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# Light yield studies for SoLid phase I

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The SoLid experiment is investigating the existence of sterile neutrinos by looking for a deficit of antive from a nuclear reactor at Mol in Belgium. It searches inverse beta decays events (a positron and a neutron in delayed coincidence) with a finely segmented detector made of thousands of scintillating cubes with a dimension of 5 cm. SoLid has a very innovative hybrid technology with 2 different scintillators to detect the positron and the neutron. The cubes are made of Polyvynil-Toluene (PVT) to detect the positrons and 6LiF:ZnS sheets are put on some faces of each PVT cube to detect the neutrons. It allows us to perform an efficient pulse shape analysis to identify the signals from neutrons and positrons. The cubes and the ZnS sheets are wrapped in Tyvek and the scintillation signals are brought by wavelength shifting fibers to MPPCs. The first module SM1 (288 kg) has been built in 2014 and has demonstrated the detection principle. SoLid phase 1 is under construction and will consist of several modules (up to 2 t).

To get a better neutrino energy resolution for SoLid phase 1, we have been working on increasing the light yield. To study more specifically the positron light yield in the PVT, we have built a test bench at LAL. We use a 207Bi source and an external trigger to look for the 1 MeV peak from conversion electrons of 207Pb deexcitation. We have been able to test the design of the cubes, their wrapping, the type and the number of fibers or the mirrors at the end of the fibers. We have found several improvements for SoLid phase 1 like designing cubes with 4 grooves instead of 2, using a thicker Tyvek wrapping, 4 multi cladding fibers instead of 2 single cladding fibers and aluminised mylar mirrors. With these changes, we should increase the PVT light yield by more than a factor 2 and improve the resolution on the positron energy from 21% for SM1 down to 15% for SoLid phase I.

The construction is well advanced and we have now several planes of 16×16 cubes. A robot has been developped to scan the planes with γ sources (207Bi, 22Na) and neutron sources (AmBe). It allows us to perform a complete off site calibration of the planes, inspired by the test bench measurements, before integration at BR2. In this poster we will show the first results of these calibrations.

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