

# Lattice QCD data analysis in Julia

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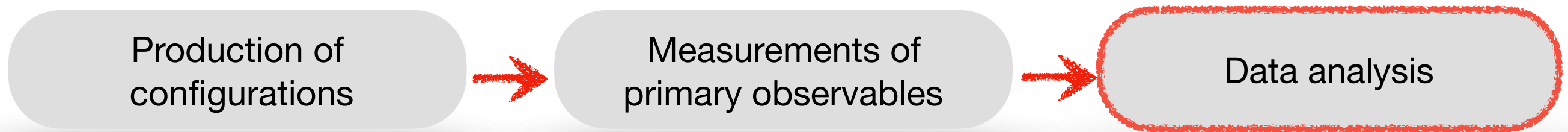
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# Motivations

- The usual workflow in Lattice QCD simulations is summarised by



- In practice, we face several challenges in data analysis



# Motivations

- These challenges are greatly simplified by the `ADerrors.jl` package [A. Ramos]
  - ▶ Determination of statistical uncertainties using the  $\Gamma$ -method
  - ▶ Automatic Differentiation (AD) techniques for error propagation
  - ▶ Error propagation in iterative algorithms
- On top of that, we present the `juobs.jl` package for higher-level analysis [AC, J. Ugarrio]
  - ▶ Direct computation of Lattice QCD observables
  - ▶ Implementation of the GEVP variational method
  - ▶ Advance fitting routines

# Outline

## 1 Introduction to Julia

- Why Julia?
- Getting started
- Julia is fast!



## 2 The **ADerrors.jl** package

- The  $\Gamma$ -method and AD
- ADerrors.jl tutorial

## 3 The **juobs.jl** package

- Main features and Lattice QCD observables
- ADerrors.jl tutorial

# Resources

## Useful links

- Julia official [website](#)
- Julia free [courses](#)
- [ADerrors](#) gitlab
- [Juobs](#) gitlab

## References

- [1] U. Wolf, “*Monte Carlo errors with less errors*”, arXiv:0303017
- [2] A. Ramos , “*Automatic differentiation for error analysis of Monte Carlo data*”, arXiv:1809.01289
- [3] A. Ramos , “*Automatic differentiation for error analysis*”, arXiv:2012.11183