center

Multi<6 to Center

Multi64 to Center

Multi16 to Center

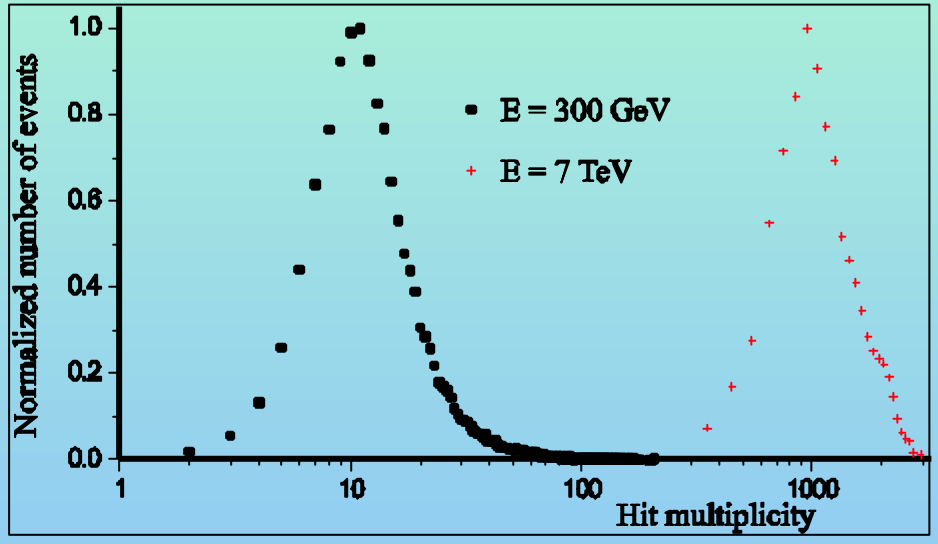
Reset from Center

Test from Center

Multi7 to Center

Multi32 to Center

Trigger

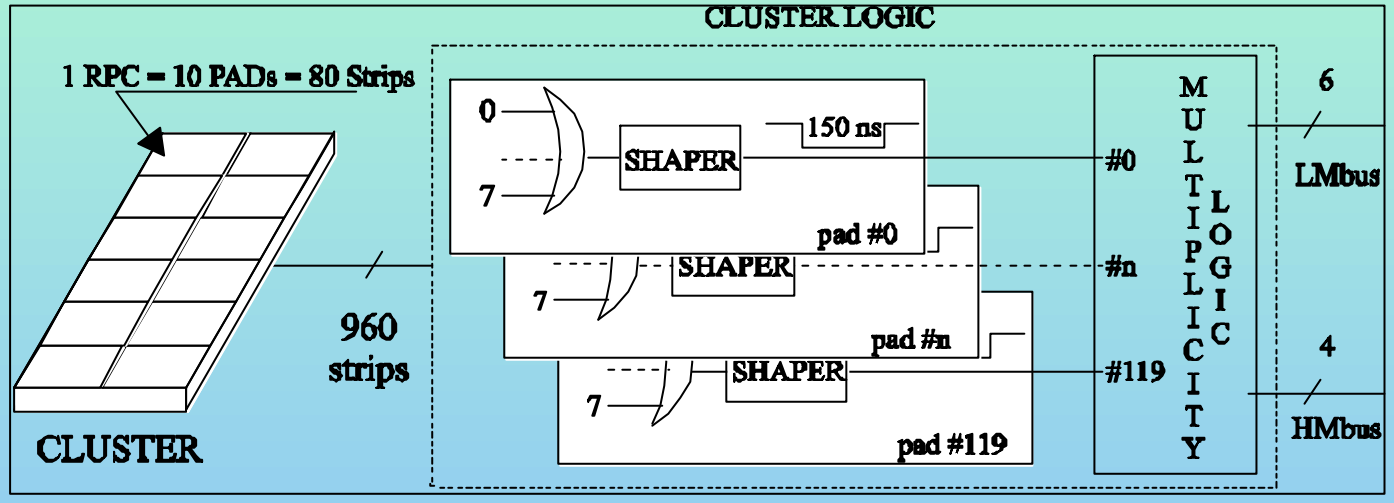


Wide range of fundamental issues in cosmic ray physics

Trigger must be able to select:

- Event density
- Hit multiplicity

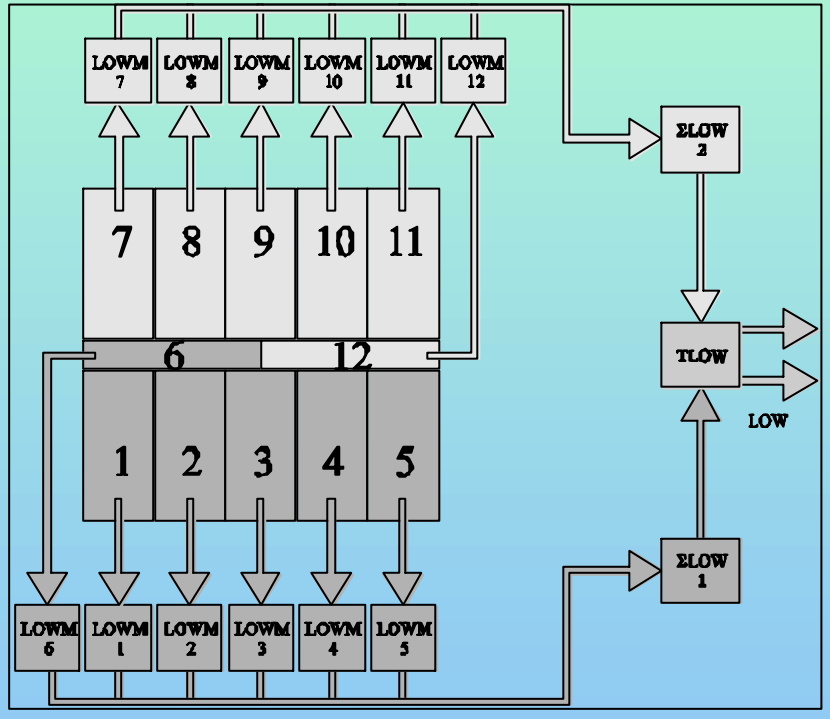
Trigger



150 ns

400 ns

Low Multiplicity



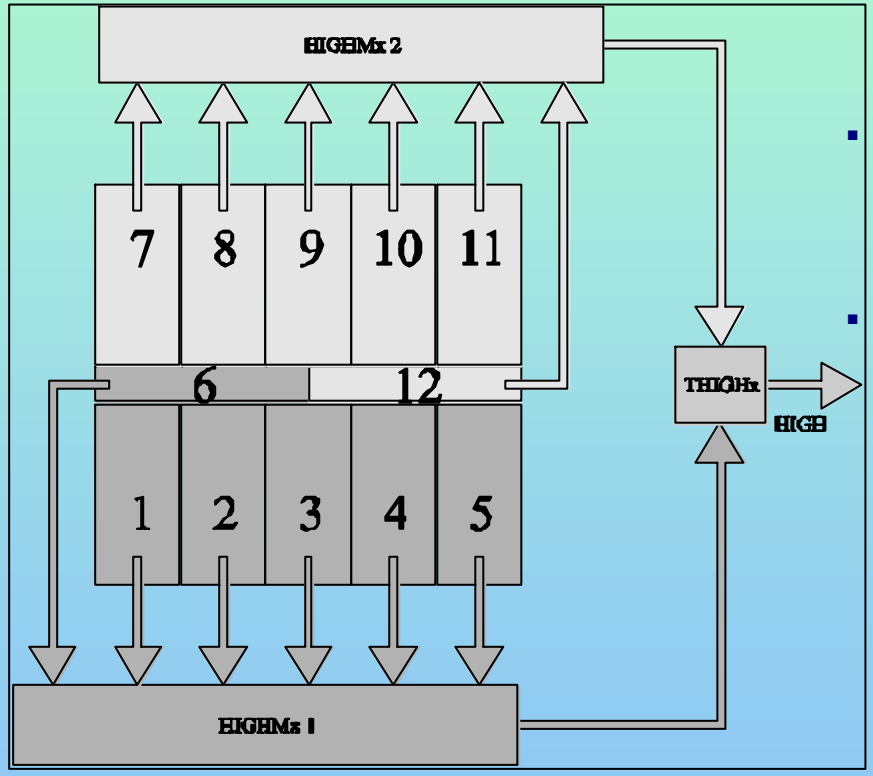
Low Multiplicity

- 2 sections (65 LS each)
  6 LOWM boards
- 2 ΣLOW (sum of LOWM)
- 1 TLOW (total sum of lowm)

Fast Trigger

- 12 CLUSTER each module
  => 3 SUPERCLUSTERs for Fast Trigger

High Multiplicity



High Multiplicity

- 2 sections (65 LS each)
- 4 HIGHM boards in parallel (7,16,32,64)
- 1 THIGH(total sum of HIGHM)

Trigger

3 different trigger logics based on LM and HM from LS. Hardware is implemented as synchronous pipelines with a common clock at 33 MHz

1) **Low Multiplicity**

Trigger when programmed threshold of fired PADs is exceeded on the entire carpet

2) **Density Trigger (Fast trigger)**

4 CLUSTERs make a SUPERCLUSTER. It triggers when exceeded a programmable

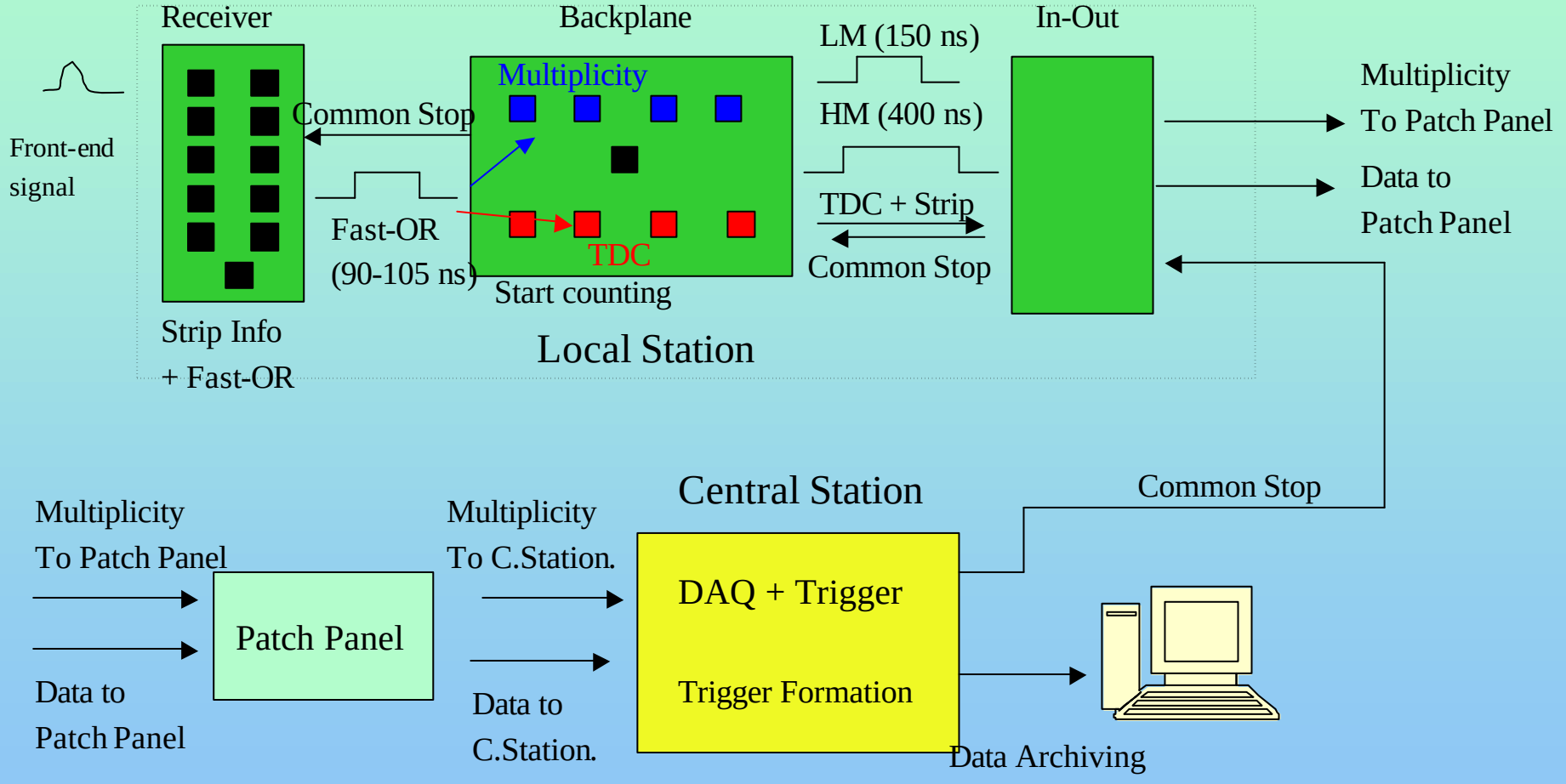
threshold (in the LM scheme)

3) **High Multiplicity**

Trigger when a programmable number of CLUSTERs with a specific multiplicity (7,16,32,64) is exceeded

All trigger are handled by a TRBOX which can mask or combine them (And and OR) to define topological triggers

Functionality Diagram



Conclusions

- The Local Station and the trigger system are working successfully in Yangbajing.

  Some upgrade are planned to read analogic big pads