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310/15

Economic Development for Physicists from Developing Countries

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STARTING A COMPANY DURING A BUBBLE AND DURING A BURST

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SYNTUNE

STARTING A COMPANY DURING A BUBBLE & DURING A BURST

The tale of two companies

Altitun	Syntune
*1997 †2002	*2003

SYNTUNE

Björn Broberg * and Jens Buus **

* Co-founder of Altitun

Co-founder and chairman of the board of Syntune

** Project manager for EU projects with Altitun participation

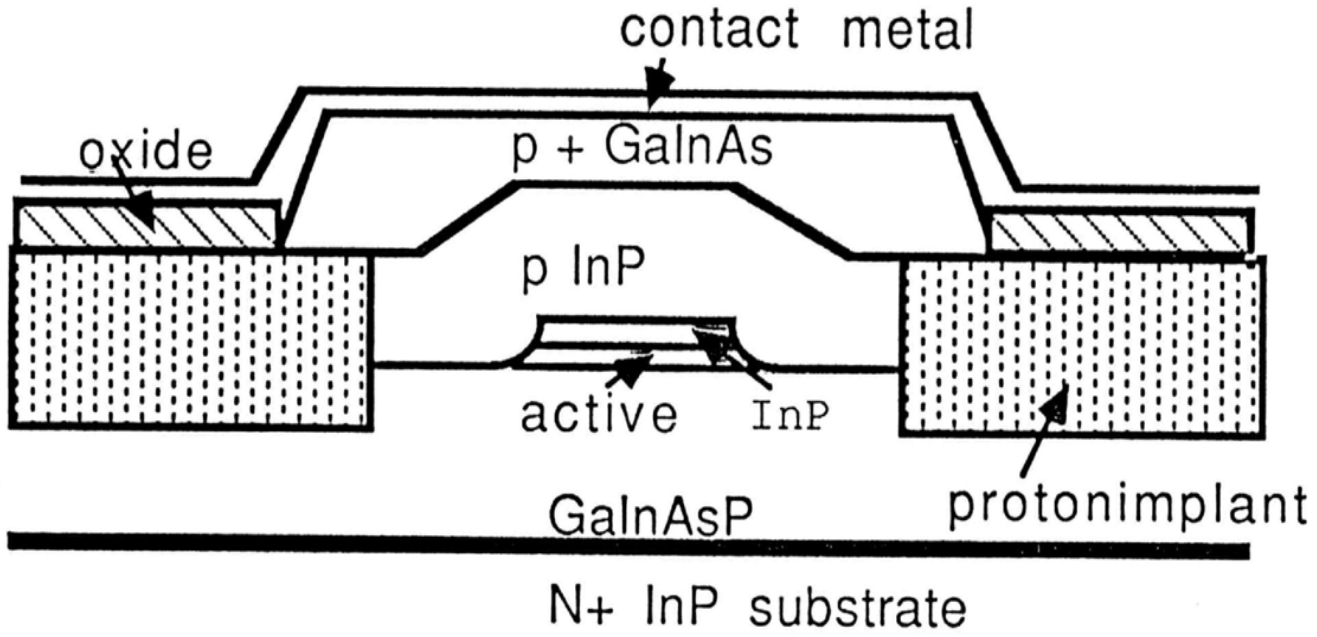
Co-founder of Syntune and chairman of its advisory board

SYNTUNE

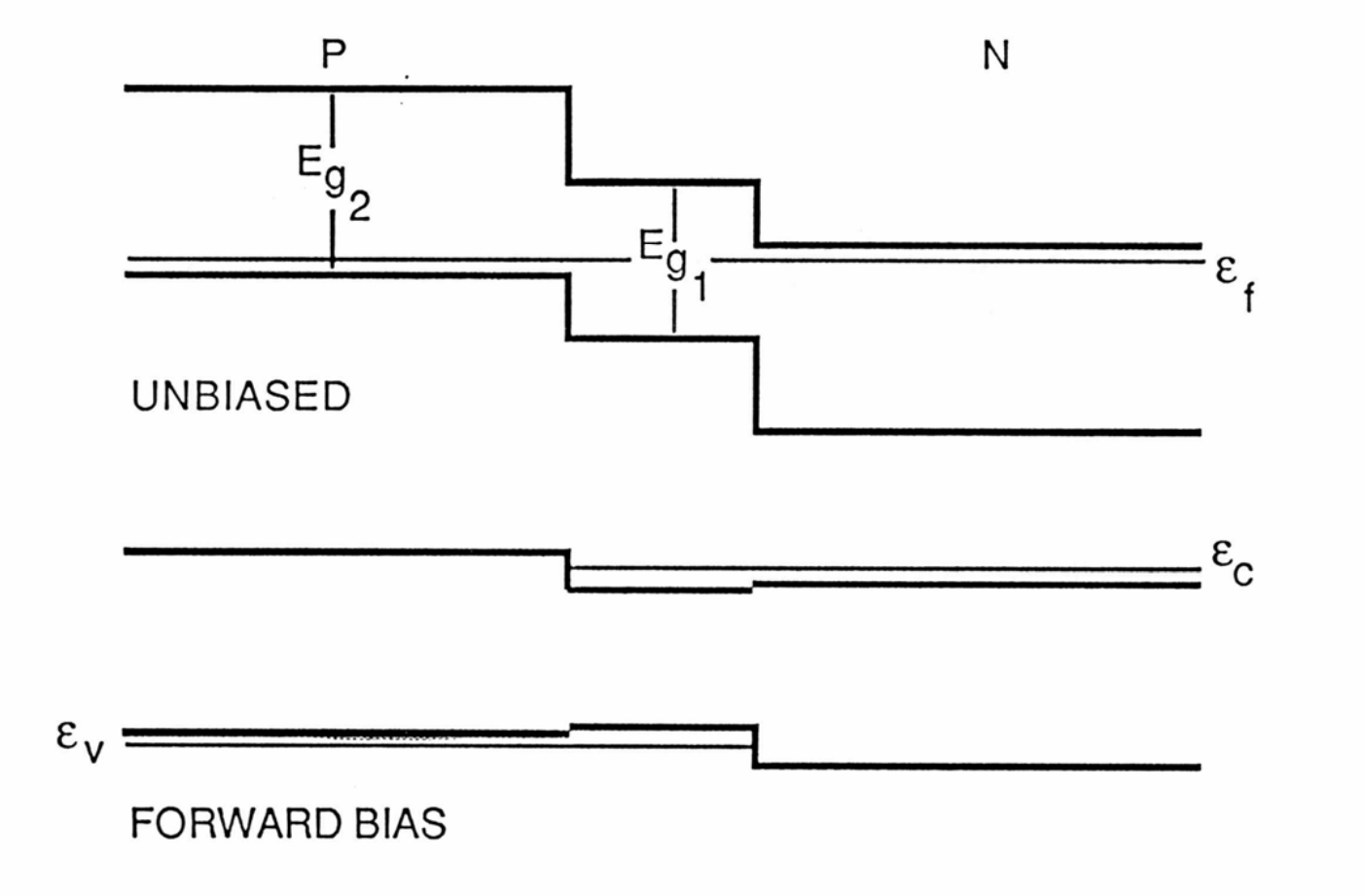
OUTLINE

- Tunable lasers
- Historical perspective
- Different times – different strategies
- Lessons

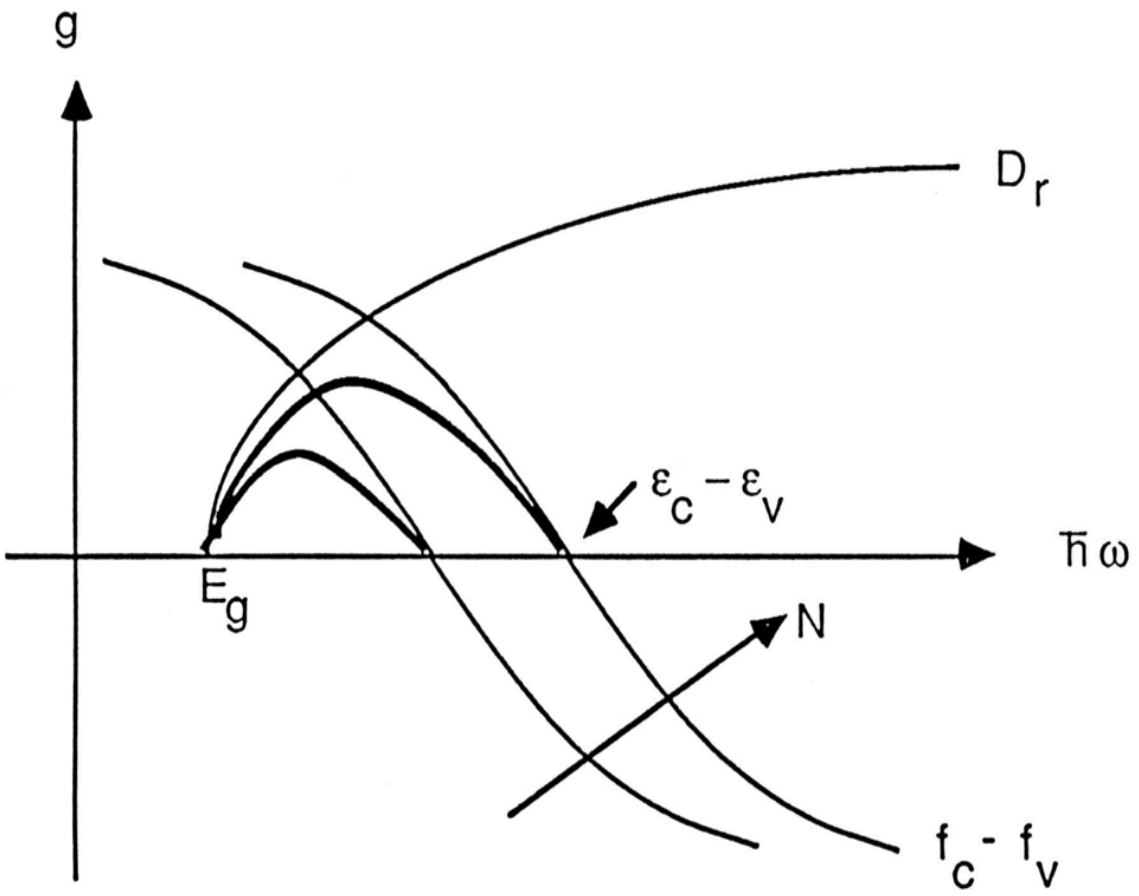
SEMICONDUCTOR LASER STRUCTURE



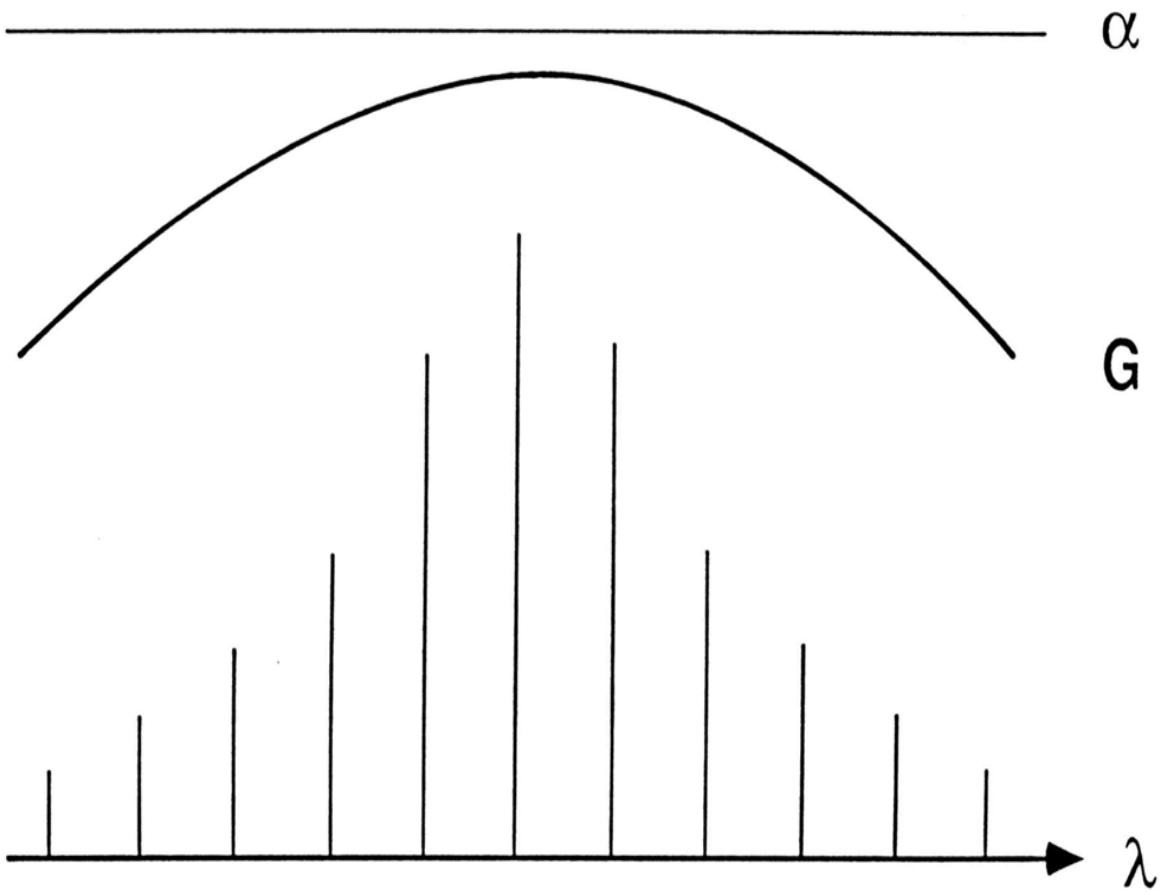
DOUBLE HETEROSTRUCTURE



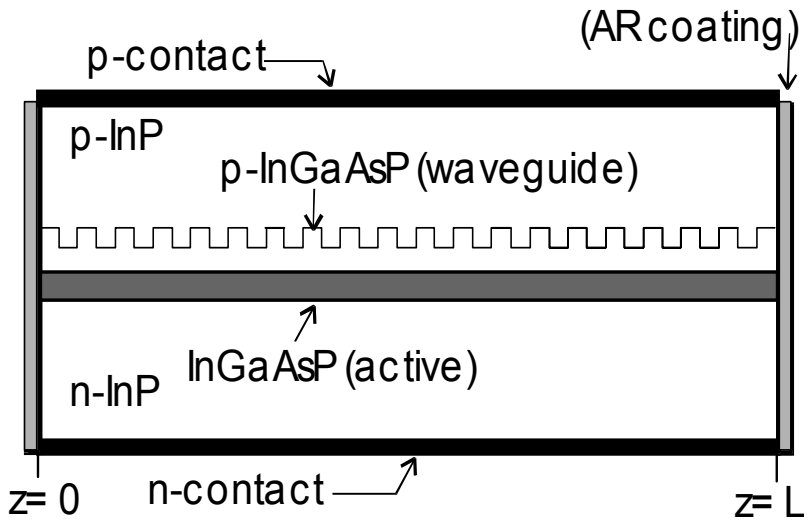
GAIN



GAIN SPECTRUM VS MODE SPACING

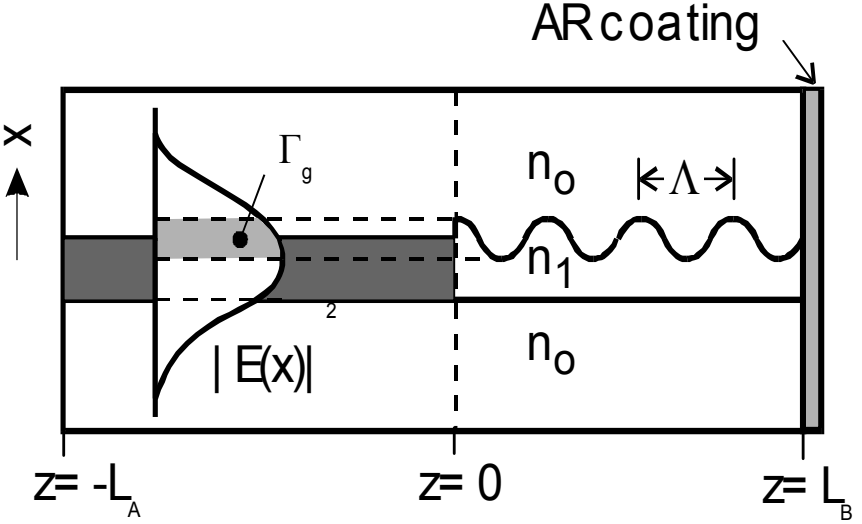


DFB AND DBR LASER STRUCTURES

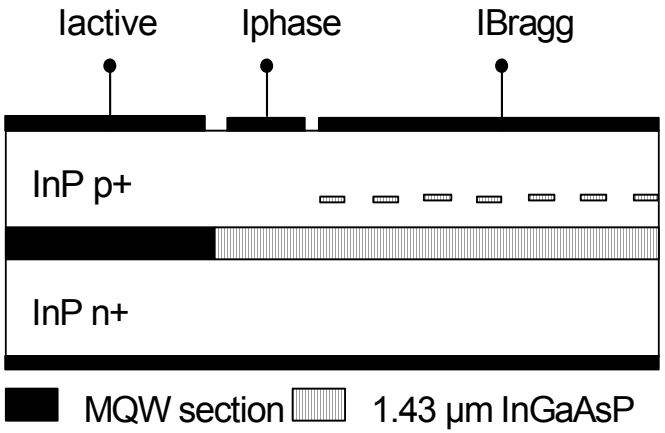


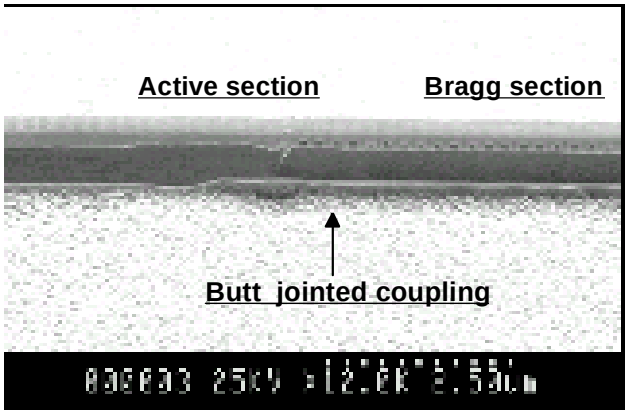
DFB

DBR



TUNABLE DBR LASER



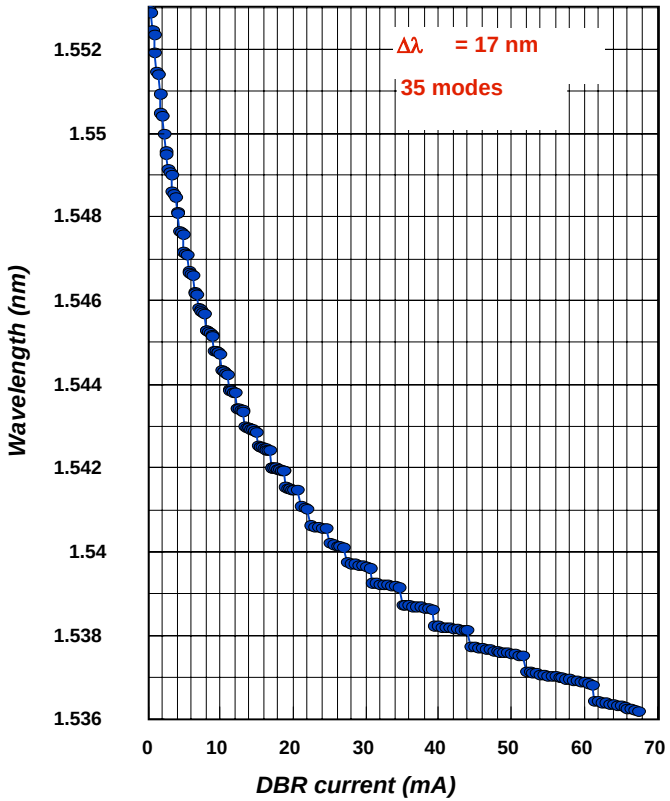


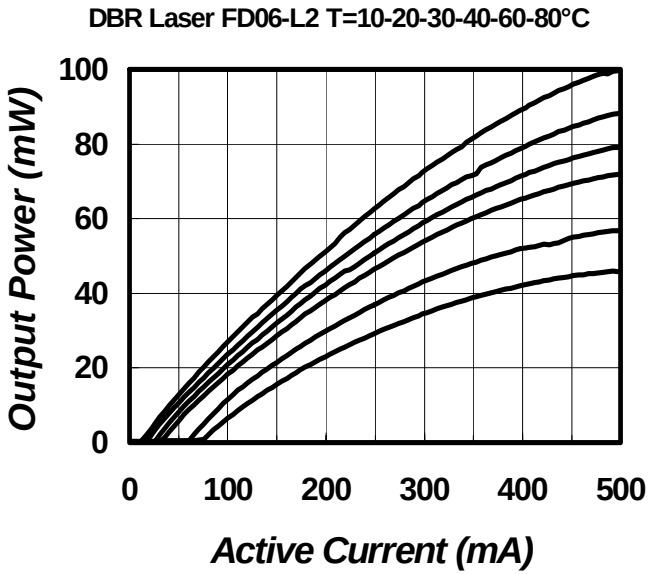
SEM view of the butt-jointed area

- Three MOVPE steps
- Butt-jointed coupling between active and passive sections
- RIBE etching of the 1.5µm width stripe
- 1.43 µm InGaAsP passive material for enhanced tuning range (0.38µm)

Alcatel 1905 TLM 10dBm / 32 channels spaced 50 GHz / SMSR >35dB

DBR PERFORMANCE





Delorme et al, Electron. Lett., Vol. 33, 210-211, 1997.

3 SECTION DBR CHARACTERISTICS

Quasi continuous tuning over about 10nm

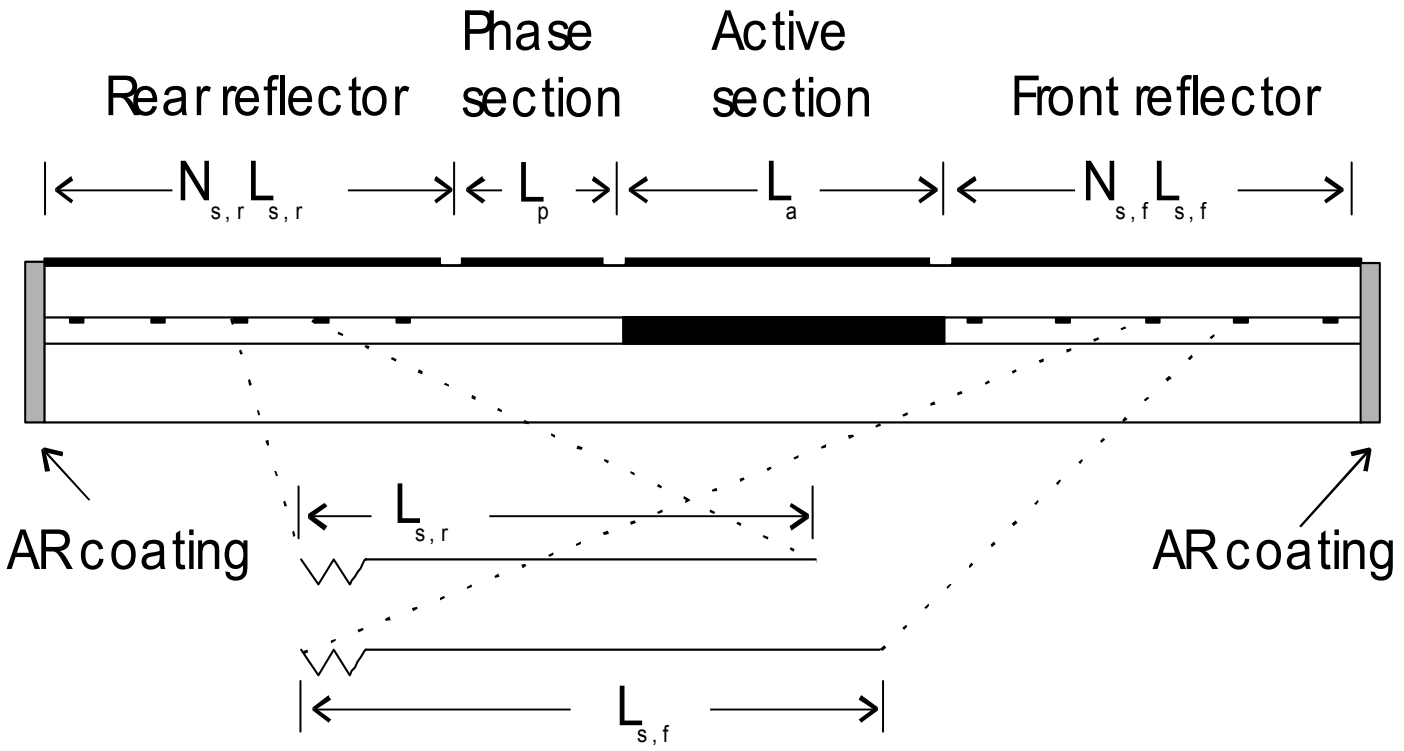
All wavelengths available

2 control currents required

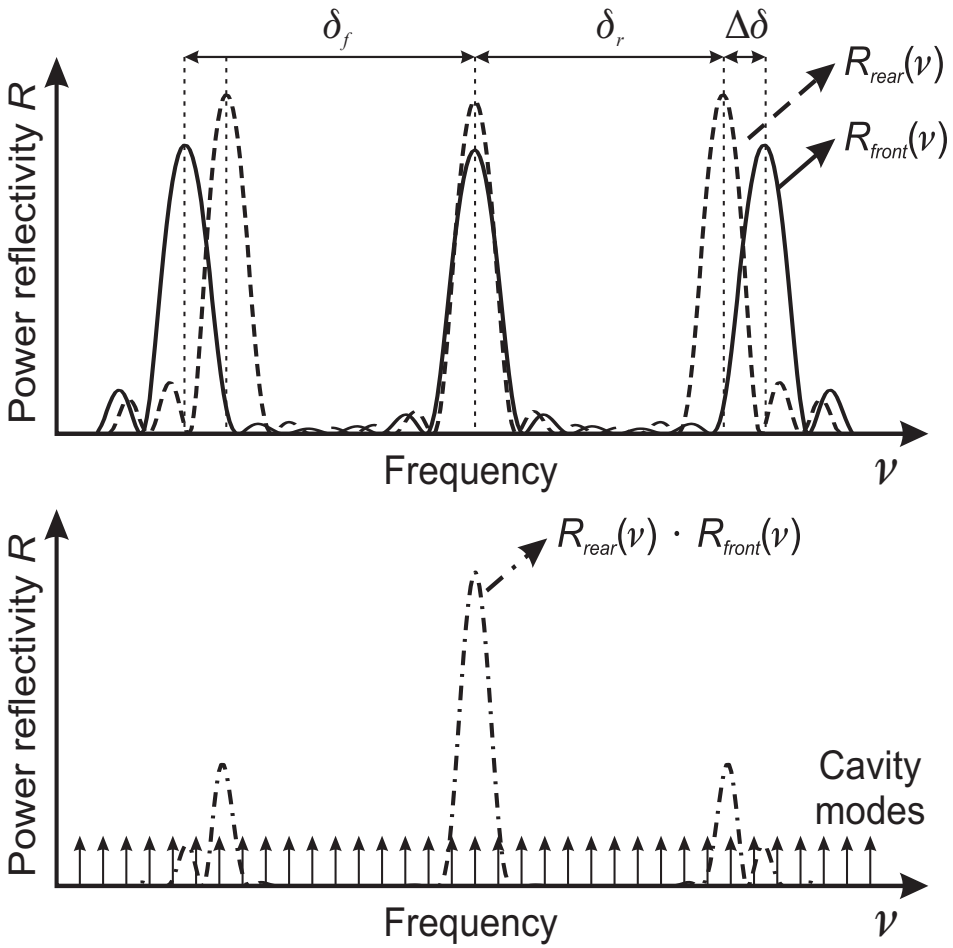
3 control currents required for constant power

Up to about 4nm true continuous tuning by use of splitting
network for DBR and phase control currents

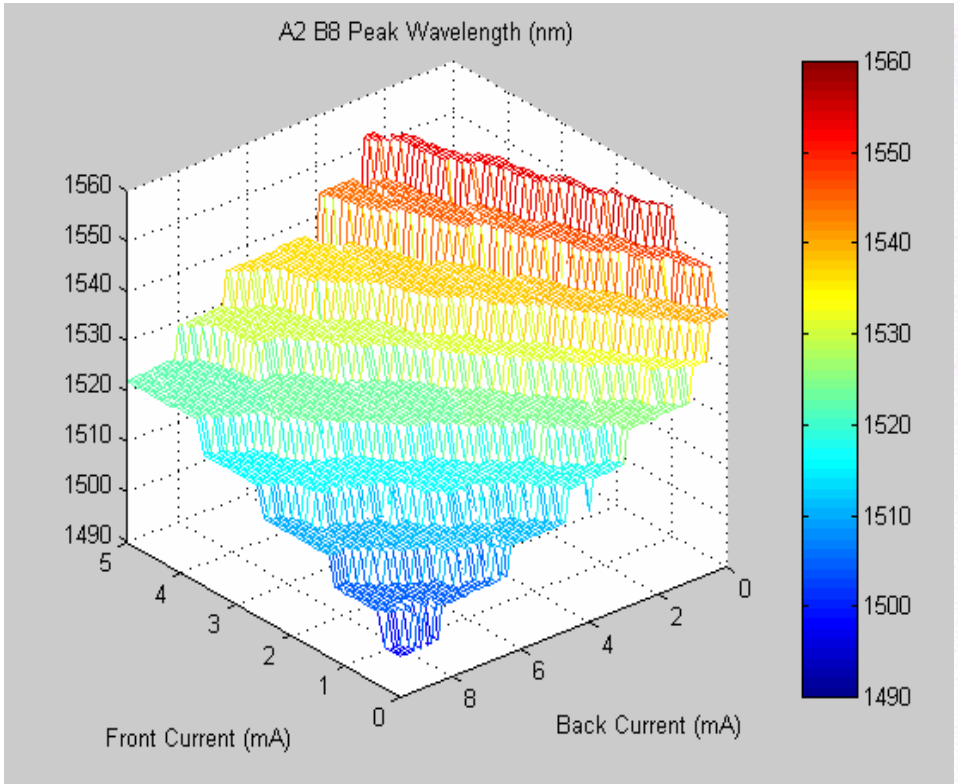
SAMPLED GRATING DBR



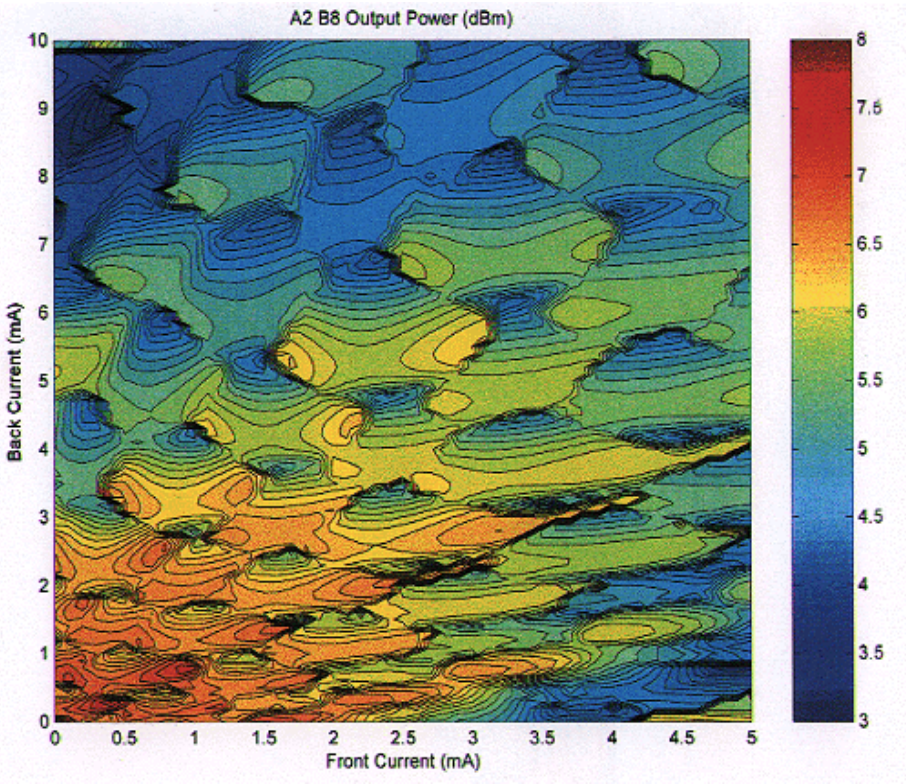
USING THE VERNIER EFFECT



SG-DBR TUNING CURVES

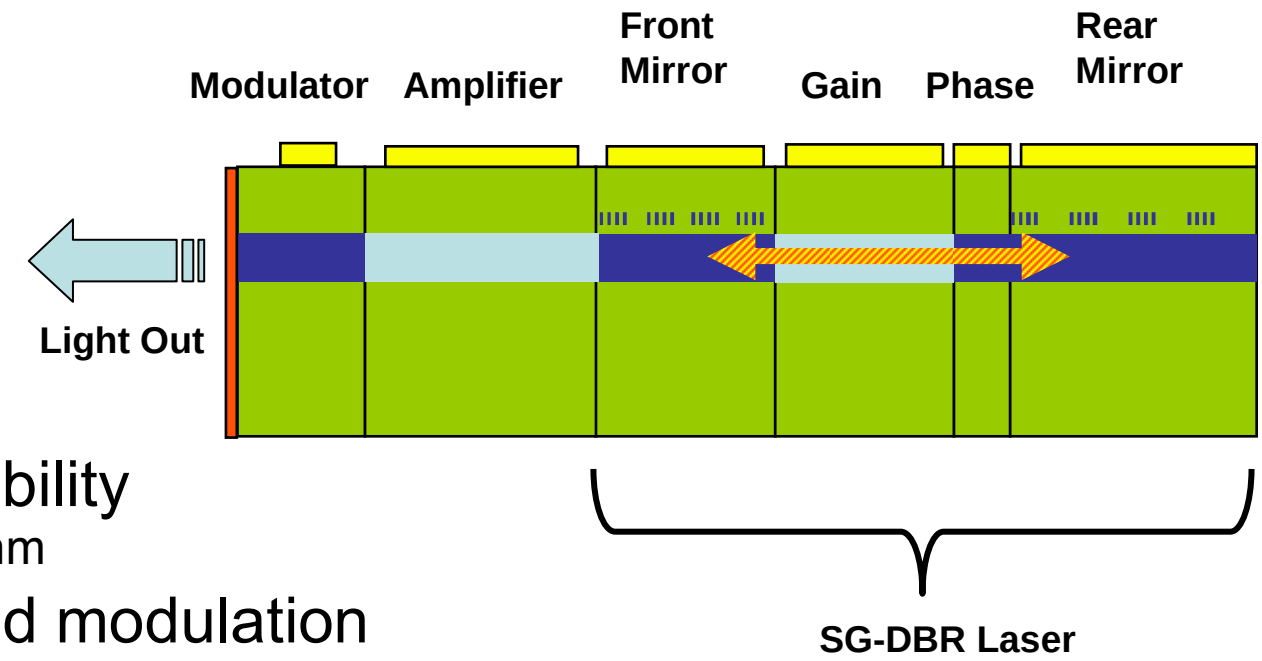


Tuning characteristic



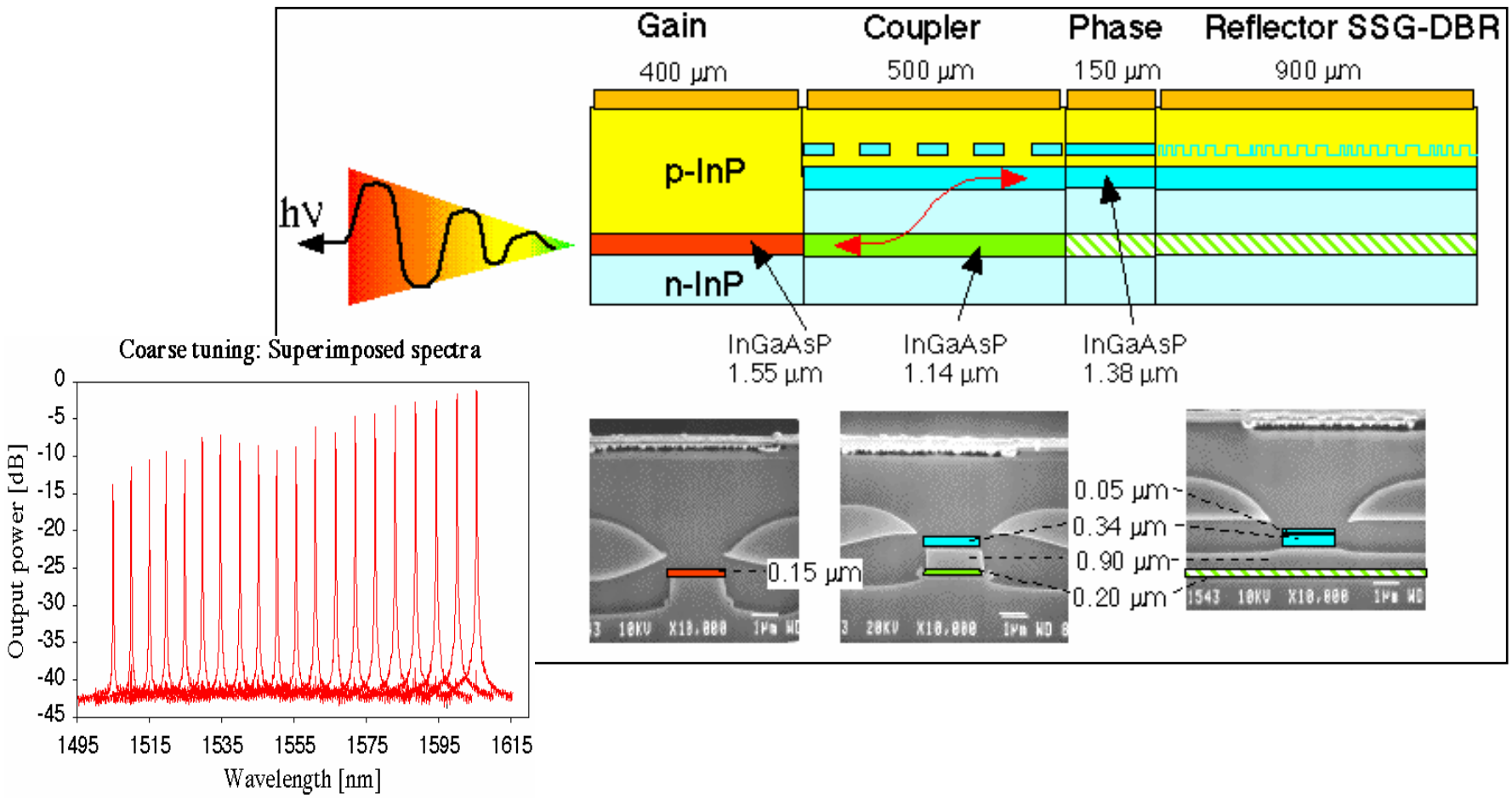
Power variation

SG-DBR WITH EAM AND SOA



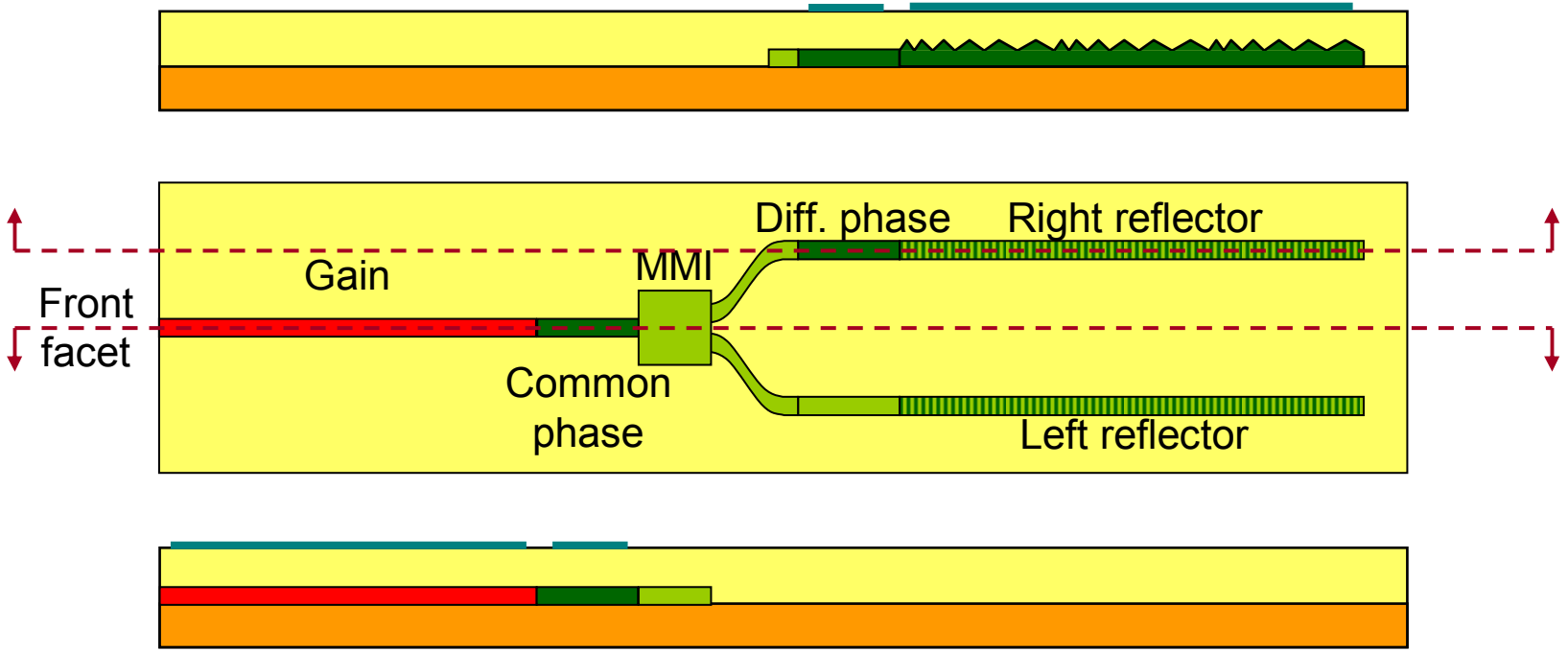
- Wide tunability
  - Up to 40nm
- High speed modulation
  - 2.5Gb/s or 10Gb/s
- Single compact package
- Same monolithic integration technology for modulator and laser tuning sections

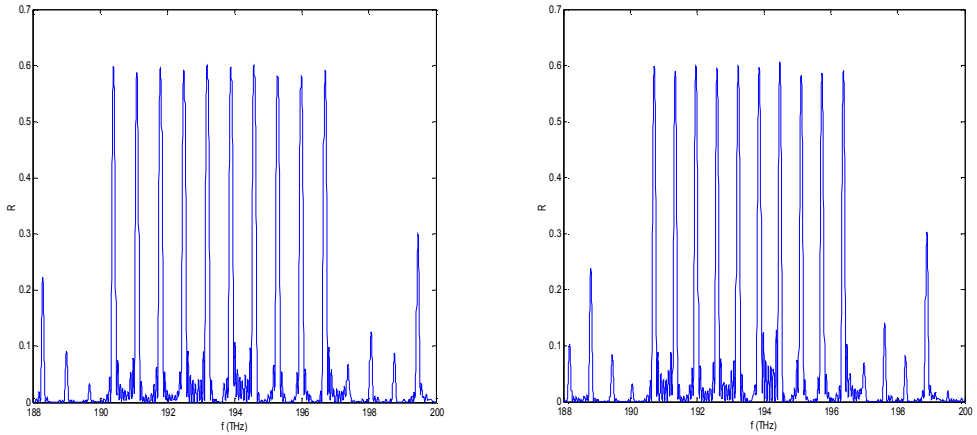
Altitun laser, the GCSR



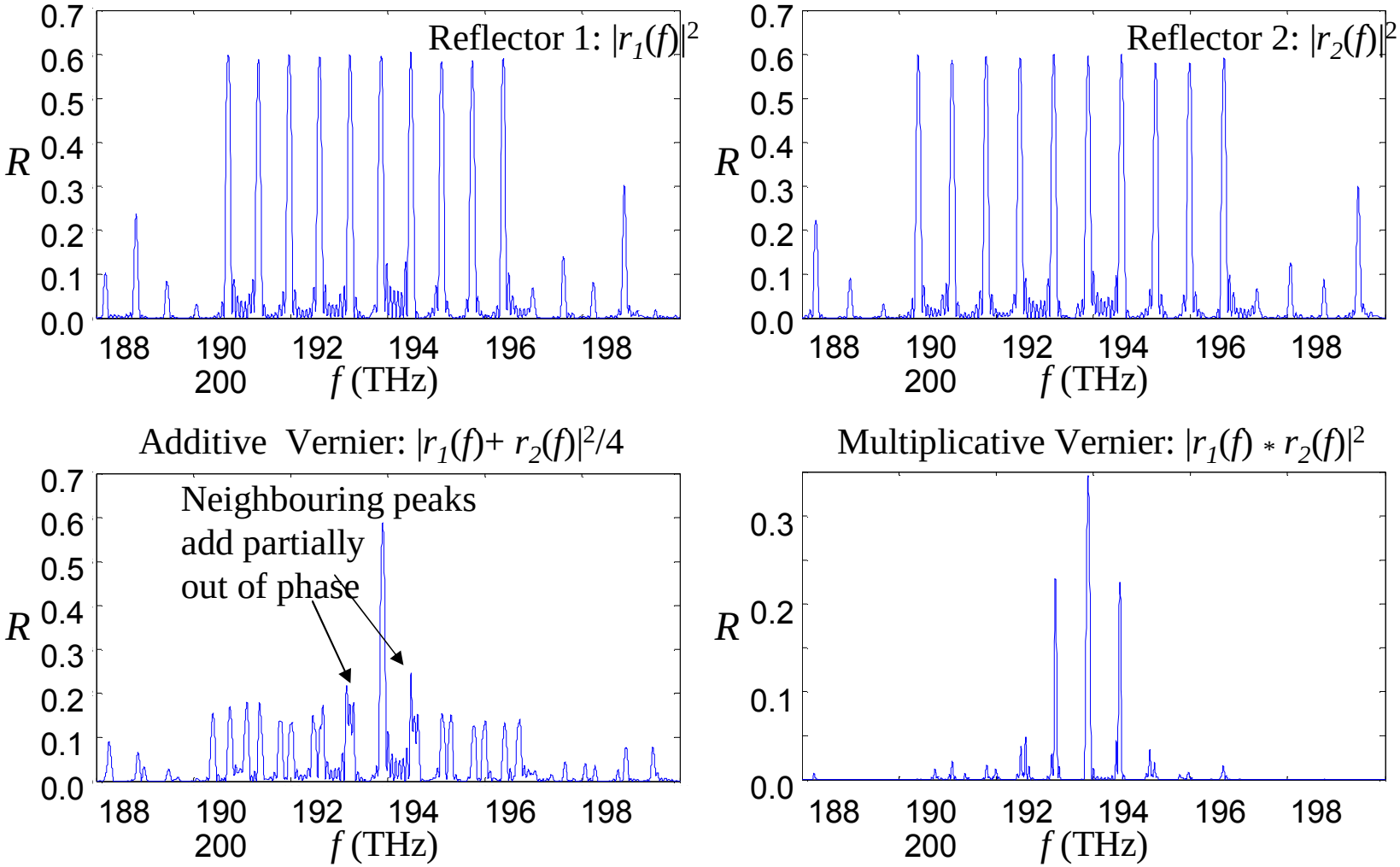
P-J Rigole et al, IEEE Photonics Technol. Lett., Vol. 7, 1249-1251, 1995.

Syntune laser, the MGY



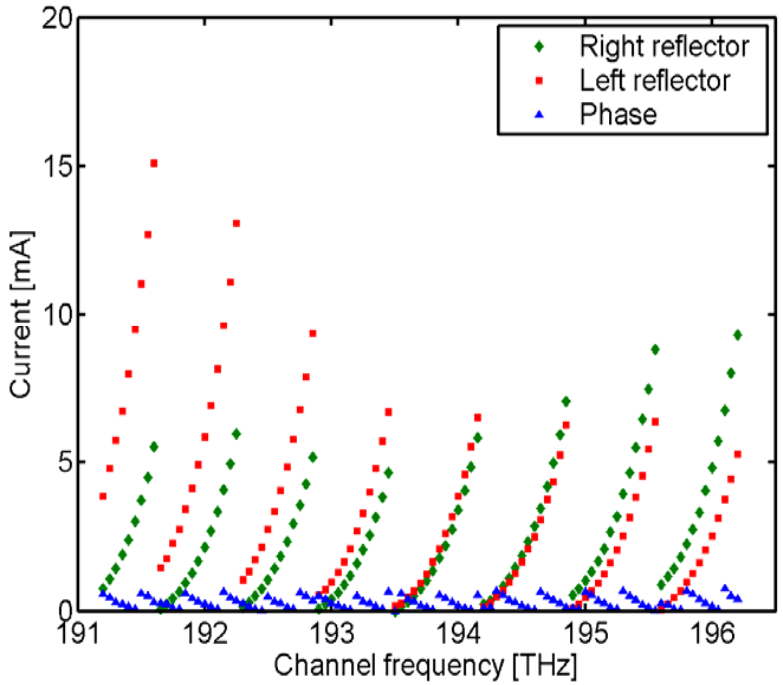


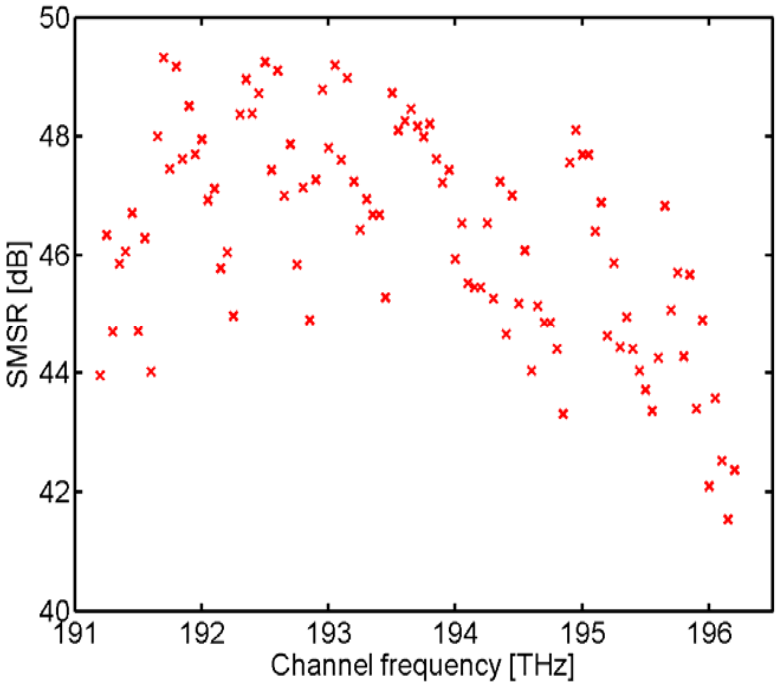
ADDITIVE VS MULTIPLICATIVE REFLECTORS



Wesström, et al, IEEE-ISLC'2002, paper TuP-16.

PERFORMANCE





Tuning currents for each channel

SMSR for each channel

Wesström, et al, OFC'2004, paper TuE2.

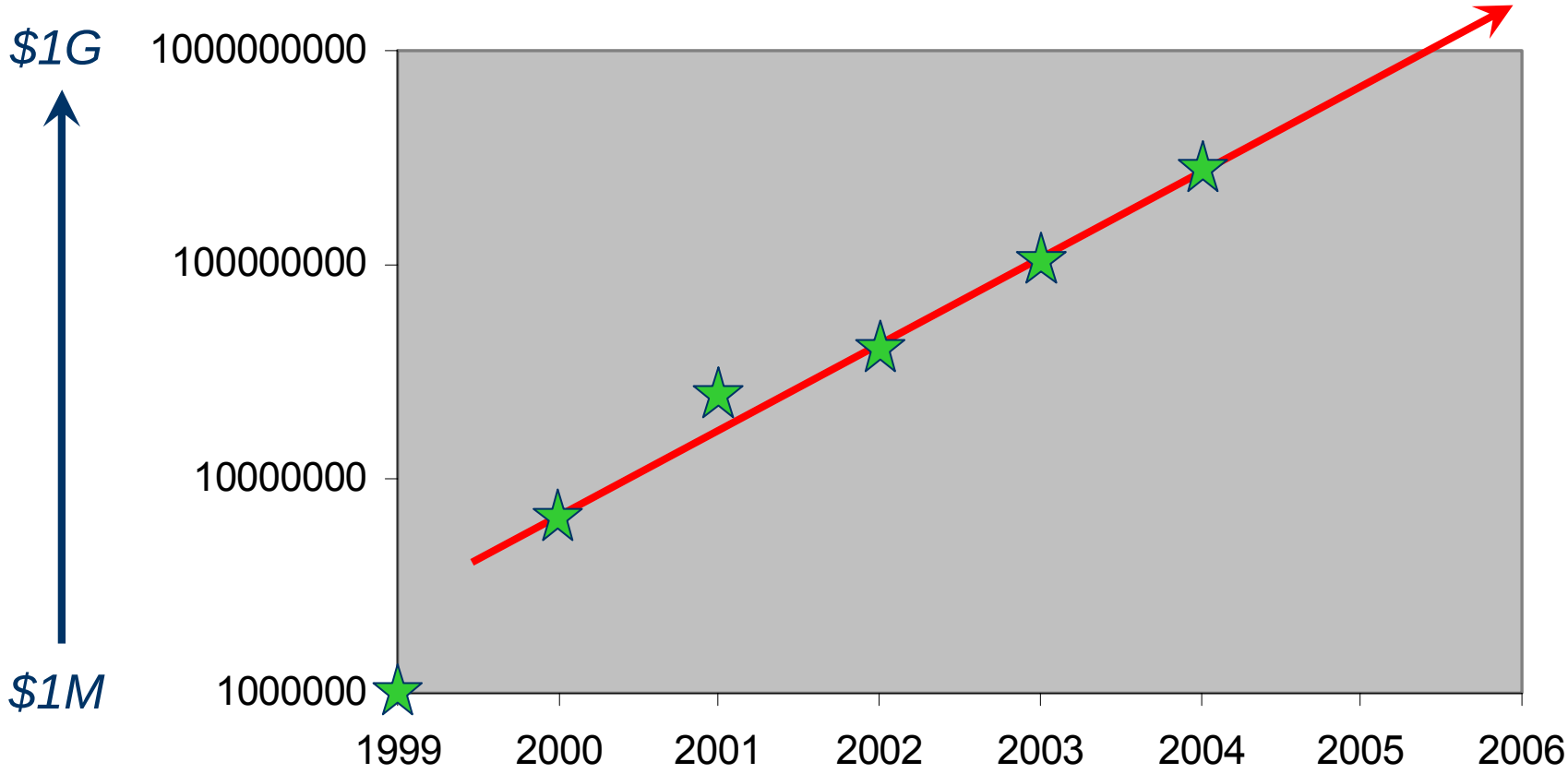
In the beginning . . (<1997)

- DFBs for thermal tuning over a few nm
- 3 section DBRs for ⩽15nm quasicontinuous tuning
- Widely tunable ECLs for test and measurement
- Lab demos of various monolithic widely tunable lasers
  (SGDBR, SSGDBR, VCF, active Y, DFB arrays)
- No tunable products for telecom
- No dedicated companies
- Control issues not dealt with in detail
- Reliability and wavelength stability for DBRs not proven
- → Not taken seriously for WDM

The bubble years (1997-2000)

- Altitun established in 1997 as the first dedicated widely tunable laser company
- Numerous other start-ups followed
- Many with own fab
- Potentially disruptive technology overlooked or neglected by the large companies
- Tunable lasers became one of the hottest component topics (together with pump lasers and FBGs)
- Many impressive market forecasts
- → Start-ups acquired at high prices
  Coretek by Nortel for $1.4G, Altitun by ADC for $0.9G

Market forecast from 1999

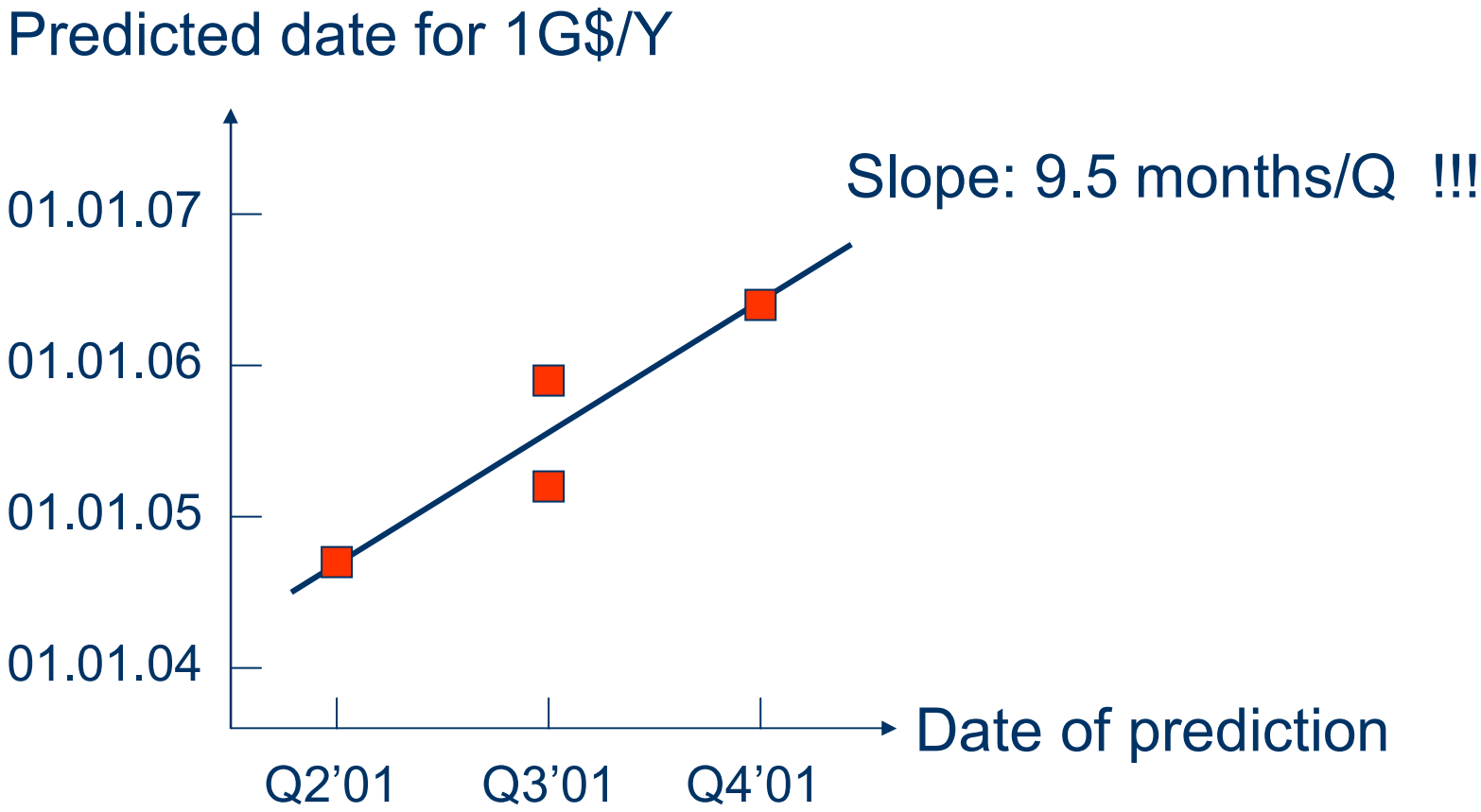


Predicted annual market for tunable lasers

The burst (late 2000 - ??)

- Market forecasts gradually getting less upbeat
- Many of the start-ups closed down
- More to follow?
- Altitun closed in 2002, fab dismantled, all equipment sold at auction
- Market just too small for a company only making tunable lasers to have its own fab
- Just the right climate to start a new business in this area!
- → Syntune started early 2003

Market forecasts from 2001



Timeline for Altitun

1987		Tunable laser research commenced by some of Altitun's founders
1992		GCSR laser principle invented by IMEC
1993		First GCSR laser manufactured and demonstrated by Altitun founders and others in Sweden
1996		Market research for tunable laser technology
1997	early	Altitun founded, 5 founders, exclusive licence of laser design from IMEC
	mid	First commercial orders and shipments of lasers from Altitun
1998	early	First round of VC financing
1999		Second round of financing, building new fab
2000	early	Major sales contracts
	mid	Altitun sold to ADC, 42 employees
2001		Production capacity ramped up, 160 employees
2002		Telecom crash, ADC/Altitun closed

Timeline for Syntune

1997		Invention of the MGY laser principle
2002	mid	MGY laser concept demonstrated by ADC/Altitun
	late	ADC/Altitun closed
2003	Jan	Syntune founded
	Feb	License agreement on basic IP
	Mar	ADC/Altitun auction
	Mar	Joins the EU project NEWTON
	Sep	First “own” lasers from first external foundry
2004	Apr	First order
	Nov	First external funding
2005	Jul	Full spec lasers from second external foundry
2006	Sep	ITLA announced
		Qualification, MGY + 10Gbit/s MZ modulator
		Still alive and well

Timeline for Silicon

1970	Vertically integrated companies, all in the same place; *no standards*
1990	Design and processing ”at home”, packaging in South-East Asia
2000	”Fabless”: One company designs, a second makes the chip, a third packages, a fourth markets; *all interfaces (design rules, processes, packages) are standardised*

Timeline for Opto

1985	Vertically integrated companies from components to systems
1995	Independent component companies deliver to the system companies
2000	Design and processing ”at home”, packaging in South-East Asia, no standards below end product level => production is hard to move
? 2005+	”Fabless” opto industry with standard processes?

Competitive landscape, 1997

- Altitun was first on the market (except for T&M ECLs), first to address tunability for telecoms
- Pitch: tunability saves money + monolithic integration long-term winning technology
- Hesitant potential customers
- Keys to overcome customers' hesitation:
  - Customers' customers understand the cost savings that tunability gives (and put pressure on their suppliers = Altitun's customers)
  - Competitors to Altitun enter the arena
- Customers prepared to pay high premium for tunability, and to compromise on performance, but very small volumes
- General lack of capacity in laser production industry
- Proprietary, non-standard processes
- Monolithic integration on InP distant prospect

Competitive landscape, 2003

- Advantages of tunability generally accepted, but deployment has been slow
- Wide range of companies and technologies for tunable lasers, with different advantages/disadvantages short/long term
- Customers want tunability, but are only prepared to pay low (or no) premium, no compromises on performance as compared to fixed wavelength lasers
- General overcapacity in laser production industry
- More mature and standardised processes
- Monolithic integration on InP commercial reality
- Concept and advantages of tunability still holds, but two main obstacles need to be overcome
  - Technology needs to be refined (smaller, better, lower power consumption etc)
  - Cost must come down

Other tunable laser companies

- Companies with tunable lasers as only (or main) product
  - Sparkolor †
  - Coretek †
  - Bandwidth 9 †
  - Iolon †
  - Agility still alive, but taken over by JDSU
  - Santur, Paxera still alive
- Average total spent per company on equipment and operating costs is probably $\geqslant$\$100M
- Additional spending by several established companies Bookham, Intel, Pirelli, Fujitsu, Furukawa, NTT
- Only a few of these have any products to show
- Total spending (“investment”) on tunable lasers probably >\$1G (excluding costs of take overs)

EU perspective

Role of EU supported R&D:

- Basic technology for Altitun developed in the UFOS and BLISS projects, before the company was spun out from IMC
- Key IP from another EU project
- Early Altitun work supported in ACTUAL
- Experimental work on the MGY laser started by ADC/Altitun in NEWTON
- Syntune took over ADC's role in NEWTON, with accompanying funding

National perspective

- Taxation of the capital gain on Altitun far exceeds the total government research support to date for optoelectronics in Sweden
- Alternative view: The tax income on Altitun pays for the Swedish participation in a whole 5-year EU framework program
- In this case the Swedish state was the biggest winner
- The loosers were the investors who bought shares in dot-com, telecom and opto companies

  (i.e. the institutions we pay high commission rates for looking after our pension savings!)

Altitun vs. Syntune 1

Altitun	Syntune
Integrated production model	Fabless model
Own growth, processing and packaging	Only design, test and qualification
Lots of equipment, some bought at a premium	Far less equipment, most bought at 5¢/$
Process tailored to design	Design tailored to process(es)
Outsourcing tried; failed	First run successful in each of 3 different fabs
Key IP licensed	Key IP licensed

Altitun vs. Syntune 2

Altitun	Syntune
Many new graduates hired (if you could get them)	Veterans come together again (you can't keep them away)
High initial costs, low marginal costs (laser with low R mirrors)	Low initial costs, high marginal costs (laser with high R mirrors)
High volume required for break even	Break even possible at low volume
Scaling difficult, scaling down may be impossible	Scaling comparatively easy
Risk: Servicing of high investment	Lack of control over fab(s)

SYNTUNE

Common sense

- Engage with a lead customer as early as possible, preferably from day 1! Get something tangible to engage them early. Powerpoint presentations will not take you very far…
- Disruptive technology will give initially reluctant customers => create your own market => win support from your customer's customers and have them to exert pressure on your customers
- Understand the value chain
- Do market surveys, talk to your customers but don't listen too much to them: not only market pull but also technology push is needed if you want to make a difference
- Fill up with money before you need it, don't be too greedy
- Aim for one size bigger, prepare for next step, make sure that your business is scalable

More common sense

- Timing is everything…
- What is right strategy at one time is not necessarily the best option at another time
- Focus on goals, be flexible about means
- Distinguish between what is core and what is peripheral
- You can do without a lot of things, but you can not do without paying customers
- Do what it takes to be taken seriously
- No pain, no gain. It takes 100% dedication…

Stay focused!

SYNTUNE

Lessons

- If something looks too good to be true, it probably is
- When companies start printing their own money (shares) the result is hyper-inflation
  Hyper-inflation always ends in tears
- Traditional multiples (like P/E and value/turnover) are more reliable in the long term than hyped expectations
- Trust your own market research (and common sense) more than “professional” market studies
- Life at the bottom of the value chain is more dangerous that higher up in the chain
- Don’t plan your future based on the potential value of options - Options remain worthless paper until the day they are converted to hard cash

WORKING AS AN INDEPENDENT CONSULTANT

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OVERVIEW

1. DEFINITION
2. TYPES OF WORK
3. WHY ARE THERE CONSULTANTS ?
4. PERSONAL EXPERIENCE
5. DIGRESSION: A COUPLE OF START-UPS
6. ADVICE

DEFINITION

An *independent* consultant is NOT:

- Employed full time by a consulting company.
- Working as a permanent freelancer.

An independent consultant is usually on his/her own, but may collaborate with other consultants.

The legal status of a consultant may vary according to local circumstances or the type of work.

VALUE PROPOSITION

What you sell: Your time

What you offer: Experience and knowledge

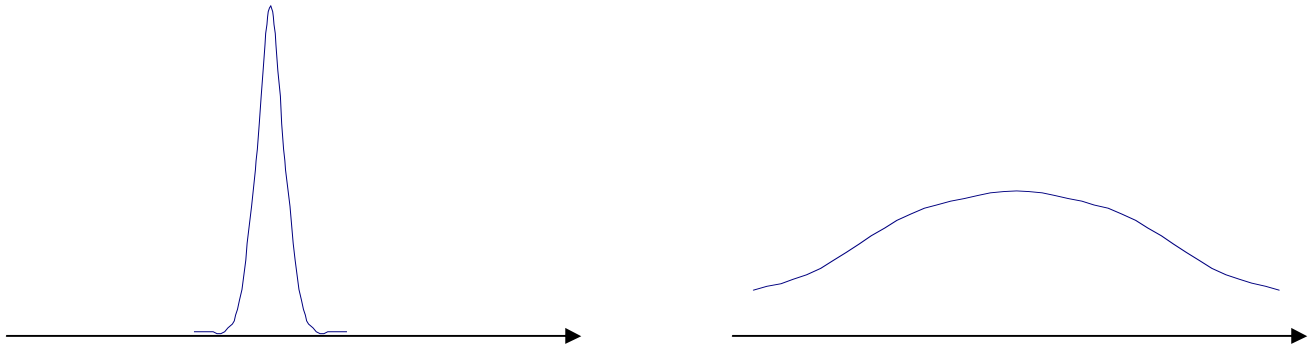
KEEP YOUR KNOWLEDGE UP TO DATE

Read journals/magazines

Attend conferences/exhibitions

Maintain contacts

KNOWLEDGE PROFILE



New graduate

Specialised jobs

Near retirement

Strategic advice

There are many types of jobs.

Consulting is often a mixture of different job types.

Composition of mixture changes over time.

JOB EXAMPLES

- Specialised design
- Development of software
- Setting up and operating special equipment
- Advice on purchasing
- Sourcing of components or equipment
- Proposal preparation
- Proposal evaluation

MORE JOB EXAMPLES

- Project management
- Project monitoring and evaluation
- Preparation of research programmes
- IP related issues, e.g. literature searches on prior art
- Technical due diligence
- Preparation of technical or market reports
- Strategic advice

ARE CONSULTANTS EXPENSIVE ?

Yes, if you just look at the hourly rate

BUT

This rate includes overhead costs such as:

Office costs, training (conferences), social costs, . . .

AND

Should include a premium for the flexibility it gives

THE COST INEQUALITY

Use a consultant if:

$$R(cust) \times T(cust) > R(cons) \times T(cons)$$

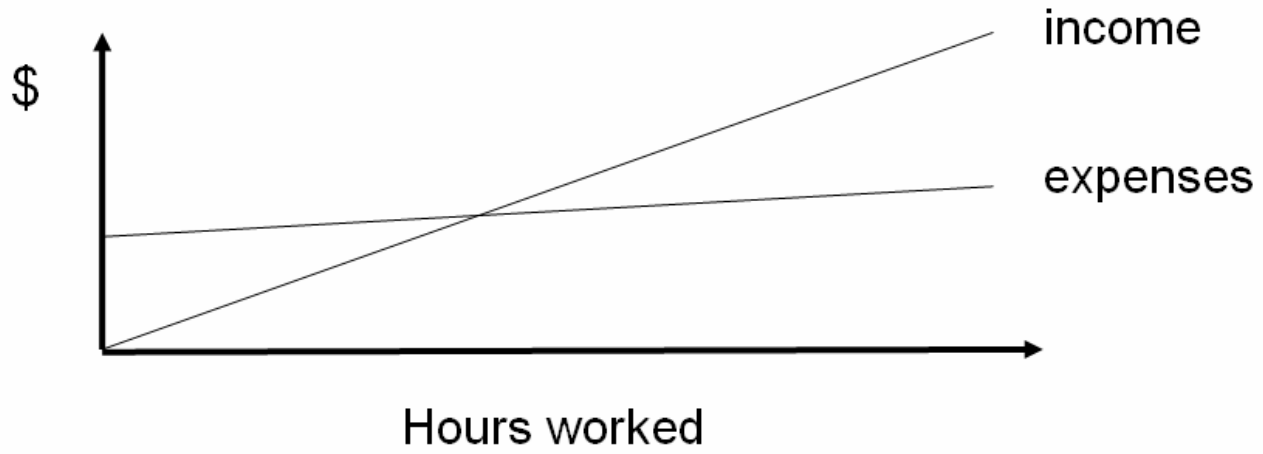
R(cust) is the customer's hourly rate, incl. overheads
T(cust) is the time the customer needs to do the job
R(cons) is the consultant's hourly rate
T(cons) is the time the consultant needs to do the job

$T(cust) \rightarrow \infty$ if the customer simply cannot do the job

A consultant may in turn use consultants for:

Bookkeeping, taxation matters, legal issues, . . .

SETTING A BUDGET



$$\text{net.inc} = (\text{rate} - \text{var.exp}) \times (\text{hours.av} - \text{O/H.time}) \times \text{load} - \text{fixed.exp} < \text{rate} \times \text{hours.av}$$

$$\text{rate} = \frac{\text{hours.av}}{\text{hours.av} - \text{O/H.time}} \times \frac{1}{\text{load}} \times \frac{\text{net.inc} + \text{fixed.exp}}{\text{hours.av}} + \text{var.exp}$$

The net income can be a small difference between two large numbers

The net average rate is (much) smaller than the (marginal) rate

WHAT IS THE RIGHT RATE ?

For all products and services:

The right rate is the rate that the market will accept.

Problem: How to find out what that is;
ebay does not work for consulting (yet)

Rate too high: Not enough customers

Rate too low: Not enough income

Issues related to price negotiation

HOW DID I END AS A CONSULTANT ?

PhD and 4 years as post-doc at T. U. Denmark

9 years in industrial R&D, 1983-1992
Plessey / Gec-Marconi / [Bookham]

Project manager for EU project from 1988

Independent consultant from 1993

Project manager for 5 further EU projects
last one finished in 2004

EU projects accounted for ~70% of 1993-2003 income

OTHER JOBS

- Proposal preparation
- Proposal and project evaluation
- Management of a national project
- Technical consulting, HP/Agilent and others
- Lecturing, short courses, book writing
- IP issues, technical reports
- Advisory board chair, Intune, Syntune, KPRC

UNPAID JOBS

There are lots of unpaid jobs

Should be considered as promotion / network building

Examples:

- Editor / associated editor of a journal
- Involvement in professional societies
- Conference committees
- Invited talks, review papers

Don’t get carried away !

ISSUES TO CONSIDER

- Job security vs independence ?
- Do you need a steady income (family, mortgage) ?
- Can you work on your own (discipline) ?
- Work from home (space, distractions) ?
- Uneven income and workload (social aspects) ?
- Can your family accept the implications ?
- What are your long term plans ?
- Not recommended as first job !

GENERAL ADVICE

- Networking is important
  - business cards, conferences, societies, website
- Consider the legal status
  - limited liability, sole trader, partnership
  - impact on liability, taxation, . . .
  - depends on type of work and local circumstances
- Watch out for NDAs and non-compete clauses
- Before taking the jump:
  - be sure you have customers
  - have a budget
  - have a plan B

FINAL ADVICE

- Don’t follow all advice blindly
  consider advice carefully
  (know the rules before you break them)
  work out what is best for you
  apply common sense