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INSTITUT DE RADIOPROTECTION ET DE SÛRETÉ NUCLÉAIRE

A NEW POWER HISTORY GENERATOR TOOL (PROTO) FOR FRENCH NUCLEAR POWER STATIONS AT IRSN

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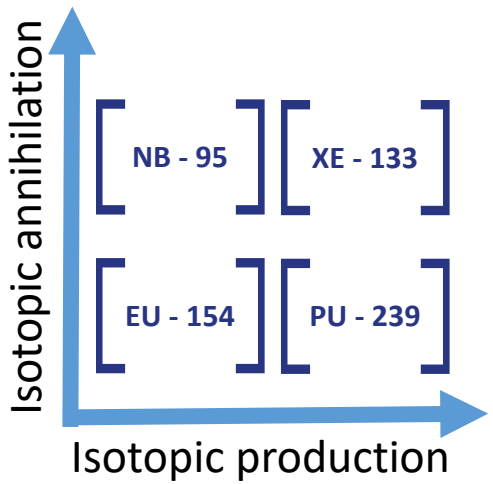
MEMBRE DE ETSON

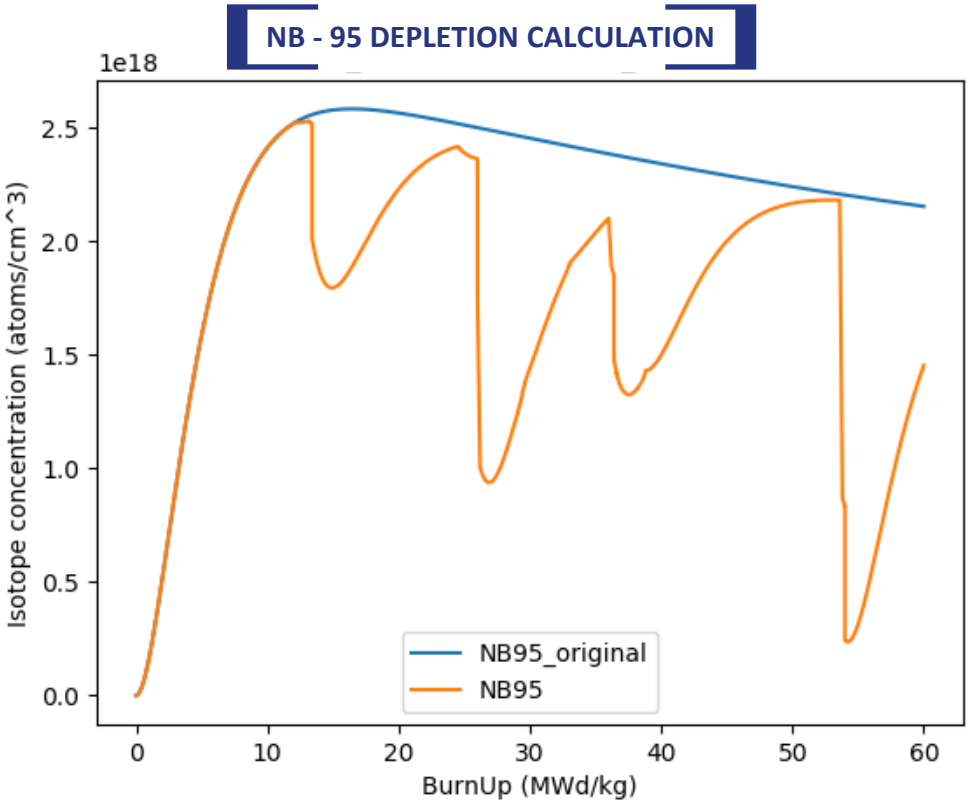
Outline

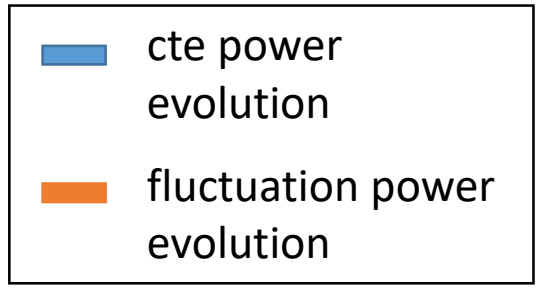
- Motivation
- Introduction to PROTO
  - Power variations study: Probability distributions
  - Histogram building (Monte Carlo routine)
- Output options
- Conclusions & Outlook

Motivation

- Project Goal: **Prediction of isotopic inventories in crisis situation** (specific isotopes, minimum reactor info, and instantaneous)
- Some nuclei present a strong dependence on power fluctuations



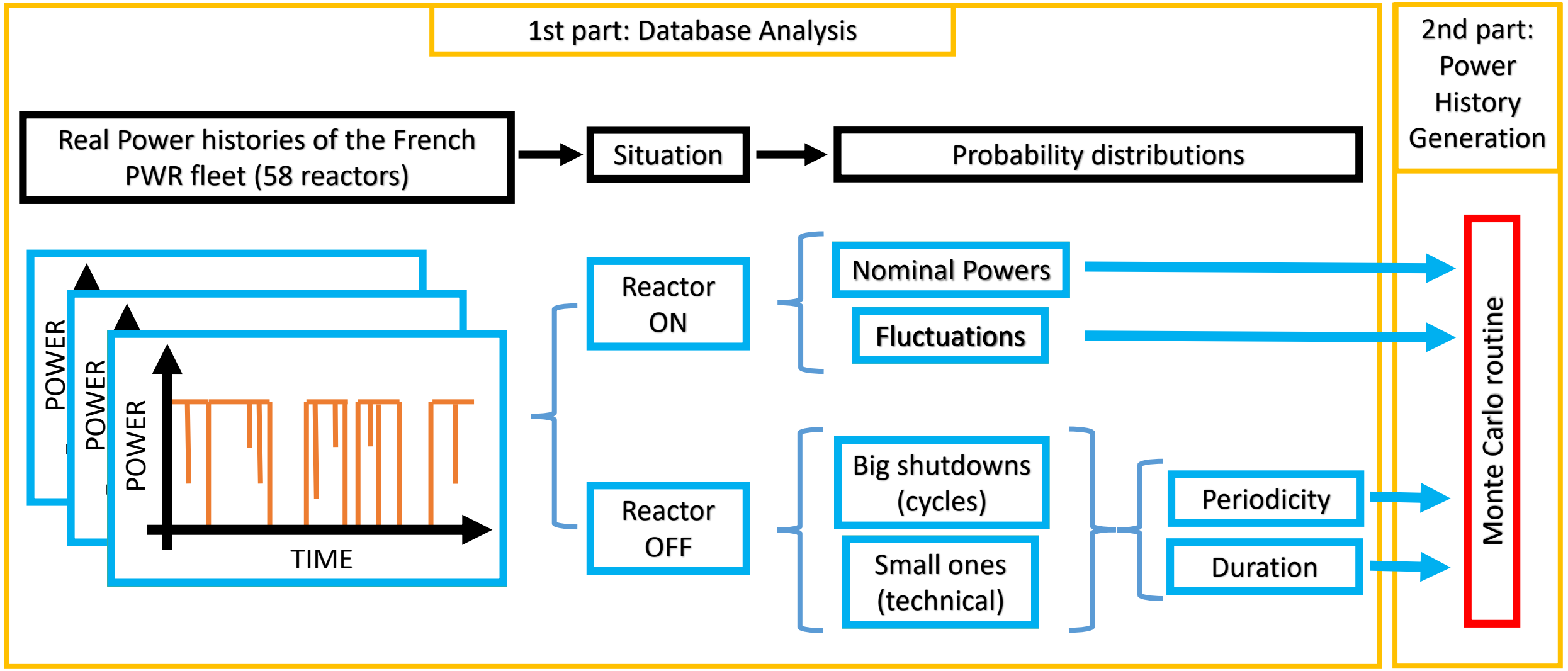




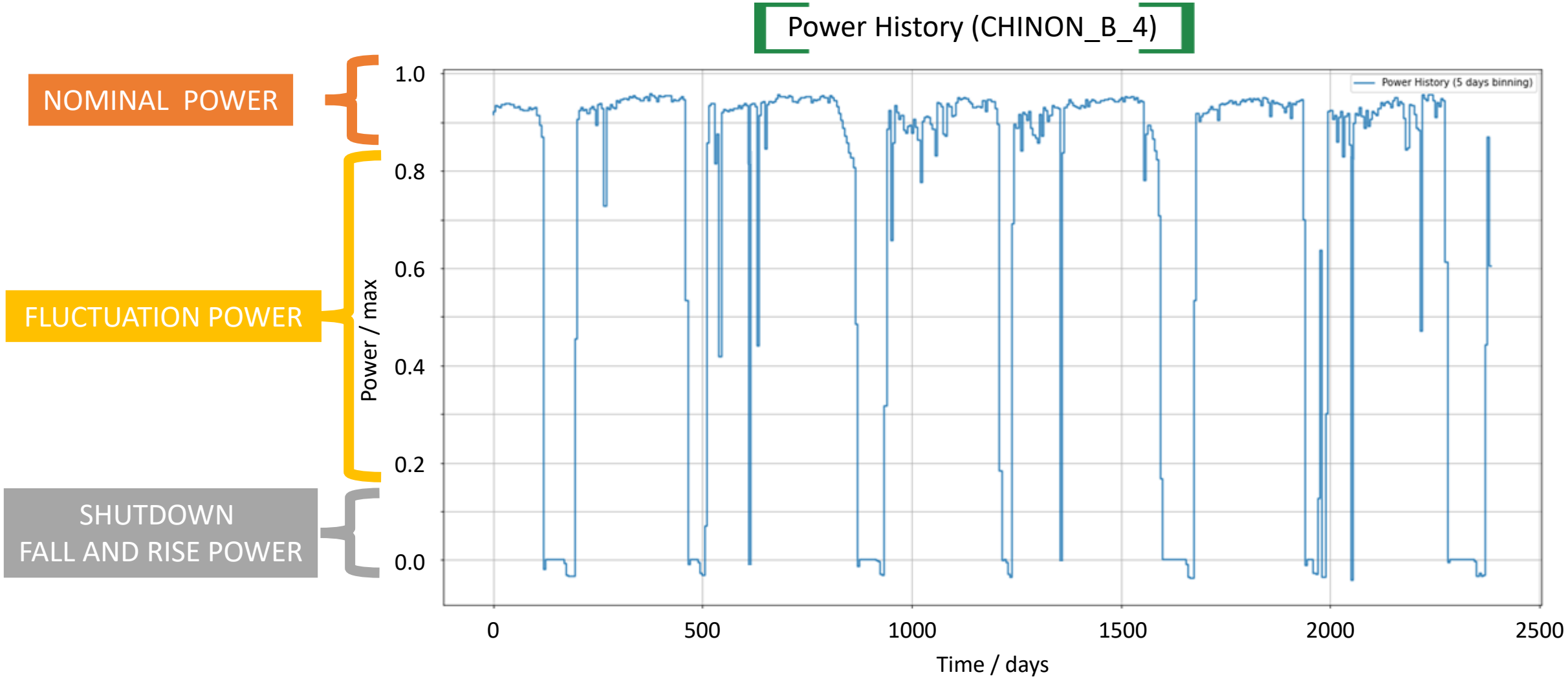
Motivation

- Project Goal: **Prediction of isotopic inventories in crisis situation** (specific isotopes, minimum reactor info, and instantaneous)
- Some nuclei present a strong dependence on power fluctuations
- Power fluctuations have an impact on the matter flux and inventories in the fuel cycle
  - Study real power fluctuations of reactors (electricity production records of RTE from 2012 to 2019)
  - In order to add these variations on fuel depletion calculations

PROTO (PoweR histOries generaTor tOol)



Reactor ON: Probability distributions



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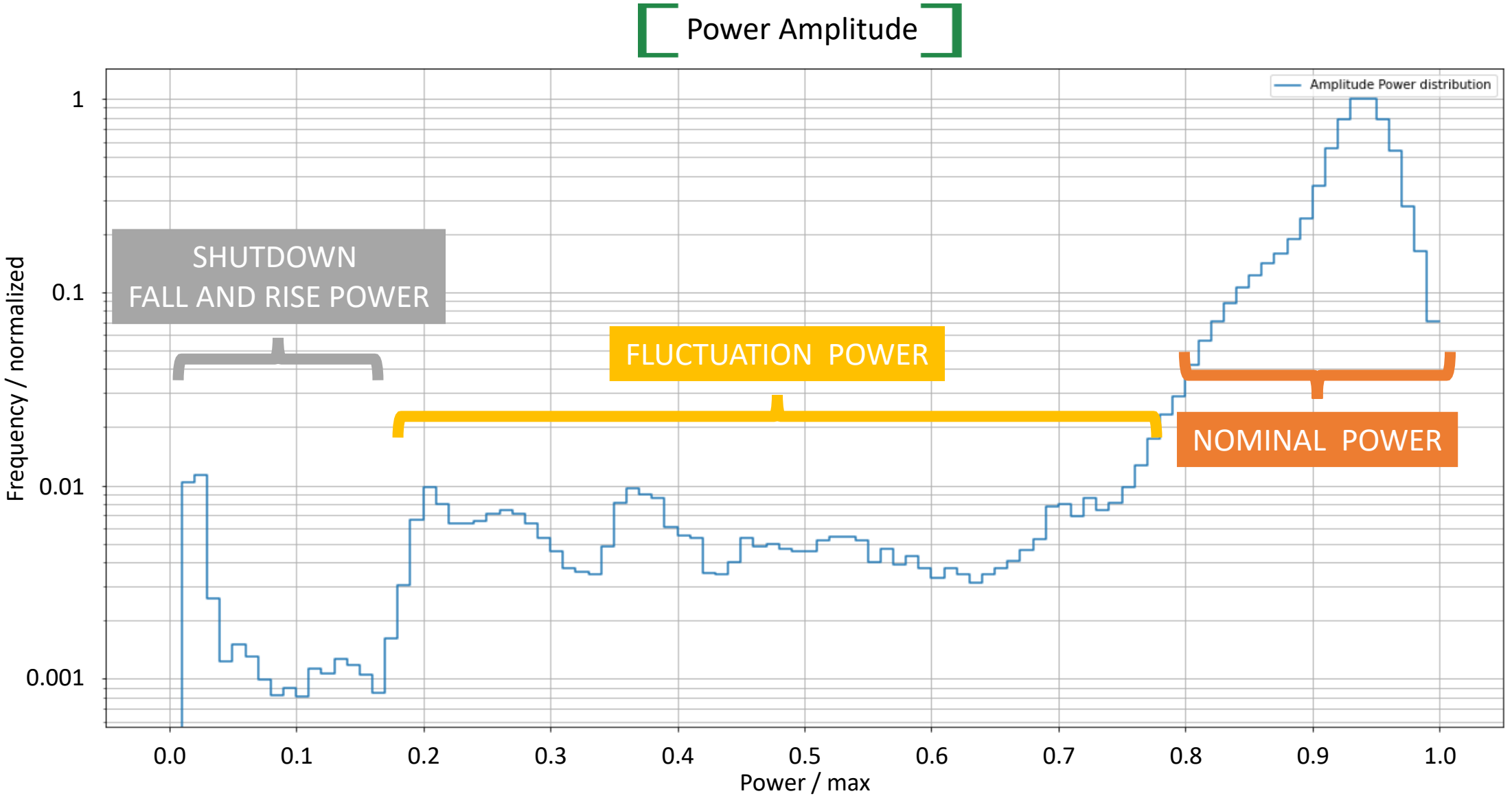
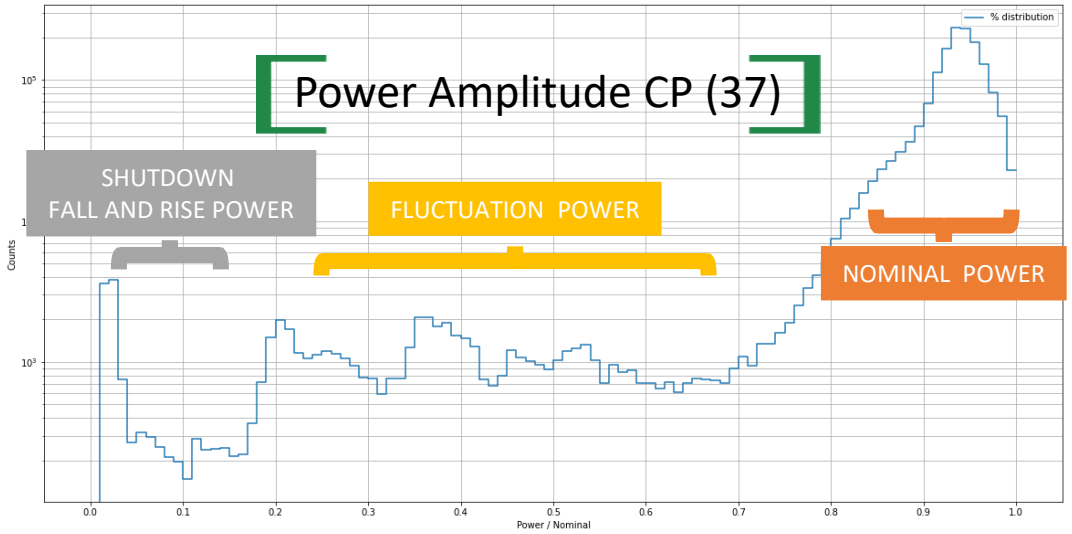
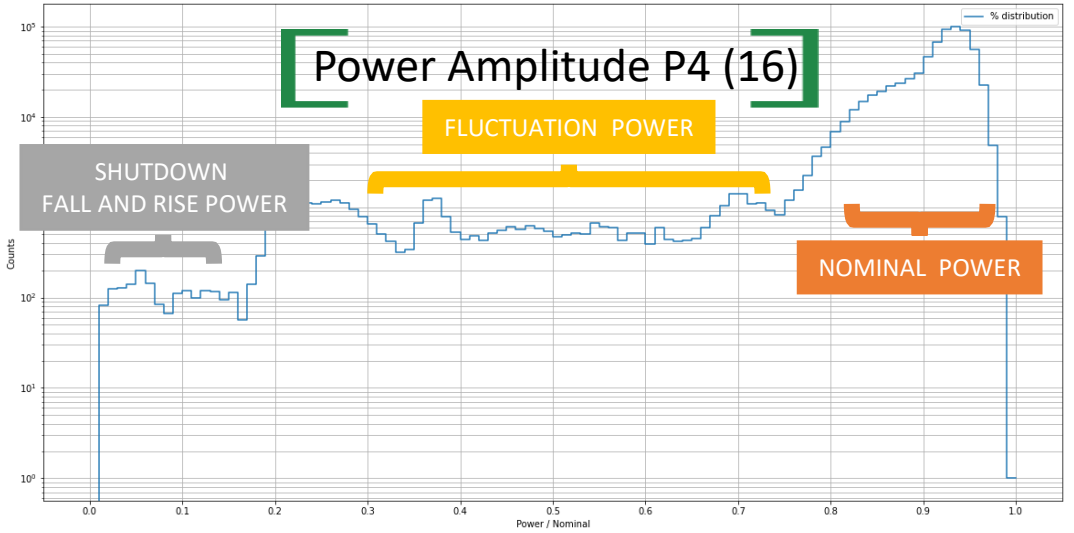
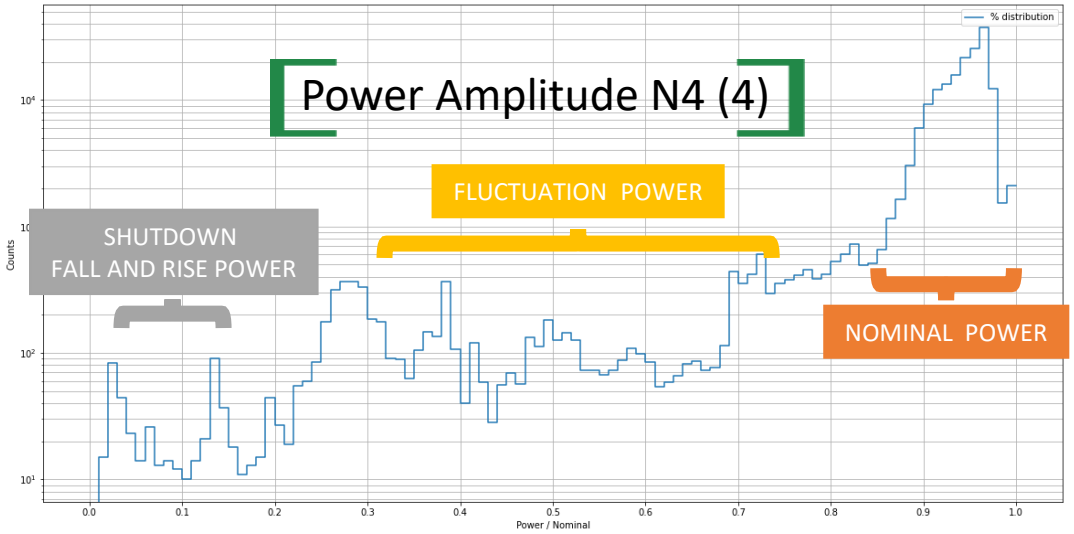


Reactor ON: Probability distributions

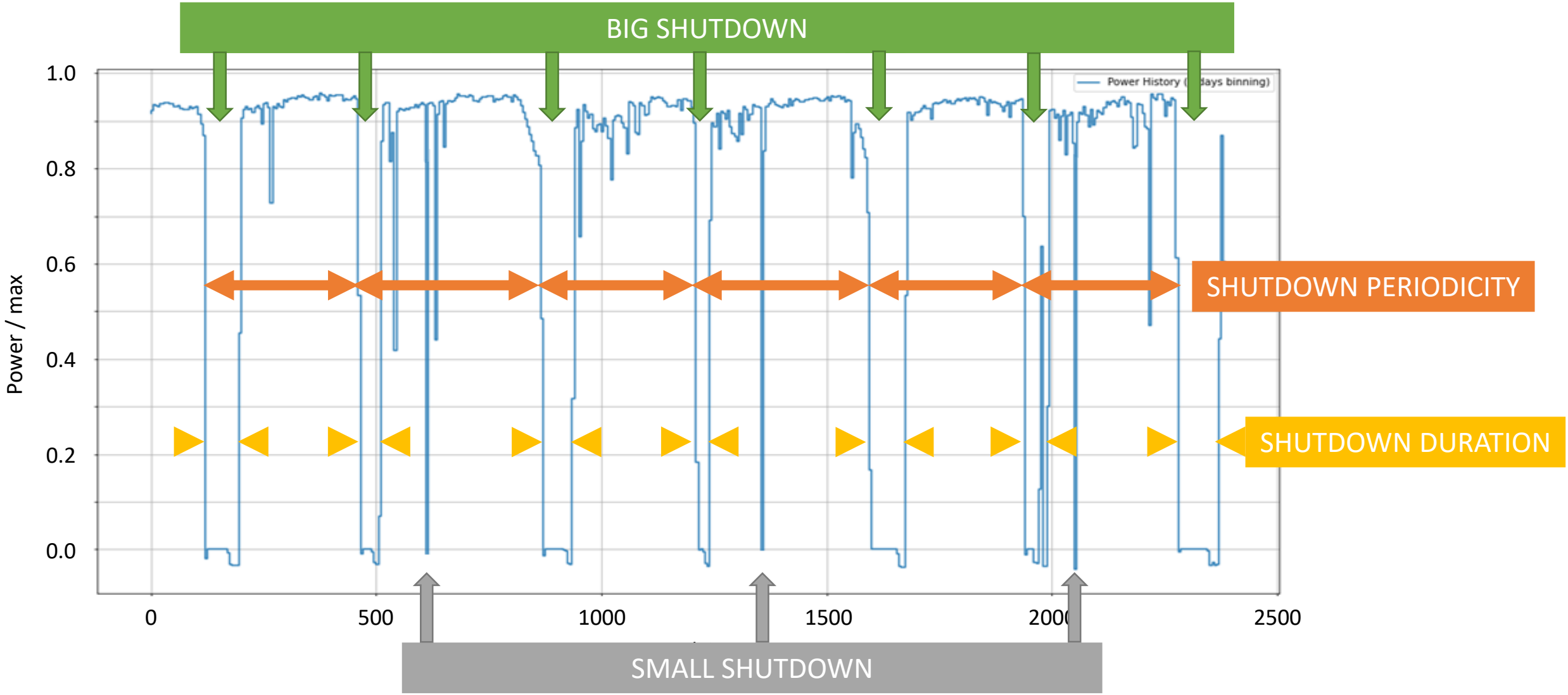




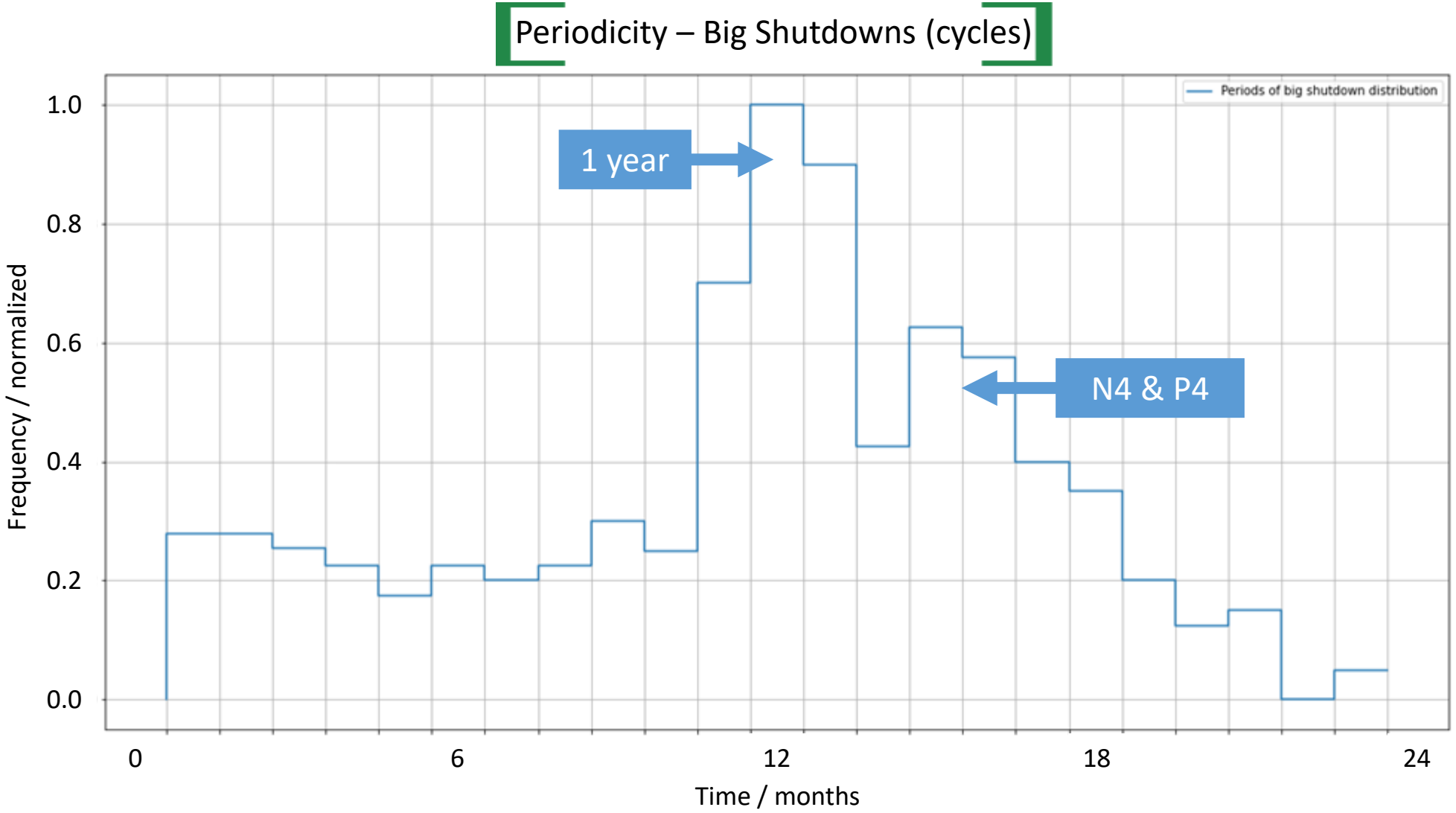


POWER MANAGEMENT IS INDEPENDENT OF REACTOR TYPES

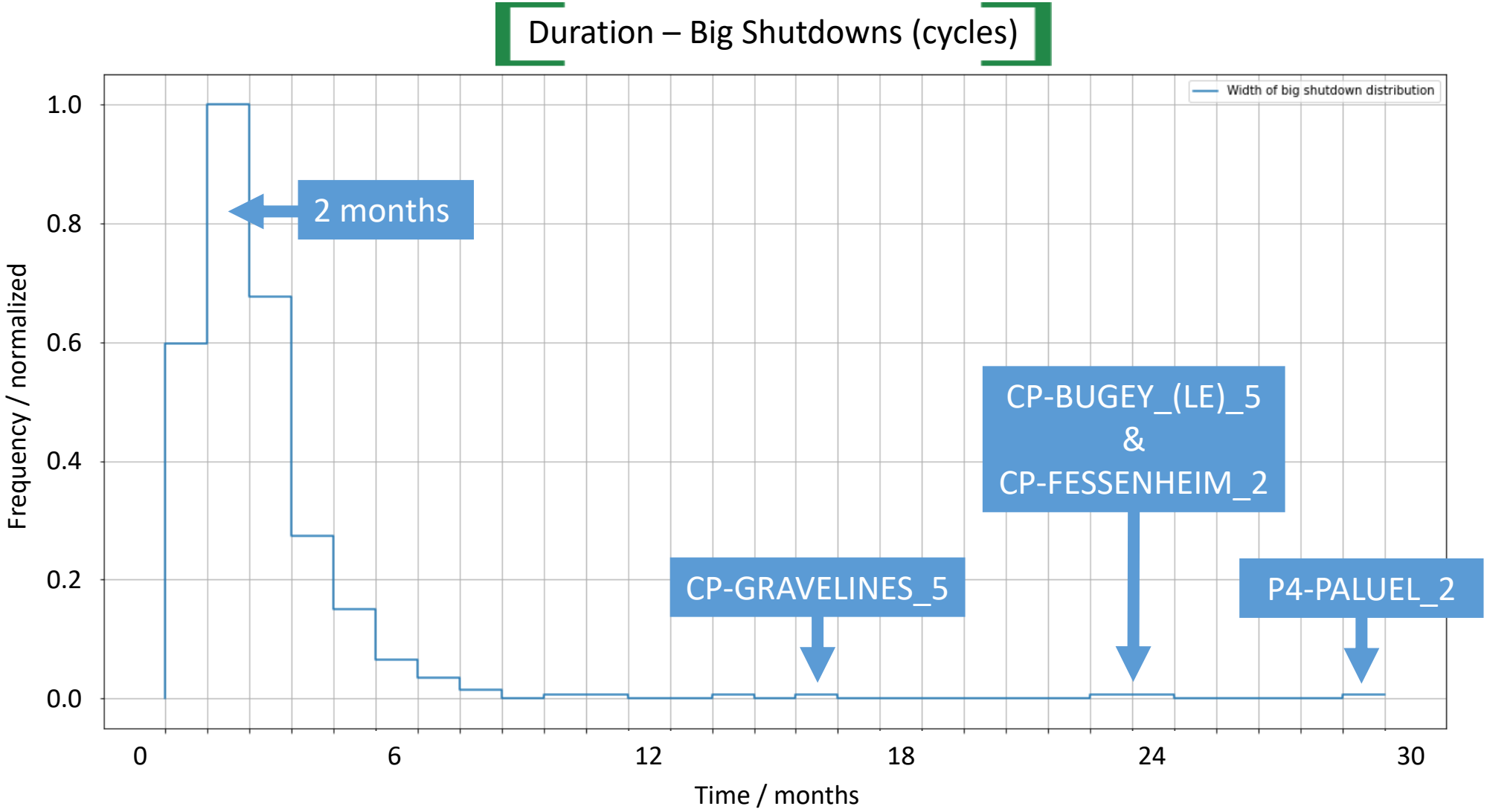
Reactor OFF: Probability distributions



Reactor OFF: Probability distributions



Reactor OFF: Probability distributions



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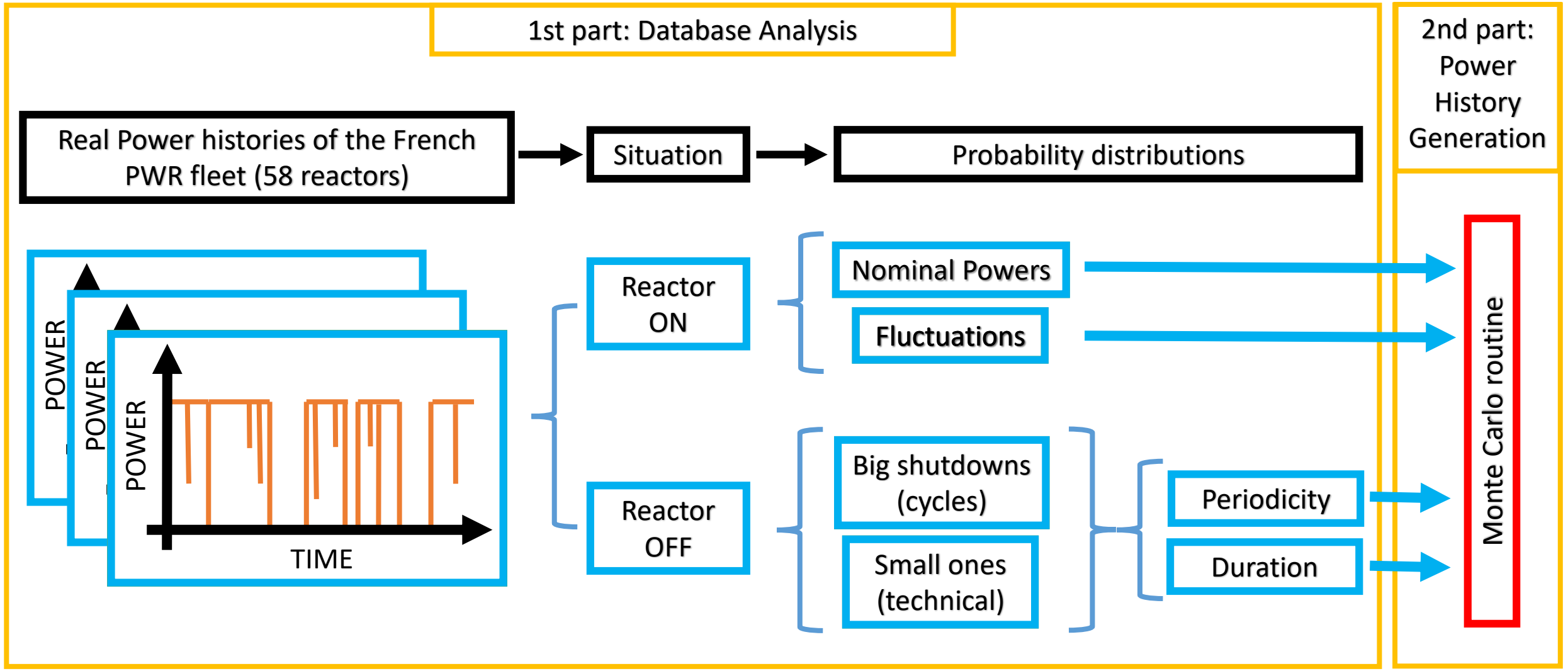


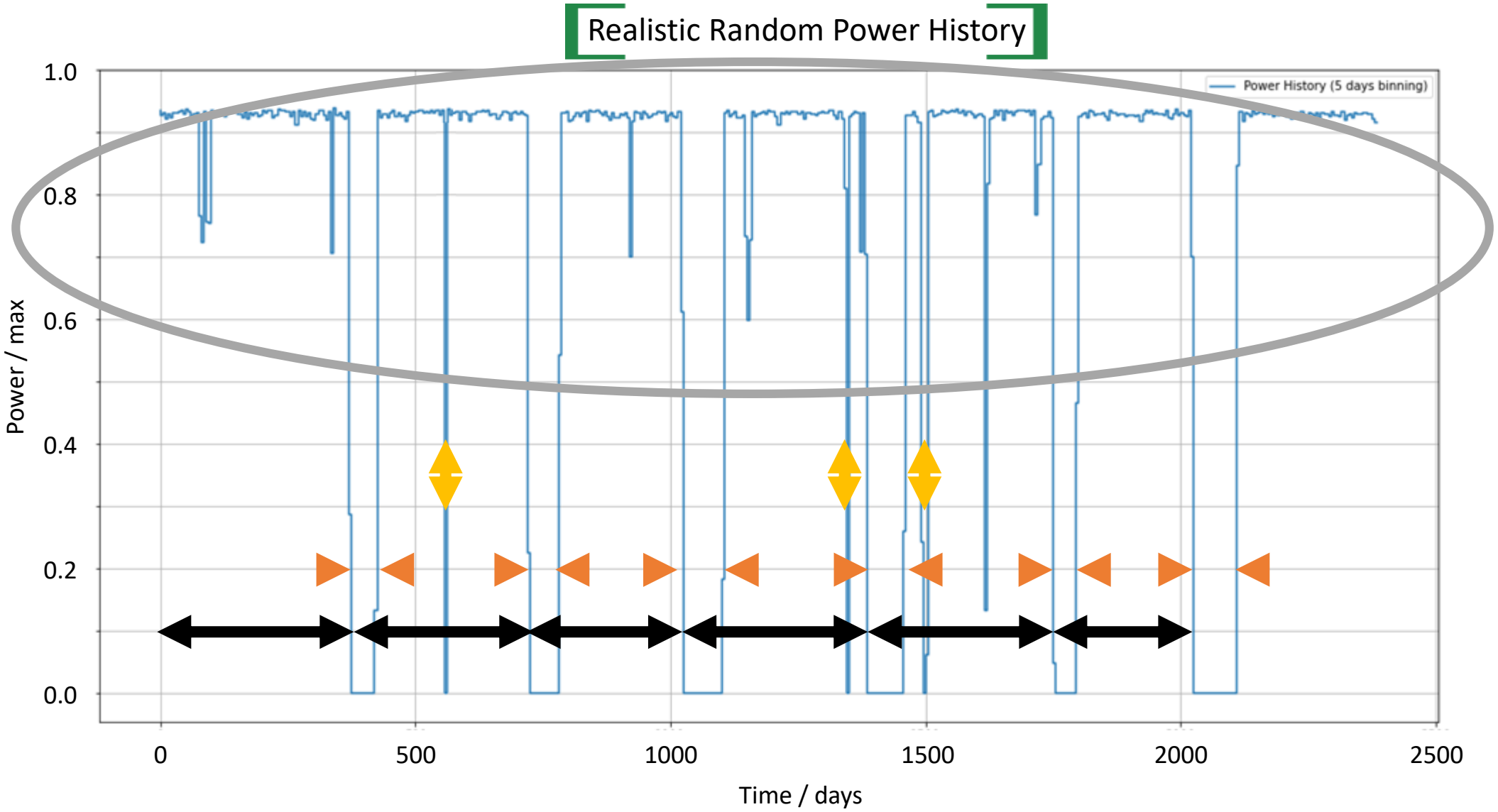
Histogram building

Cycles

Widths

Small shutdowns

Power amplides



Output options

- Binning step Units:
  - Time: from hours to years
  - Energy: BurnUp steps (MW*d/kg)
- Duration of histories:
  - Time: until a pre-selected hour (day, month or year)
  - Energy: until a pre-selected BurnUp (MW*d/kg)
- Full compatibility with CASMO input files

Conclusions

- An adaptable tool to analyze power histories
- Power management is independent of reactor types
- Compatible with updates on its database
- An adaptable Monte Carlo tool to provide realistic power histories

Outlook

- Compatibility with VESTA input files
- Implementation of stretchouts

Thanks for your attention