

IRL Status and Plans

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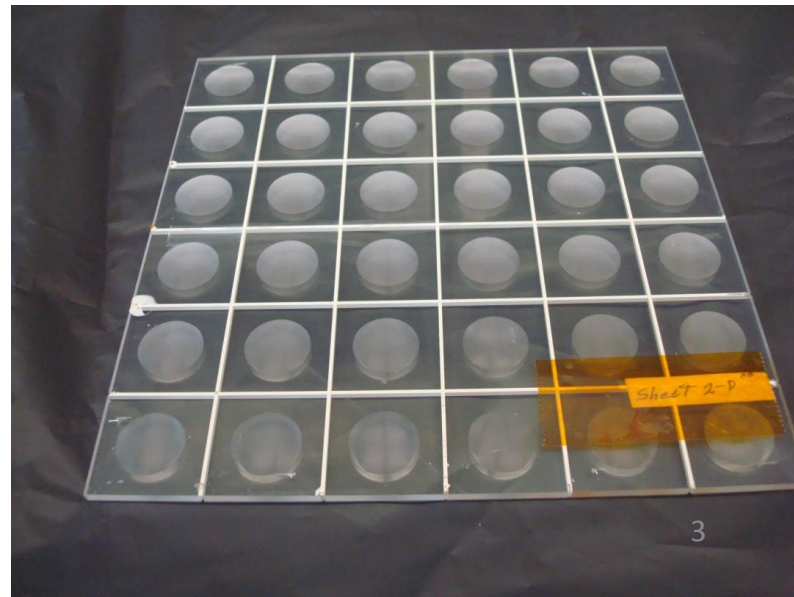
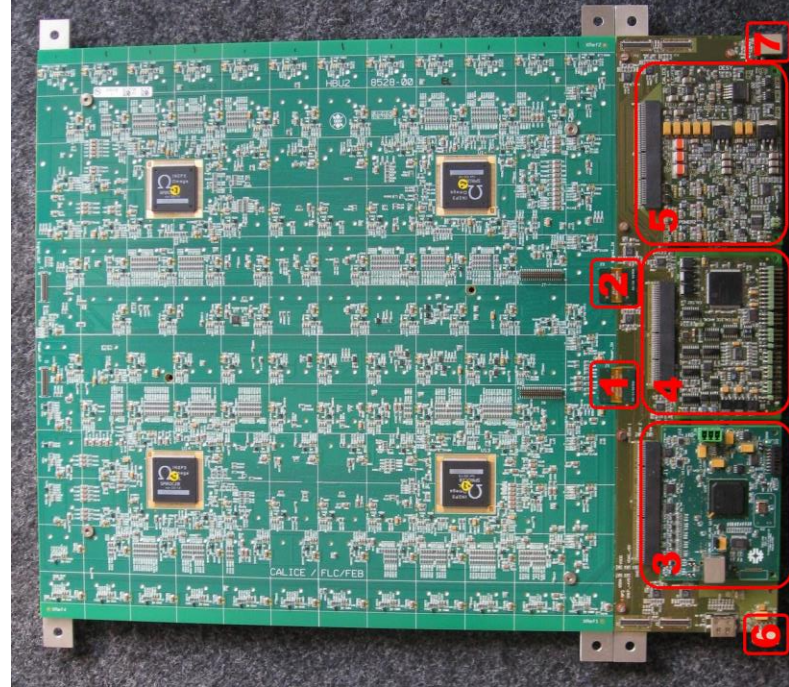


Integrated Readout Layer (IRL)

- Seeking ways to reduce the construction cost of large, granular calorimeters
- Use surface mount devices
- Mega-tiles consisting of many small tiles fabricated together
- Direct coupling to eliminate wavelength shifting fibers
 - But response over a flat cell would be non-uniform -> leads to a concave dimple to make response of the cell uniform

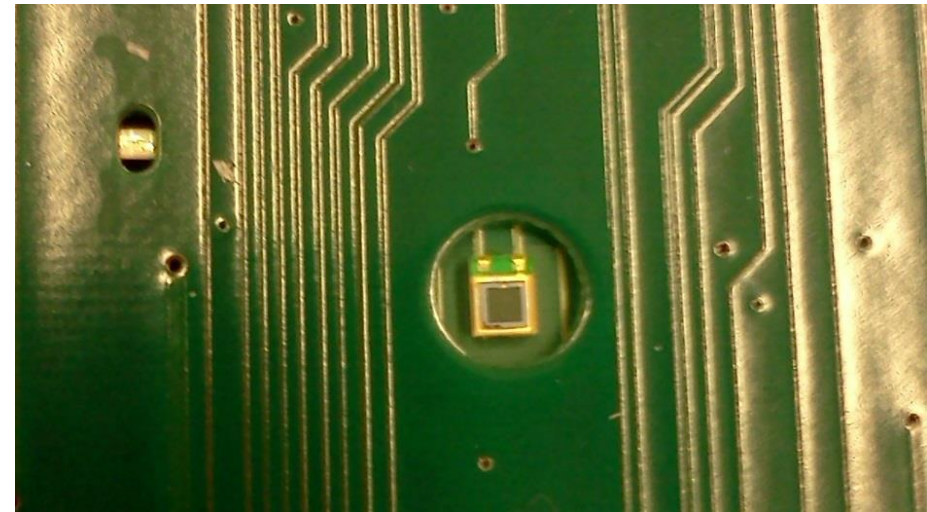
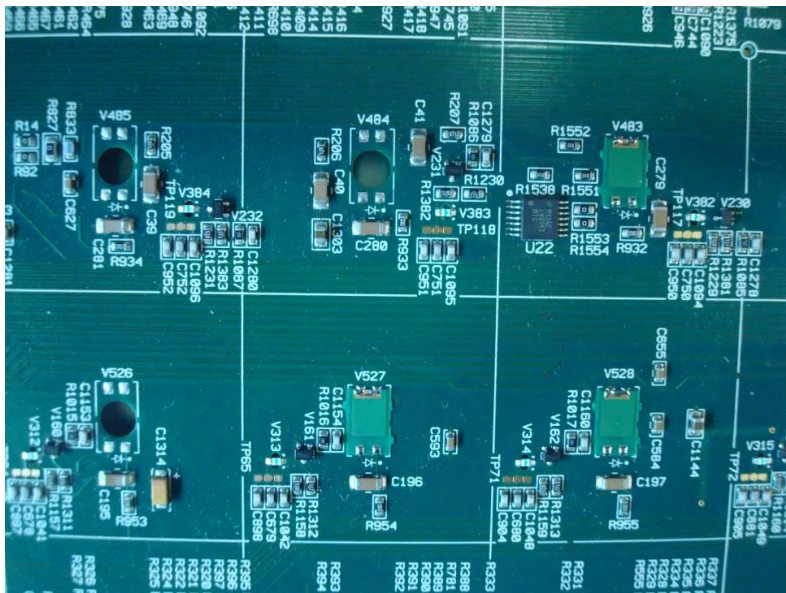
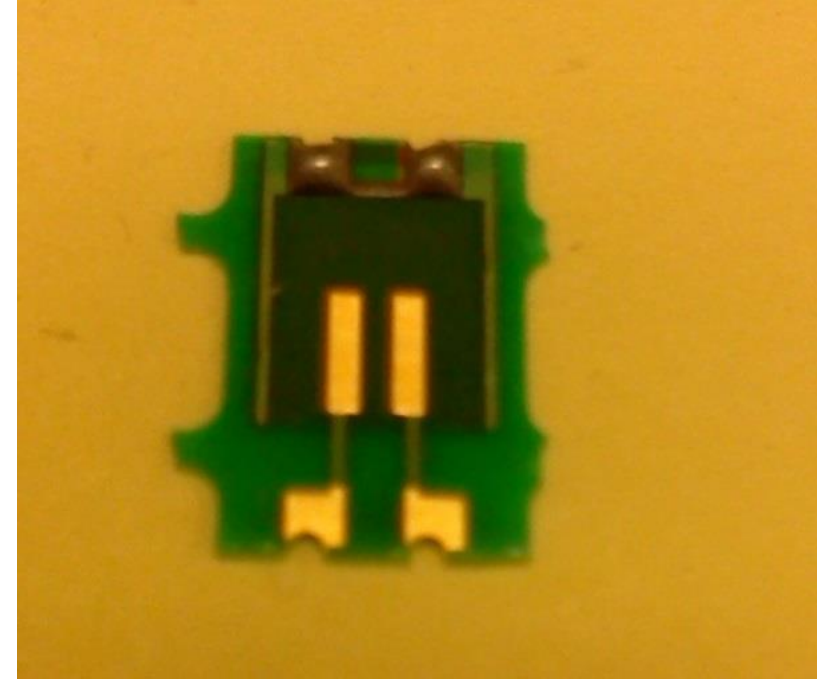
Integrated Readout Layer

- Uses HBU2 Front End with Silicon PM Readout ASIC (SPIROC) board so we had to make some compromises
- Hamamatsu MPPCs mounted on small flex circuits
- Scintillator “Megatile” with $\sim 3 \times 3$ cm cells (30.15 mm to match AHCAL dimensions) optically isolated with white epoxy
- Cells have a concave dimple improve the uniformity of the response
- Easier to assemble, does not need WLS optical fiber



MPPC Mounting and Installation

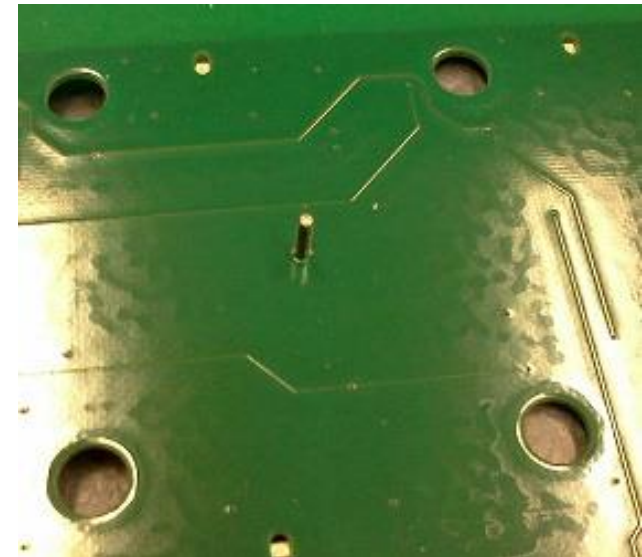
- Hamamatsu S10362 SMD MPPCs mounted on small flex circuits
- Mounted in holes on HBU2 board so that sensitive surface of MPPC is on opposite side of circuit board as ICs
- Each MPPC has its own LED (plan to test one LED for 4 MPPC which worked with our original design)
- (Cannot populate area behind SPIROC chips because of HBU2 design)



“Megatile” with Concave Dimple

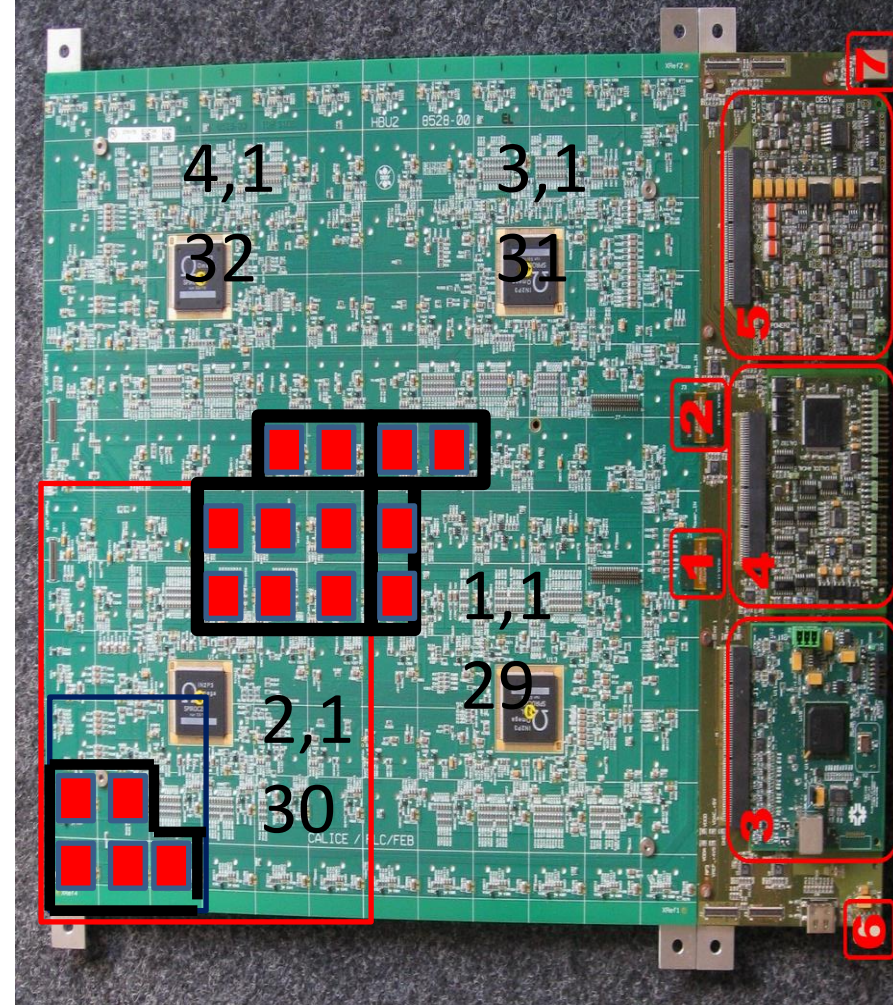
-Scintillator “Megatile”

- 3.00 mm thick with 0.05 mm accuracy
 - 30.15 x 30.15 mm cells
 - optically isolated with white epoxy
- Cells have a concave dimple machined into cast scintillator to improve the uniformity of the response
- Aligned with pins
- The Megatile is milled from one solid piece of cast polyvinyltolulene scintillator for each HBU board
- Each HBU board has four 6x6 cell Megatiles
- Megatile is rigid and provides support for circuit board
- Reflective VM2000 on flat surface

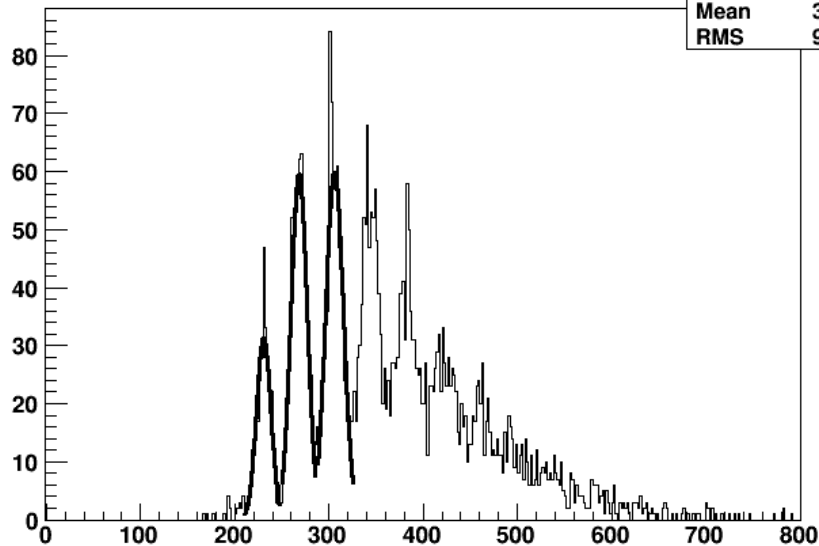


Initial Test Configuration

- 17 MPPC mounted with 25, 50 and 100 micron pixel size
- 50 micron Pixel have average gain of 40
- 25 micron Pixel MPPCs have lower gain and it is difficult to distinguish peaks
- SPIROC 1 does not work, will be replaced



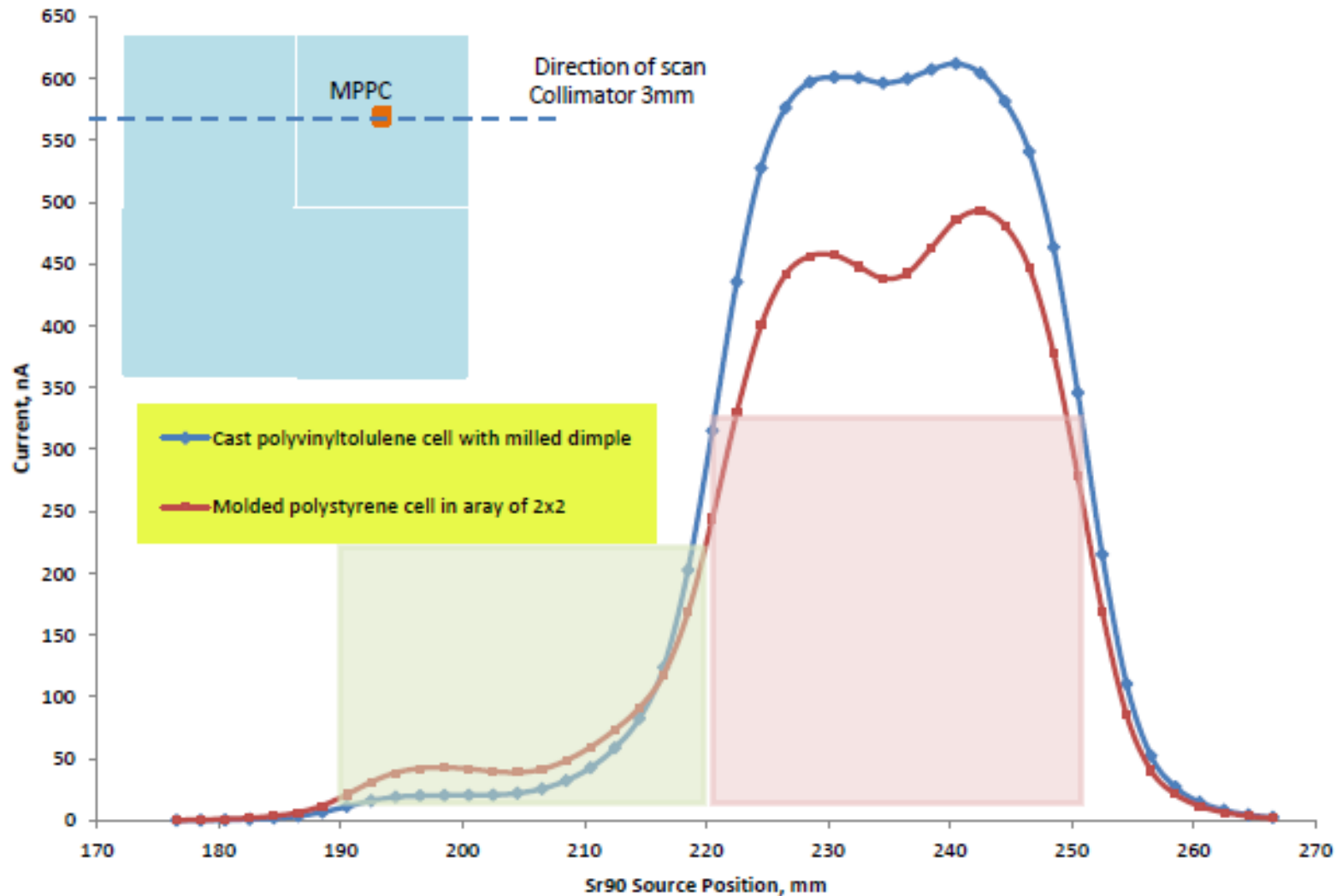
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Evaluating Tiles with Dimple Formed by Injection Molding

- Injection molded cells would be less expensive to produce than machined cells
- Two different manufacturers (Intrepid and AdvanTech) produced 2x2 arrays
- Both the arrays and machined cell have their sides painted and VM2000 on the flat surface.
- Selected dimple depth appears to overcompensate
- Promising results

30.15mm x 30.15mm square cells with 3mm thickness. Each Cell has a spherical dimple. Molded polystyrene cell is in 2x2 array. Cast polyvinyltolulene single cell has a milled dimple.



Next Steps

- Test the SPIROC replacement on original board
- Test second board
- Mount new Hamamatsu MMPCs on boards and test (new S12571 series claims to have reduced crosstalk and after-pulsing)
- Fabricate and test 9x12 machined Megatile
- Test additional injection molded cells
- Eventually place in test beam (Spring 2014)

- Special thanks to Felix, Mathias and Oskar for support