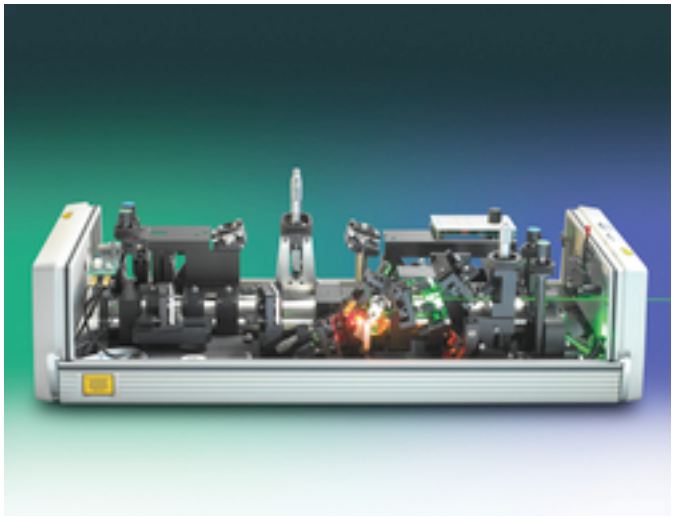
NIU/NICADD lasers for high-brightness electron beam generation & diagnostics

Oscillators

- NIU/NICADD own two Titanium:Sapphire commercial oscillator (manufactured by Spectra-Physics).
- One oscillator is installed on the DeKalb campus one is located at Fermilab in the A0 laser room
- At A0 oscillator will be used to probe Coulomb fields of the e-beam (T. Maxwell's PhD)

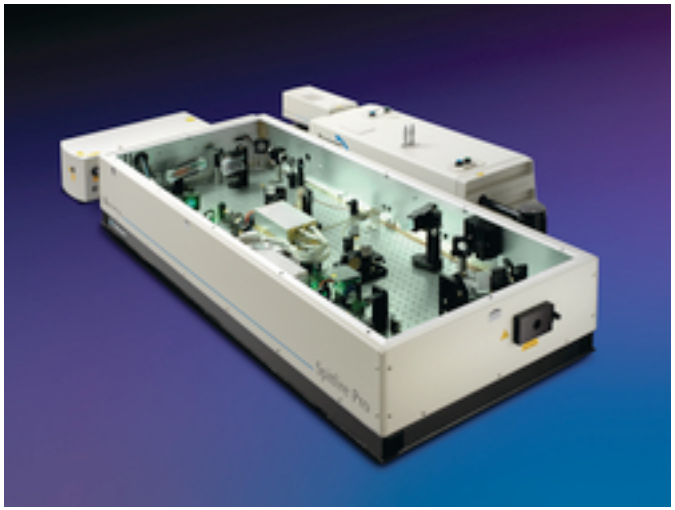


Tsunami Broadband

Output Characteristics	Tsunami Broadband fs 10 W Pump	Tsunami Broadband ps 10 W Pump	Tsunami Broadband fs 5 W Pump	T	Sub 30 Tsunami 5 W Pump
Tuning Range	700–1000 nm	700–1000 nm	710–980 nm		780–820 nm
Average Power[3]	>1.4 W at 800 nm	>1.5 W at 800 nm	>0.7 W at 800 nm		400 mW at 800 nm
Pulse Width[3, 4]	<100 fs	<2–100 ps	<100 fs		<30 fs
Peak Power[3]	>170 kW at 800 nm	-	>85 kW at 800 nm		>160 kW at 800 nm
Pulse Energy	~14 nJ	~15 nJ	~8 nJ		~5 nJ
Tsunami Broadband Models	3960-X1BB 3941-X1BB	3950-X1BB 3960-X1BB[5]	3960-M1BB 3941-M1BB		3941-30-M1S

Regenerative amplifier

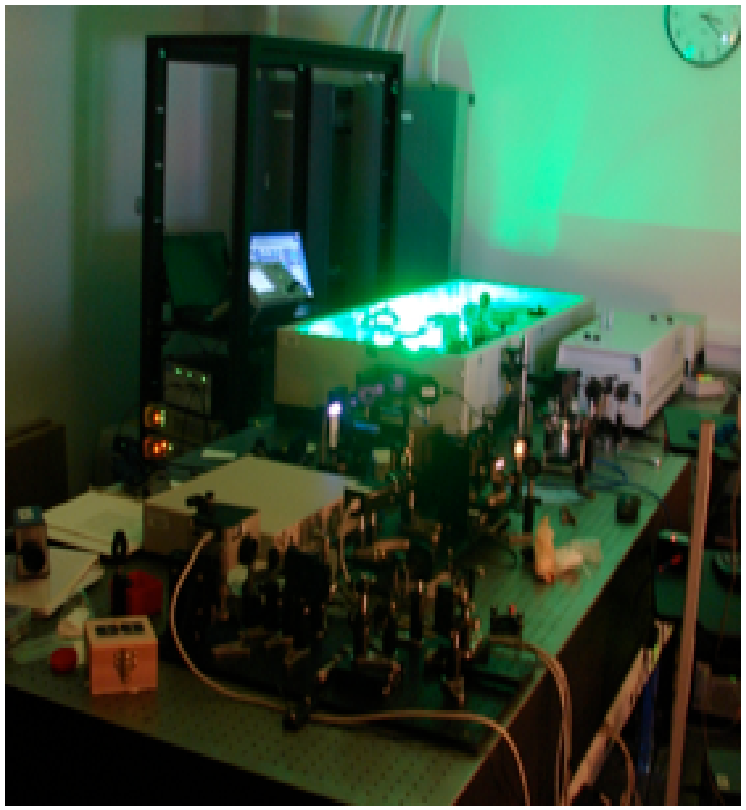
- NIU/NICADD own one Ti:Sp regenerative amplifier (Spitfire from Spectra-Physics),
- Currently located on DeKalb campus,
- Will move to A0 in January,



Output Characteristics	Spitfire Pro 35F	Spitfire Pro F	Spitfire Pro PM
Pulse Width[2, 4, 5]	<35 fs	<120 fs	<2 ps
Repetition Rate[3]		1 kHz, 5 kHz or 10 kHz	
Pulse Energy[2] (1 kHz)		>4.0 mJ (>1 mJ)	
Pulse Energy[2] (5 kHz)		>0.8 mJ (>0.2 mJ)	
Pulse Energy[2] (10 kHz)		>0.4 mJ (>0.1 mJ)	
Pre-Pulse Contrast Ratio[6]		>1000:1	
Post-Pulse Contrast Ratio[7]		>100:1	
Energy Stability[8]		<0.75% rms over 8 hours	
Tunability[9]	780–820 nm	750–840 nm	750–840 nm
Transform Limit[10]		<1.5 x transform limit	
Spatial Mode		TEM_{00} (M^2 <1.3 on both axes)	
Beam Diameter (1/e2)		7 mm (nominal)	
Polarization		Linear Horizontal	

Integrated system

- 4 mJ/pulse with ~100 fs (FWHM) corresponding to 40 GW peak power/ pulse.
- Pulse can be repeated at 1 kHz max.



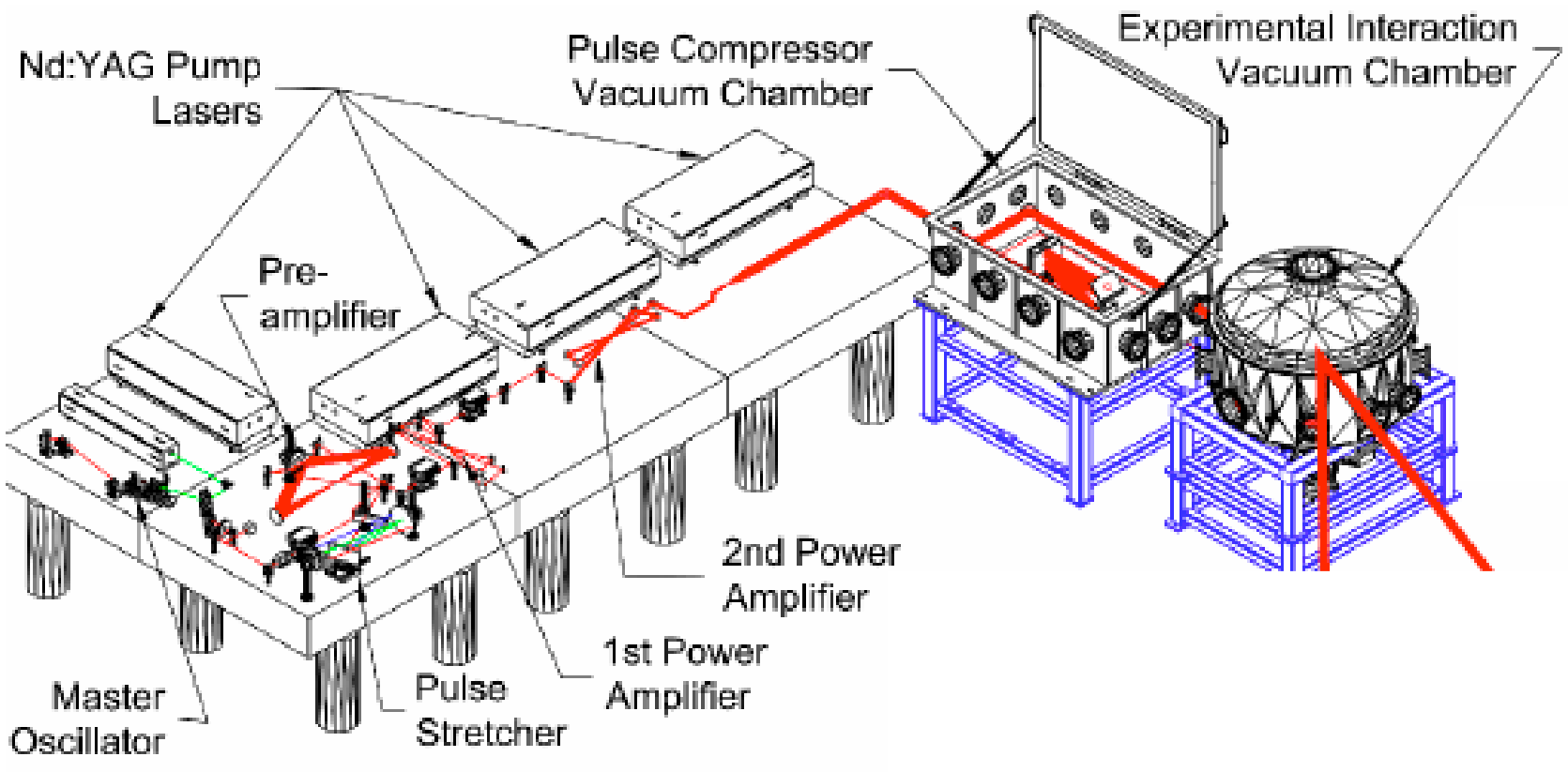
- System also incorporate a program-able pulse shaper (DAZZLER) than could be used to correct distortions and further reduce the pulse shape
- Also developed several diagnotics (single shot autocorrelator and fre-quency)

- Overall this system is NOT appropriate for proton/ion generation and acceleration

- Could however serve as a first stage of a two (or three) stages amplifier laser system

ANL's CHM TW-class laser (decommissioned)

- 30 fs, 0.6 J at 10 Hz built by Crowell's group



- Similar arrangement would fit in A0 laser room