

Reliability models of the system – results

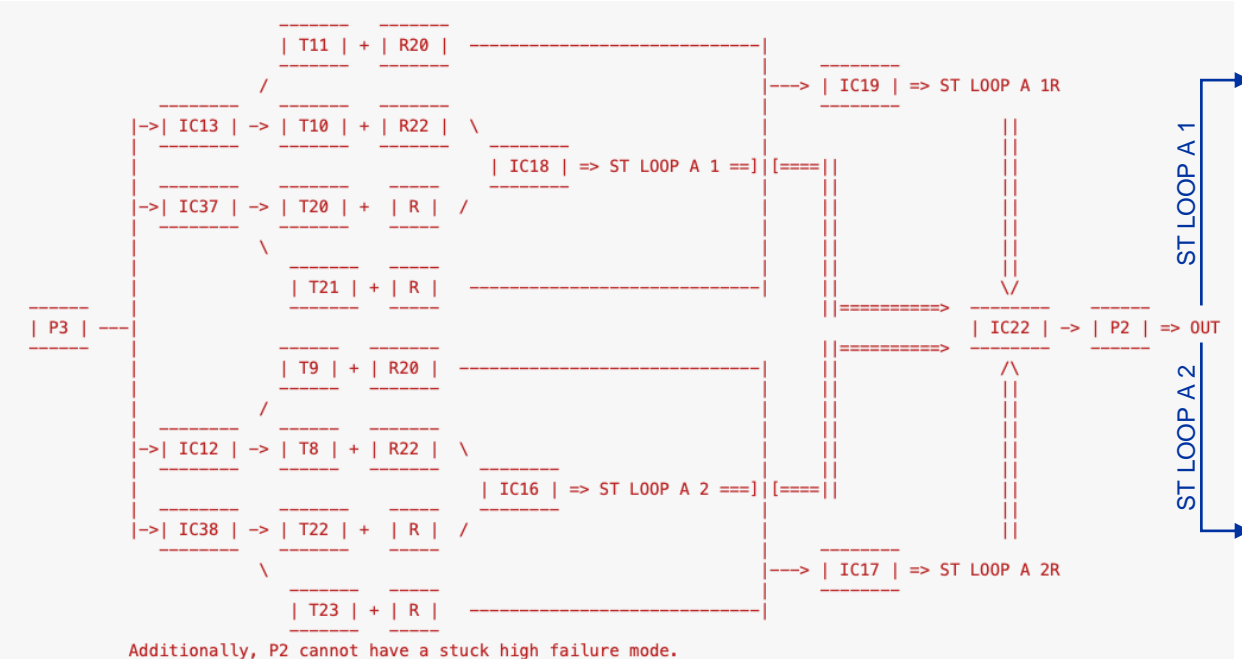
Energy Extraction Universal Controls – Progress Meeting #4

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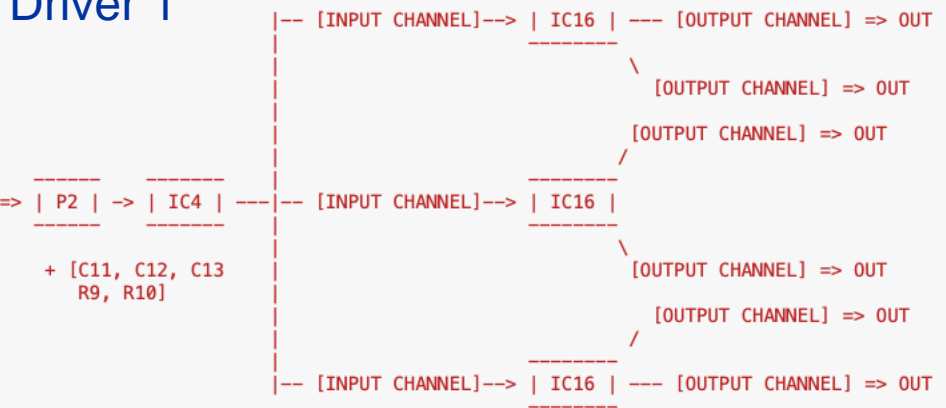
1. **Baseline model**
2. **Re-routing model**
3. **Model using FPA/SPA**
4. **Questions & next steps**

Baseline Model description

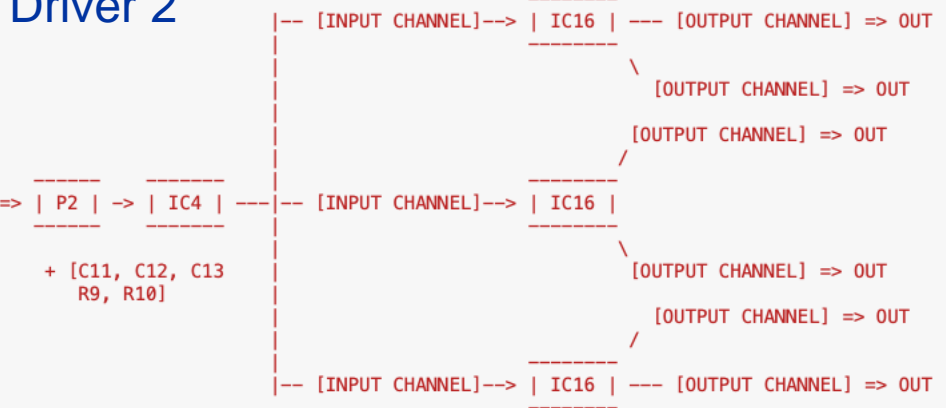
FPA/SPA



Driver 1



Driver 2

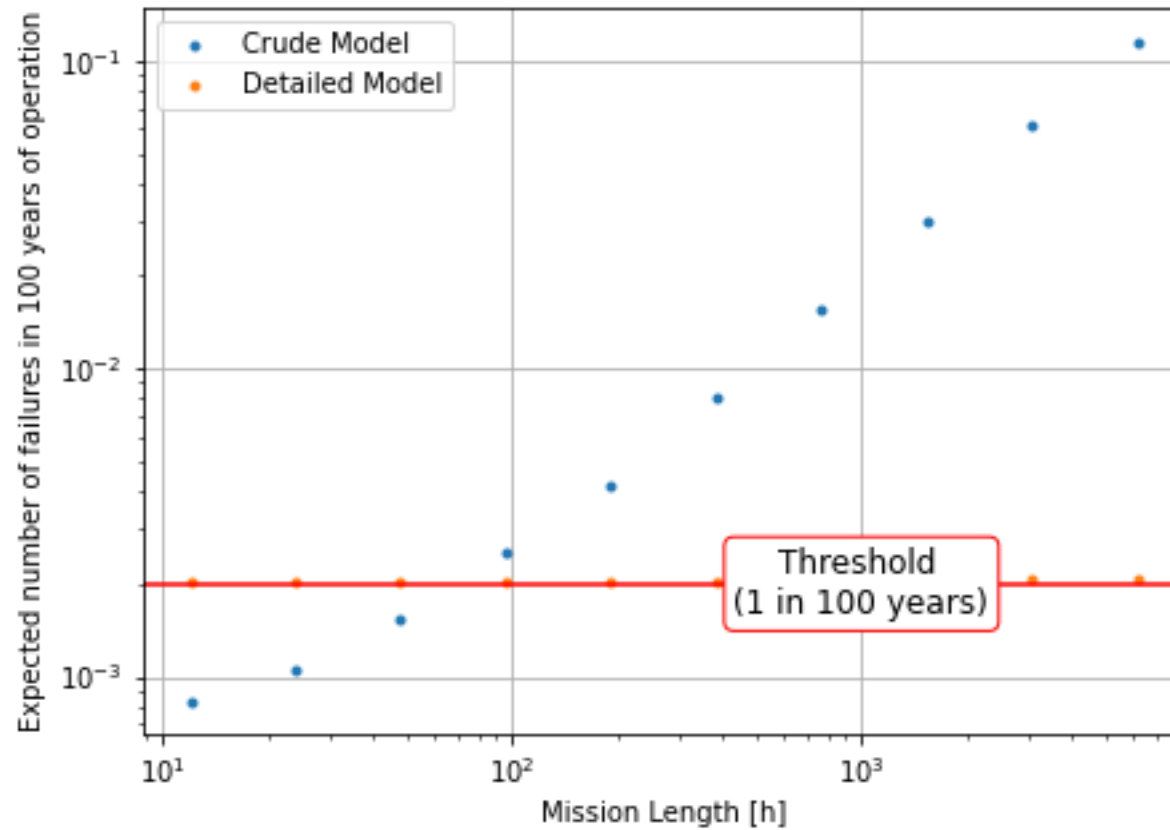


CNTL – worst case estimate (all failures critical)

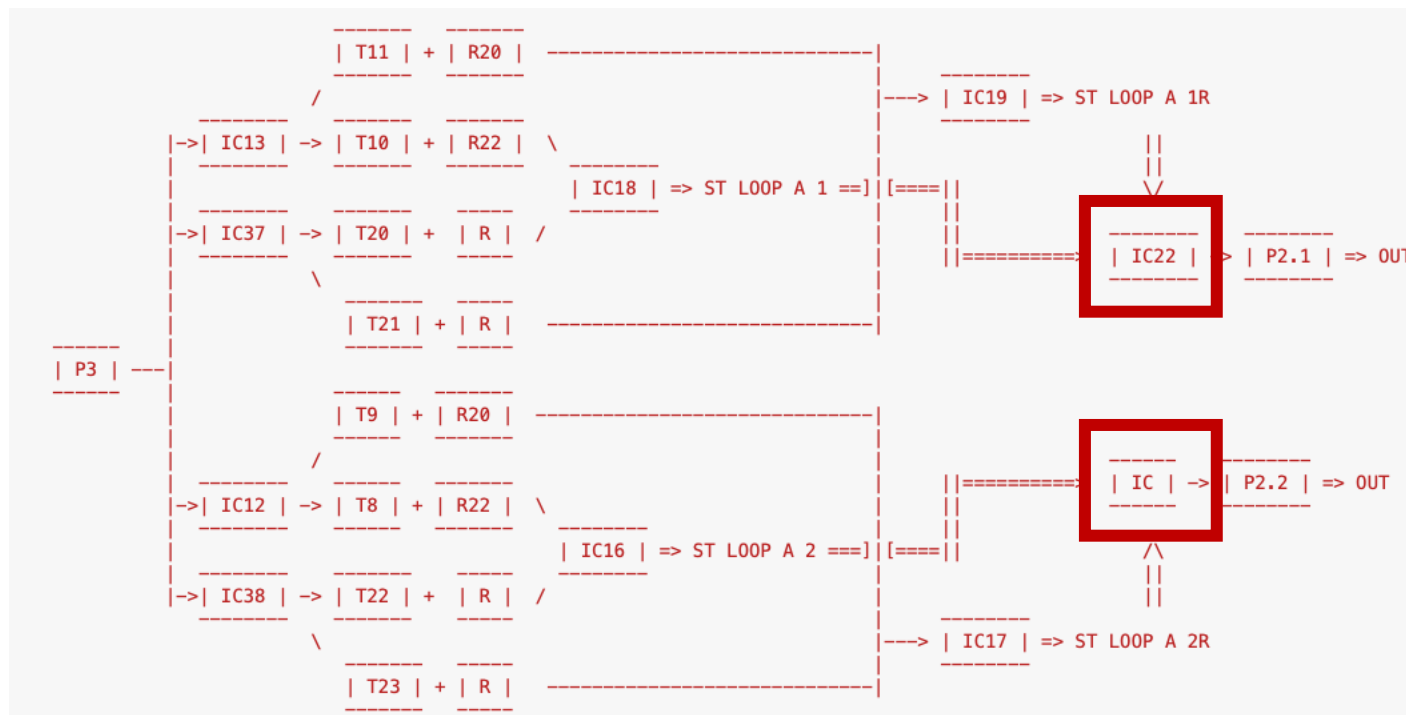
FPA/SPA, Driver, Interlock – assuming all components on the critical path are critical



Baseline Results

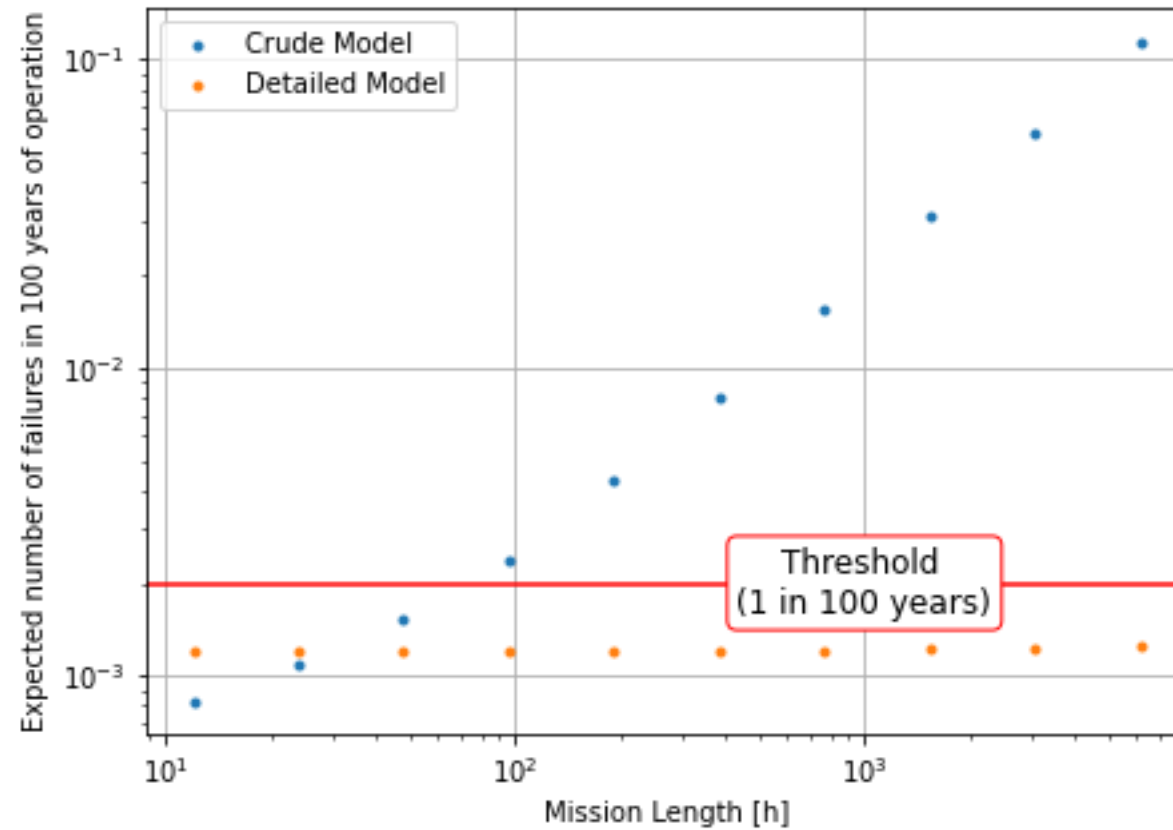


Re-routing Model description

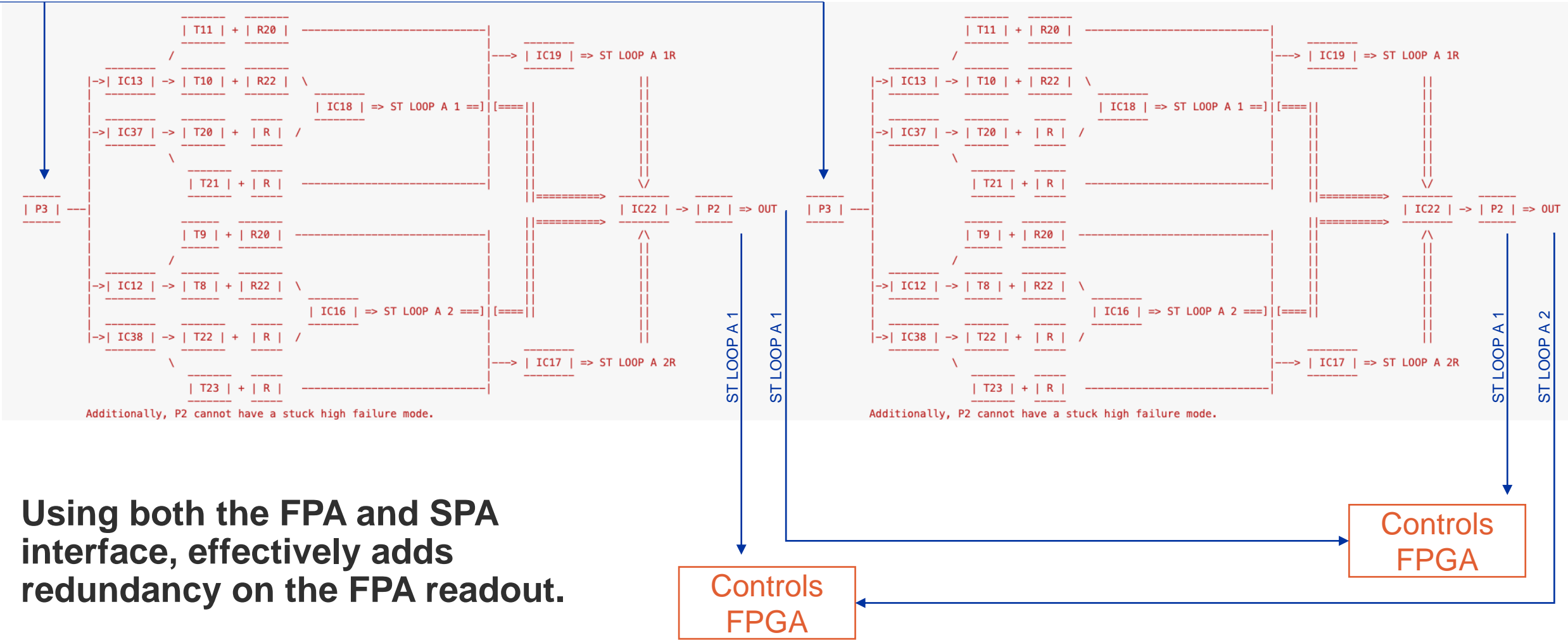


Avoiding all critical signals passing through the same voltage translator IC22.

Re-routing Results

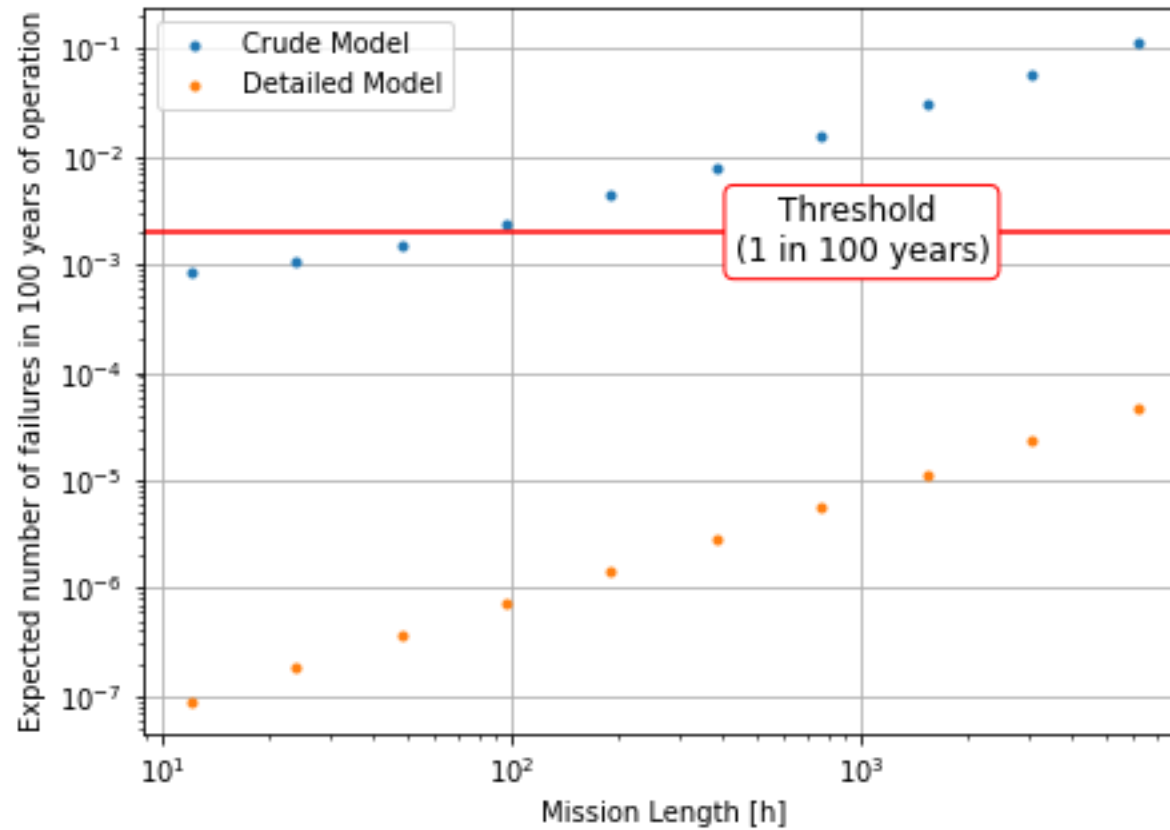


Using FPA/SPA Model description



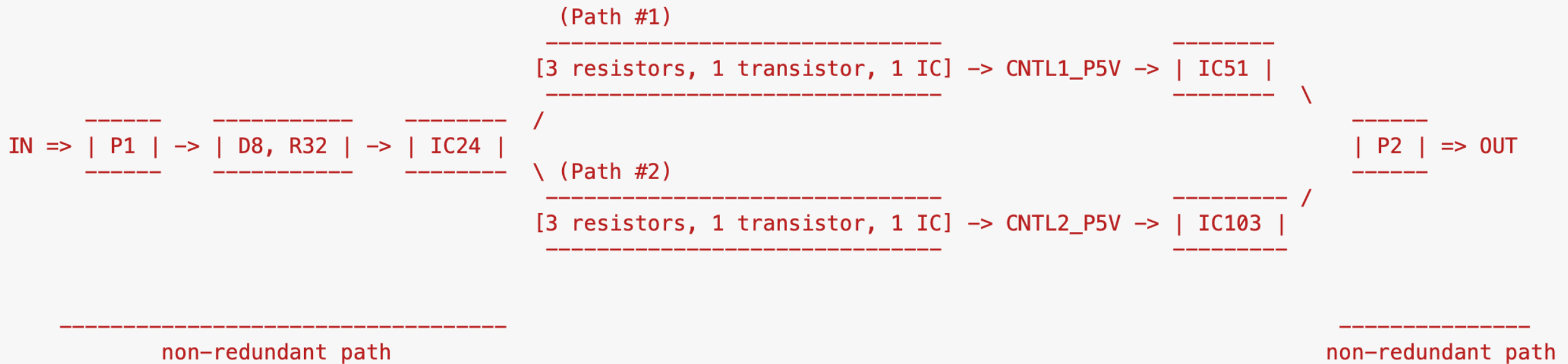
Using both the FPA and SPA interface, effectively adds redundancy on the FPA readout.

Using FPA/SPA Results



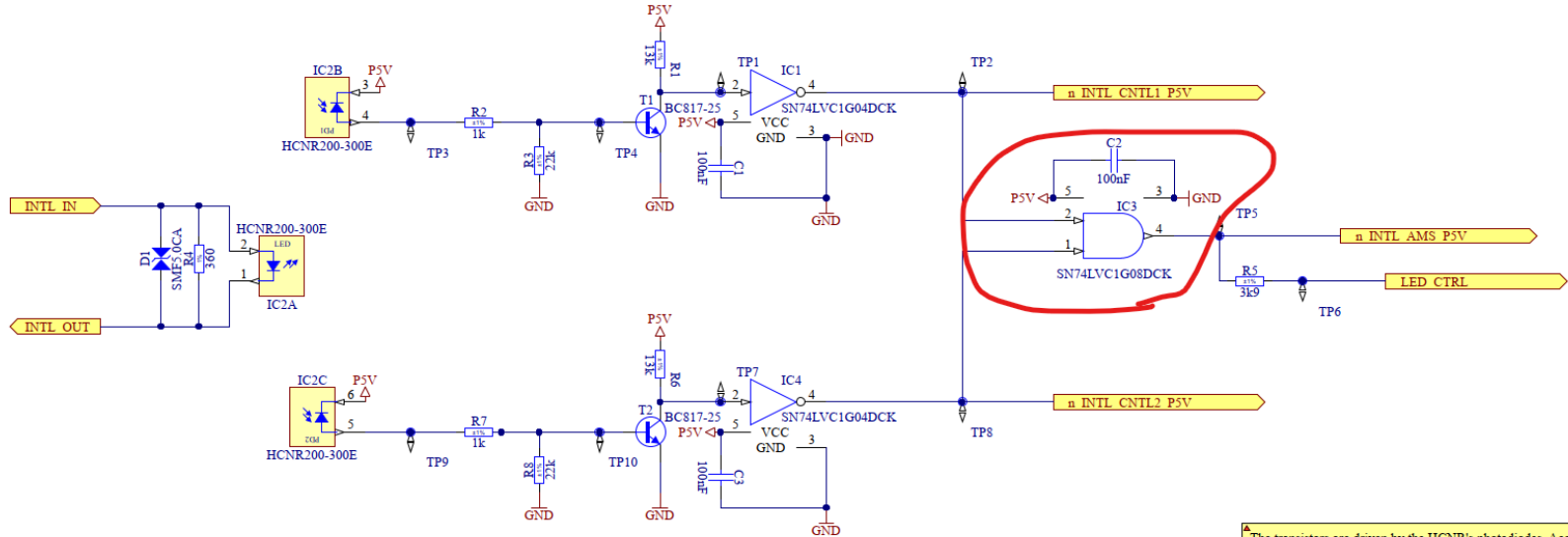
Interlock card

Interlock card Schematics



Interlock card

Potential single point of failure?



INTL Current Loop	n_INTL_CNTL1_P5V	n_INTL_CNTL2_P5V	n_INTL_AMS_P5V	LED Light
1	1	1	1	OFF
0	0	0	0	ON

Remark : Attention must be payed whether the connected interlock signal is active high or active low.

The transistors are driven by the HCNR's photodiodes. According to the datasheet, $0.25\% < \text{CTR} < 0.75\%$. To account for any decrease due to TID, the minimum CTR will be set at 0.2% .

The FPA loop current will be from 5 mA to 50 mA. Because there are two HCNRs in parallel, the current will be divided between them approximately 50:50.

$$I_{\text{base_min}} = I_{\text{led_min}} * \text{CTR_min} = 2.5E-3 * 2E-3 = 5 \text{ uA}$$

$$I_{\text{base_max}} = I_{\text{led_max}} * \text{CTR_max} = 25E-3 * 7.5E-3 = 188 \text{ uA}$$

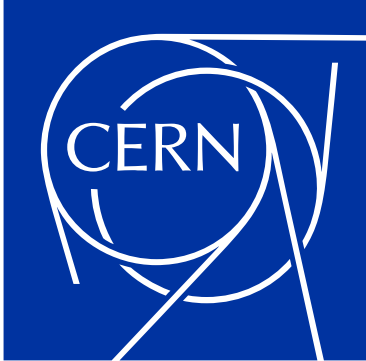
According to the BC817-25 datasheet, $160 < H_{\text{fe}} < 400$. To account for any decrease due to TID, the minimum Hfe will be set at 80.

$$I_{\text{collector_min}} = I_{\text{base_min}} * H_{\text{fe_min}} = 5E-6 * 80 = 0.4 \text{ mA}$$

$$I_{\text{collector_max}} = I_{\text{base_max}} * H_{\text{fe_max}} = 188 \text{ uA} * 400 = 75.2 \text{ mA}$$

Minimum pull-up resistor value to drop 5V:

$$R_{\text{pull-up_min}} = 5 / I_{\text{collector_min}} = 5 / 0.4E-3 = 12.5 \text{ kOhm}$$



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