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Russian – Italian joint work on development of new types of metal loaded liquid scintillators

In Laboratory Gran Sasso Russian and Italian groups, headed by Carla Cattadori and since last year Valter Fuligione, take part in joint work on development of new types of metal loaded liquid scintillators for a several international projects.

The work is under the way during 4 years

In the frame of programs new types of Indium - and Gadolinium-loaded scintillators have been developed.

Indium - loaded scintillator was developed for international project LENS for detection of low energy solar neutrino.

Scintillator has very high parameters:

In concentration - 8%;

Ligth yield -8500 photon/MeV

Transparency – 3 meters

Stability - more then 3 years

Several installation have been developed on the basis of Indium - loaded scintillator and tested in Gran Sasso underground Laboratory.


PASTA DI SEMOLA DI GRANO DURO
Termorestringenti

Finally the pilot installation of the full scale detector has been worked out. It was installed in underground Gran Sasso laboratory and successfully worked during a year.

The project of full scale detector will be developed on the basis of obtained results.

On the basis of obtained results the recipe and production technology of Gadolinium - loaded scintillators of different compositions have been developed for a few international projects.

Gd-loaded scintillator gives possibility to detect neutrino efficiently by reactions:

$\nu + p \Rightarrow n + e^+$ with following capture of neutron on Gd and production of a few gammas with total energy ~ 8 MeV

The LVD detector with volume of 2 m^3 is worked out and under the investigation now in Gran Sasso

Scintillators has very high parameters:

Gd concentration - up to 5%;

Light yield - up to 10000 photon/MeV

Transparency – 10 meters.

Stability –more than 1 year no chance of parameters

The scintillators are planned to be used in the projects:

Reactor experiment Double Shooze for determination neutrino mixing parameter $\theta(1,3)$.

LVD installation for search neutrino from supernova and Geoneutrino.

Monitoring of reactor neutrino.

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Interest of International Atomic Energy Agency (IAEA) in neutrino detection

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Monitoring of single reactors

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Monitoring of countries

Intensity and shape of neutrino spectrum depend on isotopic composition

Pu content!

Thermal power (1% ?)

The Double Chooz experiment

France: CEA/Dapnia Saclay, APC, Subatech (Nantes)

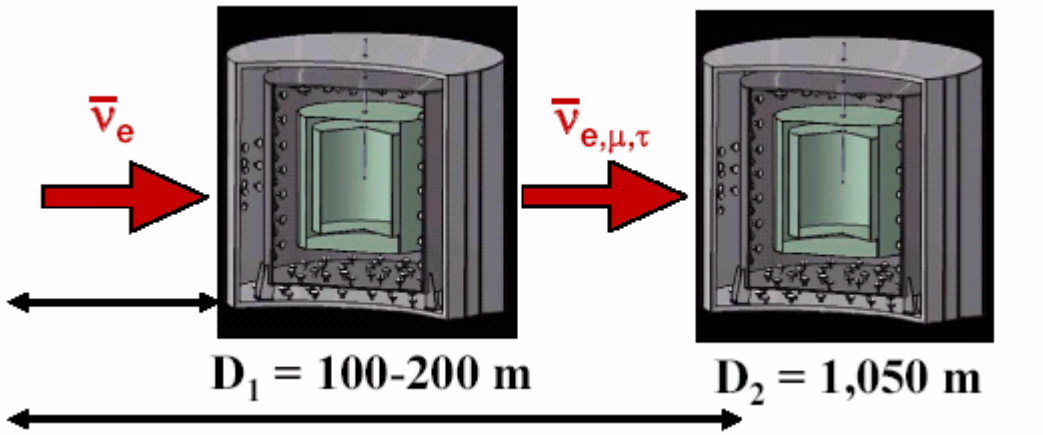
Germany: MPIK Heidelberg, TU München, EKU Tübingen, Universität Hamburg, Aachen

Italy: LNGS (Gran Sasso)

Russia: RAS, Kurchatov Institute (Moscow)

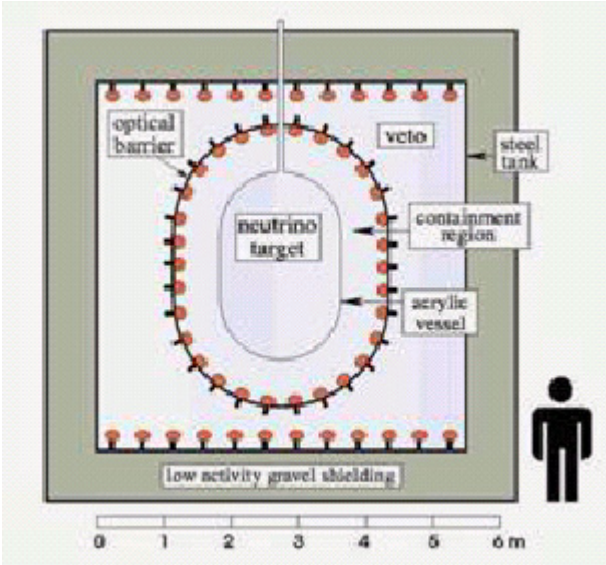
USA: Alabama, ANL, Drexel, Kansas State, LSU, Notre Dame, Tennessee, LLNL

The Double Chooz concept



- Disappearance experiment
- Sensitivity goal: $\sin^2(2\Theta_{13}) < 0.03$ (90% C.L.)
- Reaction:

  $\bar{\nu}_e + p \rightarrow e^+ + n$ (<E>~ 4 MeV, E_{th} =1.8 MeV)



The development of the Gd-loaded scintillator for detectors is the one of the main problem of the experiment

Geo-Neutrinos : a new probe of Earth's interior

- Geo-neutrinos bring to Earth's surface information about the chemical composition (U,Th and possibly K*) of the whole planet.

How much Uranium is in the Earth ?

Using of Gd-loaded scintillator in LVD installation gives possibility to decrease the background for geo neutrino detection.

Place of LVD installation in Gran Sasso underground Laboratory far away from powerful reactors gives possibility to detect geo neutrino with essentially higher sensitivity in comparing with KamLand