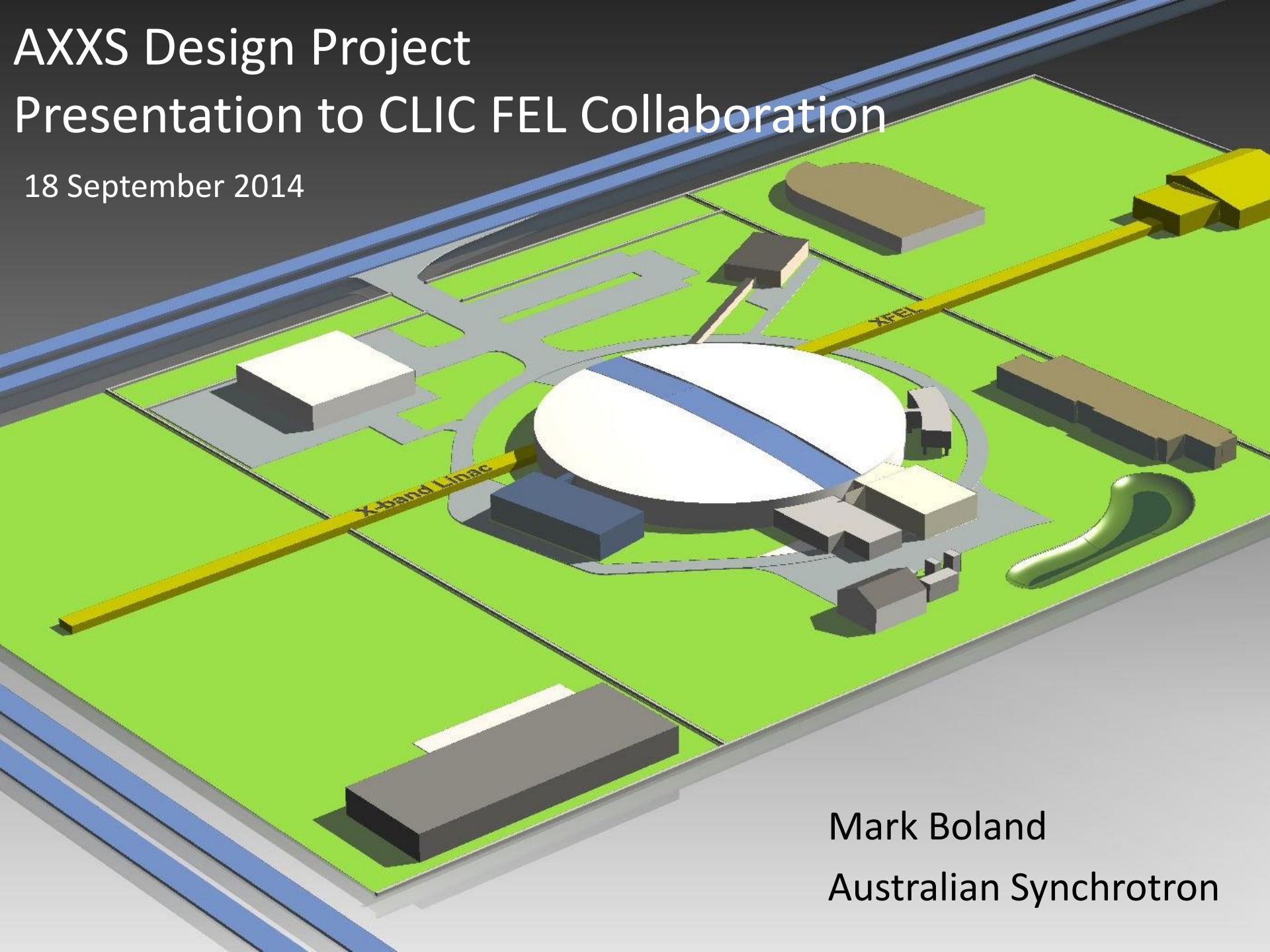


AXXS Design Project Presentation to CLIC FEL Collaboration

18 September 2014



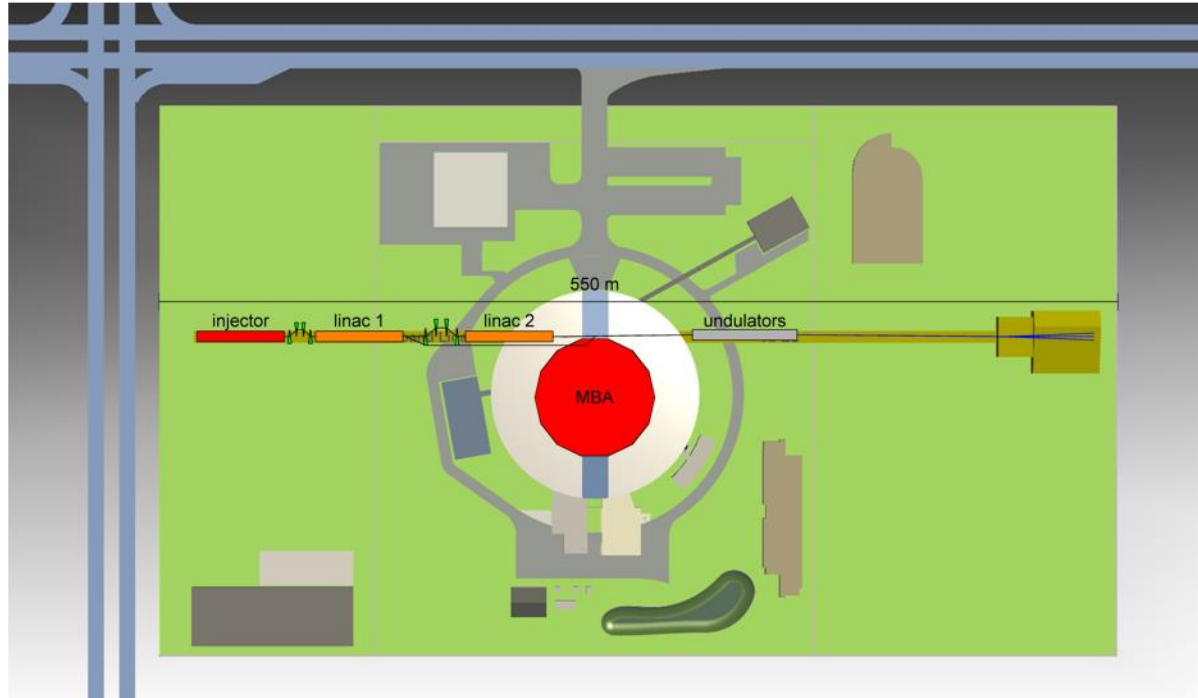
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- AXXS – Australian X-band X-ray Source
- AXXS n. /'æksɪs/ *fig.* A central prop, which sustains any system.
- Development plan for the Australian Light Source community:
 1. develop the remaining beamlines (space for an additional 6 IDs)
 2. upgrade the storage ring lattice to MBA (compact MAX IV magnets)
 3. upgrade the injector to a full energy x-band linac (3 GeV)
 4. upgrade to additional linac for (X)FEL
- Work supported by management (support letter for Horizon2020)
- Work conducted in nominal 20% research time of ASLS staff
- Work designed to overlap with XbFEL/CLIC design efforts
- Working with x-ray beamline and university researchers to arrive at requirements for the photon beam to drive the accelerator parameters
- participants: 4 physicists (Mark, Rohan, Eugene, David), one PhD (Tessa), some engineering support (four interested)

- Promoting the idea at conferences and meetings to get community feedback and user support
- ACAS Workshop Jan 2014
- IPAC'14 poster – Boland et. al.
- LER'14 workshop? – Rohan Dowd
- Australian Synchrotron User Meeting 2014?
- XRM'14 www.xrm2014.com
- MEDSI'14 www.meds2014.org

AXXS Constraints

- Site constraint 550 m:



- Same tunnel, energy and source points for storage ring upgrade.
- Time constraints: need to finish building out the remaining beamlines before justifying a new ring or FEL.

1. Injector

a. Gun

- i. LCLS baseline design, but final time structure, charge and emittance needed

b. Bunch compression

- i. Determine bunch compression requirements based on FEL requirements
- ii. Do we need harmonic compression?

c. Model

- i. Build a model of injector for tracking purposes, including space charge effects
- ii. Do we need S-band injector?

2. Main Linac

a. Model

- i. Build a model of linac for tracking purposes

b. Beam Quality

- i. Energy and emittance requirements needed based on meeting both ring and FEL needs.
- ii. Allowed energy spread, jitter etc.

c. RF

- i. RF stations, Synchronisation and stability requirements need to be based on ring and FEL requirements for energy jitter and long phase space.

d. Cavities

- i. breakdown rate at voltages needed.
- ii. Wakefield effects

3. Ring

a. Model

- i. Decide on modelling code
- ii. Impedance effects – chamber design

b. Injection scheme

- i. Need incoming beam emittance requirements to feed to linac parameters
- ii. Numerology – eg: Number of bunches, length of bunch train from linac, topup requirements.

c. RF

- i. need RF requirements of beam, including total beam current, Frequency etc.
- ii. Bunch stretcher to avoid instabilities?

4. Radiator

– Undulators

- - Need 3 and 6 GeV radiator parameters to feed to linac/injector requirements
- What undulator parameters are needed for 1 Angstrom radiation at both 3 GeV and 6 GeV? Is a 3 GeV X-ray FEL even feasible?
- SASE vs Self Seeding comparisons

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5. Endstation

- a. Need to decide on an end photon flux and energy range – even if upper limit.

- Opportunities for staff and students:
 - SwissFEL commissioning?
 - CERN/CTF3?
 - SLAC ASTA gun facility?
 - SLAC x-band activities?

AXXS Modelling Plans

- move physicists to using ELEGANT code for end-to-end accelerator modelling (presently using MATLAB AT)
- Move to Genesis code FEL modelling (presently using SIMPLEX)

FEEDBACK?

- What do you think?