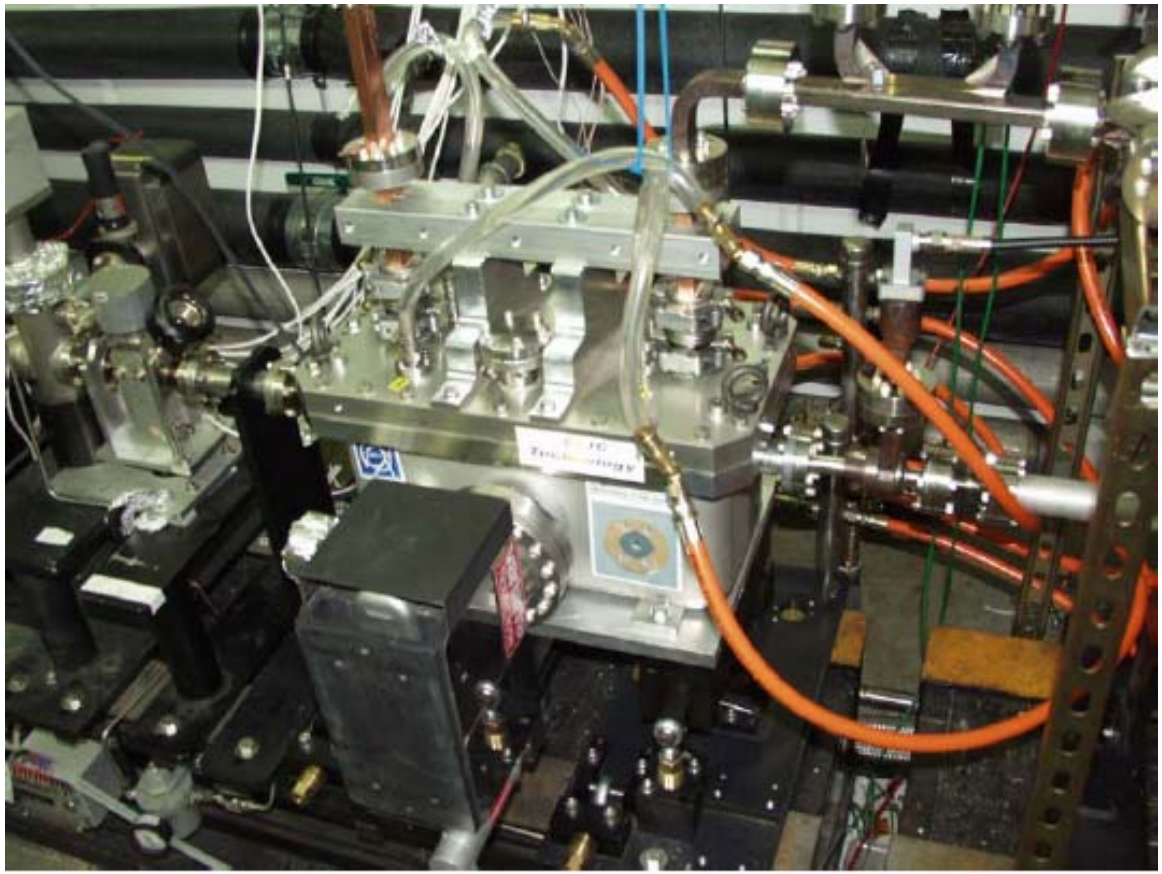
CLIC Accelerating Structure Testing at SLAC

11.424 GHz W Structure

Outline

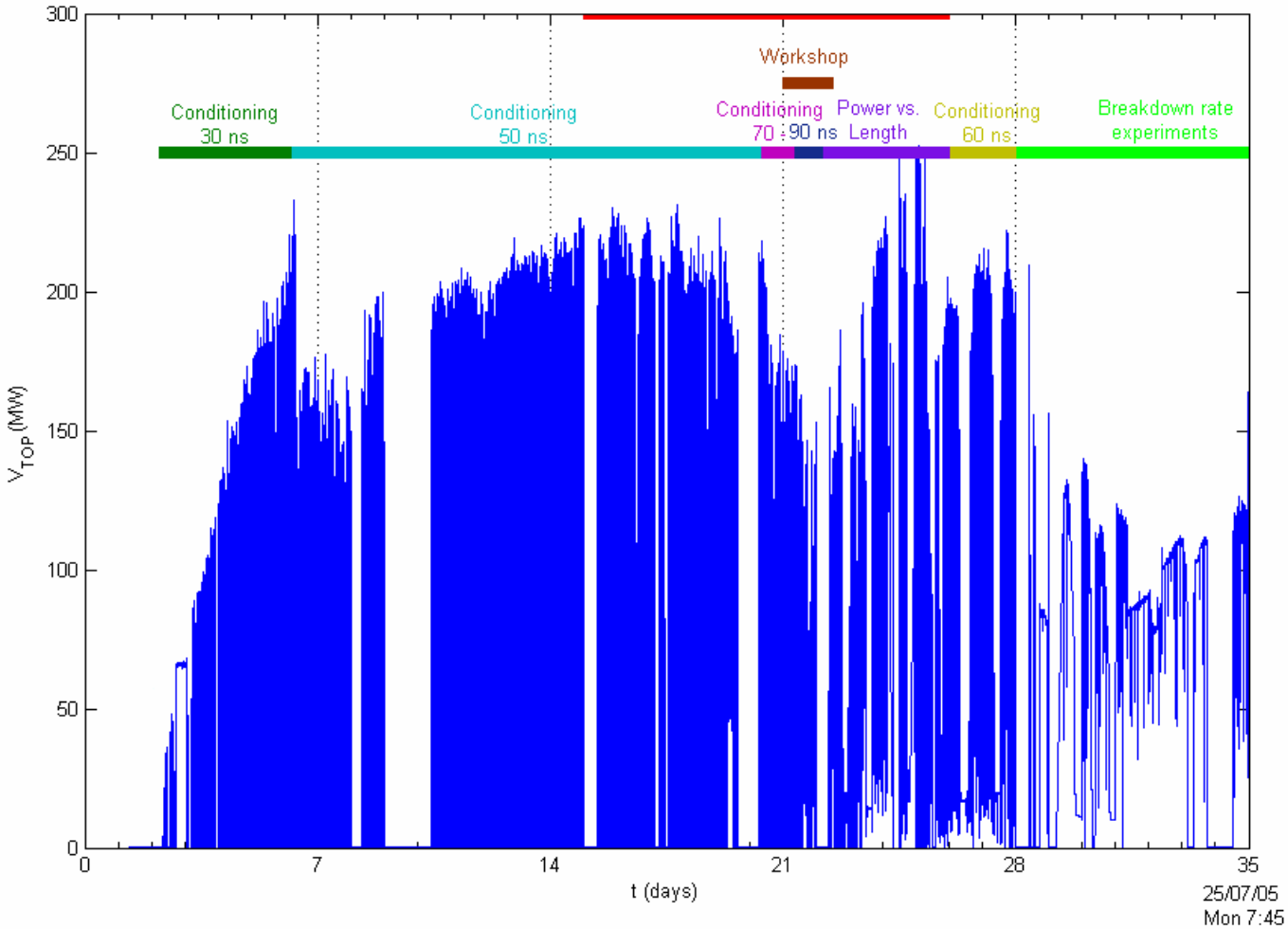
- Introduction
- Summary Conditioning
- Conditioning curves
- Power vs. pulse length experiment
- Conditioning Duty Cycle
- Comparison to Mo structure

Introduction



Same experimental setup as for the 11.424 GHz Mo Structure

Summary Conditioning



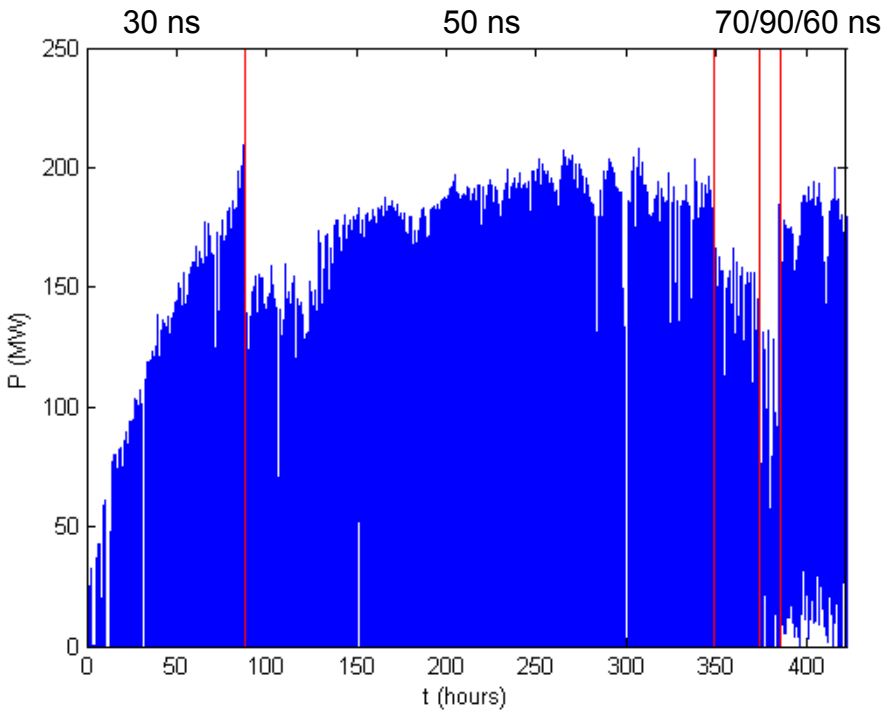
Conditioning Time distribution:

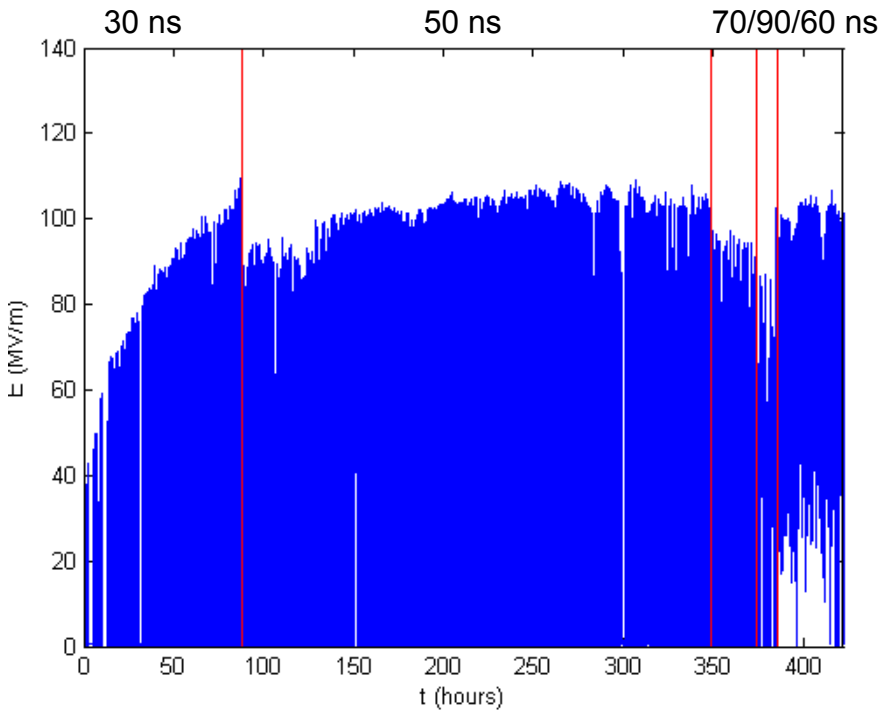
- 4 days @ 30 ns
- 14 days @ 50 ns
- 1 day @ 70 ns
- 1 day @ 90 ns
- 2 days @ 60 ns

Experiments:

- Power vs. Length
- Breakdown rates

Conditioning Curves





Highest P @ 30 ns = 220 MW

Highest P @ 20 ns = 261 MW (1)

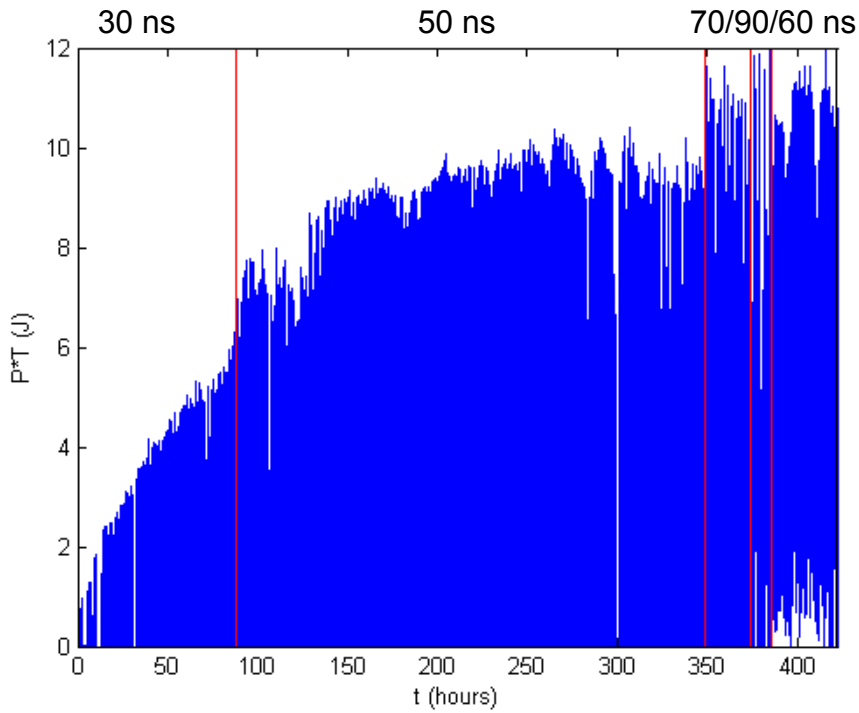
Highest 1st cell E @ 30 ns = 112 MV/m

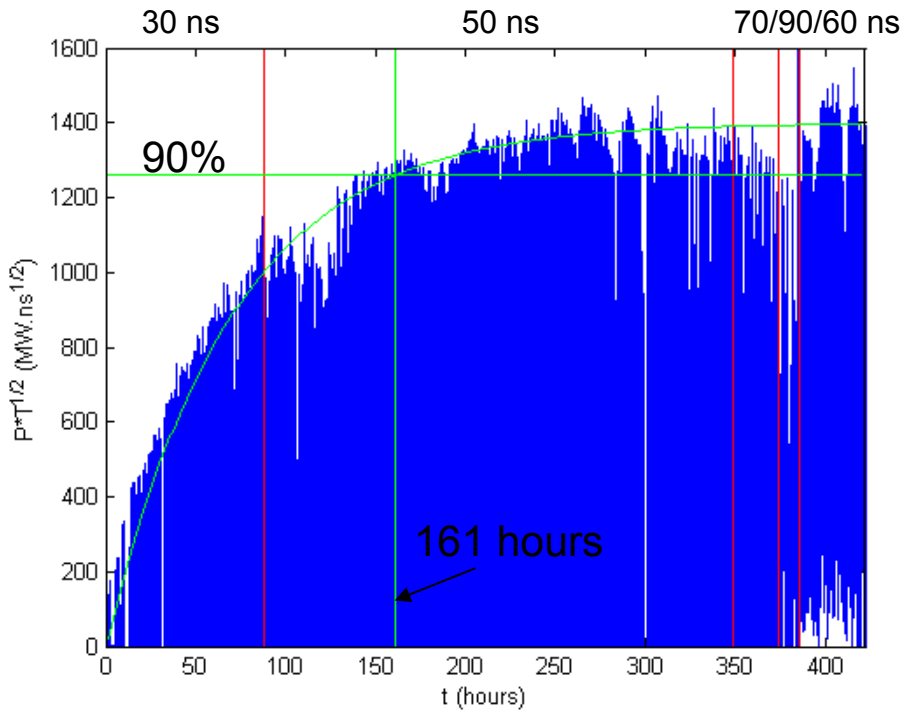
Highest 1st cell E @ 20 ns = 122 MV/m (1)

(1) Probably limited by available power

ALL Breakdown rates ~ 25 per hour @ 60Hz

Conditioning Curves





Highest U @ 30 ns = 6.6 J

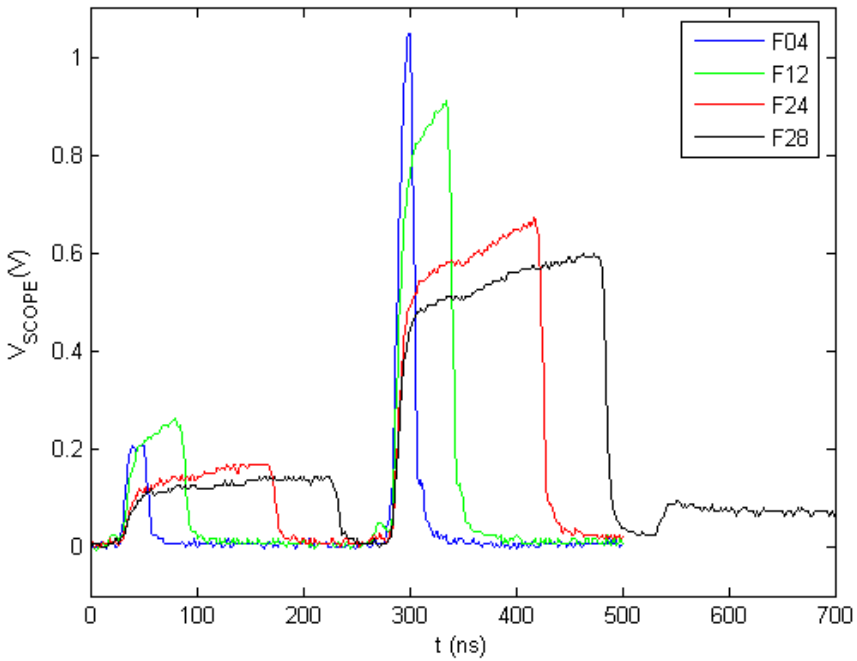
Highest U @ 20 ns = 5.2 J (1)

Highest U @ 195 ns = 16.7 J

(1) Probably limited by available power

ALL Breakdown rates ~ 25 per hour @ 60 Hz

Power vs. pulse length experiment



Pulse width definition:

- Width at half maximum of voltage in the scope
- Integral over peak voltage

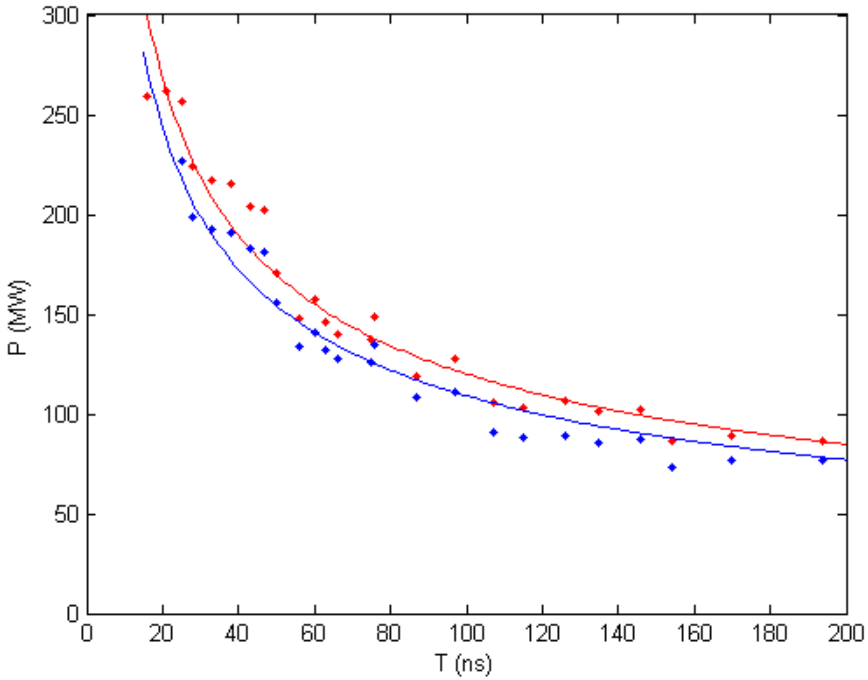
Pulse power definition:

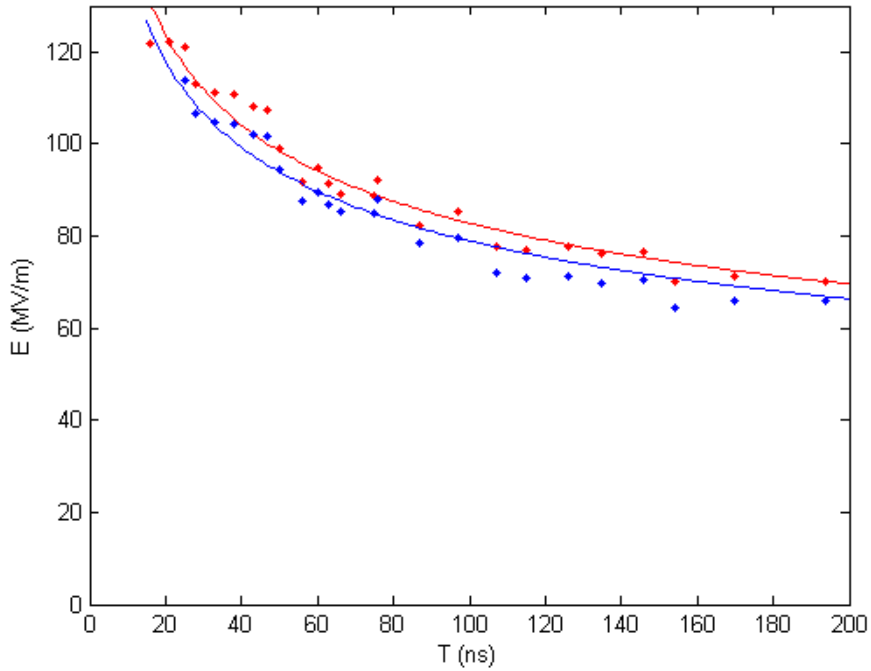
- Average peak power over several pulses
- Average flat top power over several pulses

Notes:

- V_{SCOPE} approx. linear with acc. Gradient
- Breakdown rate ~ 25 per hour @ 60 Hz

Power vs. pulse length experiment





P_{PEAK} (MW) = 1199·T(ns)$^{-1/2}$ (ρ^2 = .94)

P_{TOP} (MW) = 1090·T(ns)$^{-1/2}$ (ρ^2 = .95)

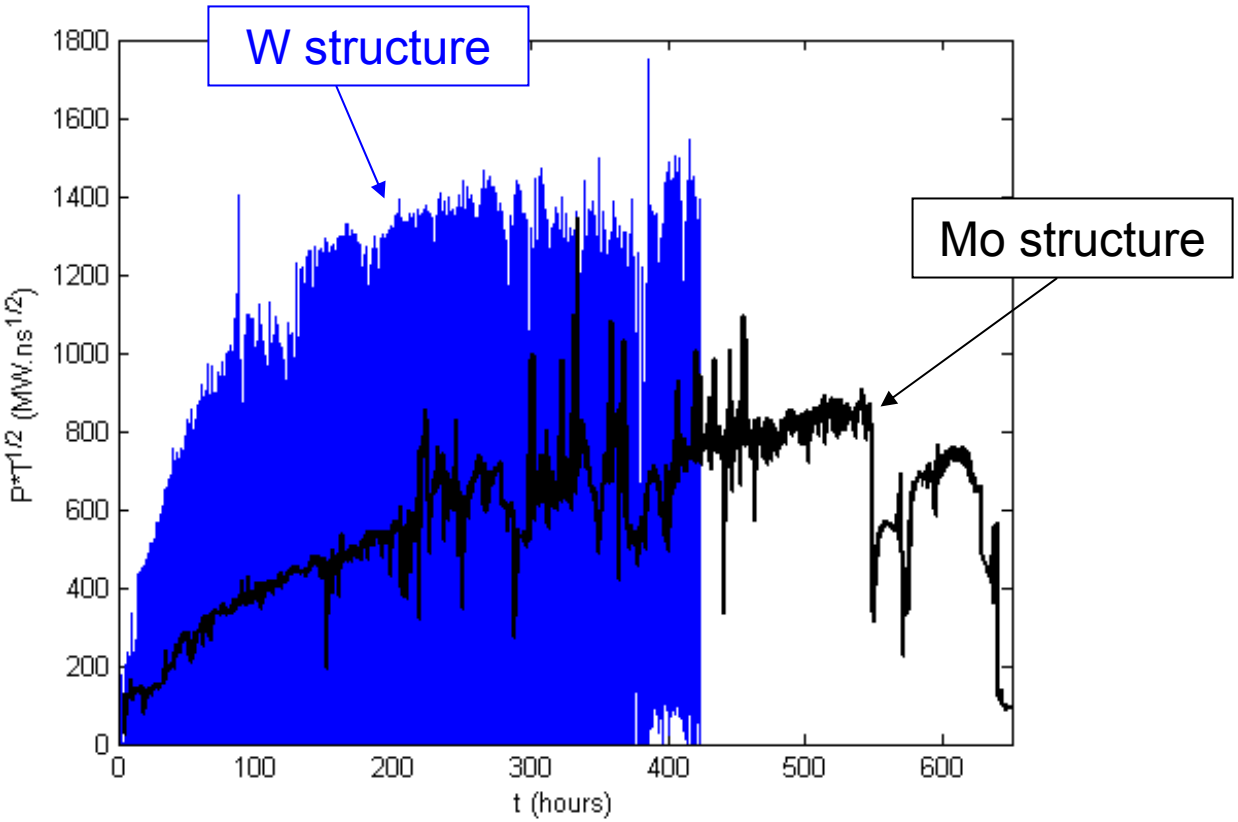
Conditioning Duty cycle

- Total considered time = $2.8 \cdot 10^6$ s = 32.6 days
- Total conditioning time = $1.7 \cdot 10^6$ s + 2 days = 21.6 days
- Total experiment time = 11 days
  - Breakdown rates = 7 days
  - Power vs. pulse length = 4 days
- Conditioning before experiments = $1.7 \cdot 10^6$ s = 19.6 days
  - Downtime = $3 \cdot 10^5$ s (18%)
  - Uptime = $1.4 \cdot 10^6$ s (82%)

Conditioning Duty cycle

- $83.5 \cdot 10^6$ “pulses” (Uptime $1.4 \cdot 10^6$ s @ 60 Hz)
- Number of breakdowns ~ 13500
- 1.9 minutes per breakdown
  - Typical wait after breakdown ~ 30 s
  - Typical power ramp up time ~ 10 - 30 s
  - Typical pulse length ramp up time ~ 10 - 30 s

Comparison to Mo structure



Note: Mo curve from Valery Dolgashev