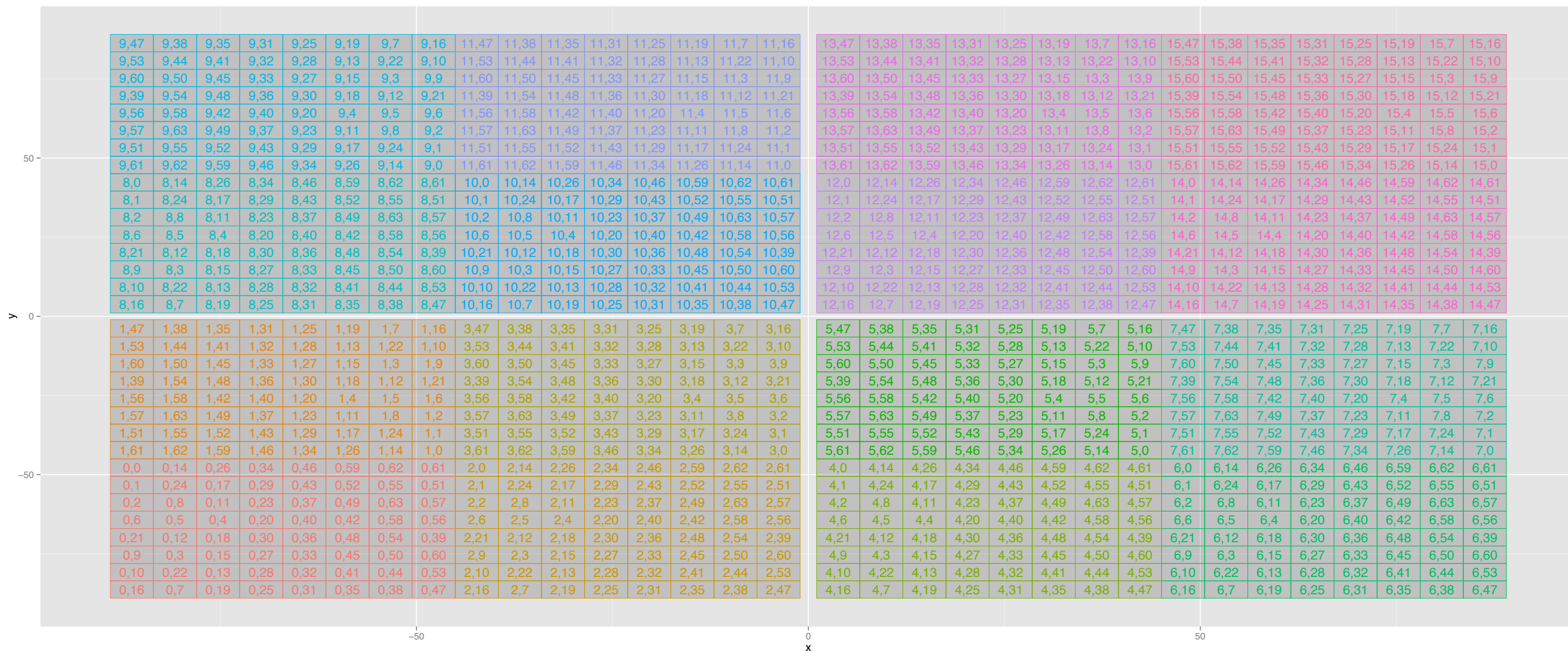


Square events

Kostiantyn Shpak (LLR)

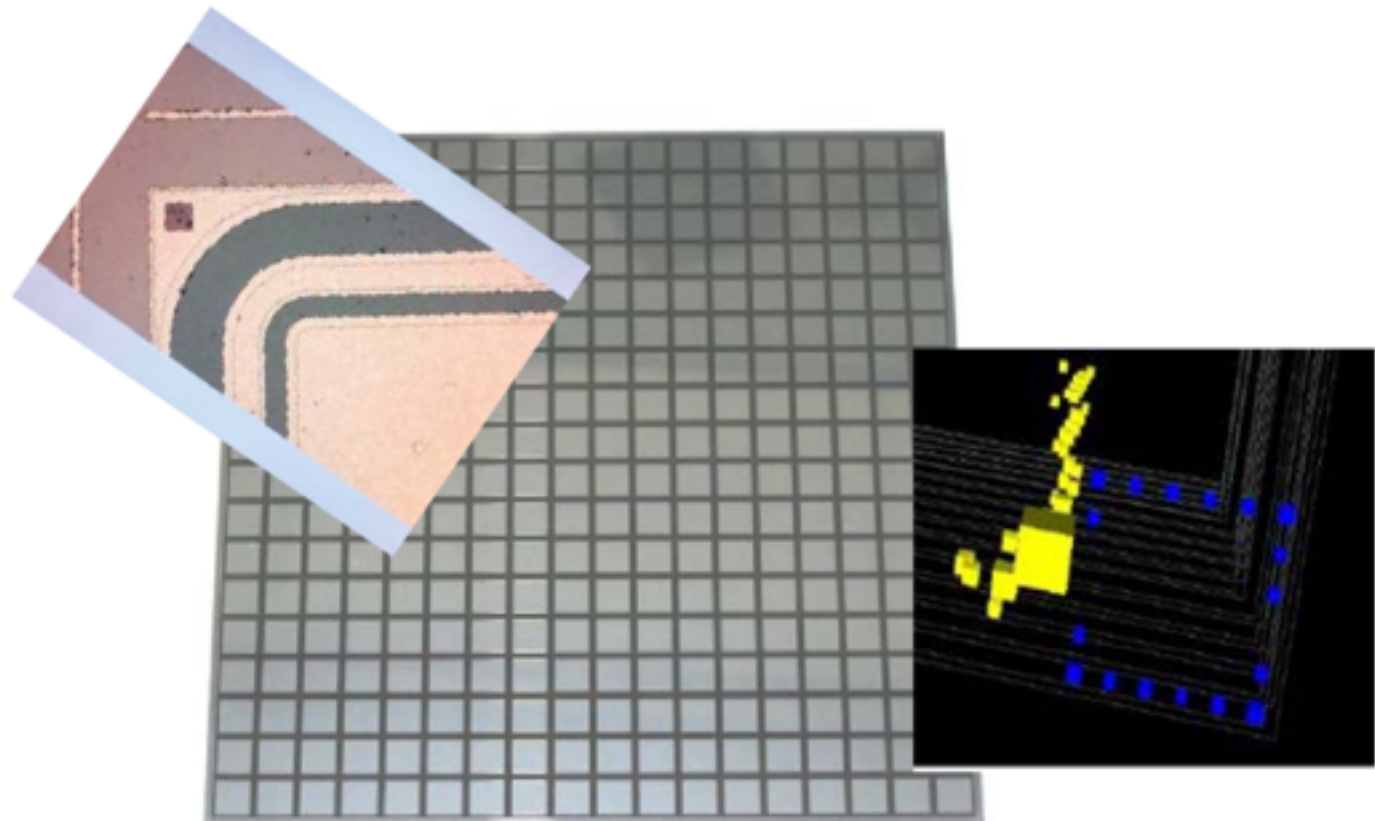
10.03.2016



“Square” event

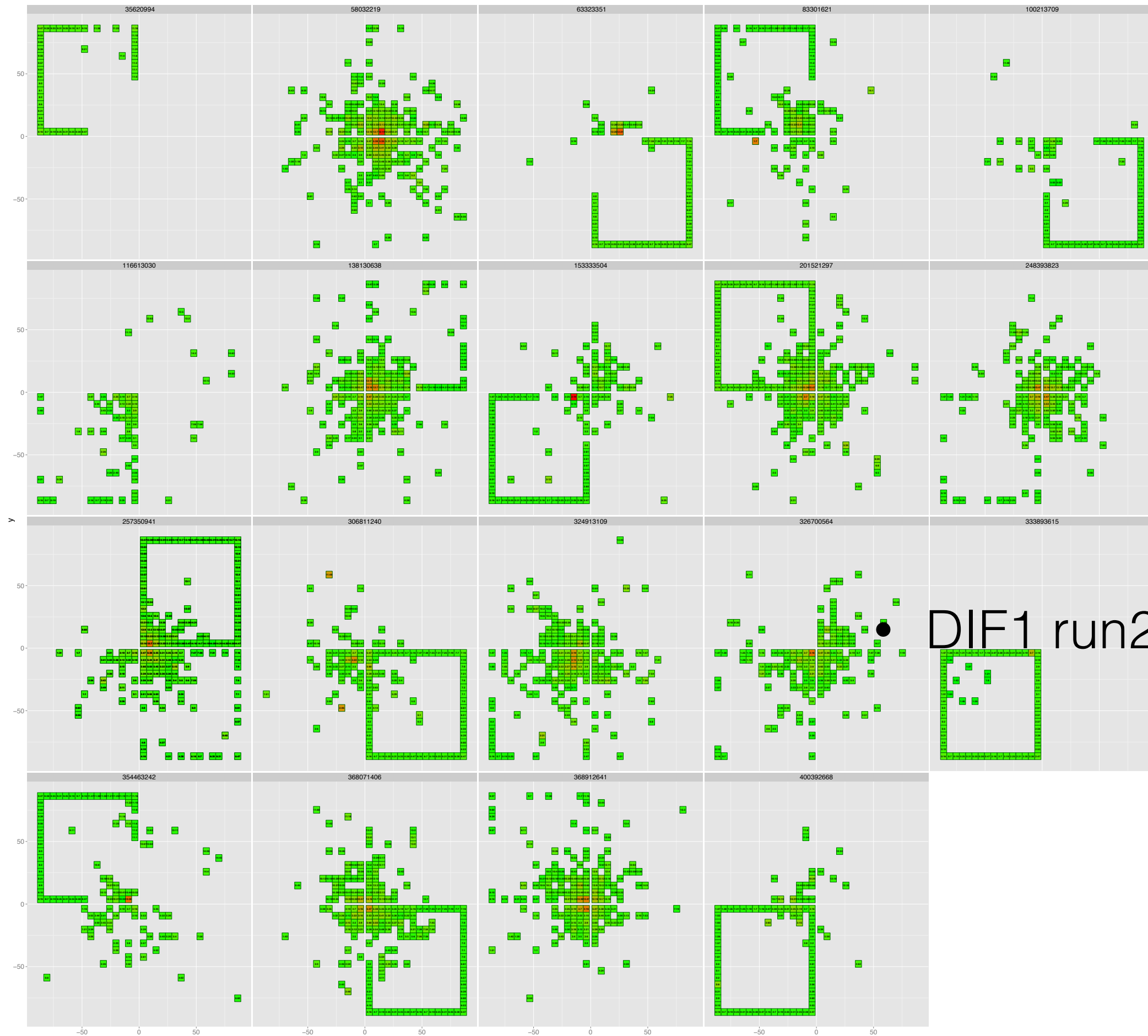
Guard ring at silicon sensor edges ensures HV stability and low dark currents. Potential is not fixed (for cost reasons, connection is technologically difficult), but left floating → electrical **cross talk** between guard ring and peripheral pixels due to capacitive coupling.

High signal at the boundary may trigger all peripheral pixels: “**square events**” seen in physics prototype.



Based on extensive simulation (electrical, analytical, TCAD, PhD and several CALICE notes) and measurements with electrical injection to Hamamatsu sensors, a segmentation of the guard ring was proposed to reduce cross talks. Sensors with several guard ring designs have been produced. **First measurements with laser started (this talk).**

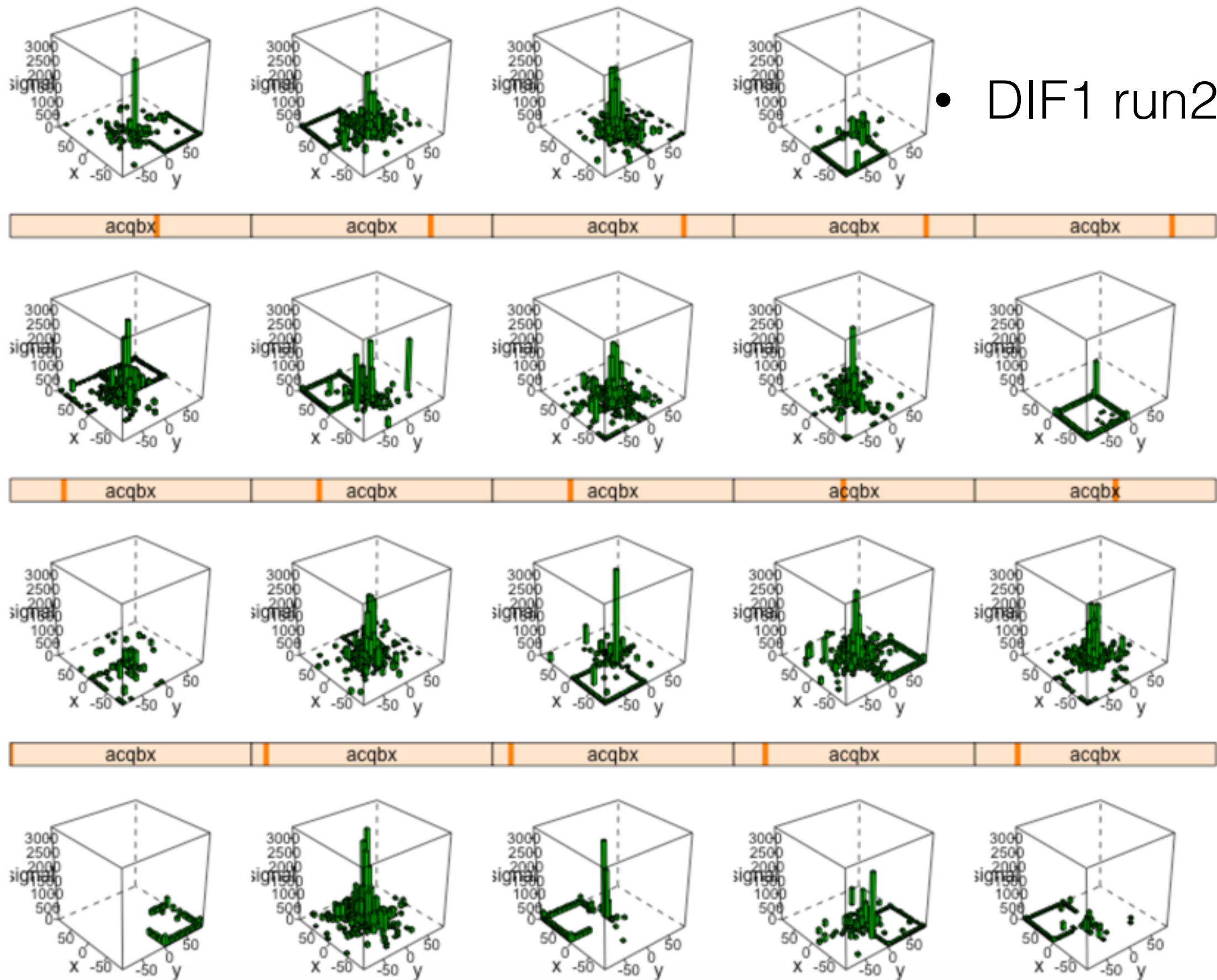
Square-events in SiWECAL prototype



• DIF1 run211

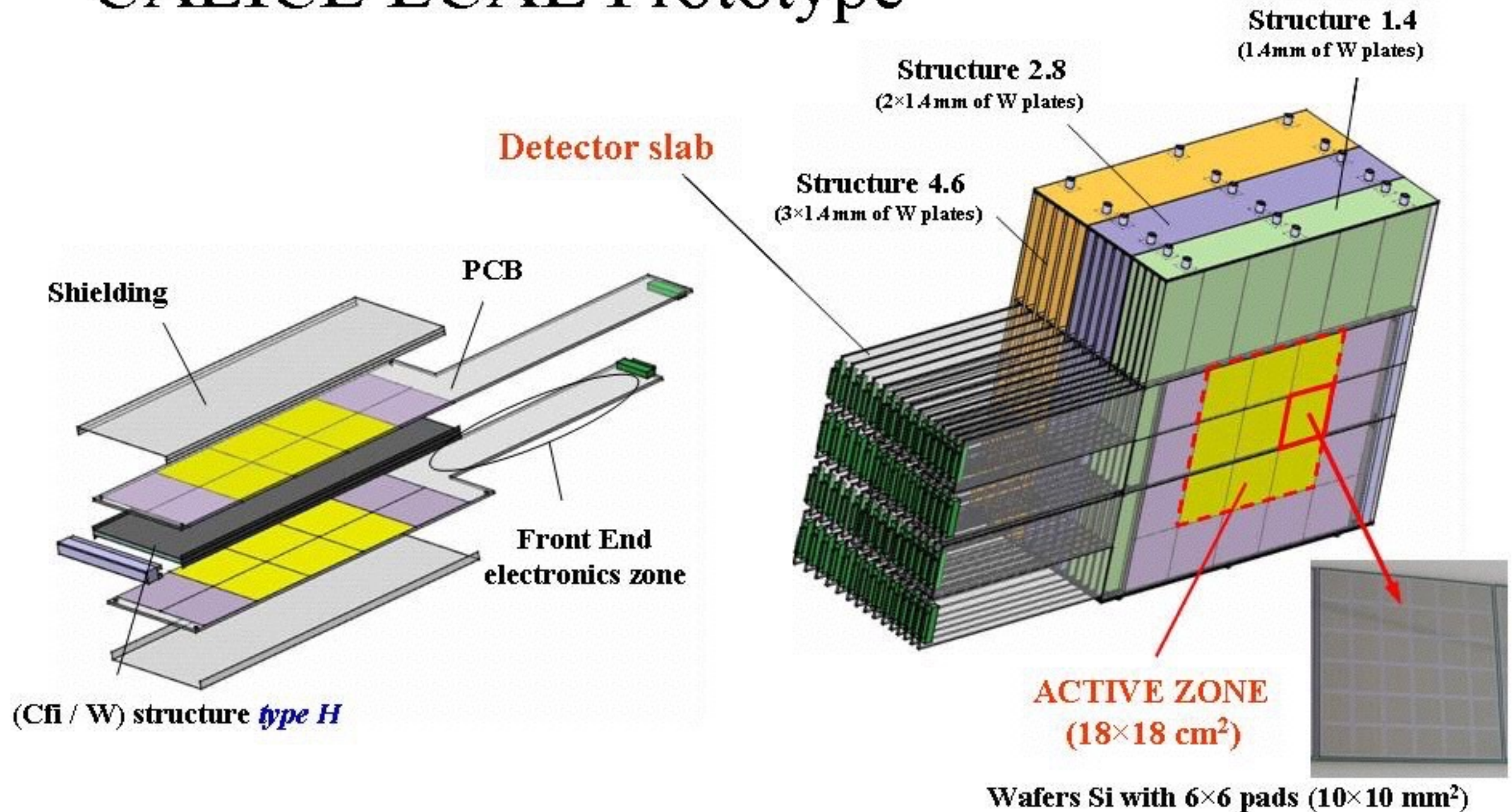
Square-events in SiWECAL prototype

• DIF1 run211

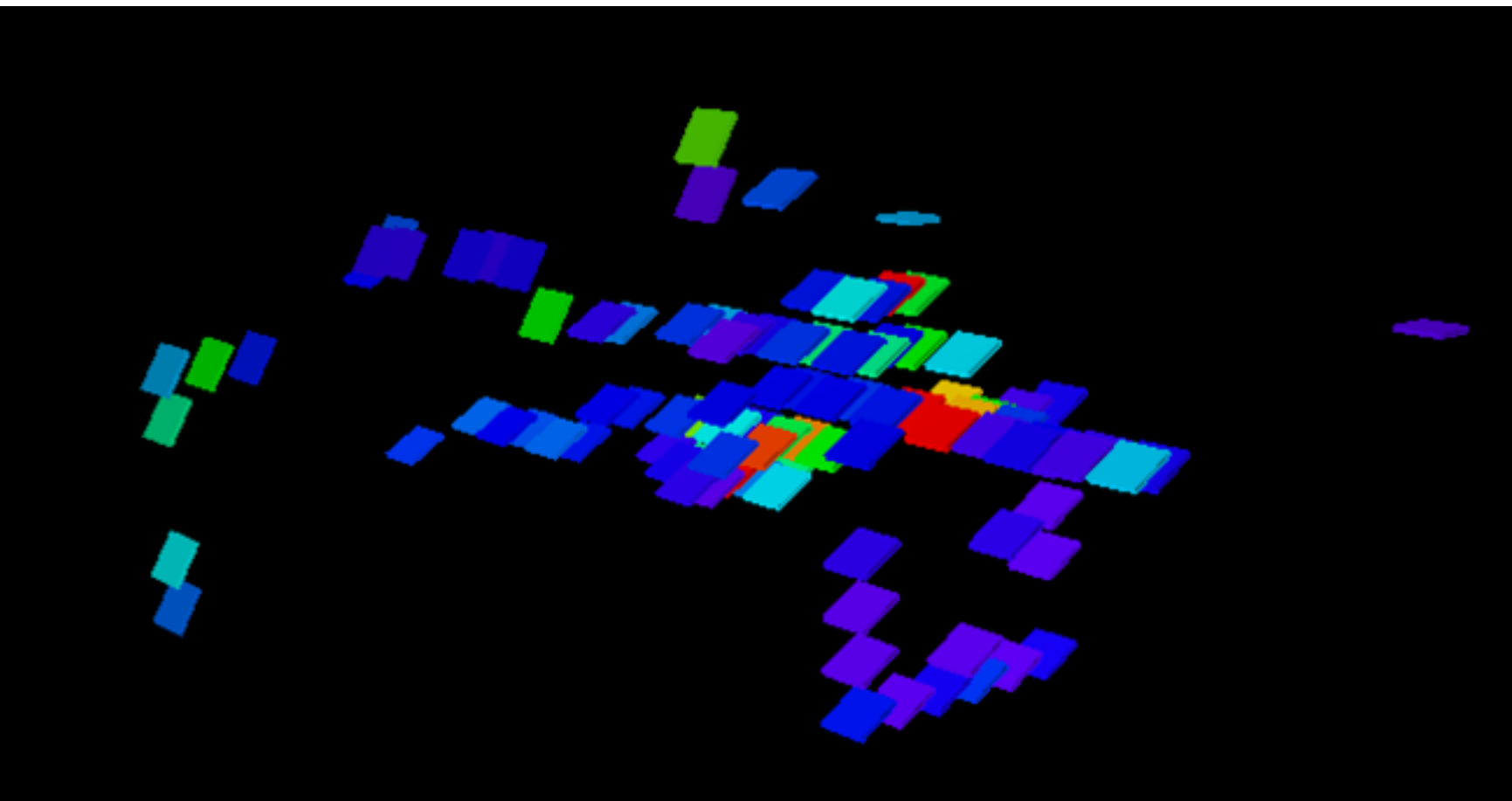


Square-events in ECAL physics prototype

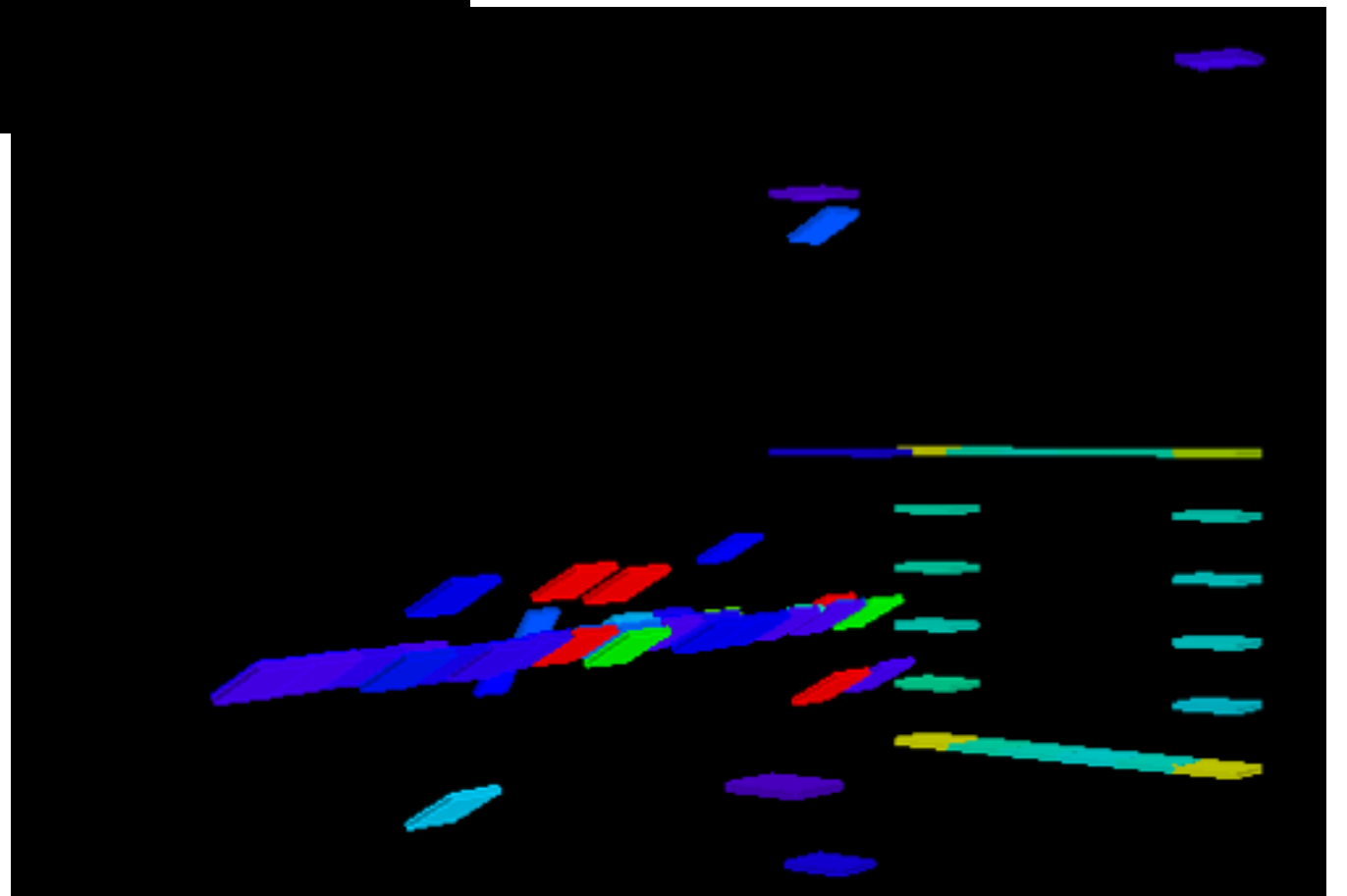
CALICE ECAL Prototype



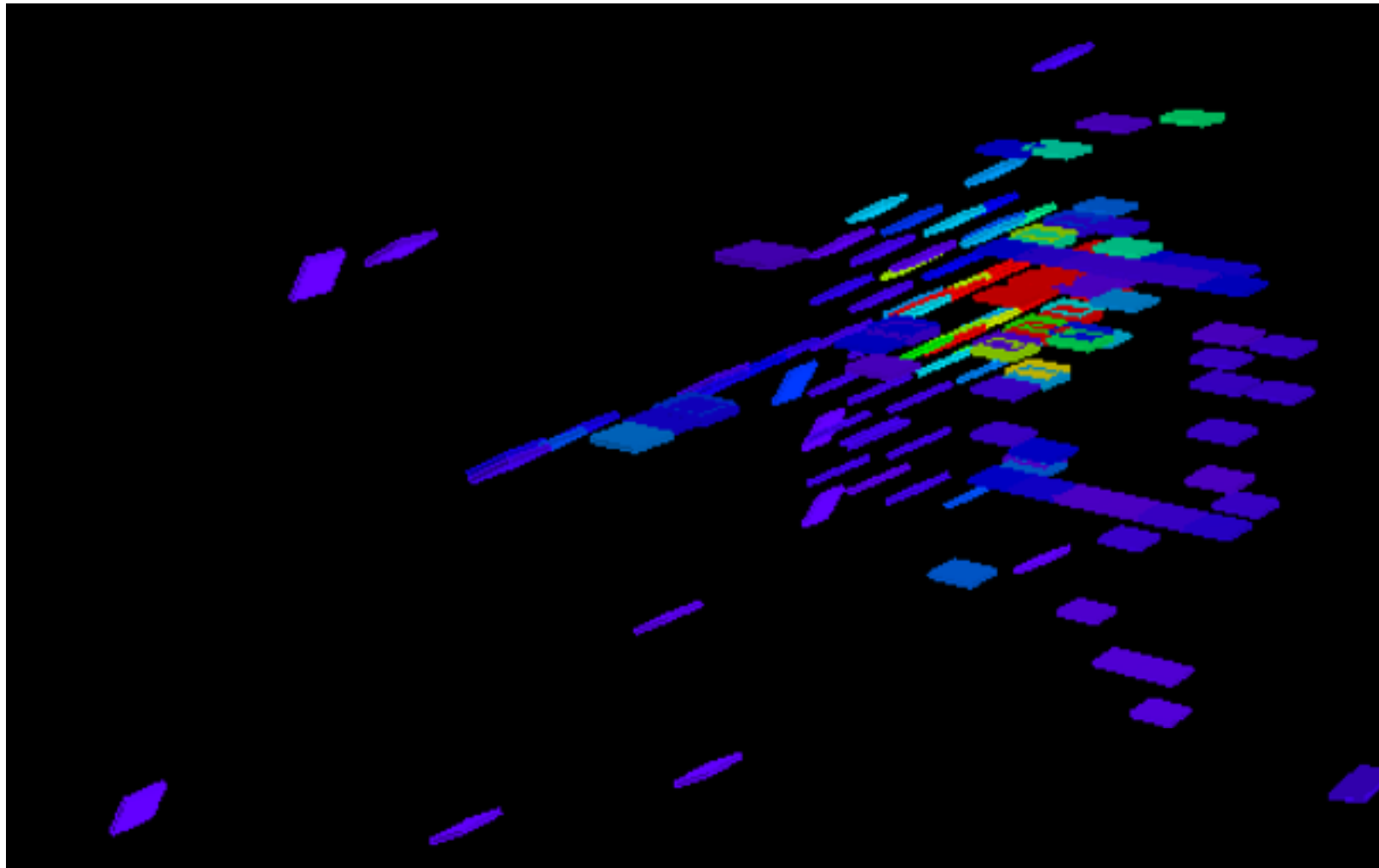
Square-events in ECAL physics prototype



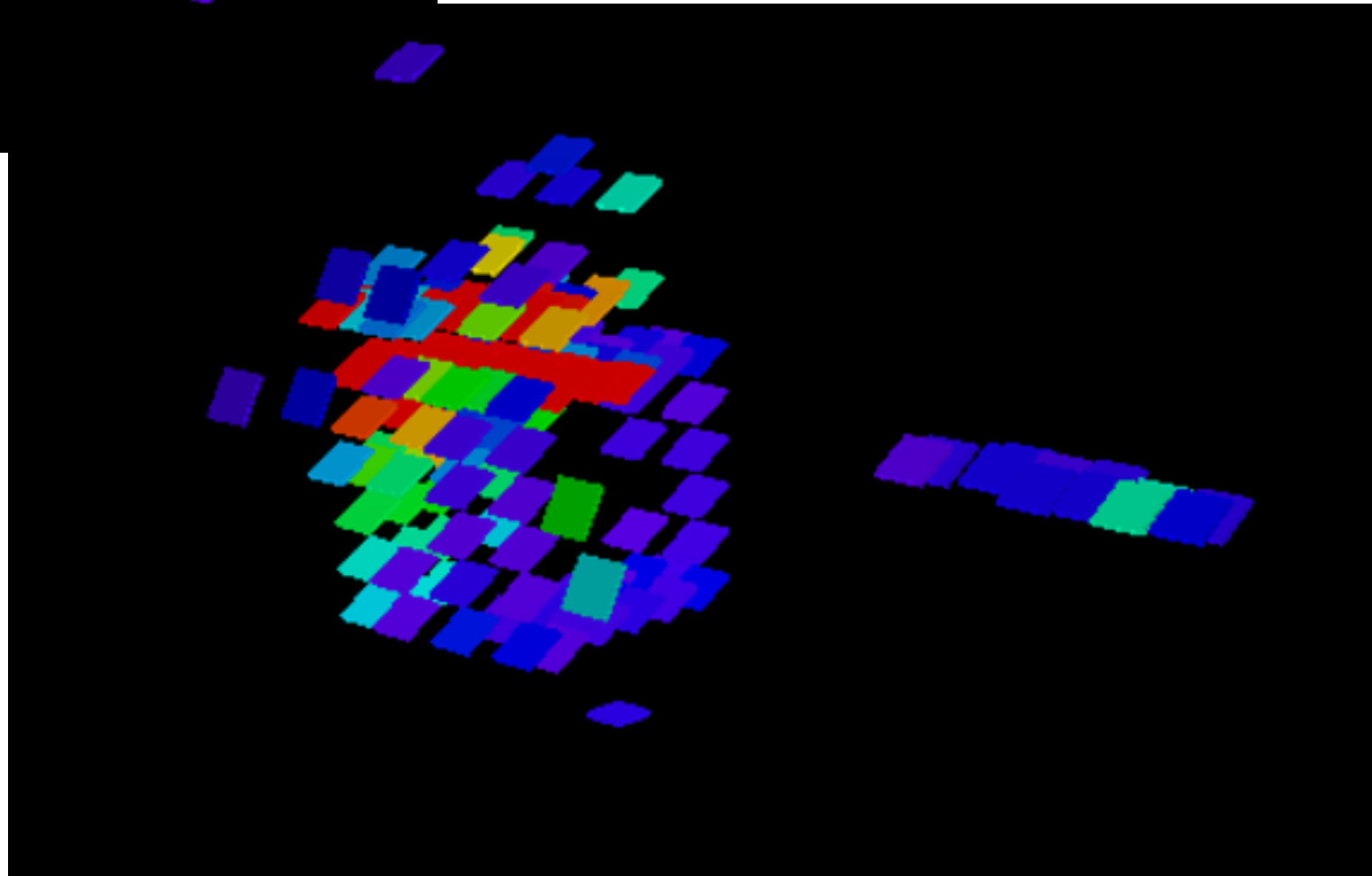
4GeV



Square-events in ECAL physics prototype



50GeV



Square-events in SiWECAL prototype

15GeV e+ run300	# of square events	# of events
dif0	0	~22000
dif1	0	~22000
dif2	0	~25000
30GeV e+ run301		
dif0	1	~48000
dif1	2	~50000
dif2	1	~48000
50GeV e+ run302		
dif0	2	~60000
dif1	4	~86000
dif2	1	~60000
100GeV e+	run 204 205 206 207 210	210 211
dif0	15	~120000
dif1	24	~150000
dif2	30	~120000
150GeV e+	run 79 82 84 86 88 114	
dif0	6	~38000
dif1	7	~43000
dif2	5	~38000

Square-events in SiWECAL prototype

50GeV pi+ run310	# of square events	# of events
dif0	2	~20000
dif1	2	~19000
dif2	3	~24000
50GeV pi+ run282		
dif0	9	~103000
dif1	12	~100000
dif2	13	~103000
80GeV pi+ run96		
dif0	0	~3500
dif1	1	~3900
dif2	3	~3900
100GeV pi+ run280		
dif0	11	~71000
dif1	8	~72000
dif2	8	~72000
100GeV pi+ run281		
dif0	7	~66000
dif1	8	~66000
dif2	12	~68000

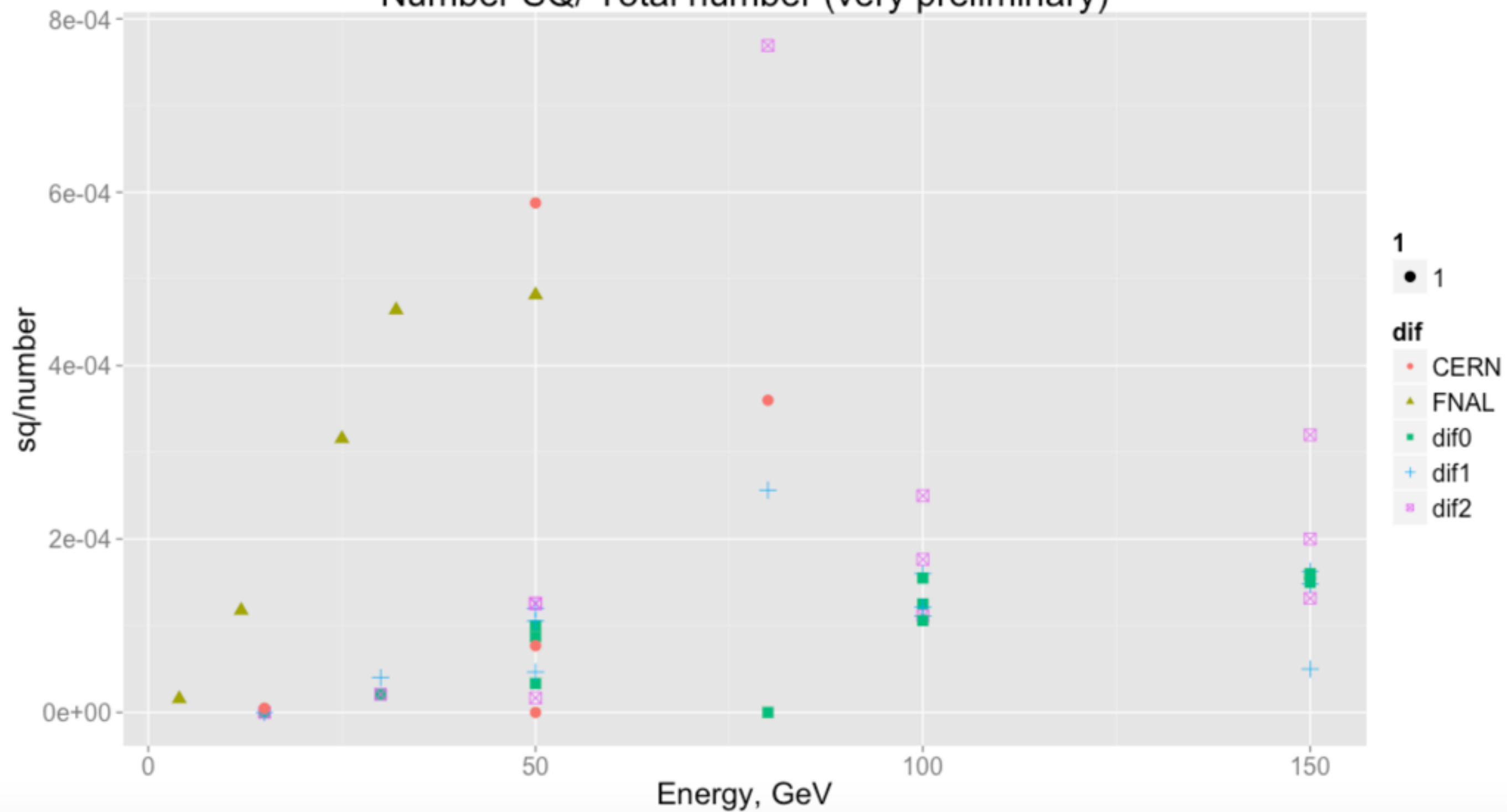
Square-events in SiWECAL prototype

[illegible]

Square-events in ECAL physics prototype

	particle	# of square events (layer 15)	# of square events (total)	# of events
FNAL'11				
4GeV 630065,67	e+ pi+	3	2115	~191000
12GeV 630061,62	e+ pi+	3	665	~25500
25GeV 630037,38,39	e+ pi+	54	2849	~171000
32GeV 630033,34,36	e+ pi+	123	5218	~265000
50GeV 630084	pi+	26	1176	~54000
CERN'07				
15GeV 331311	e+	1	161	~206000
50GeV 331316	e+	1	42	~13000
50GeV 331337	pi+	57	1992	~97000
80GeV 331325	pi+	81	3160	~225000
50GeV 331584 mu	mu	0	11	~44000

Number SQ/ Total number (very preliminary)

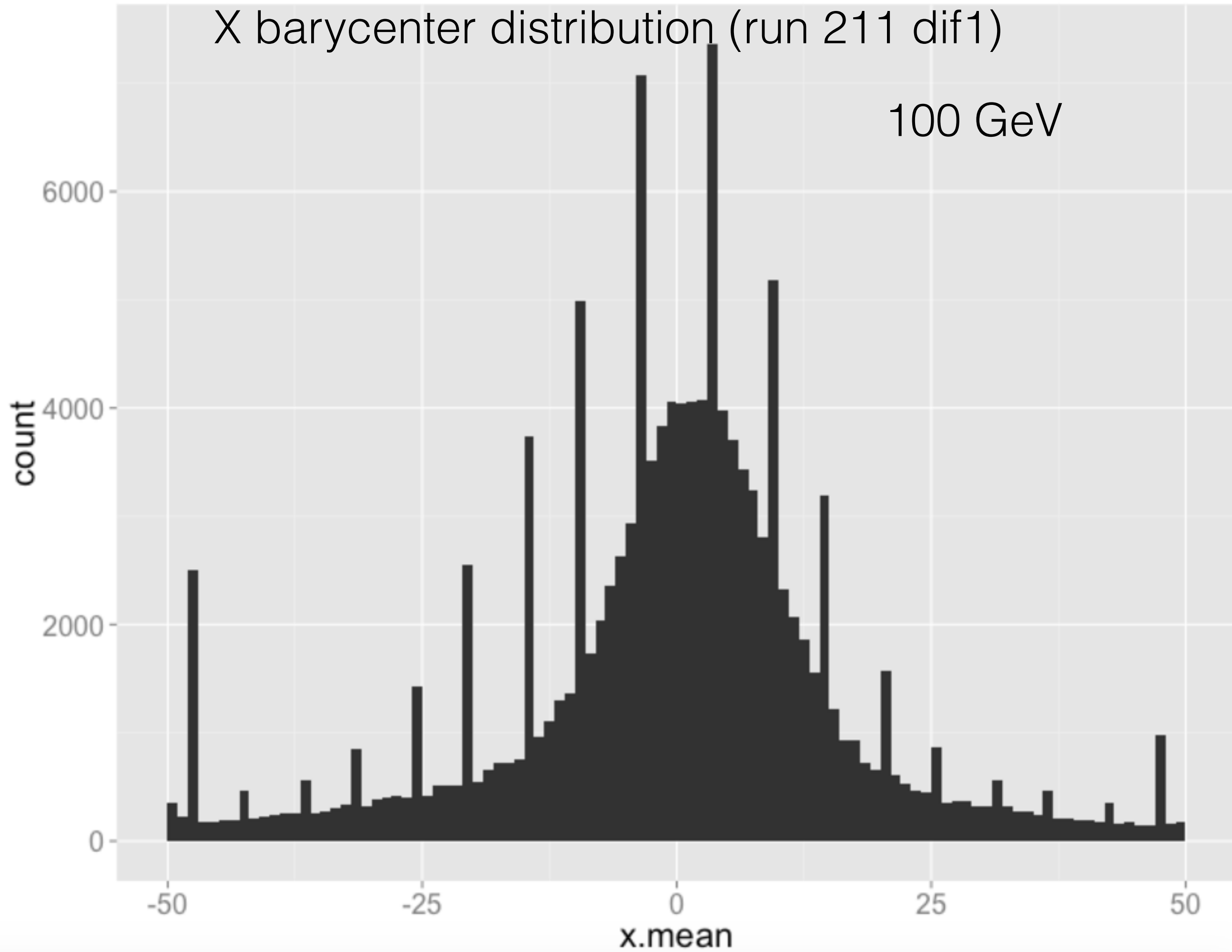


Studied issues

- **Square event**
 - low percent of square events for “traditional” calorimetry
 - current prototype has less SQ effects in comparison with old physics prototype
 - plot normalisation in future

X barycenter distribution (run 211 dif1)

100 GeV



Y barycenters distribution (run 211 dif1)

π^+/π^- components of
beam has different centers

count

10000

7500

5000

2500

0

-50

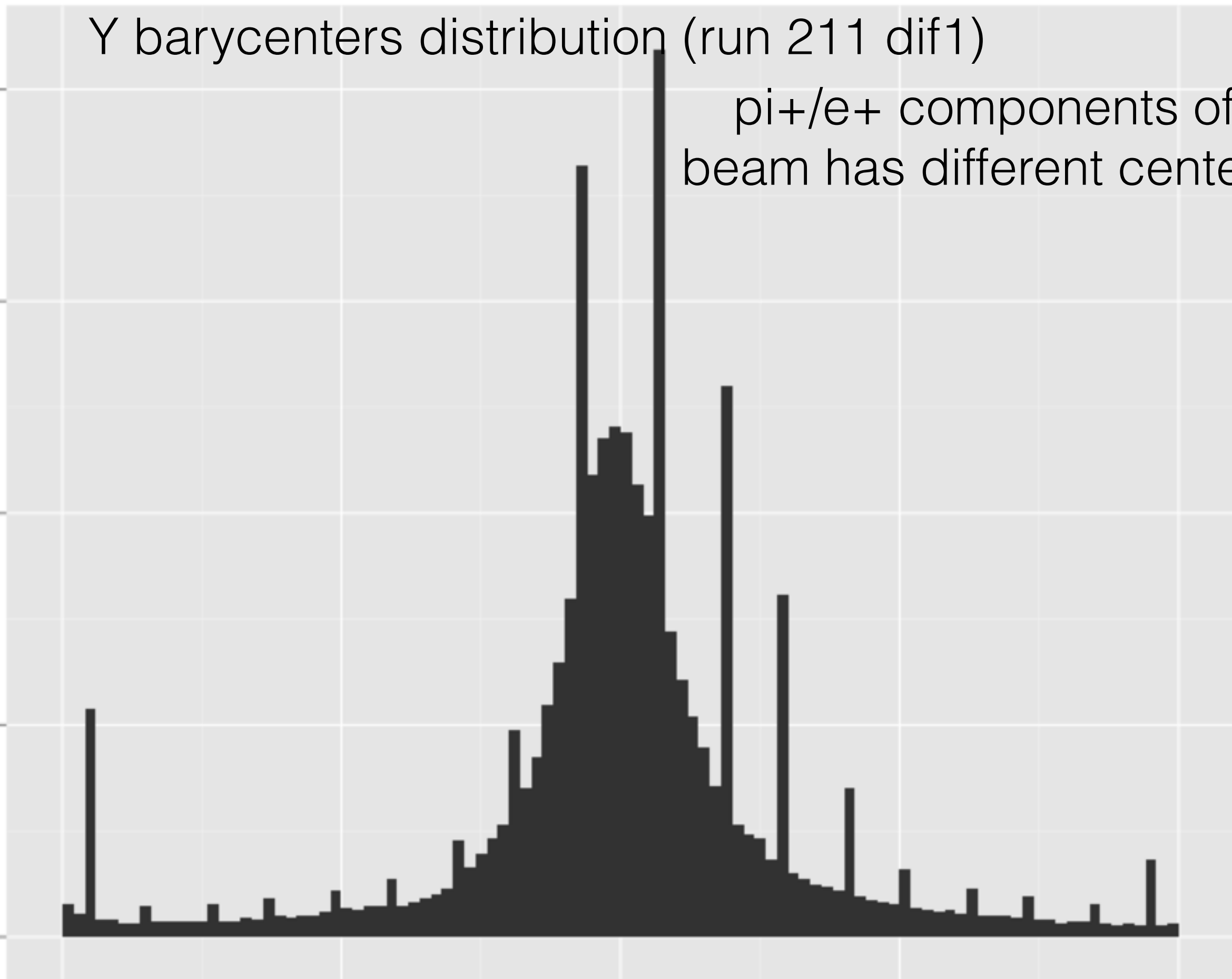
-25

0

25

50

y.mean



Radial distribution of energy in showers 100GeV run 211

SUM

Shower is wider than beam spot

$3e+08$

$2e+08$

$1e+08$

$0e+00$

0

50

100

150

200

rad

