Checks of APD matrix & Prague 16ch. preamplifier

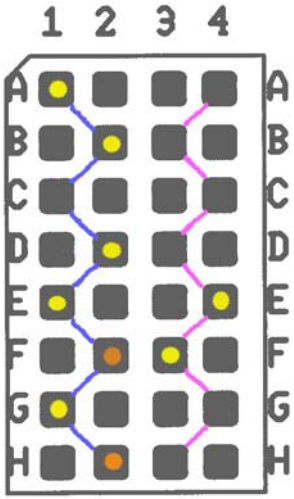
1. Cross talk between pixels
2. Homogeneity of response from pixels
3. Minical beam tests

APD:	Hamamatsu matrix S8550 with 32 pixels
Preampli:	16 channel voltage preamp on PCB
Light:	pulsed LEDs at 1 kHz
Signal:	triggered at 350 ns gate sent to ADC

Done mainly by S. Němeček, J. Zálešák, I. Polák, Institute of Physics AS CR, Prague

Measurement set-up

APD matrix



pixels with same bias V

LED

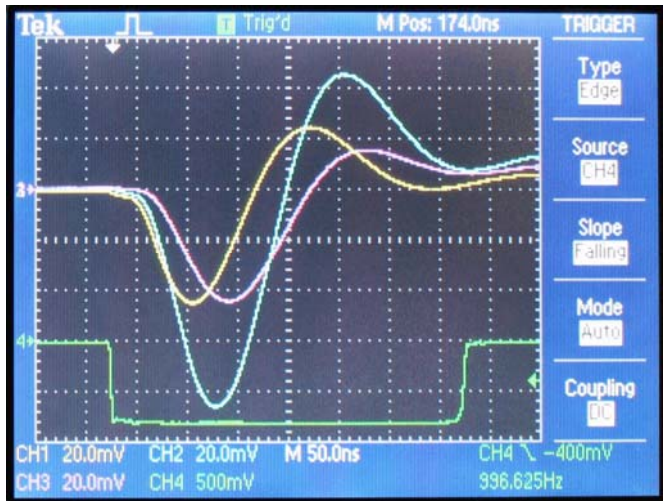
3 LED (A, C, D)

LED A, D – 3 fibres
LED C – 1 fibre

Pixels with light

Pixels w/o light

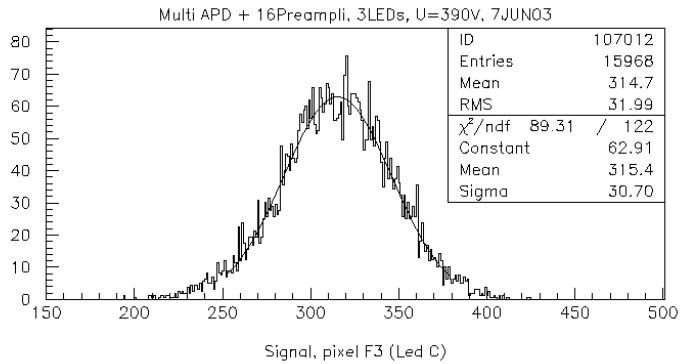
LED pulses from preamp

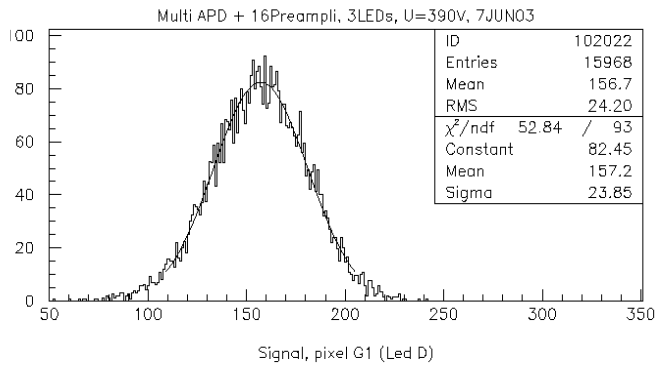


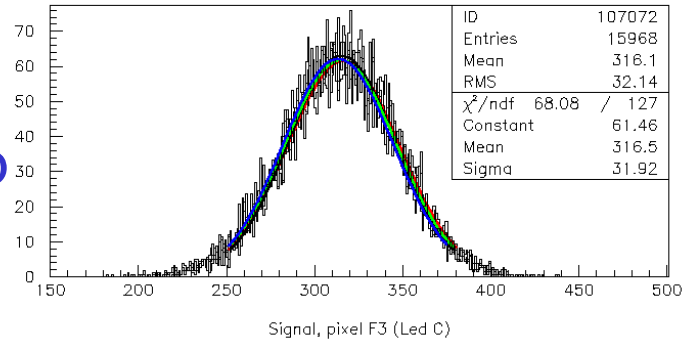
Cross talk for pixels F3, G1

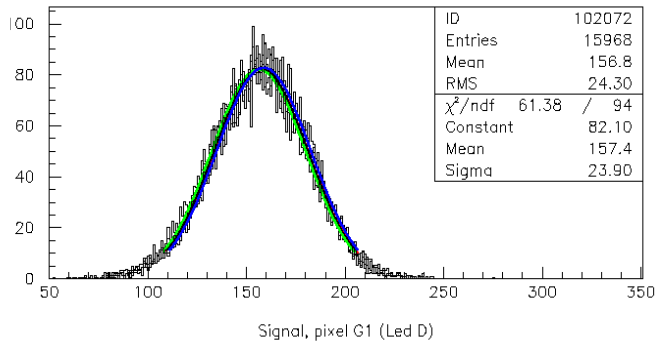
LED C on pixel switched on, other off

— LED C+D
— LED C+A
— LED C+A+D on









Cross talk between pixels < 1 %

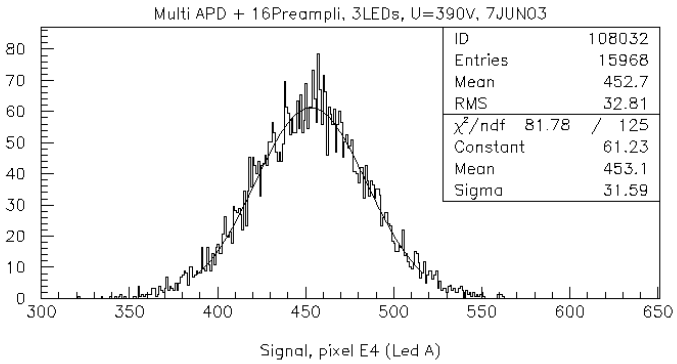
Cross talk for pixels E4, F2

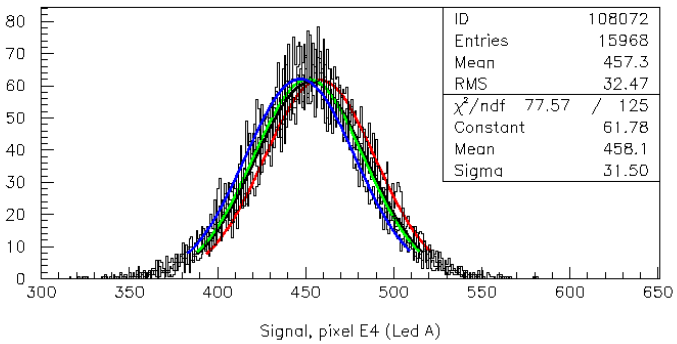
Pixel with light

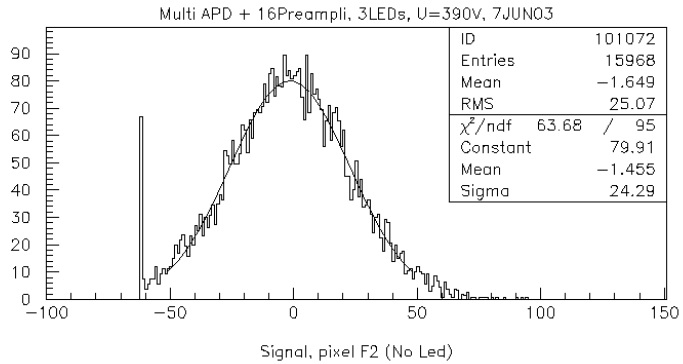
Pixel without light

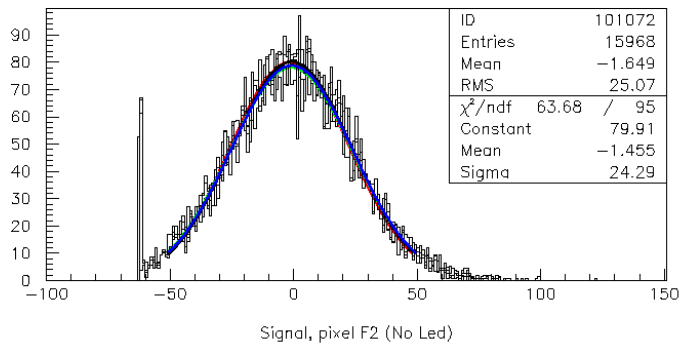
LED A on pixel switched on, other off

— LED A+C
— LED A+D
— LED A+C+D on





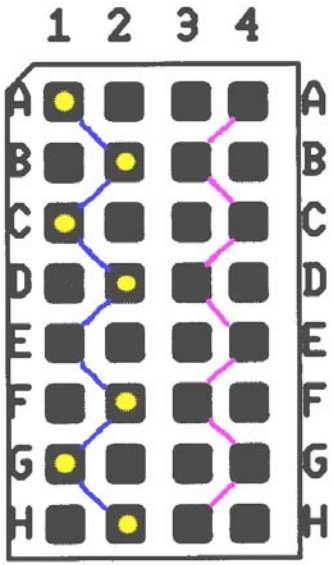




Cross talk < 1.5 %

< 1 %

Homogeneity of response from pixels



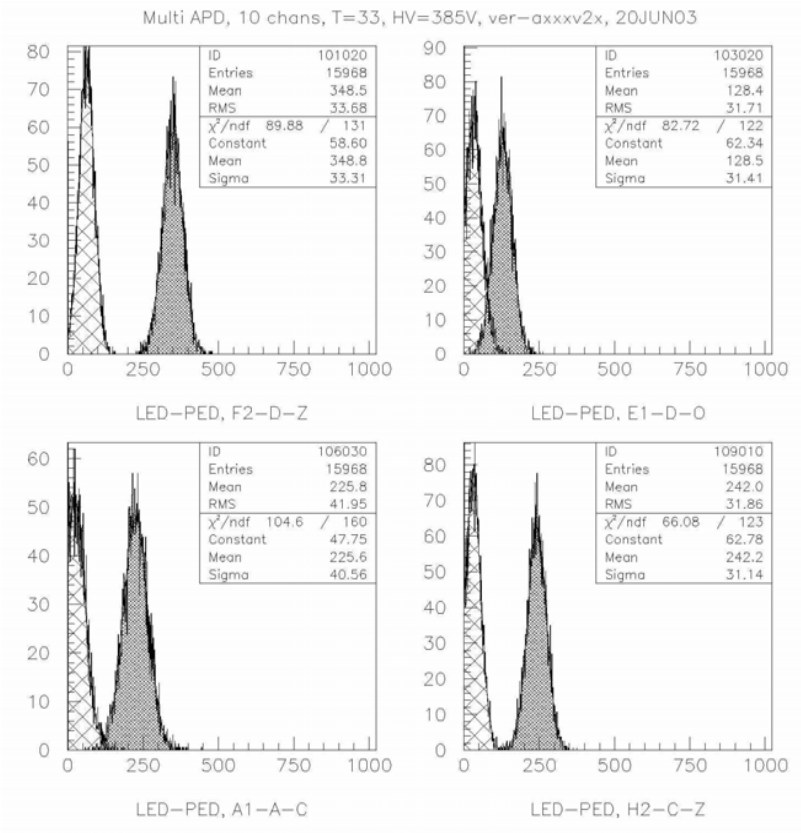
3 LED with 3+3+1 fibres used periodically on 8 APD pixels at the same bias V (left half) at the same temperature (~33 deg C)

Signals measured for:

- Reproducibility
- LED light intensity in fibres
- Signal levels from different pixels

Results

Signals & pedestals from APD pixels



ADC counts

- Reproducibility of the signal s

measurement: $< \frac{s1-s2}{s1} >= (0 \pm 33)\%$

But temperature during measurements 32-33^{0}C: relative gain error ~ 15%

- 3 fibres from the same LED give relative signals <over 8 pixels>:

LED-fibre	relative signal
A-H	0.56+-0.28
A-Z	1.00
A-C	1.36+-0.47

Our plans for beam tests

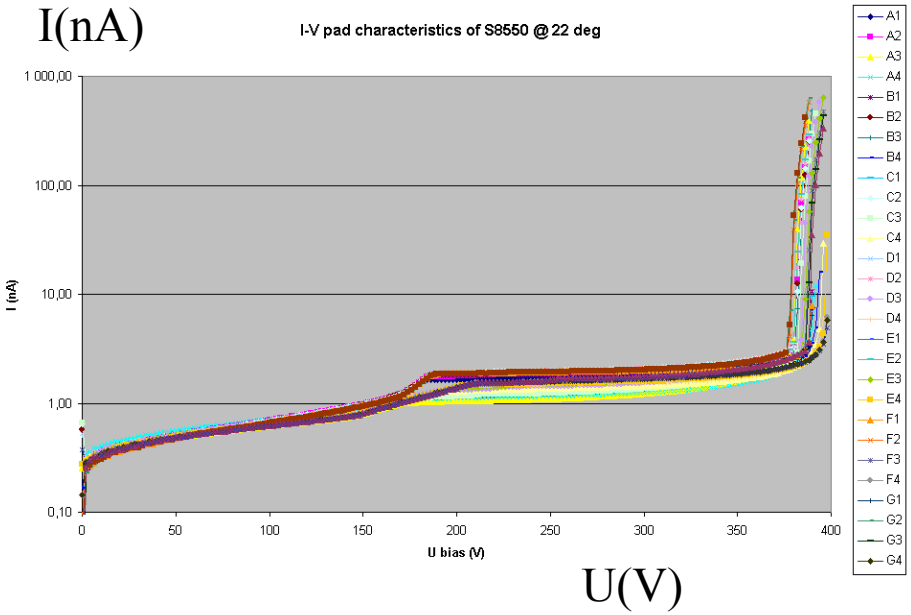
- APD – single channel (and matrix S8550) with
- Prague 16 channel preamp board and
- new board with Orsay 18 ch. preamp chip
  (PCB design done by Milan Janata in Prague)
- Backup with 16 channel PMTs (SV + JW)

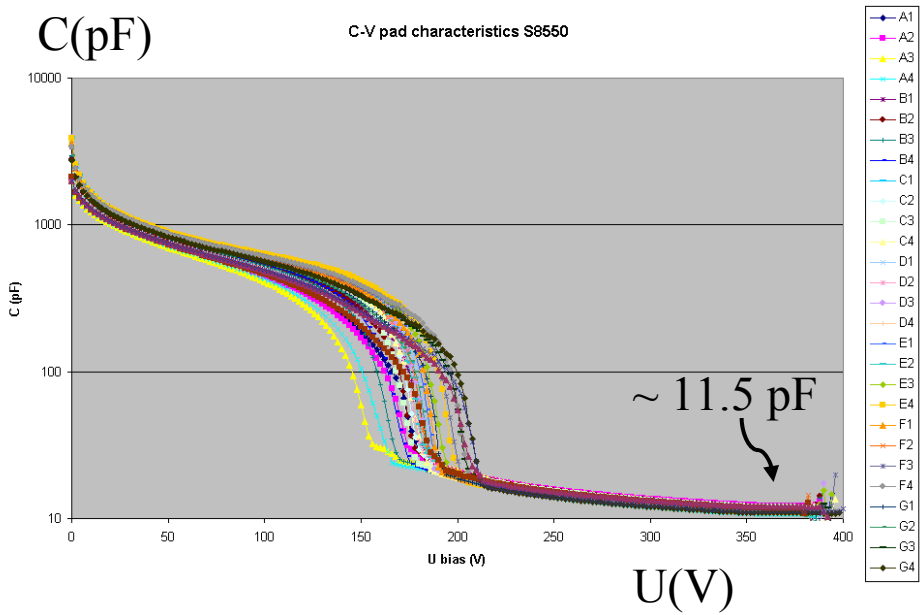
  we plan to be at DESY – weeks 32-34 (August)

  good news – 20 single channel APDs delivered last Friday in customs in Prague – available for tests this week ??

What to measure with new APDs?

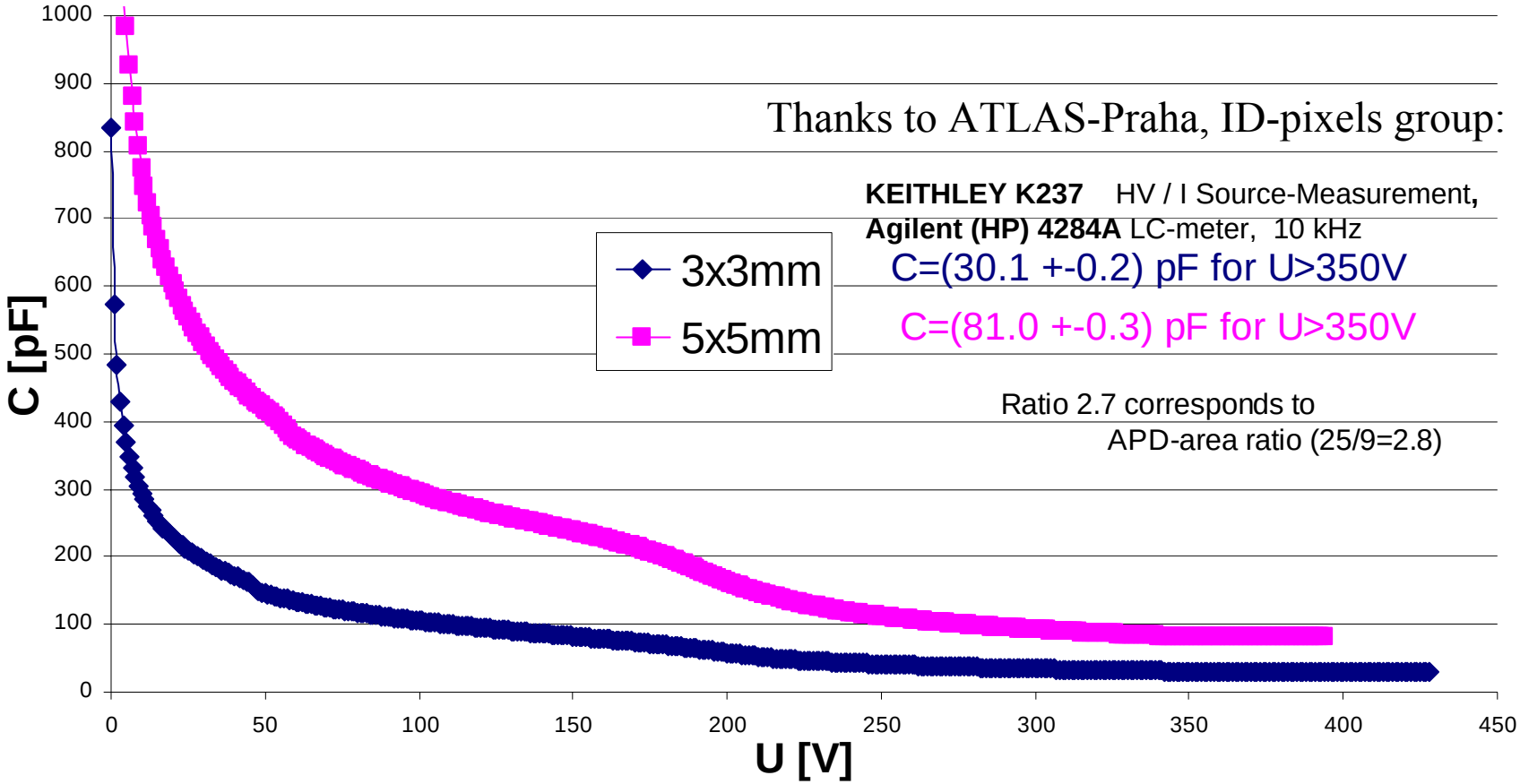
1. Current and capacitance vs. bias voltage





Results for APD matrix S8550

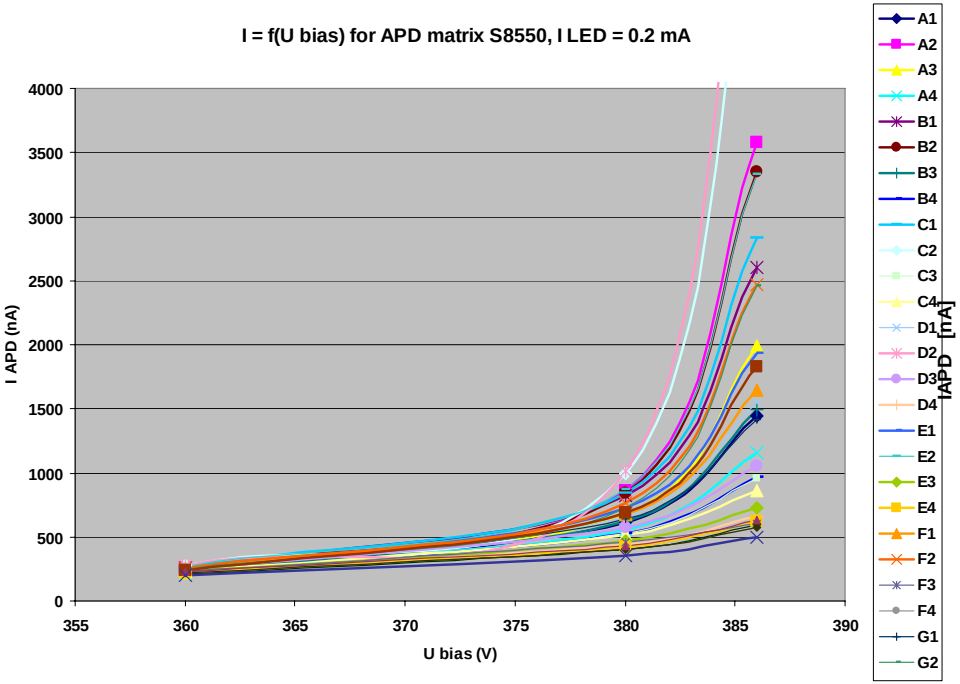
C-V characteristics of APD



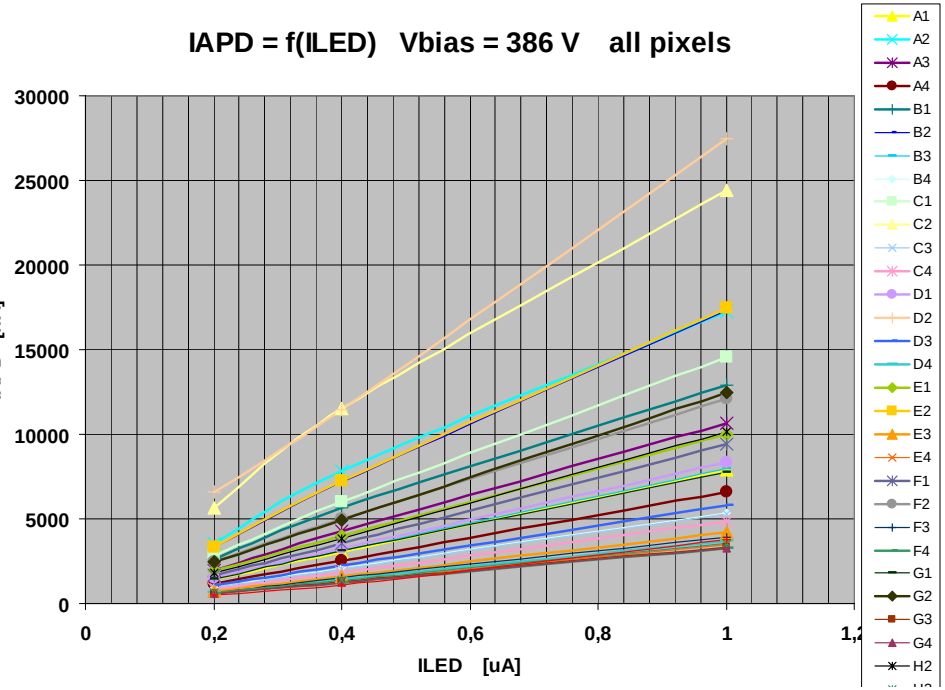
From ECFA-DESY in Amsterdam 2003 , J. Němeček: Photodectors for TileHCAL prototype

APD response to LED light

$I_{APD} = f(U_{bias})$



$I_{APD} = f(I_{LED})$



Done for all pixels of APD matrix

Two methods of measurements of APD current

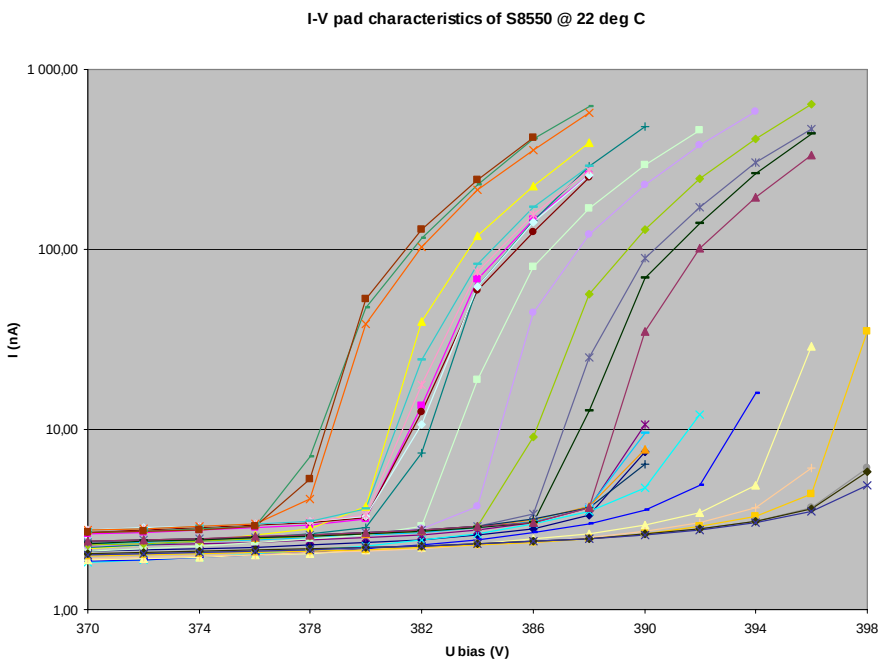
Passive: I-U characteristics

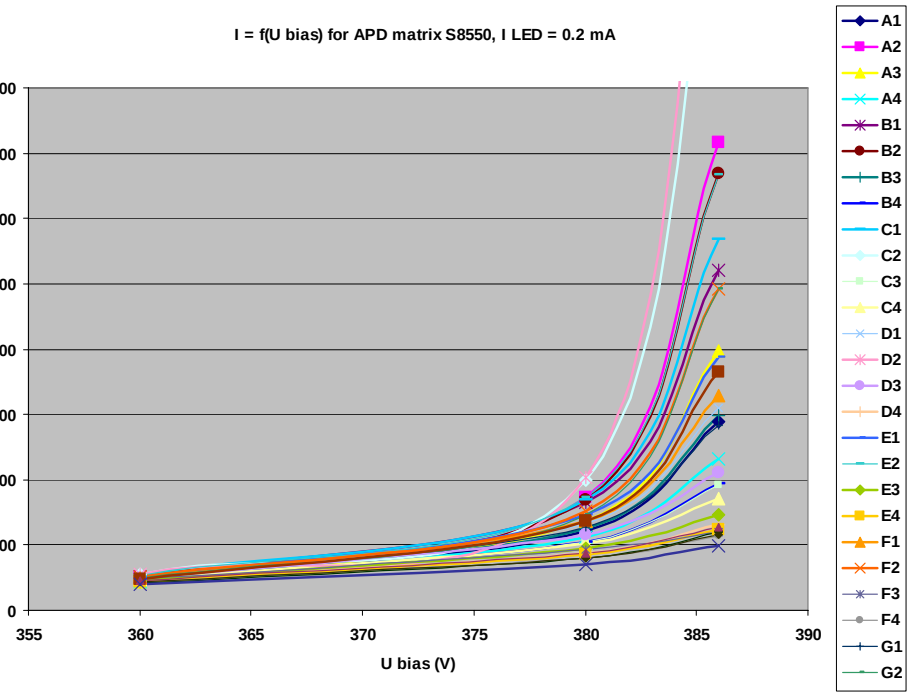
Keithley K237 HV source

HP 4284A LC meter

Active: I_{APD} as function of V_{bias} and I_{LED}

Keithley 6514 electrometer



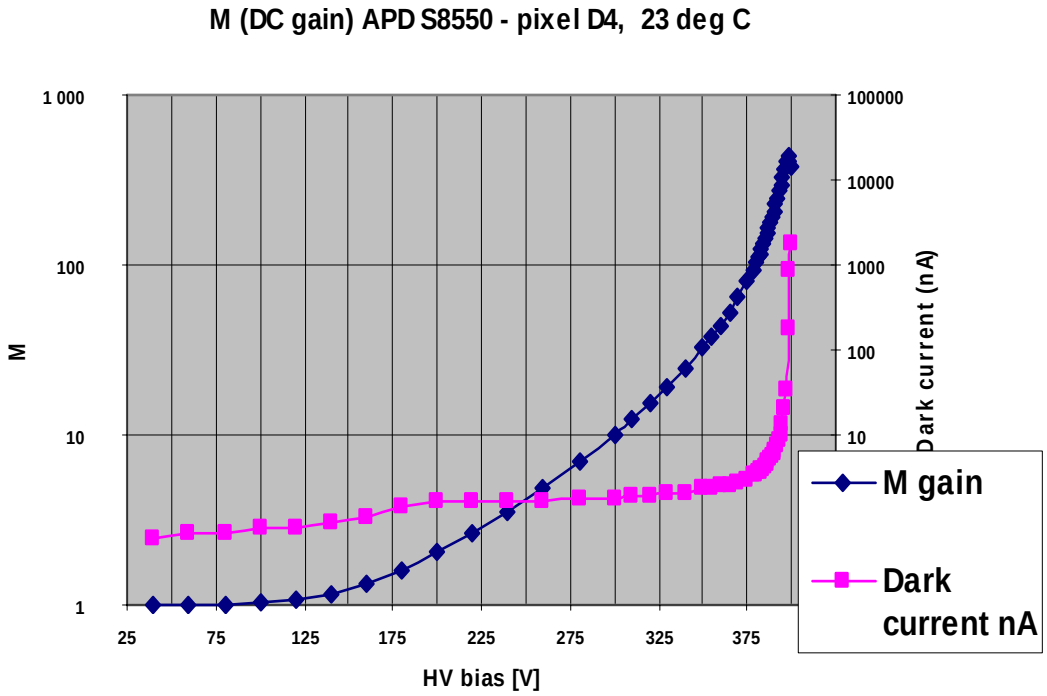


Dark current measurements

"Gain" measurements

Working point for each APD

Gain measurement for one pixel of a matrix



- Gain measurement for each APD illuminated by LED (bias 40-420V)
- Choose a common (same for all APDs) gain
- Set bias HV by setting for each APD corresponding HV
- Suitable PCB for this was developed in Prague

Conclusions

with respect to minical tests

- Single channel APD should be tested at the same temperature and selected those with similar gain
- PCB is produced in Prague which allows to set (one) bias voltage for each APD – advantage compared to APD matrix (one bias voltage for 16 pixels)
- Preampli: our 16 ch. voltage preampli stable in operation – PCB with 16 single channel APDs can be fixed on top of the board (2 boards exist)
- New board for 18 ch. Orsay chip being developed in Prague
- Gilitski preampli?
- Works on temperature stabilized box for measurements of APD characteristics and temperature sensitive HV source for APDs is under development in Prague