



**Reflections and thoughts about requirements on  
fire test scenarios to approve water mist  
extinguishing systems in ordinary hazard (OH)  
applications.**

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# Reproducibility - vs. – Representativeness

## A matter of the aim of fire tests

Described with recent findings of an OH3 test series and compared with former OH1 test series.

- **OH1 Test Scenario “Office”**
  - wooden desk
  - drawer cabinet
  - padded chair
  - two wooden walls
  - monitor with keyboard
  - several file folders filled with paper, and books
  - foam blocks, which stand for various other plastic objects on the desk



- **OH1 Test Method “Office”**
  - Comparison test with sprinkler
  - 2 Scenarios: Under 1 nozzle (U1) / Between 4 nozzles (B4)
  - Each scenario only 1 test
  - Repetition of the abnormal test or test with highest result



- **OH3 Test Scenario “Block Store”**
  - 6 EURO-Pallets
  - 84 big card board boxes
  - filled with 7.650 plastic cups

Stand close together formed as a compact block.



- **OH3 Test Scenario**

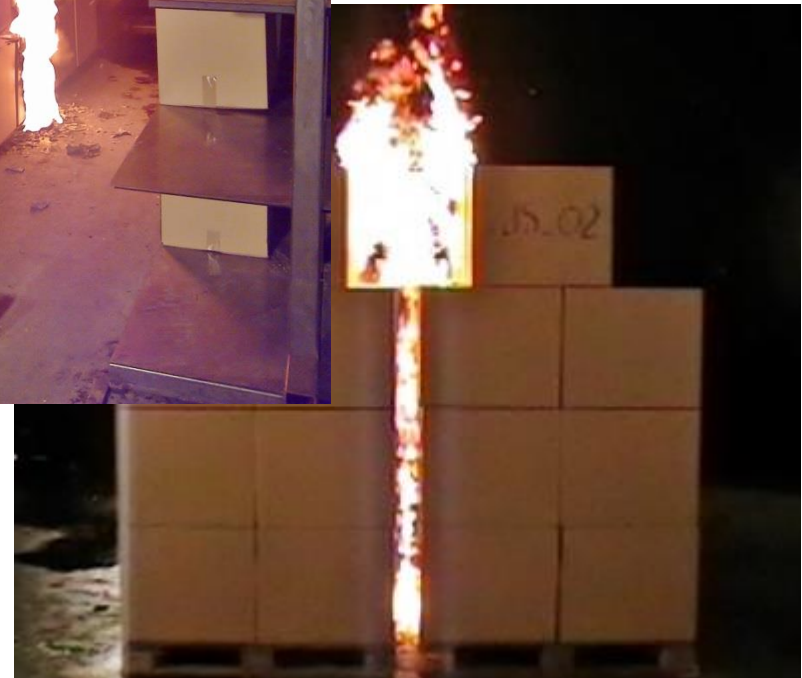
- **“Shelf Store”**

- 2 Shelves
- 60 big card board boxes
- and 20 small card board boxes
- filled with 6.480 plastic cups

Shelves stand opposite each other with a space of 1 m in between.



- **OH3 Test Method is same like OH1**
  - Comparison test with sprinkler
  - Each scenario (U1/B4) again only 1 test
  - Repetition of the abnormal test or test with highest result



Used abbreviations:

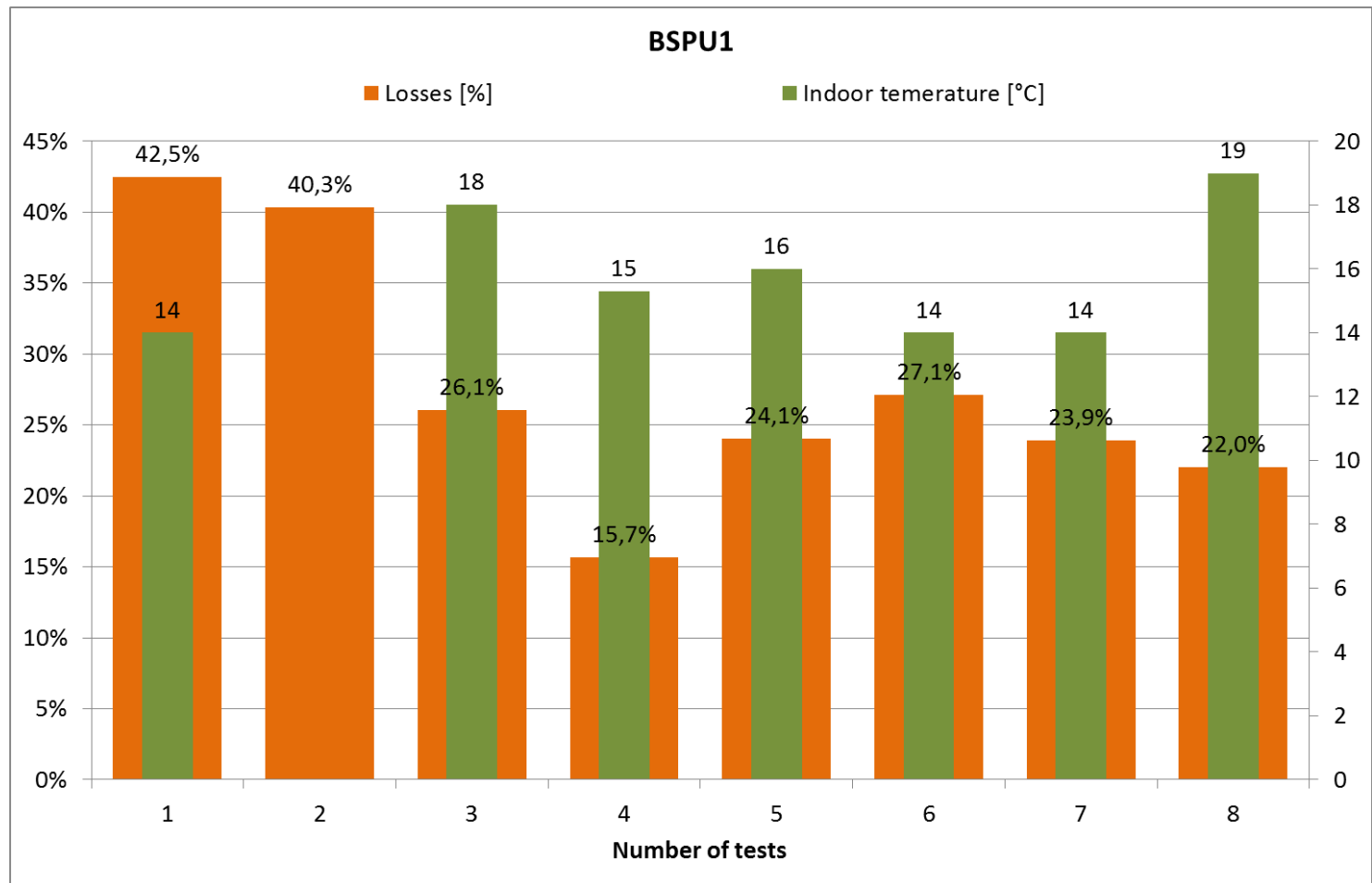
<b>BSPU1</b>	<b><u>B</u>lock <u>SP</u>rinkler <u>U</u>nder <u>1</u></b>
<b>BSPB4</b>	<b><u>B</u>lock <u>SP</u>rinkler <u>B</u>etween <u>4</u></b>
<b>SSPU1</b>	<b><u>S</u>helf <u>SP</u>rinkler <u>U</u>nder <u>1</u></b>
<b>SSPB4</b>	<b><u>S</u>helf <u>SP</u>rinkler <u>B</u>etween <u>4</u></b>
<b>OSPU1</b>	<b><u>O</u>ffice <u>SP</u>rinkler <u>U</u>nder <u>1</u></b>
<b>OSPB4</b>	<b><u>O</u>ffice <u>SP</u>rinkler <u>B</u>etween <u>4</u></b>



## Starting temperatures:

Almost same in every test, with slight deviations from average.

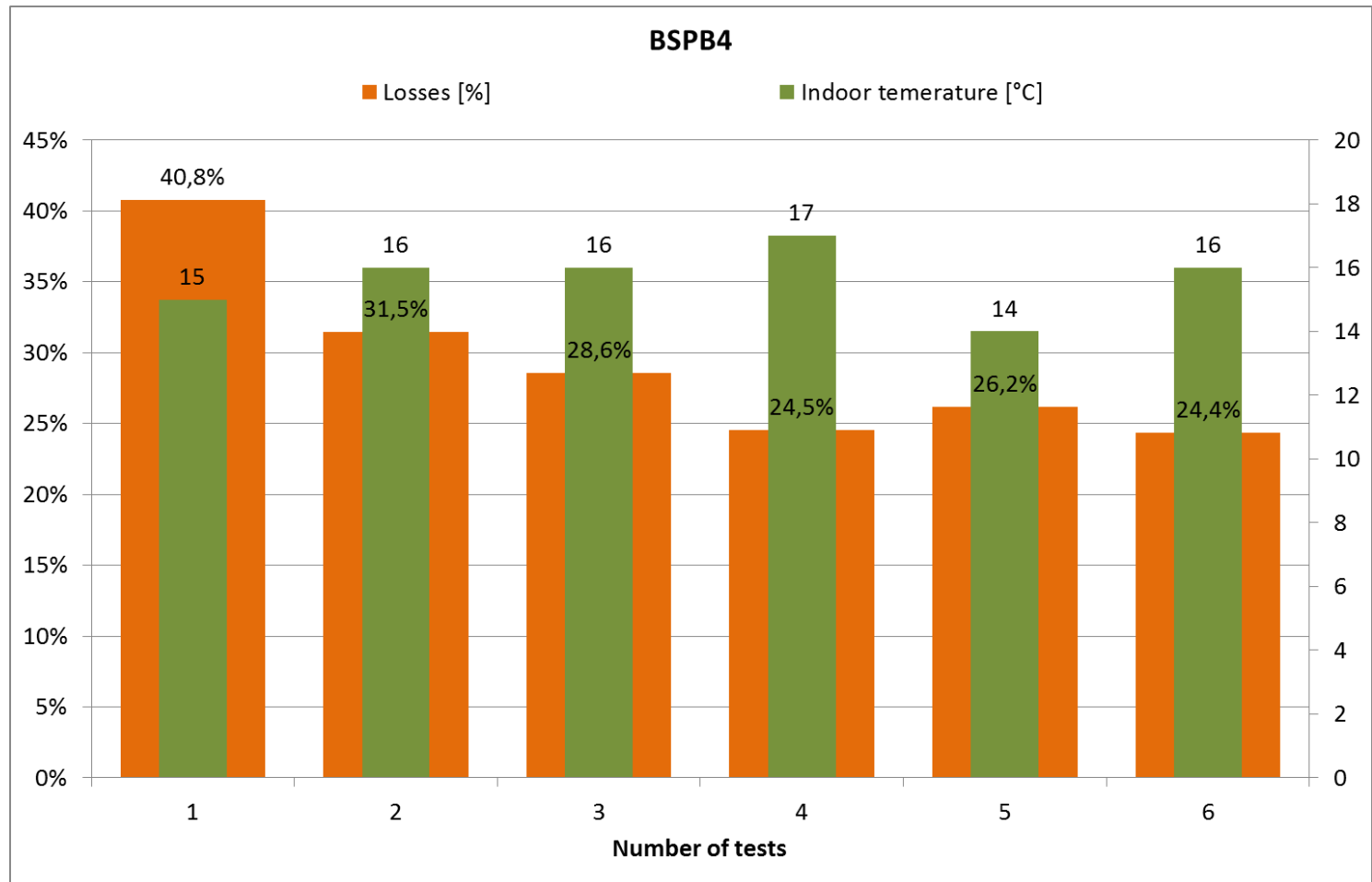
BSPU1 average 16 °C deviation  $\pm$  3 °C



## Starting temperatures:

Almost same in every test, with slight deviations from average.

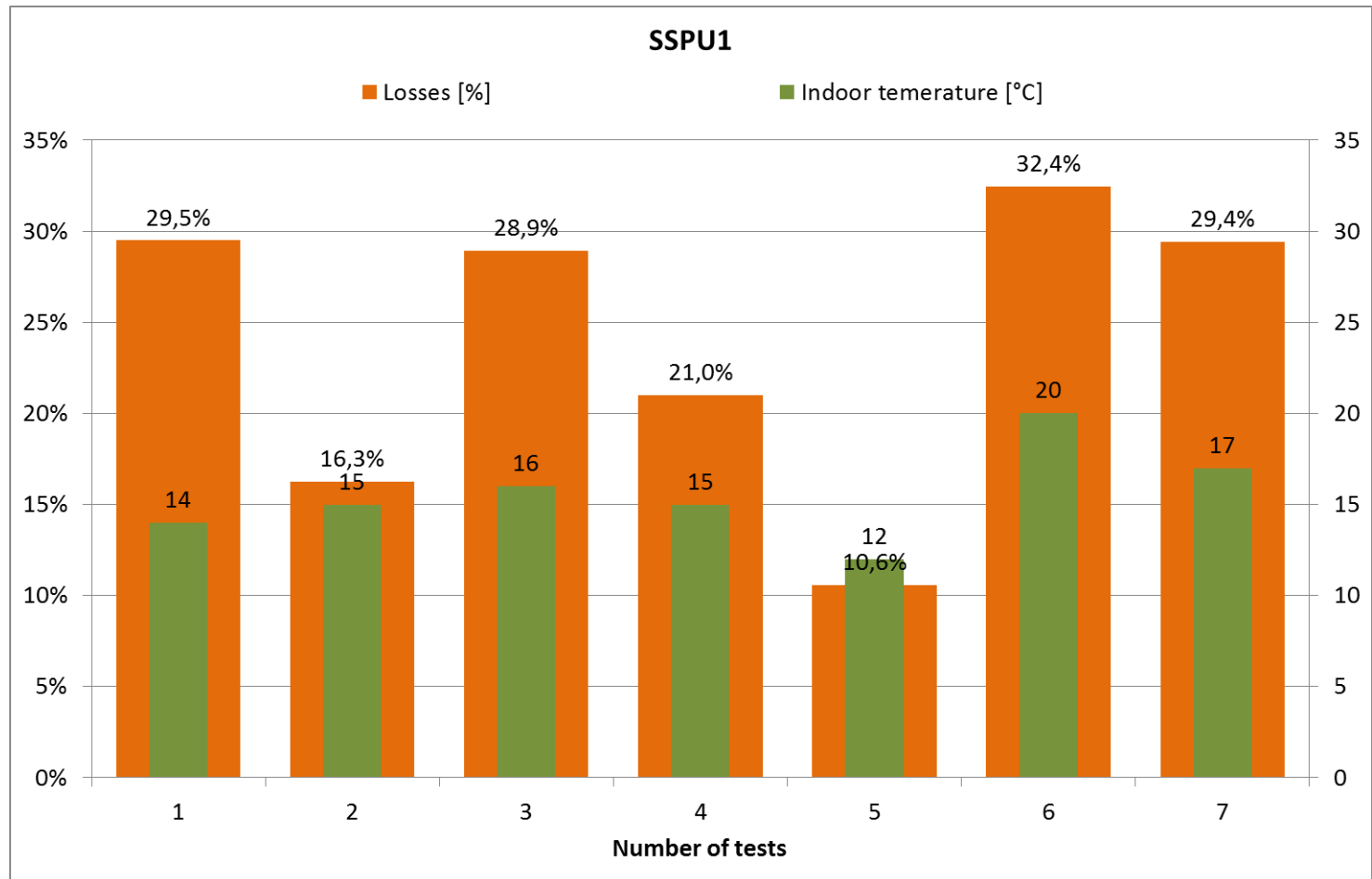
BSPB4 average 16 °C deviation  $\pm 2$  °C



## Starting temperatures:

Almost same in every test, with slight deviations from average.

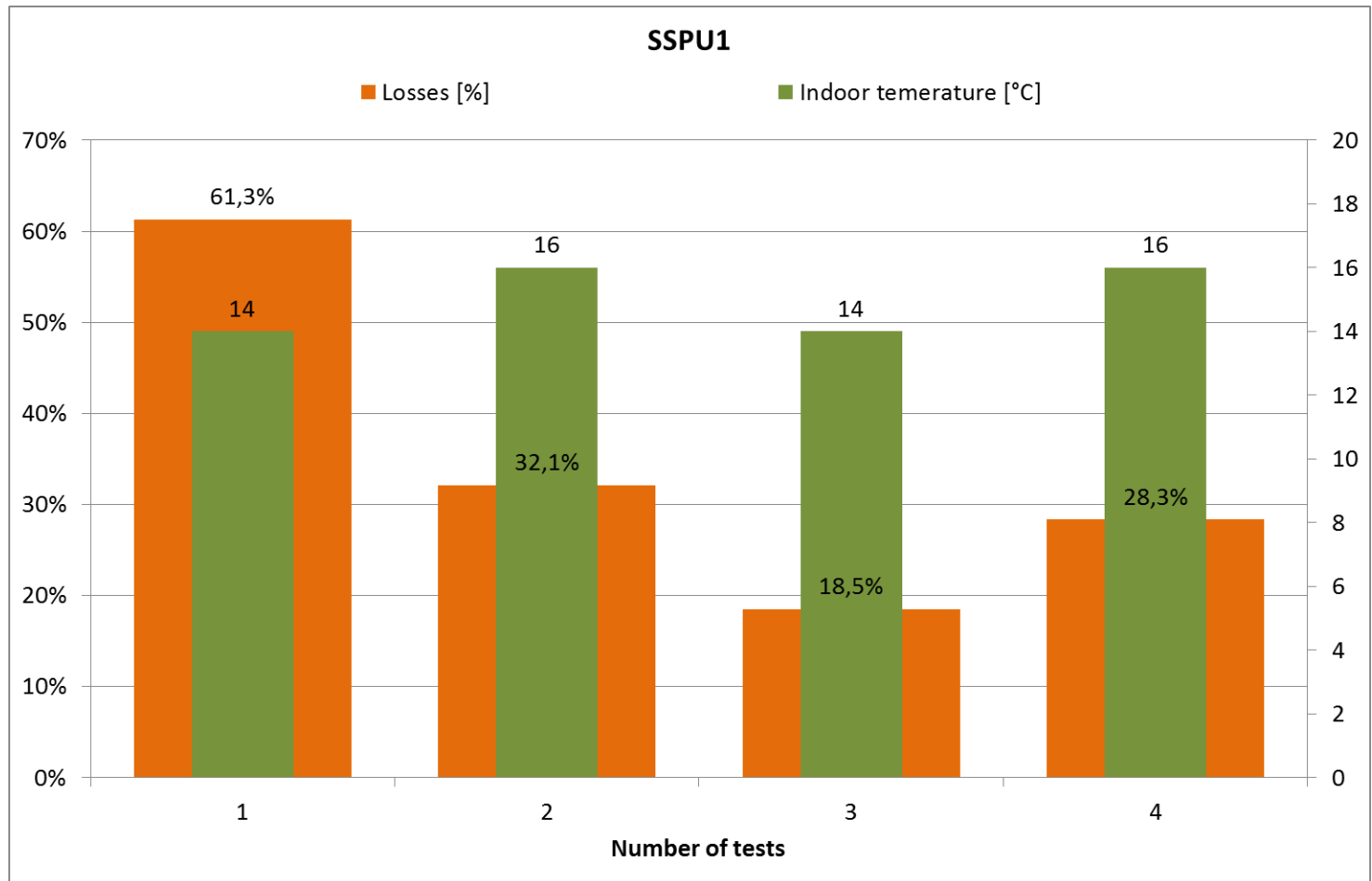
SSPU1 average 16 °C deviation  $\pm$  3 °C



## Starting temperatures:

Almost same in every test, with slight deviations from average.

SSPB4 average 16 °C deviation  $\pm$  2 °C



Starting temperatures:

Almost same in every test, with slight deviations from average.

BSPU1 average 16 °C deviation  $\pm 3$  °C

BSPB4 average 16 °C deviation  $\pm 2$  °C

SSPU1 average 16 °C deviation  $\pm 3$  °C

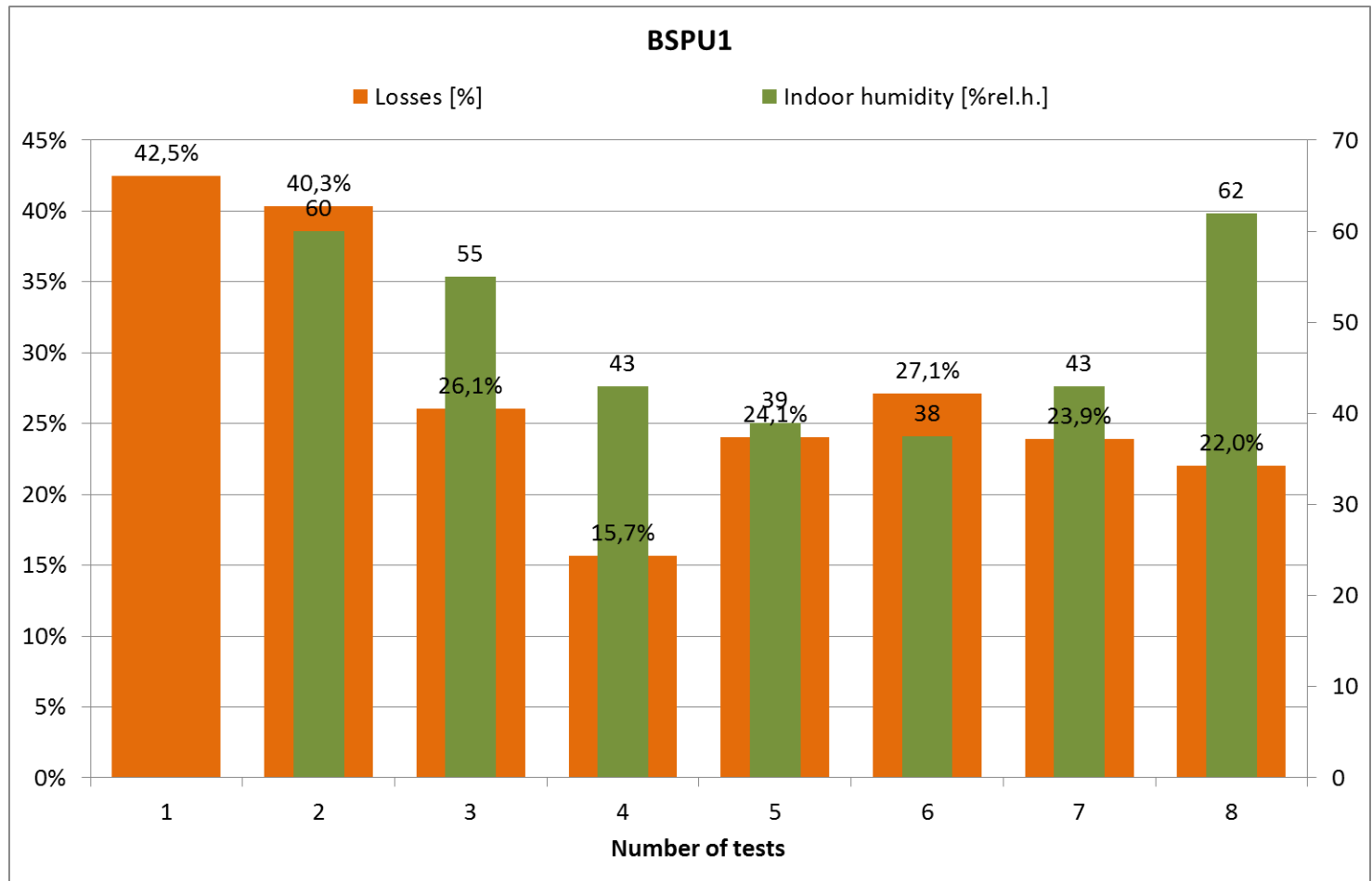
SSPB4 average 16 °C deviation  $\pm 2$  °C

There are no correlations with the damage observed.

## Room humidity:

high variance and differences between the scenarios.

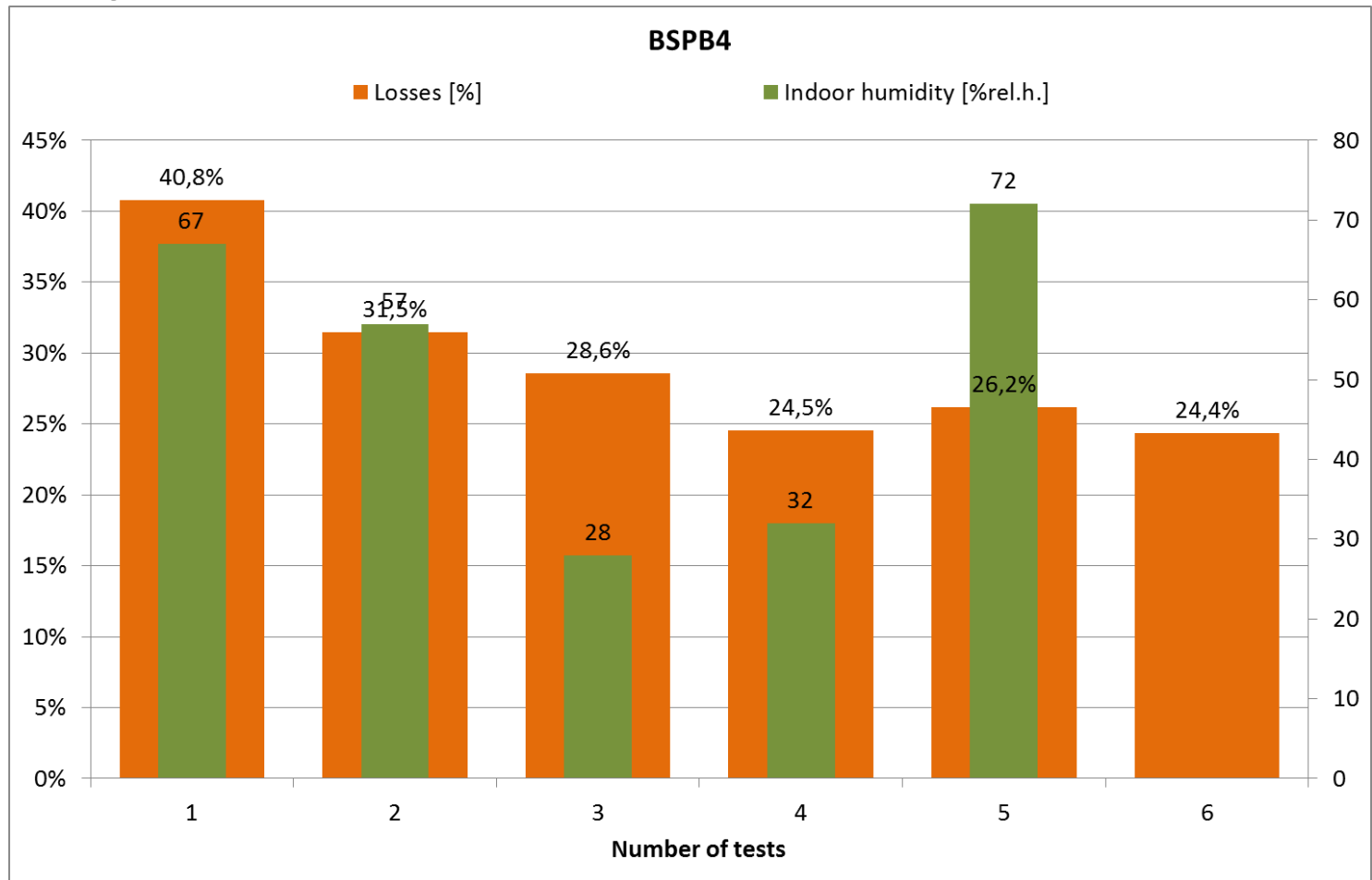
BSPU1 average 49 % deviation  $\pm$  14 %



## Room humidity:

high variance and differences between the scenarios.

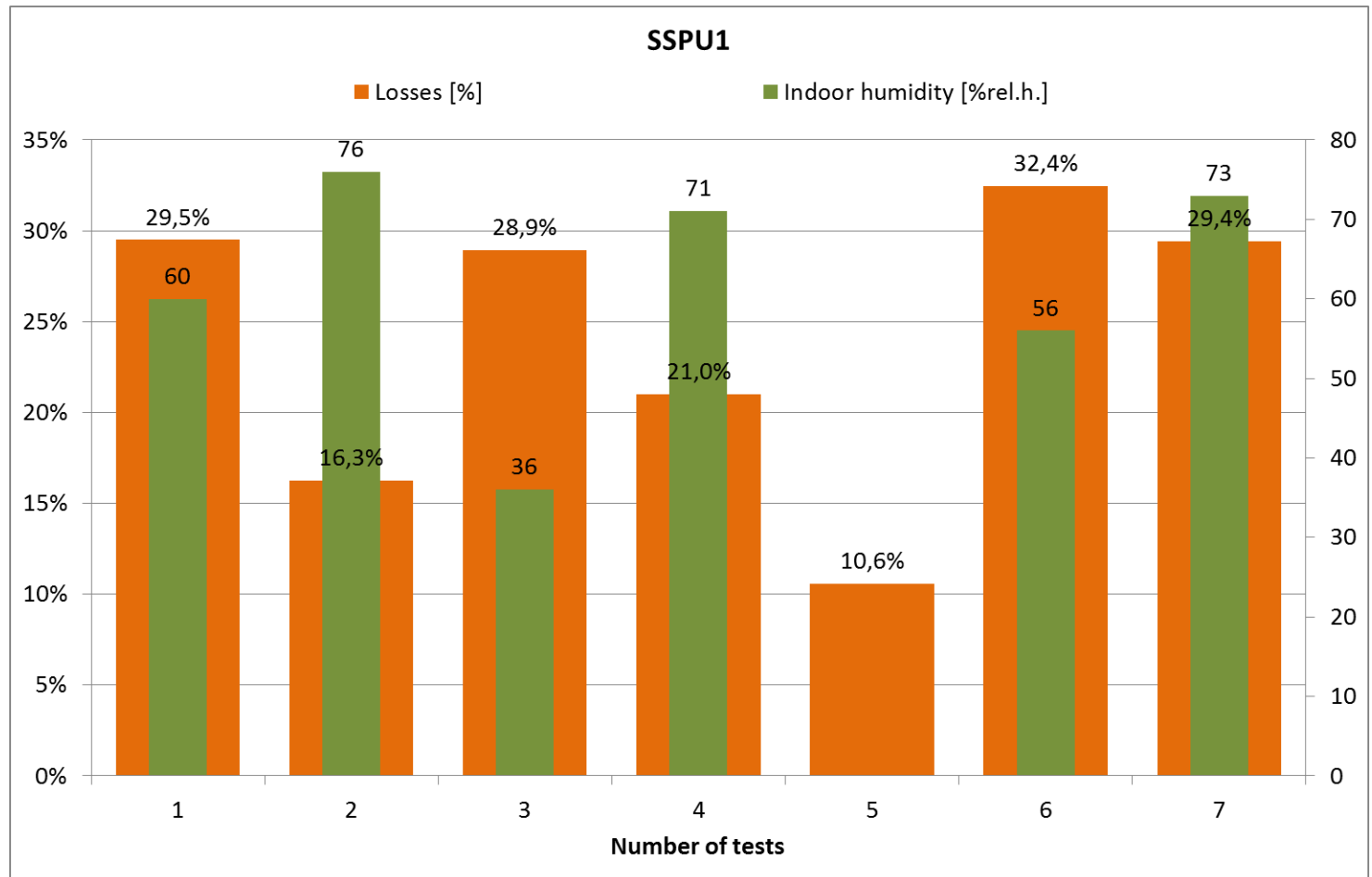
BSPB4 average 51 % deviation  $\pm$  23 %



## Room humidity:

high variance and differences between the scenarios.

SSPU1 average 62 % deviation  $\pm$  26 %

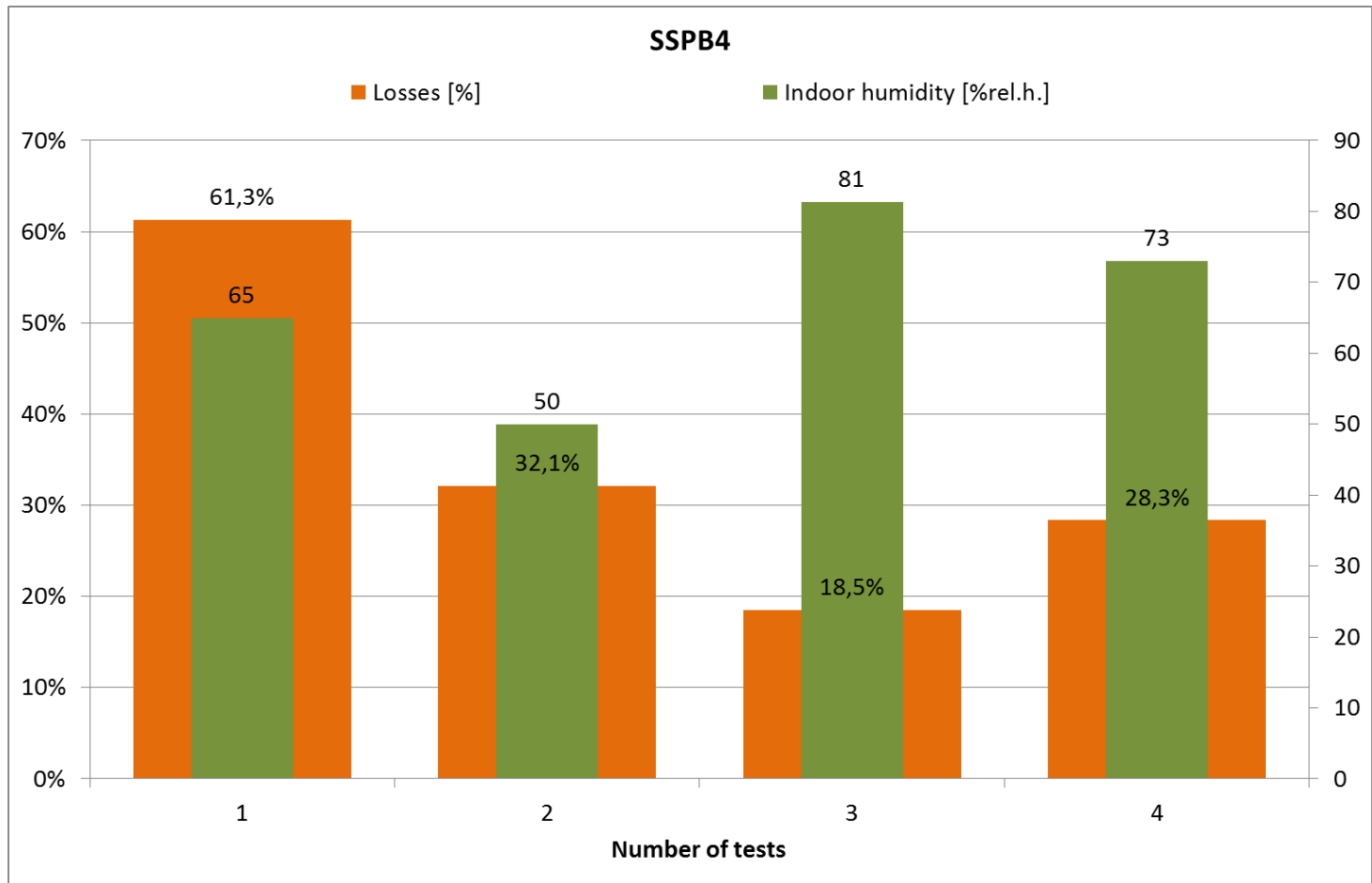




## Room humidity:

high variance and differences between the scenarios.

SSPB4 average 67 % deviation  $\pm$  17 %



## Room humidity:

high variance and differences between the scenarios.

BSPU1 average 49 % deviation  $\pm$  14 %

BSPB4 average 51 % deviation  $\pm$  23 %

SSPU1 average 62 % deviation  $\pm$  26 %

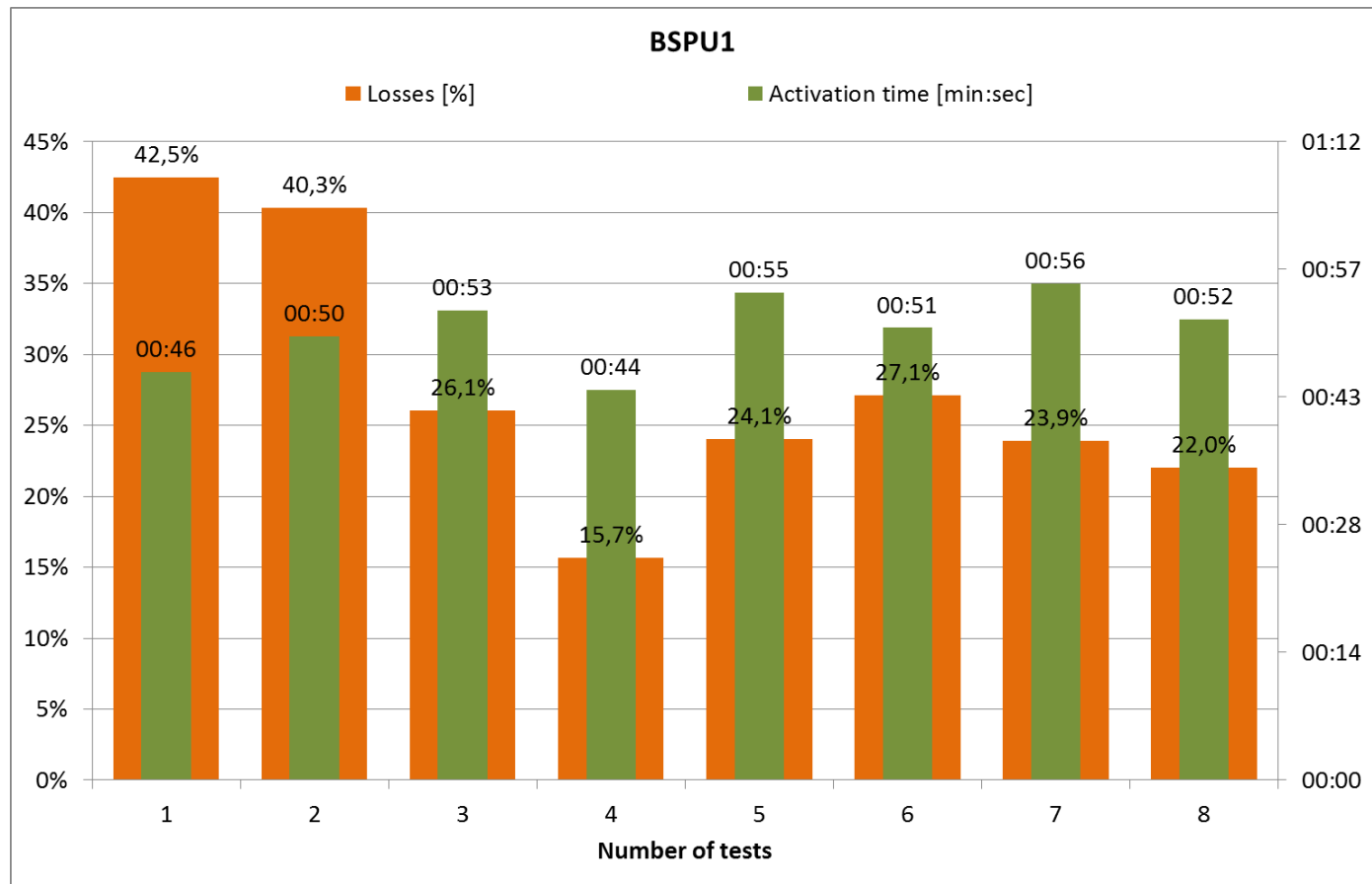
SSPB4 average 67 % deviation  $\pm$  17 %

Correlations with the damage cannot be determined.

## Release times:

In every single scenario you can see the times are similar. The deviations are relatively small.

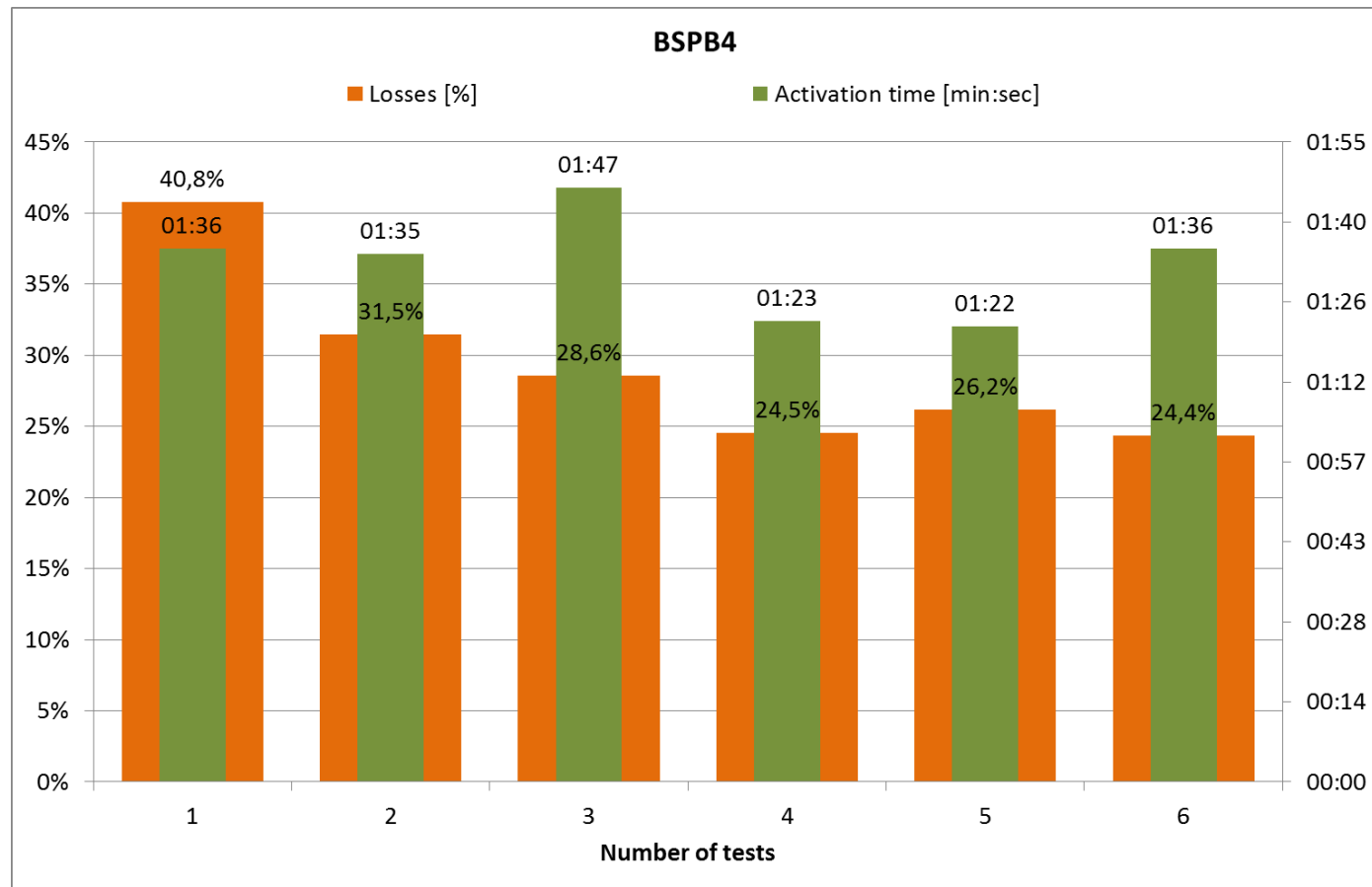
BSPU1 average 50 sec deviation  $\pm$  6 sec



## Release times:

In every single scenario you can see the times are similar. The deviations are relatively small.

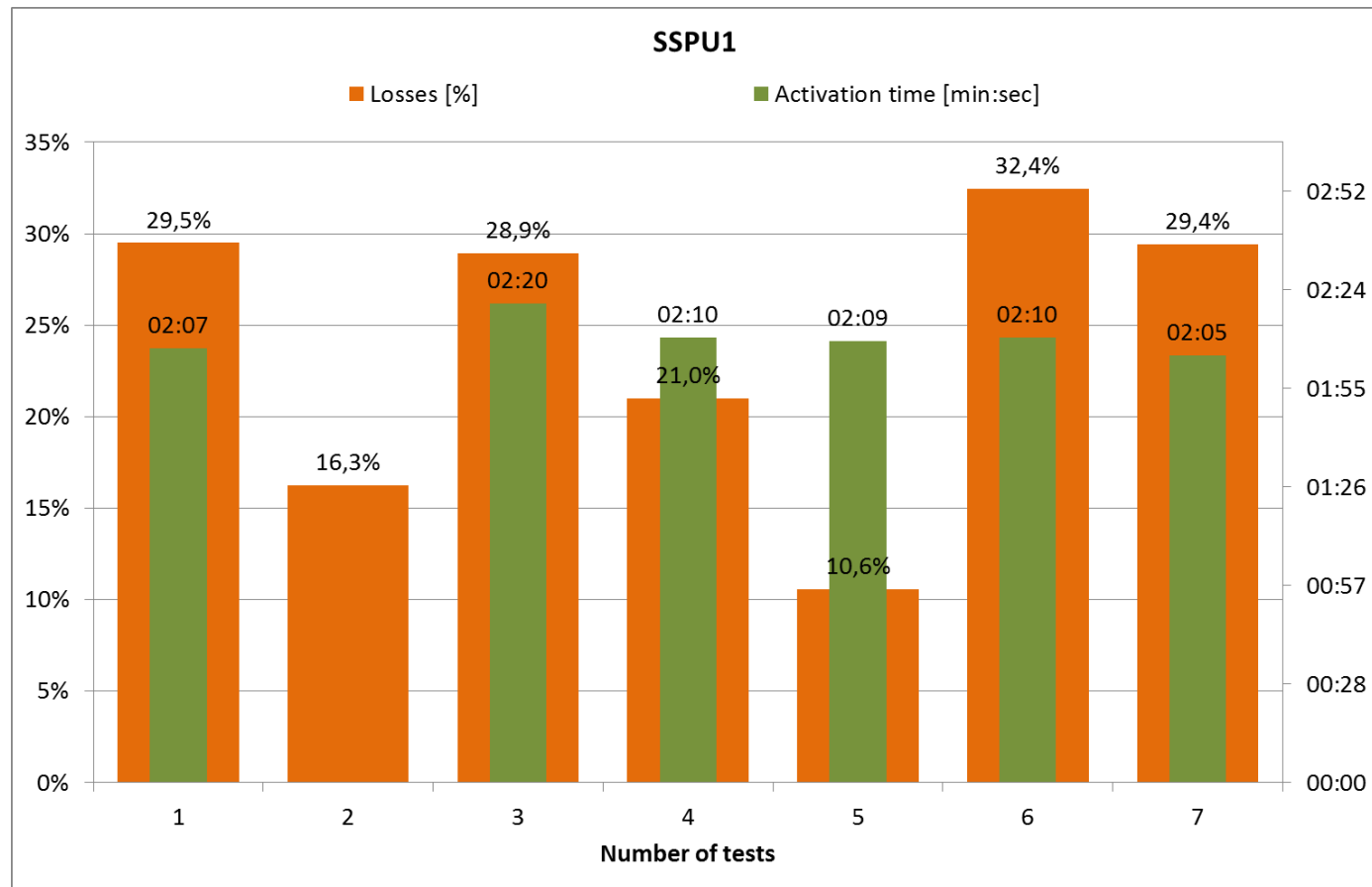
BSPB4 average 93 sec deviation  $\pm$  13 sec



## Release times:

In every single scenario you can see the times are similar. The deviations are relatively small.

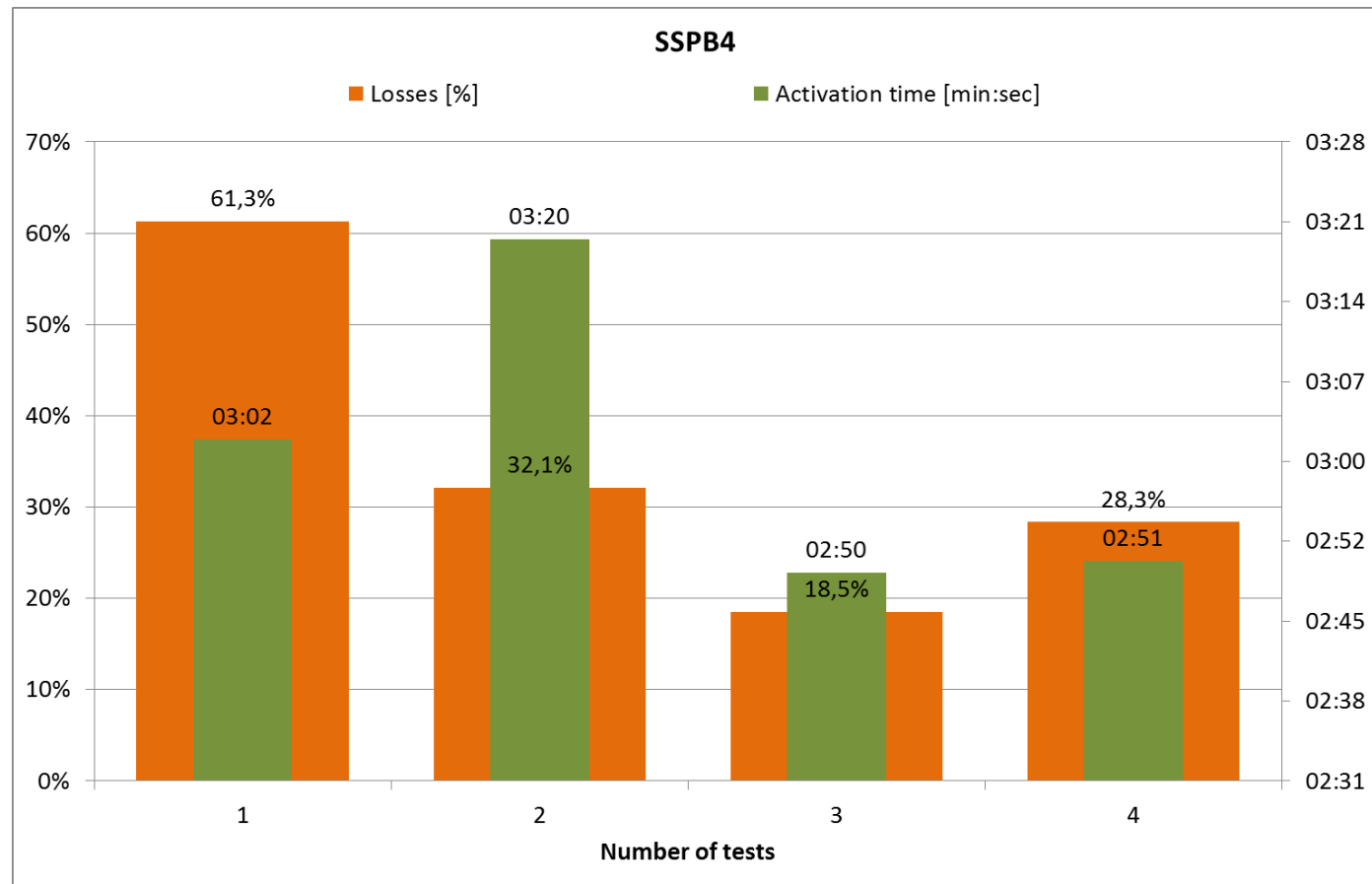
SSPU1 average 130 sec deviation  $\pm$  10 sec



## Release times:

In every single scenario you can see the times are similar. The deviations are relatively small.

SSPB4 average 180 sec deviation  $\pm$  19 sec





### Release times:

In every single scenario you can see the times are similar. The deviations are relatively small.

BSPU1 average 50 sec deviation  $\pm$  6 sec

BSPB4 average 93 sec deviation  $\pm$  13 sec

SSPU1 average 130 sec deviation  $\pm$  10 sec

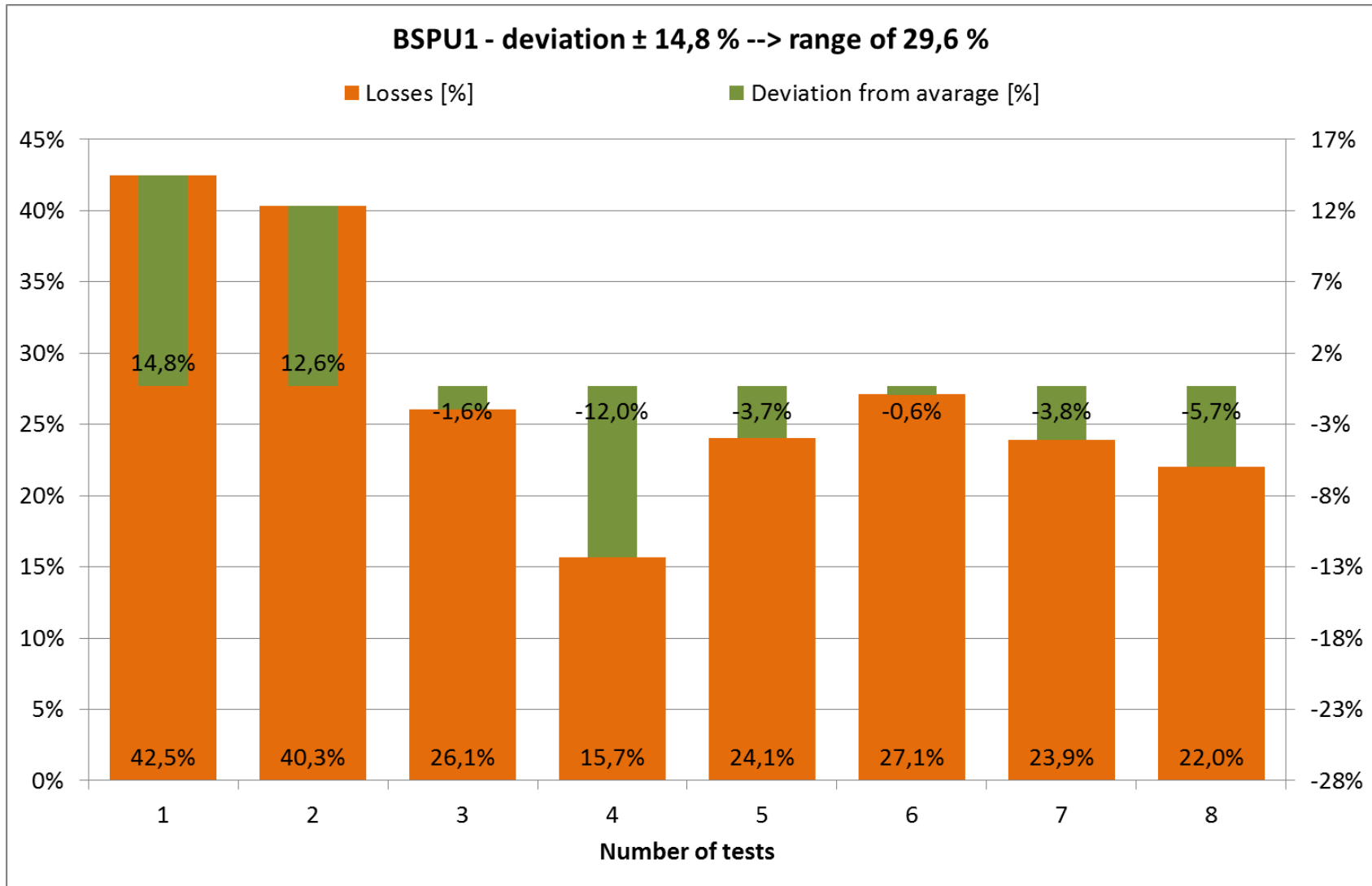
SSPB4 average 180 sec deviation  $\pm$  19 sec

Correlations with the damage cannot be determined from the boundary conditions.

And therefore these are almost irrelevant.

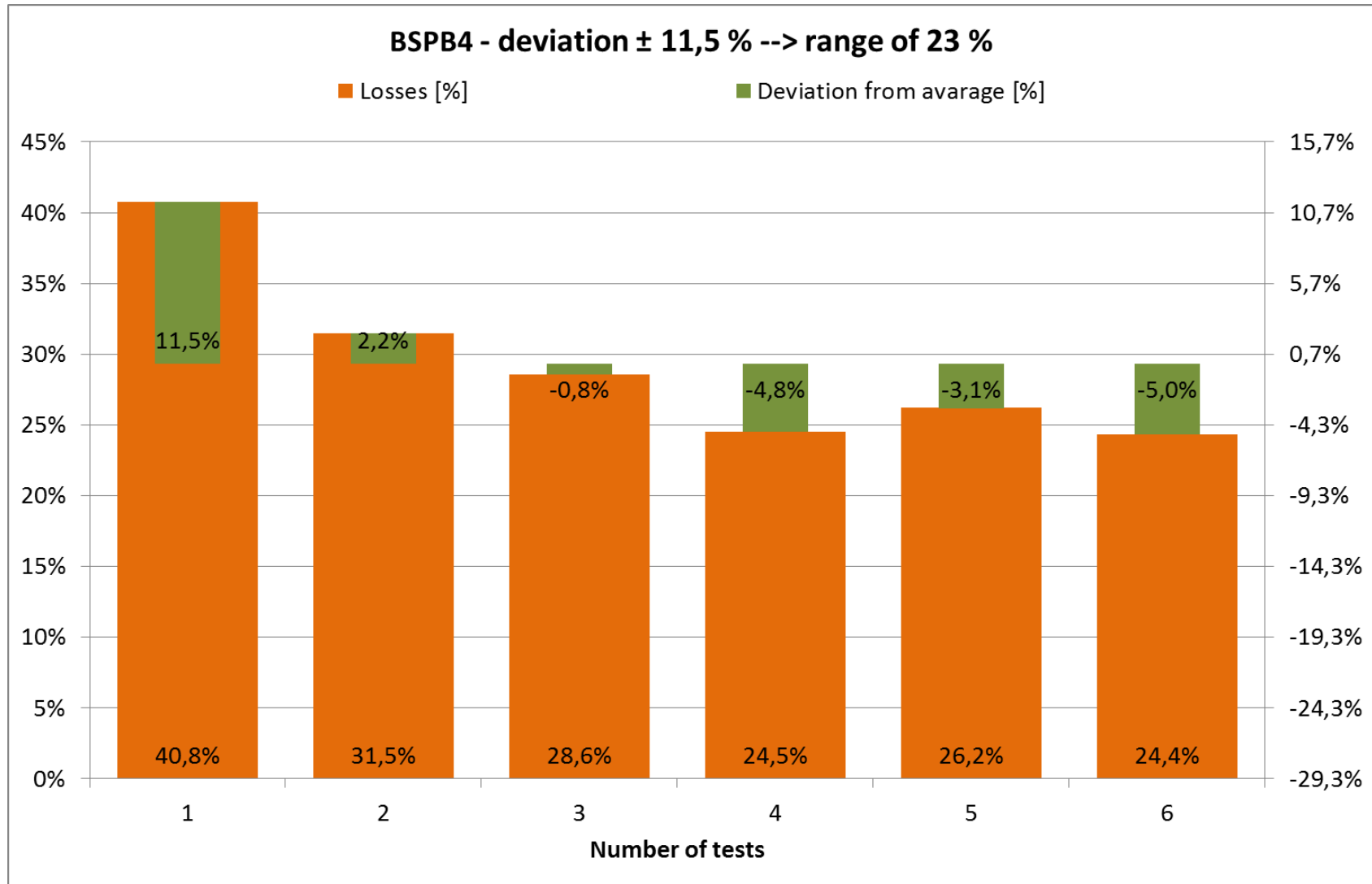
However, this should not be ignored, as they definitely allow to draw conclusions about the progress.

Consideration of the damages: BSPU1 average **27.7 %**

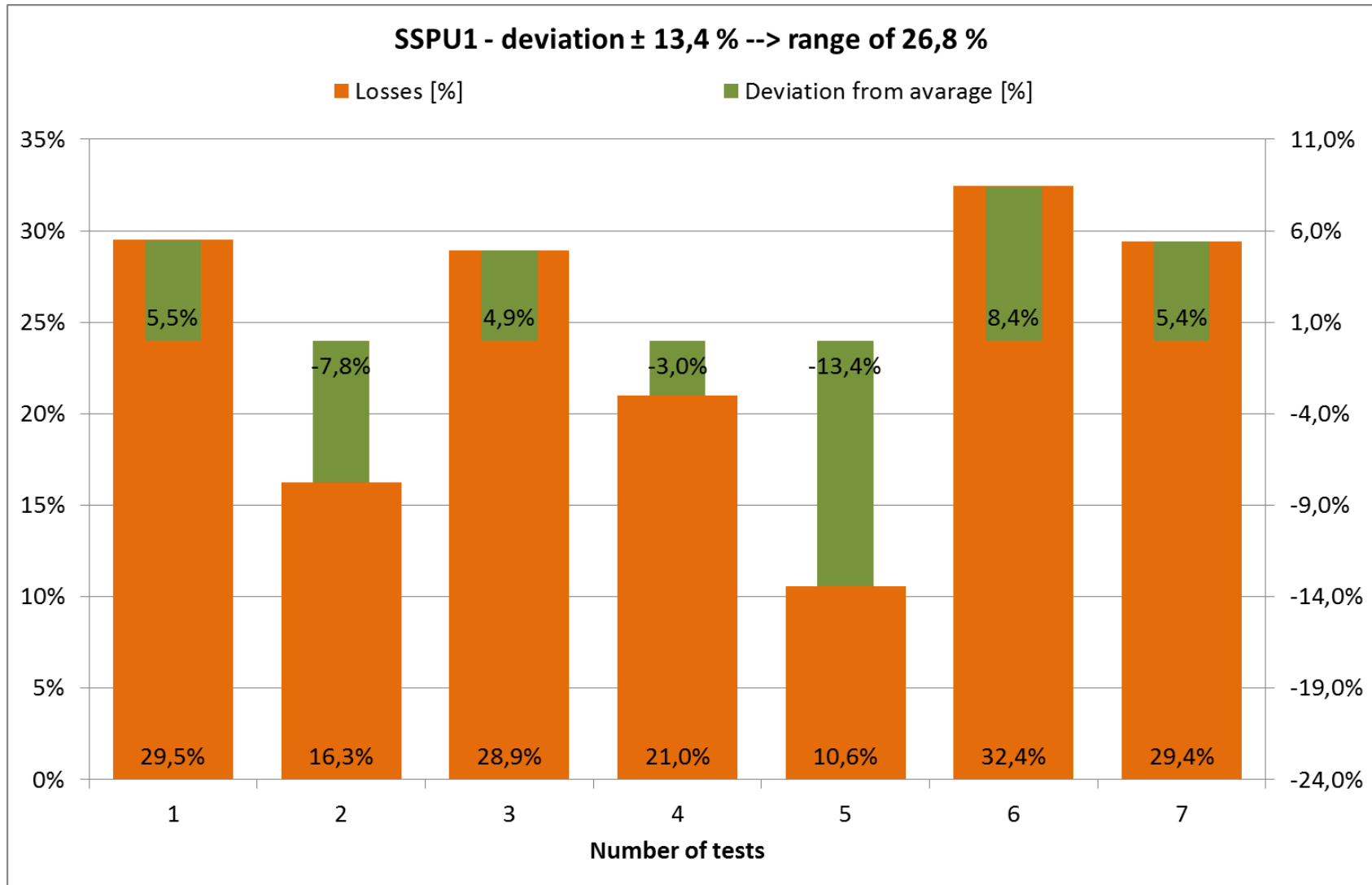




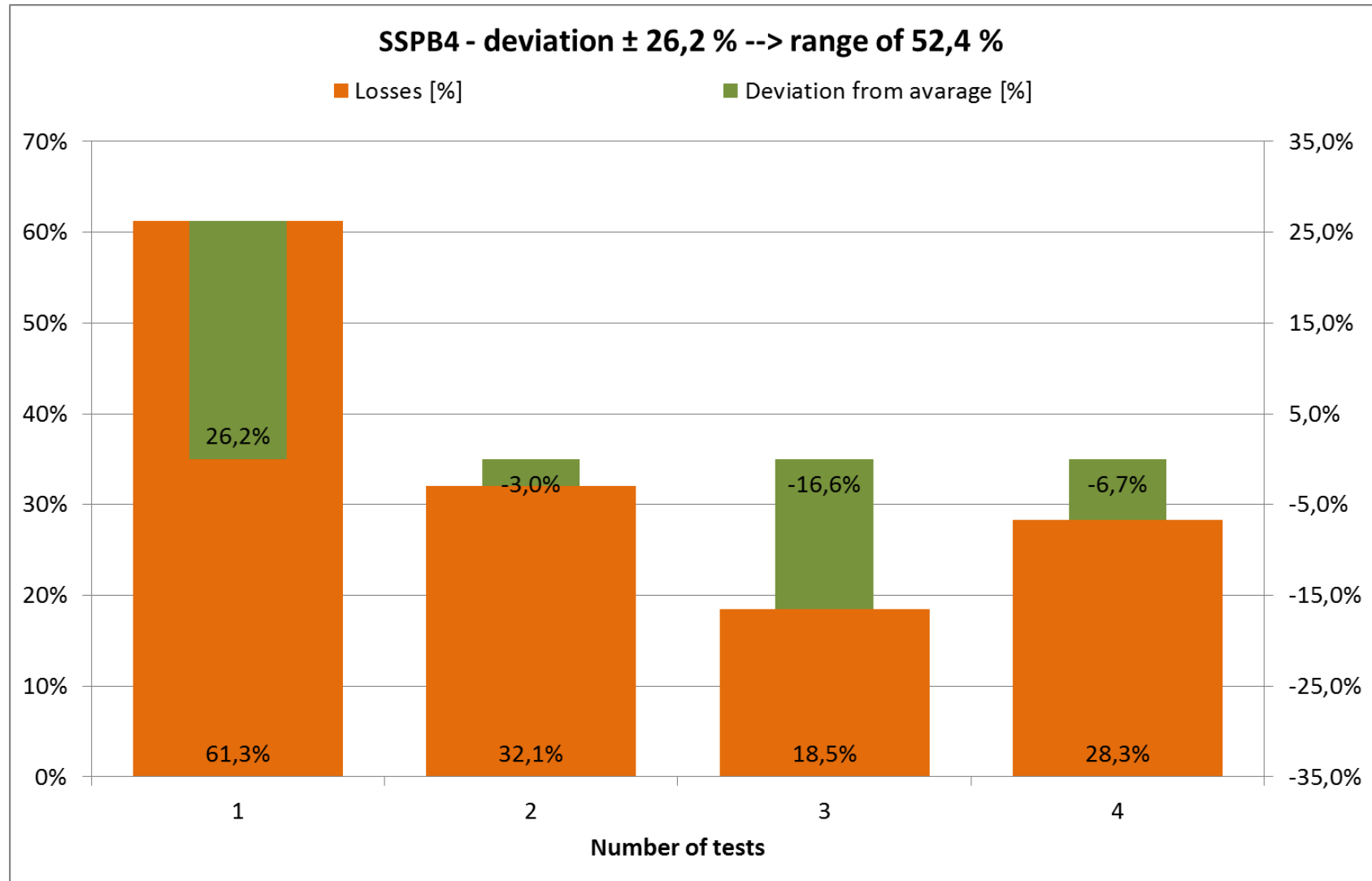
Consideration of the damages: BSPB4 average **29.3 %**



Consideration of the damages: SSPU1 average **24.0 %**



Consideration of the damages: SSPB4 average **35.0 %**



Consideration of the damages:

OH3 BSPU1	average <b>27.7</b> % deviation $\pm$ <b>14.8</b> % range <b>29.6</b> %
OH3 BSPB4	average <b>29.3</b> % deviation $\pm$ <b>11.5</b> % range <b>23.0</b> %
OH3 SSPU1	average <b>24.0</b> % deviation $\pm$ <b>13.4</b> % range <b>26.8</b> %
OH3 SSPB4	average <b>35.0</b> % deviation $\pm$ <b>26.2</b> % range <b>52.4</b> %

## To remember and comparison:

OH1 OSPU1	average <b>27.0</b> % deviation $\pm$ <b>6.4</b> % range <b>12.8</b> %
OH1 OSPB4	average <b>27.4</b> % deviation $\pm$ <b>6.4</b> % range <b>12.8</b> %

The range of damage in OH3 was significantly higher.

The water mist has almost same range.

Therefore also the randomness of being better or worse than the sprinkler is higher.

And also the chance to get higher handicap values for the comparison tests.

But this all has strong similarities with a lottery.

The OH3 fire load was significantly simplified in comparison to the fire load of OH1 office.

It is a quite homogeneous fire load.

It consists basically of cardboard boxes filled with plastic cups.

Much different to the highly complex office scenario

### Material comparison of scenarios

- OH1 office – very mixed materials
- OH3 Storages – hardly mixed materials



Representativeness of these scenarios. Very strong orientated by the real life.



Shelf store

Pallet store



Open plan office





The disadvantage is, that the results of tests can have a wide range.

In most cases caused by the collapse of the fire load during the test.

Then the fire is shielded and can develop again.

This happen every test in another way.

To create a test setup that is reproducible, then you maybe would have to find a fire load that cannot be changed in its shape and composition during fire.

But now this should be left as an impulse for further ideas. This should be well thought.

Another Idea to make the fire tests easier are to determine the reference values before the tests and prescribe in the acceptance criteria

That also means you have to do a lot of fire tests with sprinkler and average it, to get the handicap value for approval tests of water mist. But it takes much money.



Or

Do at least 3 tests of each scenario during the approval test series and average the results.

This way it is possible to pass the test with sprinkler and also with water mist close to the real average of all results.

That means you have to do more tests during the approval

But also,

A lower risk of having a “good day” of the sprinkler.

And I think there are many more Ideas



Thank you for your attention ...

Je vous remercie de votre attention ...