User Test Experiences and Needs

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- Offering SEE test as a service using
  - Heavy ion
  - Proton
  - Neutron
  - Alpha source, CF-252
  - Laser
- User test H&W could basically be the same with some specific constraints
  - Physical test board dimensions
  - Thermal vacuum
  - Parts opening
  - parasitic secondary radiation
  - Remote control
  - etc.

- To be successful and produce reliable data to the customer, a SEE test requires **both**
  – a good performance of the SEE test set-up
  – a good performance of the beam provider

  – to get the right beam and beam data (beam stability, homogeneity, ion energy, LET, flux, fluence, etc.)
  – to have the SEE test set-up working as needed (error detection, data recording,...
  – that both beam facility set-up and SEE test set-up fits together. (mechanical, electrical interfaces)

Accelerator selection criteria as a service provider

- Technical: beam characteristics
- Facility approved for SEE testing
- Overall beam acquisition cost for full characterization of a device
  - beam cost
  - travel cost
  - overall test time (user manpower)
- SEE Test slots availability

Lessons learned

- Data validation: back to home, it is to late
  - To have the beam data in real time
  - to perform a data analysis (first check) upon completion of each run
- Set-up installation: trouble issues
  - Cables and connectors:

    inversion, pin integrity,cables blocked or damaged during a tilt, etc
  - Electrical noise
  - Parasitic light

What do we need

- beam characteristics
- data validation
- set-up
- cost effectiveness
- beam availability

Beam characteristics

- Heavy ion
  - LET range > 1 to about 50 MeV/(mg/cm2)
  - ion penetration range > 100µm could be needed
  - number of ions available (number of LET points)
  - flux < 100 to >10000 #/cm2.s,
  - fluence up to >1E7 # cm2.)
- Proton
  - energy 20 to 200MeV
  - possibility of high flux / fluence (dose)

Data validation

In addition to error detection, the following parameters should be monitored and recorded all along the run and within the same time system

- Beam count versus time from the **accelerator**
- DUT U/Is versus time
- DUT temperature versus time
- Number of errors versus time

This gives a way to check data consistency and find anomalies, to correlate between events occurrence and parameters (DUT current variations, beam instability,…)

Quick check of beam calibration

Use of a reference

Set-up

- Beam count signal to the user test equipment
- User control of a beam shutter (heavy ions, DUT initialization phase integrity)
- Reliable cables and connectors (savers, electrical check)
- cables in place between beam test area and user room (long distance)
- clean power network
- protection parasitic light (heavy ion)
- Friendly beam user interface (BNL could be a good example)
- beam data log in real time

Cost issue

Possibility to fully characterize a given device in one slot:

- All ions needed (LET points) available
- All proton energies available

To reduce as much as possible all the hidden times:

- Beam preparation and tuning
- Changing DUT (pumping, etc)
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Availability

A coordination of the European facilities would be appreciated to define a global schedule and propose test slots all along the year.

Neutrons

Today mono-energetic neutrons beam are available in Europe.

For the near future, a white neutron spectrum is needed also in Europe as it could be a very cost effective solution to test commercial devices for ground applications

Lastly,

I would say that working with accelerator people for more than 10 years has been a very enjoyable experience.