First updates on the FBK SiPMs

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DUNE Photosensor Meeting (DUNE-SP-PDS)

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Plan of measurements

- We will start with standard commercial NUV-SiPM 40μm cell pitch and standard (epoxy based) package. This package should be OK also at 77 K (see below)
- Full characterization (DCS, PDE, cross-talk, direct and reverse current) at room temperature at Milano-Bicocca
- Full characterization (DCS, PDE, cross-talk, direct and reverse current) at Liquid Nitrogen at Milano and/or Milano-Bicocca
- Start dedicated optimization for DUNE in collaboration with FBK
  - Packaging for cryogenic temperatures (already developed for Dark-Side)
  - Use of 6x6 mm^2 and 10x10 mm^2 SiPMs in HD and HD-LF-technology with cell-pitch >25 μm

First photosensor batch:

Advansid ASD-NUV4S-P:

Parameter	Value
Detection area	4x4 mm^2
cell pitch	40 μm
fill factor	60%
number of cells	9340
quenching resistance	see below
cell capacitance	90 fF
nominal recharge time at room temperature	70 ns
PDE at room temperature	43%
Breakdown V	see below

Standard field configuration (**not** Low Field)
Shallow tranches (**not** HighDensity technology)

First photosensor batch:

In Milano Bicocca since yesterday

Packaging:

- *standard epoxy package by Optoi srl*
- *Not guaranteed for low temperature applications*
- *However, this packaging was successfully used at 77 K:*

Vacuum ultra-violet and ultra-violet scintillation light detection by means of silicon photomultipliers at cryogenic temperature

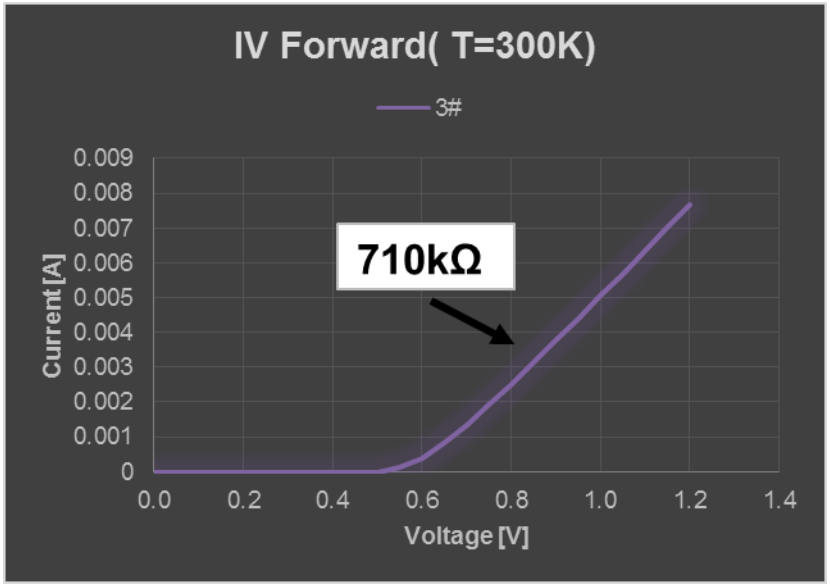
A. Falcone [a,b,*], R. Bertoni [c], F. Boffelli [a,b], M. Bonesini [c], T. Cervi [a], A. Menegolli [a,b], C. Montanari [b], M.C. Prata [b], A. Rappoldi [b], G.L. Raselli [b], M. Rossella [b], M. Simonetta [b], M. Spanu [a], M. Torti [a,b], A. Zani [b]

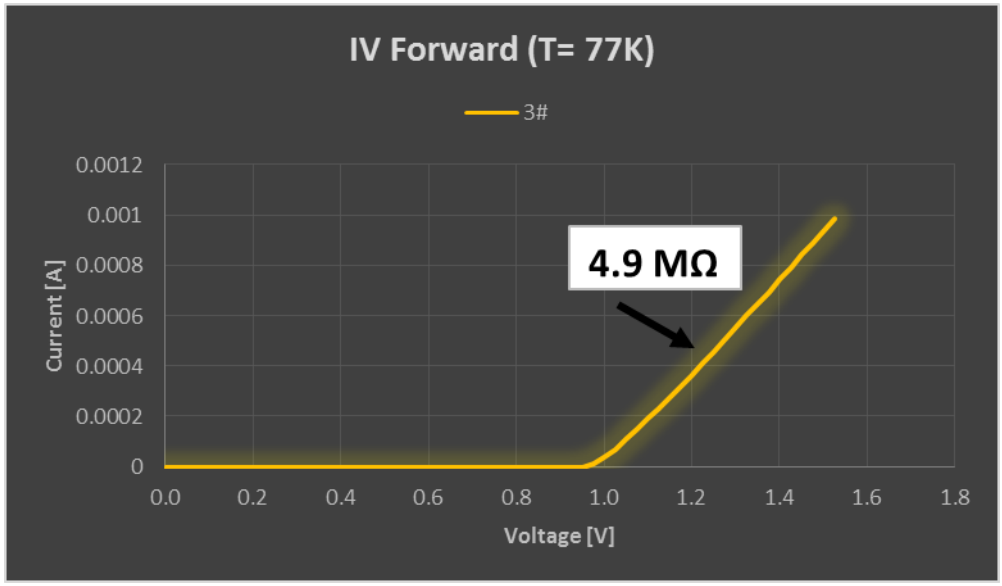
We had 8 days of delay due to administration issues.
While waiting…

Measurements from FBK

We asked FBK to perform some measurement on the quenching resistors and the variation of the resistance with temperature

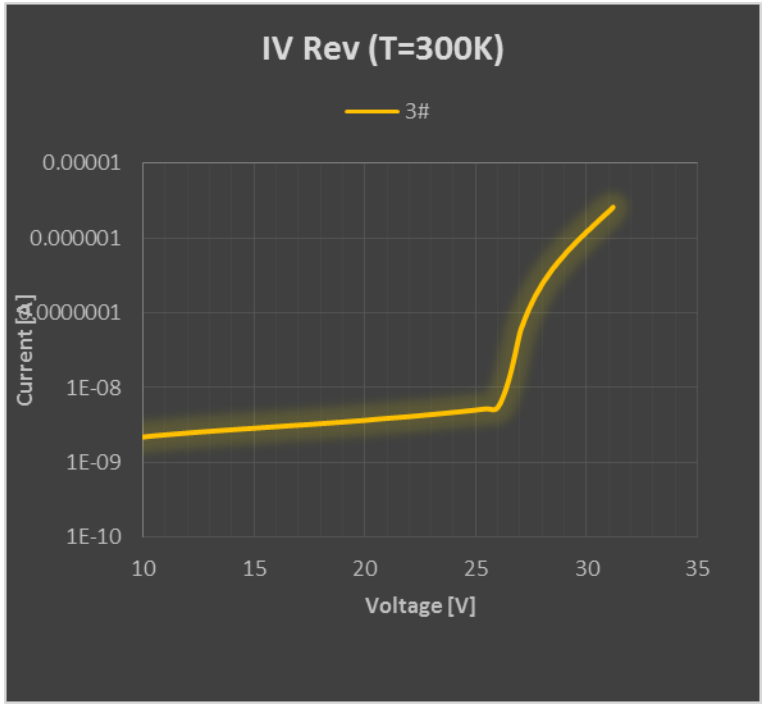
The measurements were done directly on the silicon dies without packaging: very useful to decouple packaging issues with SiPM intrinsic properties



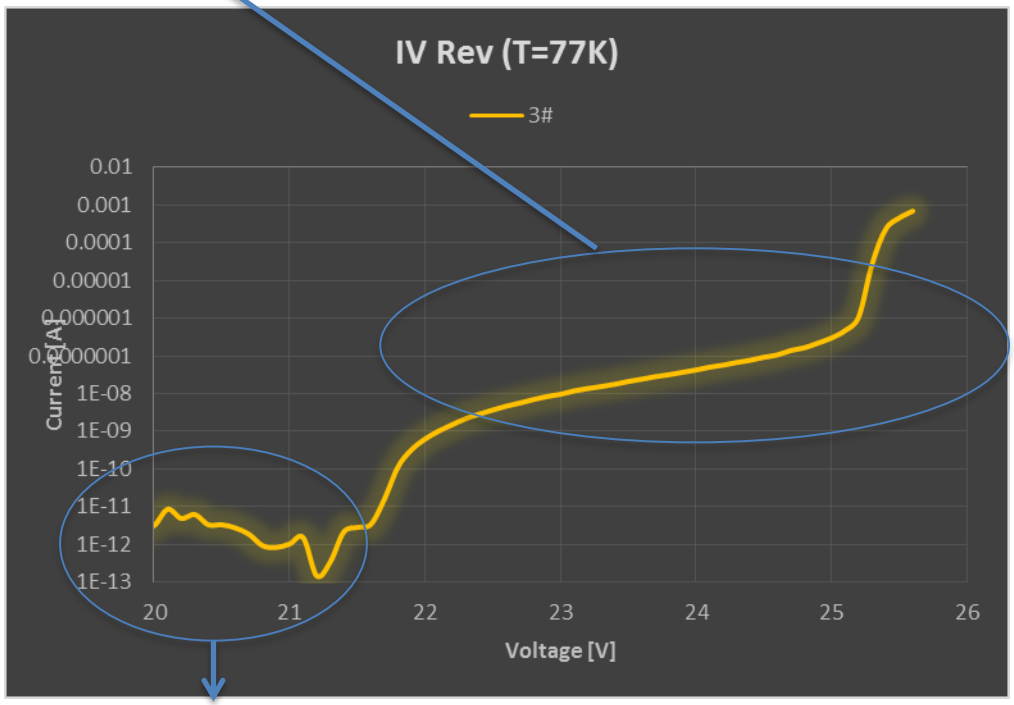


Measurements from FBK

Measurement of the I-V curve in reverse bias and change of breakdown voltage with temperature. Very preliminary because the measurement at cold were **not in dark**.



V_{bd}= 26.2 V



precision of the picoammeter

V_{bd}= 21.7 V

Conclusions

- We set up a plan for the characterization of FBK SiPM in Milano and Milano Bicocca for the next few months
- We received the first batch of photo-sensors to start the measurements at room and Liquid Nitrogen temperature
- In parallel, FBK performed for us some measurement of the I-V curve in forward and reverse bias:
  - change of quench resistance from 710 kΩ at 300 K to 4.9 MΩ: increase by a factor of 7 (OK for polysilicon resistor)
  - change in breakdown voltage from 26.2 V to 21.7 V (as for the NUV-HD-SF of DarkSide)