NEDENSAA WP4: Photosensors

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NEDENSAA meeting
Acireale/Italy 20.02.2013

Supported by
Bundesministerium für Bildung und Forschung

TECHNISCHE UNIVERSITÄT DRESDEN

Partner von DRESDEN concept exzellenz-dresden.de

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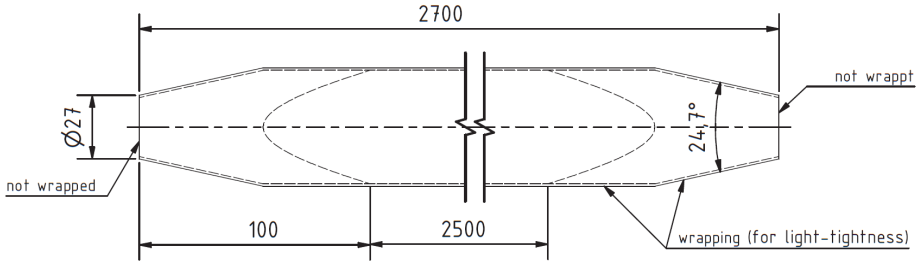
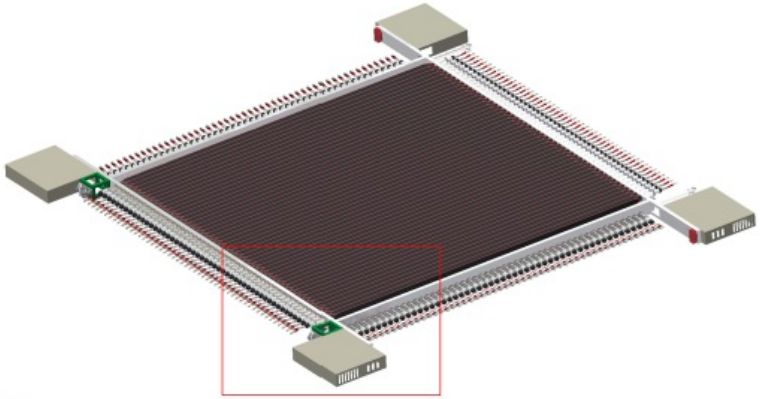
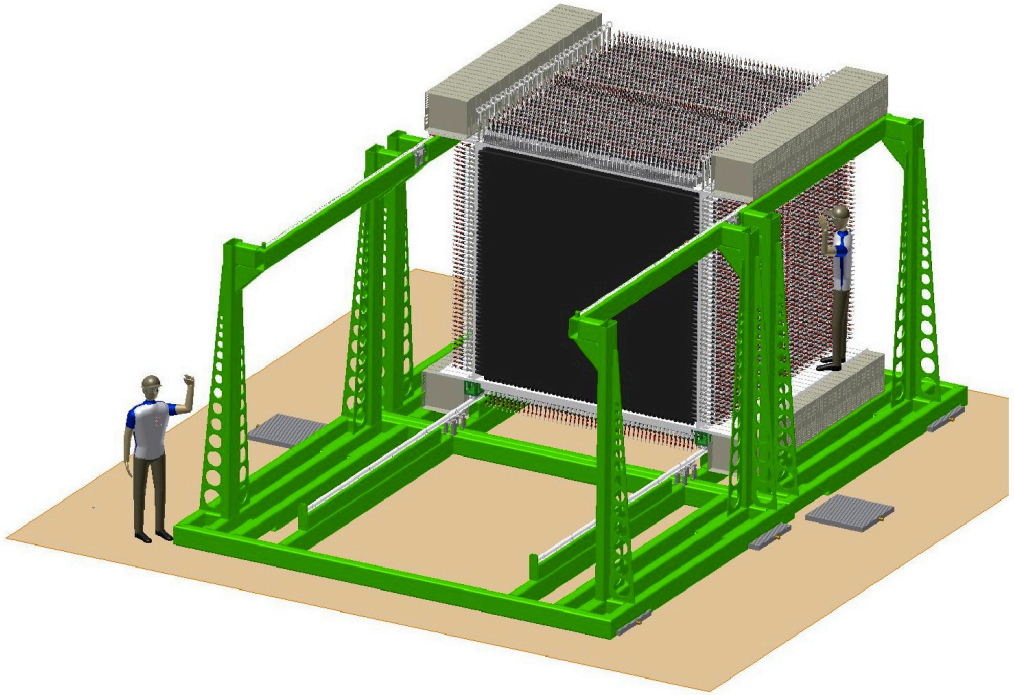
The motivation: large-volume scintillators like NeuLAND @ FAIR



NeuLAND submodule
250(270 incl. light guides)x5x5 cm³

100 submodules
build one double-plane





30 double-planes build NeuLAND
face sice 250x250 cm²
active depth 300 cm

WP4: Study the readout of large scintillators by SiPM

- From NEDENSAA proposal: “Another objective is to study the possibility to replace the traditional Photo Multipliers by new silicon photon sensitive devices built from avalanche photodiodes (SiPM) which are of great interest for certain applications due to the independence of the signal parameters from external magnetic fields, its extremely compact mechanical design, and the availability of several competing suppliers.”

- How much can the size of SiPMs be increased?
- Is it possible to have a low dark rate, for a reasonable threshold at RIB facilities?
- Can we maintain the excellent time resolution available with nowadays standard PMT’s?

	NeuLAND has/needs	**SiPM**
Geometrical size	Circle, d=2.5cm (5 cm^2)	Square, up to 1 x 1 cm^2
Rate	~Hz/cm^2	Dark rate ~MHz/cm^2
Time resolution	σ=150 ps	?

WP4, tasks from NEDENSAA proposal

Tasks:

1. Test the coupling of large area BC408/RP408 scintillation detectors (270cm x 5cm x 5cm) to SiPM's, using several standard SiPM's. Efficiency / areal coverage to be studied.

2. Test several different scintillator materials (solid plastic including BC408 and liquid like e.g. BC501A and BC537…input needed from WP2) together with given SiPM packages, to identify good matches when it comes to photon detection efficiency (for given areal coverage) and dark count rate (for given threshold).

3. Based on tasks 1 and 2, an improved SiPM package and, if needed, a custom-designed chip (in collaboration with e.g. KETEK) shall be developed for one selected scintillator material.

4. Two or more representative setups composed of scintillator, light concentrator, and SiPM shall be tested in-beam as to the efficiency and time resolution.
   Facilities available for in-beam tests:
   - DT generator for 14 MeV neutrons (TU Dresden)
   - ELBE electron test beam with picosecond time resolution (HZDR)
   - nELBE neutron time-of-flight facility (0.1-10 MeV neutrons, HZDR)
   - LNL Legnaro ion beams
   - others (see WP2)

- Use existing SiPM prototypes from several suppliers (investment funds available within NEDENSAA)
- May develop suggestions for a custom SiPM package (KETEK Munich, other suppliers?)
- No full SiPM development possible

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WP4 institutes and people

- TU Dresden/Germany (funded 01.02.2012 - 31.12.2014)
  - Thomas Cowan (TU Dresden & HZDR, PI)
  - Daniel Bemmerer (HZDR, project manager)
  - Tobias Reinhardt (TU Dresden & HZDR, PhD student; funded by NEDENSAA)
- ATOMKI Debrecen/Hungary (new partner, joined in early 2013)
  - Zsolt Dombradi
  - Gabor Kalinka

NeuLAND

- INFN Italy
  - José Javier Valiente Dobón
- Uppsala University, Uppsala/Sweden
  - Johan Nyberg

NEDA

- …also other detectors may/should benefit!