

# **CdSe OPO pumped by a 2.79-um Cr,Er:YSGG laser**

**David M. Rines, Glen A. Rines and Peter F. Moulton**



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## ACKNOWLEDGEMENTS

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### **SPONSOR**

US Army  
Night Vision and Electronic Sensors Directorate  
Ft Belvoir, Virginia

### **CdSe MATERIAL**

Gary Catella, Michael Panfil and Lee Shiozawa  
Cleveland Crystals, Inc.  
Highland Heights, OH



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## OUTLINE

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### BACKGROUND

Why CdSe?

Why Cr,Er:YSGG?

Cr,Er:YSGG LASER

CdSe OPO

SUMMARY

LOOKING AHEAD



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## WHY CdSe?

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**Large, low-scatter crystals (10x10x50 mm)**

**Low absorption**

<0.002 cm<sup>-1</sup> @ 1.06 μm

<0.001 cm<sup>-1</sup> @ 2.79 μm

<0.001 cm<sup>-1</sup> @ 10.6 μm

**Large non-linear coefficient**

$d_{eff} = 17 - 18$  pm/V

**Low walk-off**

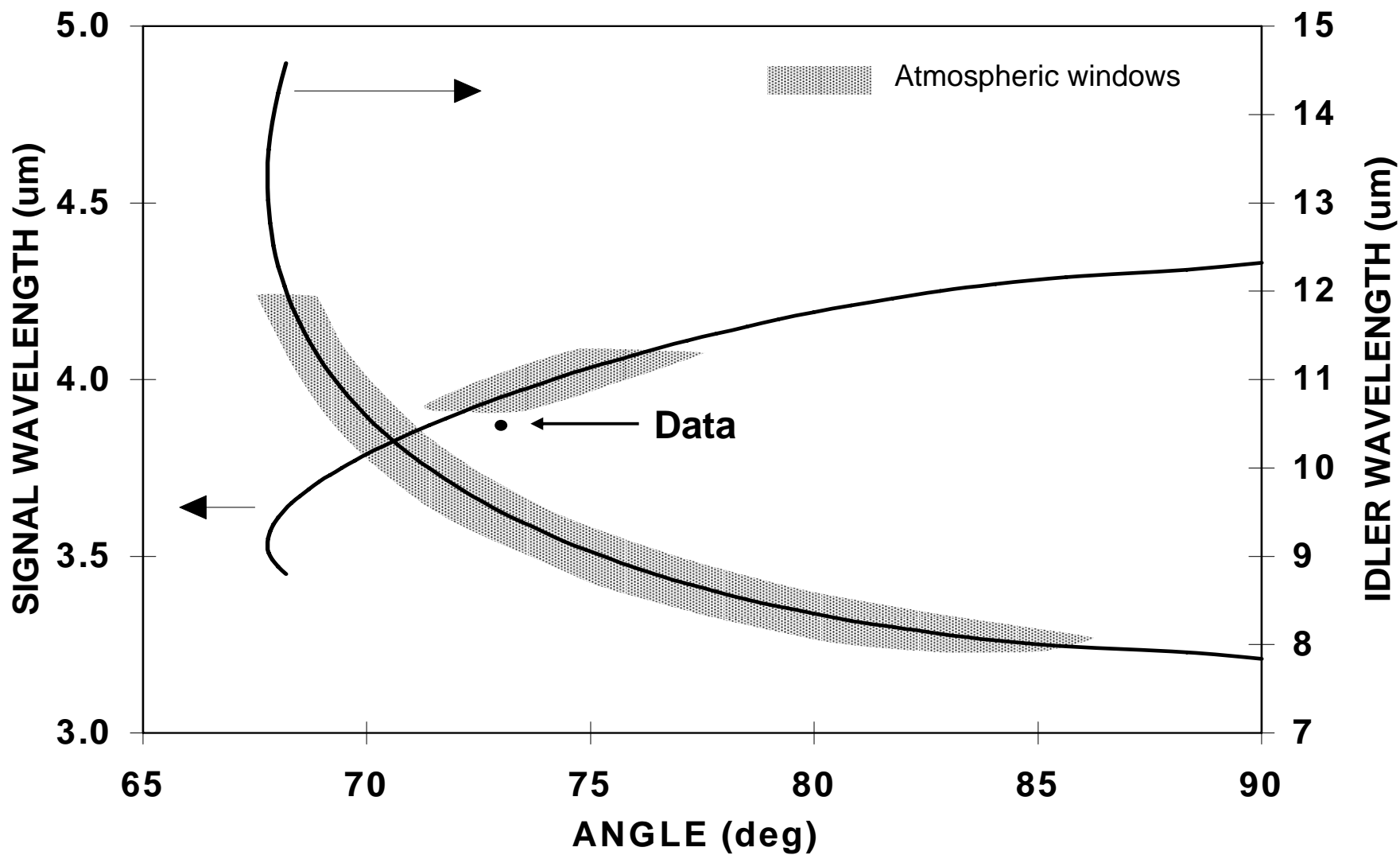
**Good thermal conductivity**

**Near NCPM with 2.79-μm pump**



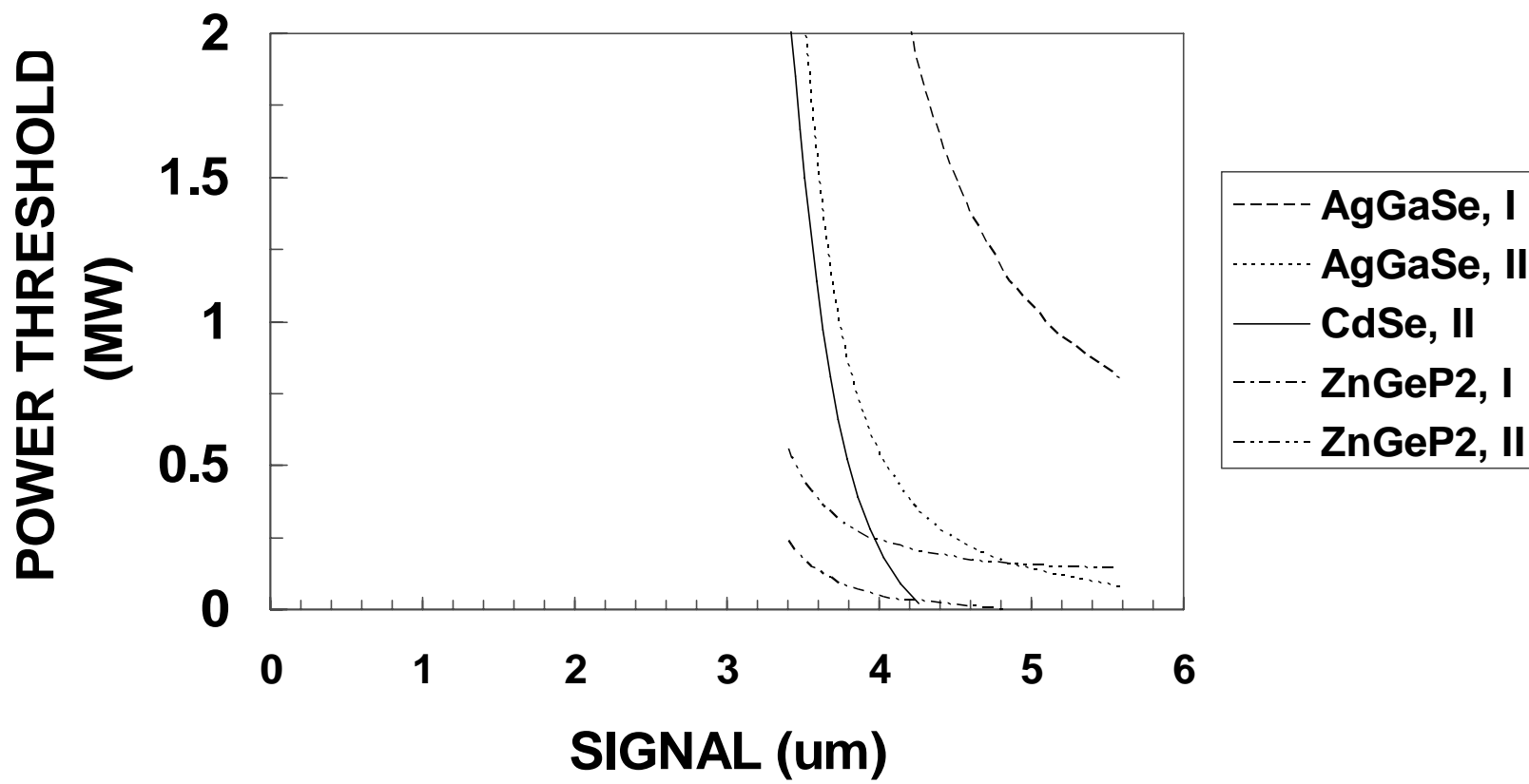
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# CdSe PHASE-MATCHING, 2.79- $\mu\text{m}$ PUMP





# POWER THRESHOLD FIGURE OF MERIT





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## WHY Cr,Er:YSGG?

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### EARLY RESULTS

25 mJ, 2 Hz, 50 ns, TEM<sub>00</sub>

90 mJ, 2 Hz, 80 ns, multimode

### GENERAL CHARACTERISTICS

1% Cr, 30% Er

+ low threshold

+ high PRF


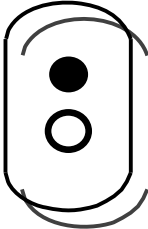
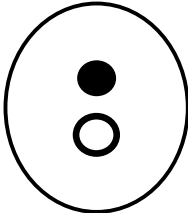
+ 2.79  $\mu\text{m}$  operation

- thermo-optics properties



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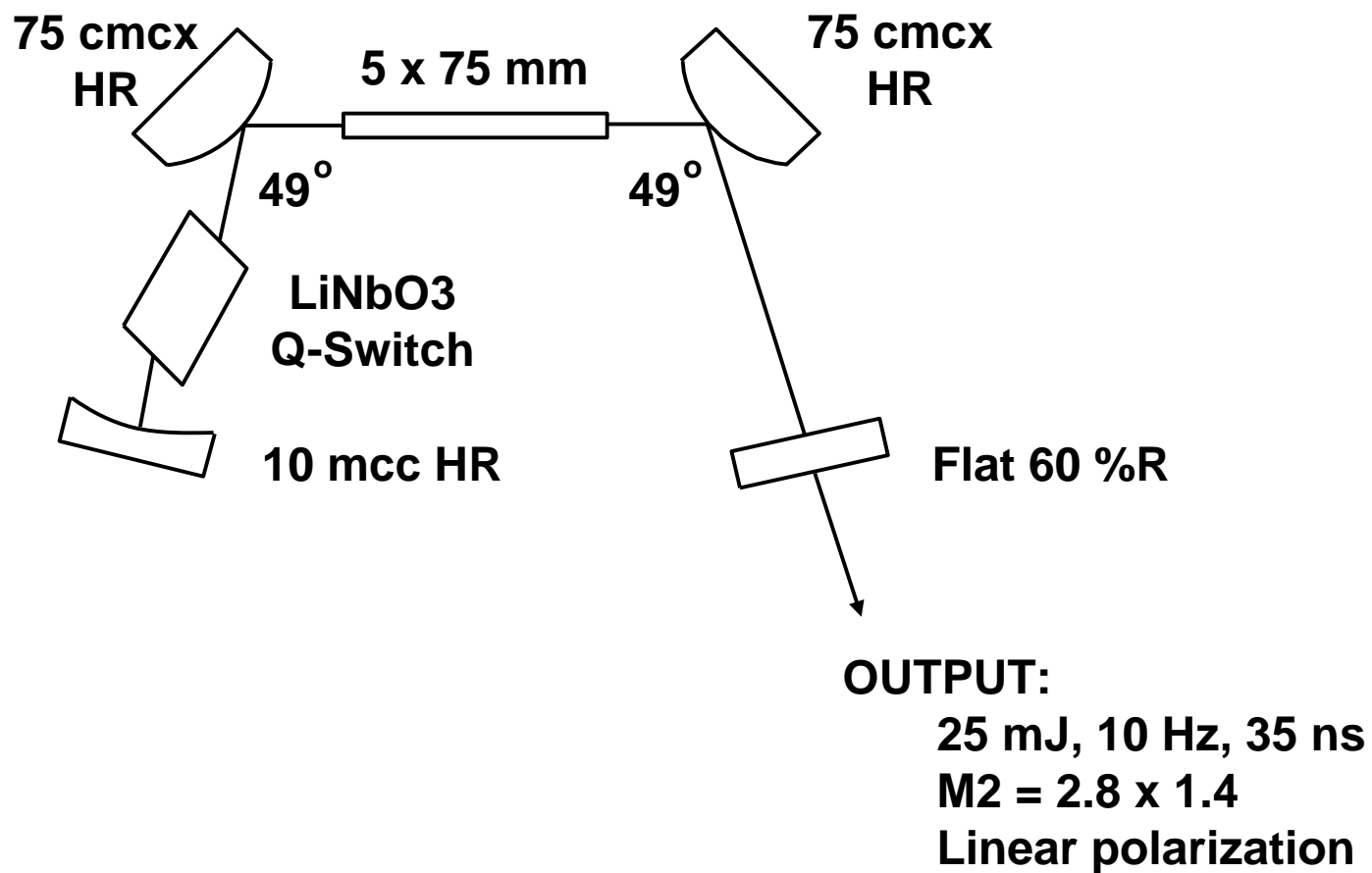
## PUMP CHAMBER COMPARISON

		<u>Pump Uniformity</u>	<u>Thermal lens focal length (cm)</u>	<u>Lens Astigmatism (cm)</u>
	<b>Close-coupled silver</b>	poor	32 , 24	8
	<b>Racetrack spectralon</b>	fair	38 , 36	2
	<b>Elliptical silver</b>	excellent	23 , 15	8



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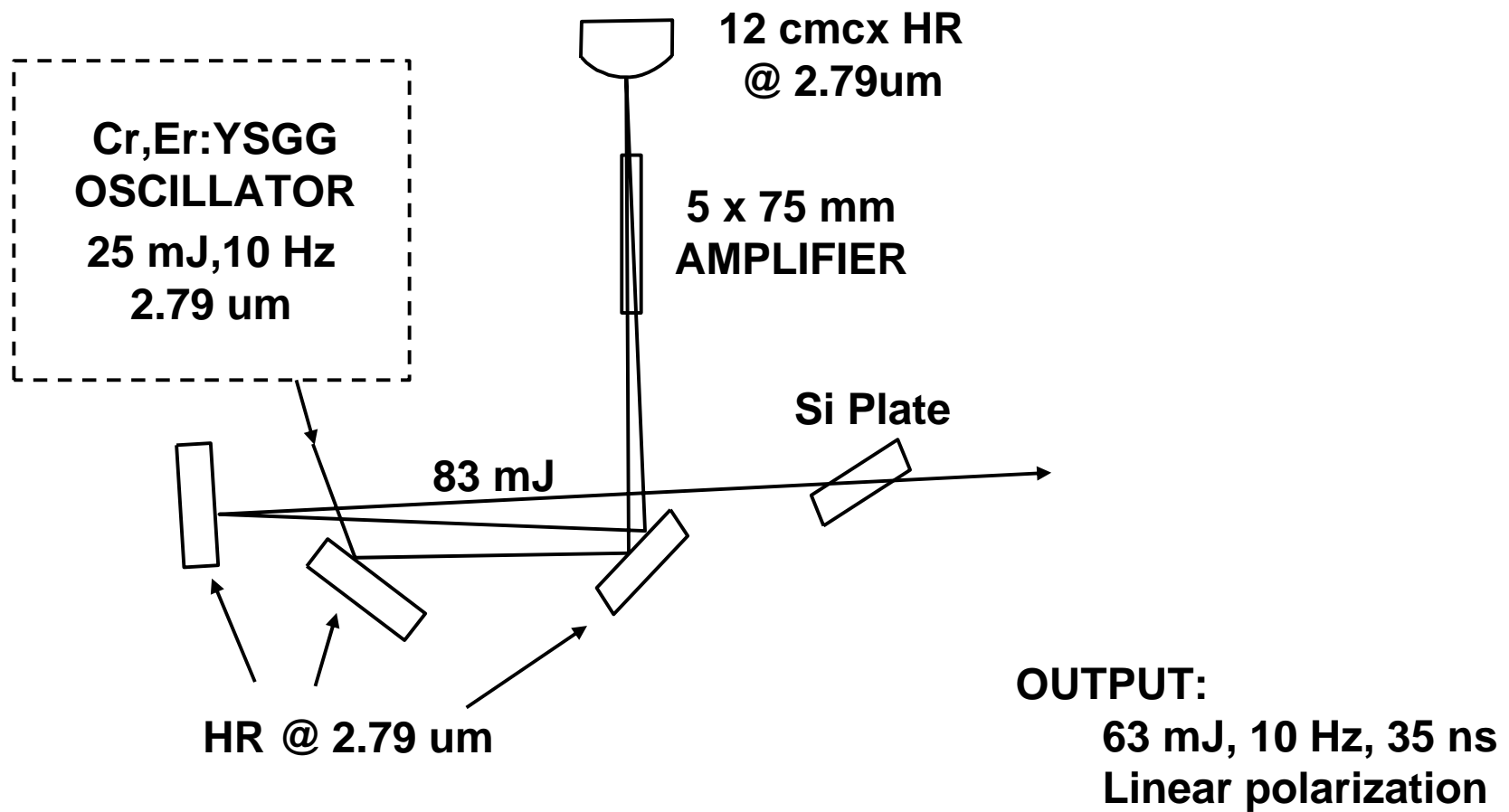
## 2.79- $\mu$ m Cr,Er:YSGG OSCILLATOR





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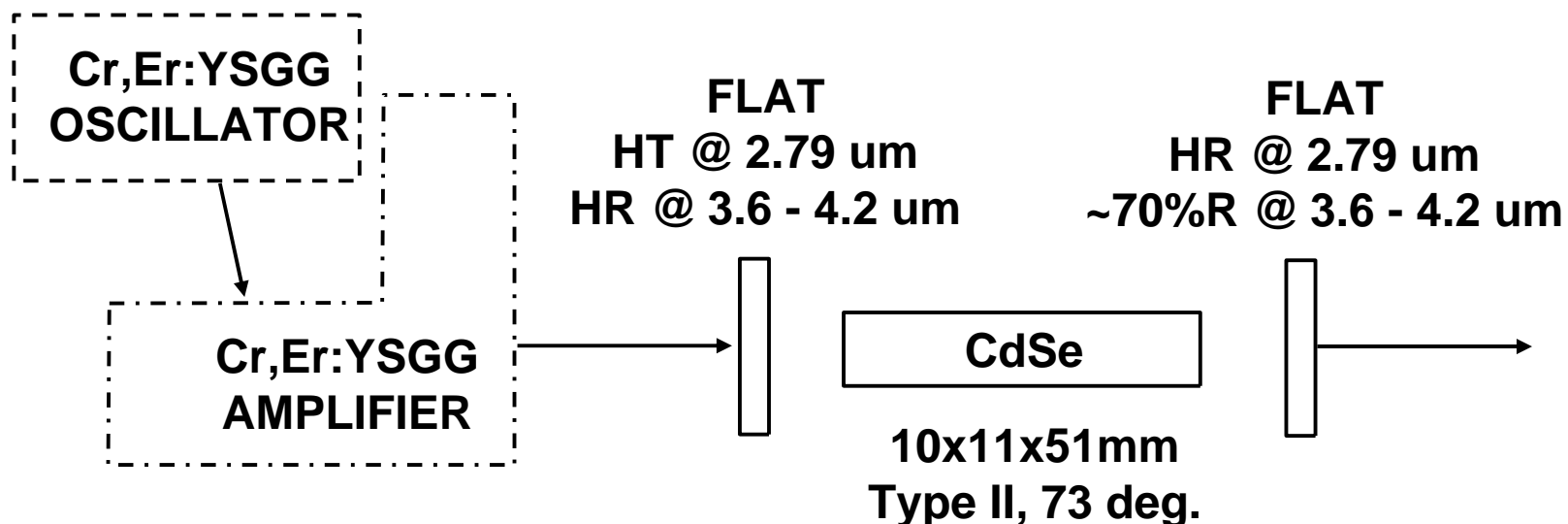
## Cr, Er:YSGG AMPLIFIER





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## CdSe OPO



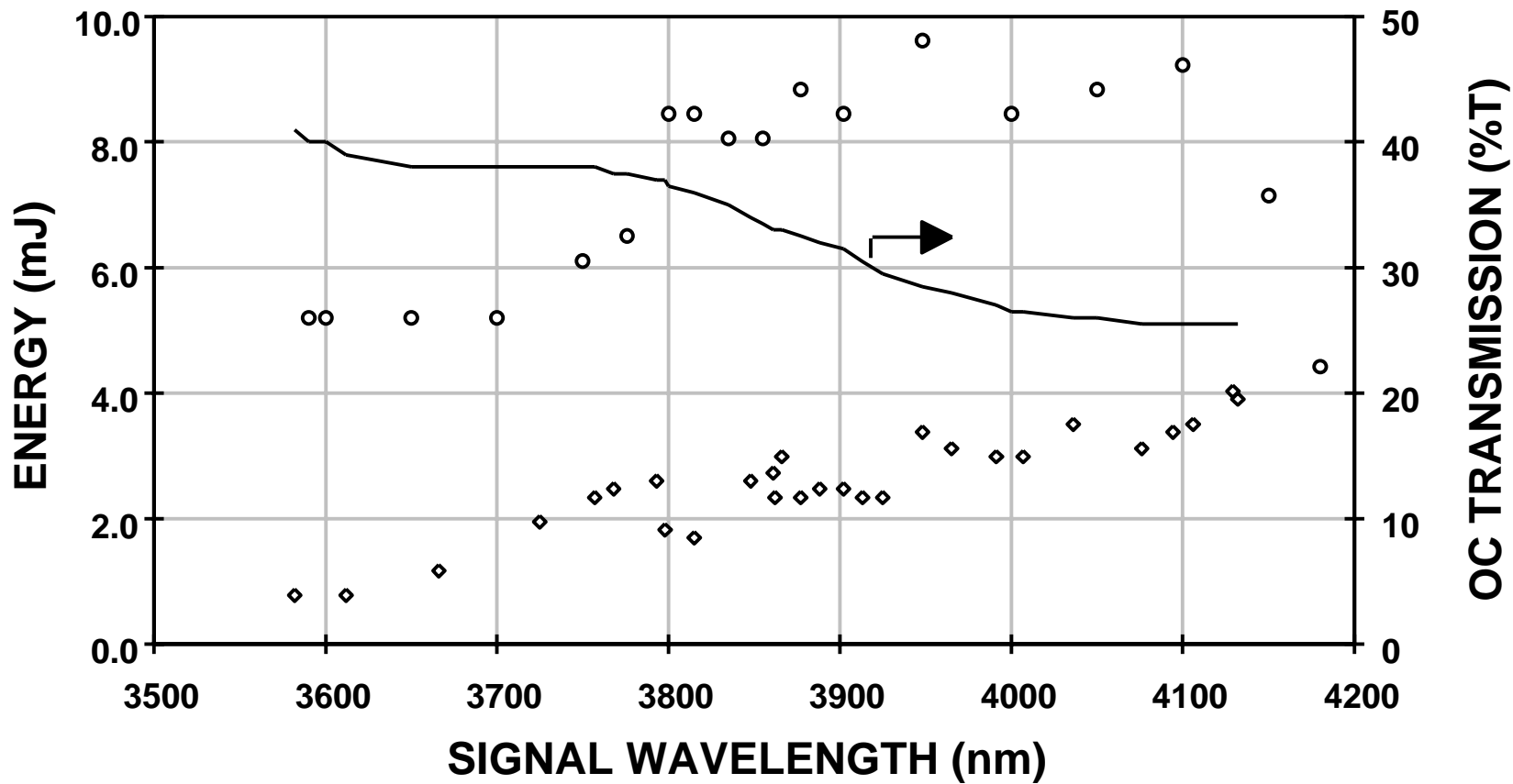
### OUTPUT

15 mJ @ 3.87  $\mu\text{m}$ , 10 Hz, 23 ns  
Signal tuning 3.58 - 4.18  $\mu\text{m}$   
28% pump-to-signal slope  
Idler tuning 12.6 - 8.3  $\mu\text{m}$   
reasonably good beam quality



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# CdSe SIGNAL TUNING CURVE





### **Cr,Er:YSGG OSCILLATOR**

25 mJ, 10 Hz, 35 ns, 2.79  $\mu\text{m}$

$M^2 = 2.8 \times 1.4$

Linearly Polarized

### **AMPLIFIER**

83 mJ, 10 Hz, 35 ns

(63 mJ linearly polarized)

### **CdSe OPO**

15 mJ, 10 Hz, 23 ns, 3.87  $\mu\text{m}$

Tuning:

3.58 - 4.18  $\mu\text{m}$  (signal)

12.6 - 8.3  $\mu\text{m}$  (idler)

28% pump-to-signal slope efficiency



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## LOOKING AHEAD

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**Better lamp-pumped materials**

**Pulsed, diode-pumped Er lasers**

2.4 mJ, 10 Hz, 9% slope (Dinerman, et al., ASSL '94)

**Tandem OPO's**