



LEAPS

League of European
Accelerator-based
Photon Sources

Wrap-up

LIP Workshop on
Digital Twins, ML & AI techniques and Virtual Diagnostics

May 11 & 12, 2021

Purpose of the workshop

Within LEAPS steps are taken to strengthen the use of digital methods with the goal to make the operation of the facilities more resilient, efficient and performant

Digital LEAPS

Starting from WG2 (Sources) a proposal was developed to work towards an integrated platform : **LEAPS Integrated Platform**

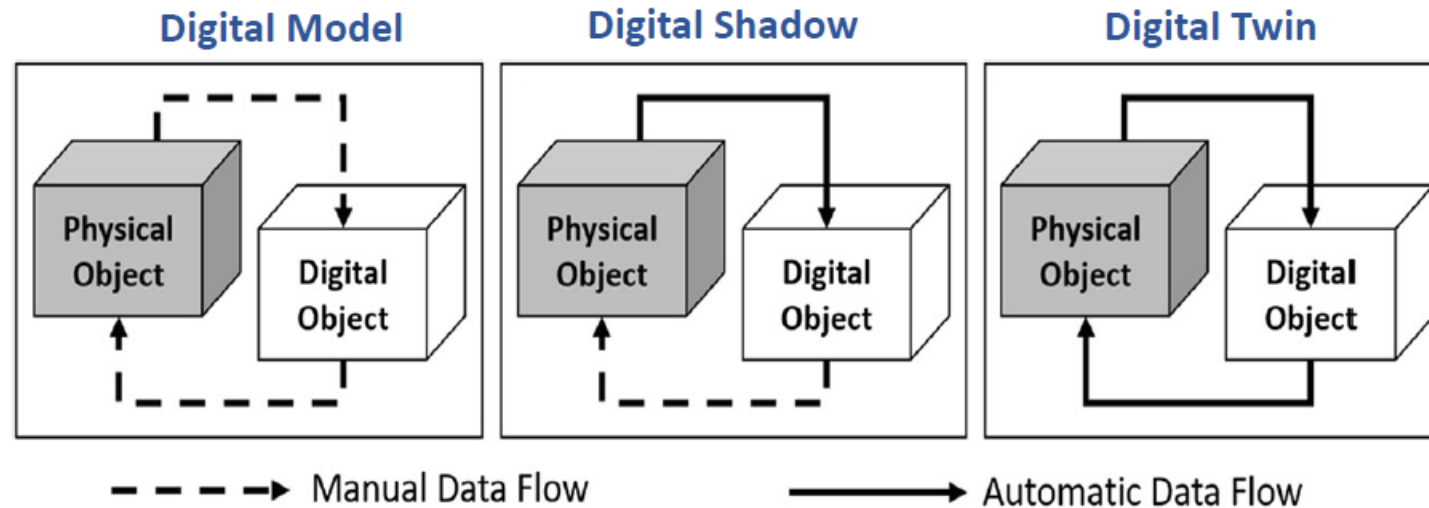
This includes accelerators and instrument signals to optimize their operation. This part was augmented by the intention to work towards automated beamline alignment.

As a first step towards formulating concrete activities and deliverables the WG2 considered it important to establish a status what is already done at LEAPS facilities (and beyond).

→ This was the starting point for this workshop.

Digital Twins, machine learning and virtual diagnostics

From talk by N. Leclercq

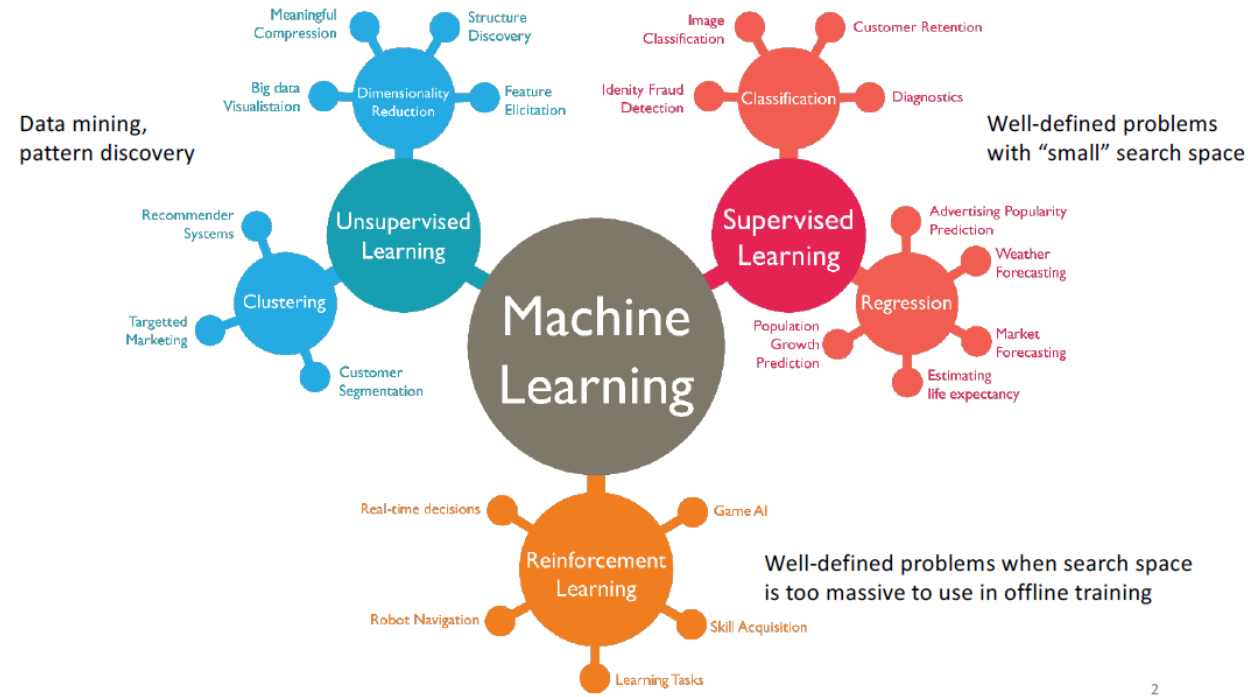


Digital Twins

- Presentations from several facilities reported about DTs existing & operable
- Application to design or operation for accelerator, x-ray beam transport, etc.
- Purpose and implementations vary widely.
- Aspects of complex simulation (accuracy) vs. fast feedback (real-time).
- Connection wanted !
- Computing challenges addressed.

Digital Twins, machine learning and virtual diagnostics

From talk by G. Valentino

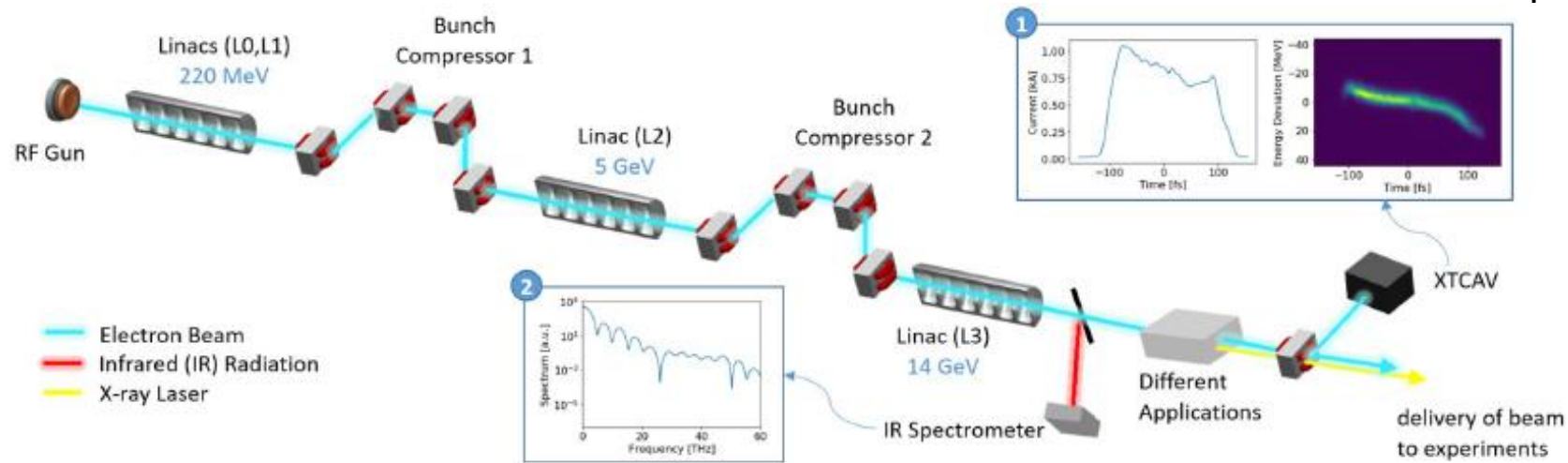


Machine learning (use of artificial intelligence)

- Presentations from even more facilities reported machine learning tools in operation or under development
- Applications range from injection to detector optimization
- Method development still on-going
- Application fields seem to increase constantly

Digital Twins, machine learning and virtual diagnostics

From paper by A. Hanuka



Virtual diagnostics

- Machine-learning based diagnostics
- Improve accelerator or more general beam diagnostics by using scalars or spectra to retrieve beam properties non-destructively and with higher resolution
- Once trained such a system allows ,real-time' feedback, much faster than a reconstruction of real data.

Finally

There were 109 registered participants.

Typical attendance varied from 60 to 100 persons in the different sessions.

A total of 25 speakers.

A big hand goes to the speakers for great presentations. Many of which are uploaded on the workshop website: <https://indico.psi.ch/e/11213>

LEAPS WG2 will need to diggest a lot of information. And will develop a proposal for DIGITAL LEAPS from it. In addition, several bits may be relevant for an upcoming proposal to the European Commission about building a Digital Twin for complex systems. Stay tuned.

Many thanks to **Marco Calvi** (PSI) to take a lead, being the driving force for this workshop, and last not least setting up most of it as well



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“The strength of LEAPS lies in its staff and users, hailing from all European countries, beyond those which host the facilities.”

Coping with the LEAPS data challenge will open the gateway to a new level of science and innovation.”

