GPU Pixel Tracks at HLT doublets filtering

Clustering & Machine Learning

Adriano Di Florio

INFN Sezione di Bari & Università degli Studi di Bari

Tracking workflow

- *Current* Future Tracking Workflow plan

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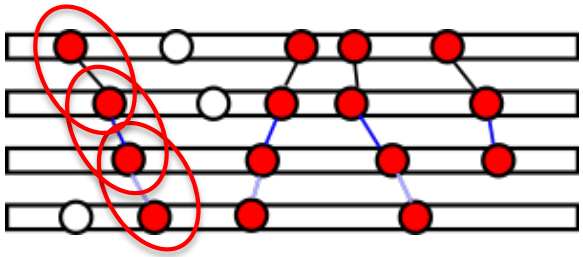
Doublets construction based mainly on geometry



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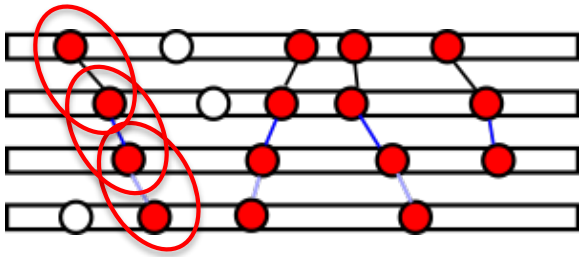
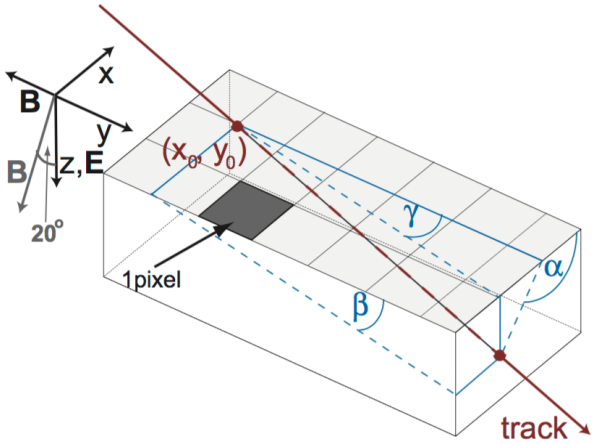
***BUT** we can get some further information form the RECO Hits*

Hit Pixel Clusters





x is azimuthal direction in the *barrel detector* and radial direction in the *forward detectors*

How is a Pixel Cluster represented in CMSSW?

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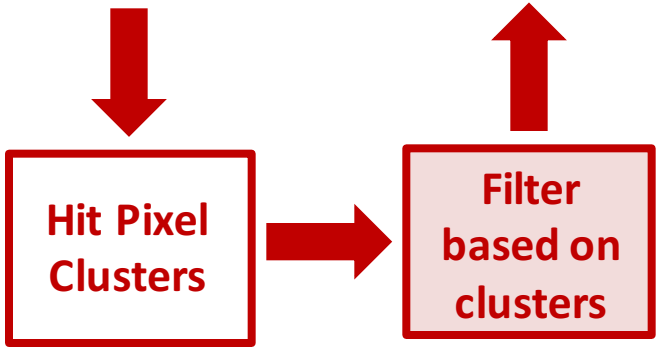

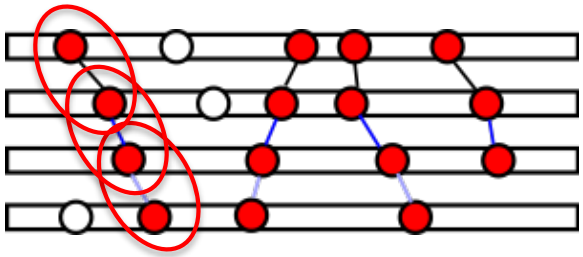

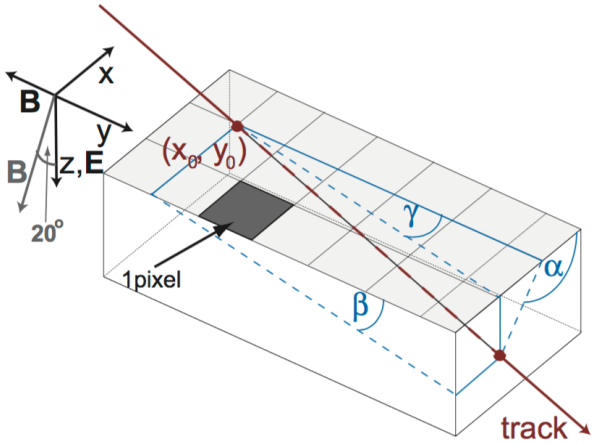

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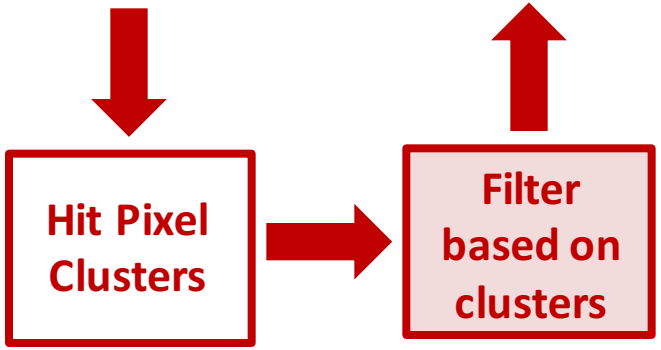

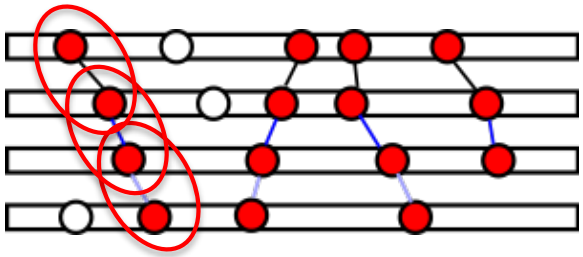

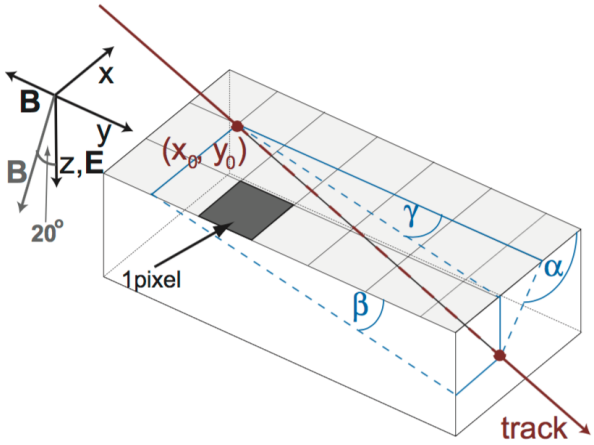

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How is a Pixel Cluster represented in the CMSSW?

Pixels Clusters

class `SiPixelCluster`

"collection" of `Pixel`

- **`uint16_t`** `x`
- **`uint16_t`** `y`
- **`uint16_t`** `adc`

Pixels Clusters

`class` `SiPixelCluster` → Two vectors of `uint16_t` with *position* and *adc* values **only** for pixels turned on

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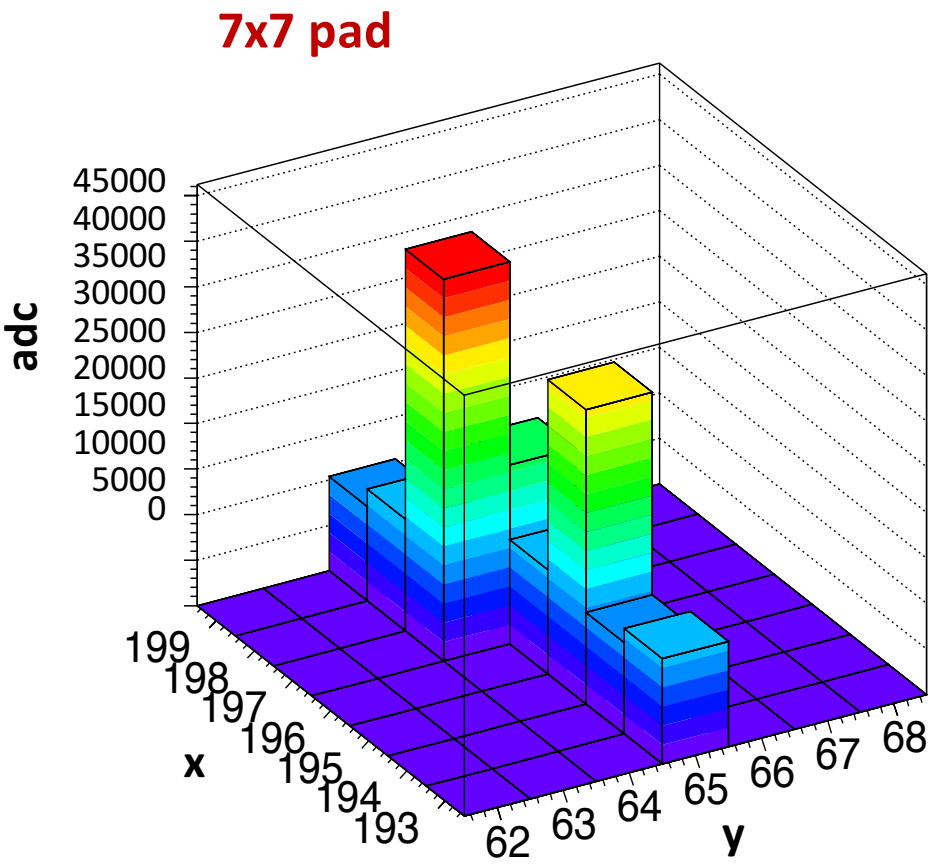

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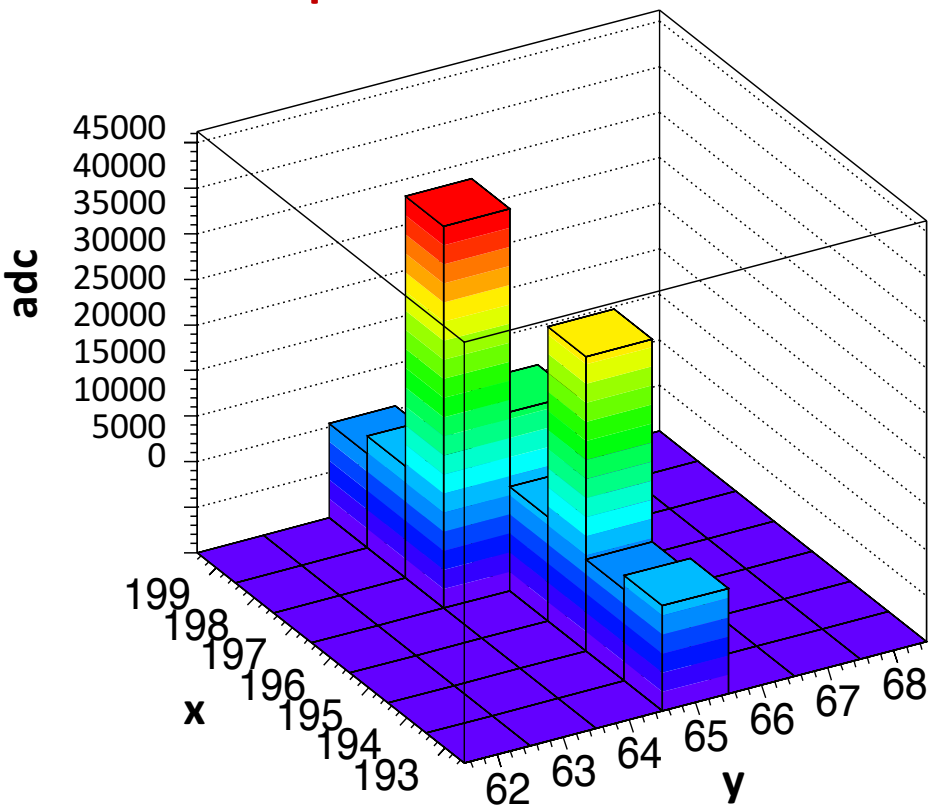
THE IDEA

Use Machine Learning & Image Recognition techniques to add an additional filtering for doublets based on clusters shapes.

7x7 pad



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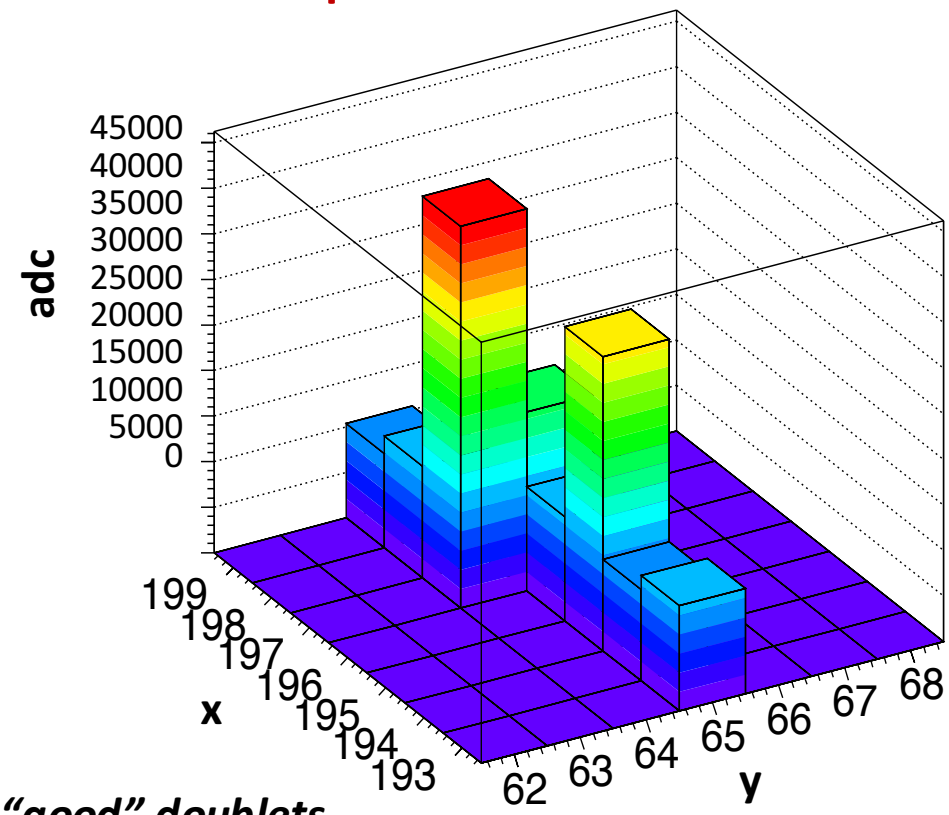
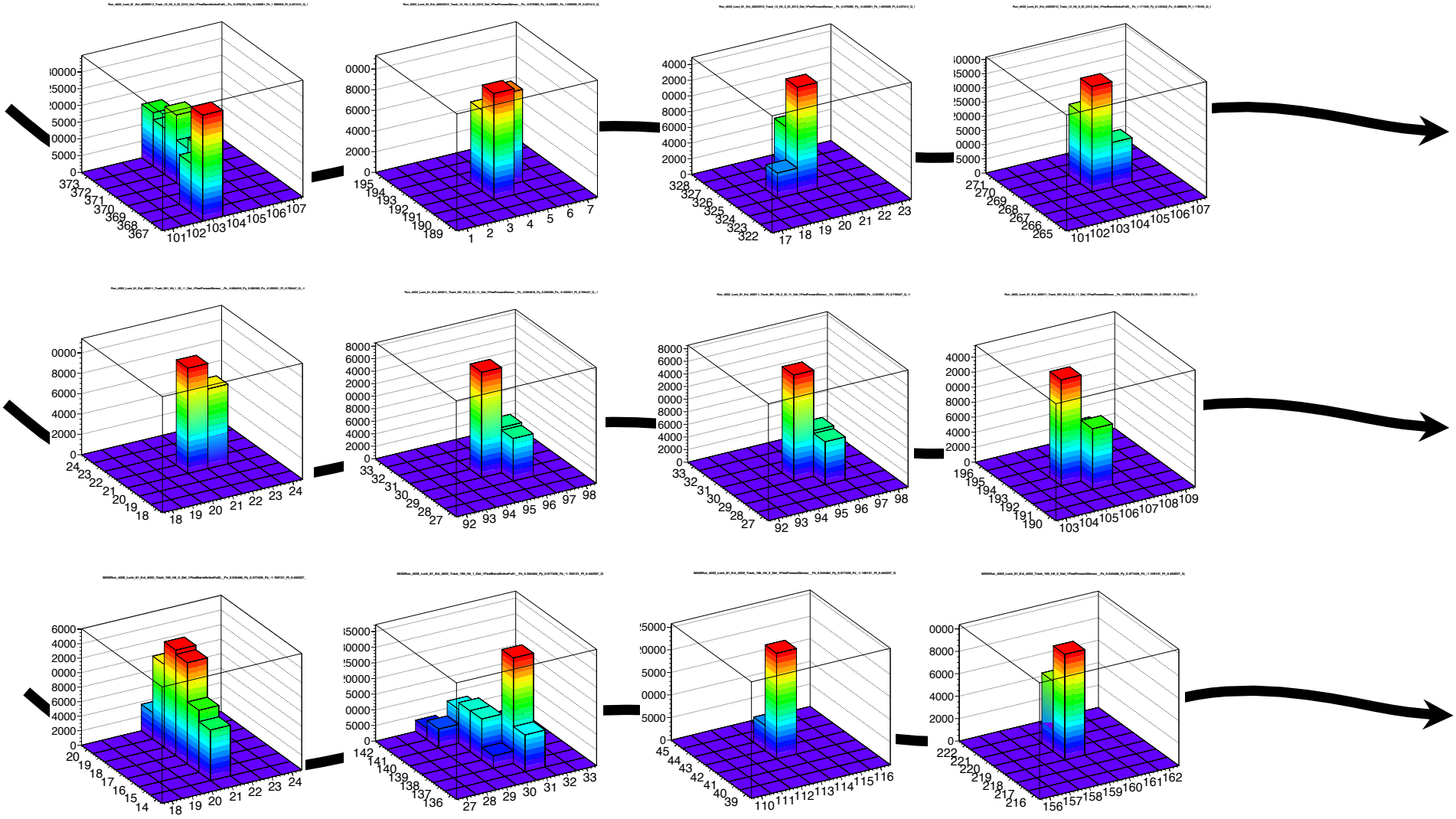


One of the first steps : *link clusters and "good" doublets*.

Matching Tracks

Example – RECO Tracks

TTbar_13+TTbar_13TeV (via runTheMatrix.py)



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RECO – SIM matching

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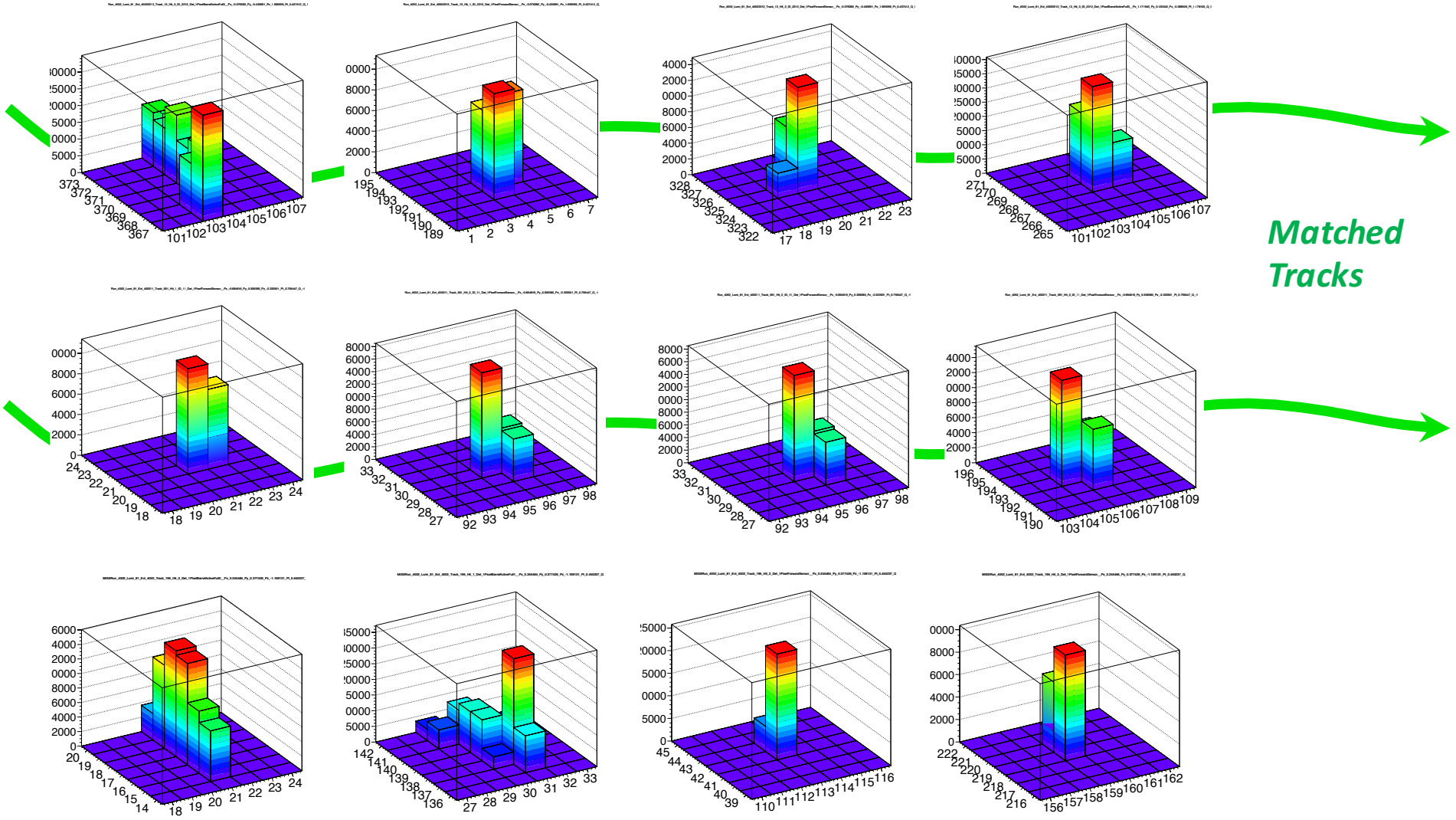

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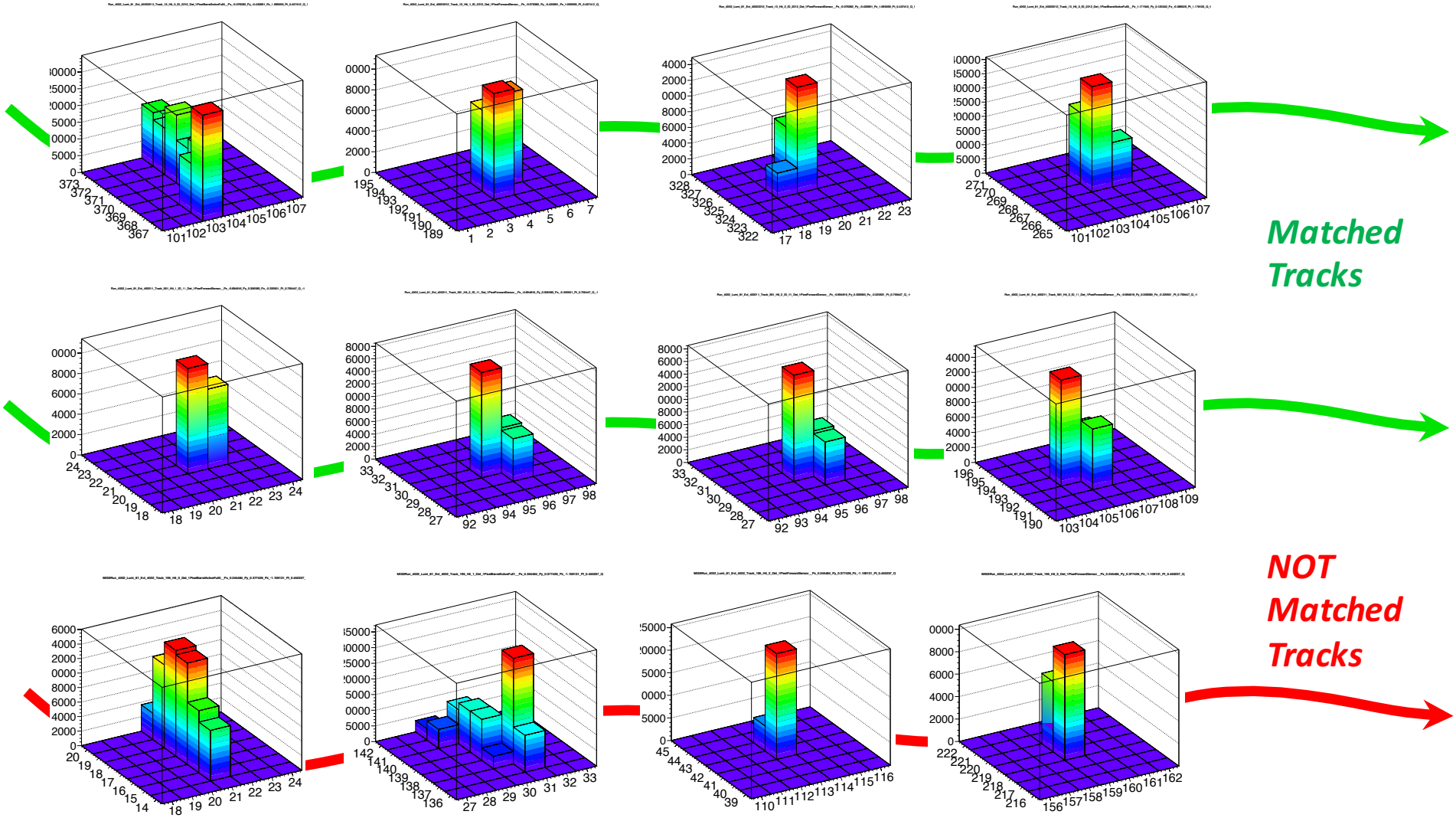
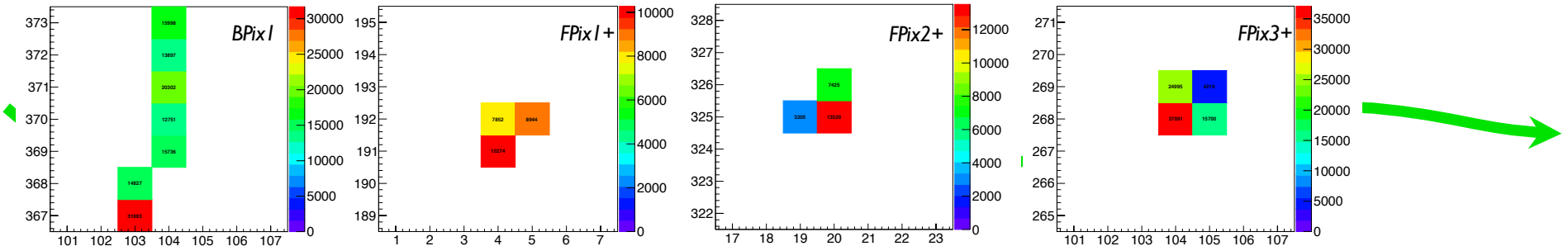


Matched Tracks

NOT Matched Tracks

Matching Tracks

proton (id: 2212)



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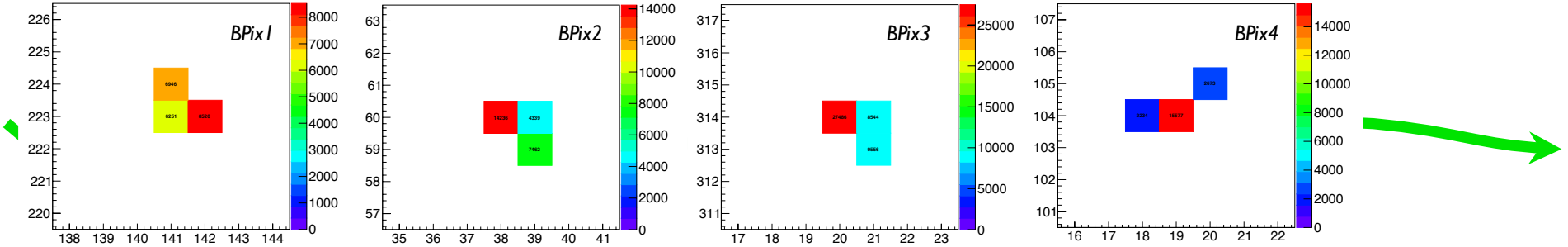
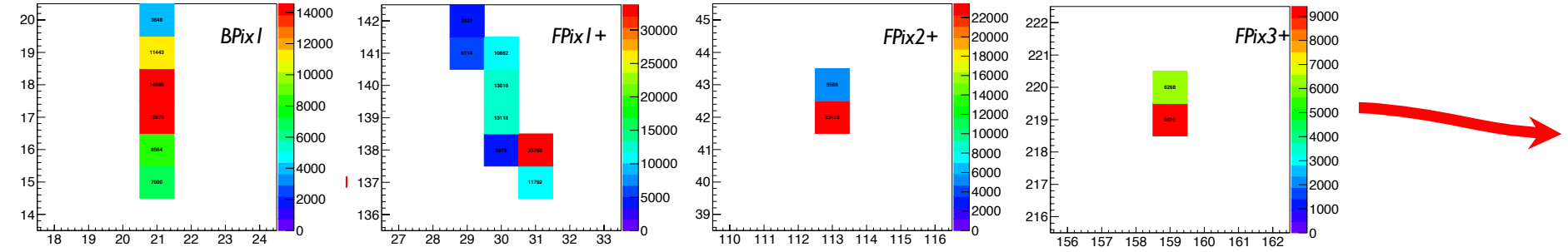


fake track



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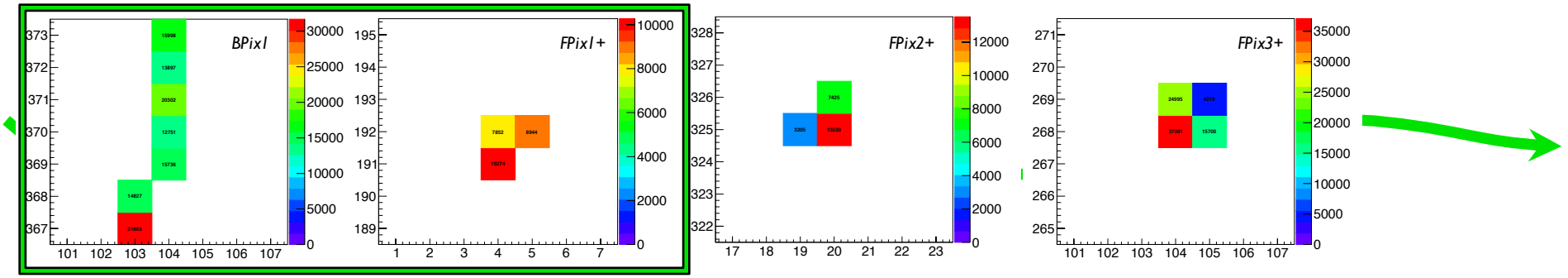

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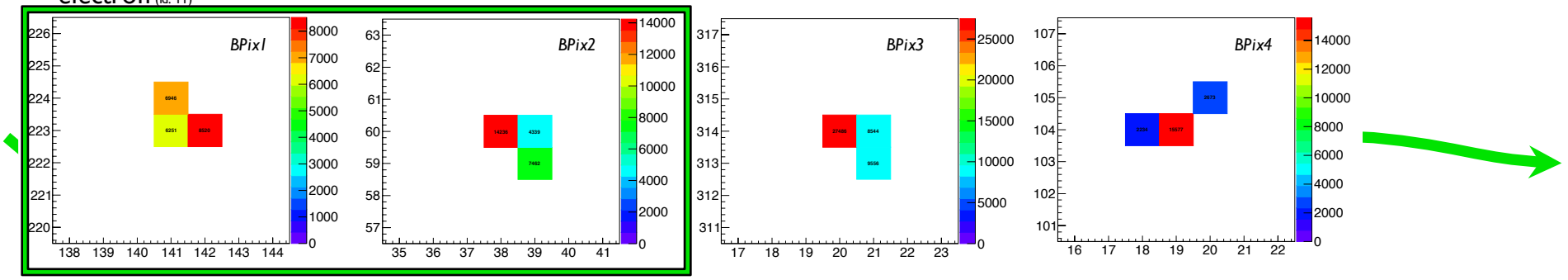

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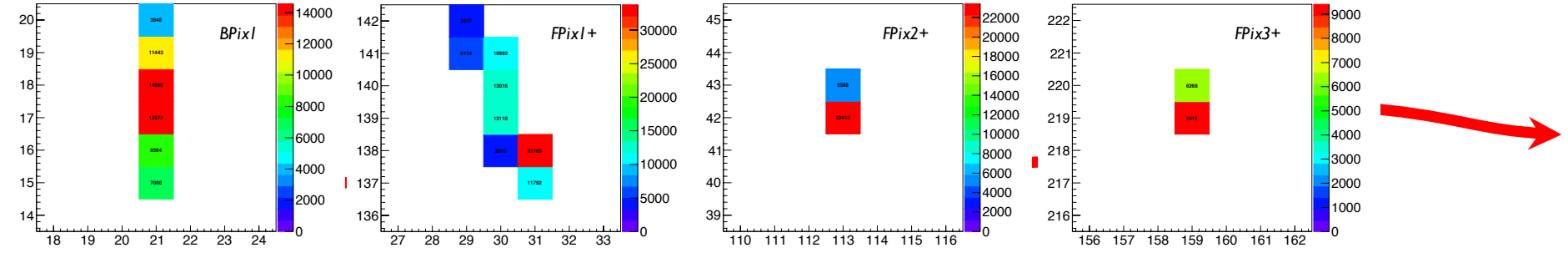

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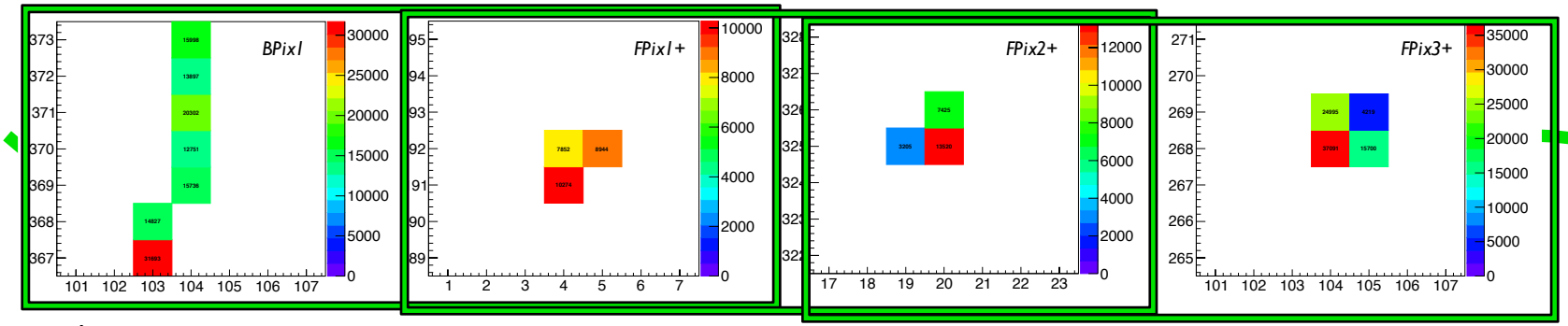

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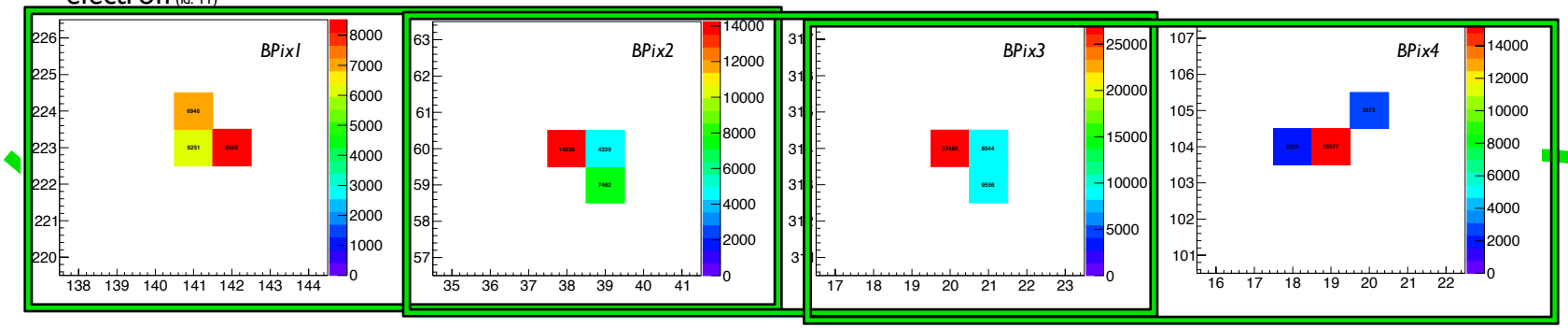

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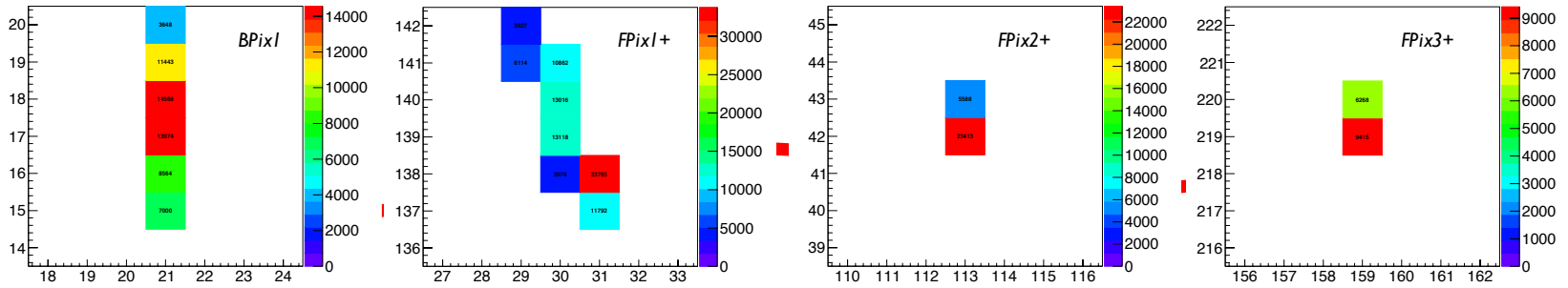

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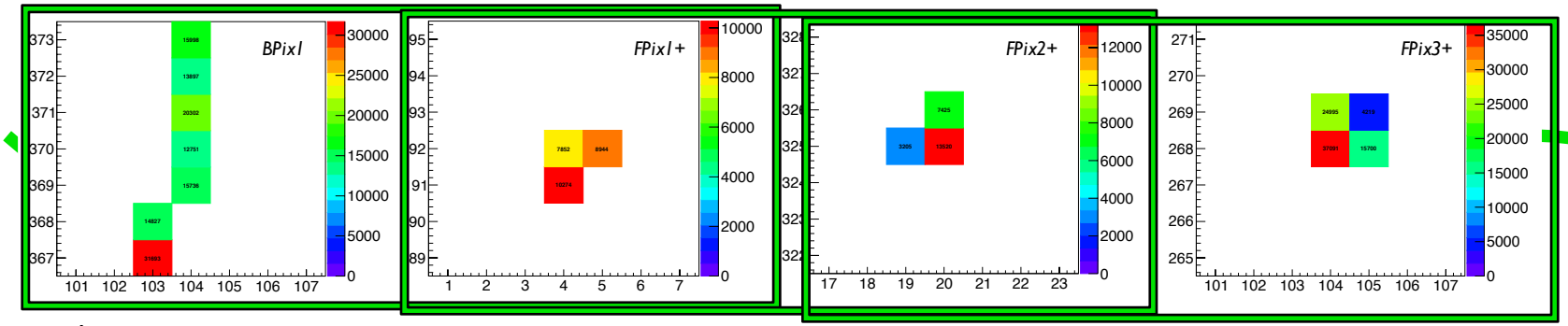

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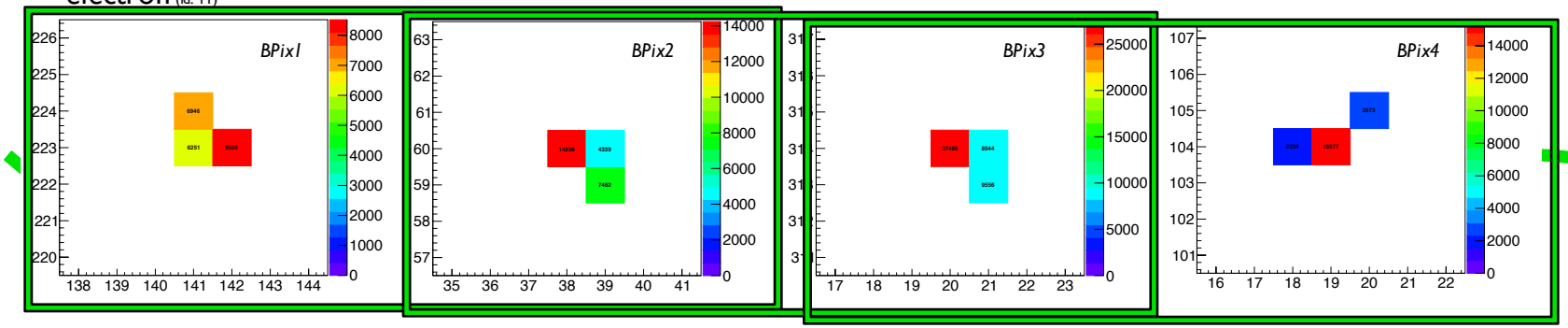

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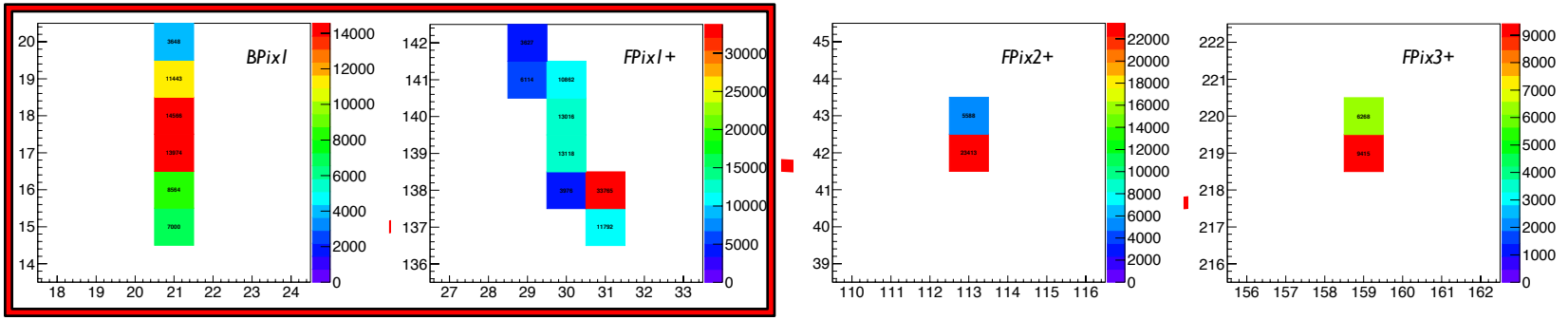

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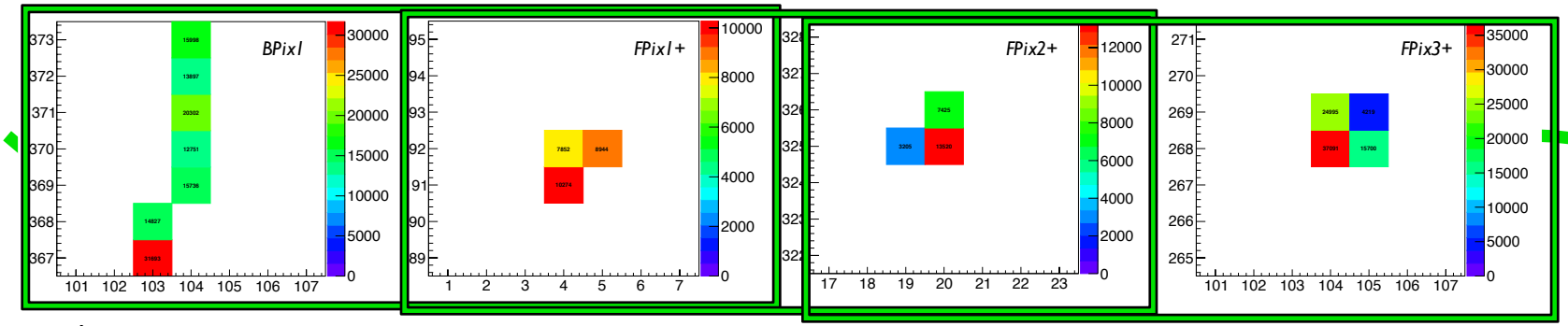

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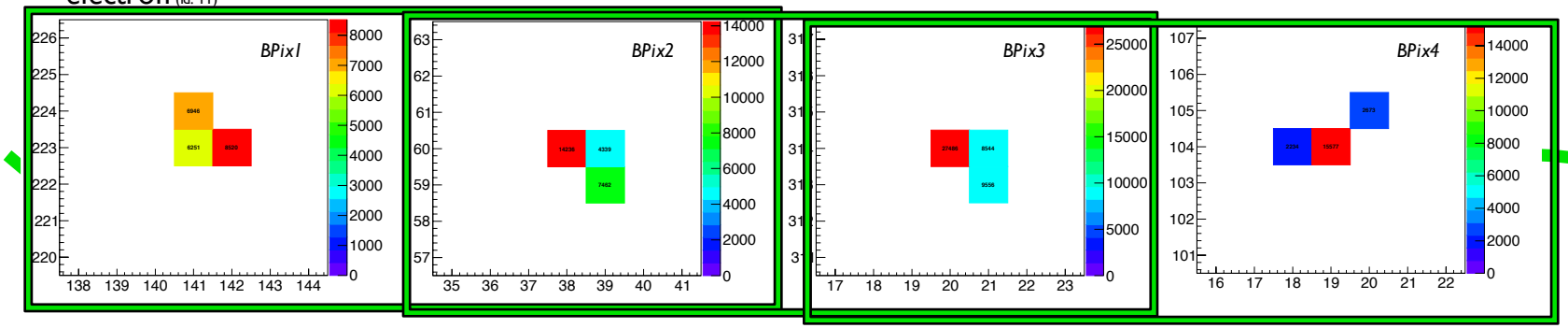

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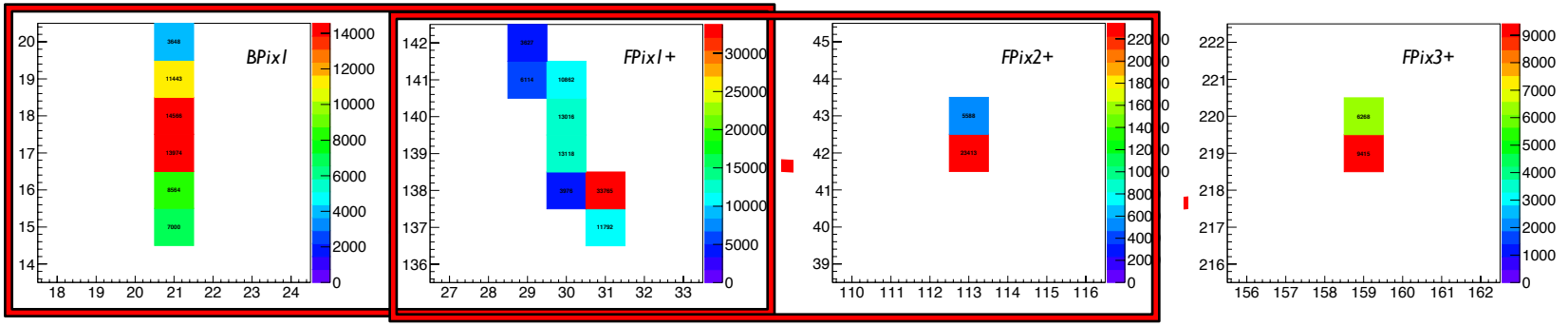

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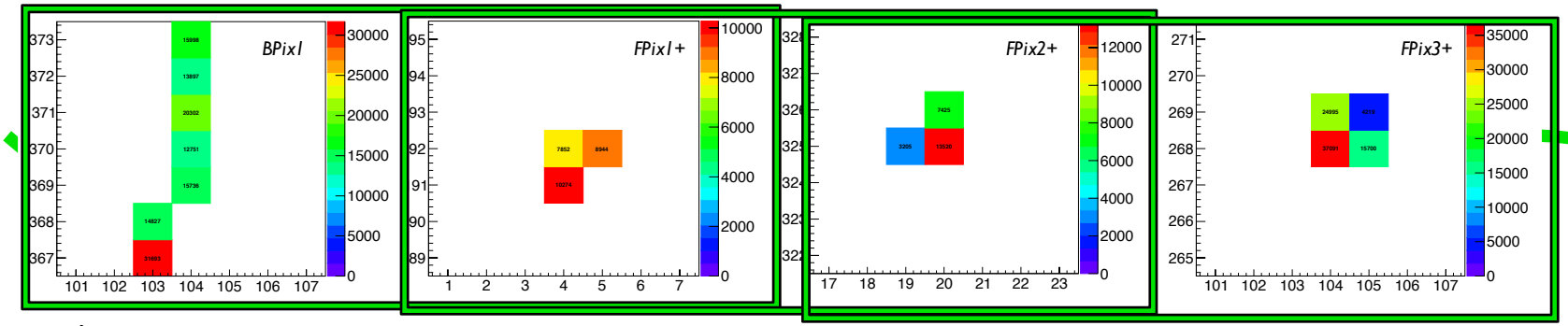

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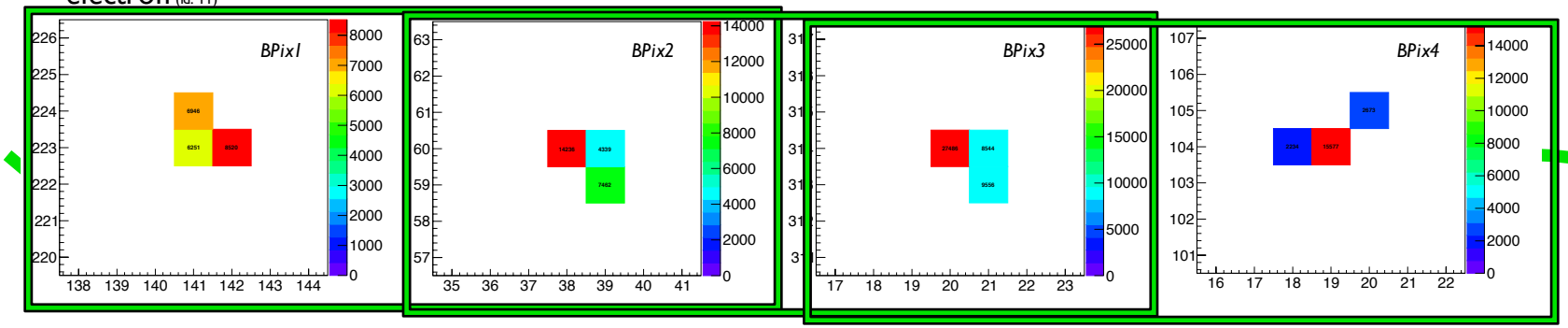

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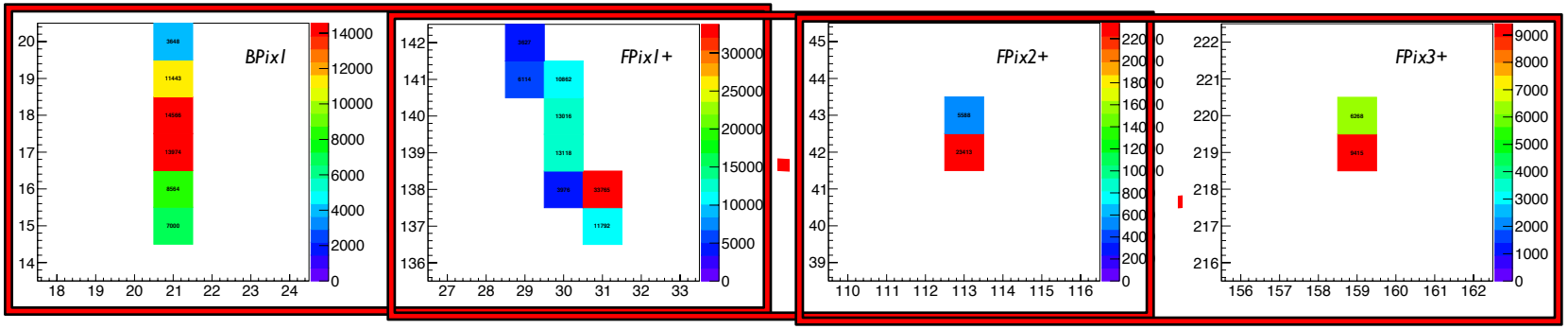
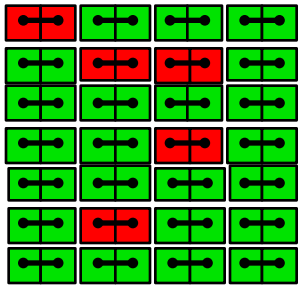


The basic idea & next plans

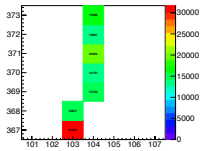
TRAINING SET

- good way?
- data format?
- . . .



CLUSTER INPUTS

- shape



- modules?
- pt?
- pdg ID ?
- . . .

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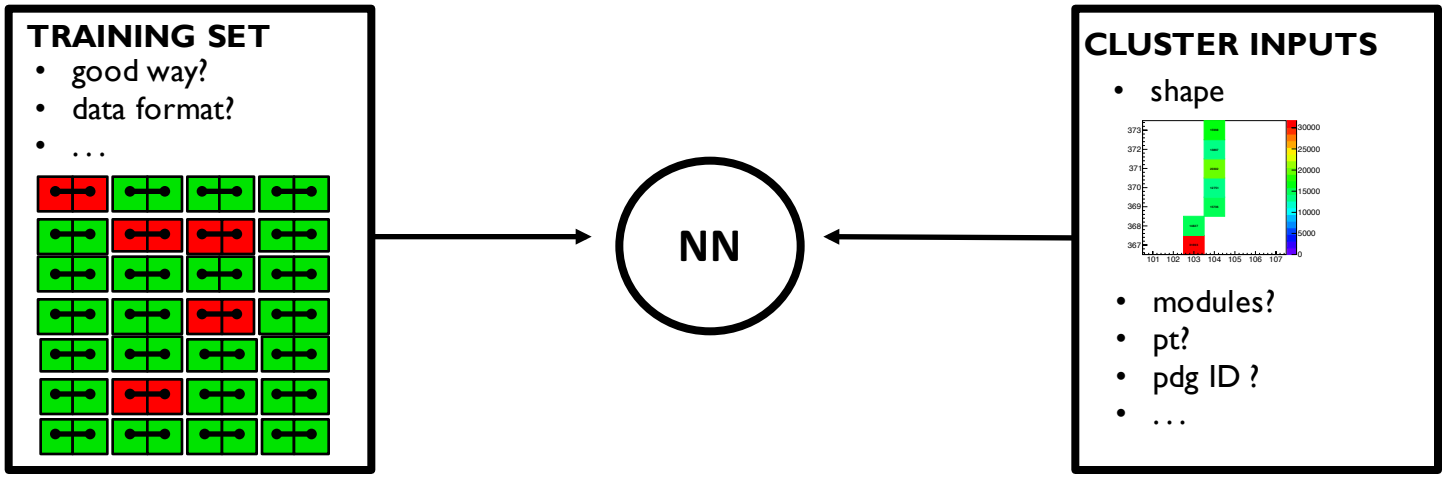

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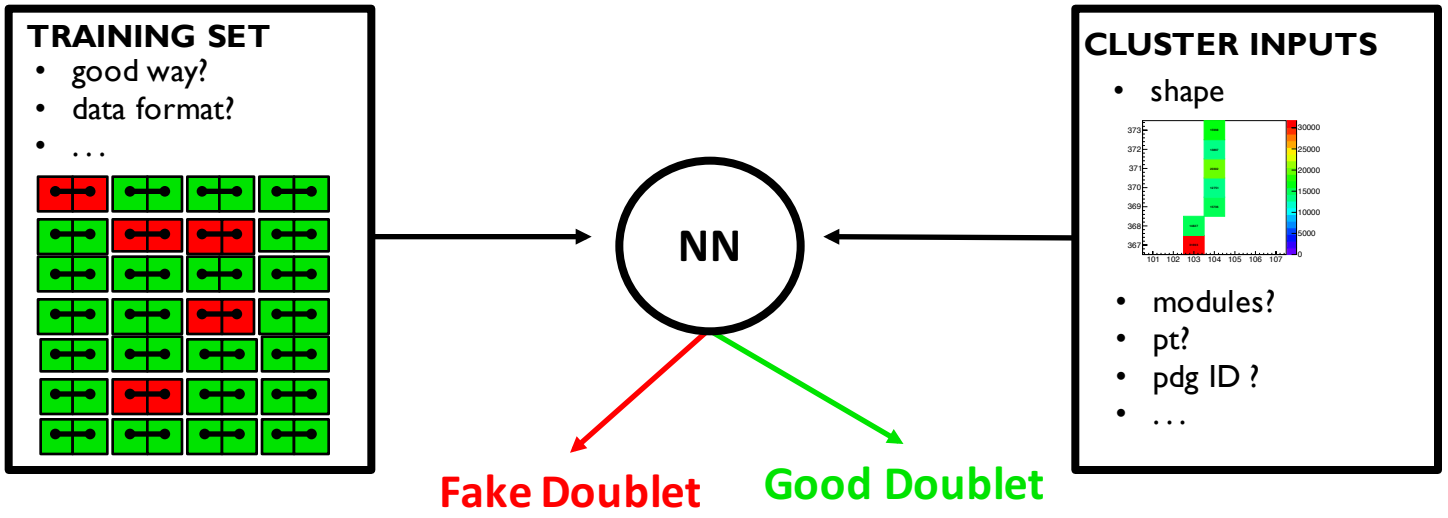

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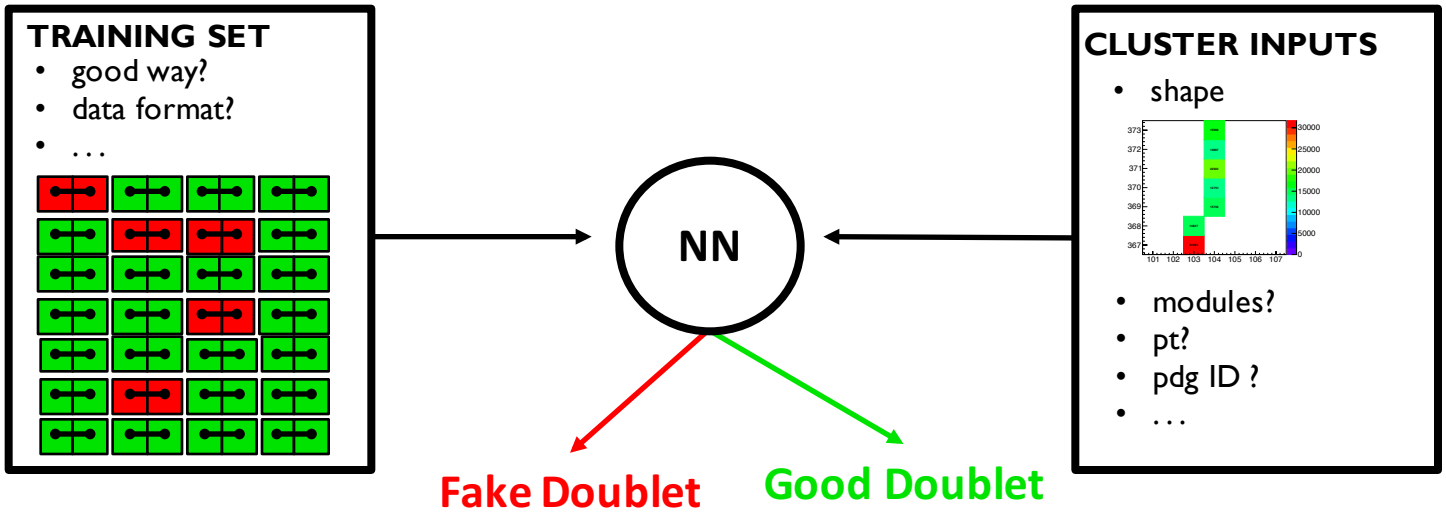

Just a glimpse . . .

- supervised learning tuning
- build up an appropriate training dataset
- undestand which inputs are usefull
- how to deal with data
- any suggestion,criticism **well accepted!**

Thank you

"I am putting myself to the fullest possible use, which is all I think that any conscious entity can ever hope to do"

HAL9000