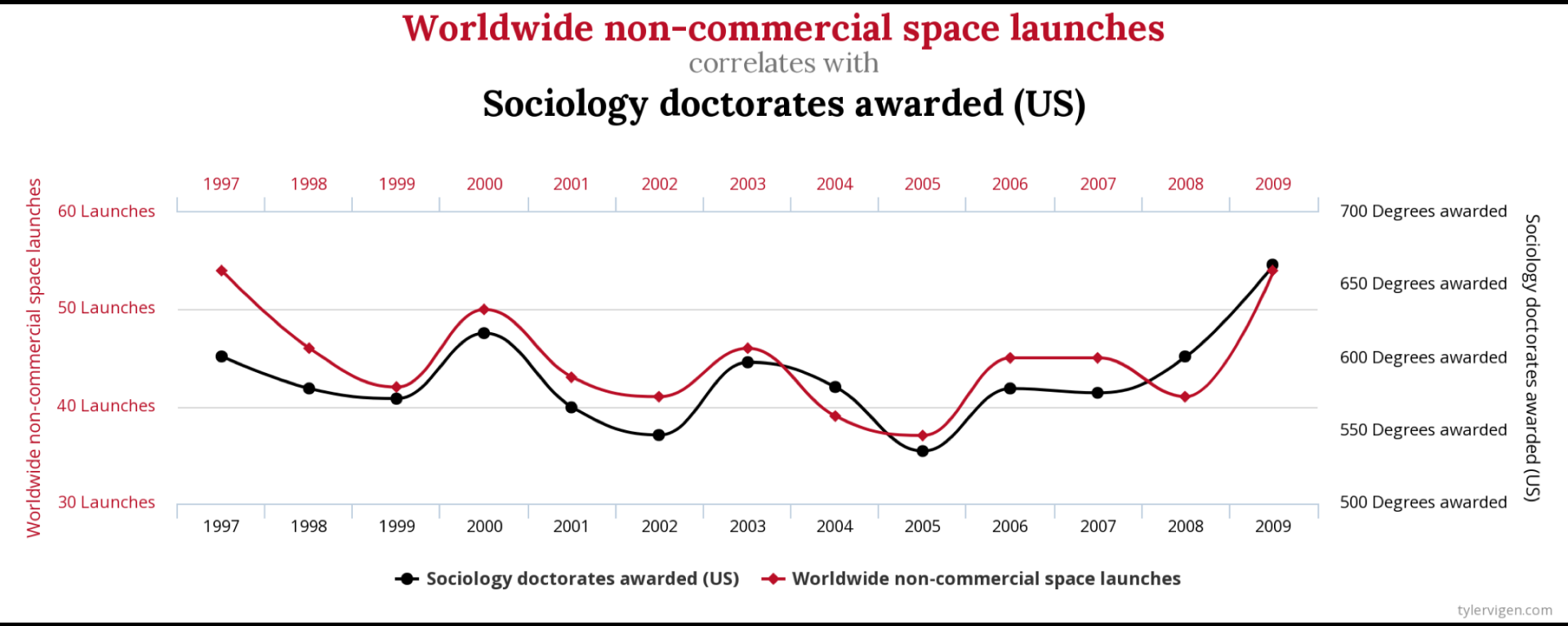
Data Analysis Session

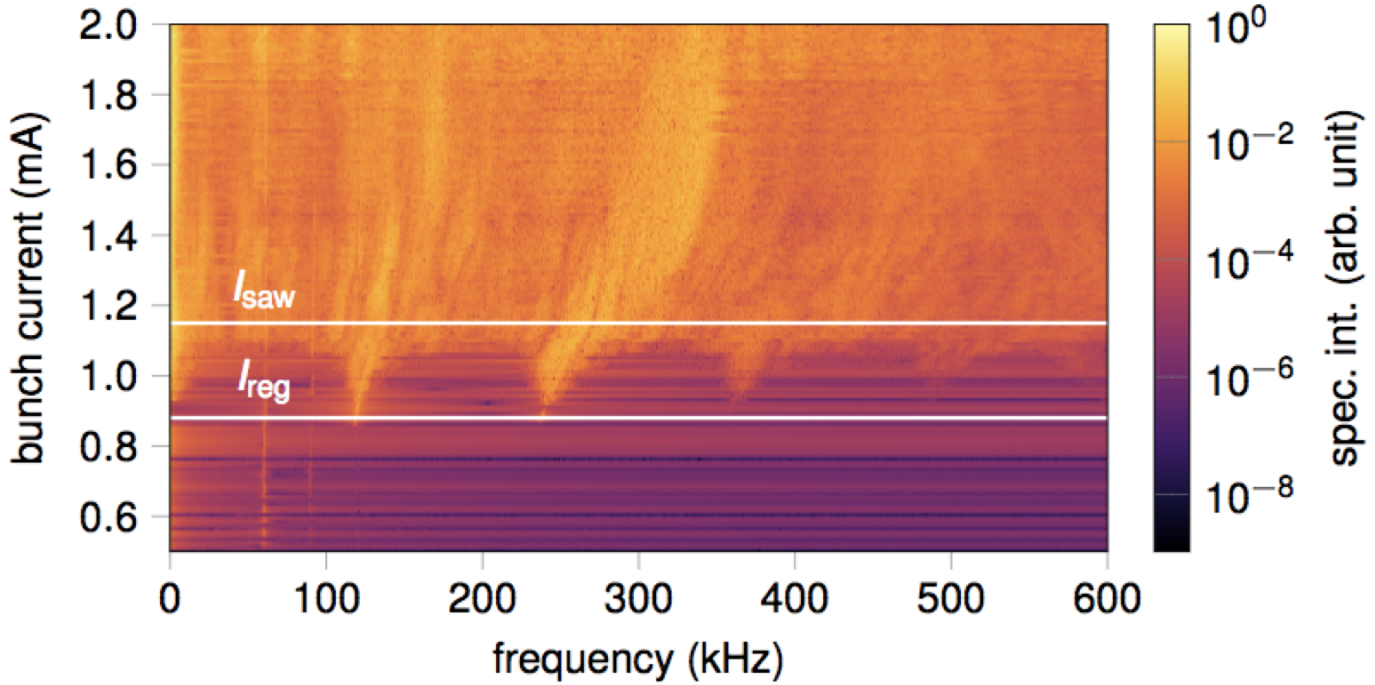


(Thanks, Jochem, for reminding me of this amazing resource.)

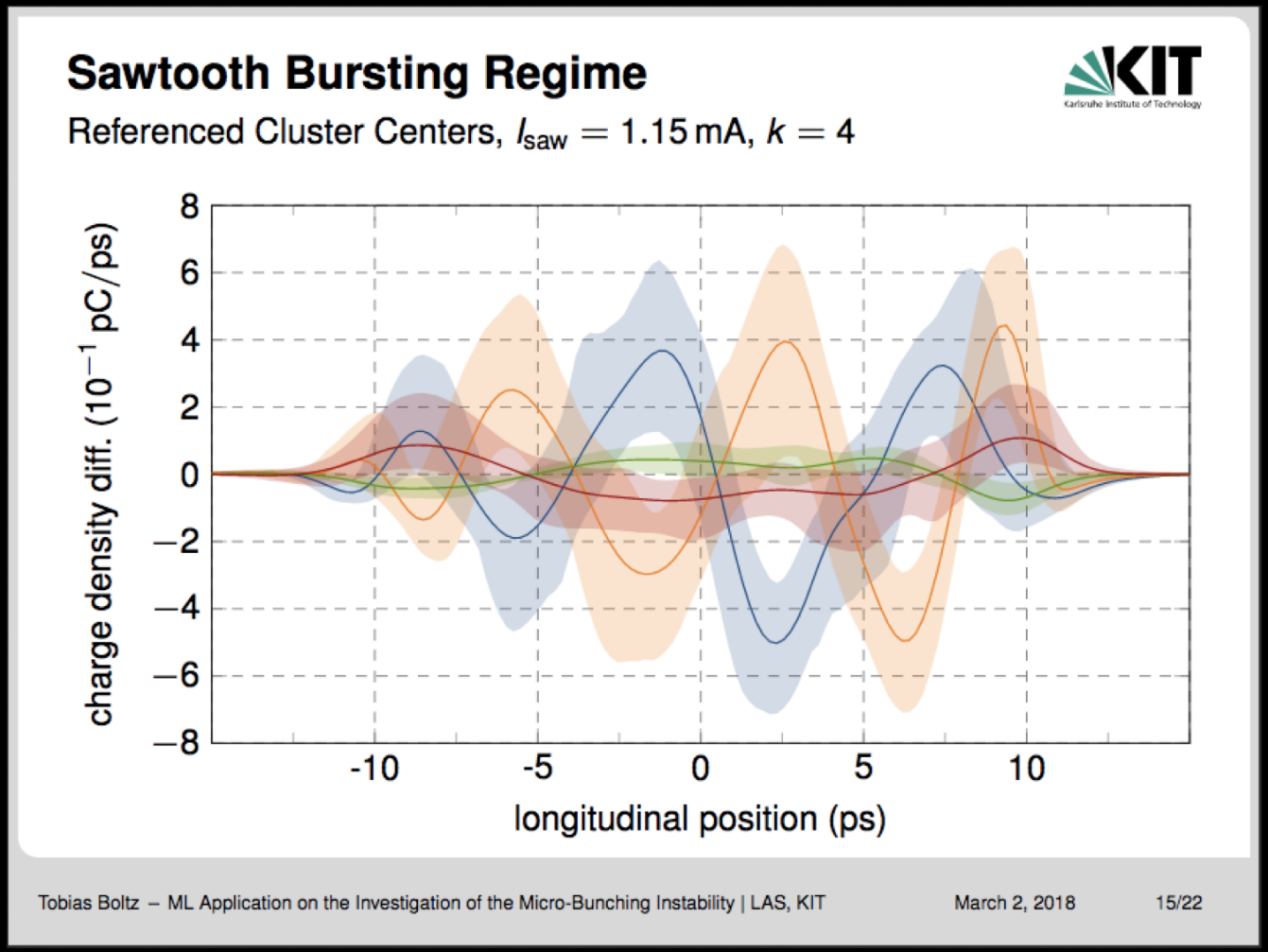
T. Boltz

Analysis of Micro-Structure Dynamics

Different Bursting Regimes: Exemplary Bunch Currents



T. Boltz

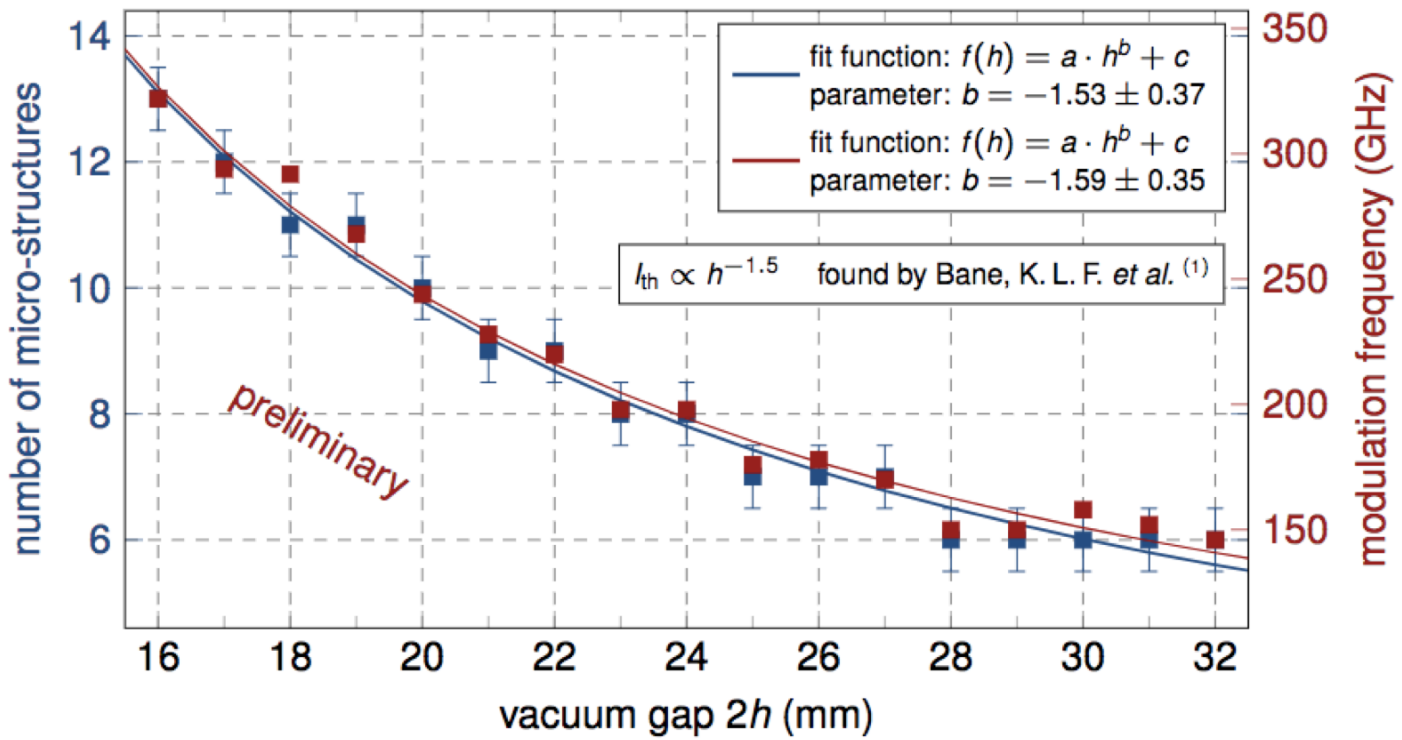


k-means clustering for bunch micro-structure

T. Boltz

Outlook

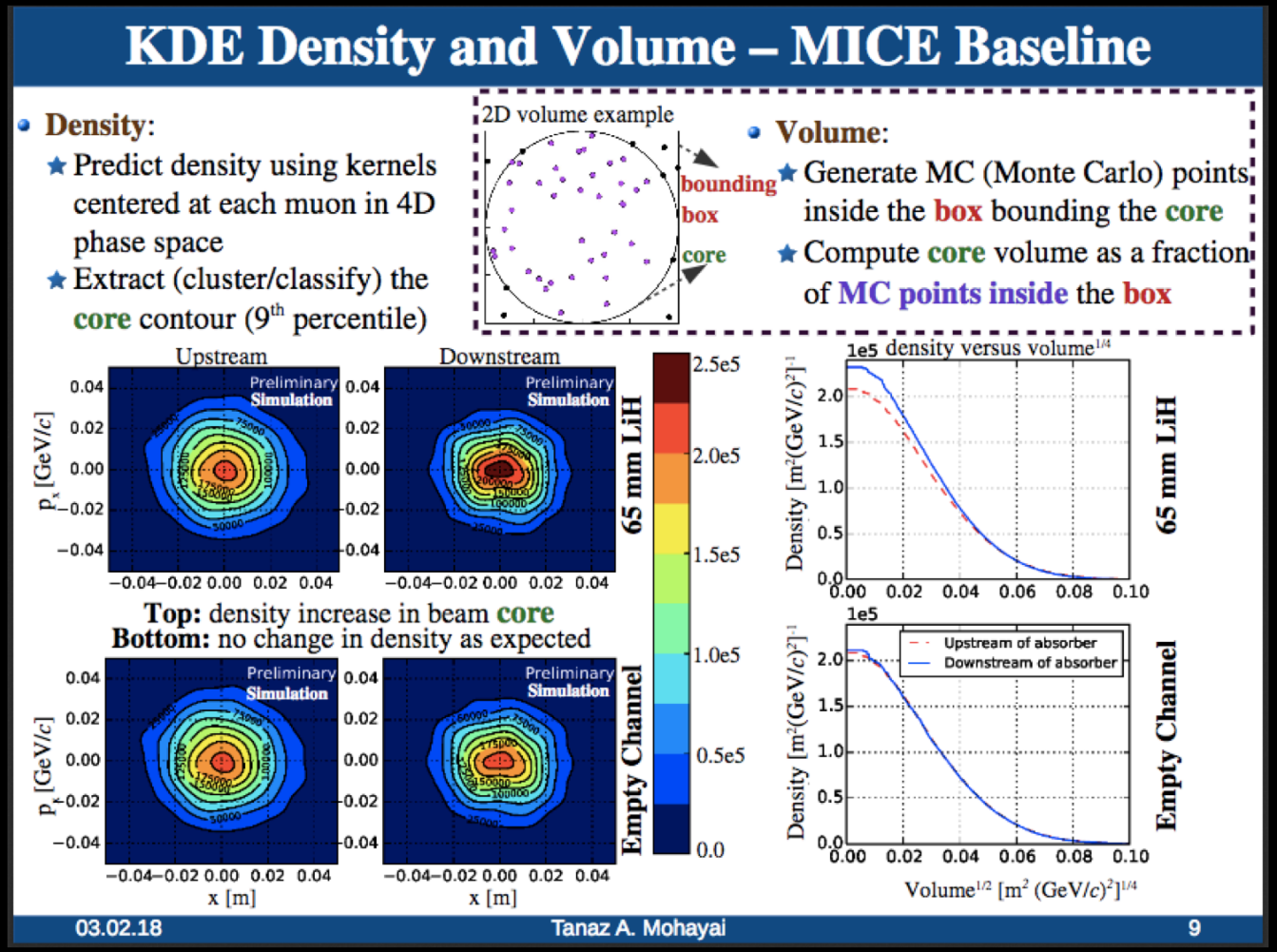
Further Studies using the Application of *k*-means



(1) Bane, K. L. F., Y. Cai, and G. Stupakov Phys. Rev. ST Accel. Beams **13** (2010)

Discovery potential from careful analysis of data pulled from ML?

T. Mohayai

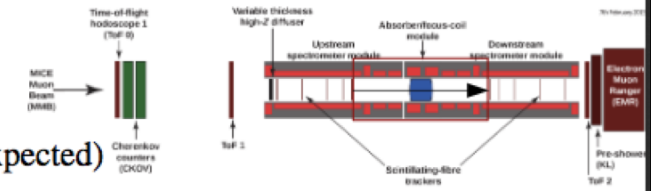


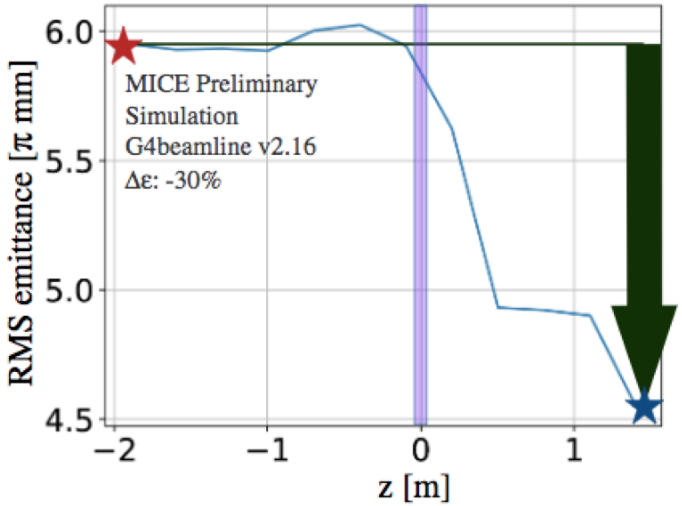
Goal: improved measurement of emittance/volume reduction.

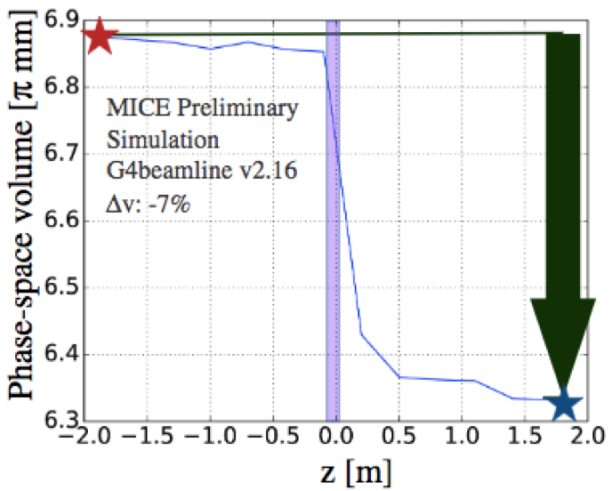
T. Mohayai

Emittance vs. KDE Volume

- Beam setting:
  - ★ Input transverse emittance: 6 π mm
  - ★ Momentum: 140 MeV/c
- RMS emittance affected by transmission loss:
  - ★ Apparent emittance reduction (**-30%** Δε not expected)
- KDE volume in units of emittance:
  - ★ Unaffected by transmission loss (yields expected **-7%** Δv)
- Future extension to **supervised** learning: expected cooling performance as output data







03.02.18 Tanaz A. Mohayai 19

KDE works on simulation, and we're all excited to see the data now.

T. Mohayai

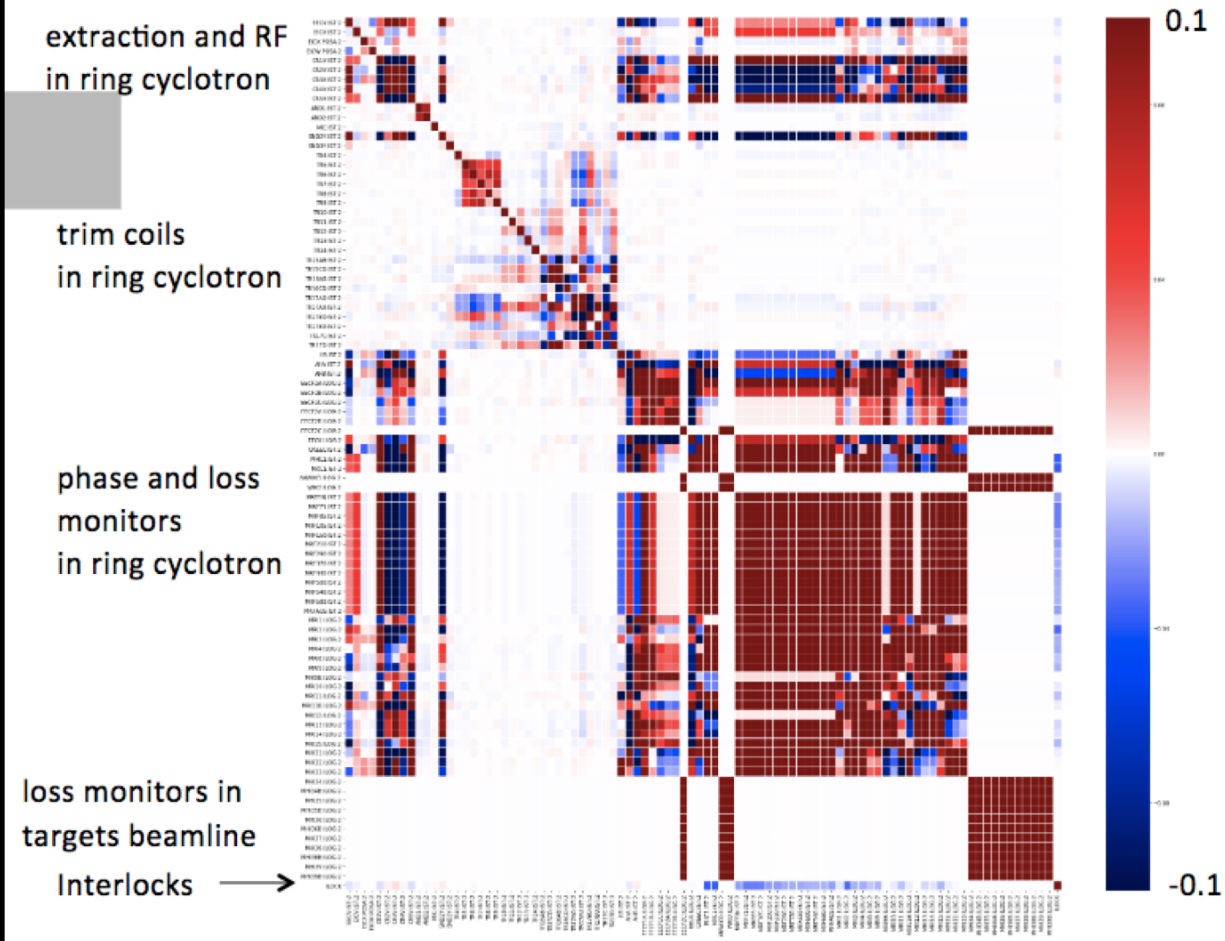
Conclusion

- KDE based measurements:
  - Provide a detailed diagnostics of the muon beam traversing a material
  - Proven to be robust against beam loss
- Re-weighter routine:
  - Removes correlations in the beam
  - Further investigation in MC and data in progress
- Future supervised learning:
  - Expected cooling performance as output data
  - Supervised re-weighting techniques (e.g. boosted decision trees)
- MICE has gathered great amount of data:
  - Application of KDE to data on-going

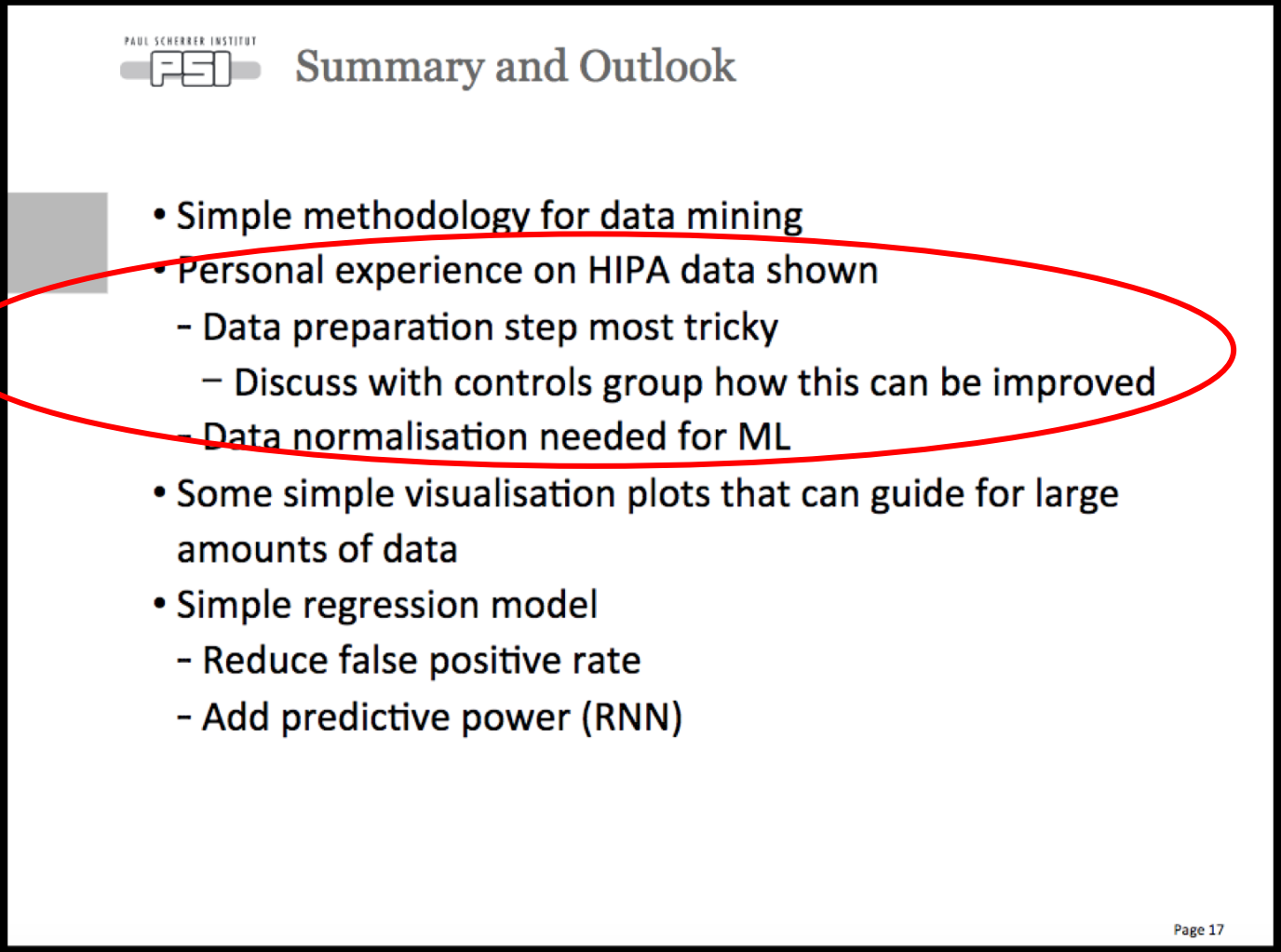
J. Snuvernik

PAUL SCHERRER INSTITUT PSI

Visualisation – correlation matrix



J. Snuvernik

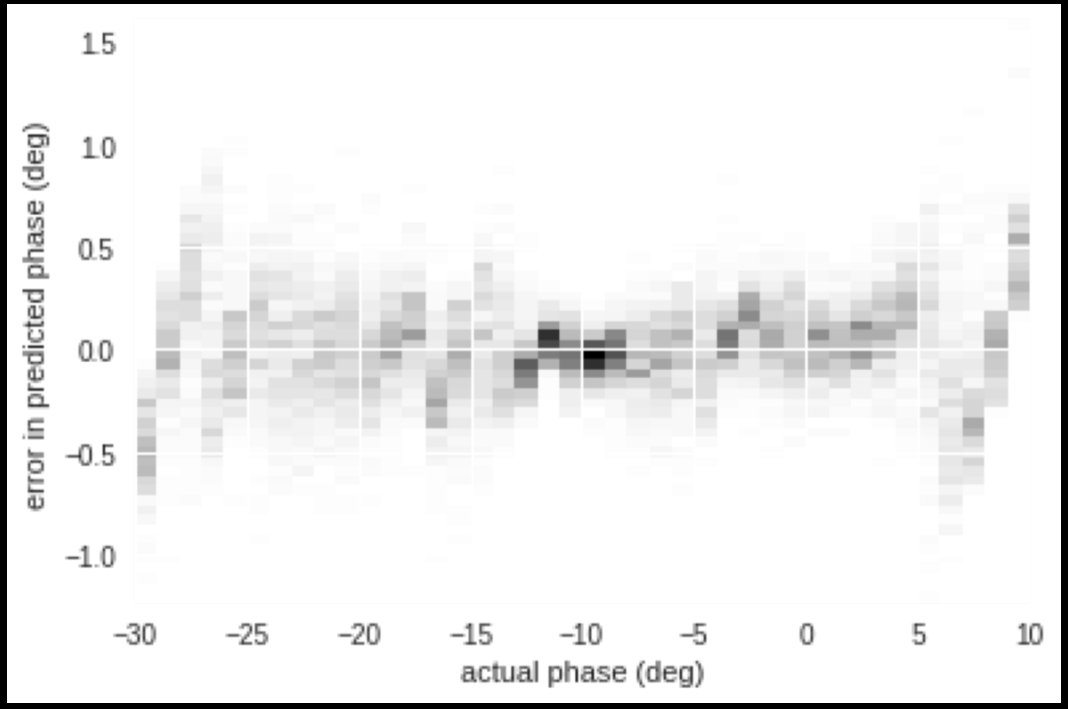


Comprehensive discussion of data preparation – very useful!

Topics during general discussion:

- What do operators need/want? Can we give them tools based on visualization & feature reduction?
- We don't have as much data as HEP. ML is greedy for data, but do we have the necessary infrastructure & culture for "big data"?
- How to connect with other communities, e.g. theorists?
- Top-down vs bottom-up motivation for ML

Congratulations to Jochem!



Want to say a few words on what you did for this result?