IPN Orsay contributions to LHAASO

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and

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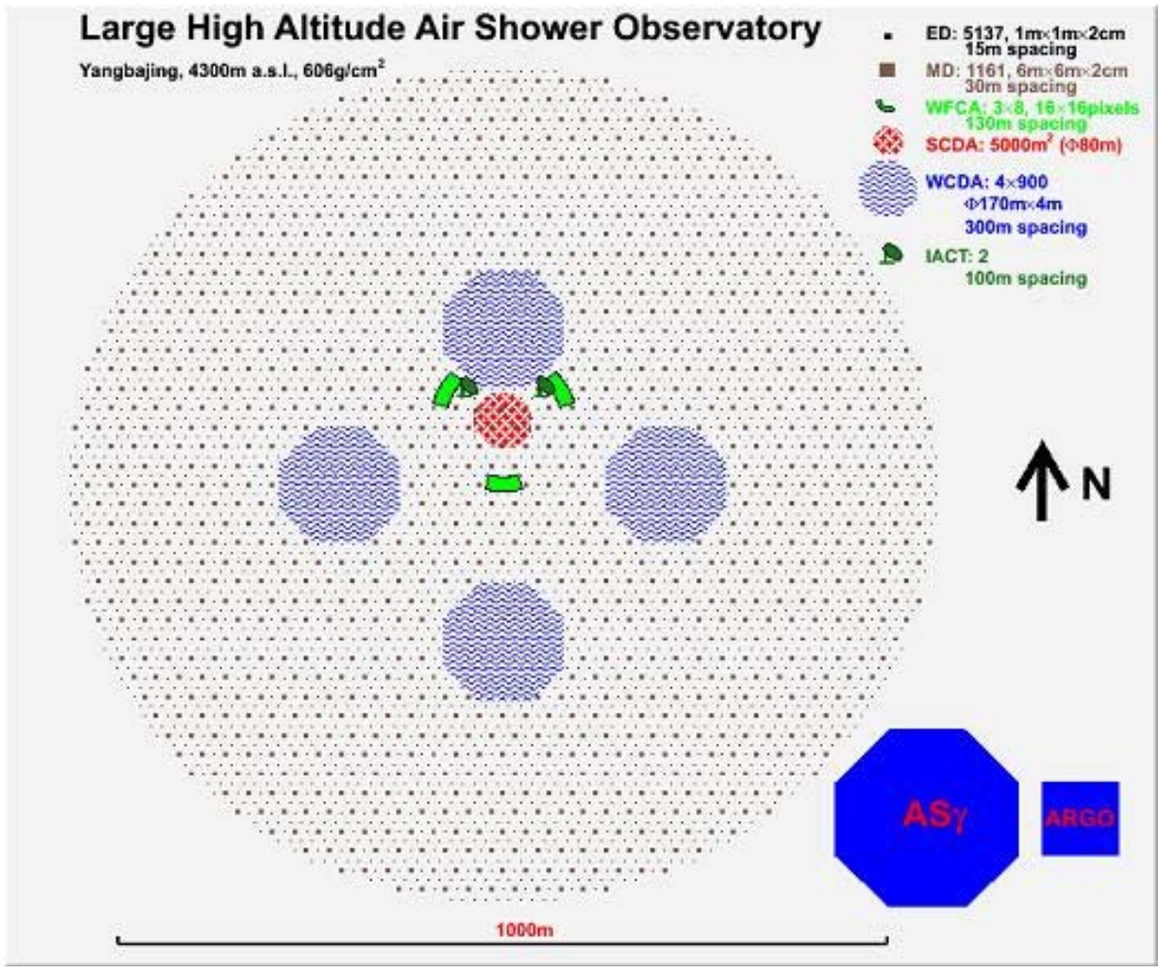
5th FCPPL Workshop - 21-23 March 2012 - Orsay/Saclay

ASIC R&D at Orsay - PARISROC

ASIC : high integration, small size and low power consumption

Benefit from the R&D for next generation neutrino experiments : PARISROC

POSSIBLE USE OF PARISROCx INTEGRATED CIRCUIT FOR SOME DETECTORS FEE



KM2A : scintillator detectors

WCDA : Cerenkov in water Detectors

WFCDA : Cerenkov/fluores -cence telescopes

PARISROC for LHAASO ?

PARISROC 2
PMT gain 10^6
Input signal: negative
Single channel hit rate: 5 kHz
Charge dynamic range: 1- 600 p.e. (100 pC)
Resolution: <20%@1pe
Disc threshold: 0.3 pe (50 fC)
Timing resolution: 220 ps
Timing precision < 1 ns

Requirements **KM2A** (KM² Array) (ED: electron detector; MD: muon detector) PMT: ET9903B or Hamamatsu R11102 (for ED) **(1.5-in) (GAIN 10^6)** Hamamatsu R5912 (for MD) **(8-in) (GAIN 1x10^7)**	**PARISROC 2**
PMT high voltage: negative	OK
Single channel hit rate: 1kHz (for ED); 10kHz (for MD)	OK
Charge dynamic range: 1-3000 electron (for ED); 1-3000muon (for MD)	OK if…..
Resolution: <25%@1e, <5%@3000e (for ED); <25%@1muon, <5%@3000muon (for MD)	OK max 0.2 p.e. (32 fC) for 10-bit ADC
Disc threshold: 0.25e (for ED) (1 e 160 fC) 0.25muon (for MD) (1 e 160 fC) (1 e 1.6 pC)	OK if… OK
Timing resolution (RMS): <1ns (for ED), <10ns (for MD)	OK
Multi-hit resolution: 30ns	To be measured

Requirements **WCDA** (Water Cerenkov detectors) PMT: XP3062 **(8-in) (GAIN 1x10^7)**	**PARISROC 2**
PMT high voltage: positive HV	NO (New version of PARISROC)
Single channel hit rate: 50kHz	NO (New version of PARISROC) 80 MHz read out frequency and ADC 8 bits to achieve the 50kHz hit rate
Charge dynamic range: 1pe-4000pe (1 e 1.6 pC)	OK
Shaping width: < 350ns	OK
Disc threshold: 0.25pe (1 e 1.6 pC)	OK
Timing Precision (RMS): <0.5ns	OK
Multi-hit resolution: 25ns	To be measured

Modifications of PARISROC2 needed to achieve the LHAASO sub-detectors requirements

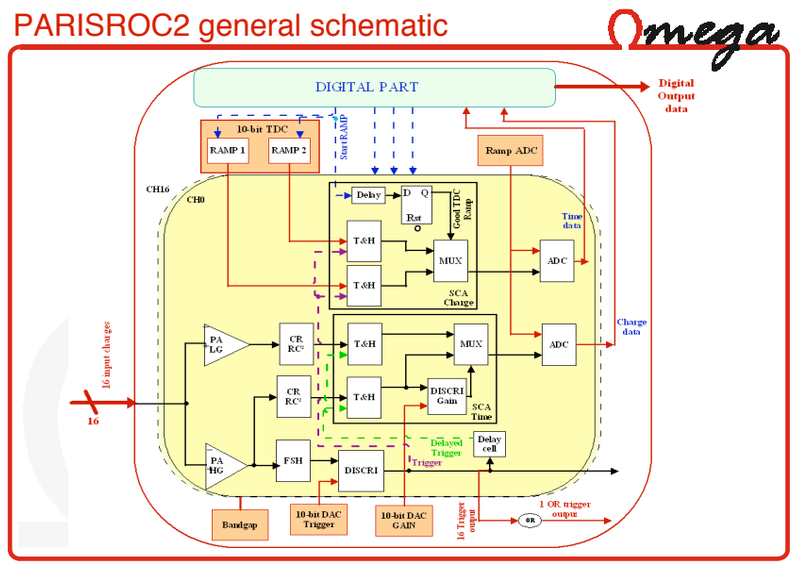
Requirements **WFCA** (Wide Field Cerenkov Telescopes Array) PMT: Hamamatsu R5912 **(1.5-in) (GAIN 2.6x10^5)**	**PARISROC 2**
PMT high voltage: negative	OK
Single channel hit rate: <5kHz (10kHz)	OK (New version)
Charge dynamic range: 1pe-3000pe (1 e 40 fC)	OK if… (New version)
Resolution: <50%@1pe, <1%@3000pe	OK if… (New version)
Disc threshold can be adjusted: 0.25pe -- 100pe	OK if… (New version)
Timing resolution (RMS): <100ns	OK

→More details in Gisèle Martin-Chassard's talk tomorrow

Electronic readout tests

→ Training tests at IPNO next month

(new board assembled)

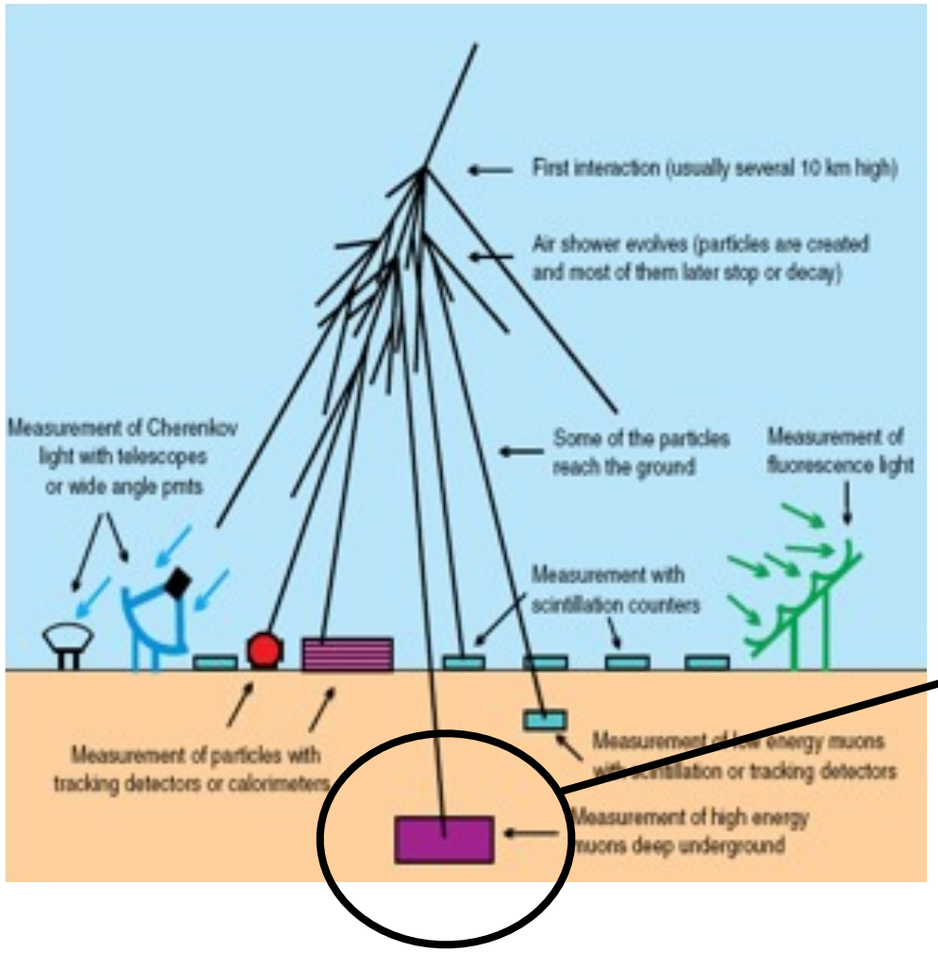


Signal acquisition on computers

→ Tests on prototype detectors in Tibet (4300m a.s.l.)

in a few months

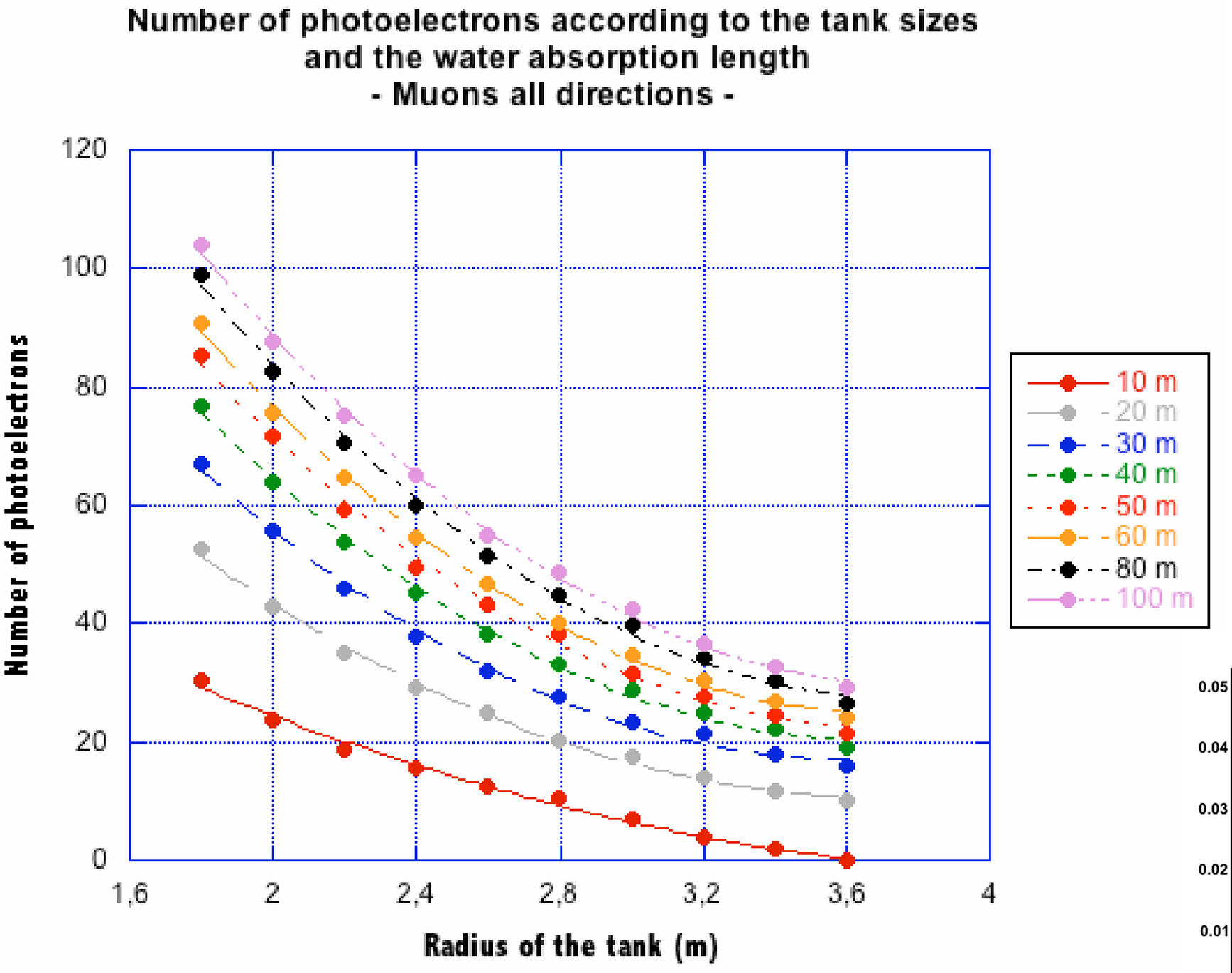
Response of muon detectors

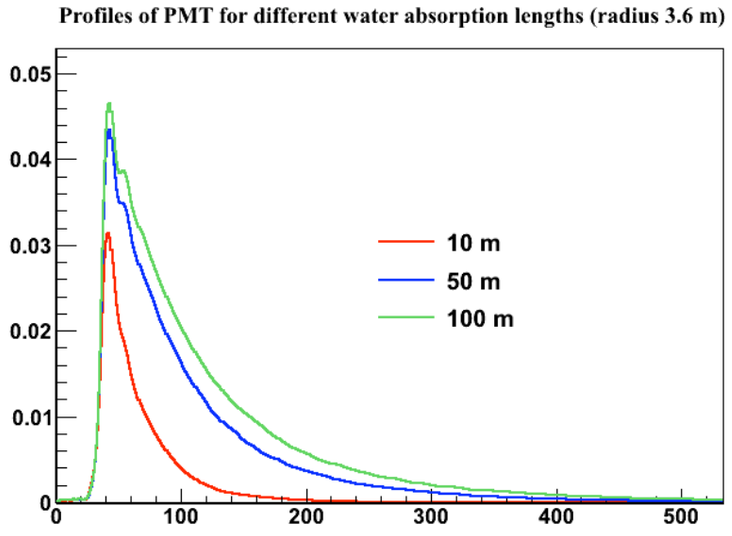


Response to ~GeV-muons depends on :

- Water transparency
- Tyvek diffusive reflectivity

Response of muon detectors





Signals measured with good accuracy

Workshop organization

~50 participants (from both HE gamma ray and cosmic ray physics)

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THIRD WORKSHOP FOR AIR SHOWER DETECTION AT HIGH ALTITUDES

Institut de Physique Nucléaire d'Orsay

October 6-7, 2011

In the recent years, the interest on astroparticle physics experiments using air shower detection techniques at high altitudes has strongly increased. The ARGO-YBJ experiment has been publishing exciting observational results, the HAWC water tank array and muon detectors in the ASγ array are currently under construction and the R&D for the LHAASO project is already well advanced.

To discuss the current results and the design for new experiments, we will hold a 3rd Workshop for Air Shower Detection at High Altitudes

Outlook

- *Electronic readout developments*

- *Simulation of the whole KM2A*
- Angular/Energy resolution studies
- Gamma/hadrons discrimination
- Mass discrimination (for CRs)

- *Simulation of the WCDA*
- Angular/Energy resolution studies
- Gamma/hadrons discrimination