NIU Integrated Readout Layer

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Integrated Readout Layer (IRL)

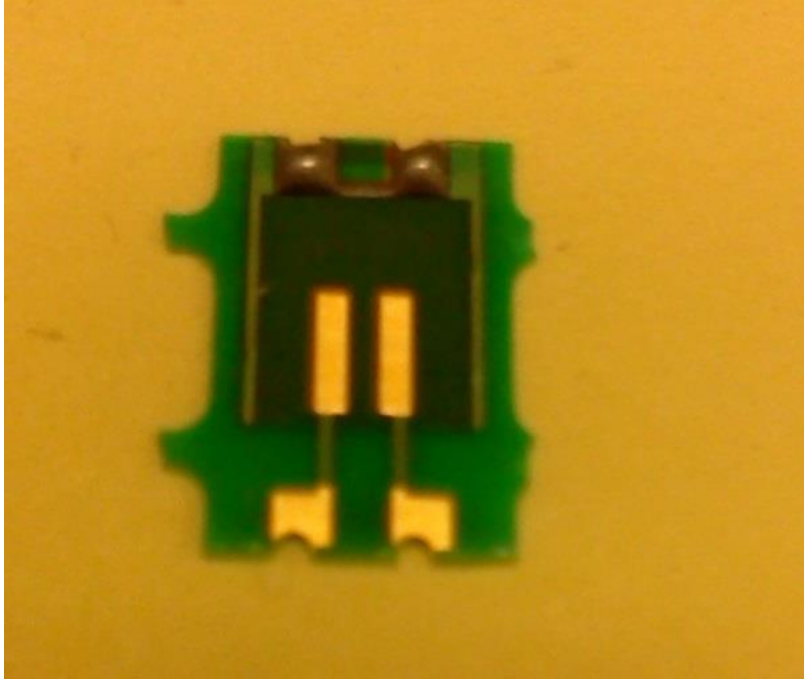
- Background and Motivation
- NIU's IRL using HBU board
- Megatiles
- Initial tests using Hamamatsu S10362 and LED calibration
- First tests with S12571 MPPC
- Stuff HBU board with 44 MPPC
- Set up scanning with Sr90 source
- New 9x11 megatile
- Summary and next steps

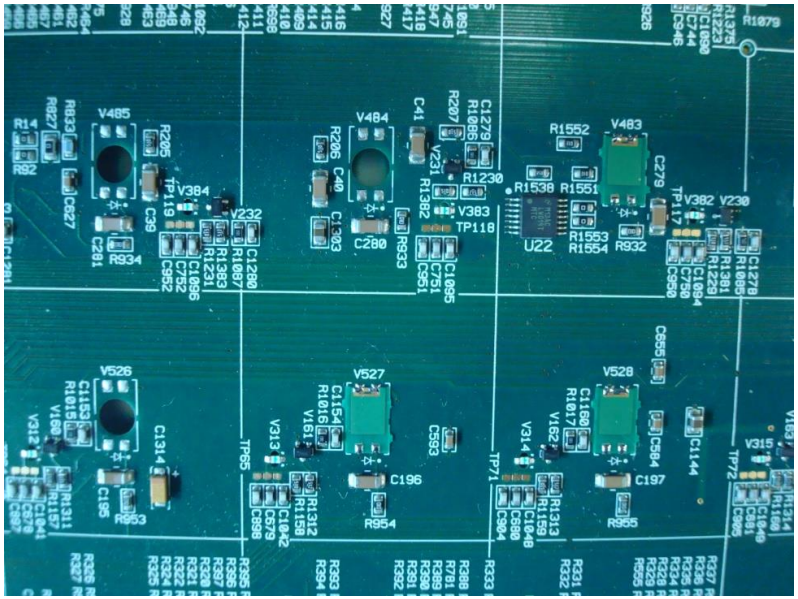
Motivation

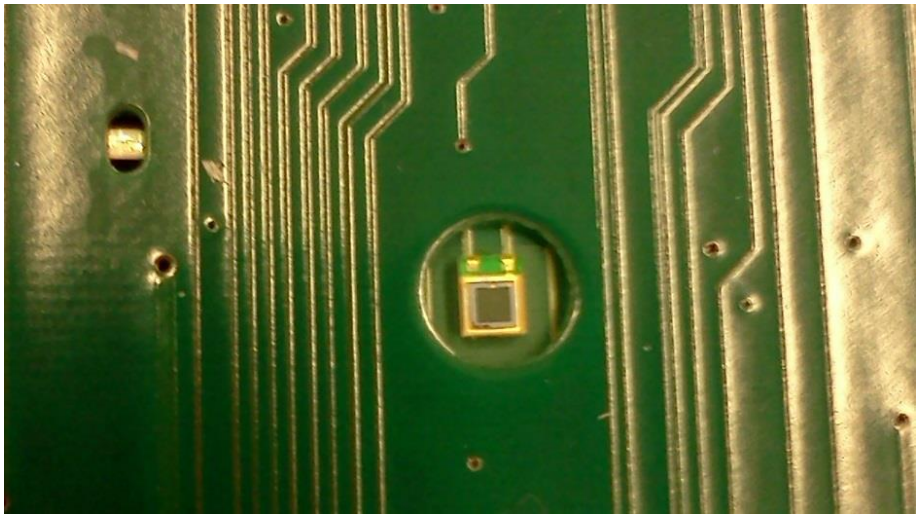
- Seeking ways to reduce the construction cost of large, granular calorimeters
- Use surface mount devices
- Mega-tiles consisting of many small tiles fabricated together
- Direct coupling to eliminate wavelength shifting fibers
  - But response over a flat cell would be non-uniform -> leads to a concave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

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

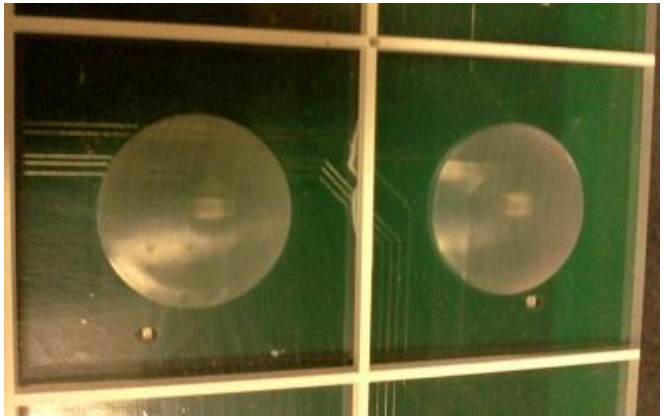
-Aligned with pins

-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

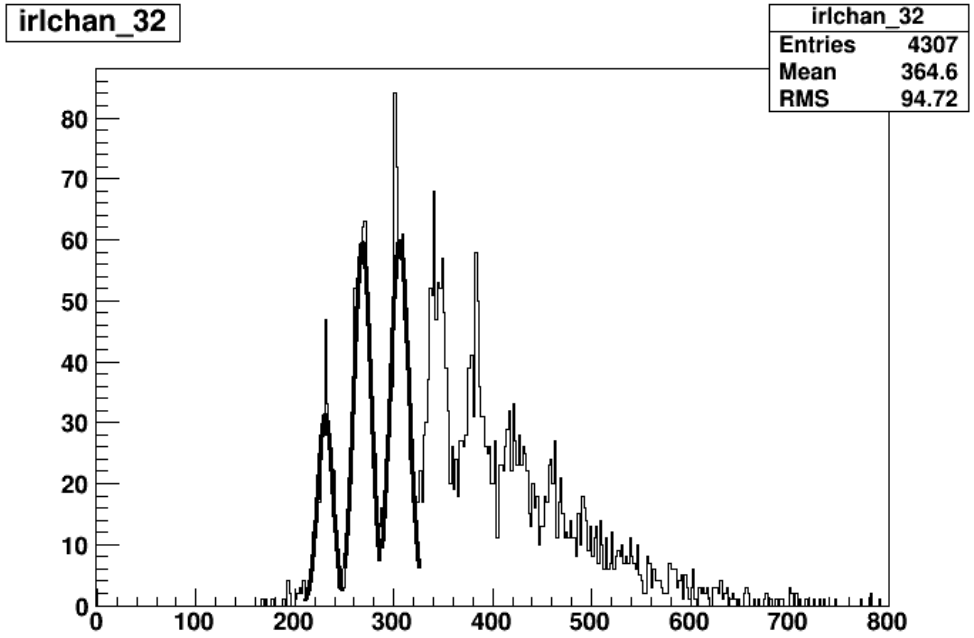


Find Single Photoelectron Spectra

-Take separation of peaks in ADC counts to be “Gain”

-50 micron Pixel have average gain of 40

-25 micron Pixel MPPCs have lower gain and it is difficult to distinguish peaks – but useful for signals with wide range

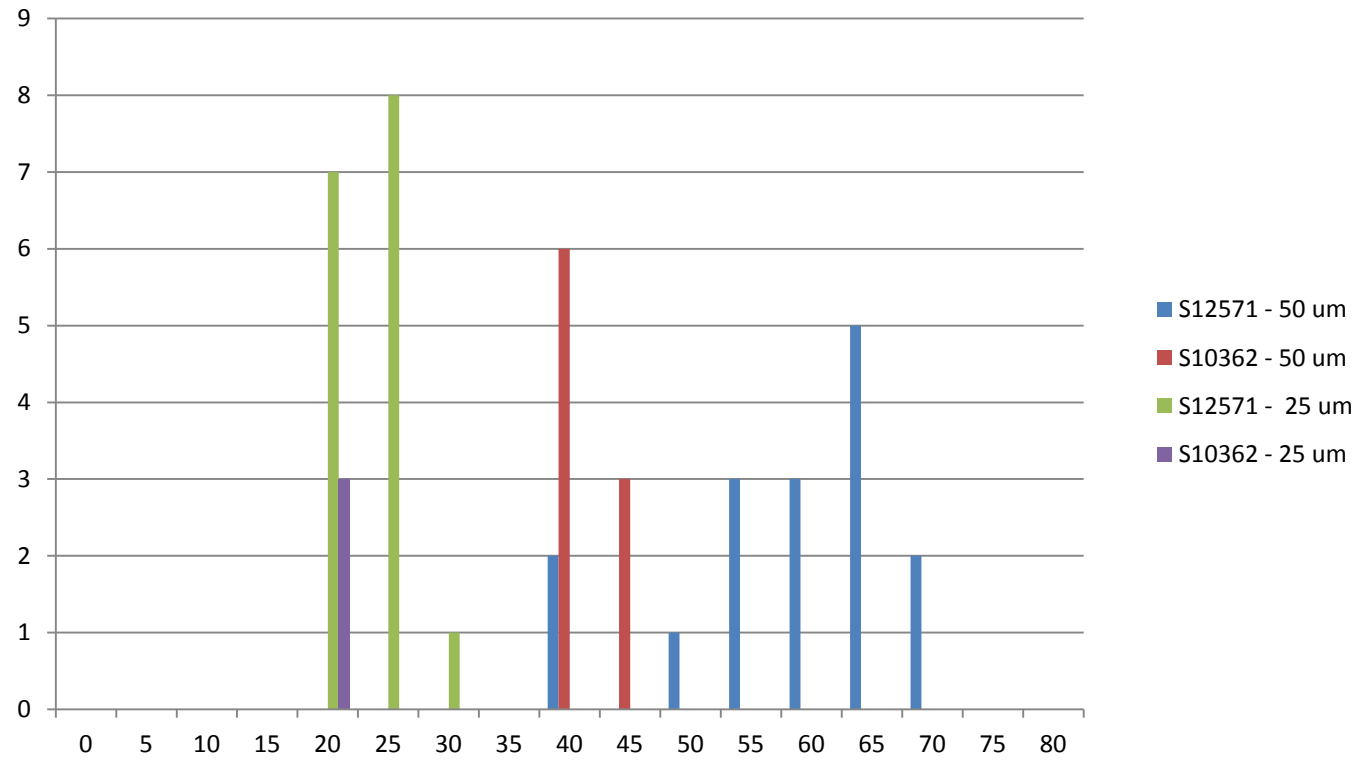


SPIROC	CHAN	MPPC#	Type	"Gain"
2	9	230	-50	**38**
2	3	231	-50	**40**
2	10	232	-50	**37**
2	4	233	-50	**40**
4	31	234	-50	**36**
2	11	235	-50	**44**
2	5	236	-50	**43**
4	30	237	-50	**44**
1	6	238	-50	---
1	0	239	-50	---
3	35	13	-25	???
3	34	14	-25	---
2	32	15	-50	**37**
2	25	10	-25	**18**
2	30	11	-25	**18**
2	31	12	-25	**17**
2	24	9	-100	**92**

MPPC S12571

- Hamamatsu's new PDE specs exclude effects of cross-talk and after-pulsing
- Eight 25um S12571 and eight 50um MPPCs
- Cover center part of HBU board and a large fraction of planned 9x11 megatile
- Had to modify power supply board to have lower base voltage for new batch of MPPCs

Distribution of Sensor Gain (in ADC counts)



	average
S12571 - 50	57
S10362 - 50	40
S12571 -25	22
S10362 - 25	18

Sensor Layout

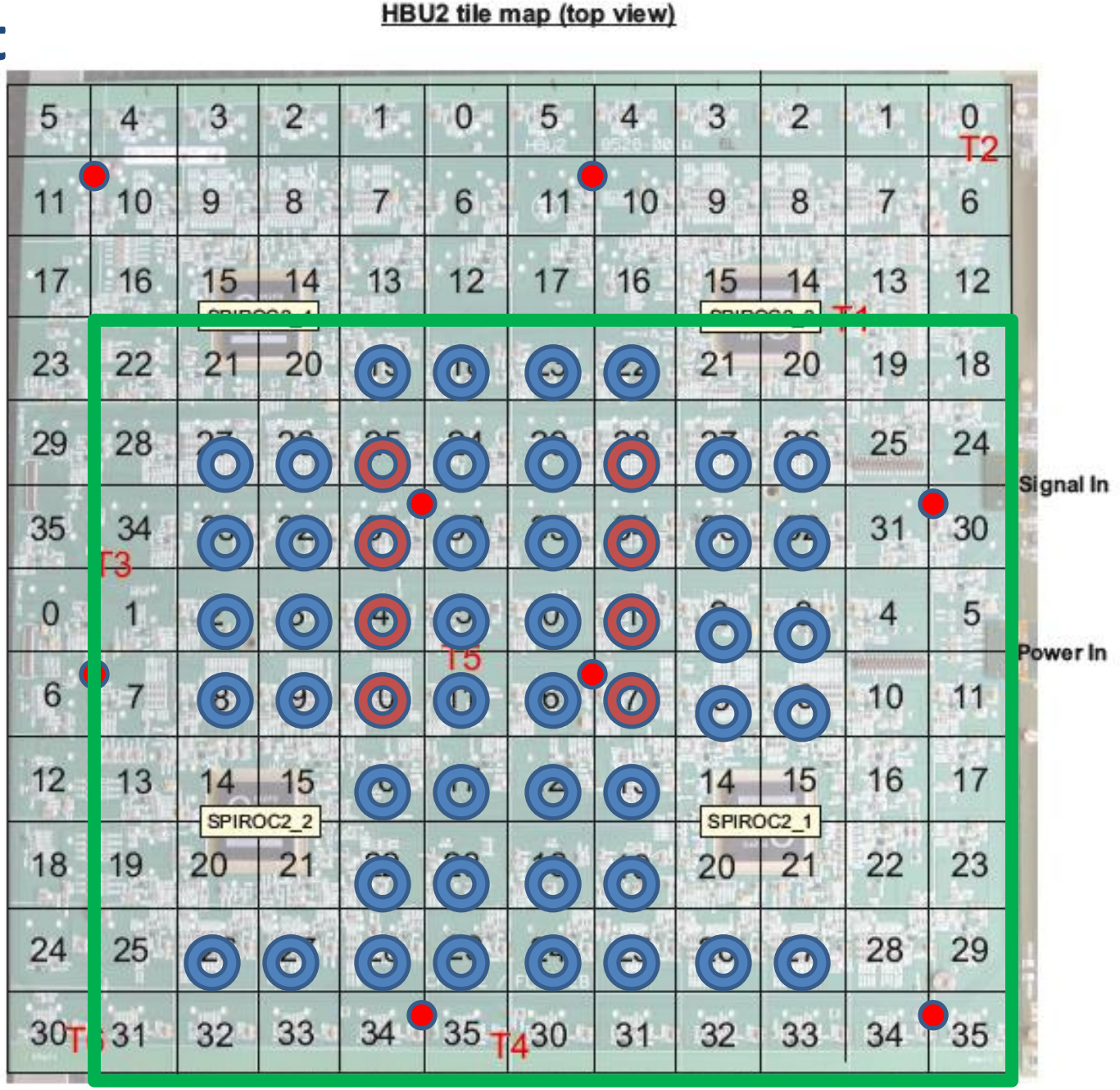
-**Added more 50 um pixel MPPCs to give a total of 44**

Green: outline of planned megatile

Blue: 50um MPPC

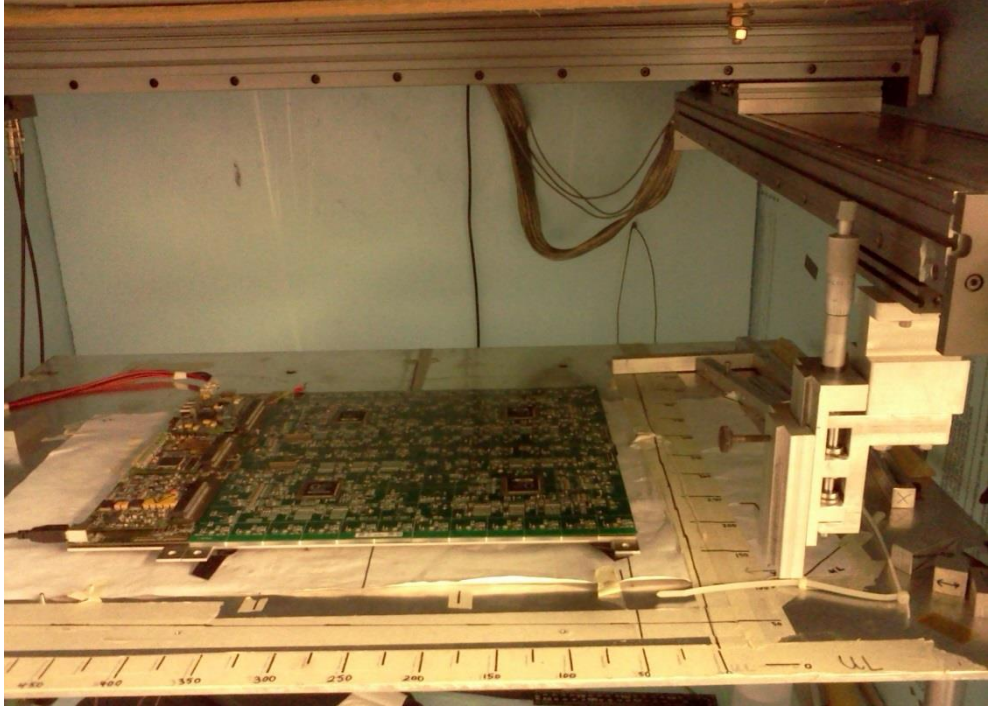
Purple: 25um MPPC

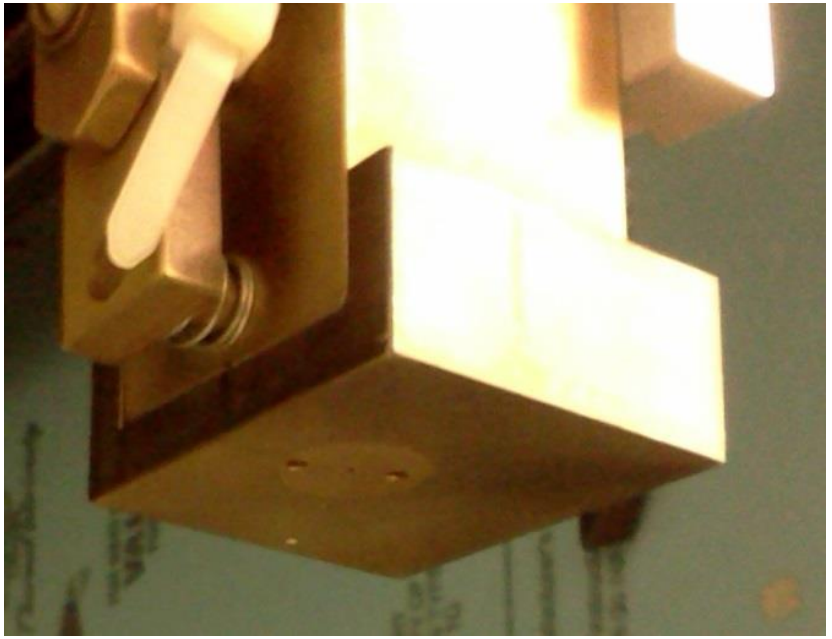
Red: holes for alignment pins



Scan Tile with Source

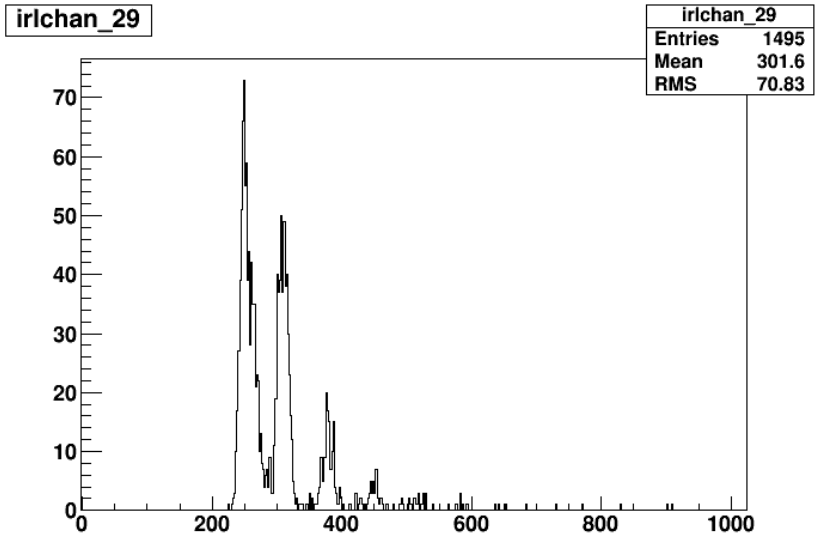
- Two axis control
- Sr90 source
- Controlled by Labview Software
- Three collimator options available
    - wide
    - pin hole
    - slit



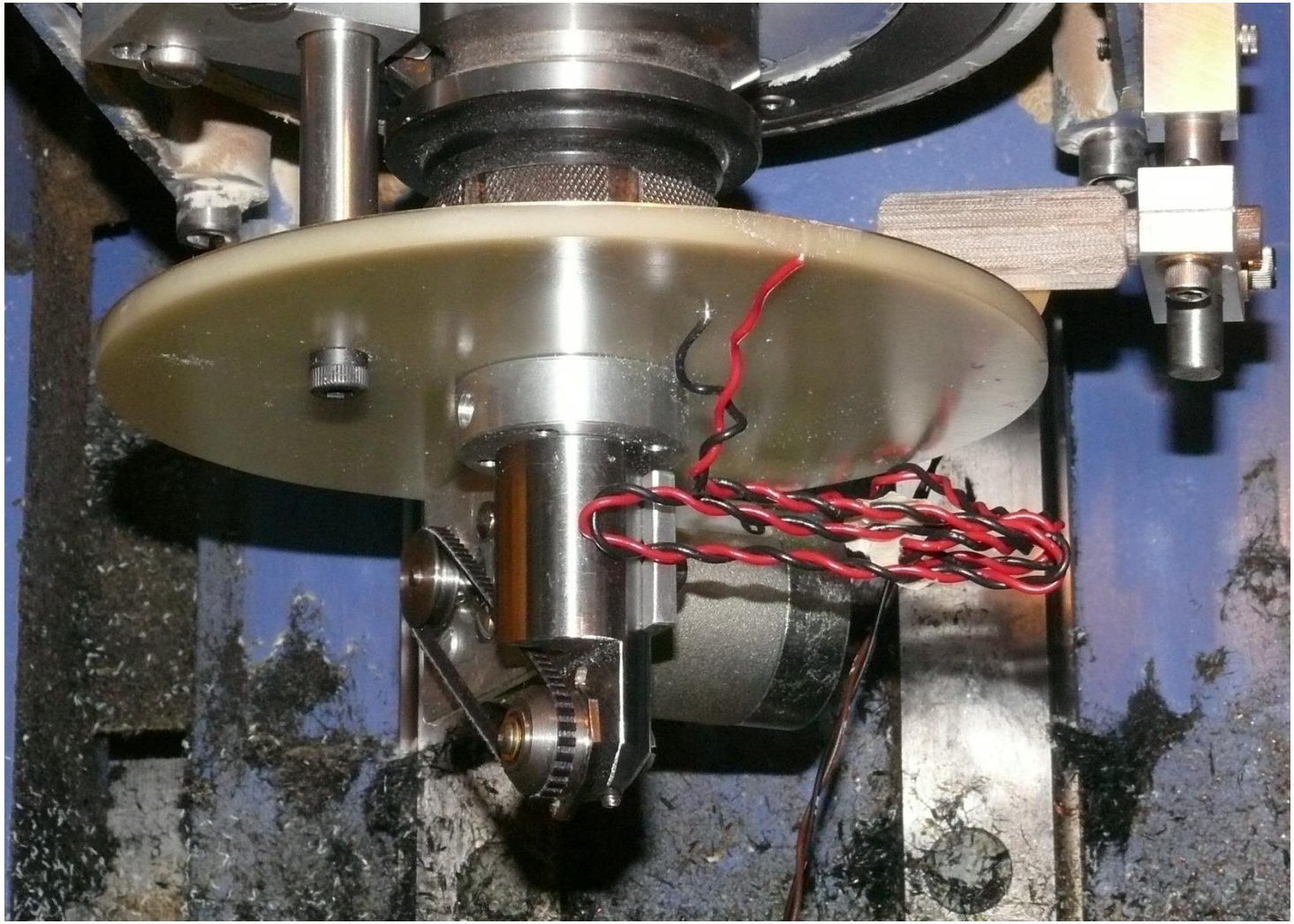


Scan Tile with Source

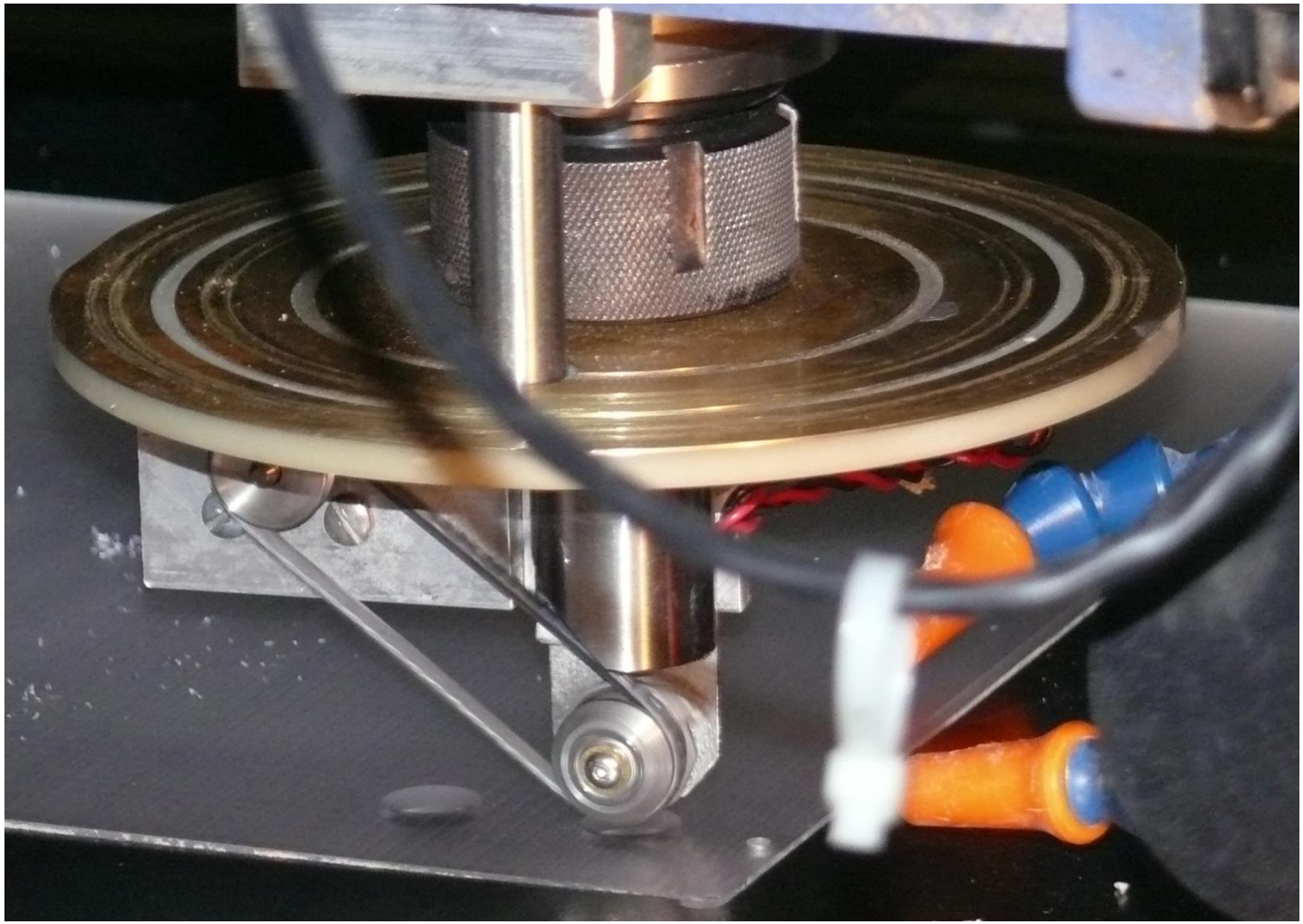
- First attempts to integrate HBU labivew software with 2 axis controller
- Need to configure software (thresholds, trigger widths)
- First reading shown…
- Beta/gamma from source goes through PC board (source – PC board – scintillator)
- May try with no scintillator – localize sensor
- Do scans with pin-hole collimator and slit



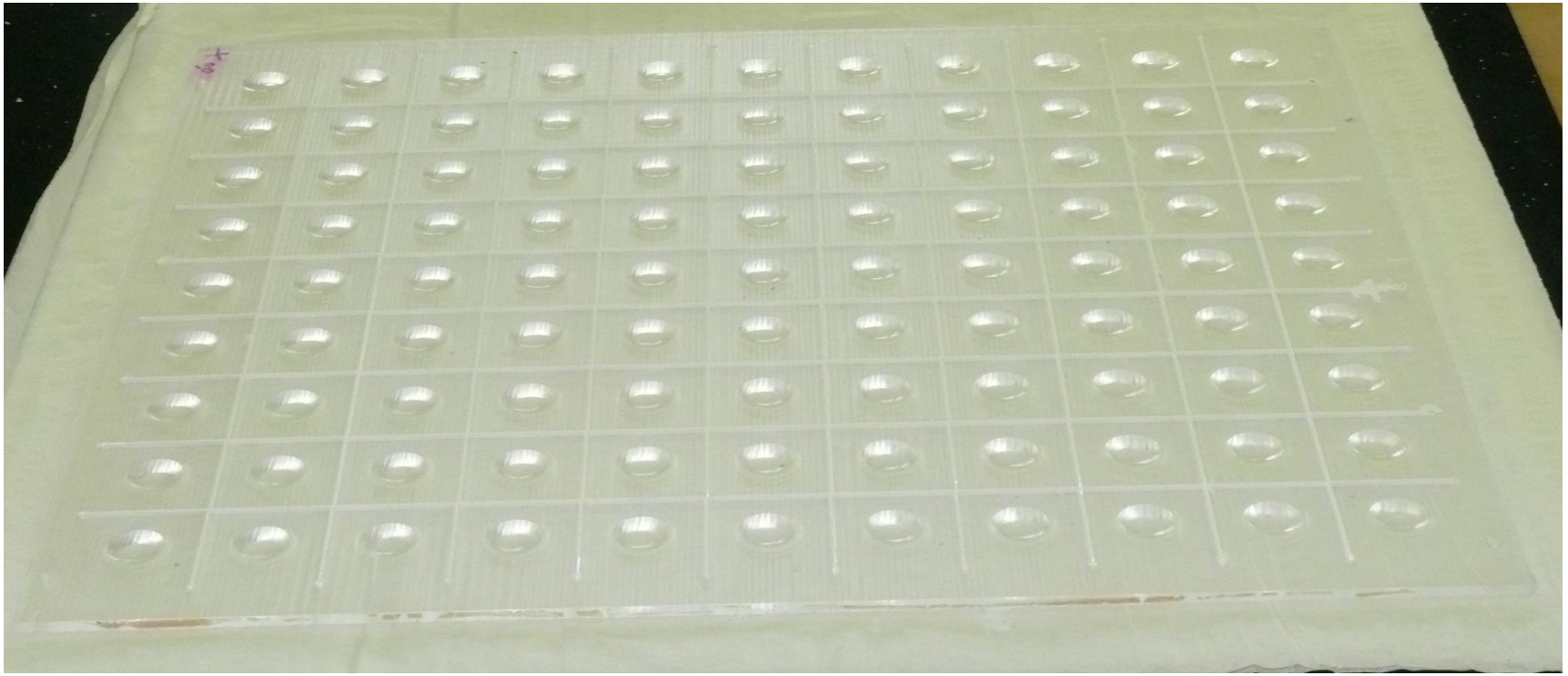
Fly Diamond Cutter for Spherical Dimple Suitable for Production a Single Cell or Array of Cells



The First Step (Dimples) in Mechanically Produced Array



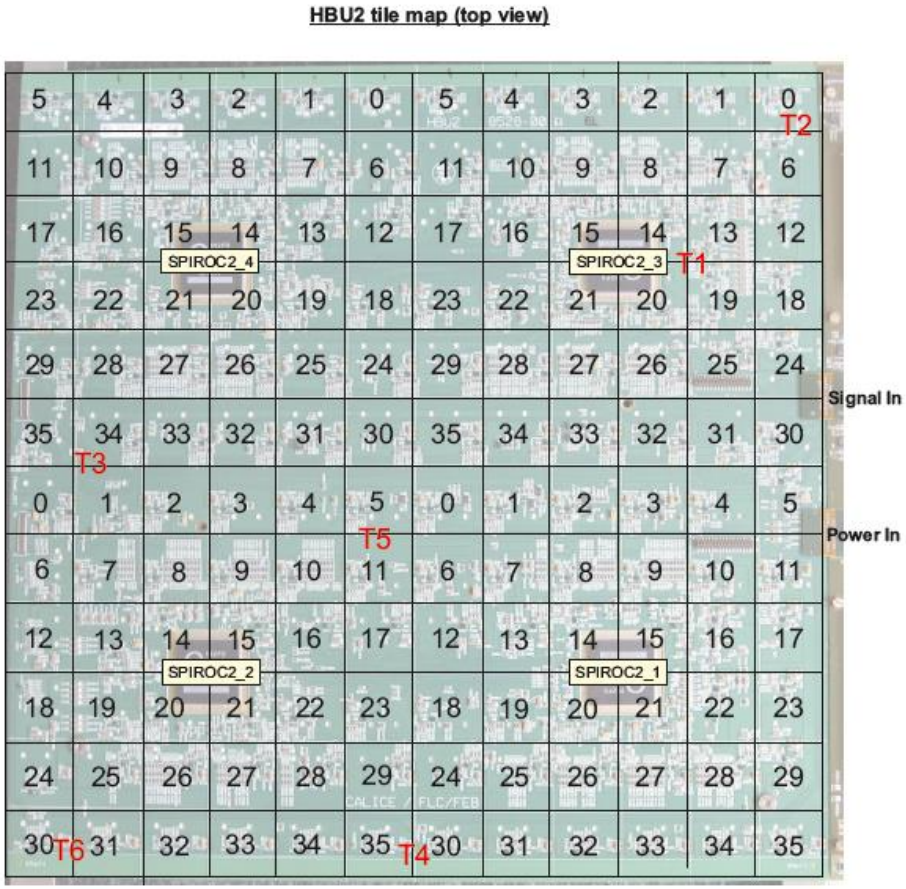
Ready for the Final Cutout

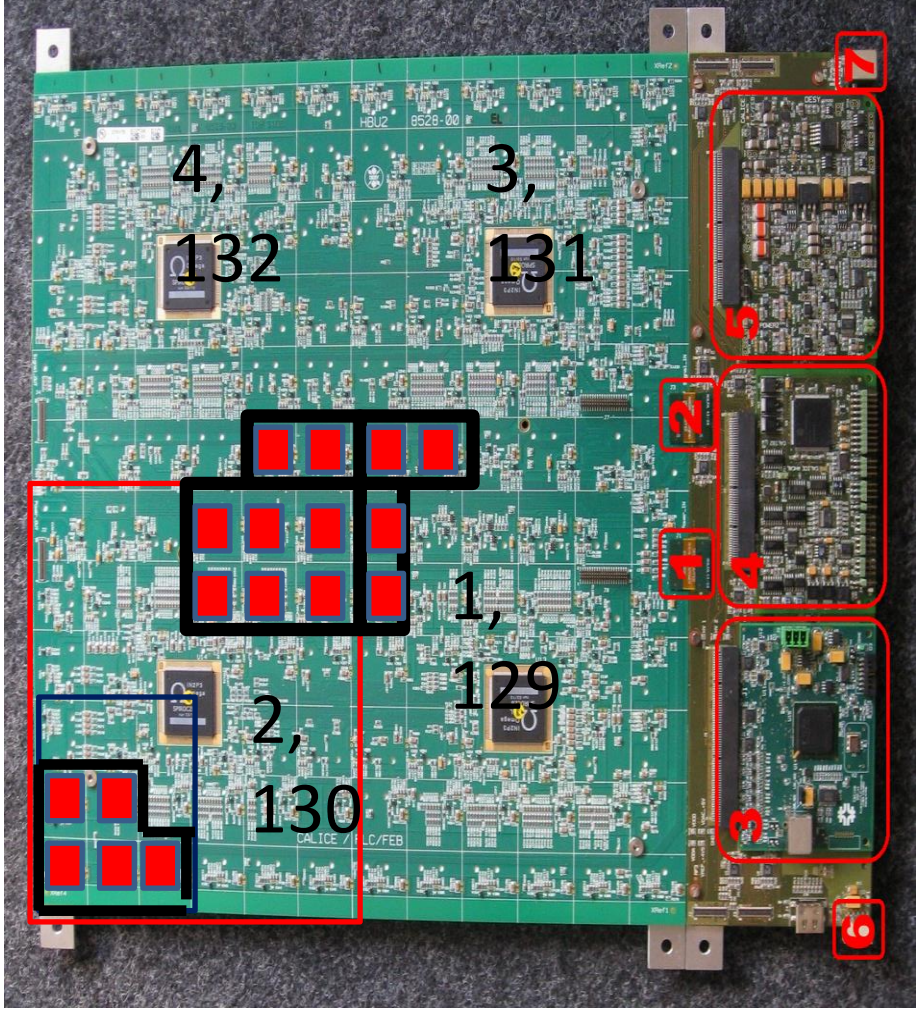
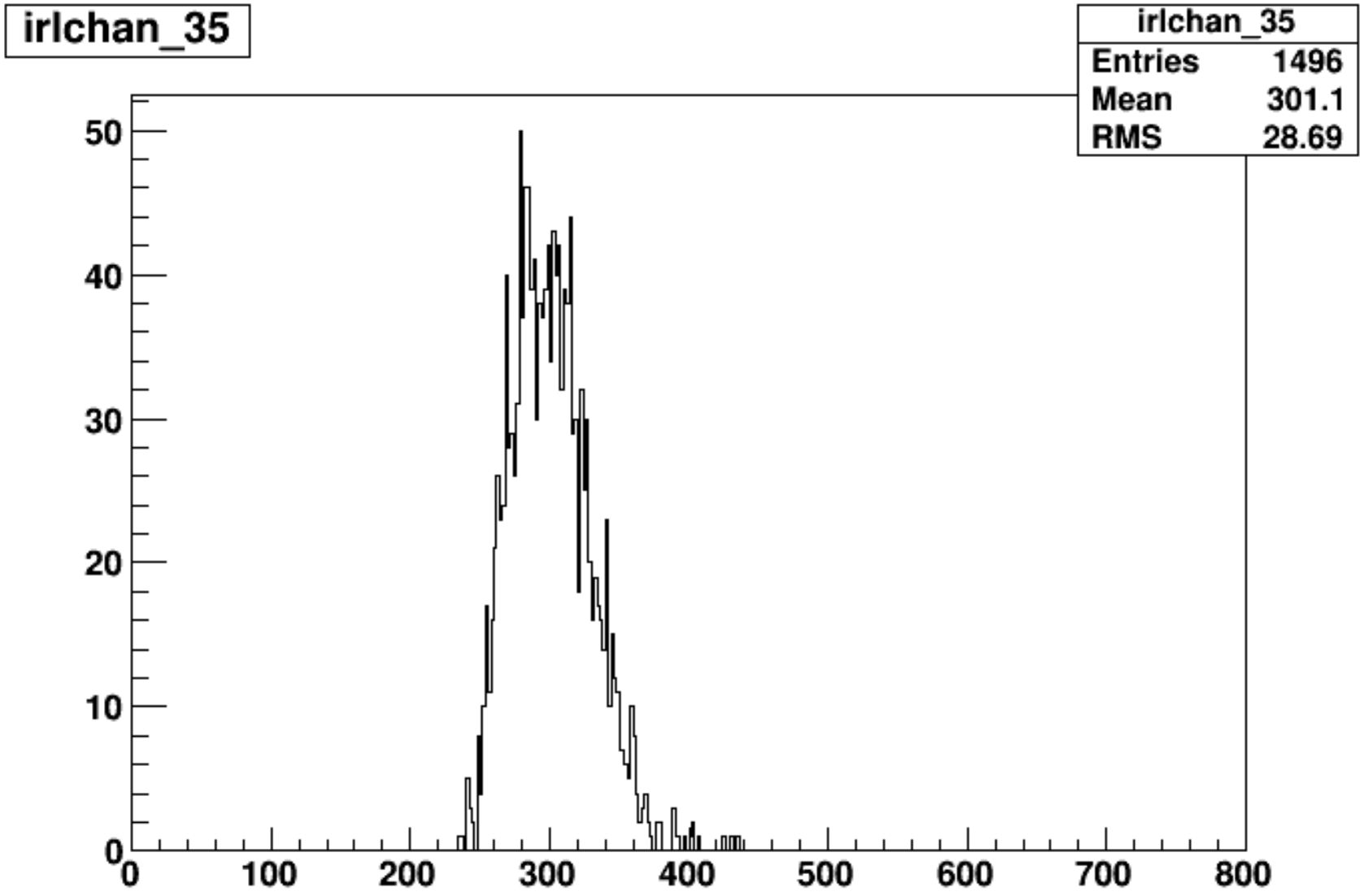


Summary and Next Steps

- Basic LED calibration functions working with HBU board with MPPC with dimpled megatile
- 44 MPPC installed and source scanning setup at NICADD
- Need to set DAQ configuration (thresholds, etc.)
- Scans with Sr90 source
  - With no tiles
  - With existing tiles
  - With new 9x11 Megatiles
- Complete calibration
- Get second HBU board (with 25um pixel MPPCs) working and calibrated
- Eventually place in test beam…

Test Configuration





Single Photoelectron Spectra of 25 um MPPC