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All-fibered high-quality low duty-cycle 40-GHz picosecond pulse source based on nonlinear compression of besselons

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All-fibered high-quality low duty-cycle 40-GHz picosecond pulse source based on nonlinear compression of besselons

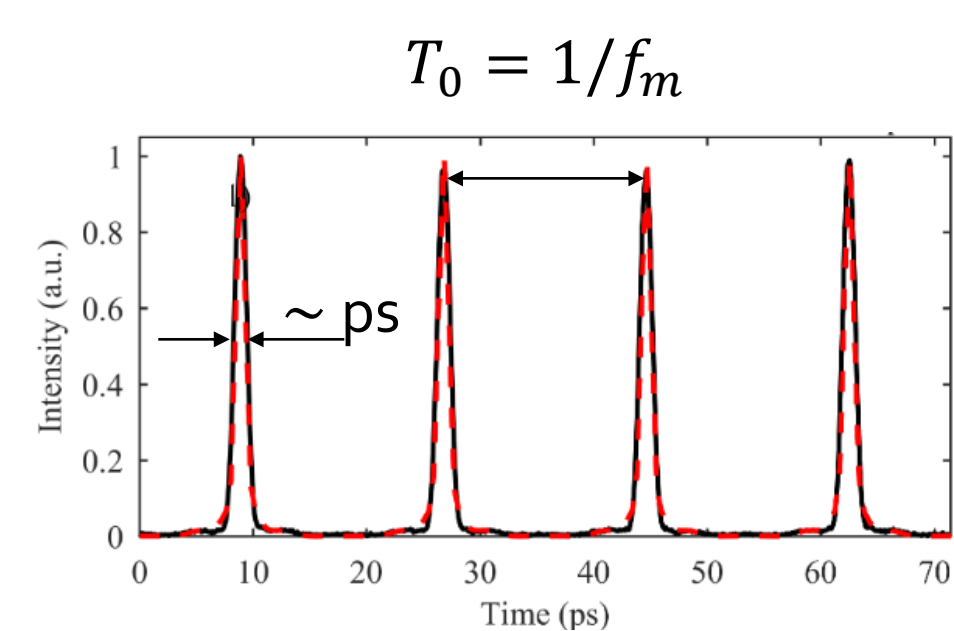


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INTRODUCTION

GOAL : Ultrashort pulse train generation at high repetition rates using a simple all optical setup



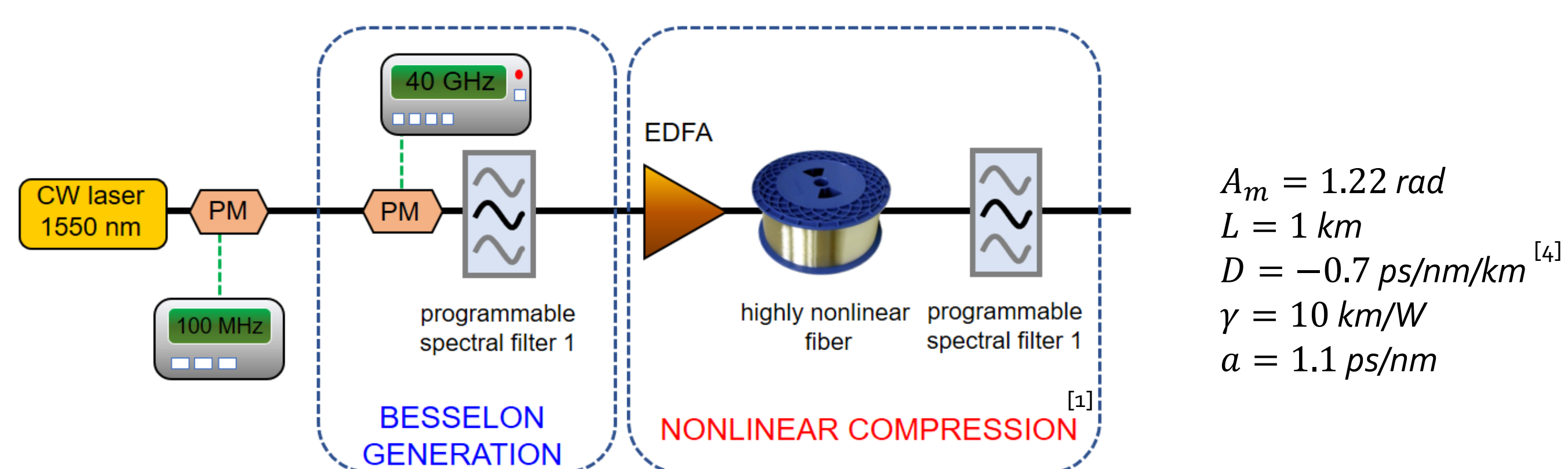
$$T_0 = 1/f_m$$

$$f_m \sim 5-100 \text{ GHz}$$

$$\text{Duty Cycle, } D = \frac{\text{FWHM}}{T_0} \ll 1$$

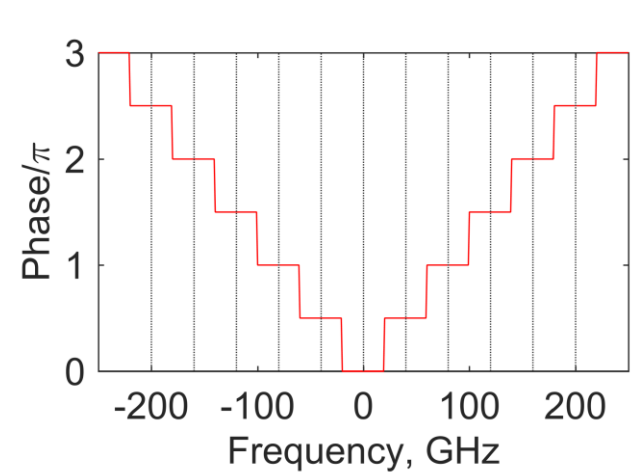
$$\text{Extinction Ratio, ER} = \frac{I(T_0)}{I(T_0/2)} \rightarrow \infty$$

I. EXPERIMENTAL SETUP



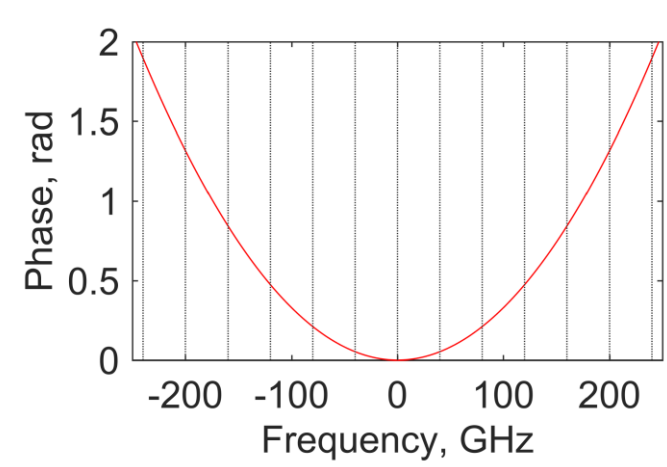
WaveShaper #1

Triangular step phase generates the Besselon waveform

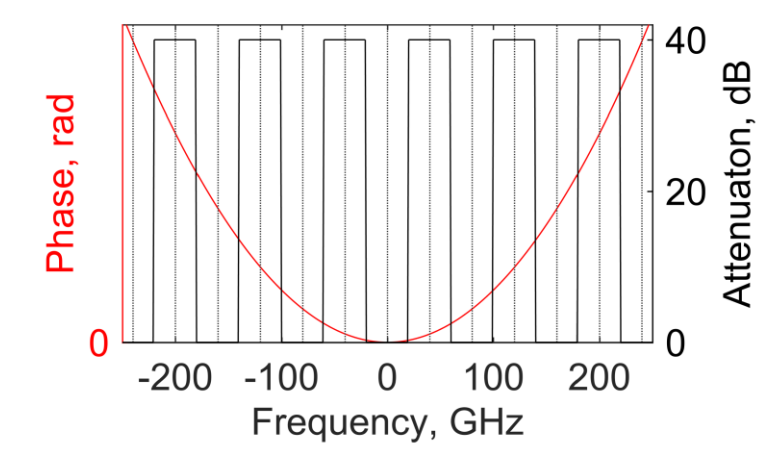


WaveShaper #2

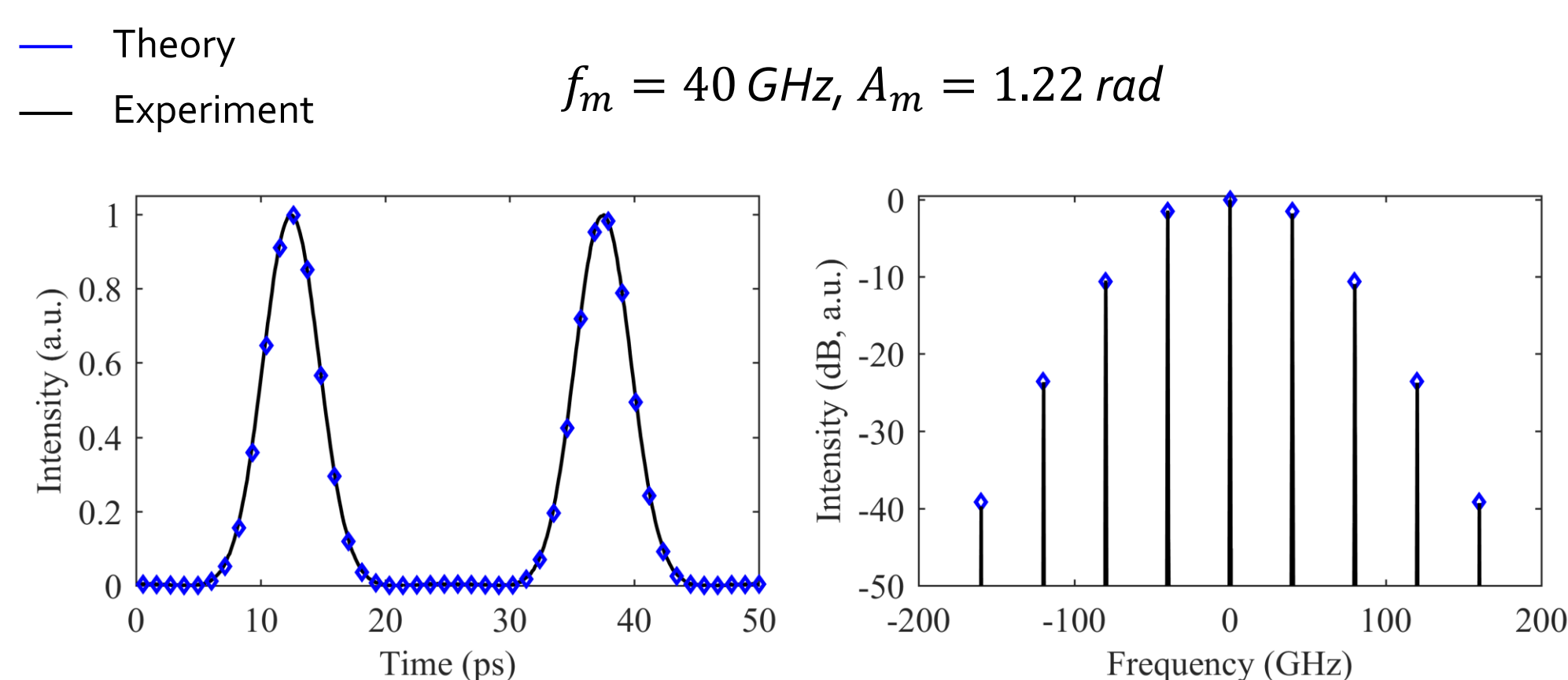
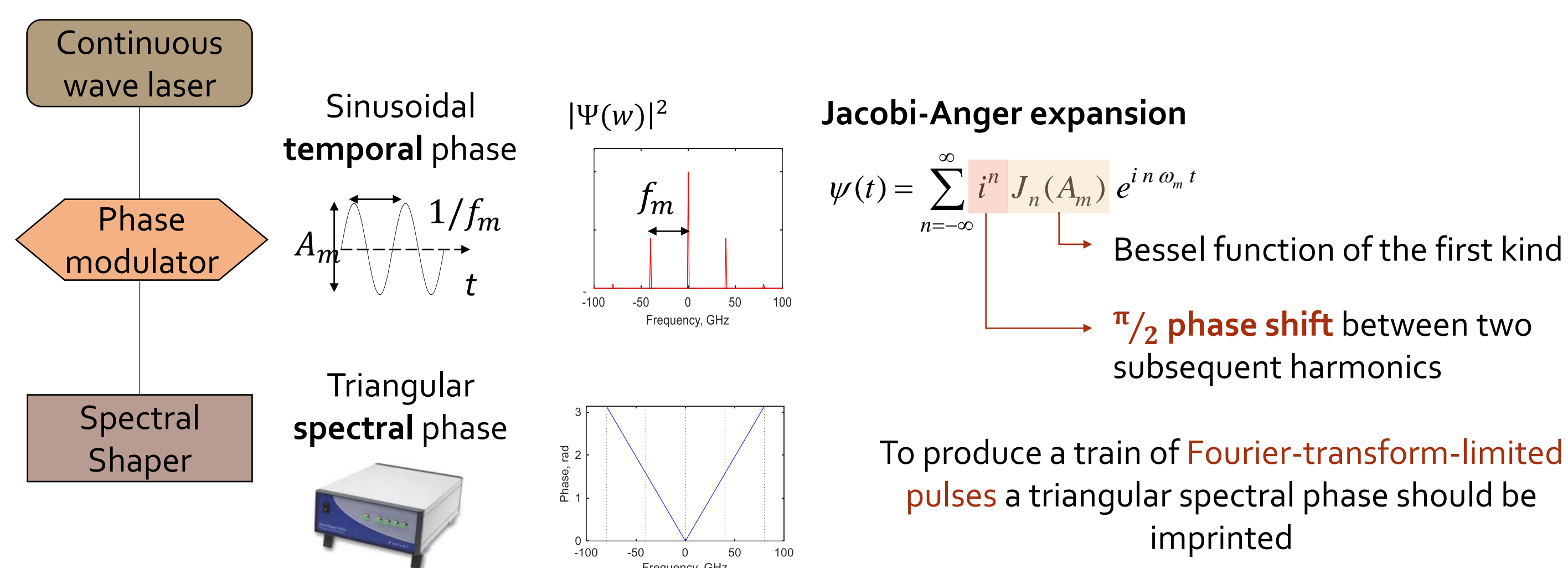
Quadratic phase compensates induced chirp [2, 5]



Suppression of spectral lines allows to multiplex the repetition rate



II. BESSELON PULSE GENERATION



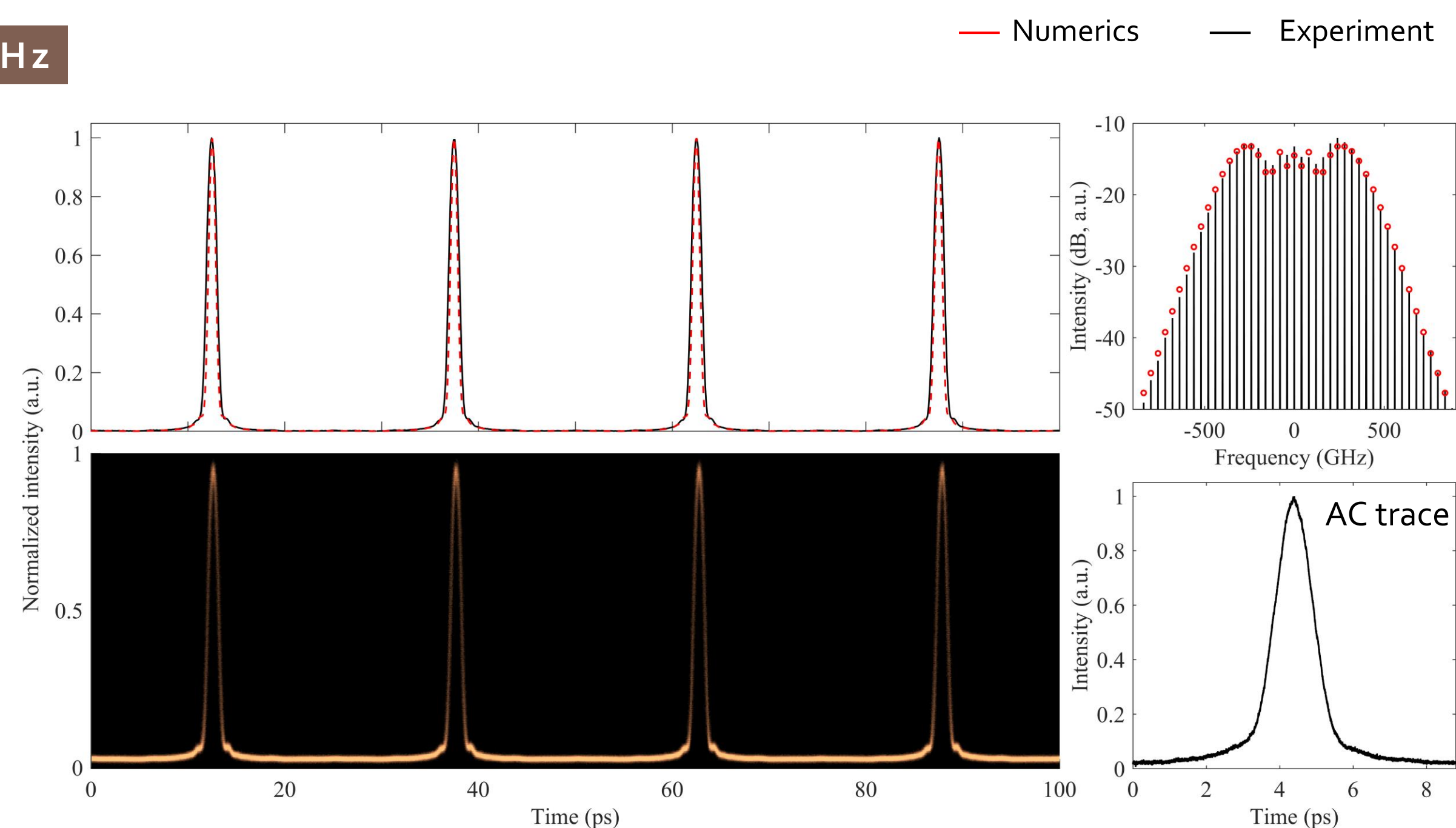
BESSELON

- Background-free
- FWHM = 5.4 ps
- Duty cycle = 0.22

For more details refer to : [3], [6]

III. NONLINEAR COMPRESSION

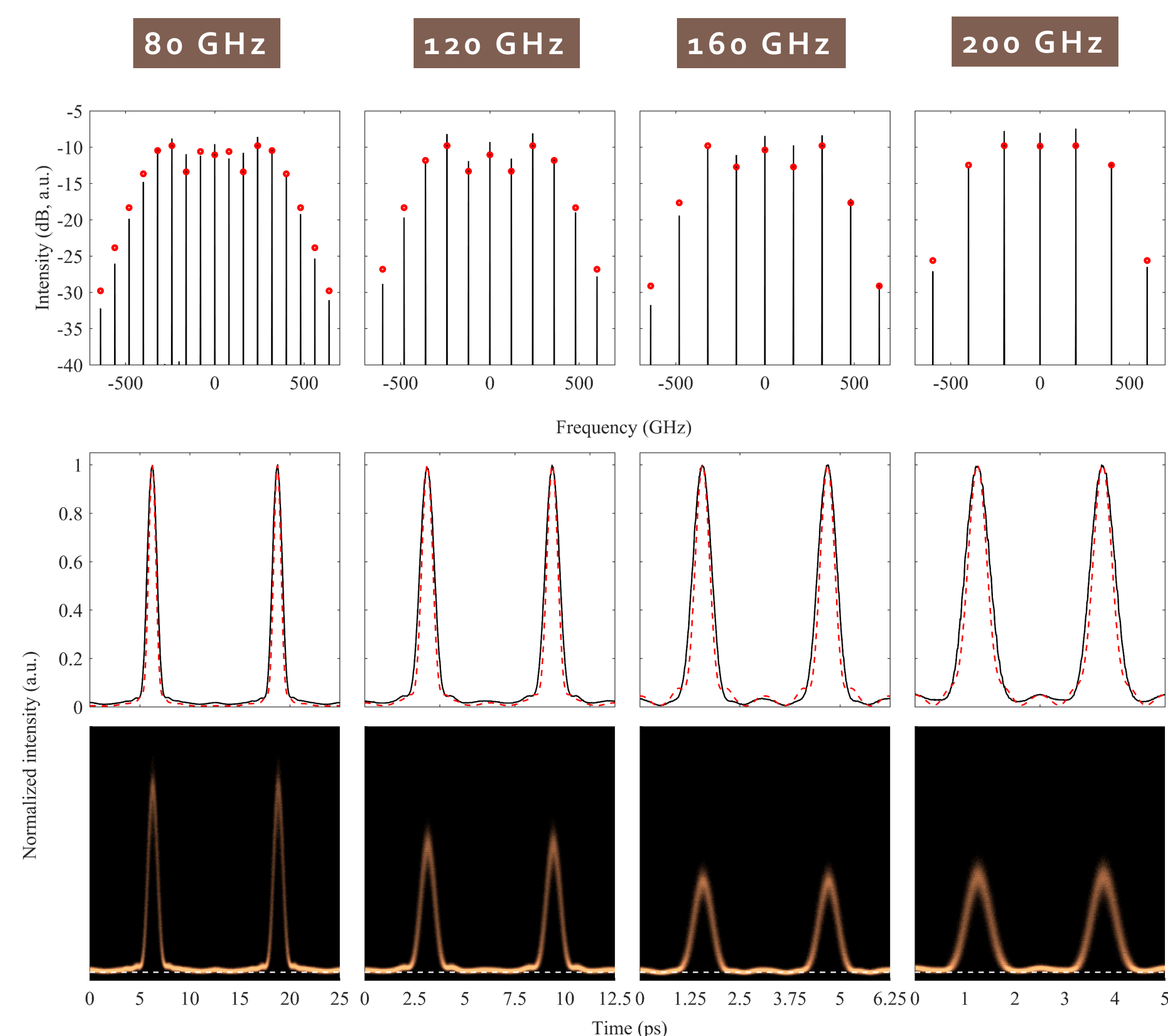
40 GHz



| | Besselon | NL compressed pulse |
|------------|----------|---------------------|
| FWHM, ps | 5.4 | 0.9 |
| Duty cycle | 0.22 | 0.04 |

× 9 times improvement

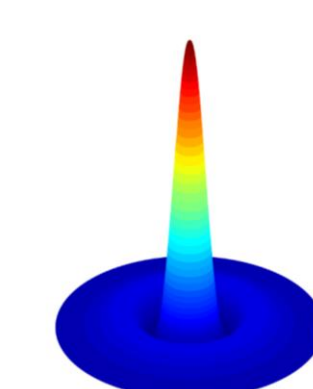
IV. REPETITION RATE MULTIPLEXING



| | 80 GHz | 120 GHz | 160 GHz | 200 GHz |
|------------|--------|---------|---------|---------|
| FWHM, ps | 0.85 | 0.77 | 0.73 | 0.95 |
| Duty cycle | 0.07 | 0.09 | 0.12 | 0.19 |

CONCLUSION

- High extinction ratio ✓
- Low sidelobes ✓
- High repetition rate ✓
- Low duty cycle ✓



- Background-free pulse train
- Sub-ps pulses at (1 : 5) × 40 GHz
- All-optical setup of low complexity
- Significant improvement of the results

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