

EUROnu

EuroNu: 4 year FP7 EU Design Study

"A High Intensity Neutrino Oscillation Facility in Europe" (started 1 Sept 08)



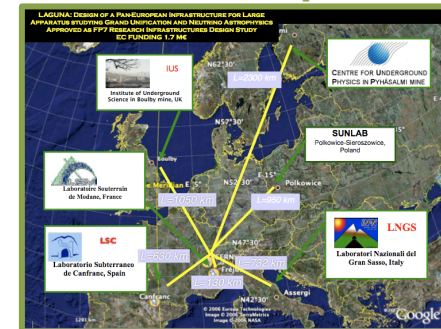
- **WP1: Management**
- **WP2: Super-Beam:** design of a 4 MW proton beam (SPL), target and collection system for a conventional neutrino beam
- **WP3: Neutrino factory:** define design for muon front-end, acceleration scheme, spent proton beam handling and component integration in an end-to-end neutrino factory simulation
- **WP4: Beta beam:** following from EURISOL, study production, collection and decay ring of beta beam for high Q isotopes (⁸Li, ⁸B)
- **WP5: Neutrino detectors:** study Magnetised Neutrino Iron Detector (MIND) performance for golden measurement at neutrino factory, water Cherenkov detector for beta and super beams and near detectors for all facilities
- **WP6: Physics:** comparison of physics performance, systematic errors and optimisation for all facilities

LAGUNA

Large Apparatus for Grand Unification and Neutrino Astrophysics

= > 7 sites candidates in Europe:

- Boulby
- Fréjus
- CNGS off-axis
- LSC
- Pyhäsalmi
- Sulab
- IFIN-HH



LENA: LIQUID SCINTILLATOR

DETECTOR LAYOUT

Cavern
height: 115 m, diameter: 50 m
shielding from cosmic rays: ~4,000 m.w

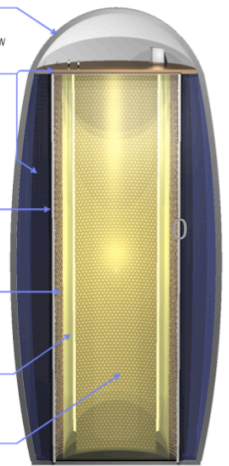
Muon Veto
plastic scintillator panels (on top)
Water Cherenkov Detector
1,500 phototubes
100 kt of water
reduction of fast neutron background

Steel Cylinder
height: 100 m, diameter: 30 m
70 kt of organic liquid
13,500 phototubes

Buffer
thickness: 2 m
non-scintillating organic liquid
shielding external radioactivity

Nylon Vessel
parting buffer liquid from liquid scintillator

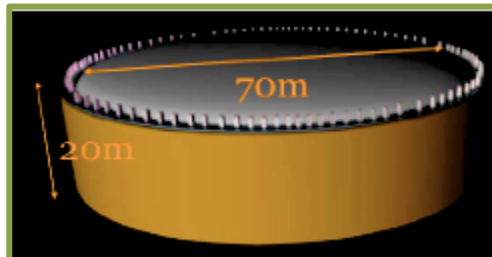
Target Volume
height: 100 m, diameter: 26 m
50 kt of liquid scintillator



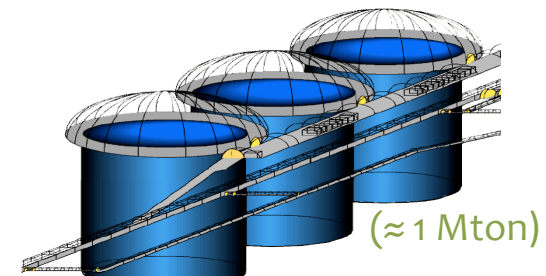
(→ 50 Ktons)

DETECTORS

GLACIER: LIQUID ARGON



MEMPHYS: WATER ČERENKOV



Proposal of a common template

- **With different neutrinos:**
 - β -beam
 - SPL –beam
 - Comb. β b & atm.
 - Comb. SPL & atm.

- **At different γ (for example):**
 - $\gamma = 100$
 - $\gamma = 300$
 - $\gamma = 590$
 - $\gamma = 3000$

Site	LAr	LSc	Wc
Frejus (130 Km) (4800 w.m.e)			
Canfranc (630 Km) (~2700 w.m.e.)			
Causo (730 Km) (~? w.m.e.)			
Poland (950 Km) (2200 w.m.e.)		Oriz.	X
Romania (?)		Oriz. ?	X
Boulby (1050 Km) (~? w.m.e.)			X
Pyhäsalmi (2300 Km) (~4500 w.m.e.)			1

○ **β -beam**




Site	LAr	LSc	WC
Frejus (130 Km)			
Canfranc (630 Km)			
Causo (730 Km)			
Poland (950 Km)			
Romania (?)			
Boulby (1050 Km)			
Pyhäsalmi (2300 Km)			

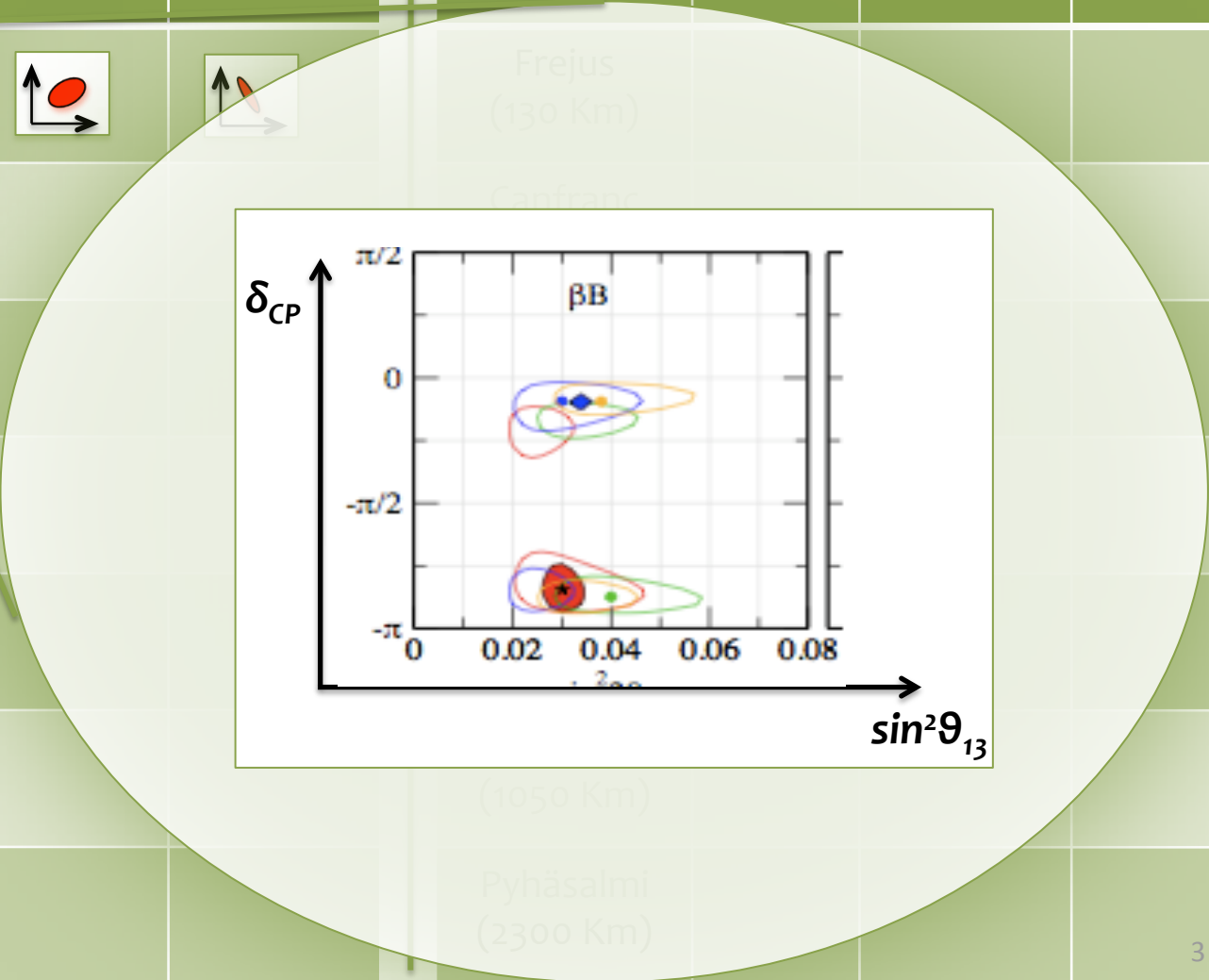
○ **SPL-beam**

Site	LAr	LSc	Wc
Frejus (130 Km)			
Canfranc (630 Km)			
Causo (730 Km)			
Poland (950 Km)			
Romania (?)			
Boulby (1050 Km)			
Pyhäsalmi (2300 Km)			

○ **β -beam**

○ **SPL-beam**

Site	LAr	LSc	WC	Site	LAr	LSc	Wc
Frejus (130 Km)				Frejus (130 Km)			
Canfranc (630 Km)				Canfranc (630 Km)			
Causo (730 Km)				Causo (730 Km)			
Poland (950 Km)				Poland (950 Km)			
Romania (?)				Romania (?)			
Boulby (1050 Km)				Boulby (1050 Km)			
Pyhäsalmi (2300 Km)				Pyhäsalmi (2300 Km)			



Detectors

- **Lar = Glacier**

Fiducial mass ?	Detector eff.?
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Fiducial mass ?	Detector eff.?
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- **LSc = Lena**

Fiducial mass 55 Kt?	Detector eff.?
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Fiducial mass 55 Kt?	Detector eff.?
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- **WC = Memphis**

Fiducial mass 440 Kt	Detector eff.?
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Fiducial mass 440 Kt	Detector eff.?
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Time of run

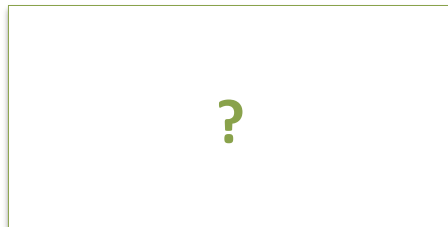
- **β -beam: 5 + 5 years**
=> ?
- **SPL: 7 + 3 years**
=> ?

BG (reactor) vs site

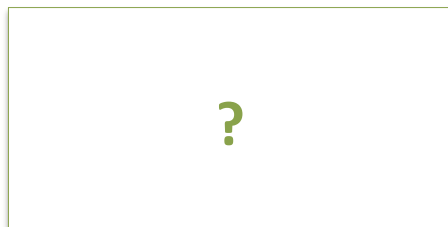
- Lar = Glacier



- LSc = Lena



- Memphys (in 1 cyl.)

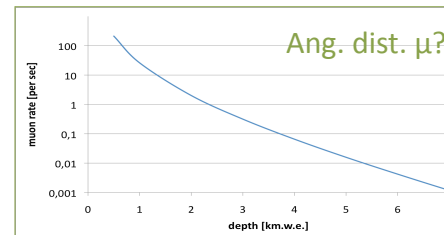


BG (μ) vs Depth

- Lar = Glacier

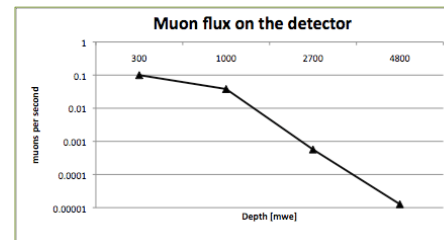


- LSc = Lena



Michael Wurm
(Lena)
26-27/01/09

- Memphys (in 1 cyl.)



MM, AT, TP.
(Memphys)
2009

APC: 7th May, 2009

CP violation phase δ , ϑ_{13} and hierarchy