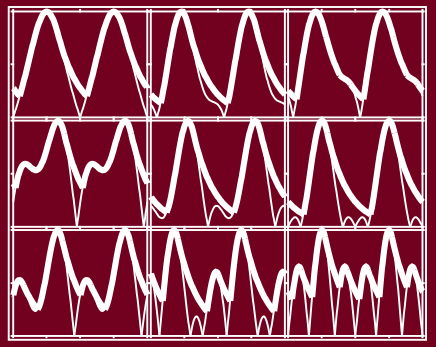
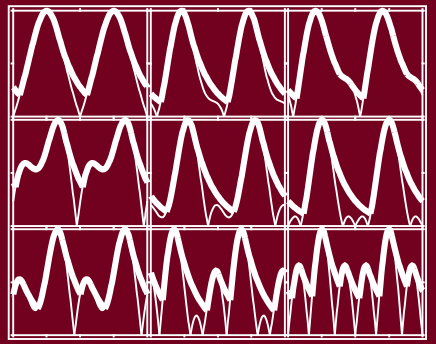
Workstream 1 Update

Software Tools for the Architecture of the Hybrid AC-DC Grid





Josh Schipper
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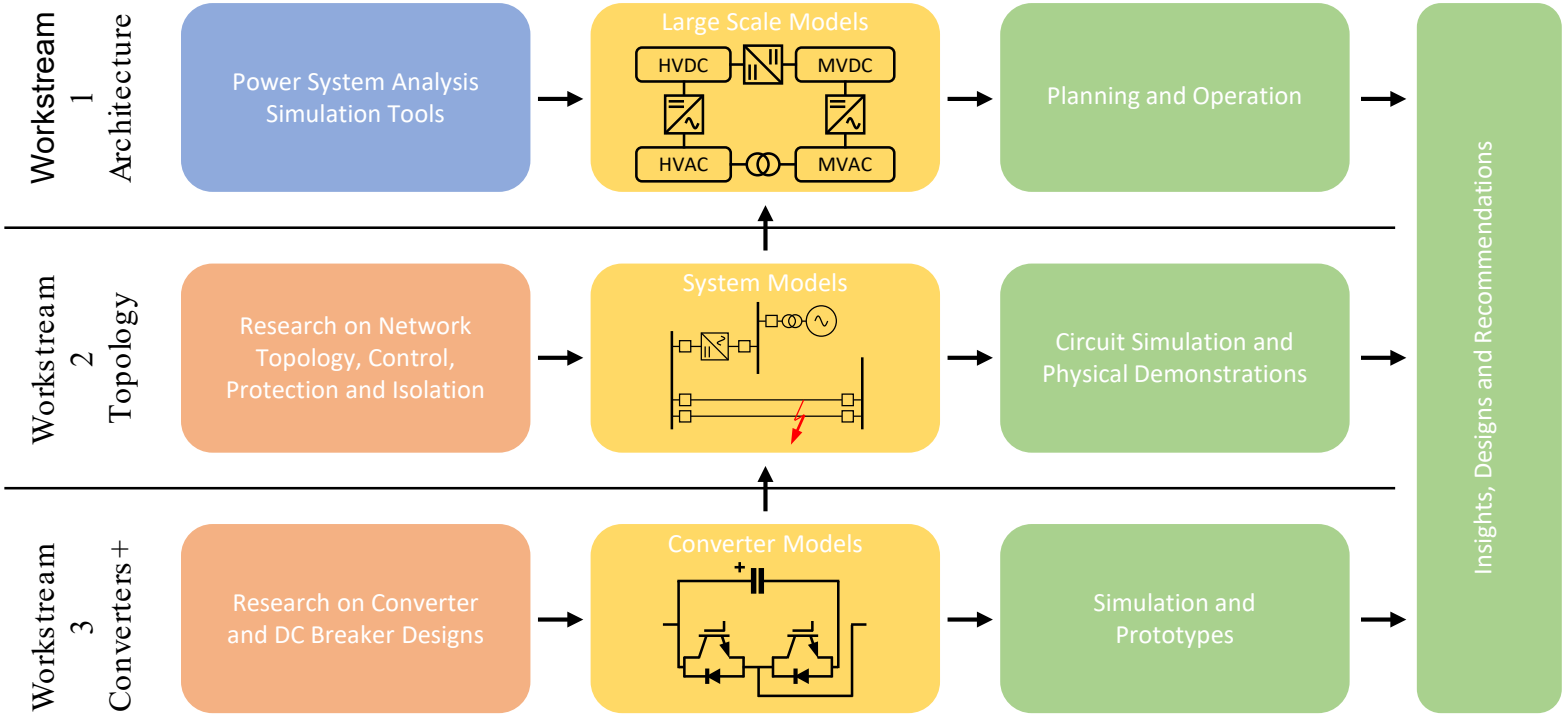
12/02/2024

Future Architecture of the Network
TE WHATUNGA HIKO

Outline

1. Workstream 1 Objectives
2. Timeline
3. Progress to Date
4. Architecture

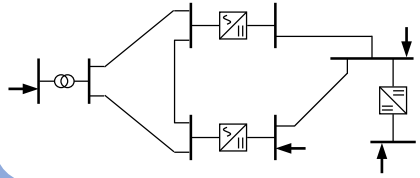
Outline of Objectives



Objectives of Workstream 1

Tools

POWER-FLOW ANALYSIS



Capabilities

- To simulate hybrid AC-DC network topologies with detailed switching and dynamic average models of converter technologies
- Capable of simultaneous simulation of both:
  - Transmission and Sub-transmission networks
  - Sub-transmission and distribution networks
  - AC and DC networks

FAN Outcomes

- Feasibility study to optimize DC integration

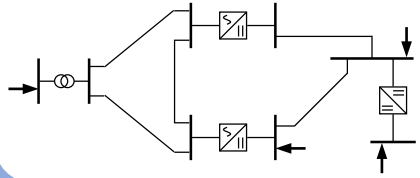
Basis for Future Industry Tool

- For Planning
- For Contingency Analysis/ Security Assessment

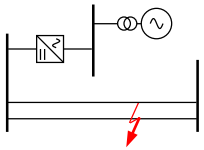
Objectives of Workstream 1

Tools

POWER-FLOW ANALYSIS



SHORT-CIRCUIT ANALYSIS



Static Assessment

Capabilities

- Capable of simultaneous simulation of both:
  - Transmission and Sub-transmission networks
  - Sub-transmission and distribution networks
  - AC and DC networks

FAN Outcomes

- Collaborate with Workstream 2 to understand the impact of protection requirements on circuit topology

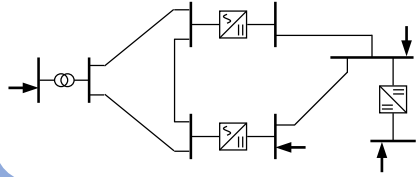
Basis for Future Industry Tool

- To address protection coordination
- Design of protection system and associated settings

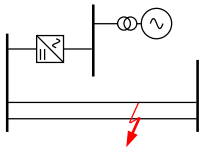
Objectives of Workstream 1

Tools

POWER-FLOW ANALYSIS

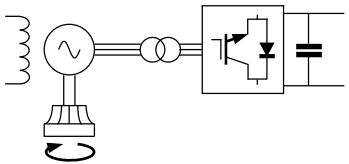


SHORT-CIRCUIT ANALYSIS



Static Assessment

DYNAMIC ANALYSIS



Capabilities

- Capable of simultaneous simulation of both:
  - Transmission and Sub-transmission networks
  - Sub-transmission and distribution networks
  - AC and DC networks
- Achieving this capability will require a large amount of smarts and computational resources to have a fast methodology.

FAN Outcomes

- Determine the system security requirements on network architecture.
- Assess the impacts of converter control design on whole networks.

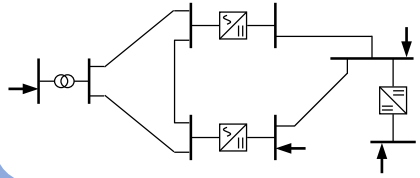
Basis for Future Industry Tool

- A planning and operational tool for assessing network stability

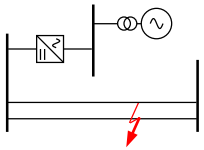
Objectives of Workstream 1

Tools

POWER-FLOW ANALYSIS

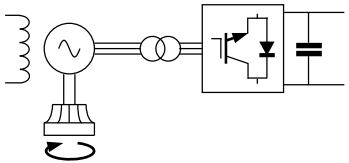


SHORT-CIRCUIT ANALYSIS



Static Assessment

DYNAMIC ANALYSIS



Models for Verification

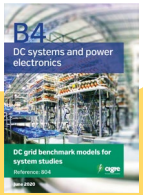
NEW ZEALAND POWER SYSTEM

EMI ELECTRICITY AUTHORITY TE MANA HIKO

TRANSPOWER

Cigre - DC GRID BENCHMARK MODELS FOR SYSTEM STUDIES

cigre



Models for Impact

NEW ZEALAND POWER SYSTEM
+ HVDC NETWORK MODEL
FUTURE WORK

Case Study 2

Case Study 1

FAN Outcomes

Case Studies Presentation
Dr Veerabrahmam Bathini

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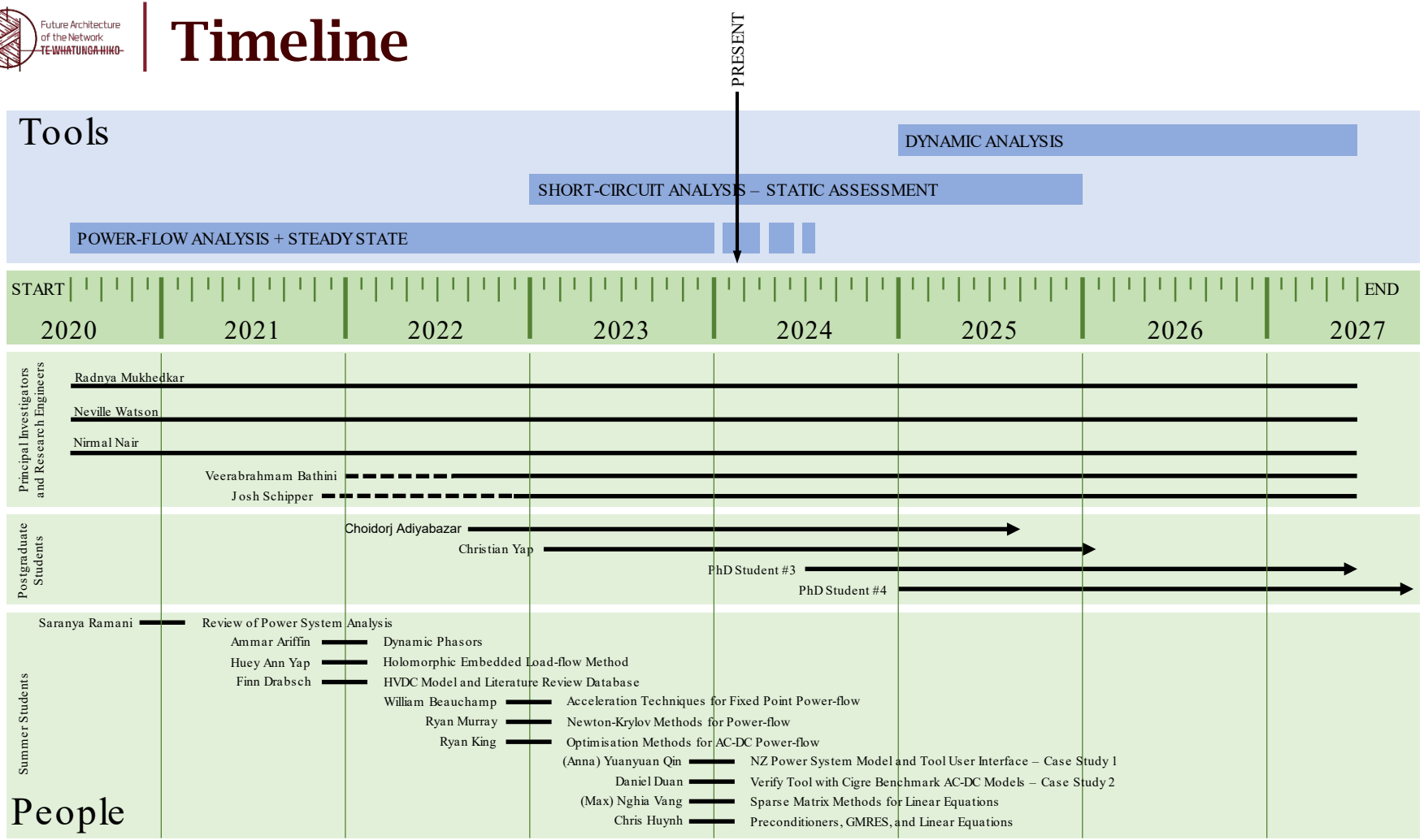
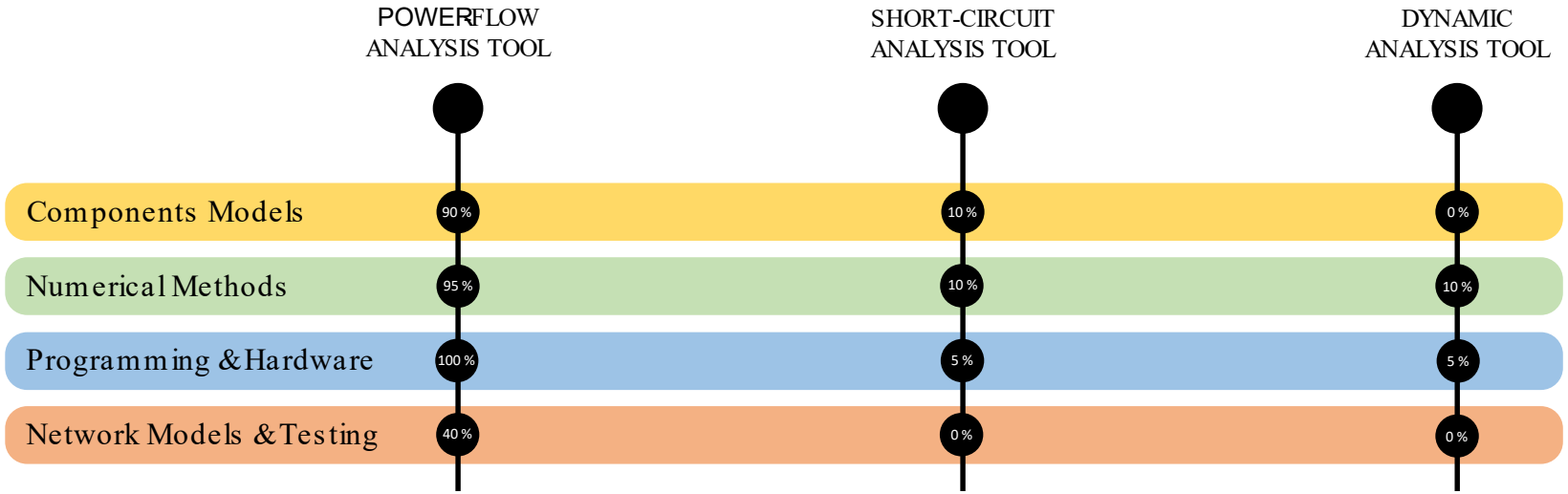
Timeline



Progress to Date



Percentages are estimates.

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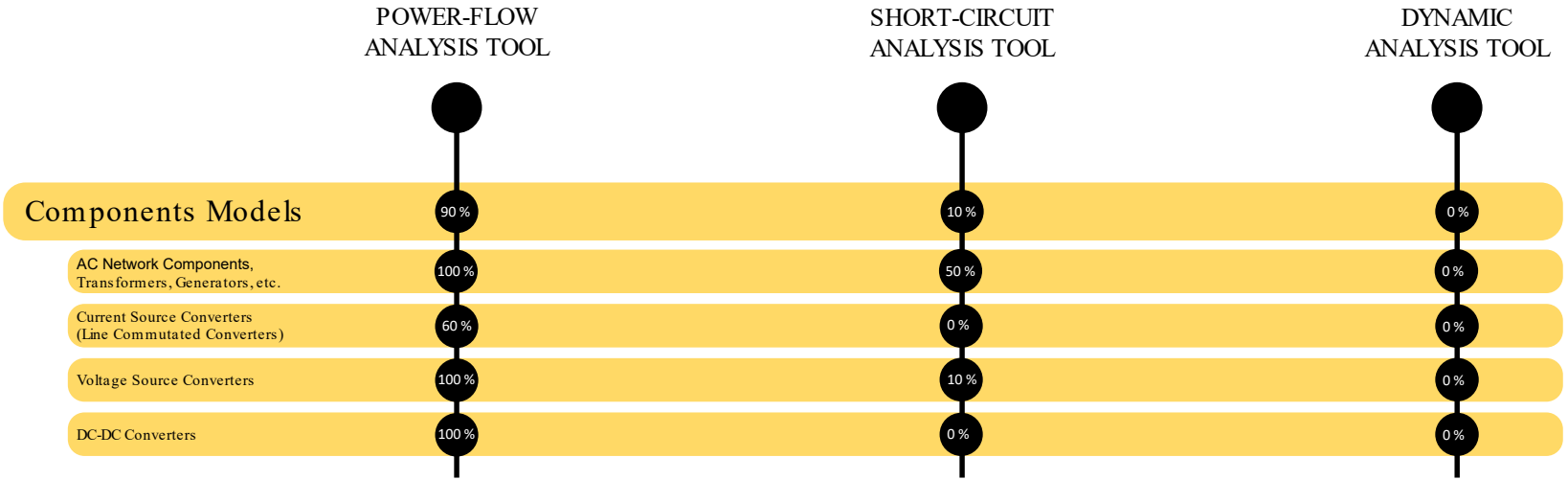
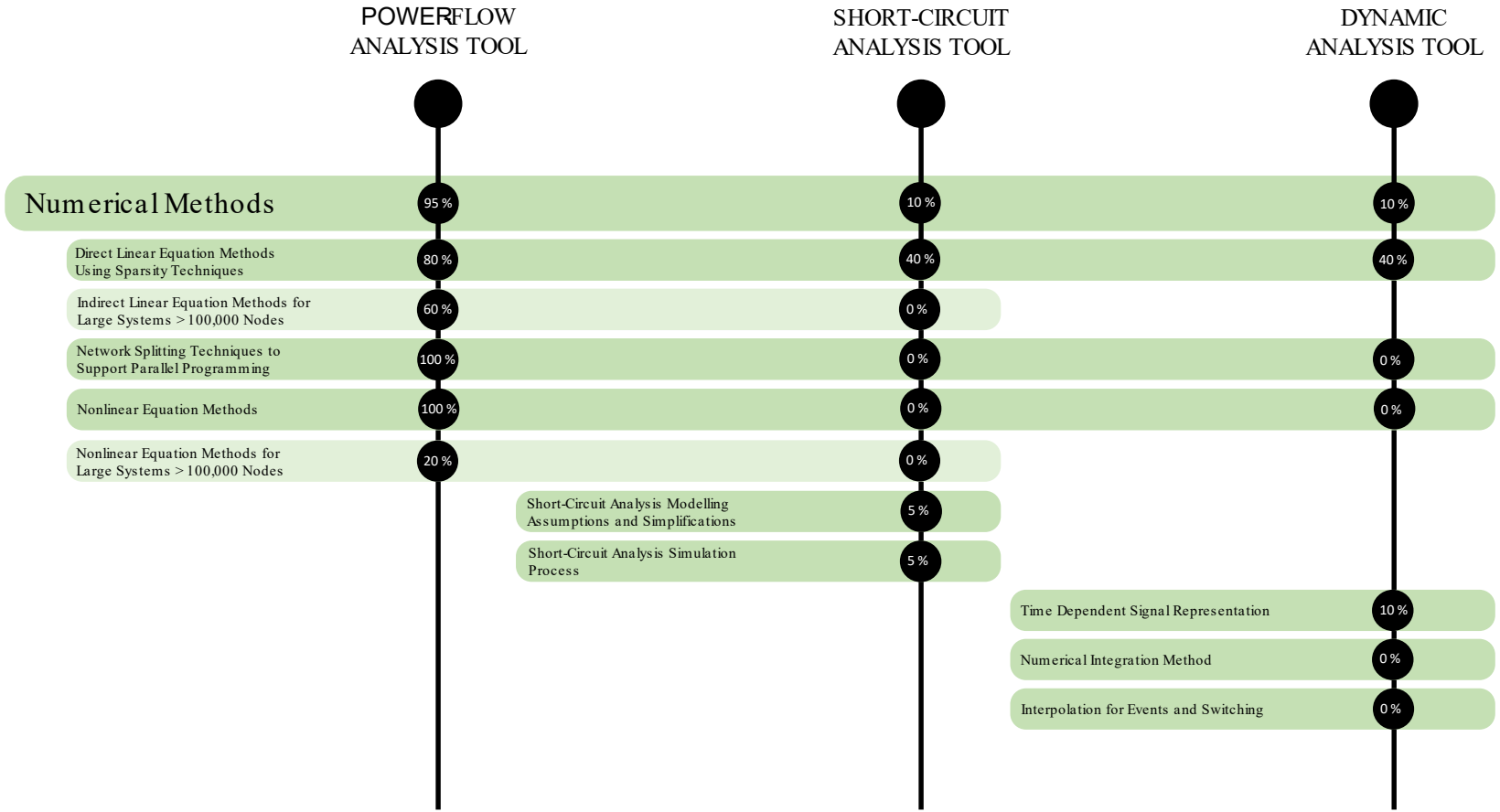
Progress to Date – Component Models

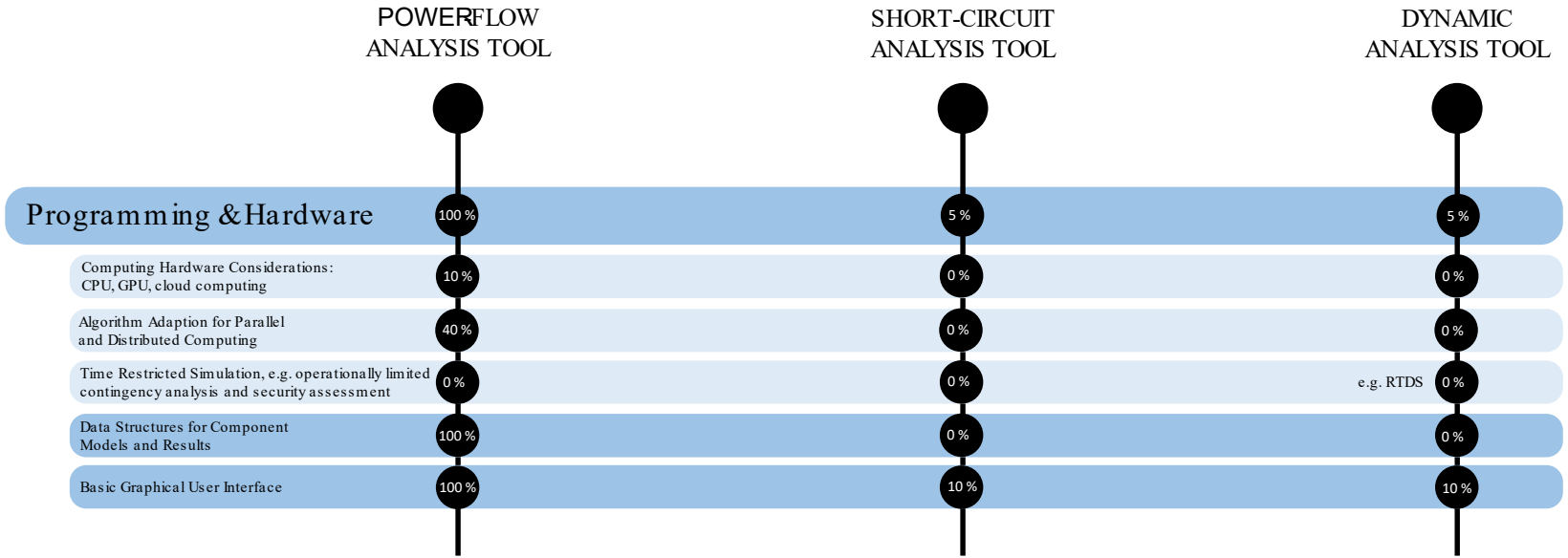


Progress to Date – Numerical Methods



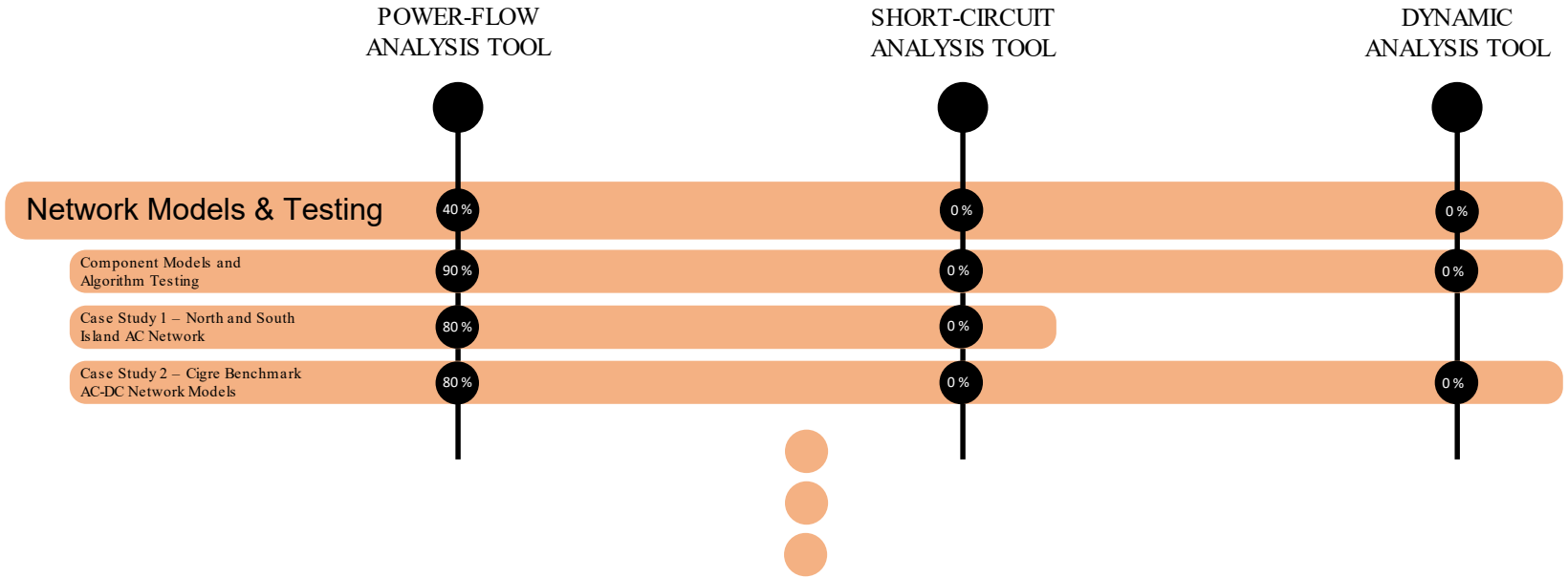
Lighter shaded boxes are not critical to tool requirements.

Progress to Date – Programming & Hardware



Outside FAN Programme Scope:
Graphical User Interface – Graphical Network Diagrams,
Database Management

Progress to Date – Network Models & Testing



Architecture – Questions that need Answering

1. What are the benefits of an HVDC grid running the length of New Zealand?

2. Is there a place for Medium Voltage DC (MVDC)? Then what about HV to MV DC converters?

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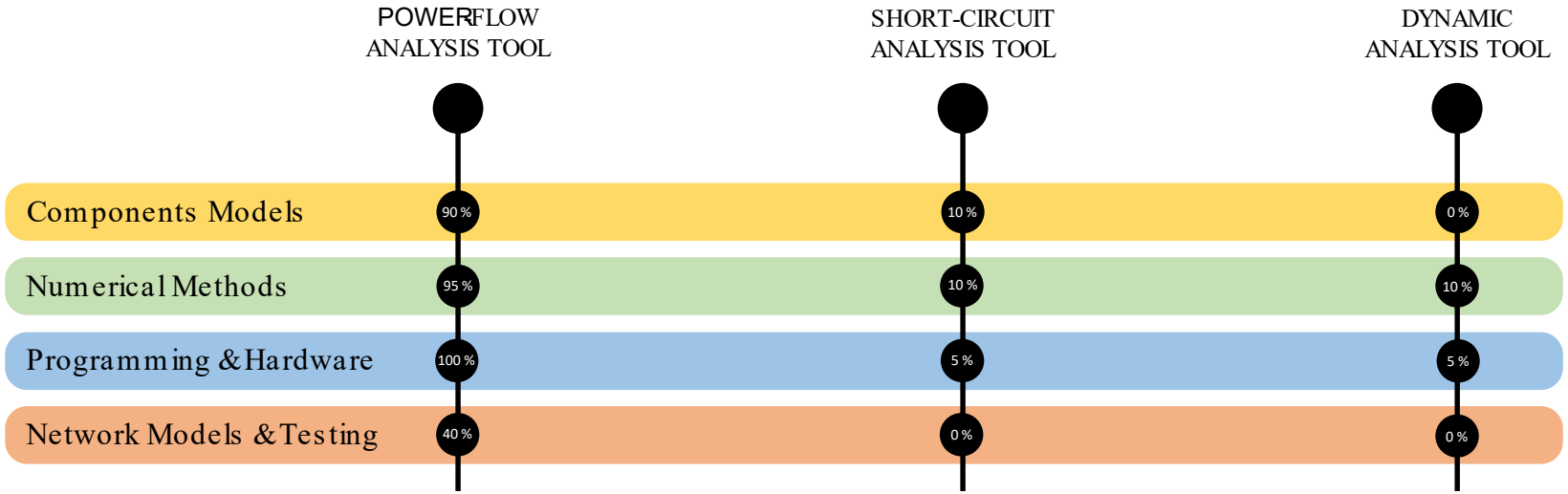
Progress to Date - Summary



FAN Research Partners

New Zealand

Overseas – University of Cambridge, Aalborg University