

Electronic Requirements

- To understand charge transfer we need a capacitance matrix:
- Experiment (LCR SR720 Probe):

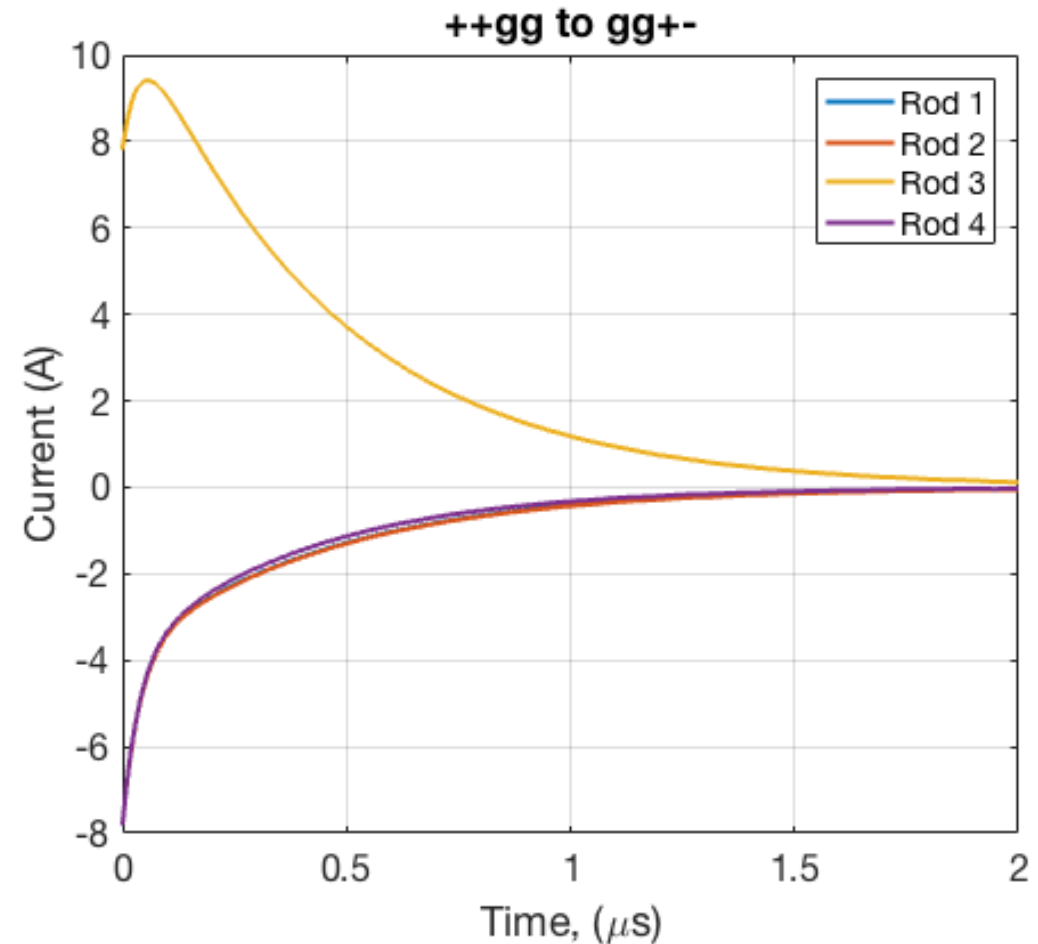
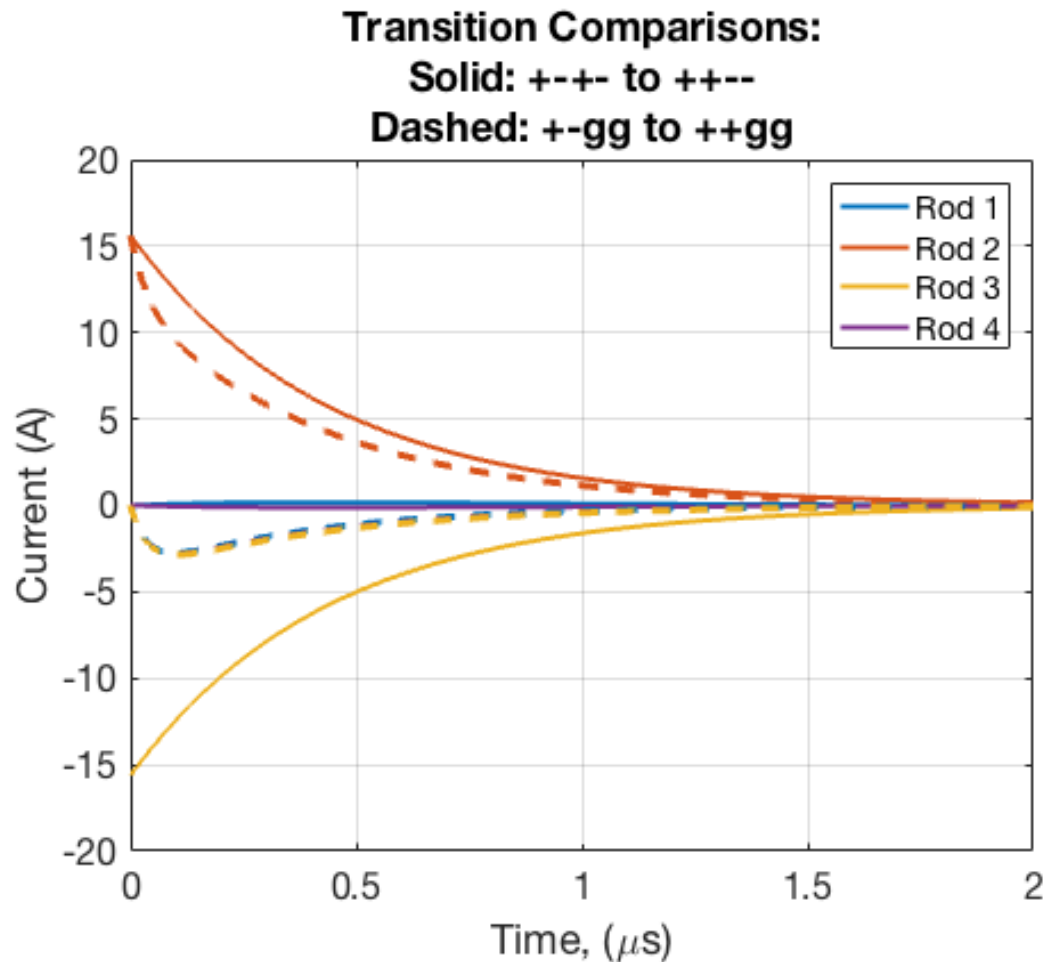
COMSOL Simulation:

(pF)	Rod 1	Rod 2	Rod 3	Rod 4	GND
Rod 1	206	-56	-64.5	-62	-33
Rod 2	-56	208	-65	-63	-37
Rod 3	64.5	-65	210	-57	-33.5
Rod 4	-62	-63	-57	206	-33.5
GND	-33	-37	-33.5	-33.5	140

(pF)	Rod 1	Rod 2	Rod 3	Rod 4	GND
Rod 1	199	-43	-55	-55	-46
Rod 2	-43	199	-55	-55	-46
Rod 3	-55	-55	199	-43	-46
Rod 4	-55	-55	-43	199	-46
GND	-46	-46	-46	-46	184

Electronic Requirements

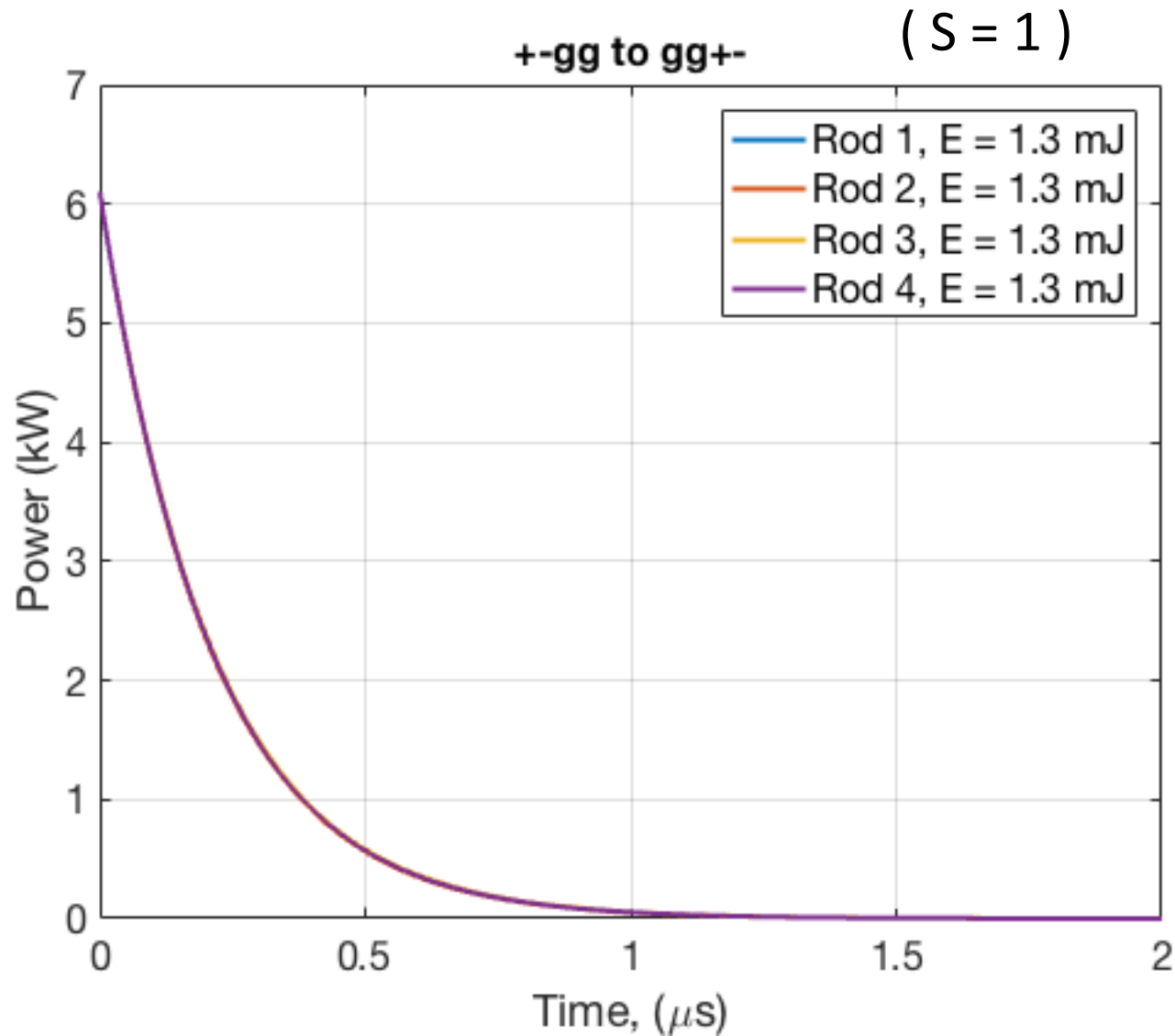
- Using Capacitance Matrix, we can solve current during edges:



Electronic Requirements

- Next we can check power dissipated in the switches.
 - Assume $R_{on} = 100 \text{ Ohms}$ for now.
 - We can check the instantaneous power
 - Energy per switch
 - Continuous power at 10 Hz

Electronic Requirements

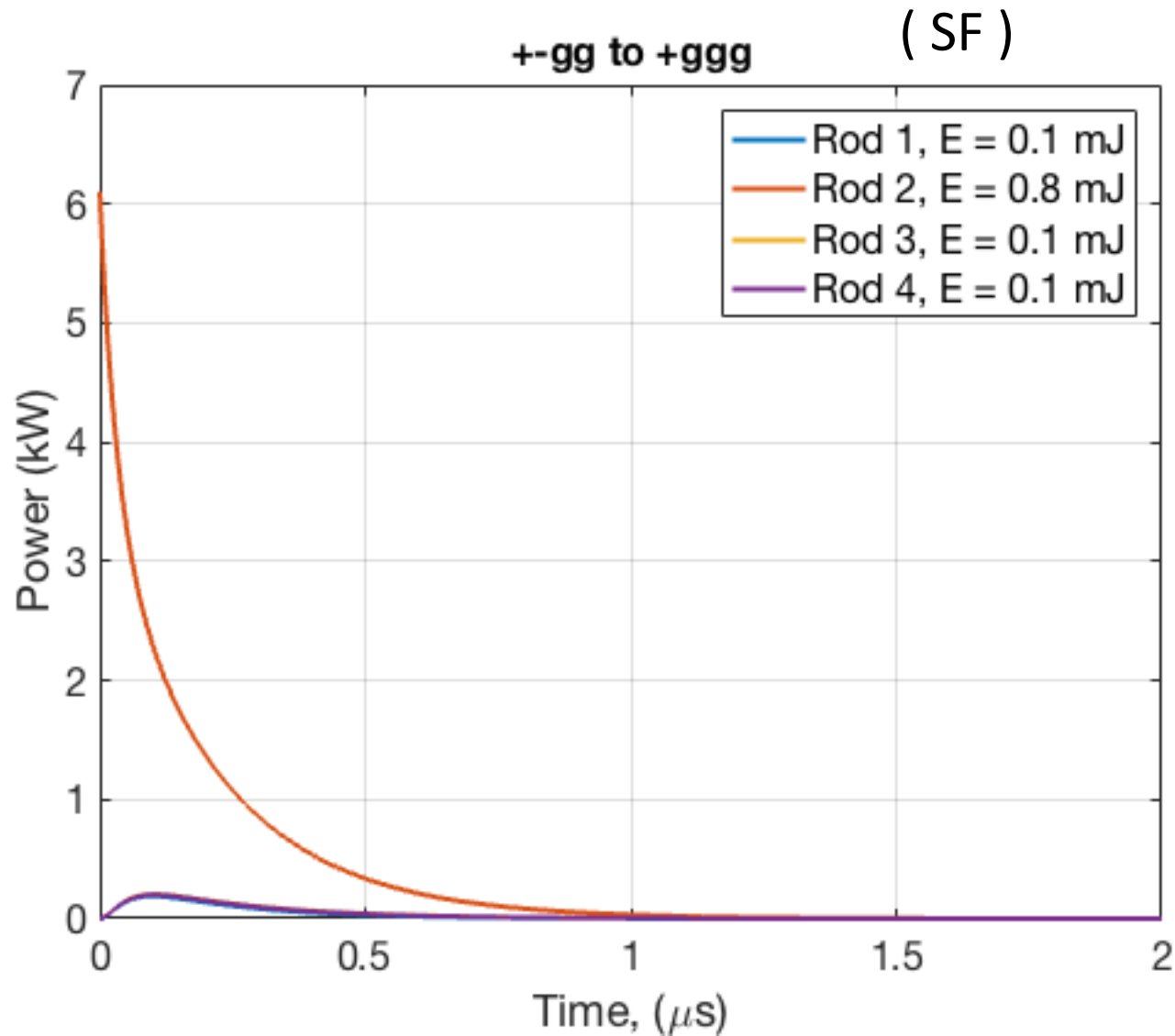


$$1.3 * 167 = 217 \text{ mJ / rod}$$

2.2 W continuous @ 10 Hz

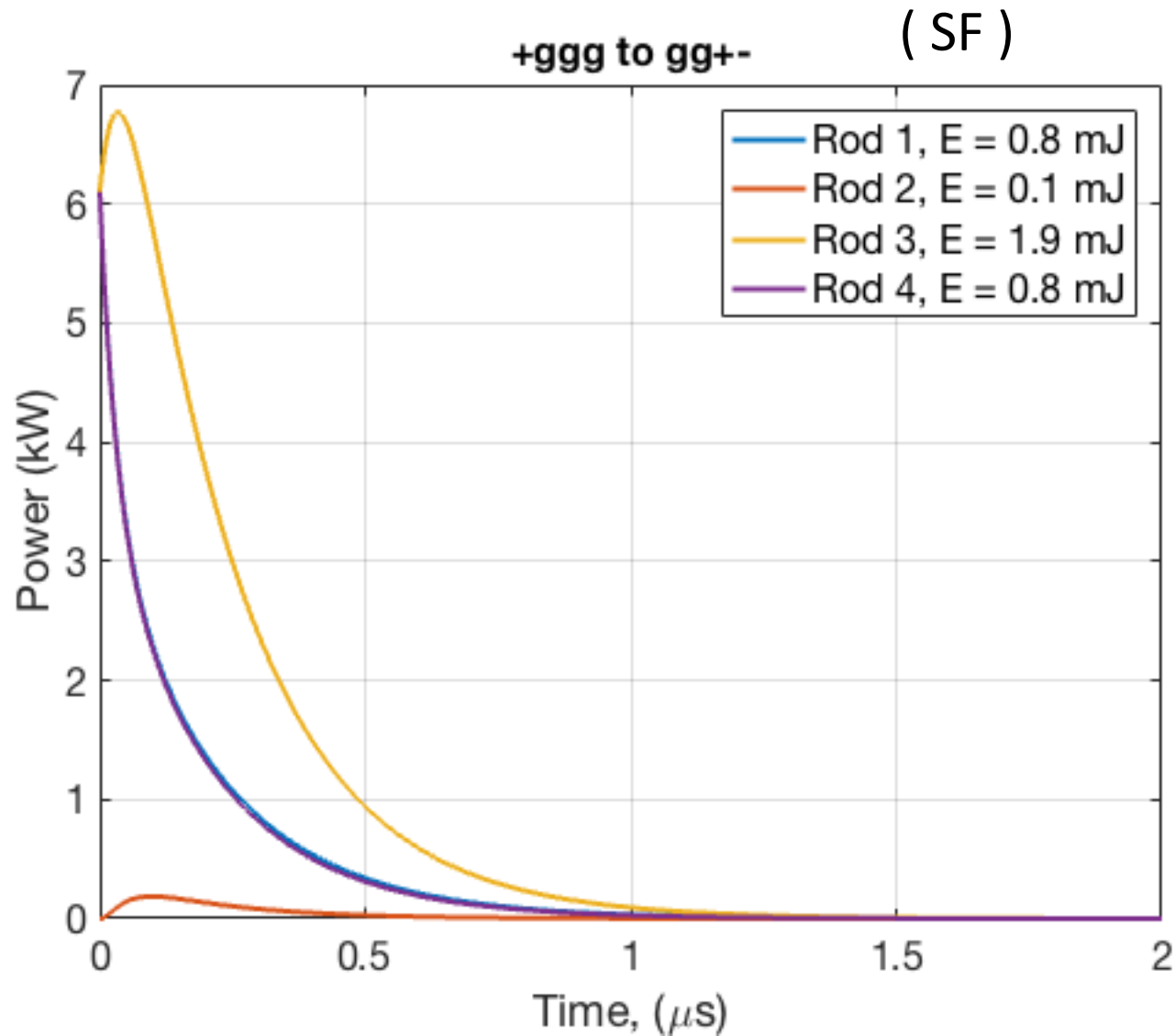
	Energy (mJ)	Power (W)
Rod 1	220	2.2
Rod 2	220	2.2
Rod 3	220	2.2
Rod 4	220	2.2

Electronic Requirements



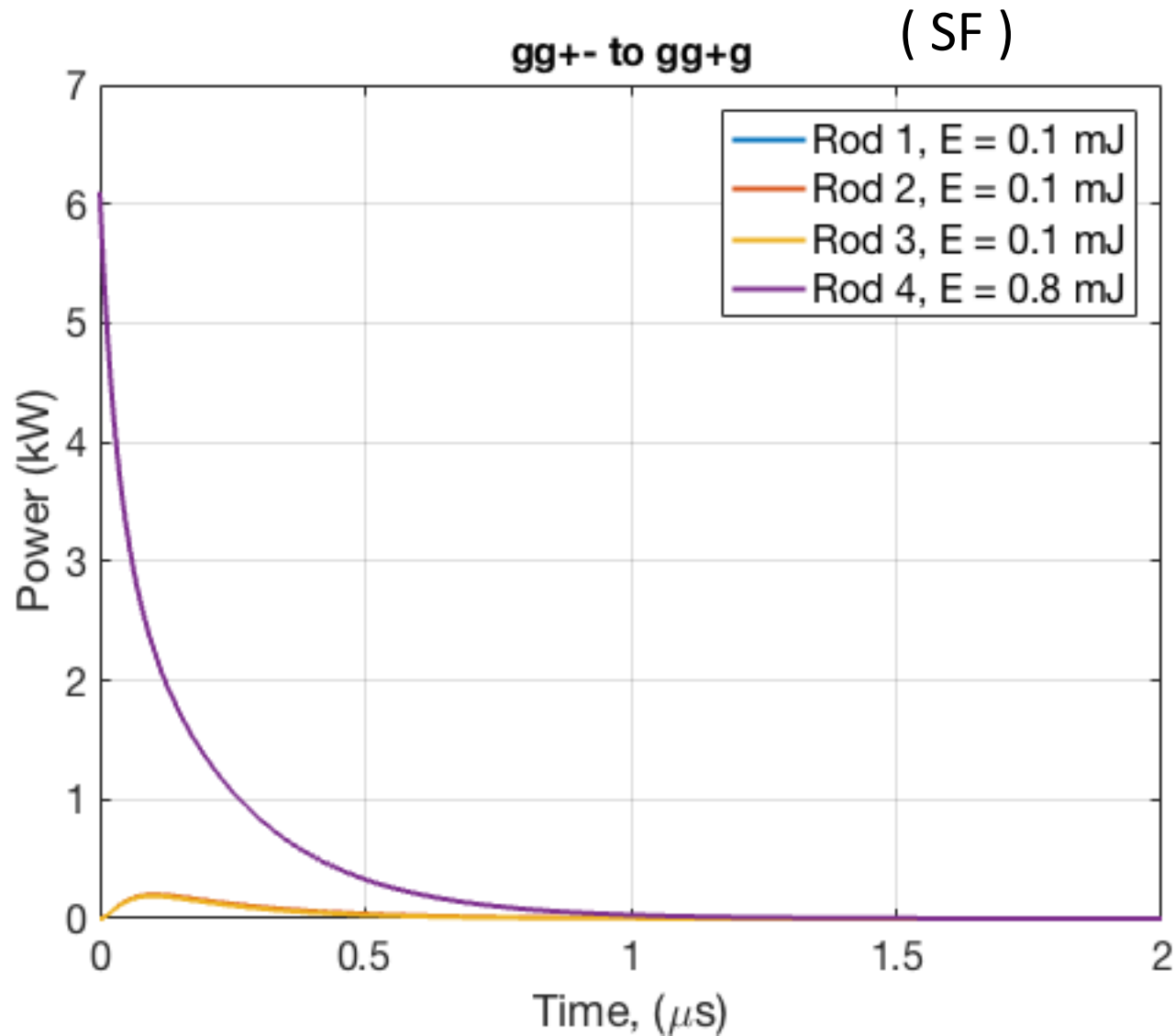
Now we consider various different transitions during the SF sequence.

Electronic Requirements



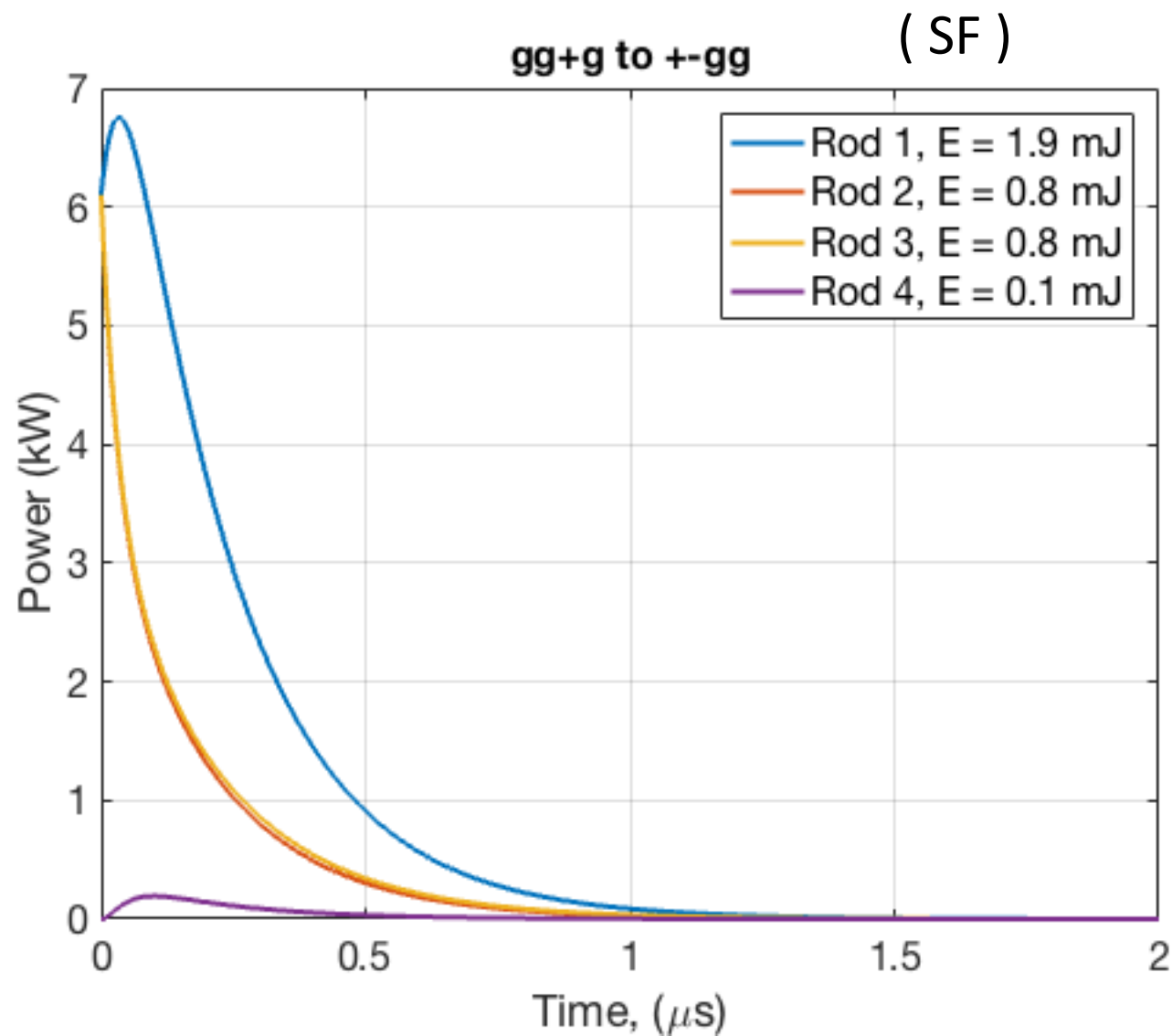
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Electronic Requirements

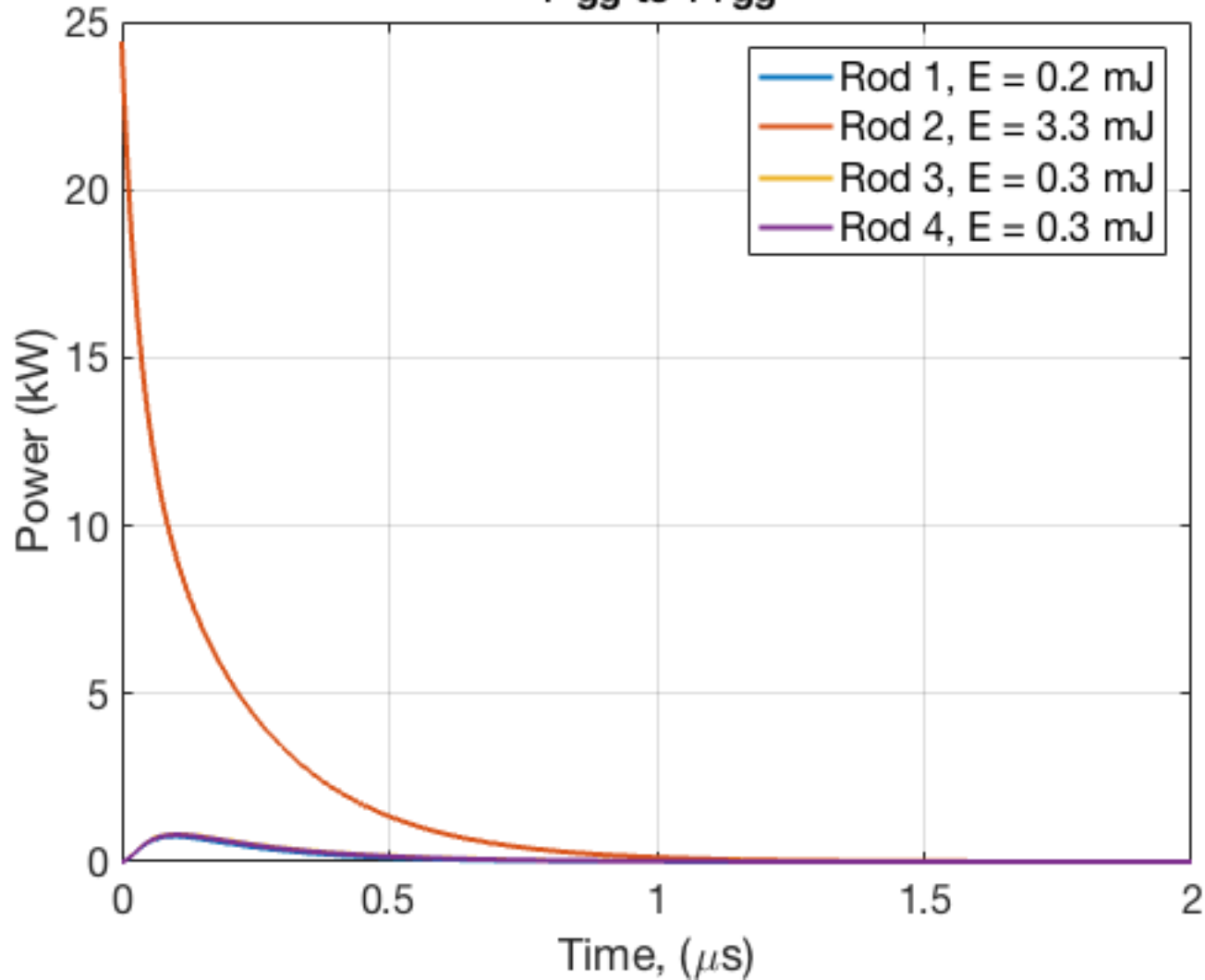


Now we consider various different transitions during the SF sequence.

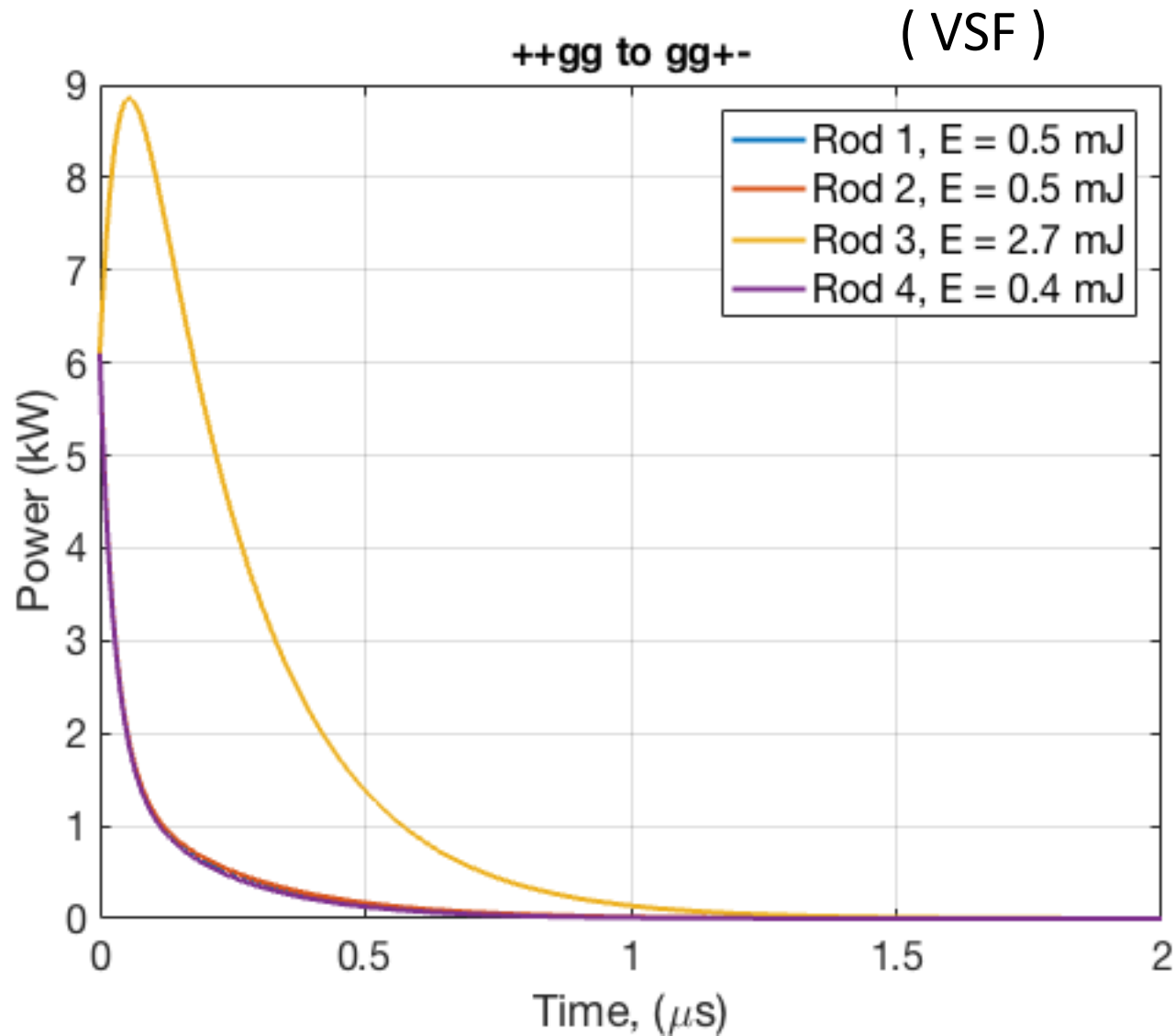
	Energy (mJ)	Power (W)
Rod 1	200	2.0
Rod 2	200	2.0
Rod 3	200	2.0
Rod 4	200	2.0

Electronic Requirements

+ - gg to + + gg (VSF)



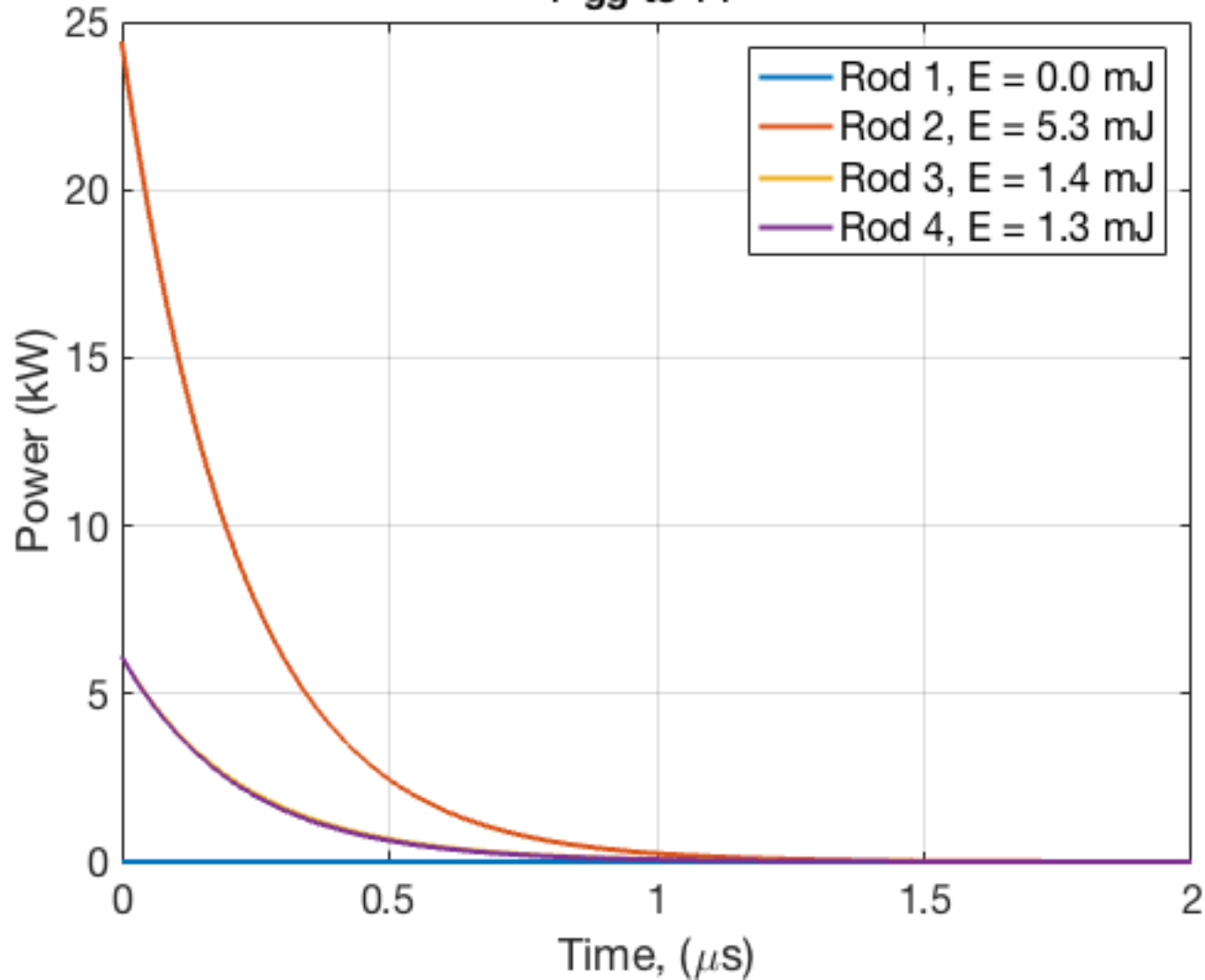
Electronic Requirements



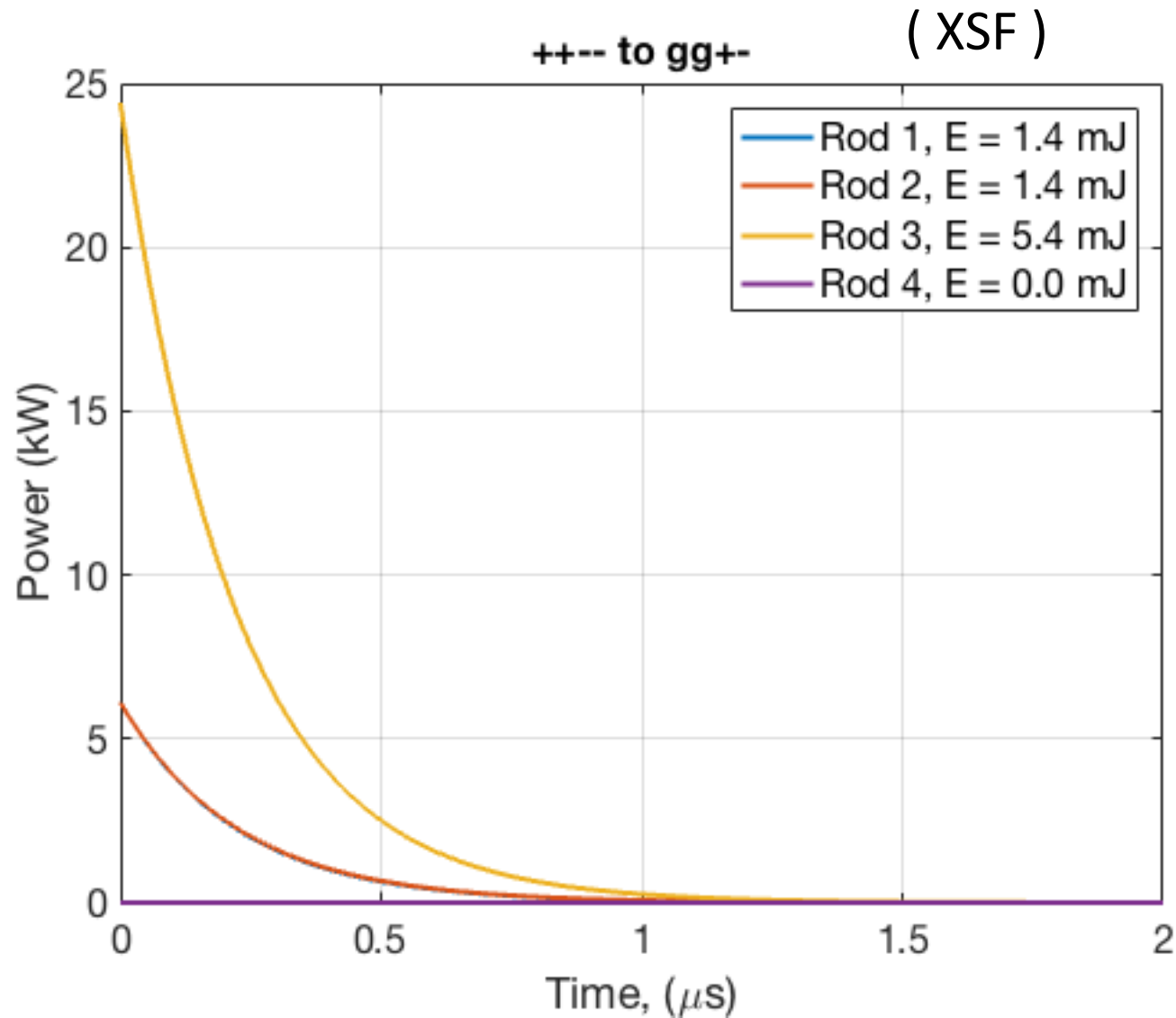
	Energy (mJ)	Power (W)
Rod 1	120	1.2
Rod 2	640	6.4
Rod 3	500	5.0
Rod 4	120	1.2

Electronic Requirements

+-gg to ++-- (XSF)



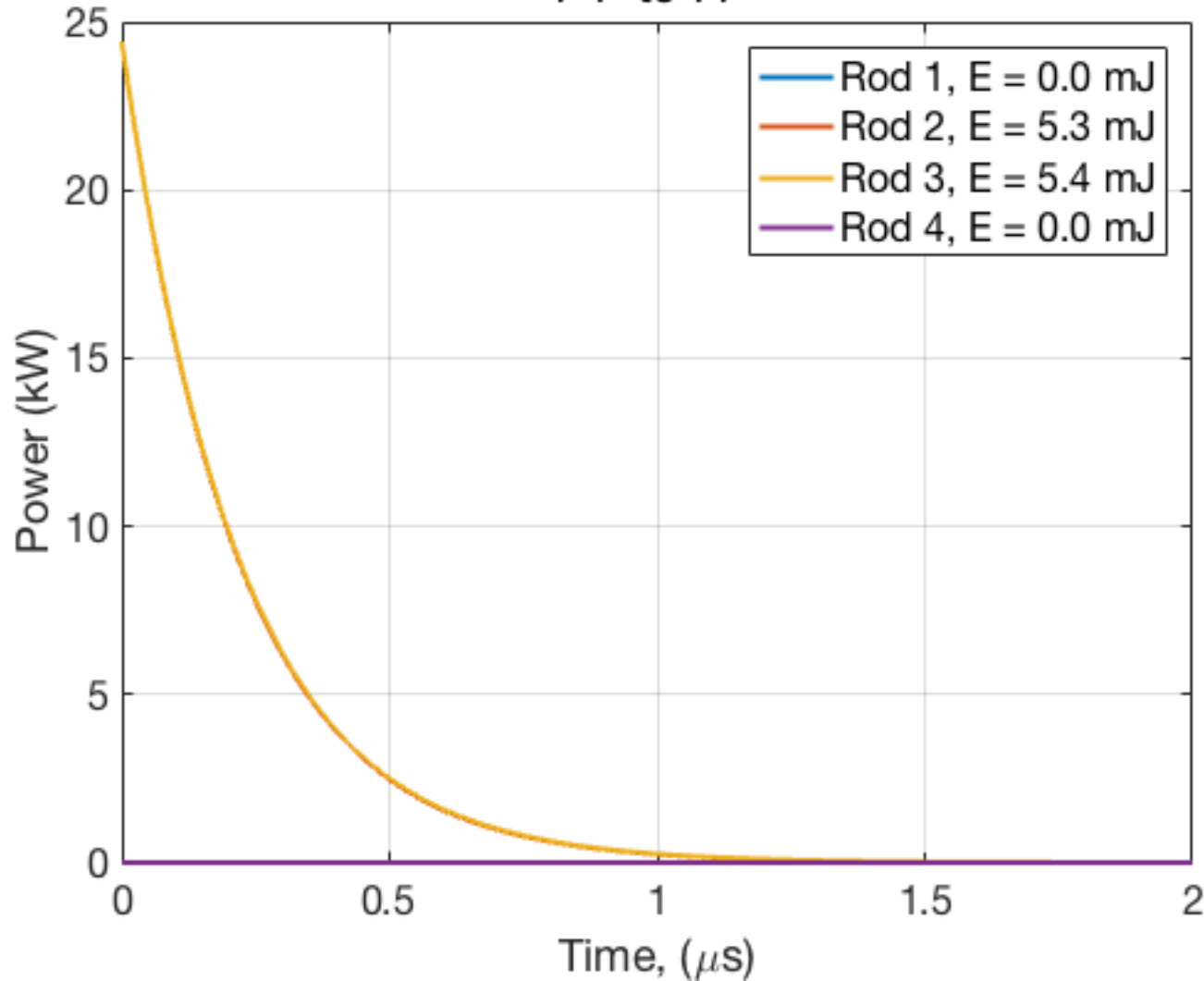
Electronic Requirements



	Energy (mJ)	Power (W)
Rod 1	230	2.3
Rod 2	1120	11.2
Rod 3	1140	11.4
Rod 4	220	2.2

Electronic Requirements

+-+ to +-+ (XSF2)



	Energy (mJ)	Power (W)
Rod 1	0	0
Rod 2	1770	18
Rod 3	1800	18
Rod 4	0	0

Electronic Requirements