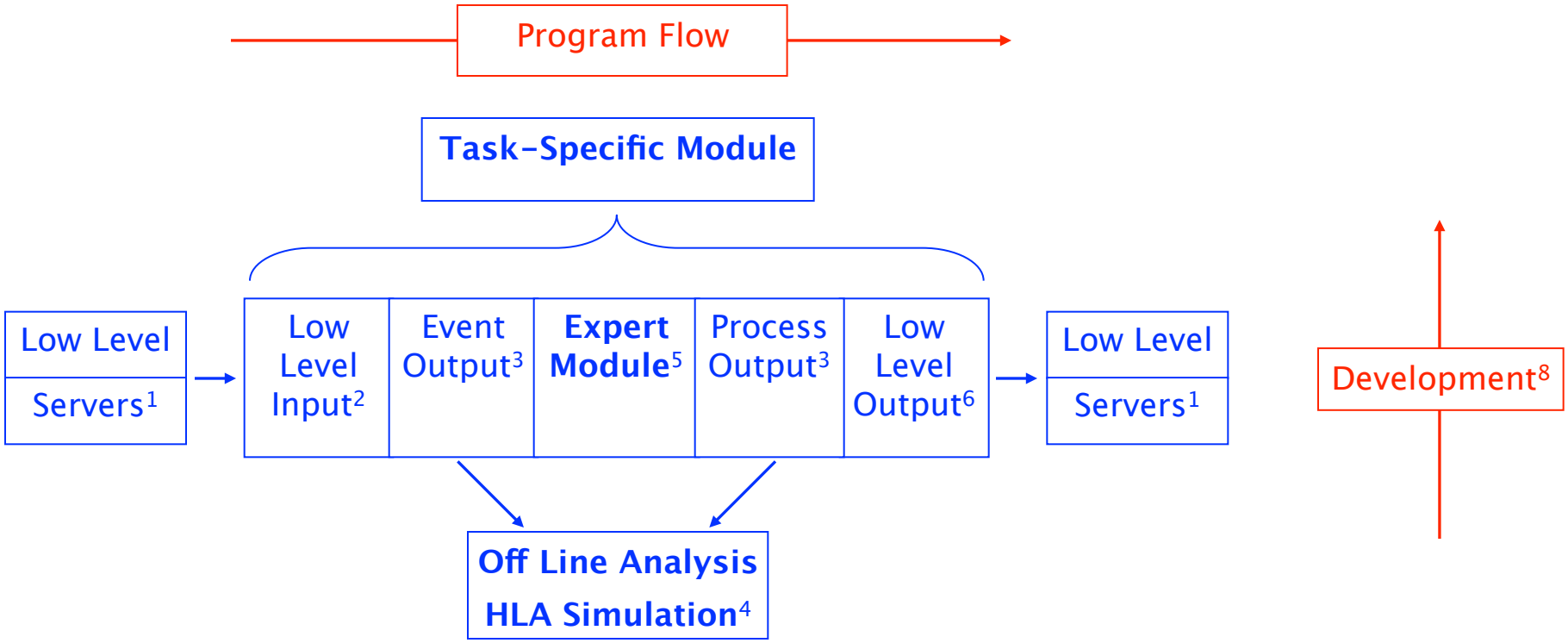
A Model for HLA Structure and Development Path



[1] HLA Servers capable of providing Channel Access PV's for model and hardware information not available from Low Level

[2] Standardized Handling of Input & control from Low Level & Server. Special instances of a Generic Data Acquisition Scheme

[3] Ensures single point source of model/configuration. Allows expert interpretation and intervention of events. Enables archiving

[4] Event reconstruction, proof-of-principle, algorithm development, post-mortem/fault accounting, run time data bookkeeping/statistics

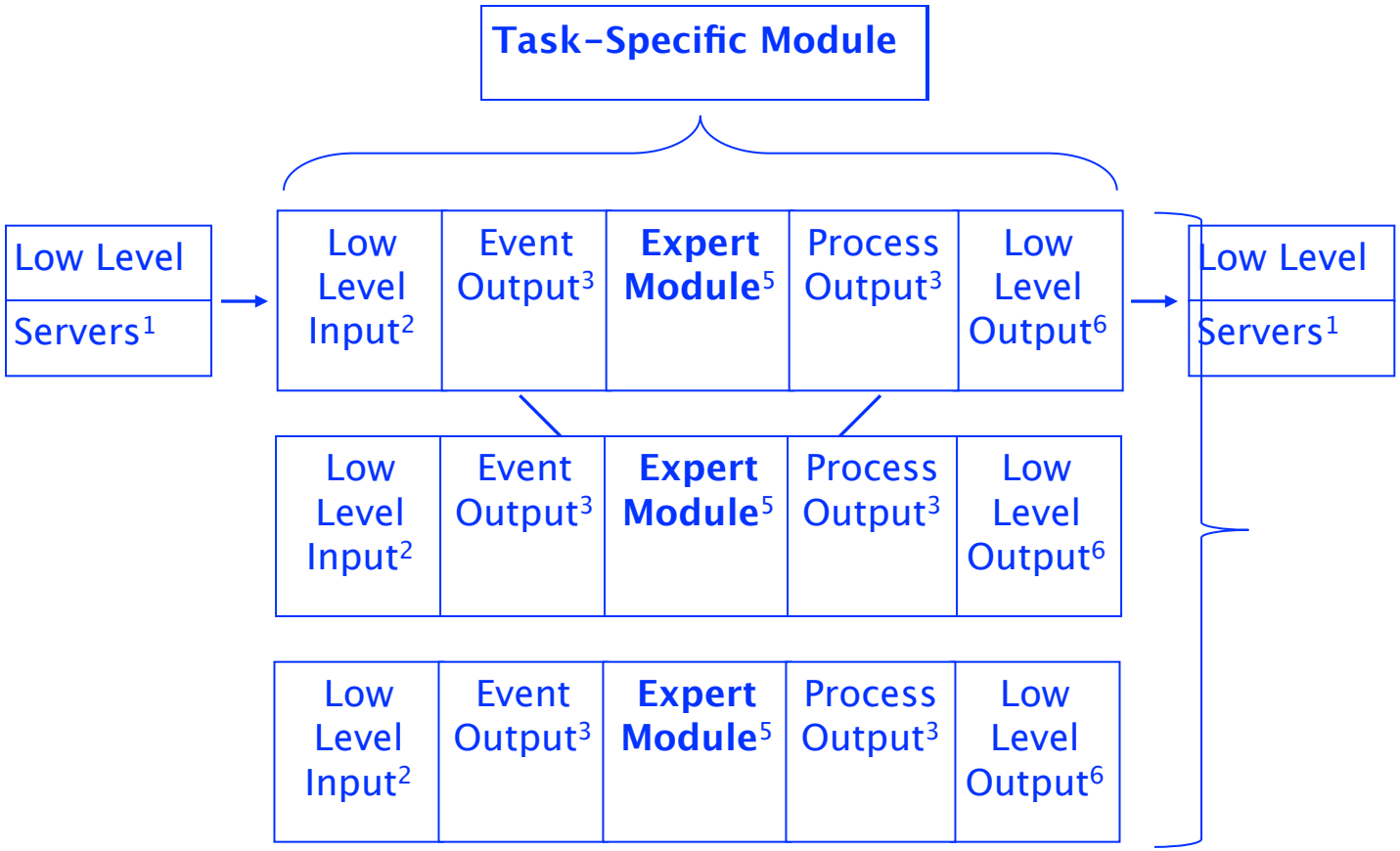
[5] GUI & algorithm allowing exploratory analysis of data and search for solutions. Modular by function

[6] Standardized Handling of Output to Low Level & Server. Special instances of a Generic Data Acquisition Scheme.

[7] Flow chart / Template driven, Goal oriented, linear process aimed at completing one task. Encompass all high level processes. May drive more than one expert module

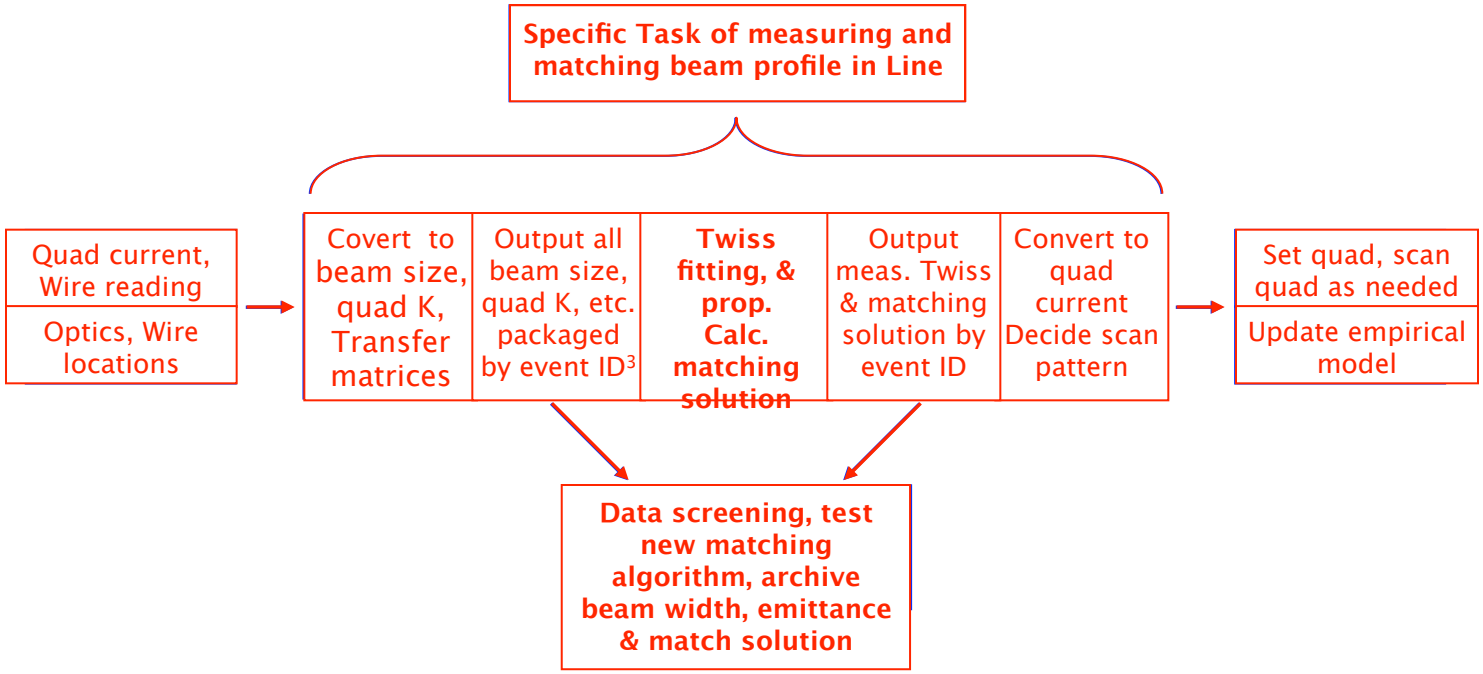
[8] Fall-back position needed at every stage. Only task-specific modules in standard operational procedure. OPs encouraged to explore expert modules.

Task-Specific Module is Goal Oriented, Can Drive



[7] Flow chart / Template driven, Goal oriented, linear process aimed at completing single well defined task. May drive more than one expert module

An Example: Measure Beam Width, Perform Twiss Fitting & Propagation, Calculate Matching Solution

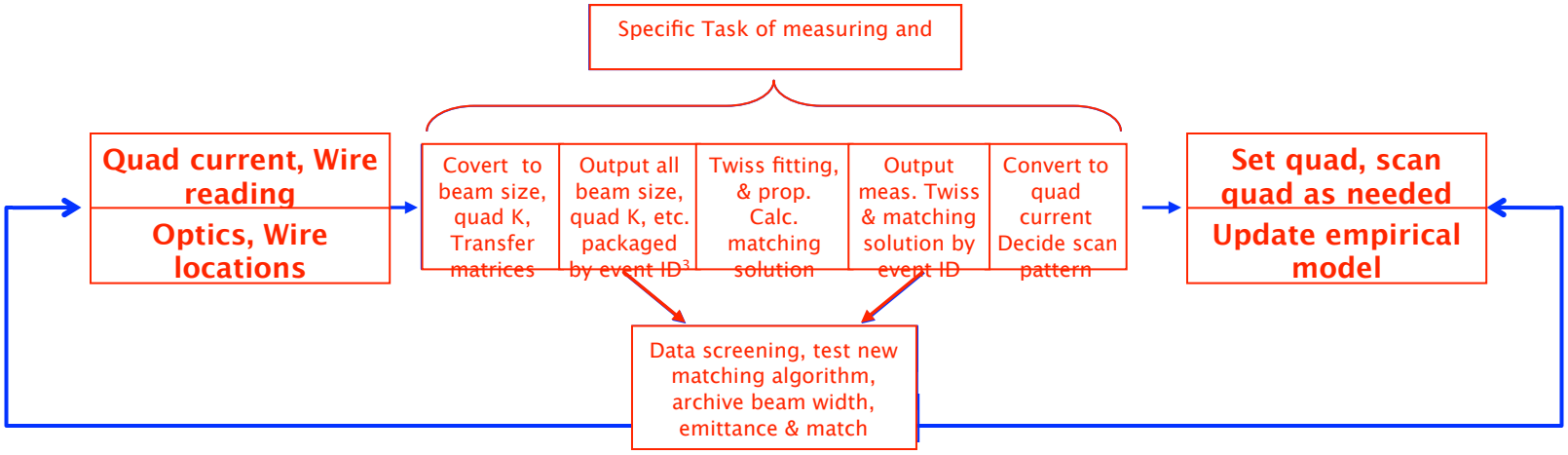


More Modular Breakdown of the Expert

Covert to wire size	Output all quantities	**Beam profile meas. & fitting**	Output all quantities	Convert to Twiss. Set quad scan
Covert to Trans. matrices	Output all quantities	**Twiss fitting, & prop.**	Output all quantities	Convert to beam env.
Covert to quad K	Output all quantities	**Calc. matching solution**	Output all quantities	Convert to quad current

HLA Simulation

- With zero error, any algorithm that works on paper will work in the control room.
- Realistic representation of the accelerator in its operational environment.
  - Realistic estimate on signal-to-noise given hardware ripple, beam jitter, noise level in signals etc.
  - Signature of failure modes due to systematic errors
- Should be indistinguishable from the real machine at the CA junction, such that an HLA prototype can be plugged into either.



Generic Data Acquisition Scheme

- Myriad machine data acquisition sequence & logic can be captured in a generic scheme.
  - Actuators (e.g., magnets) varied to put machine in different states
    - Can be multi-dimensional, correlated or uncorrelated
  - Responders (e.g., BPMs) monitored and recorded
    - Can be non-passive and involve activation of devices
  - The above can be looped & nested
  - Exception monitoring and handling
    - Generic (e.g., stop acquisition upon beam loss)
    - Task specific
    - Branching of path conditioned on data/exception
    - Exception recorded with data
- Can you think of an exception?
- Usually make up 50% of the work, repeated each time for a new application.
- A generic platform allowing easy assembly of these components into task-specific procedures can save a lot of development resource over long term.
  - All control variables of interest are CA enabled.
  - A unified, scalable data structure is established (XML? Database?).