

# Methods for reconstruction muon tracks with ANTARES



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contents:

- Input from measurements of water properties
- High energy muon track reconstruction
  - Fit strategies
  - event selection / background rejection
- Energy reconstruction
- Low energy muon reconstruction

#### The ANTARES detector







#### Muon track reconstruction





so that  $r_i$  follow the correct PDF

## Probability density function of hit residuals



for the fit

## Starting point for the Fit



## Iterative fit strategy





## Hit selections



### Optical background in the likelihood function



Amplitude of hit



number of hits used in fit

## Multi-muon rejection



Zanith angle (degrees)

### Angular resolution





error estimates from the fit describe the actual error to within ~10%.

### Results: Effective area and pointing resolution



#### **Energy Reconstruction**



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photoe lectron arrival times (ns)

#### **Energy Reconstruction**



#### **Energy Reconstruction**



Energy reconstruction accuracy factor 2-3.

#### Reconstruction of low energy muons

NB: older version of HE reconstruction. comparison with new methods still to to<sub>1</sub>be



muons using only 1 string in limited range (30°) from vertical Increase in effective volume thanks to single-string events (but probably sensitive to noise rates)

# Summary

Direction Reconstruction:

Algorithms consisting of several stages, providing increasingly accurate starting points for next stage
Starting fit at multiple starting points

Optical background included in PDF

→ Pointing accuracy < 0.2° for very high energies

Energy estimation from amount of light energy resolution: factor 2-3

Also in progress:

- shower reconstruction
- increasing efficiency by tracking sources