d-fine

Consulting at d-fine – analytical. technological. quantitative.

Dr Mark Beinker

CERN, April 11th, 2018

Agenda

Overview of d-fine

d-fine in a nutshell

d-fine DNA

» d-fine is a consultancy that carries out demanding projects with **analytical**, **technological** and **quantitative focus** with scientifically-based experts

Organisation

» d-fine is an **European consultancy** with offices in Berlin, Düsseldorf, Frankfurt, Munich, London, Vienna and Zürich
» d-fine grows sustainably and organically by **hiring graduates who start their professional career** with d-fine

Colleagues

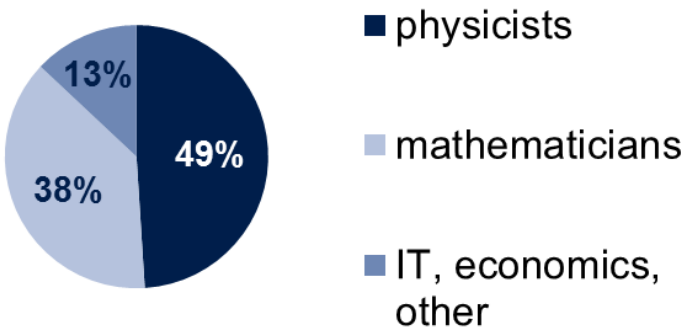
» Until 2020, **1,000** consultants will work at d-fine, mostly graduates in the fields of physics, mathematics and computer science
» Due to the consistently high qualifications and the similar educational background, d-fine achieves close **cohesion** and a very high level of **satisfaction** with its employees*

d-fine will continue to grow organically through hiring fresh talents.
In addition to the extremely interesting work, there are excellent career opportunities for new employees.

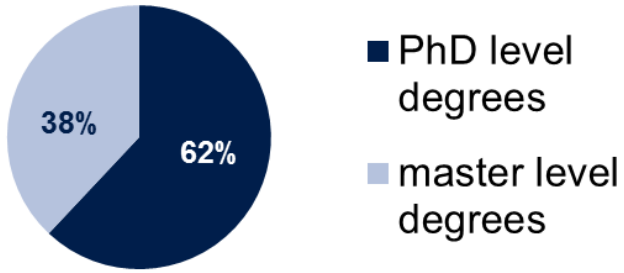
* According to kununu.com (as of May 30th, 2017)

The d-fine people…

Background in **technology, mathematics** and **science**



Highly qualified, usually in the **top percentile** during the university career



… and where they are working (selection of our customers)

Banks / financial sector

Insurance companies, e.g.

Asset Manager, e.g.

Energy industry, e.g.

Other industries, e.g.

Our employees usually work full-time at the customer‘s site – more than 150 companies of all sizes, from major enterprises to very specialized companies to start-ups

Small excursion

Physics vs. mathematical finance

Physics vs. mathematical finance – examples (1 / 3)

Physics

Thermodynamics: **Heat equation**

$$\frac{\partial T}{\partial t} - a\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2}\right) T = 0$$

t : time
T : temperature
a>0 : thermal diffusivity
x,y,z : spatial variables

Mathematical finance

Option pricing: **Black-Scholes equation**

$$\frac{\partial V}{\partial t} + \frac{1}{2}\sigma^2 S^2 \frac{\partial^2 V}{\partial S^2} + rS\frac{\partial V}{\partial S} - rV = 0$$

t : time
V : price of an option on an underlying (e.g. a stock)
S : price of the underlying
σ : volatility (variance) of the underlying
r : risk free rate

Same mathematics to solve different problems

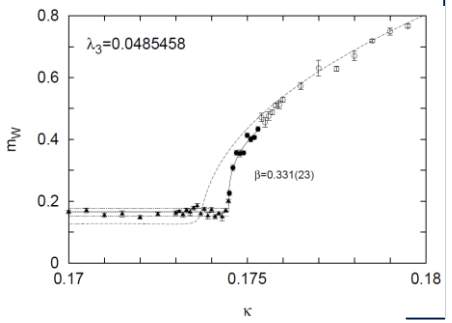
Physics vs. mathematical finance – examples (2 / 3)

Physics

Elementary particle physics: solving the path integral of pure **(lattice) gauge theory**

$$\langle \mathcal{O}(U_\mu) \rangle_T = \frac{1}{Z} \int_{per} \mathcal{D}U \, \mathcal{O}(U_\mu) \exp\{-S_G[U_\mu]\}$$

with $$Z = \int_{per} \mathcal{D}U \exp\{-S_G[U_\mu]\} \ .$$



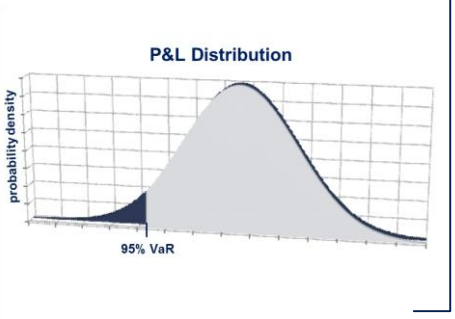
→ so-called thermalization of the configuration by Monte Carlo simulation of the gauge fields (e.g. gluons)

Mathematical finance

Risk Control: Value at Risk (VaR) computation in the context of **market risk**

$$\mathrm{VaR}_F(S, \rho, P_a, t, \Delta t) \cong -a\sqrt{\Delta t} \sqrt{\sum_{i,j=1}^{n} \Delta_i S_i(t) \sigma_i \rho_{i,j} \Delta_j S_j(t) \sigma_j}$$

with $$S_i(T) = S_i(t) \, e^{\left(\mu_i - \sigma_i^2/2\right)\Delta t + Y_i} \qquad i = 1, \mathrm{K}\ , n$$



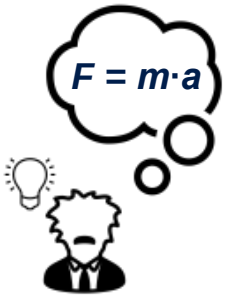
→ Monte Carlo simulation of the risk factors (e.g. stock prices)

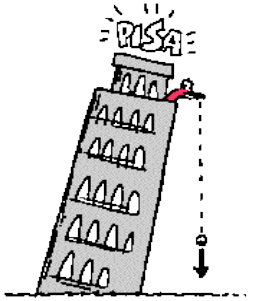
Same numerical methods to solve different problems

Physics vs. mathematical finance – examples (3 / 3)

Physics

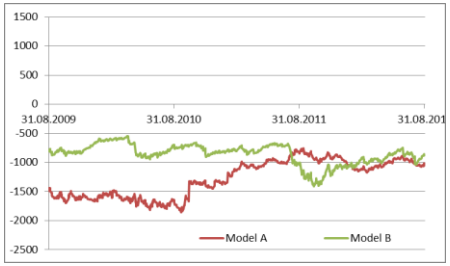
Physics in general, e.g. classical mechanics: **model validation.** Testing a theory by experiments

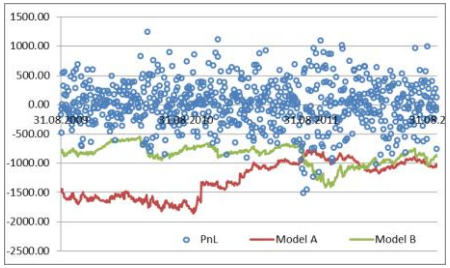




Mathematical finance

Risk Control: **model validation**. Testing a (marked) risk model by “back testing”





Same validation criteria: Check the quality of a model by testing it against “reality”

d-fine projects

The typical d-fine project…

» …does not exist!

» Instead, there are a great diversity and variety – especially from an employee perspective!

Duration

» Ranging from a few **days**, e.g. a proof of concept to the extend of 10-20 days,
» to several **weeks**, e.g. writing a business concept,
» up to several **months**, e.g. the realization of a new analysis platform.

Size

» Ranging from **1-2 employees**, e.g. for very special topics or pre studies,
» to **5-10 employees**, e.g. for model development or business analysis,
» up to **40++ employees**, e.g. for projects with business + technical components.

Content

» Ranging from **business analysis**, e.g. specification of a rating methodology,
» to **technology**, e.g. application of Artificial Intelligence or Big Data Analysis,
» to **project management**, e.g. quality, test and release management.

Due to the wide range of d-fine projects and the diverse roles within the projects, the learning curves of our employees do not flatten even after many years.

Example 1 Enable a client to hedge against early termination rights of long-term loans

Starting position

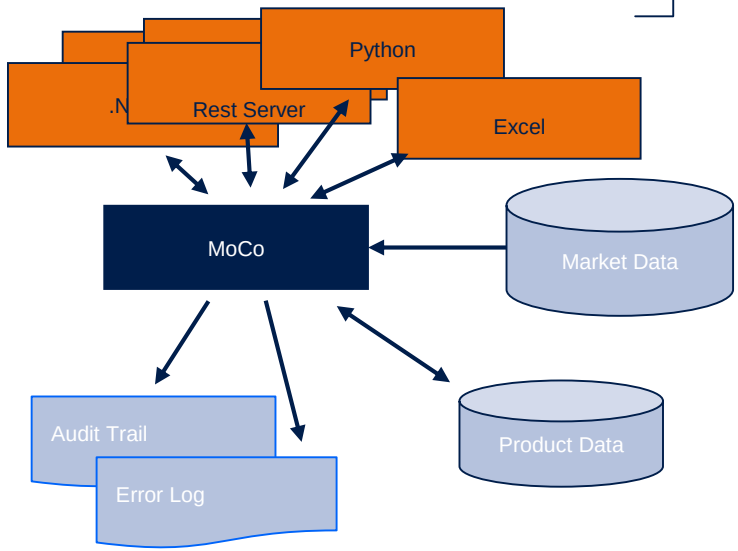
Our customer, a German bank, wants to give long-term loans to their clients (mainly small businesses and private persons). Since these clients have the legal right to terminate the loans at any time after ten years, these options need to hedged. So far, the client haven't traded these options

Project objective

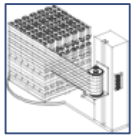
The client was aware of d-fine's proprietary in-house pricing tool MoCA and wanted to license a special version of that tool customized to the clients' needs. In addition, an appropriate Hedging methodology needed to be specified.

Role of d-fine

Analysis of various hedging approaches, from implementing a new swaption trading desk to static hedging or reporting only
Moderation of in-house discussions
Specification and implementation of required enhancement of MoCA (mainly sensitivity and VaR scenarios)
Rollout of MoCA and training of client's staff



Example 2 Using deep neural networks to increase efficiency of image recognition for inspection of pharmaceutical products



Starting position

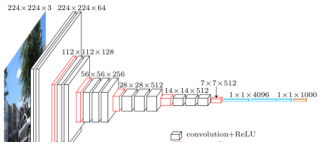
Our customer produces inspection machines to identify automatically damaged or otherwise insufficient probes of liquid pharmaceutical products in small bottles by analysing rotation images, using mainly classical methods.

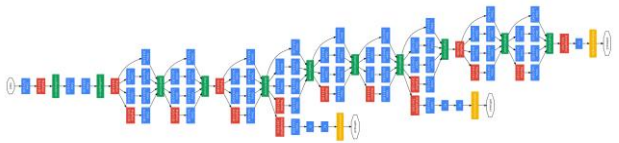
Project objective

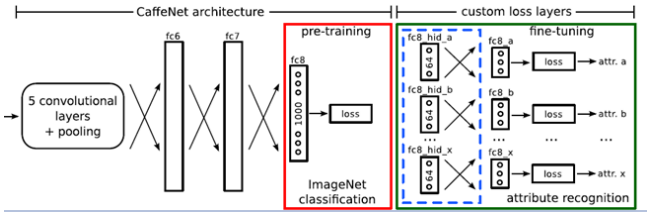
Explore the potential of various machine learning techniques to improve the efficiency of the inspection rate by reducing the failure rate

Role of d-fine

Evaluation of various DL architectures (using TensorFlow) and AI benchmarks for image recognition.
Selection and intelligent initialisation of net structure.
Optimization of training process, especially avoiding overfitting due to small sample size.
Data augmentation to increase sample size and robustness of results.
Integration of best performing method on (virtual) productive environment.







Example 3 Teaching from the financial crisis – risk-based system for a financial services regulator

Starting position

Due to growing stability concerns on the financial markets, the Irish financial services regulator (Central Bank of Ireland) decided in 2010 to establish a more risk-based supervisory process with a focus on system-relevant institutions.

Project objective

Implementation of a new software solution for more than 400 supervisors for the daily monitoring of more than 10,000 financial service providers.
Ensuring the highest standards in terms of stability, extensibility and information security.

Role of d-fine

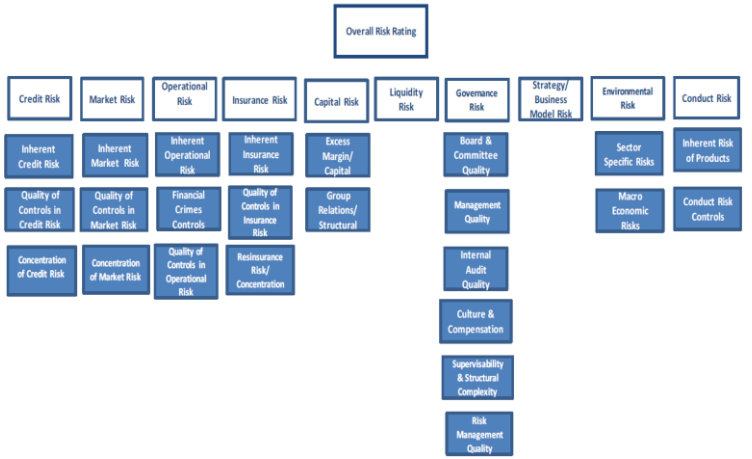
Initial analysis of requirements and implementation of the system.

Provision of sound knowledge of

» regulatory processes,

» risk methodology and

» excellent IT architecture design.



*Risk-based supervision powered by PRISM (*Probability Risk and Impact SysteM)*

* https://www.centralbank.ie/docs/default-source/Regulation/supervision/prism/gns-4-1-2-2-5-prism-explained-feb-2016.pdf?sfvrsn=2

d-fine

Example 4 Make one out of two – post merger integration of two banks

Starting position

To complement its own business, our customer, a large German real estate bank, has taken over a bank which had to be sold by the (old) parent company on the basis of an EU requirement.

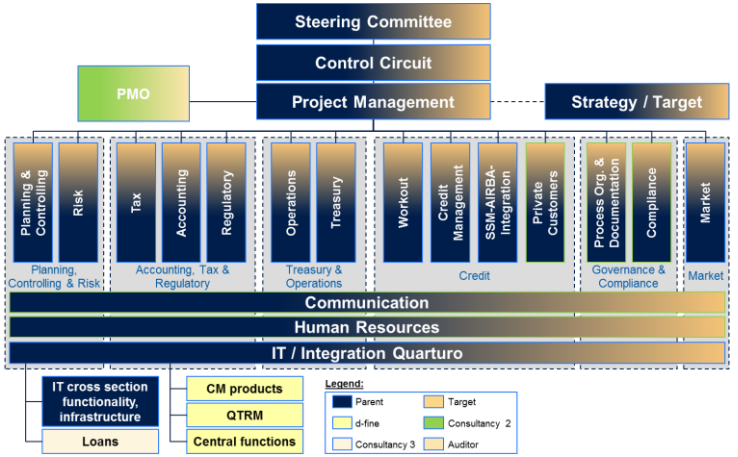
Project objective

Integration of the acquired institute on process level and technical level into the (new) bank group in order to meet regulatory requirements (e.g. reporting and accounting) and to streamline processes.

Role of d-fine

Management and execution of 3 out of 5 IT subprojects with strong attention to audit and revision-compatible documentation:

- Migration of the capital markets trading portfolio
- Migration or unification of transaction register, coverage calculation, collateral register, payment transactions
- Quality, test, and release management



Organigram (schematic) of the project structure

What we offer to (new) employees

d-fine offers attractive compensation and work-life balance

Compen-sation

- Competitive fixed **salary** plus **bonus**
- **Accident insurance** and pension fund
- **Company car program**

Work-Life-Balance

- **Free choice of place of residence** all over Germany (d-fine BLUE)
  - You may live wherever you like, we take care of your business travel and accommodation.
- Possibility of projects **close to home**
  - d-fine BLUE: Temporary “Local Contract”, i.e. working in Rhine-Main area or in Munich area, possible from level “Senior Consultant” onward
  - d-fine ORANGE: Working in Rhine-Main area or Rhineland area, possible from the first day at d-fine
- Extra program “**Childcare**”
  - Support when looking for suitable child care or emergency care in almost all big German cities

It’s the whole package that counts – work content, work-life balance, compensation!

For newly hired employees: Intensive training and supervision

Training on d-fine entry

- Approx. **4 weeks of internal initial skill adaption training** in the beginning
- My role as a professional (soft skill training)
- Advanced IT curriculum
- Basics of banking
- Practical trainings on typical trading or risk management systems, e.g. Front Arena
- Business trainings, covering various topics, e.g. credit risk, market risk, basics of valuation, capital markets business, accounting, regulation, …
- Further trainings: essential SQL, essential PowerPoint
- Internal processes (travelling expenses, time reports, HR tool, …)
- Other stuff (notebook, internal Wiki, data protection, …)

Mentoring

- **Mentoring program** during the first two to three years
- Supervision by a manager or senior manager
- Contact person for personal development and potential problems

The career entry is also facilitated by an extremely collegial corporate culture: open handling of hierarchies, from intern to partner

d-fine offers “high end training” while working full-time*

University of Oxford
- » M.Sc. or Diploma in Mathematical Finance
- » Duration approx. 2.5 years
- » Modules take place in Oxford

Mannheim Business School
- » Part time MBA
- » Duration approx. 2 years
- » Modules take place in Mannheim and abroad (e.g. USA)

European Business School
- » Executive MBA
- » Duration approx. 2 years
- » Modules take place near Wiesbaden and in Durham (UK)

HHL Leipzig Graduate School of Management
- » Part-Time MBA
- » Duration approx. 2 years
- » Modules take place in Leipzig or Cologne and abroad (Boston)

* These trainings will be offered for the d-fine BLUE career track only. The d-fine ORANGE career track contains different training offerings.

From training to trainer

Trainings

- **CFA** (Chartered Financial Analyst, optional certification is possible)
- **FRM** (Financial Risk Manager, optional certification is possible)
- **Actuary** *
- Additional internal and external trainings, e.g. on finance, soft skills, software, project management, …

Confe-rences

Participation / presentations at **international conferences** and seminars, e.g.

- European Credit Risk Conference (Vienna)
- Annual Capital Allocation and Management Conference (London)
- RiskMinds Conference (Amsterdam) & QuantMinds Conference (Lissabon)
- Testing & Finance Conference (Frankfurt)

Coopera-tions with universities

Cooperation with **leading universities**

- FSFM – regular holding of the lecture Stochastics I
- Ruprecht-Karls-University Heidelberg – annual lecture week
- Goethe-University Frankfurt am Main – individual talks and lectures
- HU Berlin – supported by d-fine PhD scholarship since 2012

Life long learning (and teaching) – not just a phrase, but the reality at d-fine

* This training will be offered for the d-fine BLUE career track only.

d-fine and corporate social responsibility – education

d-fine supports science by…

…scholarships

Wir fördern das Deutschland STIPENDIUM

» **TU Darmstadt** and **Cologne University**: Parallel support of several students by a so-called Deutschland-stipendium

HUMBOLDT-UNIVERSITÄT ZU BERLIN

» **HU Berlin**: Support of PhD students in mathematical finance by the **d-fine PhD Scholarship** “Optimization in Financial Markets”

…sponsorships (selection only)

VWI ESTIEM Karlsruhe

MNU 2018 BUNDESKONGRESS MÜNCHEN-GARCHING

OPON 2018

dts 2015 BERLIN

STUNT Studentische Unternehmensberatung Bielefeld

LATTICE 13 JULY 29 – AUGUST 03 2013 MAINZ, GERMANY

…long-running sponsorships

DPG

Mathematik-Olympiade

HGSFP

FIT FOR TUMORROW

IBInvest

Deutsches Jungforscher Netzwerk juFORUM e.V.

BERLINER BÖRSENKREIS

…cooperations

MCnet

ITN STRIKE

ITN STRONGnet

Σ VBFWM

Frankfurt School of Finance & Management

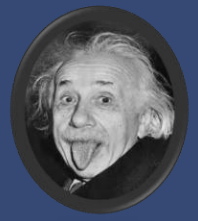
German Excellence. Global Relevance.

Who we are looking for

... and why physicists, mathematicians and (business) informatics fulfil most of them

Excellent analytical / methodical skills

- Stochastic methods
- Monte Carlo methods
- Differential equations

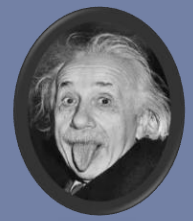


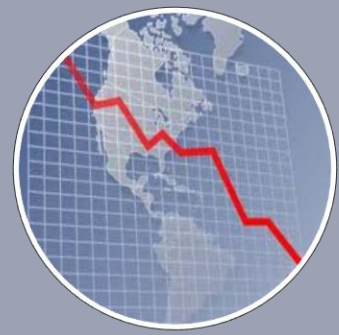
Strong IT know-how

- Programming
- Numerical methods
- Data bases

Good communi-cation skills, high social competence

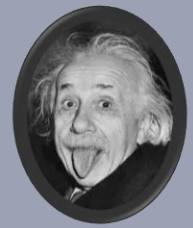
- Presentation skills
- (Simple) representation of complex topics
- Very good English skills





Good understanding of economics and business processes

- Interest in financial markets and economy
- Mechanics of financial markets
- Regulatory requirements



?

d-fine

Additional ways to learn more about d-fine

Workshops

- Several times a year, 2-3 days, cool locations
- Exciting topics, joint group work
- For advanced students / PhD candidates / post-docs
- Requires a full application
- d-fine bears all costs

d-fine Days

- 4 times a year in different places, each in the hotel, each ½ day
- Lots of interesting lectures and time for questions
- For students / PhD candidates / post-docs
- Requires a registration
- Arrival will be refunded after consultation

d-fine Dinner

- Several times a year in the evening
- With delicious food and plenty of time for questions
- For students / PhD candidates / post-docs
- Requires a registration
- Arrival will be refunded after consultation

There are many ways to learn even more about d-fine. Use them!
Current dates can be found at http://www.d-fine.com/en_DE/career/events-for-university-graduates/

Contact

Dr Mark Beinker
Partner
Tel +49 69 90737-305
Mobile +49 151 14819-305
E-Mail mark.beinker@d-fine.com

d-fine

Berlin
Düsseldorf
Frankfurt
London
München
Wien
Zürich

Zentrale

d-fine GmbH
An der Hauptwache 7
D-60313 Frankfurt/Main

Tel +49 69 90737-0
Fax +49 69 90737-200

www.d-fine.com


d—fine