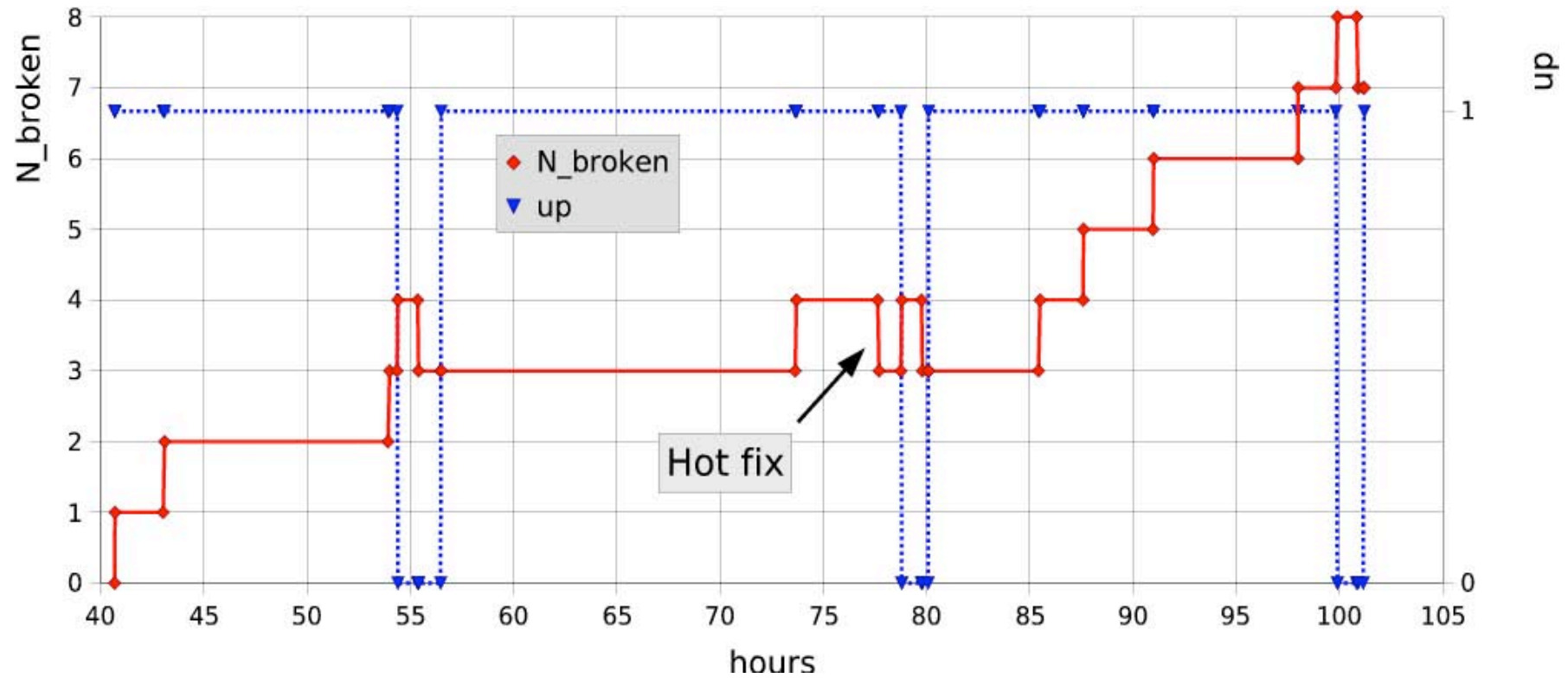# Benchmarking Availability Code with HERA

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(DESY)

Stochastic Approach

- simulate availability ($\Leftrightarrow$integrated luminosity) of collider after commissioning
- developed by Tom Himel within the scope of the US LC Technology Options Study
- quantitative, objective comparison of different designs to assist in decision making

Example

Why Benchmarking?

- model ⇔ reality
- wrong model might introduce bias towards one of the designs

Simulation

- component list with MTBFs (mean time between failures)
- calculation of failure frequency
- failure management & recovery

HERA in 2000

- mature machine (8 years of running experience)

- 100 pb^{-1} delivered luminosity

- sophisticated control & monitoring system in place

- systematic logging of failures

HERA MTBFs

- determined from operator log book failure entries and HERA component list
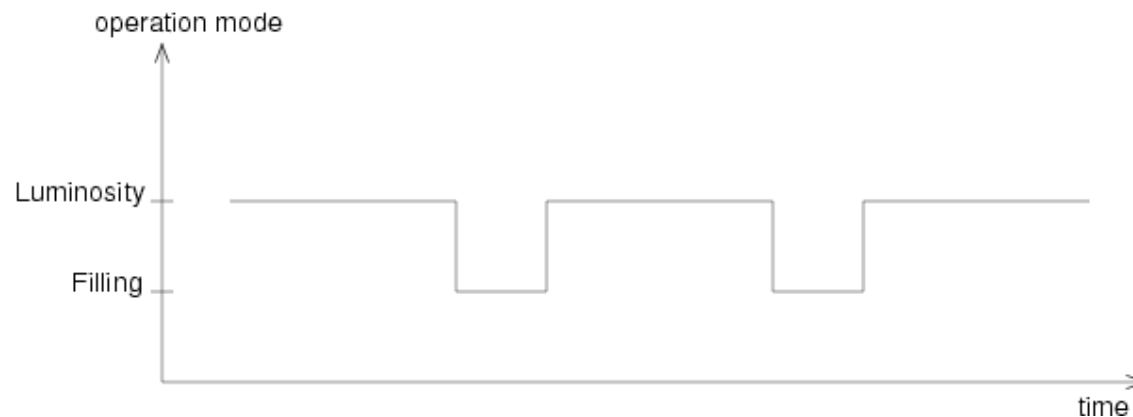- comparison with ILC simulation is ongoing

Calculation of Failure Frequency

program generates
correct # failures
from MTBFs

	# failures	
Region	HERA	simulated
PIA	1	1.2 ± 0.2
DESY 2	3	4.3 ± 0.4
DESY 3	2	1.8 ± 0.3
LINAC 2	6	6.1 ± 0.5
LINAC 3	7	7.1 ± 0.5
PETRA	34	33.8 ± 1.1
H1	13	13.4 ± 0.7
ZEUS	28	27.7 ± 1.0
HERA-B	11	11.9 ± 0.7
HERMES	11	10.7 ± 0.6

New operational aspect

- HERA as a storage ring requires refilling phase

- implementation of storage ring mode in progress

Failures in Storage Ring

Operation mode	Failure	Consequence of failure
luminosity	storage ring	filling
	pre-accelerators	hot repair or delayed filling
filling	storage ring	filling
	pre-accelerators	filling

Failure Management & Recovery

will compare with HERA:

     integrated luminosity, failures of components, time spent doing repairs, time and frequency of luminosity running and filling, time spent doing luminosity tuning, total downtime, downtime caused by pre-accelerators

Summary

- ## MTBFs

  - in progress

- ## calculation of failure frequency ✔

- ## failure management & recovery

  - requires implementation of accelerator phases (pre-accelerators, magnet massage) in addition to luminosity production

Conclusions

- an important tool to address operational aspects of accelerators

- benchmarking is under way with promising intermediate results

- further benchmarking input from other sites?