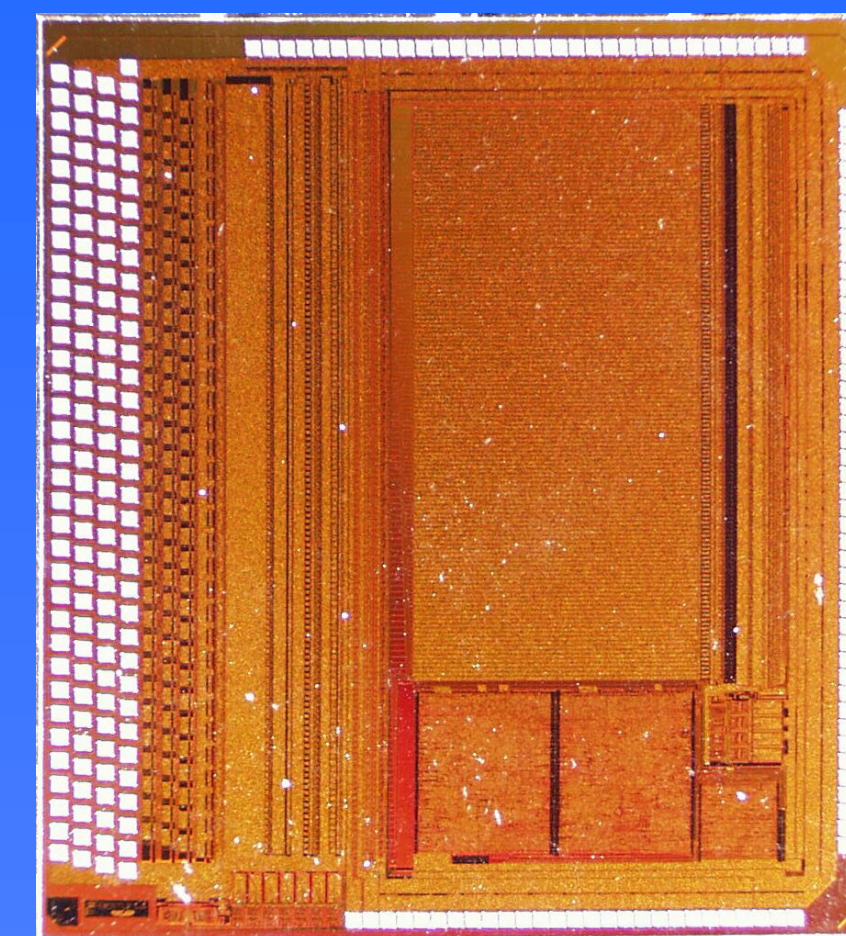


**Beetle 1.0**

First prototype of the radiation hard readout chip

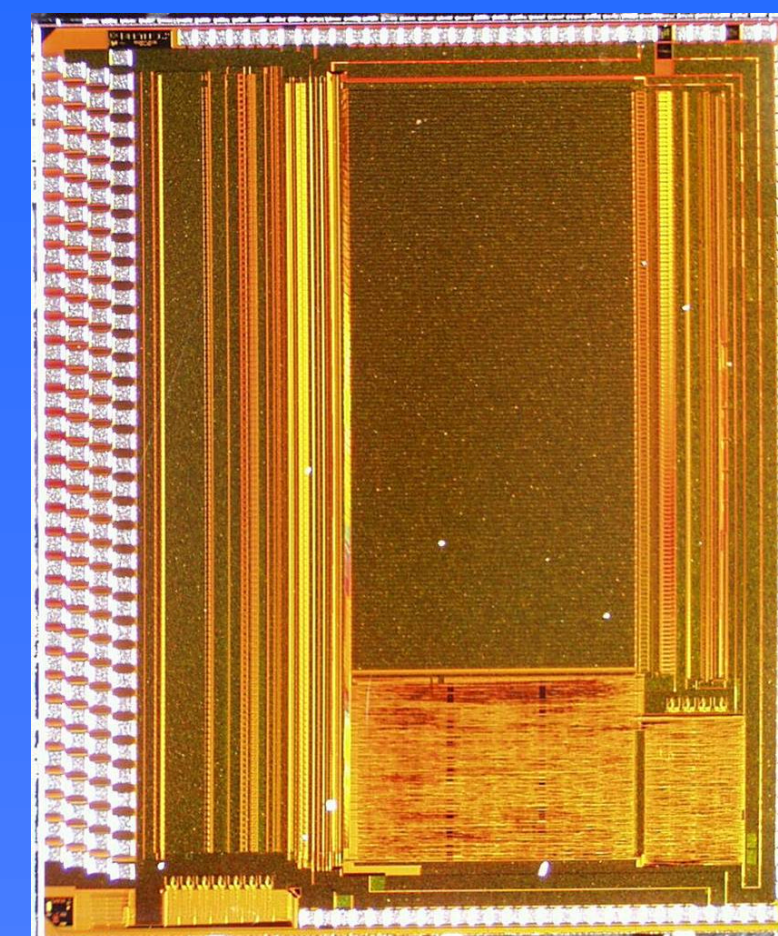
- 6.1 mm x 5.5 mm
- 128 analog channels
- 40 MHz sampling / readout
- I<sup>2</sup>C-Interface
- 10 bit bias generators



**Beetle 1.1**

Improved version of the first readout chip

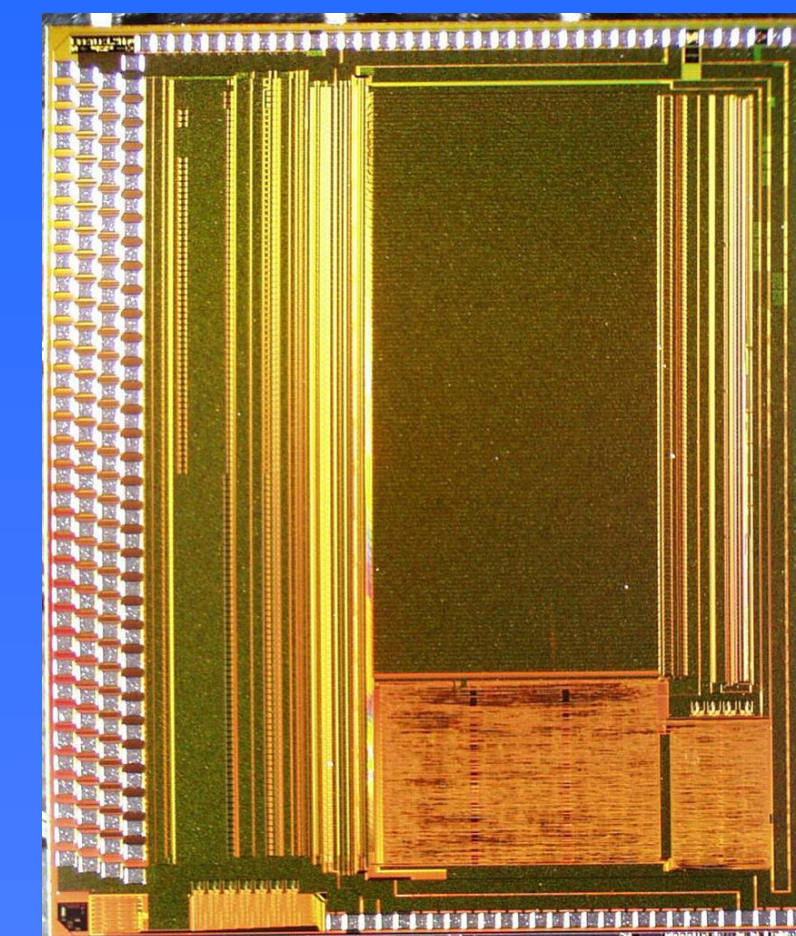
- 6.1 mm x 5.5 mm



**Beetle 1.2**

SEU robust digital logic

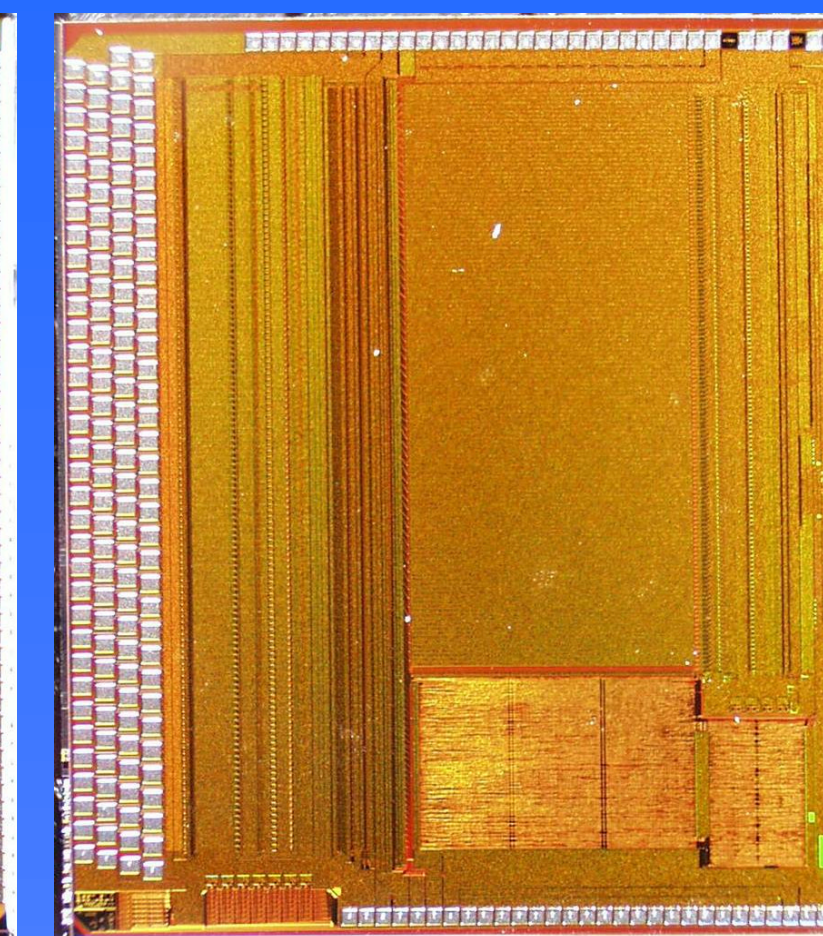
- 6.1 mm x 5.1 mm
- new analog front-end (FE 1.1)
- new digital logic (SR 1.0)
- all missing features now implemented



**Beetle 1.2MA0**

Readout chip for LHCb RICH detector

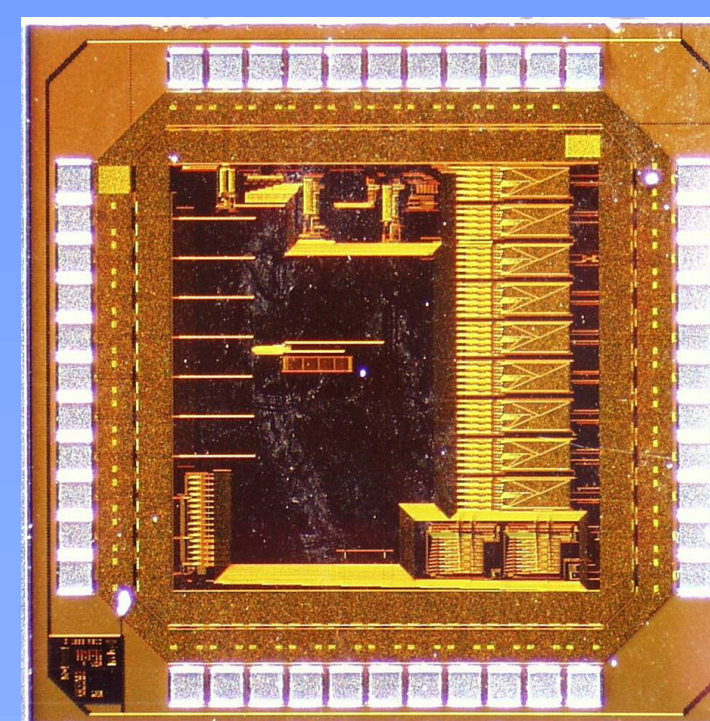
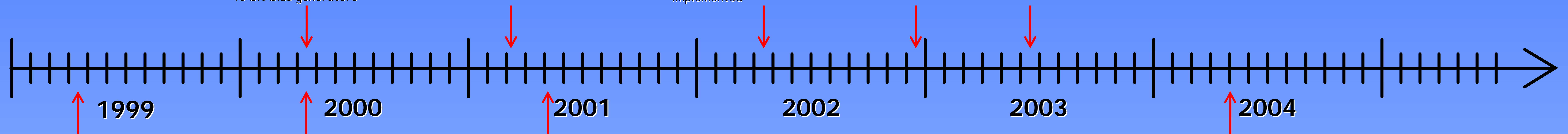
- 6.1 mm x 5.2 mm
- modified analog front-end for MA-PMTs



**Beetle 1.3**

Analog improved version of the Beetle 1.2 readout chip

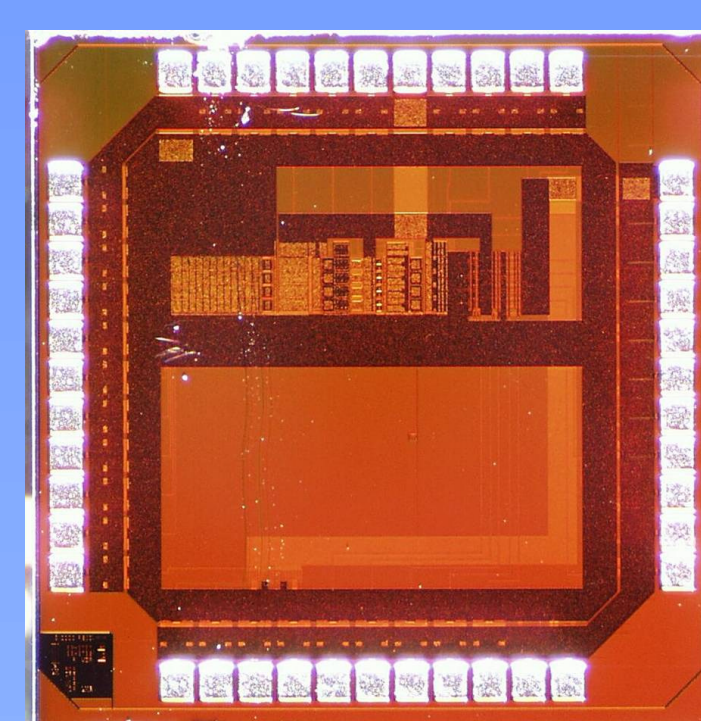
- 6.1 mm x 5.4 mm
- new power routing
- modified comparator
- new current output driver



**BeetleBG 1.0**

Bias generator test chip

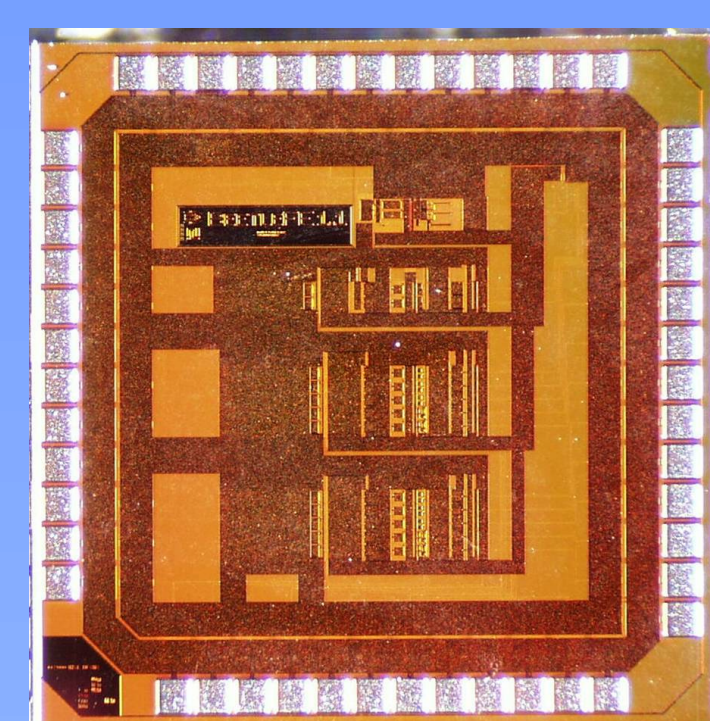
- 2.0 mm x 2.0 mm



**BeetleCO 1.0**

Comparator test chip

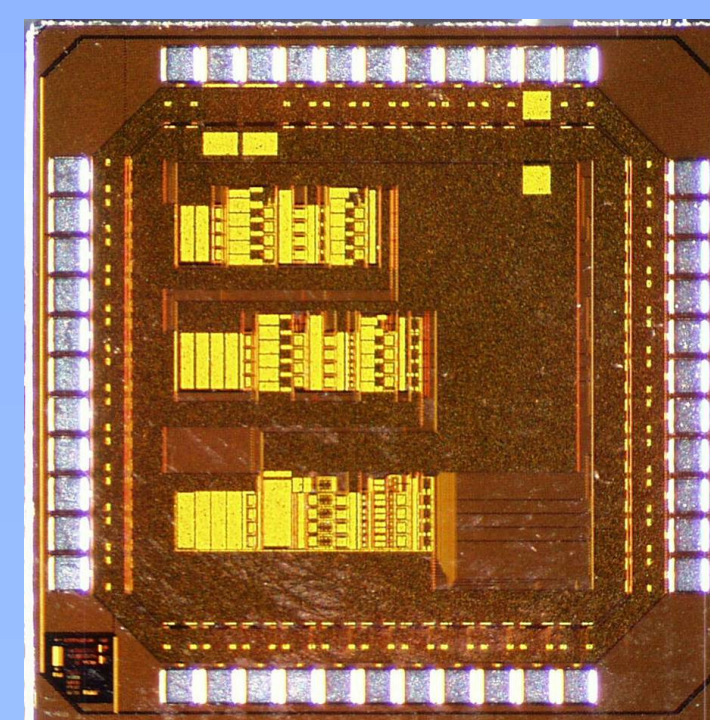
- 2.0 mm x 2.0 mm



**BeetleFE 1.1**

Front-end test chip

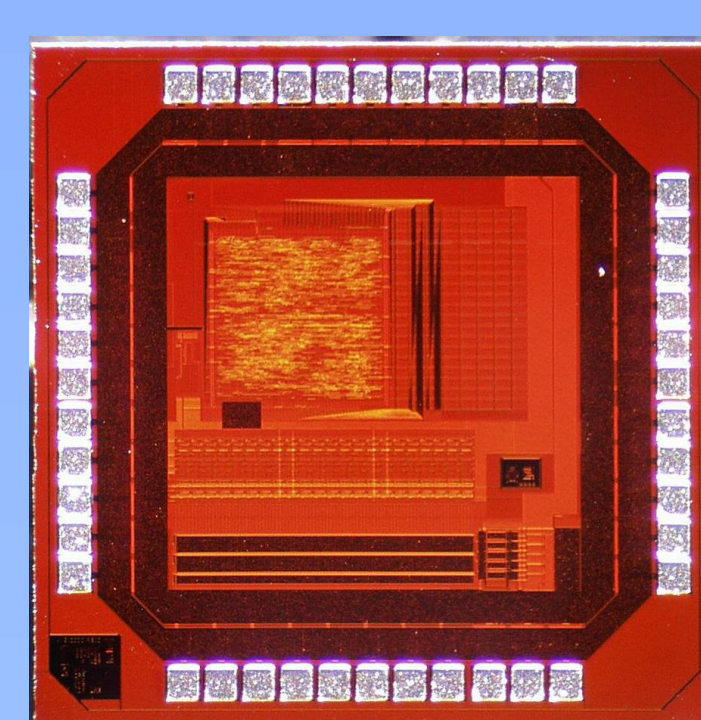
- 2.0 mm x 2.0 mm



**BeetleFE 1.0**

Front-end test chip

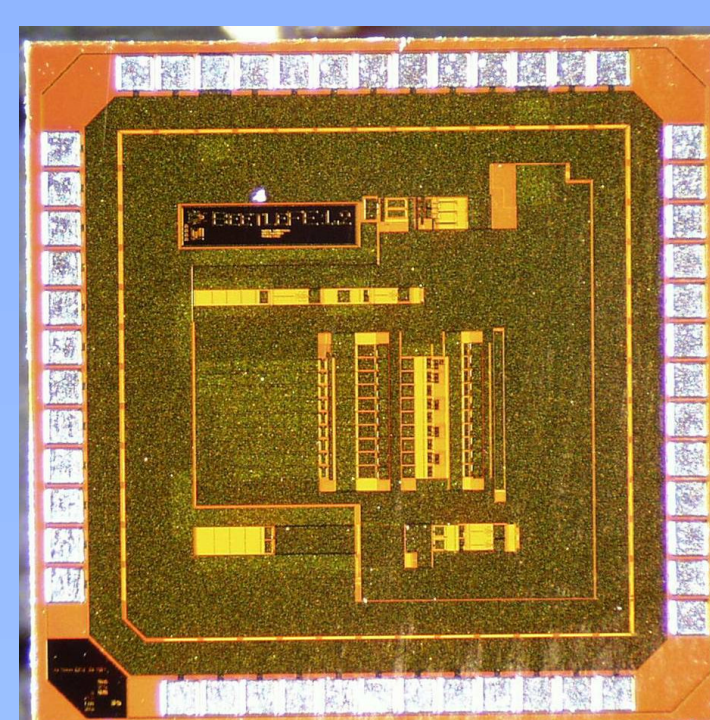
- 2.0 mm x 2.0 mm



**BeetlePA 1.0**

Pipeamp and I<sup>2</sup>C test chip

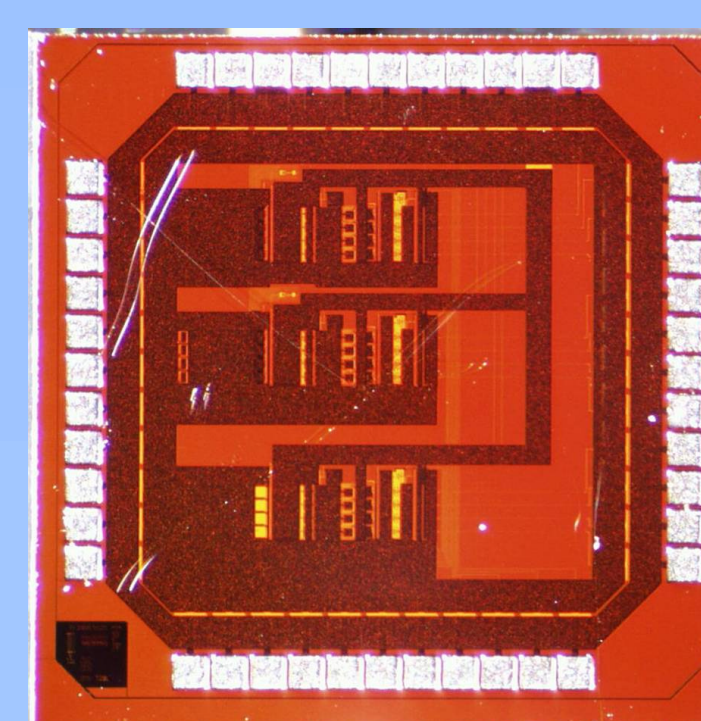
- 2.0 mm x 2.0 mm



**BeetleFE 1.2**

Front-end test chip

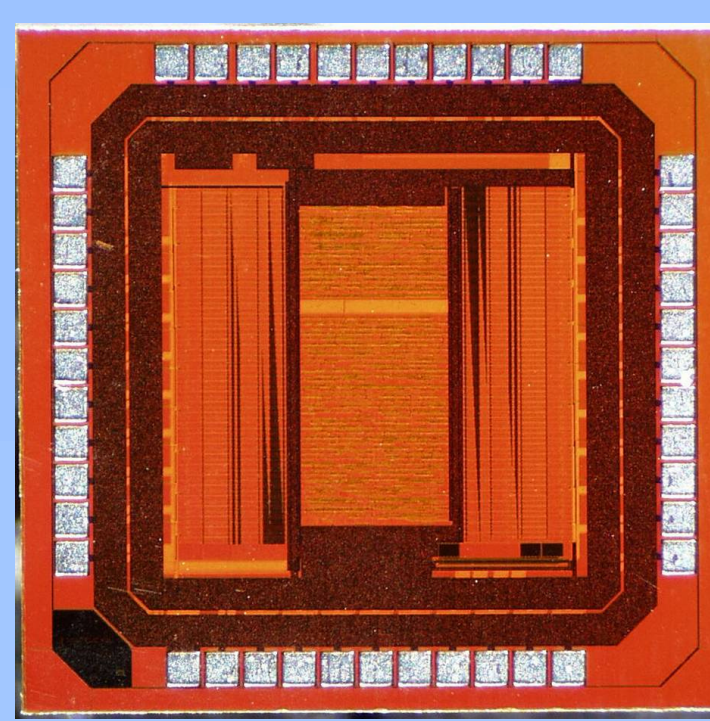
- 2.0 mm x 2.0 mm



**BeetleMA 1.0**

MA-PMT test chip

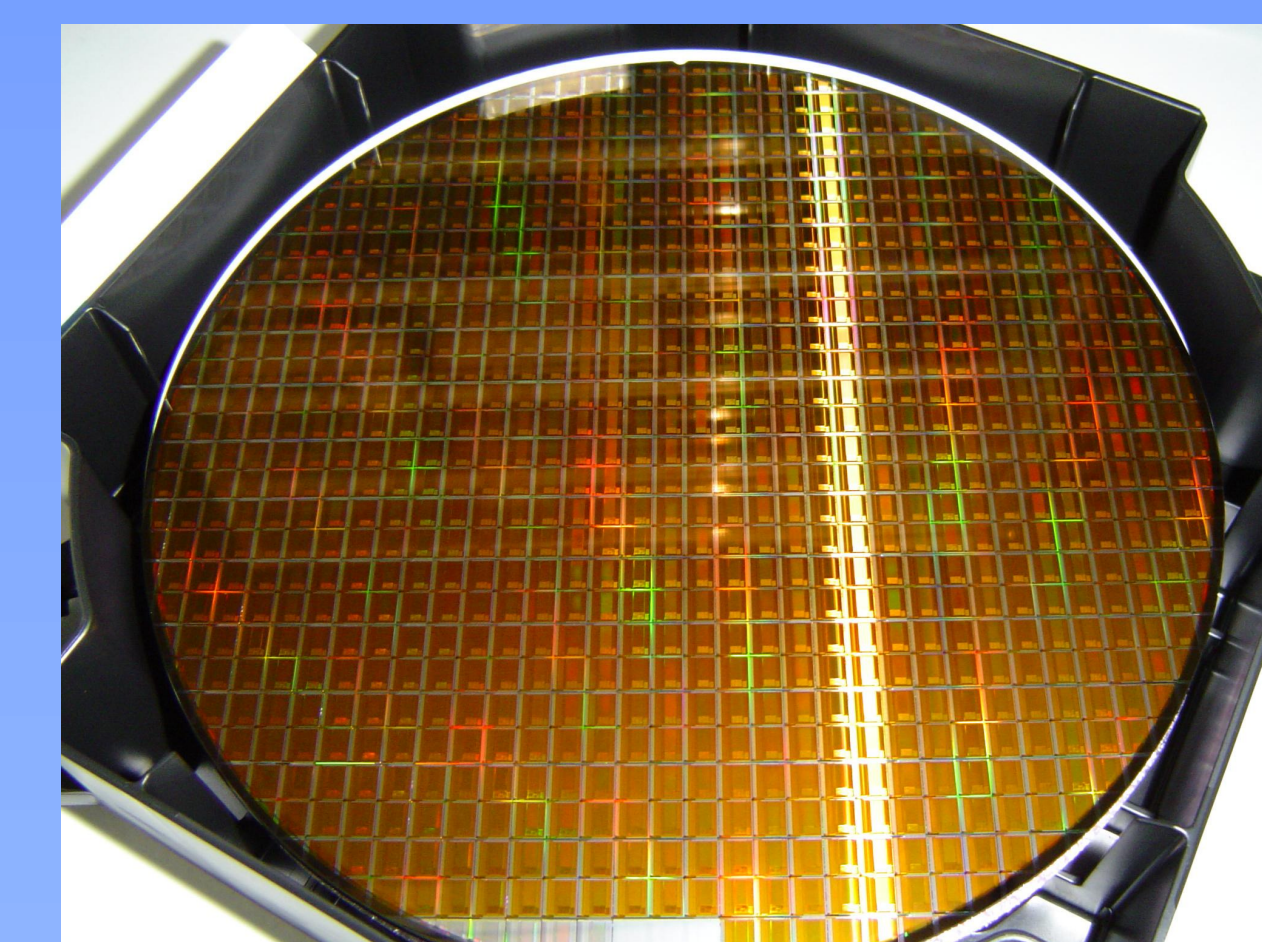
- 2.0 mm x 2.0 mm



**BeetleSR 1.0**

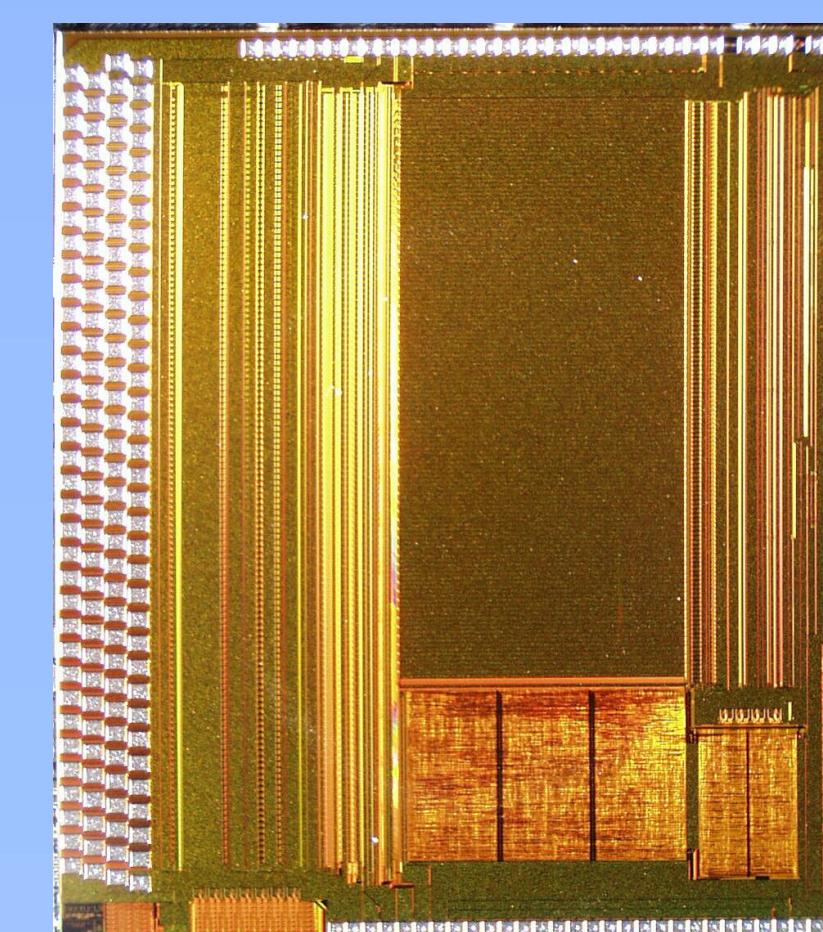
SEU robust I<sup>2</sup>C test chip

- 2.0 mm x 2.0 mm



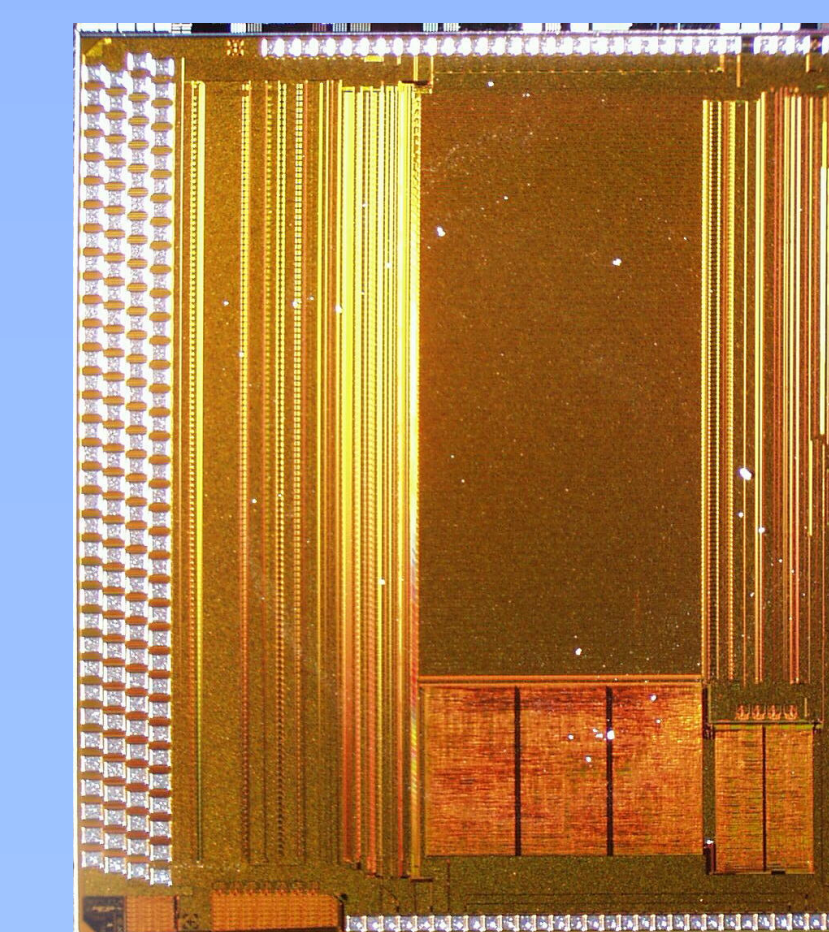
**Beetle Engineering Run**

Pre-Production Run with 3 different Beetle versions (1.3 / 1.4 / 1.5)



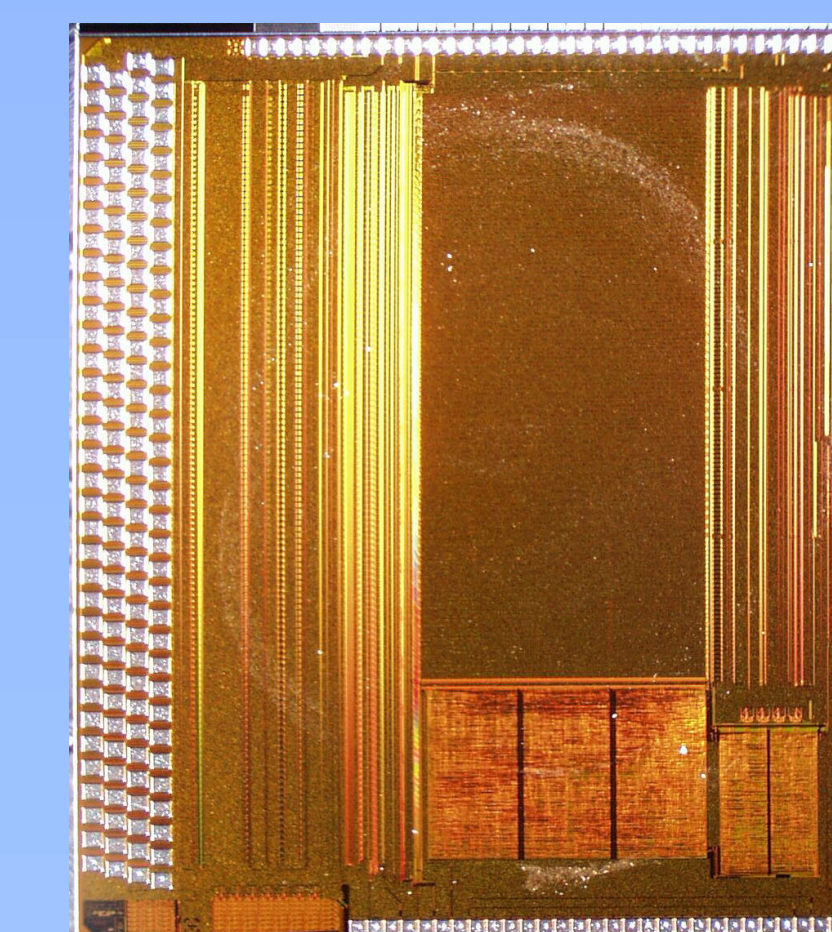
**Beetle 1.3**

- 6.1 mm x 5.4 mm
- no modifications (compared to previous submission)



**Beetle 1.4**

- 6.1 mm x 5.4 mm
- modified comparator
- modified analog routing



**Beetle 1.5**

- 6.1 mm x 5.4 mm
- changed power routing
- new pipeline cell
- modified pipeamp