# LATTES : Large Array Telescope for Tracking Energetic Sources





#### Where we stand



Mário Pimenta, Rio May 2017

## An opportunity



#### Source sensitivities



## The challenge



Differential sensitivity to steady sources in one year

#### Requirements

- High altitude (~ 5000 a.s.l)
- Low energy threshold and good background rejection
- Large FoV coverage
- Large area + low cost
- Reliability and good control of systematics
- Standalone operation

#### The concept: an hybrid detector













**RPCs** : time and spatial resolution **WCDs**: e.m. energy, μ tagging and trigger

## Baseline design : the unit station



#### - Thin lead plate

- To convert the secondary photons
- Improve angular reconstruction

#### Resistive Plates Chamber

- Sensitive to charged particles
- Good time and spatial resolution
- Improve geometric reconstruction
- Explore shower particle patterns at ground

- Water Cherenkov Detector
  - Sensitive to secondary photons and charged particles
  - Measure energy flow at ground
  - Improve trigger capability
  - Improve gamma/hadron discrimination

#### Baseline design : the array



40 x 90 stations 140 x 140 m<sup>2</sup>

 $+ \sim 500$  stations in a sparse array

## Simulation/Analysis chain:

end-to-end realistic simulation
See Bernardo talk
first order reconstruction algorithms
See Ruben talk



## Photon/hadron discrimination:

 $\checkmark$  first order algorithms



# Sensitivity curves:

✓ (very) conservative curves

See Ruben talk



Differential sensitivity to steady sources in one year

## Sensitivity curves:

optimistic (?) educated guess (2<sup>nd</sup> order algorithms ...)

See discussion ...



Differential sensitivity to steady sources in one year

# RPC R&D: standalone low-gas flux



#### Aluminium case almost 100% tight



#### Gaseous volume



More than 30 RPCs units already constructed and in operation in 6 different places (Coimbra, Lisboa, Santiago de Compostela, Rio, Sao Carlos, Malargue).



Pad Plane

Atmospheric Sensors Plane

#### RPC stability in the Pampa

See R&D talks



Tierra del Fuego



✓ Constant efficiency !

#### Readout

See R&D talks

✓ RPC readout board (based on MAROC 3)



#### Science

#### What we have been writing ...

Monitor the gamma-ray sky above 50 GeV, bringing to ground the wide field-of-view and large duty cycle observations characteristic of satellites, with comparable sensitivity and a cost one order of magnitude lower.

Powerful time-variance explorer, ideal for the observation of source variability (namely flares in known sources) and transient sources (bursts in previously dark regions). It will also play a fundamental role in the search for emissions from particular extended regions of the sky, such as the Fermi bubbles, remnants of jet emission from the black hole in the center of our galaxy detected in Fermi data, or dark matter annihilation in the galactic center, galactic halo or dark matter clumps.

We need to quantify and get support from theoreticians !!!

# To do list:

- Built an enlarged LATTES collaboration
- Establish links with CTA/HAWC/LHASSO
- Science opportunities (in particular 50- 500 GeV)
- Site procurement
- General design baseline and alternatives
- Sparse array
- Simulations data sets
- Better reconstruction algorithms
- Better gamma/hadron algorithms
- Detector detailed design and prototypes
  - RPCs
  - WCDs
  - Trigger and data readout
  - Auxiliary systems: Power, gas, sensors and slow controls
- •Thermal simulation (freezing?)
- Funding opportunities
- Schedules
- •Articles and conferences