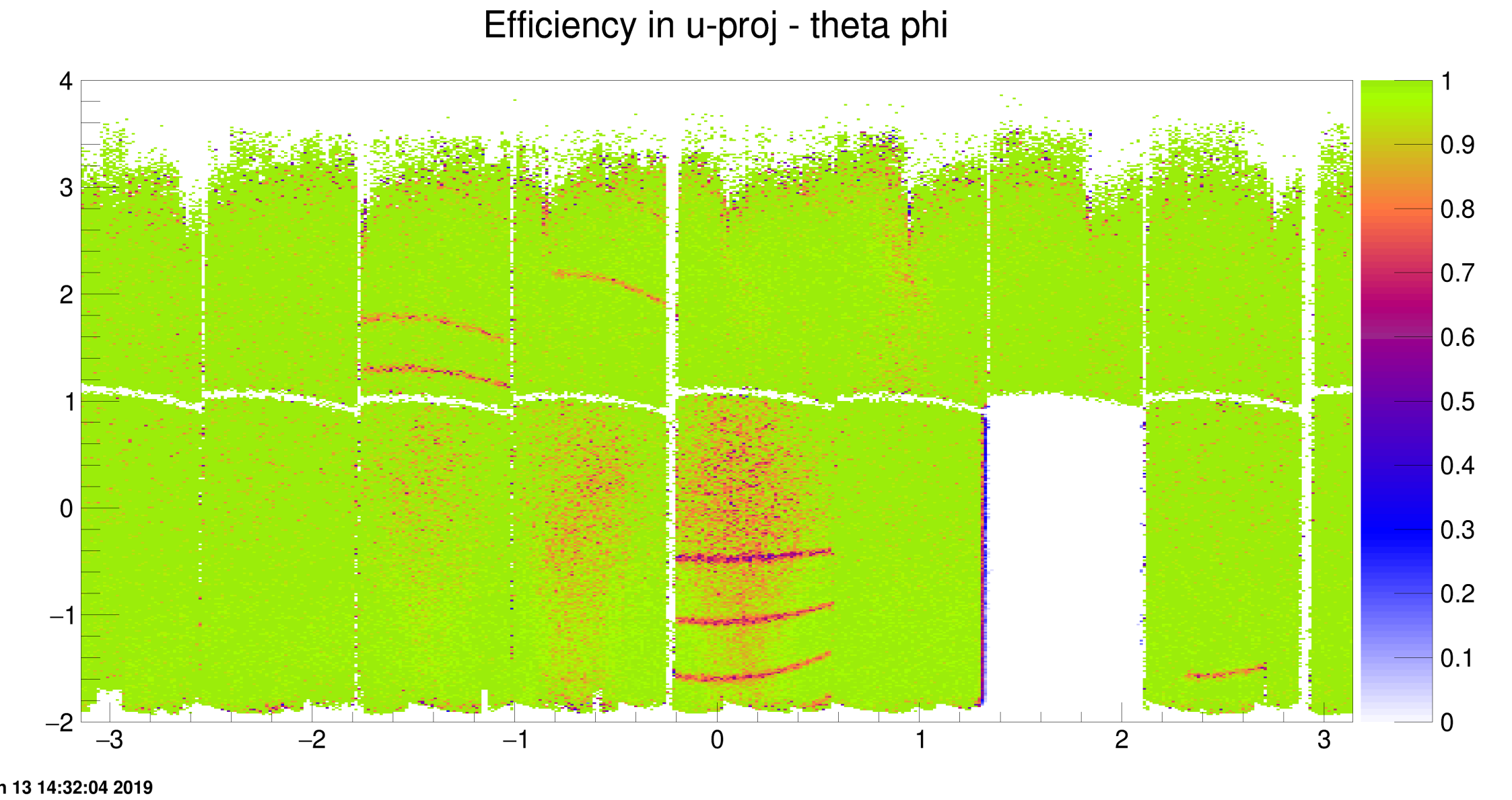
Inefficiencies

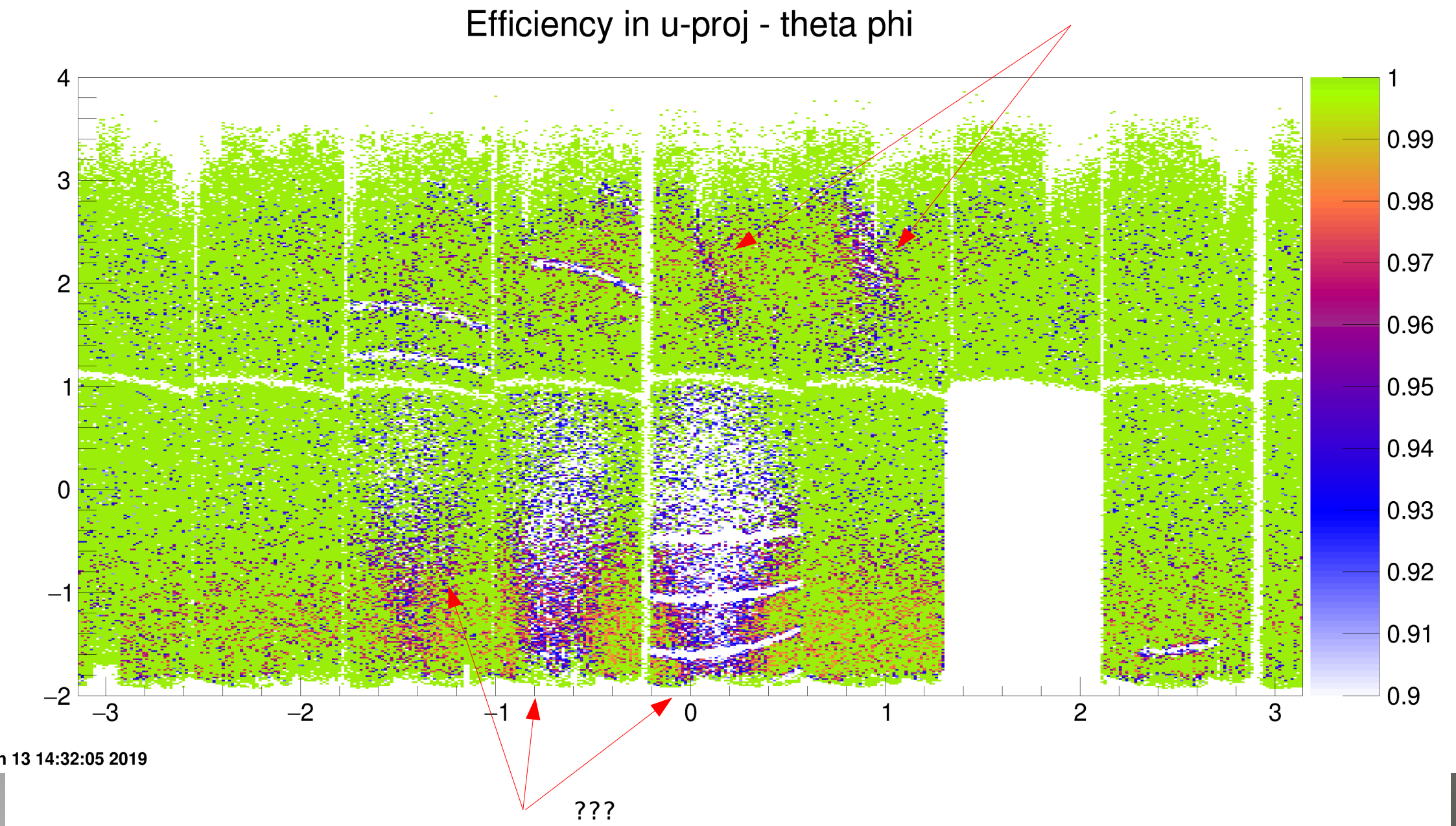
- Ring structures seen in hit maps
  - Do they correlate with inefficiencies?
    - Hard to see: Small effect need lot of statistics
  - Working point of our modules?

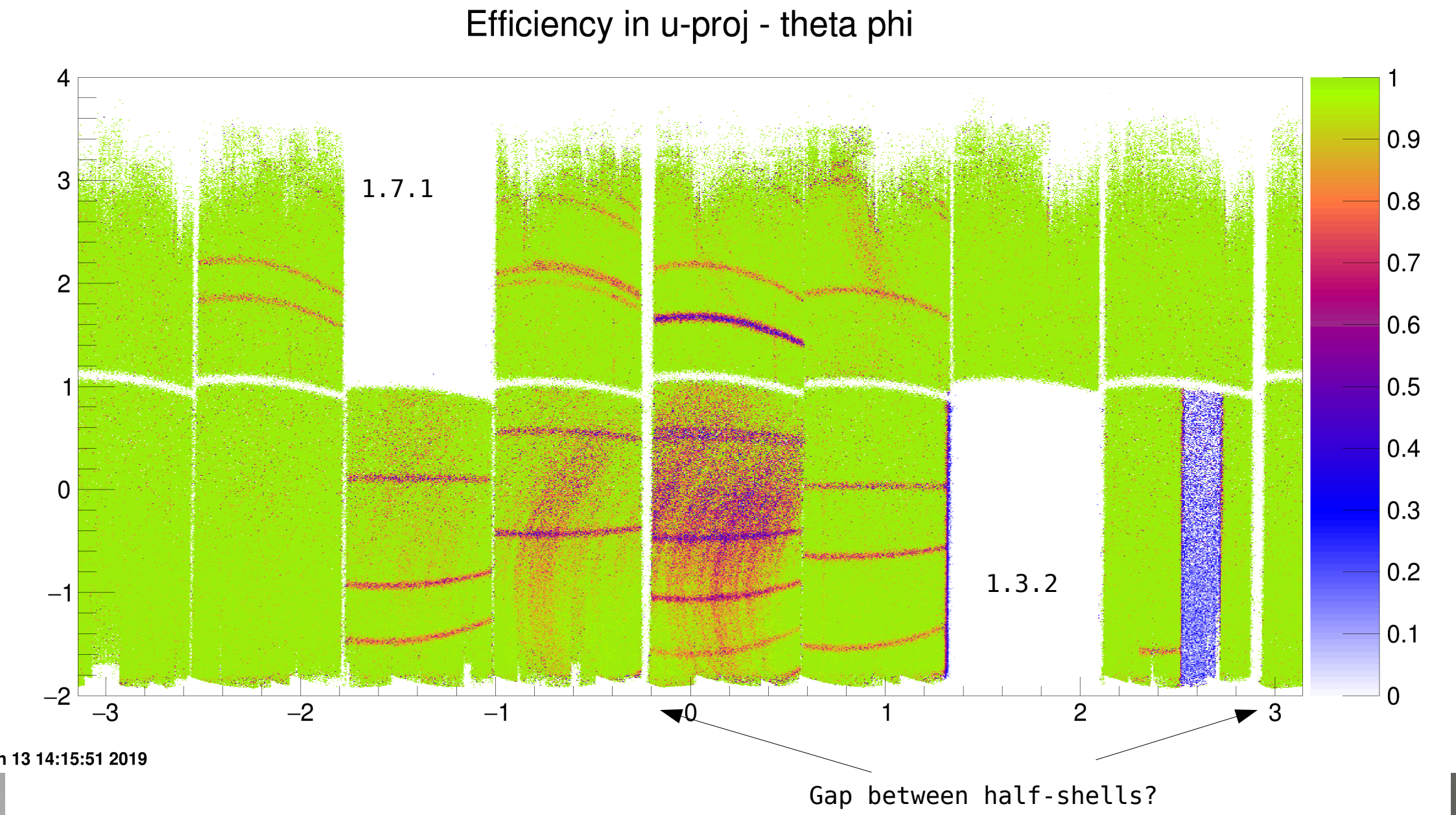
- QCS incidents → radiation dose → change of working points
  - Other damages? Yes …
  - Number of ‘dead’/masked gates increased dramatically

- Using changed (“fixed”) efficiency calculation



n 13 14:32:04 2019


Efficiency in u-proj - theta phi
4
3
2
1
0
−1
−2
−3
−2
−1
0
1
2
3
1
0.99
0.98
0.97
0.96
0.95
0.94
0.93
0.92
0.91
0.9
n 13 14:32:05 2019
???


Efficiency in u-proj - theta phi
1.7.1
1.3.2
4
3
2
1
0
−1
−2
−3
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−1
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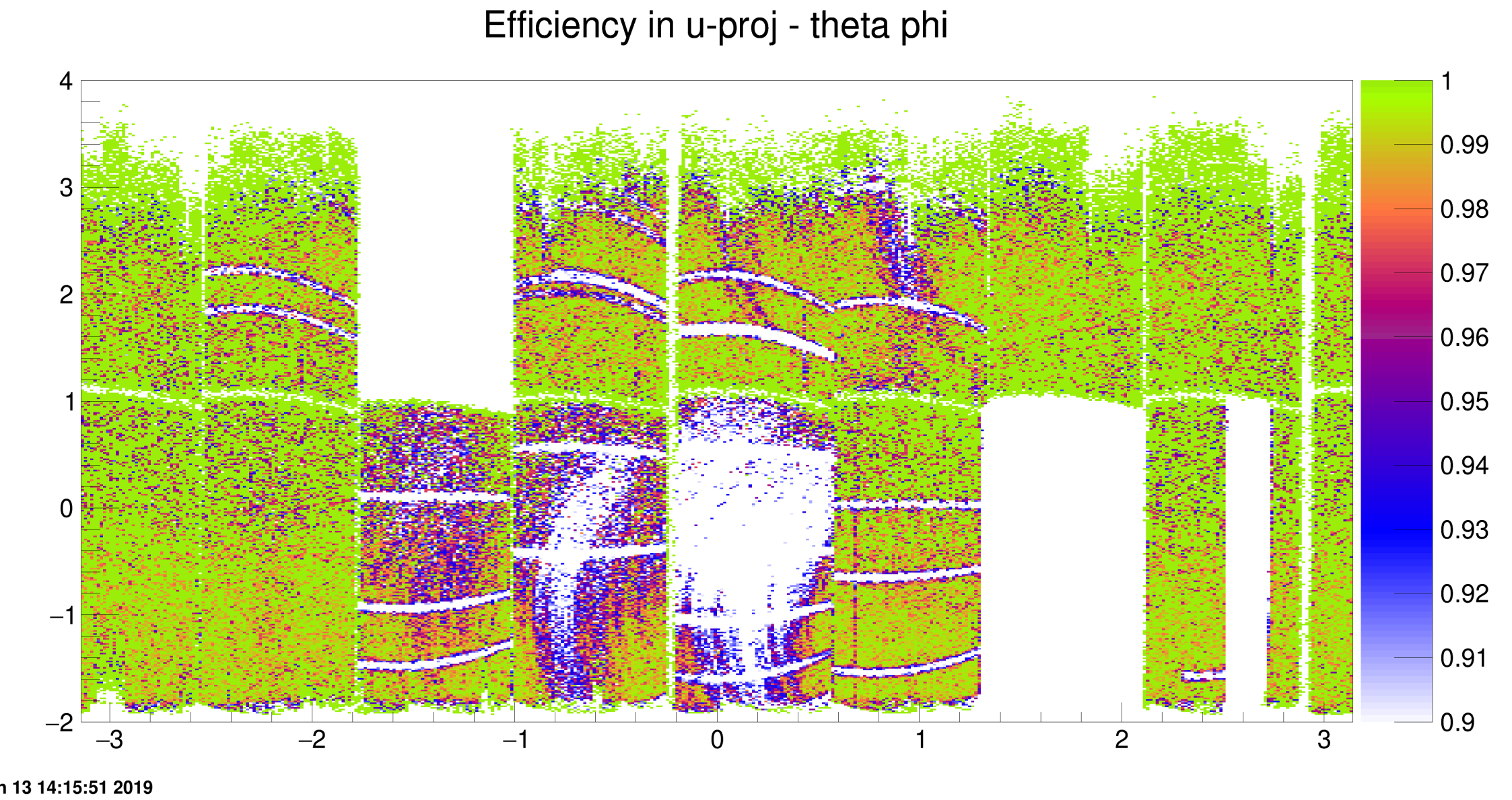
0.6
0.5
0.4
0.3
0.2
0.1
0
n 13 14:15:51 2019
Gap between half-shells?


Efficiency in u-proj - theta phi
4
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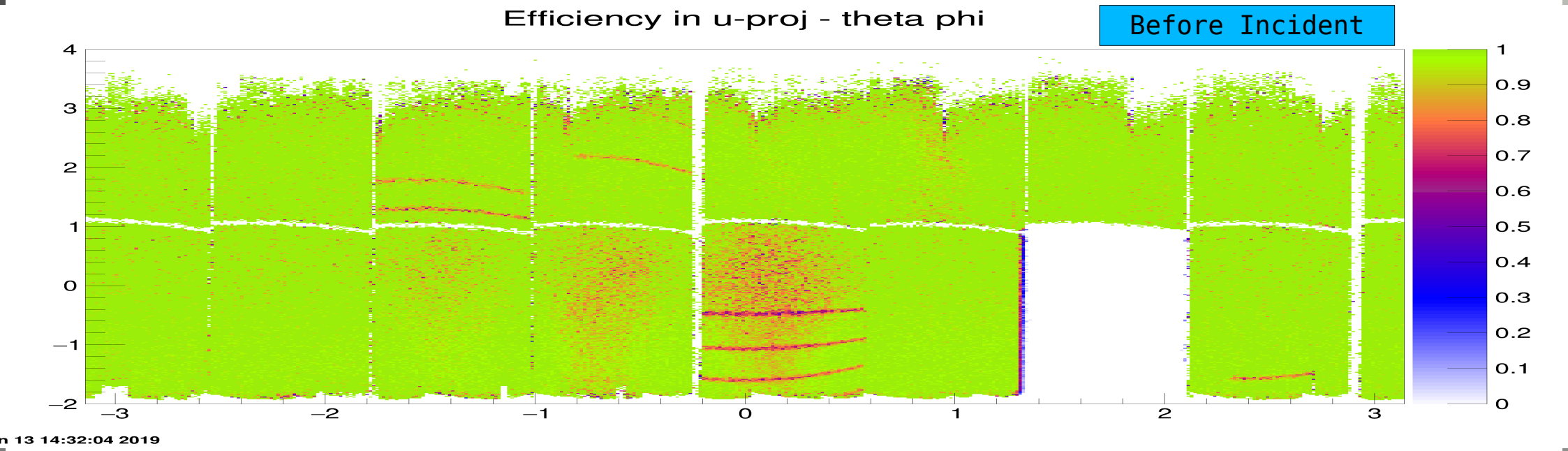
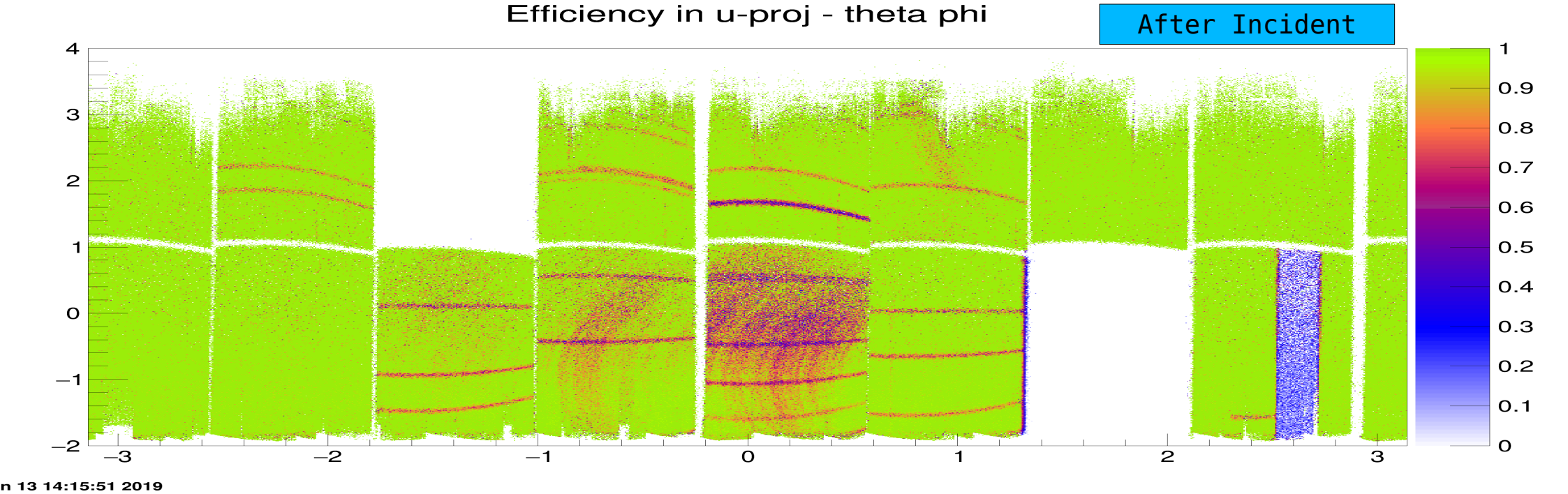
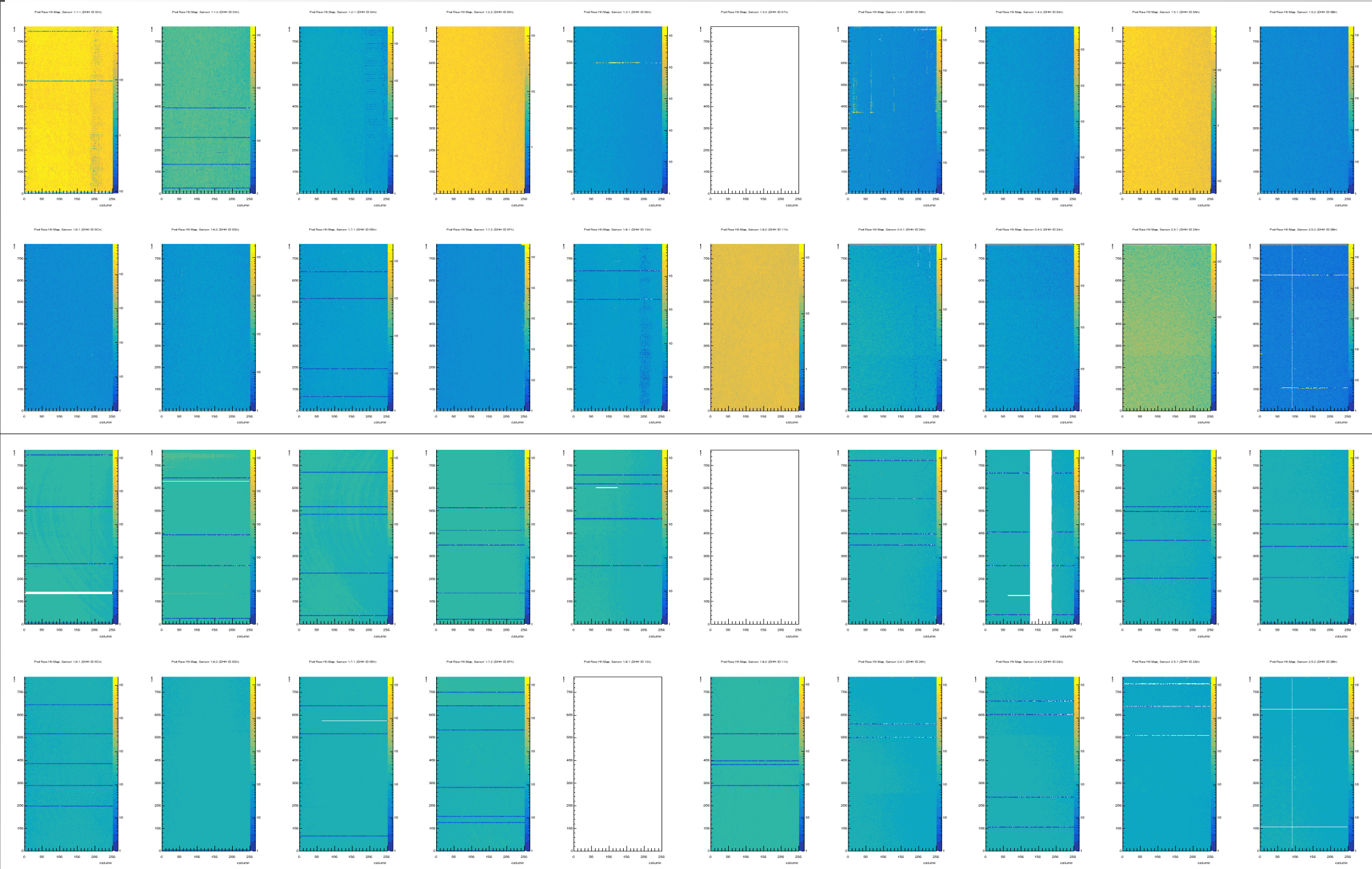
0.9
n 13 14:15:51 2019

Comparison

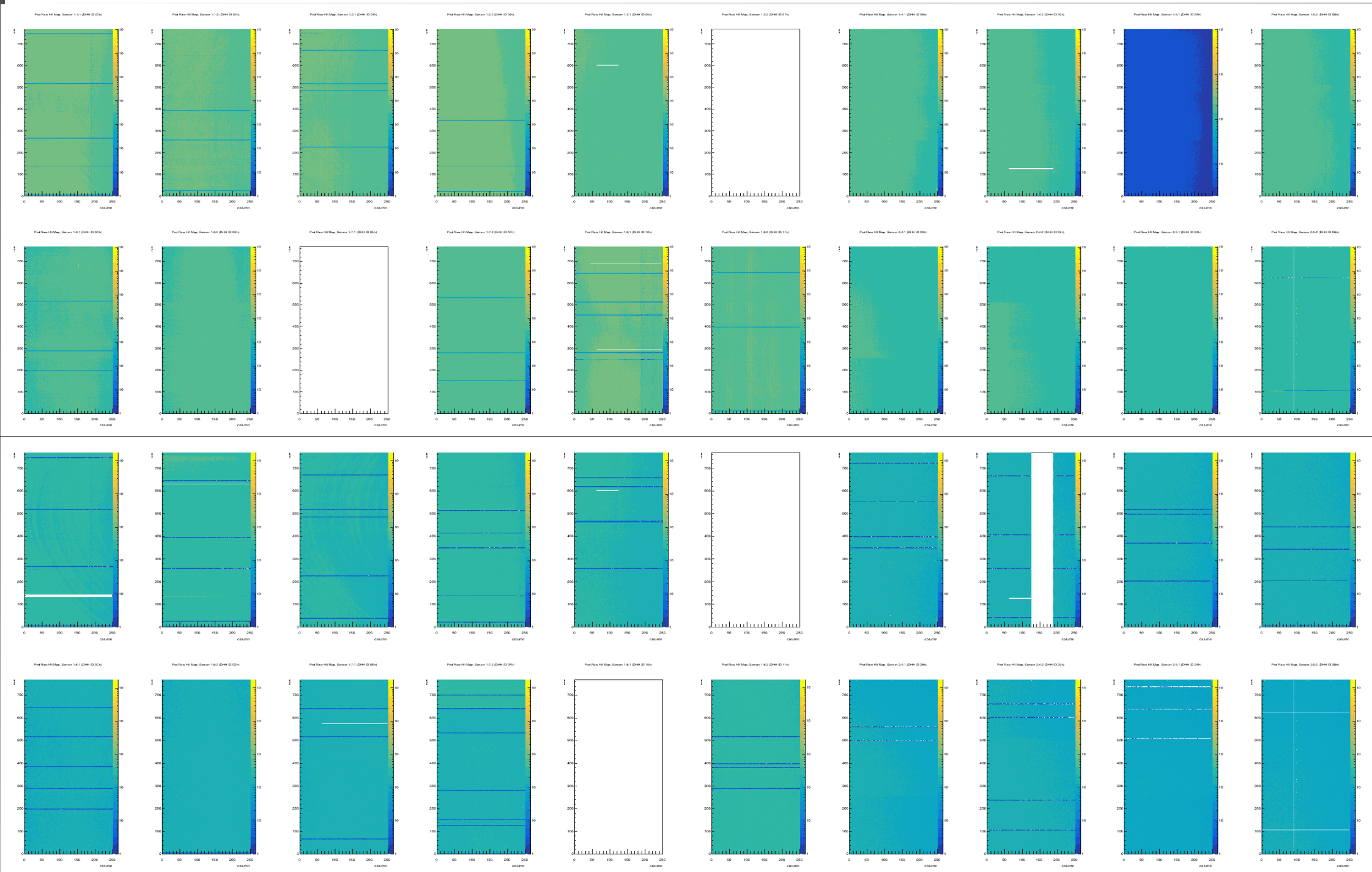

Efficiency in u-proj - theta phi
Before Incident
n 13 14:32:04 2019


Efficiency in u-proj - theta phi
After Incident
n 13 14:15:51 2019

Exp7 r00916 vs Exp8 r024xx (after third incident)



Exp8 r01707 (after first) vs Exp8 r024xx (after third incident)



Numbers

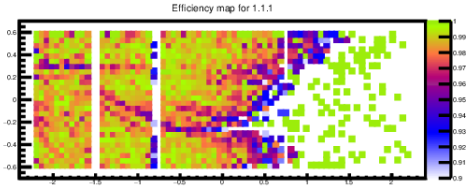
- ~80 ‘dead’ gates now → 2% coverage loss
- 2 dead modules ~ 10%
- 1 dead dhp link ~ 1.2 %

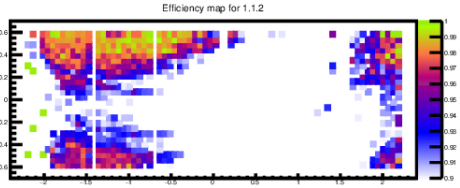
- Within 2 weeks, we went from
  - 14 (+ 8 half-masked or noisy gates)
  - 32 (+6 half-masked or noisy gates)
  - 37 (+5 half-masked or noisy gates)
  - 81 (+ 4 half-masked or noisy gates)
    - three gates recovered or no mask needed anymore?

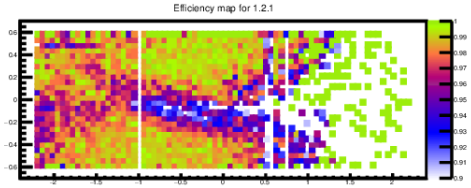
Summary

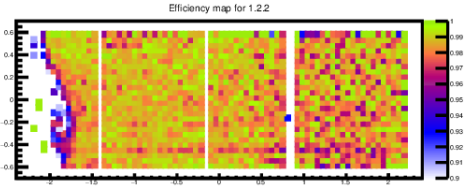
- Ring structures ↔ Inefficiencies
- Inefficient “gates” ↔ low/no hit counts in hit maps
- “broken’ gates by radiation damage in Switcher or sensor?
    - Broken or noisy=masked? Tbc
- Assumption that same channel in different switches breaks at same event time (→ delta=32 gates) can not be verified

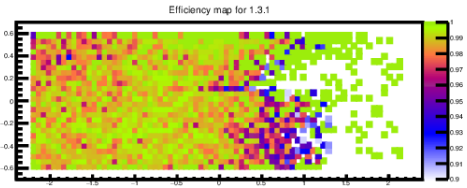
Efficiencies (before 2nd incident)

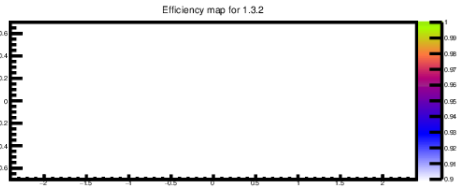

Efficiency map for 1.1.1

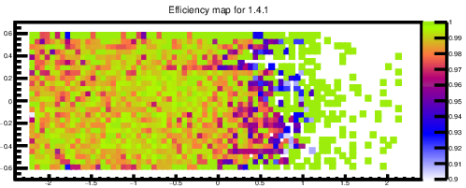

Efficiency map for 1.1.2

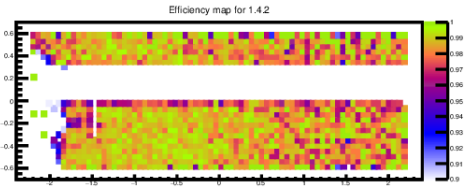

Efficiency map for 1.2.1

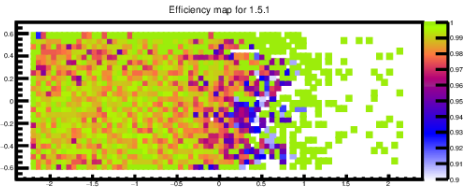

Efficiency map for 1.2.2

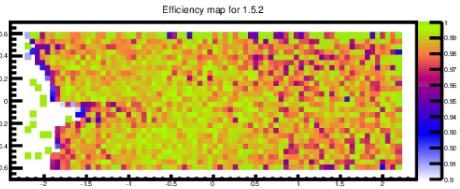

Efficiency map for 1.3.1

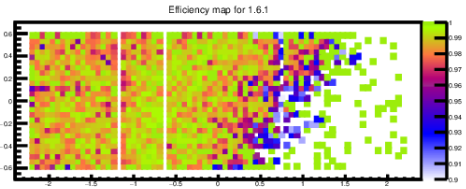

Efficiency map for 1.3.2

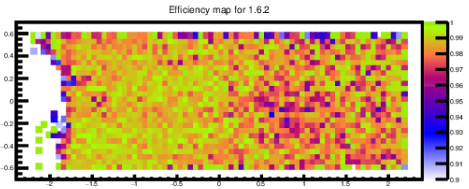

Efficiency map for 1.4.1

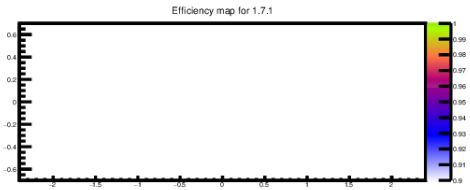

Efficiency map for 1.4.2

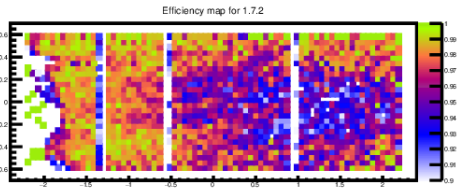

Efficiency map for 1.5.1

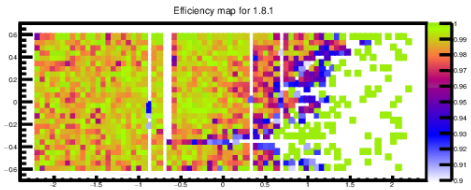

Efficiency map for 1.5.2

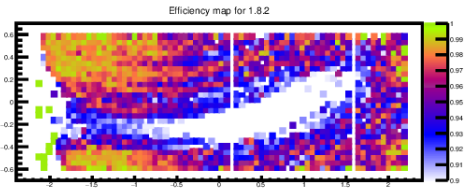

Efficiency map for 1.6.1

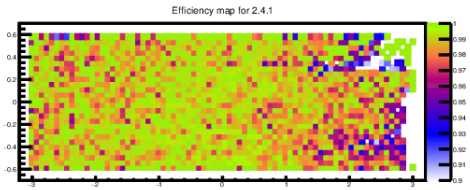

Efficiency map for 1.6.2

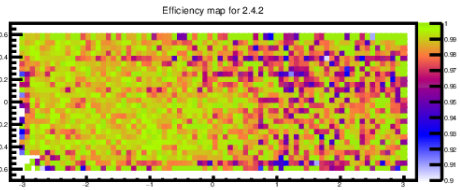

Efficiency map for 1.7.1

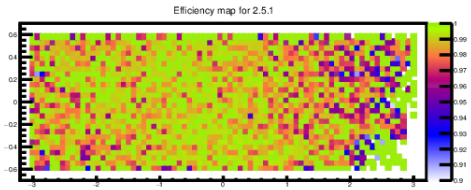

Efficiency map for 1.7.2

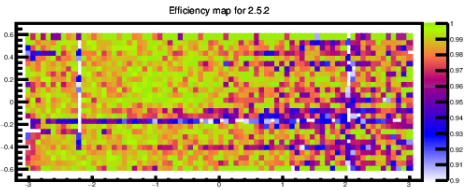

Efficiency map for 1.8.1

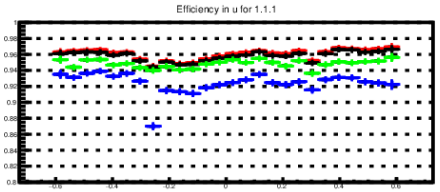

Efficiency map for 1.8.2

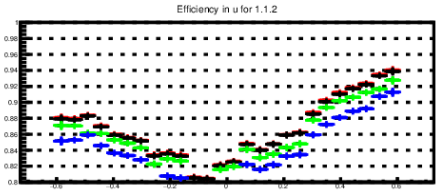

Efficiency map for 2.4.1

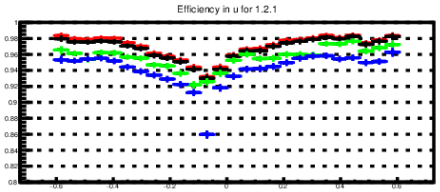

Efficiency map for 2.4.2

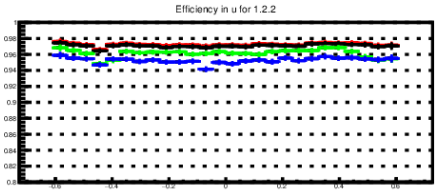

Efficiency map for 2.5.1


Efficiency map for 2.5.2


Efficiency in u for 1.1.1


Efficiency in u for 1.1.2


Efficiency in u for 1.2.1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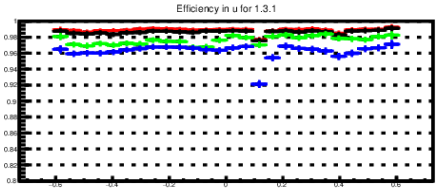
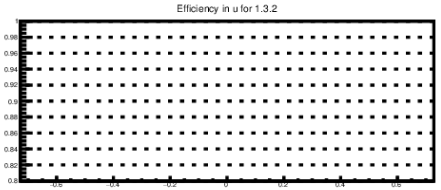
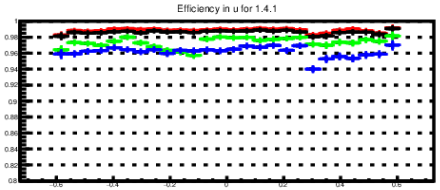
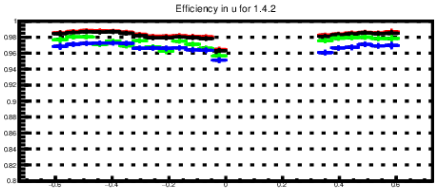

Efficiency in u for 1.3.1


Efficiency in u for 1.3.2


Efficiency in u for 1.4.1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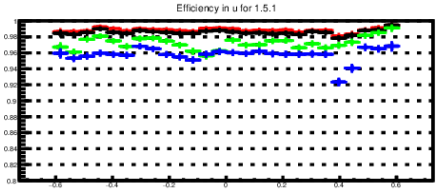
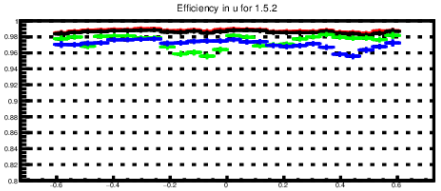

Efficiency in u for 1.5.1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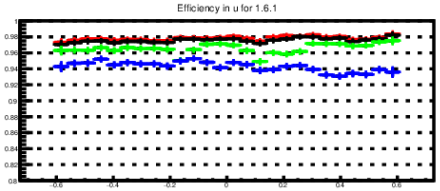
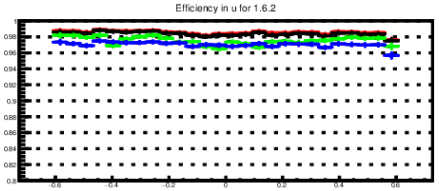

Efficiency in u for 1.6.1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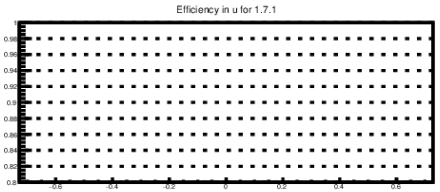
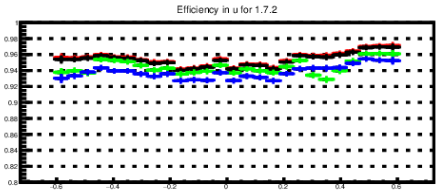
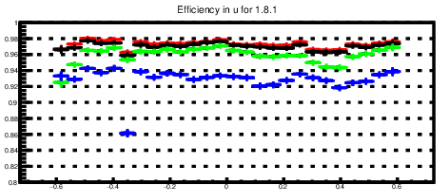
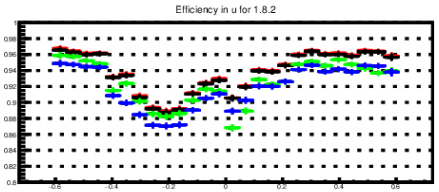
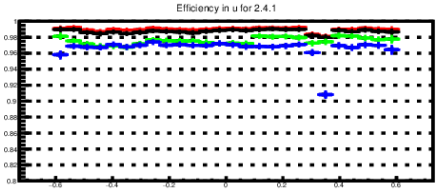
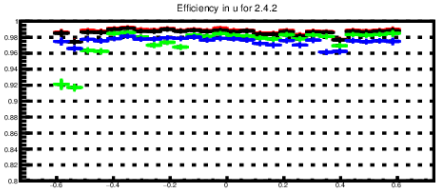

Efficiency in u for 1.7.1

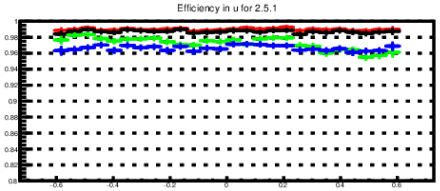

Efficiency in u for 1.7.2

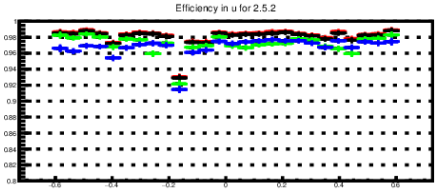

Efficiency in u for 1.8.1

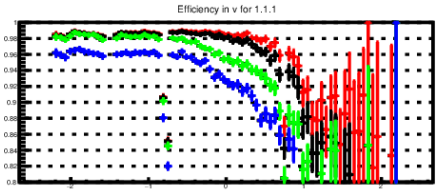

Efficiency in u for 1.8.2

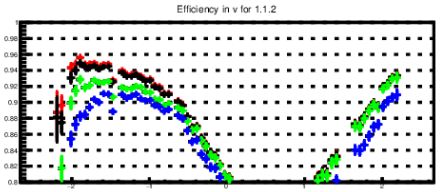

Efficiency in u for 2.4.1

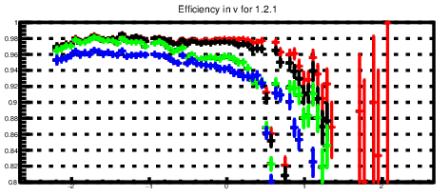

Efficiency in u for 2.4.2

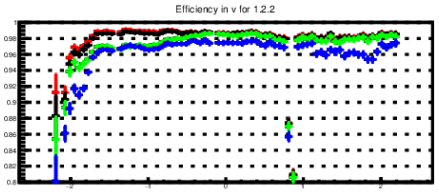

Efficiency in u for 2.5.1

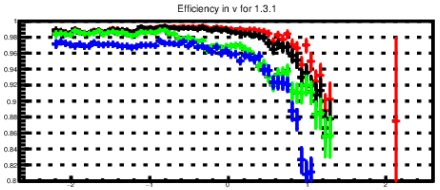

Efficiency in u for 2.5.2

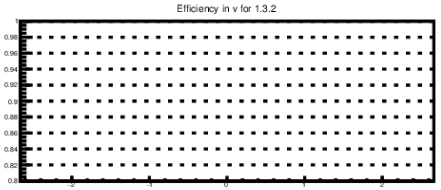

Efficiency in v for 1.1.1

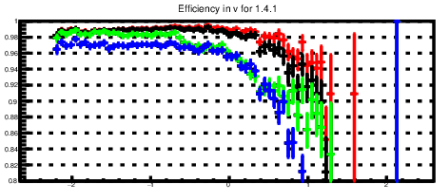

Efficiency in v for 1.1.2

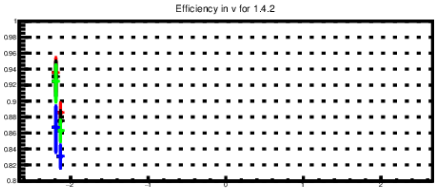

Efficiency in v for 1.2.1


Efficiency in v for 1.2.2


Efficiency in v for 1.3.1


Efficiency in v for 1.3.2


Efficiency in v for 1.4.1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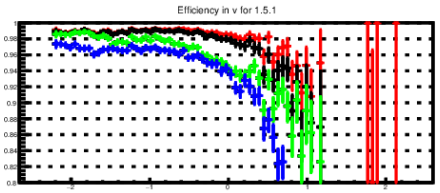
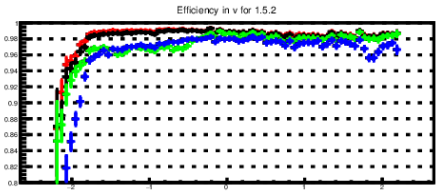
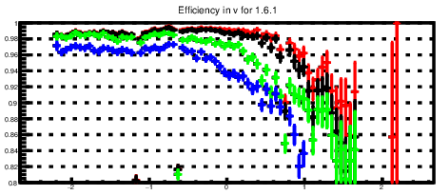
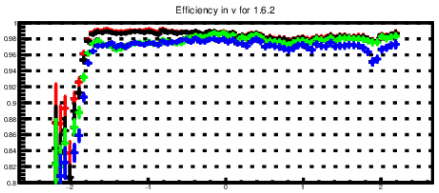
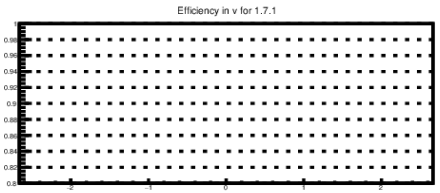
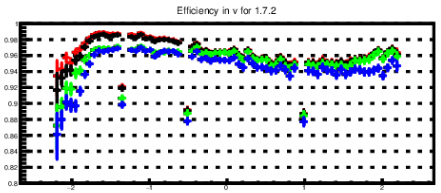

Efficiency in v for 1.5.1

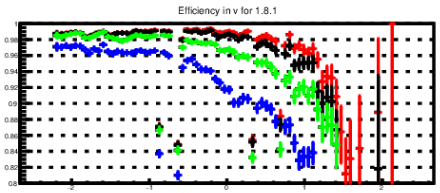

Efficiency in v for 1.5.2

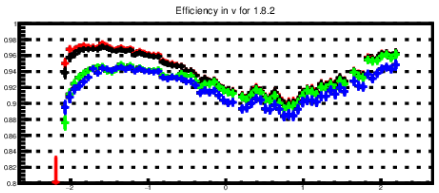

Efficiency in v for 1.6.1

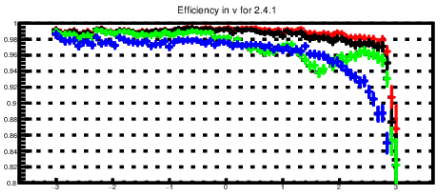

Efficiency in v for 1.6.2

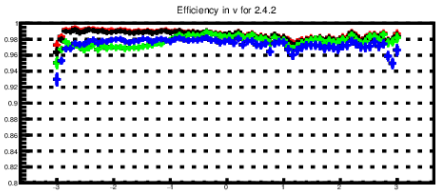

Efficiency in v for 1.7.1

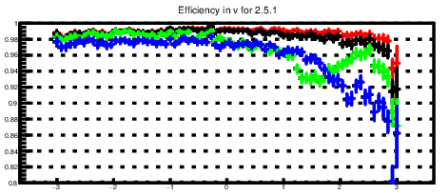

Efficiency in v for 1.7.2

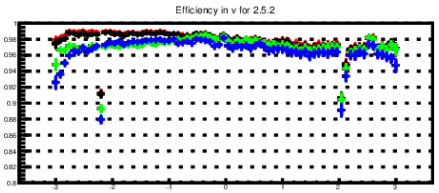

Efficiency in v for 1.8.1


Efficiency in v for 1.8.2


Efficiency in v for 2.4.1


Efficiency in v for 2.4.2


Efficiency in v for 2.5.1


Efficiency in v for 2.5.2