

# Status report on Double Chooz

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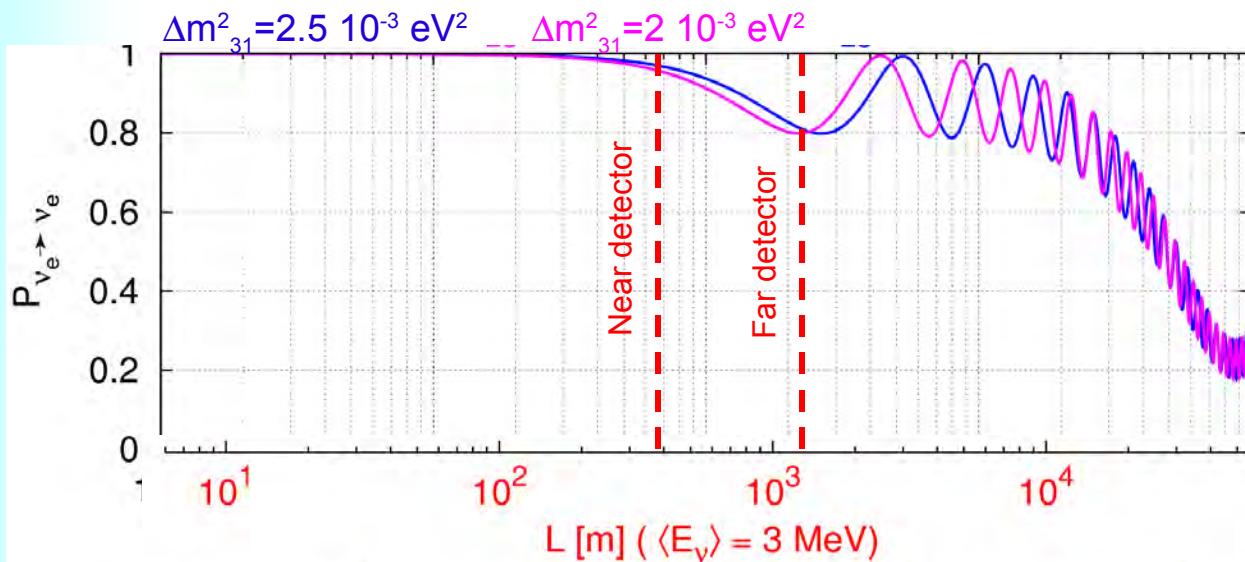
for the Double Chooz collaboration

# Overview

- $\theta_{13}$  measurement at reactors
- Double Chooz detector and discovery potential
- Status of the detector

# $\theta_{13}$ measurement at reactors

$$P(\bar{\nu}_e \rightarrow \bar{\nu}_e) = 1 - \sin^2(2\theta_{13}) \sin^2(\Delta m_{31}^2 L / 4E)$$



Present limit from CHOOZ:

$$R = 1.01 \pm 2.8\%(\text{stat}) \pm 2.7\%(\text{syst})$$

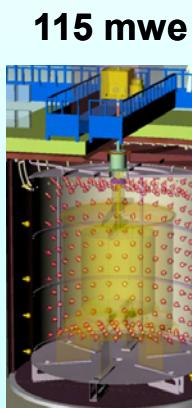
$$\sin^2(2\theta_{13}) < 0.15 \text{ (90\% C.L.) at } \Delta m_{31}^2 = 2.5 \times 10^{-3} \text{ eV}^2$$

1<sup>st</sup> source of systematic error in CHOOZ: uncertainties on reactor neutrino spectrum

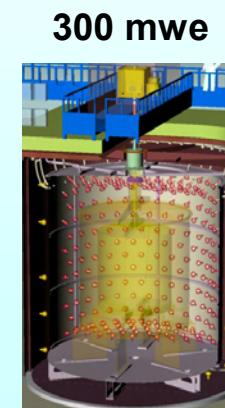
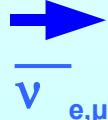
→ The Double Chooz solution



Nuclear Power Station

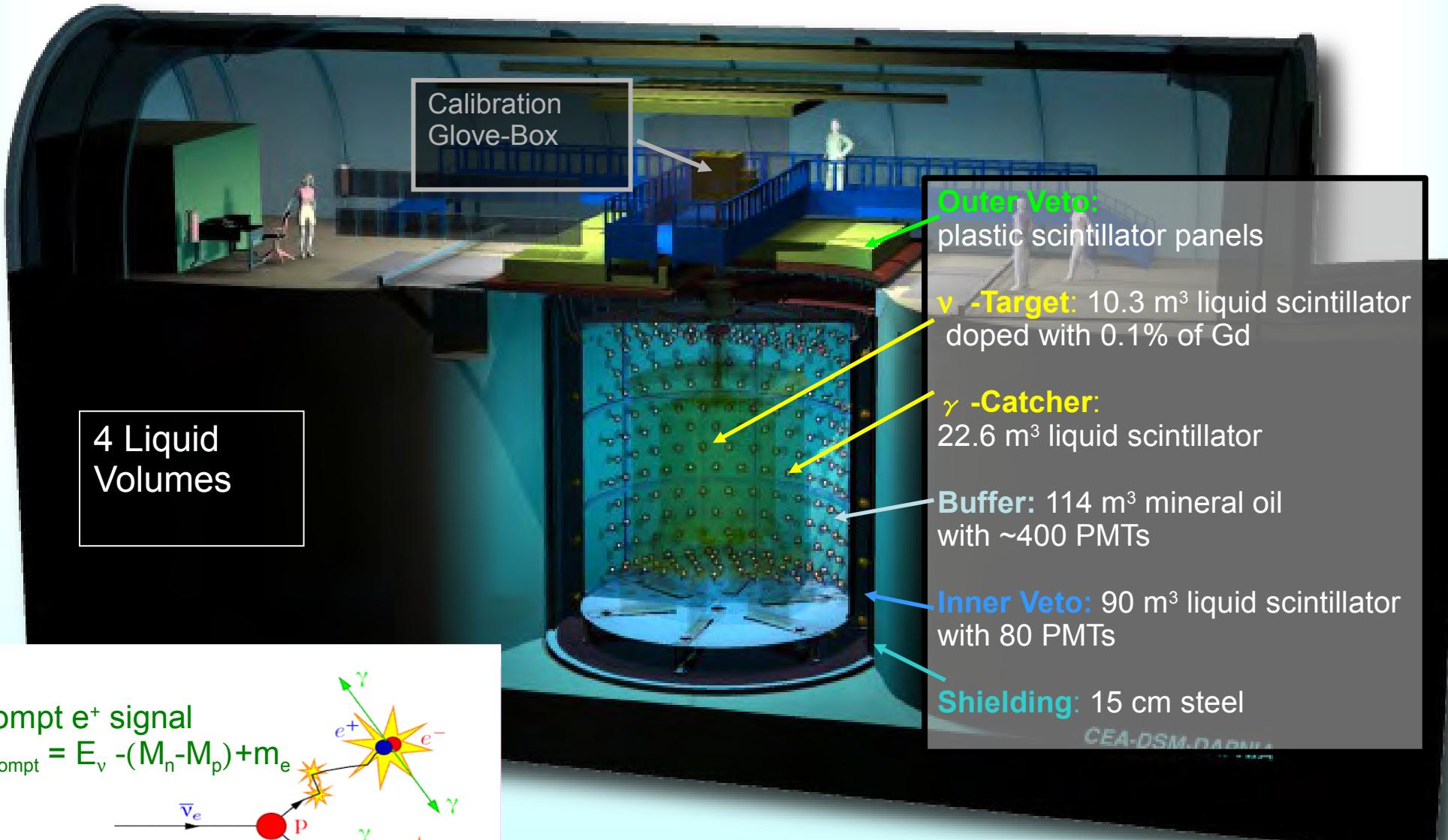


Near detector  
 $d=400 \text{ m}$   
218 ev./day

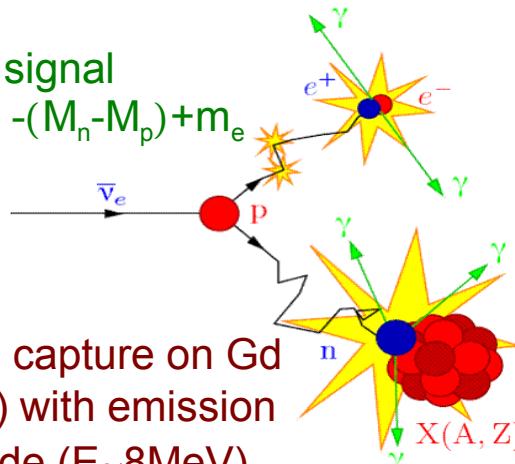


Far detector  
 $d=1050 \text{ m}$   
40 ev./day

# The detectors

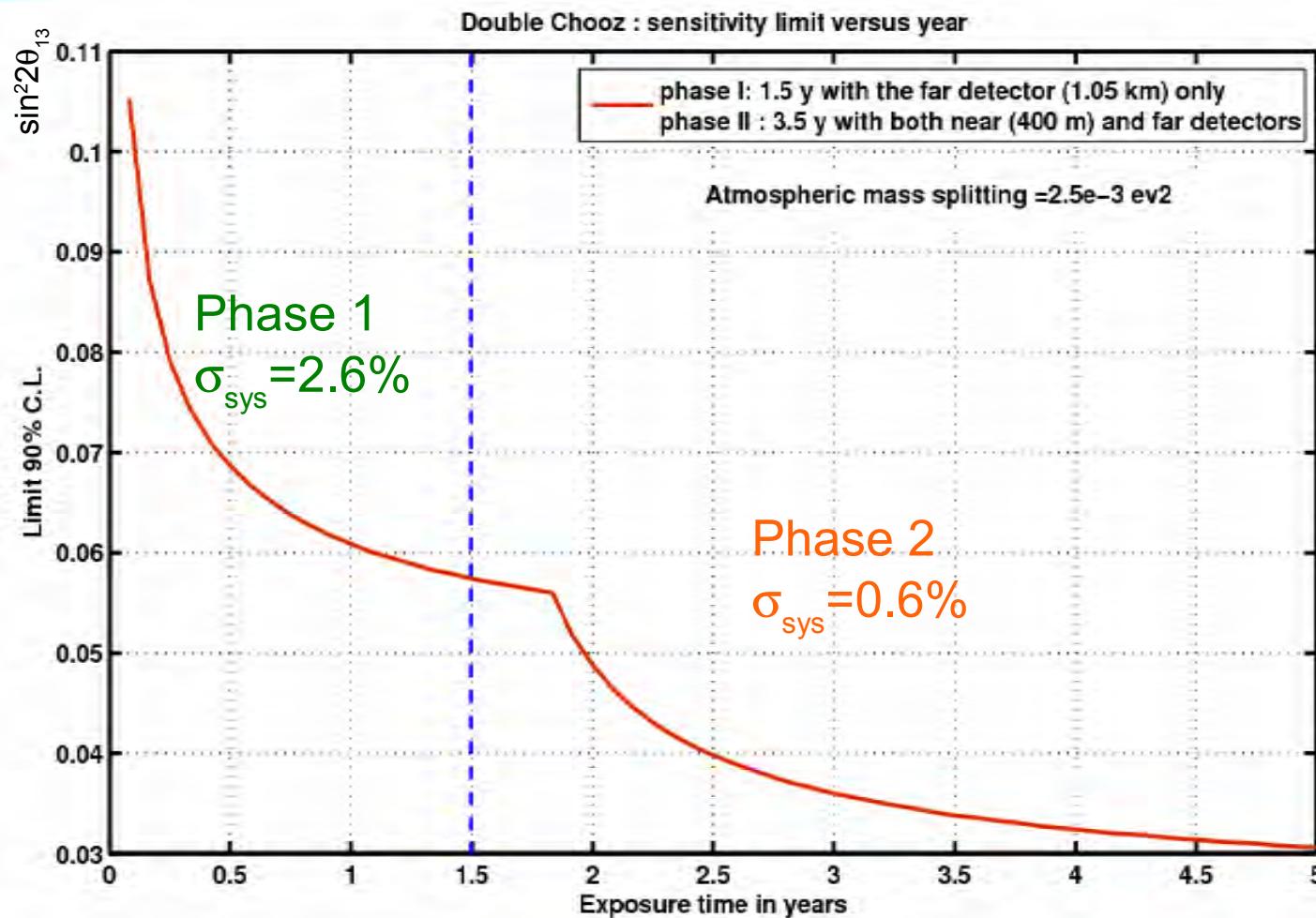


Prompt  $e^+$  signal  
 $E_{\text{prompt}} = E_{\bar{\nu}_e} - (M_n - M_p) + m_e$



Delayed n capture on Gd  
( $\tau \sim 30 \text{ ms}$ ) with emission  
of  $\gamma$  cascade ( $E \sim 8 \text{ MeV}$ )

# Double Chooz sensitivity to $\theta_{13}$



Two phases:

- 1) Far detector only  
10 x CHOOZ statistics  
 $\sin^2 2\theta_{13} < 0.06$
- 2) Far + Near detectors  
Shape Analysis  
 $\sin^2 2\theta_{13} < 0.03$

Error description	Absolute	Realative
Production cross section	1.9%	/
Reactor power	2.0%	/
Energy per fission	0.6%	/
Solid angle	/	0.06%
Detection cross Section	0.1%	/
Target mass	0.2%	0.2%
Number of protons	0.5%	0.1%
Particle identification	0.4%	0.4%

# Far detector construction (1)

June 08: starting of the work



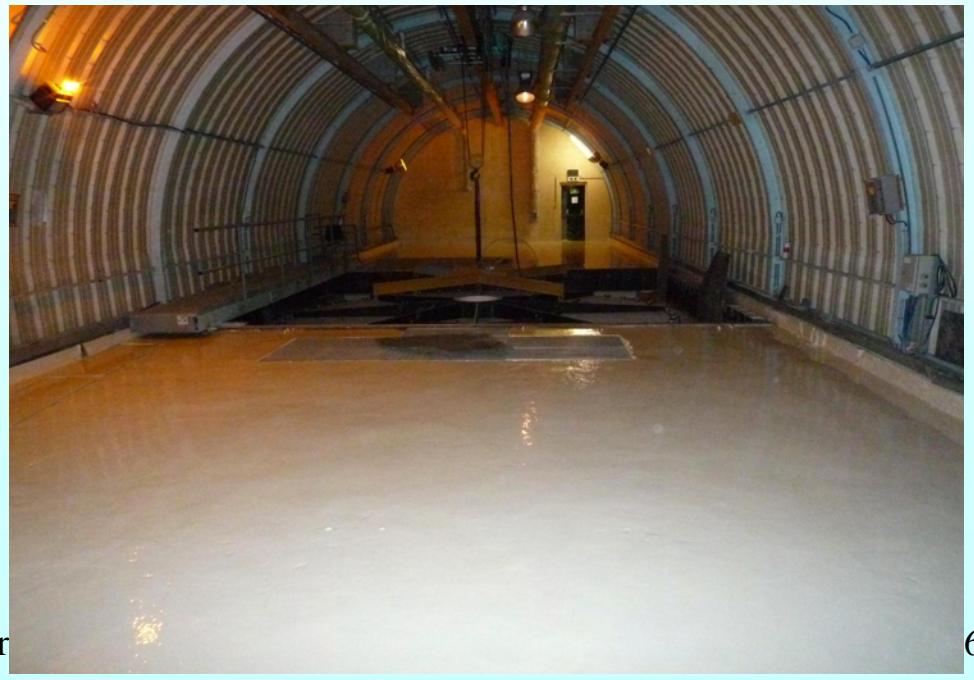
September 08: the steel shielding.



November 08: the inner veto tank



Dec 08 - Jan 09: painting and cleaning

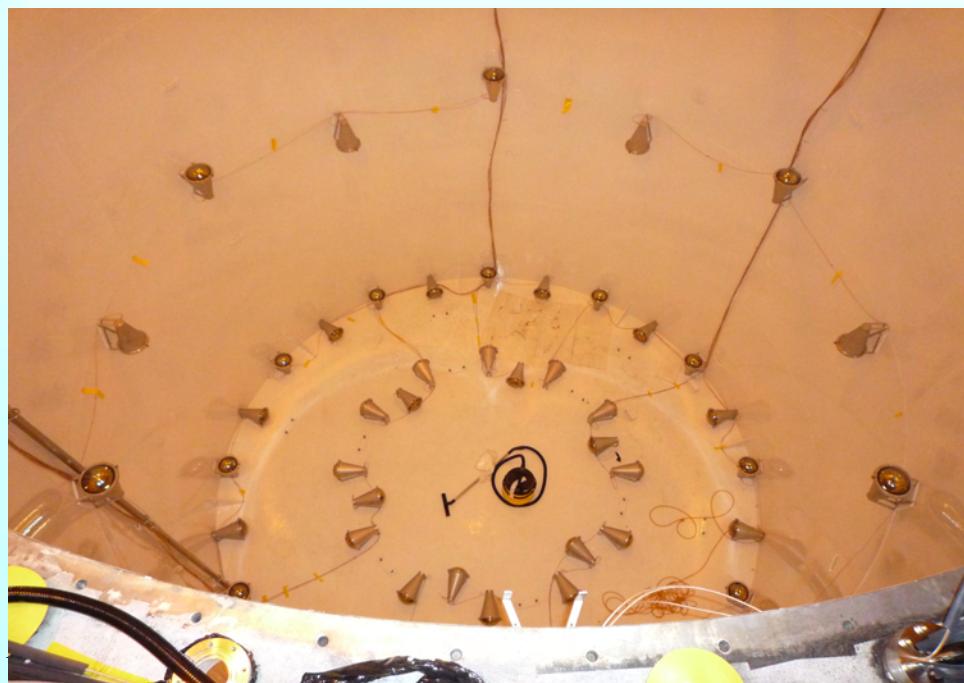


# Far detector construction (2)

February 09: the inner veto cleaning ....



...and the inner veto PMT mounting



le Moriond EW 200

and the ISO6 tend mounting...

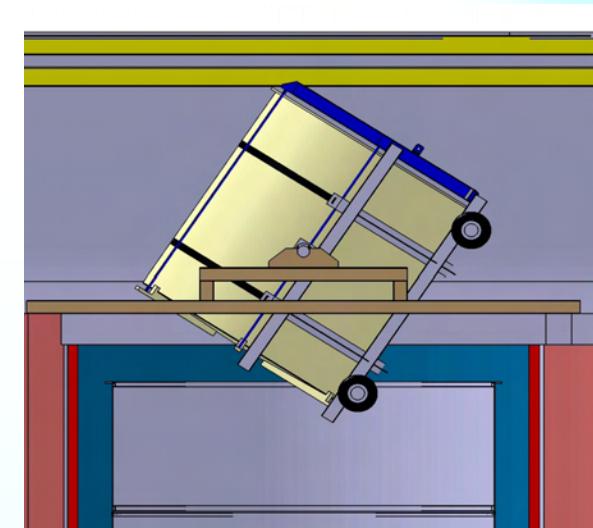


Presently: Buffer tank installation



# Future

- Spring 09: buffer PMT integration
- Summer 09: acrylic target and  $\gamma$ -catcher integration



- Autumn 09: DAQ installation and liquid filling

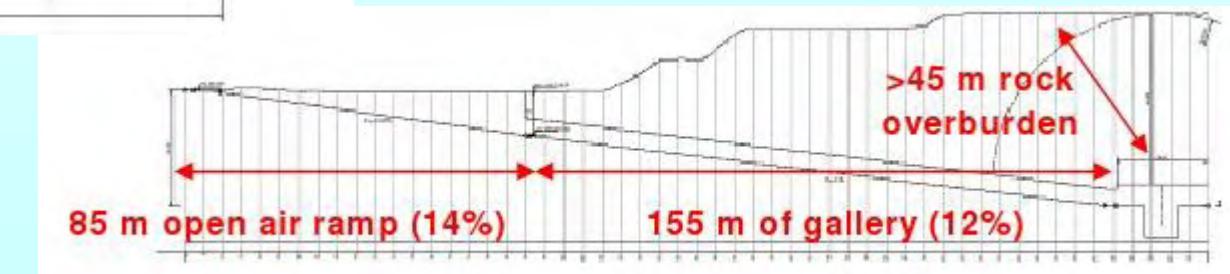
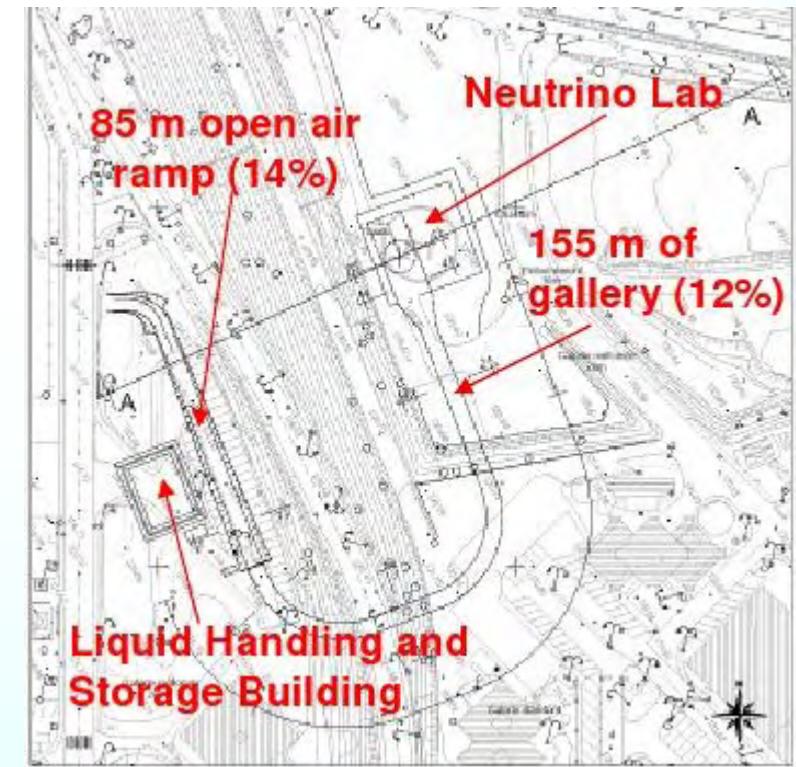
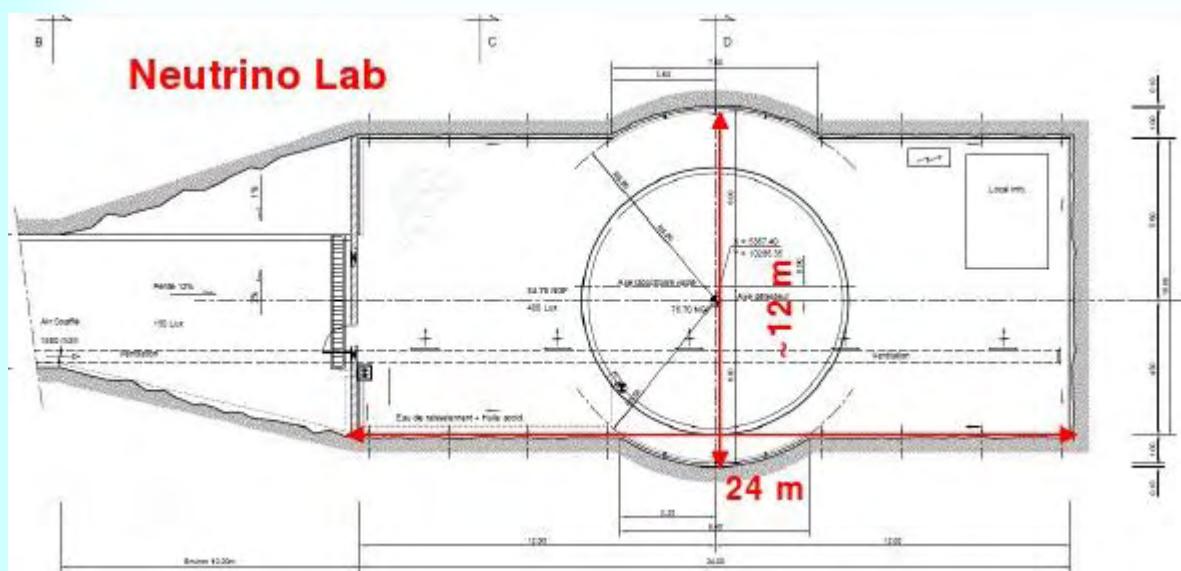


High precision  
weight measurement  
of target liquid

- First neutrino event @ the end of this year
- Beginning 2010: outer veto and glove box installation

# Near laboratory

- Site engineering study completed
- Starting of construction soon
- End of construction middle 2011



# Conclusions

- Double Chooz is the first “new generation” reactor neutrino experiment using 2 identical detectors
- We reduce background and errors respect to CHOOZ
- Far detector under construction
- First data from far detector at the end of this year
  - If no oscillation measured:  $\sin^2 2\theta_{13} < 0.06$  in 1.5 years (90% C.L.)
- Data taking with far + near detectors from 2011
  - If no oscillation measured:  $\sin^2 2\theta_{13} < 0.03$  in 3 years (90% C.L.)