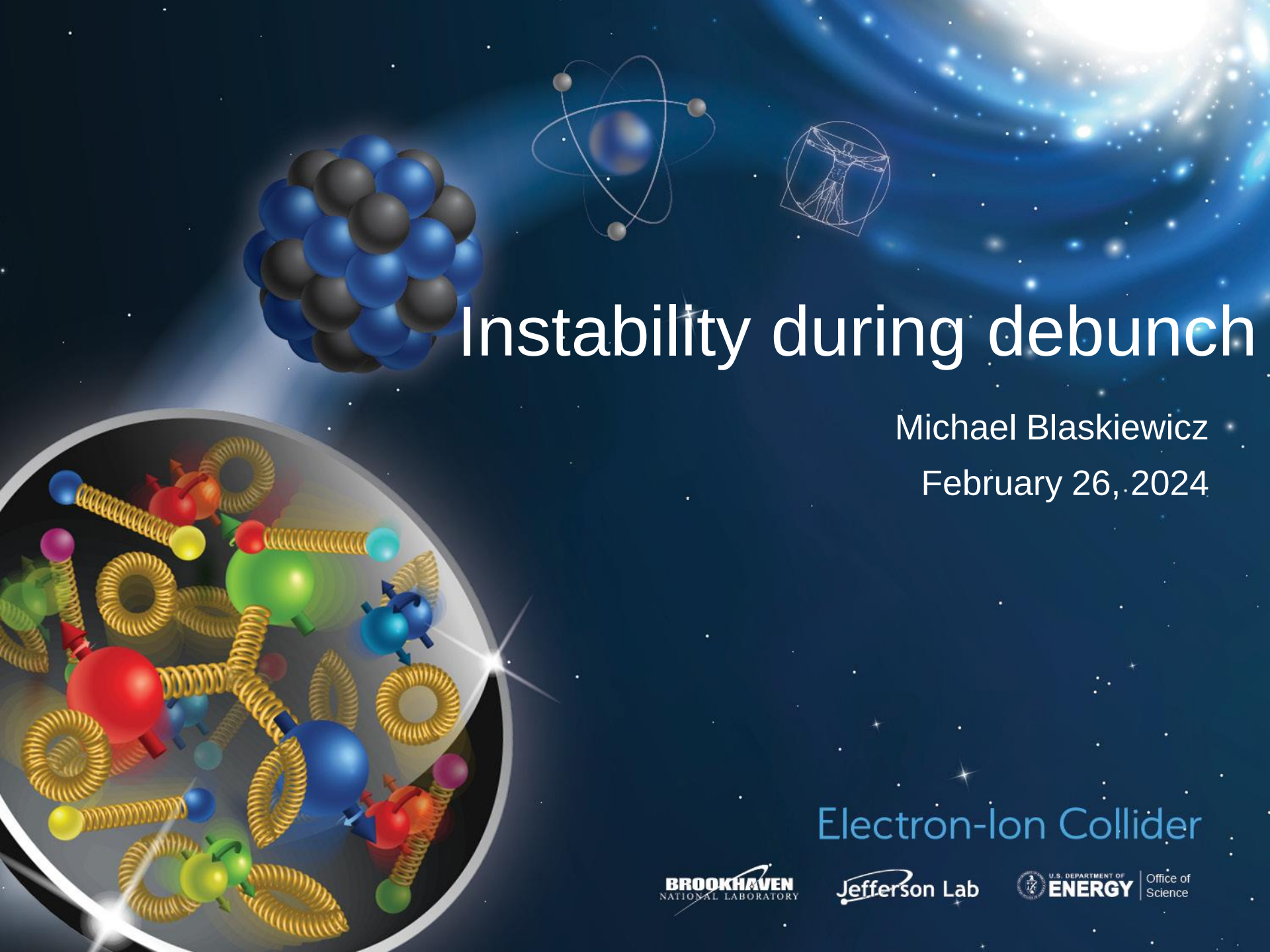


Instability during debunch

Michael Blaskiewicz

February 26, 2024

Electron-Ion Collider

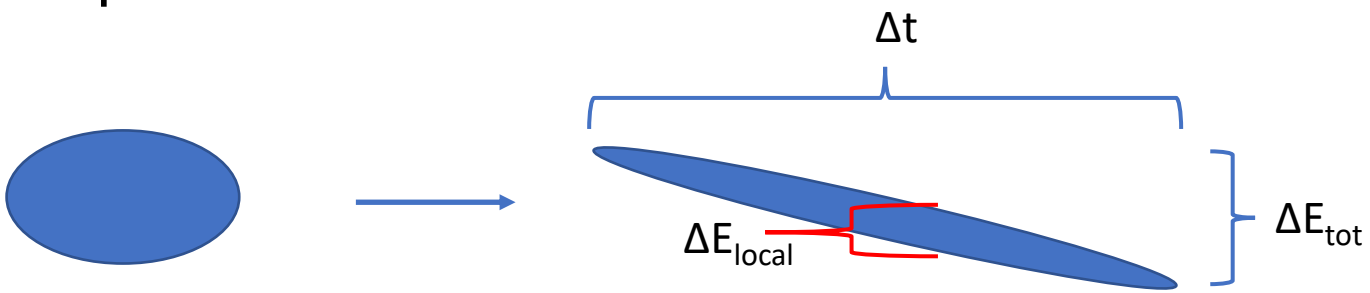
BROOKHAVEN NATIONAL LABORATORY

Jefferson Lab

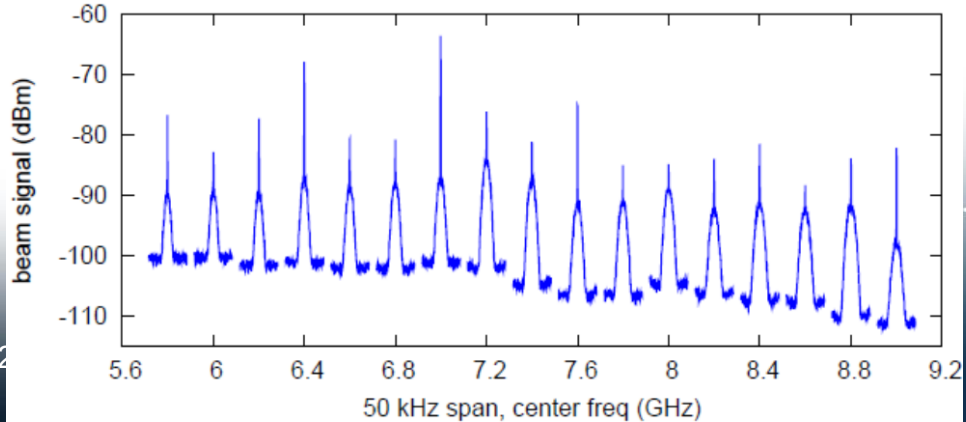
U.S. DEPARTMENT OF ENERGY | Office of Science

Basic idea

- Suppose you have a single bunch in the accelerator and turn the RF quickly to zero.
- As the beam debunches the local energy spread drops.



- Microwave stability scales as $ZI_{peak}/\sigma_E^2 < K$
- The growth rate depends on Z and is calculable assuming a known momentum distribution.
- The longitudinal pickup is well understood.
- Cable attenuation will be measured.



Experimental Plan

- title: broad band impedance measurement
- spokesperson: Mike Blaskiewicz
- Team: Mike, Kevin Mernick, Alexei Blednykh, MCR
- goal: measure broad band longitudinal impedance
- benefits: helpful for EIC planning
- description:
- Inject a single proton bunch into 9 MHz. 197 is off and FMD is inserted.
- Reduce voltage until bunch length is maximum.
- Snap off voltage
- Take turn by turn data with longitudinal Schottky pickup.
- Take turn by turn WCM data at same time for instantaneous current and dp/p.
- May need to shift timing window to catch longitudinal instability.
-
- Hazards: no hazards
- resources: fast scope, various pickups
- applications: wall current monitor, rf ramps, specialized code from Kevin
- time: 2 , 4 hour blocks. One if all is good the first time.
- personnel: MCR, Mike, Kevin Mernick, Alexei Blednykh

- Analysis
- Mike/Alexei will do calculations and present. Write a tech note if warranted.