- Session I: Absolute neutrino mass
- Session II: Oscillations at low energies
- Session III: Oscillations at high energies
- Session IV: Messengers of the universe
- Session V: Messengers of new physics

Session III: Oscillations at high energies

Session III (plenary): Oscillations at high energies Chair: Lucia Votano		
Time	**Speaker**	**Title**
8.40 - 9.15	Claudio Giganti	*T2K results and perspectives (pdf)*
9.15 - 9.50	Ryan Patterson	*Oscillation searches with the NuMI beam (pdf)*
coffee break (20')		
10.10 - 10.45	Omar Benhar	*Neutrino cross sections and precision oscillation parameters (pdf)*
10.45 - 11.20	Giovanni De Lellis	*Searching for tau and heavier neutrinos (pdf)*
11.20 - 11.55	Marzio Nessi	*The CERN Neutrino Facility (pdf)*

Session III (parallel) Oscillations at high energies **Conveners**: Pilar Coloma and Andrea Longhin		
Time	**Speaker**	**Title**
16.00-16.20	Mattias Blennow	*Mass hierarchy at future oscillation facilities (pdf)*
16.20-16.40	Pedro Machado	*Learning about the CP phase in the next 10 years (pdf)*
16.40-17.00	Enrique Fernandez-M.	*Future prospects for CP violation in oscillations (pdf)*
17.00-17.20	Emiliano Molinaro	*Leptogenesis: recent developments (pdf)*
17.40-18.00	Soebur Razzaque	*Super-PINGU for measuring CP violation (pdf)*
18.00-18.20	Antonia Di Crescenzo	*OPERA (pdf)*
18.20-18.40	Elizabeth Worcester	*LBNF (pdf)*
18.40-19.00	Alessandra Tonazzo	*LBNO (pdf)*
19.00-19.20	Elena Wildner	*ESSnuSB (pdf)*

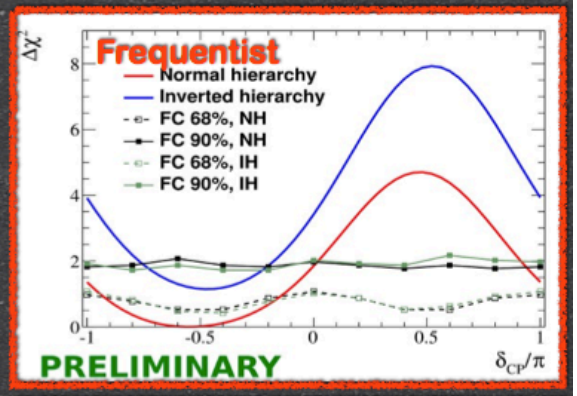
T2K: Joint ν_e / ν_μ fit

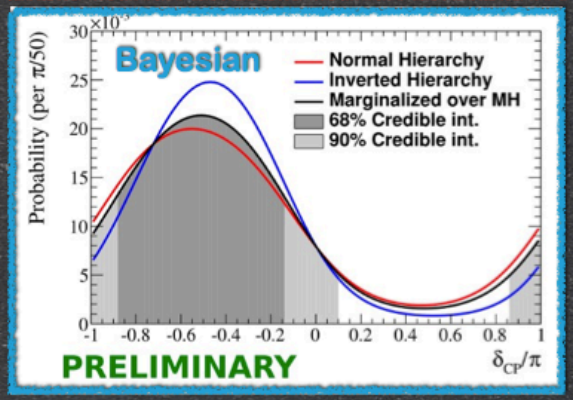
Joint fit analysis

2 different analyses:
- Frequentist based on Feldman-Cousins
- Bayesian based on Markov Chain MC

- Use reactor constraint from PDG $\sin^2(2\theta_{13})=0.095\pm0.010$
- Both analyses give similar results
- Best fit value of $\delta_{CP} \sim -\pi/2$
- Values of $\sim 0.1 < \delta_{CP}/\pi < \sim 0.8$ excluded at more than 90% CL
- (very) weak preferences for NH and second octant

(%)	NH	IH	Sum
$\sin^2\theta_{23} \le 0.5$	18	8	26%
$\sin^2\theta_{23} > 0.5$	50	24	74%
Sum	68%	32%	





T2K ND Sterile Search:

Results

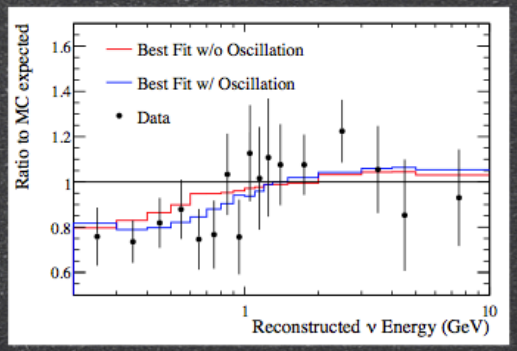
Frequentist method for confidence intervals (FC)

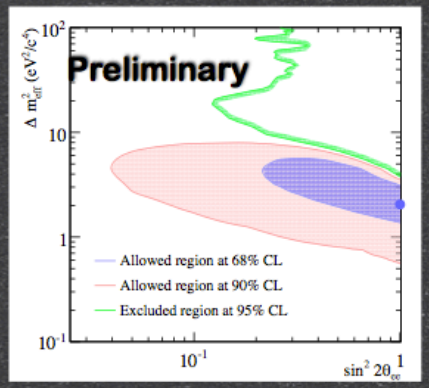
p-value with respect to null oscillation hypothesis: 8.4%

Best fit values $\sin^2 2\theta_{ee}=1$ and $\Delta m^2_{41}=2.14\ eV^2$

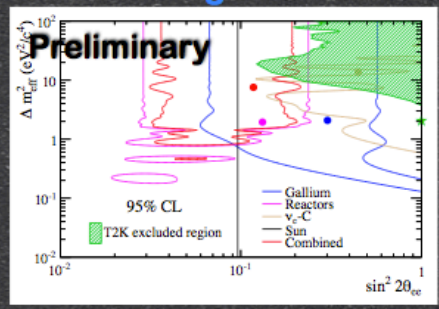
95% CL excluded intervals: $\sin^2 2\theta_{ee}>\sim 0.3$ and $\Delta m^2_{41}>\sim 7\ eV^2$

need to repeat this analysis when more data will be available!





95% CL comparison: T2K with reactor and gallium anomaly



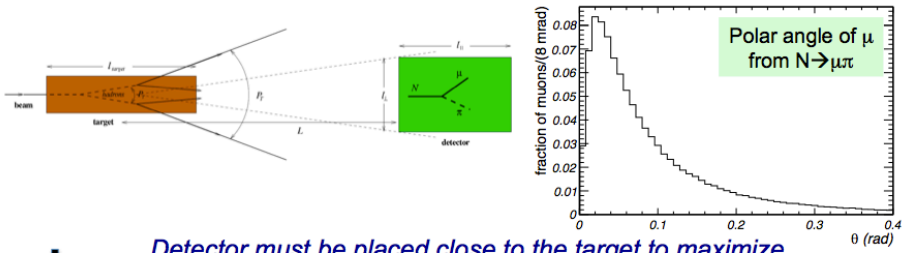
39

SHIP: Heavy neutrino search (CERN)

Experimental requirements

- *Search for HNL in Heavy Flavour decays*

  → *Beam dump experiment at the SPS with a total of 2×10^{20} protons on target (pot) to produce a large number of charmed hadrons*
  CNGS: 1.8 x 10^{20} pot, 2011 run: 4.8 x 10^{19} pot
- *HNLs produced in charm decays have significant P_T*



→ *Detector must be placed close to the target to maximize geometrical acceptance*

→ *Effective (and "short") muon shield is essential to reduce muon-induced backgrounds (mainly from short-lived resonances accompanying charm production)*

Secondary beam-line

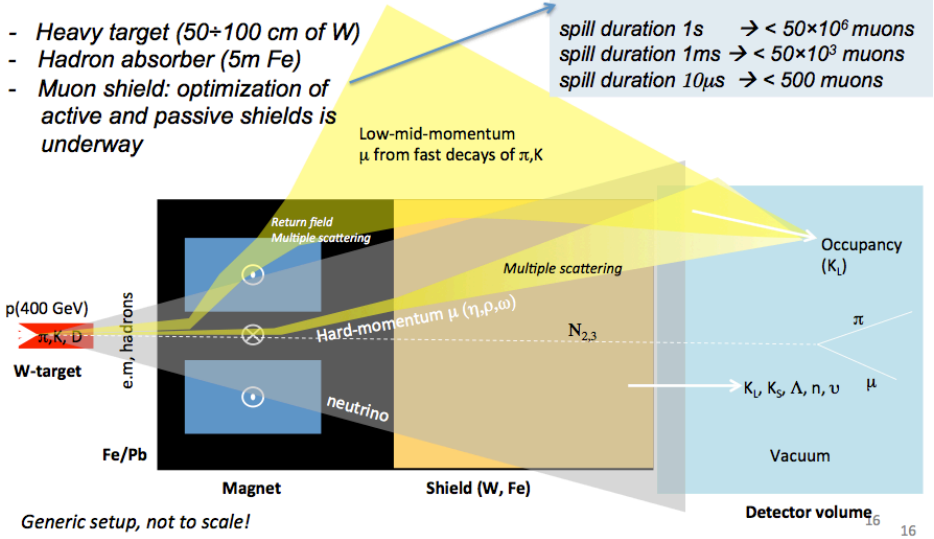
(different from a conventional neutrino facility)

Initial reduction of beam induced backgrounds

- *Heavy target (50÷100 cm of W)*
- *Hadron absorber (5m Fe)*
- *Muon shield: optimization of active and passive shields is underway*

Acceptable occupancy <1% per spill of 5×10^{13} p.o.t.

spill duration 1s → < 50×10^{6} muons
spill duration 1ms → < 50×10^{3} muons
spill duration 10μs → < 500 muons



Generic setup, not to scale!

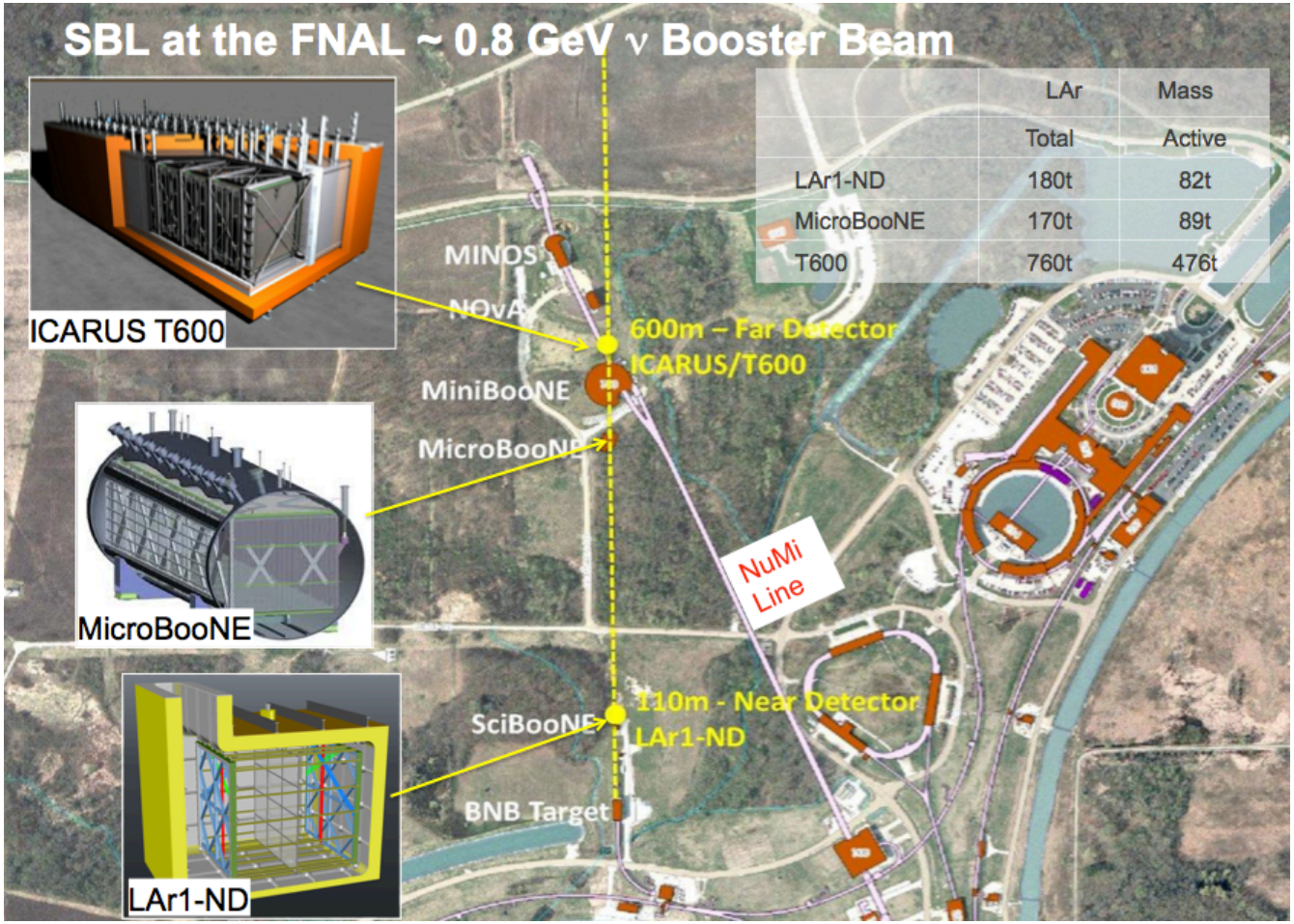
16

Marzio Nessi: CERN Plans

In summer 2014 some more events

- *APPEC Paris meeting dedicated to Large Neutrino Infrastructures, where most FAs and leaders in the field where present and have started drafting a possible future strategy*
  - *CERN broke symmetry and announced that it will freeze for the moment all types of Neutrino beams at CERN (Short and Long Baseline) in favor of common activities in the US and Japan*
- In July FNAL management called for a meeting/discussion on how to plan the future of the the LBNF facility in the US creating two working groups:
  - *IIEB : an interim steering group which should bring together a new international Collaboration able to lead the detector and physics effort*
  - *An ad hoc taskforce which should draft the rules for a US based international High Intensity Facility*

Marzio Nessi: CERN Plans



Also multiple slides with detailed description of LBNF: LBNE beamline, far site, etc

Marzio Nessi: CERN Plans

Details on projects considered for “neutrino platform”, info on how to propose other projects. Specifics given for WA104, WA105

LBNF (my talk):

Overview

2

- Physics Introduction
- Comment on US Neutrino Strategy
- Experiment Optimization Studies
- LBNE Status
  - Experiment Design
  - Physics Sensitivity
  - 35-ton Prototype
  - Analysis Tools
  - Systematic Uncertainty
- Summary and Outlook

Elizabeth Worcester: Long-Baseline Neutrino Experiment NOW, 10 September 2014

Questions:

- Timescale in light of reformulation?
- Risk of scaling up to 35 kt?
- Possibility/location of additional WbLS detector?
- Appropriate to ask people to join LBNE in light of LBNF? (Stavros Katsanevas)

LBNO (Alessandra Tonazzo)

Summary and outlook

- **LBNO** : a staged approach for a "very long"-baseline neutrino experiment
  - 2300km baseline
    => MH discovery @5σ guaranteed in 4-5 years of phase 1
    => δ_{CP} coverage @3σ: large since Phase-1, @5σ: with Phase-2
    including realistic systematics and study of their impact
  - large overburden => interesting potential for p-decay, SN neutrinos, atmospheric and solar neutrinos, indirect DM searches
- The Design Study phase is now concluded, the LAGUNA-LBNO D.S. deliverables will soon be available on ArXiv
- Next step: **LBNO-DEMO (WA105)**
  - demonstrator for a 100-ton-scale DLAr detector @ CERN Neutrino Facility, to test technical solutions and physics measurements

Questions:

- Are you going to join LBNF? DOE $ not on table forever
- Patrick Huber: 2nd max is nice, clean way to access CPV, but very expensive way – be careful spending $ to go after 2nd max

ESS: Elena Wildner

5 MW!!!!

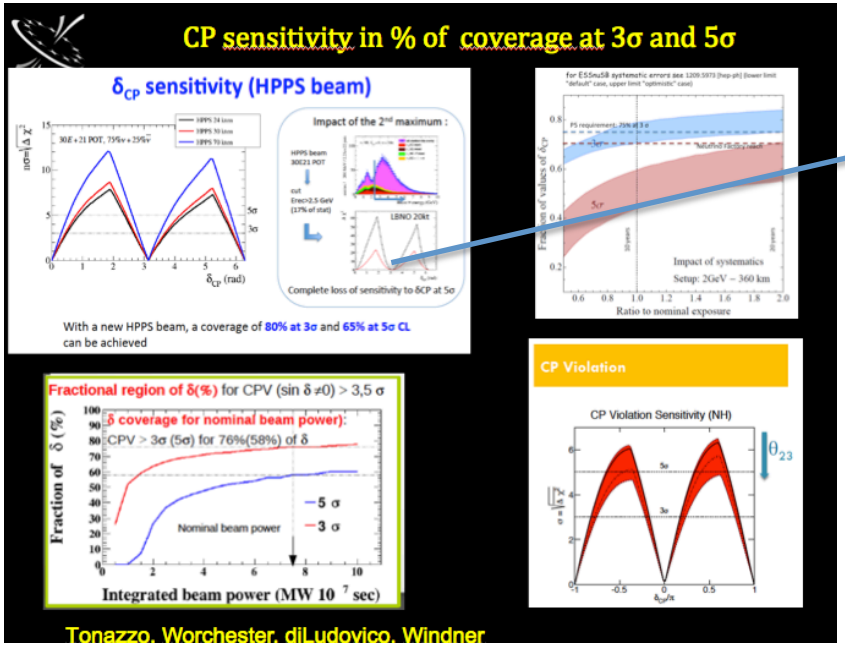
When and to what price ?

- ✓ Total price of ESSnuSB including the detector is 1.2 BEUR:
  - ✓ 100 MEUR linac
  - ✓ 200 MEUR accumulator
  - ✓ 200 MEUR target station
  - ✓ 700 MEUR the far detector

- ✓ If we have our CDR in 2018 and if we convince everybody to build this facilities, we could start construction at the moment when the neutron facility will be ready, i.e., 2023. The construction could last up to 2030-2032 when we will be able to start data taking.

- ✓ If LBNE starts earlier (e.g. 2029-2030), in one or two years ESSnuSB will accumulate more protons on the target than LBNE.

Summary Talk: Stavros Katsanevas



Strong emphasis on 2nd max.

- "P5 opened Fermilab to the rest of the world"
- "Question of baseline is open, although it is difficult…"

THE PRESS RELEASE I

APPEC

"Neutrino physics enters the global era"

- The agencies and laboratory directors gathered at the International Meeting on Large Neutrino Infrastructures agreed that the understanding of the neutrino sector is a worldwide priority promising physics beyond the Standard Model in a unified theoretical framework that goes from the Electroweak Scale to the highest energy scales. Furthermore, this program is complementary to neutrino related measurements made in cosmology and provides crucial input to the knowledge of the Universe…

1. Concerning the first domain, they welcome the recent approval by the CERN council of the medium-term CERN plan, including the hosting of a neutrino platform at CERN for R&D and prototyping for the next generation of neutrino detectors, as the main CERN investment to the development of a worldwide program.
2. They also welcome the proposed upgrade of the J-PARC beam and the proposal to construct Hyper-Kamiokande, … with large international participation in Kamioka…
3. They support the vision of the HEPAP/P5 report to host an international facility for short and long-baseline neutrino oscillations at Fermilab, where internationally driven collaborations are encouraged to propose a program optimised in baseline and detector technology. This approach, in parallel with the decision of Fermilab to upgrade its beam infrastructure (PIP-II) gives the opportunity for a rich international neutrino program at Fermilab.