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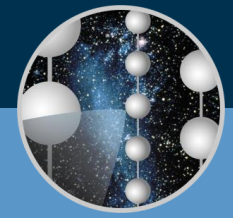
HEX Corsika

inter-string distance and self-veto efficiency

Sebastian Euler

IceCube Gen2 Workshop

28 January 2015



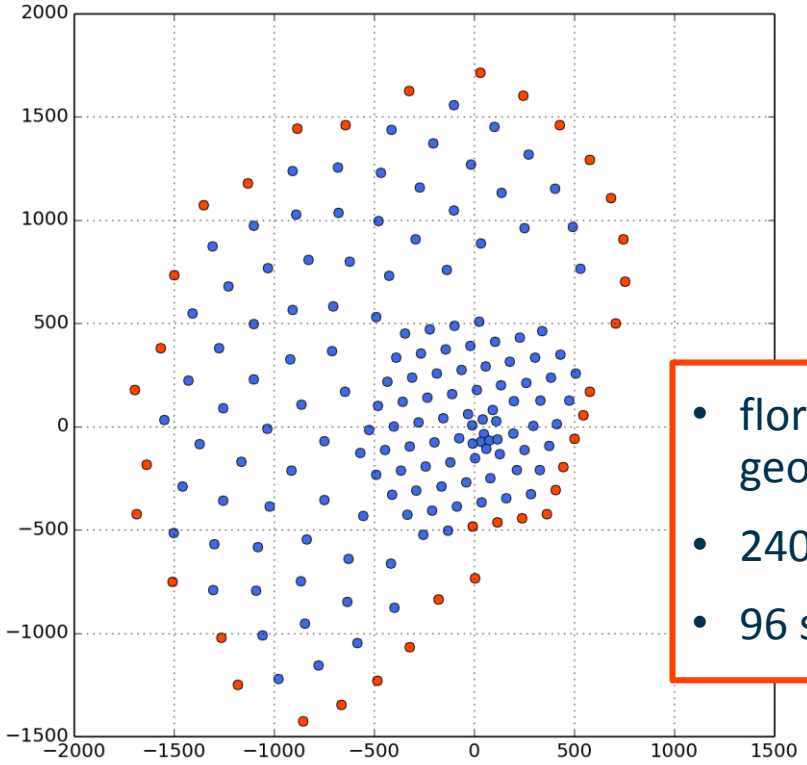
HEX Corsika datasets

ID	Geometry	CORSIKA Type	Energy range	NShowers/File	NFiles	Total livetime	Notes
0001	floralV01 240m 96strings	unweighted	600 GeV - 1e11 GeV	10 million	1000	7.7 min	
0002	DecaCube 250m	unweighted	600 GeV - 1e11 GeV	10 million	1000	7.7 min	
0003	IC86	unweighted	600 GeV - 1e11 GeV	10 million	1	0.46 sec	test dataset with IC86 only
0004	floralV01 240m 96strings	unweighted	6 TeV - 1e11 GeV	1 million	10	23.3 sec	
0005	floralV01 240m 96strings	5-comp.	6 TeV - 1e11 GeV	100000	98	??	
0006	floralV01 240m 96strings	unweighted	6 TeV - 1e11 GeV	100000	1	0.23 sec	test dataset, E_cut = 273 GeV
0007	floralV01 240m 96strings	unweighted	6 TeV - 1e11 GeV	100000	1	0.23 sec	test dataset, E_cut = 1 GeV
0008	floralV01 240m 96strings	unweighted	600 GeV - 1e11 GeV	1 million	1		test dataset, E_cut = 1 GeV
0009	floralV01 240m 96strings	unweighted	6 TeV - 1e11 GeV	100000	3000	11.7 min	E_cut = 10 GeV
0010	floralV01 300m	unweighted	6 TeV - 1e11 GeV	100000	2000	7.8 min	
0011	floralV01 240m 96strings	5-comp.	6 TeV - 1e11 GeV	100000	997	??	
0012	floralV01 300m	5-comp.	6 TeV - 1e11 GeV	100000	997	??	
0013	floralV01 300m 96strings	5-comp.	6 TeV - 1e11 GeV	100000	999	??	
0014	floralV01 240m 96strings lookUp	5-comp.	6 TeV - 1e11 GeV	100000	999	??	
0015	IC86	5-comp.	6 TeV - 1e11 GeV	100000	1000	??	
0016	floralV01 240m 120strings	5-comp.	6 TeV - 1e11 GeV	100000	999	??	
0017	Truncated 250m (21 strings)	5-comp.	6 TeV - 1e11 GeV	100000	1000	??	
0018	OuterLayerTruncated 250m	5-comp.	6 TeV - 1e11 GeV	100000	1000	??	

- https://wiki.icecube.wisc.edu/index.php/HEX_Corsika
- database is growing…

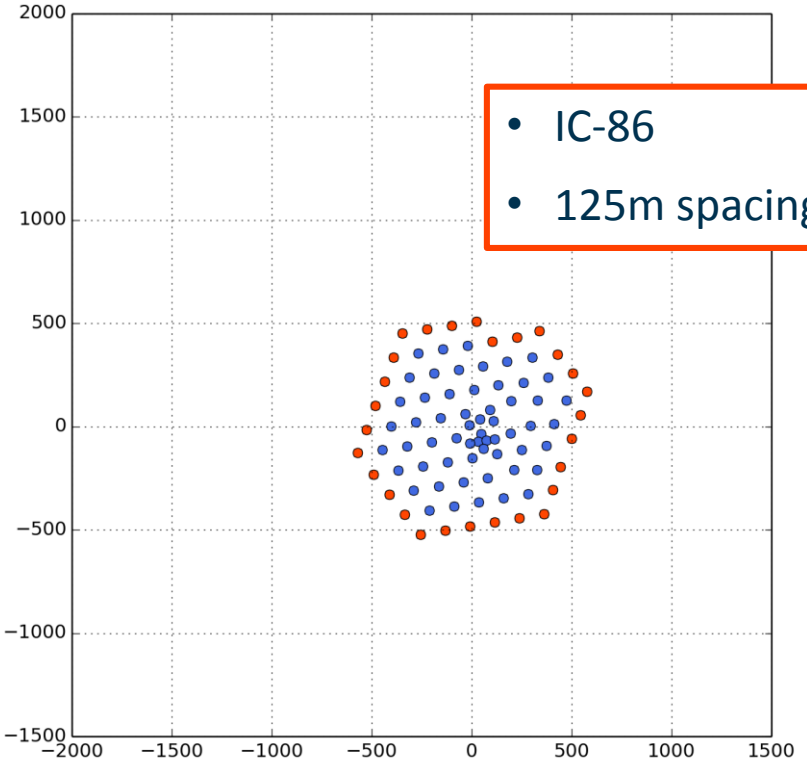
Veto with larger string spacing

- IceCube Meeting at CERN: veto for HEX with 240m spacing seemed to be very weak
- is it really so much worse than for IC-86?
- compare:



- floral HEX geometry
- 240m spacing
- 96 strings

VS.



- IC-86
- 125m spacing

Veto with larger string spacing

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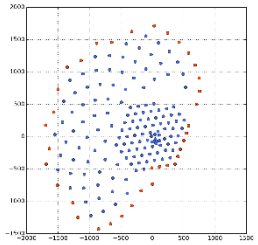
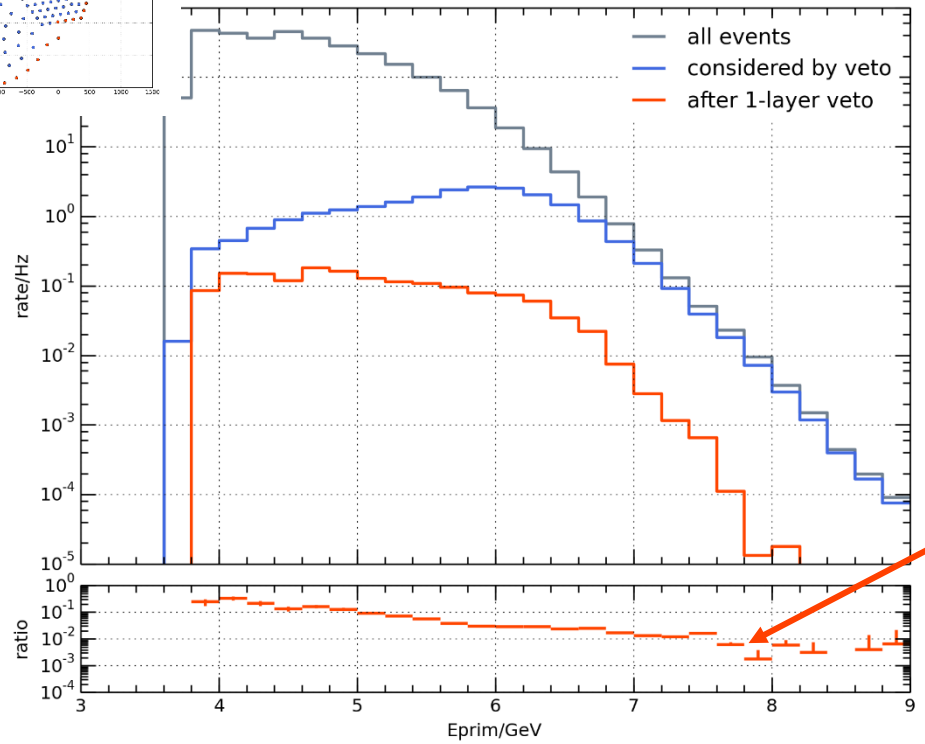
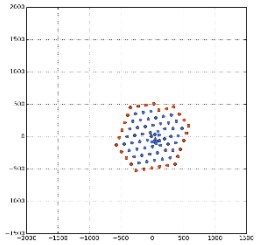
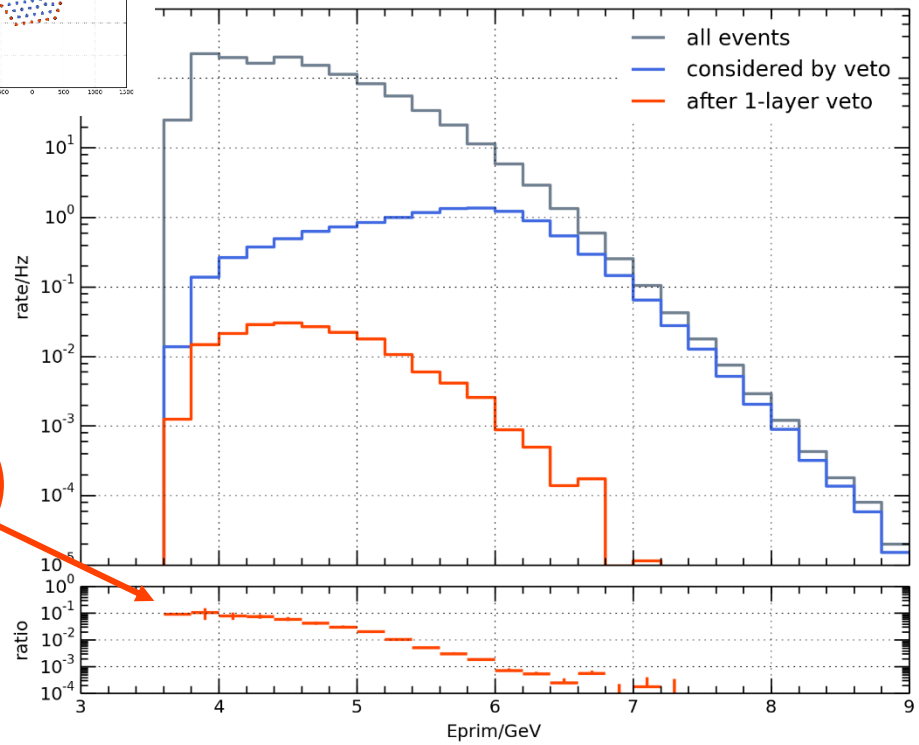




ratio
after/before
veto





Veto with larger string spacing

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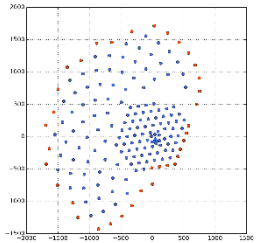
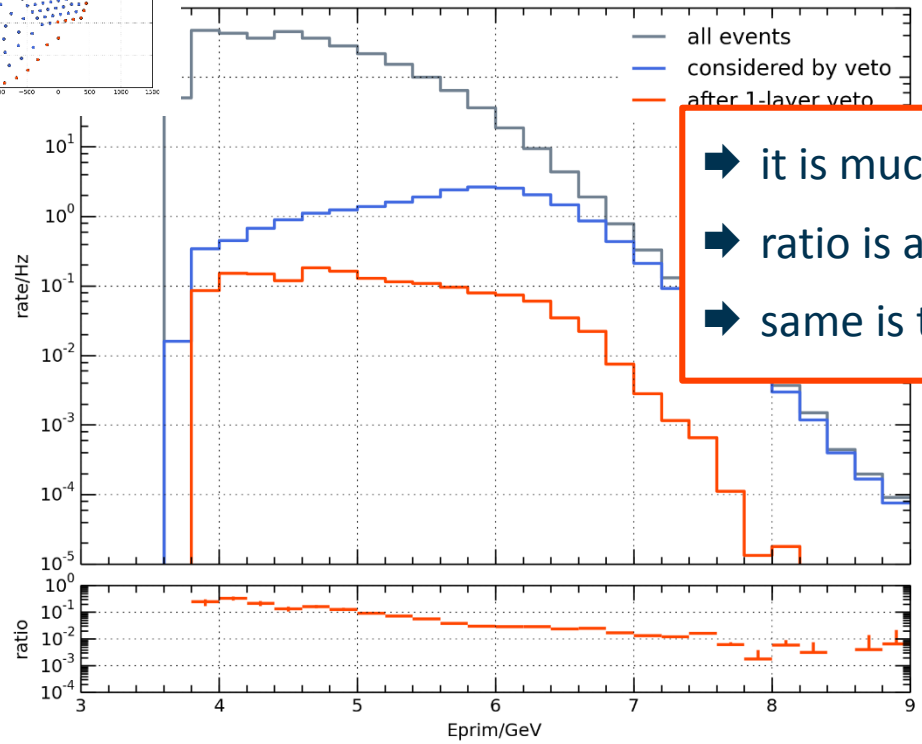
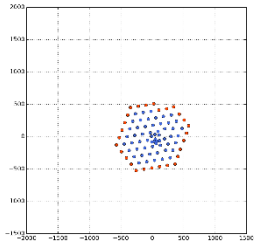
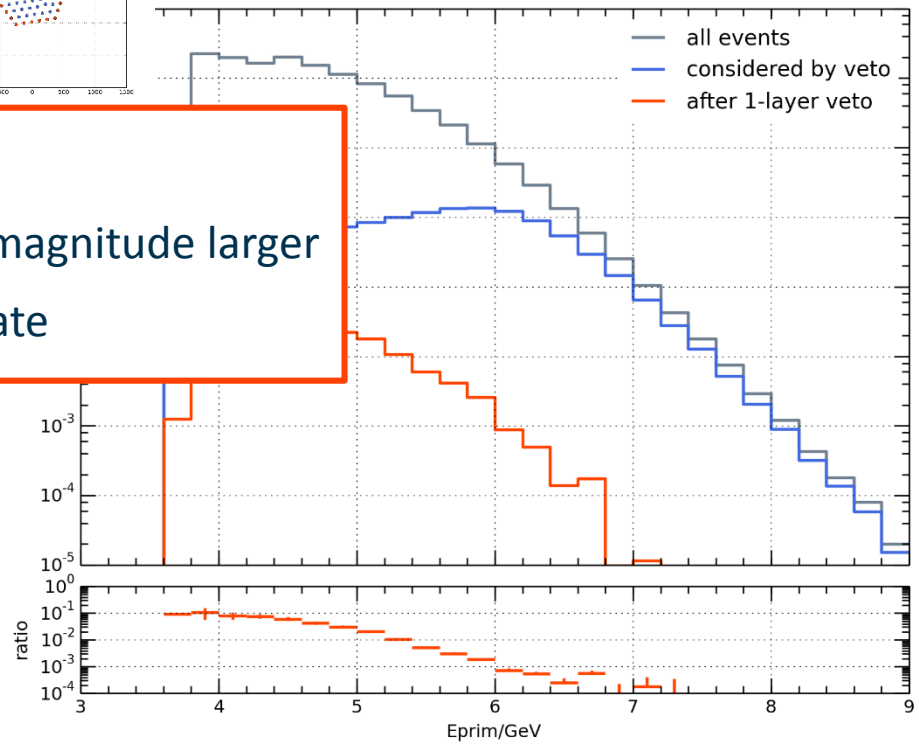






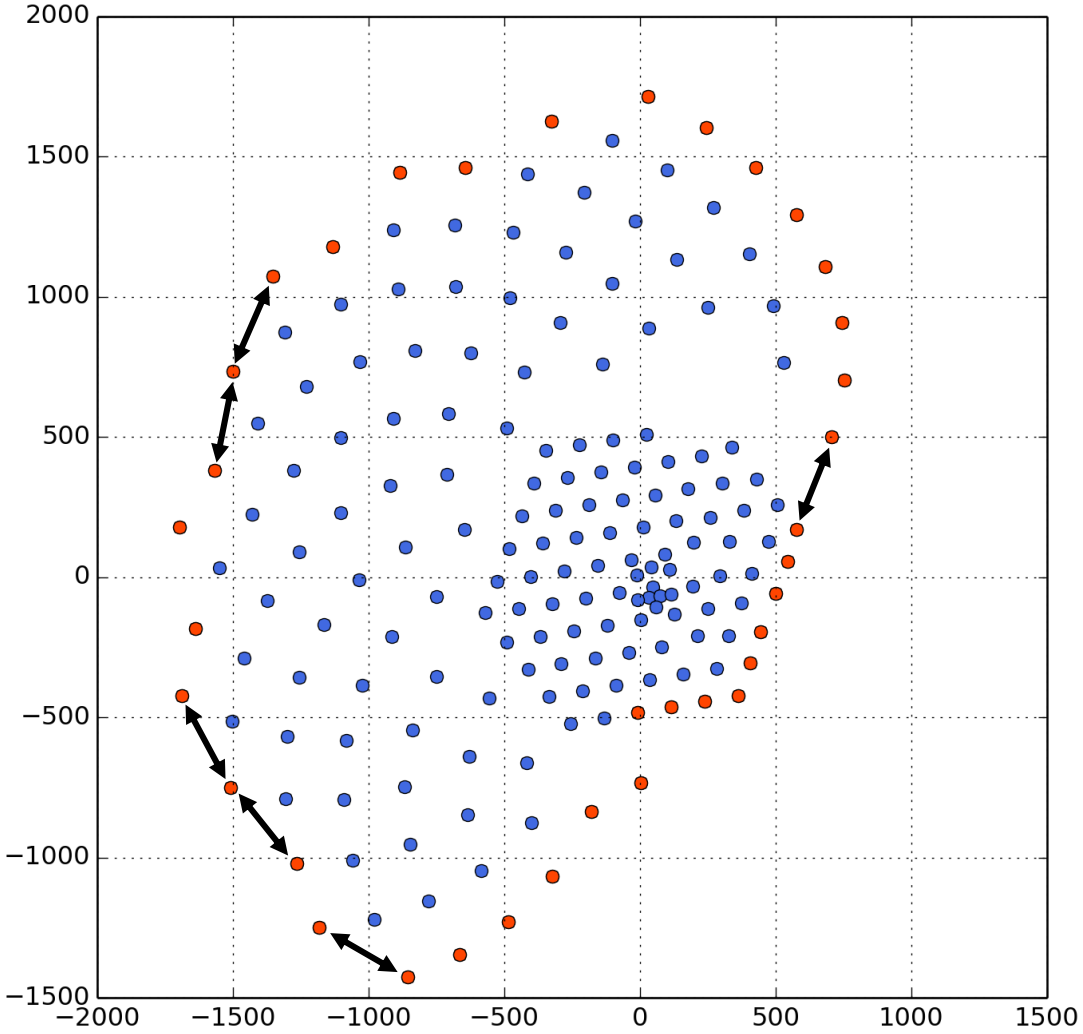


➡ it is much worse!

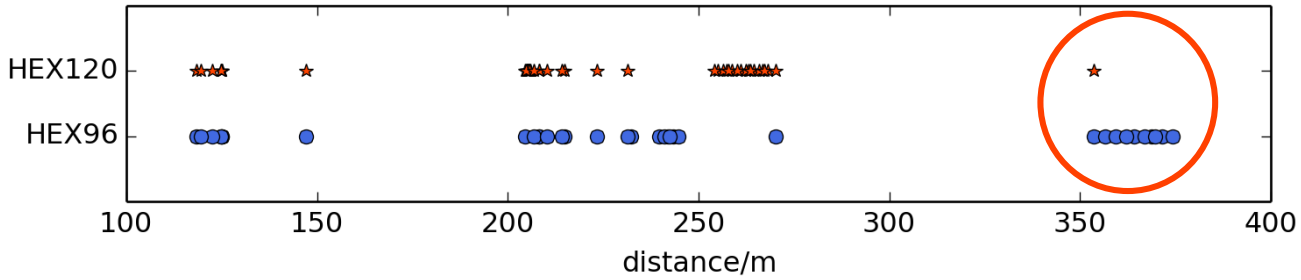
➡ ratio is almost 2 orders of magnitude larger

➡ same is true for absolute rate

Why is the veto so much worse?



- floral geometry, „**240m spacing**“
- plot distance between neighboring veto strings



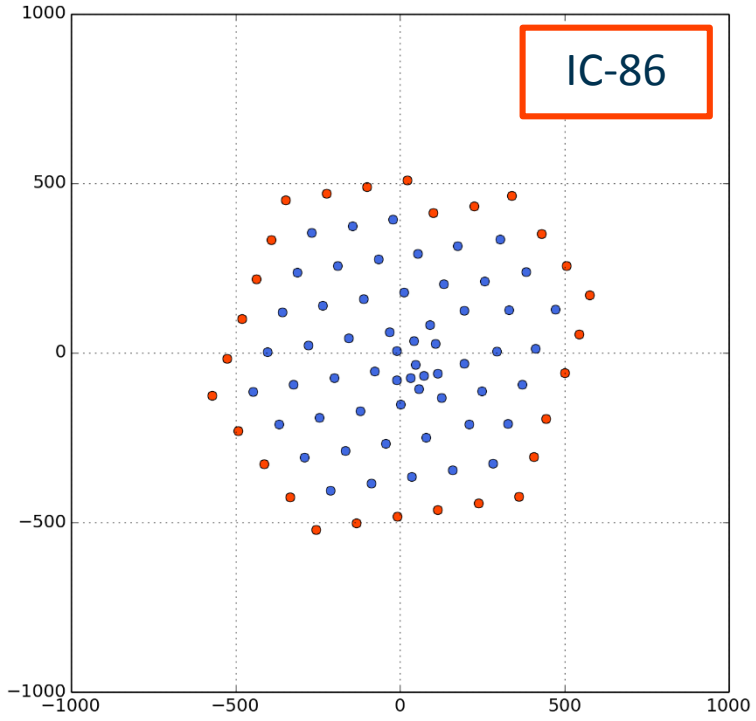
➡ distance can be significantly larger than 240m

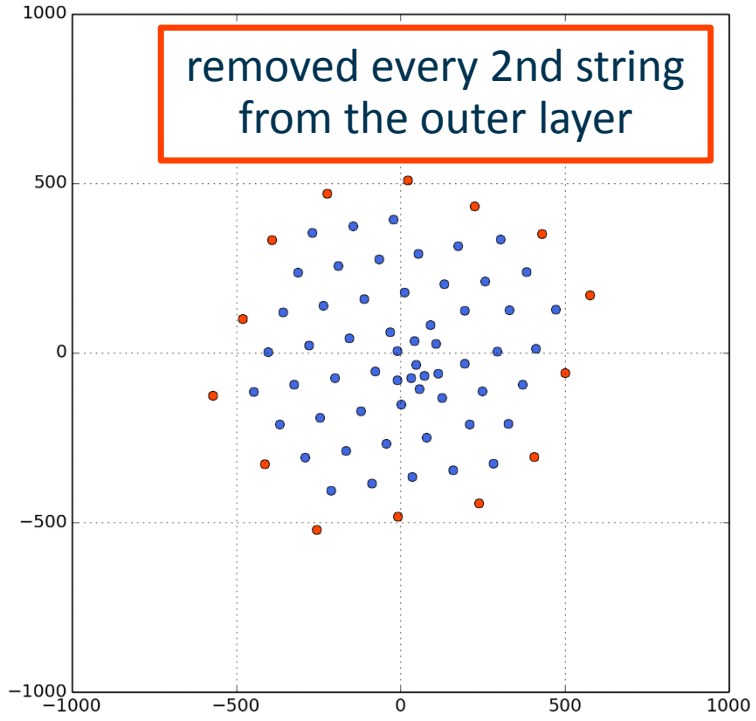
➡ poorly defined veto layer

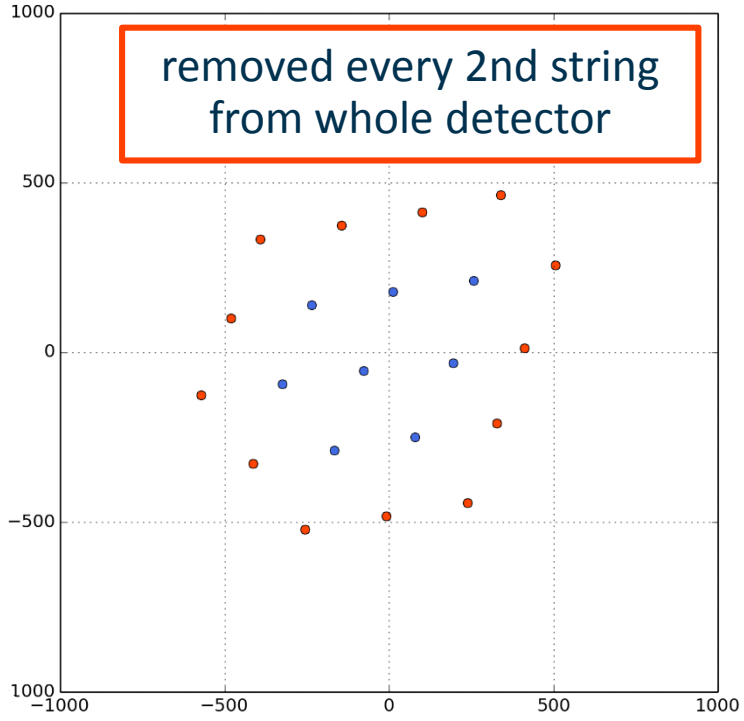
➡ slightly better for the 120-string version

Influence of veto string distance

- remove every second string from IC-86
- compare to „standard“ IC-86
- similar to study on experimental data by Andreas Gross a few months ago

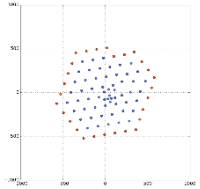




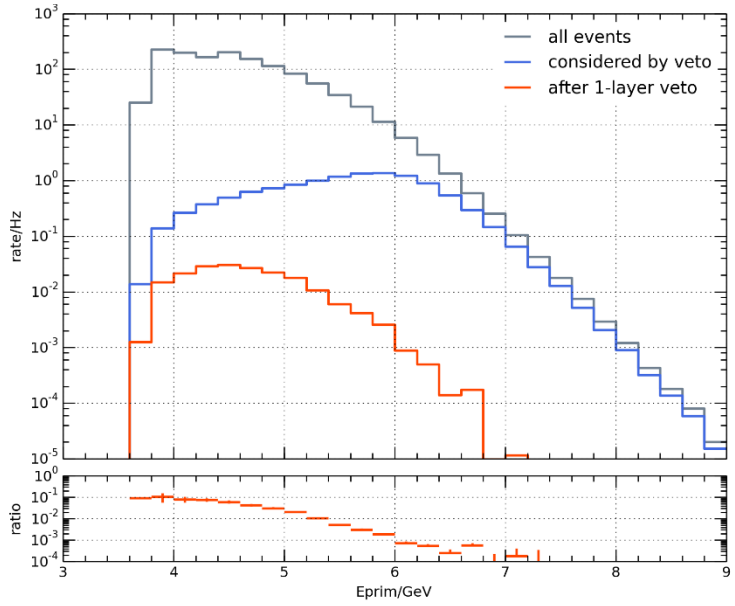


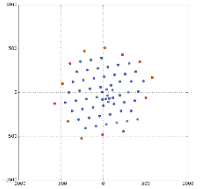
Influence of veto string distance

- larger spacing of the veto layer makes it significantly weaker
- removing every other string in the whole detector only reduces low-energy part

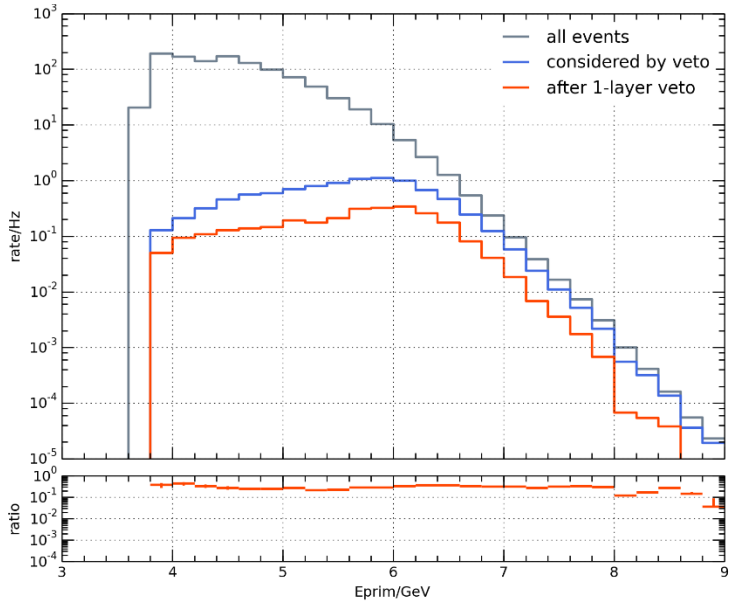


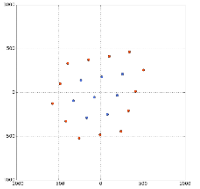
IC-86



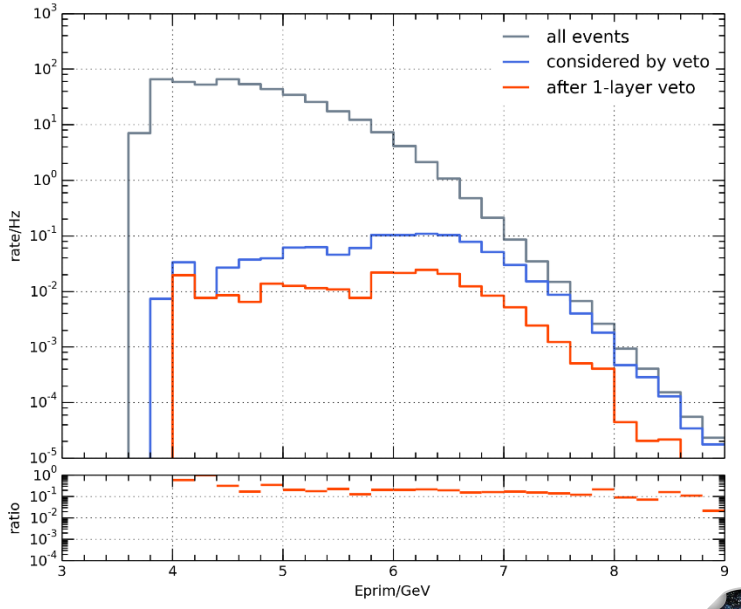


removed every 2nd string from the outer layer



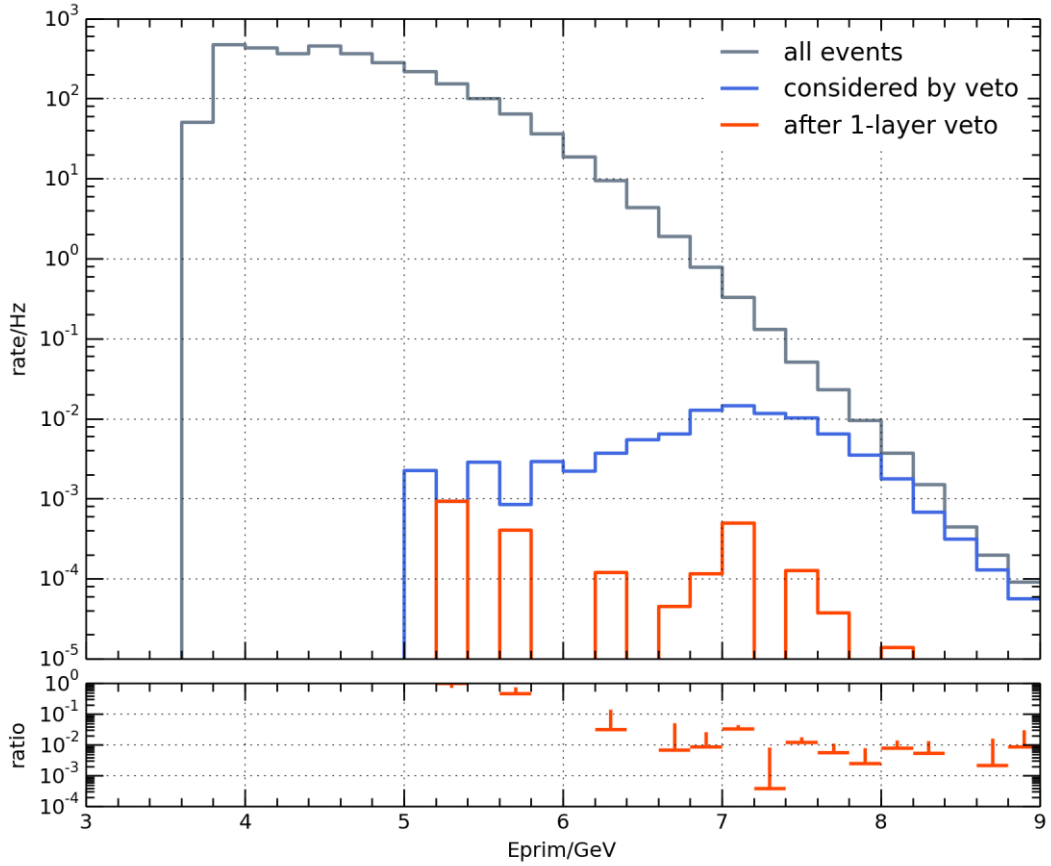


removed every 2nd string from whole detector



The BIG caveat…

- most of the remaining events have low quality (low charge)
  - events outside IceCube
  - low-energy muons



➡ remove those by q_{tot} cut (as done in HESE)

➡ HOWEVER: current datasets have insufficient statistics

(also, q_{tot} is hard to compare between different geometries)

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Summary

- database of HEX Corsika datasets is growing
- veto is significantly weakened by larger string spacing…
- … at least for not-so bright events
- with the current statistics, it is not possible to determine the veto efficiency where it really matters

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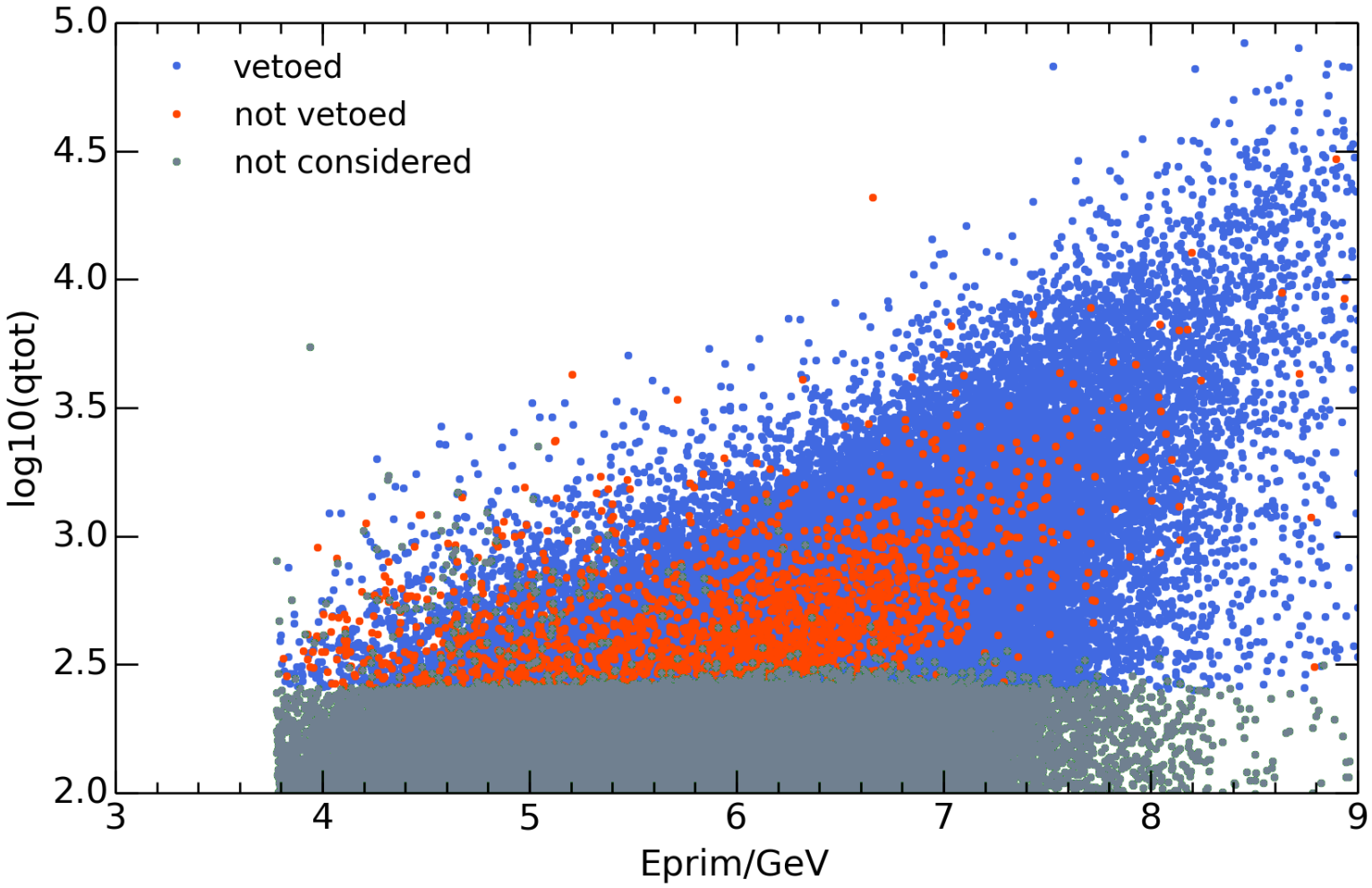
- concentrate on baseline geometry and generate more statistics at higher energies?
- find location in /data/sim for these datasets?

Backup



- for finding the vertex, the HESE veto module requires more than 250 PE
- smaller events are not even looked at and are rejected right away