Upgraded design of the RF quadrupoles

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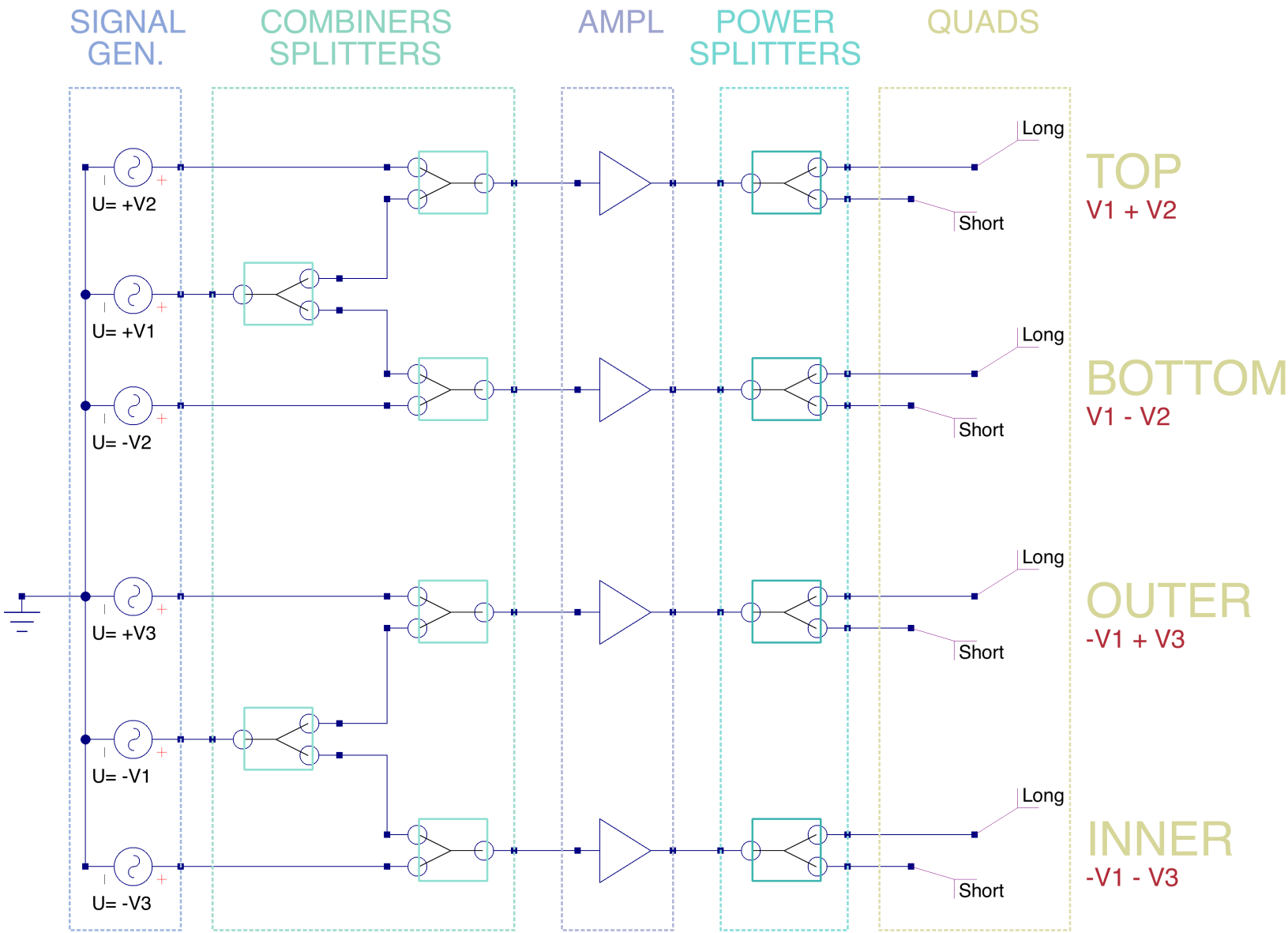
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Outline

- Upgraded design with the vertical RF scraping
- What do we need from Fermilab
- Compatibiliy with the original scraping

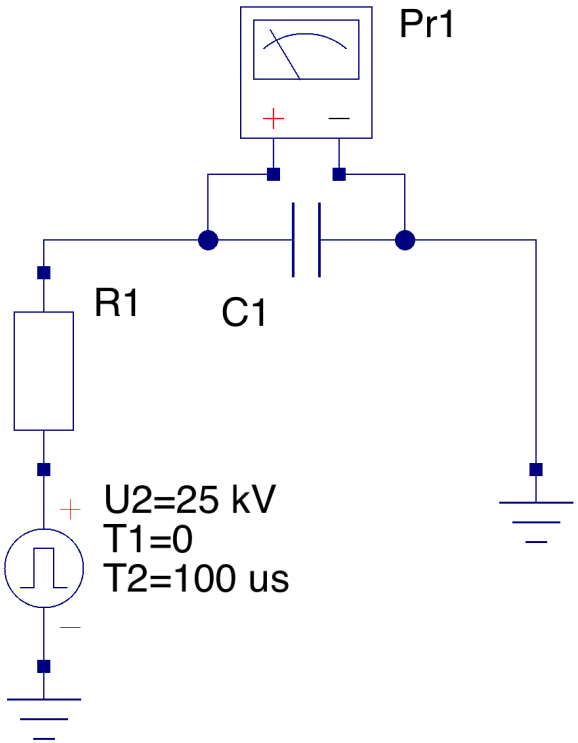
Overall schematics of one quad section

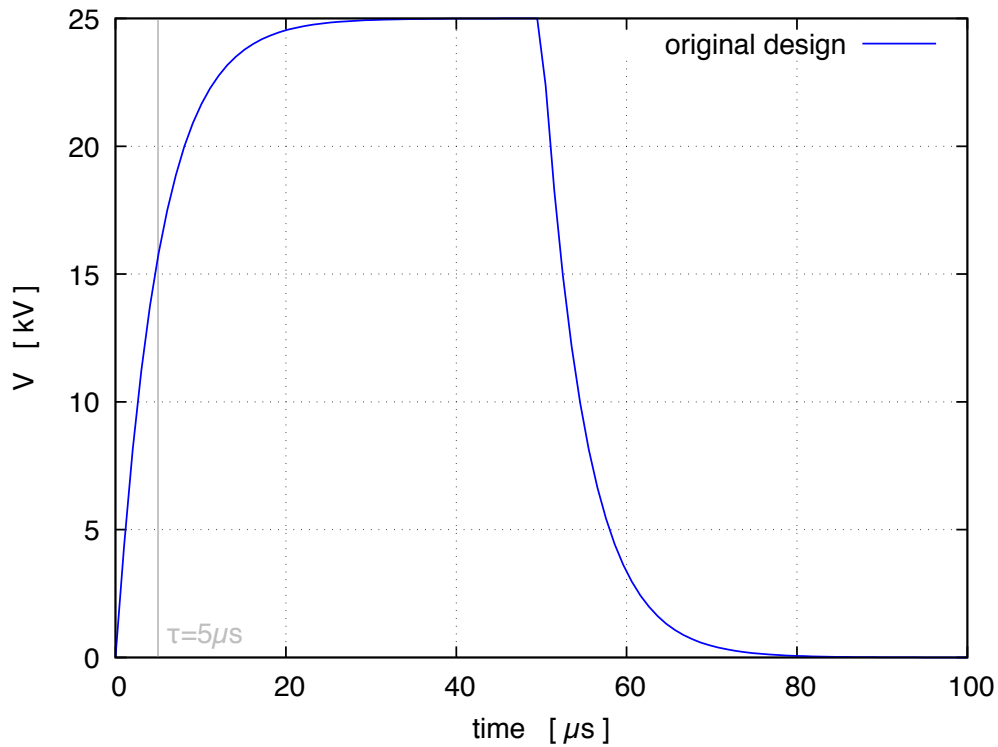


Overall schematics of one quad section

- We are planning to install two quad sections (2 long, 2 short quads)
- We will probably need 2 racks
- Better to install on non-sparking quads
- Resistor values should be determined soon

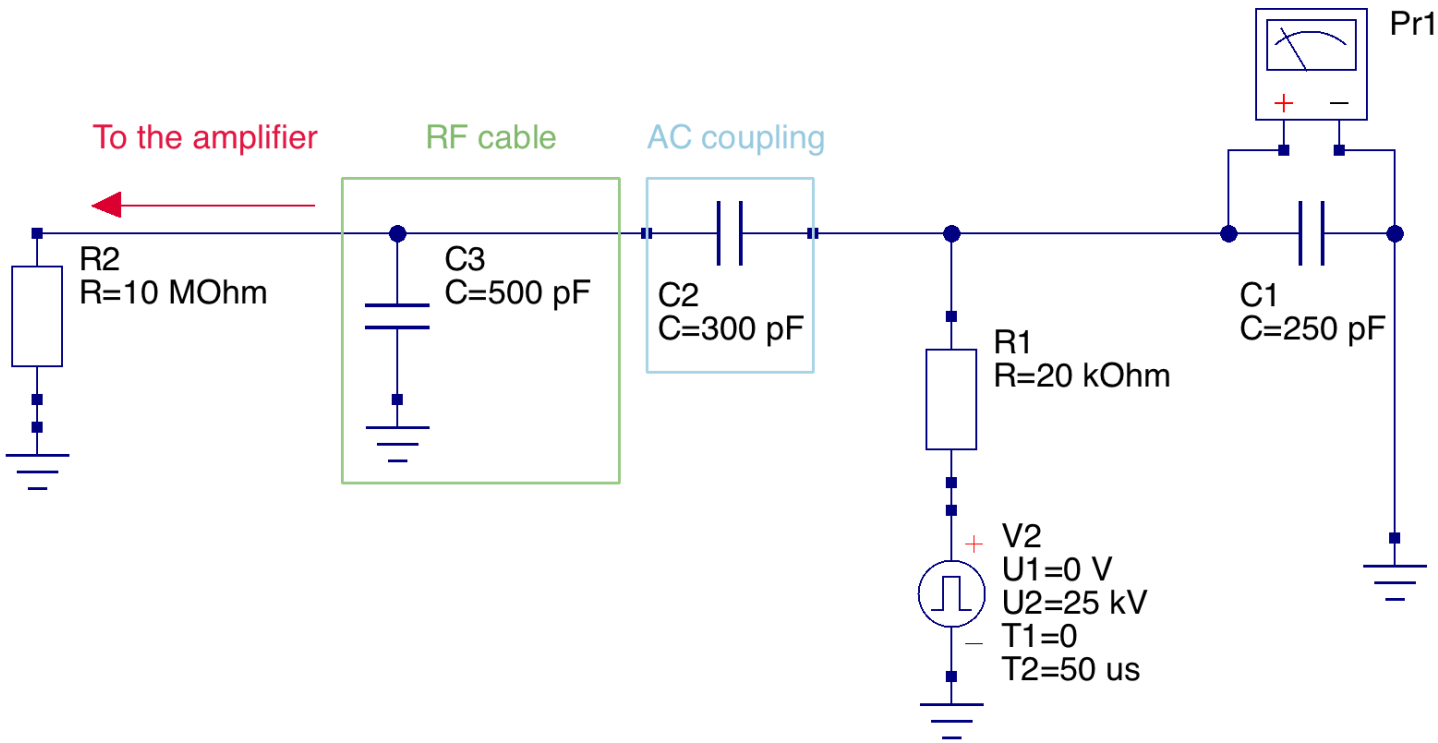
Original quad design





R1 and C1 have varying values to make 5 μs time constant

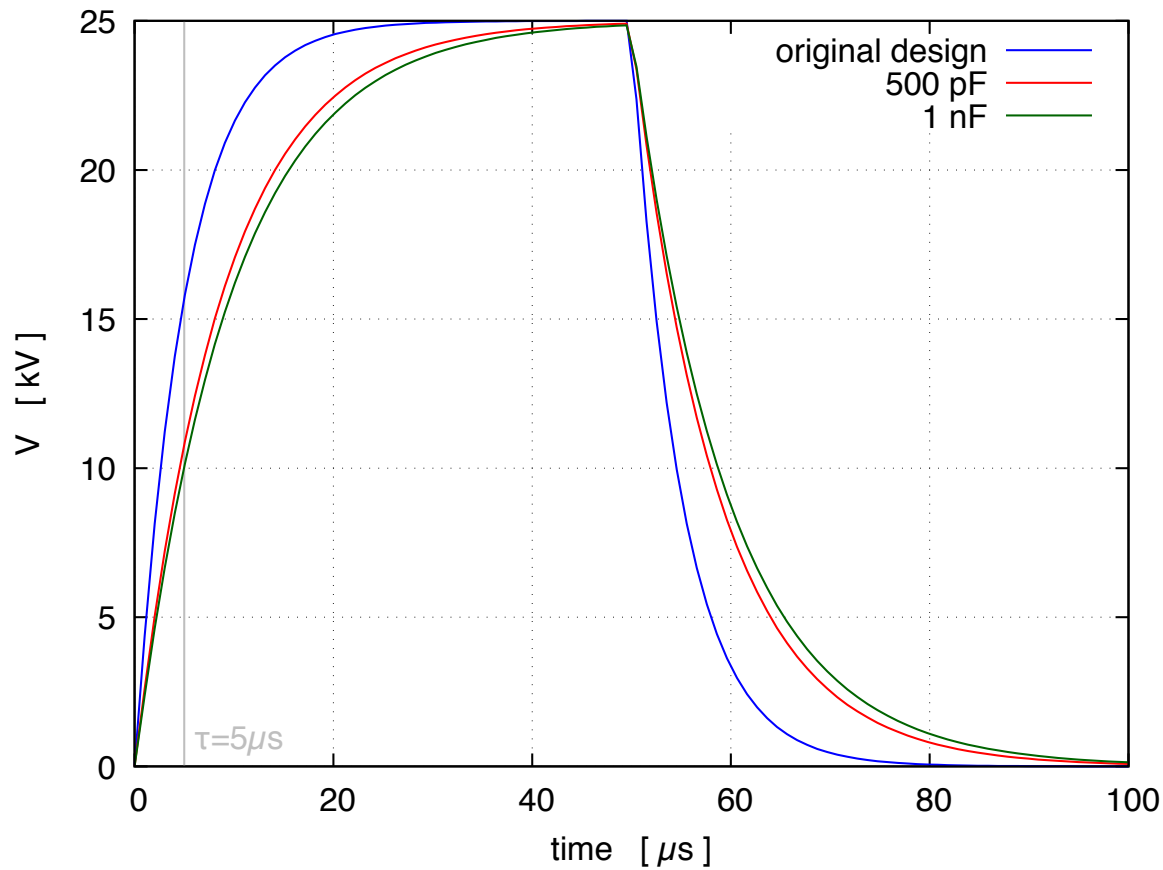
Equivalent circuit of the August test



- 5m cable corresponds to 0.5 nF capacitance
- We did not pay attention to the time constant since we assumed only our scraping would be used
- For compatibility with the original design, we need to take the cable capacitance into account

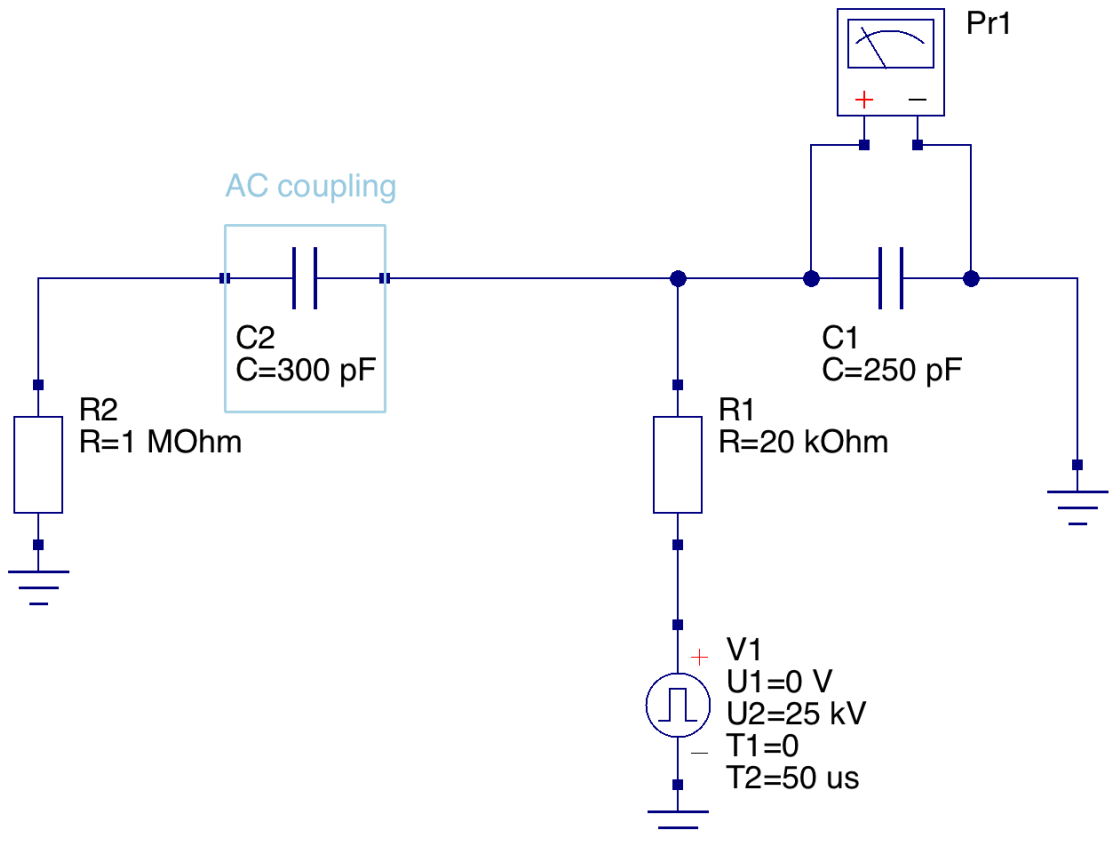
Time constant vs. cable length

- The power cable has a relatively big capacitance (≈100 pF/m)
- We used 5m in August and planning to use 10m in the future
- The cable doubles the time constant

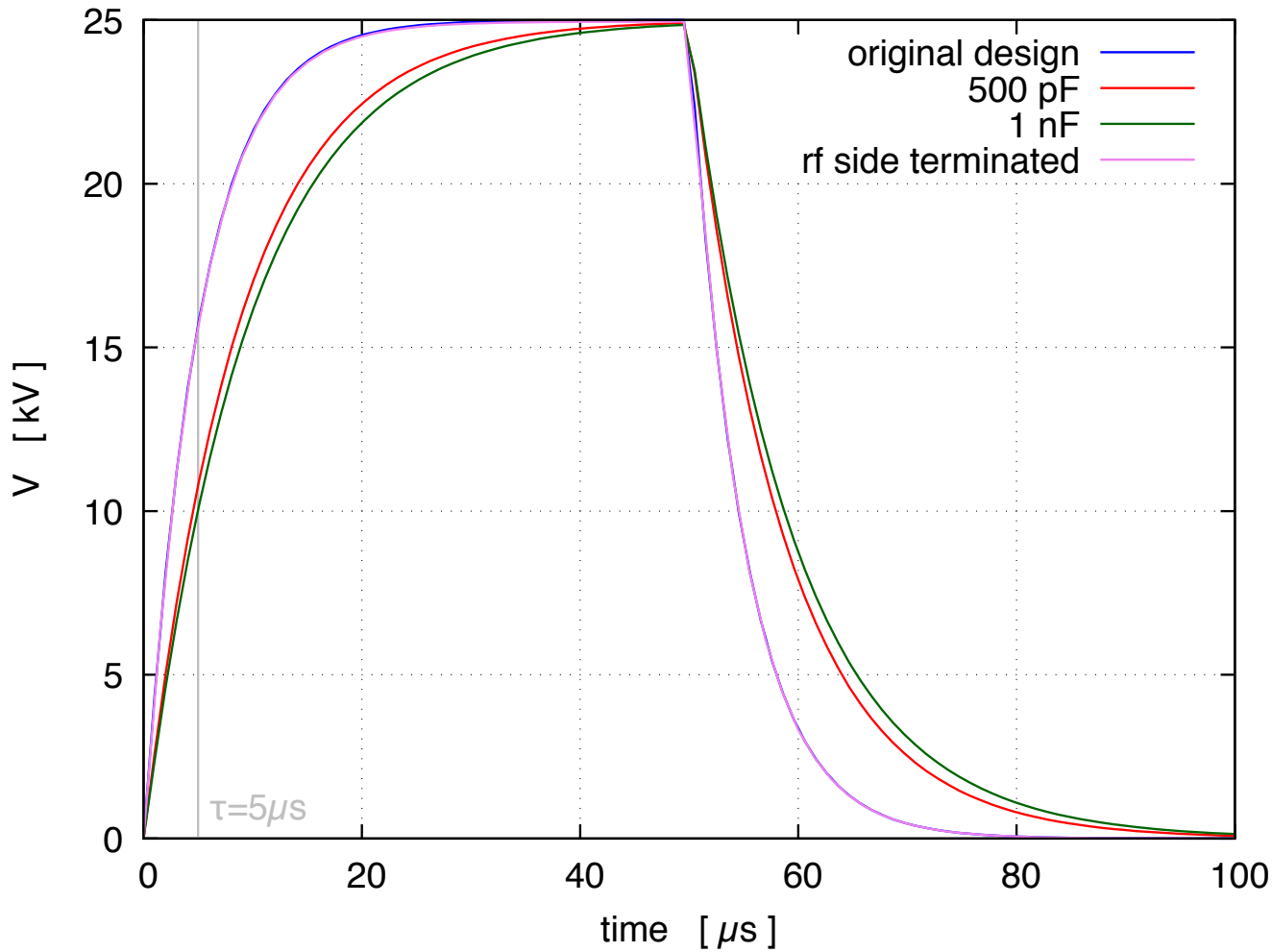


Termination with high impedance

- In case of going back to the original design
  - We suggest to disconnect the RF cable
  - and terminate the RF input with high impedance
- Then the current to the left branch becomes negligible



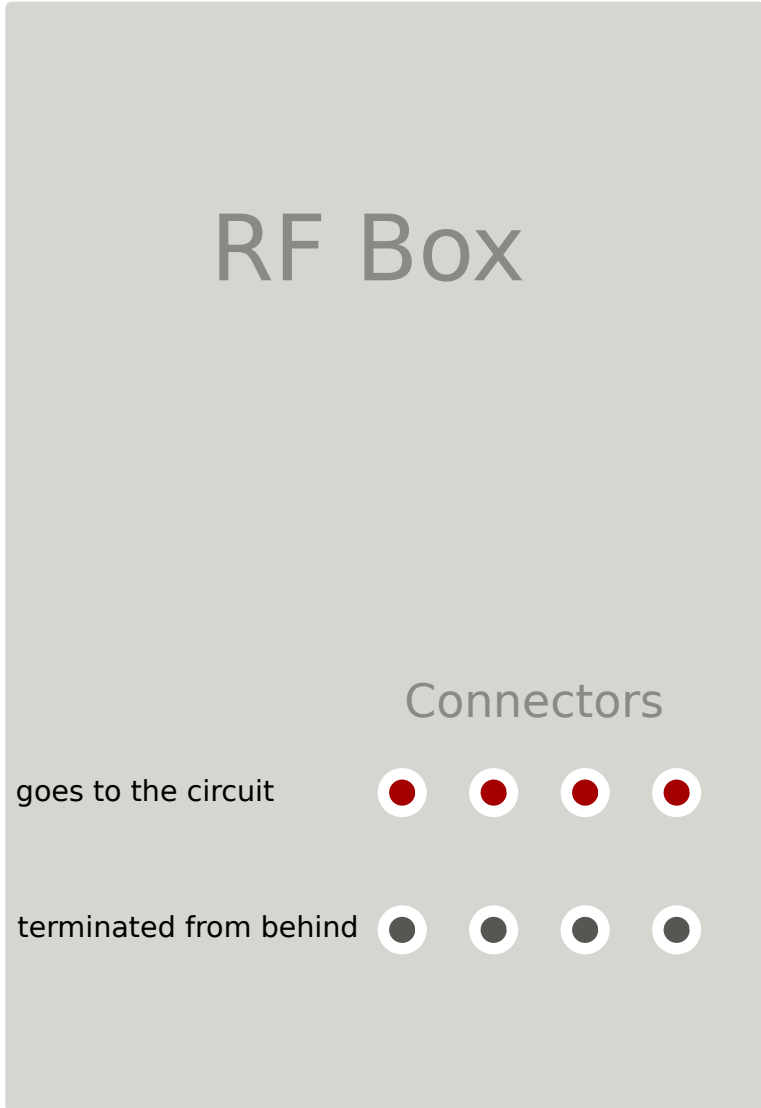
Simulations with and without termination



ONCE THE RF PART IS TERMINATED, THE SETUP BECOMES COMPATIBLE WITH THE ORIGINAL DESIGN

Switching between the schemes

- When the RF part works, the amplifiers will be connected to the connectors represented with red circles. They go to the quads.
- The connectors with gray circles are always terminated from the back side. They don't go anywhere.
- In case of canceling the RF scraping and CBO reduction,
  - The amplifiers will be disconnected from the red connectors
  - They will be connected to the gray ones for safety
  - We will terminate the red connectors with 1MΩ resistors to use the original scraping



Summary

- We have slightly upgraded the design since the August test.
- This will require a bit more power consumption.
- Actually we would like to go with even higher power to see if we can get away with 2 quad sets instead of 4
- We will also modify the setup to be compatible with the original scraping scheme
- We need Fermilab to purchase eight power dividers to be used in 2 quad sets