

# NGT Algorithm Workshop

Lattice QCD at the large scale on exascale  
computing facilities

Jacob Finkenrath

10. Dec 2024



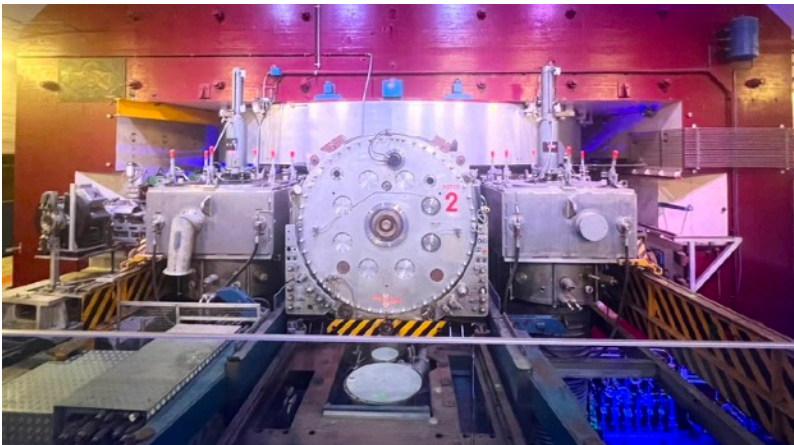
**NexTGen**  
Next Generation Triggers

# Outline

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◆ 2nd Day of the NGT algorithm workshop



# Day 2 - Challenges

## HMC: Movement of topology

- Tunneling

$$\tau_{tunn}(Q) = C_{tunn} \cdot \exp\{0.9/a\}$$

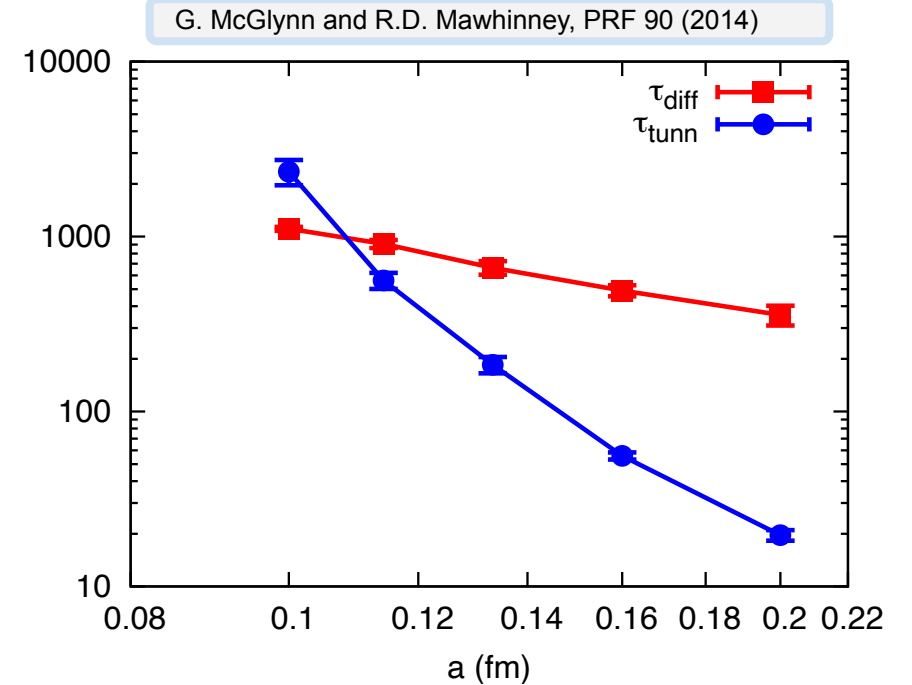
with  $C_{tunn} \propto \mathcal{O}(1)$

- Diffusion

$$\tau_{diff}(Q) = T/8D_{diff}$$

with  $D_{tunn} \propto \mathcal{O}(1)a^2 - \mathcal{O}(1)a^4$

This leads to  $\mathcal{O}(1000)$  MDU autocorrelations for  $a < 0.4$  fm



# Day 2 - Agenda

## Morning Session

09:00	<b>Parallel tempered metadynamics</b> <i>Timo Eichhorn</i>  4/3-006 - TH Conference Room, CERN 09:00 - 09:45
10:00	<b>Full QCD simulations with milder topological freezing via Parallel Tempering on Boundary Conditions</b> <i>Claudio Bonanno</i>  4/3-006 - TH Conference Room, CERN 09:45 - 10:30
	<b>Coffee break</b>  4/2-011 - TH common room, CERN 10:30 - 11:00
11:00	<b>Normalizing Flows for Gauge Theories</b> <i>Ryan Abbott</i>  4/3-006 - TH Conference Room, CERN 11:00 - 11:45
12:00	<b>Continuous gauge flows</b> <i>Simone Bacchio</i>  4/3-006 - TH Conference Room, CERN 11:45 - 12:30

# Day 2 - Agenda

## Afternoon Session

14:00	<b>Contour deformation and normalising flows</b> <i>4/3-006 - TH Conference Room, CERN</i>	<i>Yukari Yamauchi et al.</i>	<a href="#">🔗</a> 14:00 - 14:45
15:00	<b>Unfreezing topology with nested sampling</b> <i>4/3-006 - TH Conference Room, CERN</i>	<i>Urs Wenger et al.</i>	14:45 - 15:30
	<b>Coffee break</b> <i>4/2-011 - TH common room, CERN</i>		15:30 - 16:00
16:00	<b>Global fermion corrections to accelerate lattice QCD simulations</b> <i>4/3-006 - TH Conference Room, CERN</i>	<i>Jacob Friedrich Finkenrath</i>	16:00 - 16:45



# NEXTGEN TRIGGERS ALGORITHM WORKSHOP

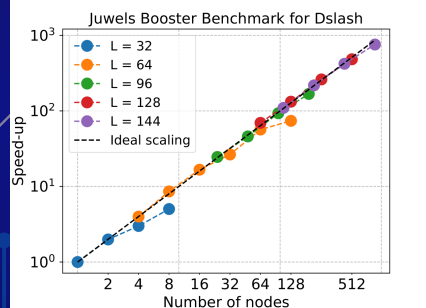
## Lattice QCD at the large scale on exascale computing facilities

### Speakers:

Ryan Abbott (MIT), Simone Bacchio (Cyprus), Lorenzo Barca (DESY), Peter Boyle (BNL), Claudio Bonanno (Madrid), Timo Eichhorn (Wuppertal), Jacob Finkenrath (CERN), Roman Gruber (ETH), Tim Harris (ETH), Alessandro Lupo (Marseille), Sofia Vallecorsa (CERN), Michael Wagman (Fermilab), Evan Weinberg (Nvidia), Urs Wenger (Bern), Yukari Yamauchi (University of Washington)

### Organisers:

Kate Clark, Matteo Di Carlo, Felix Erben, Jacob Finkenrath (chair), Andreas Jüttner, Bartosz Kostrzewa, Simon Kuberski, Stefan Roiser, Phiala Shanahan, J. Tobias Tsang



### Day 1

Variance reduction; Long distance noise and excited states

### Day 2

Novel sampling algorithms for fine lattice spacing; Fine lattice spacings and ML for physics

### Day 3

Novel computing architectures; Scientific computing in the era of LLMs

9 - 11 December 2024

Location: 4/3-006 TH Conference Room,  
CERN

More information



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