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Correlation studies for likelihood variables

R. Cassell, M. Charles, G. Halladjian, U. Mallik, R. Zaidan

Introduction

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- Correlation factor:
  - Defined as:

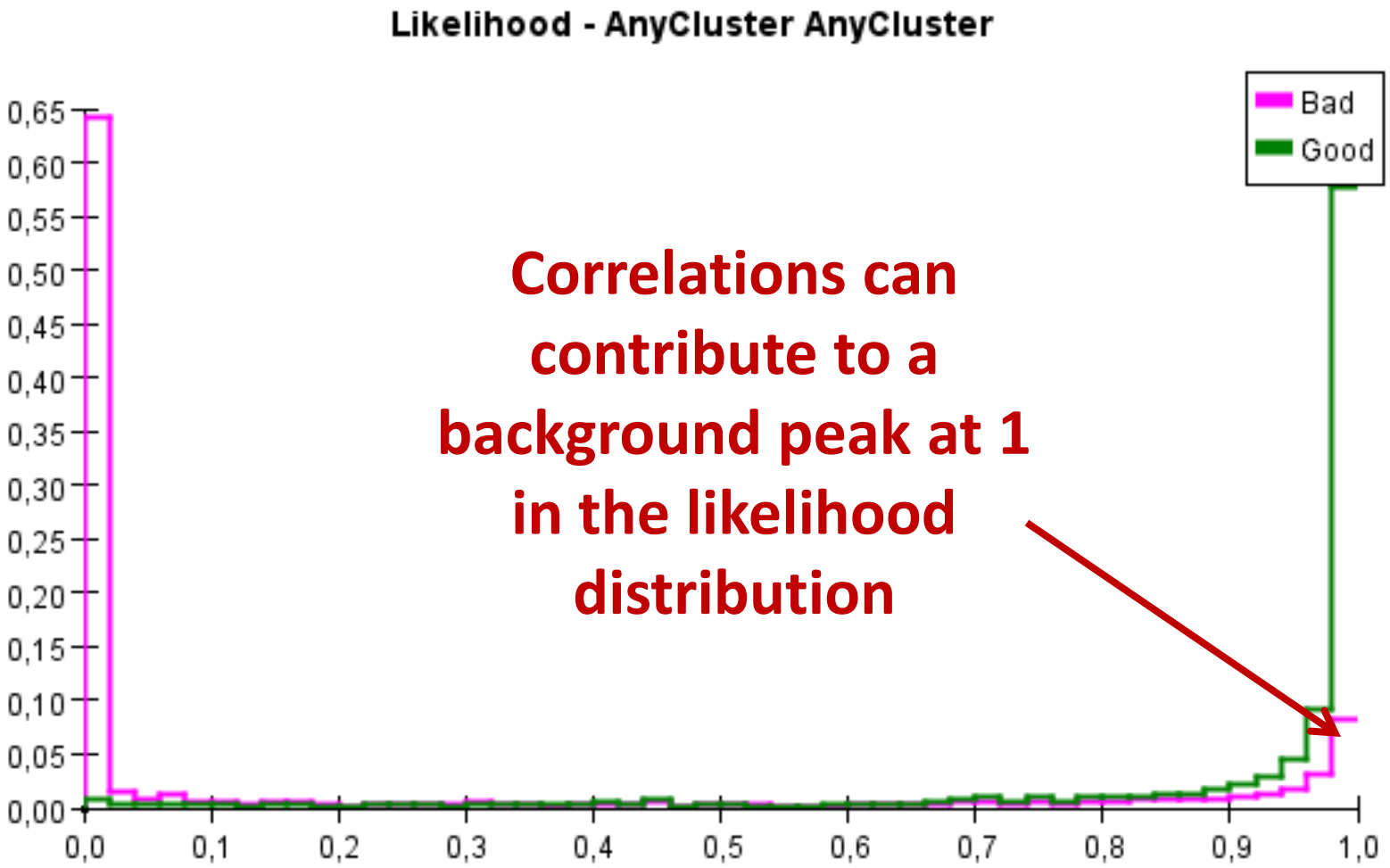
$$\rho_{x,y} = \frac{\langle (x-\bar{x}) \times (y-\bar{y}) \rangle}{\sqrt{\langle (x-\bar{x})^2 \rangle \times \langle (y-\bar{y})^2 \rangle}} = \frac{\mathbf{cov}_{x,y}}{\sigma_x \times \sigma_y}$$

  - Measures the degree of correlation:

$$-1 \leq \rho_{x,y} \leq 1$$

- Likelihood function assumes independent variables:
  - Correlations between variables may cause peaks in the likelihood distribution for background in the signal region and vice versa.

Introduction



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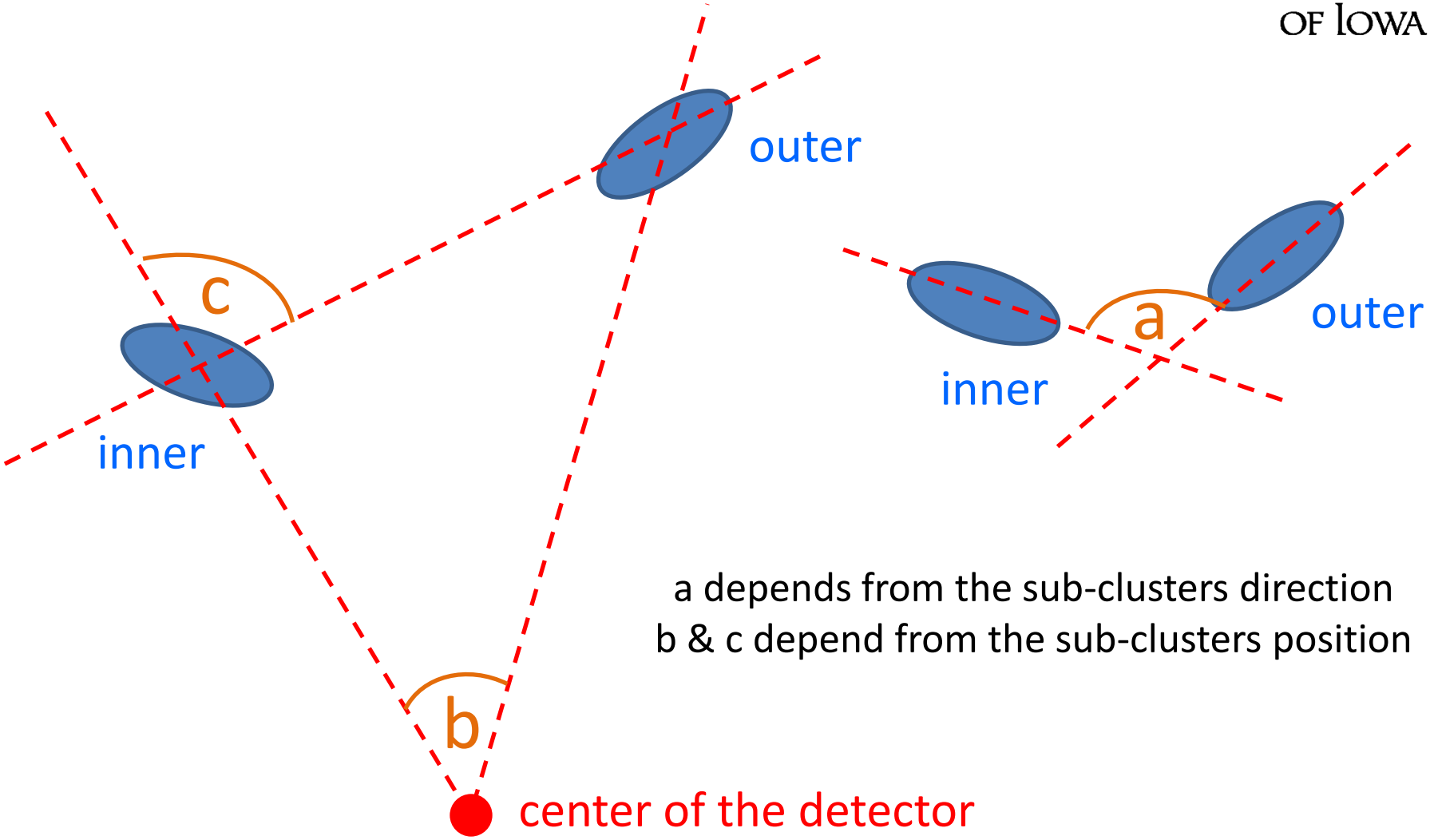

a depends from the sub-clusters direction
b & c depend from the sub-clusters position

Any Cluster to Any Cluster: angle ‘c’ vs angle ‘b’

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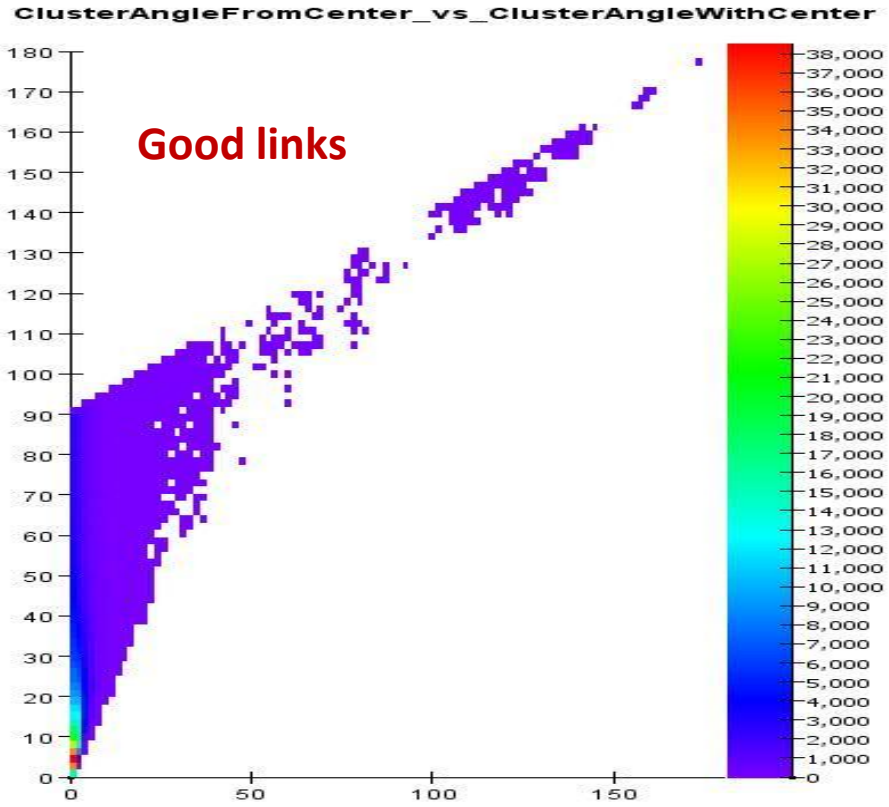

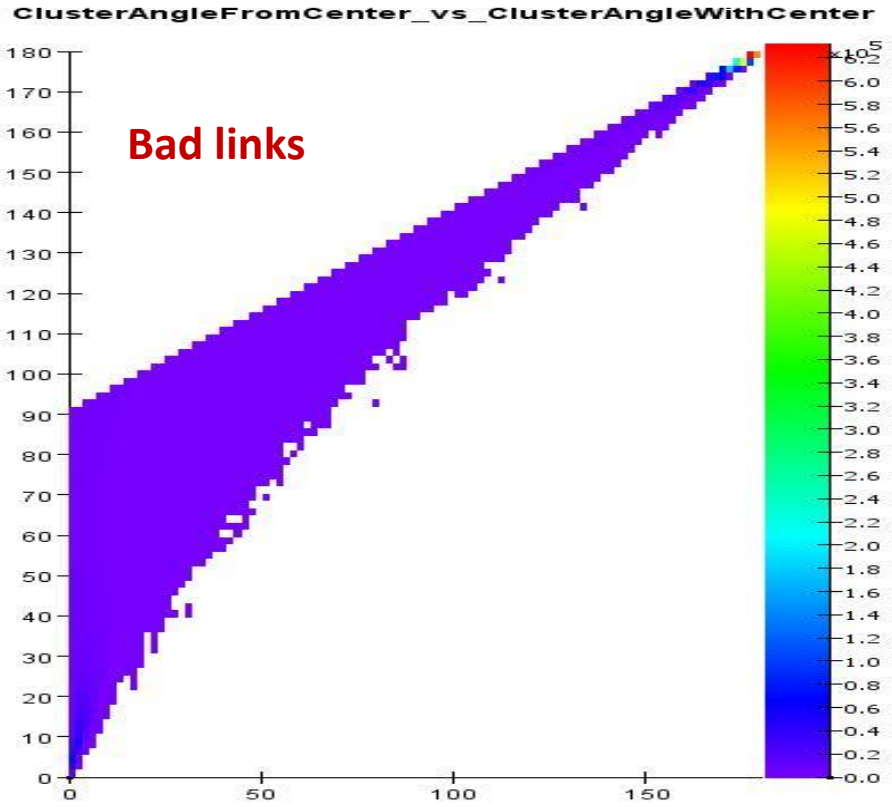

Any Cluster to Any Cluster: angle ‘c’ vs angle ‘b’

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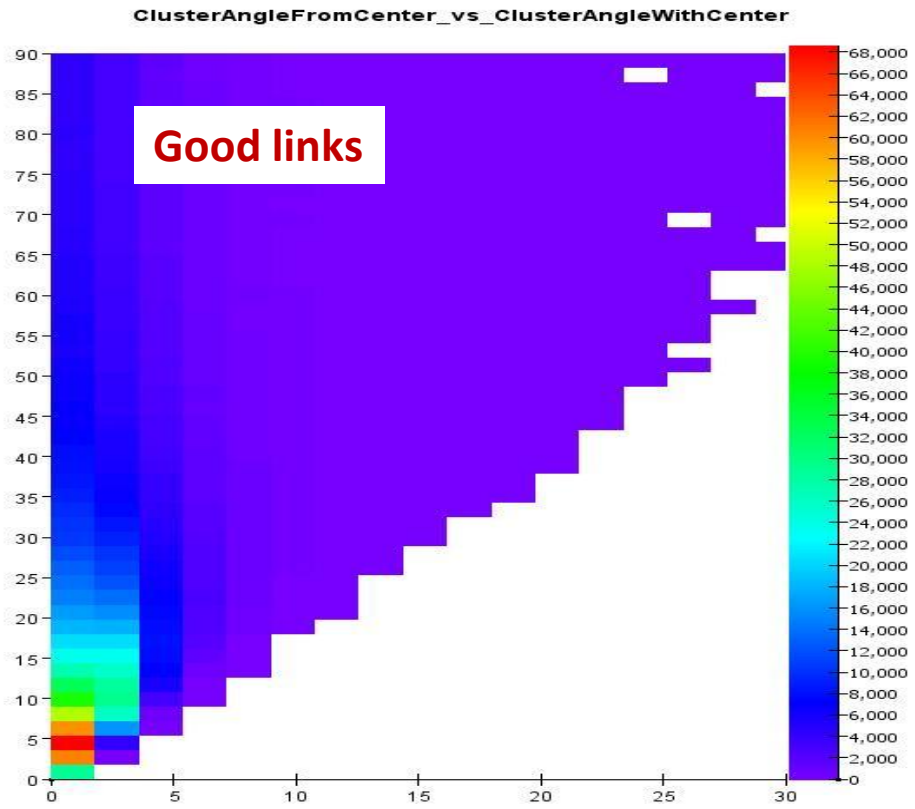

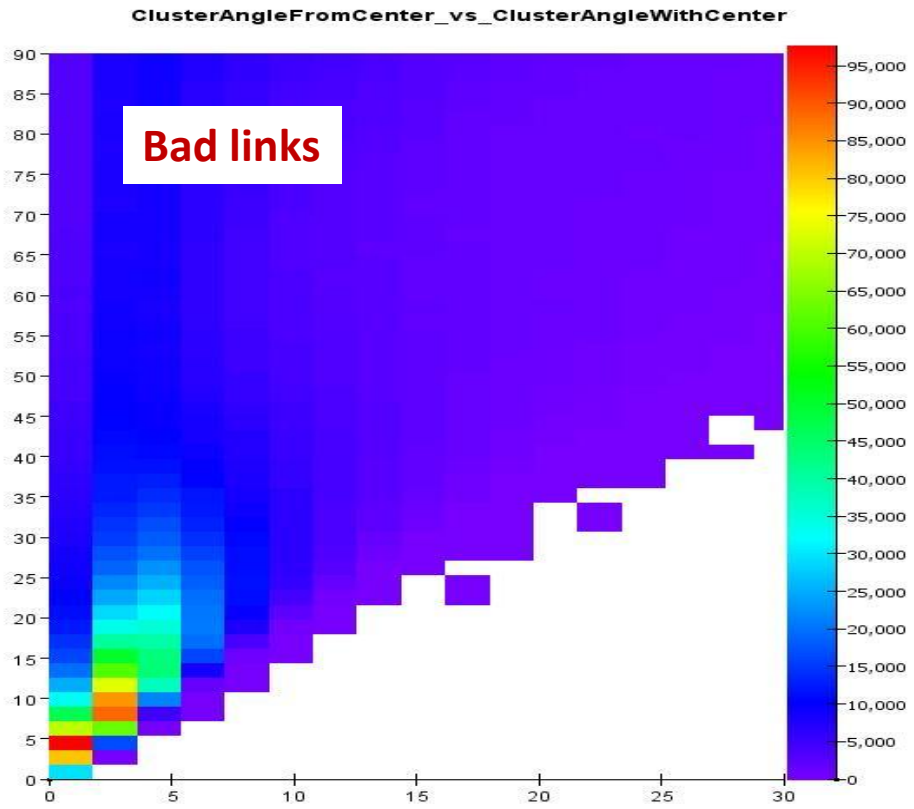

We should cut on angle ‘b’.

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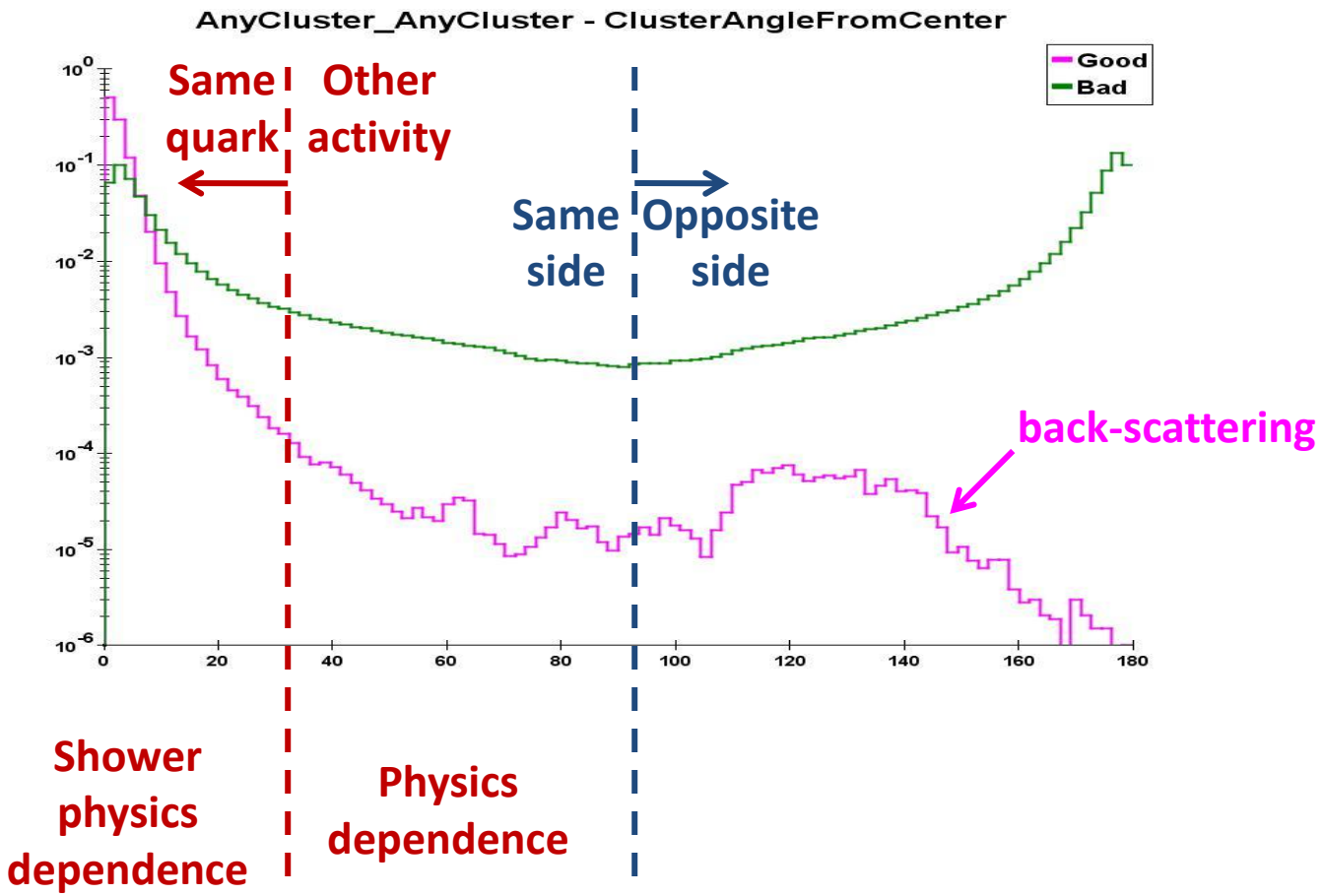
to reduce combinatorics but also to eliminate physics dependence.



Clump to Clump: DOCA vs. MinDistance

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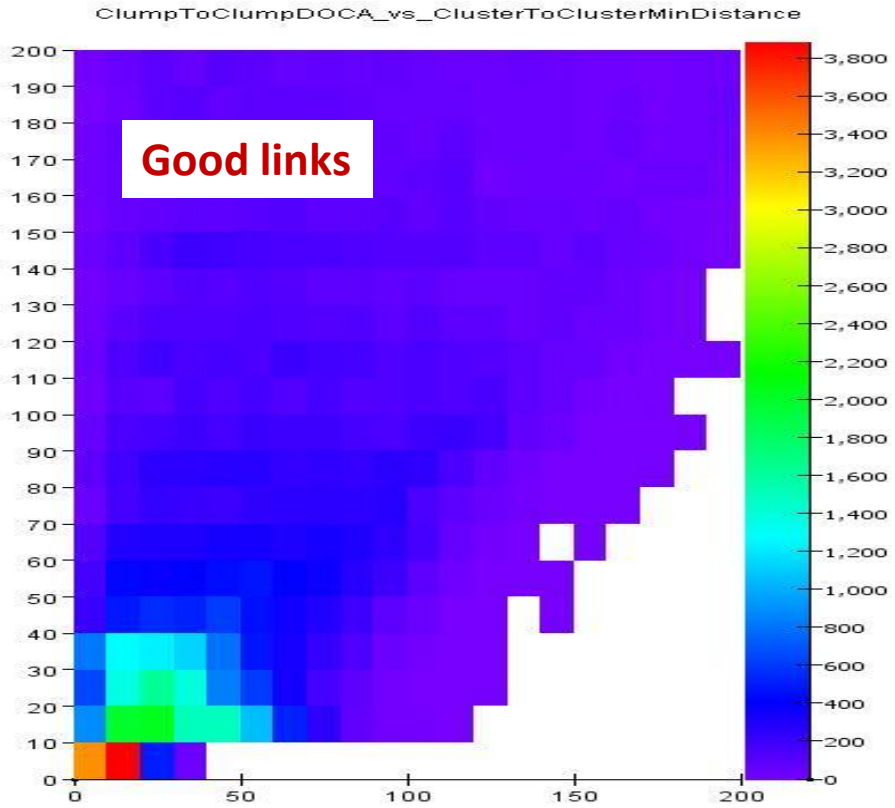

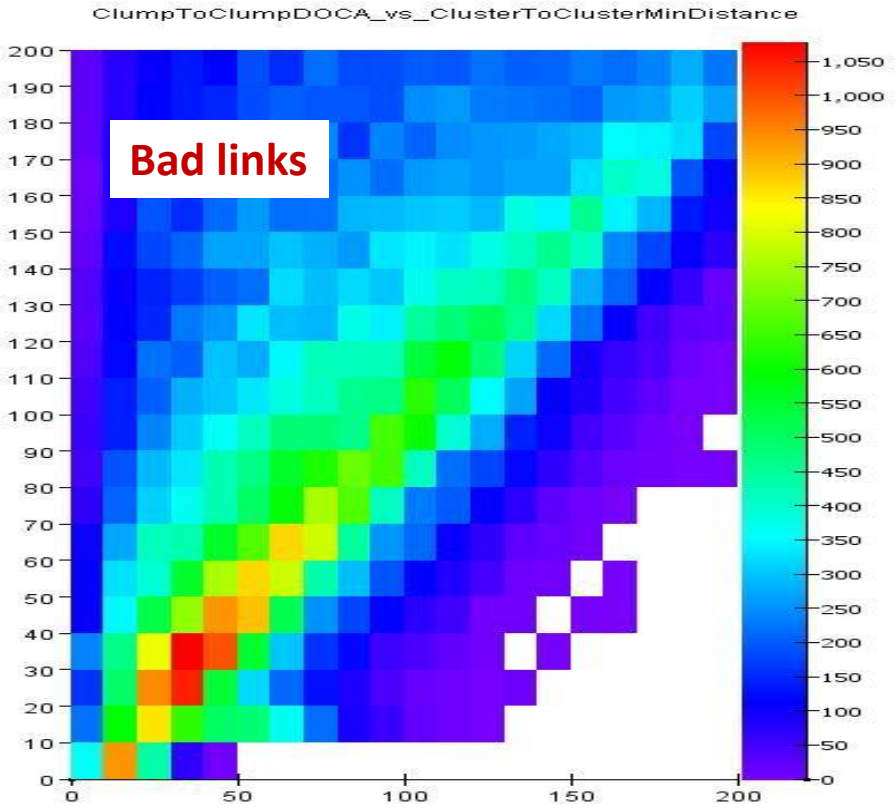

Clump to Clump: good links

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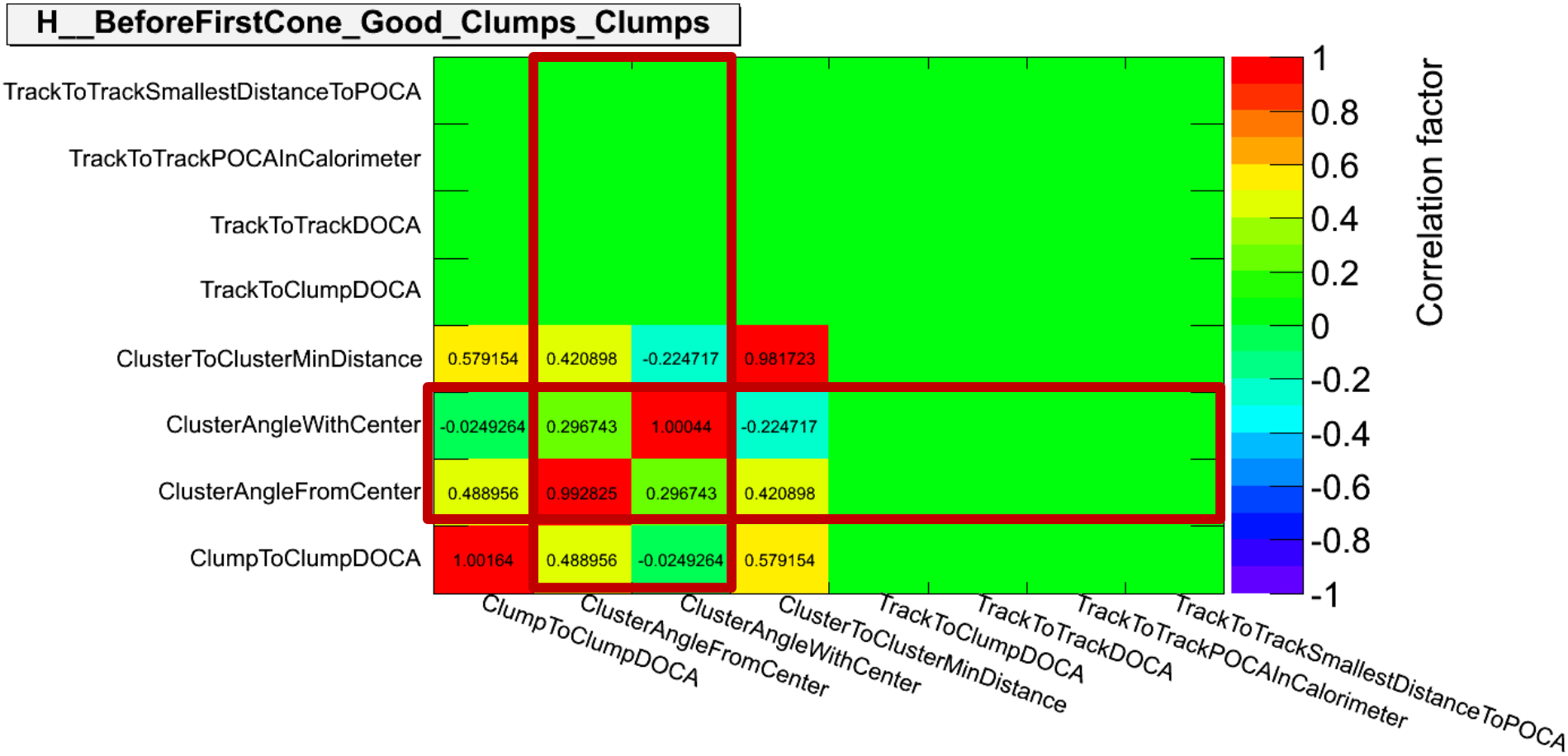

Clump to Clump: bad links

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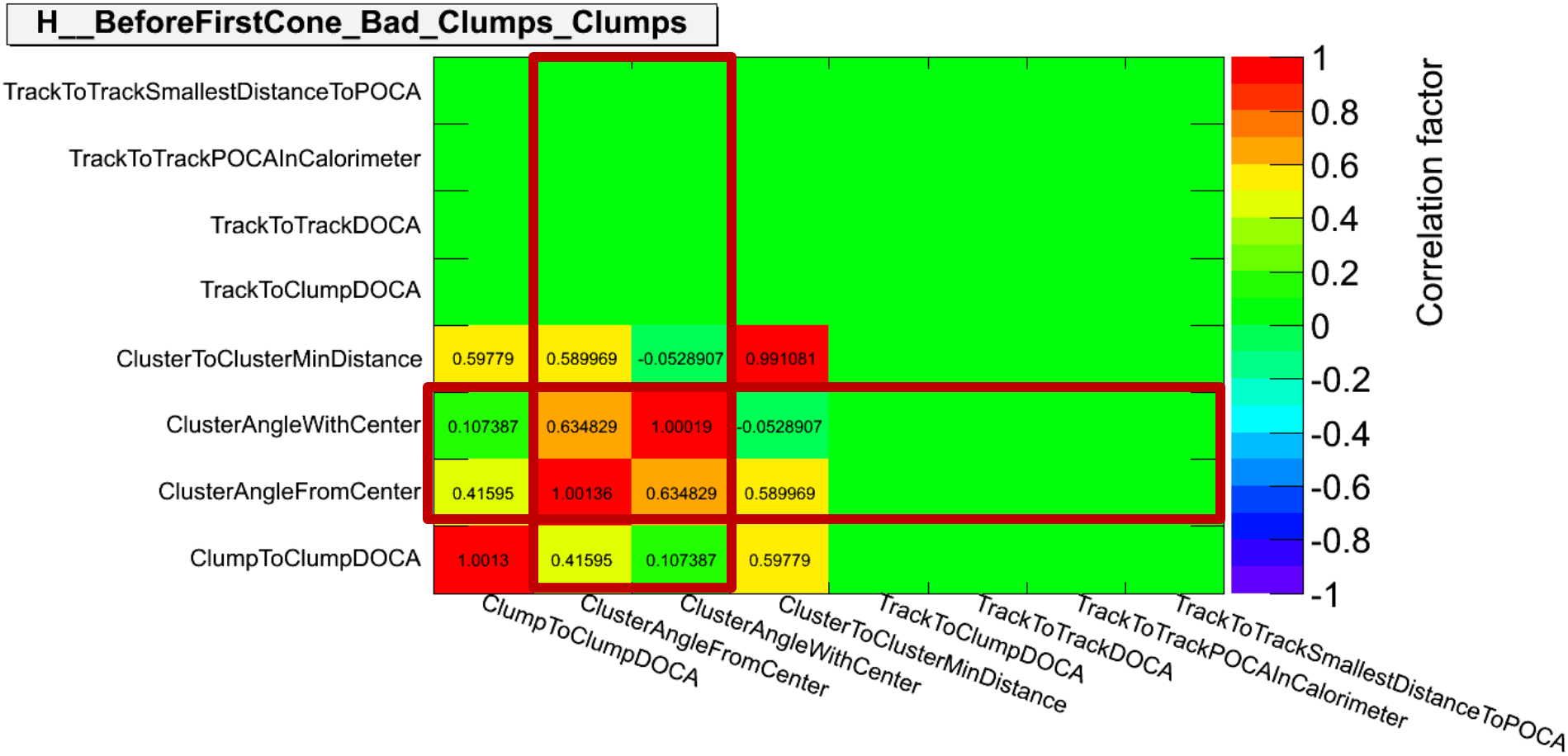
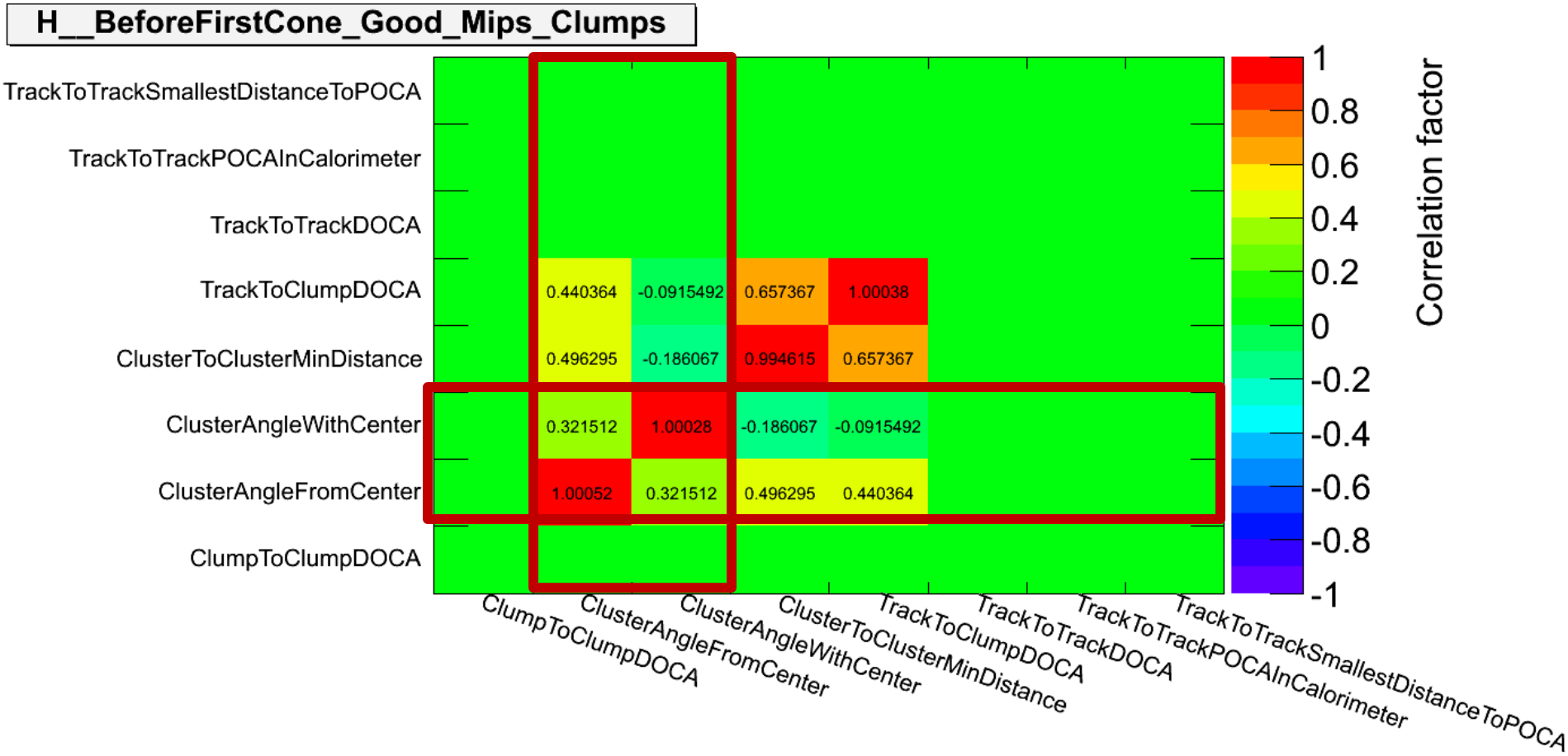


MIP to Clump: good links



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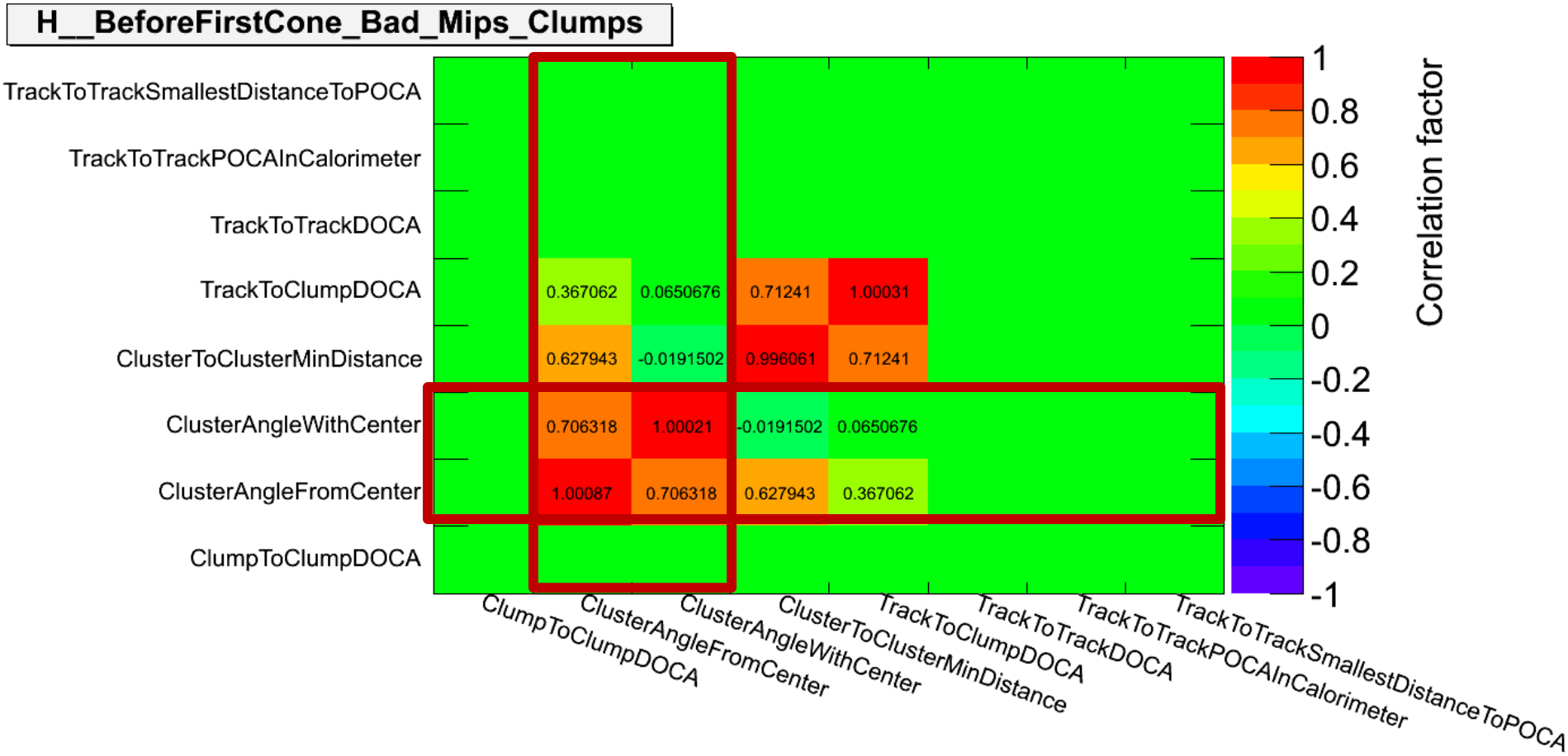

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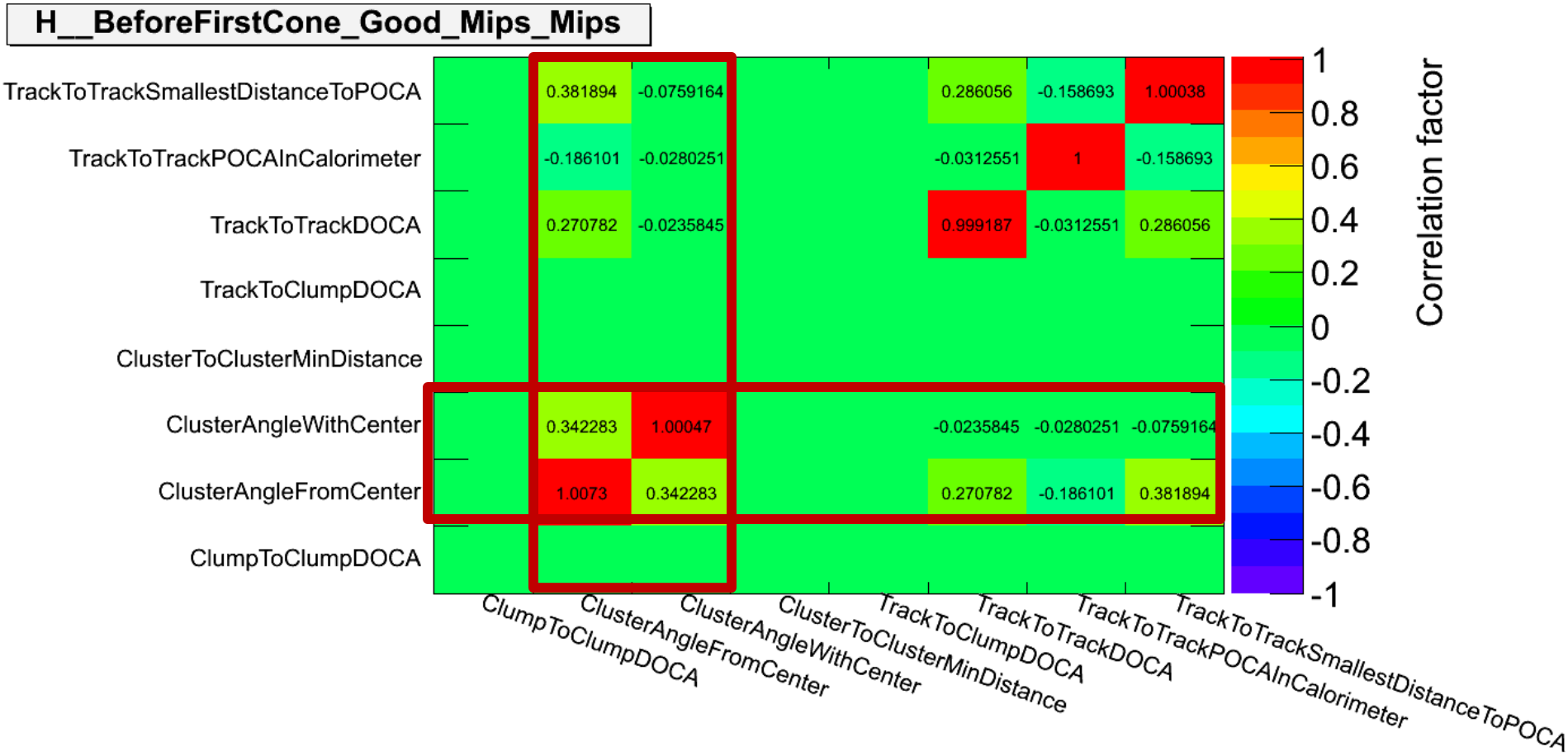

MIP to MIP: bad links

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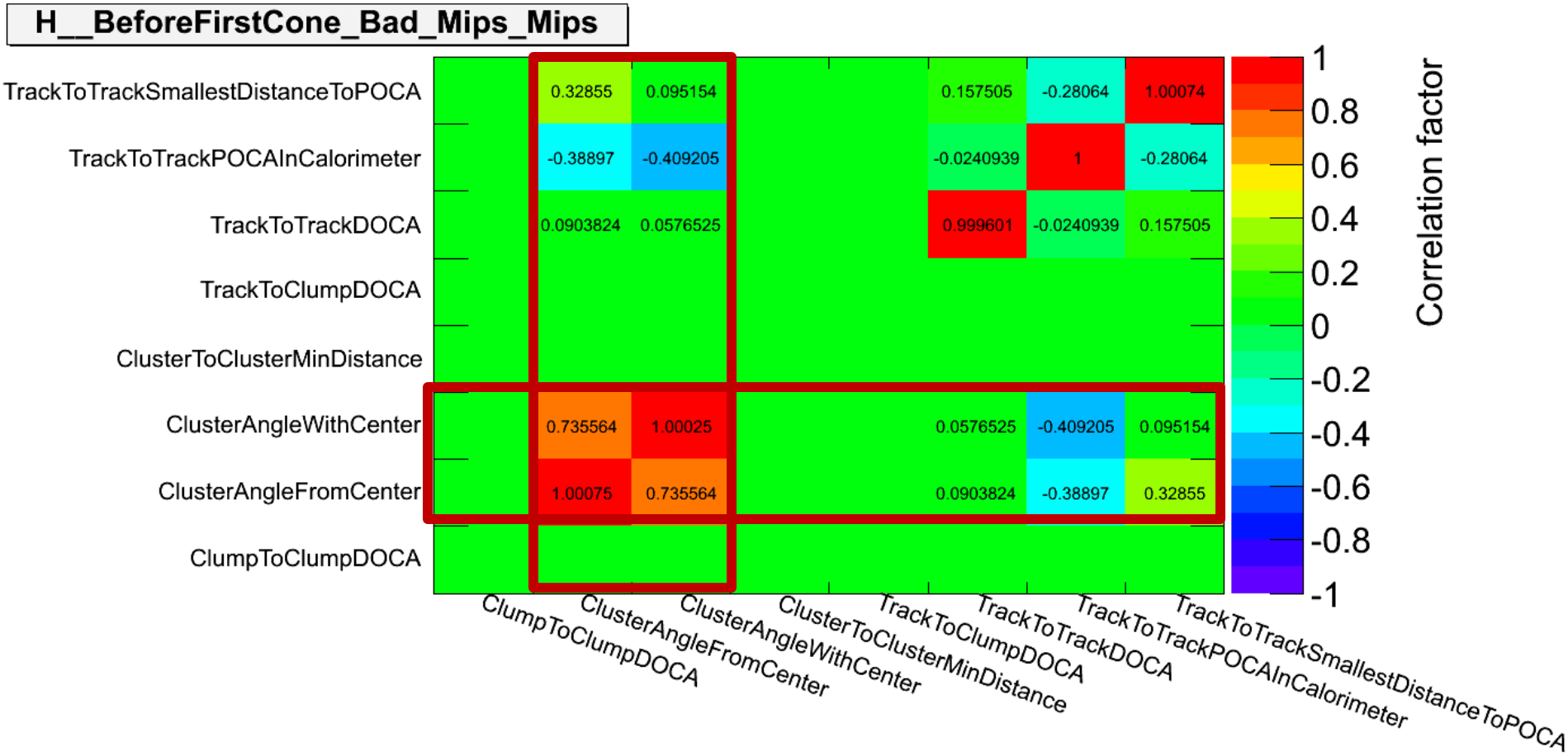

Conclusion

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- Should use multi-dimentional PDFs in some cases:
  - This would take correlations into account in the likelihood definition.
  - Code is ready for this.
- Should not be dependent on what happens outside the jet region:
  - Impose a cut on angular separation.