# *Preliminary LBB Process Flow Diagram*

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# Diagramming: An Iterative Process

**Develop initial process diagram**
Nuregs, reports, papers, literature

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**Review by & discussion with technical experts**

↓

**Modify diagram, detail models**

↓

**ID uncertainties**

↓

**Treat uncertainties**

↓

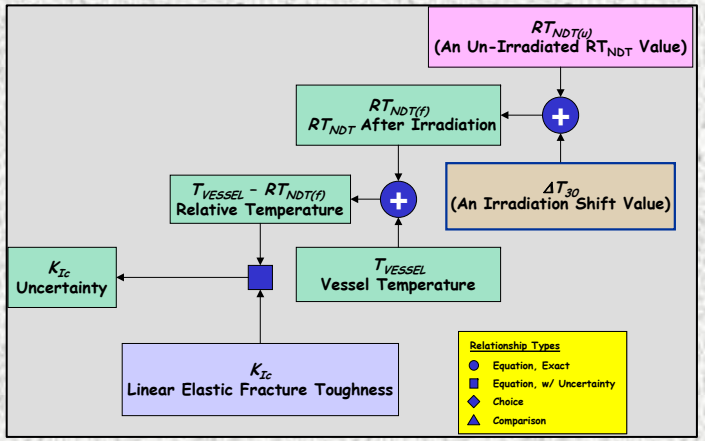
**Code process**

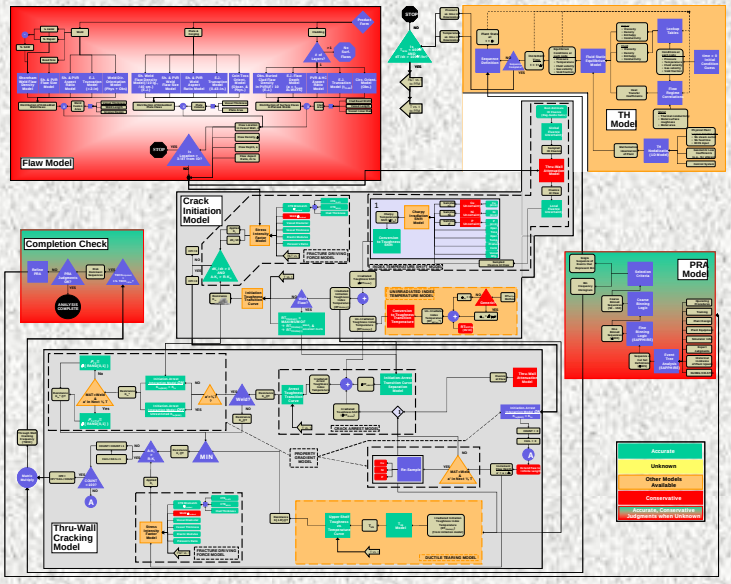
↓

**Parameter studies**

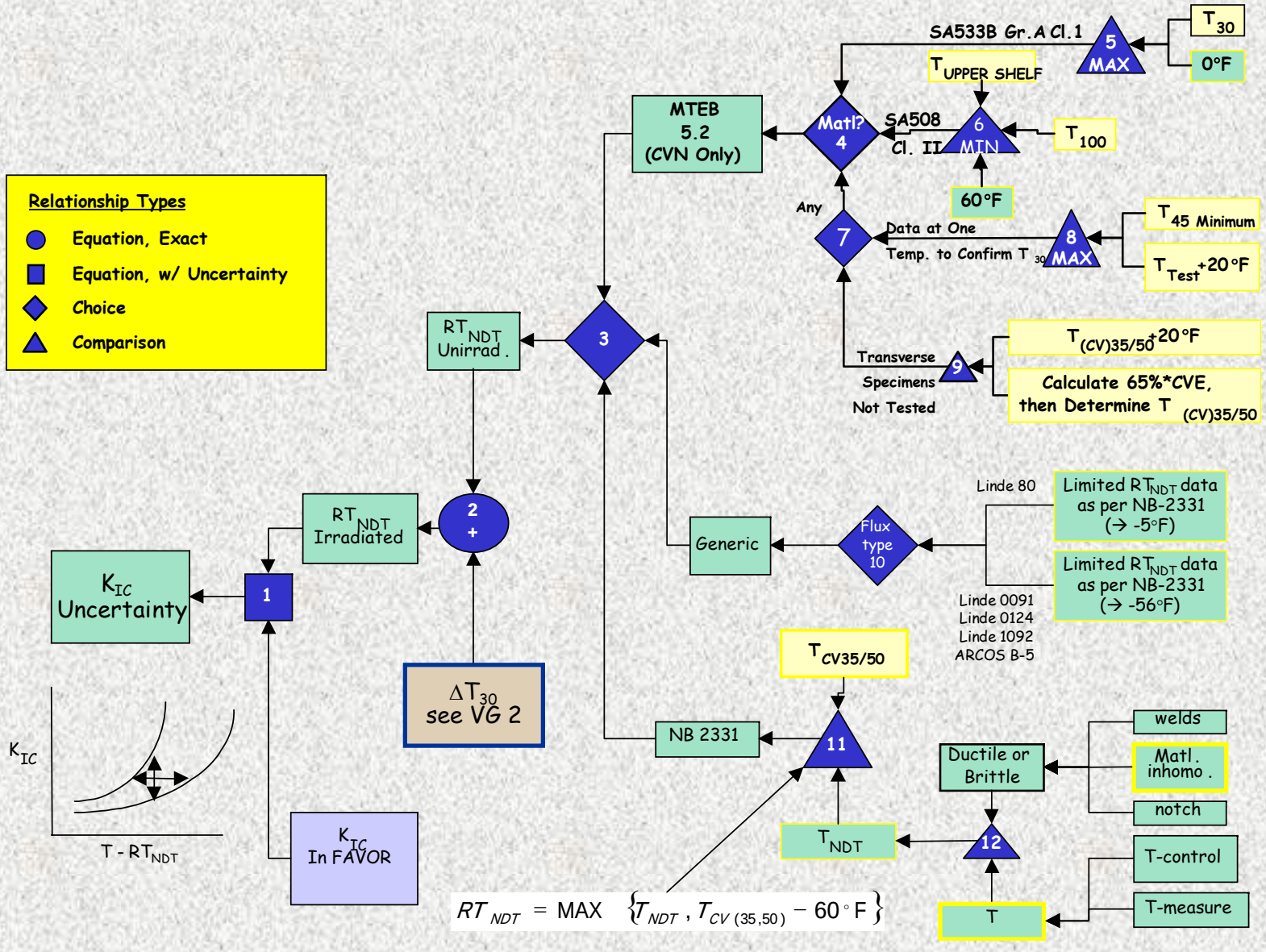
↓

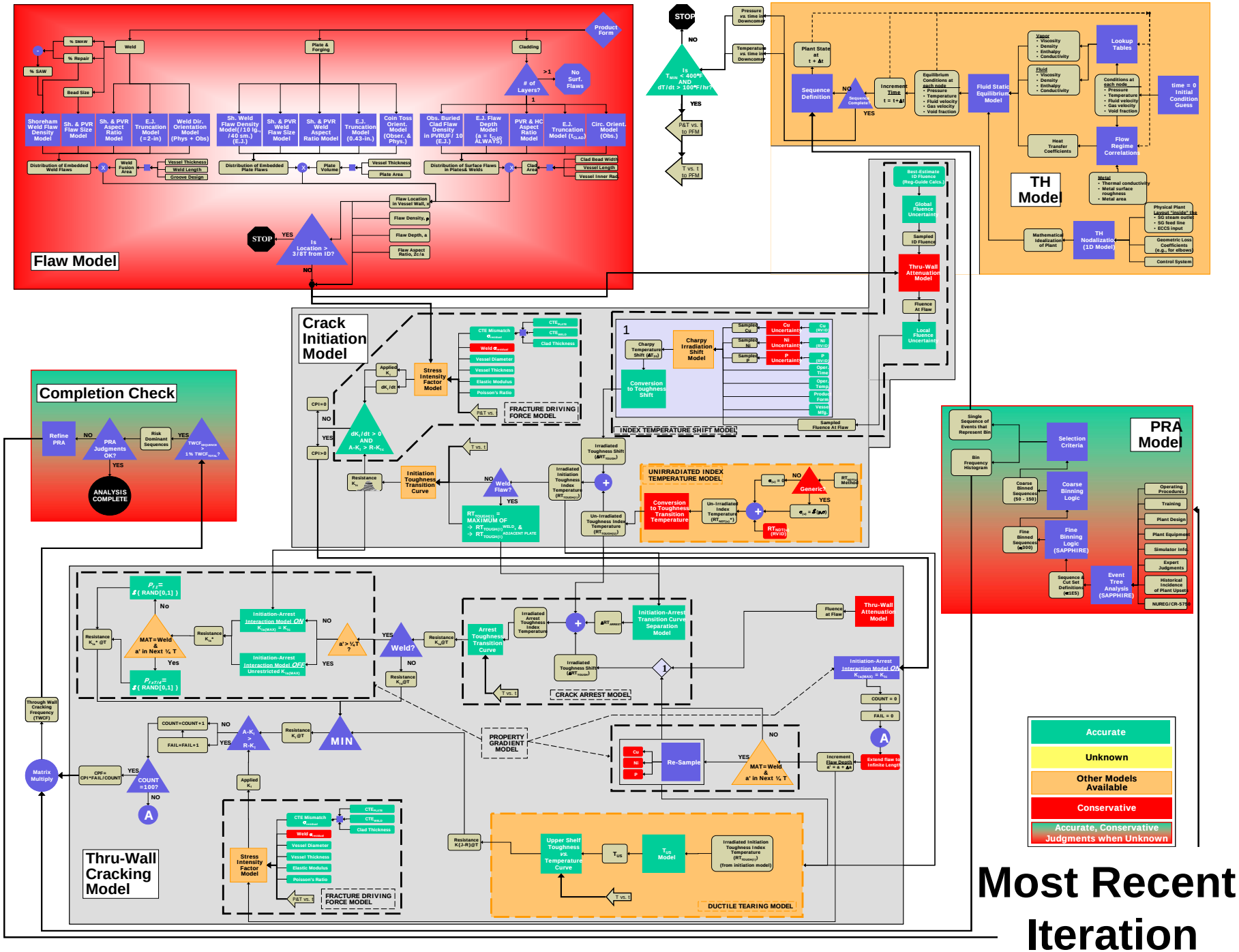
**Finalize diagram & code**



# Preliminary PTS Process Flow Diagram

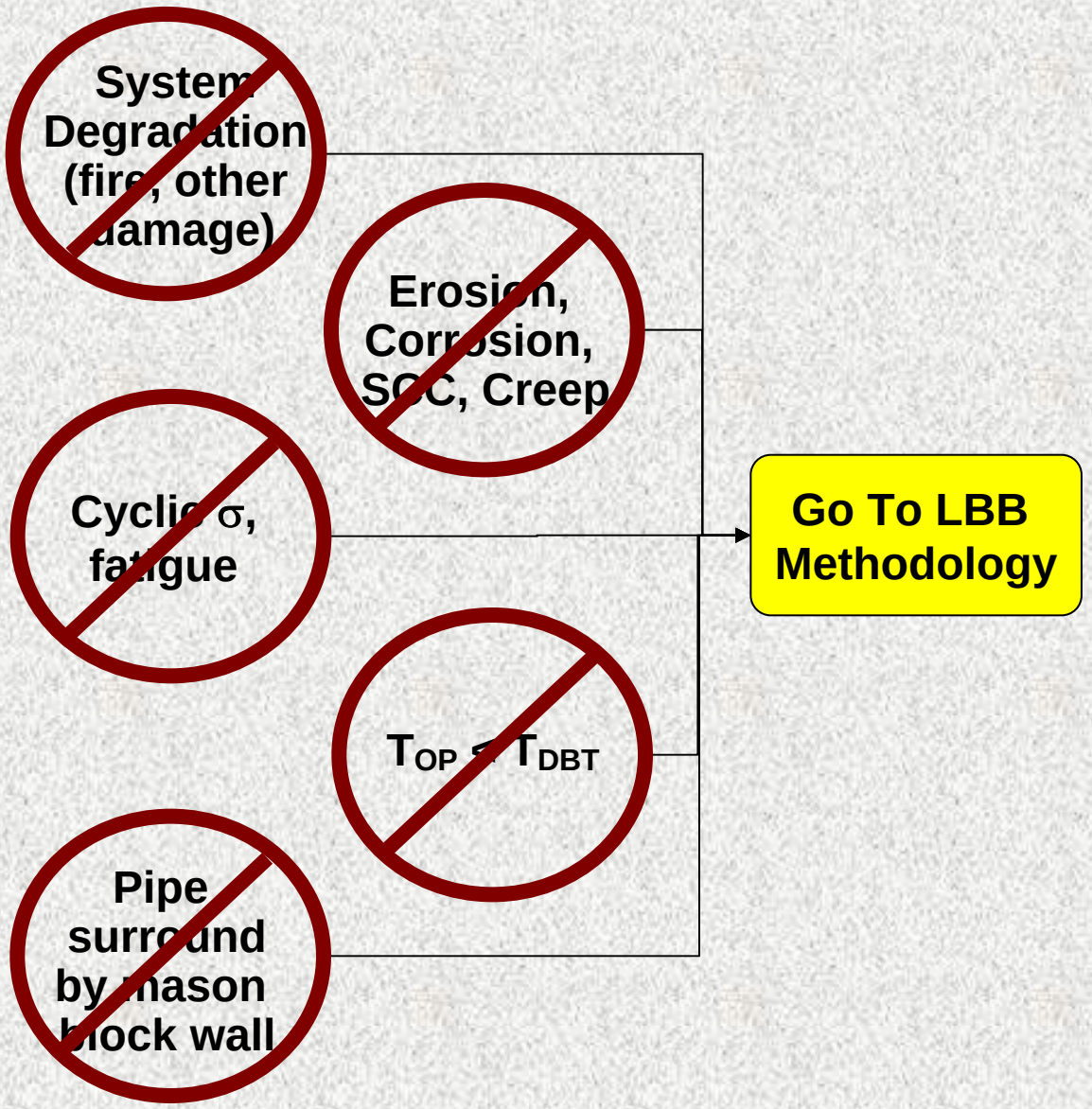


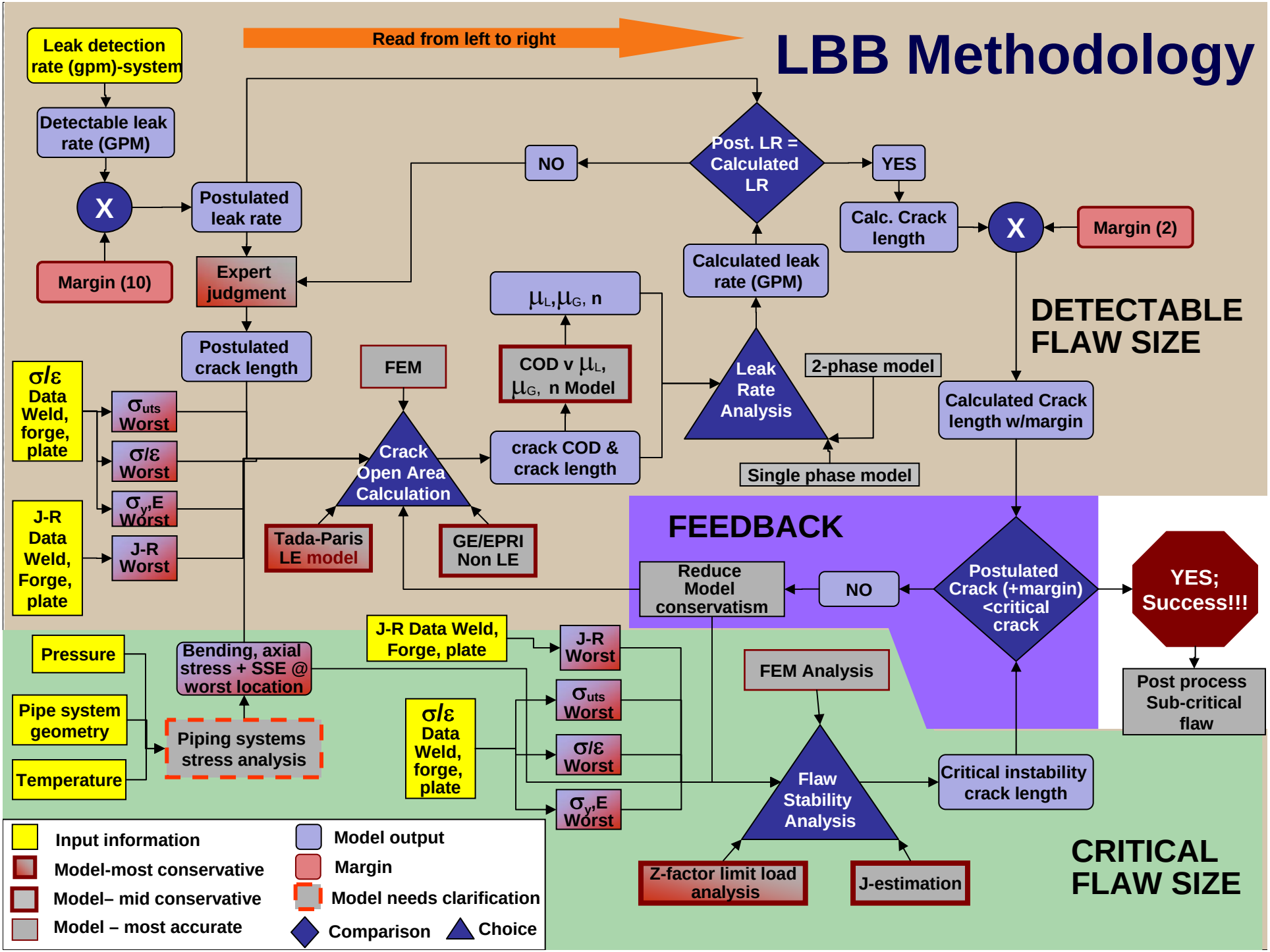


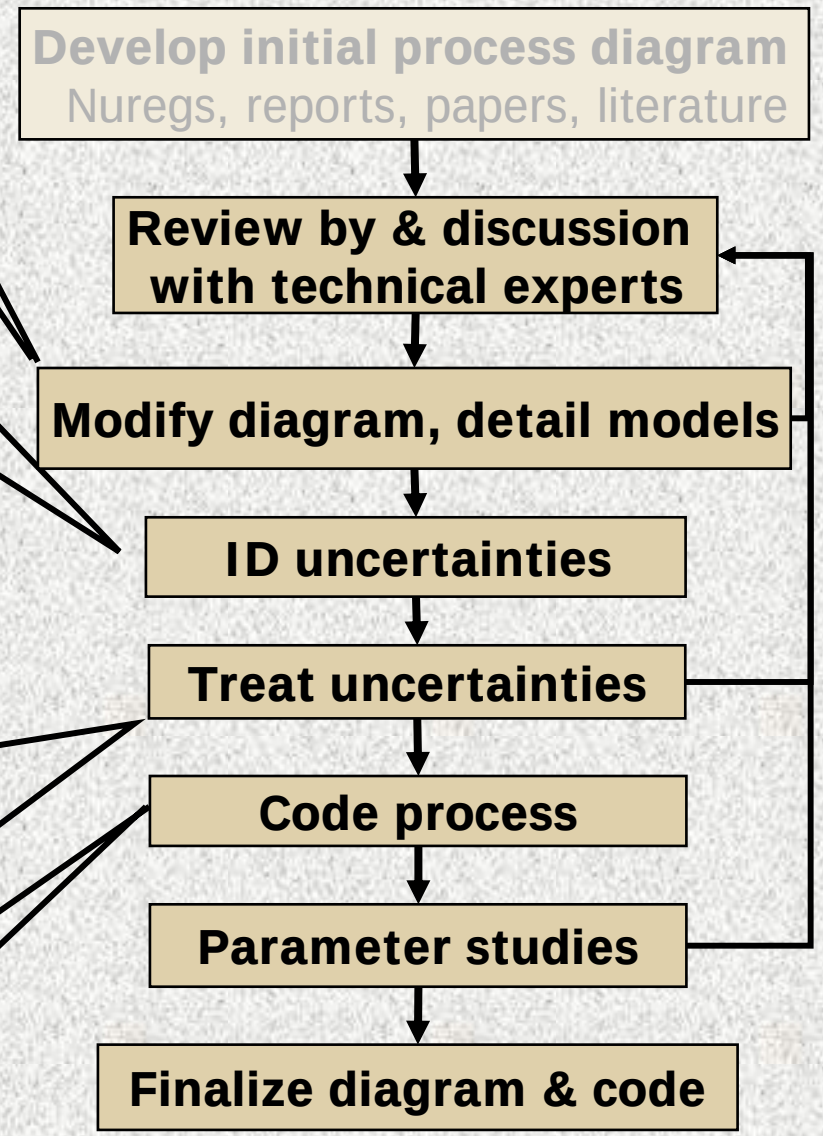

# Most Recent Iteration

# Screening for Use of LBB Methodology

**Before an LBB analysis can be undertaken it must be demonstrated that these factors are not active over entire life of plant:**




LBB Methodology
Read from left to right
Leak detection rate (gpm)-system
Detectable leak rate (GPM)
X
Margin (10)
Postulated leak rate
Expert judgment
Postulated crack length
Post. LR = Calculated LR
NO
YES
Calc. Crack length
X
Margin (2)
Calculated leak rate (GPM)
DETECTABLE FLAW SIZE
μL,μG, n
COD v μL, μG, n Model
Leak Rate Analysis
2-phase model
Single phase model
Calculated Crack length w/margin
σ/ε Data Weld, forge, plate
σuts Worst
σ/ε Worst
σy,E Worst
J-R Worst
J-R Data Weld, Forge, plate
FEM
Crack Open Area Calculation
crack COD & crack length
Tada-Paris LE model
GE/EPRI Non LE
FEEDBACK
Reduce Model conservatism
NO
Postulated Crack (+margin) <critical crack
YES; Success!!!
Post process Sub-critical flaw
Pressure
Pipe system geometry
Temperature
Bending, axial stress + SSE @ worst location
Piping systems stress analysis
J-R Data Weld, Forge, plate
J-R Worst
σ/ε Data Weld, forge, plate
σuts Worst
σ/ε Worst
σy,E Worst
FEM Analysis
Flaw Stability Analysis
Critical instability crack length
Z-factor limit load analysis
J-estimation
CRITICAL FLAW SIZE
Input information
Model-most conservative
Model– mid conservative
Model – most accurate
Model output
Margin
Model needs clarification
Comparison
Choice

# Work Remaining

- All models need to be fully diagrammed and understood
- Model conservatisms need to be identified
- Deficiencies in knowledge (data and modeling) need to be identified & remediated
- Best Estimate models need to be identified and used to treat uncertainties
- Models to account for currently screened damage mechanisms need to be identified & incorporated
- A fully probabilistic model needs to be developed