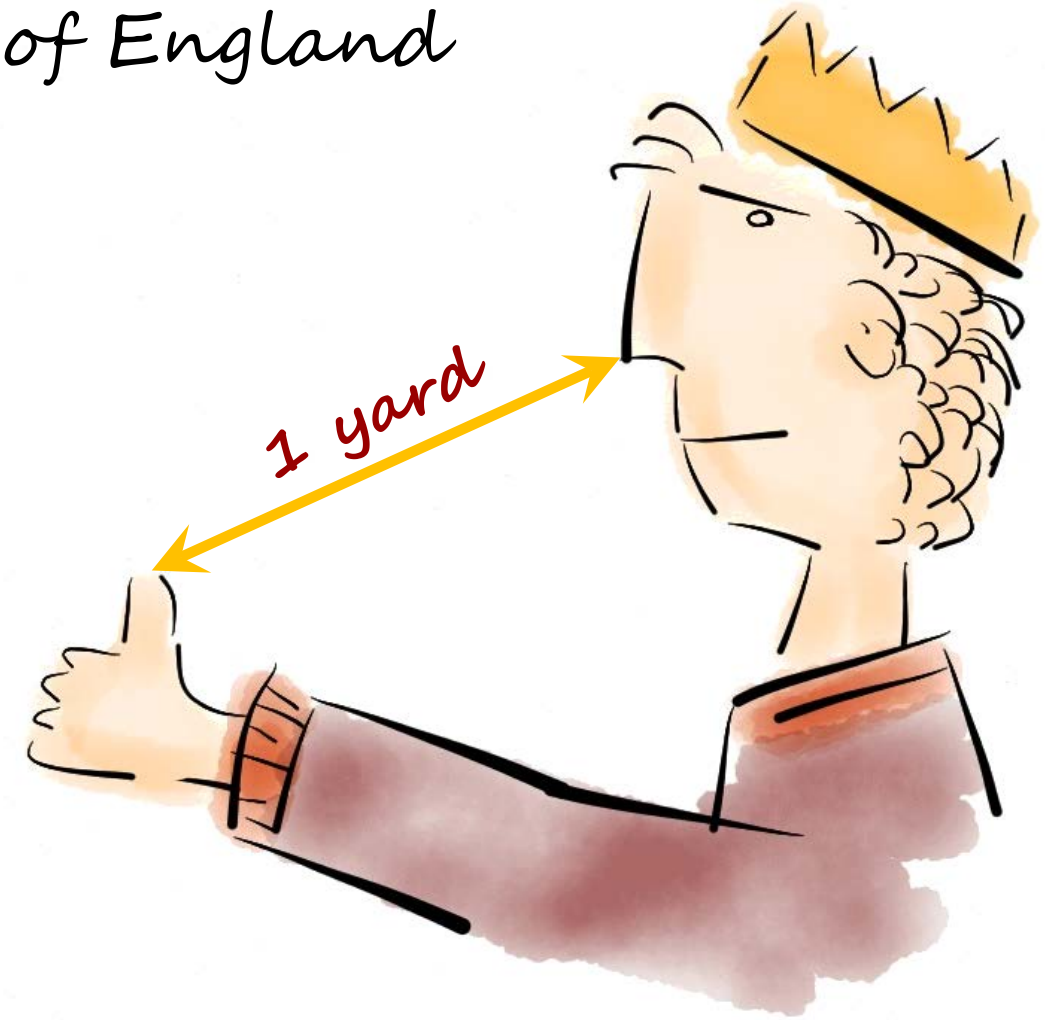
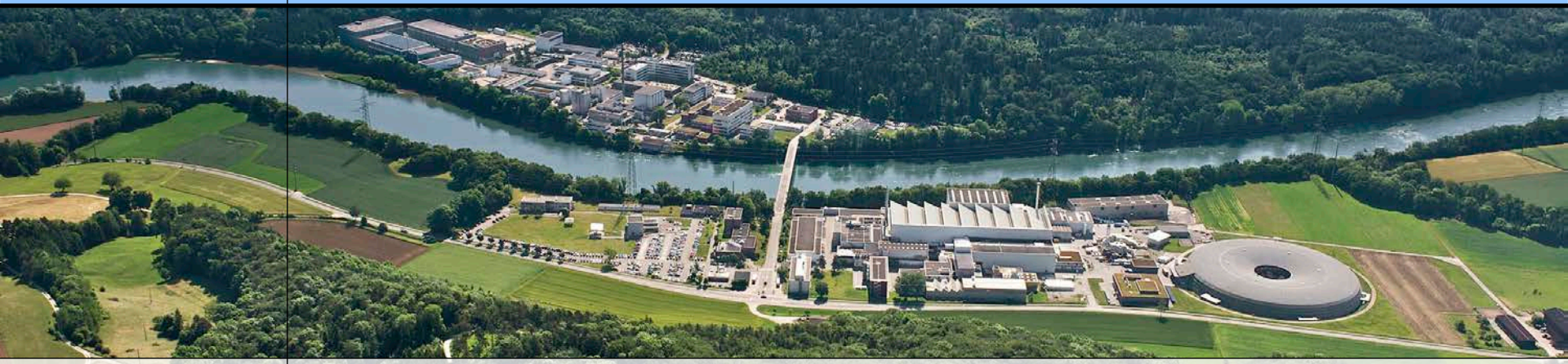
King Henry I of England



Serving a market demand:
Comparison requires a common standard!

PAUL SCHERRER INSTITUT

PSI



Wir schaffen Wissen – heute für morgen

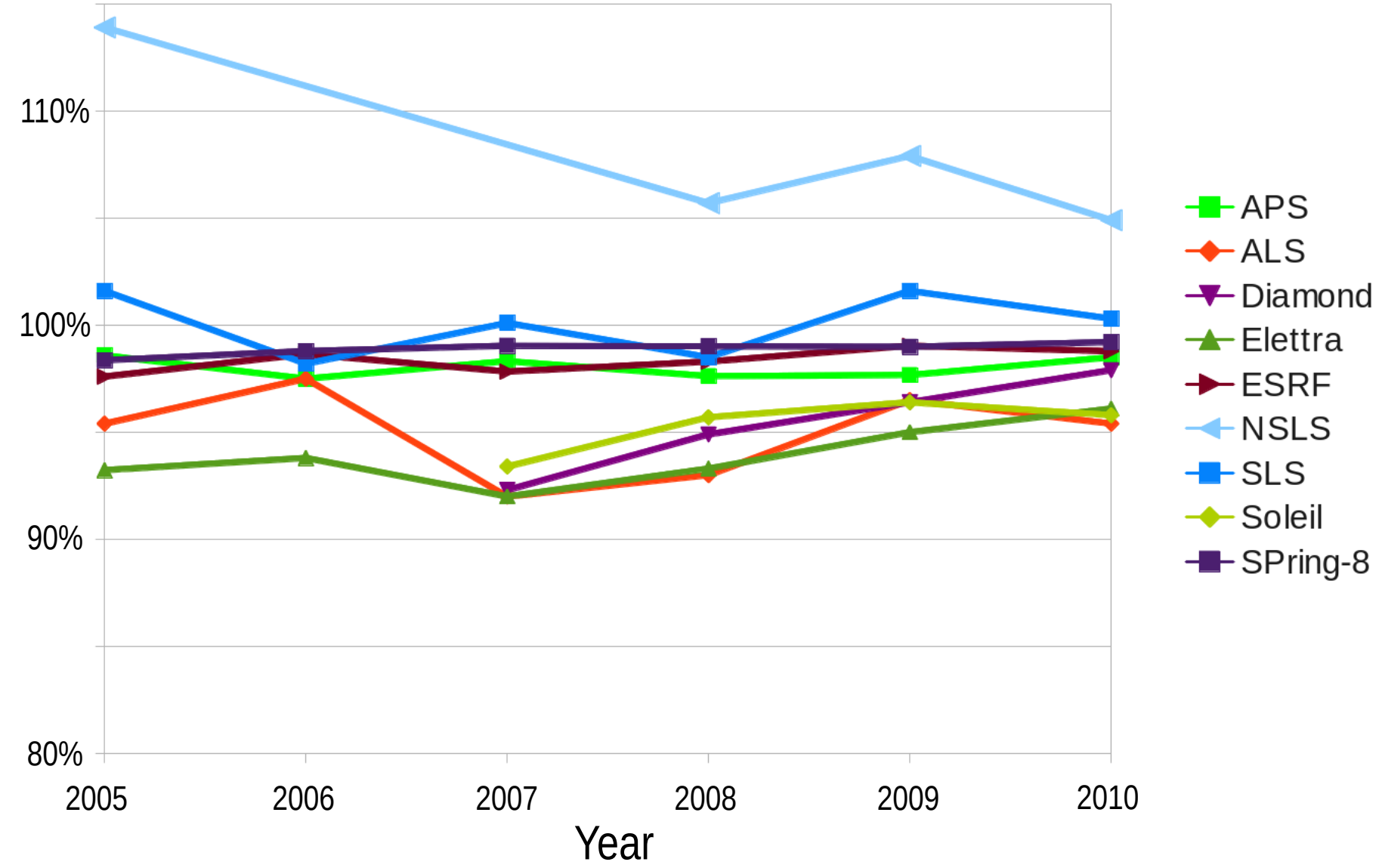
Paul Scherrer Institut

Andreas Lüdeke, on behalf of the Initiative Team for:

A Common Operation Metric for 3rd Generation Light Sources

How do we compare Accelerator Operation Reliability?

Beam Availability



Survey on Failure Analysis of ten Light Sources

- How do you exactly define “beam downtime”?
- How do you exactly define “beam availability”?

Survey published: A. Luedeke, Phys. Rev. ST Accel. Beams 12, 024701 (2009)

- No two facilities were calculating “beam availability” in the same way!
- Some examples:
  - **Downtime**: often defined in common sense rules.
  - **Short up-time:** some did count every up-time, some dismiss up-times up to 1 hour.
  - **Compensation time**: some subtract it from downtime, some not.

- “Beam availability”: shows reliability of one facility over time; BUT
- Comparison of numbers from different facilities is meaningless!!!

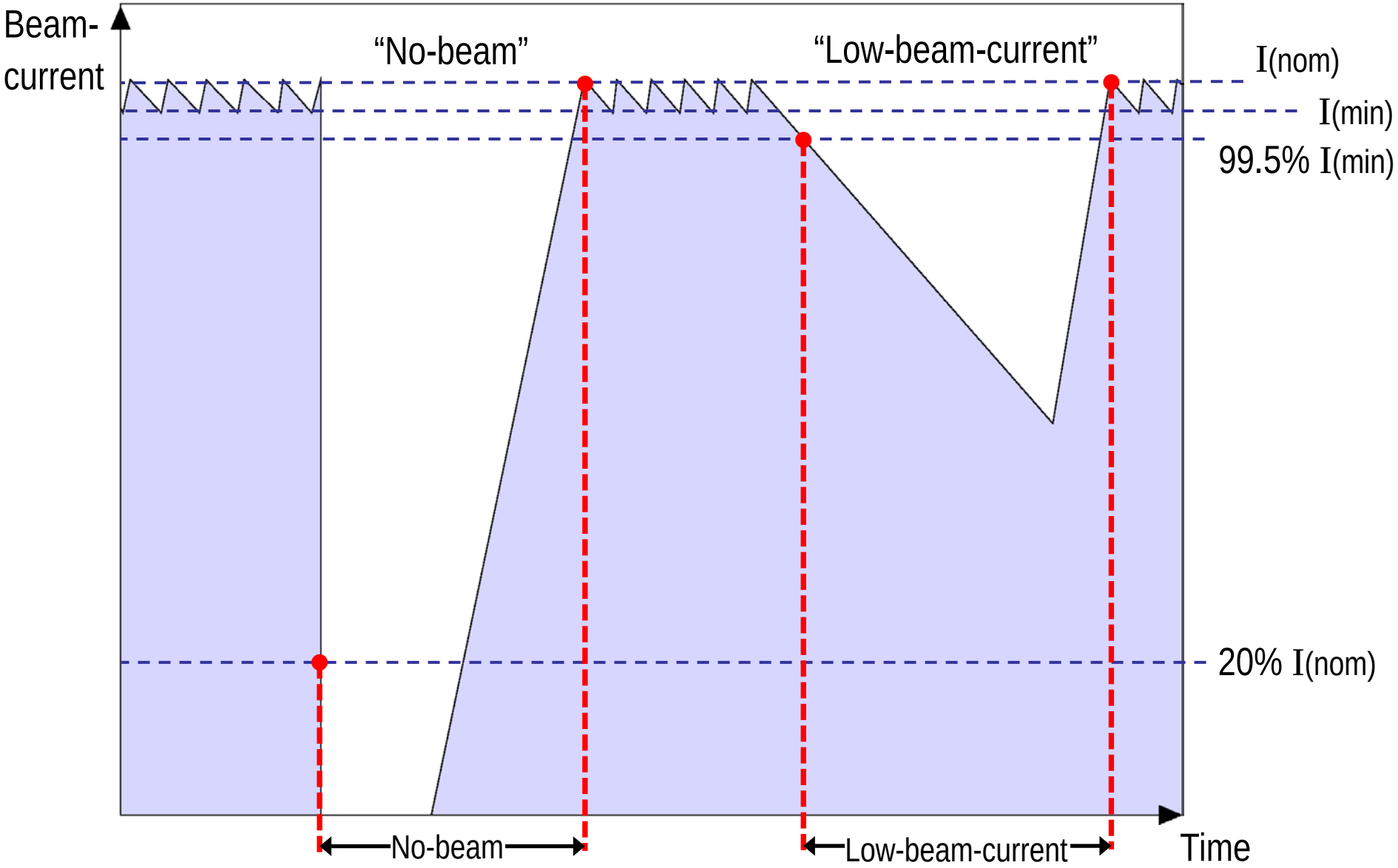
Accelerator Reliability Workshop 2013, Melbourne

- Michael Bieler from DESY initiated a discussion round:
  "How do we measure Accelerator Reliability at our Light Sources?"
- Survey results from 2008 reproduced.
- Michael's conclusion:
  We need a world wide common standard on accelerator reliability!
- We've started the initiative for
  A Common Operation Metrics for 3rd Generation Light Sources

How to define this Standard?

- Redefine “downtime” and “beam availability”?
- No, that would not work:
  - Risk of ambiguity.
  - Risk of resistance.
  - Too simple to be meaningful.
- Instead start with a list of common failure modes.

Primary Failure Modes



Secondary Failure Modes

- Low lifetime
- Beam blow-up
- Distorted orbit
- Distorted bunch filling
- Bunch impurity
- Beam unrelated
- Short user uptime
- Beam feedback outages

User Schedule Statistics

- Scheduled User Experiment Time (users scheduled > 1 month ago)
- Scheduled User Reserve Time (user re-scheduled ≥ 1 month ago)
- Spontaneous User Compensation Time (user re-scheduled < 1 month ago)
- User Time: sum of the above

- Example: Vacuum leak, 5 days beam outage
  - Management decision:
    - 5 days for repair used as shutdown,
    - next shutdown in two weeks shortened by 5 days.
  - Accounting:
    - “No-beam” event of 5 days.
    - Add 5 days to Spontaneous User Compensation Time.
    - This adds 5 days to User Time.

Failure Mode Statistics: what to publish?

- Publish for each failure mode:
  - Failure count
  - Total duration
- Publish user schedule statistics:
  - $T_{Scheduled}$
  - $T_{Reserve}$
  - $T_{Compensation}$
  - $T_{User} = T_{Scheduled} + T_{Reserve} + T_{Compensation}$

Failure Mode Statistics: how to use it?

- Simple beam availability:

$$A_{(simple)} = \frac{T_{User} - \sum T(\text{no-beam})}{T_{User}}$$

- Compensated beam availability:

$$A_{(compensated)} = \frac{T_{User} - \sum T(\text{no-beam})}{T_{User} - \left(T_{Compensation} + T_{Reserve}\right)}$$

- Mean Time Between Distortions:

$$MTBD = \frac{T_{User}}{Count(\text{no-beam}) + Count(\text{low-beam-current}) + Count(\text{orbit-fb-fail})}$$

Summary

- We propose a simple, distinct and standardized operation metrics:
  - Primary failure modes: clearly defined, easy to measure.
  - Secondary failure modes: work-in-progress.
  - Defined accounting for user schedule statistics.

- *Only such a standard allows a meaningful comparison of the reliability of 3rd generation light sources!*

I would like to thank my colleagues of the Initiative-Team:

- Michael Bieler, PETRA III at DESY,
- Montserrat Pont, ALBA at CELLS,
- Jean-Francois Lamarre, SOLEIL.

Visit us at our poster on Thursday: THPRI023

Or visit the web page http://sites.google.com/site/comi3gls or contact us.