TP3 Stressed Sensitivity Test: Process for Determining ISI Impairments

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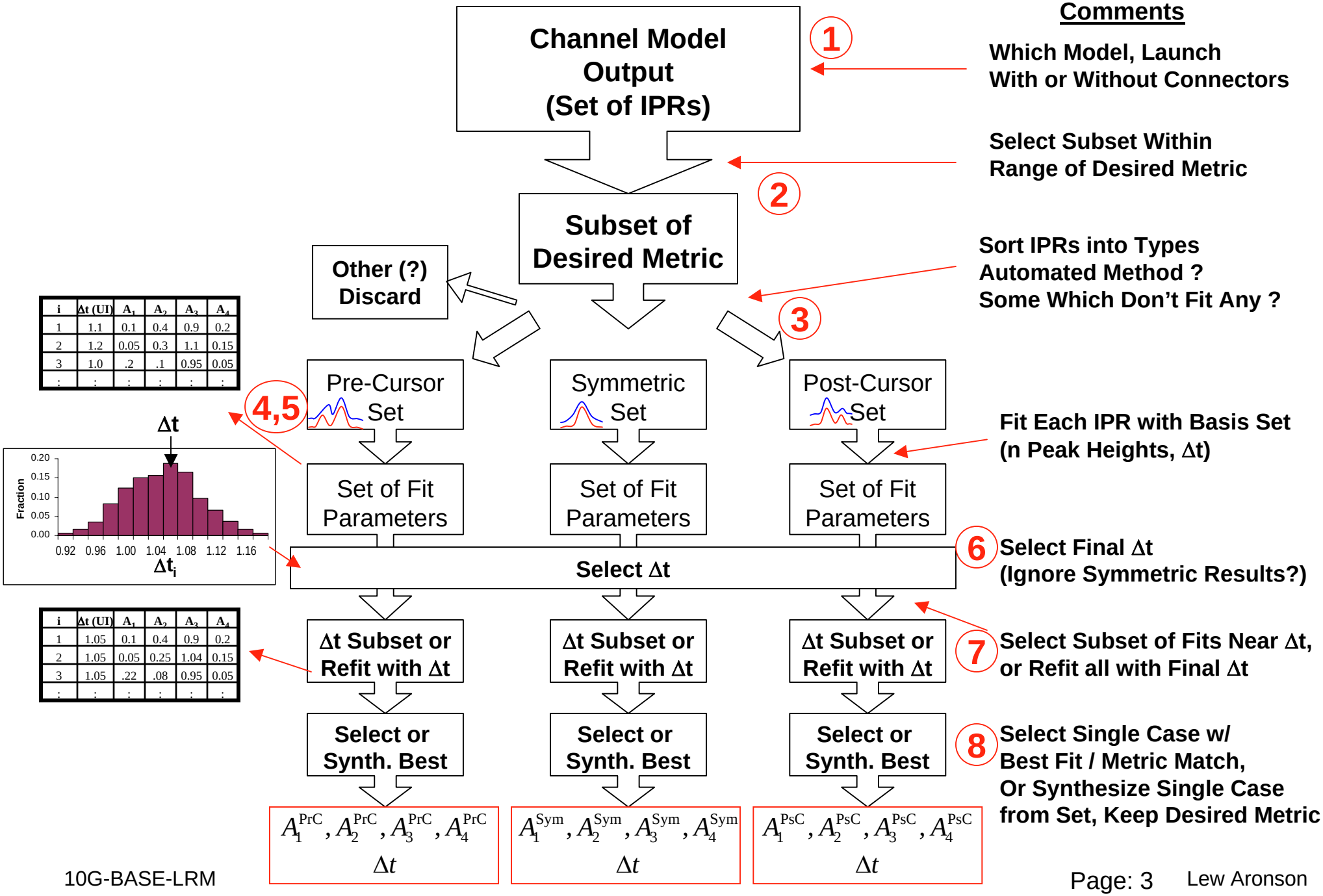
Background

- **Choosing ISI impairments for Stressed Test Determined by Many Factors**
  - **Channel Model to Use**
    - **Cambridge / Monte Carlo (both), w/ or w/out Connectors, Launch**
  - **Level of Impairment**
    - **Choice of Metric**
    - **Choice of Value of Metric Corresponding to Difficulty of Test and Coverage**
  - **Number and Type of Impairments**
    - **Consensus is 3 Impairments: Post-Cursor / Quasi Symmetric / Pre-Cursor**
  - **How to Represent Those Impairments in Standard**
    - **Example: 4 Peaks, equal Peak Spacing (value), Pulse Response (rise/fall)**
  - **How to Generate Each Final Impairments from a Number of Channel Model Cases**
- **Line of Attack:**
  - **Focus on Last 3 Items (Process for Generating Cases from Set of IPRs)**
  - **Then Deal with Channel Model and Metric Type**
  - **Generate 3 IPRs for a Range of Metric Values**
  - **Finally Deal with Choice of Metric Value (Do it at January Meeting if Necessary)**

Selection Flow Chart



Comments

Detail Comment on Proposed Process

- 1 – Choice of model
  - Cambridge or Monte Carlo. Monte Carlo may make more sense in the integration of connectors. Perhaps we can run both and see if the results look appreciably different
  - Connectors: **It would seem that we would certainly use a model including connectors**. Then, the Monte Carlo Model with a statistical distribution of connector errors would seem the best.
  - Launch: To the extent this is not settled by other task force work, we perhaps only have two important cases to look at: Center and Offset launch, but both should incorporate the tolerance factors
  - **If we can design the algorithm to derive the final results automatically, we can run the different models with different assumptions and just see how significant the differences in the results look.**
- 2 – Metric Choice and Value.
  - There has been much discussion, **but PIE-D still seems to be a useful choice**. Certainly if we construct the system it would be interesting to rerun with a finite metric to see if it actually changes the result. However, we should not let that slow us down at this stage. Perhaps it is best to wait for the final results and then ask the question of how large a finite EDC would have to be to have a reasonable excess penalty.
  - The value is certainly something we should keep as a free parameter, I.e. run the process over a range of values (say PIE-D = 4.5, 4.75 …6 dB)
  - Using these choices, Step 2 generates a subset of impulse responses with a certain range of the target metric (For example, all IPRs with PIE-D = 4.75 ± 0.125 dB).

Detail Comment on Proposed Process

- 3 – Sorting Channel Model IPRs by Type
  - This step involves taking the subset of channel IPRs of a given metric and sorting them into pre-cursor, post-cursor and quasi symmetric.
  - One might also anticipate that some IPRs are obvious poor choices for any category and we should probably just drop those (we will be dropping most of the others anyway!).
  - **We need a mathematical test for 'pre-cursorness' etc. I suspect a simple test such as positive, negative and low skew or something of the like might do. If not, power on one side or the other (say at > 100 ps out) from the largest peak.**
- 4 – Choice of Basis Functions
  - Basis Functions refer to the way the final results is specified in the document and will suggest (but not necessarily require) a particular tester implementation.
  - We have been discussing specifying some number of peaks at a uniform channel spacing.
  - Two general ways to go
    - Fixed spacing of 1 UI: Allows use of FFE circuits or D-flip flop arrays+ attenuators.
    - N-fixed space peaks with uniform (same for all three cases) but not necessarily 1 UI spacing.
    - We suggest 2nd case as best for instruments. First choice probably has challenges in controlling noise shaping / Noise addition. 1 UI spacing may also not be ideal.
    - We further suggest 4 peak choice. Allows simplest, lowest loss splitter (5+ complicates this a lot). Generating required signal levels is not trivial.
  - Final IPR is basis function with choice of rise/fall time (seem to be converging on 47 ps, but we should settle). Effectively, final IPR also includes 7.5 GHz BT reference receiver (for signal calibration).

Detail Comment on Proposed Process

- 5 – Fit each IPR of each subset type by fit to basis functions
  - Use Δt, A1,A2, A3 and A4 (peak heights) as fitting parameters (actually one peak height is arbitrary, and final function would be normalized).
  - Note that except for Δt, this is a linear curve fit, so fastest approach might be repeating linear fit for a range of Δt (or converging with respect to Δt). In fact, keeping the results for multiple Δt's might be a useful in further steps.
  - Fitting metric might be errpk and PSR function introduced by Petre. For each case the resulting PIE-D of the fit should be calculated. Perhaps that should be a fitting metric as well, but see below.
  - Final result is a table of the 5 fit parameters (normalized), with the fit quality and PIE-D
- 6 – Select a single Δt, common to all 3 subsets, which will be used in the final result.
  - Suggest using pre- and post-cursor sets to select Δt as the symmetrical set will probably yield Δts too small for the other subsets.
  - Suggest creating histogram of number of cases vs. resulting Δt. Then choose Δt as the peak or mean value of this histogram (see diagram).
- 7 – Create subsets using final Δt.
  - Choose subset of results near selected Δt, or refit all IPRs with selected Δt (retaining ,multiple Δt values from step 5 useful here).
  - Refitting symmetric case may be needed as symmetric cases may yield smaller Δt values in original fit.

Detail Comment on Proposed Process

- 8 – Choose or Synthesize single case from each subset.
  - Choosing single case sounds arbitrary, but in principle, all IPRs in set are valid final choices
  - If choosing final set, look for best shape match (errpk and PSR) and metric match. I.e. the best choice is the IPR which happens to fit best with the basis functions and thus easiest to generate accurately.
  - If synthesizing results, need algorithm to blend results. In any case, we need to make sure the synthesized result has the desired metric. No suggesting for a synthesis method.
- 9 – Final results and misc choices
  - Above process results in 13 entries for the TP3 (receive) table: four peak heights for each ISI and a single Δt.
  - We could choose to make the pre-cursor and post-cursor cases symmetrical, perhaps choosing which to use for both based on the which has the best quality of fit to a real case. This would reduce the number of elements in the table to 9.

Summary of decisions needed on process

- Choice of algorithm to sort into pre-, post- or symmetric and possible discard subsets
- Choice of basis functions (suggest fixed Δt, 4 peaks, 47 ps rise fall time, 7.5 GHz reference receiver).
- Fitting metric. Suggest Petre's errpk / PSR, though forcing EDC performance metric (I.e. PIE-D if that is used) is a possibility as well (though handled later).
- Algorithm for choosing common Δt. Suggested peak of histogram of Δt's from pre- and post cursor fits.
- Method of getting IPRs with common Δt.
  - Choose subset of results with near the common Δt. -or-
  - Refit all functions with common Δt (may be needed for symmetric case)
- Method of selecting final choice
  - Choose case with best fitting metric and closest to desired EDC metric (hopefully the best shape fits tends to ensure this anyway) – Recommend this method -or-
  - Synthesize final choice from all cases in subset (but make sure EDC metric is desired value)
- Decide if we want to make pre- and post cursor cases symmetric.