

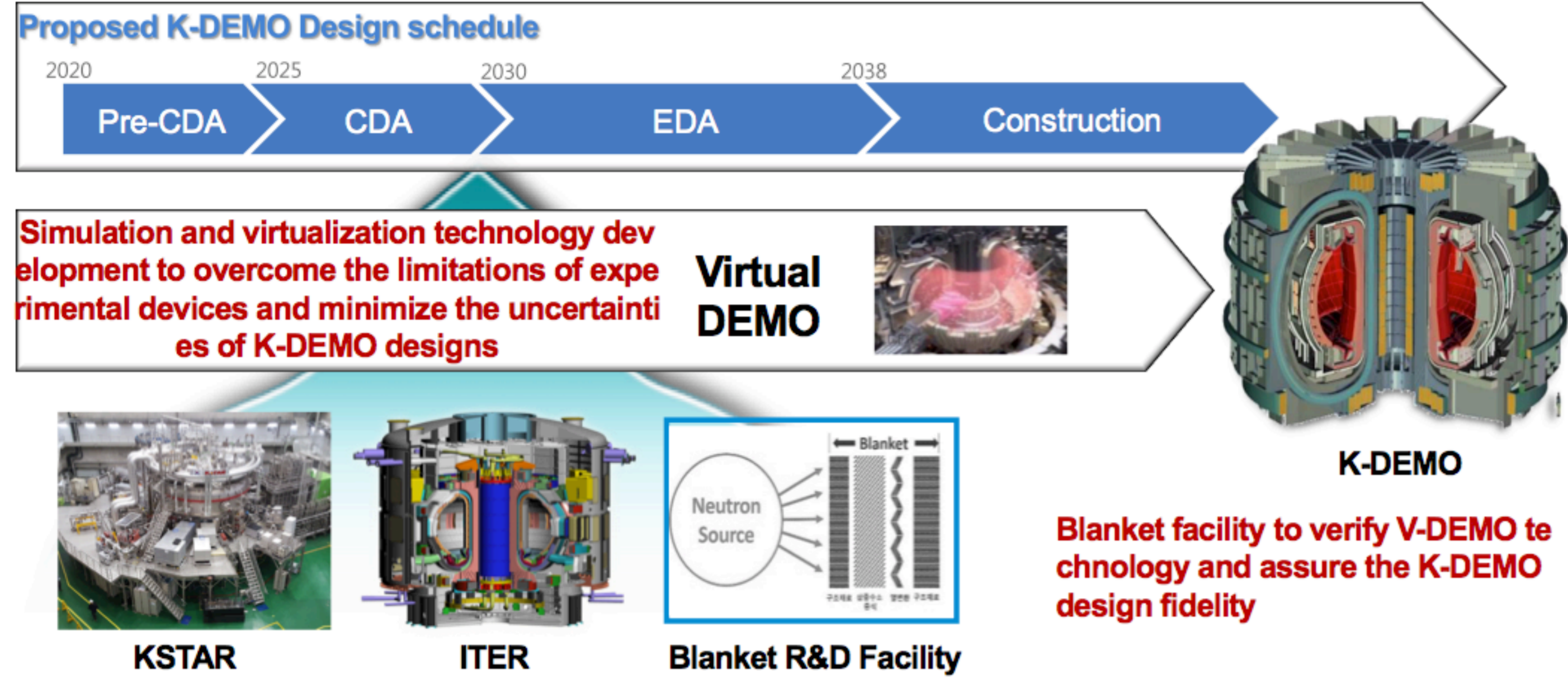
# A Planning Study of Virtual DEMO based on Computer Simulations

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## 1. Introduction



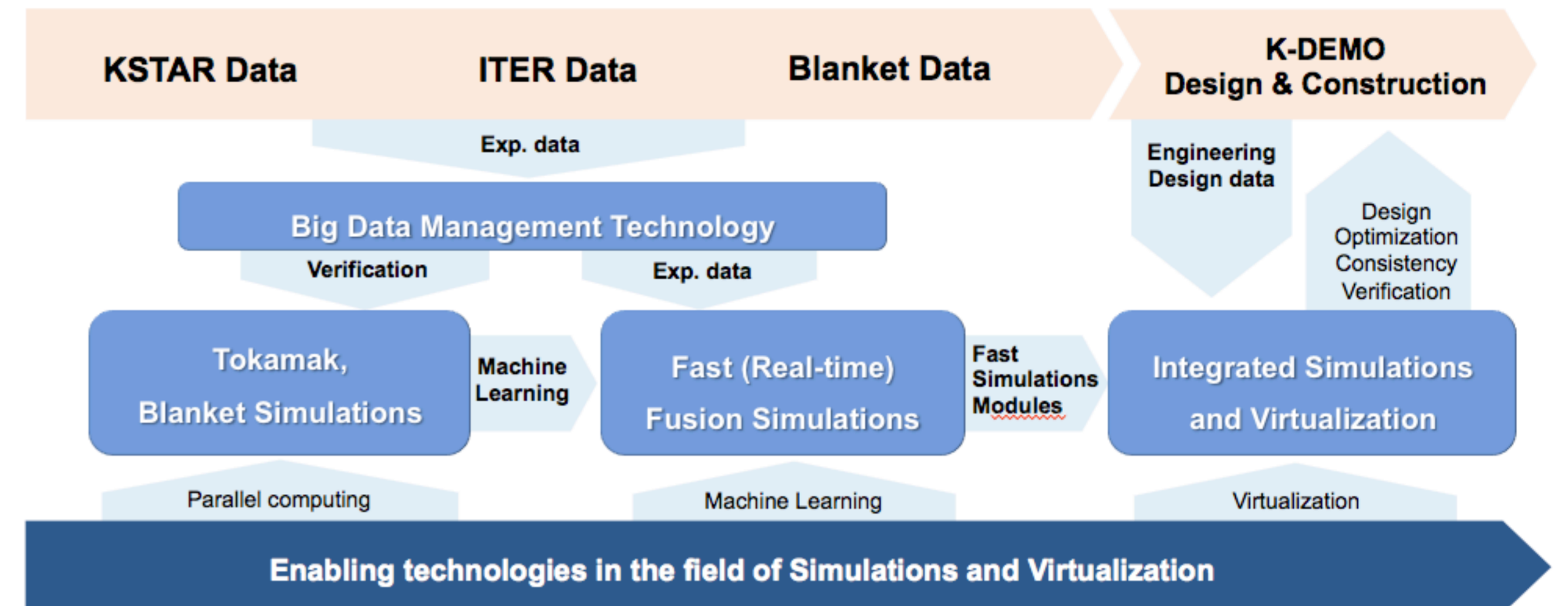
- Accelerate K-DEMO design and construction with simulations and virtualization technologies



## 3.3 Development Structures



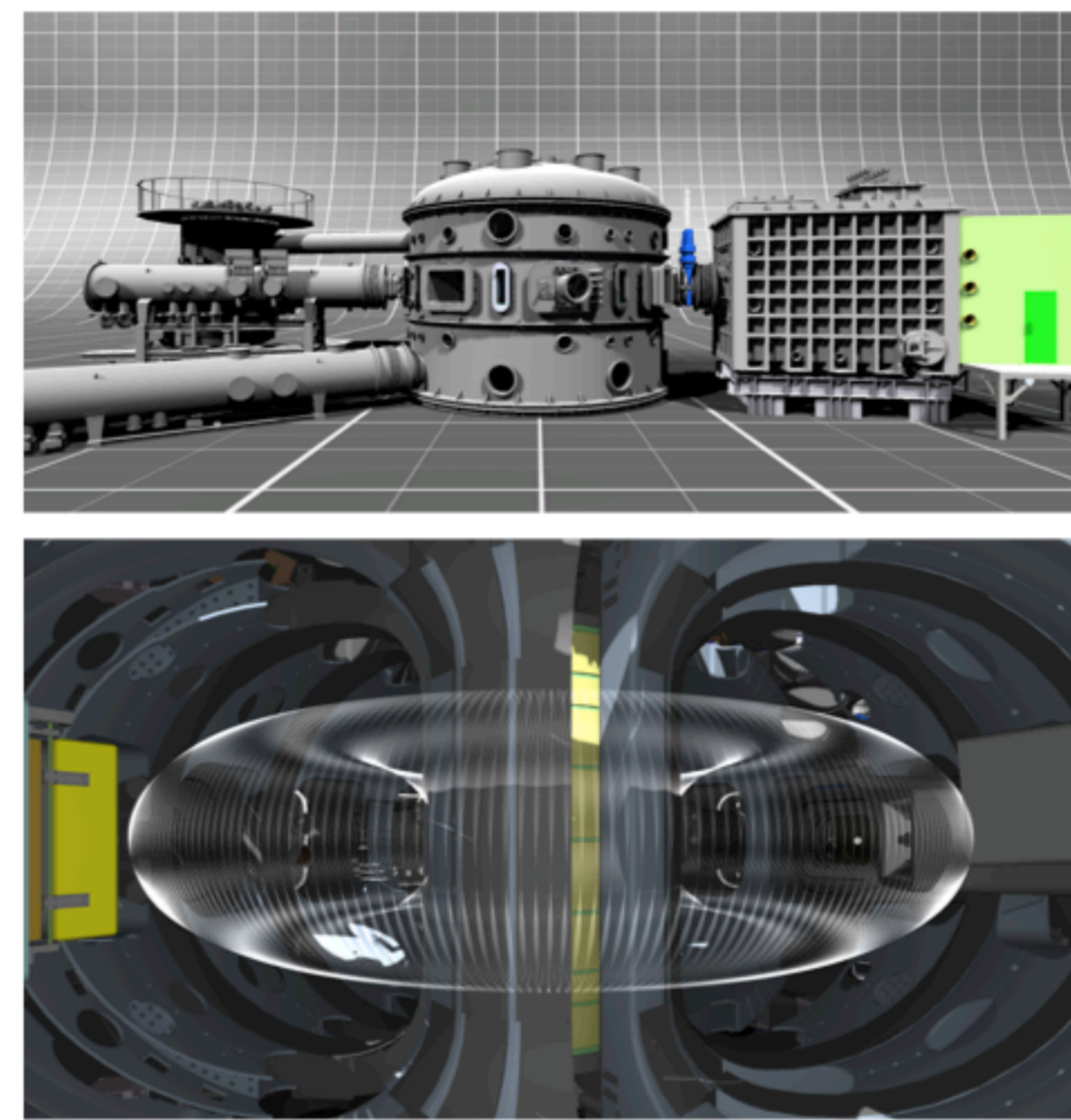
- Organization considering relations between different technology sectors
- Stepwise development and integration of two pillars: experiment operation and fundamental technology development



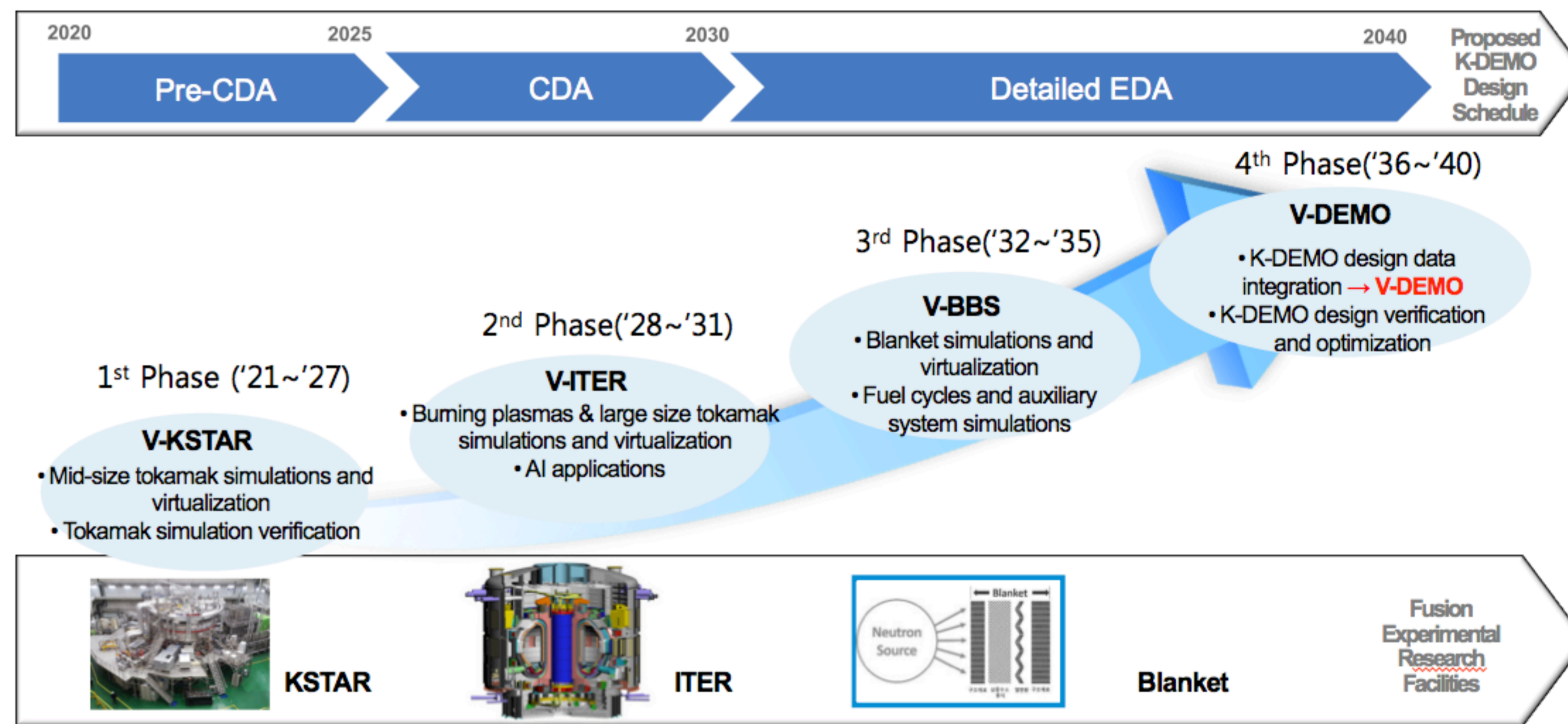
## 2. Virtual DEMO Definitions and Goals



- Definition**
  - Virtual fusion plant established in the virtual space utilizing technologies such as supercomputing or artificial intelligence
- Goals**
  - Quantitative prediction capabilities of fusion plant main functions such as core performance and stability etc.
  - Integrated simulations of fusion power plant incorporating tokamak, blanket and BOP
- Applications**
  - Provision of requirements for detailed engineering designs
  - Verification of physical and engineering consistencies and optimization of plant designs



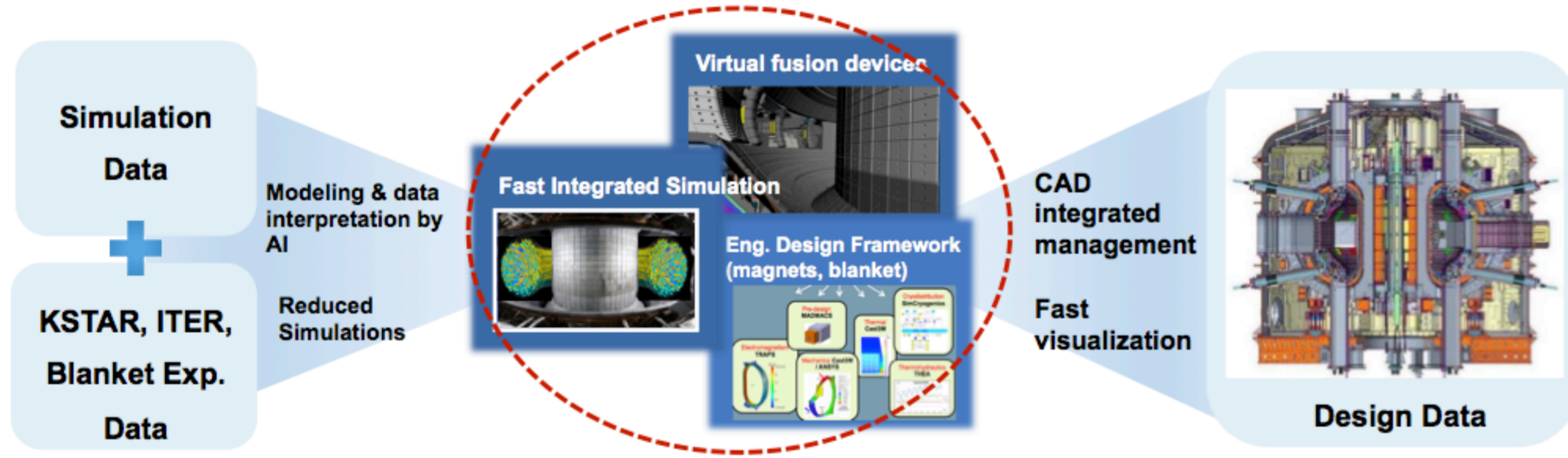
## 3.4 Phased Approach



## 3.1 R&D Strategies



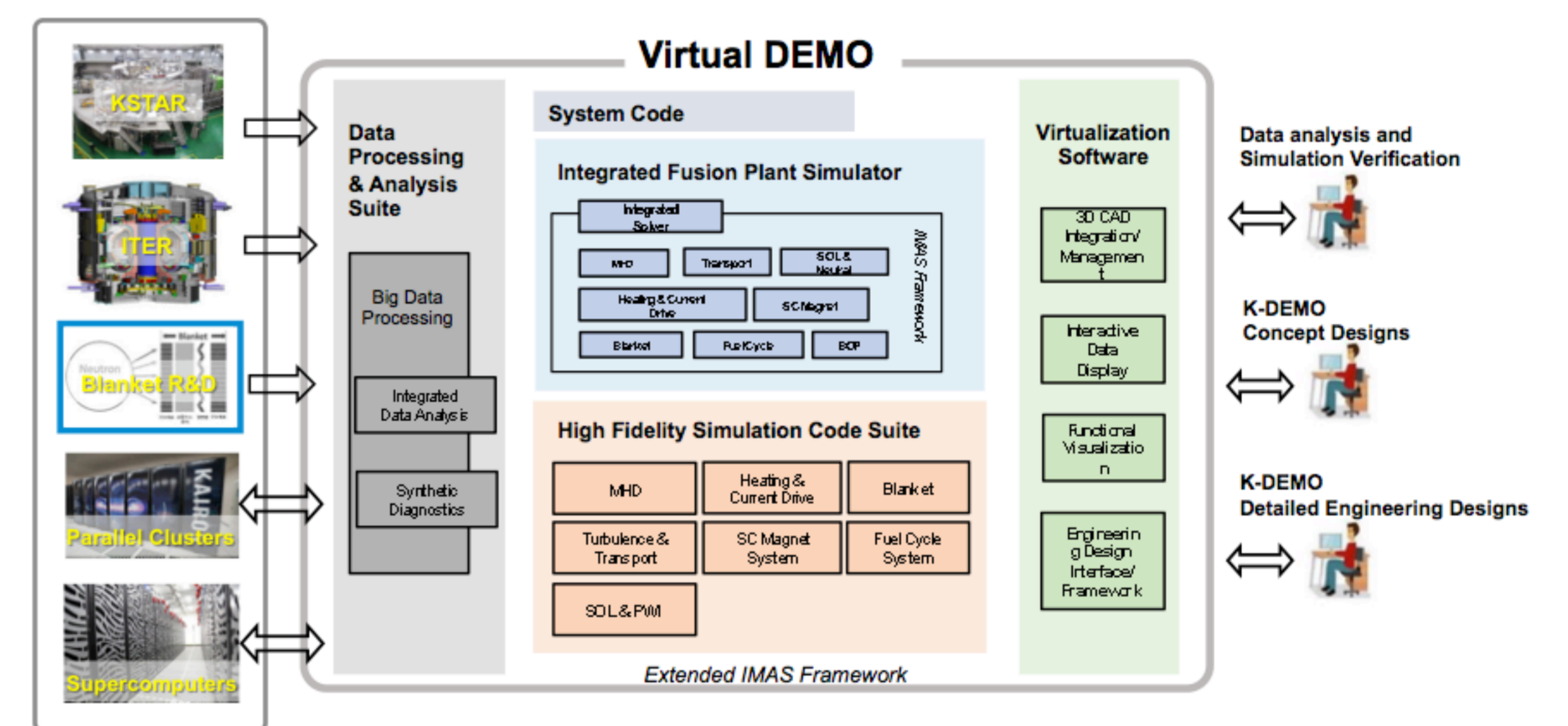
- Fusion performance and stability prediction: Supercomputing simulations**
- Fusion power plant integrated simulation: Nuclear simulations (Nuclear analysis, BOP)**
- Software core & fundamental technologies: Common basis of simulations and virtualization**
- Simulation verification and validation: Data from KSTAR, ITER and other experimental facilities**
- K-DEMO design support with expedited simulations incorporating virtualization and AI technologies**



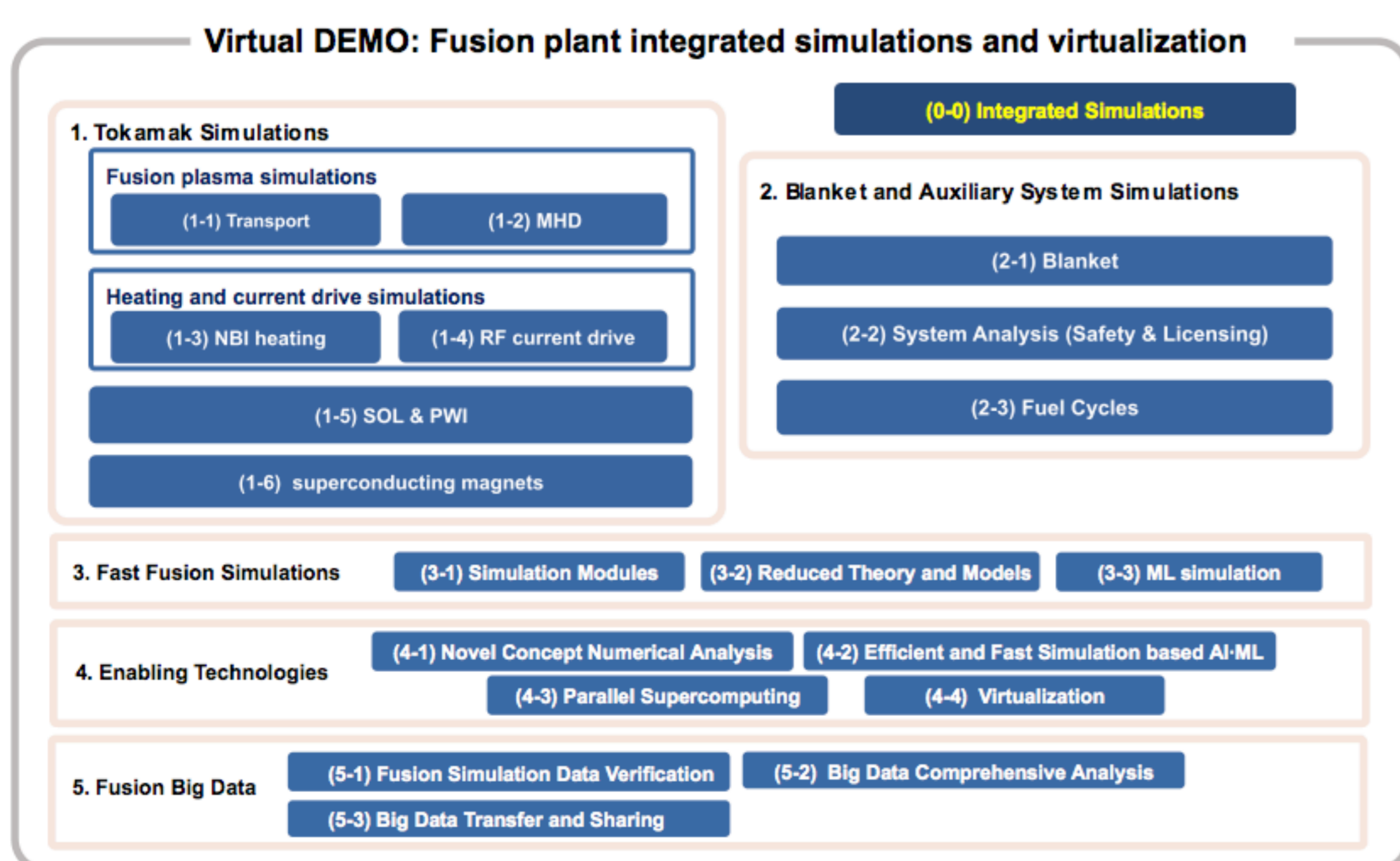
## 4.1 Applications



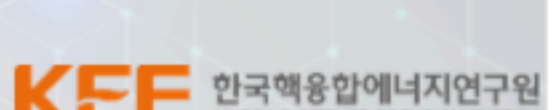
- Software Required for K-DEMO Design Activities**
  - Pre-CDA and CDA: System Codes and Integrated Simulators
  - Detailed EDA: High Fidelity Codes for Requirements Determination and Design Consistency Evaluation
  - Digital Twin for K-DEMO Construction and Operation



## 3.2 Fields and Components



## Summary



- Virtual DEMO bridges the present (KSTAR, ITER) and the future (K-DEMO)**
  - Simulation development Verified and Validated by KSTAR, ITER, Blanket facility
  - Integration between Physics (Tokamak) and Engineering (Blanket, BOP, Licensing etc)
  - K-DEMO design optimization, Safety analysis/Licensing preparation, and Construction risk and cost minimization

