



MICRO-50, Boston, October 2017

Tutorial:

Microarchitecture Level Reliability Assessment

Throughput and Accuracy
<http://micro50-tutorial.di.uoa.gr/>

Organizers/Presenters:

Athanasios Chatzidimitriou, Manolis Kaliorakis, Dimitris Gizopoulos

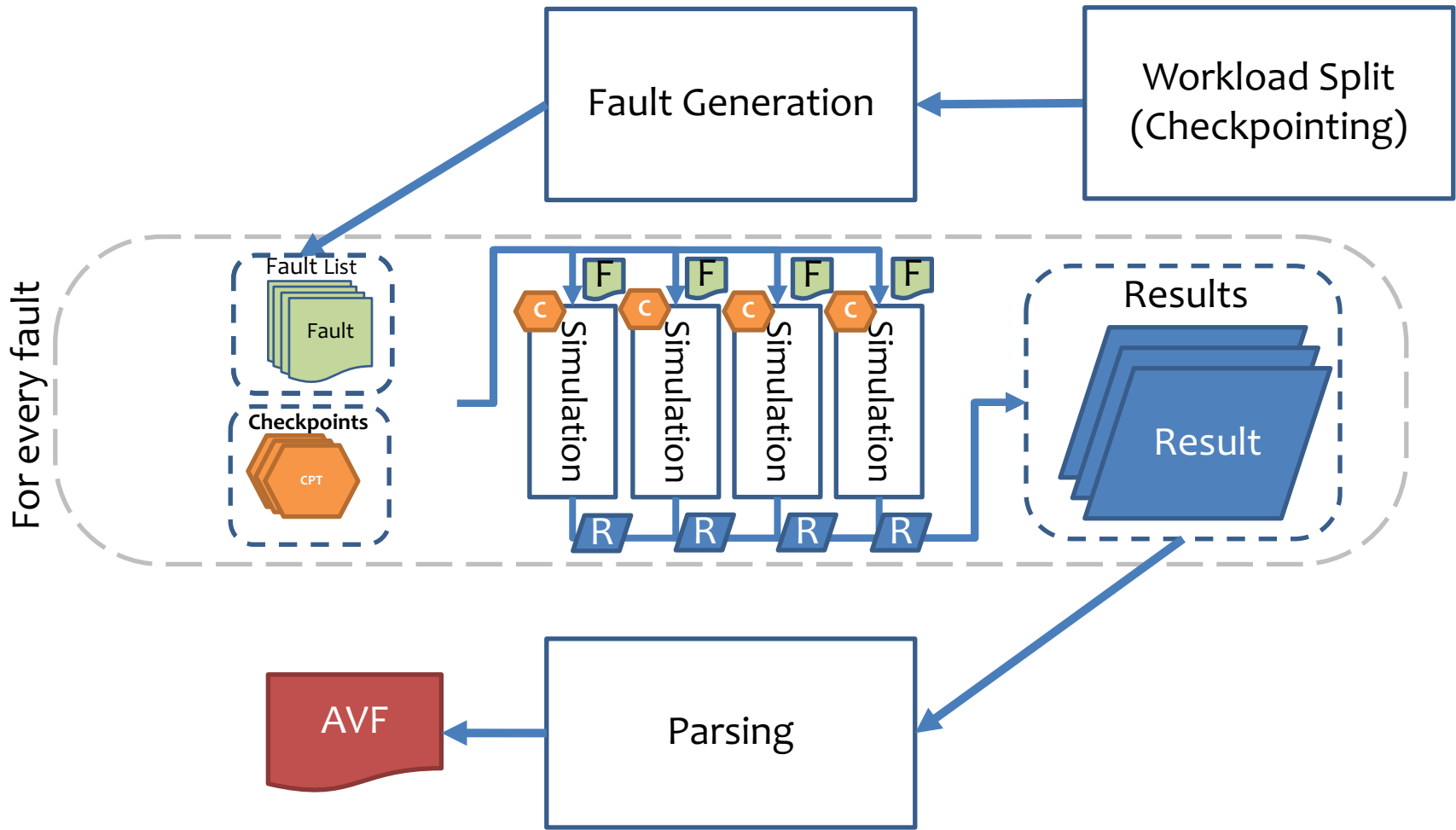


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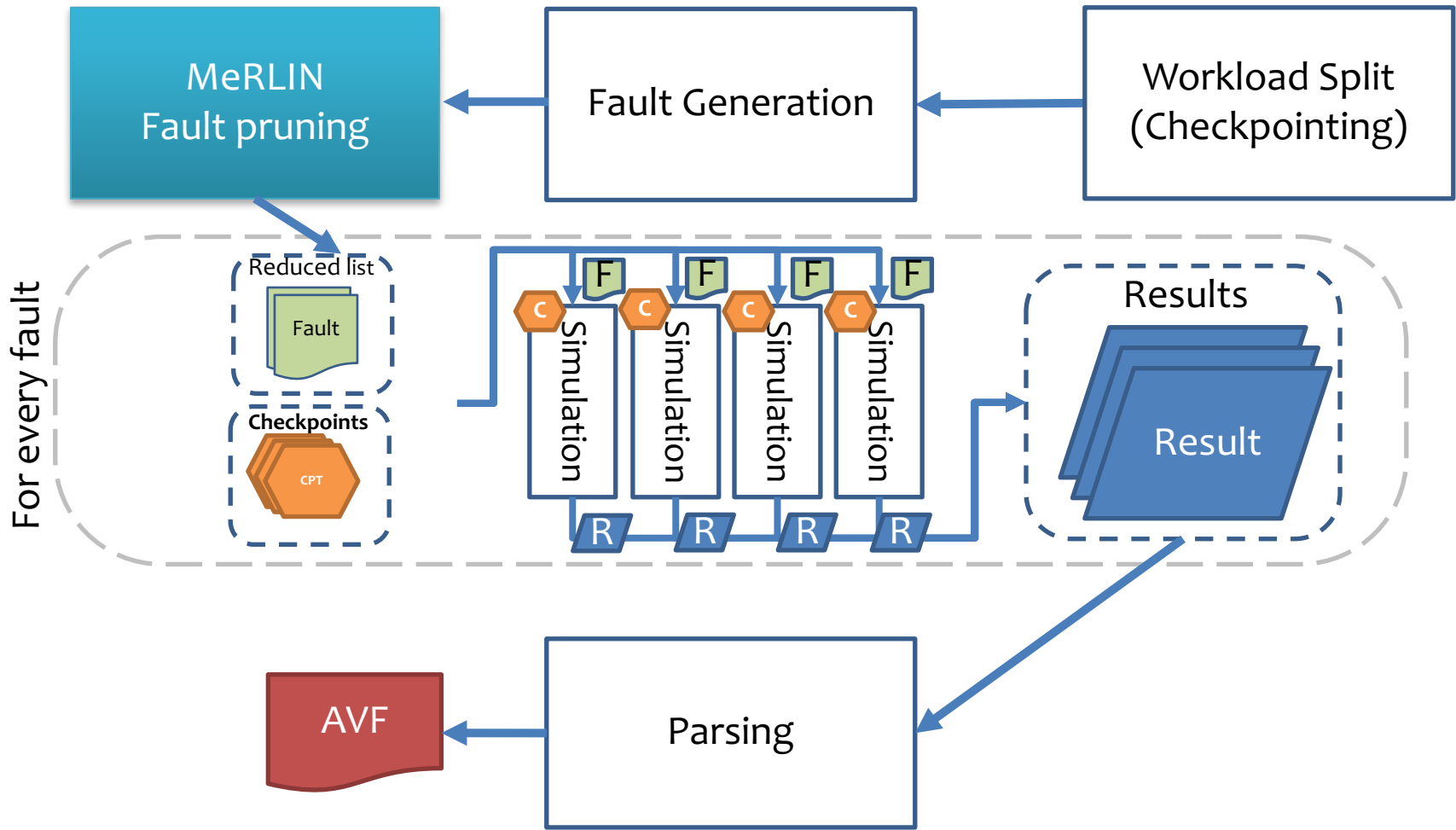
Part 5:

GeFIN + MeRLiN combination

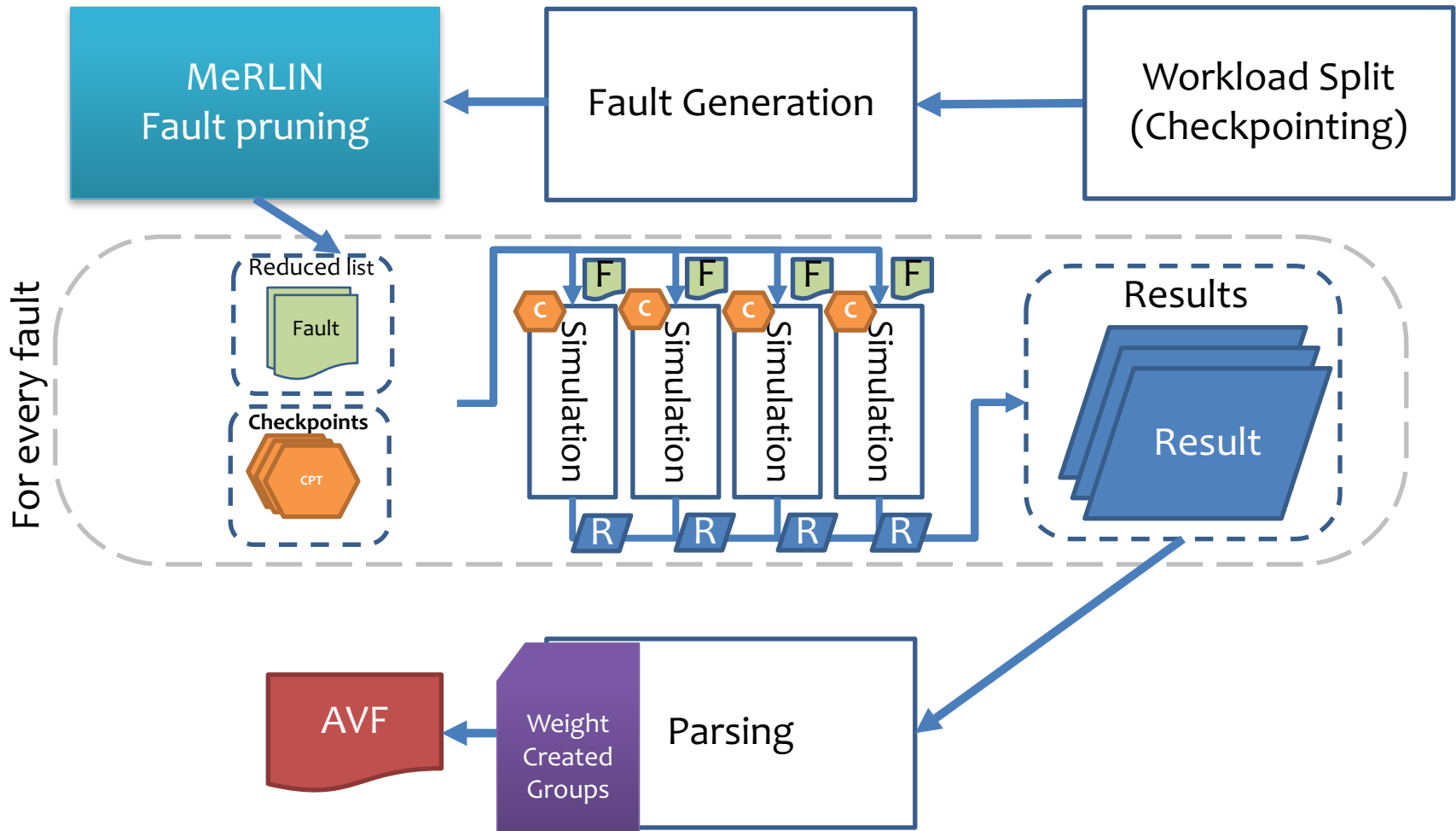
Statistical Fault Injection



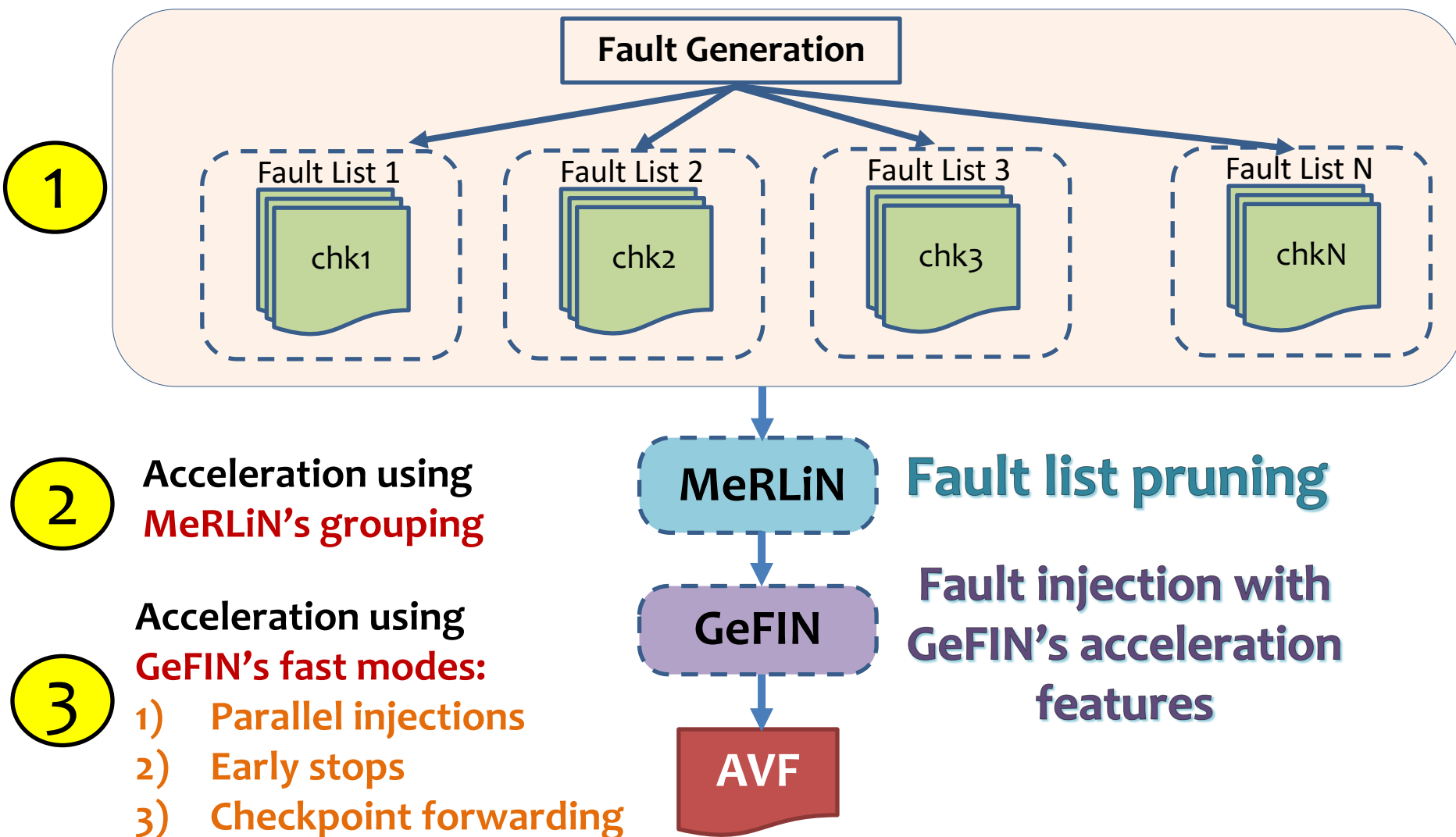
Statistical Fault Injection



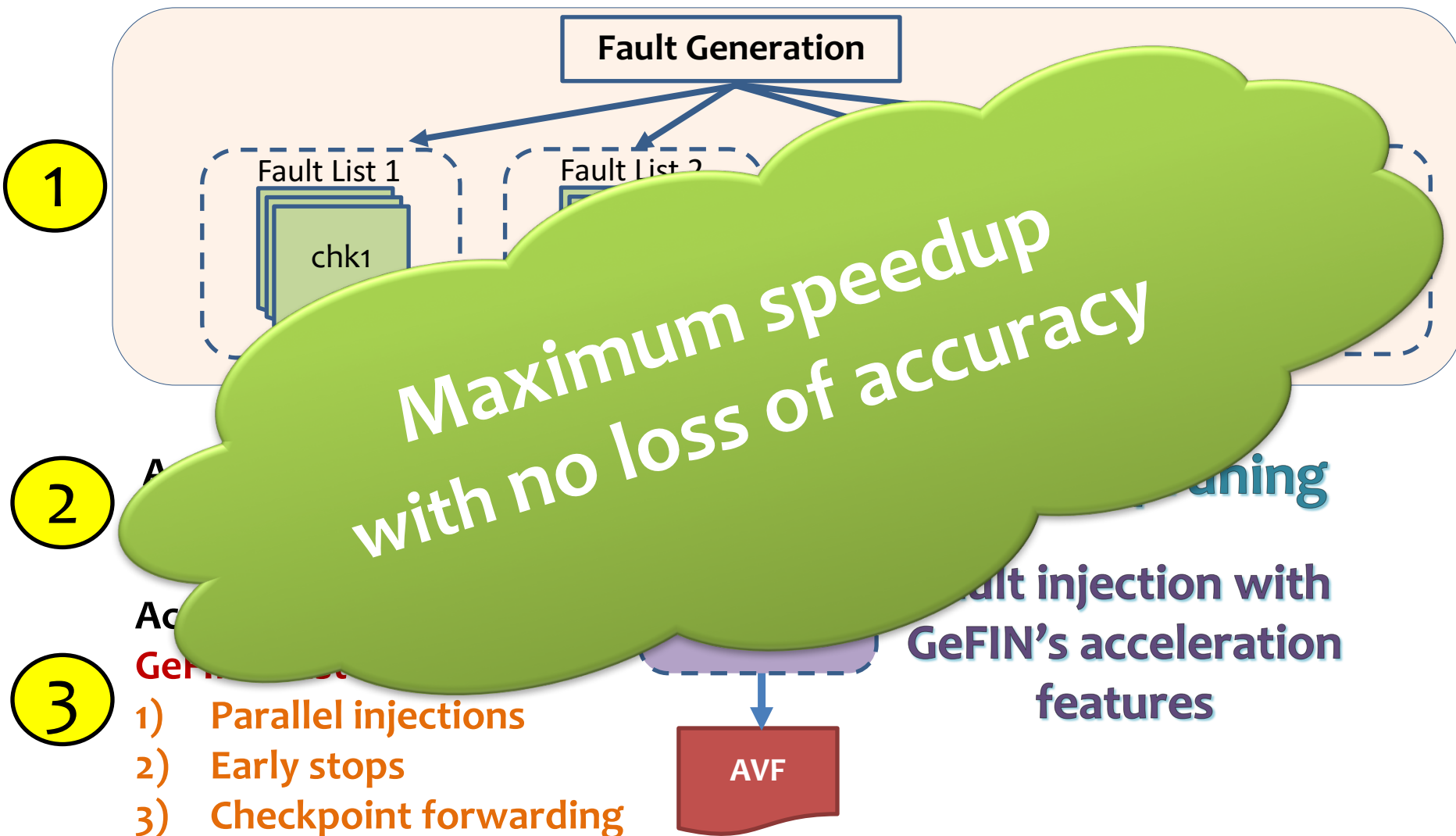
Statistical Fault Injection



GeFIN + MeRLiN Flow



GeFIN + MeRLiN Flow



Experimental Setup

- ✓ Simulate an **Intel Haswell processor**
- ✓ Use of **3 MiBench benchmarks** (sha, susan_c, susan_e)
- ✓ 3 main hardware structures
(**RF** with 168 regs., **SQ** with 46 entries, 32KB **L1D**)
- ✓ Use **3 different machines** for our experiments:

Machine	#1	#2	#3
benchmark	susan_c	susan_e	sha
simulation time of golden run	7.38 secs	16.23 secs	65.52 secs
# cores/threads	8/16	6/12	10/20
cpu type	Intel Xeon E5-2630 v3 @ 2.4GHz	Intel i7-4960X @ 3.6GHz	Intel Xeon E5-2690 v2 @ 3GHz
L3	20MB	15MB	25MB
RAM	64GB DDR4 @ 2133MHz	64GB DDR3 @ 1866MHz	96GB DDR3 @ 1866MHz
Kernel version	Linux kernel 3.13.0	Linux kernel 3.13.0	Linux kernel 3.13.0



Experimental Setup

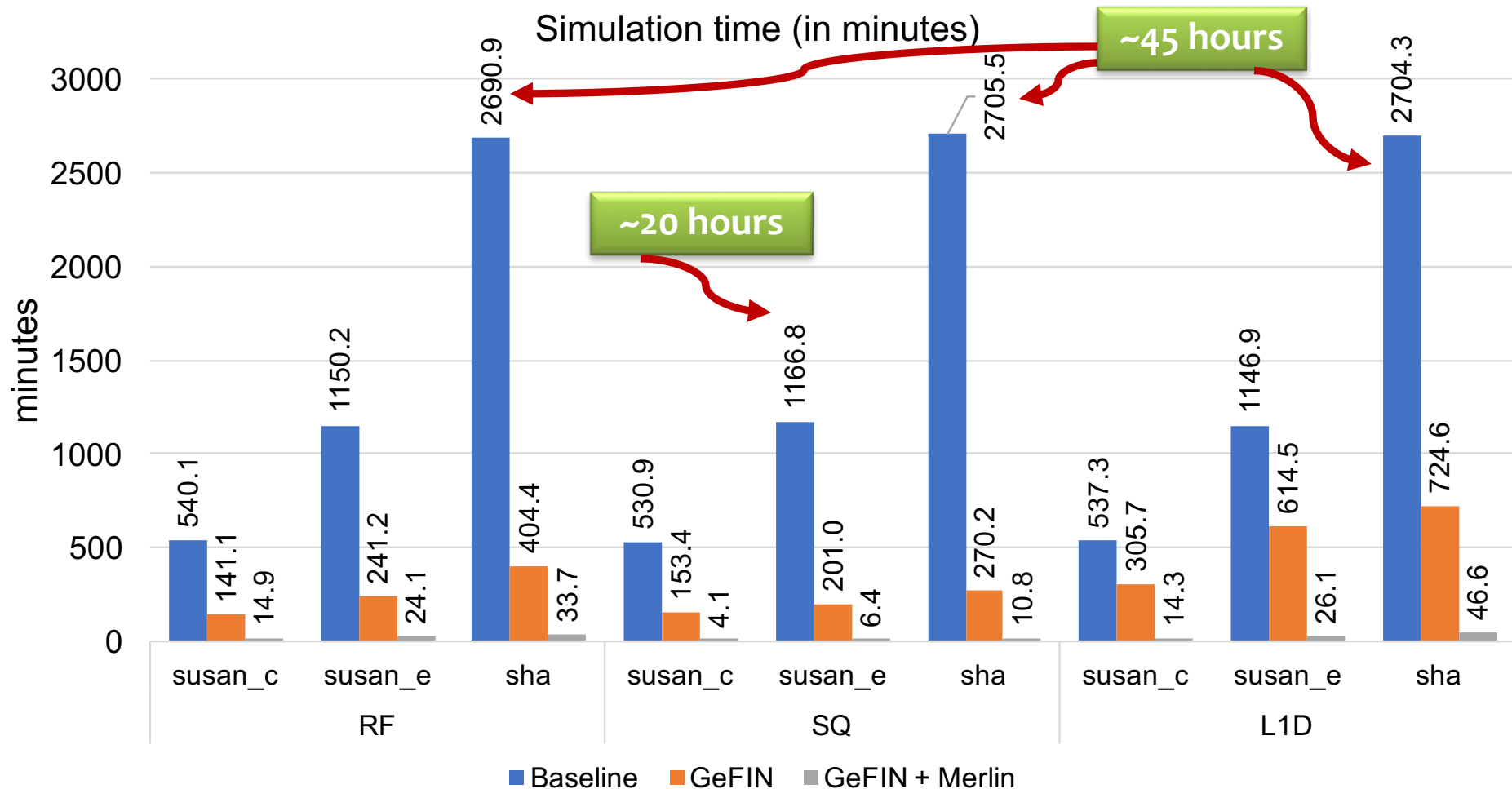
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23,873 faults per campaign:
error margin = 1%
confidence level = 99.8%

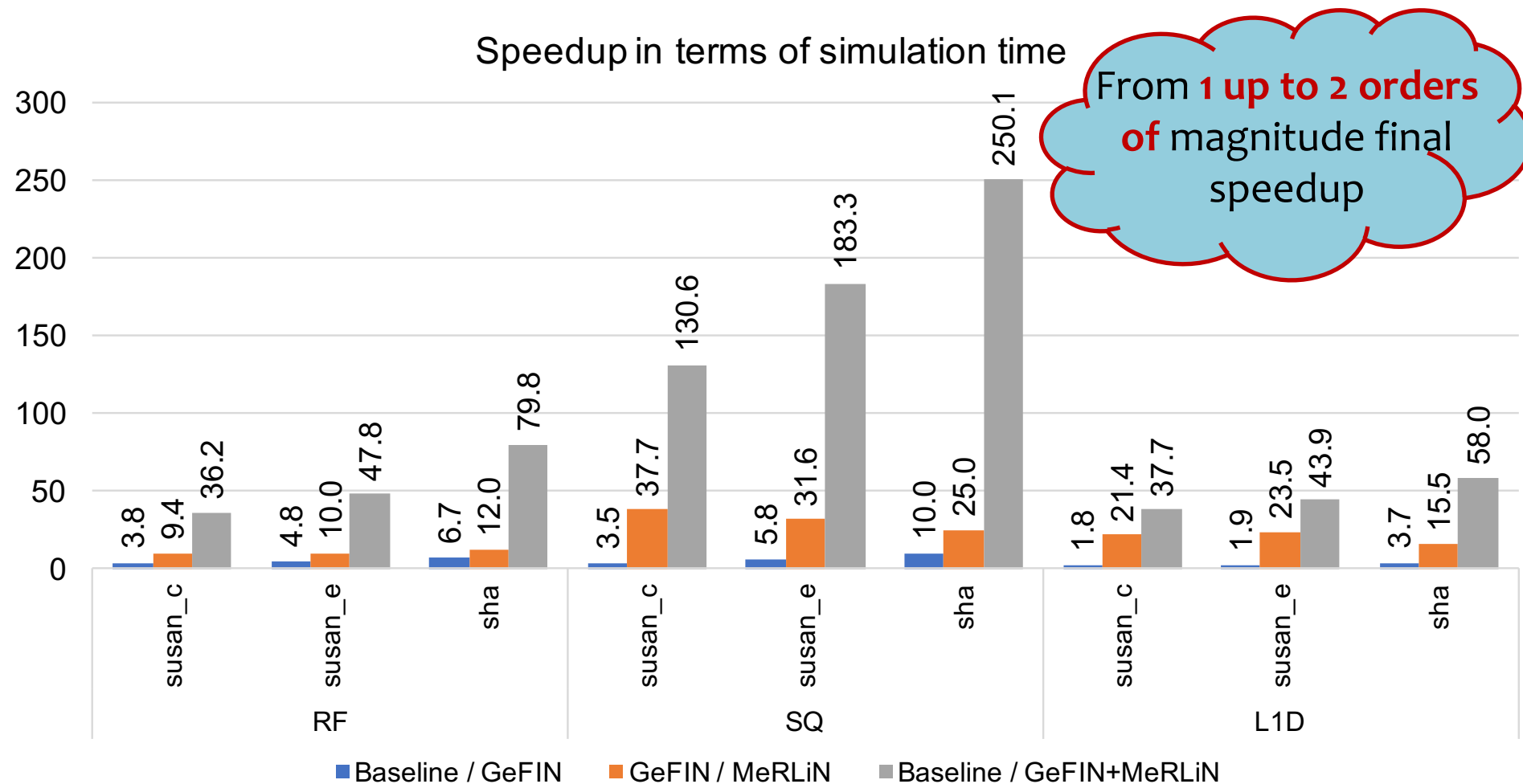
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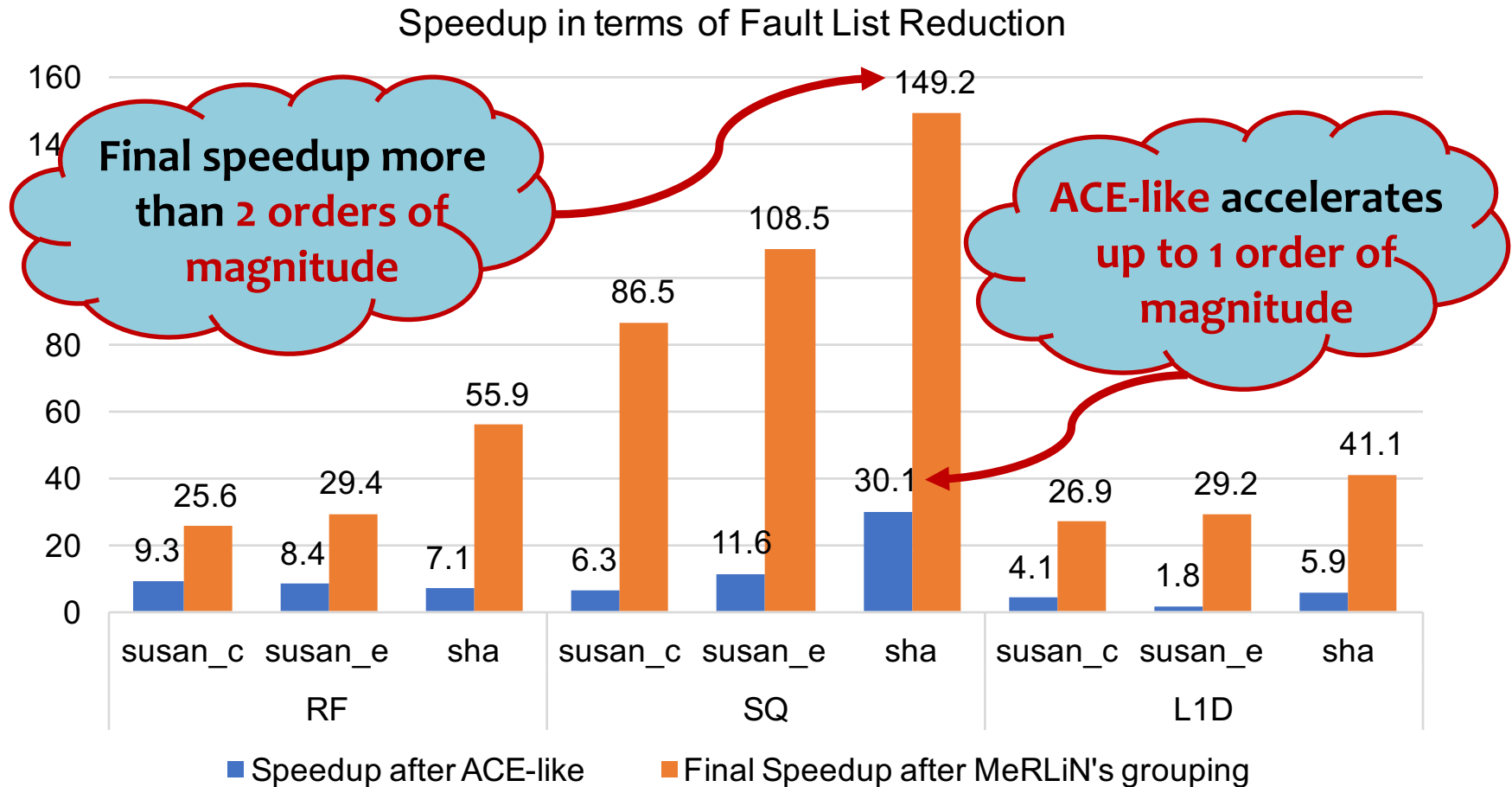
Actual Simulation Time



Acceleration (Simulation Time)



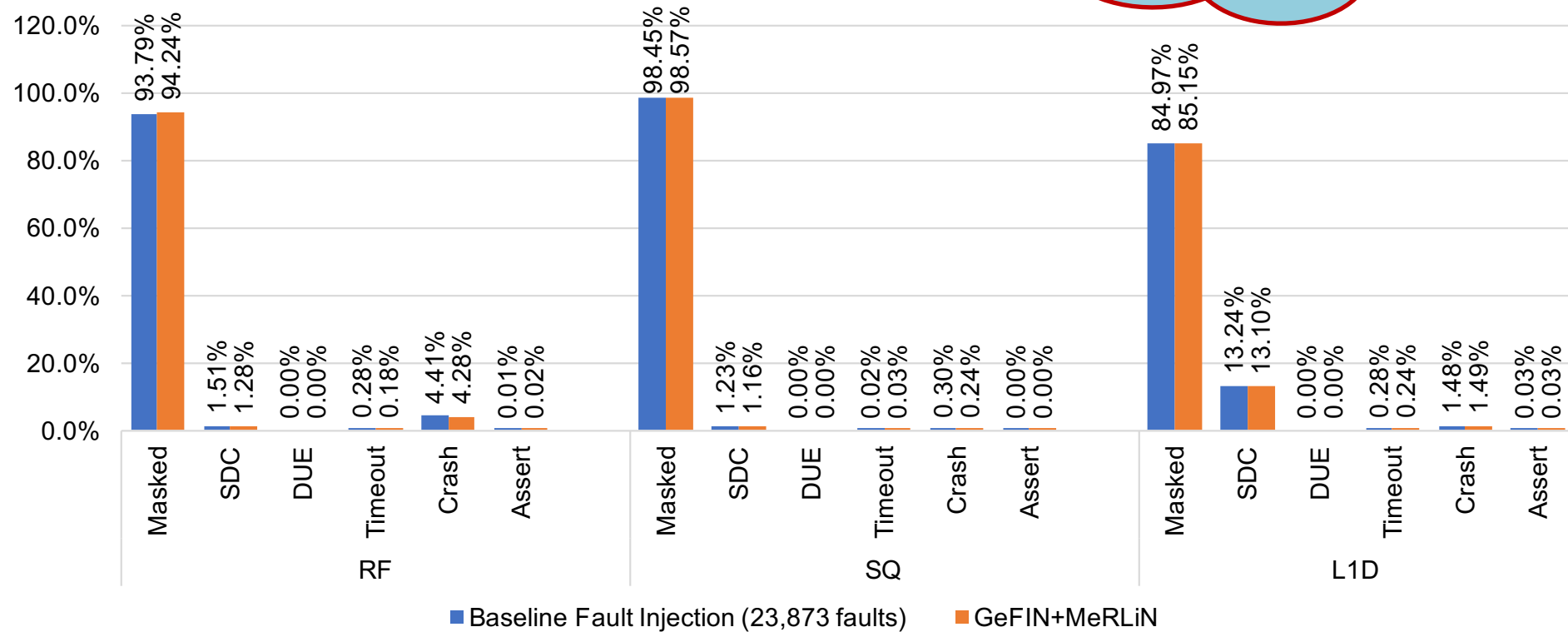
Acceleration (Fault List Reduction)



Accuracy using 6 Classes of Fault Effect

Each bar represents the **average**
for the 3 benchmarks

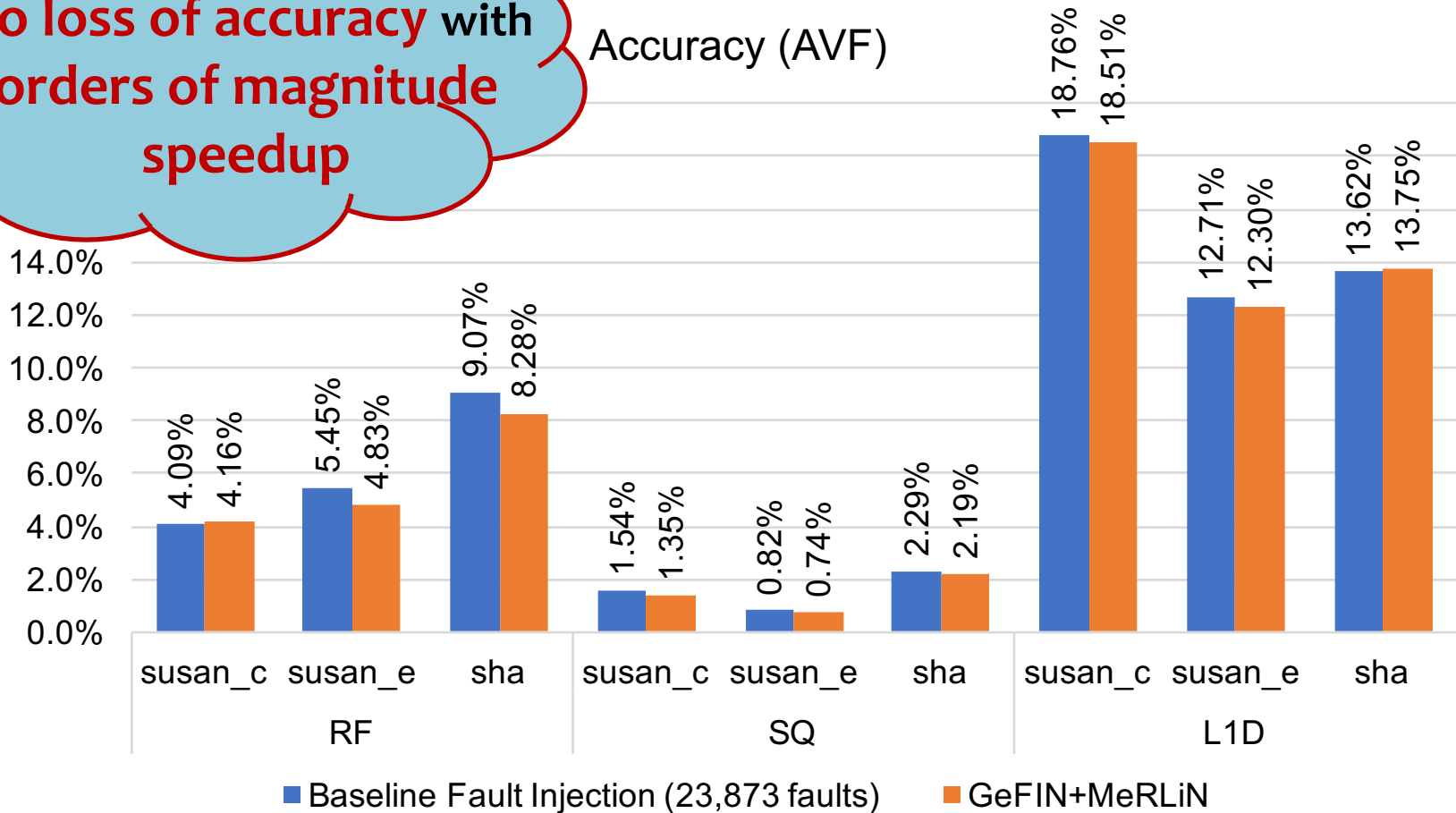
Very accurate results
also for each
benchmark



Final Accuracy Estimation

No loss of accuracy with
orders of magnitude
speedup

Accuracy (AVF)





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Next ...
Closing

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