

Testbench for SiPM characterization

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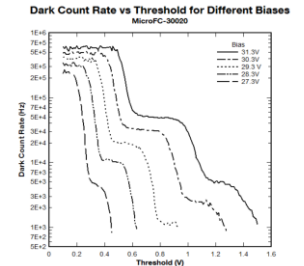
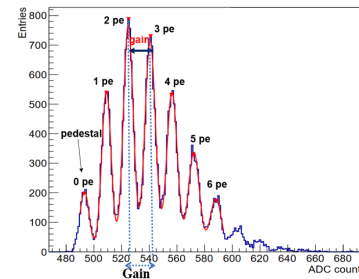
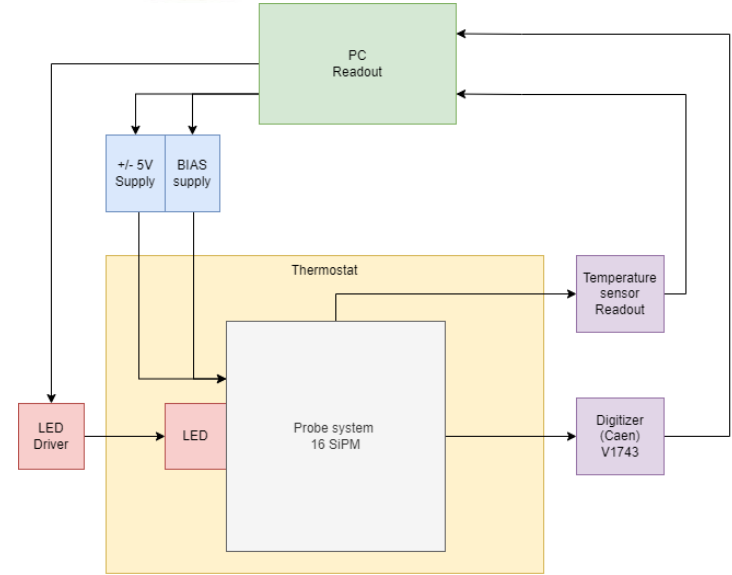
Block diagram

For mass characterization SiPM (Optimal bias, Dark current, SiPM Gain) need prepare methodic and testbench with maximized automatization.

One solution for this task use probe system. This way will minimize manual work and escape soldering for SiPM.

Testbench Setup:

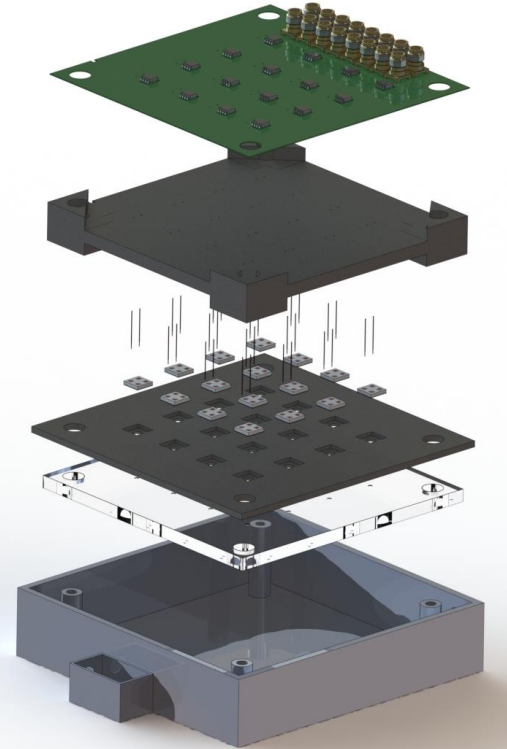
- Readout PC
- Bias and low voltage supply
- LED driver
- Digitizer 16 CH



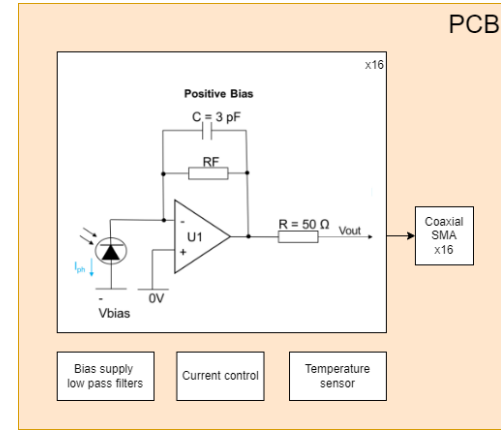
Basic concept probe system for characterization:

1. PCB with Amplifiers, temperature sensor and bias control
2. Probe system with mechanical support
3. LPG (Light Guide Plate)
4. Black box

- Test SiPM without soldering
- Parallel readout for 16..128 CH
- Temperature control
- One reference channel for light stream monitoring?



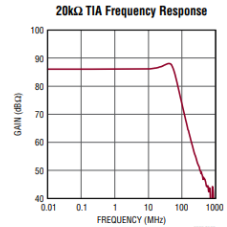
- Transimpedance amplifier.
- Read ambient temperature. (Sensor on PCB)
- SMA or another interface to digitizer connection.
- **Internal or external bias control?**
- **Read current for each SiPM?**
- SMA or another interface to digitizer connection.
- Optimize transimpedance for single photon mode.
- Optimize for read Dark Count Rate. (Without LED)



LTC6268/LTC6269

FEATURES

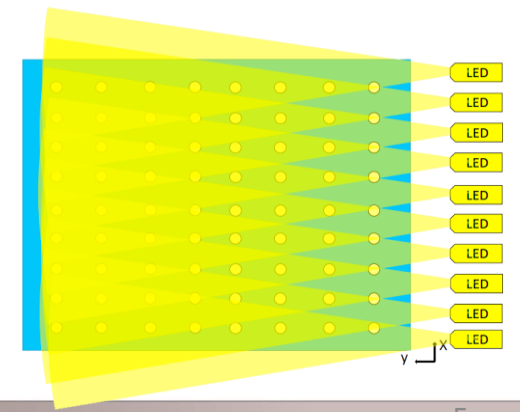
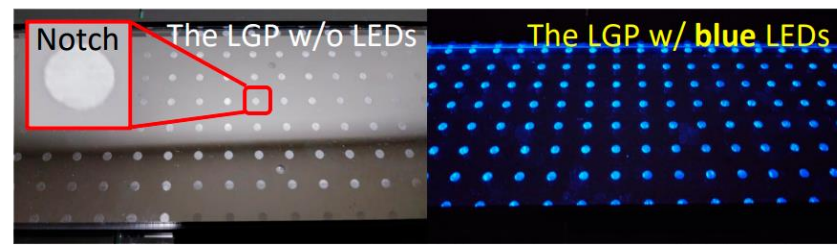
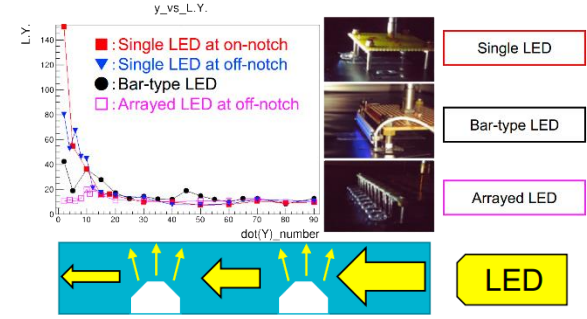
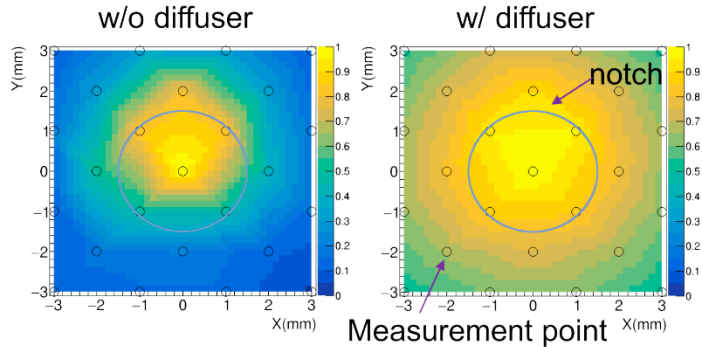
- Gain Bandwidth Product: 500MHz
- -3dB Bandwidth (A = 1): 350MHz
- Low Input Bias Current:
 $\pm 3 \text{ fA}$ Typ. Room Temperature
 4 pA Max at 125°C
- Current Noise (100kHz): $5.5 \text{ fA}/\sqrt{\text{Hz}}$
- Voltage Noise (1MHz): $4.3 \text{ nV}/\sqrt{\text{Hz}}$
- Extremely Low C_{in} 450fF
- Rail-to-Rail Output
- Slew Rate: 400V/ μs
- Supply Range: 3.1V to 5.25V
- Quiescent Current: 16.5mA
- Harmonic Distortion (2V_{p-p}):
-100dB at 1MHz
-80dB at 10MHz



LPG modules

One of the ways to distribute light can be LGP module (Use in T2K SFGD detector).

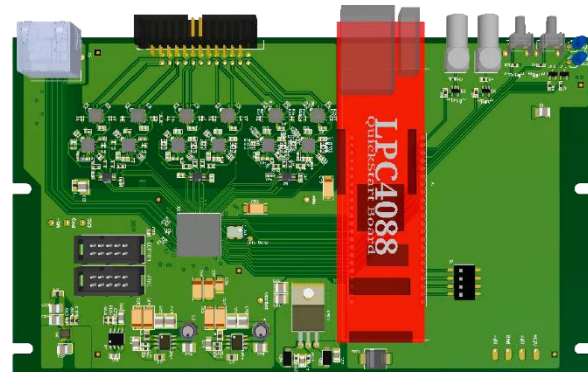
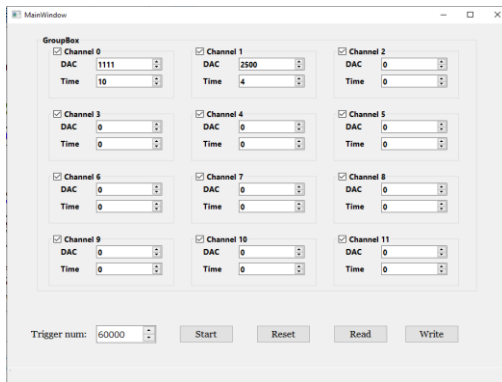
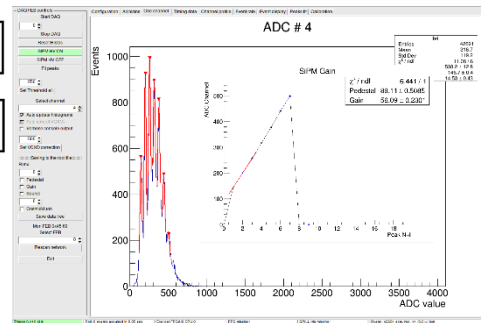
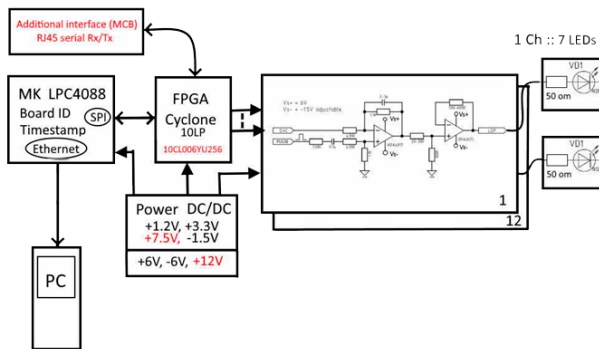
Panel based on plexiglass sheet with 1mm notch. For 4x4 module will be enough 2-4 single LED or one bar-type LED



LED Driver

- Number of channels – 12 per board
- NIM standard board
- Interface - RJ45 – Ethernet UDP
- Pulse width - 5ns – 600ns
- Amplitude - 0 – 6.5V
- 2 coaxial input/output

We can easily rework firmware and software for our tasks



Next steps?



Dzhelekov Laboratory
of Nuclear Problems



Joint Institute for
Nuclear Research

1. Amplifier Simulation
2. Prepare components for Probe System
 1. 3D printing of some components
 2. CNC processing of plexiglass
 3. Preparation first iteration PCB
3. Develop software for centralization control all components (currently ready some independent scripts and applications)
4. Etc...