Minutes of the DarkSide calibration meeting

12.04.2021

Participants Pierre Barrillon, Alessio Caminata, Marco Carlini, Davide Franco, Alexander Kish, Andrei Oleinik, Pascal Pralavorio, Peter Skensved, Marie van Uffelen, Hanguo Wang, Isabelle Wingerter-Seez.

Next meeting: In a month time. Pierre Barrillon will circulate a doodle poll in a couple of weeks to fix the date.

The INDICO agenda of the meeting is available at this link. The files of the presentations are attached to the agenda.

Points to remember

1. **Motor: characteristics and tests - Peter Skensved**
   - Peter Skensved is currently testing a motor from the Anaheim company (California), which fulfils the specifications (L010413 - 23MD Series, Anaheim Automation 23MD306S-00-00-00). The test setup includes and evaluation board and a homemade board on top of it (see Fig. 1). Peter presented a video.
   - The tests performed so far show that the motor is performing well; in particular, the temperature is not getting high under operation and the motor can be controlled properly by the boards mentioned above (recycled from SNO+).
   - Peter is under way to order a decoupling board to insulate the load from the noise induced by the motor.
   - As it was agreed, Peter will purchase four (? or five to have a spare)) motors for DS20k; two of which will serve to validate the system at with the mock up at LN2 temperature.

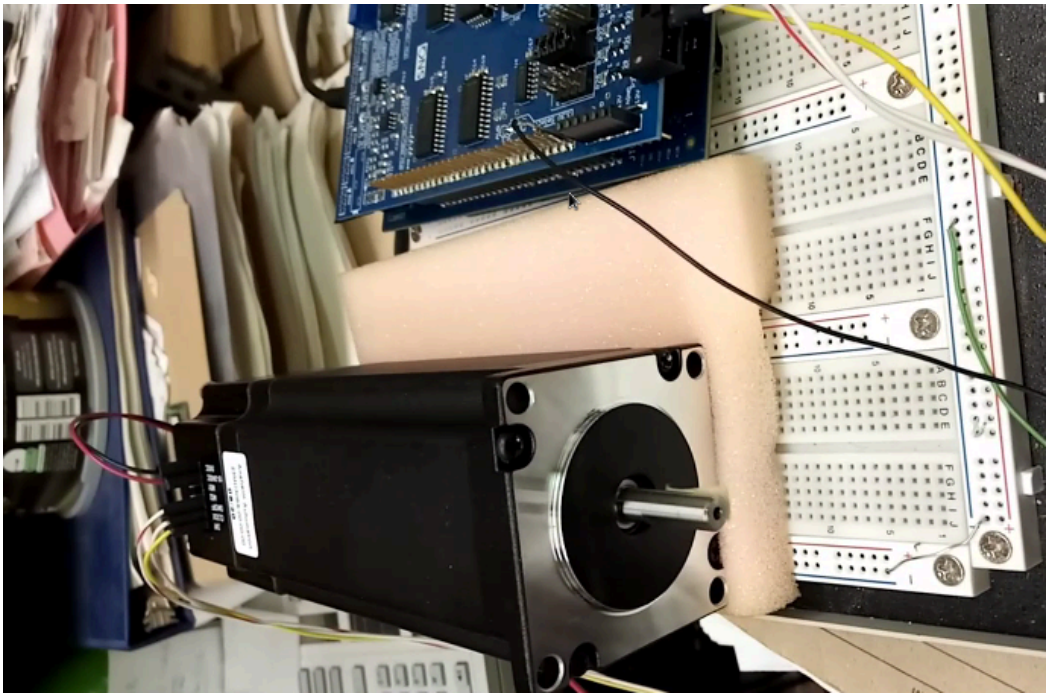

Figure 1 *Test setup at Queens University (Ca): the Anaheim motor (bottom) with the evaluation and custom board (blue, top)*

Peter explained that the use of a custom board might not be necessary, as performant evaluation boards exist on the market.

2. Report on the DD-gun development - Andrey Oleinik

- Andrey Oleinik presented the evolution of the current development at the Lomonosov Moscow State University and at the Belgorod State University in Russia, of a small Deuterium-Deuterium neutron generator. His presentation is available on the agenda. Andrey recalled the steps that lead to the current design of a 32 mm diameter and 120 mm length source and power generator together.
- This source is being prototyped; it is planned to use less than 40W of power; three power cables are necessary. The estimated lifetime for the source is 400 hours (?). The expected neutron flux is about 200-250 neutrons/s in 4π.
- The next steps are to measure the flux, make refinement on the internal target, integrate the DD-gun in the capsule and test.
- Alessio Carminata asks whether the gun had been tested at LN2 temperature: tests are planned for the futur.

3. Plan C simulations - Alexander Kish

- Alexander Kish presented first studies of the level of NR and ER induced by a pure neutron source (such as a DD-gun) for the two current plan-A and plan-C detector designs. Alex's slides are available on the agenda.
- Alex studied the impact of the Gd topped acrylic in the plan-C design and showed that for a given flux, the rate of neutrons in the TPC would be reduced by a factor 20 because of the conjunction of the increased acrylic thickness (5 to 15 cm) and the presence of Gd.
- Alex studied the possibility to design a zone in the Gc acrylic with a reduced thickness in order to position of DD-gun in front of this window and increase the neutron flux.
- Several discussions took place about:
    - The respective roles of acrylic thickness and Gd as a neutron barrier
    - The presence of pile-up of photons with neutrons in the time window of the neutron interaction
    - The small rate of neutrons for calibration int his context.
- On page 5, the text at the bottom on the left "baseline Plan-A" should read "baseline Plan-C".

4. Round table

- The fabrication of the mechanical pieces for the motor boxes at QU have been slowed down again after new restrictions to access the workshop have been imposed because of COVID-19. An early large fraction of the necessary pieces has been produced; though not enough to be able to assemble one full box.
- There is no estimated date yet for the completion of the fabrication.