

XAL Model Verification & Test

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Compare XAL to MAD (1)

- XAL formalism differs slightly from MAD
 - energy is *kinetic* energy
 - longitudinal coordinates differ by relativistic factors (products of β and γ)
- LCAVITY elements (RfGap in XAL) are modeled as thin-lens elements
- SBEND strength defined as B [Tesla]
- QUAD strength defined as G [Tesla/m]
- sequential drift spaces (and MARKERs) are combined

Compare XAL to MAD (2)

- design optics, R-matrices only
- acceleration OFF (SBEND, QUAD, DRIFT, MATRIX)
- SBEND
 - matrix computation same as MAD
 - problems fixed: zero bend angles, no fringe fields, incorrect gaps, “split bend disease”
- QUAD and DRIFT OK
 - matrix computations same as MAD
- MATRIX not implemented in XAL ... Paul is adding it now
- R-matrices agree, even down to 6 MeV

Compare XAL to MAD (3)

- design optics, R-matrices only
- acceleration ON (LCAV, SBEND, QUAD, DRIFT, MATRIX)
- LCAV
 - matrix computation not same as MAD
 - problems: thin lens, no entrance/exit focusing
 - matrix product $R_{\text{total}} = R_{L/2} * R_{\text{XAL}} * R_{L/2}$ agrees with MAD at high energy, but differs at low energy ... XAL is probably “more correct” than MAD, since MAD assumes fully relativistic beam
 - new XAL Class *ThickLCavity* will be defined; java code that implements MAD matrix computation is already written

Issues

- MATRIX elements
- LCAVITY elements
- problems in MAD-to-Oracle process
 - FINT values for SBENDs not in tape files
 - length of MATRIX elements not in tape file
 - Rij values for MATRIX elements not in tape file
- special MAD MARKER types (WIRE,PROF,INST,etc.) are MARKER elements in XAL
 - Paul is working on a fix
- MARKER elements from MAD deck are not in XAL model
 - DBMARKnn, ...

Next

- “online” (not design) model checkout
 - “LEM Lite”
 - “BDES-to-B”
- XAL model output (Twiss, R-matrices) to Oracle
 - tools + interface to select and download (to java, Matlab, ...)