UAL Uses and Possibilities

- Why is UAL broadly applicable?
- Where is UAL currently being used, and for what?
- What else could UAL be used for? Suggestions...

- Features for Broad Applicability
  - UAL has a broad set of "base" objects (PAC)
    Particles/Beams, Optics, Beamline elements, Survey...
  - Really useful for accelerators
    "Wheeeeere's the beam?": all about particles/lattices/transport
    Still some round pegs (not Peggs) for square holes (e.g. envelopes)
  - Modular and easily extensible (APF etc)
    C^{++} glued together by Perl (EAP/APE/PEA Framework)
    Flexibility at the cost of complexity; doc a must
    The Blob Effect: trying to absorb every code in existence!
  - Dynamically-loaded shared objects
    You can't always get what you want, but you get what you need
    But this is not the 60's: You only get what you need once

Where is UAL currently being used?

- RHIC Offline Analysis
  - Slow but Complete instantiation of operating machine
    Suitable for subtleties: dynamic aperture, triplet nonlinearities, ...
  - Used by Beam Studies folks, tests of measurement/correction/spin/etc
- RHIC Online Modeling
  - Fast but simple, incomplete wrt nonlinearities
  - ATR transfer line, RhicInjection with map ATR/RHIC offsets
  - Fast Teapot in development to compare to OptiCalc: third-order maps
  - Connected to offline/beam study world through "SXF" exports
- SNS Ring
  - Space charge, freq/diffusion maps, half-integer modeling
- GSI
  - GSI synchrotron tracking, using ORBIT space-charge
  - IBS and e^- cooling modules added locally, quickly
  - Fast Teapot: tracking with all nonlinearities, space-charge

What could UAL be used for? (RHIC-centric)

- Improvements to RHIC Online Modeling
  - Proper b_2 radial tune/chromatic feed-down analysis
  - Online complex response functions using ZLIB
- RHIC Instrument Simulation
  - Loop closure, beam transport, transfer functions, ...
  - Modules for pickup simulation, cable effects, signal analysis
  - A challenge: instrumentation of collective nonlinear effects
    Schottky of resonances; transition/α_1 tomography sims
- Beam Collimation Transport
  - Beam tracking through material, bunches or particles
  - Mesh with as complete an accelerator model as necessary
- Proton Therapy/Imaging
  - Simulations require beam transport, material interaction, detectors
  - All fit naturally into beam-centric orientation of UAL
  - Separate out reconstruction, non-particle based analysis
    Another square peg, another round hole

Suggestions and Visions

- Strength of UAL: modularity, extensibility, framework
  - A "scripting environment" for particle-based accelerator physics and simulation
  - GSI example: complex transport modules incorporated quickly
- Long learning curve, too difficult for novice use
  - *Especially* true for non-Perl programmers
  - Documentation and examples help some, but either method browser (Doxygen) or...
  - Perhaps a LabView-like visual programming environment would unlock the full power of UAL to mere mortals