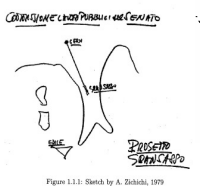


Figure 1.1.1: Sketch by A. Zichichi, 1979

First results of the CNGS beam monitor with LVD

H. Menghetti for the LVD Collaboration
Bologna University and INFN

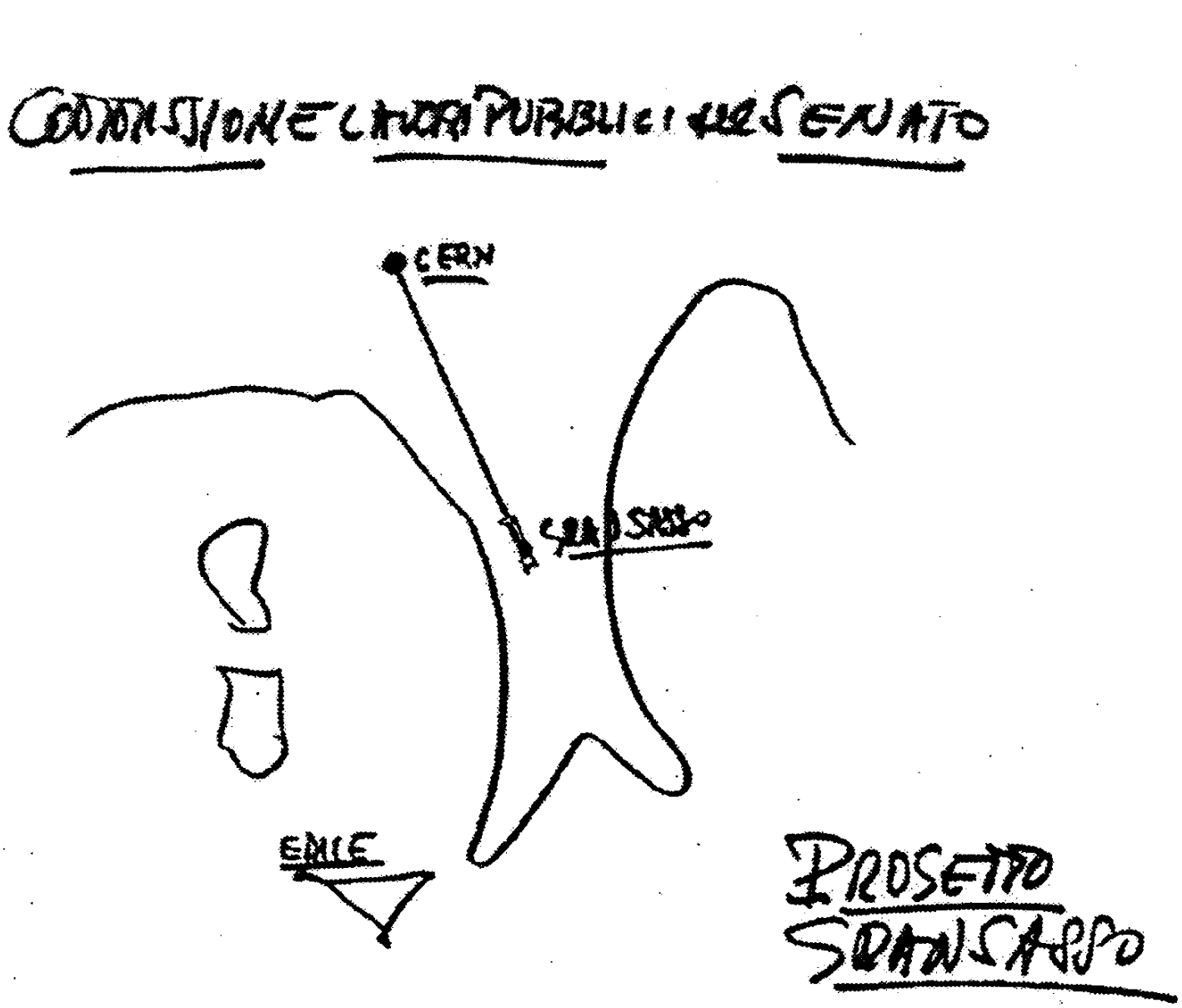


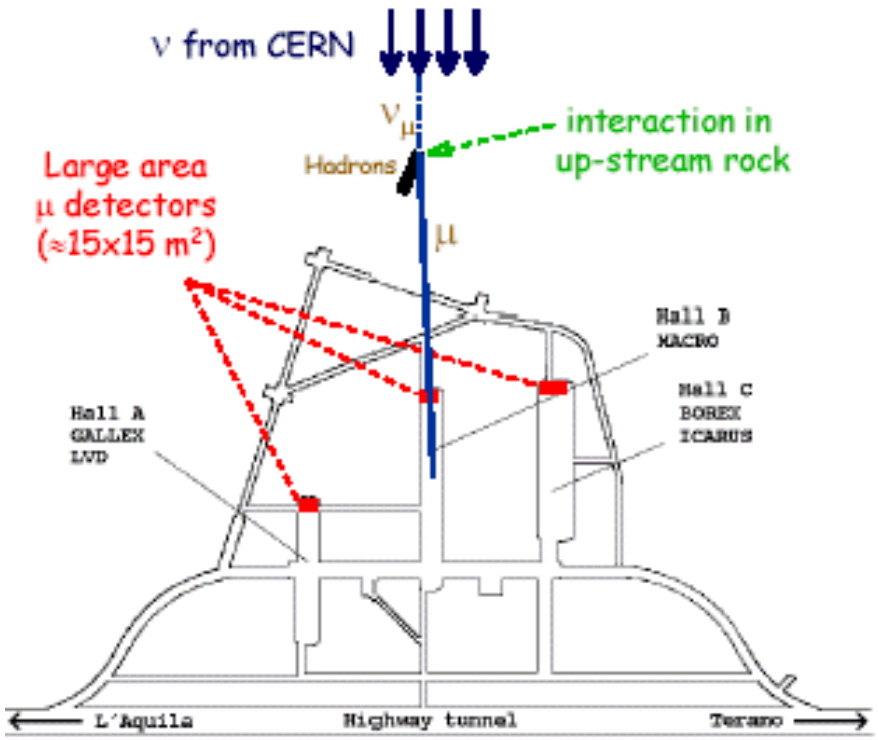
Figure 1.1.1: Sketch by A. Zichichi, 1979

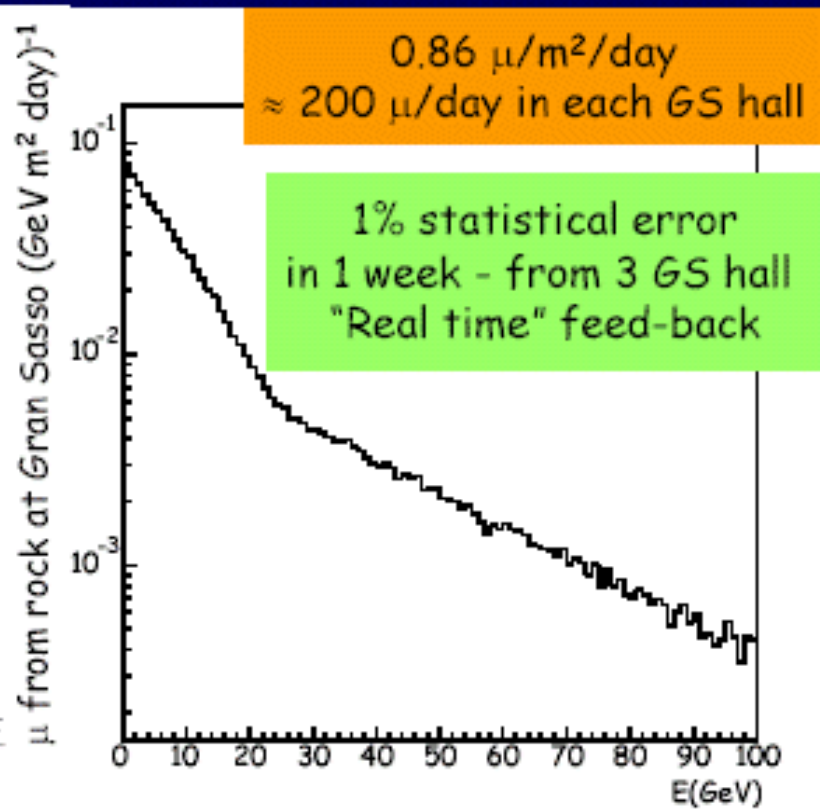
Why a monitor at LNGS ?

"to get some feed-back":

Neutrino flux monitors at Gran Sasso

monitor intensity and time-stability of beam

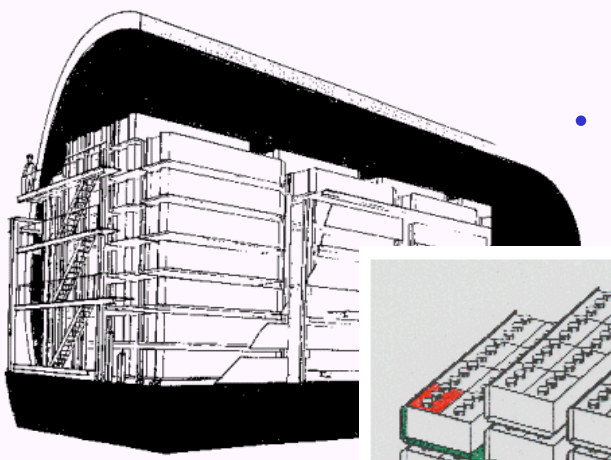




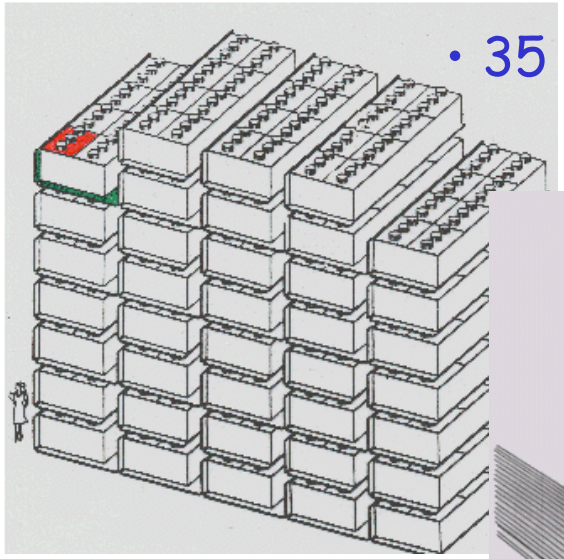
18 September 2002 — CNGS - a long baseline neutrino beam facility in Europe, presented by K. Elsener (CERN) at Aarhus University — 48

Large Volume Detector

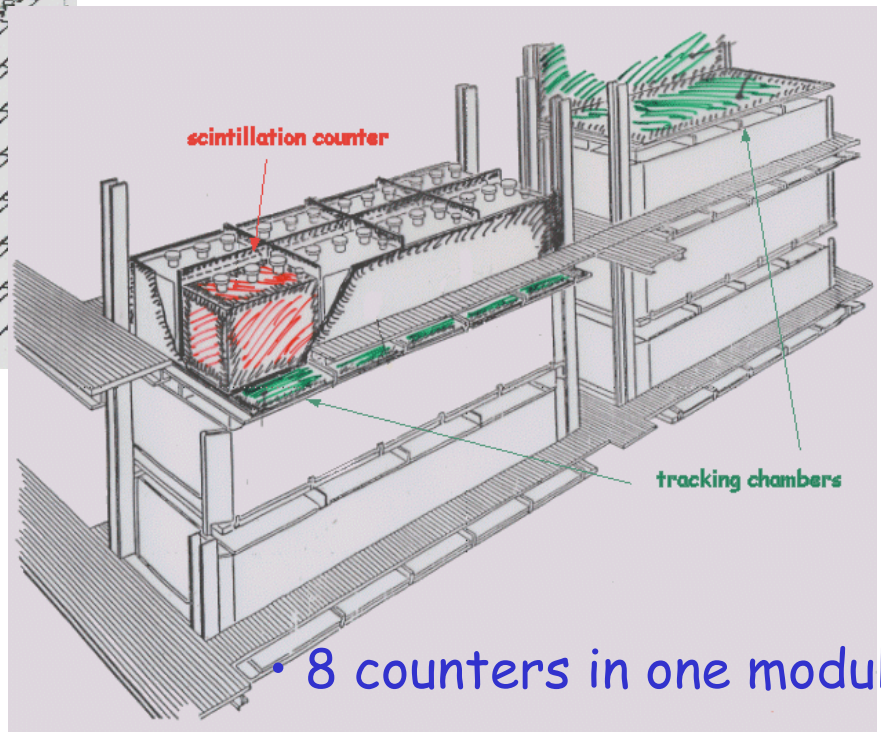
Large Volume Detector



- 3 identical towers in the detector

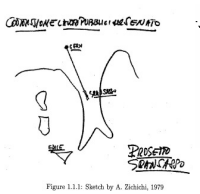


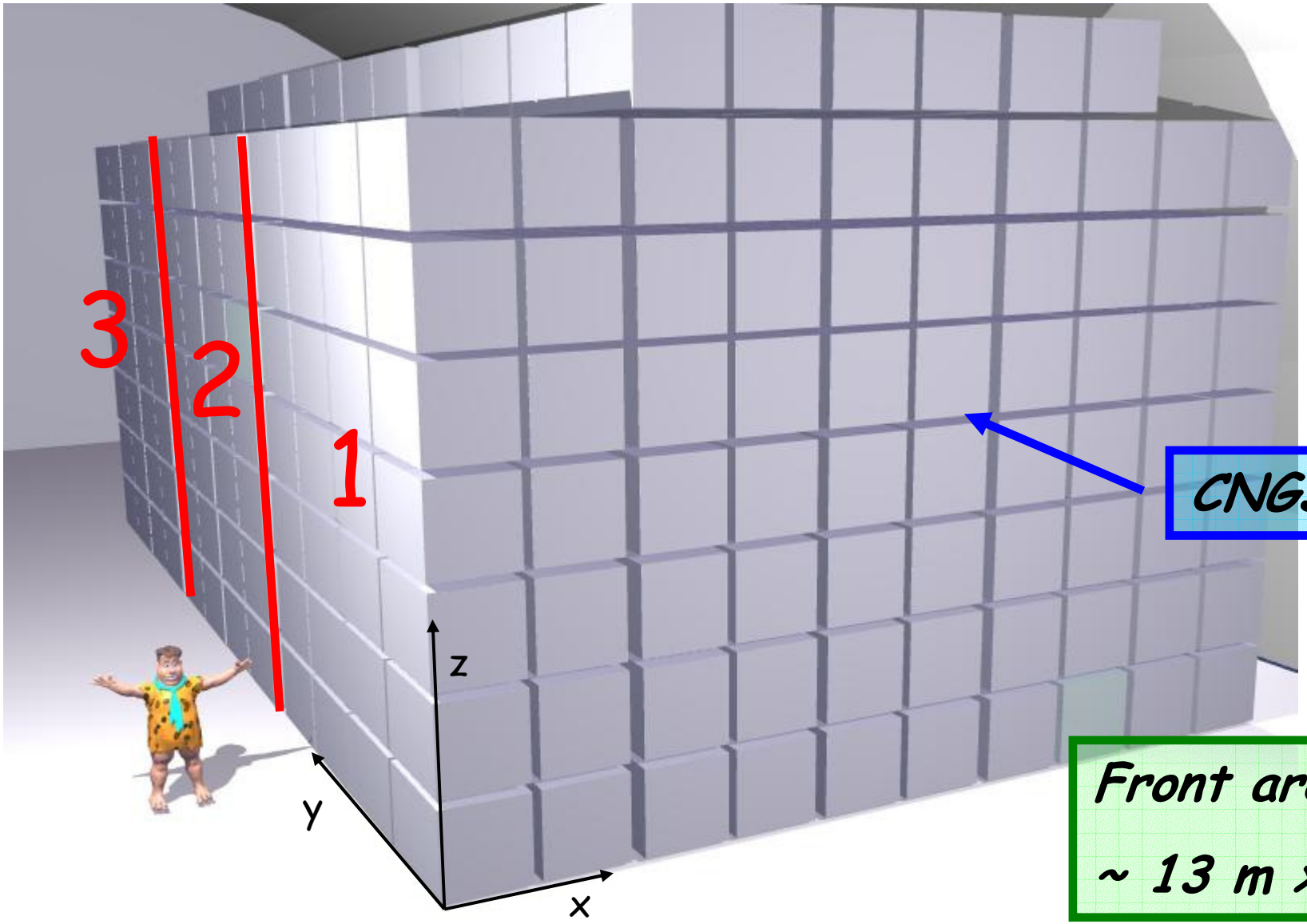
- 35 active modules in a tower



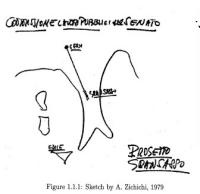
- 8 counters in one module

Large Volume Detector



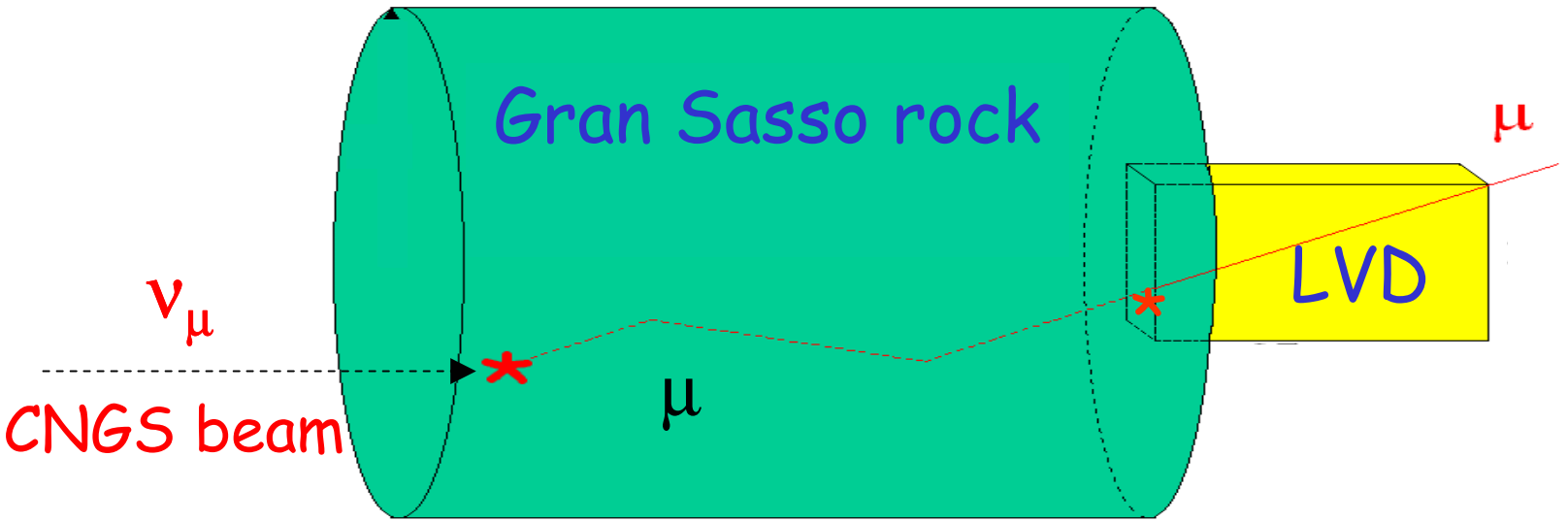


LVD monitor of the CNGS beam

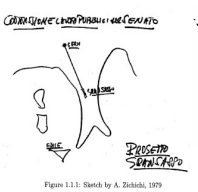


Neutrinos from CNGS are observed through:

- the detection of muons produced in neutrino CC interactions with the surrounding rock or in the detector
- the detection of the hadron jets produced in neutrino NC/CC interactions in the detector



LVD monitor of the CNGS beam



The neutrino candidate are defined as at least a signal from a counter of the detector with an energy deposit greater than 100 MeV.

We can discriminate CNGS event from cosmic muons requiring:

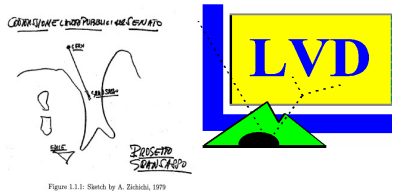
- horizontal direction of the reconstructed muon
- time coincidence of the event with the CNGS time spill

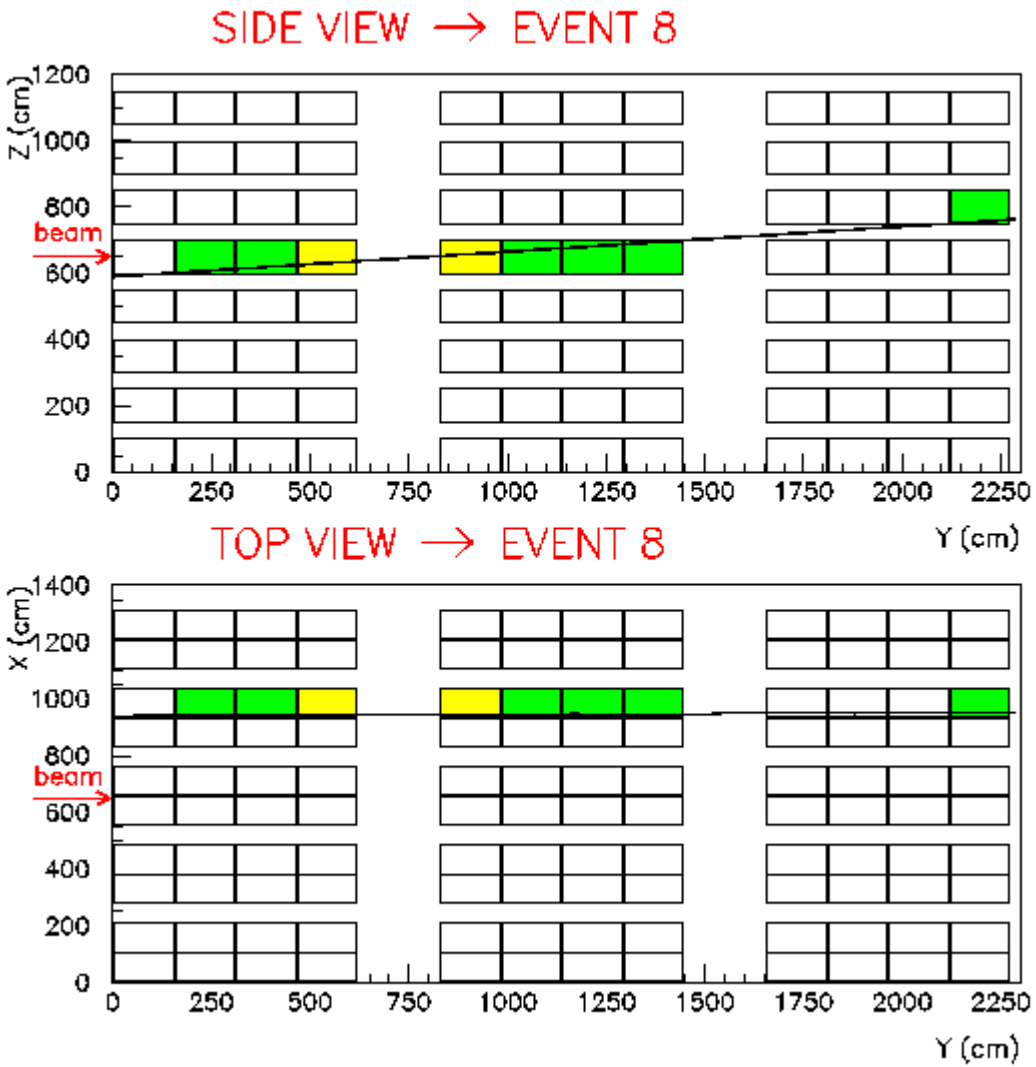
(cosmic muon background is then about 0.2 events/day)

From the Montecarlo simulation we expect $6.67\ 10^{-16}$ events/proton on target (p.o.t.)

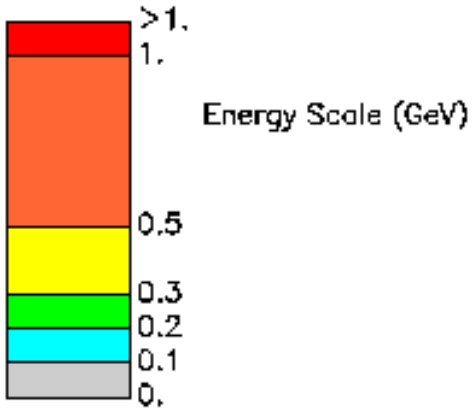
1 year of data (200 days) -> $4.5\ 10^{19}$ p.o.t. -> 150 events/day

Event Display: μ from rock

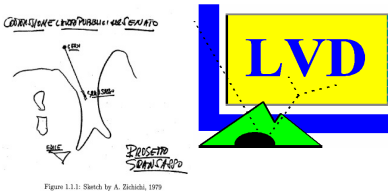


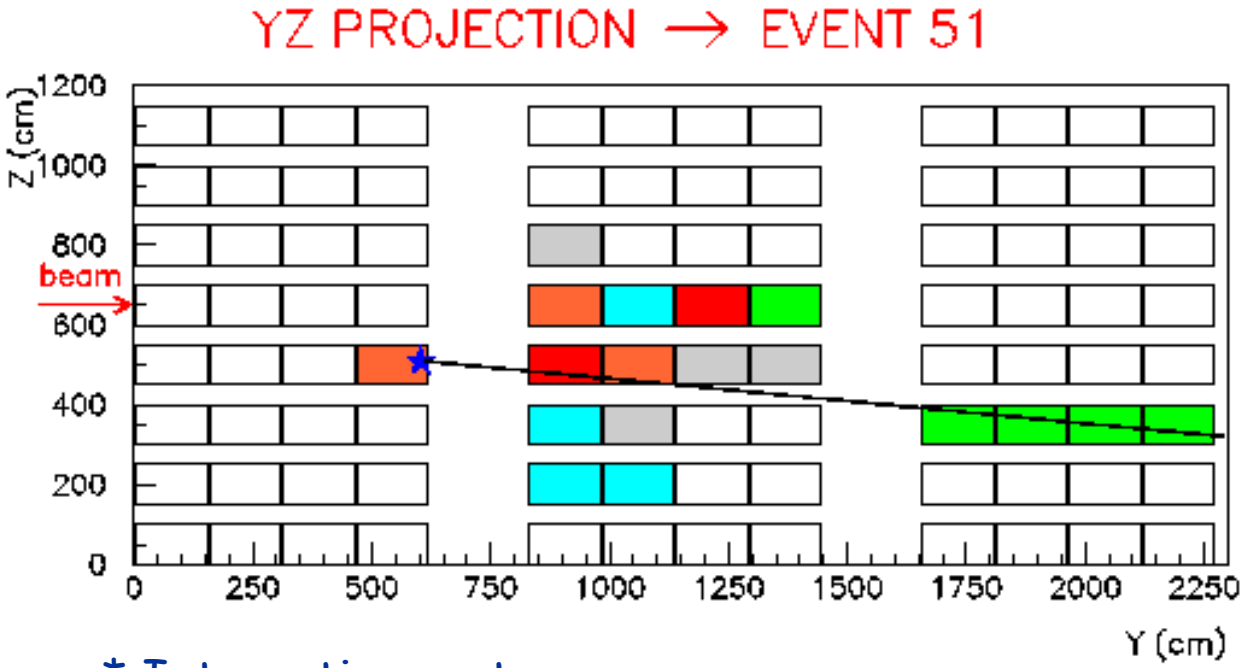


Simulation !



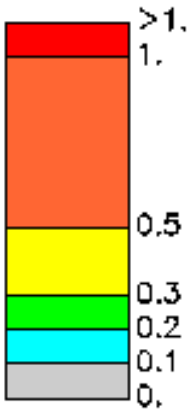
Event Display: internal ν CC

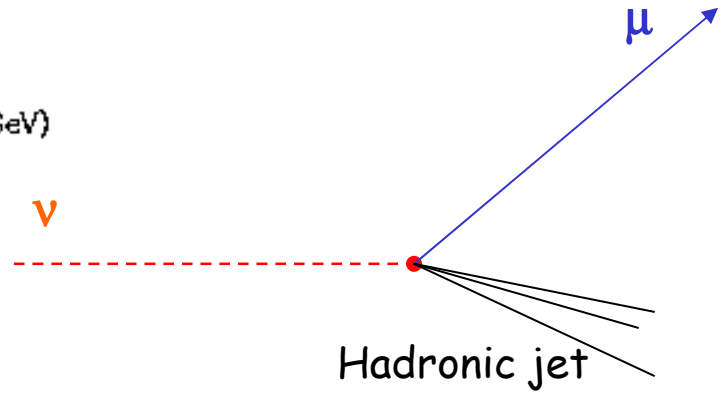




Simulation !

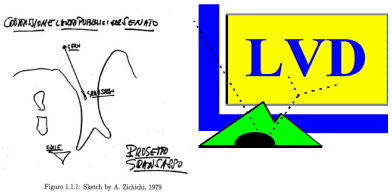
* Interaction vertex
Eν = 26.1 GeV
Eμ = 5.6 GeV
E released = 8.7 GeV
Missing E_h = 6.8 GeV
Missing Eμ = 3.6 GeV
Missing E_{IRON} = 7.0 GeV

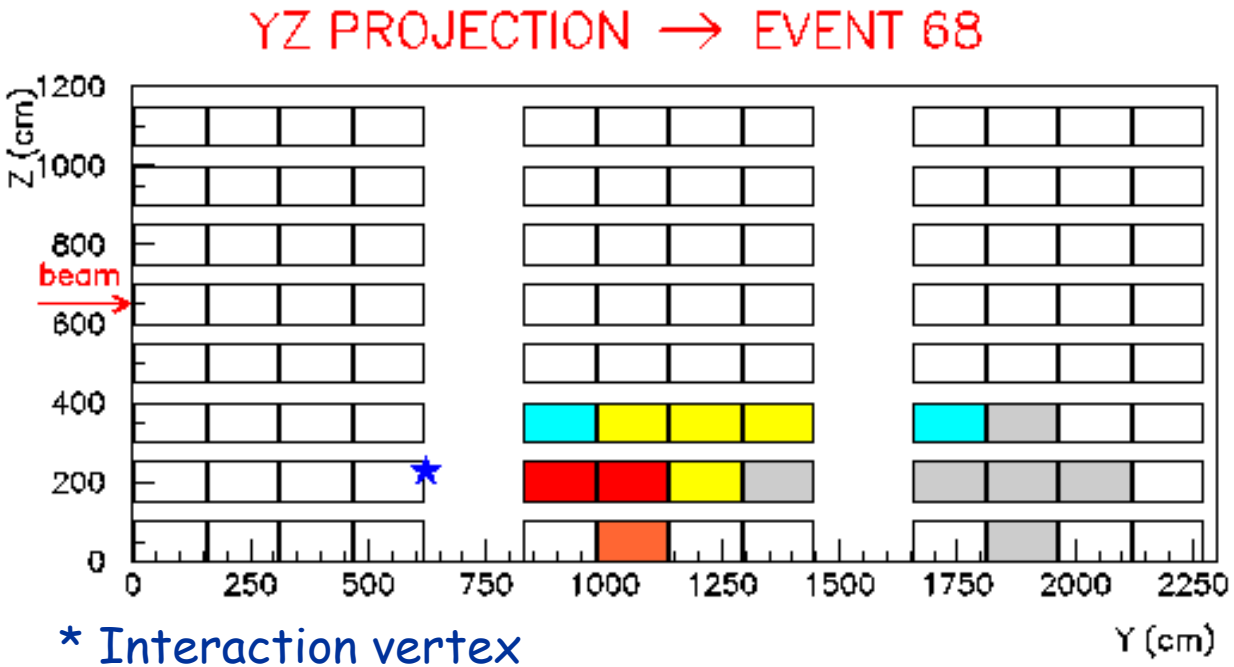




H. Menghetti for the LVD Collaboration, *First results of the CNGS beam monitor with LVD*, LNGS, August 22nd 2006

Event Display: internal ν NC





Simulation !

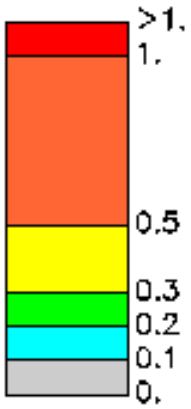
* Interaction vertex

Eν = 19.5 GeV

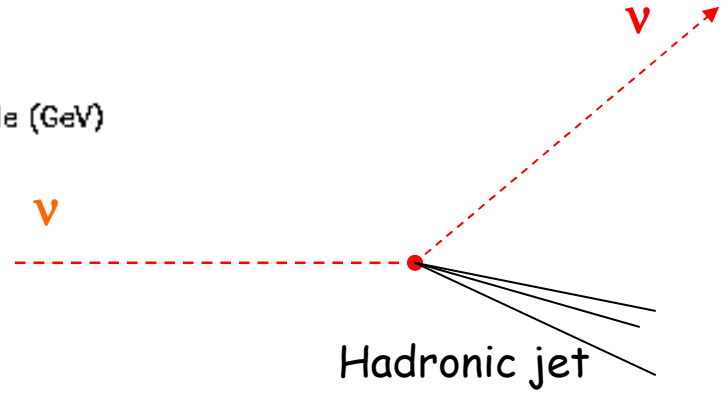
E released = 9.8 GeV

Missing E_h = 1.6 GeV

Missing E_{IRON} = 8.1 GeV



Energy Scale (GeV)



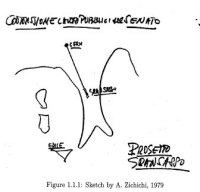
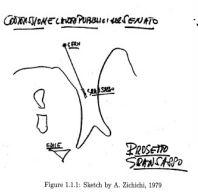


Figure 1.1.1: Sketch by A. Zichichi, 1979

Results

CNGS beam: commissioning



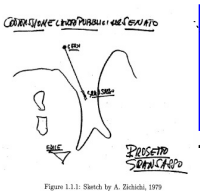
During the commissioning week, 14 - 18 August, the CNGS beam started.

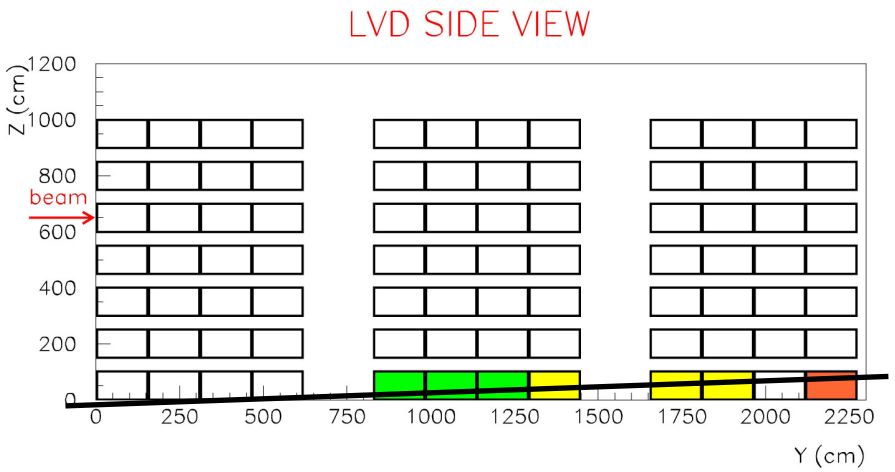
On the 16th there were the first beam spills with high intensity (about 1.3 10^{13} p.o.t./spill); the integrated beam intensity during this period was 2.79 10^{15} p.o.t. and we expected 1.9 events.

We observed 2 events (cosmic background of about 0.07).

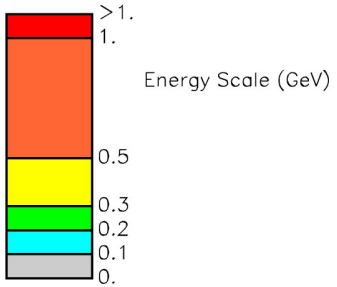
On August 16th, at 20:08:03 UTC, the LVD detector has seen the first CNGS event: ***OvE***!

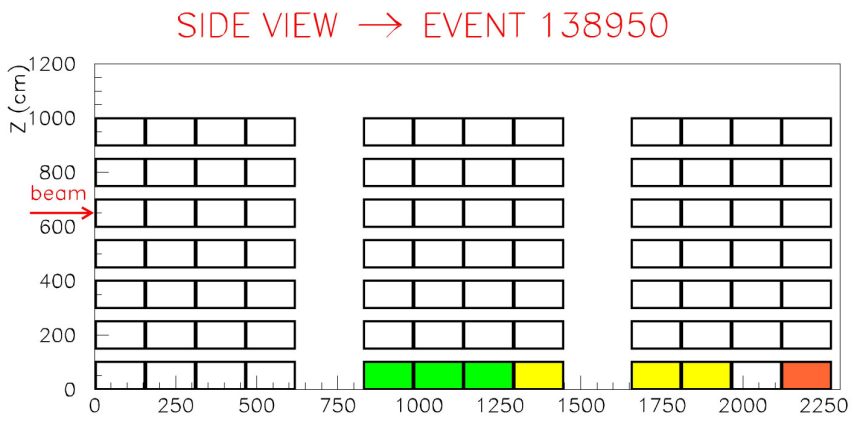
The first CNGS event: OvE

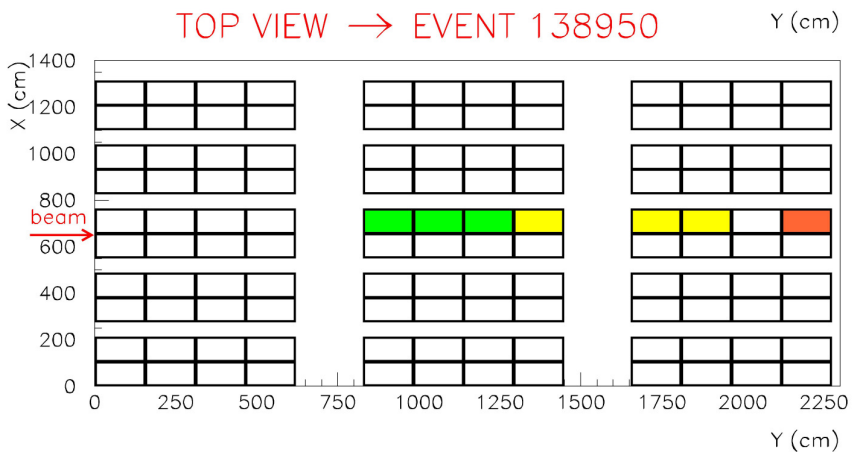




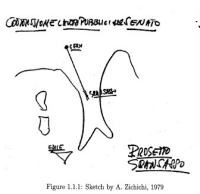
Run 28543 Event 138950
16/8/6 21.8.3
Total energy= 2.18491 GeV
released in 7 counters



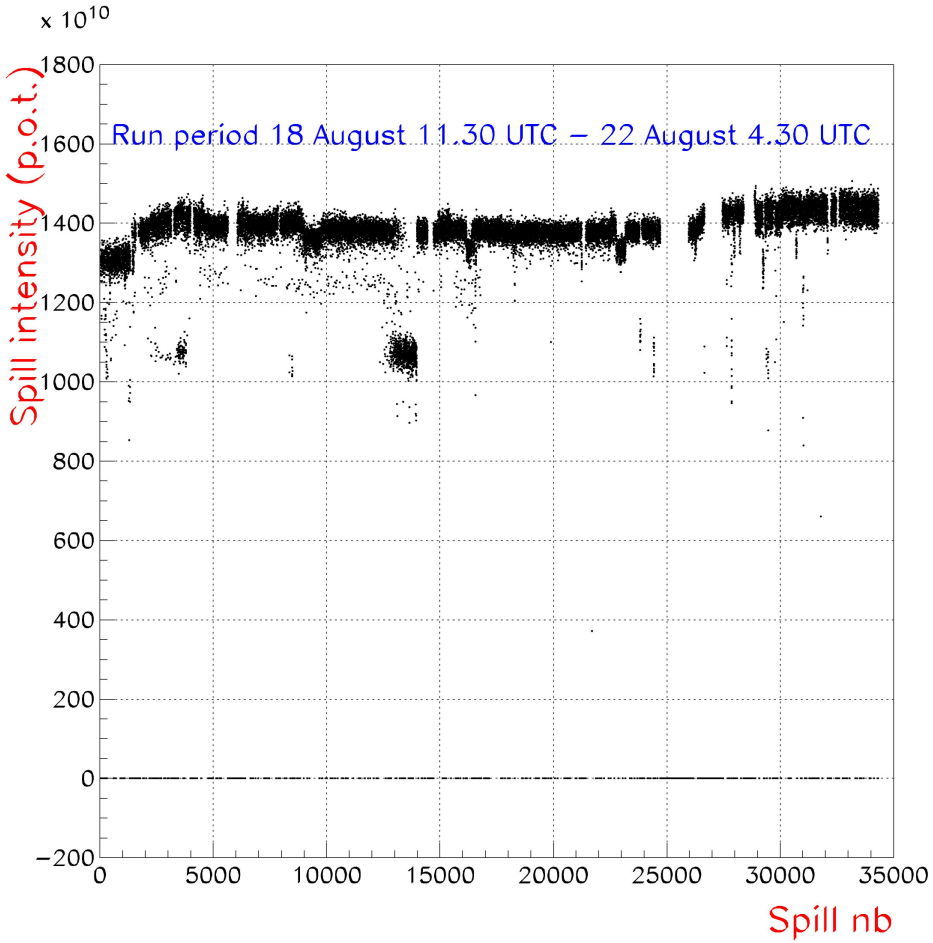




CNGS beam run

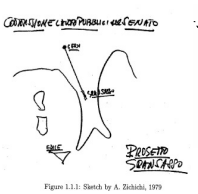


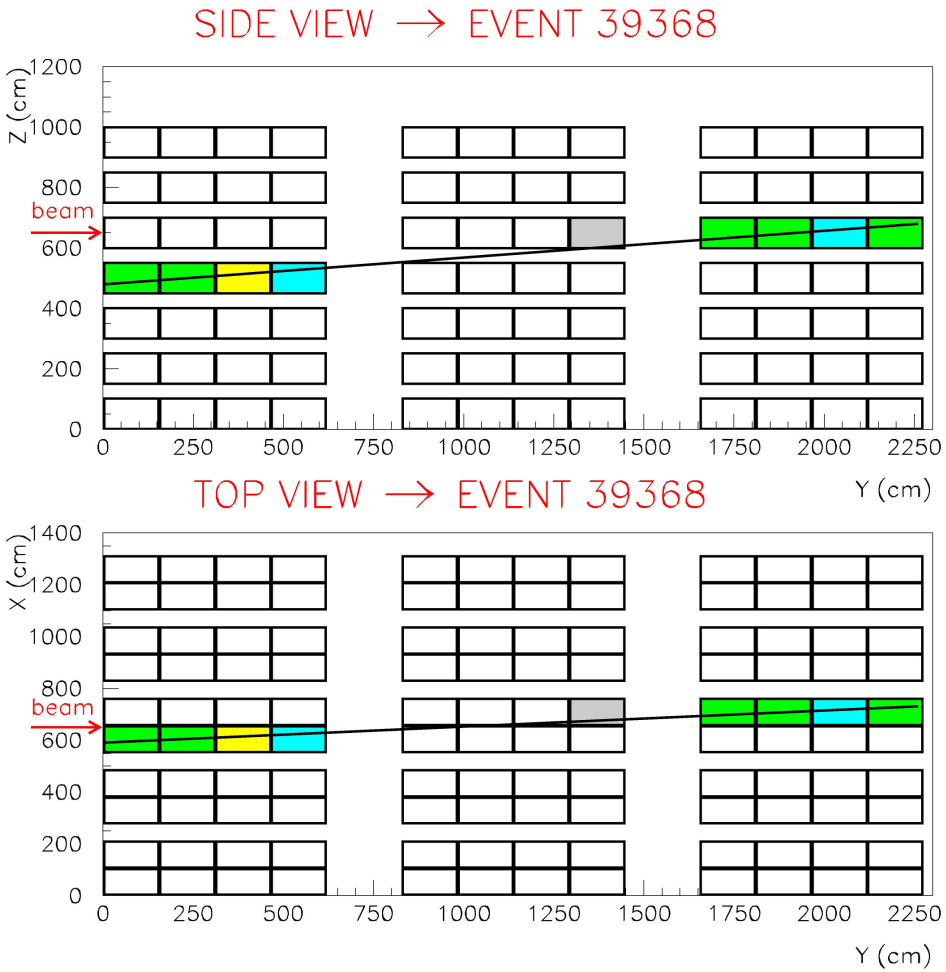
From August 18th, at about 11:30 UTC, the CNGS beam started with an intensity of about 1.4 x 10^{13} p.o.t./spill, about 60% of the nominal intensity).



In about 89 hours of data taking LVD has collected 289 CNGS events.

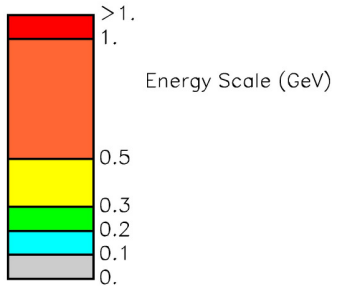
Event Display: μ from rock



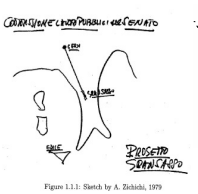


DATA !

Run 28569 Event 39368
19/8/6 13.15.7
Total energy= 1.93895 GeV
released in 9 counters

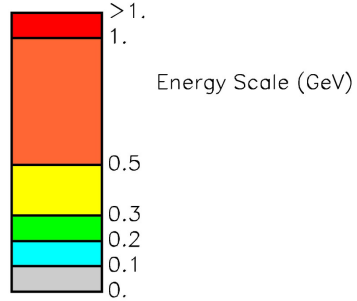


Event Display: internal ν CC?

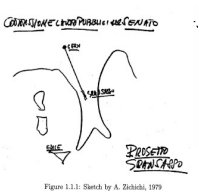


DATA !

Run 28577 Event 102901
20/8/6 10.6.27
Total energy= 7.75282 GeV
released in 38 counters

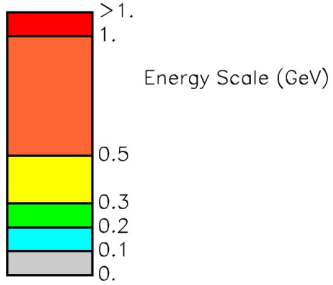


Event Display: internal ν NC/CC?

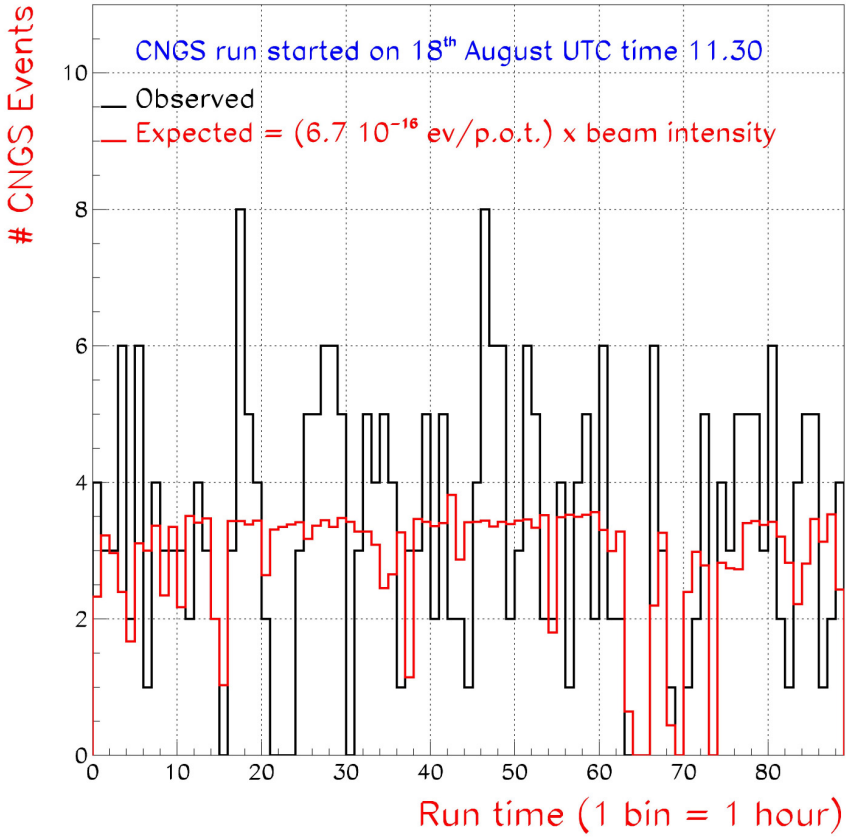


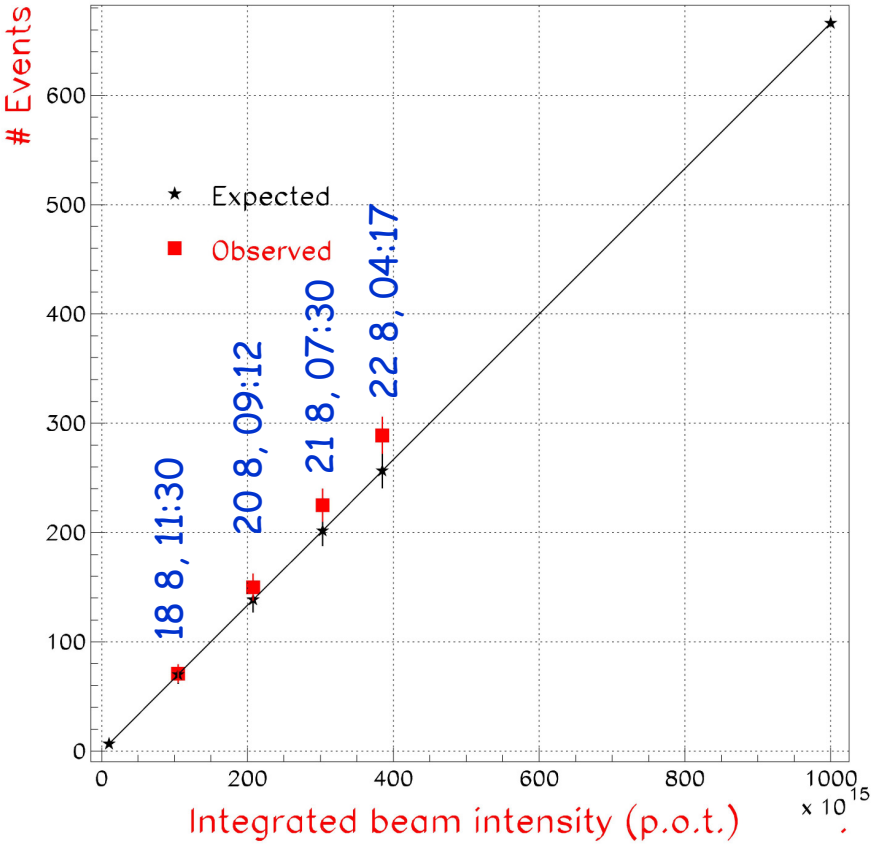
DATA !

Run 28560 Event 38069
18/8/6 14.44.58
Total energy= 1.26835 GeV
released in 9 counters



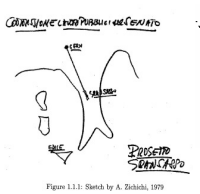
LVD rate



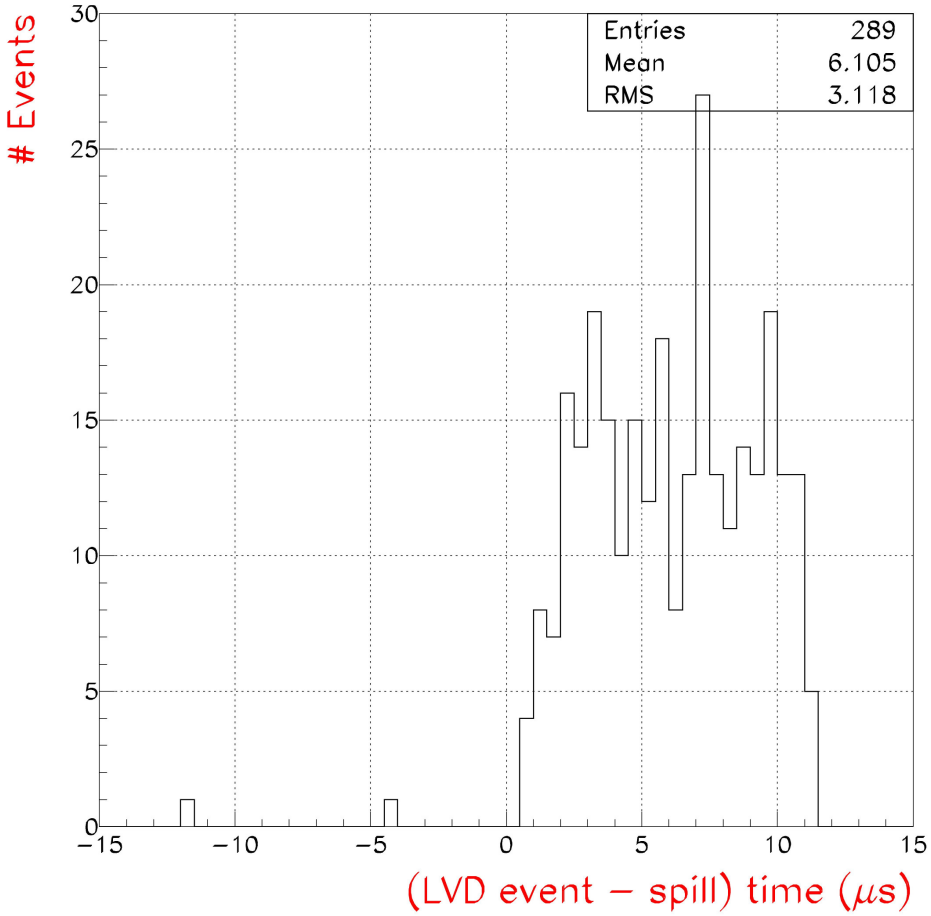


Agreement between the observed events and the expected from the beam intensity!

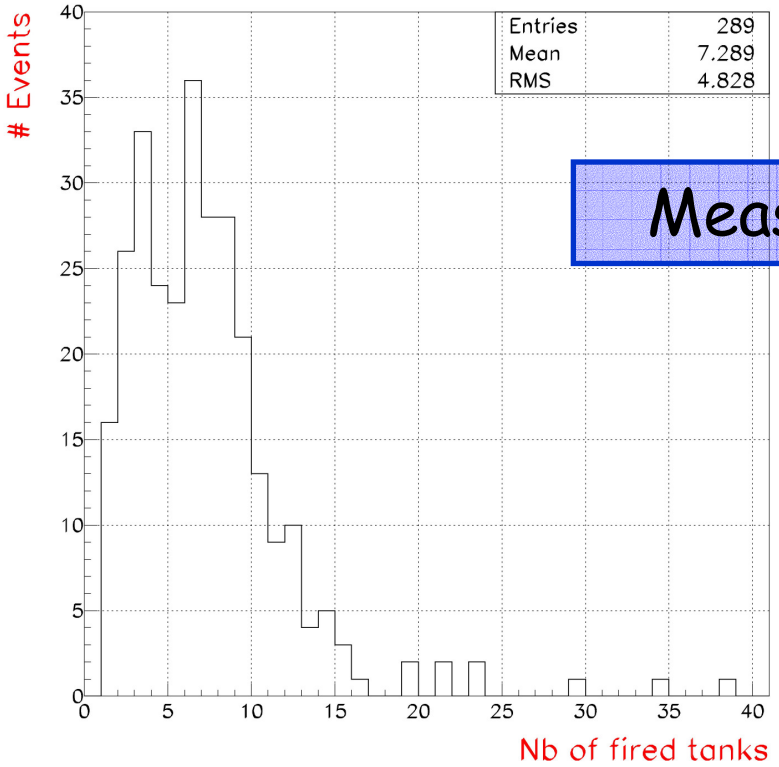
Time event distribution

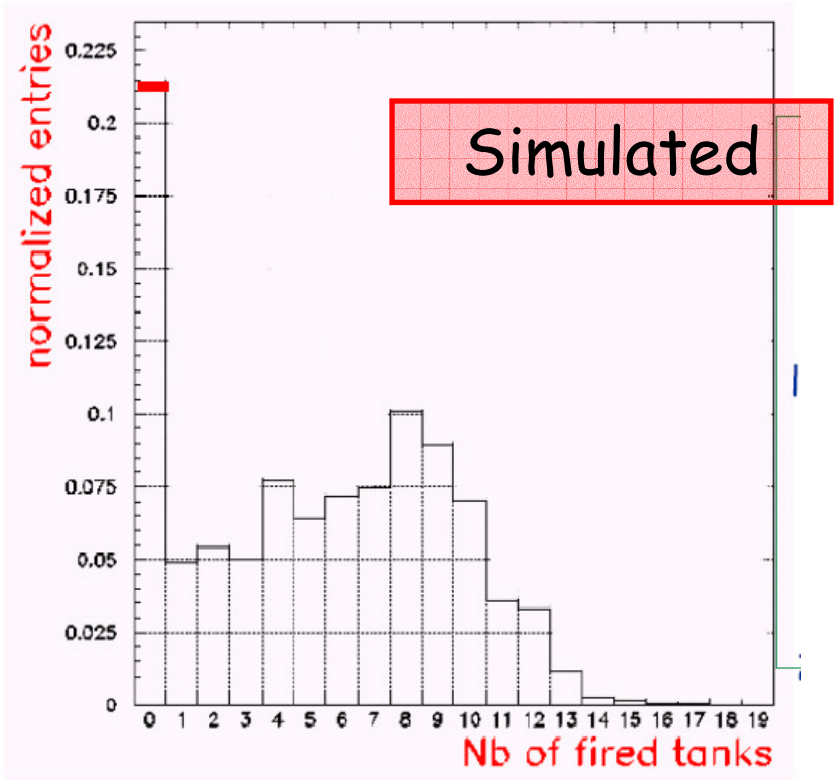


The LVD CNGS events time distribution with respect to the time spill agrees with the duration of the spill!

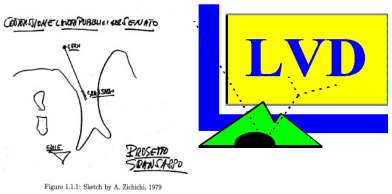


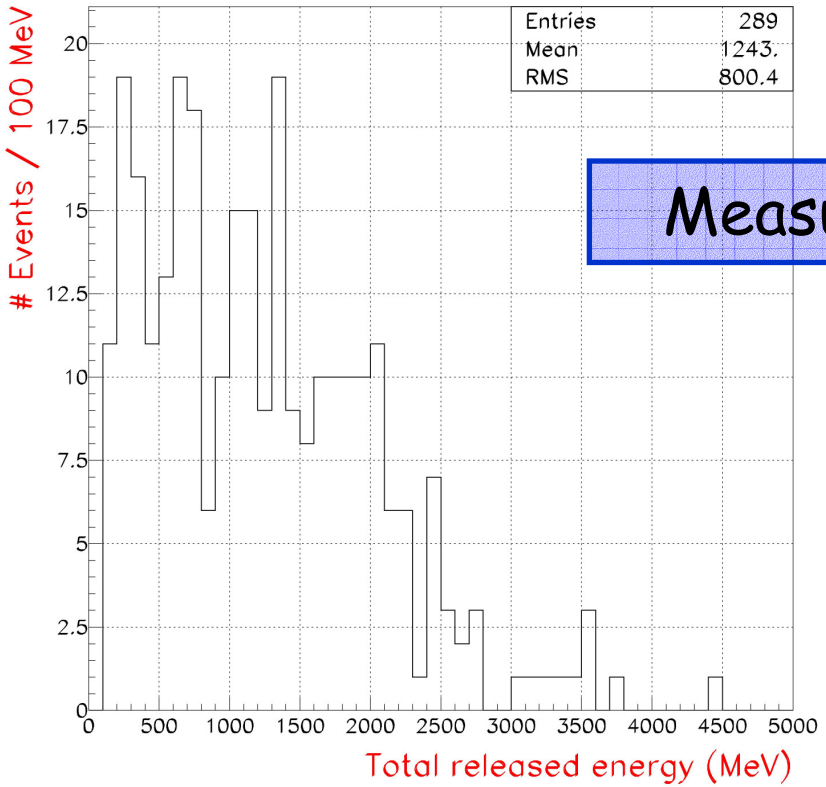
Nb fired counters



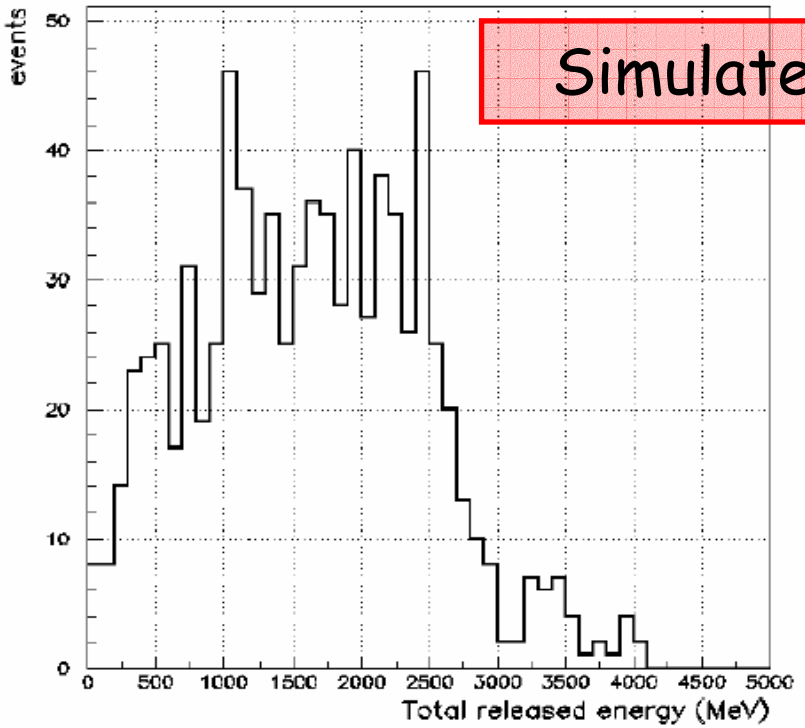


Total energy released



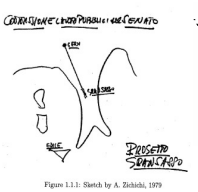


Measured



Simulated

Beam database

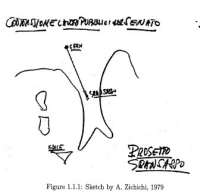


It seems that there are some discrepancies in the CNGS beam database:

- sometimes there is no information about the beam spill intensity (about 5%)

- some good events (about 10% - preliminary) are not in coincidence with the time spill

Conclusion



The analisys of data taking with the LVD detector shows that:

the CNGS beam is working very well as it was expected

✓ we continue to collect data and update the results

✓ we want to make a deeper analisys of the data to extract more informations (external/internal, CC/NC)

CONGRATULATIONS TO THE CNGS CERN GROUP AND TO ALL LNGS PEOPLE!

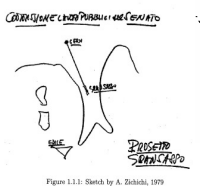


Figure 1.1.1: Sketch by A. Zichichi, 1979

The End?
No, the Beginning!