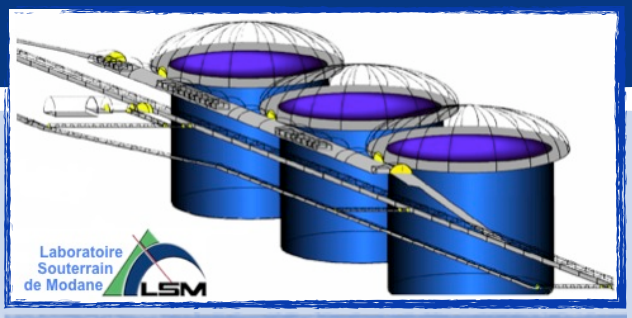
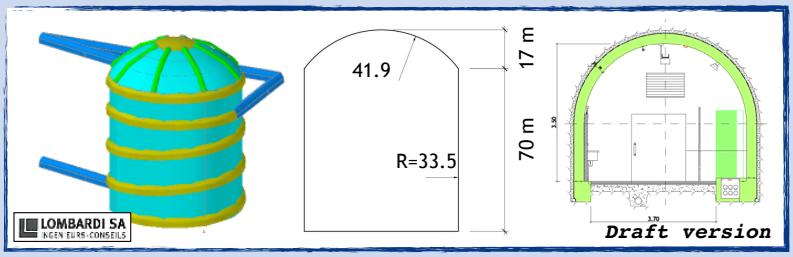
MEMPHYS

1-3 October 2009 - CERN



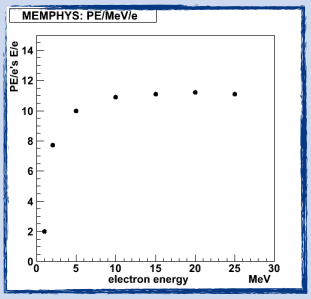
A water Čerenkov detector project of megaton scale to be installed in an underground site (studied in the LAGUNA European Design Study) and dedicated to nucleon decay, neutrinos from supernovae, solar and atmospheric neutrinos, as well as neutrinos from a **super-beam** or **beta-beam** coming from CERN.

Proposed cavern excavation and layout for the LAGUNA study



Summary of the physics potential of Memphys (440 ktons). The (*) stands for the case where some Gd is added.

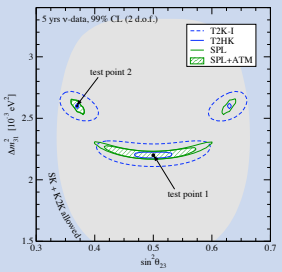
Proton decay	
$e^+ \pi^0$	1.0×10^{35}
anti-ν K^+	0.2×10^{35}
SN ν (10 kpc)	
CC	2.0×10^5(anti-ve)
ES	1.0×10^3(e)
DSNB ν (S/B 5 years)	43-109/47 (*)
Solar ν (Evts. 1 year)	
^{8}B ES	1.1×10^5
Atm. ν	4.0×10^4
Geo ν	need 2 Mev thr.
Reactor ν (Evts. 1	6.0×10^4 (*)



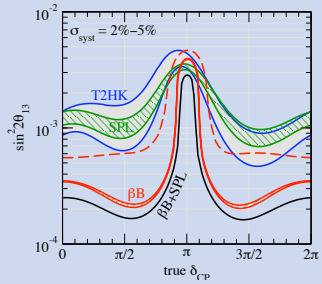
Memphys Geant4 simulation. Number of photoelectrons per Mev as a function of energy.

BEAMS

The main goals in neutrino physics will be pushing the search of a non-zero θ_{13} angle or its measurement in the case of a discovery previously made by one of the reactor and accelerator experiment (i.e. Double-Chooz or T2K); searching for possible leptonic CP violation; determining the mass hierarchy and the θ_{23} octant.



Allowed regions after 5 years neutrino data taking for SPL and ATM+SPL compared to T2HK and ATM+T2HK data.



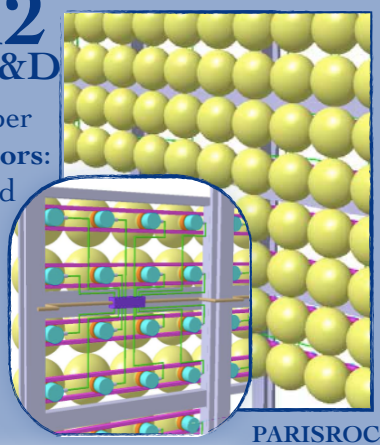
CP violation discovery potential for BetaBeam , SPL and T2HK. The width of the bends corresponds to values for the systematic errors from 2% to 5%.

PMm2 R&D

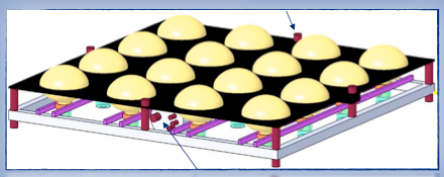
http://pmm2.in2p3.fr

- Large number of **light sensors**: need grouped acquisition;

- Common HV
- Common readout
- Common signal digitization



Demonstrator:



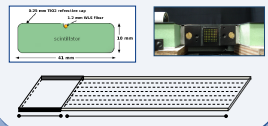
PARISROC

Memphyno

TEST BENCH for photodetection and electronic solutions for LARGE detectors

- Full test of the "electronic and acquisition" chain;
- Trigger threshold studies;
- Self-trigger mode;
- Track reconstruction performances;
- Gd doping: flexibility and performance.

Scintillator plans for the μ Hodoscope:



Test with muons:

Start with *4* PMT 10": Borexino

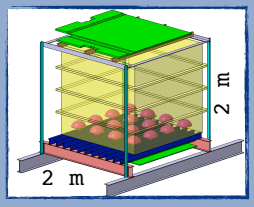
Test@Fréjus LSM

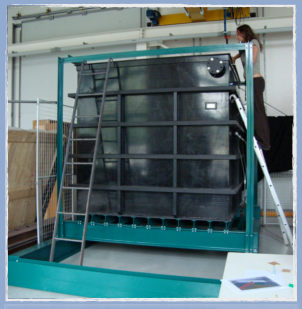
Test with underground background, same as MEMPHYS.

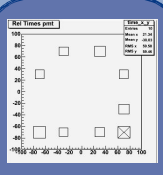
Test with e and π

- beam@CERN &/ or - beam@LAL

Test with the PMm2 Demonstrator@APC







Simulations with electrons and muons

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http://www.apc.univ-paris7.fr/APC_CS/Experiences/MEMPHYS/

References:

- "Physics potential of the CERN-MEMPHYS neutrino oscillation project" JHEP 0704:003,2007. e-Print: arXiv:hep-ph/0603172v3
- "MEMPHYS: A large scale water Čerenkov detector at Fréjus"" arXiv:hep-ph/0607026v1