

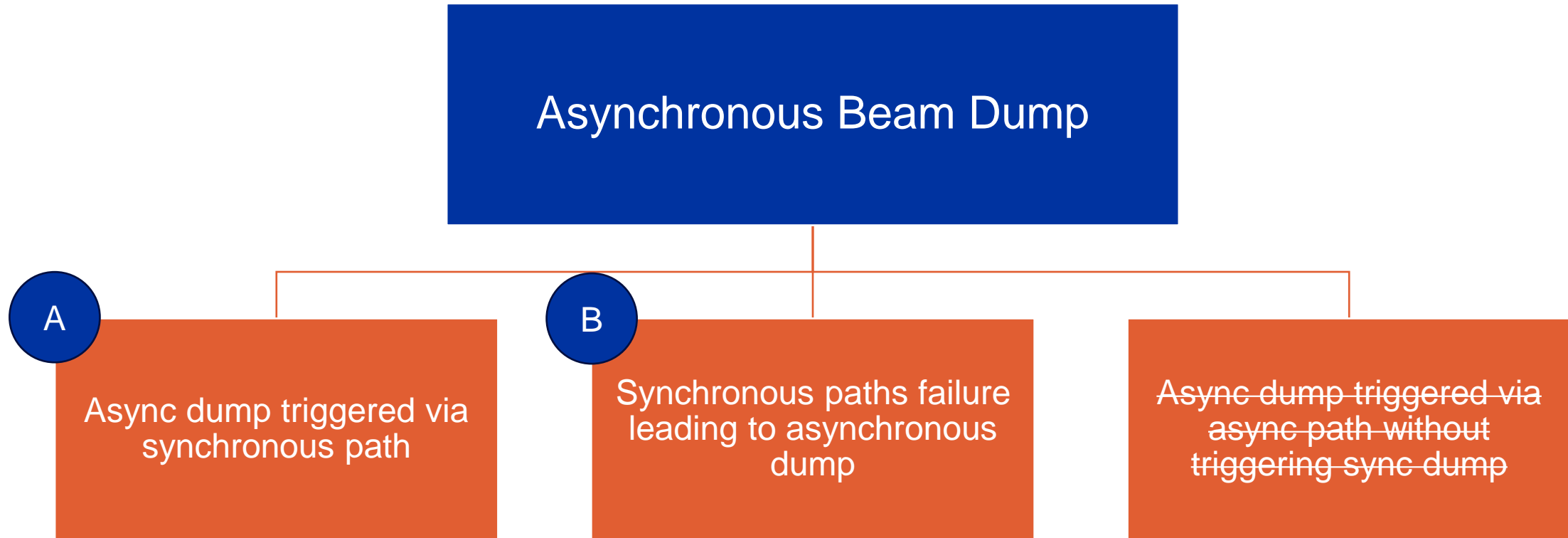
Asynchronous Dump Simulations & Summary

TSU CONS Reliability Study Meetings #10

List of contents

- 1. Asynchronous beam dump – causes**
- 2. Asynchronous beam dump via synchronous path**
- 3. Synchronous beam dump failures causing asynchronous beam dumps**
 1. Model description
 2. Simulation results
- 4. End-effects summary for the FMECA**

Asynchronous Beam Dump – causes

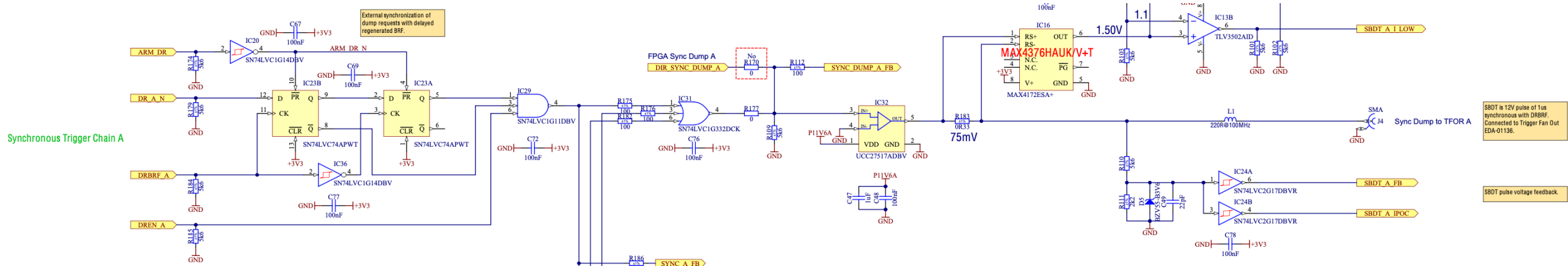


Async dump triggered via synchronous path

Summary

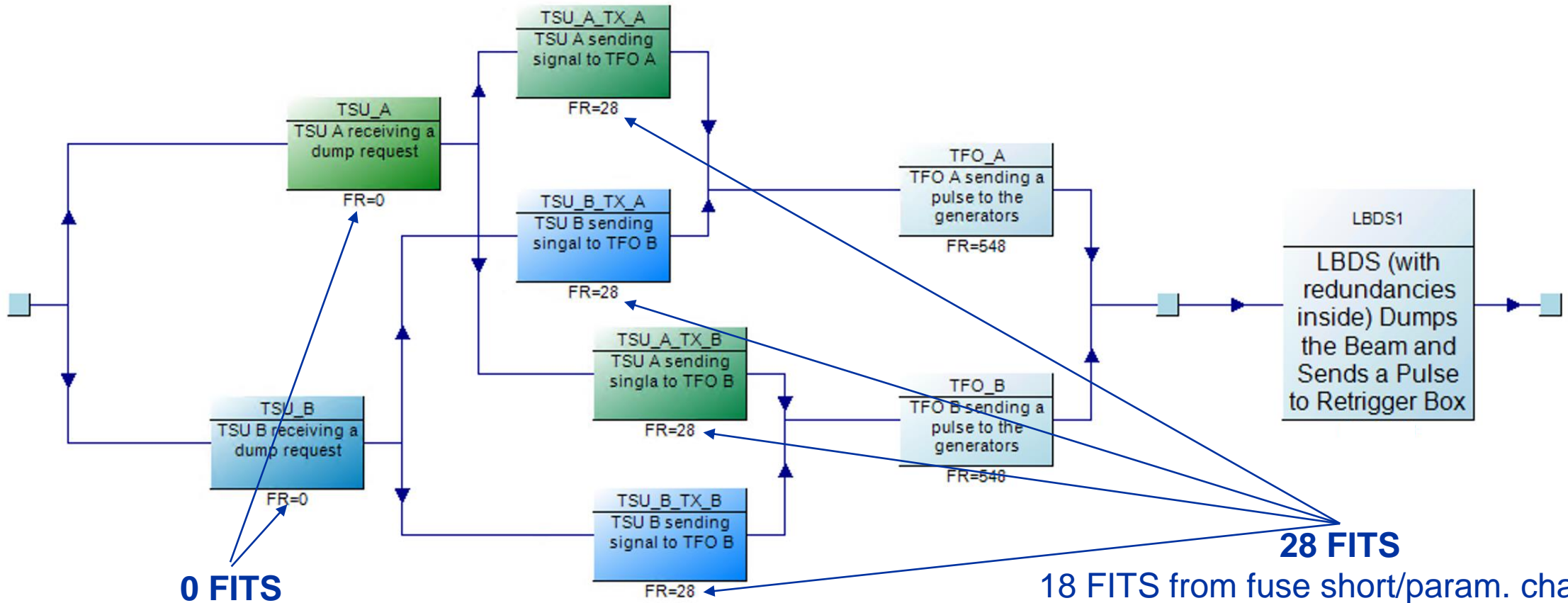


- **Total failure rate: 8 FITS**
 - To be checked by IPOC, async dump via sync path.
- **Caused by 8 components (ICs: gates, flip flops, gate drivers) failure modes:**
 - Stuck high,
 - Parameter change.
- **Also causing loss of SBDT A or B paths; require checking by IPOC.**



Synchronous paths failure causing async dumps

Model description



0 FITS
 Failure modes like "BETS stuck to TRUE"
 cause missed dumps

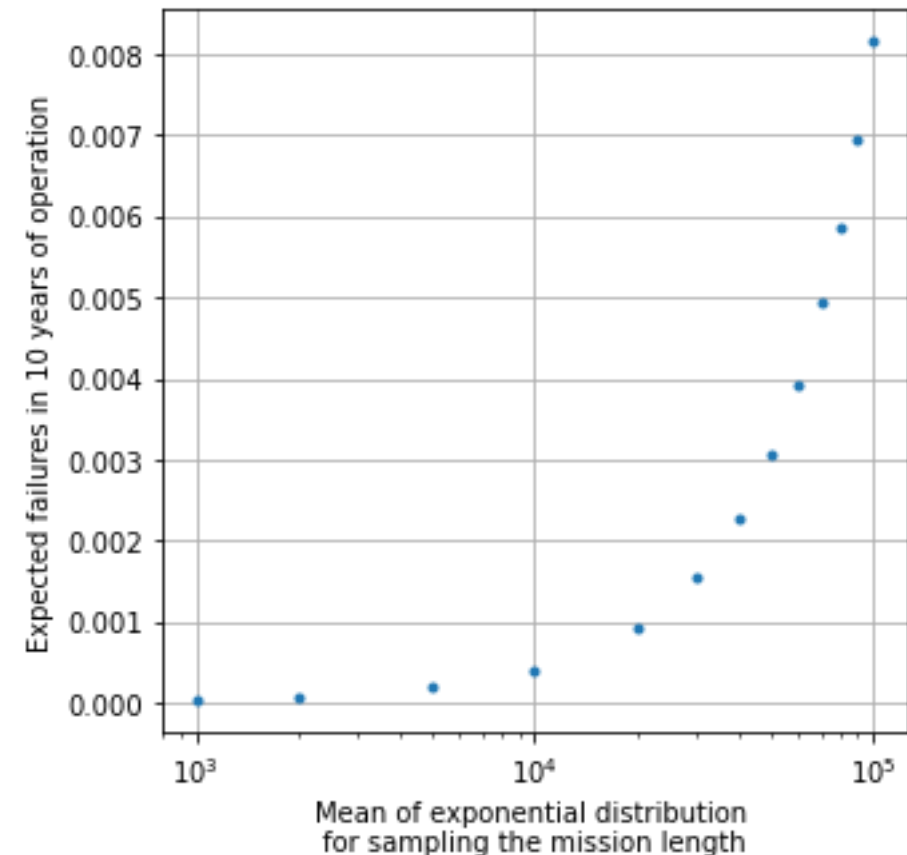
28 FITS
 18 FITS from fuse short/param. change;
 10 FITS from remaining components
 causing SBDT path to be blind

Synchronous paths failure causing async dumps

Simulation results



- **Upwards trend as the missions get longer.**
- **At 100,000 h missions (no IPOC for entire lifetime), less than 0.01 failure in 10 years.**
 - Requirement: 1 in 10 years.
- **FMECA shows very low contribution of TSU failures to causing asynchronous dumps.**
 - 28 FITs for blind synchronous dump per SBDT path (“before” redundancy within individual TSUs).



End-effects summary

Probability of occurrence per end-effect

Failure end-effect	Prob. estimation @ mission = 12h	Prob. estimation @ mission = 7,200h	Requirement
Missed dump (incl. TSU* + LBDS)	5×10^{-4} in 1,000 years	5.8×10^{-4} in 1,000 years	1 in 1,000 years
Async beam dump (incl. TSU* + TFO)	B 4.3×10^{-7} in 10 years	2.4×10^{-6} in 10 years	1 in 10 years
	A Async dump via sync paths: 9.5×10^{-4} in 10 years		
Spurious dump (incl. TSU + RTM)	8.7×10^{-3} in 1 year		1 in 1 year
Downtime (incl. TSU + RTM)	5.9×10^{-3} in 1 year		1 in 1 year

* No relevant failure modes found in TSU RTM

Next steps

- **HW study complete**
 - → Document study and findings
- **At kick-off meeting said to get in touch again when prototype is being tested to**
 - Qualify based on run-hours/demands (can provide inputs on required tests already now)
 - Update FMECA & models if you do significant changes



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