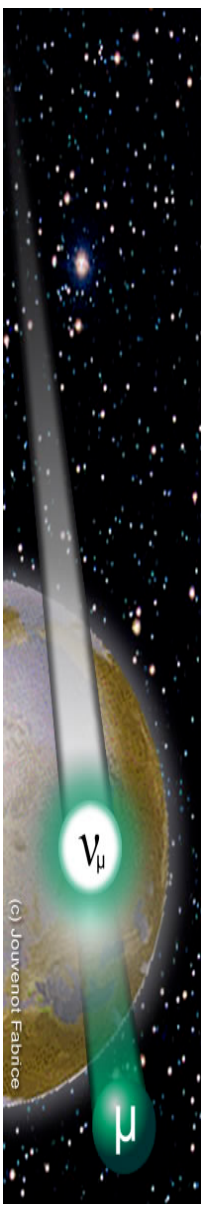
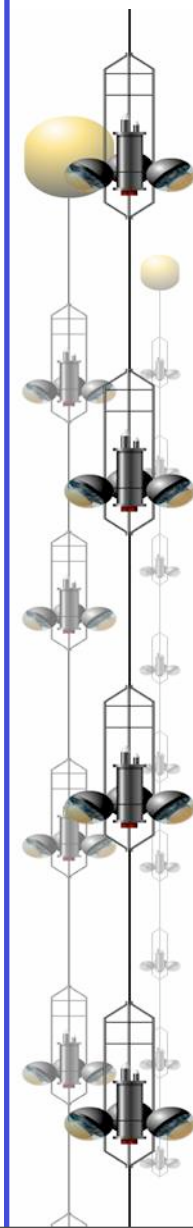
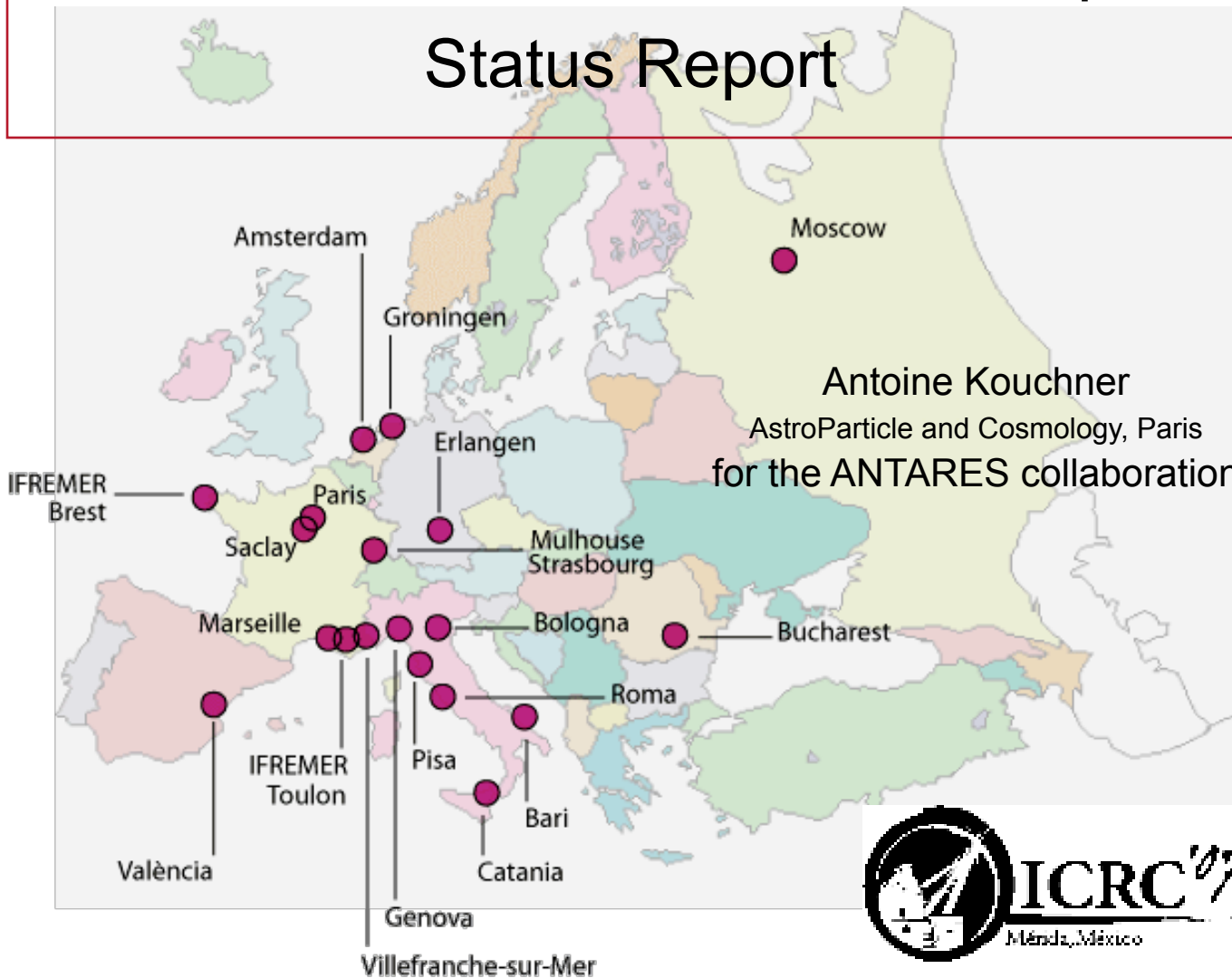




The ANTARES Neutrino Telescope Status Report



(c) Jouvevot Fabrice

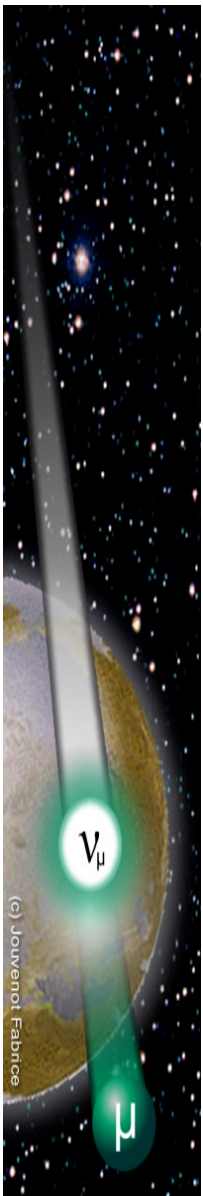
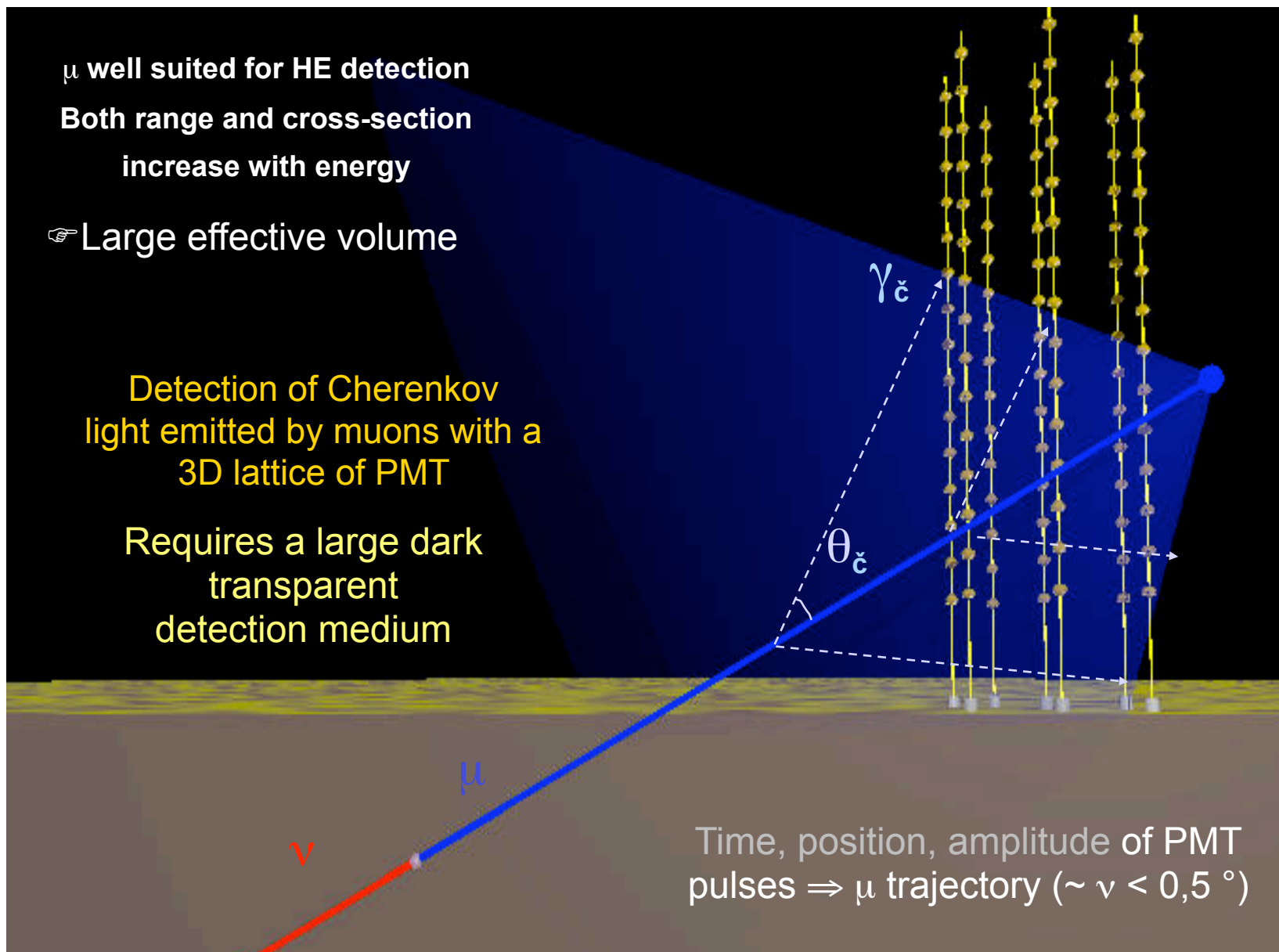


Detection principle

μ well suited for HE detection
 Both range and cross-section
 increase with energy
 → Large effective volume

Detection of Cherenkov
 light emitted by muons with a
 3D lattice of PMT

Requires a large dark
 transparent
 detection medium





Detection principle

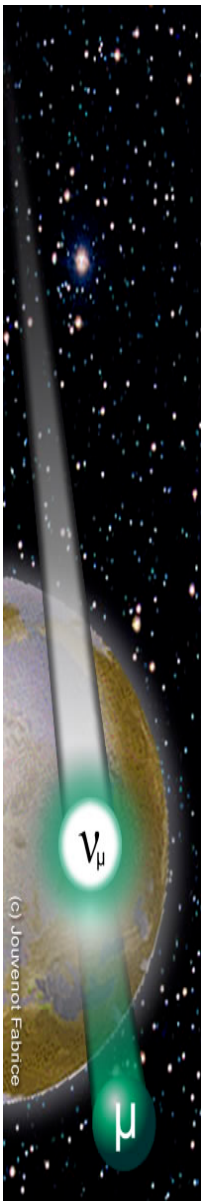
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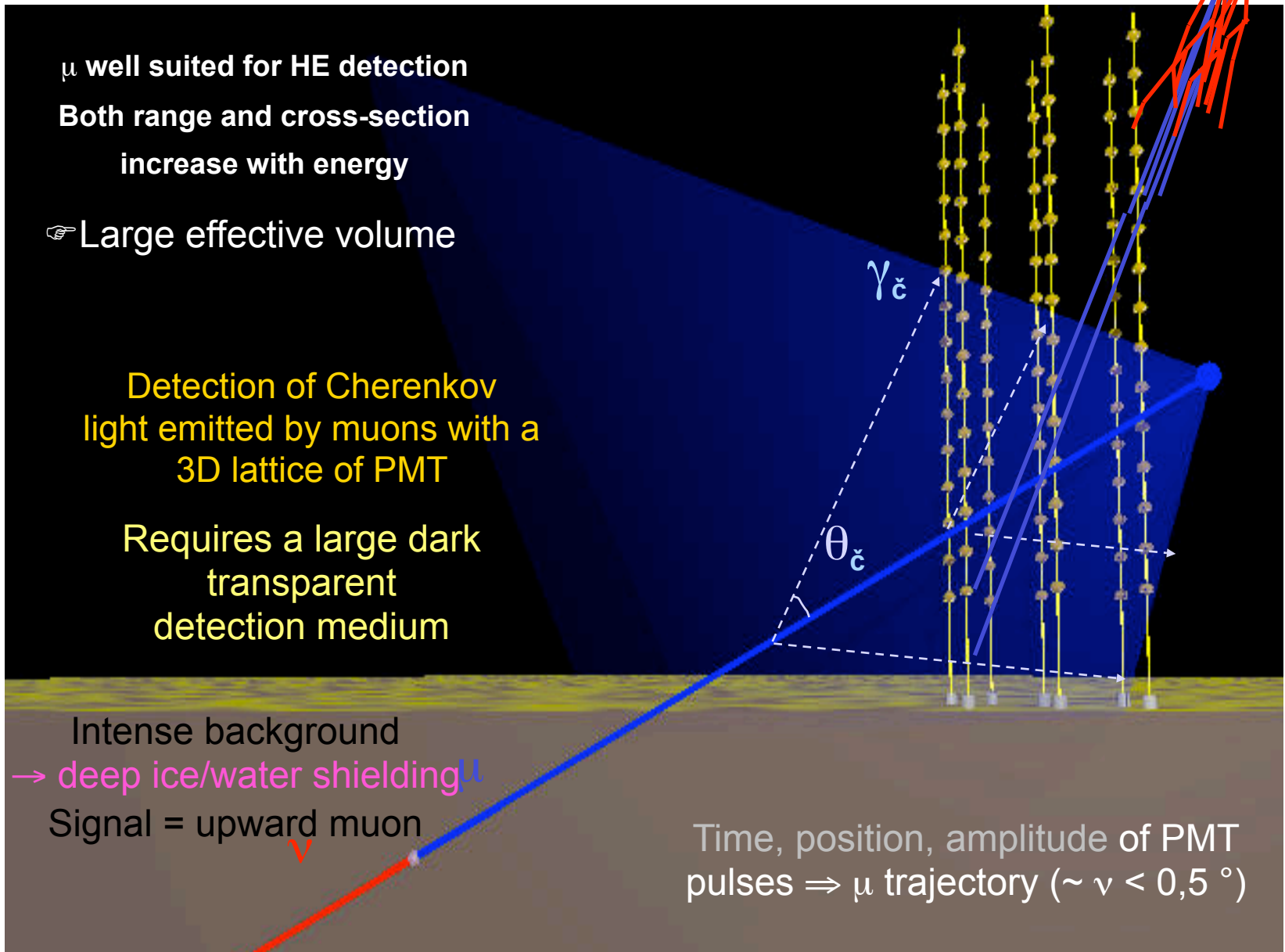
Requires a large dark
 transparent
 detection medium

Intense background
 → deep ice/water shielding
 Signal = upward muon

Time, position, amplitude of PMT
 pulses $\Rightarrow \mu$ trajectory ($\sim \nu < 0,5^\circ$)

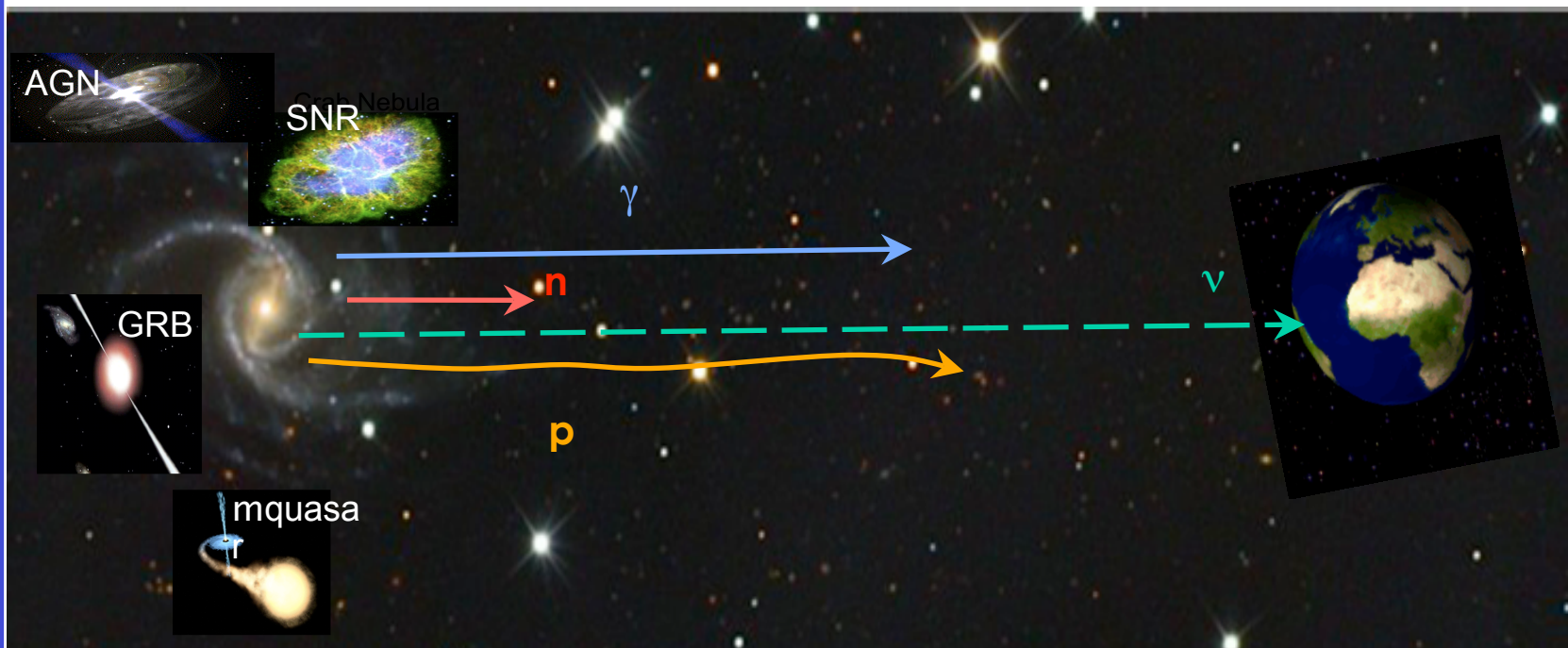


(c) Jouvencot Fabrice





HE neutrino astronomy

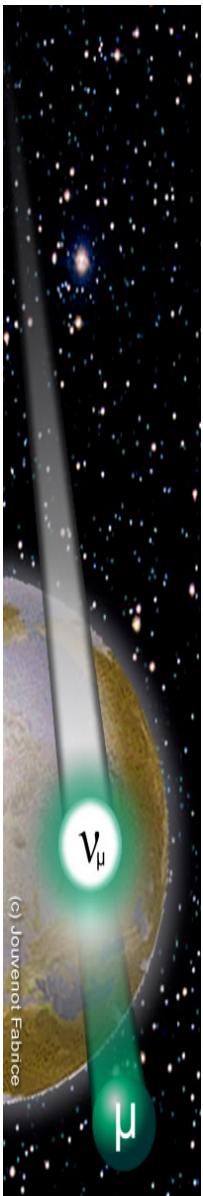


❖ HE ν production in astrophysical sources

- Cosmic ray interactions: $p+A/g \rightarrow \text{mesons} \rightarrow n$
- Decay of heavy particle
- DM (WIMP) annihilation: $DM + DM \rightarrow \dots \rightarrow n$

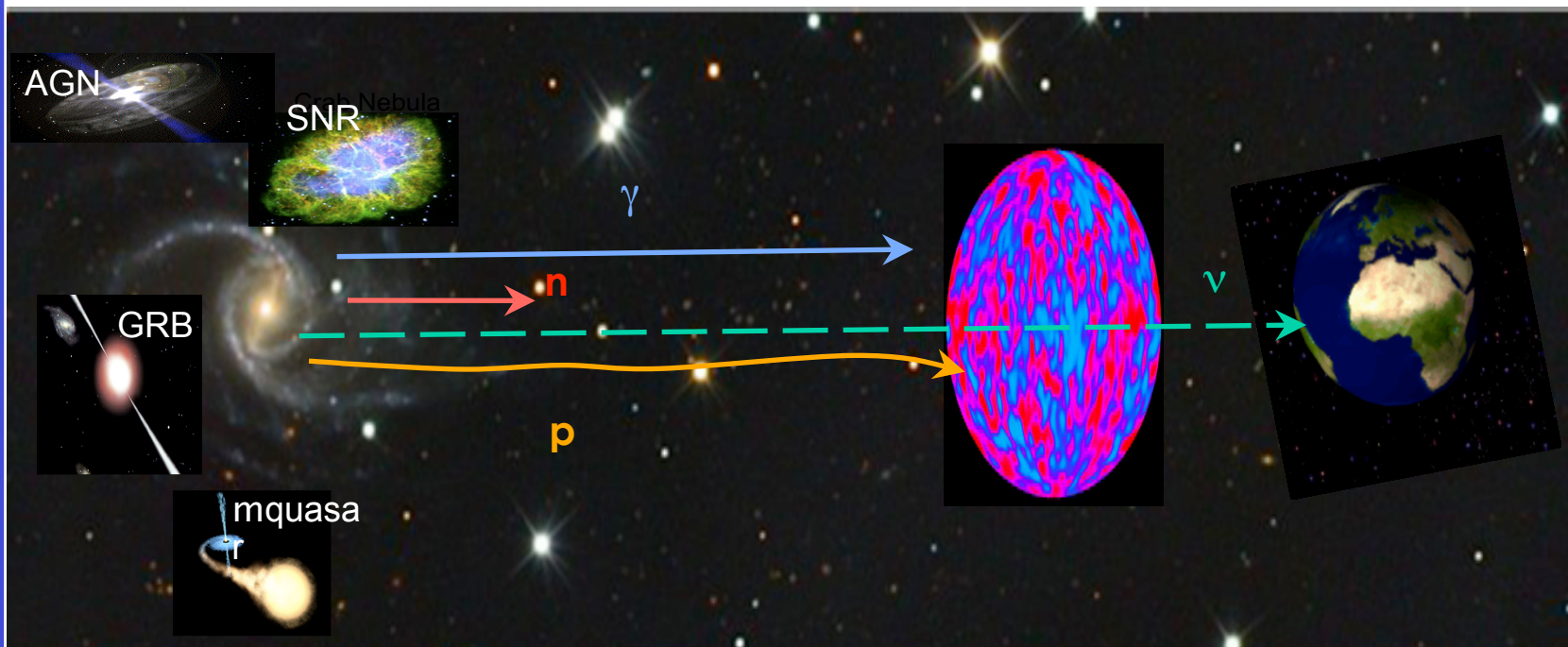
❖ Interdisciplinary Deep Sea Studies:

- oceanography, sea biology, seismology...





HE neutrino astronomy

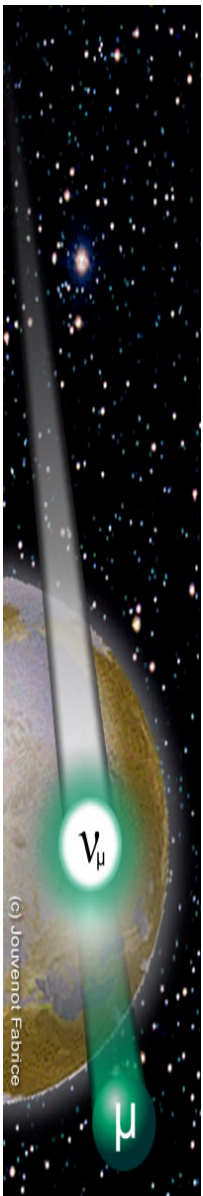


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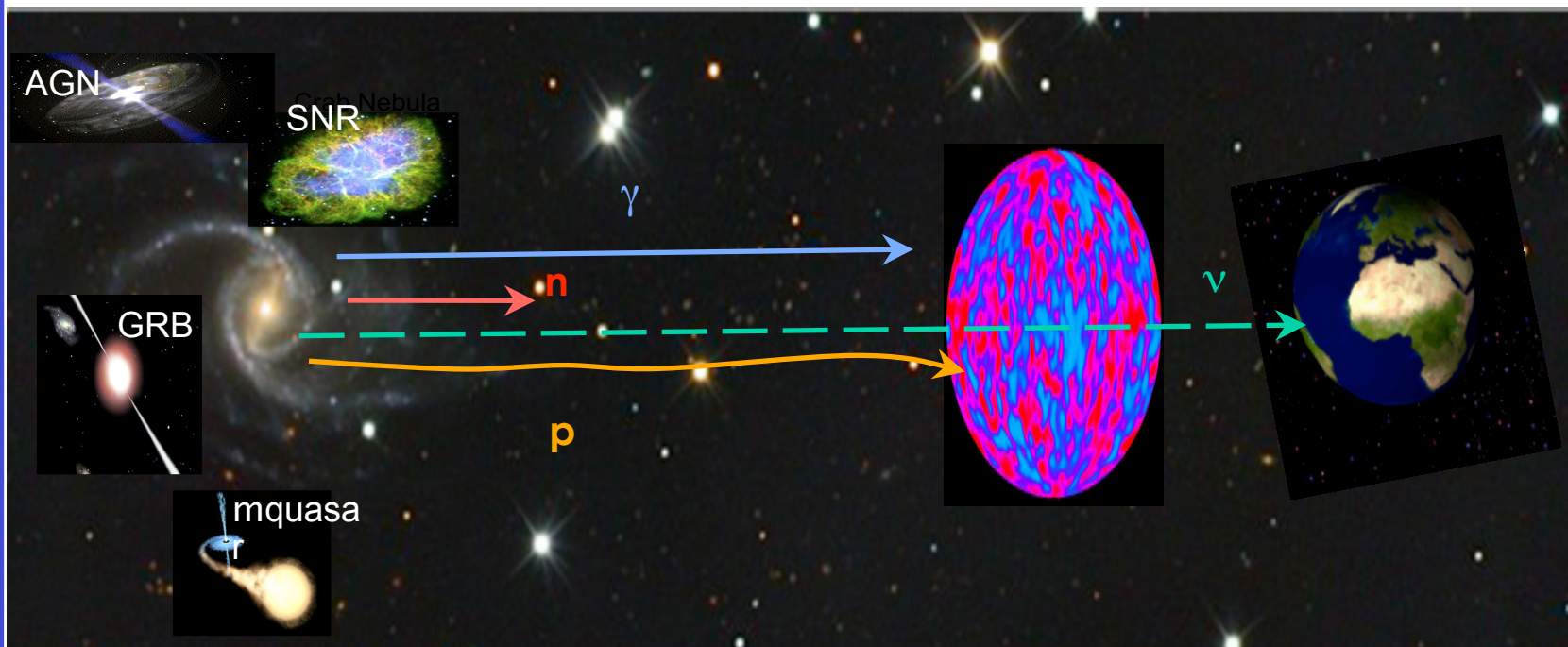
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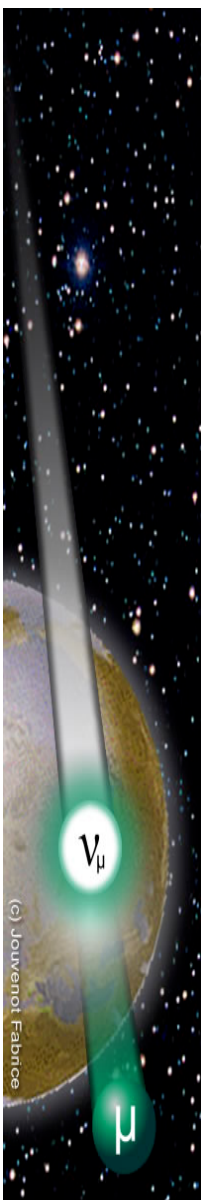
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Point-sources search,
J.A. Aguilar,
this session

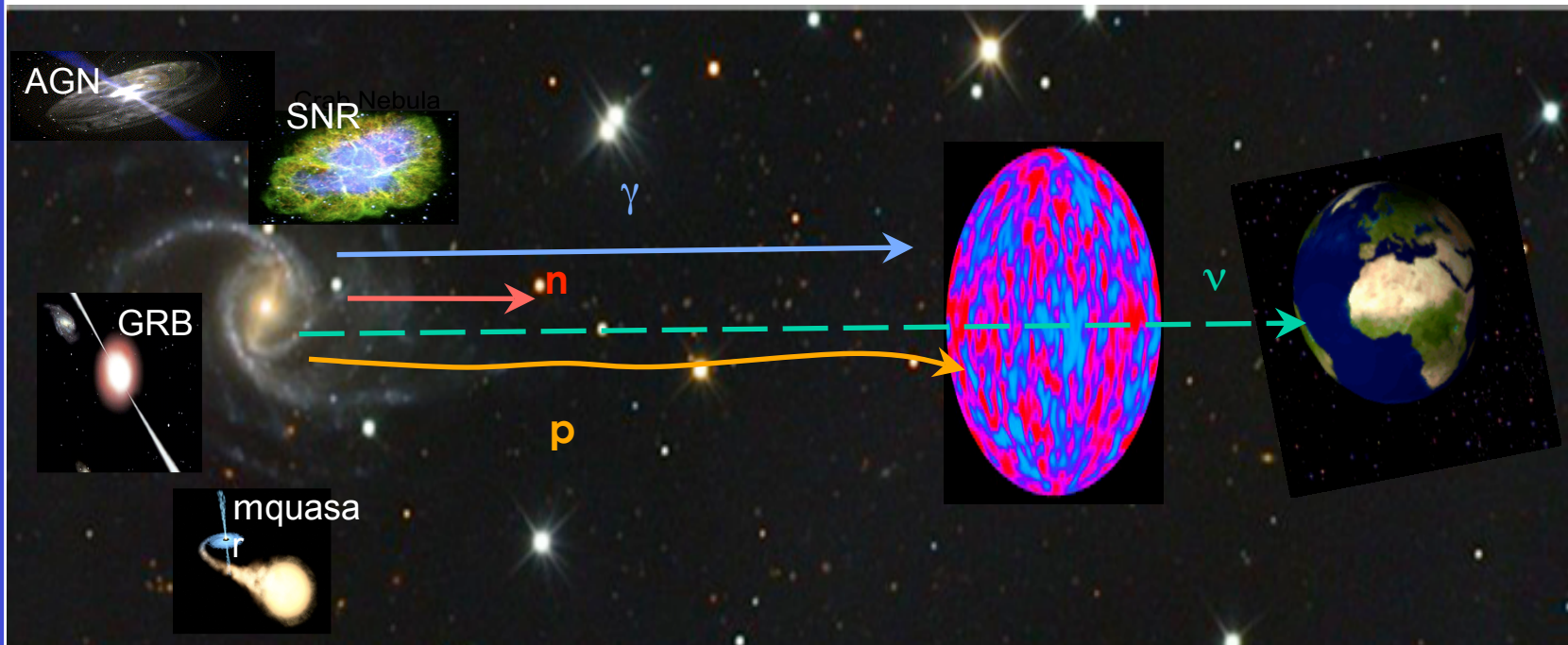
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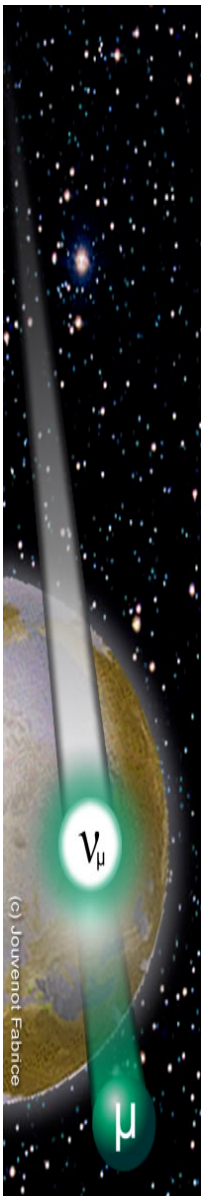


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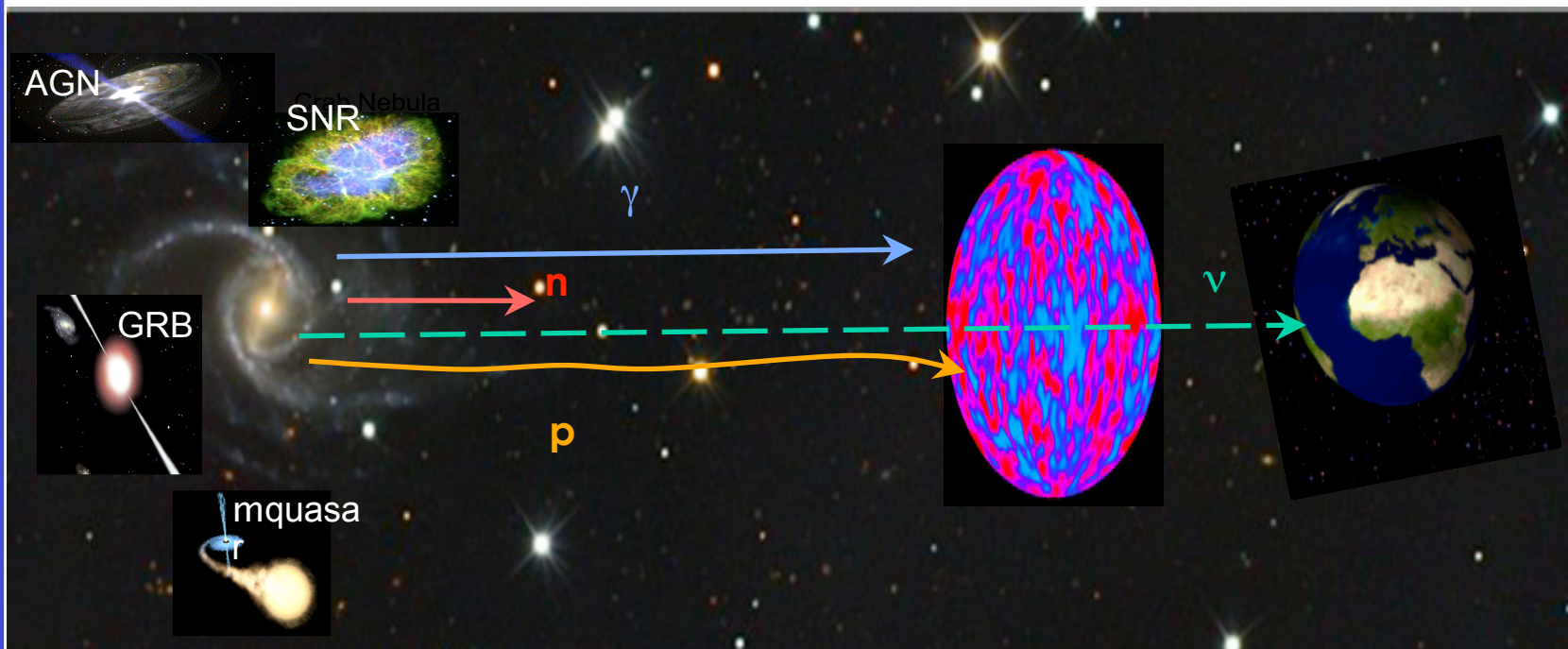
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HE neutrino astronomy



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See talk from
E. Falchini
OG.2.5

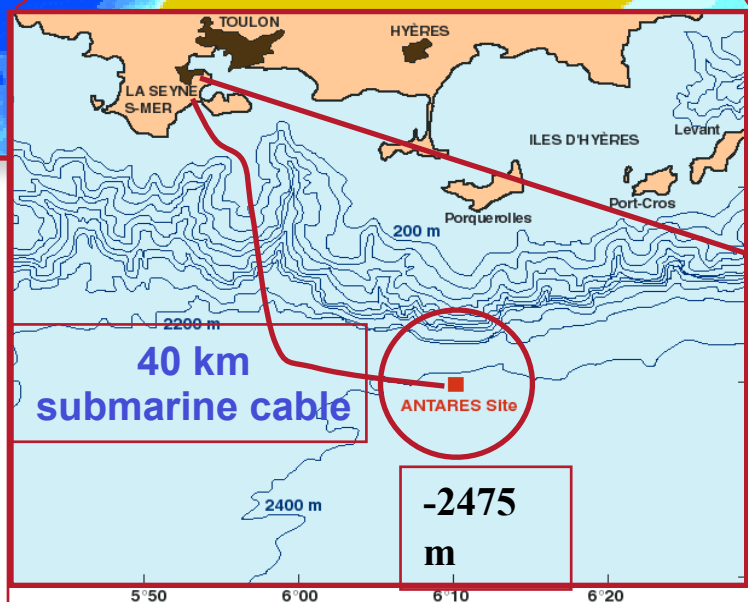
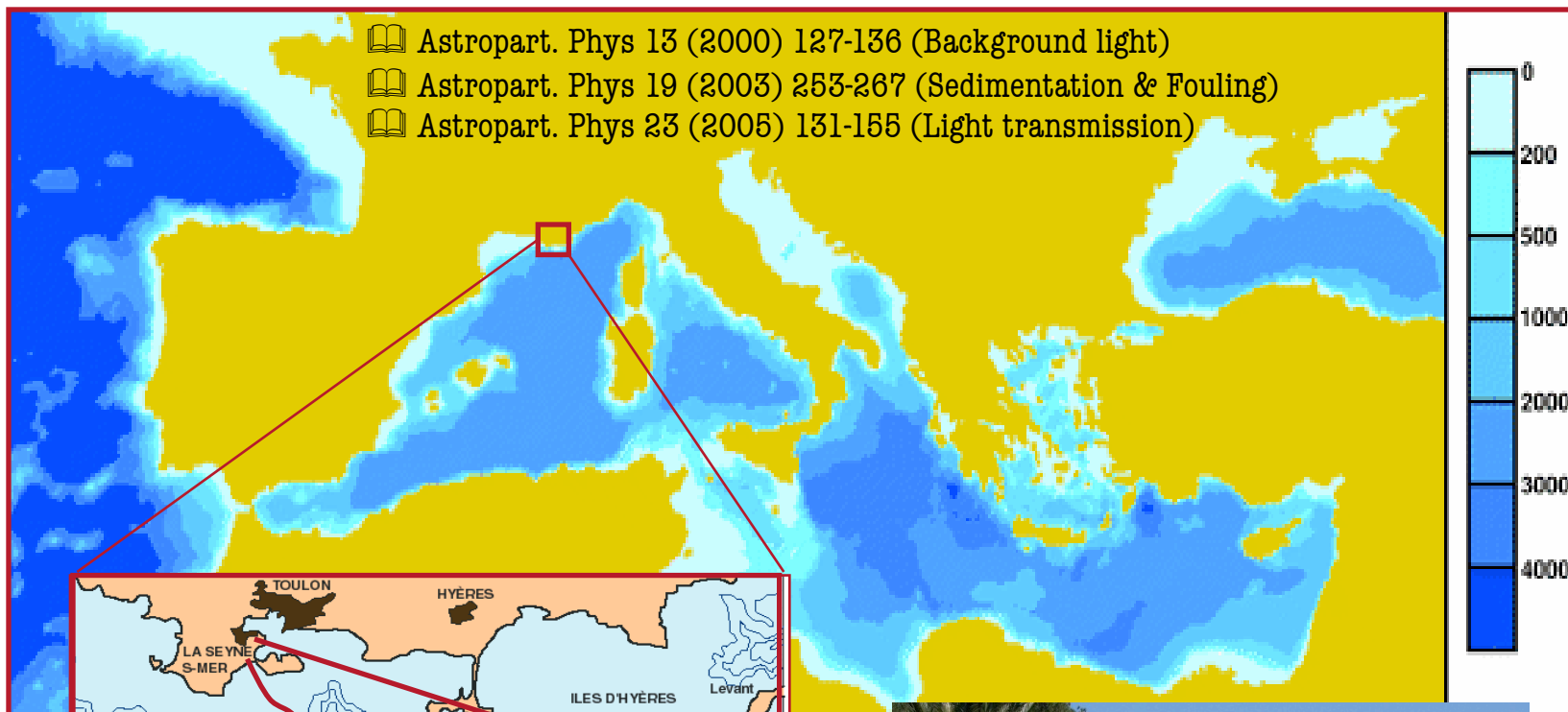
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ANTARES site

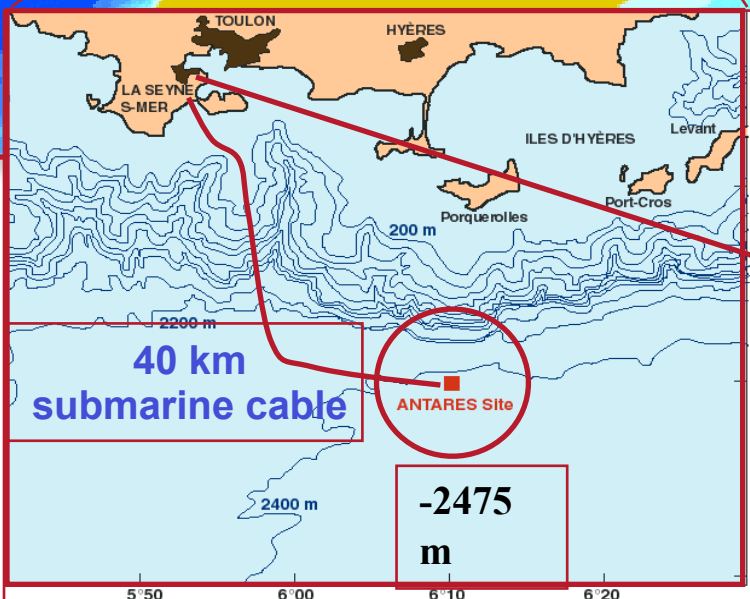
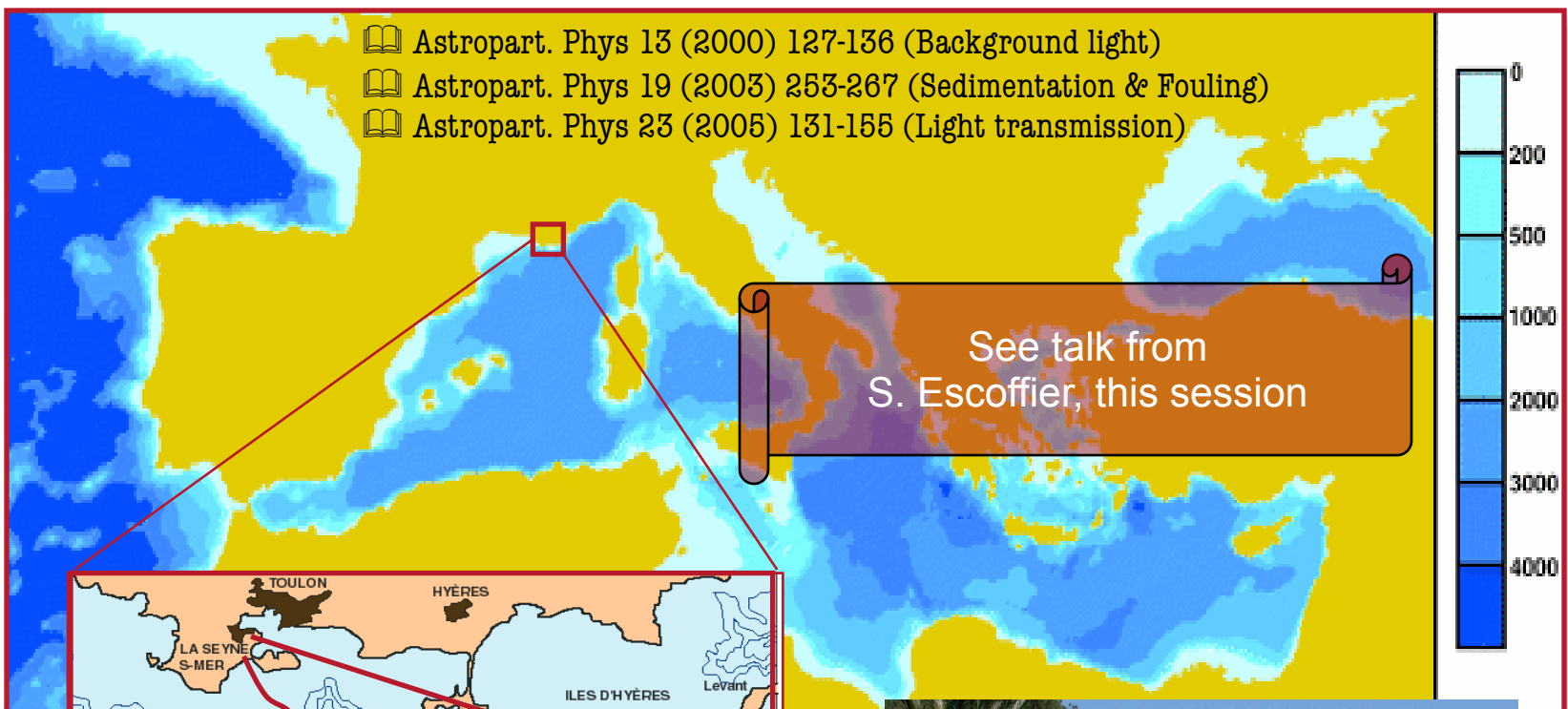
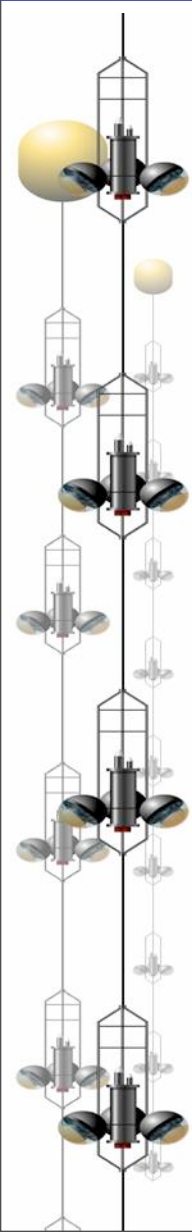
-  Astropart. Phys 13 (2000) 127-136 (Background light)
-  Astropart. Phys 19 (2003) 253-267 (Sedimentation & Fouling)
-  Astropart. Phys 23 (2005) 131-155 (Light transmission)



ANTARES shore station

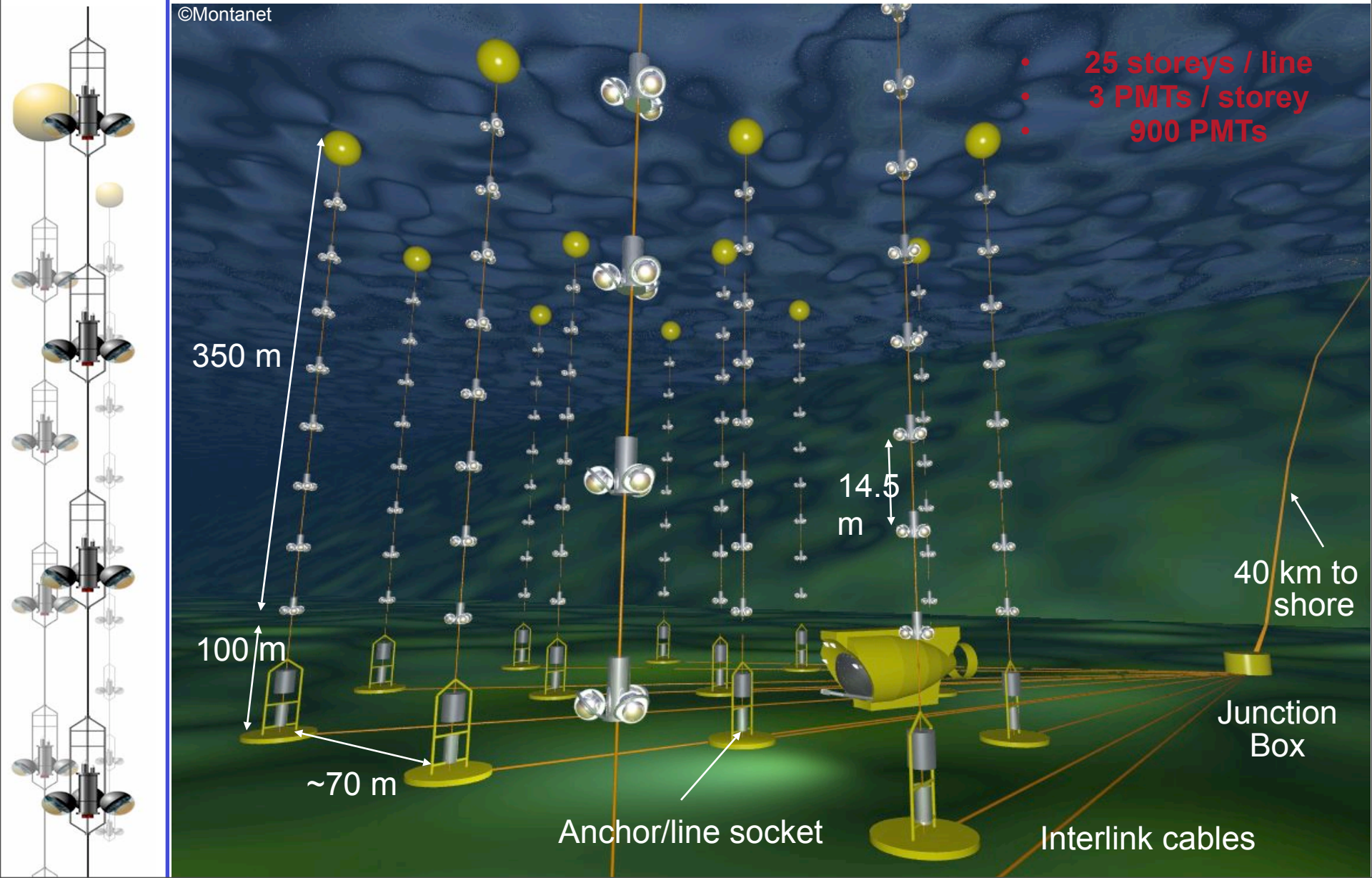


ANTARES site



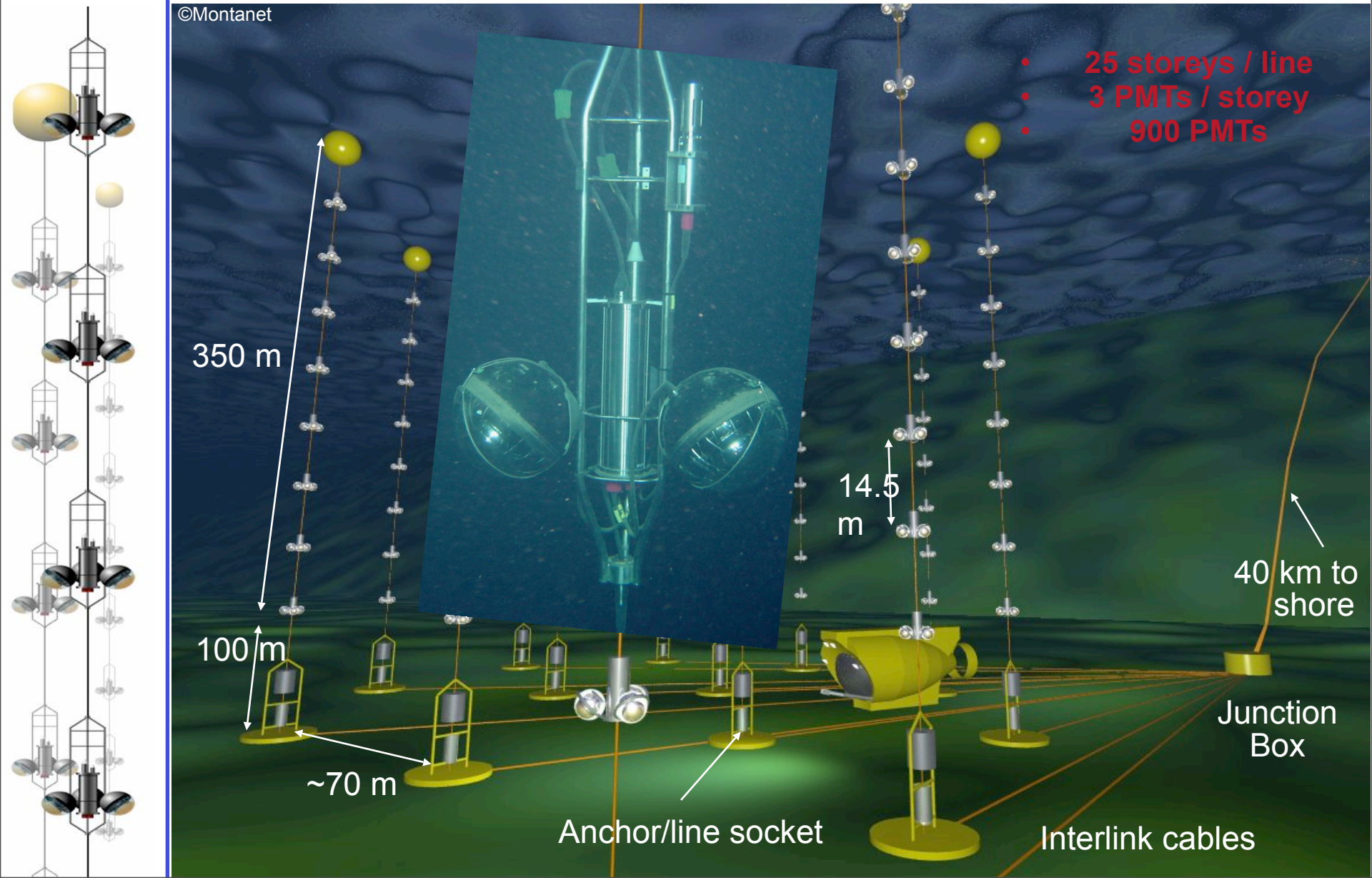
The 12 string Antares Telescope

©Montanet

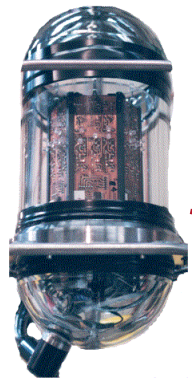
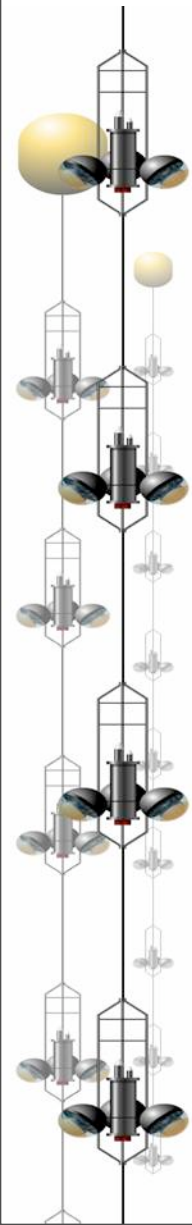


The 12 string Antares Telescope

©Montanet




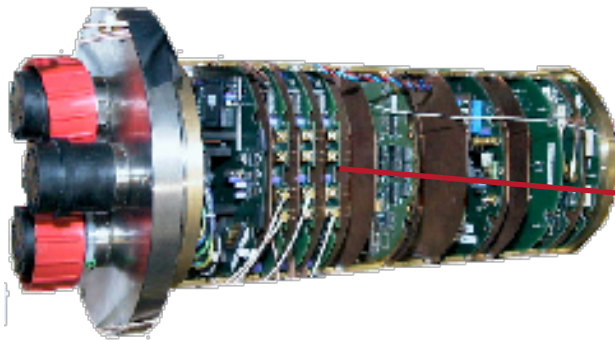
Basic detector element: storey



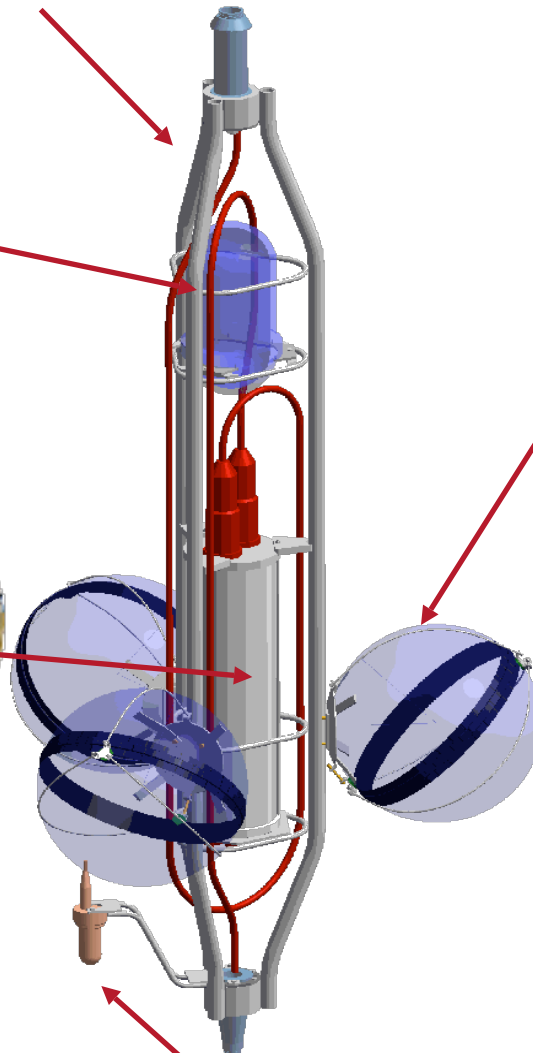
Titanium frame: support structure

Optical Beacon
with blue LEDs:
timing calibration


 [astro-ph/0703355](https://arxiv.org/abs/astro-ph/0703355)




Local Control Module (Ti):
Front-end ASIC, DAQ/SC,
DWDM,
Clock, tilt/compass, power
distribution...



Optical Module:
10" Hamamatsu PMT in
17" glass sphere
photon detection

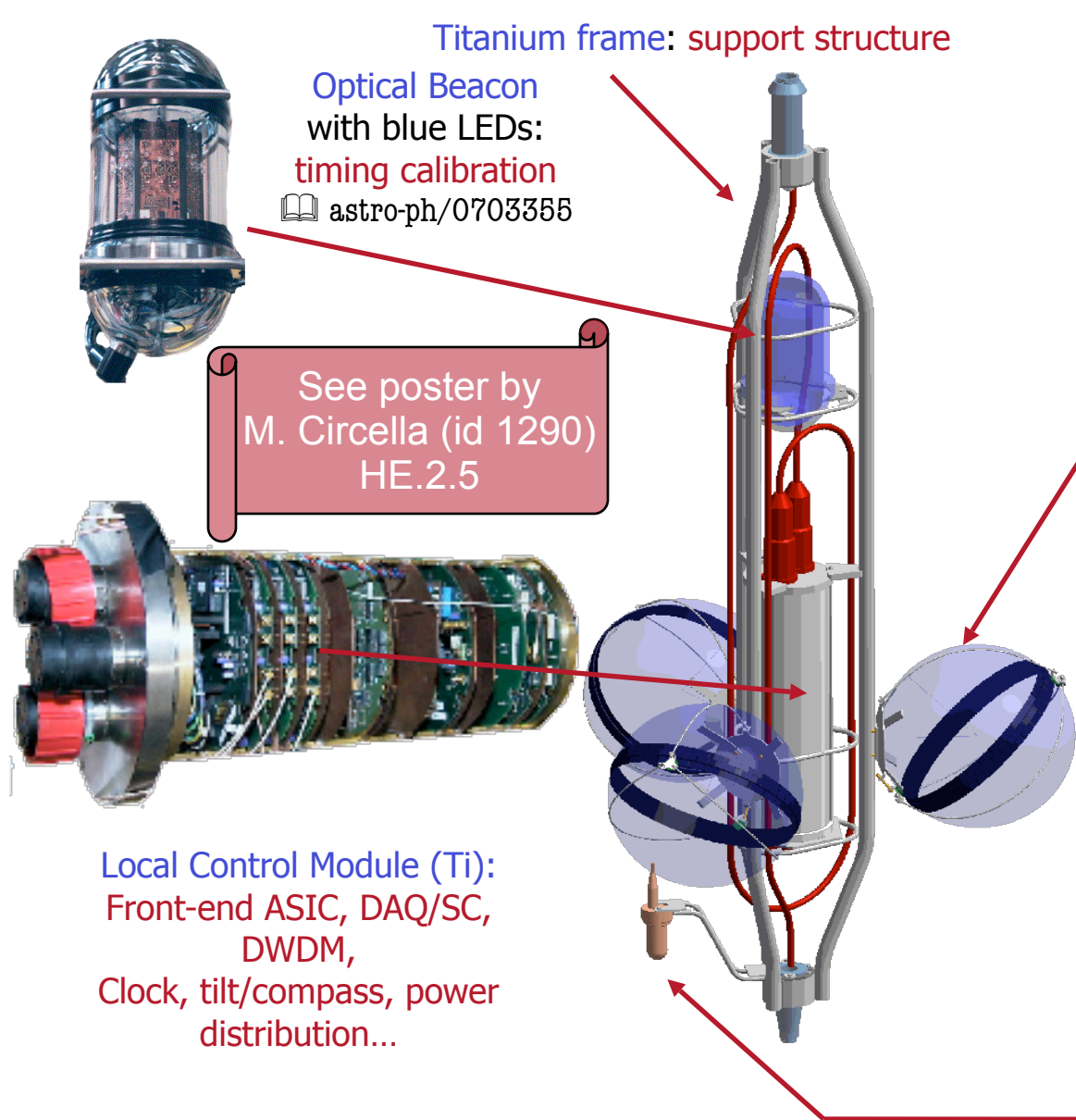
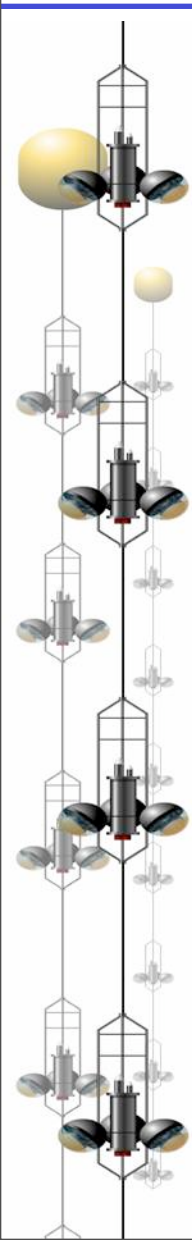
 NIM A484 (2002) 369

 NIM A555 (2005) 132




Hydrophone:
acoustic positioning

Basic detector element: storey



Titanium frame: support structure

Optical Beacon
with blue LEDs:
timing calibration


 astro-ph/0703355


See poster by
M. Circella (id 1290)
HE.2.5

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ANTARES Construction Milestones

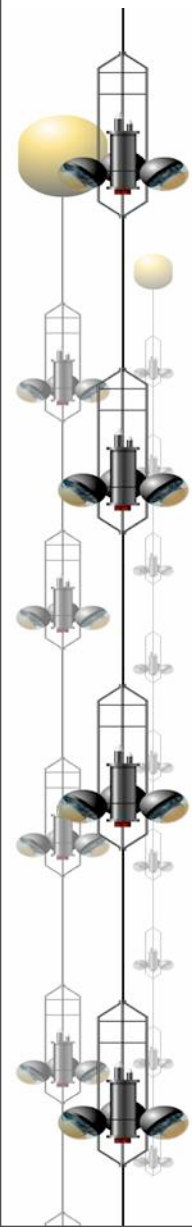


2001 – 2003:

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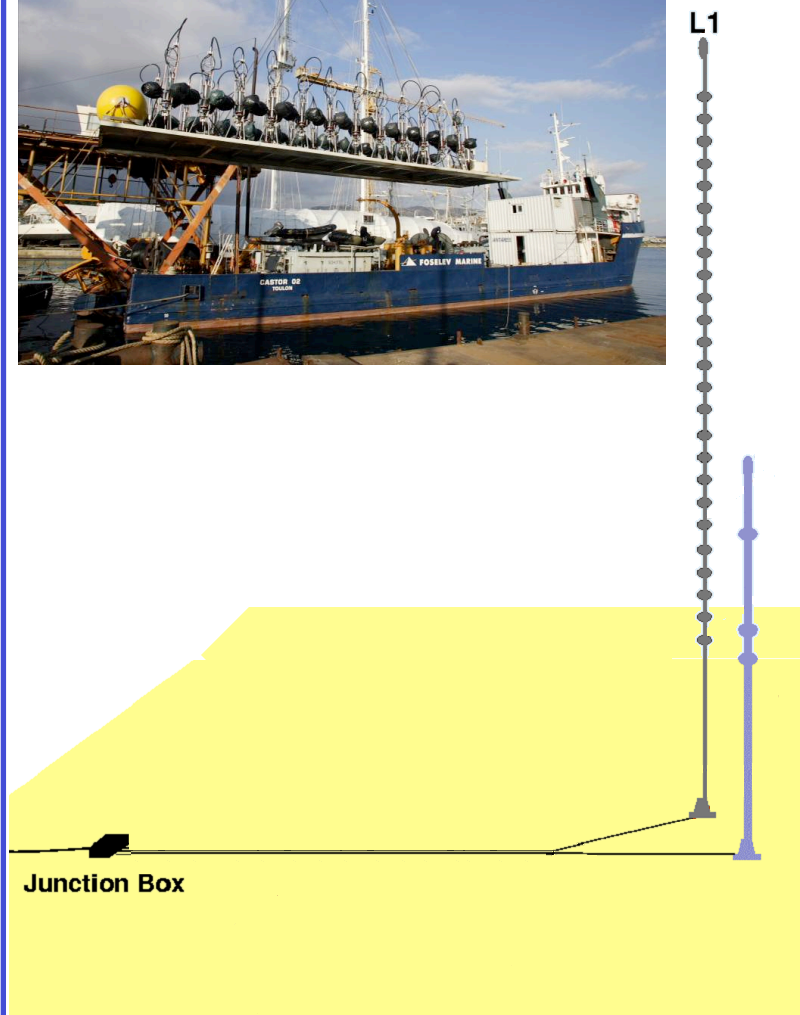
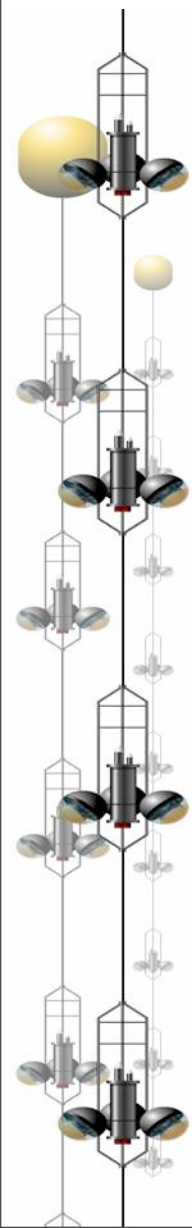


Junction Box





ANTARES Construction Milestones



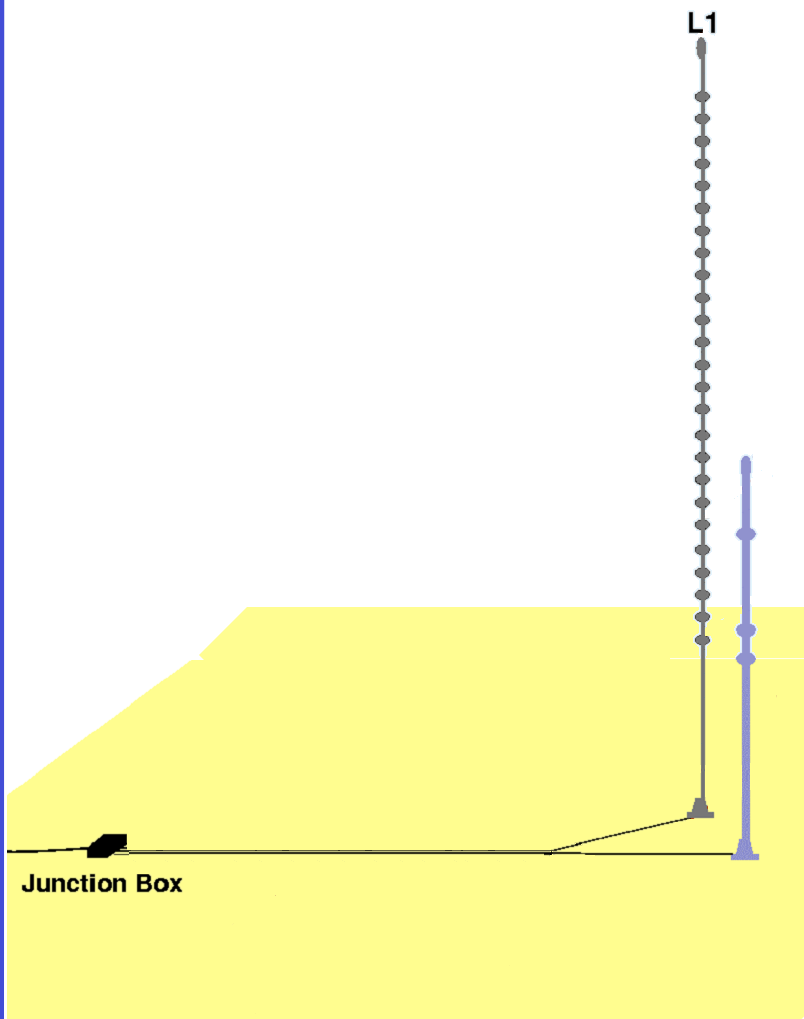
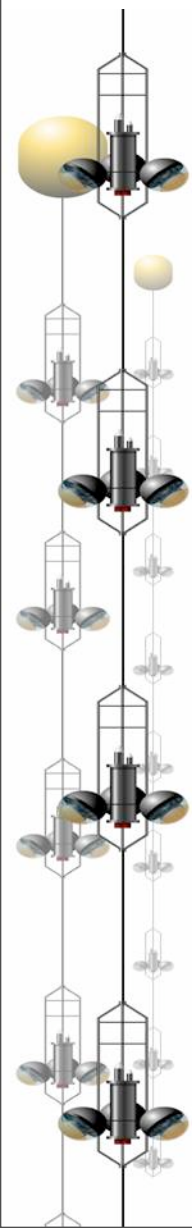
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12 April 2005 → 6 April 2007
📖 Astropart. Phys 26 (2006) 314
- **Line 1 running since 2 March 2006, first complete detector line**
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ANTARES Construction Milestones



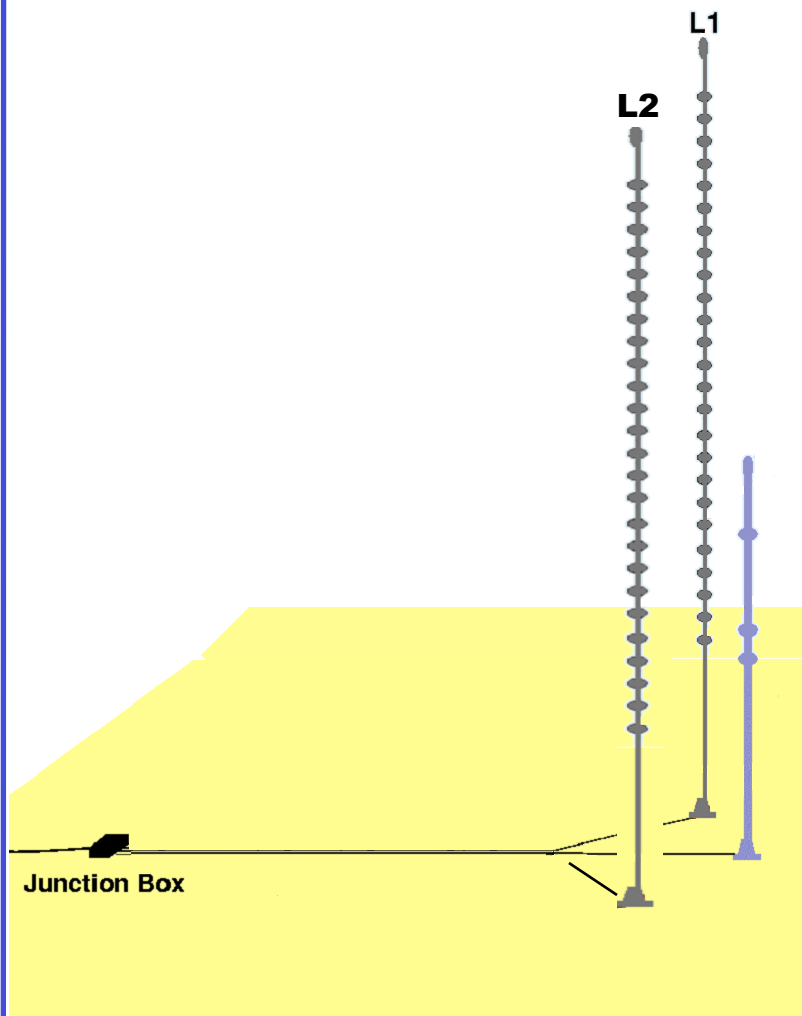
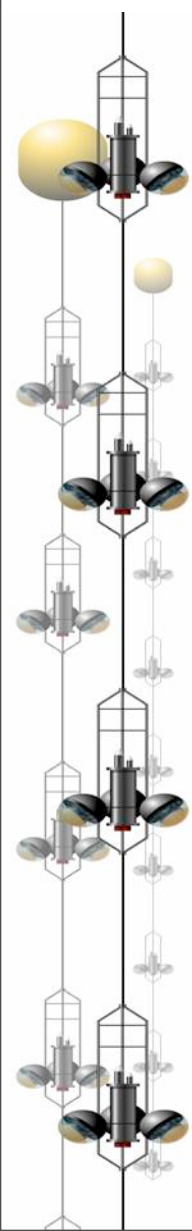
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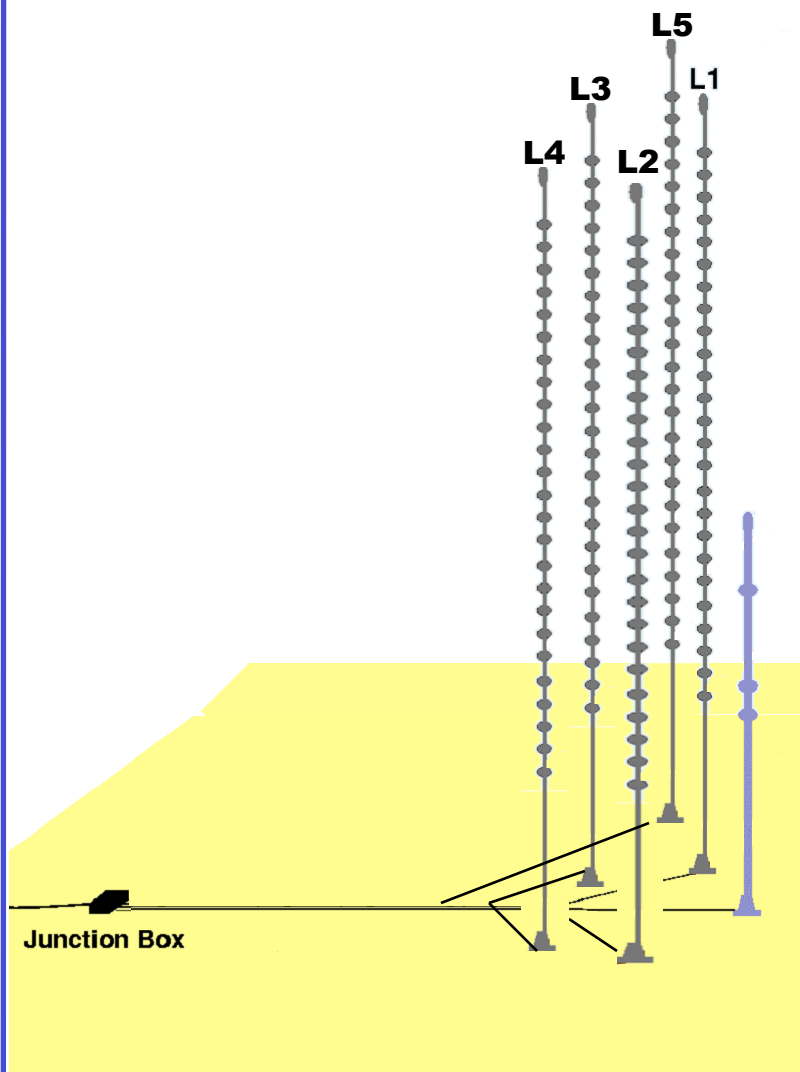
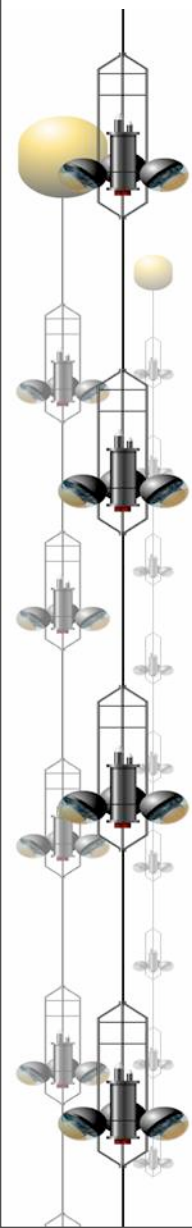
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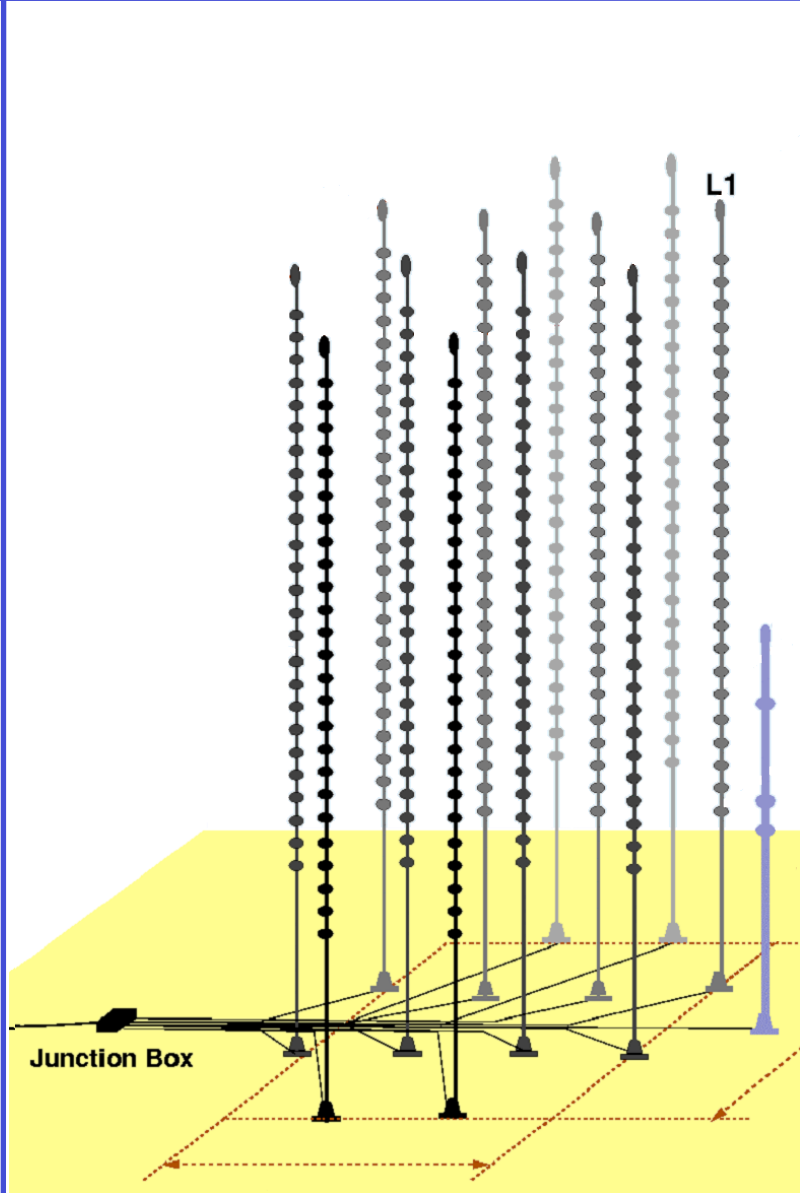
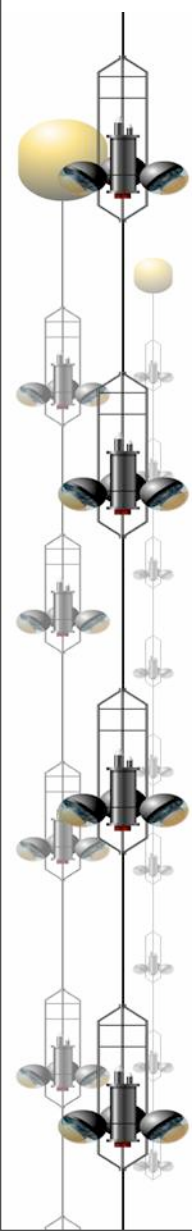
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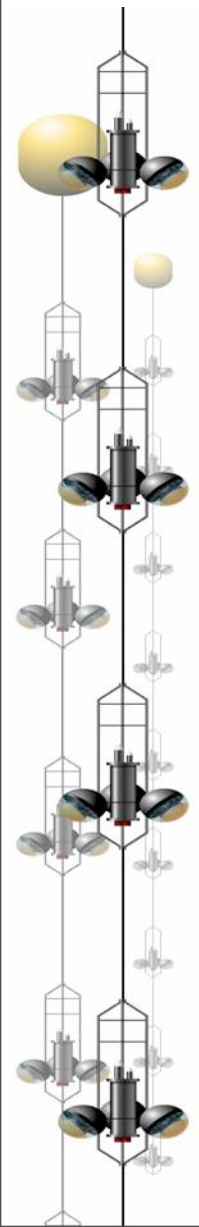
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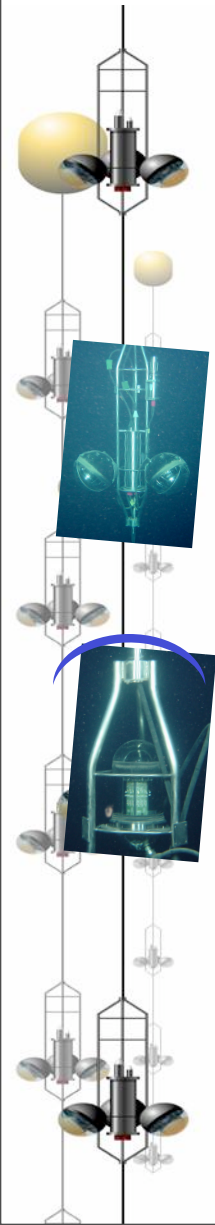
Full completion early 2008 !

Detector Calibration

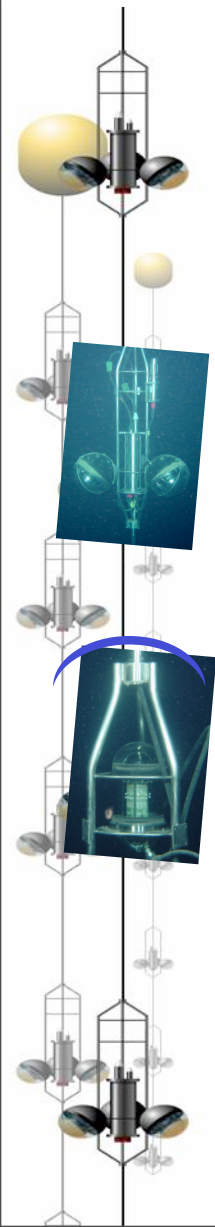


Detector Calibration

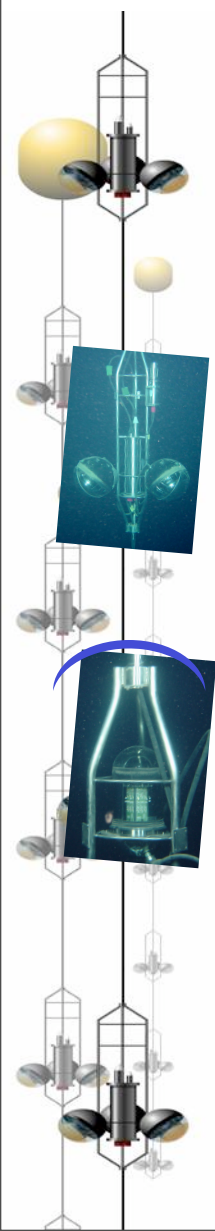
Led Beacon
Intense light:
PMT TTS
negligible



Detector Calibration

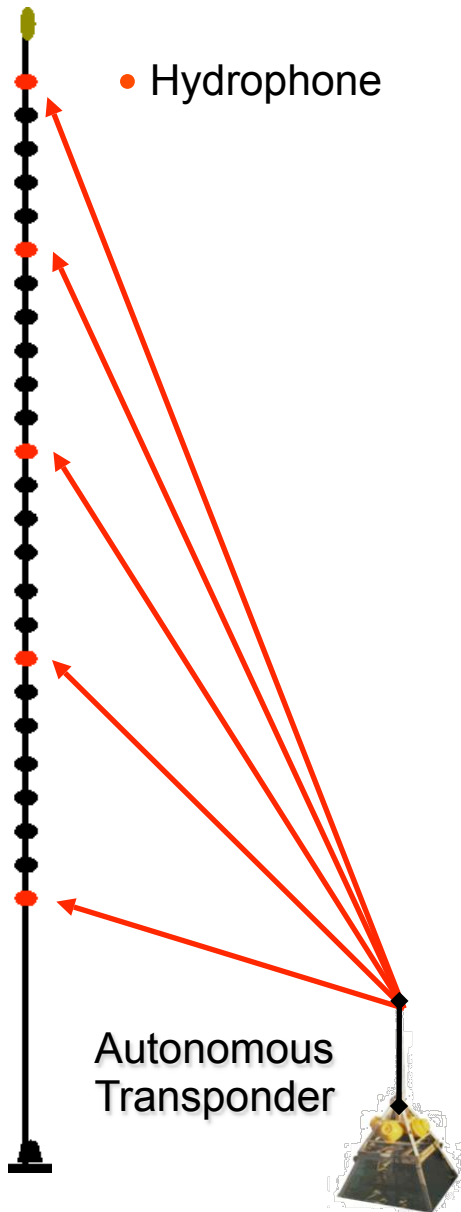
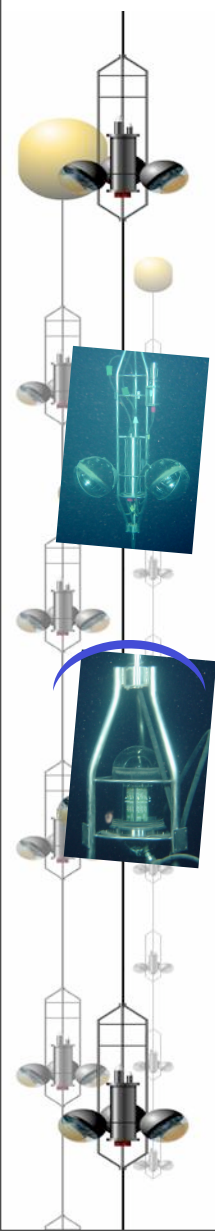


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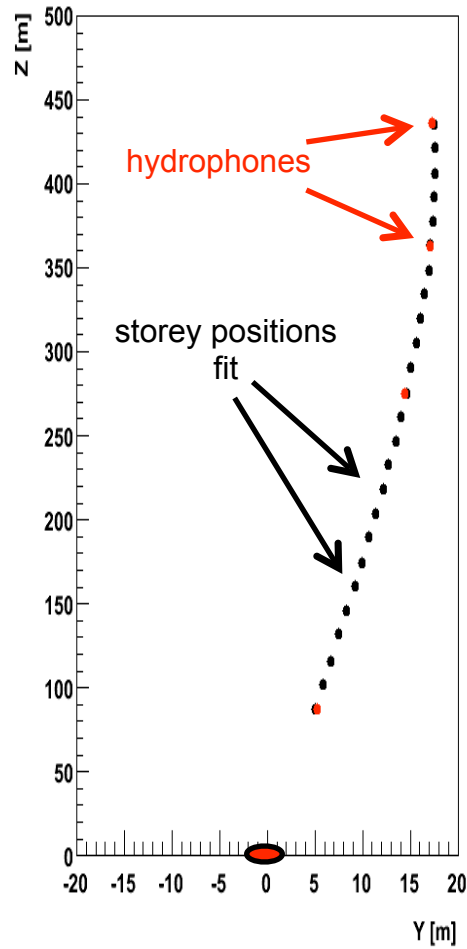


Timing resolution
of electronics
 $\sim 0.5\text{ns}$

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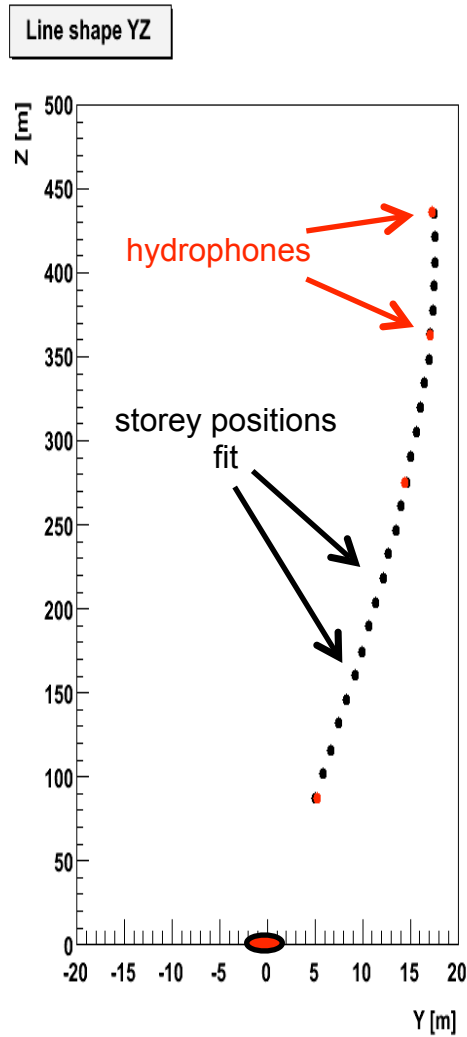
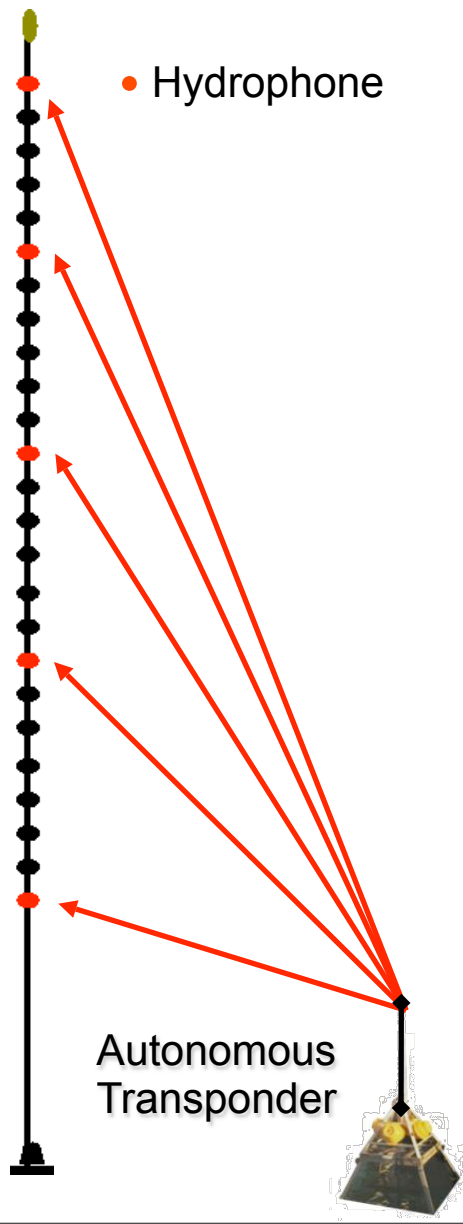
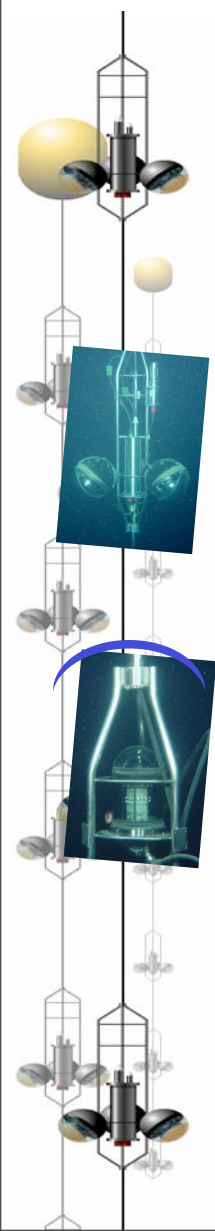


Line shape YZ



Timing resolution
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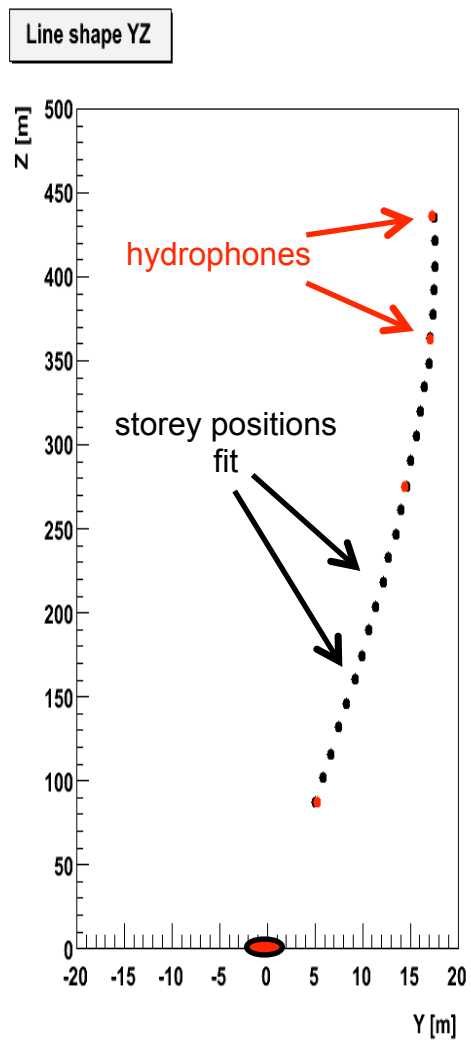
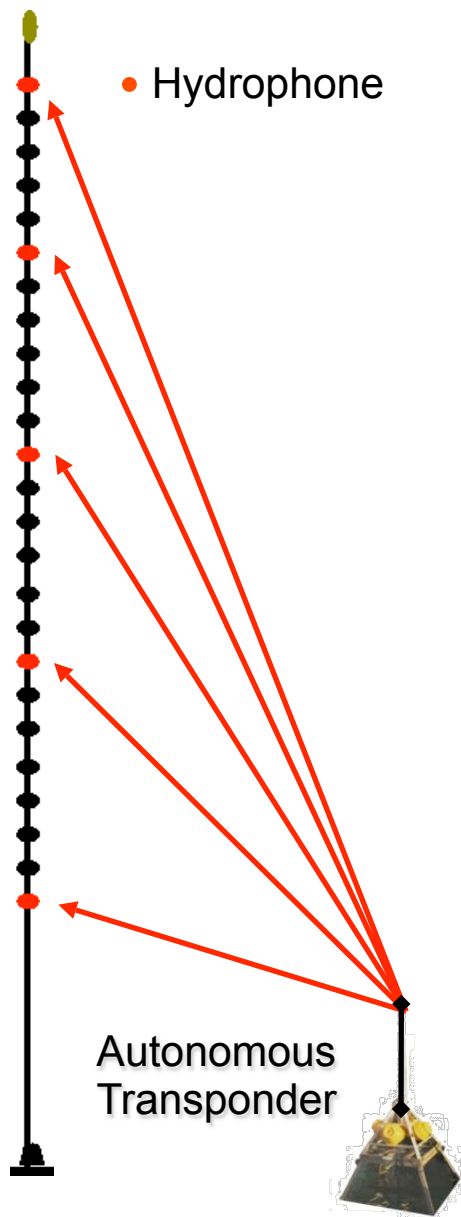
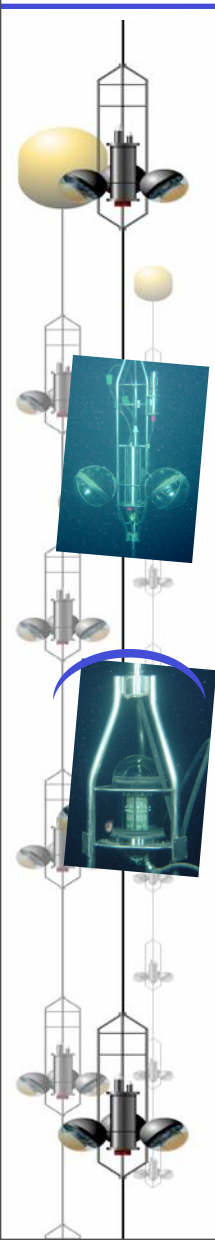
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Positioning
resolution
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Detector Calibration



Timing resolution of electronics $\sim 0.5\text{ns}$

See poster by F. Fehr (id 481) OG.2.7

Positioning resolution $< 10\text{ cm}$

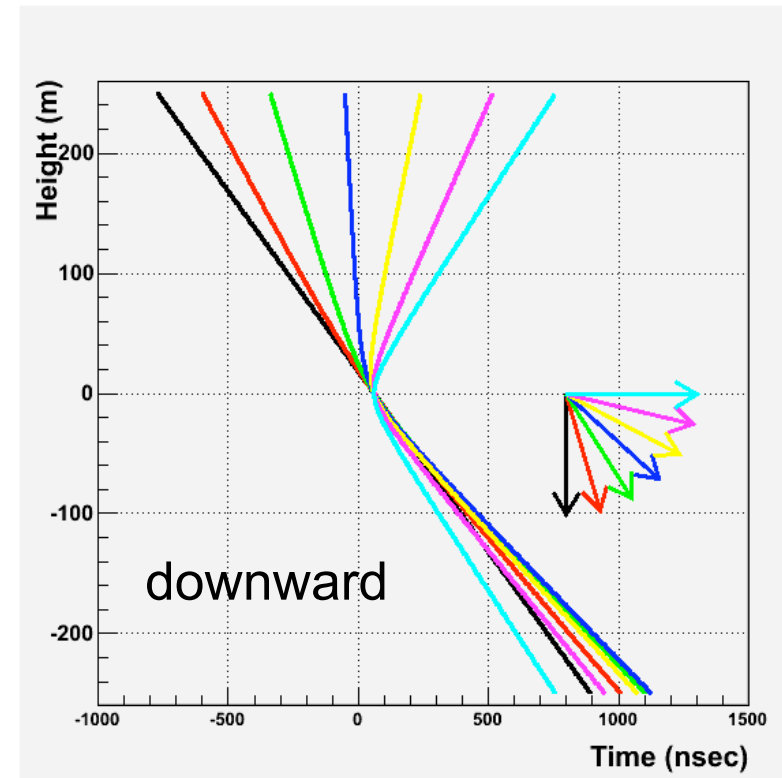
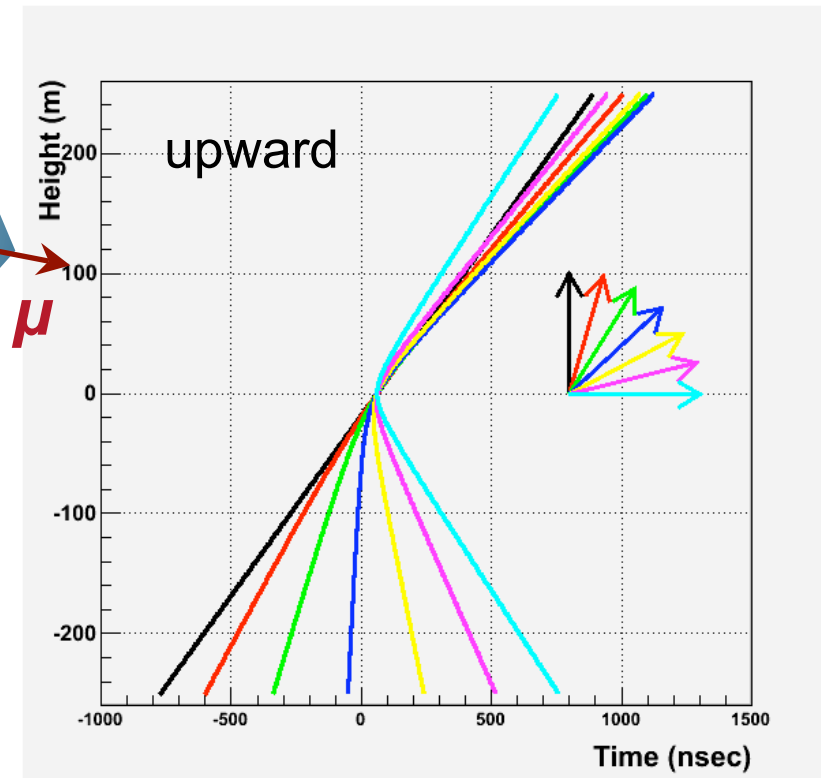
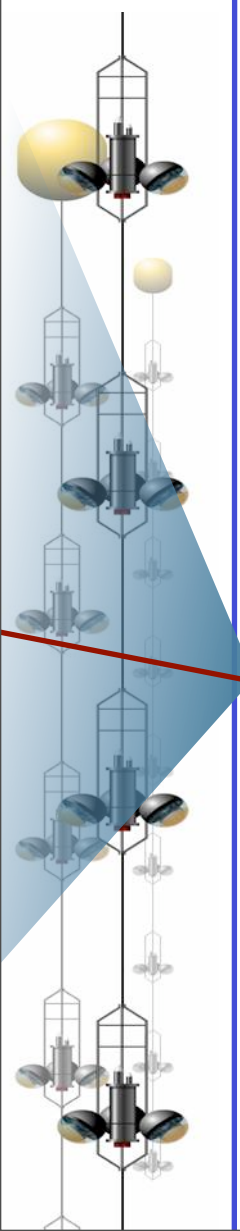
Event displays

Hits are plotted for each line: height (z) versus time (t)



Characteristic pattern depending on zenith angle and distance of closest approach

Several reconstruction strategies available 1D, 3D, χ^2 , ML



Event displays

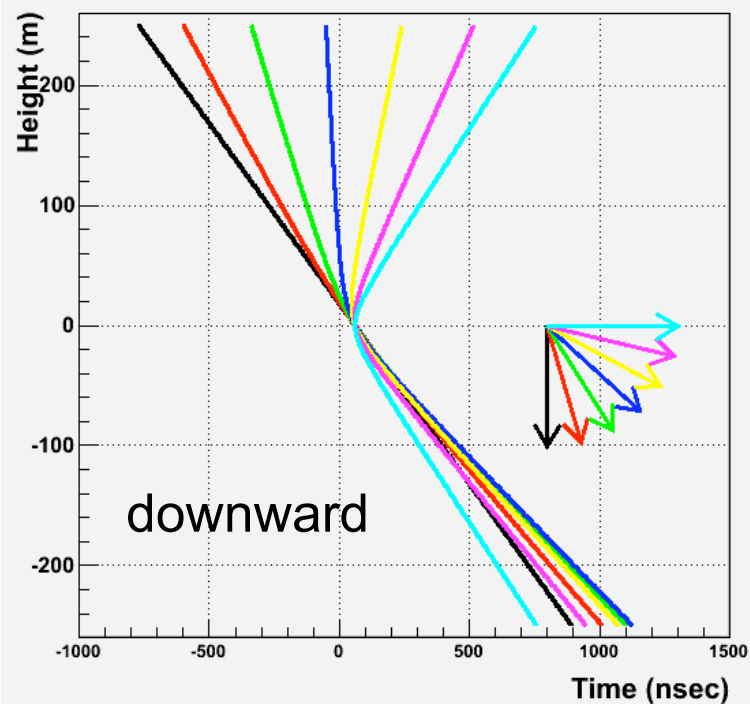
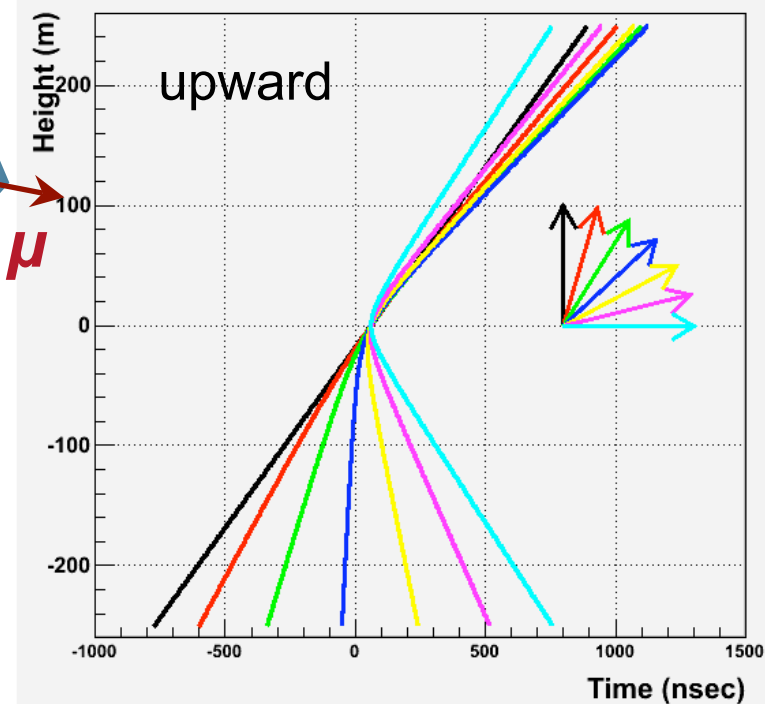
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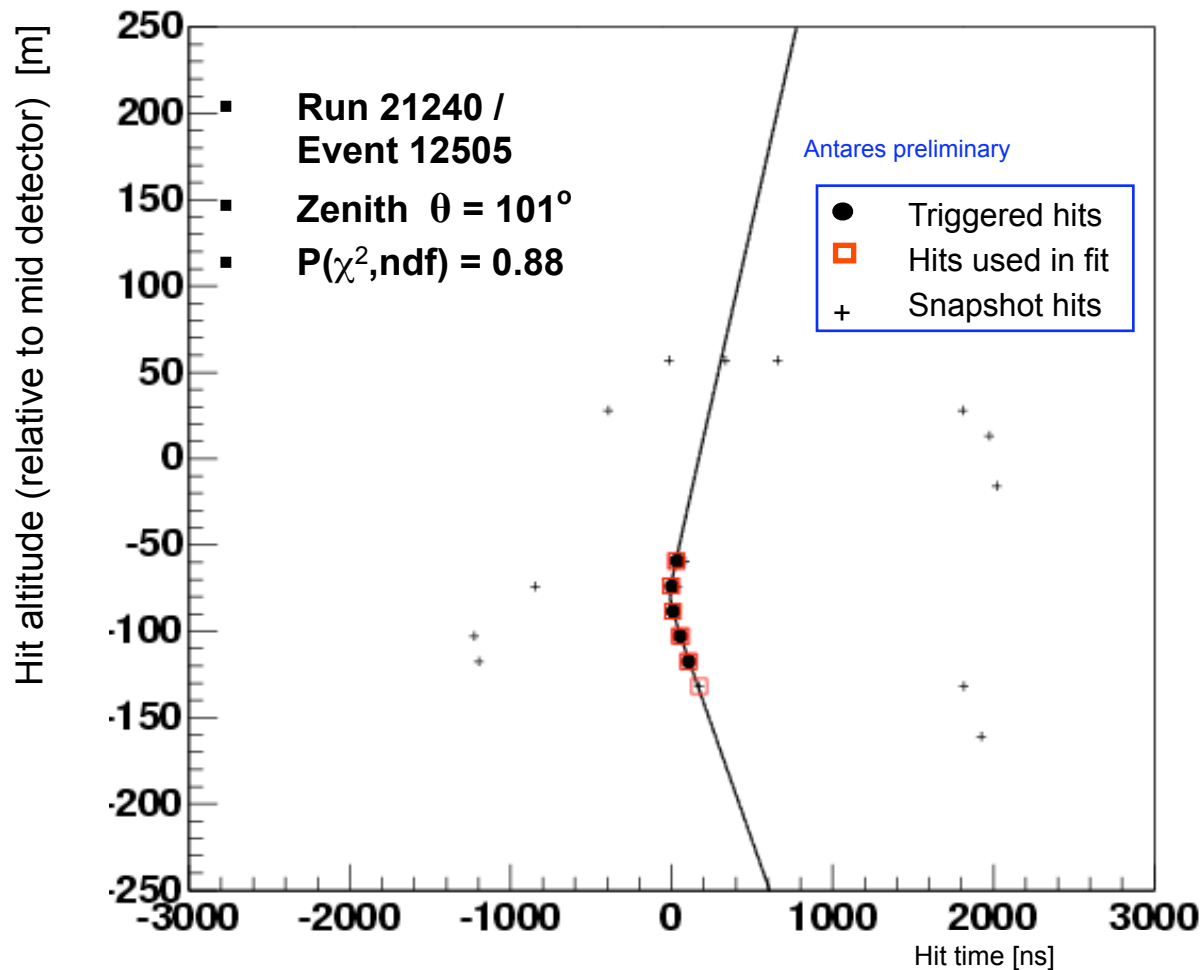
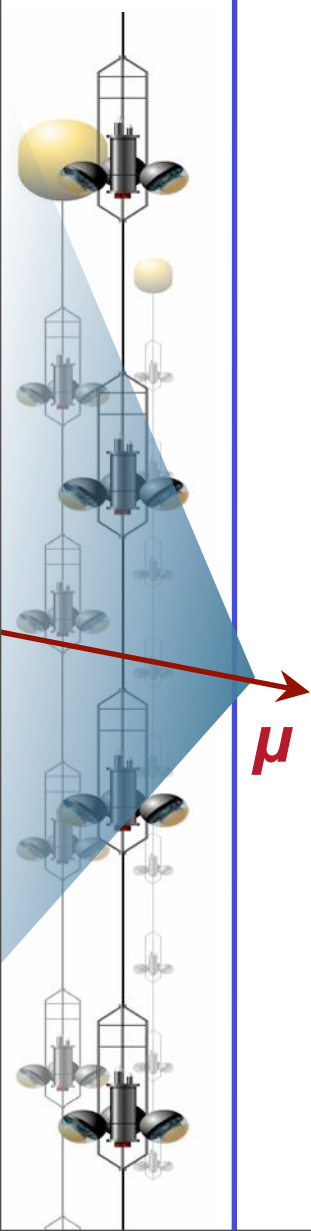
See poster by Y.Becherini (id 481) HE.2.3



Atmospheric muon tracks (L1)

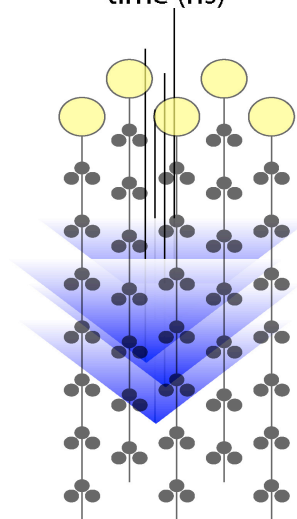
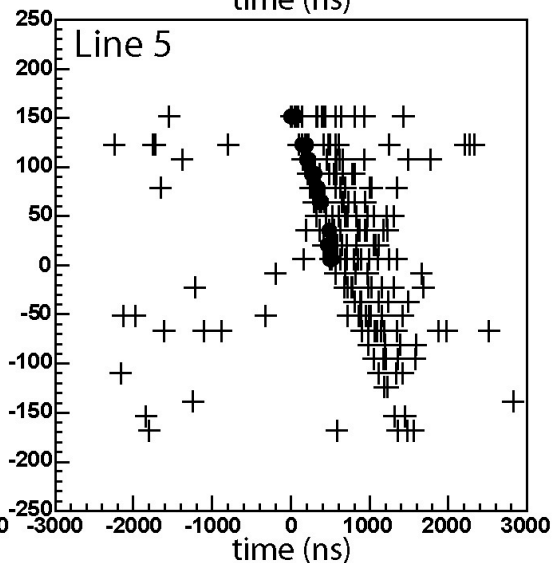
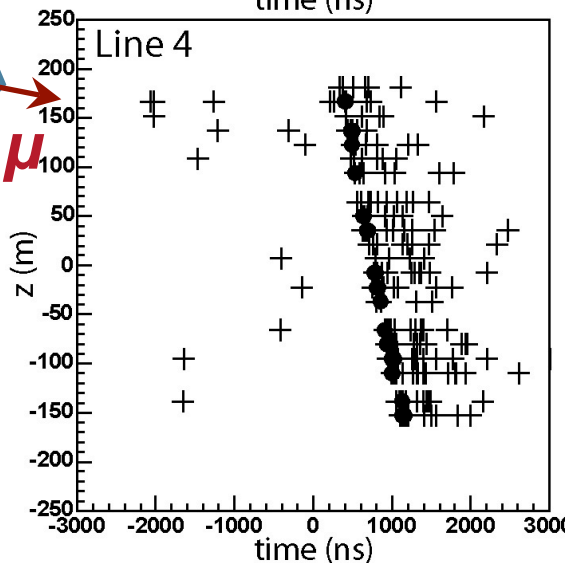
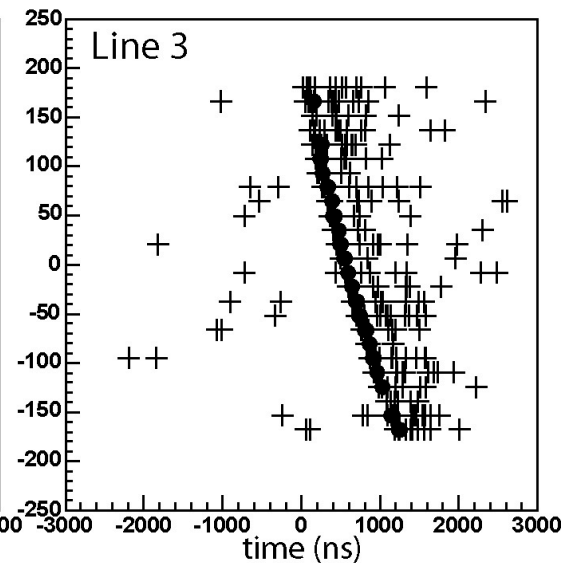
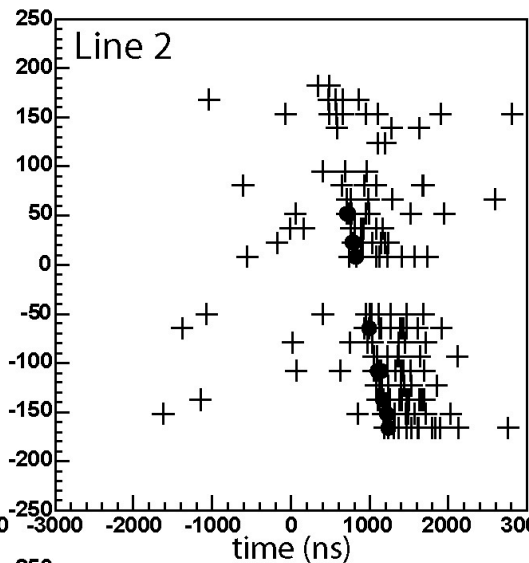
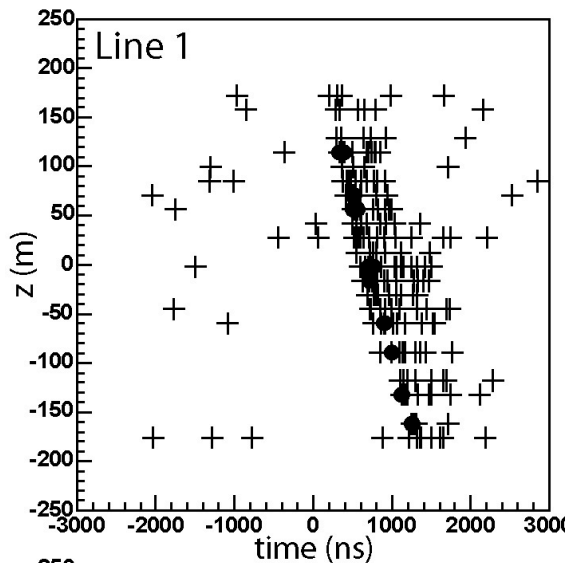
Reconstruction with 1 line (poor sensitivity to azimuth):

Algorithm minimizes χ^2 to find zenith angle of track





5 line detector displays

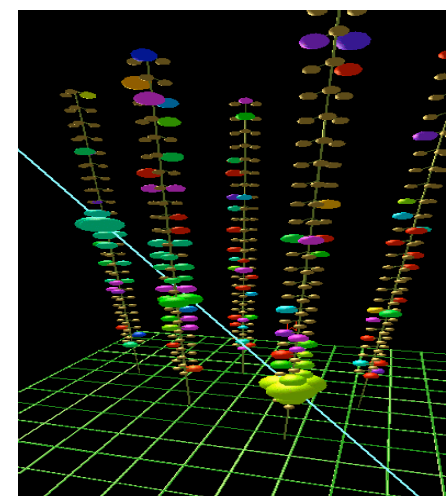
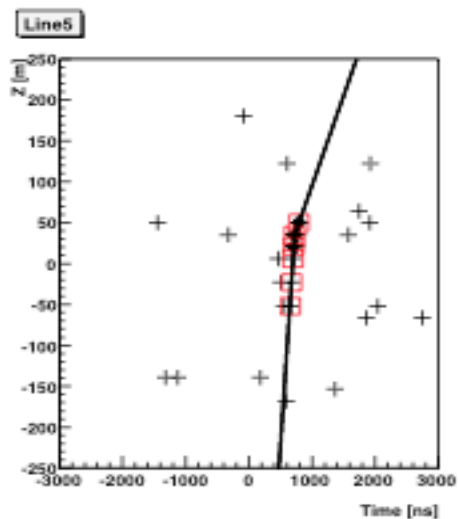
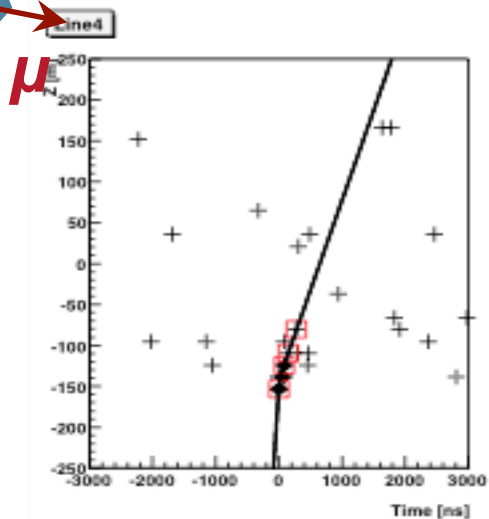
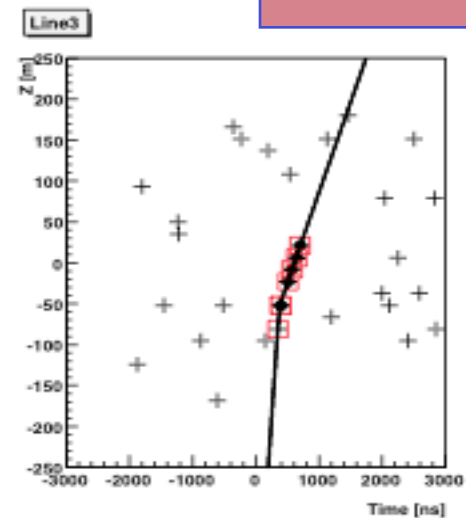
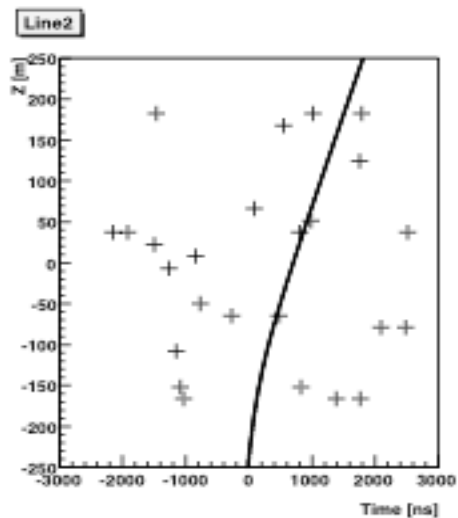
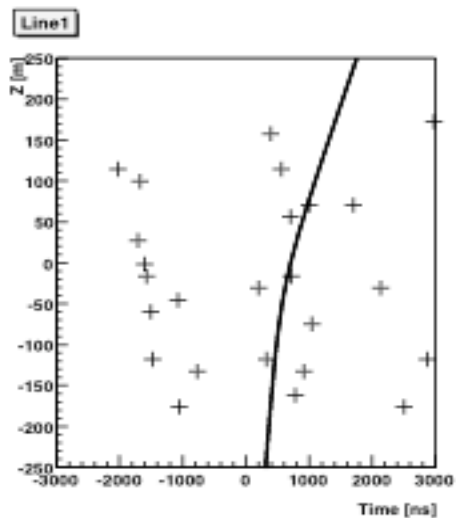




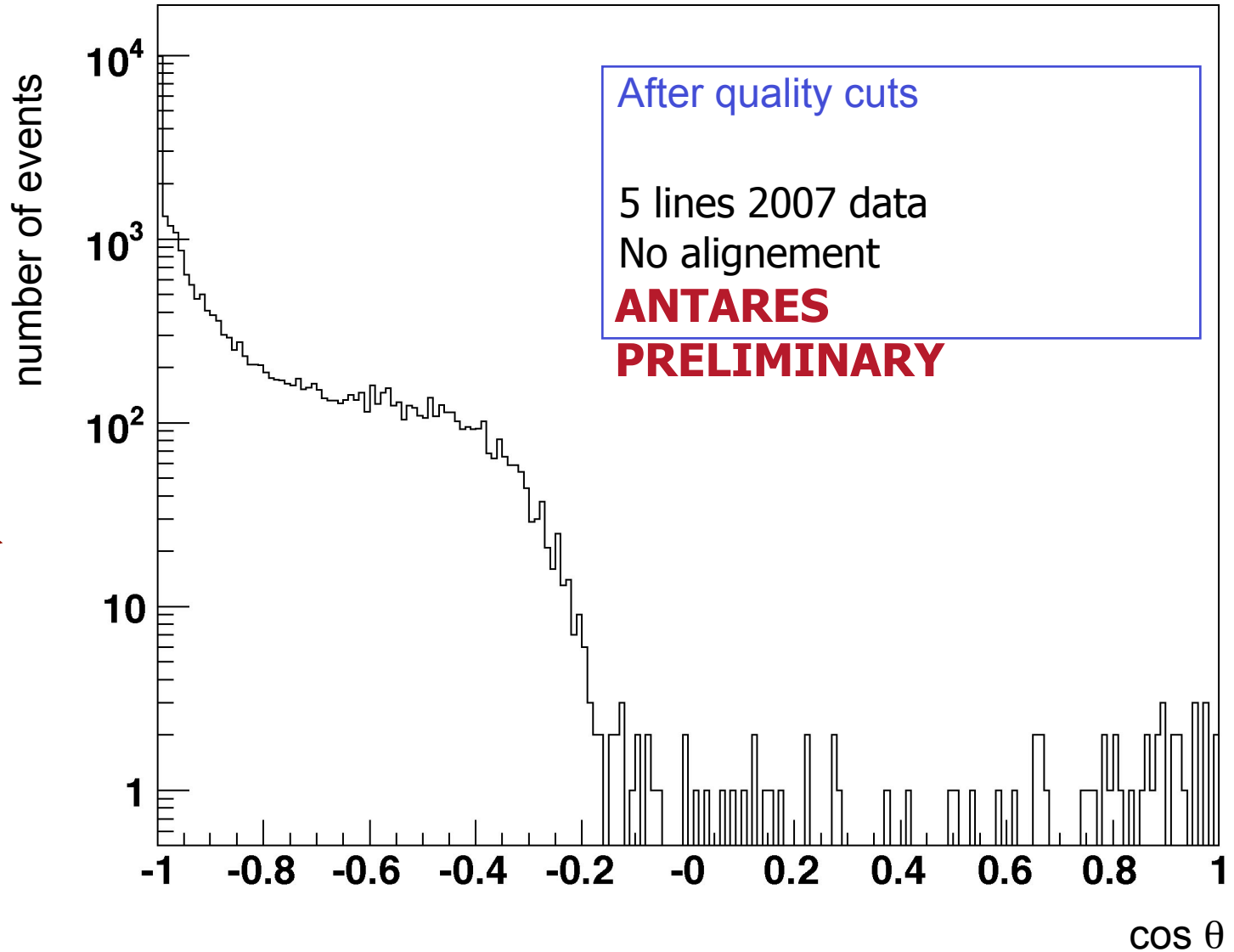
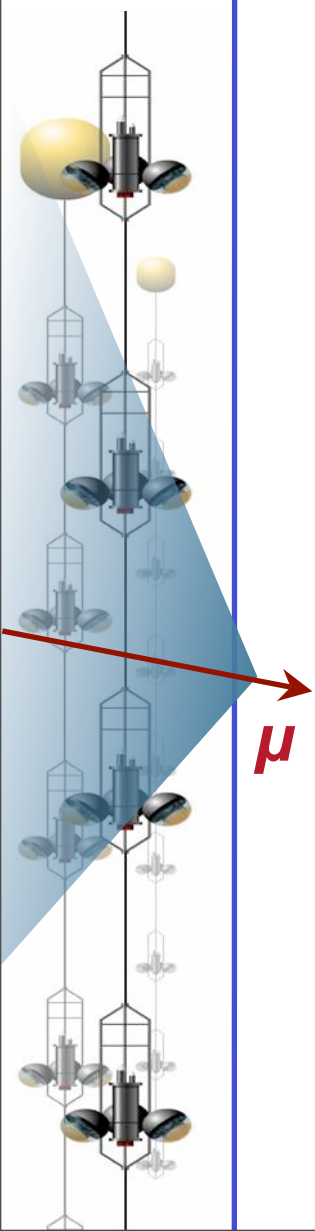
Atmospheric neutrino candidate

Run : 25929 Event : 6742 FrameTarget : 18 FrameIndex : 61770
 a: 37.1597 b: 22.0716 t0: 164892932.2 θ : 0.61779 ϕ : -3.7146 # fits : 4

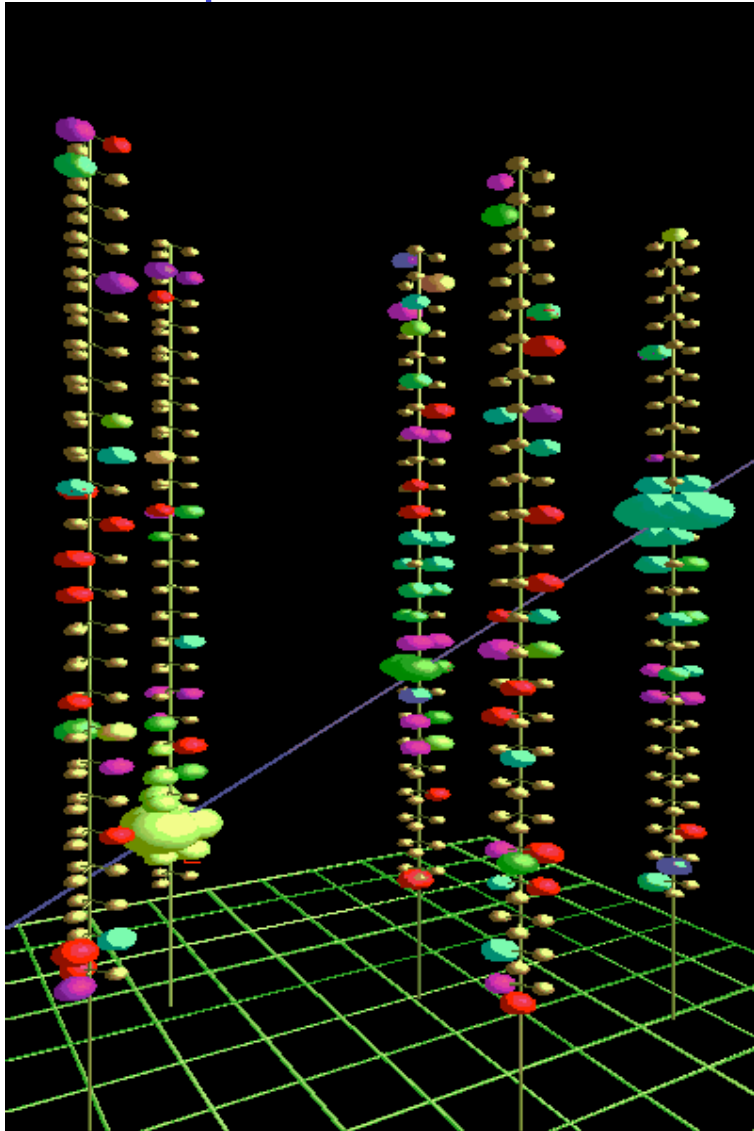
$$\theta = 35^\circ$$



Nadir angle distribution

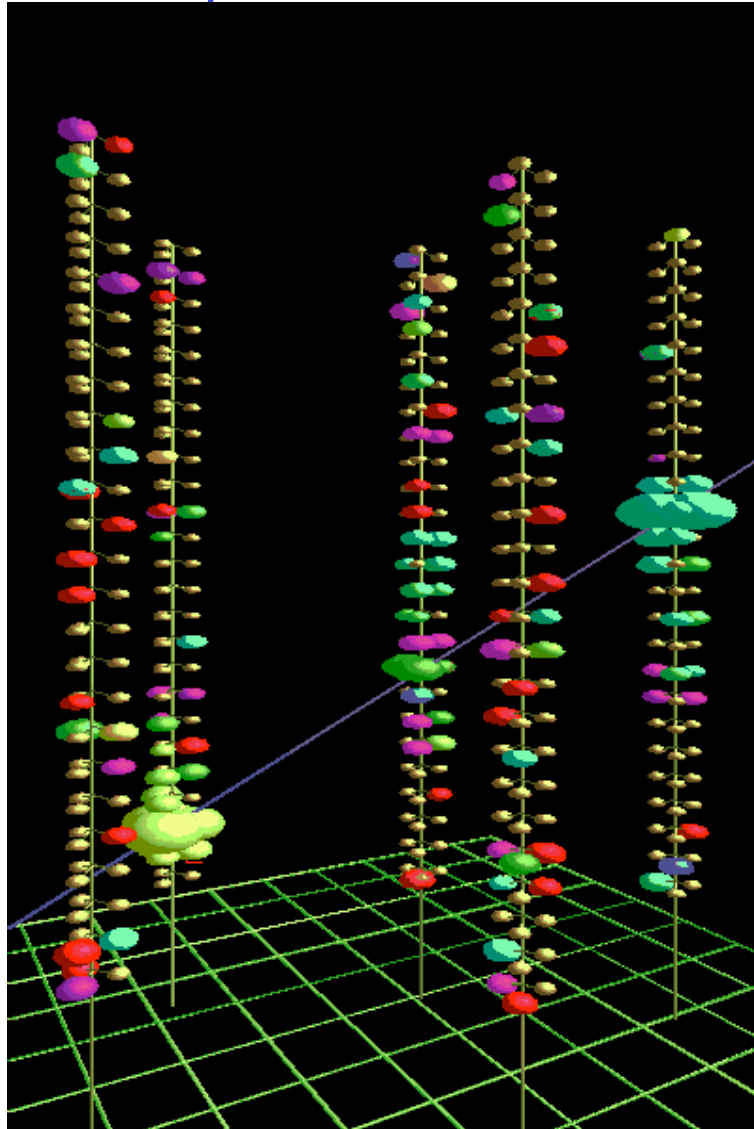


Conclusions and Outlook



- Major step forward during the last year
- Detector working well within design specifications:
 - Junction Box in operation since Dec. 2002
 - 5 lines delivering data on the site
 - All technical problems solved
- 12 lines detector complete early 2008:
Operation for science ≥ 5 years
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**Candidates for
first undersea neutrino !!**