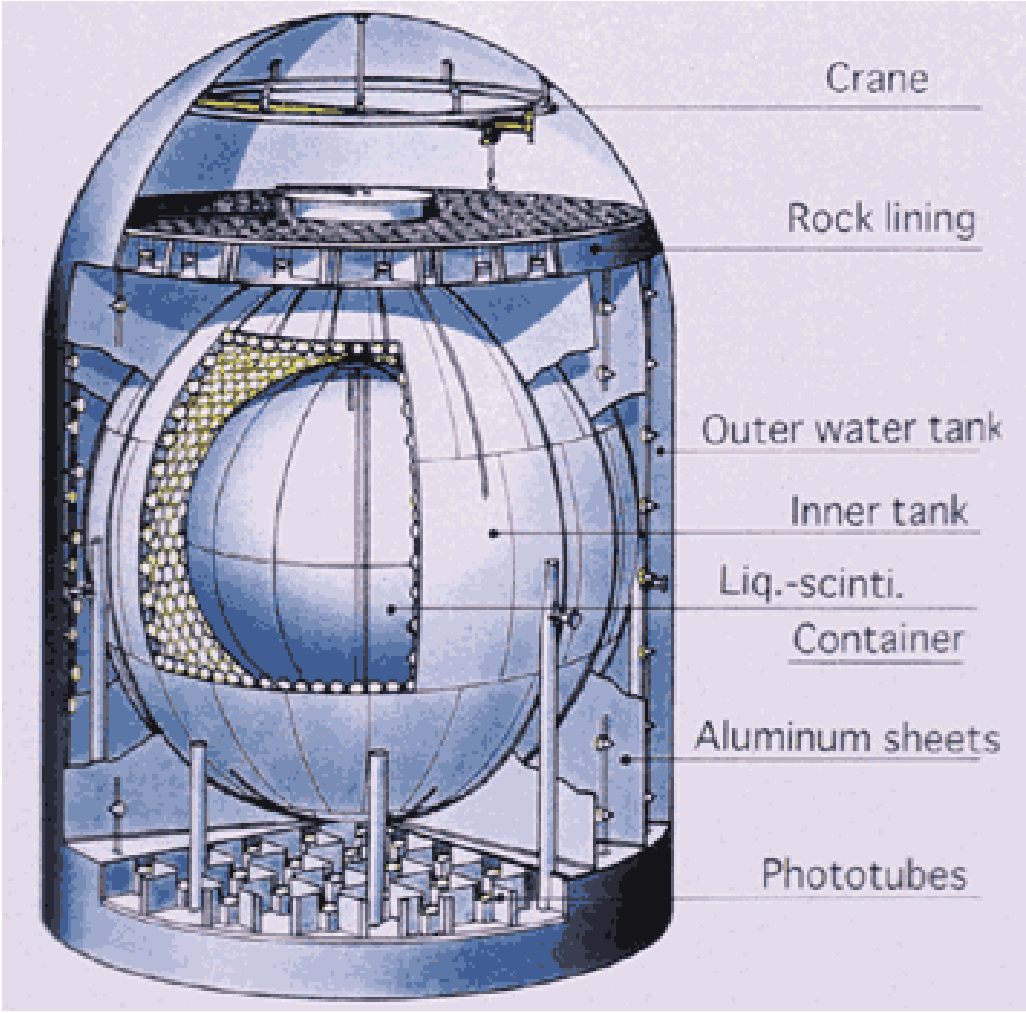
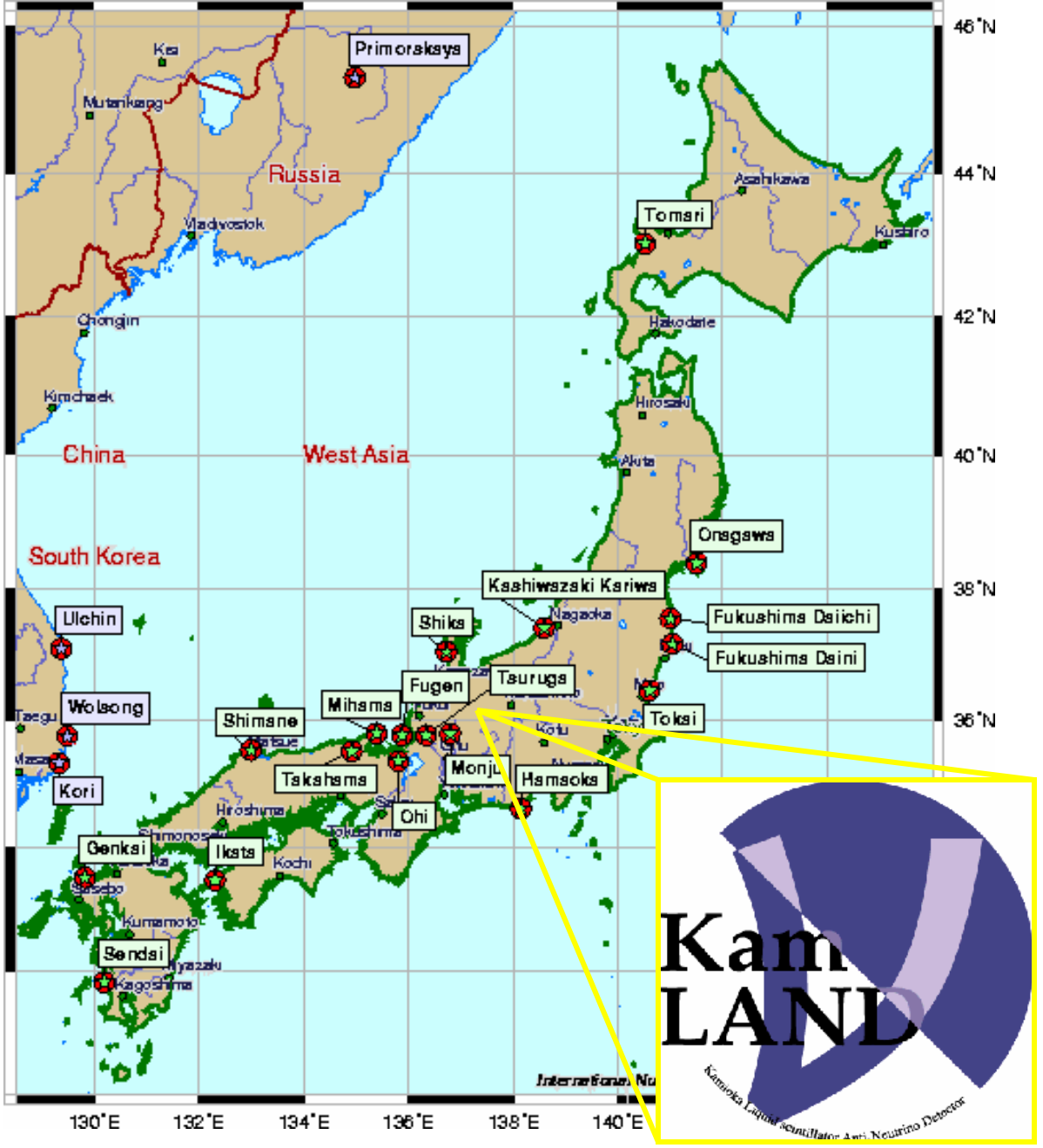
KamLAND: brief status report

Tohoku, KEK, Alabama, Caltech, Drexel, Hawaii, LBNL, New Mexico, Stanford, Tennessee, TUNL, UCB, Collaboration

KamLAND: the ultimate reactor neutrino oscillation experiment

- 1 kton liq. Scint. Detector in the Kamioka cavern
- ~1300 17" fast PMTs
- ~700 20" large area PMTs
- 30% photocathode coverage
- H_2O Cerenkov veto counter
- Multi-hit deadtime-less electronics
- Δm^2 sensitivity $7*10^{-6}$ eV^2 LMA-MSW solution within reach <u>on the earth !</u>

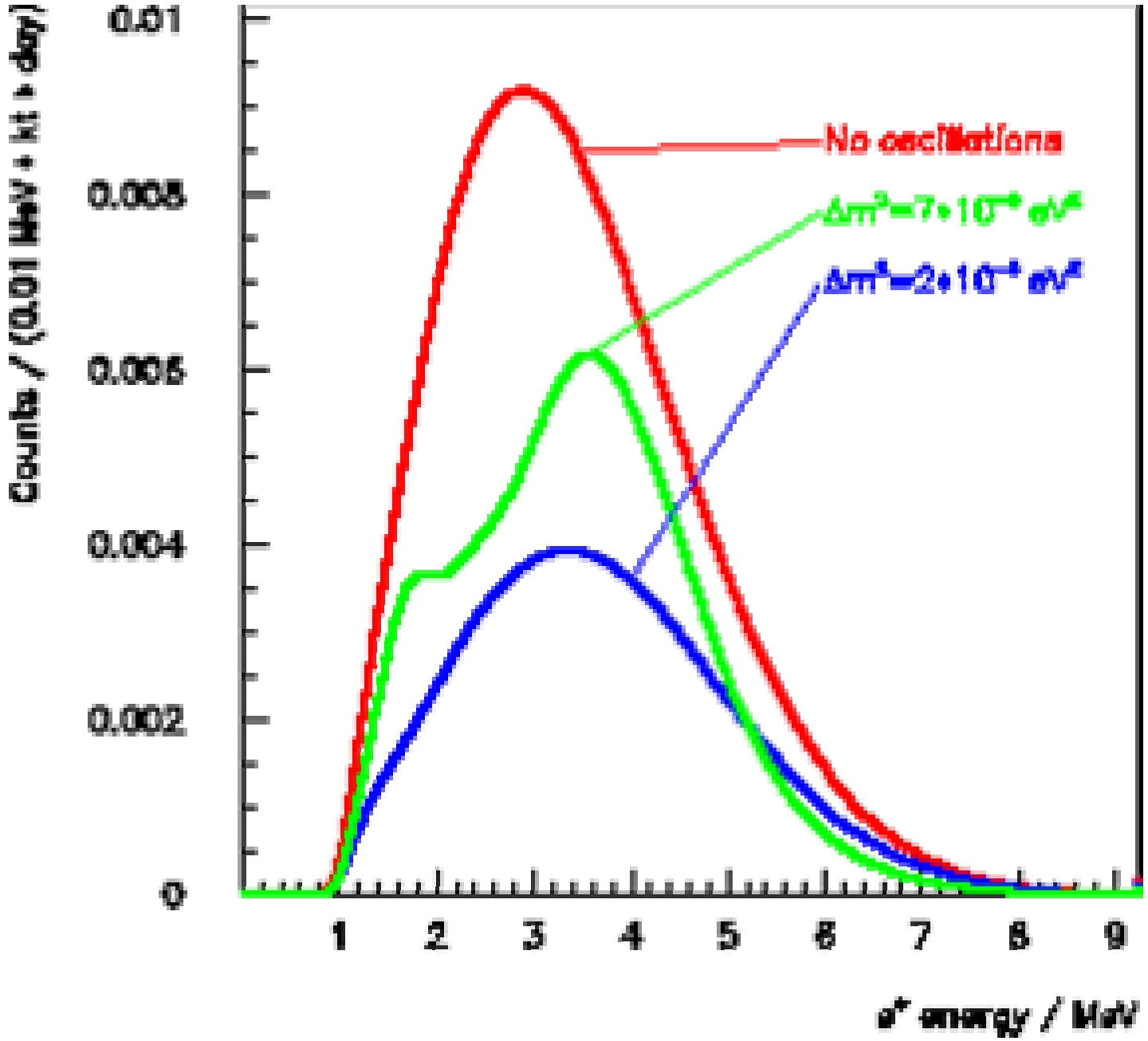



Primorskaya
Russia
Tomari
Onagawa
Kashiwazaki Kariwa
Fukushima Daiichi
Fukushima Daini
Tokai
Shika
Fugen
Tsuruga
Mihama
Shimane
Takahama
Monju
Hamaoka
Ohi
Ikata
Genkai
Sendai
Ulchin
Wolsong
Kori
China
West Asia
South Korea
46°N
44°N
42°N
40°N
38°N
36°N
130°E
132°E
134°E
136°E
138°E
140°E
KamLAND

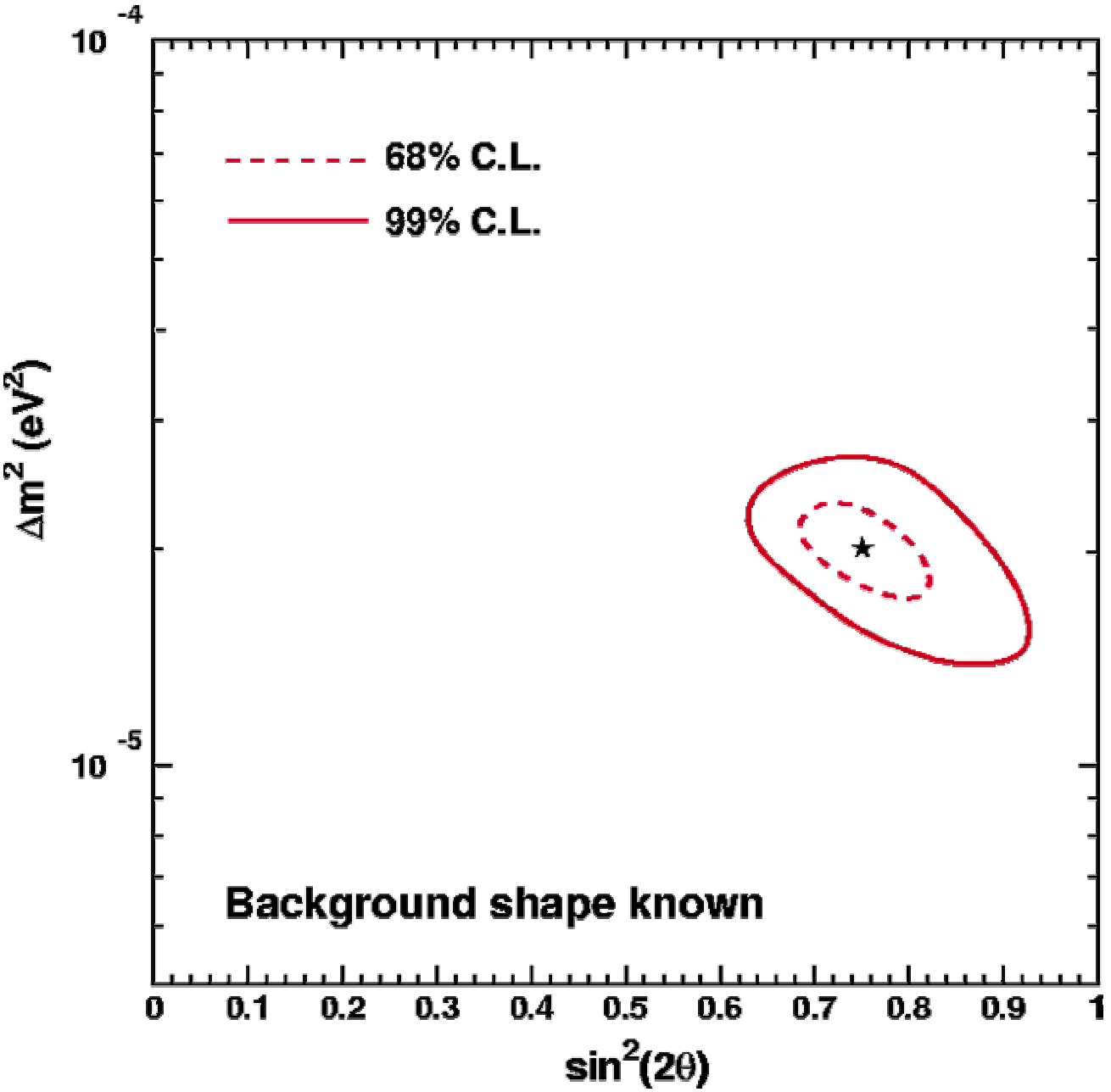
Baseline is limited:
85.3% of signal has
140 km < L < 344 km

The total electric power produced "as a by-product" of the vs is:

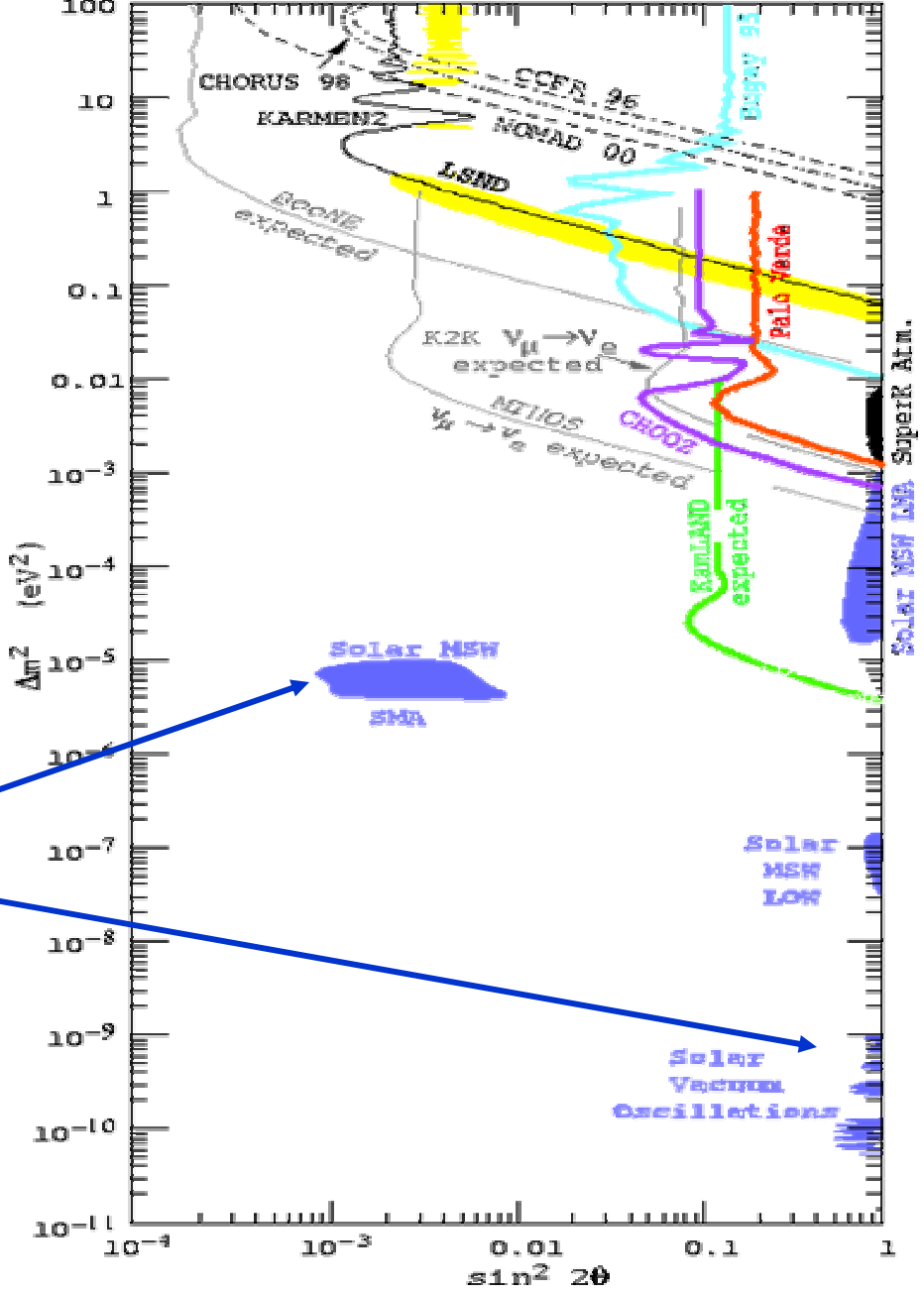
- ~60 GW or...
- ~4% of the world's manmade power or...
- ~20% of the world's nuclear power


Counts / (0.01 MeV • kt • day)
0.01
0.008
0.006
0.004
0.002
0
No oscillations
1
2
3
4
5
6
7
8
9
e+ energy / MeV

Very accurate measurement possible if the LMA-MSW solution is correct !



KamLAND has a real chance of observing oscillations in the LMA-MSW regime !!



Mostly ruled out
By most recent
SNO result

Other physics topics include:

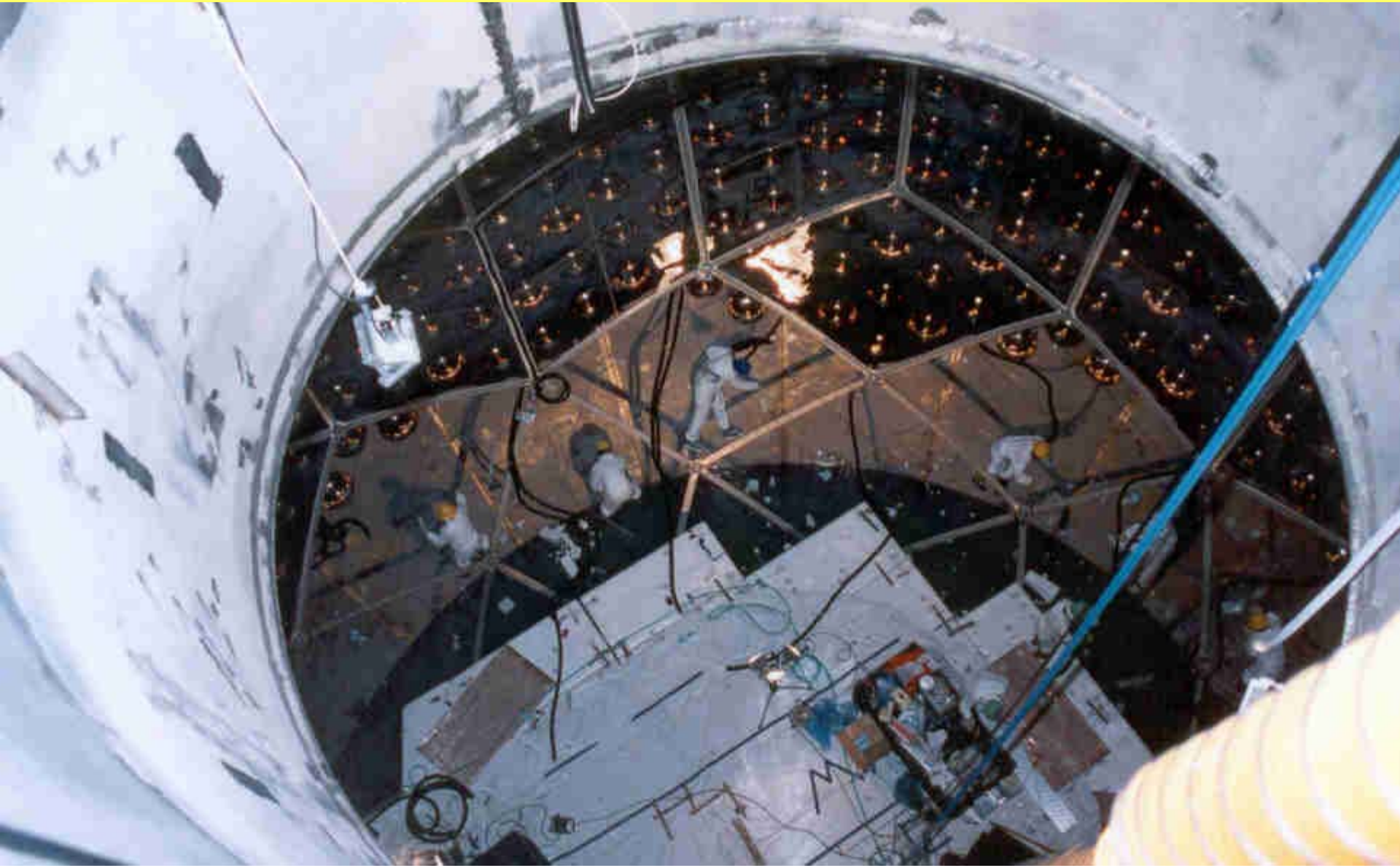
- Terrestrial neutrinos
- Supernovae
- Solar anti-neutrinos
- Exotic nucleon decay modes

In addition KamLAND is a *scalable* detector
A possible future physics topic is the detection of Be^7 neutrinos from the sun… if backgrounds will allow this
Every effort has been made to preserve this possibility and after reactor neutrino running we will learn how large backgrounds for singles are

KamLAND construction timeline

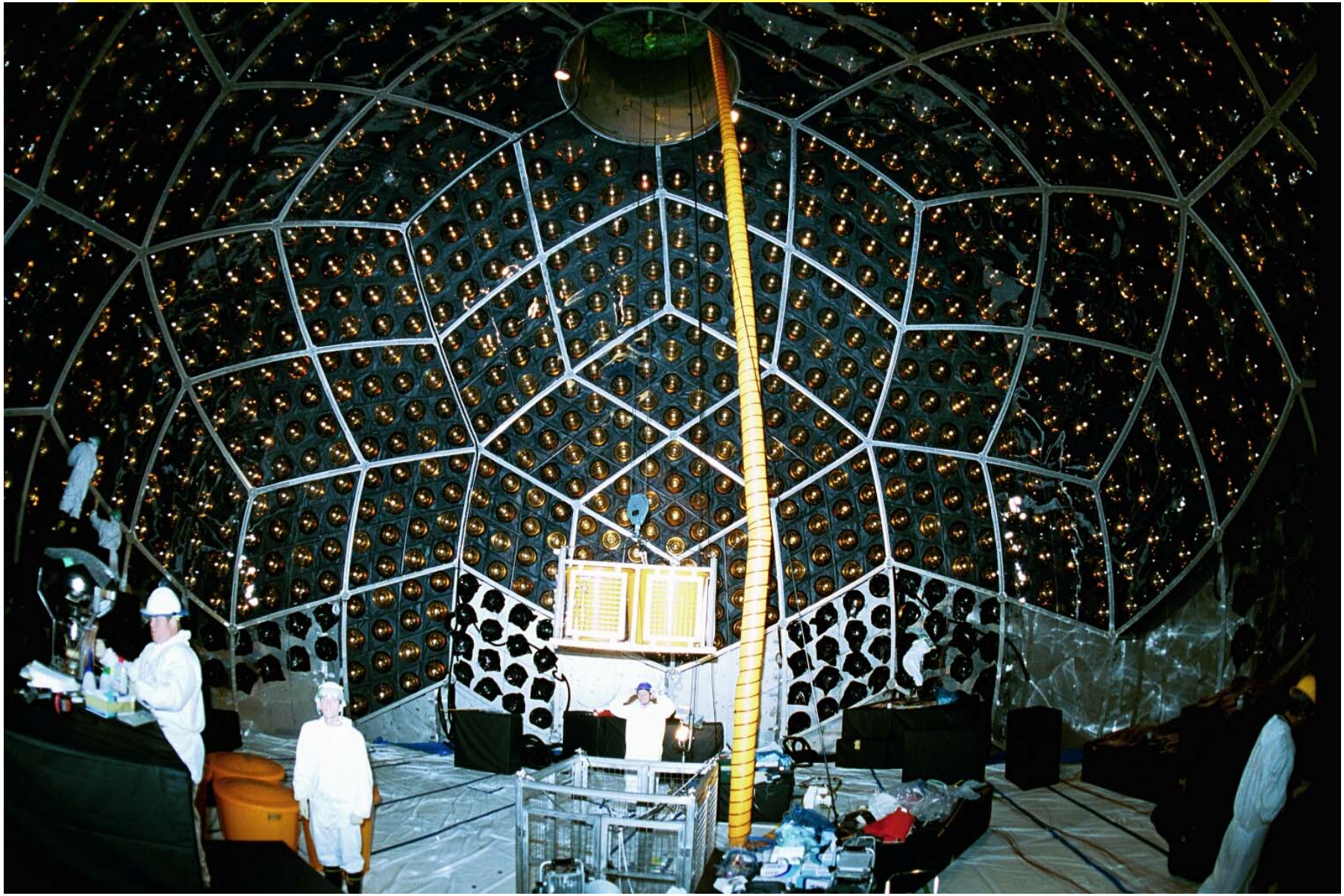
- Summer 2000 — PMT installation
- Winter 2000-01 — Veto counter installation
- Feb 2001 — Balloon insertion
- March 2001 — Ehut installation
- Mar-Apr 2001 — Balloon inflation and test
- Apr-May 2001 — Plumbing for fill
- Jun-Sept 2001 — Fill MO and LS
- Aug-Sept 2001 — Engineering runs with Macro Elec.
- Sept 2001 — FEE/DAQ/Trigger integration (LBNL)
- end Sept 2001 — First data taking tests with FEE

Cleaning the KamLAND sphere (Summer 2000)

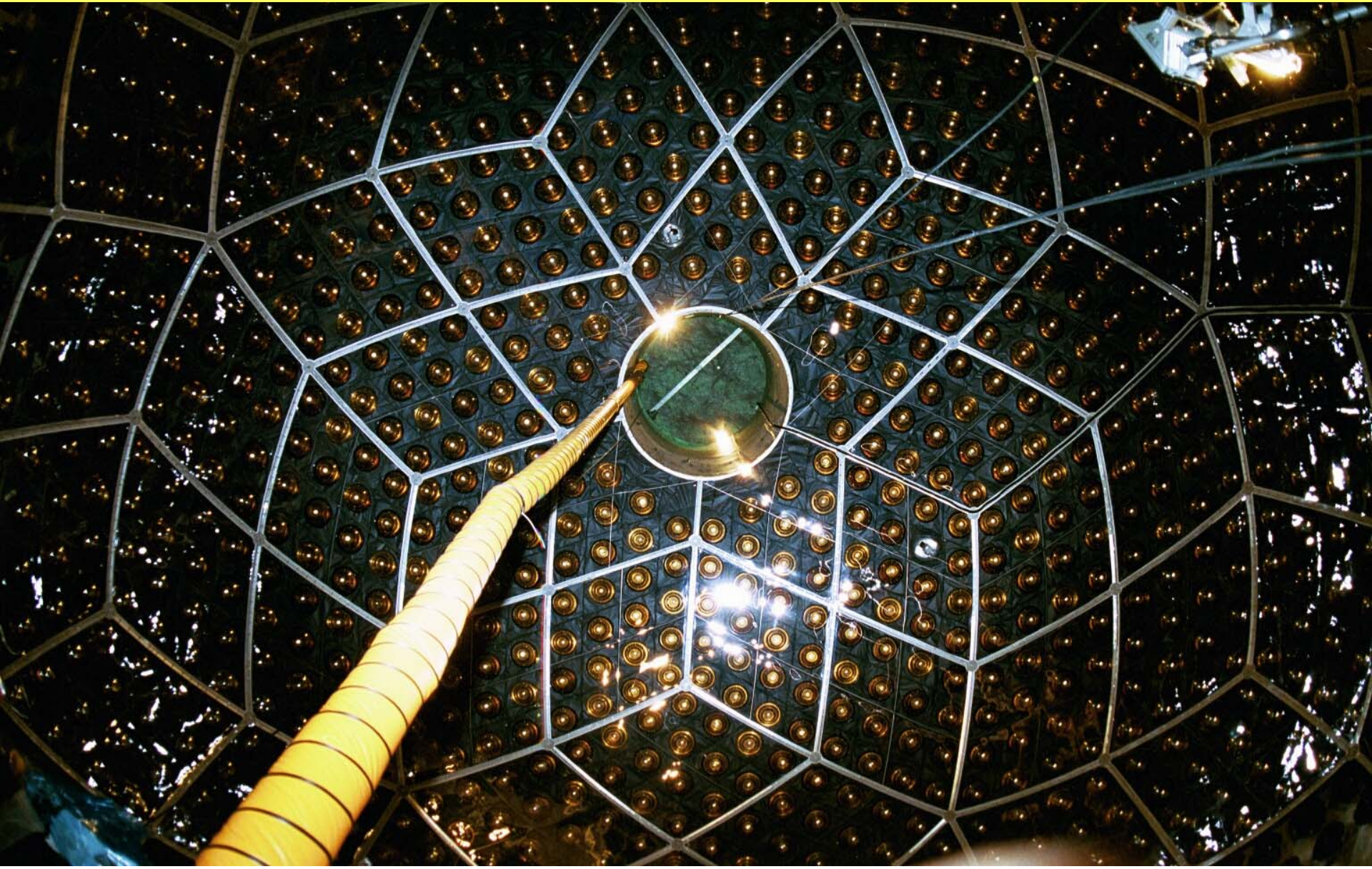


Installing 17" and 20" PMTs in KamLAND (Summer 2000)

KamLANDers hard at work (Summer 2000)



The completed detector, looking up



Balloon installed (Apr 2001)

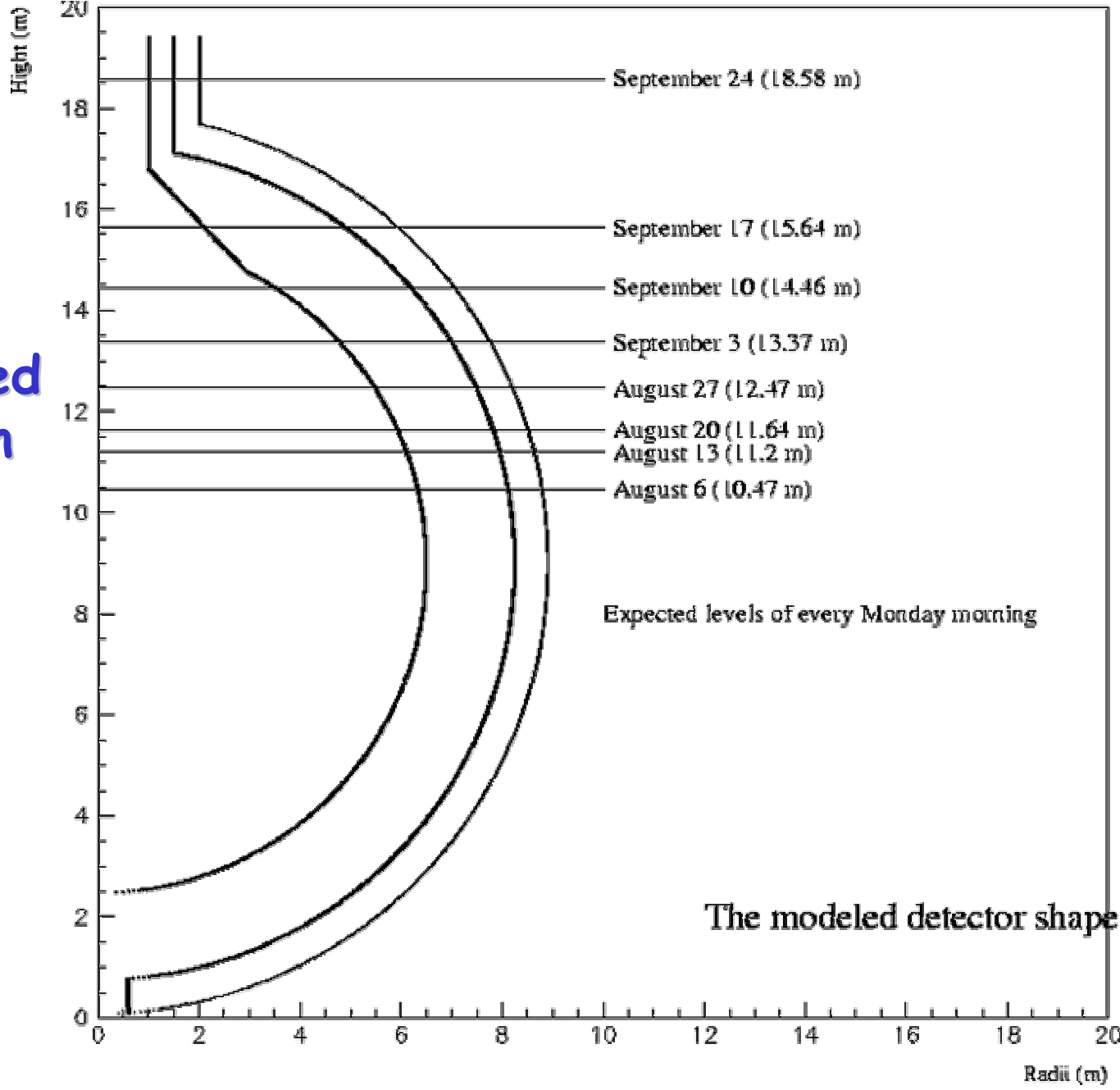
Receiving a paraffine load in the mine

Pseudocumene and paraffine oil of two different densities are blended to obtain 20% pseudocumene concentration inside the balloon and same density outside.

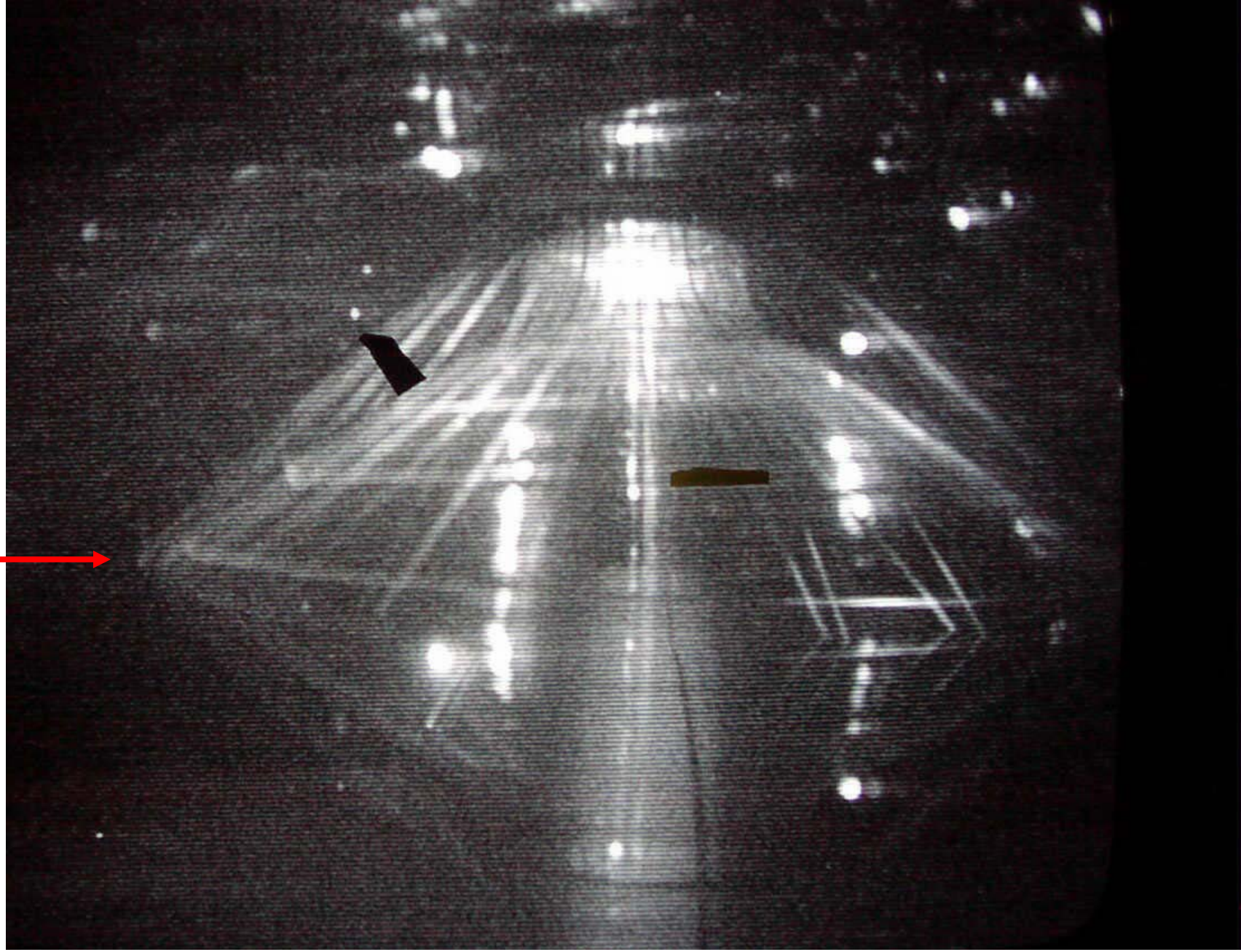
PPO concentration is 1.5 g/l of the final blend.

During blending the liquids are pre-purified, closed circulation and re-purification are started at the end of the fill.

Recent filling history (volumes estimated using full balloon modeling under stress)

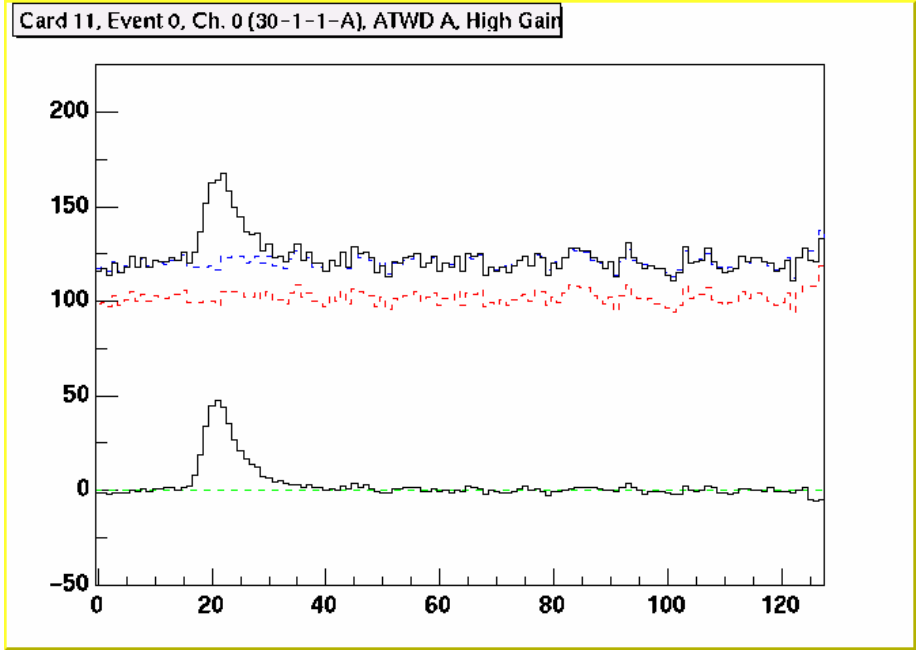


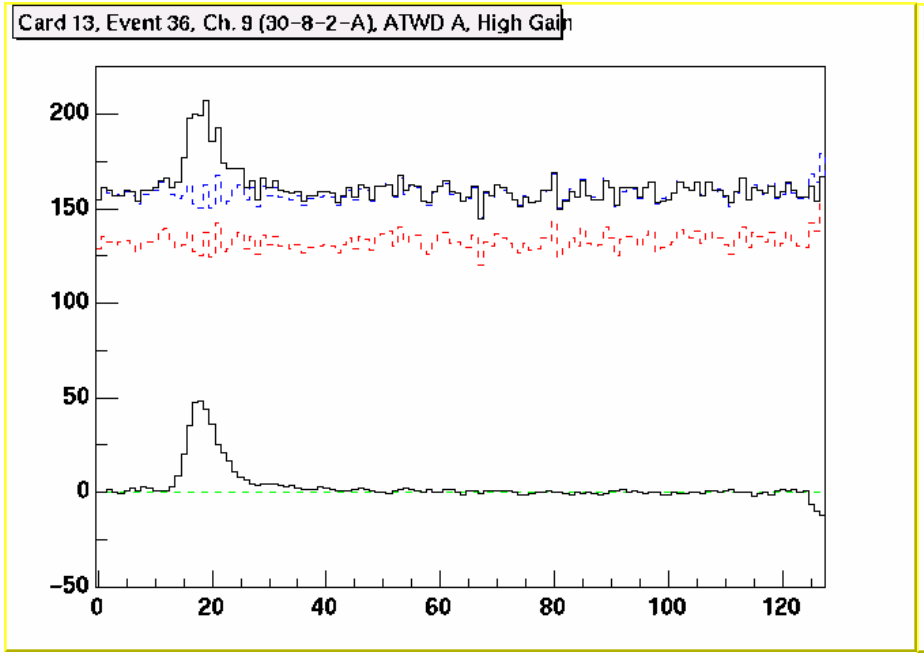
Liquid level in KamLAND on Sept 11, 01

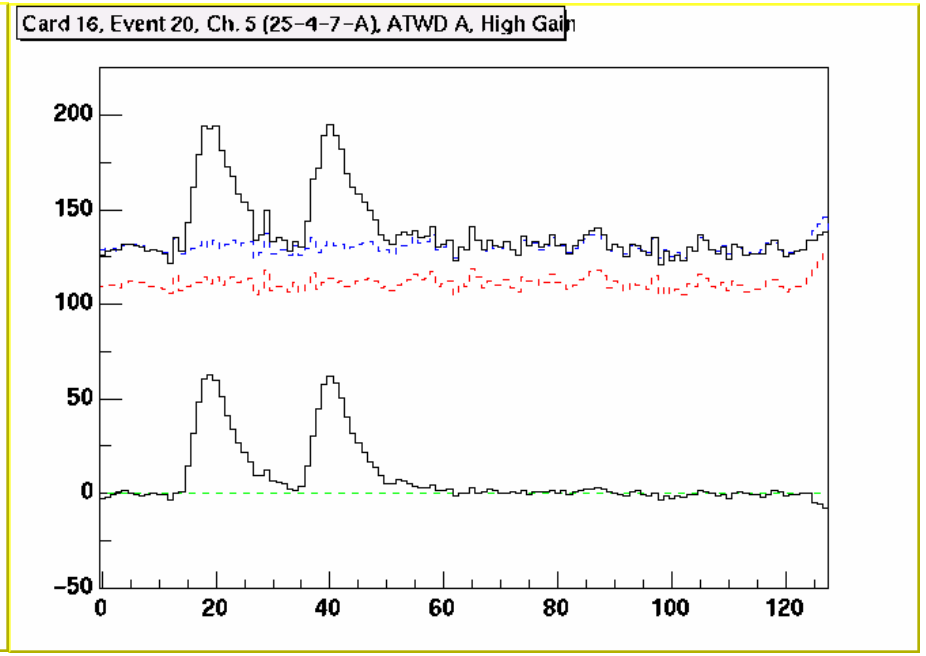


Detector fill finished as of Sept 24, 2001

Waveforms taken with FEE from PMTs inside the scintillator







Initial 17" PMTs gain results

Gain peaks ~$0.9*10^7$

10% low respect to the calibration done in Sendai

⇒ reasonable:

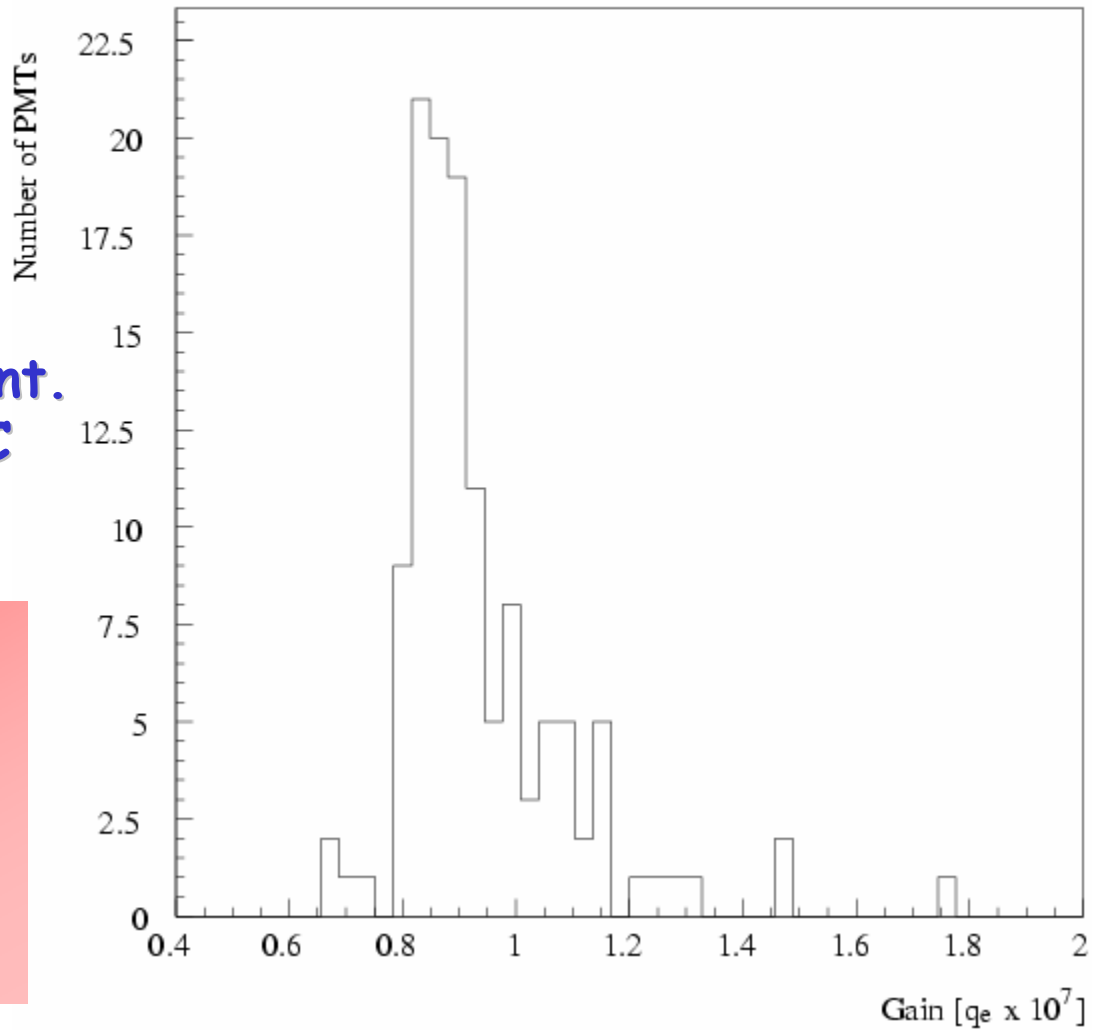
temp = 20C Sendai

10C in the scint.

CuBe dy tempco ~ –0.001/C

for 11 dy 9.99^{11} = 0.89

First run using the magfield comp. coils: good comp. (earth magfield effect up to 50%)



…stay tuned…