LHCf protection from beam failures

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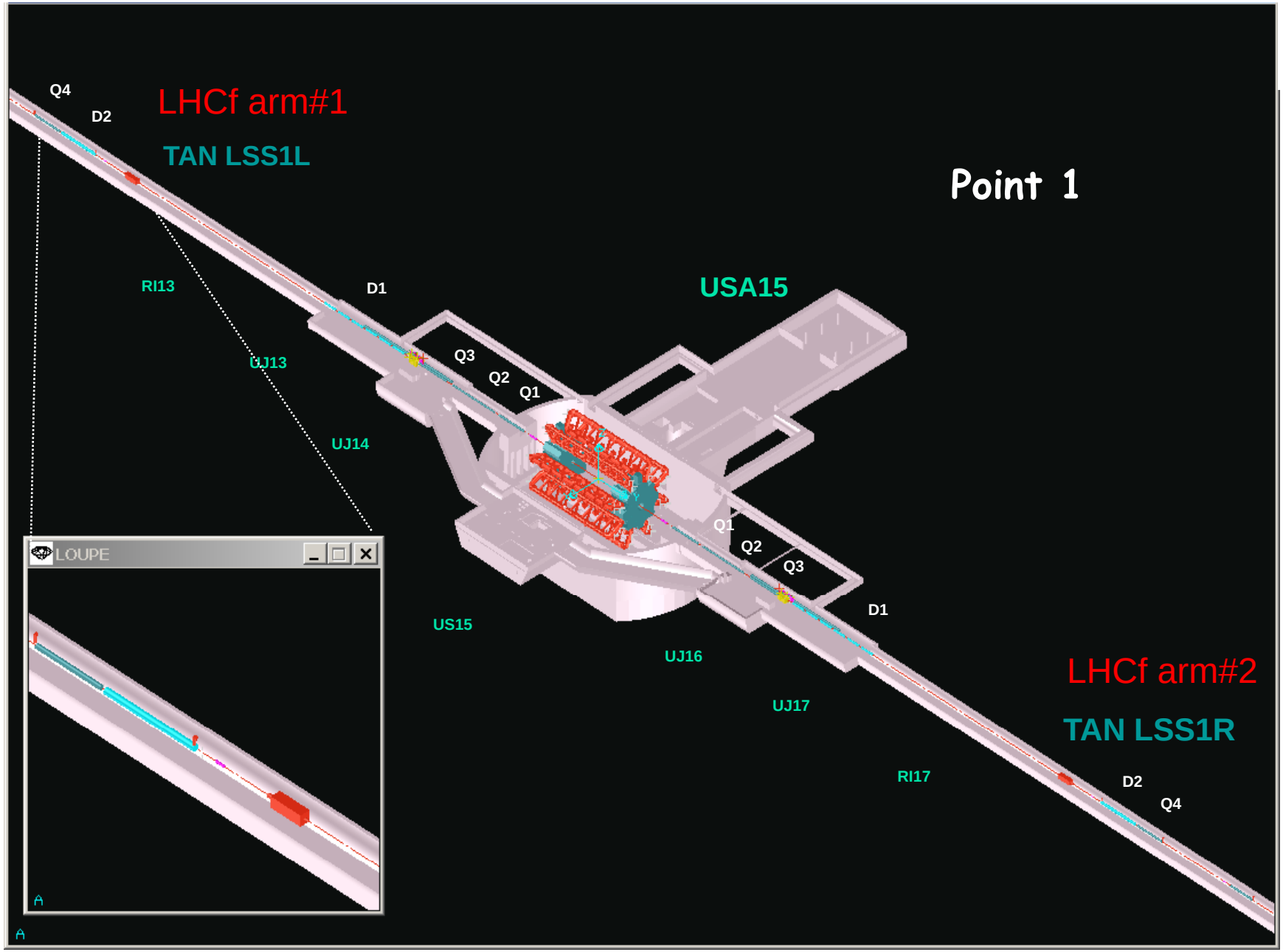
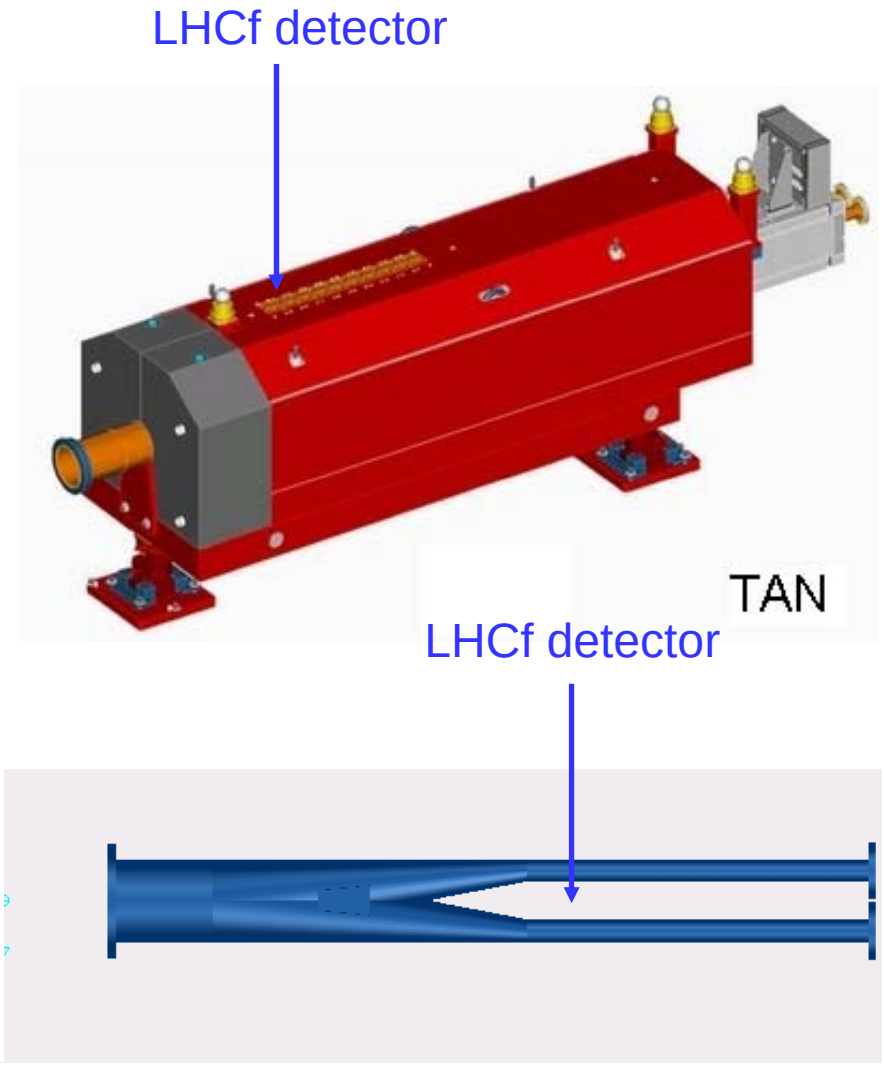
Joint LHC Machine Experiments Meeting on experiments protection from beam failures,
CERN, 12 June 2007

LHCf detectors location (in the machine)

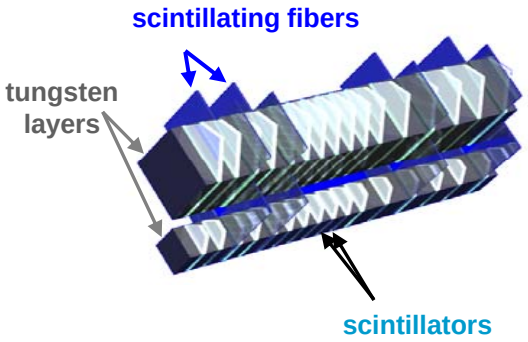


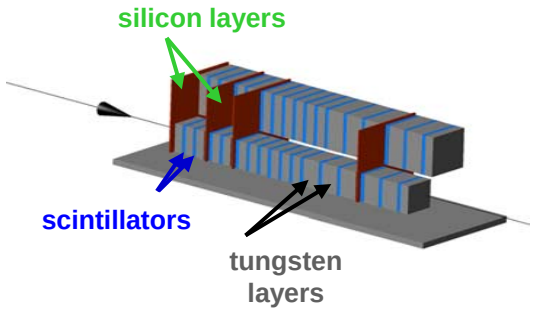
LHCf detectors location (inside the TAN)

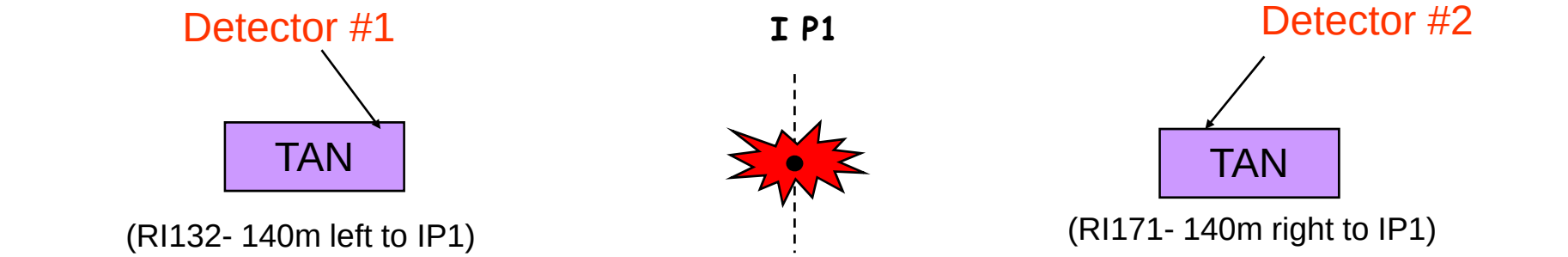
in each TAN
1 slot with 10 movable Cu bars



LHCf detectors



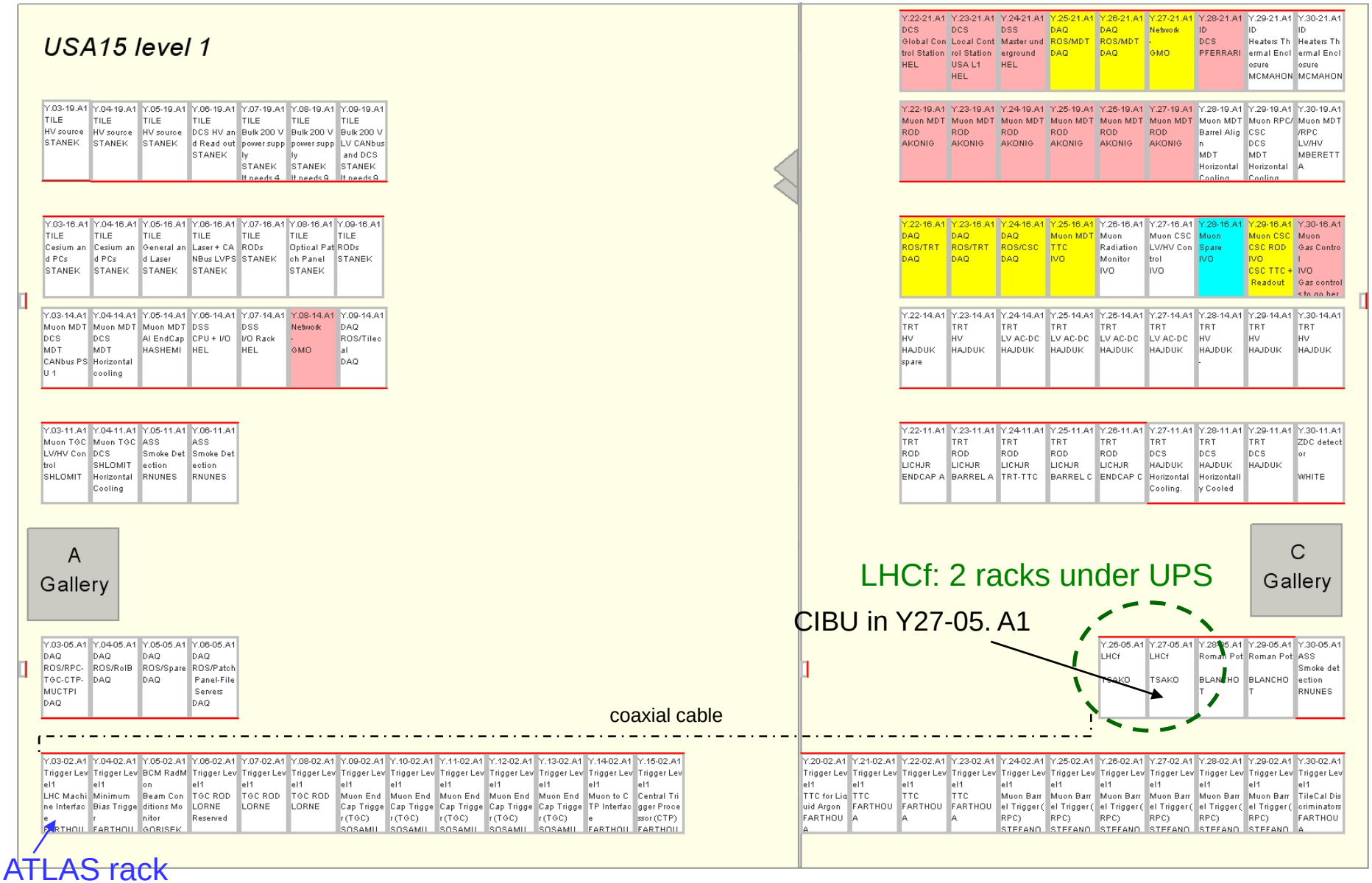




LHCf detectors: inside the TAN for protons runs at $L<10^{30}$ cm^{-2} s^{-1}
At $L>10^{30}$ cm^{-2} s^{-1} both detectors are removed from TAN (replaced by Cu bars or ATLAS ZDC ECAL)

No special dedicated detector for the LHCf protection.
LHCf scintillators =>LHCf protection.

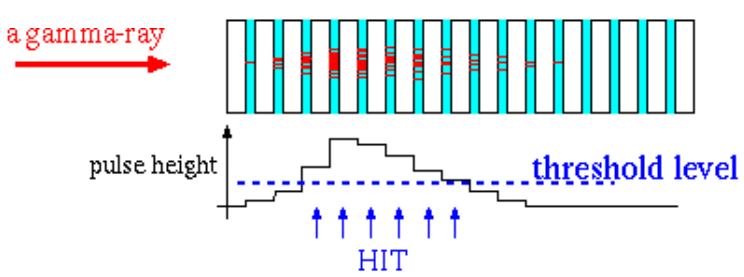
LHCf racks in USA15 level 1

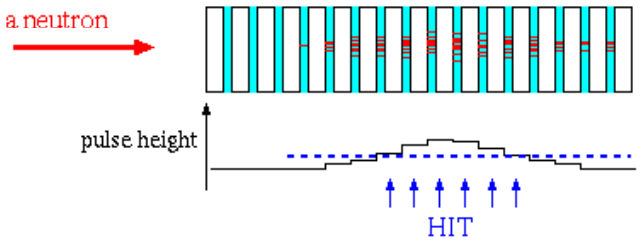


LHCf CIBU signal production

- related to the scintillators signals of arm#1 and arm#2

- very simplified model: LHCf calorimeter is composed of tungsten plates and 16 plastic scintillators.





- measurement of showers induced by a single γ-ray/n from the IP.
γ-ray showers: very stable profiles, energy dependent pulse height.
n showers: very irregular in the starting point and pulse height.

1 event ⇔ some of the scintillator signals > predefined threshold level (by software, in view of background rejection).

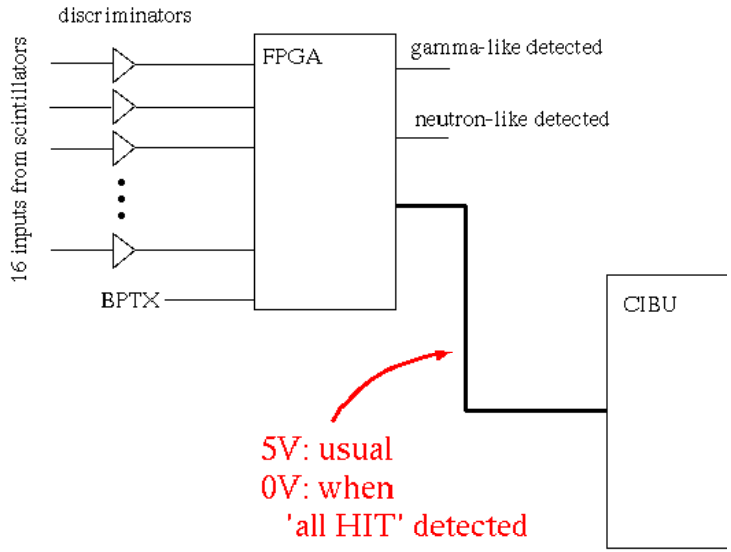
‘all hit event’ ⇔ uniform large signals in all the 16 channels, all exceed the threshold level.

LHCf CIBU signal production

In LHCf operation condition, ‘all hit’ never occurs unless beam itself hits the detector.

‘gamma like or neutron like’ event
no event
} => 5 V signal to CIBU => beam permit

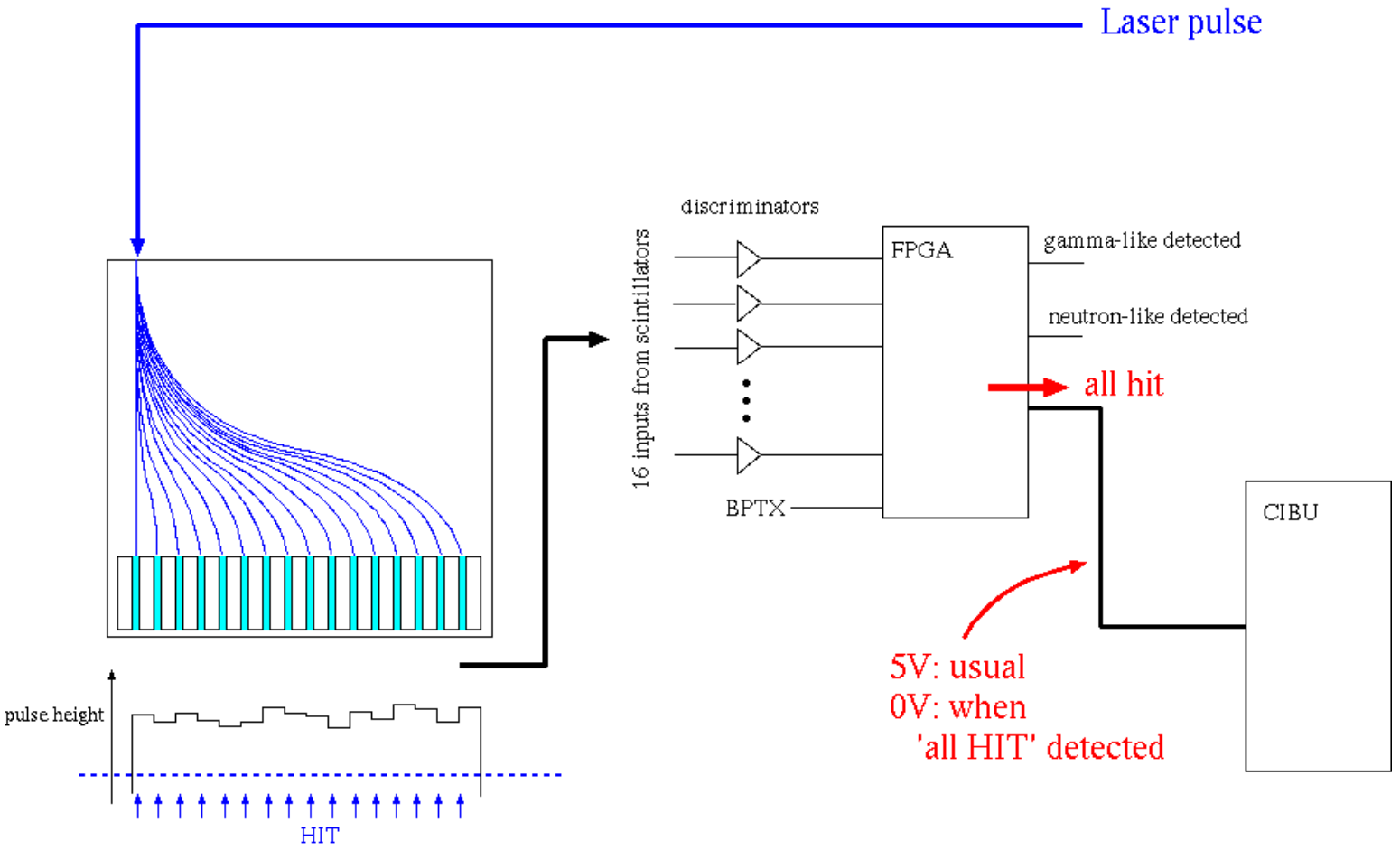
‘all hit event’ => 0V signal to CIBU => beam dump



When LHCf = not in TAN, LHCf CIBU signal =bypassed in the BIC removing a jumper
=> manual intervention and modification of the BIC configuration file
⇔ agreement of B. Puccio as only 1 or 2 times /year

LHCf racks under UPS => no beam dump request in case of LHCf racks power failure

LHCf CIBU signal production - commissioning



'All hit' signal = generated by laser pulse.
Though it can not make very large signal, but by lowering the threshold level, the beam hit condition can be simulated.

LHCf detectors during beam injection

- PMT HV = on

(assuming no beam on the electronics - 10 cm above beam line plane))

- Si V_{bias} = off
- electronics in rack= on

Beam damages to LHCf

- 1 bunch (10^{10} p) => no problem @ 450Gev, 7 TeV
- detector damage level= 10^{16} MIP/cm^2 (7 TeV) - *preliminary estimate*

Questions to the machine

Reminder: LHCf detectors are located in between the 2 beam pipes

- during settings : possibility to send pilot bunch in the LHCf detectors?
- during LHC run: possibility that beam hits the LHCf detectors?