LIGO

Lasers Working Group summary

B. Willke

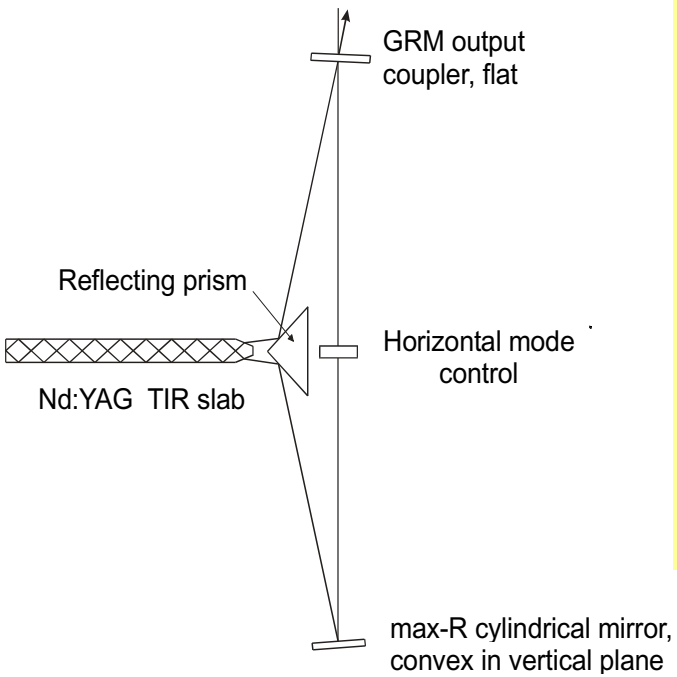
LSC meeting, LLO March 2003

PSL development path

- design studies 1/01 – 3/03
  - *compare different topologies and head designs at the 100W level*
- conceptual design 3/03 – 5/04
  - *demonstrate a laser at the 200W level close to noise requirements*
- final designs 5/04 – 9/05
  - *build first article (LASTI laser) that meet noise and reliability requirements*
- fabrication 1st unit 9/05 – 6/06

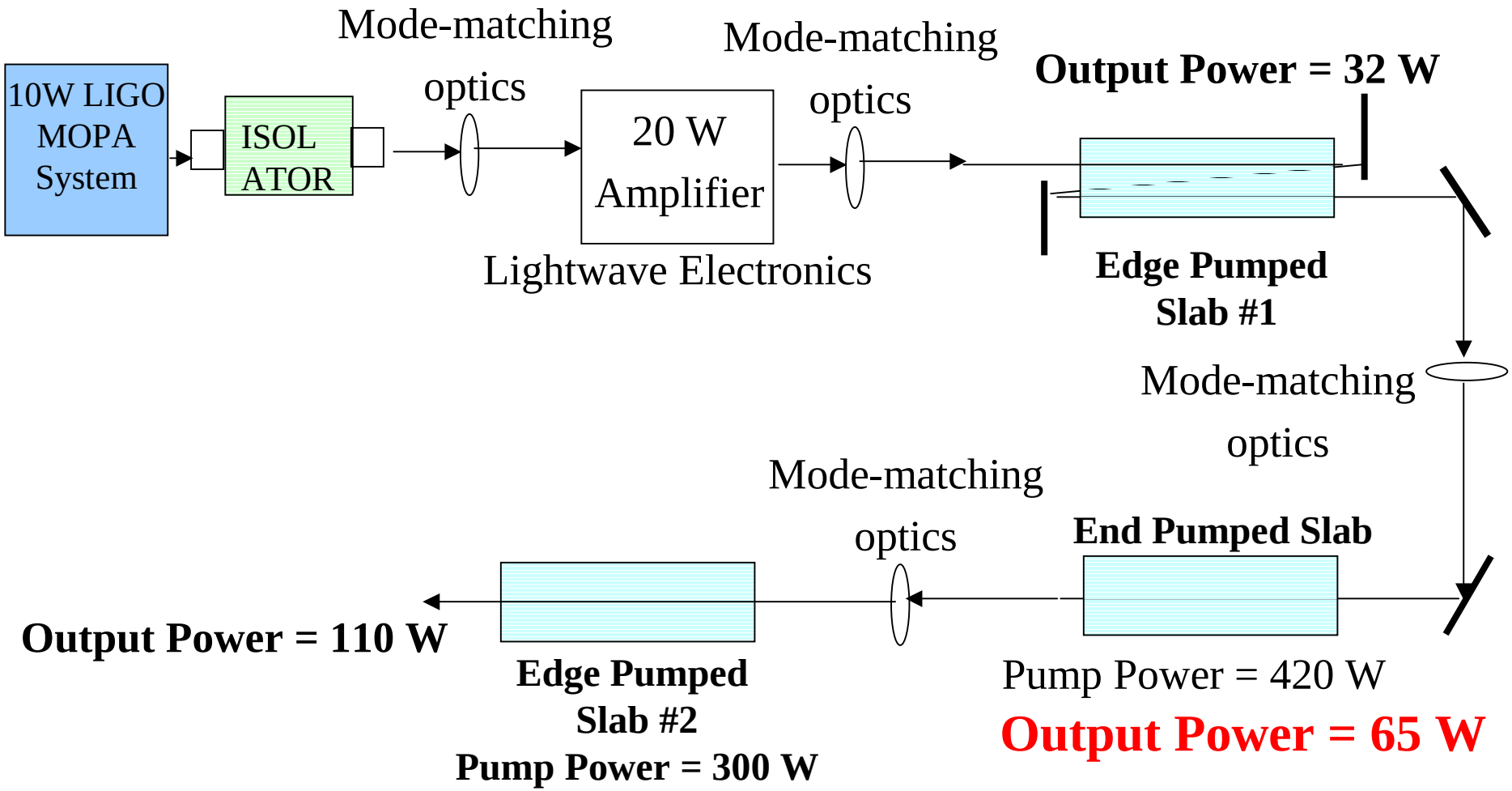
stable-unstable oscillator - Adelaide

100W Laser Configuration



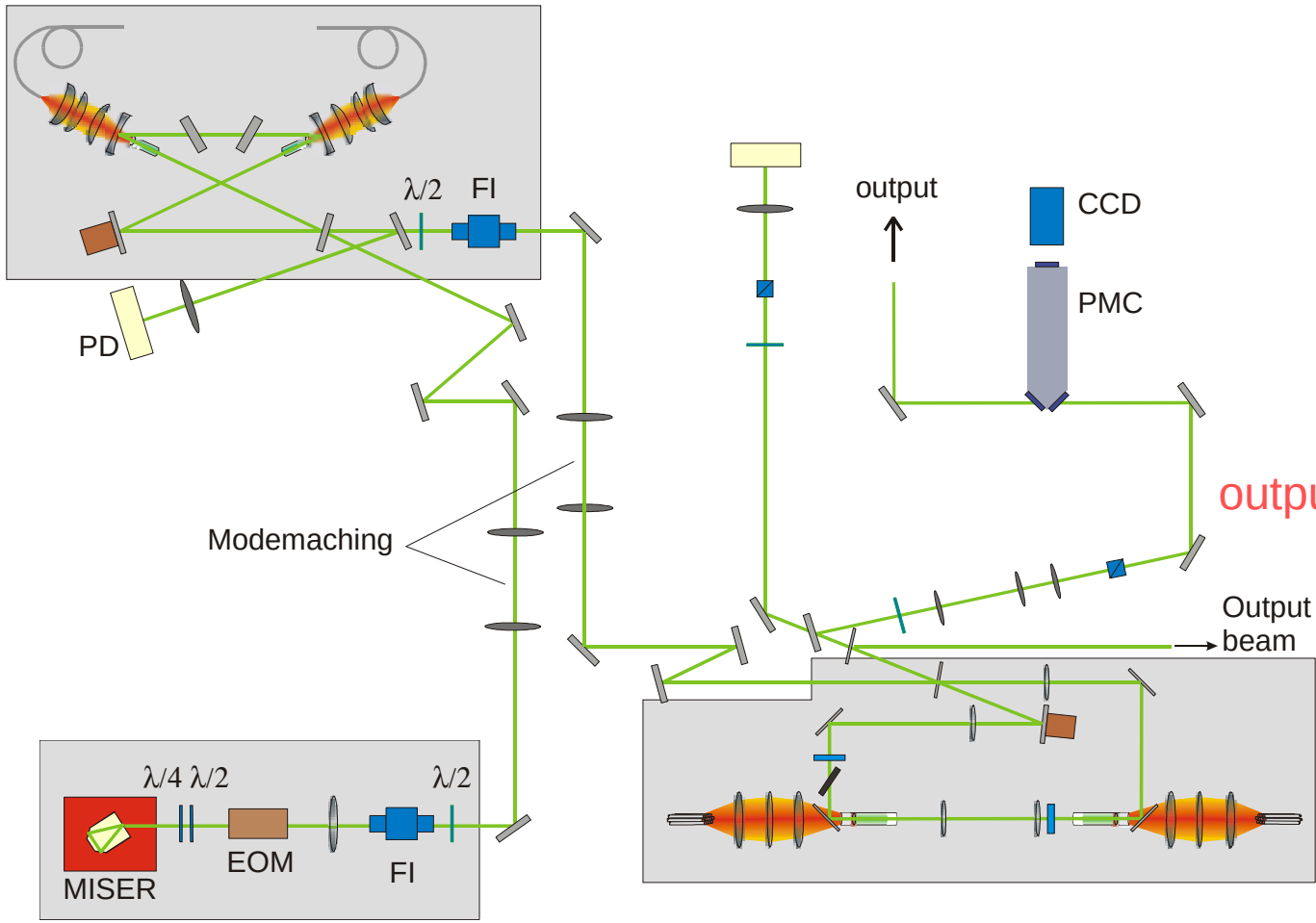
- demonstrated 30W injection-locked stable-unstable oscillator
- technical problems and delays in 100W system
  - inhomogeneous pump light distribution / pump light fluctuations
  - slabs not delivered to specifications
  - birefringence in vertical directions

Experimental Setup for 100W demonstration



High Power Locking Scheme

Setup



output power: 80W

©LZH

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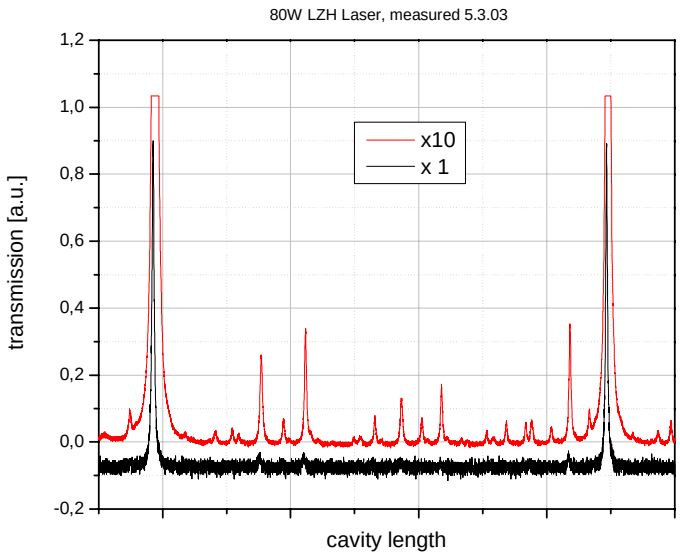
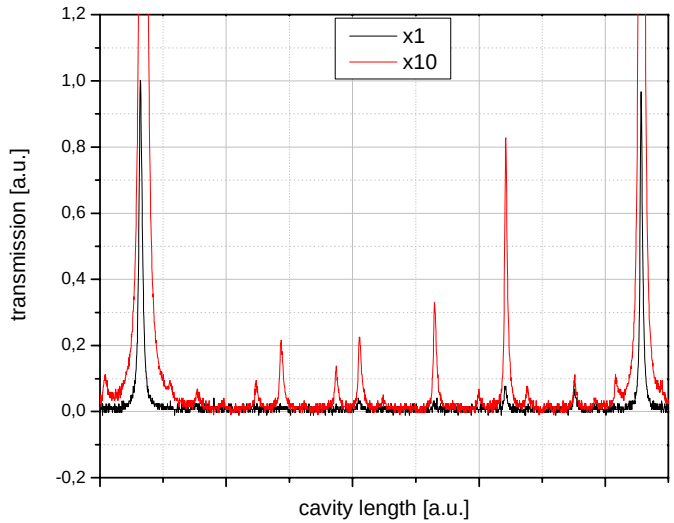
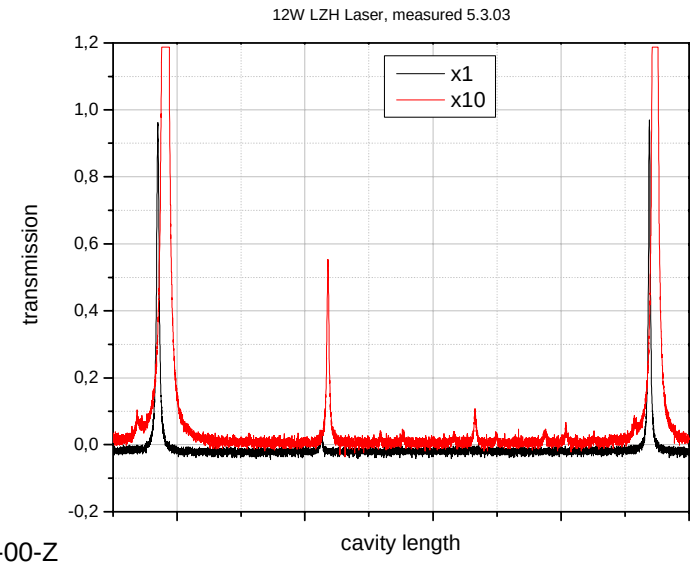
spatial profile – scanning cavity

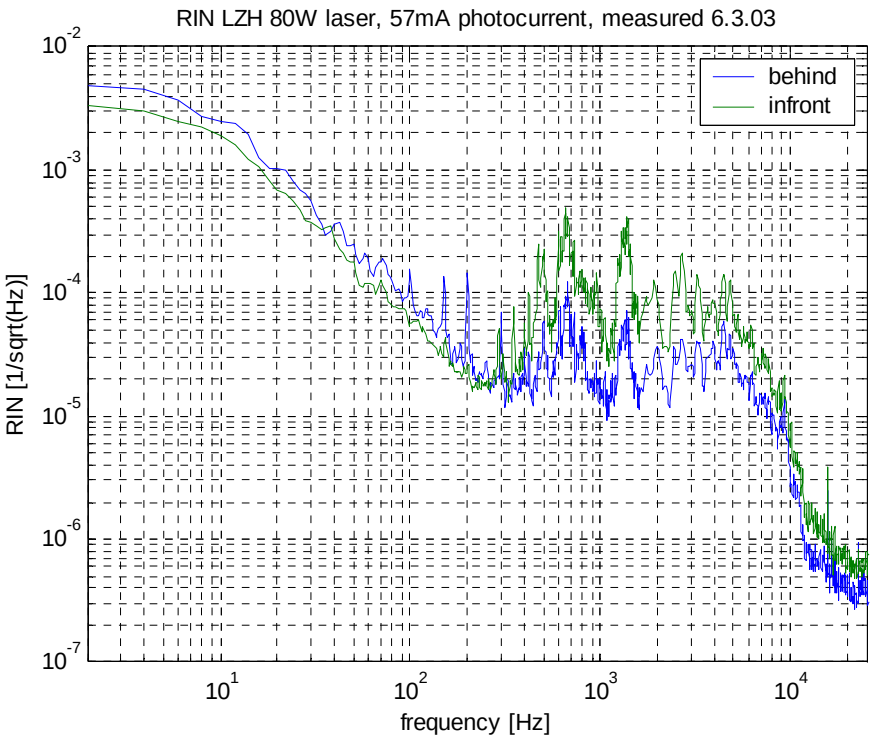


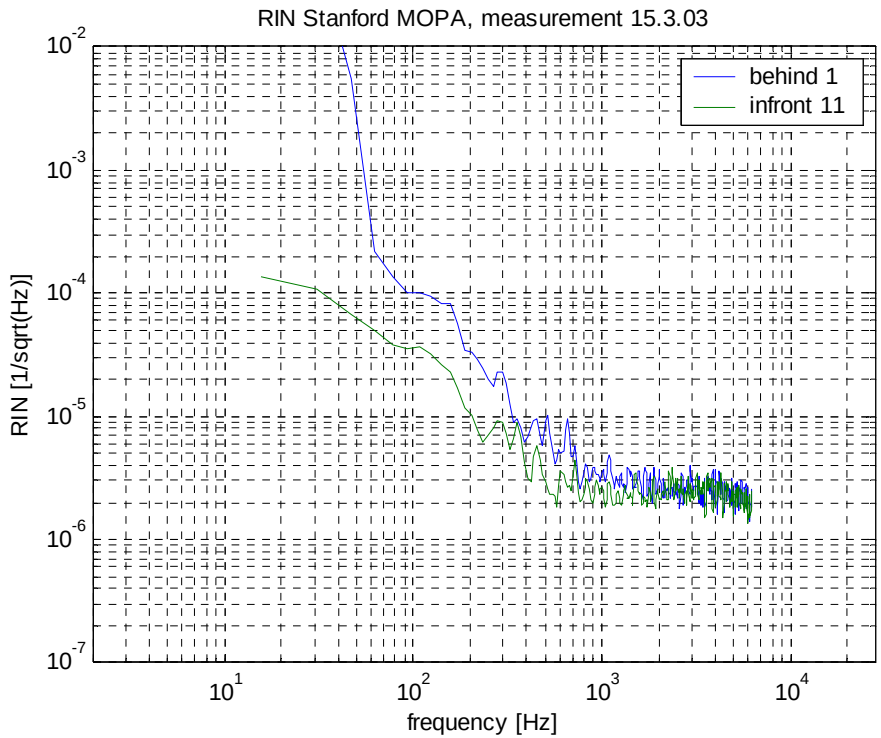




	mode count	locked
Oscillator:	T=81%	T=74%
MOPA:	T=84%	T=73%

RIN – GW band


RIN LZH 80W laser, 57mA photocurrent, measured 6.3.03
behind
infront
RIN [1/sqrt(Hz)]
frequency [Hz]


RIN Stanford MOPA, measurement 15.3.03
behind 1
infront 11
RIN [1/sqrt(Hz)]
frequency [Hz]

laser power

(Stanford)	oscillator LZH	MOPA
output power	80W	65W
power fluctuations (over 10s)	high	low
RIN - GW band / RF	similar	
higher order mode content	similar	
fluctuations between power in higher order modes	low	high

downselect

- performance of MOPA / oscillator at current power levels is similar
- scaling concept to 200W level: risks involved in all systems
- most efficient choice (delays, costs) for conceptual design phase (to be performed at Laser Zentrum Hannover) is to choose

  injection-locked stable-rod oscillator
- LSC will support the MOPA / injection-locked stable-unstable development at Stanford and Adelaide as back-up solutions for the PSL