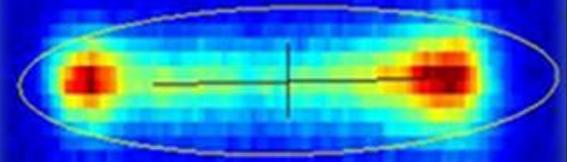

Characteristics of an Ideal Test Facility (A discussion)

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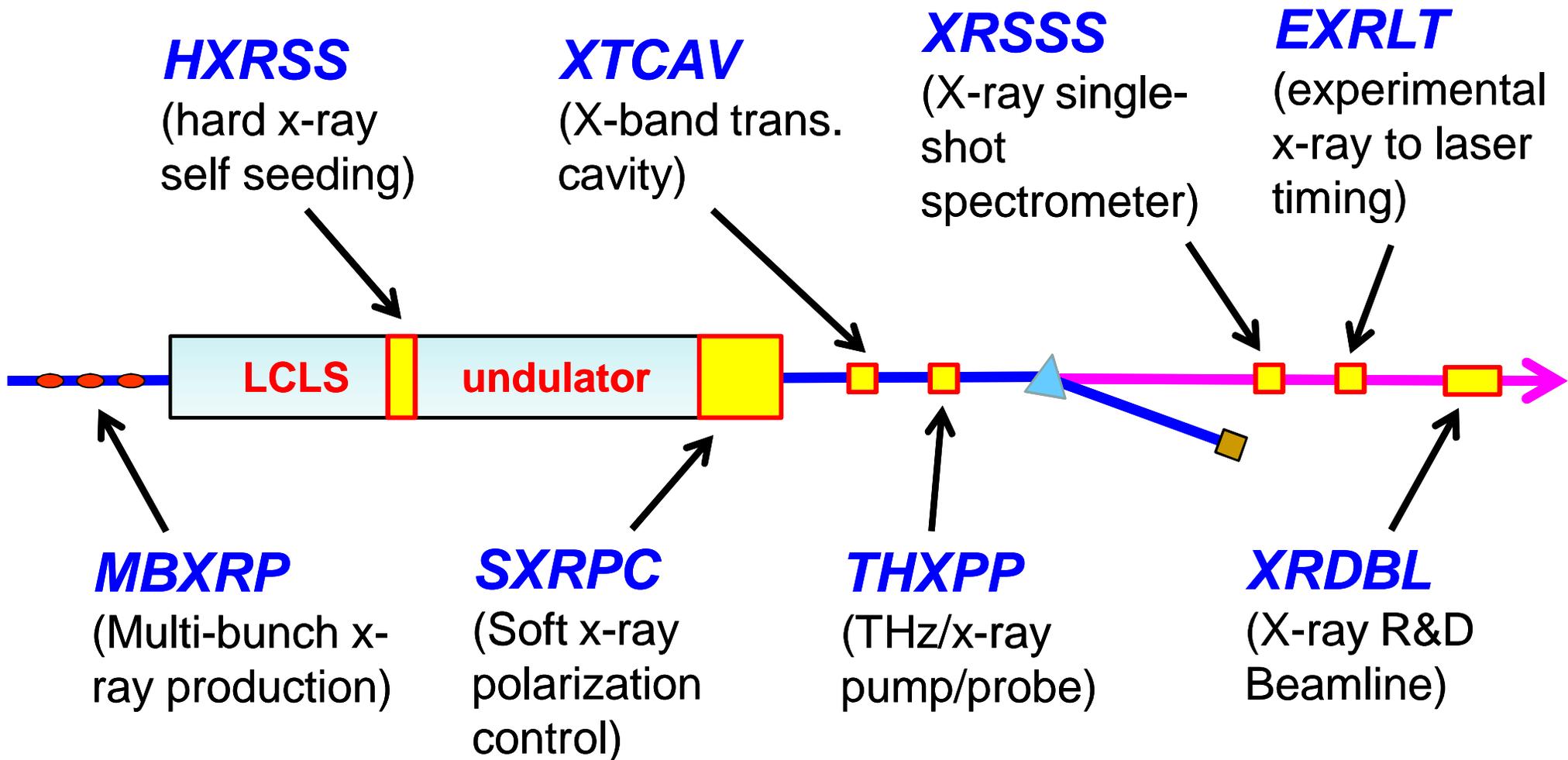
Why Experimental Accelerator R&D?

- Source brightness has been increasing 1000x every decade with future challenges in understanding dynamics
- Accelerator research requires parallel advancement of beam theory and experiment
 - Many concepts require experimental study because they are either too complex to fully model or because the risk of failure is too high
 - Other concepts are only uncovered experimentally
- The ideal test facility(ies) will need to support broad range of R&D topics ranging from studies of basic physics to demonstrating complex systems
 - Requires a range of beam conditions and experimental durations

Test Facility Requirements

- Operating user facilities will enable some R&D, especially that which is directed toward the program
- Other R&D requires more time or hardware modification than available at an operating user facility
- Examples:
 - Demonstration of SASE at short wavelengths: UCLA, ATF, TTF, ...
 - SPPS at SLAC studied many of the short bunch issues pre-LCLS
 - Concept of emittance exchange was demonstrated at A0 at FNAL
 - CSR Δe was measured at CTF-II, then SPPS and then the LCLS
 - Echo-7 experiment demonstrating a soft x-ray seeding technique
 -

FEL R&D using LCLS machine development time (Near term impact – 1~5 years)



Test Facility Characteristics

- Broad range of requirements on test facilities
 - Some experimental R&D can only be performed with high quality beam at operating user facilities but other requires special configurations or time
- Cost of R&D facilities increases with scale
 - FACET (20 GeV) costs 10x more per year than ATF (60 MeV)
- Program will need a combination of quasi-parasitic use of operating facilities and a diverse set of dedicated test beds
- To optimize for range of studies:
 - Enable greater use of user facilities for focused experiments
 - Use 'small' facilities for exploratory studies
 - Develop larger-scale facility(ies) for complex experiments

User Facilities vs. Dedicated Test Stands

- Accelerator user R&D facilities can reduce costs and enable support for a broad range of studies
 - Ex: ATF at BNL and FACET at SLAC
 - Proposals are competed against each other
 - Common infrastructure provided by the test facility
- Other R&D needs to be linked to local teams and facilities
 - Some programs are specialized and require long-term commitments
 - Facilities must be competed against needs and user facilities
- All test facilities should be encouraged to accept outside proposals and should maximize synergy across Office Science programs
 - May require some increased support

Some Existing Accelerator R&D Test Beds

- ATF and SDL @ BNL
- CESR/TA @ Cornell
- Duke Storage Ring @ Duke
- IR FEL @ JLAB
- AWA @ ANL
- Neptune @ UCLA
- NLCTA and ASTA @ SLAC
- BELLA and FACET @ LBNL and SLAC
- ATF and ATF2 @ KEK
- SCSS @ Spring-8
- TTF / FLASH @ DESY
- EMMA and ALICE @ Daresbury
- CTF-III @ CERN
- Some of these facilities have been aimed at specific R&D programs while some have supported broad R&D programs
- Test beds enable detailed study of fundamental accelerator processes and technology as well as the opportunity for accelerator education
- Approximate breadth of programs
 - ~ directed program
 - ~ broad-based (acc. user) program
 - ~ mixed program

Summary

- Many critical R&D topics can be directly pursued at operating user facilities in a quasi-parasitic mode
- Dedicated test facilities are required to support other critical R&D (and provide a training ground for students)
 - Balance between accelerator R&D user facilities and dedicated facilities to maximize user community and minimize costs
 - Example: 5 x 100k\$ facilities, 3 x 1M\$ facilities and 1 x 10M\$
 - Need mechanism to prioritize facilities and maintain flexibility
 - Maximize synergy across Office of Science programs
- Important to maintain diverse set of dedicated test facilities as well as dedicated time at user facilities to enable next generation of light sources