Magnets & IDs for the ALS-II Proposal

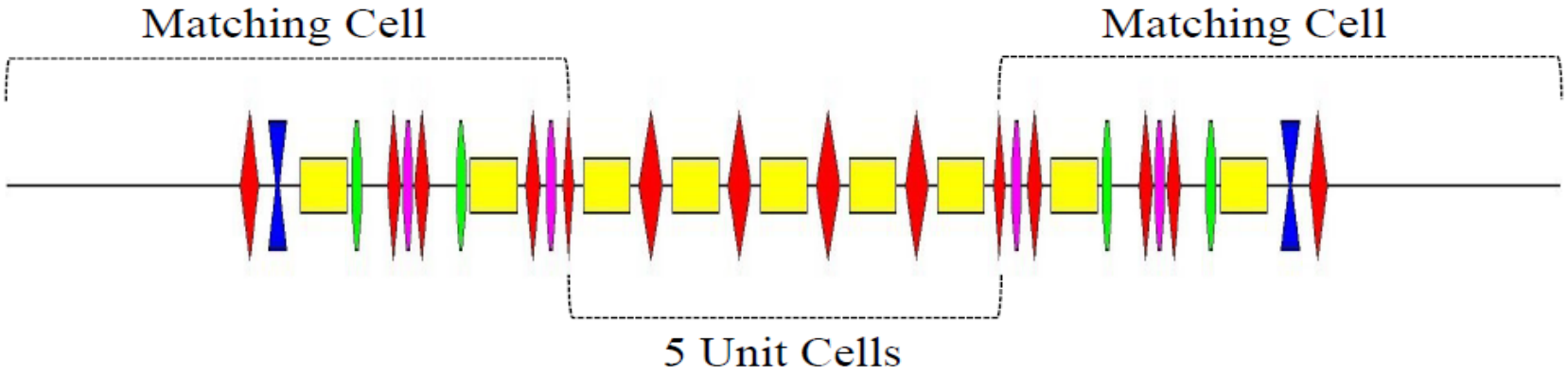
H. Tarawneh
on behalf of
D. Arbelaez, R. Duarte, J.-Y. Jung, A. Madur, S. Prestemon, D. Robin, R. Schlueter, C. Steier, C. Swenson

Outline

- ALS-II Magnet Lattice
- Magnetic Elements.
- Superbend Magnet Proposal.
- Potential IDs for ALS-II.

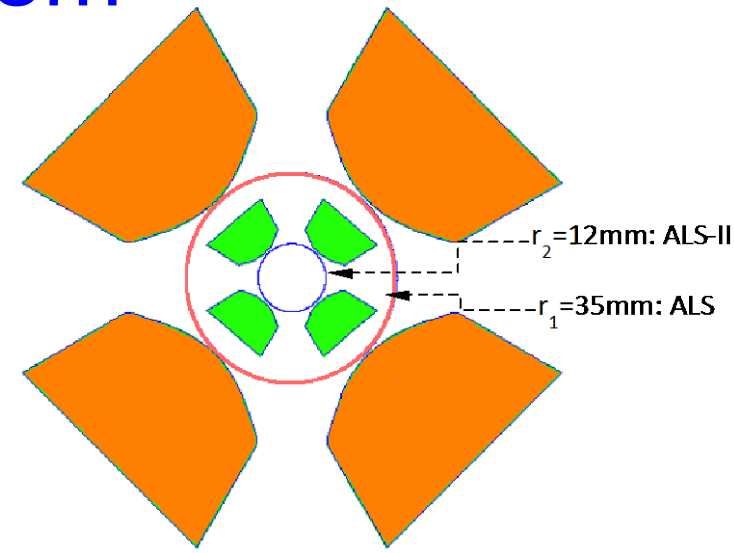
Candidate Magnet Lattice for ALS-II

- The ring admittance is defined by the low gap ID, hence small aperture, small size magnets to achieve low emittance without damping wigglers.
- The ALS-II SR has 12 superperiods with 9 bending magnets.
- Center 5 dipole cells have non-zero dispersion but very small.
  No sextupole magnets there due to small betatron functions (ESRF approach).
- Matching cell with two dipoles;
  -To match zero dispersion in the straight sections and low beta values for matching the electron-photon phase spaces.
  - Creates high dispersion within the matching cell for chromatic and harmonic correction.
- Straight section length of 5.15 m and circumference of 196.4 m.

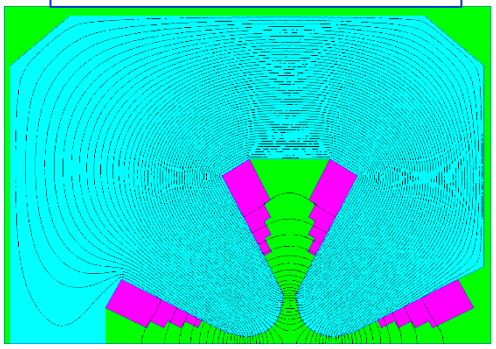


ALS-II Magnet System

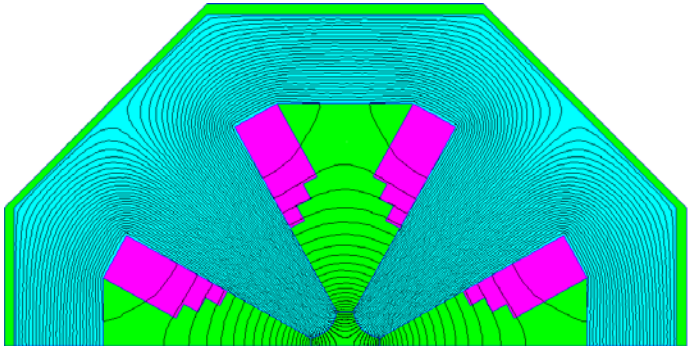
- Third generation light sources = generous physical apertures (except for IDs which define much smaller admittance) – smaller apertures (factor 3) = much stronger magnets
- Nowadays field quality with smaller magnet apertures achievable
- MBA lattices provide smaller natural emittances
- NEG coating - distributed pumping in small chambers (cheaper)



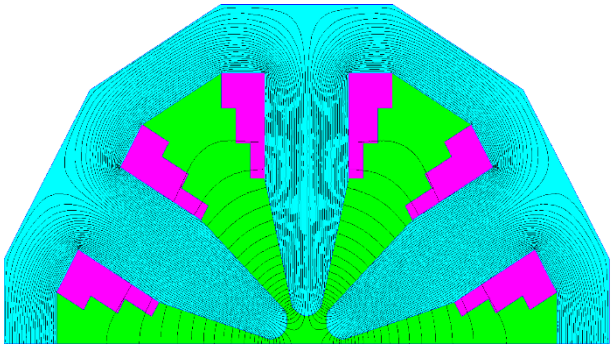
0.78 T & 50 T/m

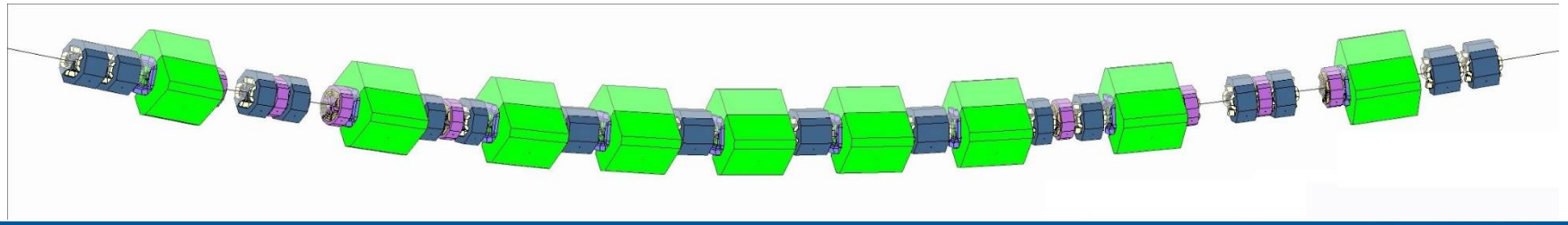


100 T/m

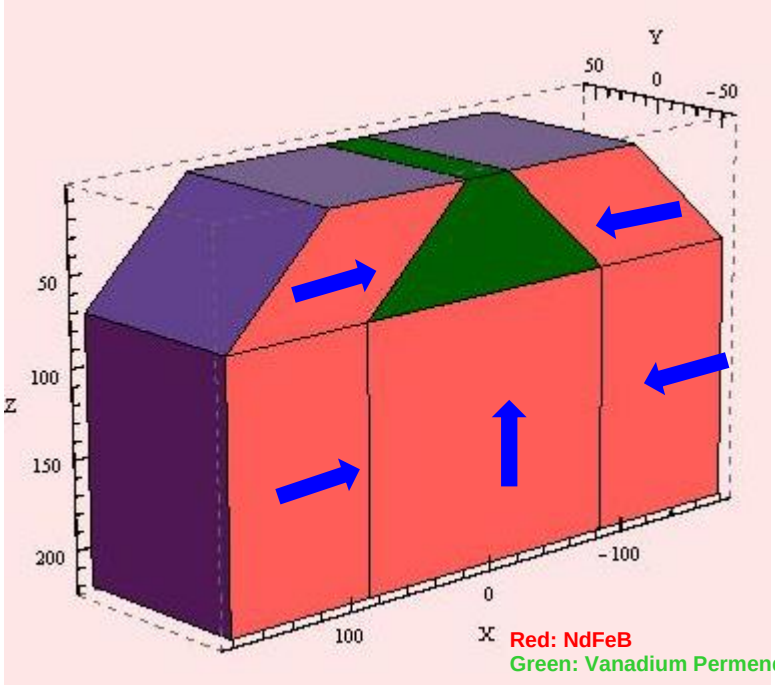


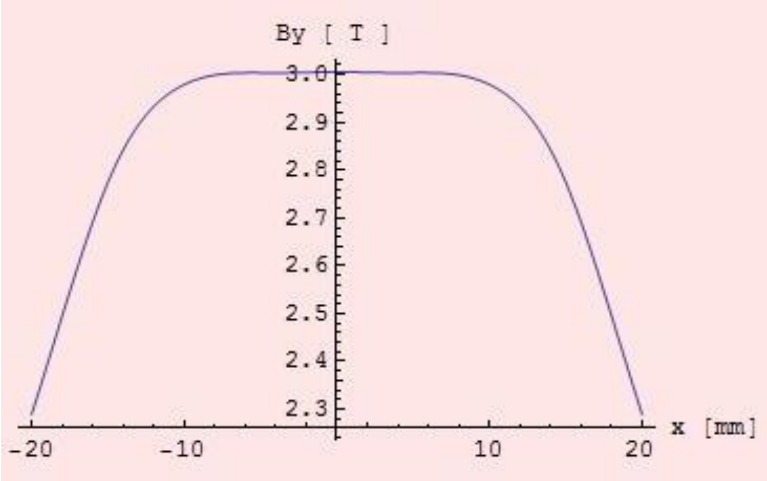
3000 T/m^2



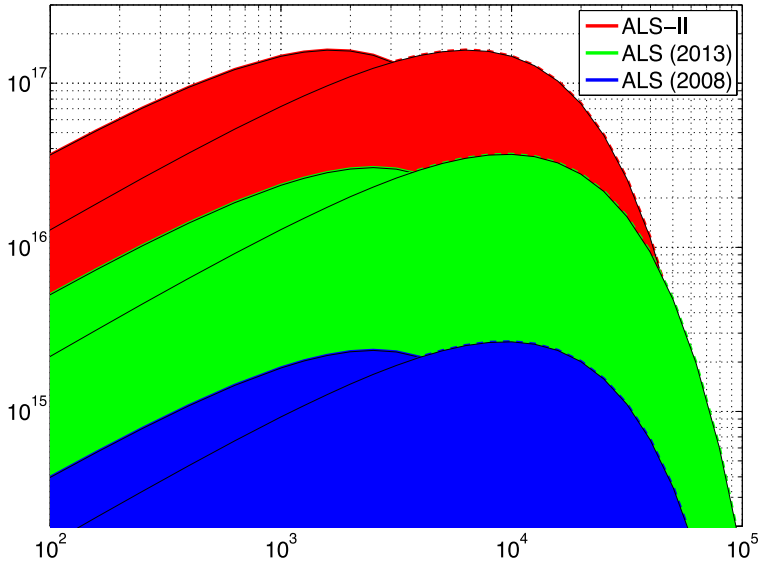


‘Superbend’ with 3T Field





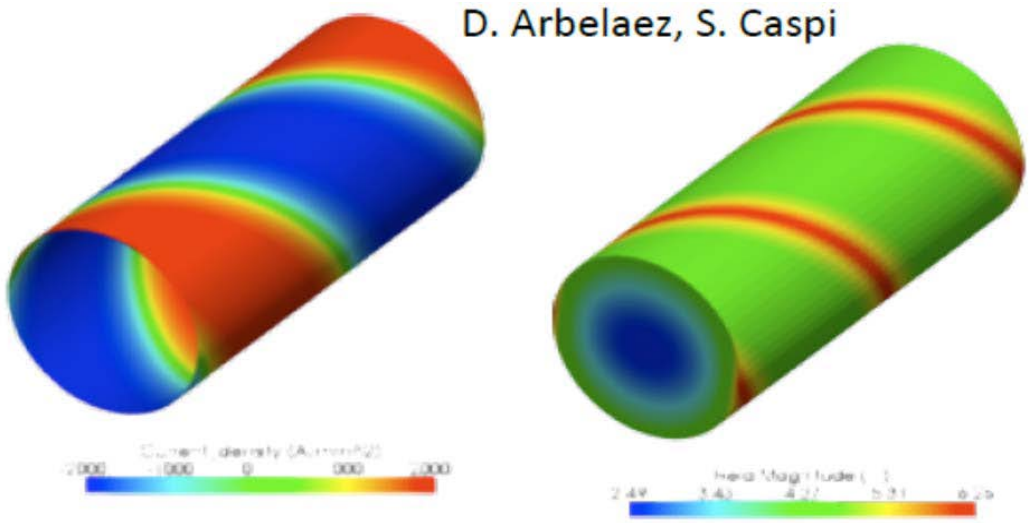
- Providing high brightness bend magnets sources is one design goal.
- One tentative solution is to place some higher field (3 T) permanent magnet dipoles in few arcs
- Excellent brightness performance up to >20 keV.



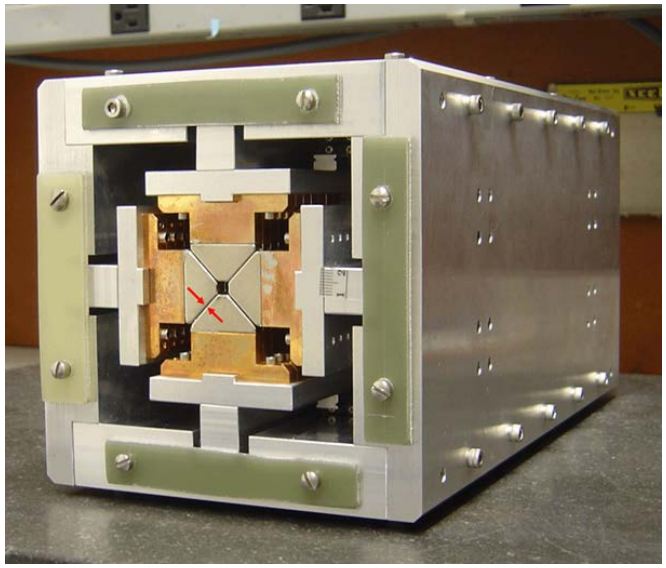
Potential IDs for ALS-II

The low emittance of DLSR and on-axis injection allow small vertical & horizontal apertures in the straight sections:

- Smaller gaps allow higher performance (shorter period, i.e. more flux) undulators.
- Round beam allows to go from flat undulator geometries (which were fine for linear polarization) to round ones.
- Potentially large advantage for polarization control undulators (could be both permanent magnet or s/c).
- ID performance, effect on beam dynamics, heat load is under study.



Bifilar Helical Undulator



A. Temnikh – Delta Undulator

Summary

- Dramatic performance improvements beyond ALS to approach diffraction limit are possible by;

  Small aperture magnet size allows for strong multipole magnet.

  Small size and large number of magnet elements.

- High brightness hard x-ray source using 3T PMM Superbend appears feasible as an option.

- Small emittance (round beam) and small aperture give the ability to reduce not only the vertical but horizontal gaps (round pipe) for insertion devices that allows for improved performance (flux, brightness and polarization).