

SPS Availability Statistics 2024

Information I

These slides are a template to summarize availability of your machine in 2024. Please correct and complement the slides considering the following questions:

- What are the main events & challenges impacting availability this year?
 - Is this shown in the data, and does it match your expectations?
 - Is any crucial aspect not visible in the data that should be pointed out?
- What is the outlook for next year?
 - Are you expecting interventions over YETS that might improve availability?
 - Could certain circumstances lead to an availability degradation?

Information II

- There will be additional questions on each slide. Feel free to spread out comments over multiple slides as required
- **We only need reviews of 2024.** Previous years are already well covered (e.g. see the Special RAWG on Accelerator Availability 2023, linked)
<https://indico.cern.ch/event/1340975/>
- All SPS faults this year can be found at:
https://aft.cern.ch/search?timePeriod=%257B%2522timePeriodType%2522%253A%2522fixed%2522%252C%2522startTime%2522%253A%252201012024000000%2522%252C%2522endTime%2522%253A%252201012025000000%2522%257D&accelerator=SPS&hadStates=BLOCKING_OP&excludedFaultStates=NON_BLOCKING_OP%252CUNDERSTOOD%252CSUSPENDED

Availability Schedule

Availability is counted over time periods as follows:

- L4, PSB, PS, SPS: starts once beam is required by a downstream machine
- L3, LEIR starts once beam is delivered to LHC
- LHC starts with beam commissioning
- ISOLDE, AD/ELENA, EAST, NORTH starts with respective physics period

Dedicated MDs and Technical Stops are excluded from availability monitoring.

SPS time periods are on the next page. [Should these times be wrong, please correct them and let us know](#)

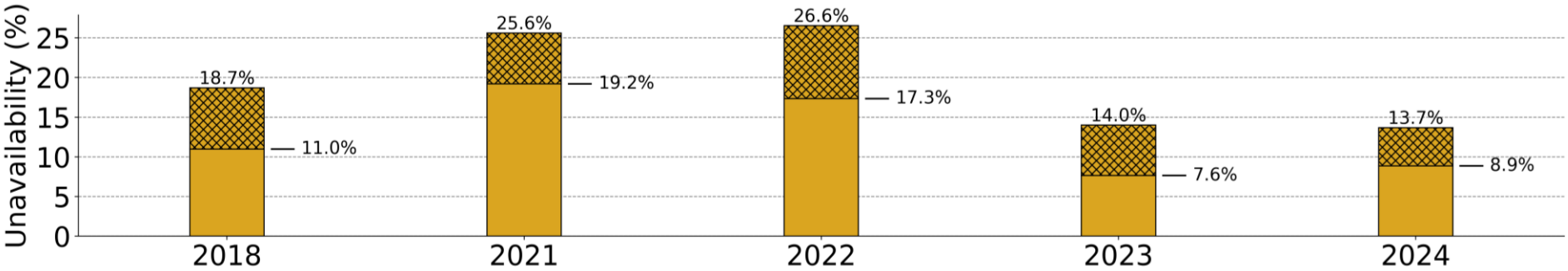
SPS Physics Periods

- ('15-03-2018 09:00:00', '18-06-2018 09:00:00')
- ('20-06-2018 09:00:00', '17-09-2018 09:00:00')
- ('19-09-2018 09:00:00', '10-12-2018 06:00:00')
- ('28-06-2021 09:00:00', '15-09-2021 14:00:00')
- ('16-09-2021 11:00:00', '15-11-2021 06:00:00')
- ('18-04-2022 09:00:00', '17-05-2022 04:00:00')
- ('17-05-2022 17:00:00', '13-09-2022 08:00:00')
- ('14-09-2022 12:00:00', '28-11-2022 06:00:00')
- ('03-04-2023 00:00:00', '10-05-2023 08:00:00')
- ('10-05-2023 12:00:00', '19-06-2023 20:00:00')
- ('21-06-2023 20:00:00', '30-10-2023 06:00:00')
- ('08-03-2024 09:00:00', '17-04-2024 08:00:00')
- ('17-04-2024 18:00:00', '24-04-2024 08:00:00')
- ('24-04-2024 18:00:00', '08-05-2024 08:00:00')
- ('08-05-2024 18:00:00', '22-05-2024 08:00:00')

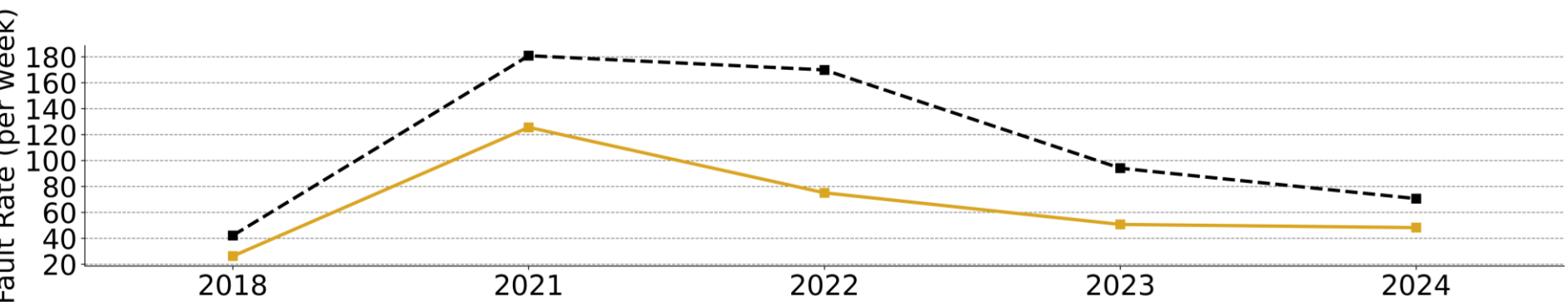
- ('22-05-2024 18:00:00', '29-05-2024 08:00:00')
- ('29-05-2024 18:00:00', '12-06-2024 07:30:00')
- ('14-06-2024 23:00:00', '19-06-2024 08:00:00')
- ('19-06-2024 18:00:00', '24-07-2024 08:00:00')
- ('24-07-2024 18:00:00', '29-07-2024 08:00:00')
- ('29-07-2024 20:00:00', '30-07-2024 08:00:00')
- ('30-07-2024 20:00:00', '31-07-2024 08:00:00')
- ('31-07-2024 18:00:00', '28-08-2024 08:00:00')
- ('28-08-2024 18:00:00', '11-09-2024 08:00:00')
- ('11-09-2024 18:00:00', '02-10-2024 08:00:00')
- ('02-10-2024 18:00:00', '16-10-2024 08:00:00')
- ('16-10-2024 18:00:00', '24-10-2024 08:00:00')
- ('24-10-2024 18:00:00', '13-11-2024 08:00:00')
- ('13-11-2024 18:00:00', '20-11-2024 08:00:00')
- ('20-11-2024 18:00:00', '02-12-2024 06:00:00')

2024 in Context

Injector Complex Accelerator



With injector complex Accelerator only



Does 2024 match your expectations?

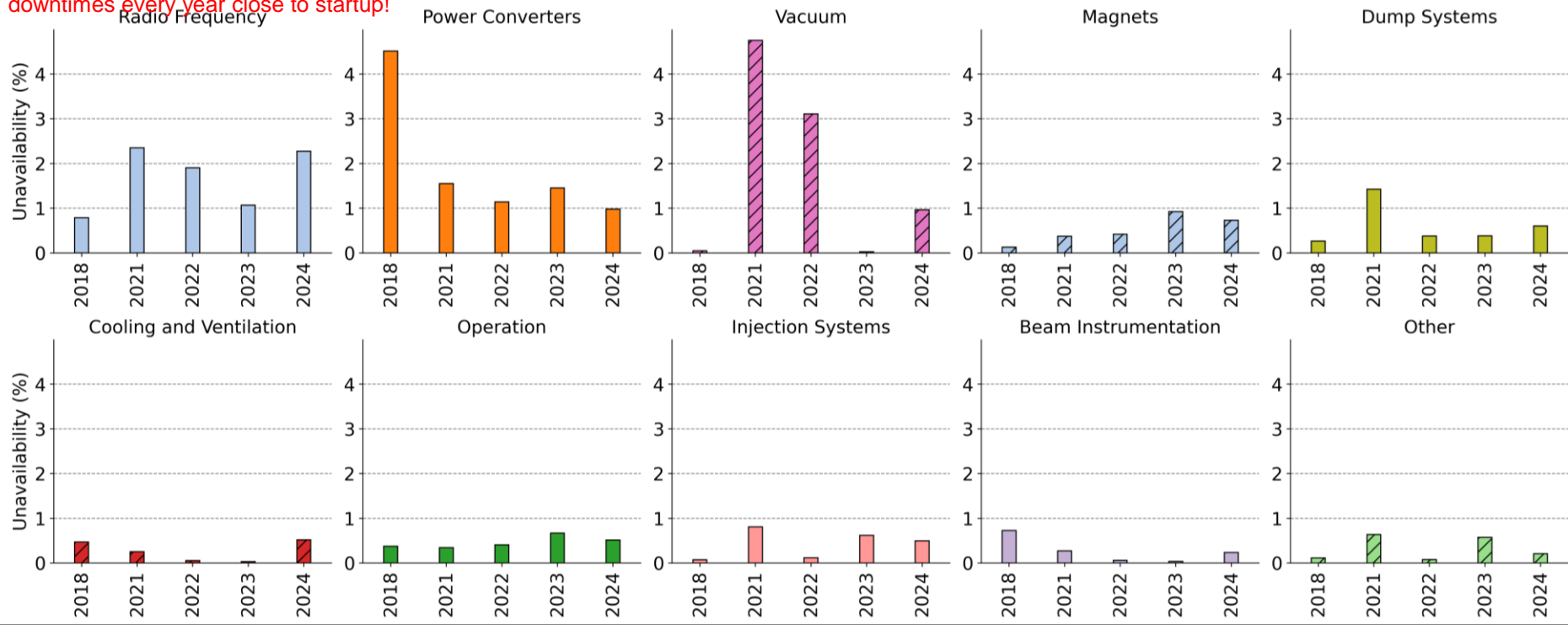
What could be responsible for the observed trends?

This fits quite well with what I would expect – we had fewer faults, but those that came in, were really long, lasting sometimes for more than a day!

System Downtime

Quite a few issues this year with the cavities, 1, 3 & 6 with many hours downtime – so not a surprise. Big problems with CV in BA3 after non-return valve removal, also there, expect big fault. Vacuum and magnets led to exchange of 4 dipoles which makes up for quite some time as well. I am surprised to see such an impact on power converters; maybe that's TI2, T18 lines, or also the SMD stations, for which we have quite heavy downtimes every year close to startup!

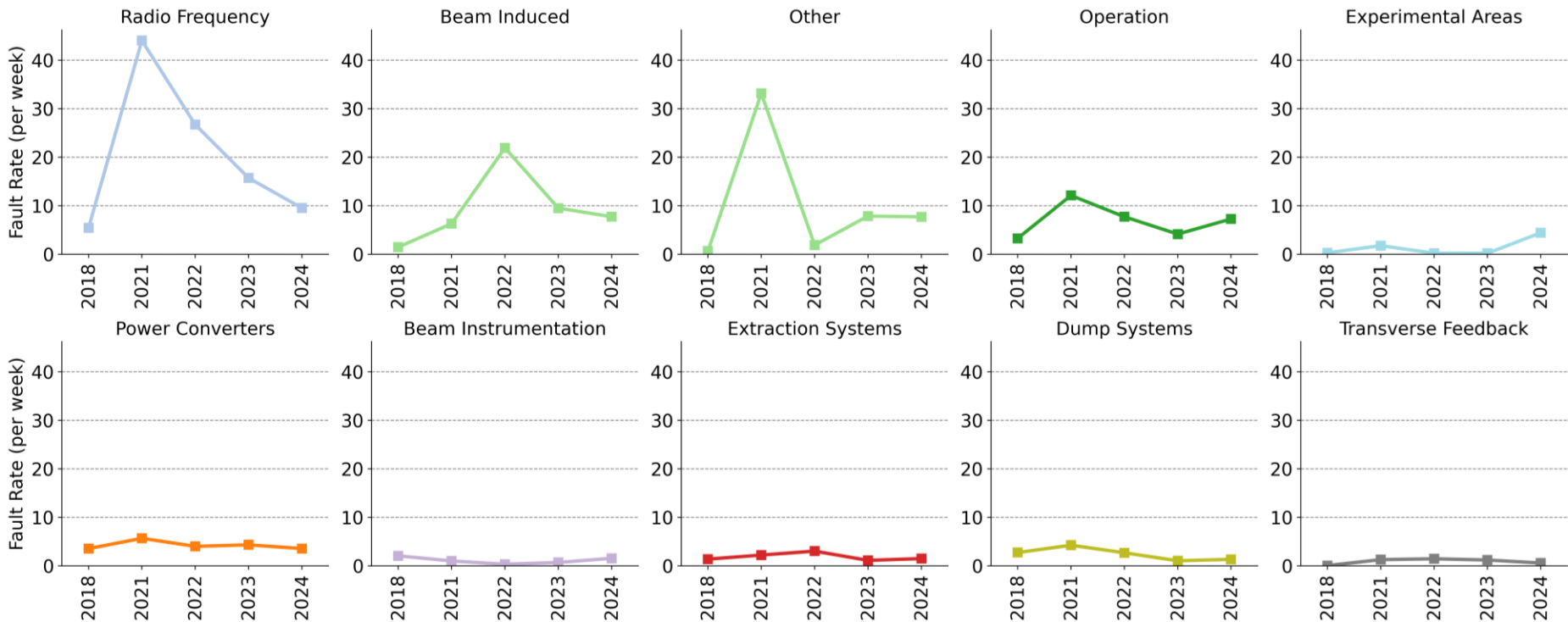
Please elaborate on the main events and down time.
Can any trends be easily explained?



System Failure Rate

RF mitigations are foreseen, the hope is that this will improve; the BA3 problem might still have some spurious pieces in the cooling circuit, but a lot of cleaning has already been done; magnets are expected to keep failing at given rate...

Are any mitigations foreseen?
How to you expect this to evolve in 2025?



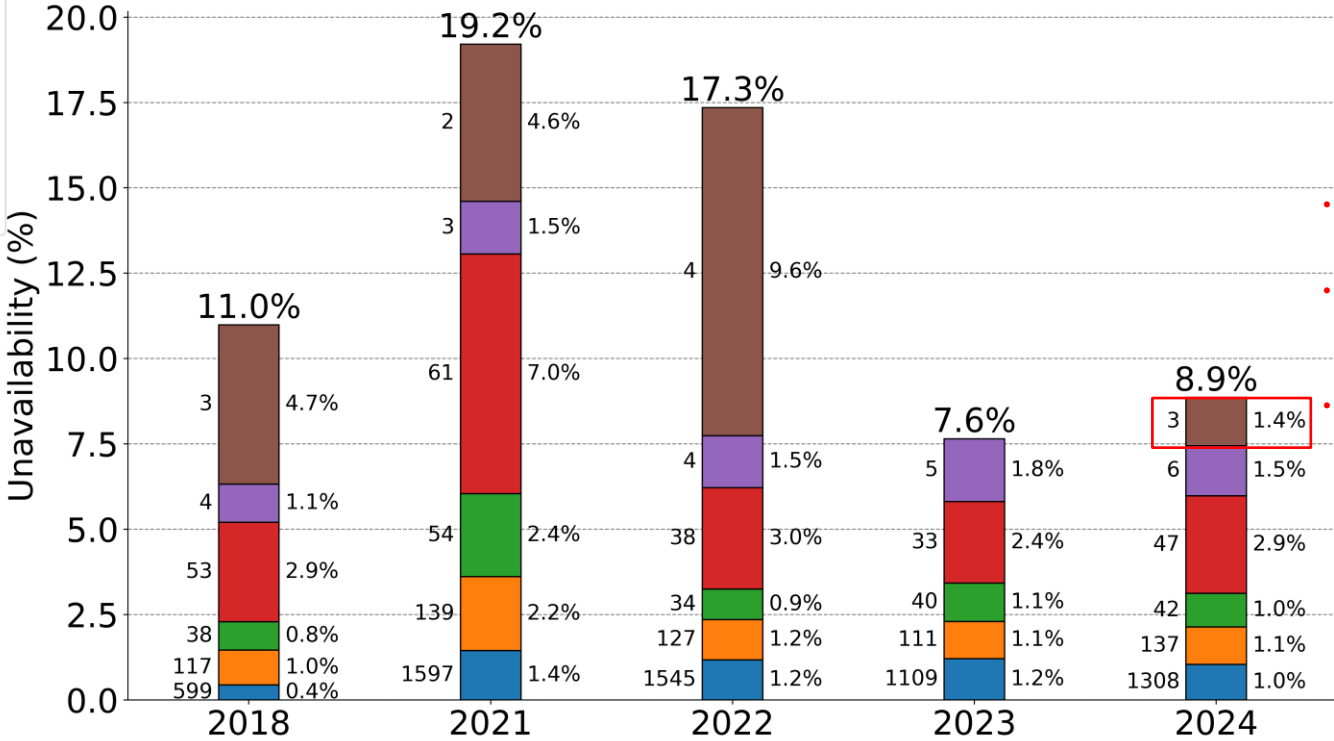
Unavailability by Duration

As expected – hope to reduce the long downtimes next year – in particular from RF and CV!

Do these trends match your expectations?
Any positive trends worth remarking?
Are any trends worrying?

(w/o injector complex)

SPS



- Magnets: MBB 635.30 inter-turn short, 1d 9h, 10 Jun
- Vacuum: Exchange of magnet MBA.63450 with leaking vacuum chamber, 1d 3h, 30 May
- CV: Water circuit blocked, 1d 3h, 25 Jun

Summary & Conclusion

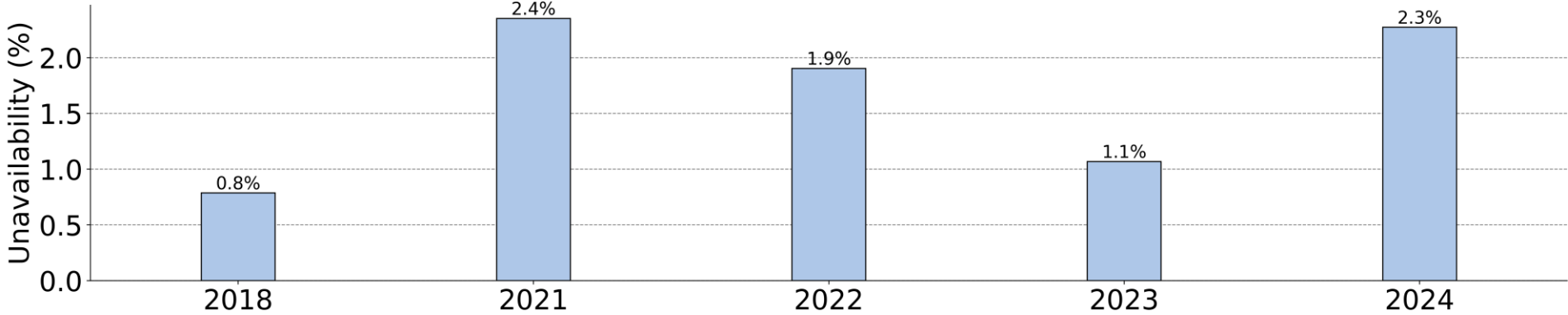
- Main message and conclusion for 2024?
 - Plagued by quite a few big systems failures such as RF, CV, EPC, and magnets (4 failures!) in '24
 - Dipole failures are still within statistics, though; RF being consolidated and CV has been cleaned
- Would you like us to provide AFT statistics for a specific problem in more detail?
 - Problems with access system management – patrol broken due to careless manipulations, this is never recorded, as it happens during stop periods; how can this be made more apparent?
- What is the outlook for next year? Are there any availability problems expected unless they are addressed over the YETS?
 - Nope
- Desiderata for fault tracking and AFT tool?
 - Removal of faults below 2 minutes...
 - Still a bit “clunky” (admittedly not very quantitative predicate) to use, but probably to be expected with web UI technology

Appendix – top 5 systems for unavailability

For additional information / interest.

We will follow up on specific equipment down time with the relevant experts separately, but feel free to comment if you see something.

SPS - Radio Frequency



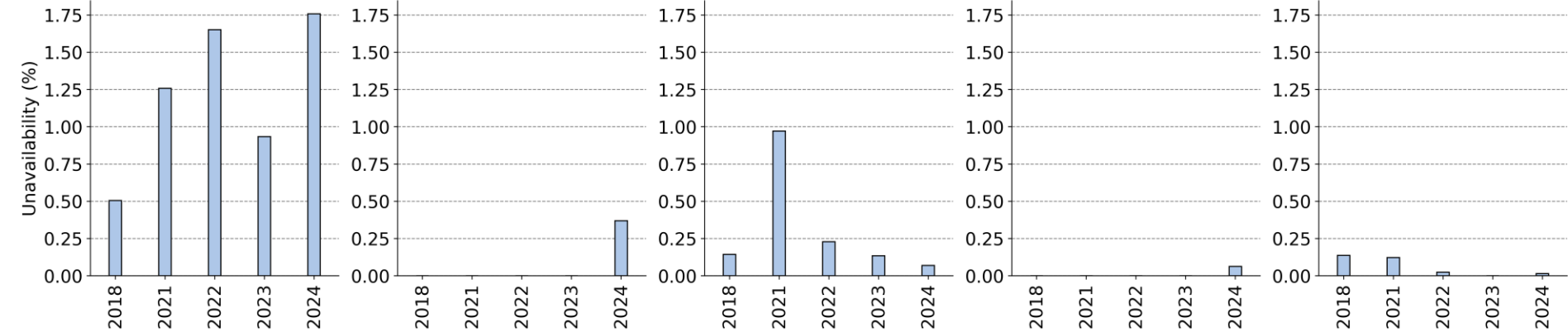
RF Power System

RF Structures

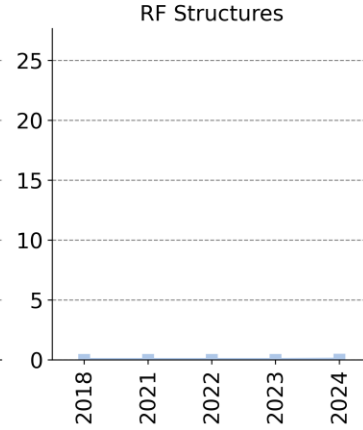
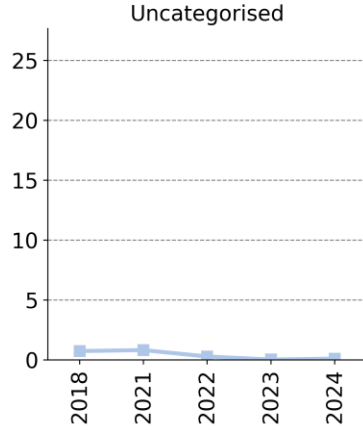
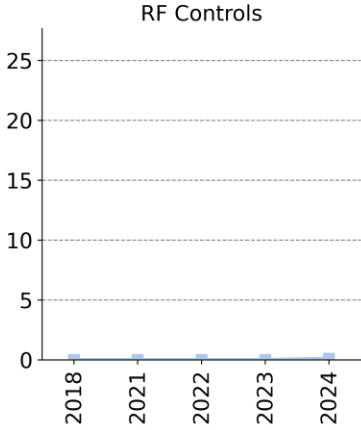
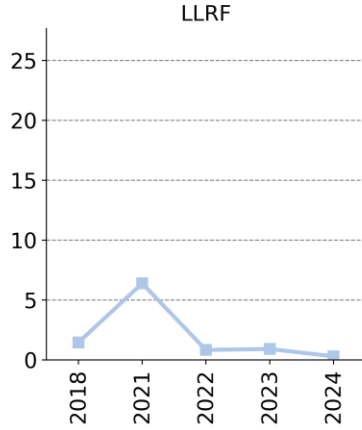
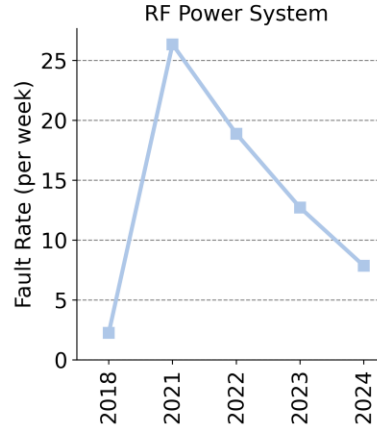
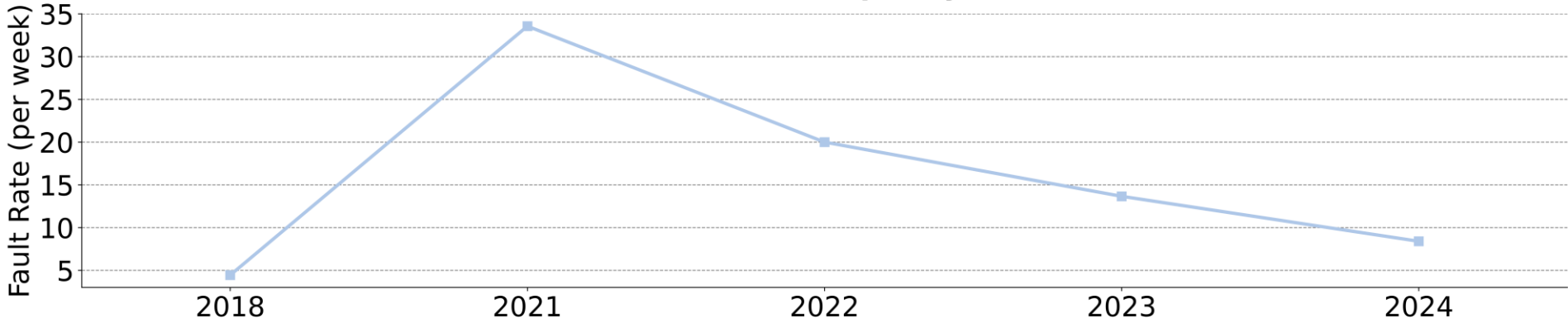
LLRF

RF Controls

Uncategorised

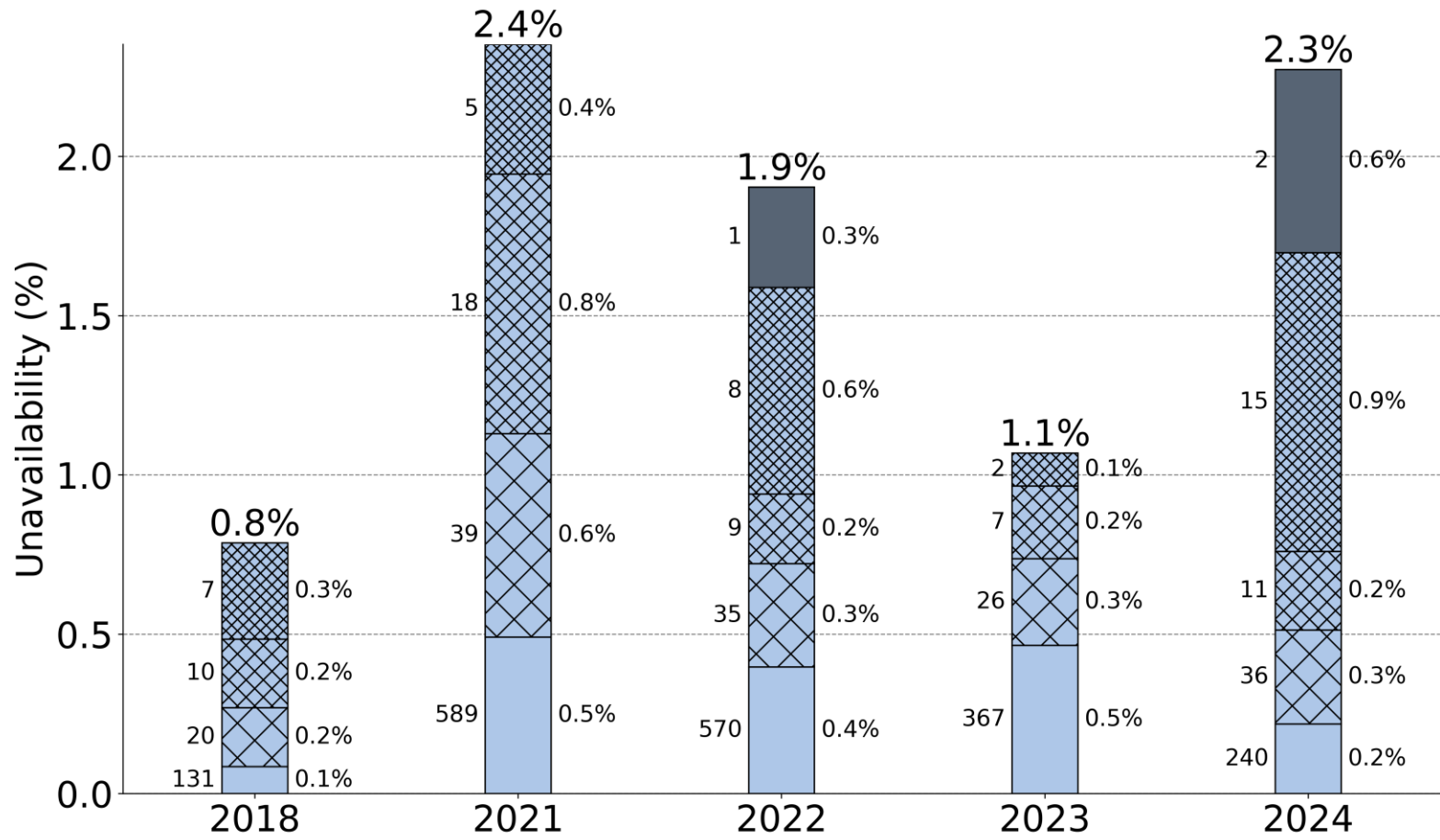


SPS - Radio Frequency

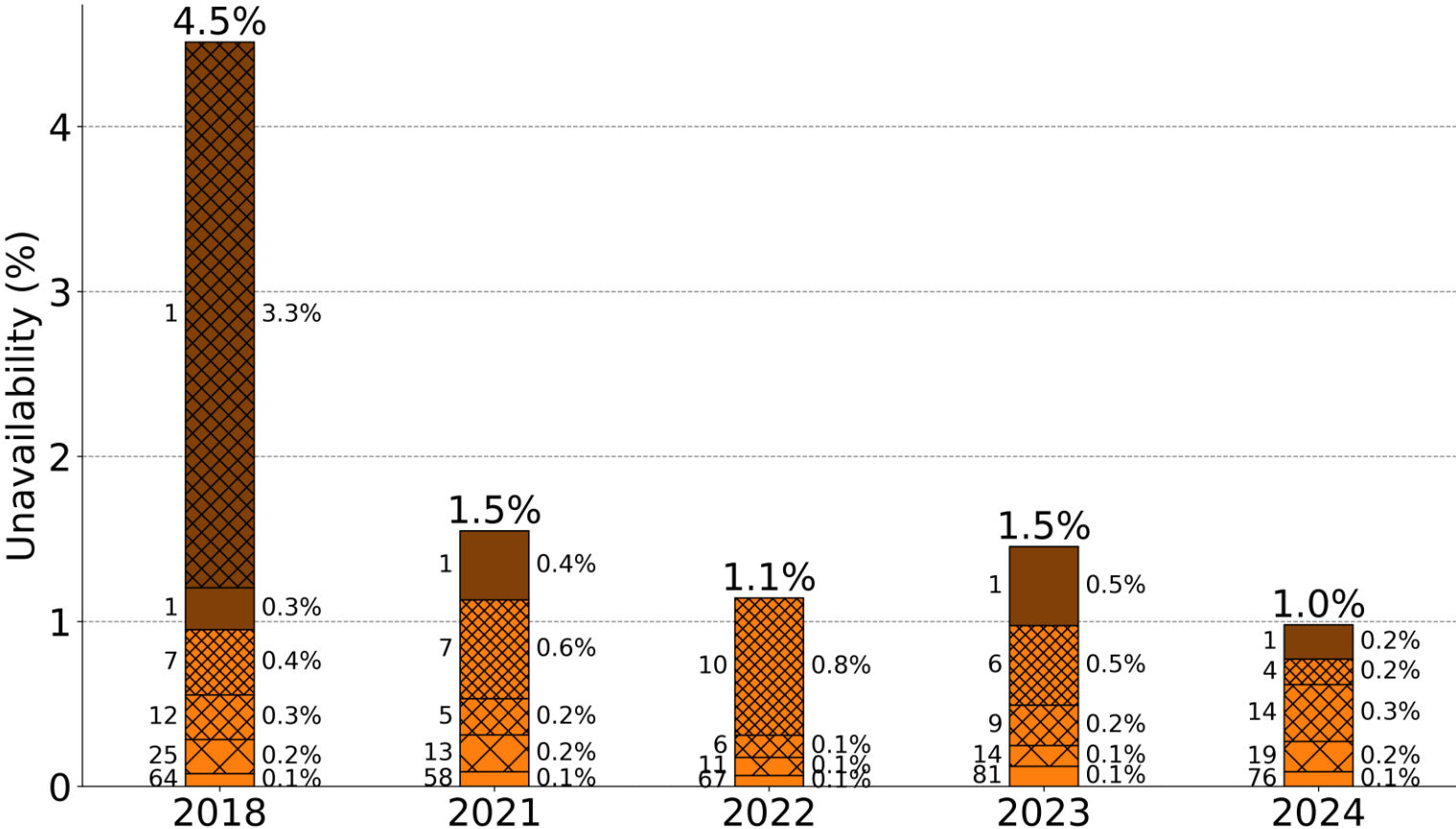
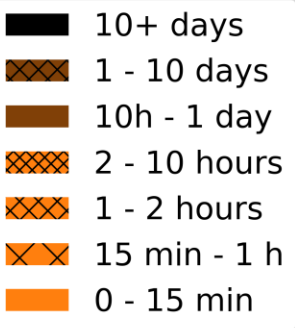


SPS - Radio Frequency

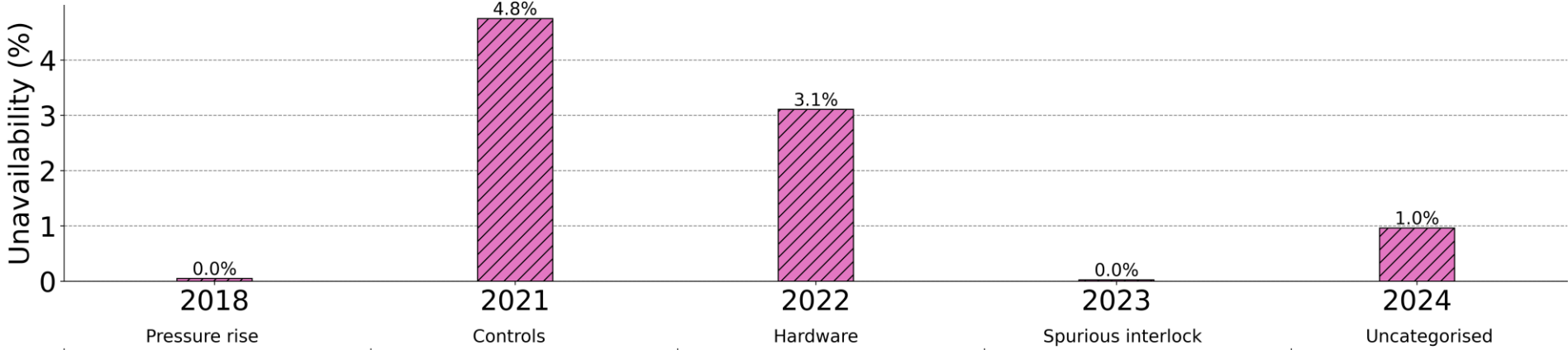
- 10+ days
- 1 - 10 days
- 10h - 1 day
- 2 - 10 hours
- 1 - 2 hours
- 15 min - 1 h
- 0 - 15 min



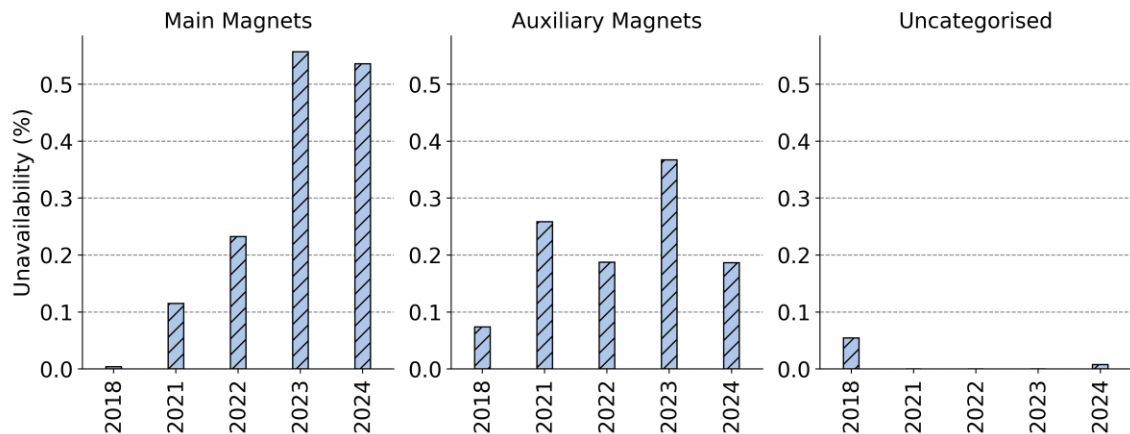
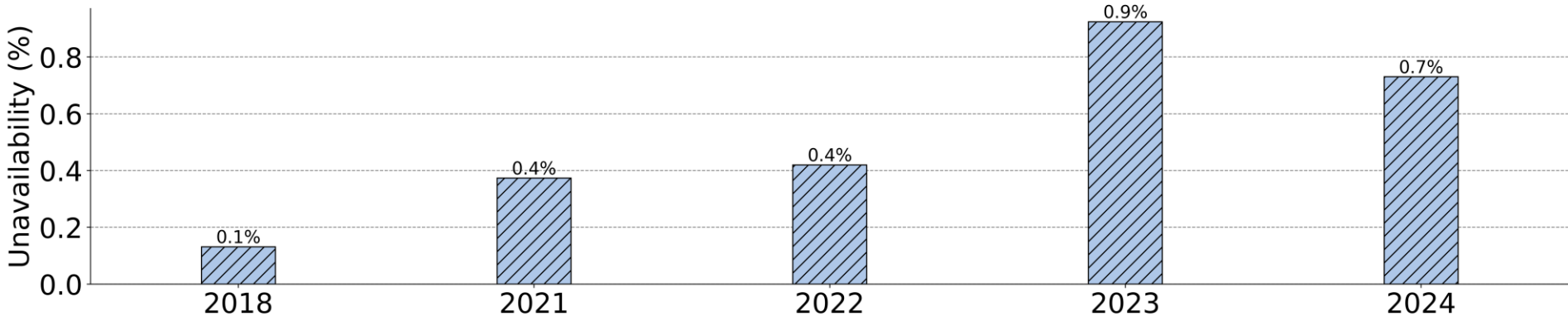
SPS - Power Converters



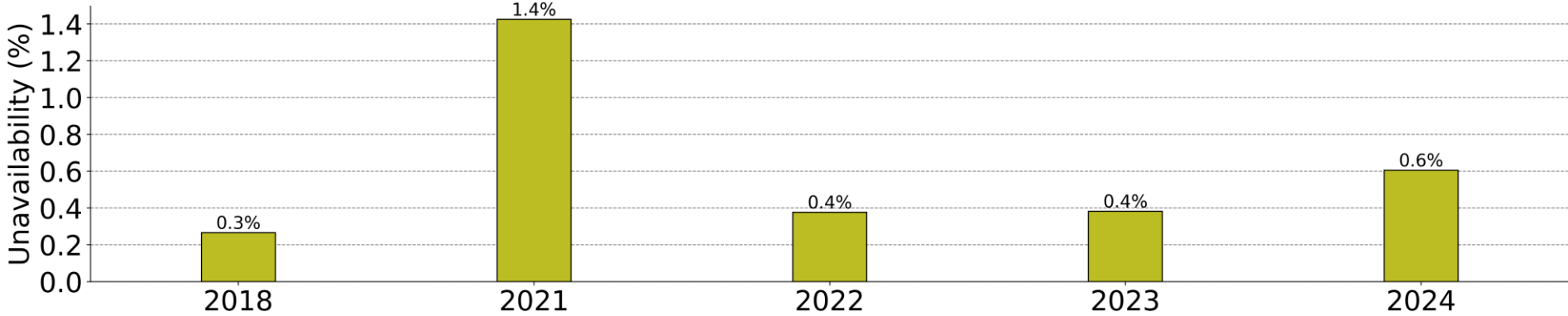
SPS - Vacuum



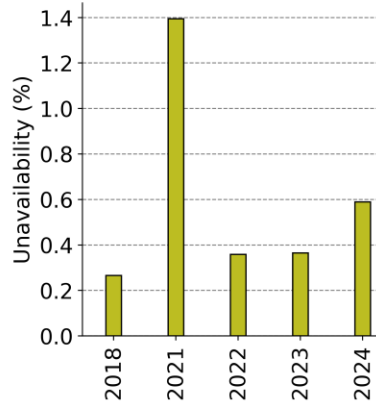
SPS - Magnets



SPS - Dump Systems



Kickers



MKD soft start

