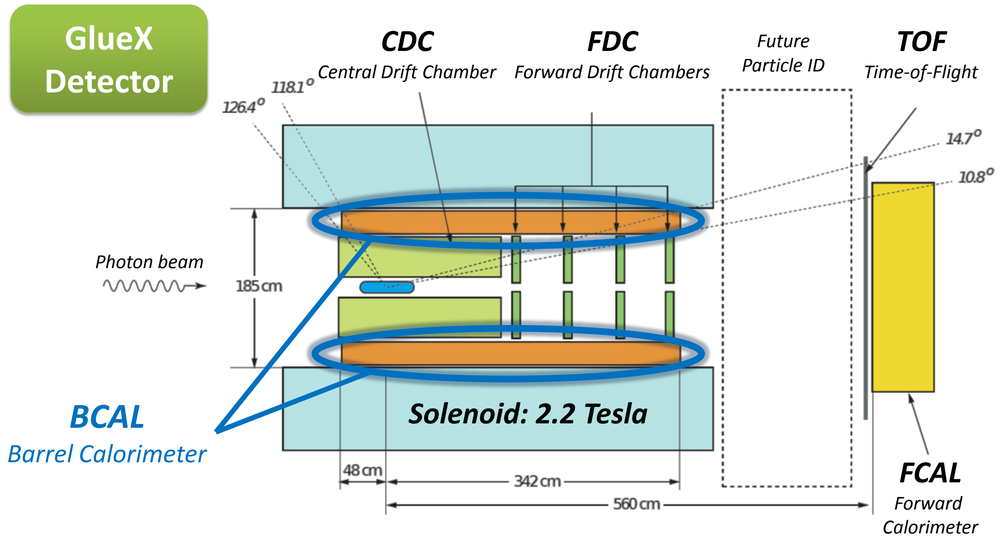
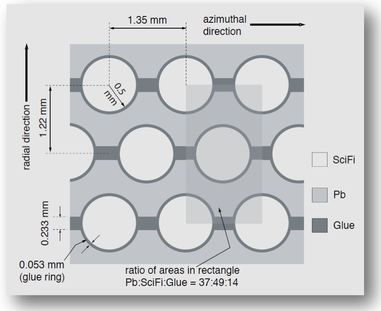
SiPM – Readout of Barrel Calorimeter

GlueX Detector



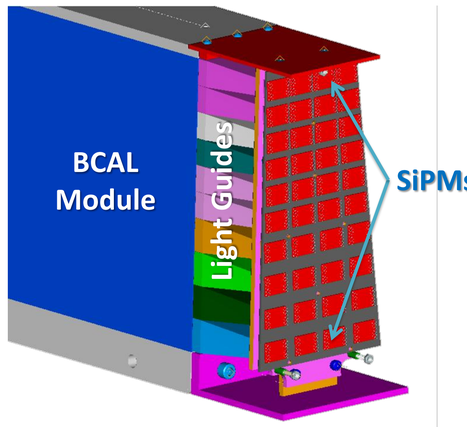
A **390 cm** long **Electromagnetic Barrel Calorimeter** (**BCAL**) is inserted into the solenoid which generates a **2.2 Tesla** magnetic field to detect particles in large angles. It measures *energy deposition* between 50 MeV to 5 GeV and provides *timing* and *position* information.

Section View of BCAL



BCAL uses a **Pb/SciFi** matrix design to have both a compact size and a very good energy resolution.

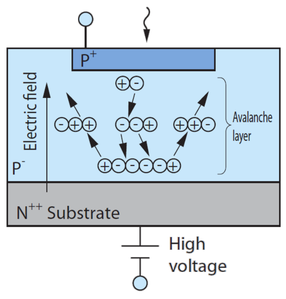
Light Collection of BCAL



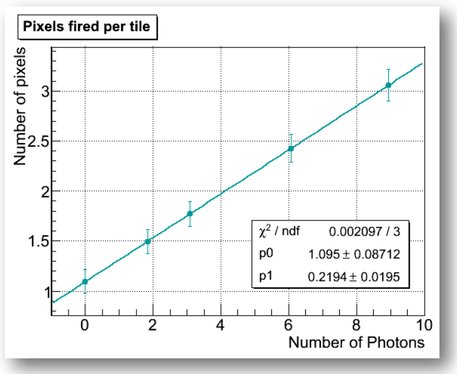
The BCAL modules are coupled on both ends to arrays of **Si**licon **P**hoton **M**ultipliers (**SiPM**) with light guides.

SiPM (Silicon Photo Multiplier)

is a new type of photon-counting device made up of multiple **APD** (**A**valanche **P**hoto**D**iode) pixels operating in Geiger mode. Each APD pixel outputs a pulse signal when it detects one photon, and the output of the SiPM is the total sum of all the pixels.

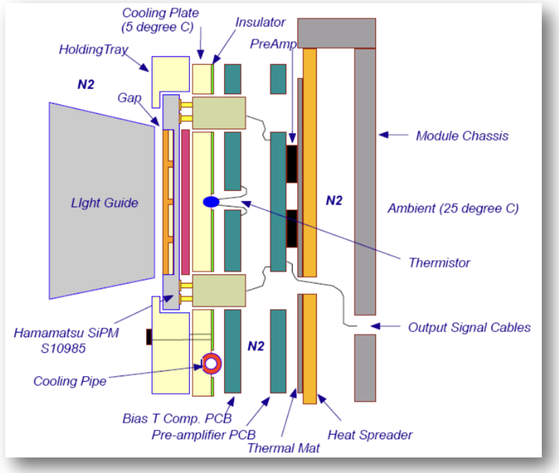


Linearity of SiPM



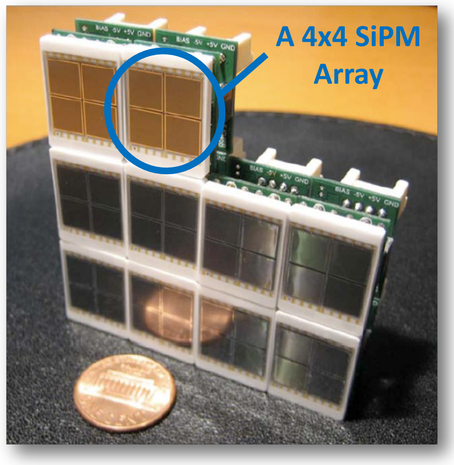
SiPM shows an excellent photon-counting capability and the pixels fired has a very linear dependence on the input light intensity.

Individual photon peaks can also be clearly identified.



Cool the SiPMs

The SiPMs will be cooled to **5°C** to reduce the dark noise. Passive bias voltage compensation circuit will be used as well to further stabilize the gain.



4x4 SiPM Arrays for BCAL

- ***Geometry*** 4x4 array of 3x3mm SiPM tiles
- ***Pixel size*** 50 μm, 57600 pixels per array
- ***Detection Efficiency*** > 20%
- ***Gain*** ~ 10^6
- ***Not*** sensitive to strong magnetic field
- ***Noise*** ~ 20 MHz for full array
- ***Total Number of SiPMs*** 3840

Pulse Shape and ADC Spectrum of a 3x3 mm SiPM Tile