Supplemental Document

applied optics

Spectral shaping of an ultrafast ytterbium fiber laser via a passive intracavity optical filter: a simple and reliable route to sub-45 fs pulses: supplement

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Supplemental Information

Grating Separation (mm)	32.25	31.25	30.75	30.25	29.75	29.25	28.75	28.25
Total GDD (fs^2)	-3140	-1570	-785	0	785	1570	2355	3140

Table S1: Above are the distances between two gratings within the oscillator system used to keep the net cavity dispersion near zero total GDD, and the corresponding net cavity dispersion values at those distances. These values are calculated from the well-known anomalous dispersion added through a double-pass grating setup and then verified through the experimental technique of Knox et al [21]. This experimental method was found to be more-reliable further away from net-zero dispersion, but sufficed to determined a net-zero cavity dispersion at a grating separation of roughly 30.25 mm for both the shortpass and longpass filters used in this experiment. This was in moderate agreement with previously performed calculations that pegged the zero-crossing point of the dispersion to be at a grating separation distance of 28.85 mm.

Pulse Duration (fs)

Grating Separation (mm)	32.25	31.25	30.75	30.25	29.75	29.25	28.75	28.25
0 degrees	71.5	67.2	49.4	43.1	44.6	50.6	57.8	69.4
5 degrees	68.3	61.5	49.4	43.3	42.5	51.6	46.8	65.2
10 degrees	64.1	57.3	50.2	43.8	41.4	47.2	60.4	65.6
15 degrees	51.5	51.1	46.6	56.4	56.2	67.8	63.2	N/A
20 degrees	54.5	52.1	54	58.5	60.9	64.3	62	N/A

FWHM (nm)

Grating Separation (mm)	32.25	31.25	30.75	30.25	29.75	29.25	28.75	28.25
0 degrees	16.931	38.895	45.614	49.454	49.158	28.719	30.731	45.781
5 degrees	32.861	37.415	43.125	48.273	48.021	29.165	30.28	43.597
10 degrees	37.398	45.747	51.805	52	50.078	22.767	29.401	70.45
15 degrees	47.985	53.865	57.537	52.951	46.835	50.116	48.709	N/A
20 degrees	50.387	56.993	51.384	60.789	67.9	64.921	63.331	N/A

-10dB (nm)

Grating Separation (mm)	32.25	31.25	30.75	30.25	29.75	29.25	28.75	28.25
0 degrees	43.255	68.84	76.506	79.372	83.071	84.771	86.659	85.364
5 degrees	47.364	68.044	75.207	78.973	82.67	84.712	86.542	85.46
10 degrees	53.808	72.864	77.626	80.585	84.429	84.941	85.338	84.784
15 degrees	61.309	77.708	82.109	84.752	85.437	85.667	84.011	N/A
20 degrees	72.931	82.15	84.525	85.163	83.186	79.997	78.013	N/A

Table S2-S4: The following tables are the pulse durations (Table S1) and corresponding FWHM and -10dB bandwidths (Tables S3 and S4) for the shortpass filter system as it is scanned from a grating separation of 28.28 mm to 32.25 mm (+3000 fs^2 to -3000 fs^2). Tables are color coded individually, but keep the same color scheme across each other such that blue represents both the shortest pulse as well as the largest bandwidths, while red denotes a longer pulse or a smaller bandwidth.

Pulse Duration (fs)

Grating Separation (mm)	**32.45**	**31.45**	**30.95**	**30.45**	**29.95**	**29.45**
No Filter	83.3	73.6	69.6	68	63	64.6

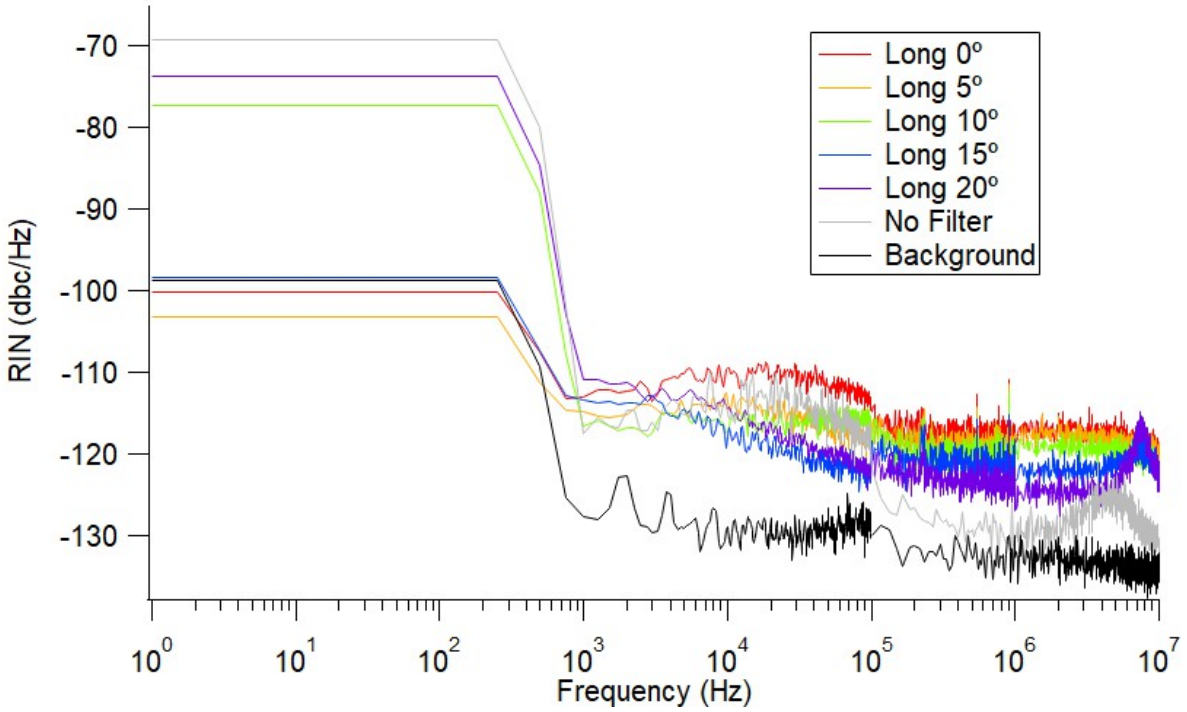
FWHM (nm)

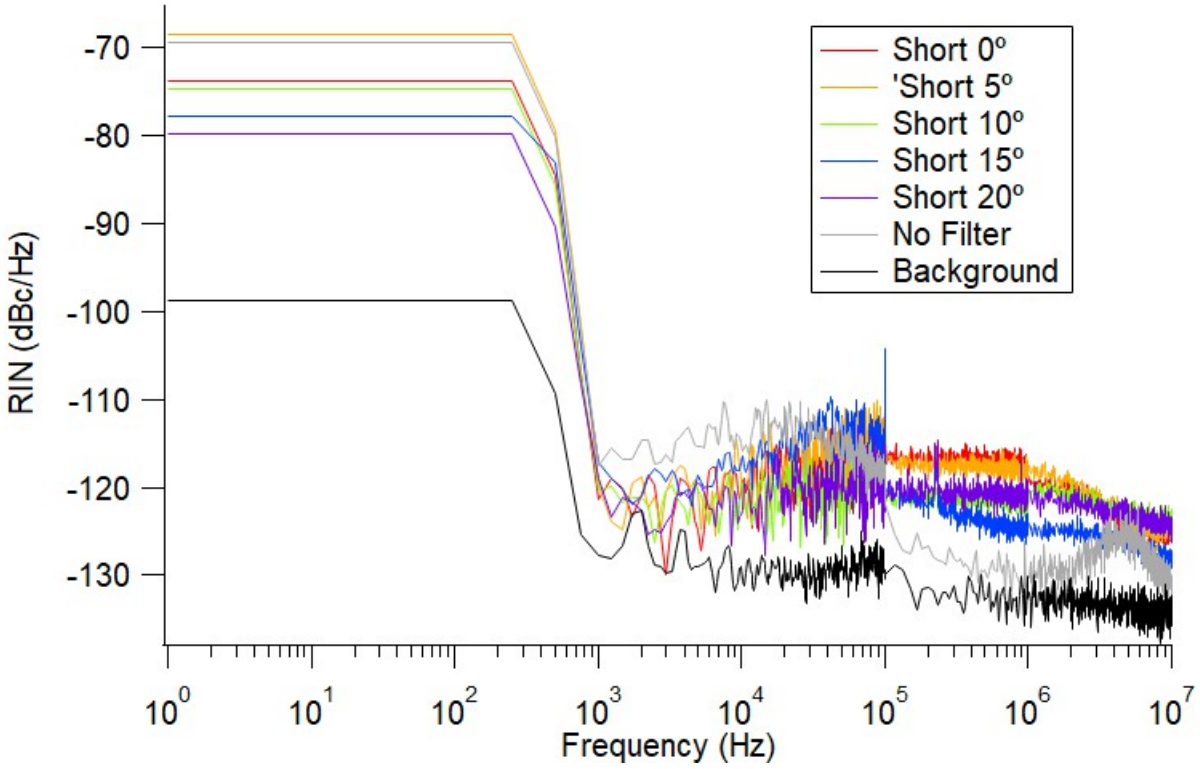
Grating Separation (mm)	**32.45**	**31.45**	**30.95**	**30.45**	**29.95**	**29.45**
No Filter	18.024	16.047	17.709	19.49	20.092	20.124

-10dB (nm)

Grating Separation (mm)	**32.45**	**31.45**	**30.95**	**30.45**	**29.95**	**29.45**
No Filter	43.776	48.897	51.989	55.067	62.566	69.28

Table S5: Pulse durations for the oscillator system with no optical filter in place as the total grating separation was scanned from 29.45 mm to 32.45mm as well as the corresponding FWHM and -10dB points for each pulse.





Figures S1-S2: Relative intensity noise values for all incident angle positions with the longpass (S1) and shortpass (S2) filters from 0-10MHz. Each trace is an averaged set of data over either 3 or 4 tests performed over the course of 1.5 months at different mode-locked positions.

Figure S3: Laser spectra identical to Fig. 2 in the text but plotted on a linear scale.

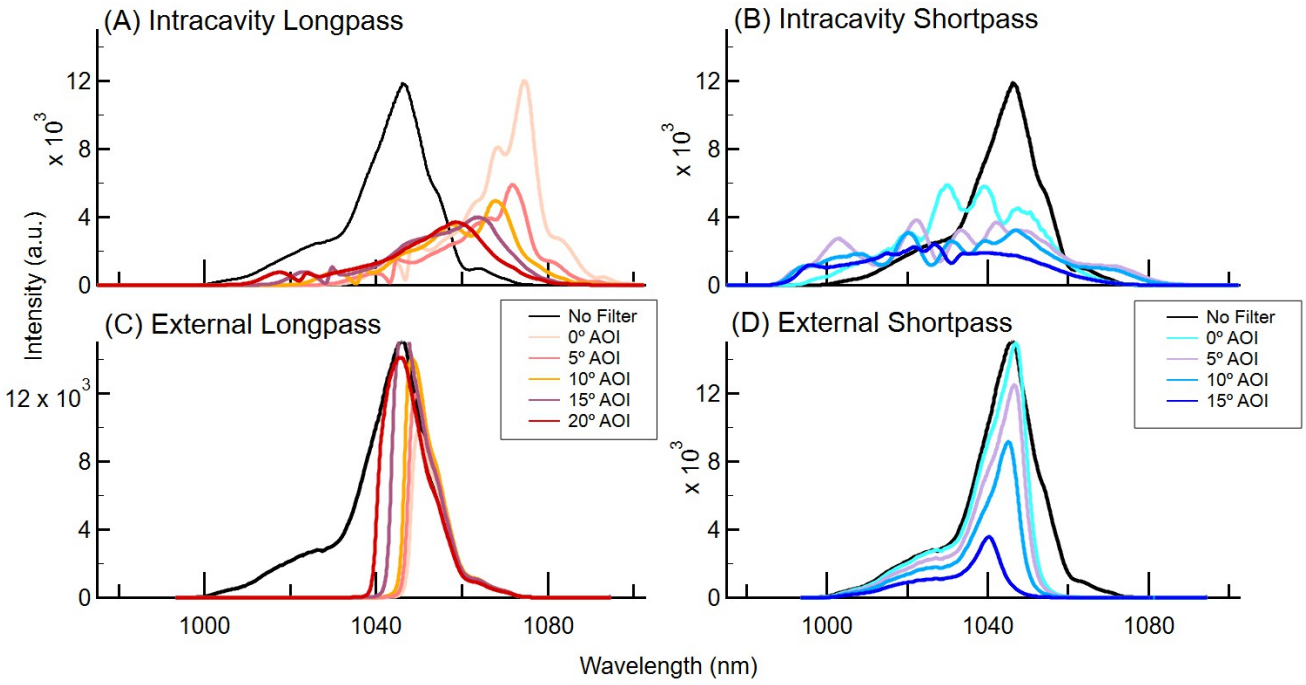


Figure S4: Sample pulse reconstruction intensity and phase recorded with the Swamp Optics GRENOUILLE and processed with their commercial software. The red traces are the phases in radians, right axis, and the blue traces are the temporal pulse reconstructions.