IPN RAKETT – USER MEETING 21

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IPN Rakett – project intro

- Project aim: **Speed-up** of the FanSi-model
- Background: The FanSi model has a **long run-time**
- Method: **Decompose** the optimisation problems

Project facts

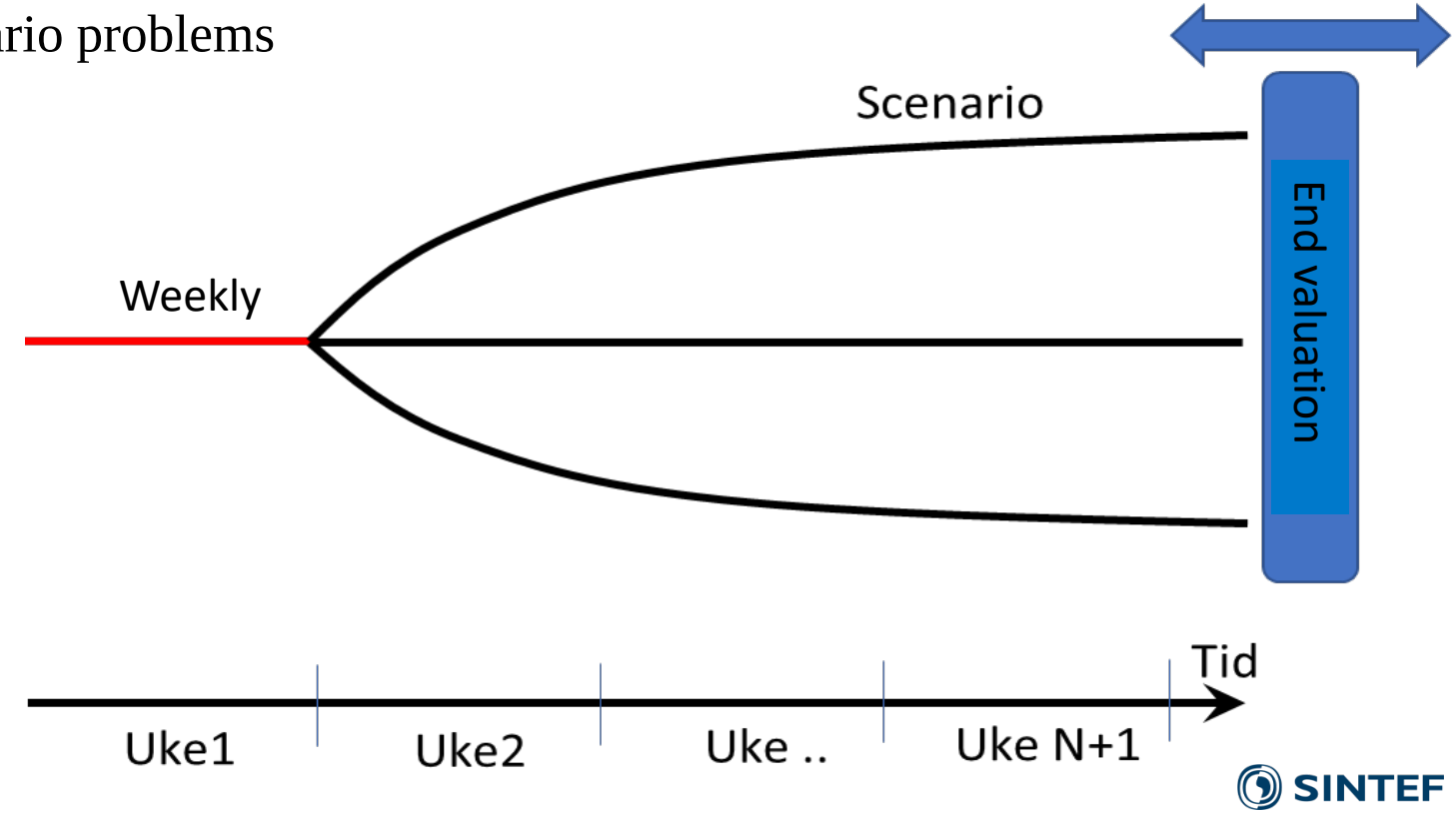
- Participants: Statkraft, Statnett, NVE and SINTEF
- Norwegian research council IPN - project
- Periode 2020 - 2022

RAKETT = Reduksjon **A**v **K**jør**ET**id baser**T** på dekomponering for markedsmodeller med detaljert vannkraft

SINTEF

The FANSI model

- Scenario Fan Simulator
  - Electricity market
  - Detailed hydropower
- Decomposed in time: weekly and scenario problems
- The problems cover many time-steps



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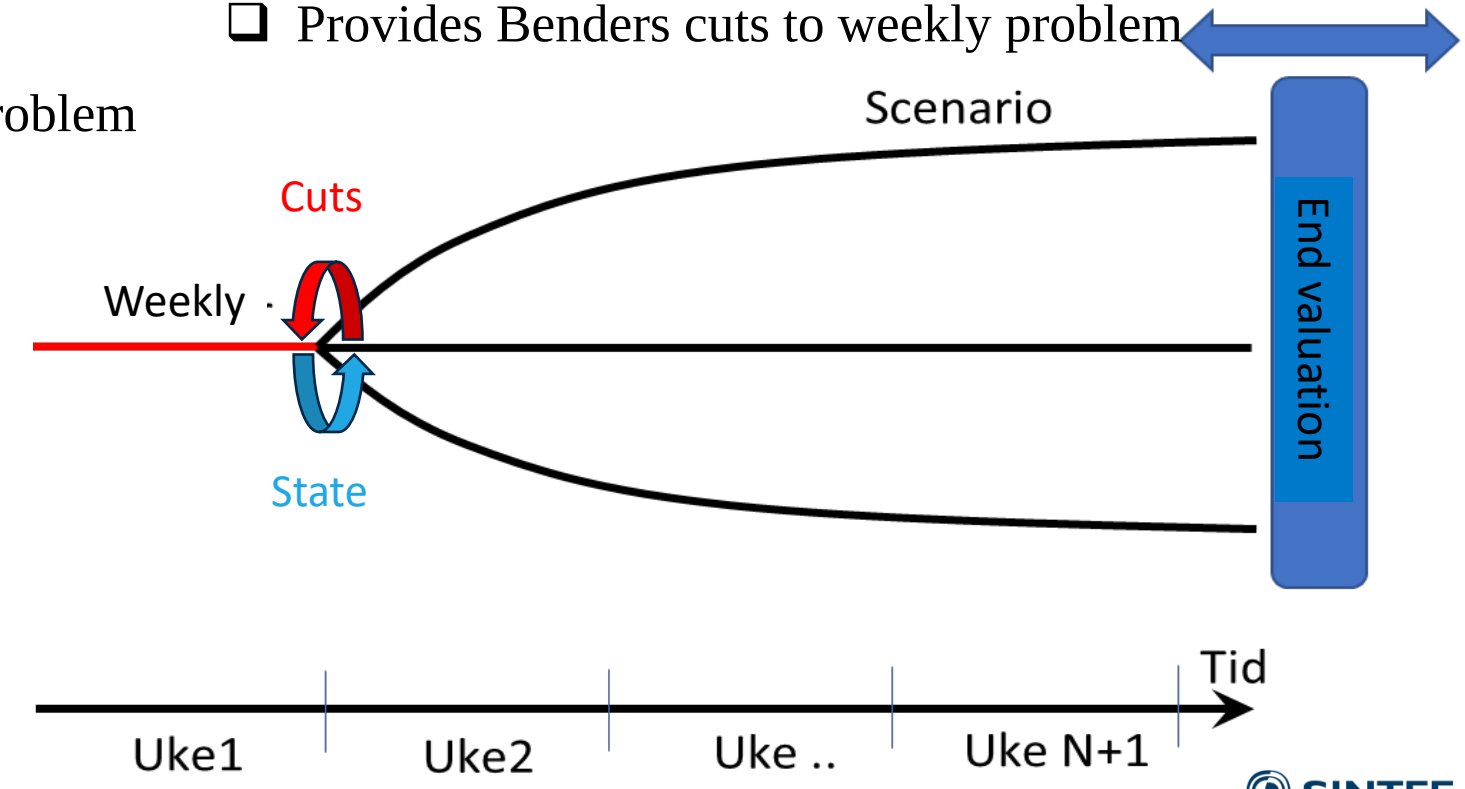
The ~~FANSIC~~ model

Weekly problem

- Benders cuts decribes future costs
- System state passed on to scenario problem
- Model results

Scenario fan

- Scenario problems
- Rolling horizon
- Represents future uncertainty
- Provides Benders cuts to weekly problem



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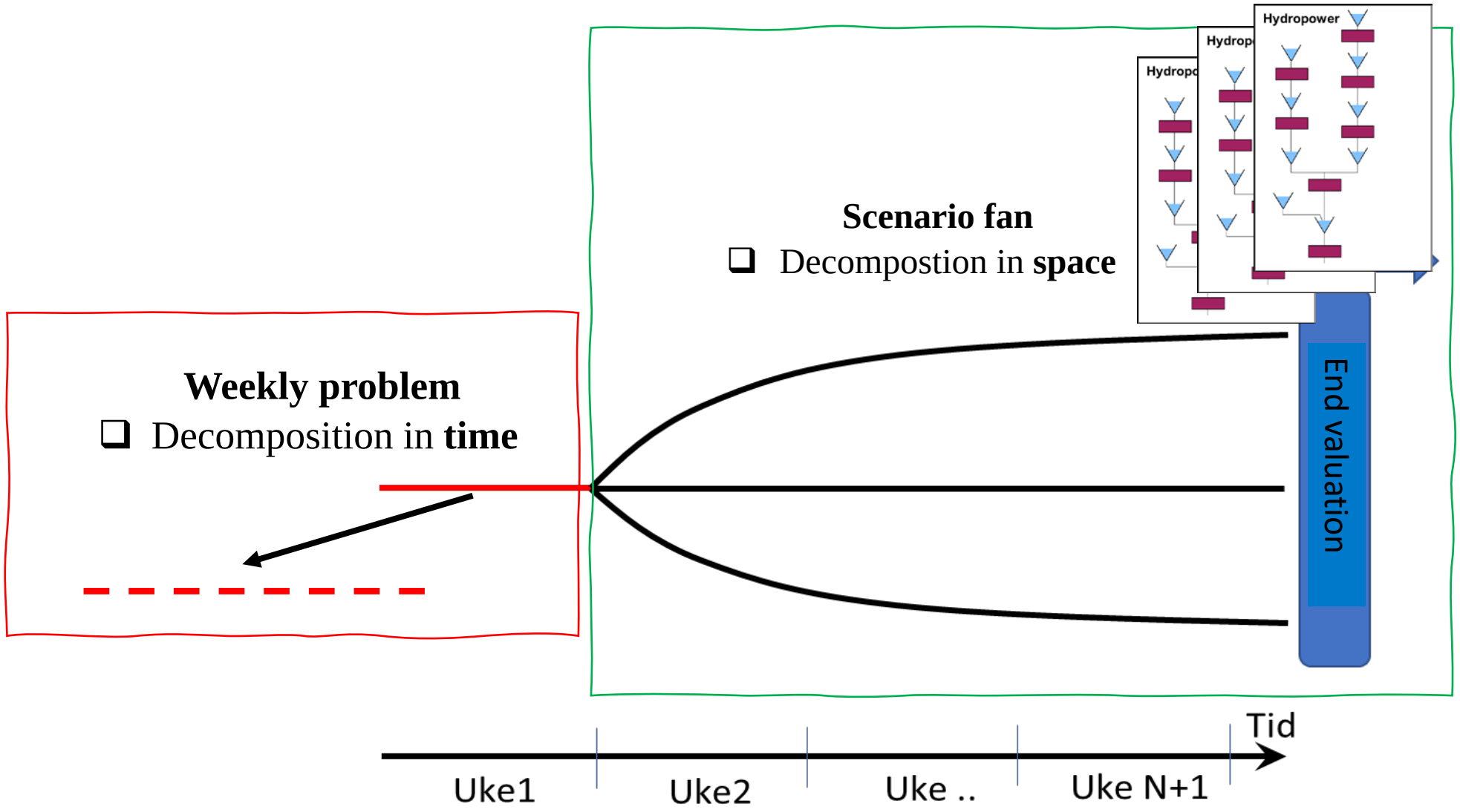
The ~~FANSIC~~ model – further decompostion



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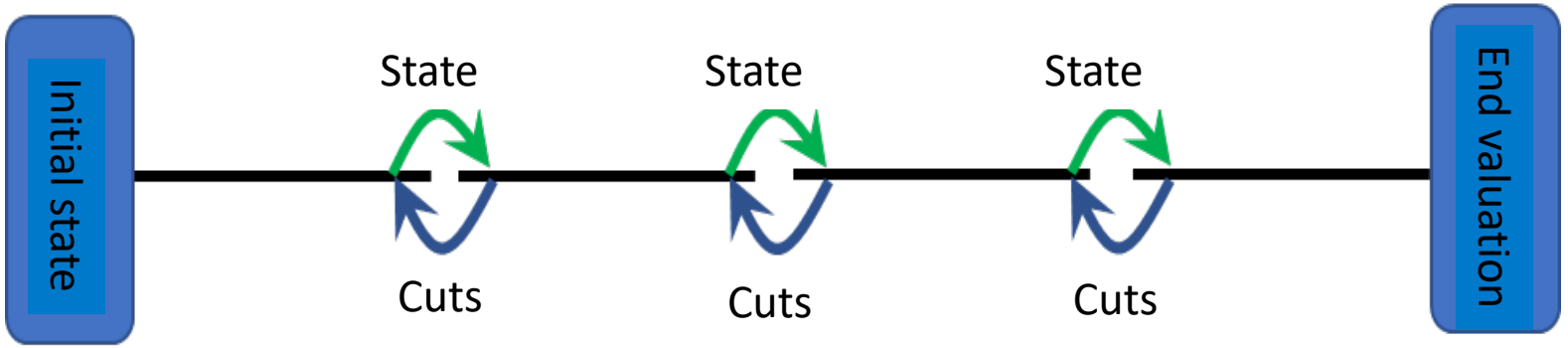
Multi-stage decomposition in time



1) Forward simulation
2) Backward cut calculation

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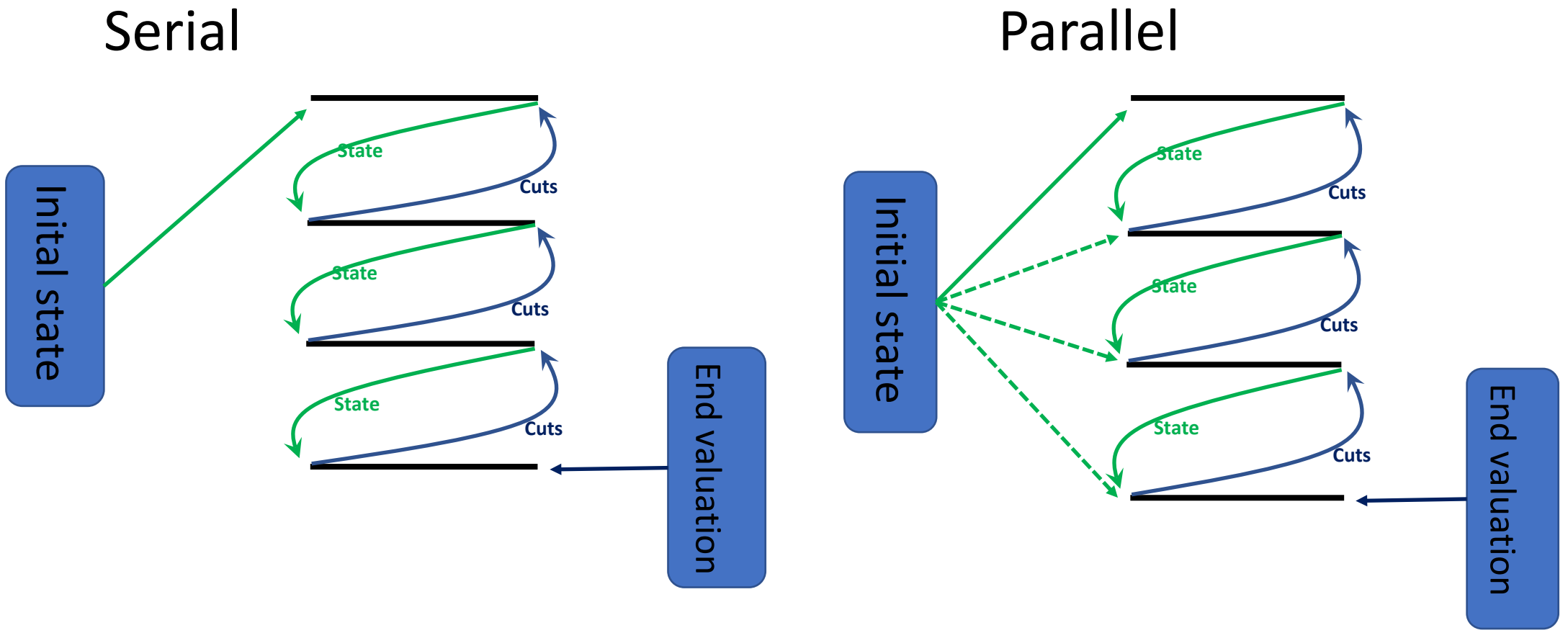
Parallelisation



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Benders decomposition in time

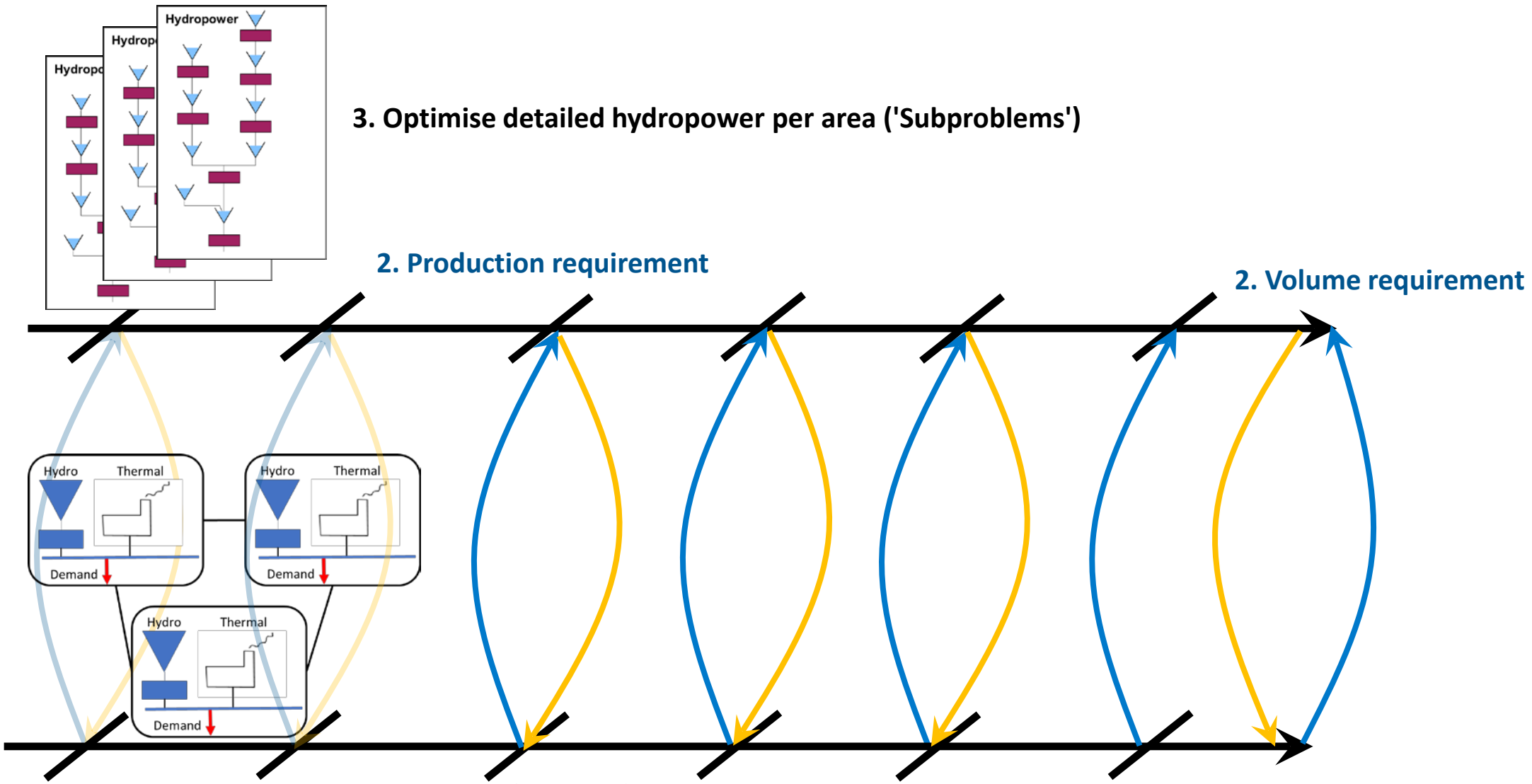
Pros

- Already applied in FanSi
- Well known method
- Parallel processing of weekly problem

Cons

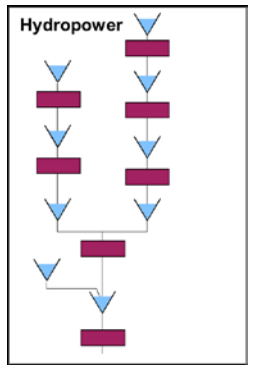
- Serial in nature
- Best applied on systems with small reservoir changes (weekly problem)

Spatial decompostion - illustrated



Spatial decompostion - illustrated

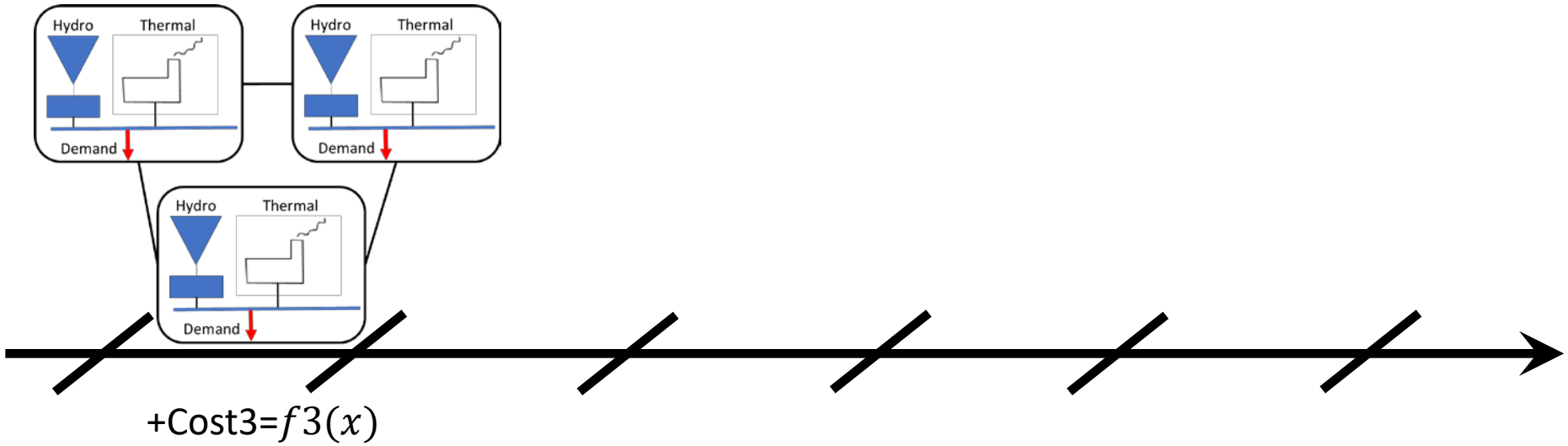
$f(x)$



Build costs functions for hydropower iteratively

Costs functions described by Benders cuts

+Cost1=$f1(x)$ +Cost2=$f2(x)$



+Cost3=$f3(x)$

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Spatial decompostion

Pros

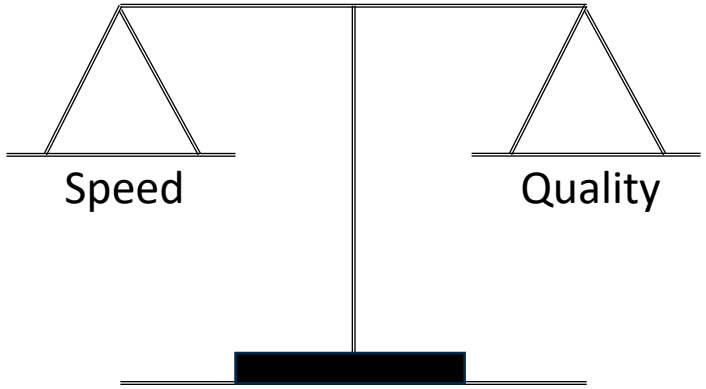
- Parallel processing
- Has similarities to EMPS: Can be seen as an optimization approach to detailed drawdown ("tappefordeling")

Cons

- Extra layer of parallelisation in FanSi
- Master problem size increases per iteration

Summary

- Two decompostion schemes under study
  1. Weekly problem - Benders decomposition in time
  2. Scenario problems – Benders decomposition in space
- Lagrangian relaxation has been studied
  - Potential for speed-up, but at the cost of result quality
- CPLEX-solver algorithms studied
  - Parameter tuning



Summary

- **Potential** for **speed-up** is **confirmed**