



Status of the Double Chooz, Experiment

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 Double Chooz: Collaboration, Experimental concept, Detector, Physics Prospect, Status & Schedule,

• Summary

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Double Chooz Collaboration



35 institutes, 8 countries

Double Chooz Experiment



TIBL



Detecctor Design/ Physics Prospects

How to improve CHOOZ result?

CHOOZ Result : $sin^{2}(2\theta_{13}) < 0.2$ R_{osc} = 1.01 ± 2.8% (stat) ± 2.7% (syst)

NUBL Double Chooz: 2 phases We are here now! Timeline 2010 2011 2012 2013 2008 2009 2007 Data Taking (Phase 1) **Construction Far** Design Cstr. Data Taking (Phase 2) Near Phase 1: Far Detector Only Phase 2:Far + Near Detector Identical detectors cancel **Improve statistics** systematics on. ✓ Large target volume ✓ Longer stable operation ✓ Neutrino flux/Reactor power ✓ Acceptance, Cross section and etc... **Improve systematics** Better detector design ✓ Low BG PMT/material Better understand of Background ✓ Buffer oil/Gamma catcher and Energy scale is important ✓ Improved Cosmic-Veto detectors for the further reduction of systematic errors

CHOOZ Result :**sin²(2**θ₁₃)<**0.2**

 R_{osc} (=Observe/Exptect)= 1.01 \pm 2.8% (stat) \pm 2.7% (syst)



Detector Design

New 4-region large detector concept

Outer Veto: plastic scintillator strips (400 mm)

v-Target: 10,3 m³ scintillator doped with 4.5g/l of Gd compound in an acryclic vessel (8 mm)

 γ -Catcher: 22,3 m³ scintillator in an acrylic vessel (12 mm)

Buffer: 110 m³ of mineral oil in a stainless steel vessel (3 mm) viewed by 390 PMTs

Inner Veto: 90m³ of scintillator in a steel vessel equipped with 78 PMTs

Veto Vessel (10mm) & Steel Shielding



How much can we improve?

@CHOOZ: R = 1.01 ± 2.8%(stat) ± 2.7%(syst)

- Statistical error -

Luminosity incerase $L = \Delta t \times P(GW) \times Np$

Large detection volume & Long stable operation are necessary

	CHOOZ	Double-Chooz
Target volume	5,55 m ³	10,2 m ³
Target composition	6,77 10 ²⁸ H/m ³	6,82 10 ²⁸ H/m ³
Data taking period	Few months	3-5 years
Event rate	2700	CHOOZ-far : 50,000/3 y CHOOZ-near: ~2.5x10 ⁵ /3 y
Statistical error	2,8%	0,5%

Systematic on Analysis/Selection



Efficiency is **INSENSITIVE** to the energy scale error In total, **0.2~0.3%** syst. err.:

OUBLE

Better Energy calibration (depends on position) realize further reduction





Backgrounds

Estimated with CHOOZ OFF data & Simulation (represent CHOOZ data well)





@CHOOZ: R = 1.01 ± 2.8%(stat) = 2.7%(syst)

- Systematic errors -

Systematic error	CHOOZ	Dobule Chooz
Reactor Cross section	1.9%	-
Number of protons	0.8%	0.2%
Detection efficiency	1.5%	0.5%
Reactor power	0.7%	-
Energy per fission	0.6%	-
Total systematic error	2.7%	<0.6%

Double Chooz Goal in Phase 2 (Far+Near) Thanks to improved detector design and 2 detectors concept

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Achievable sensitivity of $sin^2 2\theta_{13}$



(5 year measurement)



Status of construction/ Schedule in the future

Far detector construction

Material	Status of installation
Steel shield	Complete 🖌
Inner veto tank	Complete 🖌
Inner veto PMT (8" 78PMTs)	Complete 🗸
Buffer tank	Complete 🗸
Buffer tank PMT(10" 390PMTs)	Complete 🗸
Gamma catcher and Target vessels	Complete 🗸
Close Lids	Complete 🗸
Electronics/DAQ installation	On going
Liquid filling	Soon











PMT installation

400High performance low background 10" PMTs(Oil proof) (HAMAMATSU R7081MOD-ASSY)





Acrylic vessel installation



Gamma Catcher transport



Gamma Catcher installation



Acrylic vessels in lab

Acrylic vessels in buffer tank









Status of the Near site





Summary

- The Double Chooz experiment
 - Double Chooz will be the first of a new generation of reactor neutrino experiments. It is the one of the best experimental concept to measure θ_{13}
- The status of DoubleChooz Experiment
 - Detector Construction are close to the final stages.
 - Installation of DAQ/Electronics starts in the next week.
 - Filling of Liquid Scintillator follows.
 - We should observe the neutrino from reactor in this year!
 - Construction of the near site/detector will be started soon.
- Prospects for the future
 - First data taking expected to start in 2010 with far detector only ⇒sin²(2θ₁₃) < 0.06 in 1.5 year
 - From year 2011~, take data with the both near and far detectors
 ⇒sin²(2θ₁₃) < 0.03 in +3 years