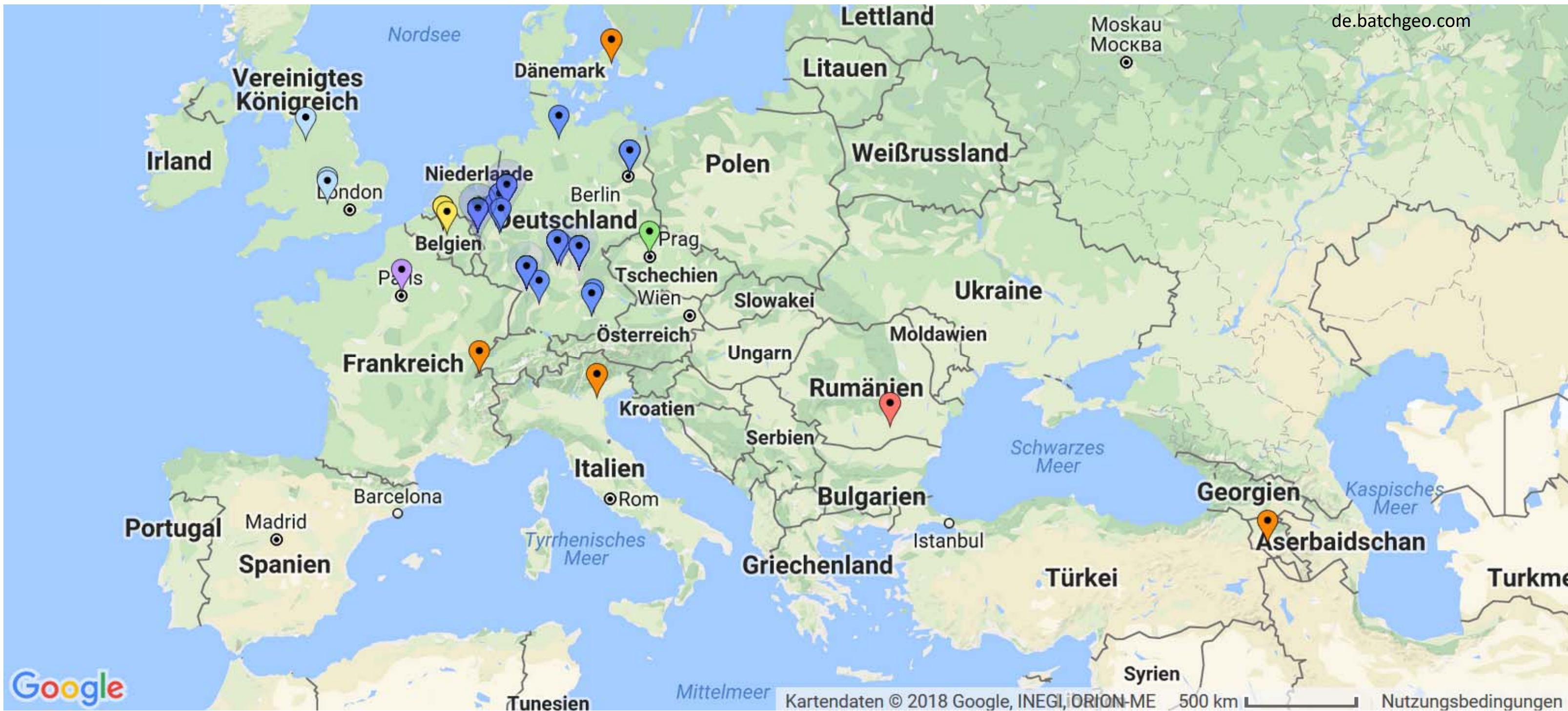


Welcome! Big Data Science in Astroparticle Research



Martin Erdmann, Andreas Haungs

WLAN access

Eduroam

Guests without Eduroam use MOPS

Login: BDSAR Passwort: hohoxe



WLAN Login (nur Android)



Coffee, eat

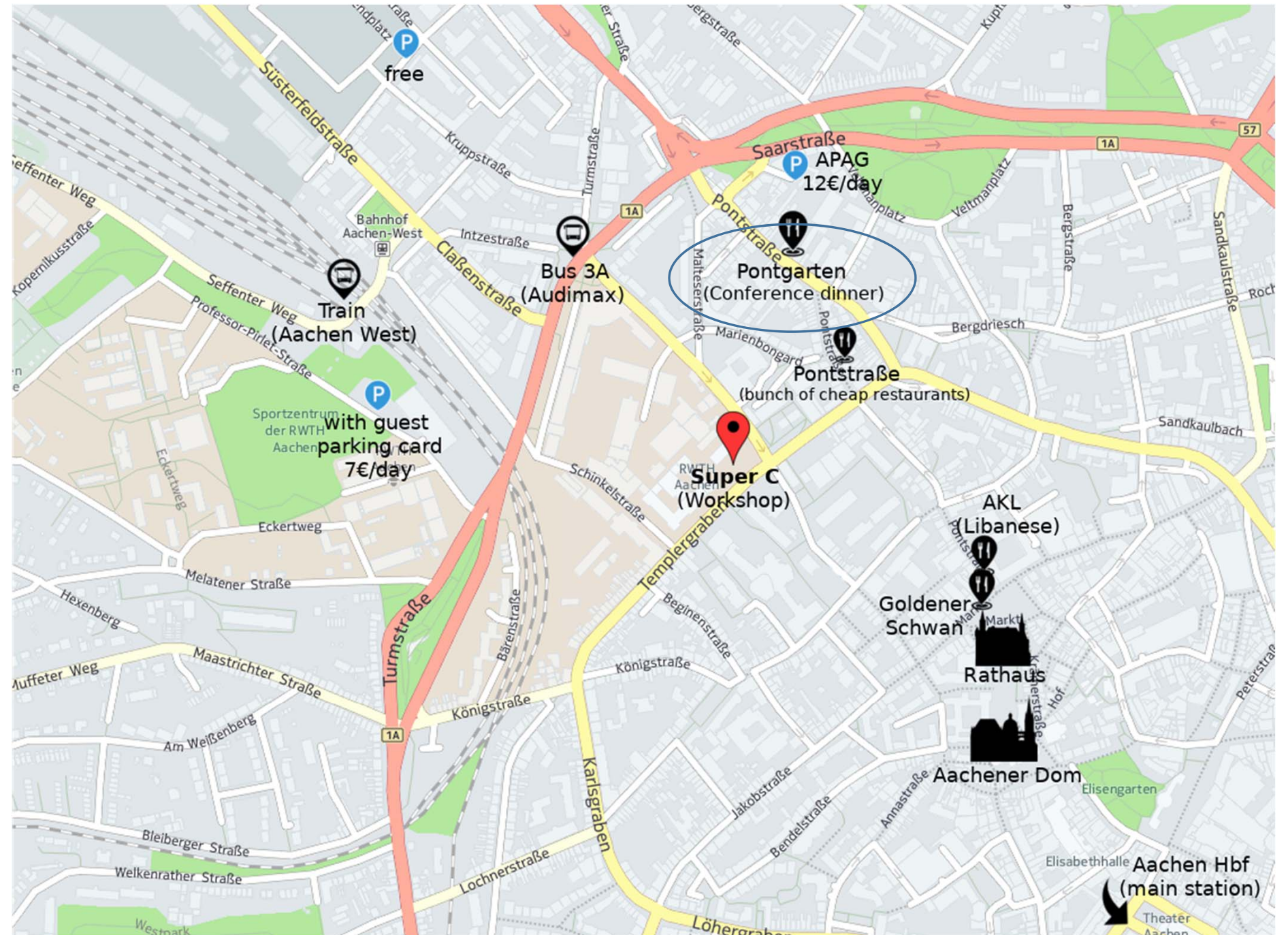
Yes, we'll have coffee breaks



19-Feb Dinner of your choice

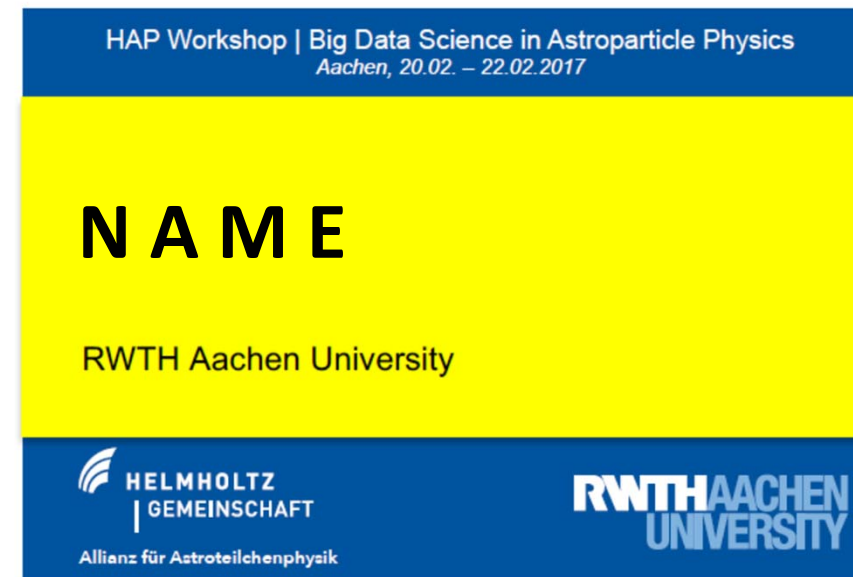
20-Feb Lunch of your choice

20-Feb Conference Dinner



Martin Erdmann, Andreas Haungs

Local organization



Workshop organizers: Florian Briechle, Martin Erdmann, Jonas Glombitza, Andreas Haungs, Yannik Rath, Marcus Wirtz

Reception desk: Gerlinde Schmidt

VISPA for tutorial: Benjamin Fischer, Erik Geiser, Marcel Rieger, Felix Schlüter, Martin Urban

New paradigm in physics

- Up to now: **physics laws & mathematics** are basis for algorithm development → machine learning with physicist's favorite observables
- New: **machines exploit data deeper** than physicist's algorithms so far

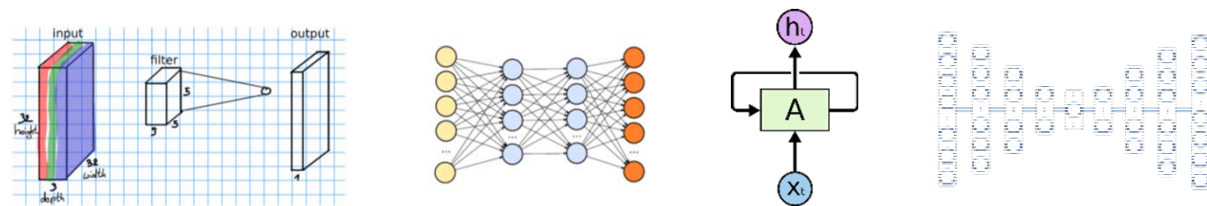
- **Together we ought to keep working on the fundamental change to include machines in our daily work**



1st Workshop 20.-22. Feb-2017

Deep Learning

Network concepts & applications



Supervised machine learning

Tutorial: fully connected, convolutional

Open Data

Existing: The Virtual Observatory (Astronomy)

KCDC Kascade data preservation & publication

Future: Big data challenges in radio astronomy (SKA)

BMBF: Accelerating the Digital Transformation
in Science → *message: do it!*

Evaluation

Discussion on future

Meet again in 1 year (today!)

Reputation of Software work

...

Today: 2nd Workshop 19.-21. Feb-2018

Deep Learning

- Supervised & unsupervised machine learning
- Causality & stability of networks
- Network training with simulations $\neq$ data

Tutorial: 14:15 basics & convolutional, 16:15 adversarial

Open Data

Projects envisioned

- National initiatives: research data alliance, data center, application for funds
- International: initiatives in United Kingdom

Evaluation: Tuesday 16:00

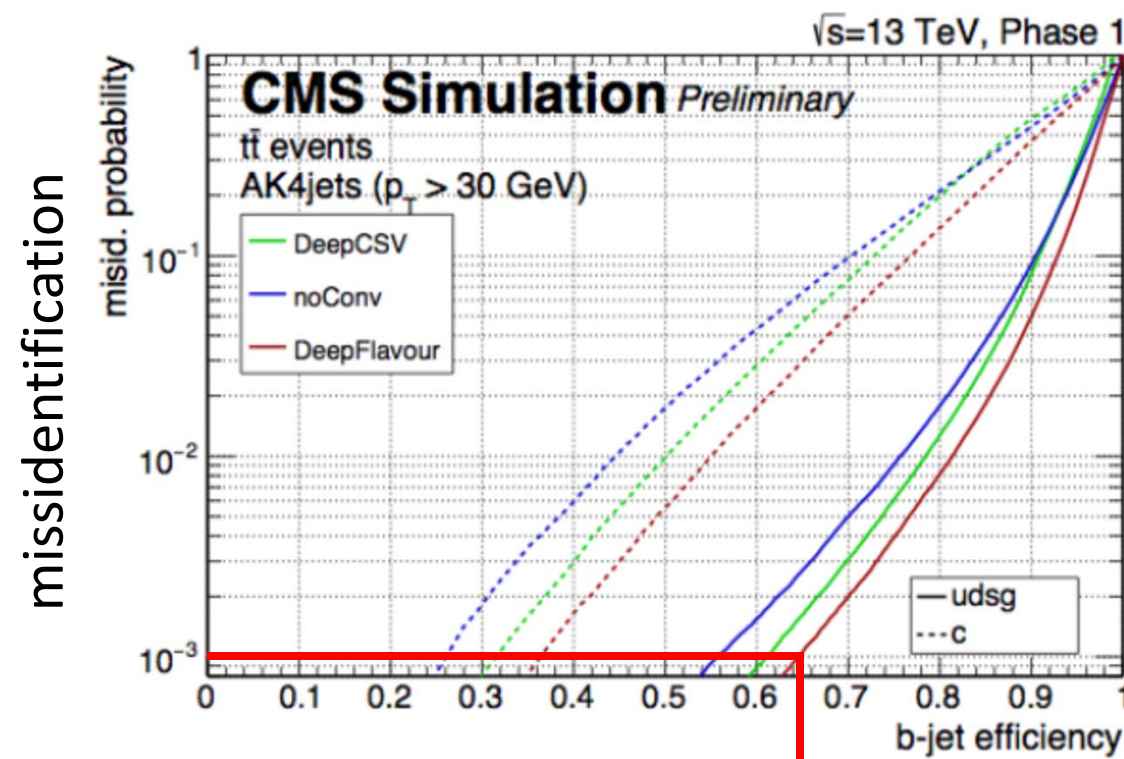
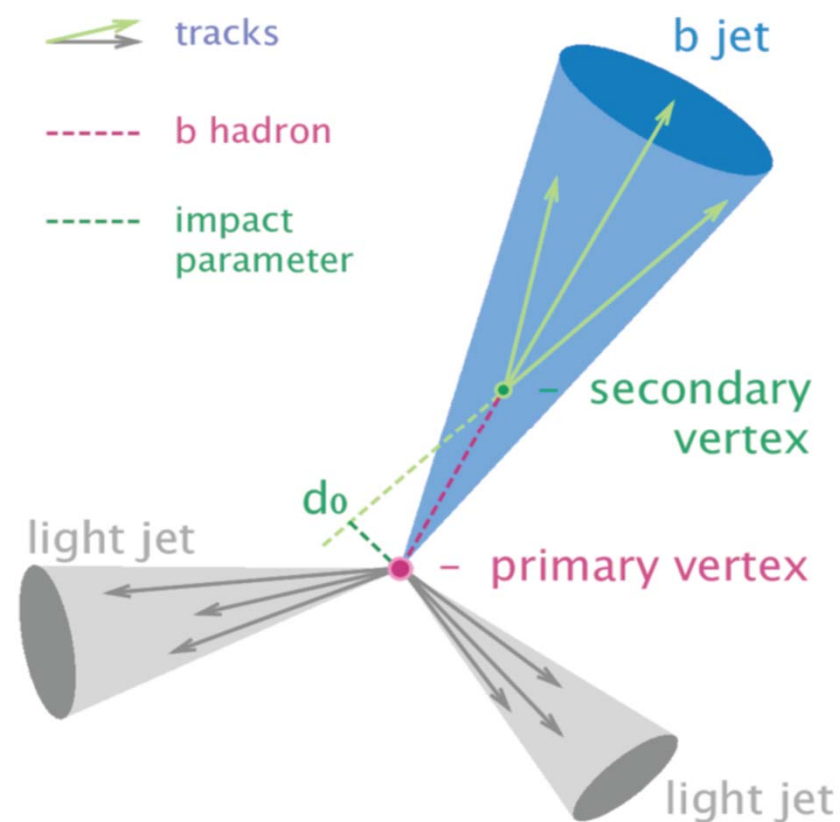
Discussion on future: Wednesday

lots of discussions & initiatives happend in 2017

Supervised deep learning

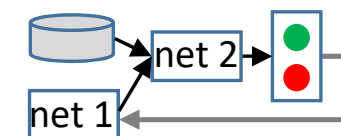
Keynote Tuesday 9:15: Dr. Markus Stoye

DeepJet: jet classification with the CMS experiment



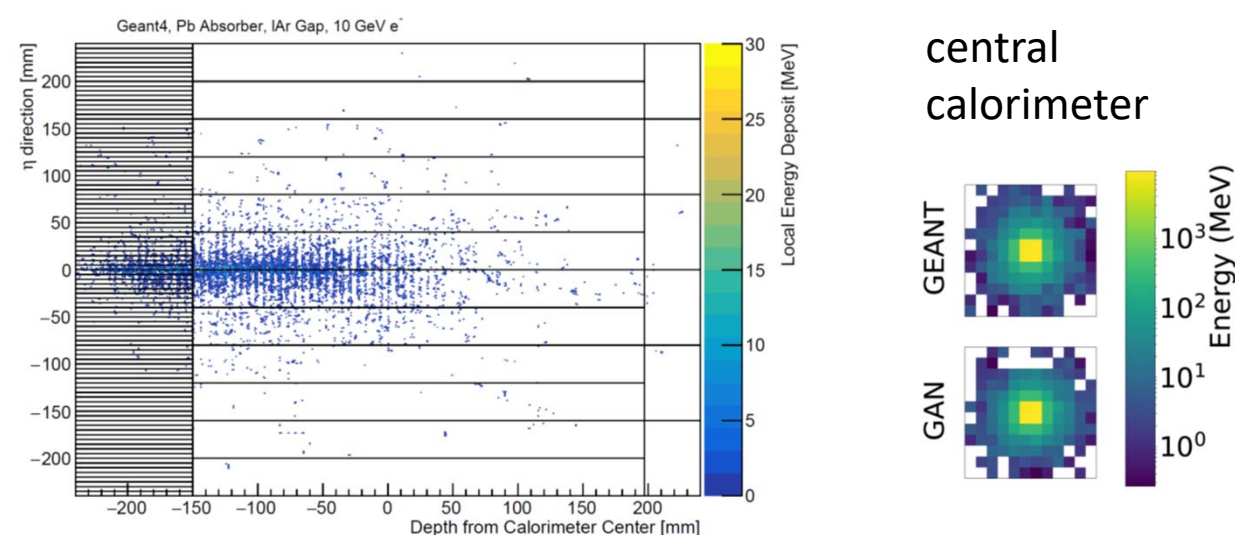
+10% identification efficiency

Unsupervised: Generative adversarial networks 'GAN'



M. Paganinia, L. de Oliveira, B. Nachman, PRD 97 (2018) 014021

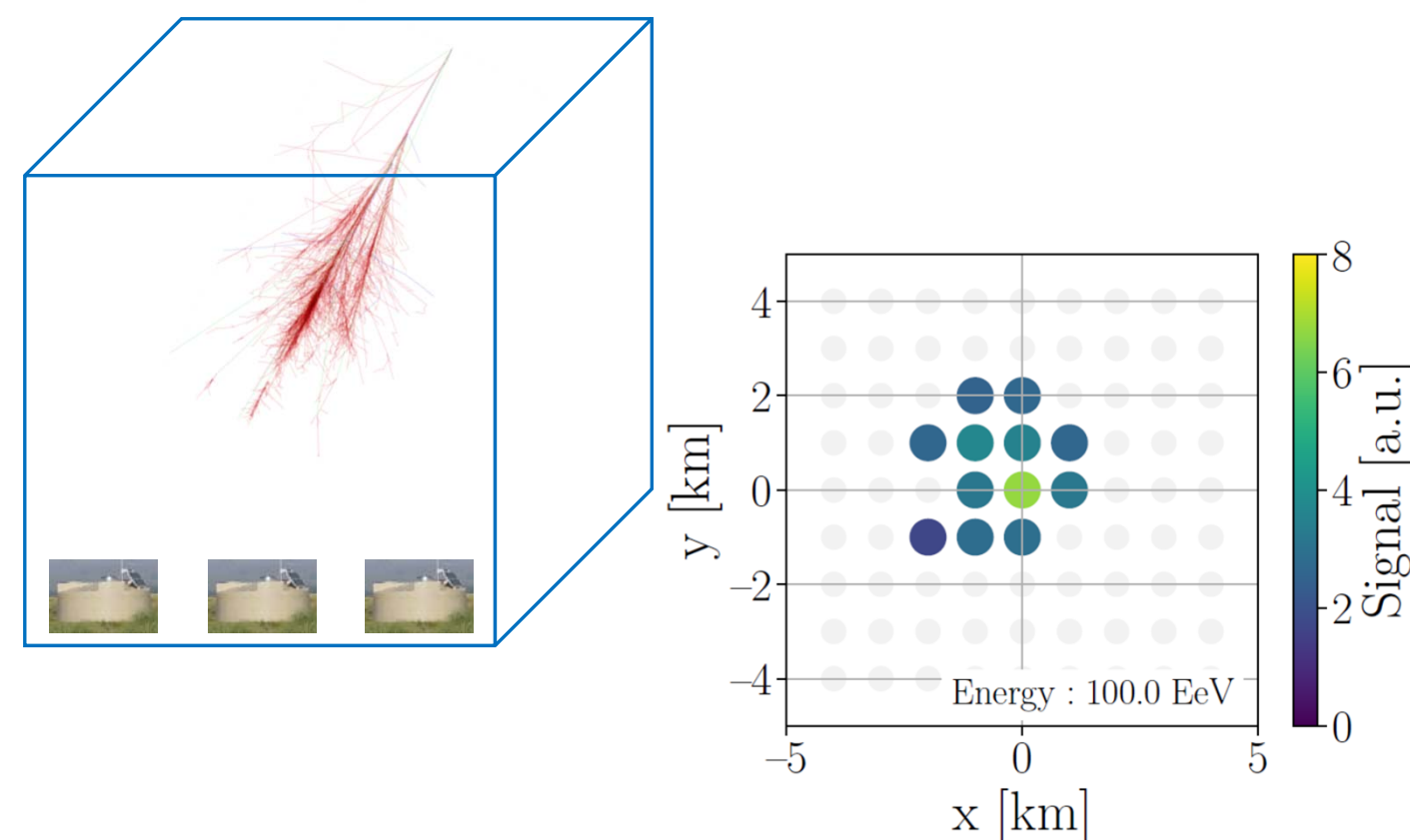
Calorimeter simulations



Generation Method	Hardware	milliseconds/shower
GEANT4	CPU	1772
GAN	CPU	2.03
	GPU	0.012

M. E., L. Geiger, J. Glombitza, D. Schmidt, arXiv:1802.03325

Air shower simulations

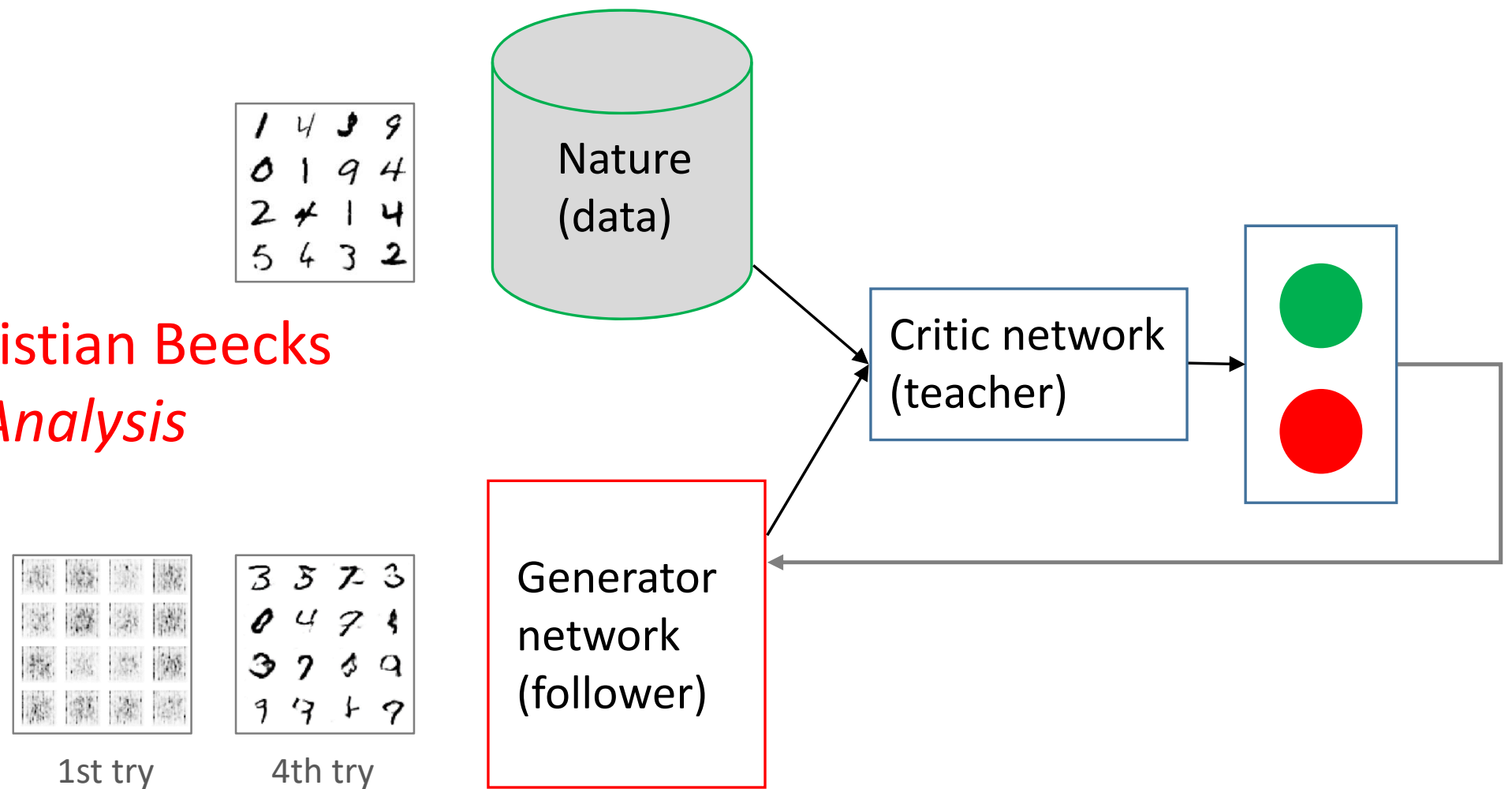


CORSIKA: 1 air shower / day / CPU >> GAN

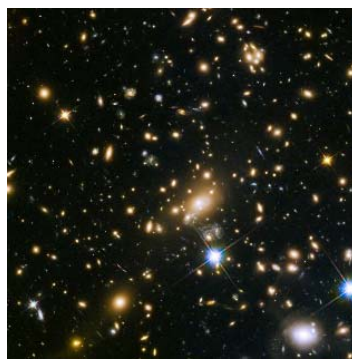
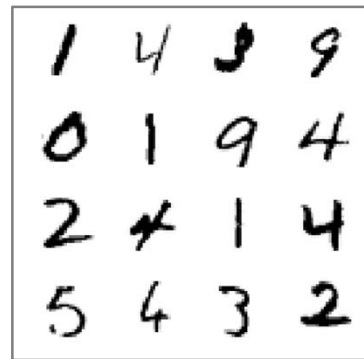
Transport of probability density functions (pdf)

Tutorial Monday 16:15 Jonas Glombitza:
Unsupervised adversarial training

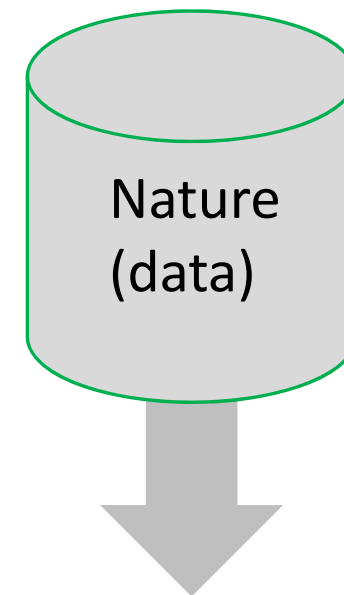
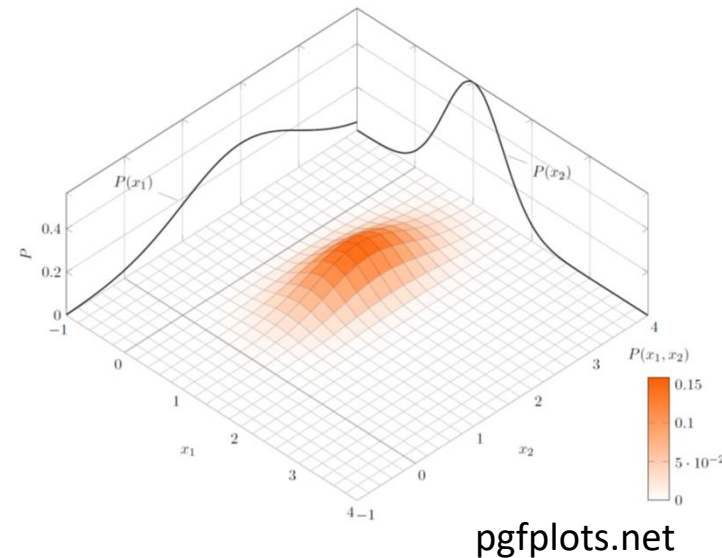
Keynote Tuesday 11:10: Dr. Christian Beecks
Efficient Similarity Search and Analysis



Causality & adversarial: derive physics from pdf?



ESA/Hubble



Generator
network
(holds pdf
of data)

Discuss with you
future prospects:

Reverse
engineering?

PHYL

Physics laws

$$F = m a$$
$$E = m c^2$$

Keynote Tuesday 14:30: Dr. Wojciech Samek
Making Deep Neural Networks Transparent

Initiative for a National Data Centre for Astroparticle Physics

Initiative for a Data and Analysis Centre for Astroparticle Physics
Karlsruhe, 2-Nov-2017
2 November 2017
Karlsruhe Institute of Technology (KIT)
Europe/Berlin timezone

Overview
Scientific Programme
Timetable
Contribution List
Author List
Registration
[Registration Form](#)
Participant List



[Campus Plan](#)

for the slides, please click left on "Contribution List"!!

preliminary Agenda: click left on 'Timetable' or below on 'Poster'

Organizing Committee: Andreas Haungs (KIT), Christian Stegmann (DESY), Achim Streit (KIT), Sabine Bucher (KIT)

Discuss with you
future prospects:

Goals

- Data catalogues & computing resources
- Analysis & simulations
- User interface to data & analysis
- User support & user platforms

Keynote Wednesday 9:00: Dr. Peter Wittenburg, *Research Data Alliance*

Keynote Wednesday 9:45: Prof. Tony Hey, *Big scientific data and Data Science (UK)*

Workshop Program

	Date	Title	Presenter
Deep Learning	Monday 14:00	Welcome, Organisational Matters	Prof. Martin Erdmann
	Monday 14:15	Tutorial Deep Networks: Introduction, Fully-Connected, Convolutional Architectures	Mr. Yannik Rath
	Monday 16:00	Tutorial on Adversarial Generative Networks, Wasserstein distance	Mr. Jonas Glombitza
	Tuesday 09:00	Message of the Vice-Rector for Research and Structure of the RWTH Aachen University	Prof. Rudolf Mathar
	Tuesday 09:15	DeepJet: jet classification with the CMS experiment	Dr. Markus Stoye
	Tuesday 10:00	Application of machine learning methods to H.E.S.S. data analysis	Dr. Idan Shilon
	Tuesday 10:20	Event Reconstruction in IceCube using Deep Learning Techniques	Mr. Mirco Huennefeld
	Tuesday 11:10	Efficient Similarity Search and Analysis	Dr. Christian Beecks
	Tuesday 11:55	Generating and refining particle detector simulations using the Wasserstein distance in adversarial networks	Mr. Lukas Geiger
	Tuesday 12:15	HexagDLy - Hexagonal Convolutions with PyTorch	Mr. Tim Lukas Holch
	Tuesday 12:35	Deep machine learning implementation in FPGA	Dr. Michele Caselle
	Tuesday 14:30	Making Deep Neural Networks Transparent	Dr. Wojciech. Samek
	Tuesday 15:15	Denoising radio traces with autoencoder on Tunka-Rex experiment	Dr. Dmitriy Kostunin
	Tuesday 15:35	Deep Neural Network searching for an air shower radio signal	Dr. Radomir Smida
	Tuesday 16:00	Evaluation (web)	
	Tuesday 16:30	Investigating deep convolutional autoencoders to mitigate systematic differences between data and simulations	Dr. Stefan Geißelöder
	Tuesday 16:50	Using Deep Learning to optimise a SUSY search at CMS	Dr. Adam Elwood
	Tuesday 17:00	Introduction to Open Data	Prof. Uli Katz
	Tuesday 17:20	FACT Open Data Release	Mr. Maximilian Nöthe
	Tuesday 19:00-22:00	Workshop Dinner Pontgarten	
Open Data	Wednesday 09:00	Research Data Alliance	Dr. Peter Wittenburg
	Wednesday 09:45	Big scientific data and Data Science	Prof. Tony Hey
	Wednesday 11:00	Progress on analysis and data centre for astroparticle physics	Dr. Andreas Haungs
	Wednesday 11:20	Concrete goals for (Astro-)particle progress related to Big Data Science	Prof. Alexander Schmidt
	Wednesday 11:40	Discussion on Big Data Science in Astroparticle Research	Erdmann, Haungs