

Multi-color Pulse Mode Table - SHORT FORM - Status 4/10/2017

SOFT X-RAYS

Technique	Pulse Separation	Min Pulse Duration	Energy Separation	Max Energy/Pulse	Mode	Comments
Fresh Slice						Modes with the dechirper + orbit control.
Two SASE Pulses	~15 - +850 fs	~5-8 fs	+/-2.5%	200 - 500 uJ (20 fs duration)	SASE	Probe intensity is higher if the max delay req'd is 35 fs. Pump pulse intensity is higher if the min delay req'd is +15 fs or more (no zero delay).
Linear SASE + Polarization Controlled SASE	~15 - +850 fs	~5-8 fs	+/-2.5%	300 uJ	SASE	Only pump polarization can be controlled. See also comments re: Fresh-slice, Two SASE Pulses.
One Pulse Self-Seeded, One SASE	0 - 50 fs	~15-20 fs	+/-2.5%	100 uJ seeded, 200 uJ SASE	SASE SEEDED	Only probe polarization can be controlled. See also comments re: Fresh-slice, Two SASE Pulses. Requires longer setup.
Three SASE Pulses	0 - 900 fs (1st to 2nd), 0 - 50 fs (2nd to 3rd)	~5-8 fs	2.5% range for all	100 uJ	SASE	Second pulse has lowest intensity, weak if E > 700 eV.
Split Undulator SASE	0 - 50 fs	40 fs	+/-2.0%	30 uJ	SASE	Minimally invasive, easy to maintain.
Double Slotted Foil	15 - 70 fs	~ 10 fs	+/-1.5%	100-300 uJ	SASE	Minimally invasive, easy to maintain. Delay and energy separation are not independent, minor tuning needed between changes.
Two bucket (ns spacing)	350 ps increments, +/- 38 ns	40 fs	+/-2%	0.5 - 1 mJ (100 fs duration SASE)	SASE SEEDED	Under development
Twin Bunches (fs spacing) w/o slotted foil	125 fs max	70-100 fs	+/- 2.5 %	1.3 mJ	SASE	Intensity performance comparable to Fresh-slice. Max time separation shorter and tuning more invasive. Recommend Fresh Slice going forward.
Twin Bunches (fs spacing) w slotted foil	~ 70 fs (bunch duration)	3-10 fs	+/- 2.5 %	50 uJ	SASE	

HARD X-RAYS

Technique	Pulse Separation	Min Pulse Duration	Energy Separation	Max Energy/Pulse	Mode	Comments
Twin Bunches						Requires long setup (laser stacker/injector tune).
Two SASE Pulses	0 - 125 fs	~ 10 fs	0.2-3%	2 mJ (30 fs duration)	SASE	1st/probe pulse always higher photon energy
Twin bunches + V slotted foil	+/- 50 fs	~5-10 fs	~3%	50 uJ	SASE	
Twin bunches + HXR Self-Seeding	0-100 fs	~ 10 fs	~1 %	150 uJ per pulse	SEEDED	Both colors or a single color can be seeded. Requires longer setup time (hours).
Double Slotted Foil	7-20 fs	~ 10 fs	+/-1.5%	100-300 uJ	SASE	Minimally invasive, faster setup than twin bunches. Delay/energy separation not independent, minor tuning needed between changes.
Two bucket (ns spacing)	350 ps increments, +/- 38 ns	20 fs	~ 2%	1-2 mJ (40 fs duration SASE)	SASE SEEDED	Under development

For detailed information and trade-off decisions, contact the Instrument Scientist!