

# TECHQM: Introduction

*Peter Jacobs, LBNL*



On behalf of the workshop organizers:

Brian Cole

Miklos Gyulassy

Uli Heinz

Peter Jacobs

Berndt Mueller

Jamie Nagle

Peter Petreczky

Xin-Nian Wang

Urs Wiedemann

# Theory-Experiment Collaboration for Hot QCD Matter

The goal of TECHQM is to further the understanding of hot QCD matter through detailed, quantitative analysis of heavy ion collision experimental data and theory, together with the dynamical modeling which connects them.

We mean “Collaboration” in the literal sense: “working together”

# Genesis of TECHQM

- Topical Theory Center proposals
- RHIC Theory Upgrade (U. Heinz, Rutgers Town Meeting on QCD)

2007 NSAC Long Range Plan Recommendation:

The experiments at the Relativistic Heavy Ion Collider have discovered a new state of matter at extreme temperature and density—a quark-gluon plasma that exhibits unexpected, almost perfect liquid dynamical behavior. We recommend implementation of the RHIC II luminosity upgrade, together with detector improvements, to determine the properties of this new state of matter.

....Achieving a quantitative understanding of the quark-gluon plasma also requires new investments in modeling of heavy ion collisions, in analytic approaches, and in large-scale Computing.

The **complex, dynamic nature of a heavy ion collision** dictates the need for **extensive theoretical modeling** as the bridge between experimental observations and underlying properties of the hot QCD Matter.

While good progress has been made in this area, there are **still significant conceptual and modeling uncertainties** which limit the accuracy with which conclusions can be drawn about the properties of QCD matter.

In the view of the TECHQM working group, **elucidation and reduction of these uncertainties requires coherent, sustained, collaborative effort of experts** in all stages of a heavy ion collision.

**A collaborative effort of theorists and experimentalists**, aimed at systematic validation of different approaches to the modeling of heavy ion collisions, **will be able to go significantly beyond the scope achievable by individual research groups.**

This is not an issue for the RHIC or LHC communities in isolation.

In our view, **full understanding of the physics at both facilities will require a unified approach**, to compare and contrast their results within common calculational frameworks.

# Goals of TECHQM

TECHQM is not aimed at advances in fundamental theory or experimental data analysis, but rather at building the bridge between the two.

TECHQM must be inclusive of multiple, different approaches to each problem

- No single approach can capture the full complexity of heavy ion collisions
- Its strength will be the coherent, collaborative, in-depth study of different conceptual approaches and different numerical implementations

# Goals of TECHQM: short term

Start with tractable problems - consider areas that are best developed experimentally and theoretically

- Collective flow
- Jet quenching
- The connection between the two

→ agree on a short term, practical plan for collaborative work  
→ start working

# Agenda of this meeting

This is a workshop for experts.

Extensive, in-depth discussion is essential for it to succeed.

This morning: plenary

- overview talks on each sub-area
- emphasis is on open issues, not past accomplishments

This afternoon: parallel sessions

- detailed discussion of open issues
- drafting of short-term work plans

Tomorrow morning: plenary

- final discussion and agreement on work plans
- discussion and establishment of initial collaboration structure and organization

One organizational tool - TECHQM wiki site:

[https://wiki.bnl.gov/TECHQM/index.php/Main\\_Page](https://wiki.bnl.gov/TECHQM/index.php/Main_Page)