CAPITAL GAIN CONSULTANTS

MERCK
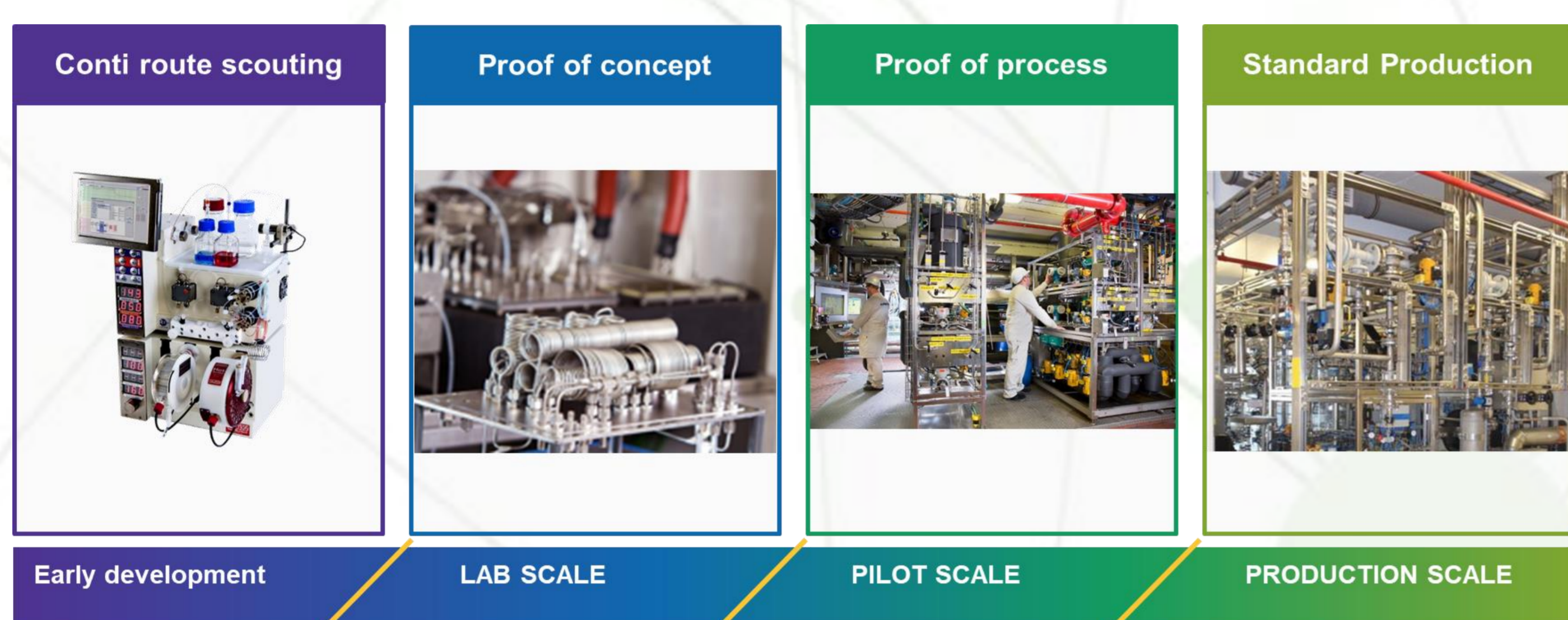
TECHNISCHE UNIVERSITÄT DRESDEN

KE-ƎN

Operating window exploration of continuous reaction plant

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Continuous reaction plant

- Work package 5.3 – Focus on production scale

| Conti route scouting	Proof of concept	Proof of process	Standard Production
Early development	LAB SCALE	PILOT SCALE	PRODUCTION SCALE

Use case description

- Title: Continuous reaction plant MERCK

- Goal: Increase of process efficiency and stability by finding a suitable operating window

- Description:

    - Plug flow reactor (continuous, steady state process) with two reaction steps in a tube reactor and hydrolysis step

    - Multipurpose plant in production scale

    - During a production run detrimental shut-downs occur due to exceeding of critical values (e.g. pressure)

## Proprietary Tools

- CHEMCAD and SIMCA
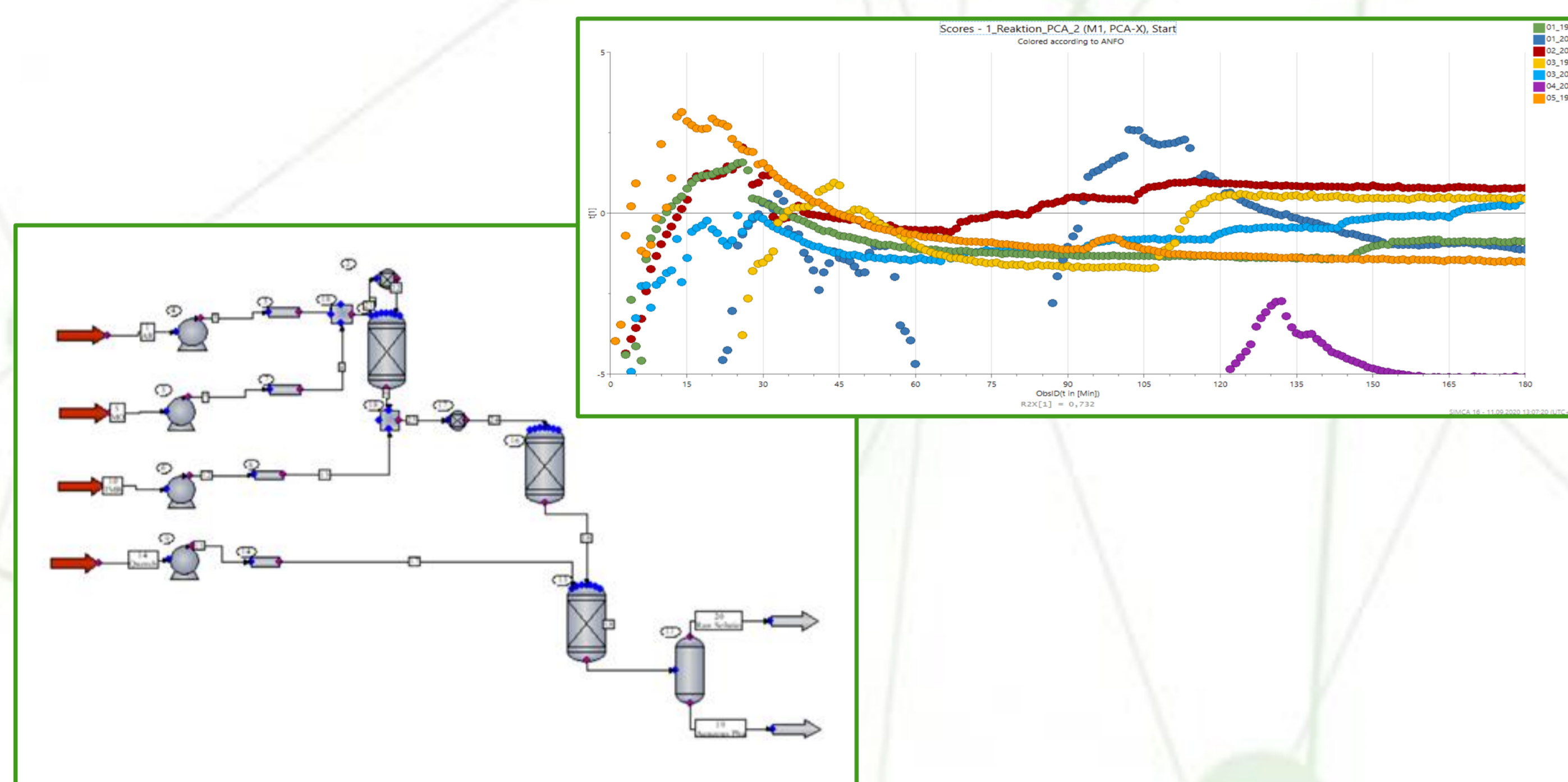
Data characteristics and methods

- Data characteristics:

    - Design data (P&IDs)

    - Process data (temperature, pressure, flow rate,…)

    - Product data (concentration and yield)

- Methods:

    - Multivariate data analysis, Multivariate sensitivity analysis

        - SIMCA: Multivariate data analysis

    - Process modelling with the depth required

        - CHEMCAD: Process modelling and simulation

Transfer learning [1]

- Motivation: usage of existing knowledge gained from simulation models from engineering phase or data gathered from lower scaled plants in order to reduce amount of data required for model
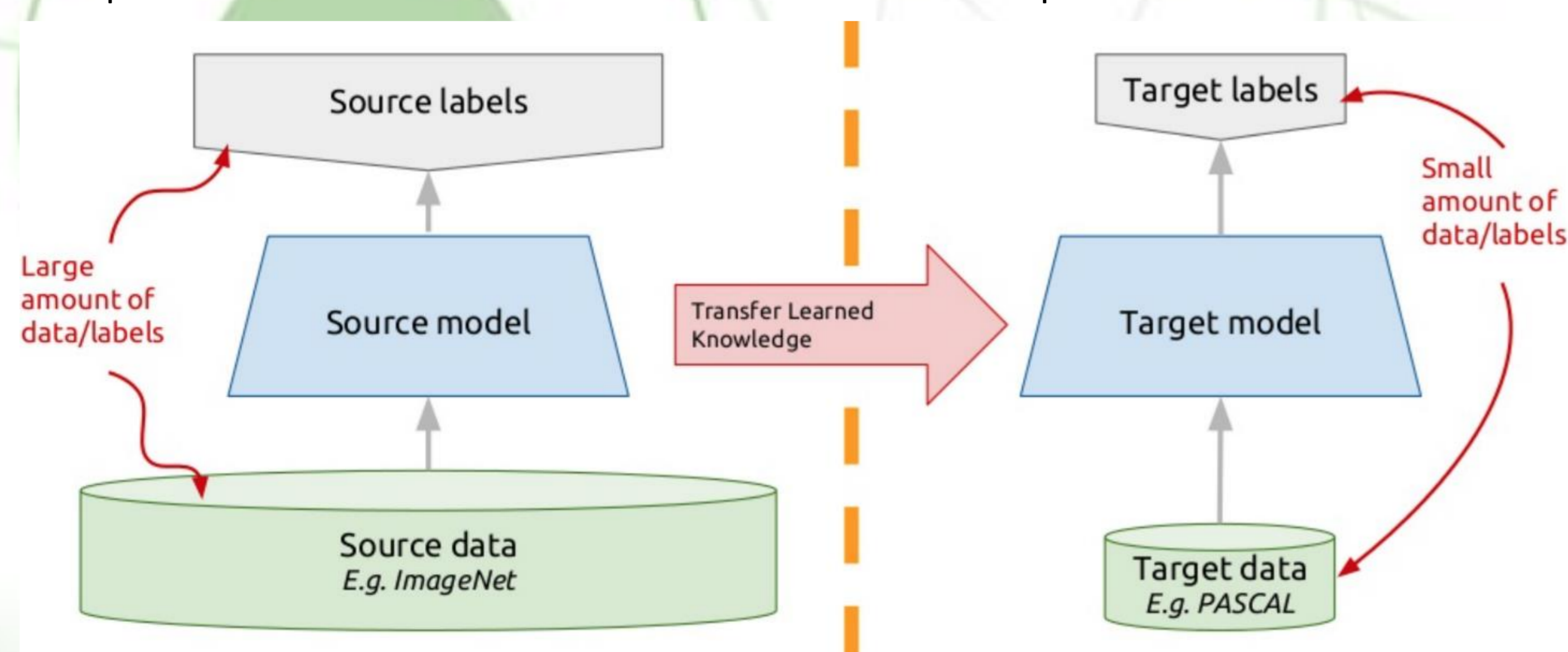
Approach

- Based on historical process data, the operating range will be investigated to increase process efficiency and stability.

- A multivariate data analysis will be conducted to identify the influence of coupled parameters and to understand correlations between different parameters.

- A comprehensive process simulation will be set up to take process phenomena like pressure drop, hot spots, residence time, heat transfer, etc. into account.

- Based on this prework, a sensitivity analysis will be conducted.

- Combining these insights will facilitate to reduce the amount of false alarms, to warn earlier and more focused and to integrate maintenance steps in a more efficient in the operation procedure.

[1] Kevin McGuineness - Transfer Learning (D2L4 Insight@DCU Machine Learning Workshop 2017)

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