

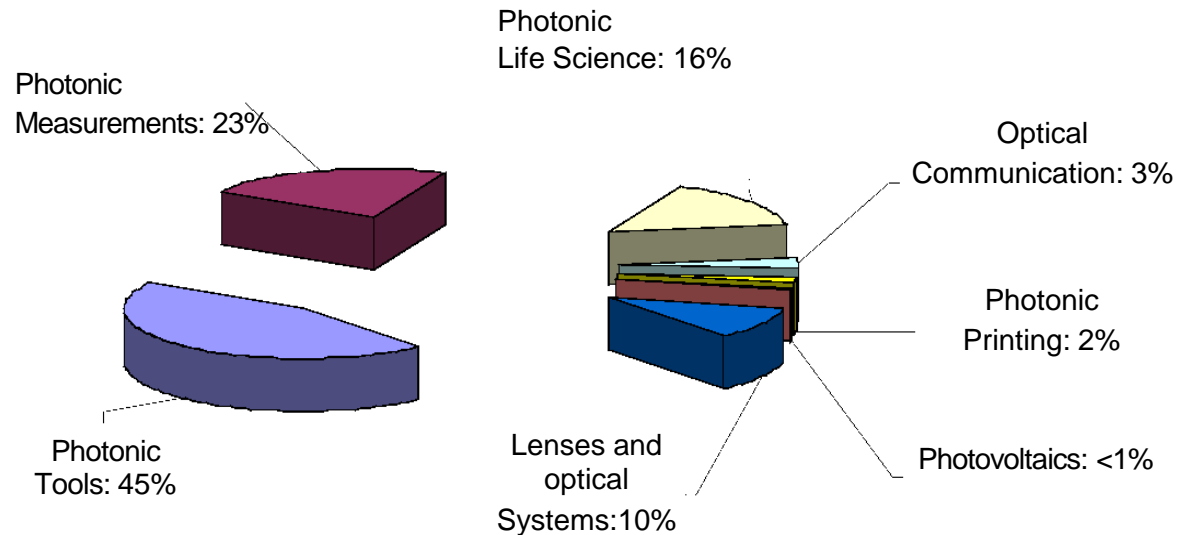
Photonic in Switzerland and in Europe

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Direct Photonic Revenue Switzerland 2007

Photonic Revenue, Switzerland 2007



Total: 3'100 Mio CHF

•OPTECH CONSULTING - August 2008

Swiss Photonic Industry: Within Europe

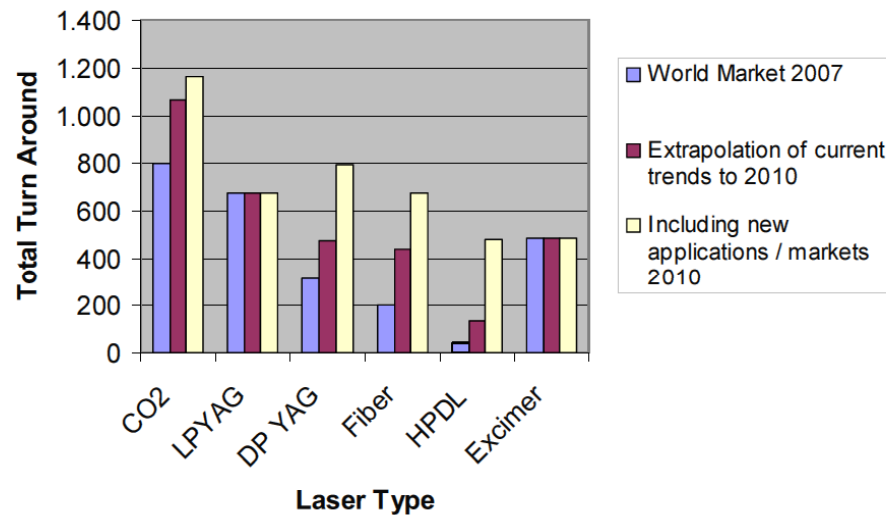
Production Volume in Switzerland

>1000 Mio. CHF				Photonic Tools
500 to 1000 Mio. CHF			Photonic Measurement	
100 to 500 Mio. CHF	Optical Communication	Lenses and optical systems	Photonic Life science	
<100 Mio. CHF	Photovoltaics		Photonic Printing	
	<2%	2% bis 4%	5% bis 19%	>20%

Fraction within Europe

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Photonic Tools: Trends

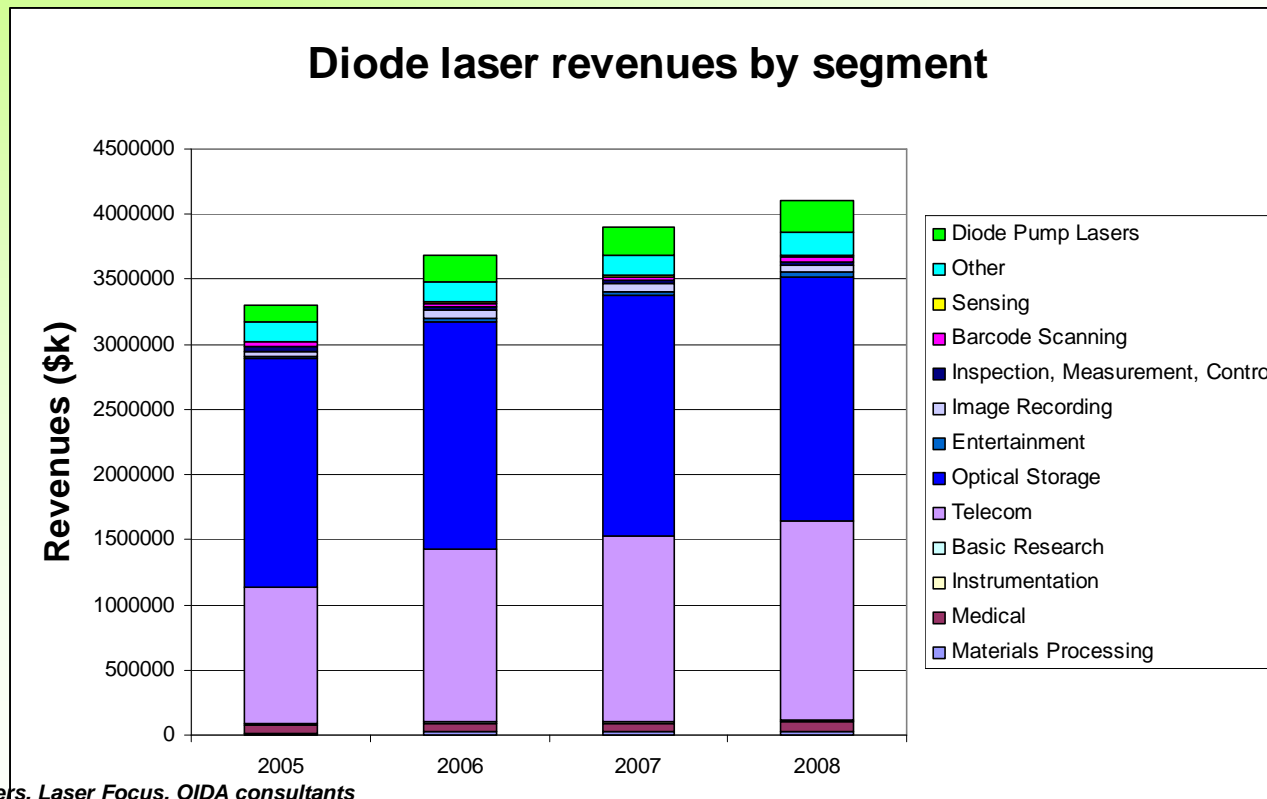


Source: Prof. Dr. Reinhart Poprawe, ILT (AKL 2008)

- LPYAG are very inefficient
- CO2 lacks fiber cable delivery
- DP YAG/Disk, Fiber and HPDL consume much less energy, can be routed through fiber cables can have much better beamquality
 - Green Photonics
 - Power Photonics
 - Remote Tools

Diode laser revenues by application

- Diode pump lasers grow faster than rest



Sources: OIDA, OIDA members, Laser Focus, OIDA consultants

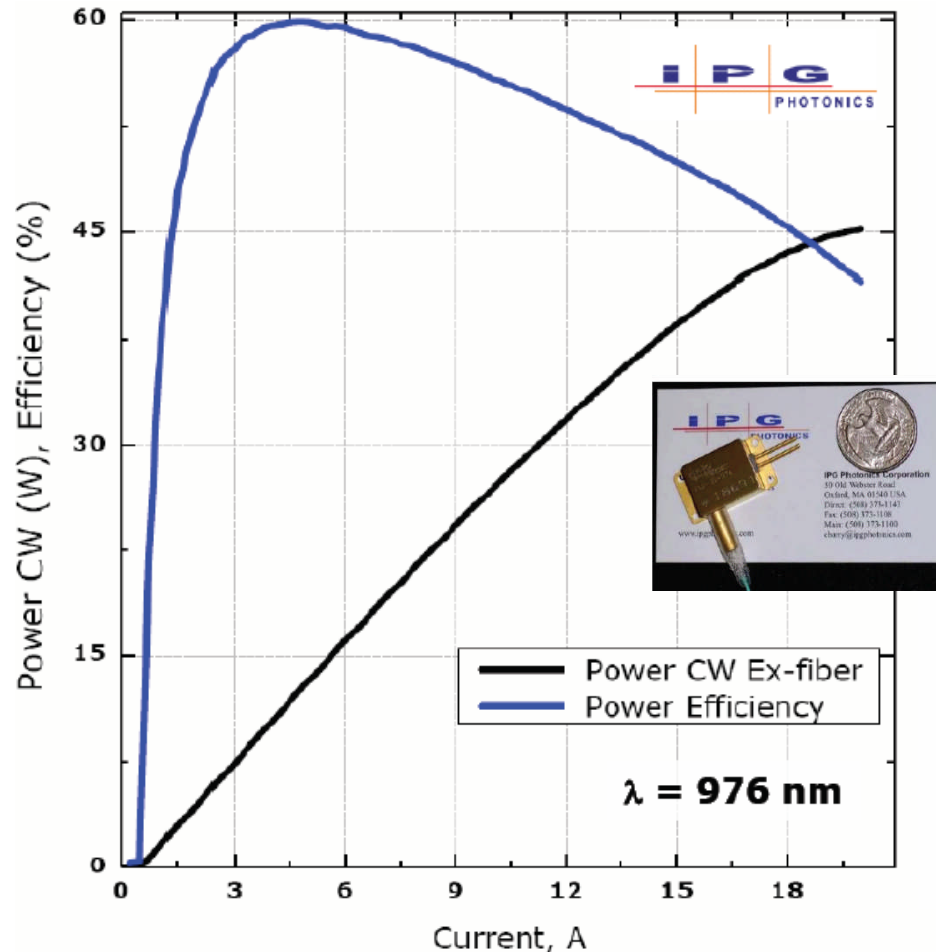
Michael Leby
(leby@oida.org)



■ Where is the new cash cow?

Example IV: Fiber Coupled Devices of 2008 design:

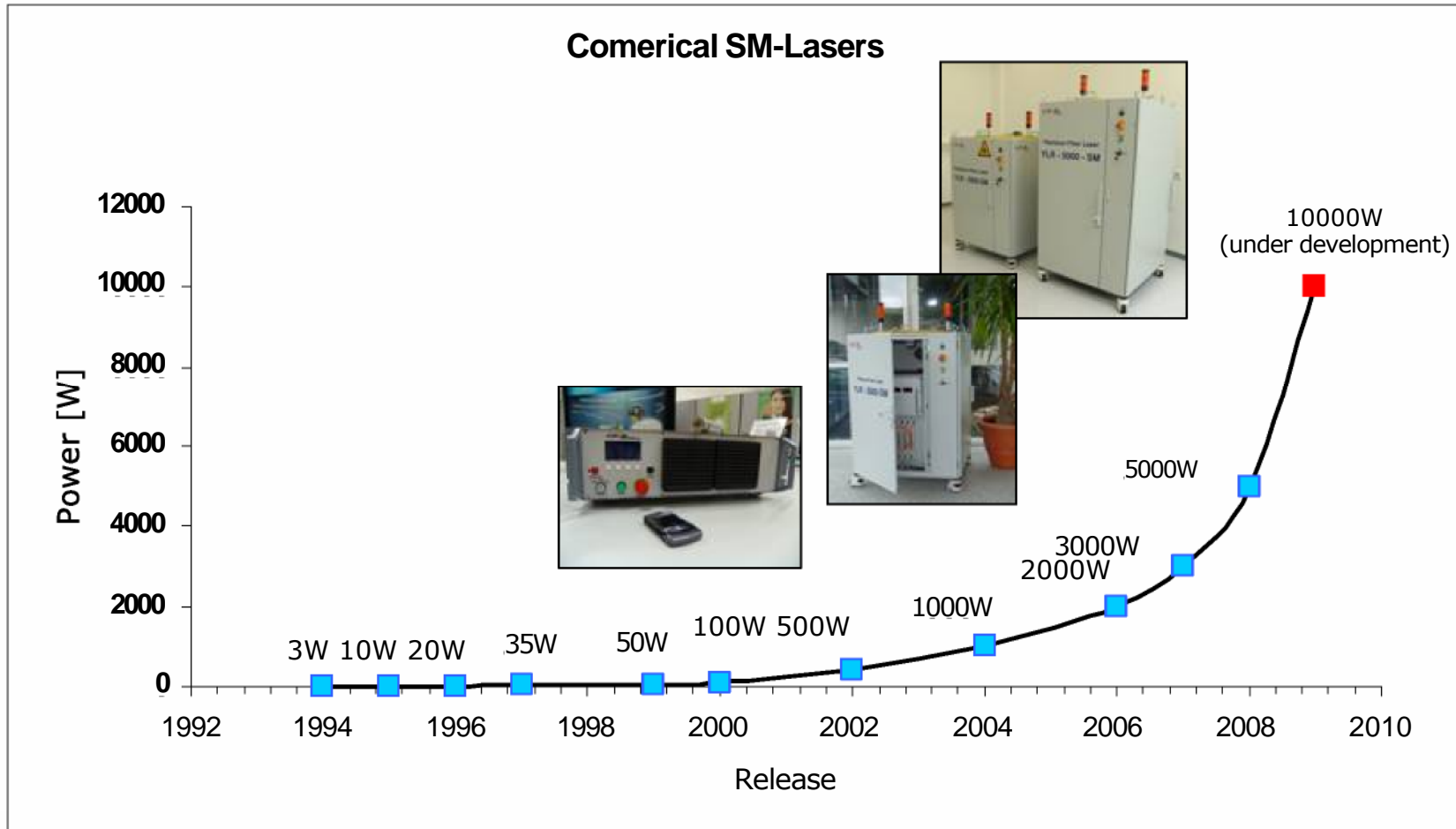
PLD-30-9xx series (based on L=4.5mm COS): $\varnothing=100\ \mu\text{m}$ fiber , $\text{NA} < 0.12$



- Single emitter-based technology ensures high reliability of the pumps
- High fiber coupling efficiency (>90%) ensures industry highest power, brightness and power efficiency



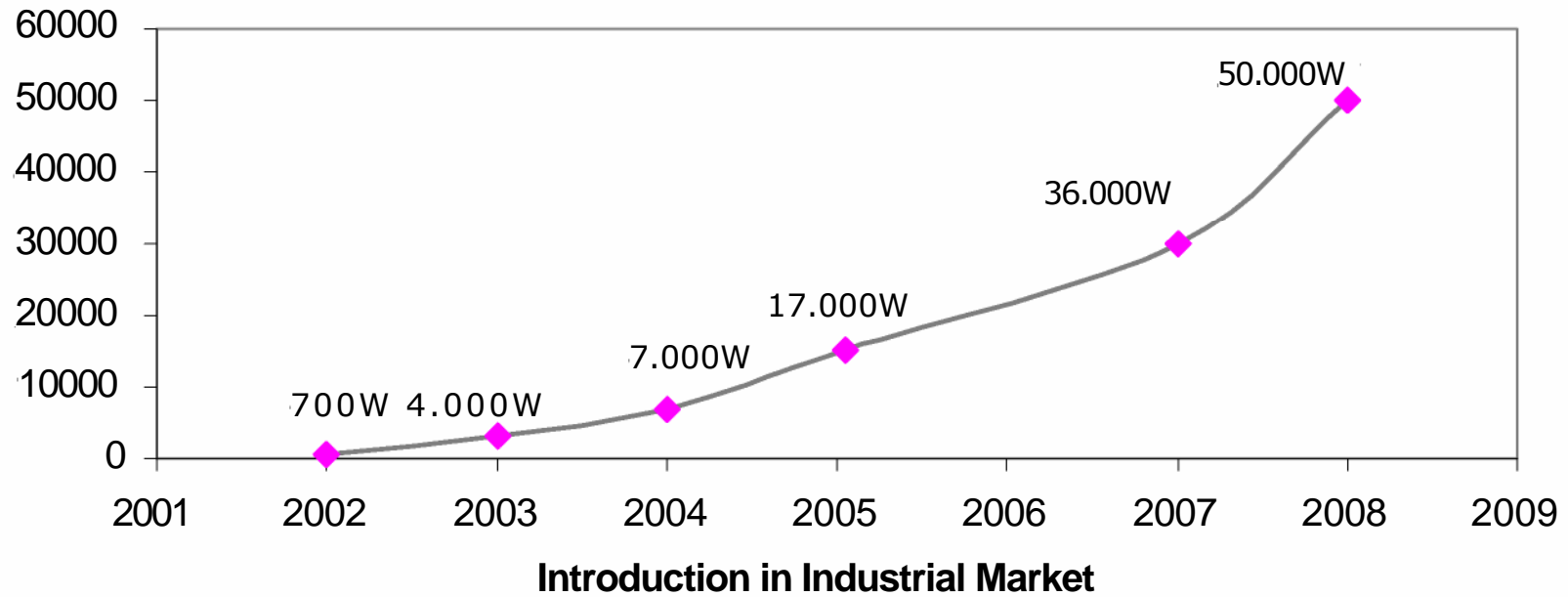
Status and Development of Single Mode Fiber Lasers



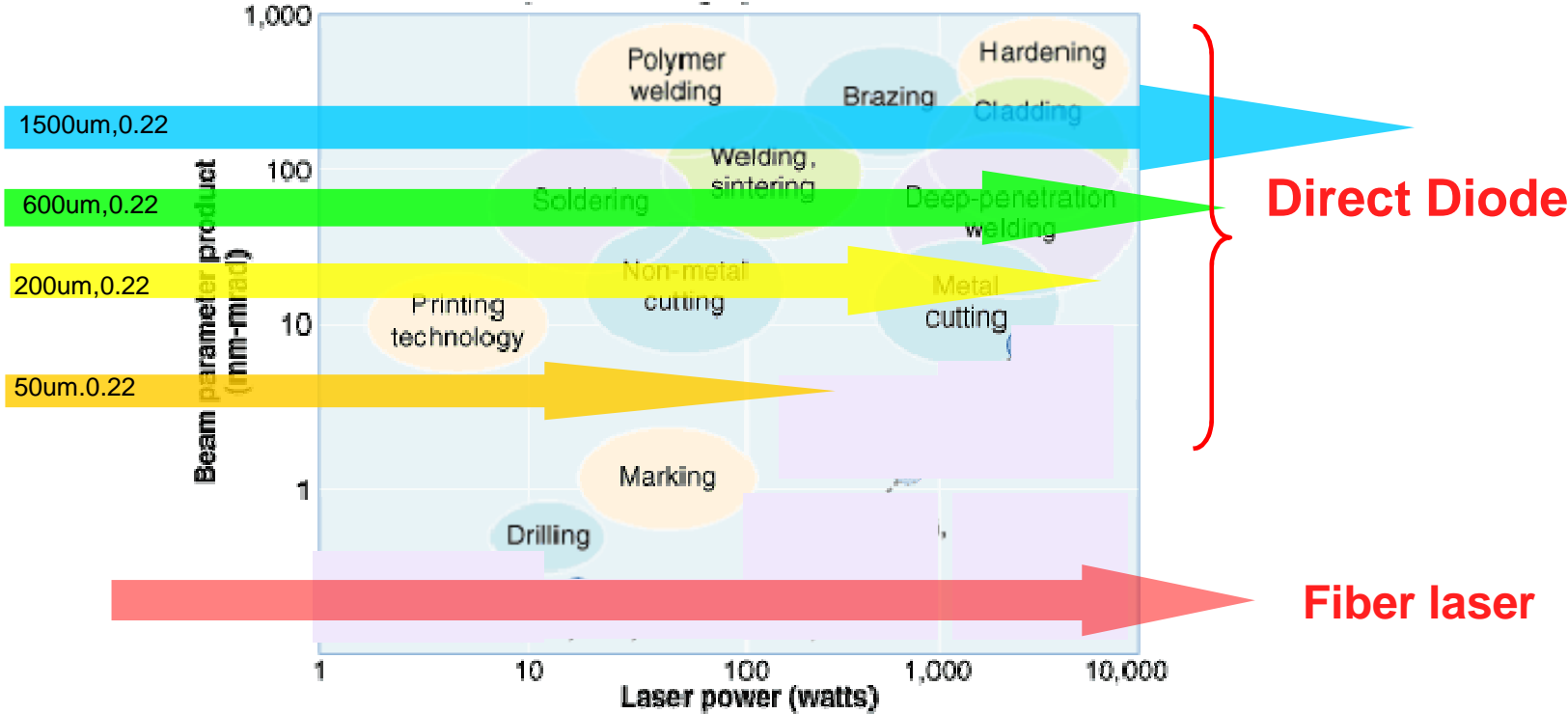


High Power Fiber Lasers - History

Power development of Low Order Mode Fiber Lasers



Photonic Tools: Trends



Source: P. Loosen, Fraunhofer Inst., Fuer Lasertechnik, Aachen, Germany

Power Photonics

- Power efficient, Fiber delivery, Solid state reliability



Photonic Tools: Industry in Switzerland

Manufactuerer	Products
Bookham	High power laser diodes
Bystronic	CO2 sheet metal cutting
Lasag/Swatch	Fine cutting and welding
Laser Automation	Fine cutting and welding
Leister	Plastic welding
Soudronic	Sheet metal welding
Synova	Lasaer-waterjet cutting
Oerlikon Solar	Photonic manufactruing of photovoltaics
Trumpf	CO2 Sheet metal cutting, laser marker

Alphabetical order

Additional: Ruetschi Technology, Swisstec, Sysmelec,...

Swiss Industry could do direct diode and fiber laser systems:

- But need **national goal** to launch direct diode systems to bring companies together
- How?

9xx MM Broad Area Single Emitters



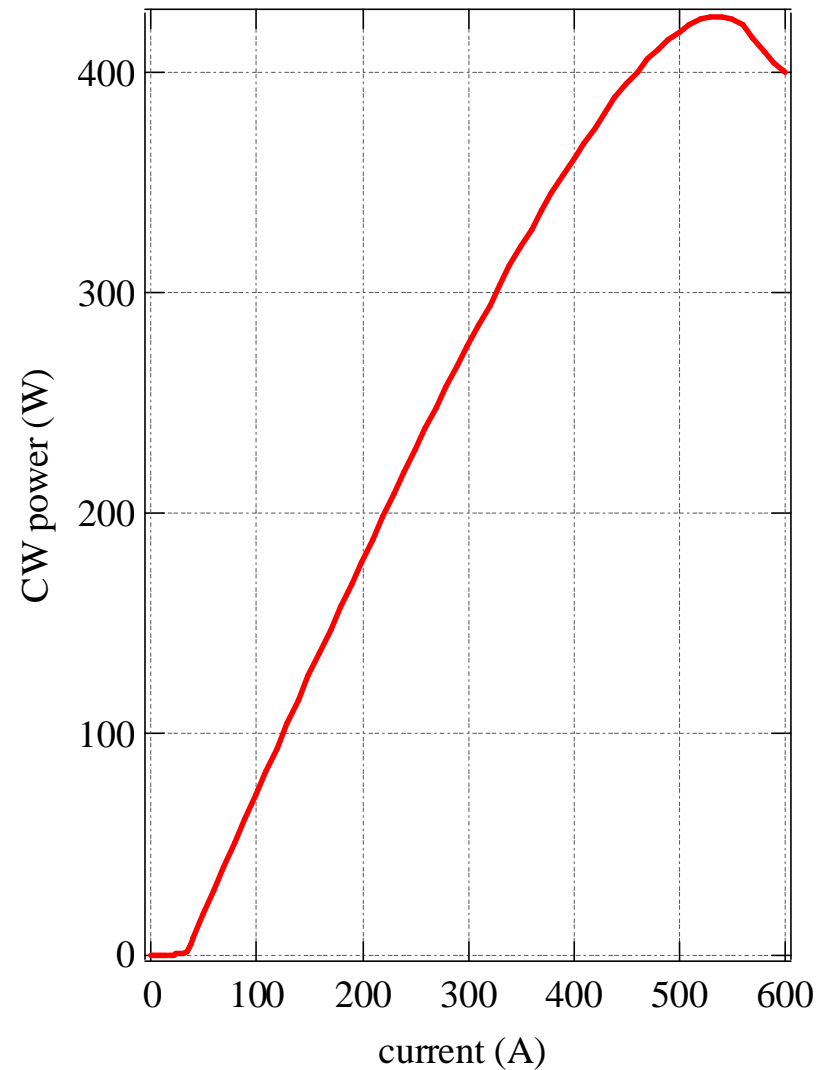
WL	Chip on Submount	Chip on C-Mount	Uncooled Module 2-pin	Multi-Emitter Module 2-pin
915, 940, 960, 975nm	9W SES9-9xx-01	9W SEC9-9xx-01	8W BMU8-9xx-01/2-R	20W MU20-9xx-01/2-R
915, 940, 960, 975nm	11W SES1 1-9xx-01	11W SEC1 1-9xx-01	10W BMU10A-9xx-01/2-R	

- Chip stripe width: 90um
- AlN submount or Cu C-mount
- Passively cooled packages with floating anode/cathode
- 105um fiber with 0.22/0.15NA

Bar with 425W CW at 980nm



- 425W at 980nm, 1cm, 50% FF
- On standard MCC
- 3.6mm long laser cavity



Innovation funding Classification

1. Program Innovation

- Full time program office runs program with declared goal
- Expert panel review but decision by program office
- Top down, either by open calls or by appointment

2. Bottom up Innovation

- Submit proposals anytime to administering office
- Peer review and decision by industry/institute embedded experts or international experts

1. Industry funding

- Money goes to industrial partner

2. Institute funding

- Funds go only to institute

3. Matching funding

- Institute is only partially funded, need also transfer from industry

Germany: Program Innovation

- BMBF
 - Has large innovationfunding available
 - For optical technologies has delegated funding management to „Verein Deutscher Ingenieure“ (VDI) (70Mio€/Jahr, more than EU projects!)
 - „Funding agency on behalf of the BMBF“ run by Peter Soldan/VDI
 - **Program Innovation** (“Verbundforschung”)
 - VDI „arranges“ a set of bilateral programs (one institute and one industry partner)
 - All bilateral programs together are designed to establish technology leadership under the direction of the VDI, funded by the BMBF
 - **Funding goes to industries as well institutes**
 - Program is recognized to be successful
- BMBF
 - Role Model for Swisslaser and CTI

Innovation Funding in Switzerland

Internationale F+E-Initiativen	Nationale F+E-Initiativen
F+E-Rahmenprogramm der EU (300 Mio. CHF)	KTI Kommission für Technologie und Innovation (120 Mio. CHF)
EUREKA (2-3 Mio. CHF)	BFE Bundesamt für Energie (27 Mio. CHF)
IMS Intelligent Manufacturing Systems (1-2 Mio. CHF, zusätz. Mittel in EU-Programm)	BAFU Bundesamt für Umwelt (14 Mio. CHF)
<i>COST</i> (7 Mio. CHF)	<i>SNF Schweiz. Nationalfonds</i> (650 Mio. CHF)
ESA European Space Agency (120 Mio. CHF)	Ressortforschung div. Ämter (175 Mio. CHF) *)
Internat. F+E-Organisationen (~40 Mio. CHF)	Private Energiefonds (~2-3 Mio. CHF)
	Gebert RUF Stiftung (privat, 10 Mio. CHF)
Andere internationale Programme	Andere nationale Programme
CIP Wettbewerbsfähigkeit und Innovation (eventuell 10 Mio. CHF)	seco Staatssekretariat für Wirtschaft – Förderung Regionalpolitik (70 Mio. CHF)
INTERREG (~15 Mio. CHF)	Stiftung Klimarappen (privat, 100 Mio. CHF)

() = jährliche öffentliche F+E-Beiträge der Schweiz; teilweise bestehen Überschneidungen

*) = davon ~122 Mio. CHF für Landwirtschaft sowie Entwicklung & Zusammenarbeit

- SNF (650Mio), EU (300Mio),
- KTI (120Mio), ESA (120Mio), Stiftung Klimarappen (100Mio)
- BFE (27Mio)

Photonics Innovation Funding in Switzerland

- NSF (**Proposed by Professors, evaluated by international experts**)
 - NCCR QP
 - 10Mio CHF/year (5Mio/year) administered by director (Prof. B. Devaud-Pledran)
 - Funding of institutes (salary, equipment, material)
 - <10% to industry (salary, equipment, material)
 - New call for NCCRs (dec 15, 2008 deadline)
 - A few proposals in photonics are submitted, mostly by Professors
 - Nano Terra
- EU (**European integration innovation**)
 - Photonics call deadline: Organic Photonics (30M€ in Nov 2008), Photonics applications (60M€ in June 2009), Small acceptance ratio (1:6?)
- KTI (**Bottom-up innovation**)
 - Networks > „Program Innovation“
- BFE (**Mixed program and bottom up innovation**)

Most innovation in Switzerland is based on individual bottom up initiatives and evaluated by foreign (international) experts. In addition industry is not funded (exception EU projects)

How can we have a national goal?

KTI supports networks (i.e. Swisslaser.Net) which can push national innovation goals

CTI: Powerful Innovation Funding

- „Die Fördergelder des Bundes fließen ausschliesslich an die Hochschulen. Die KTI finanziert damit nicht nur jährlich die Saläre von rund 1000 Forschenden, sondern unterstützt den Auf- und Ausbau einer wettbewerbsfähigen F+E an den Hochschulen.
- Die Wirtschaft profitiert von den Projektergebnissen und vom wissenschaftlichen Nachwuchs für das F+E-Kader.”
 - **Botschaft über die Förderung von Bildung, Forschung und Innovation in den Jahren 2008–2011** (07.012 vom 24. Januar 2007)
- i.e.:
 - Cash contribution from industry is not necessary (darf aber sein)
 - In addition to salary also equipment and material (Auf-und Ausbau) can be funded at insititutes
 - Start-ups get direct funding (through coaches, ..)

Botschaft über die Förderung von Bildung, Forschung und Innovation in den Jahren 2008–2011 (07.012 vom 24. Januar 2007)

Übersicht über die Beiträge nach dem BG vom 30. Sept. 1954¹⁰⁸ über die Vorbereitung der Krisenbekämpfung und Arbeitsbeschaffung für die Periode 2008–2011 (in Mio. Fr.)

	2008	2009	2010	2011	2008–2011
Projektförderung F+E	76	80	85	93	334
Nationale und internationale F+E-Netzwerke und -Programme	31	36	41	46	154
Unternehmertum und KTI-Start-up-Förderung	11	11	11	11	44
Total KTI-Fördertätigkeit	118	127	137	150	532

Swisslaser/CTI Initiative

National Goal: Photonic Tools

- How:
 - Transferkolleg “Industrial Photonics”
 - Workshops, platform for networking
 - Seeding projects
 - “Gleichlange Spiesse” Initiative
- **National Laser Processing application lab: Initiative**
 - Macro and RPT: Inspire/ Prof. Wegener, ETH Zürich
 - Micro: IALT/Prof. Neuenschwander, FH Burgdorf
- **Direct Diode Source: Initiative**
 - Ch. Bosshard, CSEM Alpnach
- **Fiber Laser: Initiative**
 - V. Romano, Uni Bern