



Charge sharing study using G4

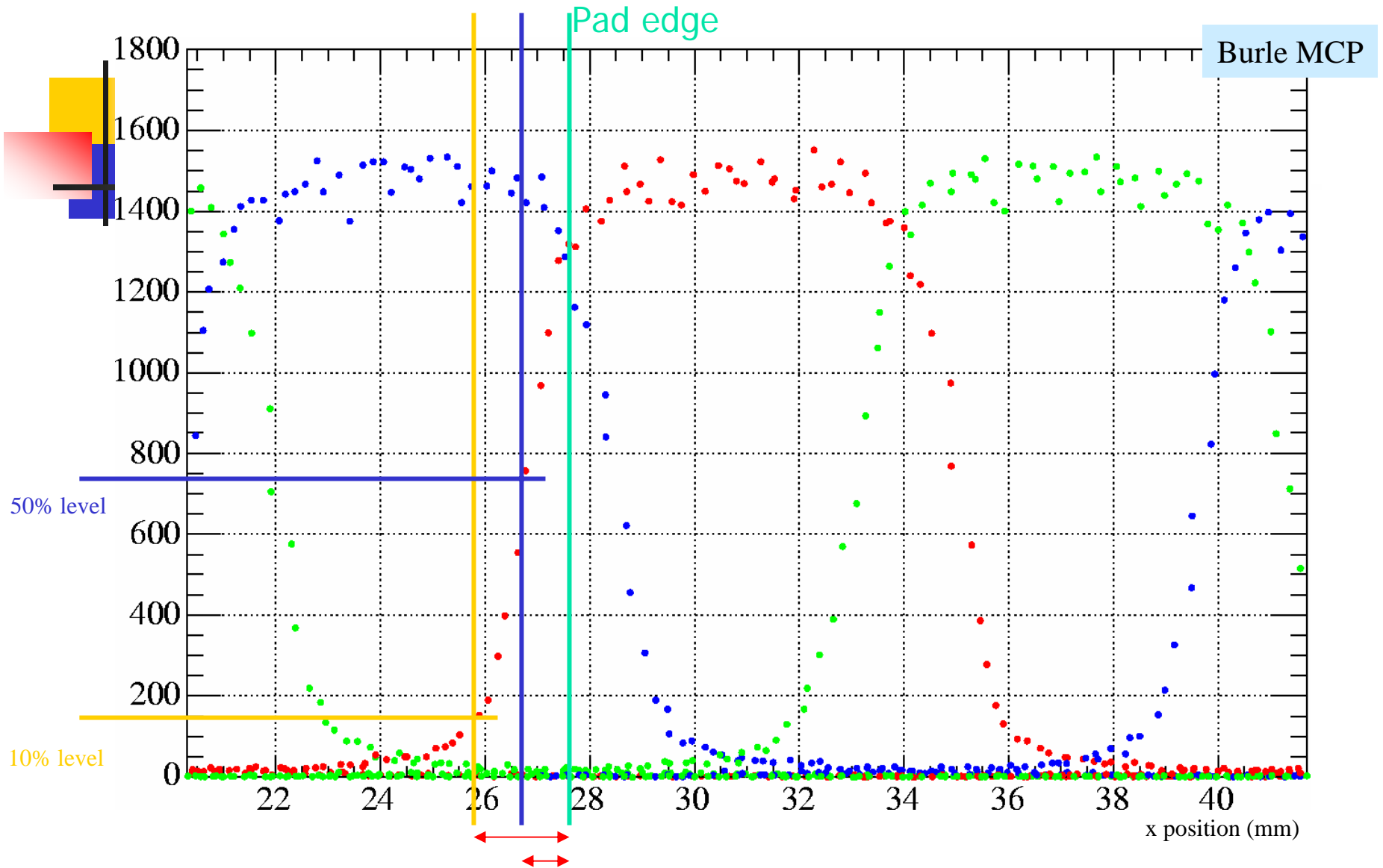
21.2.



Main features of ch. sharing

- It depends on the position of the hit inside the pad and its distance from the neighbor pads.
- Up to 4 pads can be involved in charge sharing.

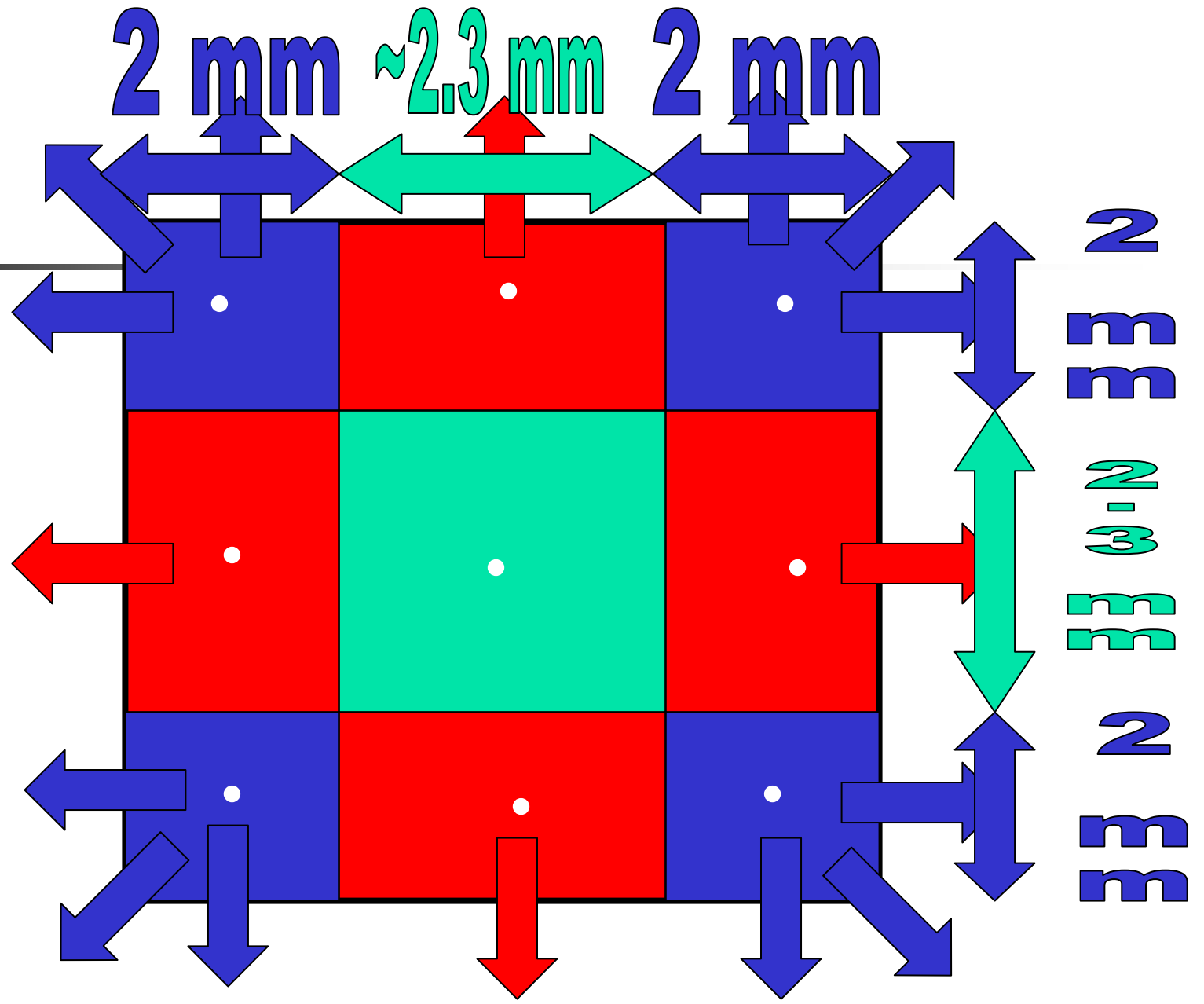
CHARGE SHARING RANGE



~1mm range for drop to 50% relative hit probability

~2mm range for drop to 10% relative hit probability

one pad





Distance dependence

Requirements:

- On the edge of neighbor pad – 90% probability of the hit
- 1 mm far from the edge – 50% probability of the hit
- 2 mm far from the edge – 10% probability of the hit => requirements for error function



Sampling according error function

- Based on the distance from the edge, the error function is used to accept or refuse the hit.
- If hit was registered in the “edge pad”, sampling is done in appropriate direction.
- If hit was registered in “corner” pad, sampling is done in both directions – both have to be true.

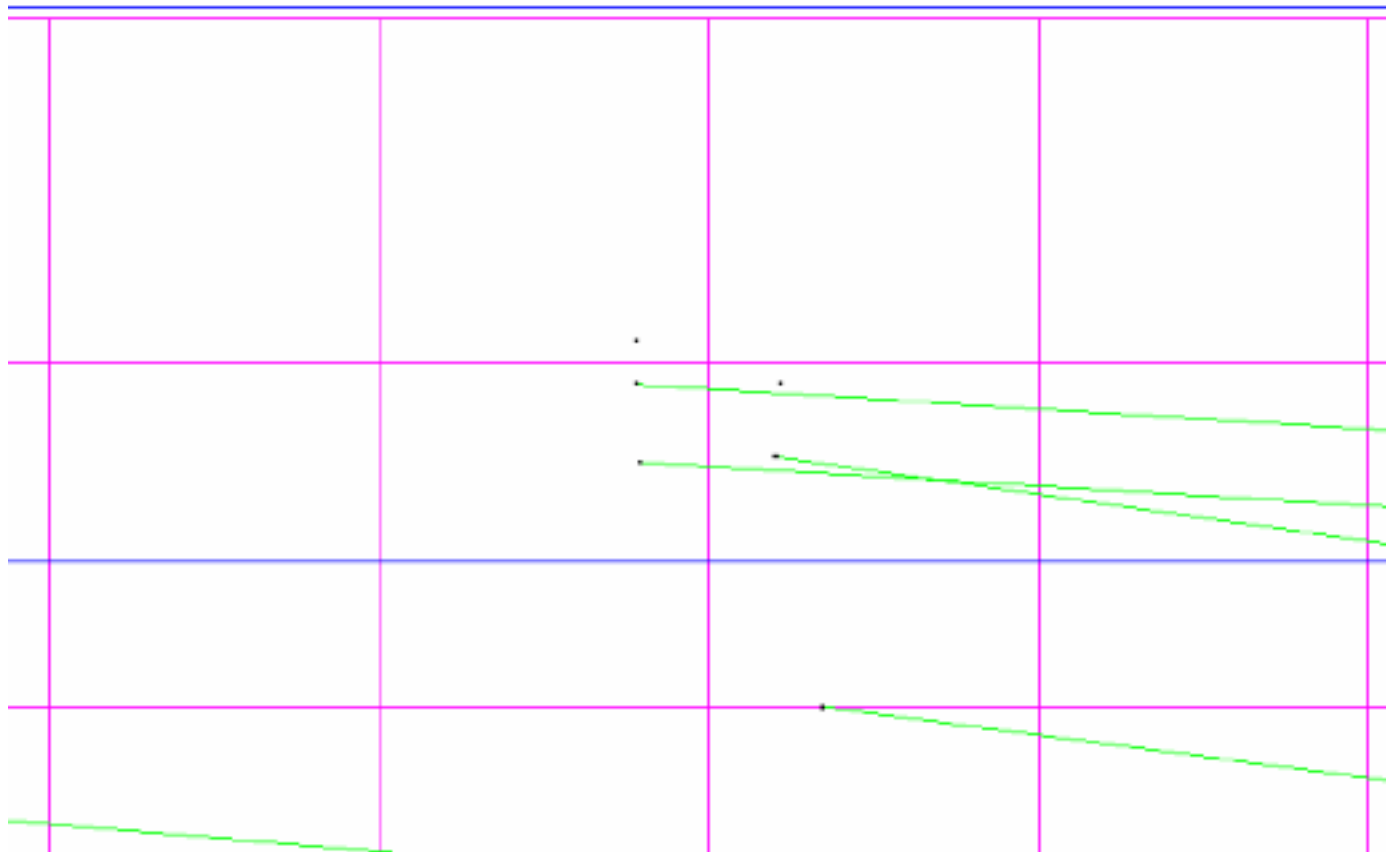


Implementation of ch. sharing

Hits have:

- Different positions (to be in the appropriate pads).
- Different time (same time of propagation + TDC smearing).
- Same direction cosines and cherenkov angle !!

Hits in the detection plane



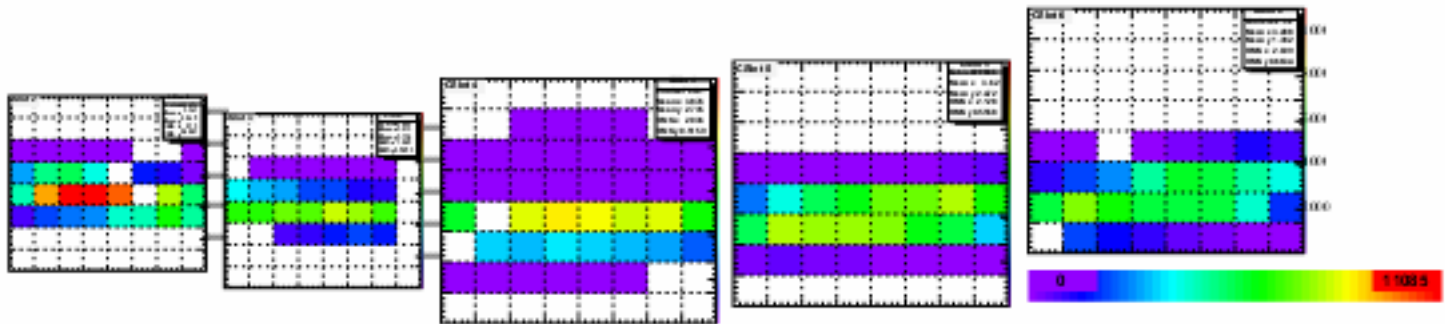


Probability of 2,3, and 4-pad ch. sharing

- Different types of charge sharing were studied
- 2,3, or 4 pads involved
- Blindness of PMTs were taken into account

All hits

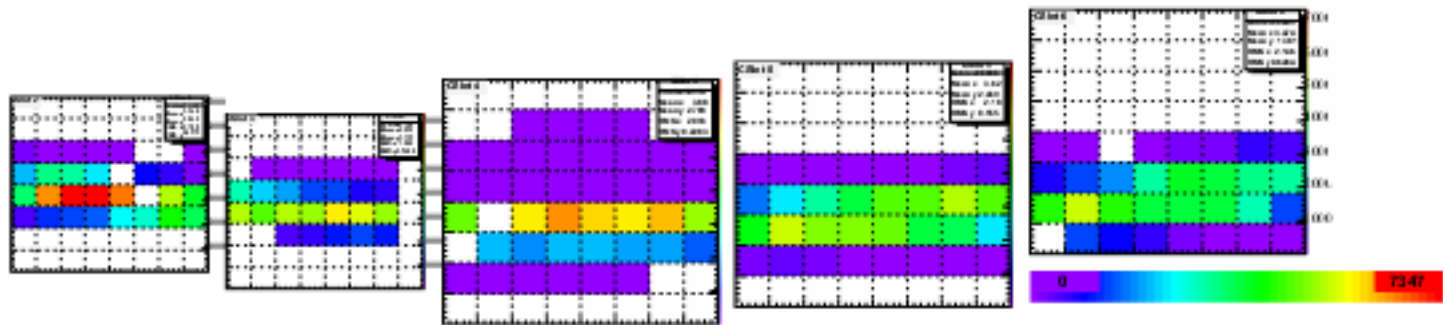
All hits, total number of hits = 443352



No hits removed

Charge sharing removed

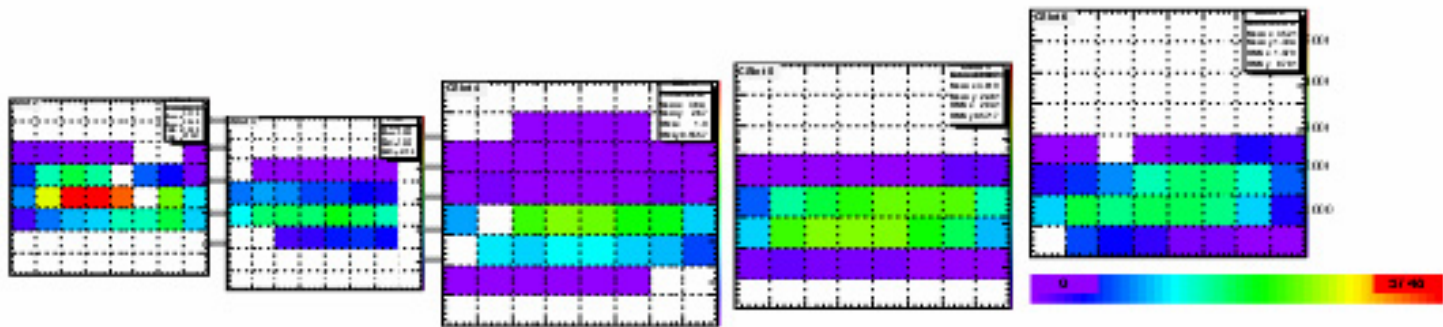
Charge sharing removed, total number of hits = 301473



charge sharing removed – only “primary” hit
when charge sh. has occurred

Only charge sharing hits

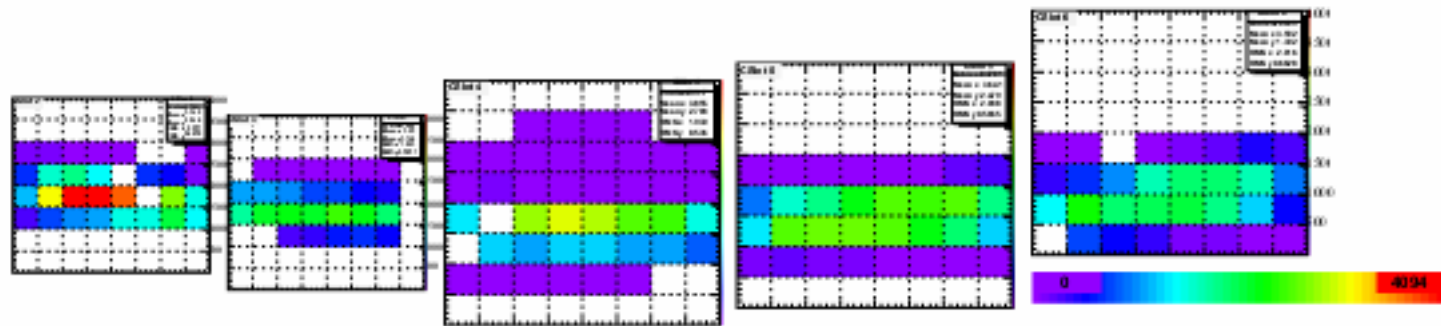
Only charge sharing hits (one is real), total number of hits = 205104



Only charge sharing hits (including "primary" hit)

Charge sharing (2 pads involved)

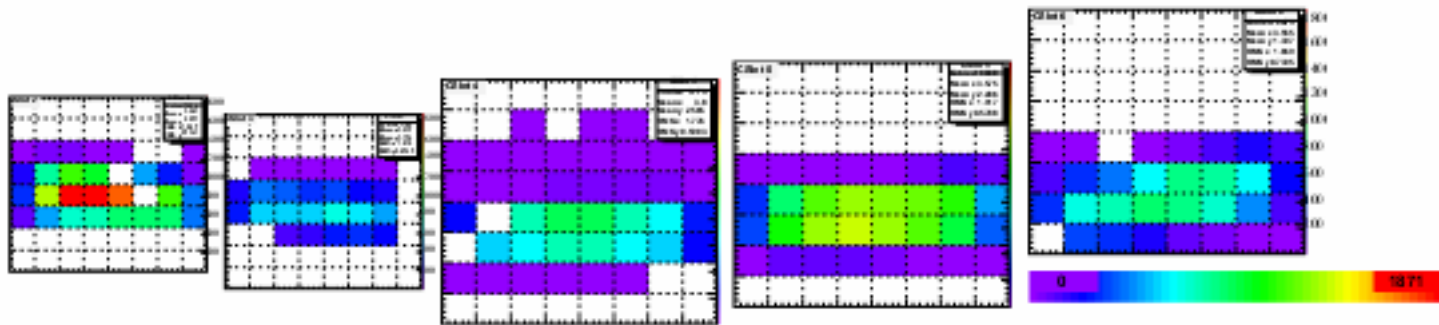
Only charge sharing (2 hits), total number of hits = 147542



“primary hit” + one pad hit due to ch. sh.

Charge sharing (3 or 4 pads involved)

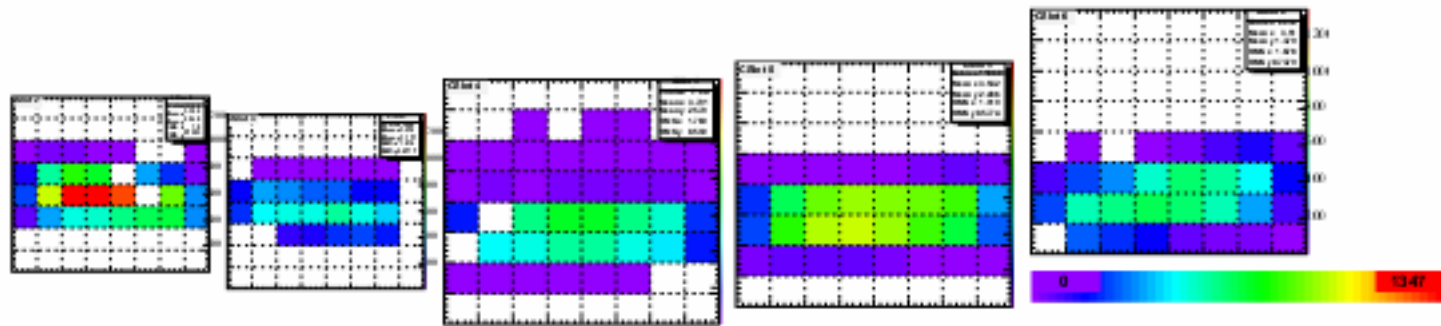
Only charge sharing (3 or 4 hits), total number of hits = 61002



“primary hit” + two or three pads hit due to ch. sh.

Charge sharing (3 pads involved)

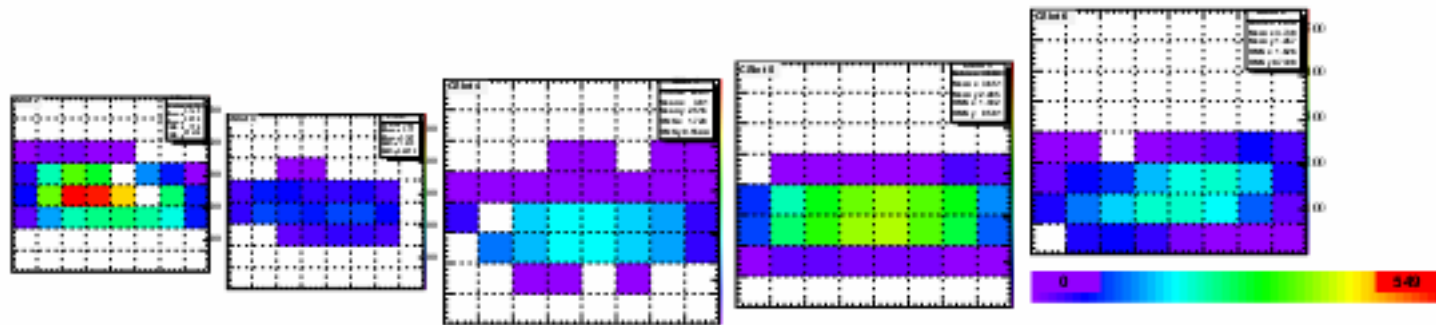
Only charge sharing (3 hits), total number of hits = 46157



“primary hit” + two pads hit due to ch. sh.

Charge sharing (4 pads involved)

Only charge sharing (4 hits), total number of hits = 15132



"primary hit" + three pads hit due to ch. sh.



Charge sharing summary

	Total hit	Percent
2 pads ch. sh	147542	33.3% (16.7)%
3 pads ch. sh.	46157	10.4% (6.9)%
4 pads ch. sh	15132	3.4% (2.6)%
Total	208831	47.1% (26.2)%



Conclusion

- Charge sharing does not change the shape and occupancy of the Cerenkov ring
- It creates about 26% of “fake” hits