# Densities mixture unfolding for heavy ion jet spectra

Philip Hackstock

TU Vienna

August, 9, 2016

TECHNISCHE UNIVERSITÄT WIEN
Vienna | Austria

# Overview

- Unfolding in general
- Densities mixture unfolding
- Summer project status quo & plans

# The unfolding problem

- Measurements (e.g. $dN/dp_T$ vs. $p_T$) can be viewed as a convolution of the truth, a response and acceptance function
- Detectors are not perfect
- In vector notation (and in an ideal world):

$$\vec{m} = \bar{X}\vec{t}$$
$$\bar{X}^{-1}\vec{m} = \vec{t}$$

- Inversion of $\bar{X}$ generally not possible

# Migration Matrix

- created on the base of simulations
- connects measured and 'true' values
- literal redistribution just an analogy

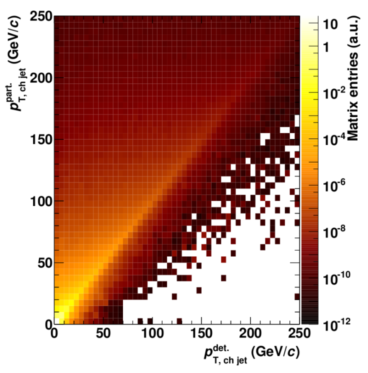


Figure: Rudiger Haake, dissertation, 2015

# Mixture Densities unfolding

- Method by Nikolai Gagunashvili from University of Iceland
- Starting point is experimentally measured histogram $\boldsymbol{P}$
- Representation as linear combination with $s$ components:
  $\boldsymbol{P}(x^{'}) = \sum_{i=1}^{s} \int_{\Omega} dx K_i(x, \lambda_i) A(x) R(x^{'}|x)$
  $\Omega$: domain of x
  $K_i$: probability density function
  $A(x)$: detector's acceptance function
  $R(x^{'}|x)$: detector's response function

# MDU II

- 'Least square rebuild' histogram:
  $\boldsymbol{P}(x^{'}) = \sum_{i=1}^{s} w_i \int_{\Omega} dx K_i(x, \lambda_i) A(x) R(x^{'}|x)$
  $w_i$: weights for the components
- Find the weights $w_i$ by iterative least square fit
- Truth is then given: $\boldsymbol{p}(x) = \sum_{i=1}^{s} w_i K_i(x; \lambda_i)$

# My tasks

- Fully understand Gagunashvili's code
- Speed up the process with parallel computing
- Adapt it for heavy ion jet spectra for ALICE

# References

- Ruediger Haake's dissertation:
  Measurement of charged jets in p-Pb collisions
- Densities mixture unfolding paper by Nikolai Gagunashvili:
  1410.1586
- Additional information on unfolding at ATLAS:
  1104.2962v1

# Contacts

Philip Hackstock
philip.hackstock@cern.ch
e1253210@student.tuwien.ac.at