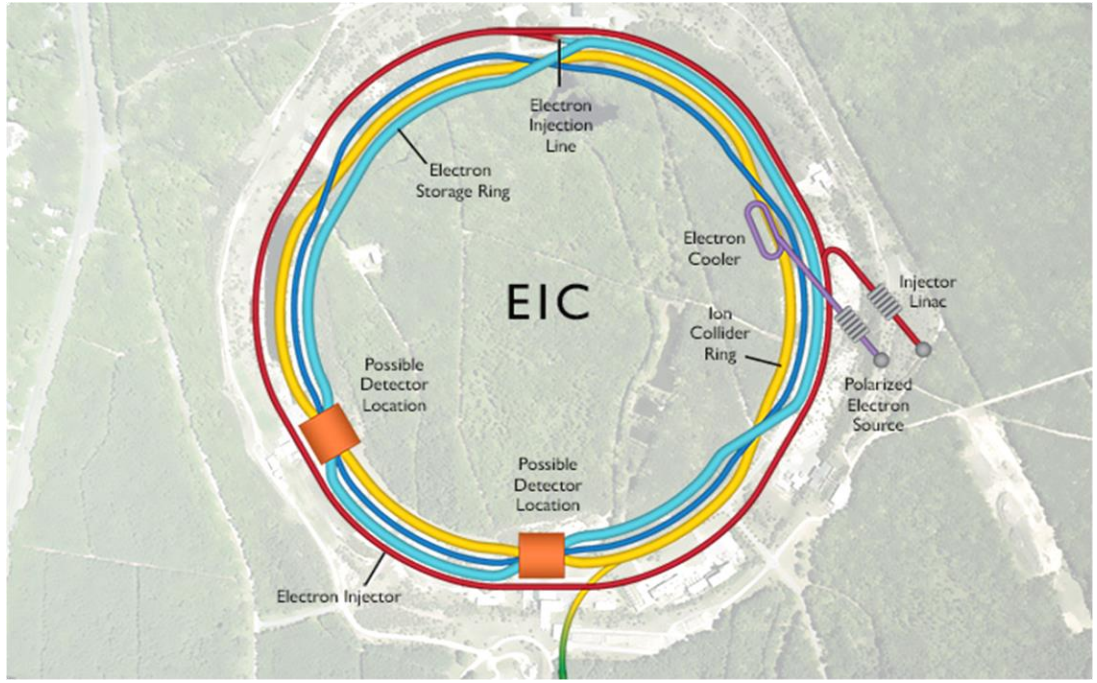
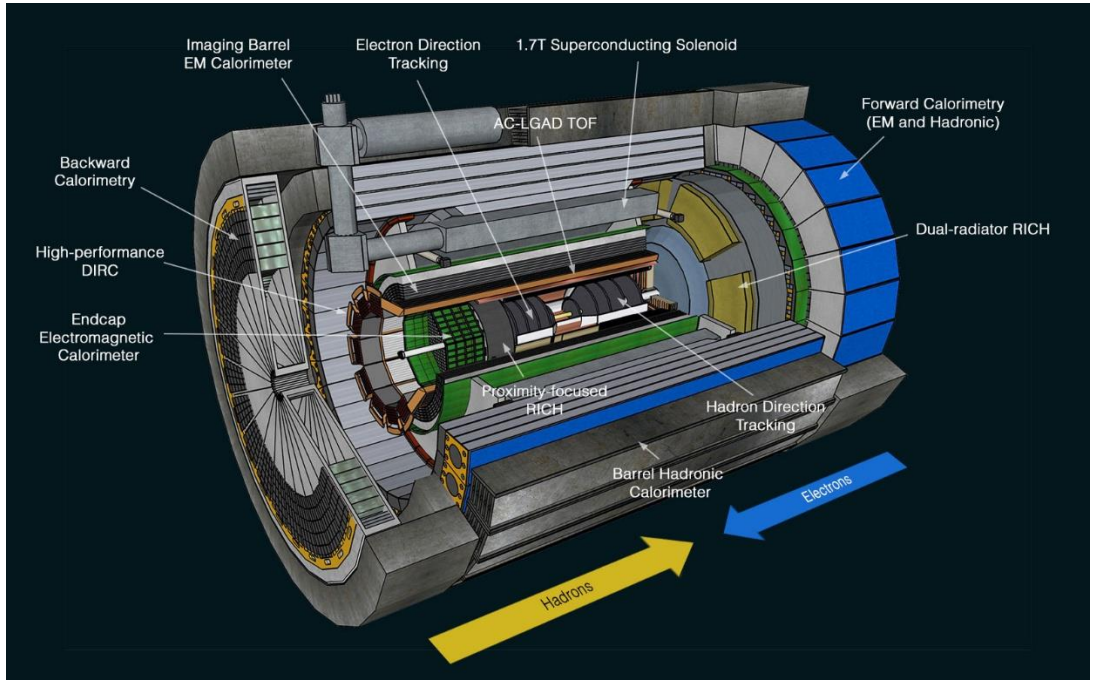
A Proposal for the Clock and Control Distribution for EIC Experiment (ePIC)

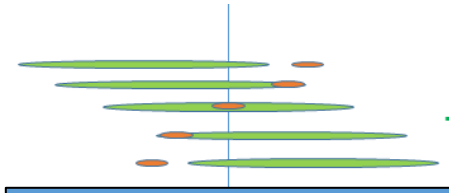
J. W. GU (for ePIC collaboration)



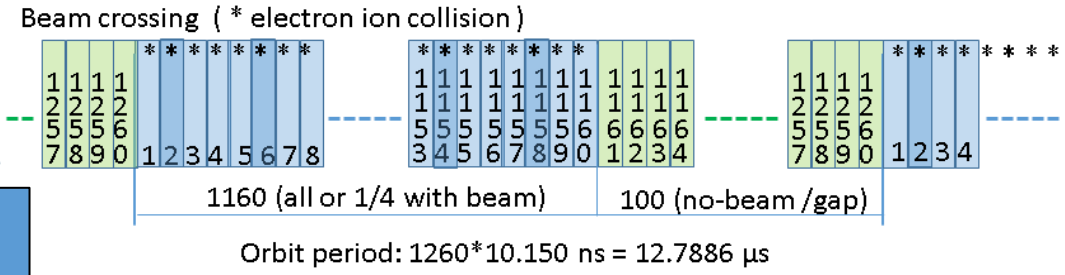


	ESR	HSR
RMS bunch length σ_z [mm/ps]	7-9/23-30	75-60/250-200

Electron Beam Energy: 5 – 18 GeV
Proton Beam Energy: 41, 100, 275 GeV
Luminosity: 10^{34} $cm^{-2}s^{-1}$



Beam Crossing every 10.15ns, or 98.5 MHz



ePIC DAQ /Clock Control distribution electronics

GTU: Global Timing Unit

control encoding, status decoding.
The interface for machine clock source,
Data acquisition control and monitor etc.

DAM: Data Aggregation Module:

The clock/control fanout, and status/busy accumulation.
local control over the RDO boards connected, though the main function of the DAM is for Data Acquisition.

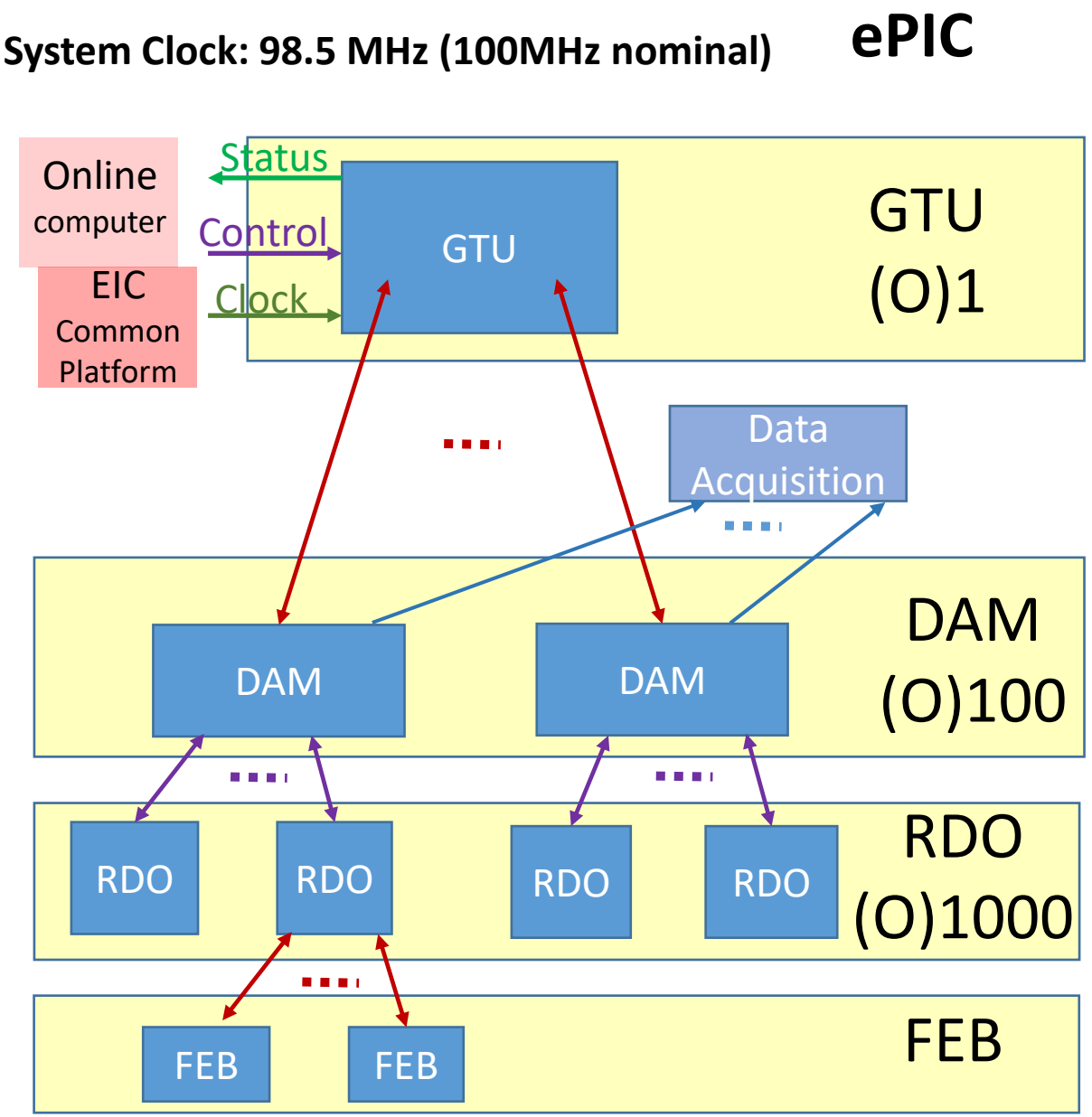
RDO: optical interface of detector ReaDOut

control decoding, status encoding.
The clock/control interface to the front end electronics.
Data collection from Frontend boards, and data transmission to the DAM

FEB:

Detector dependent Front End / ASIC carrier boards.

System Clock: 98.5 MHz (100MHz nominal)



Clock Distribution

GTU fanouts:
Additive Jitter <1ps
Phase: fixed

Dedicated fiber
Additive Jitter <1ps
Phase: fixed

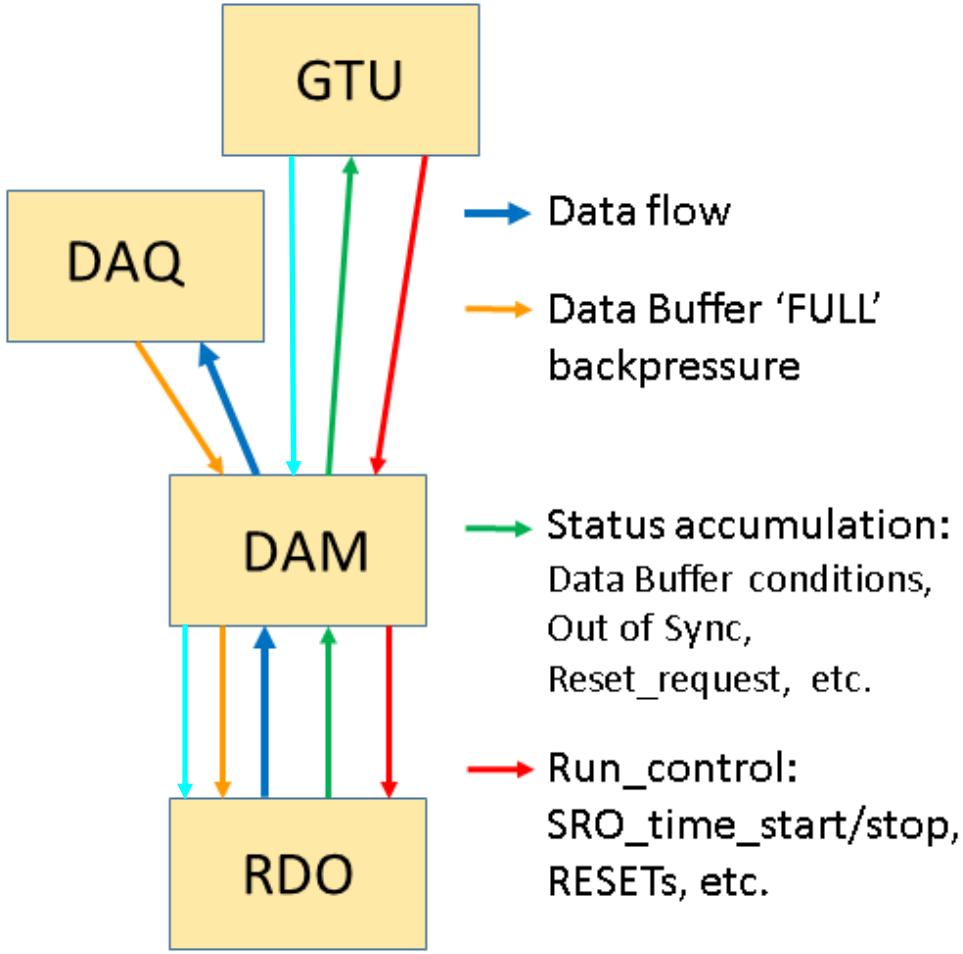
DAM fanouts:
Additive Jitter <1ps
Phase: fixed

Optic fiber cable:
Additive Jitter <1ps
Phase: fixed

RDO Rec Clock:
Additive Jitter <3ps
Phase: stable,
fixed with PseudoClock

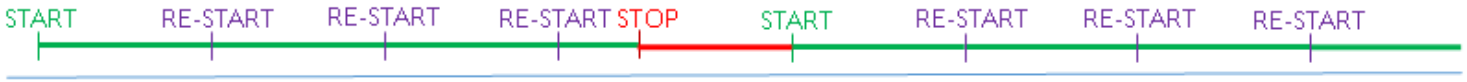
Beam Crossing phase aligned

Control Distribution



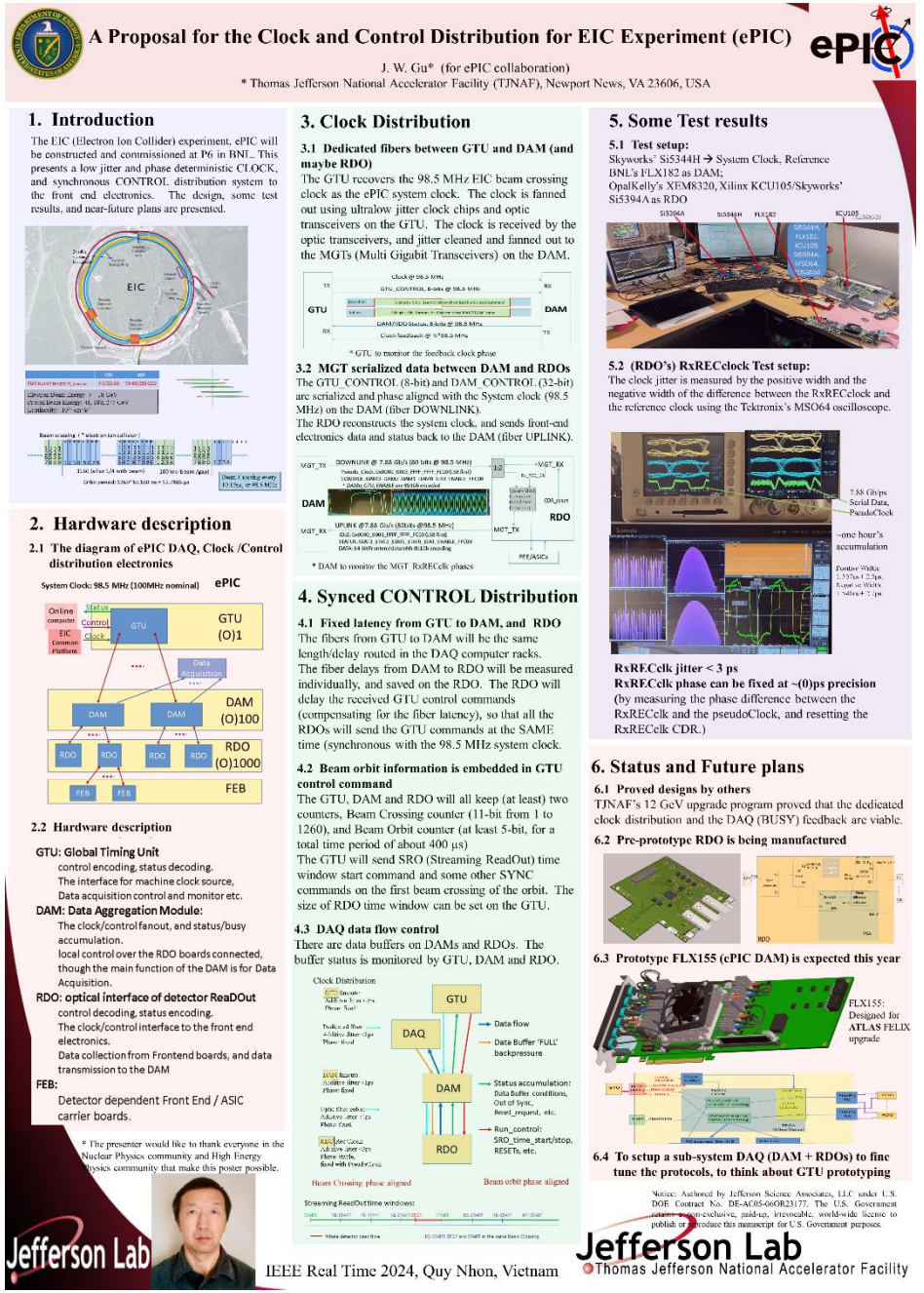
Beam orbit phase aligned

Streaming ReadOut time windows:



Whole detector dead time

RE-START: STOP and START at the same Beam Crossing



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1. Introduction

2. Hardware description

3. Clock Distribution

4. Synced CONTROL Distribution

5. Some Test results

6. Status and Future plans

Jefferson Lab

IEEE Real Time 2024, Quy Nhon, Vietnam

Jefferson Lab
Thomas Jefferson National Accelerator Facility