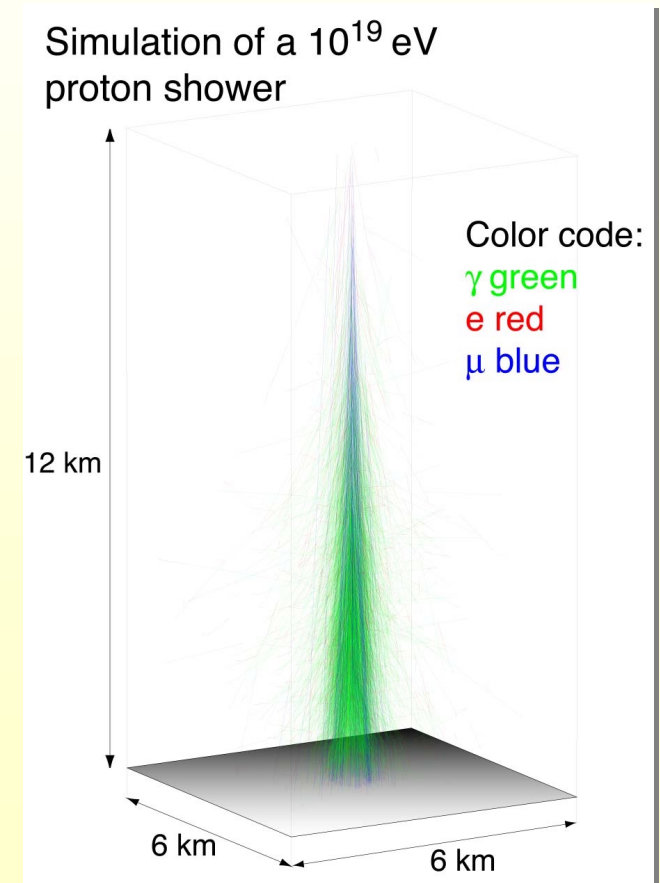


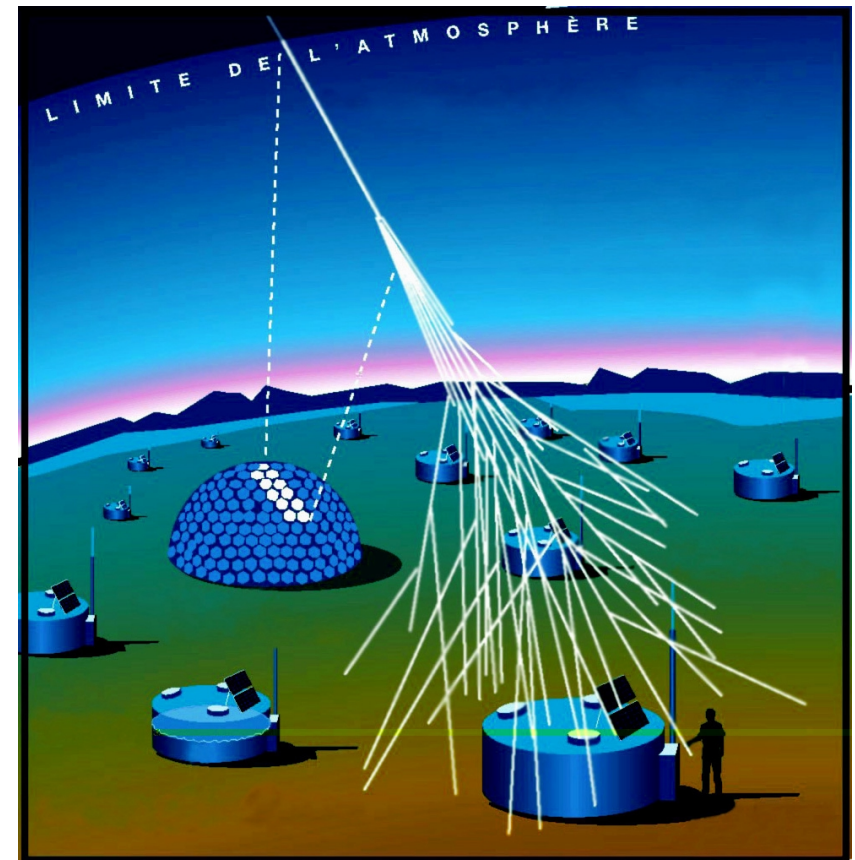
The Pierre Auger Project: The Highest Energies in the Universe

- The highest-energy **cosmic rays** are a fundamental problem of **particle astrophysics**
 - **Energies** are 100 million times higher than in our largest accelerators (CERN or FERMILAB)
 - No plausible mechanism for the **sources** of particles of such extraordinary energy
 - What is the **nature** of these particles?
Atomic nuclei or yet unknown **exotic objects** ?





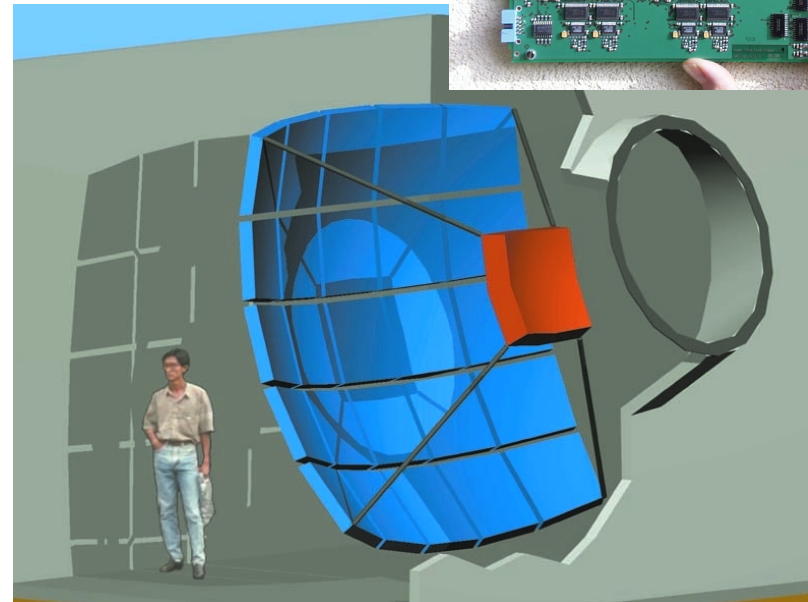
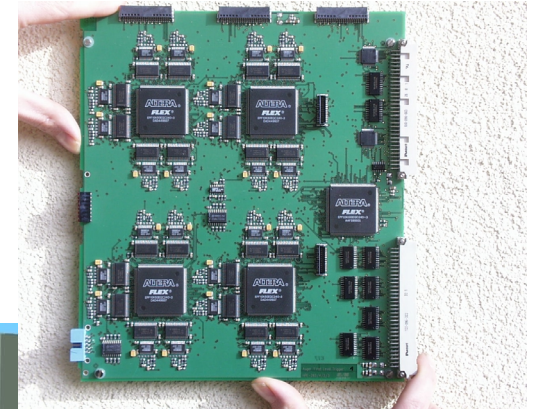
The Pierre Auger Project: International Cosmic Ray Observatory in Argentina

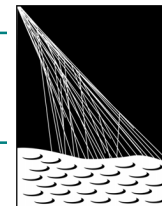
- The High-energy cosmic rays are very **rare events**
 - 1 event above 10^{19} eV per km^2 and year
 - need very large detectors, large flat area & clear sky needed **go to Argentina**
- The **Pierre Auger Observatory**
 - Pierre Auger discovered extended air showers in 1938 on the Jungfraujoch
 - **1600 detectors** over 3000 km^2 count secondary particles at ground level
 - **30 electronic telescopes** with 13000 pixels observe shower tracks in the night sky



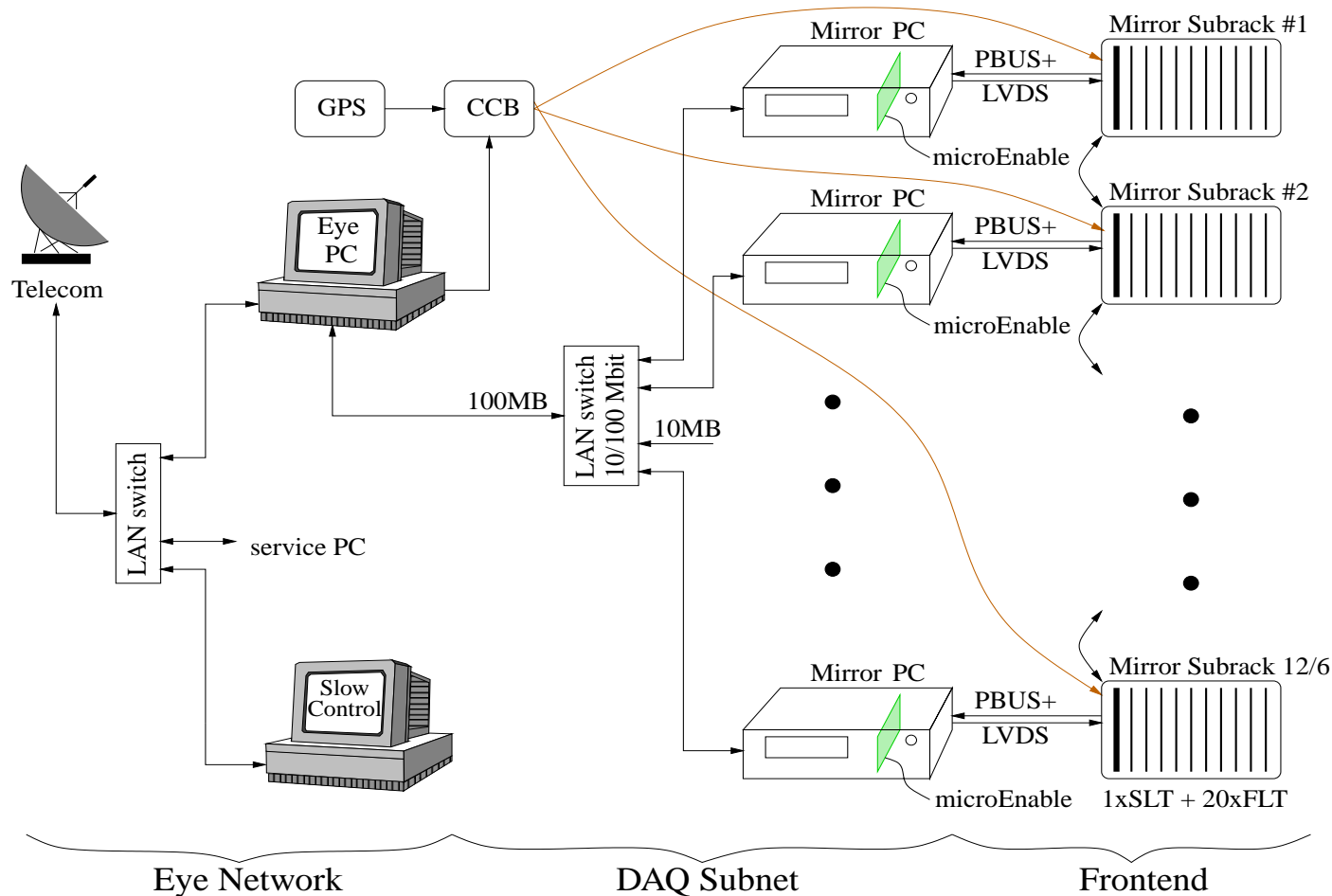
The Pierre Auger Project in Germany

- Development, construction and operation of air shower fluorescence telescope systems
-  Forschungszentrum Karlsruhe
 - Mirror systems, optical components, simulation of air showers and detectors
 - **Digital electronics, data compression and transfer**
-  Universität Karlsruhe (TH)
 - Experiment control
 - Simulations, data analysis





DAQ and Electronic of FD station



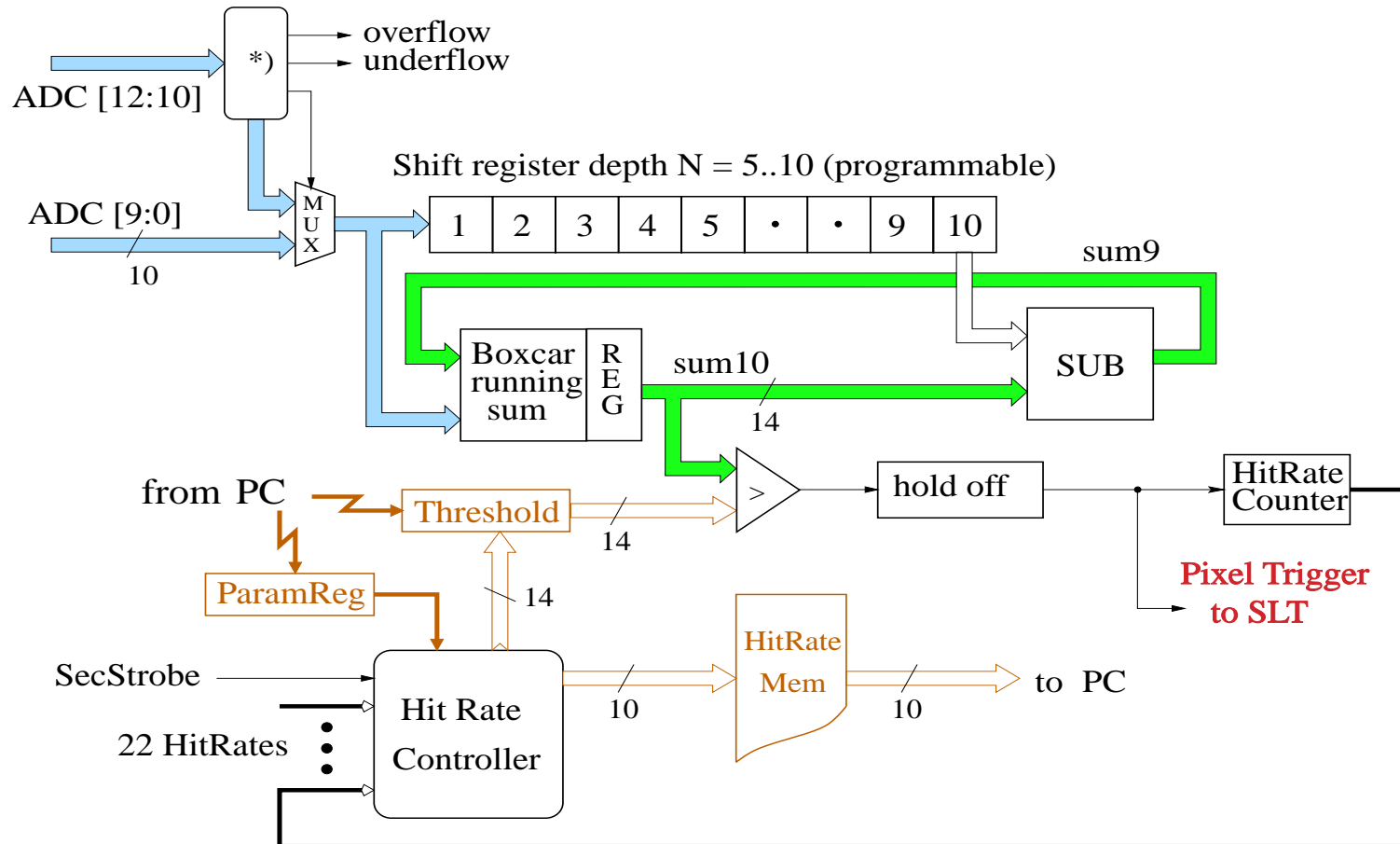
PMT camera:

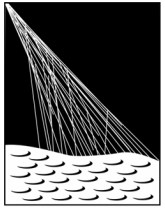
- 22 x 20 pixels

Front end boards:

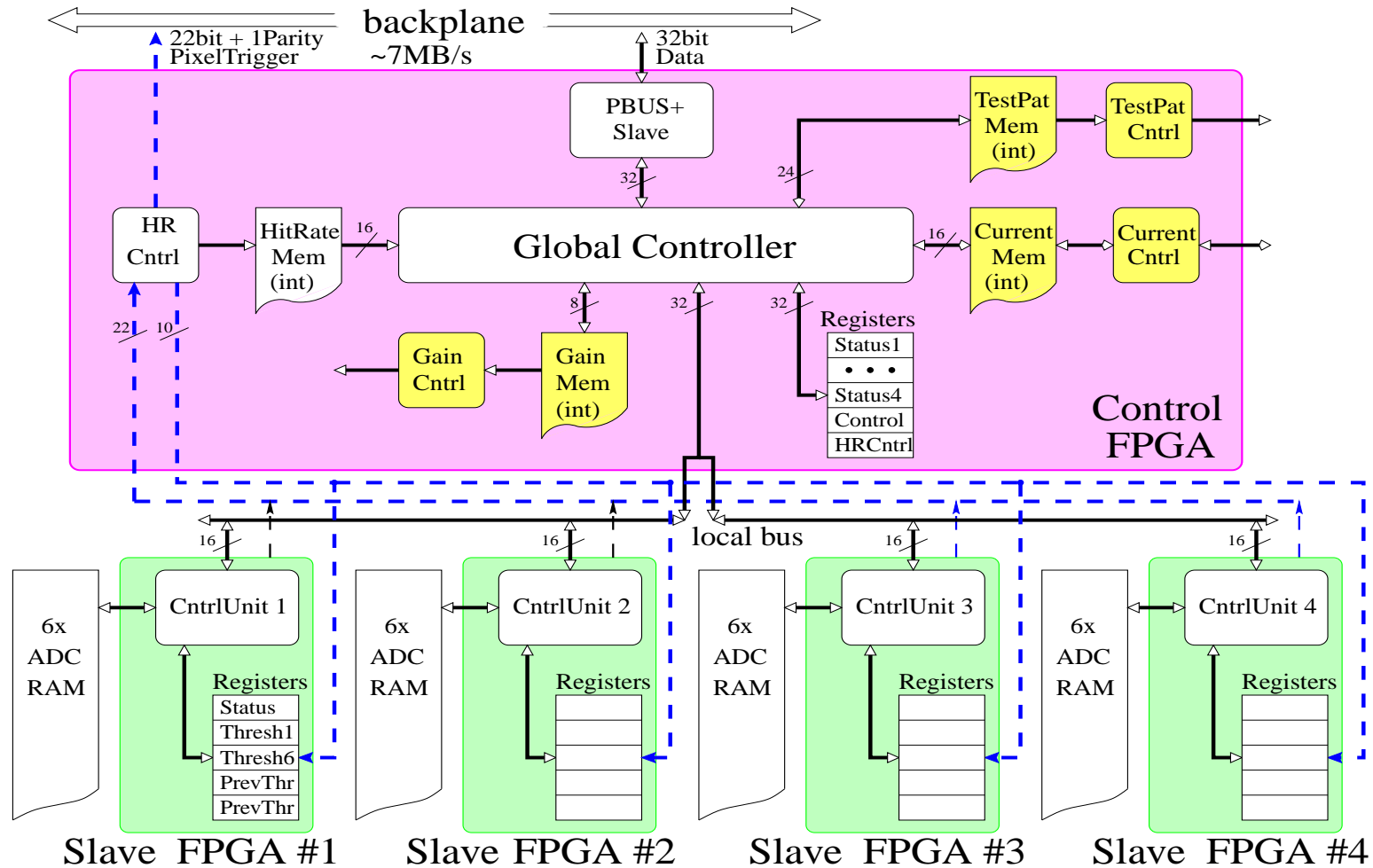
- 20 Analog Boards with amplifiers
- 20 **First Level Trigger** Moduls (FLT) with 22 identical channels
- 10 MHz sample rate
- 1 **Second Level Trigger** Modul (SLT) for track recognition

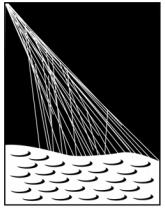
Pixel trigger and hitrate regulation



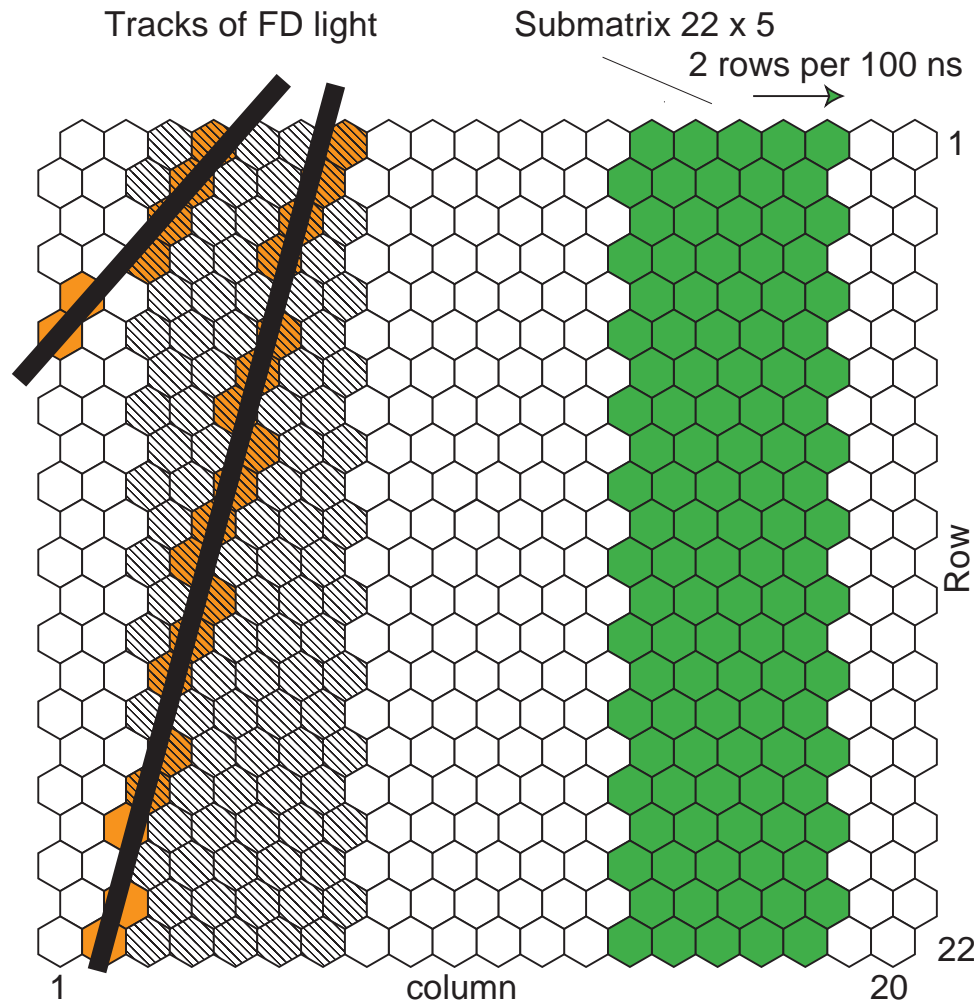


FLT Structure: 4 Slave FPGA & Global Controller

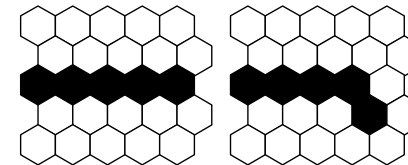




2. Trigger Level: Pattern Recognition

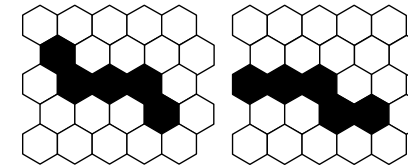


Basic Pattern



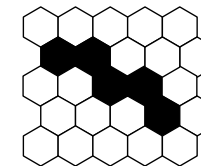
Type 5_0

Type 4_1



Type 1_3_1

Type 3_2



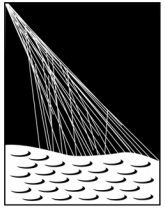
Type 2_2_1

by rotation and
mirror reflection

39 types, 108
types with hole

total number of combinations:

2102 per row,
37163 per matrix



Current Status of Prototype

- **FD building :**
 - foundation being laid, south wall of building erected
 - datum points aligned
- **Telescope:**
 - various mirror elements (different designs) produced, mounts and frame fabricated
- **Front end electronic:**
 - 6 FLT modules (prototype) produced, most features tested
 - 3 SLT modules (prototype) produced
 - Readout via SLT and Memory & Time management working
 - 4 modules for pattern generation produced (not yet tested)
 - measurements of noise & linearity with 7 PMTs successful
 - 2 analog boards ready, preamplifier for 150 PMTs produced

Summary and outlook

- Determination of energy spectrum, origin and composition of particles with $E > 10^{19}$ eV opens view to new interesting physics
- **Hybrid design** of Cerenkov and FD stations improves energy determination
- Prototype of **FLT** and **SLT** modules partly tested
- Integration test with camera and telescope at Rome in Sep. 2000
- Commissioning and construction of **prototype in Argentina 12/2000**
- final design and setup of all detector parts **until 2004**
- DAQ for 15-20 years (ca. 30 events/year with $E > 10^{20}$ eV)