Online Model Architecture

AP Video, 4/8/03

Online Model Structure

- Xal view of the accelerator: Accelerator nodes
- Model view of the accelerator: lattice
- Connection between the two views, and working with the model.

XAL Structure

- View the accelerator as a set of “Accelerator Nodes”
  - These nodes correspond to devices in the beamline
  - Node types include quad, corrector, BPM, current monitor, ….
  - Physical devices with multiple components are separated into multiple “nodes” at the same location
    - E.g. MEBT quad + correctors + BPM = 4 nodes

- These Accelerator nodes are grouped together in sequences
  - MEBT, DTL1, …CCL, SCL1, …HEBT
  - Sequences can be “pasted together”

XAL Accelerator Node Structure

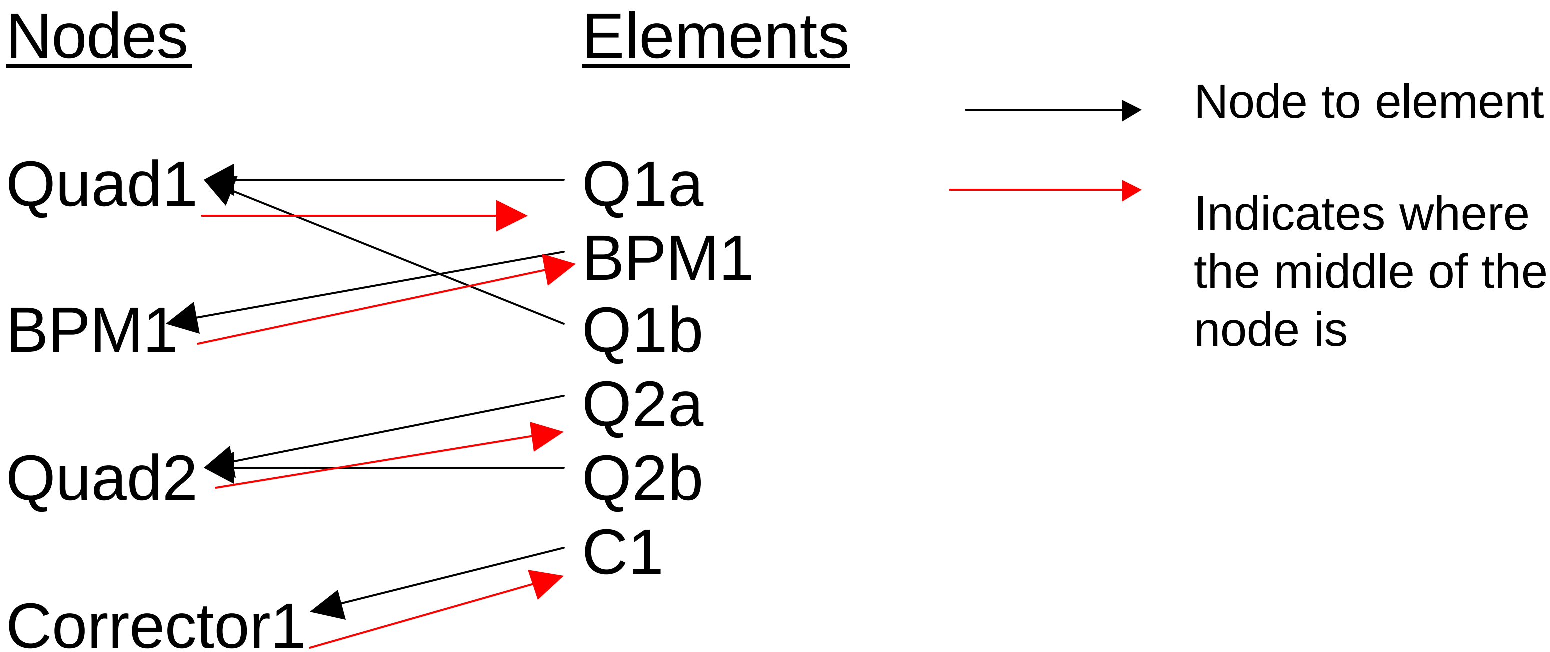
- The information about these nodes is stored in the Global Database
  - We create an xml file with this information in it
  - Only static information is included here
  - Note: no drifts are included in the database – only real devices
  - Populated through HEBT

The Model Structure

- "Model" consists of 2 main parts (based on Malitsky design)
  - Probe: the type of beam model, needs initial conditions.
    - ParticleProbe (Working: for centroids, single-particle, etc.)
    - EnvelopeProbe (Working: for Trace3D-type simulations)
    - *EnsembleProbe (In Progress: for multi-particle simulations)*
    - *ParticleRespProbe (first-order perturbations from a single-particle trajectory)*
    - *EnvelopeRespProbe (first-order perturbations from an envelope trajectory)*
  - Elements: the usual set of lattice elements used in lattice transport codes
    - Have drifts, thin lens, quads, dipoles, + rf gaps implemented
- The results (I.e. twiss parameters + particle coordinates) are stored in the probe as a function of longitudinal position along the elements

Relationship between the Accelerator Nodes and Model Elements

- Need to go from Accelerator Nodes to Model Elements
  – One to many
  – Deal with overlapping elements, …
  – Need to remember where to look for model results too



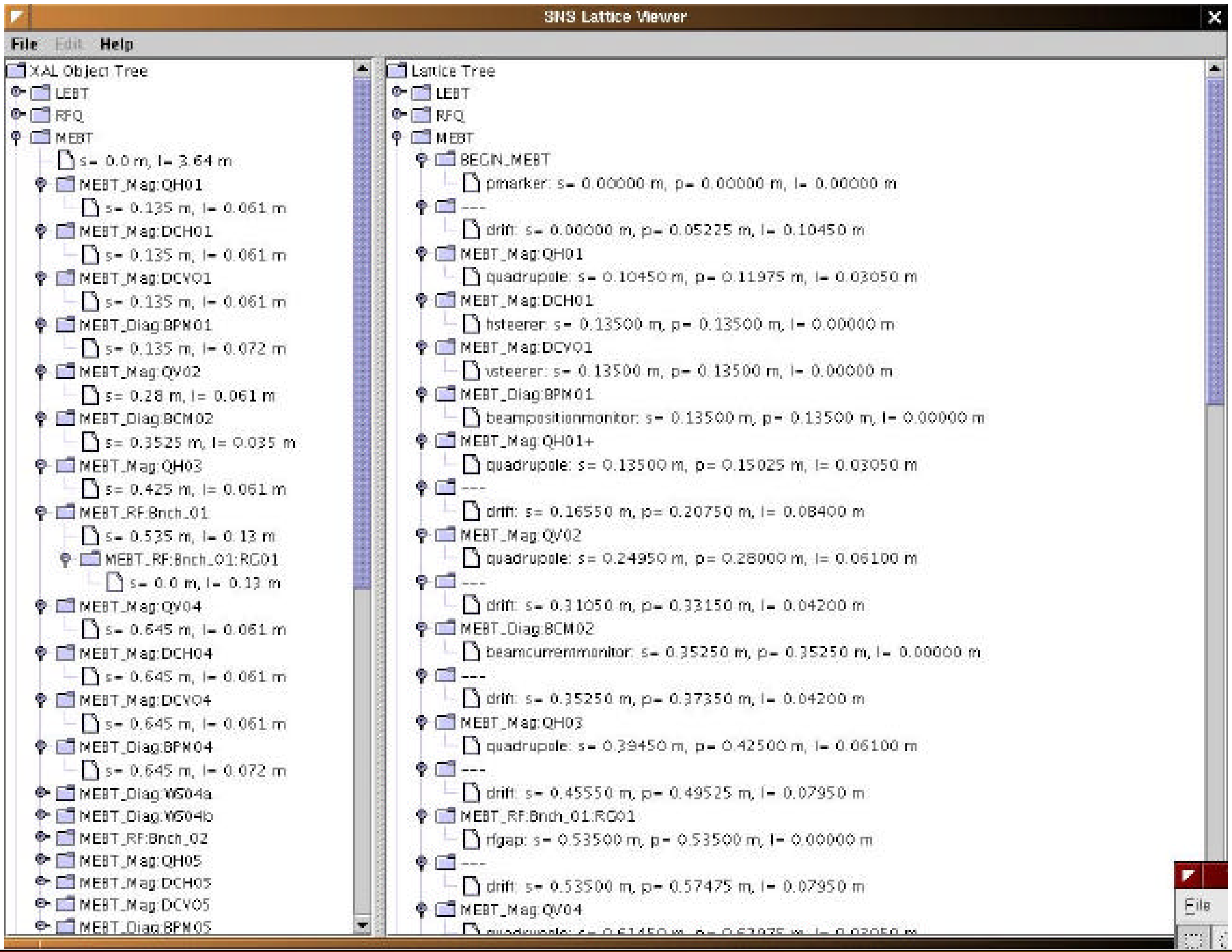
Lattice Generator

- Lattice generator is the intermediate step
  - Input a sequence of accelerator nodes, output a list of elements
  - Split the quads, correctors are not split, diagnostics are “markers”
  - Each lattice element includes a reference to its parent Accelerator Node
  - Have a map indicating which element represents middle of the node

- From the lattice generator file:
  - Make a set of model elements
  - Make external lattice files
    - Requires synchronization with the machine to get live values

Lattice Generation

- Accelerator Node to Lattice Element mapping



Working with the Model

- Need to hide much of the details with convenience methods
- Details are being worked out but the steps include:

- Start with Accelerator Sequence
  - Generate lattice using the lattice generator
    - `Lattice lat = LatticeFactory.getLattice(seq);`
    - Includes a map from Accelerator Node to model element(s)
  - Set up probe
    - `IProbe  probe = ProbeParser.parseUrl(strFileName);`
  - Launch the probe through the elements
    - `lat.propagate(probe);`
  - Retrieve info from the probe using the “lattice map”
    - `probe.getTwiss(node1);`

- Higher level model manipulations will involve propagating probes within a solver framework
  - E.g. tune