Goals:

- To develop the photon counting detector package tailored for space applications

- requirements
  - solid state
  - low mass and low power
  - picosecond resolution & stability
  - CW operation (not gated)
Philosophy

- use the SPAD chips available operated in active quenching mode
- reduce the after-pulsing effects by shortening the circuit loop delay
- = > develop a new quenching circuit with the loop delay << 20 nsec
CW SPAD circuit

Figure 1: Active quenching circuit for the laser transponder

CO comparator
PF pulse forming
MC monostable
OR gate

PROTOTYPE BOARD

ECL 100 k logic
32x40 mm, SMD
loop delay 2.6ns
Vab < 1.2 Volt
CW SPAD operation

Dark count and timing resolution versus bias
Active area diameter 40 um, +25 C

I.Prochazka, K.Hamal, J.Blazej, B.Sopko, CTU Prague, Oct.2002
CW SPAD operation

Dark count rate versus temperature
Active area diameter 40 um
CW SPAD optional gating

Gate ON time response, 100 um chip, 1 V above
risetime < 80 psec, risetime+overshot < 140 psec

20 psec/channel, 2 nsec / screen

I.Prochazka, K.Hamal, J.Blazej, B.Sopko, CTU Prague, Oct.2002
Conclusion

- The active quenching and gating circuit for the CW operation of Si SPAD 40 um has been designed and tested.
- The SPAD dark count rate is 10 Hz to 10kHz within the temperature range -60 to +25 C.
- The timing resolution is 30 psec RMS.
- Suitable for space: radiation resistant Mass < 30 grams, Power < 400 mW.