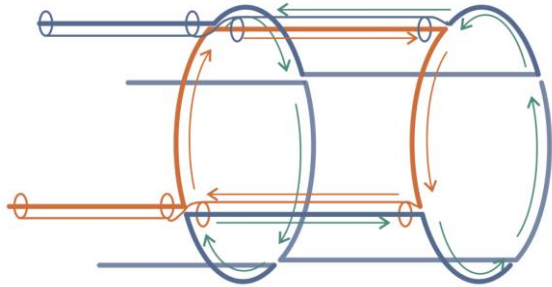


Development of the Kicker Power Supply

Johannes Alt¹, Martin Sack¹, Timothy Hume², Philipp Schmidt-Wellenburg²,
Georg Müller¹

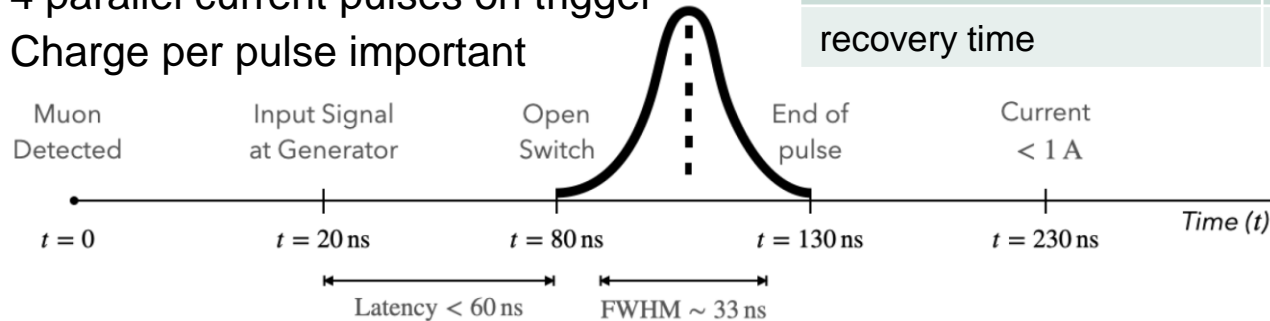
¹Karlsruhe Institute of Technology, ²Paul Scherrer Institute

Generator Requirements



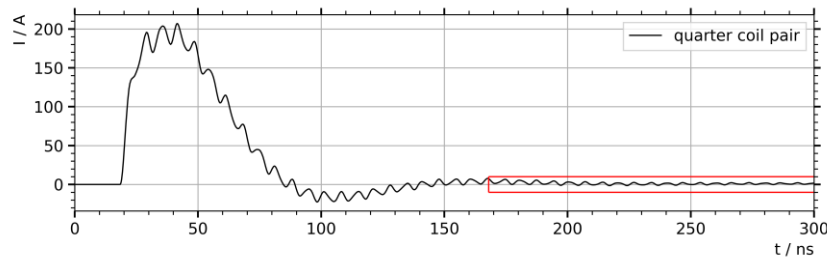
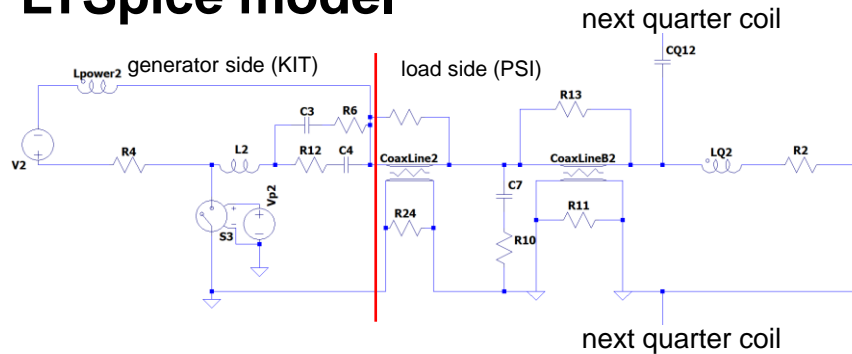
- 4 x ~100nH
- 4 parallel current pulses on trigger
- Charge per pulse important

Parameter	Value
pulse start delay	< 70ns (ideally < 60ns)
FWHM	33ns – 66ns
peak current amplitude	4 x 200A
current oscillations after >150ns	< 10A (ideally < 1A)
repetition rate	2000/s
recovery time	< 20μs



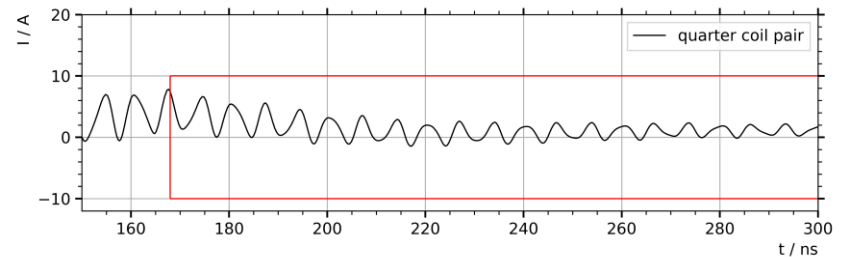
Simulation and Damping

LTSpice model



Main challenge: Damping

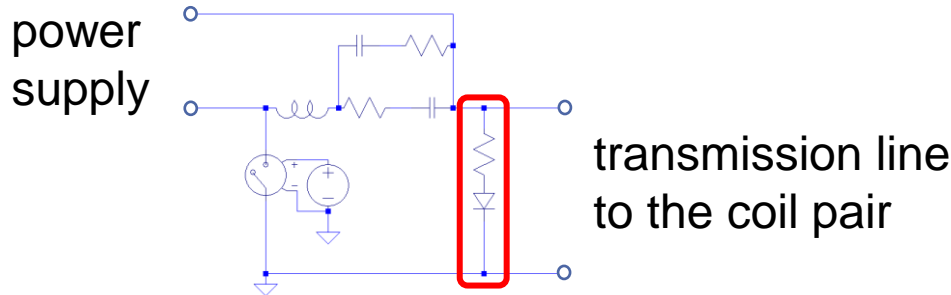
- current 150ns after pulse start $< 10A$
- circuit is sensitive to series inductance of the generator



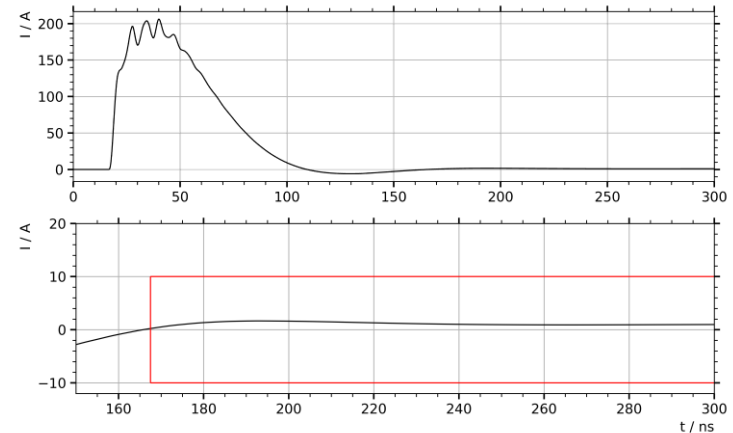
Simulation and Damping

Improved damping:

- add diode and termination resistor
- implementation in simulation:

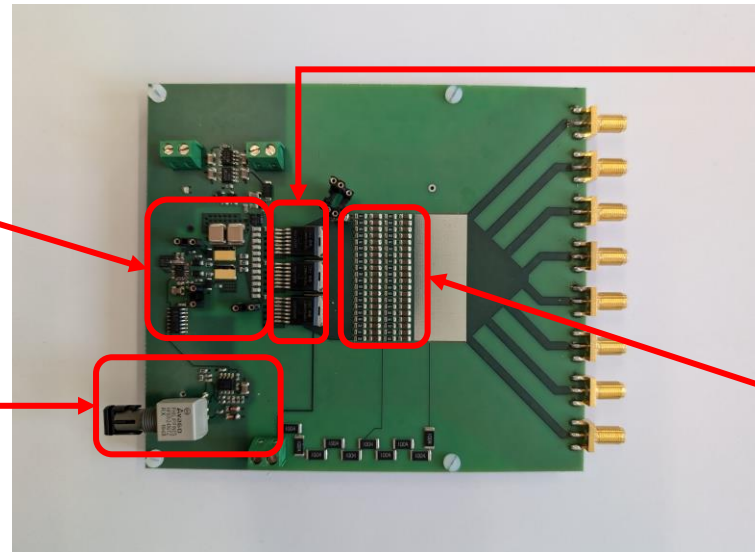


- simulation showed promising results
- needs to be verified with hardware measurements



The Test Stage PCB

- Designed for up to 800V and 100A
- Passive pulse forming
- Rise-time (10%-90%) below 4ns



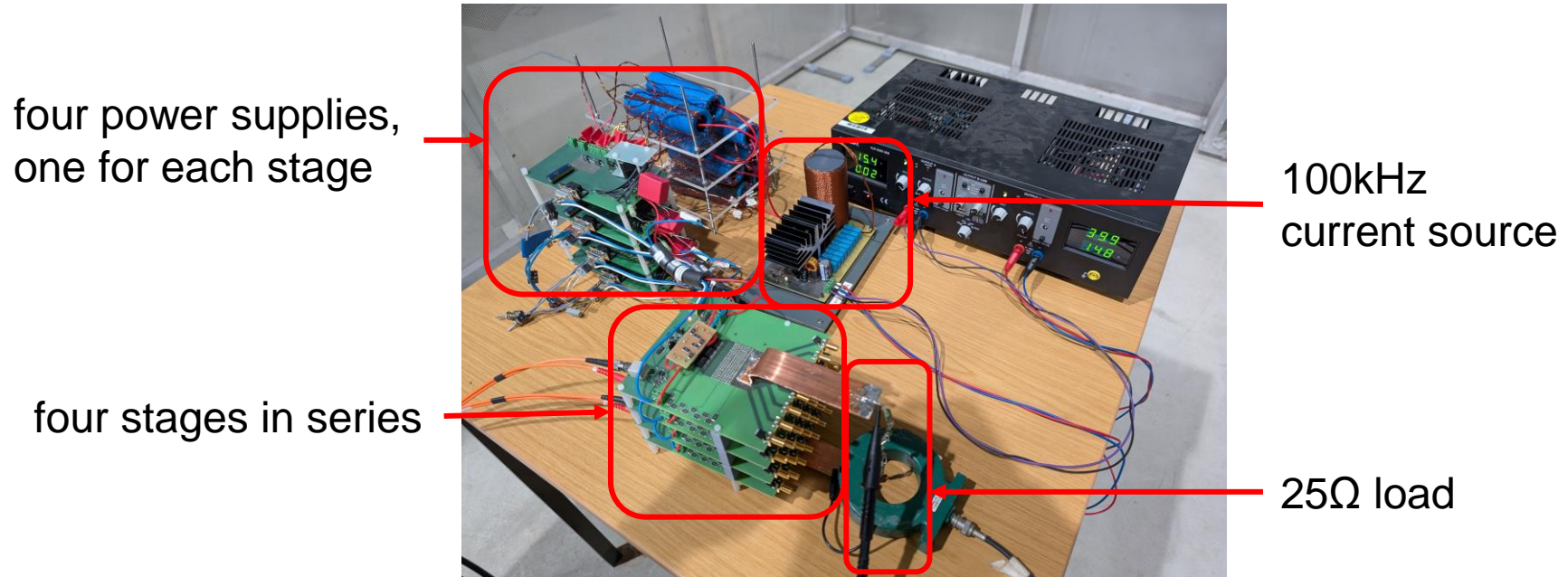
SiC-MOSFET driver
with gate boosting

optical fiber
receiver, connected
to the main control
unit for triggering

SiC-MOSFETs

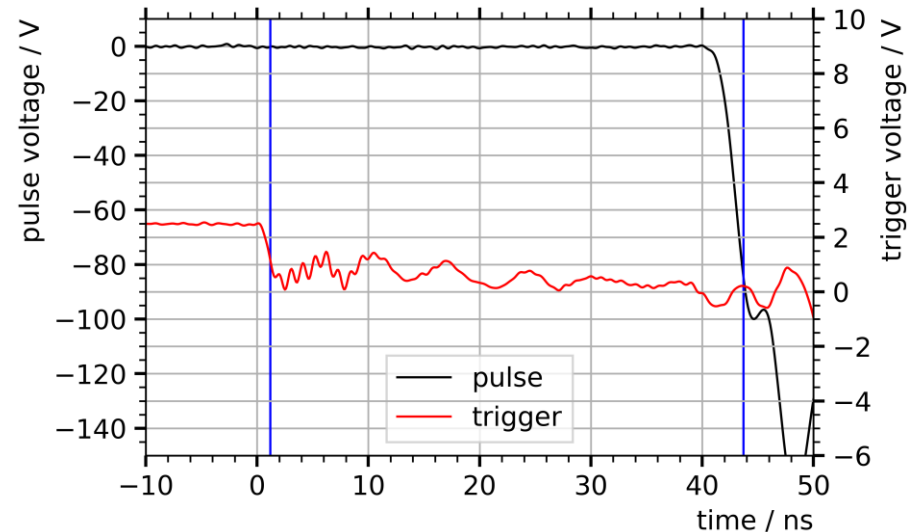
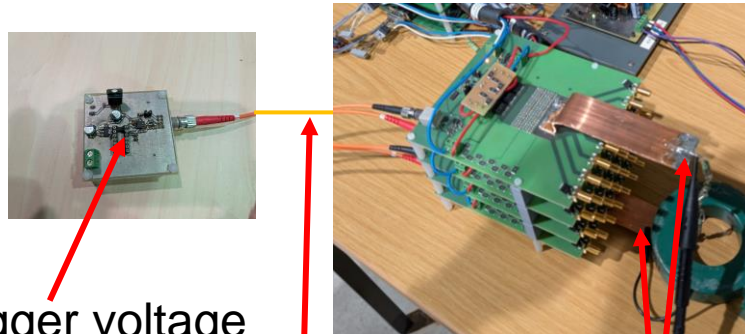
pulse capacitors
and pulse
shaping resistors

Four Stage Setup



Preliminary Output Delay Measurement

- Measuring the time between the input to the fiber optic transmitter of the preliminary control unit and the pulse begin at the output
- Measured at 50% crossing of both signals
- Delay times below 45ns



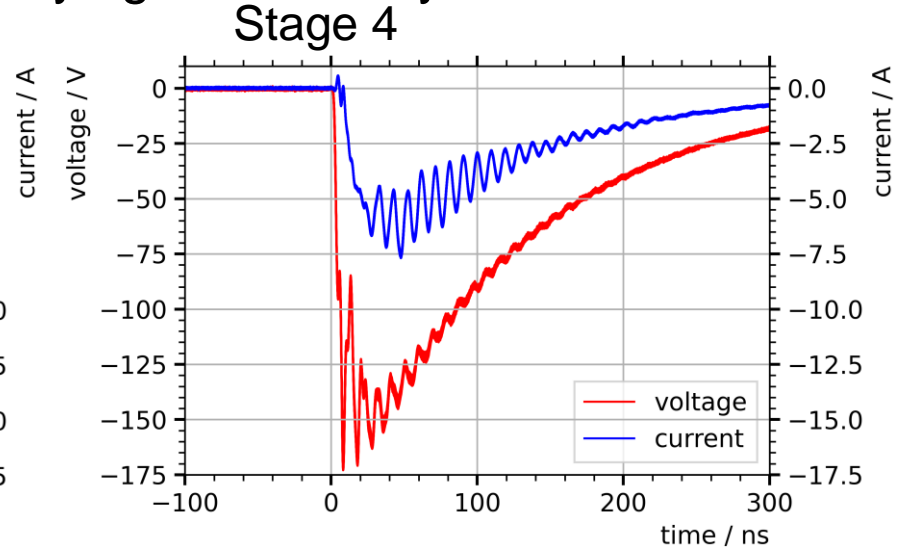
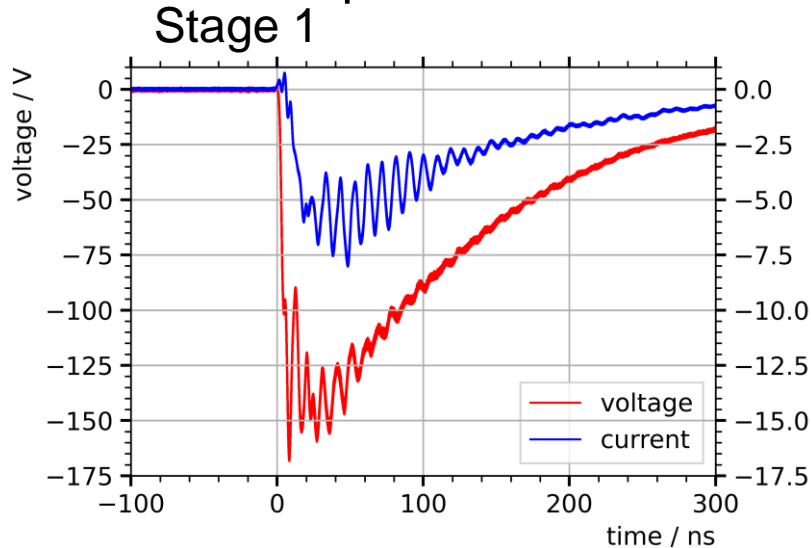
trigger voltage

1m optical fiber

pulse voltage

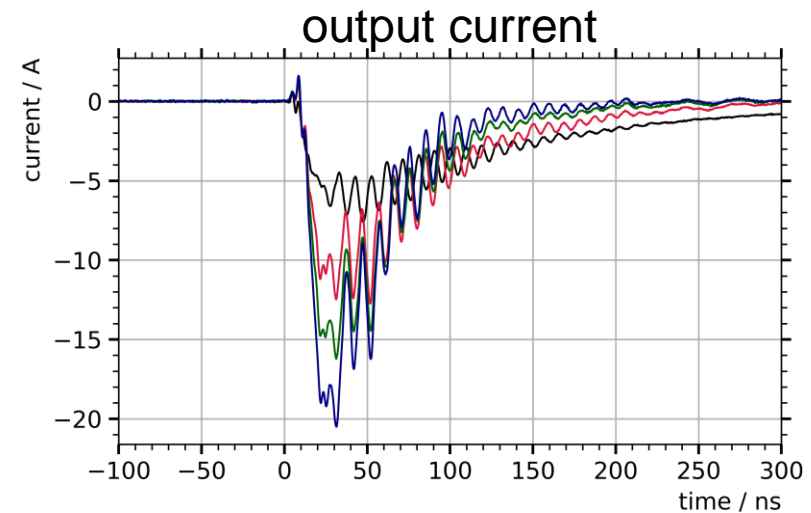
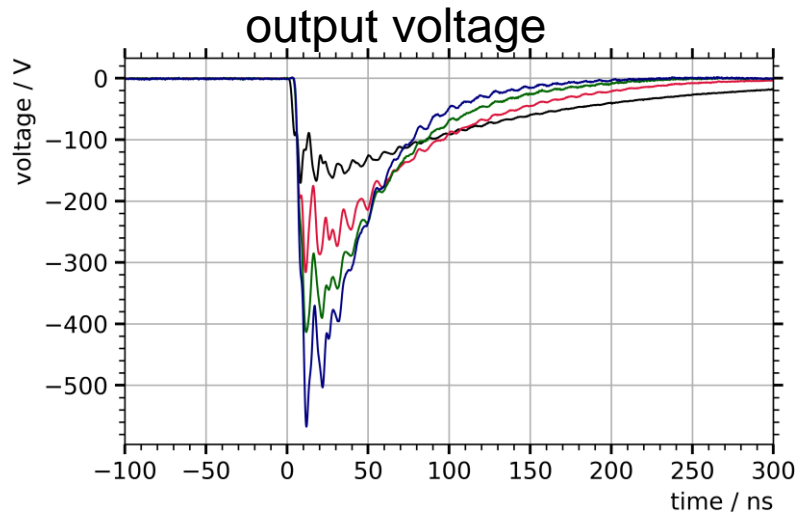
Preliminary Single-Stage Operation

- 200V stage charging voltage and 25 load
- 100 voltage and current waveforms overlayed
- Results as expected and with satisfying consistency



Preliminary Multi-Stage Operation

- Preliminary test with up to four stages
- 200V stage charging voltage and 25Ω load
- Shows expected results



Summary

- Promising simulation results regarding damping of the oscillations
- First test stage PCB designed and build
- Preliminary measurements with up to four stages show expected results