



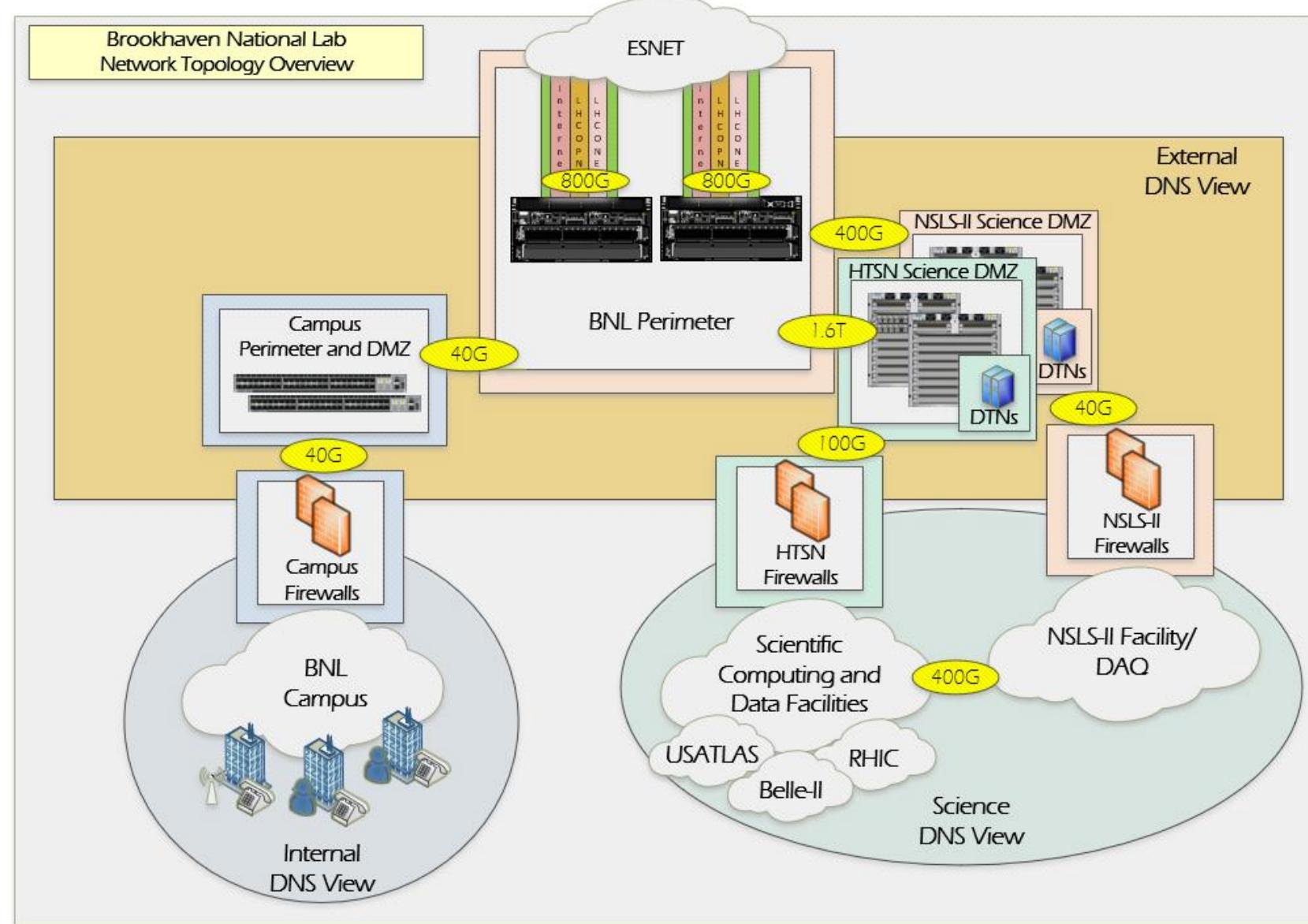
EIC WAN Strategy and Connectivity Framework

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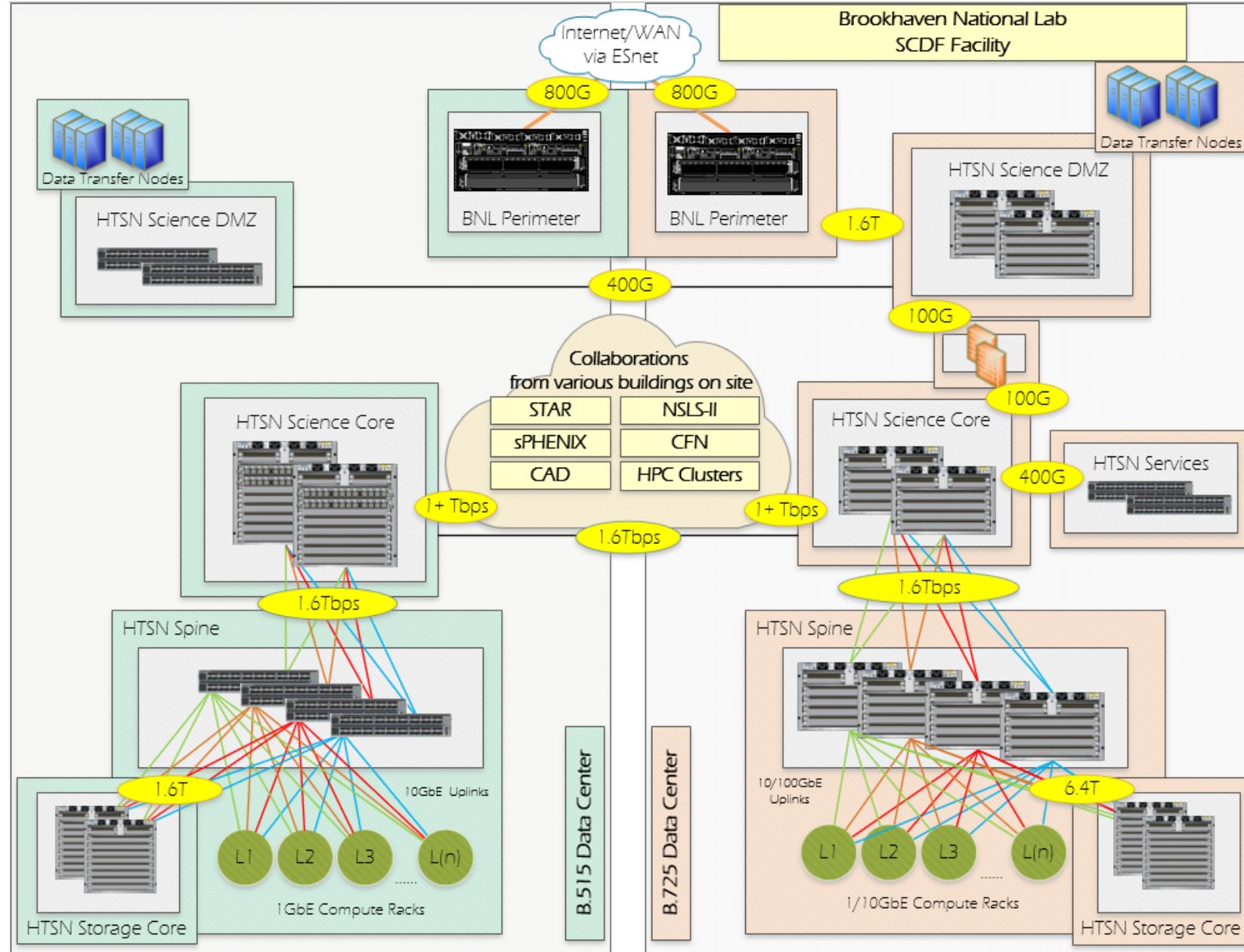
12/1/2025



BNL High Throughput Science Network (HTSN)



BNL SCDF Network Infrastructure



EIC Inter-Site Connectivity Architecture

Proposed Wide Area Network (WAN) Model:

The EIC WAN design mirrors the proven LHC connectivity model, using a combination of Virtual Circuits, LHCONE, and ESnet to provide resilient, predictable data movement between E-tiers.

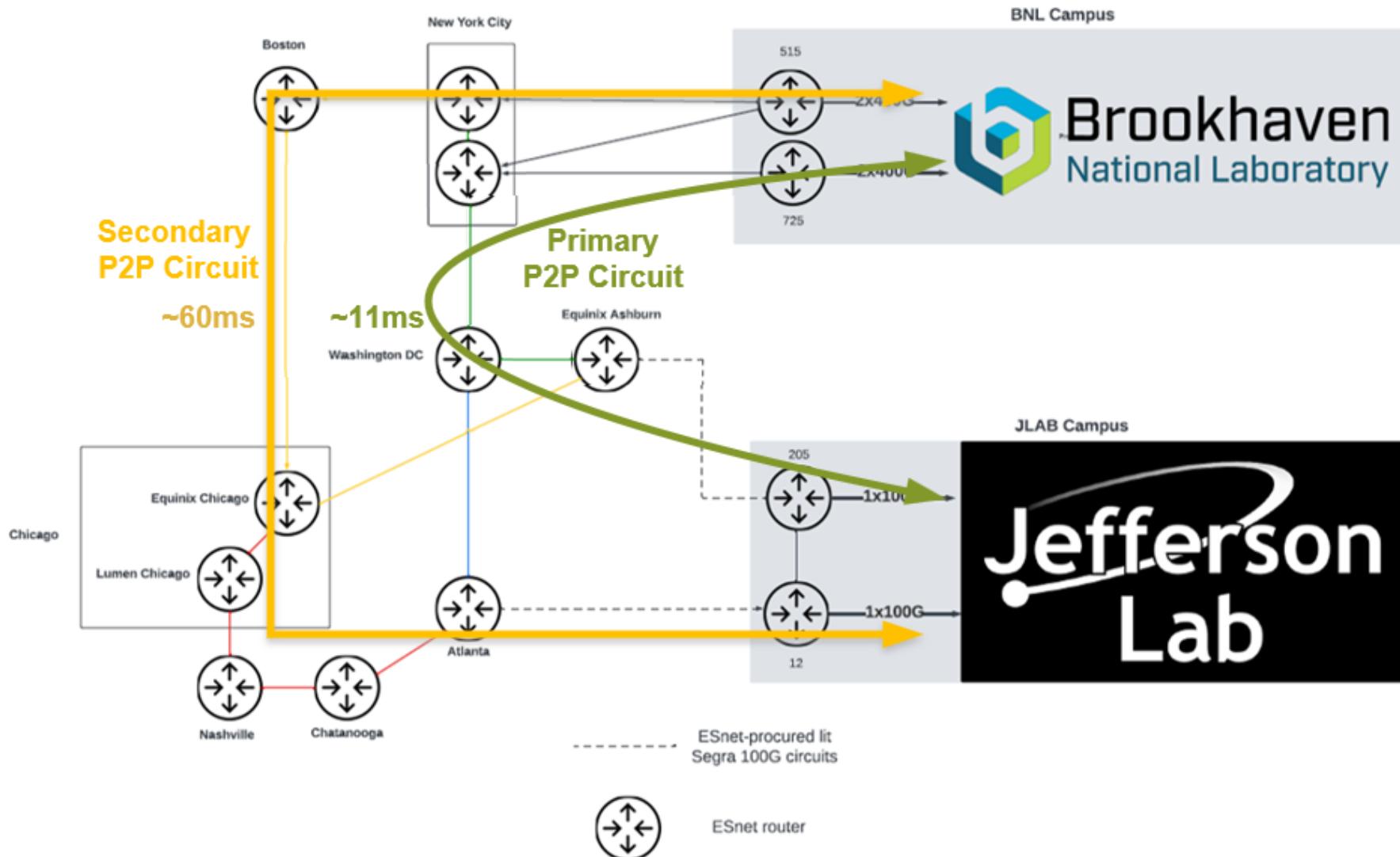
E0/E1 \leftrightarrow E1 Connectivity (BNL \leftrightarrow JLAB):

- Uses dedicated, diverse virtual point-to-point circuits between BNL and JLAB.
- Provides guaranteed bandwidth, predictable performance, and isolated traffic paths.
- Supports all connectivity between E0 DAQ, BNL E1, and JLAB E1.

E1 \leftrightarrow E2 Connectivity:

- We recommend that EIC join LHCONE to interconnect E1 sites with national and international E2 partners.
- LHCONE is a global L3VPN overlay widely deployed across research and education networks (e.g., SINET, GEANT, Internet2, CENIC).
- Using LHCONE:
 - Simplifies onboarding new institutions by leveraging an existing, trusted R&E ecosystem
 - Reduces operational overhead by avoiding the need for a separate, EIC-specific VPN
 - Minimizes routing complexity for collaborating E2 sites already on LHCONE

E0/E1 ↔ E1 Connectivity (BNL ↔ JLAB)



EIC Network Path Selection and Connectivity Model

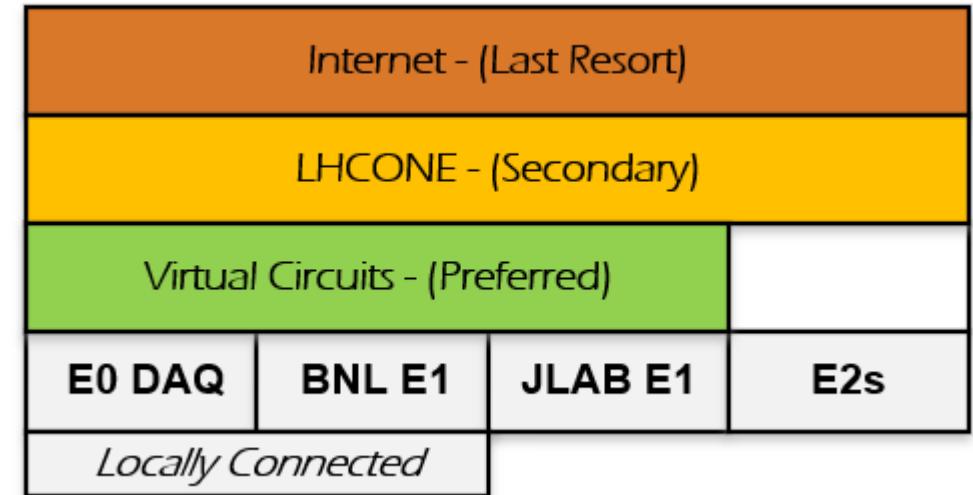
E0↔E1 (BNL↔JLAB)

Path Selection Order:

1. Point-to-Point Virtual circuits
2. LHCONE
3. General Internet via ESnet

E1↔E1 (BNL↔JLAB)

Same connectivity profile and path selection order as E0↔E1



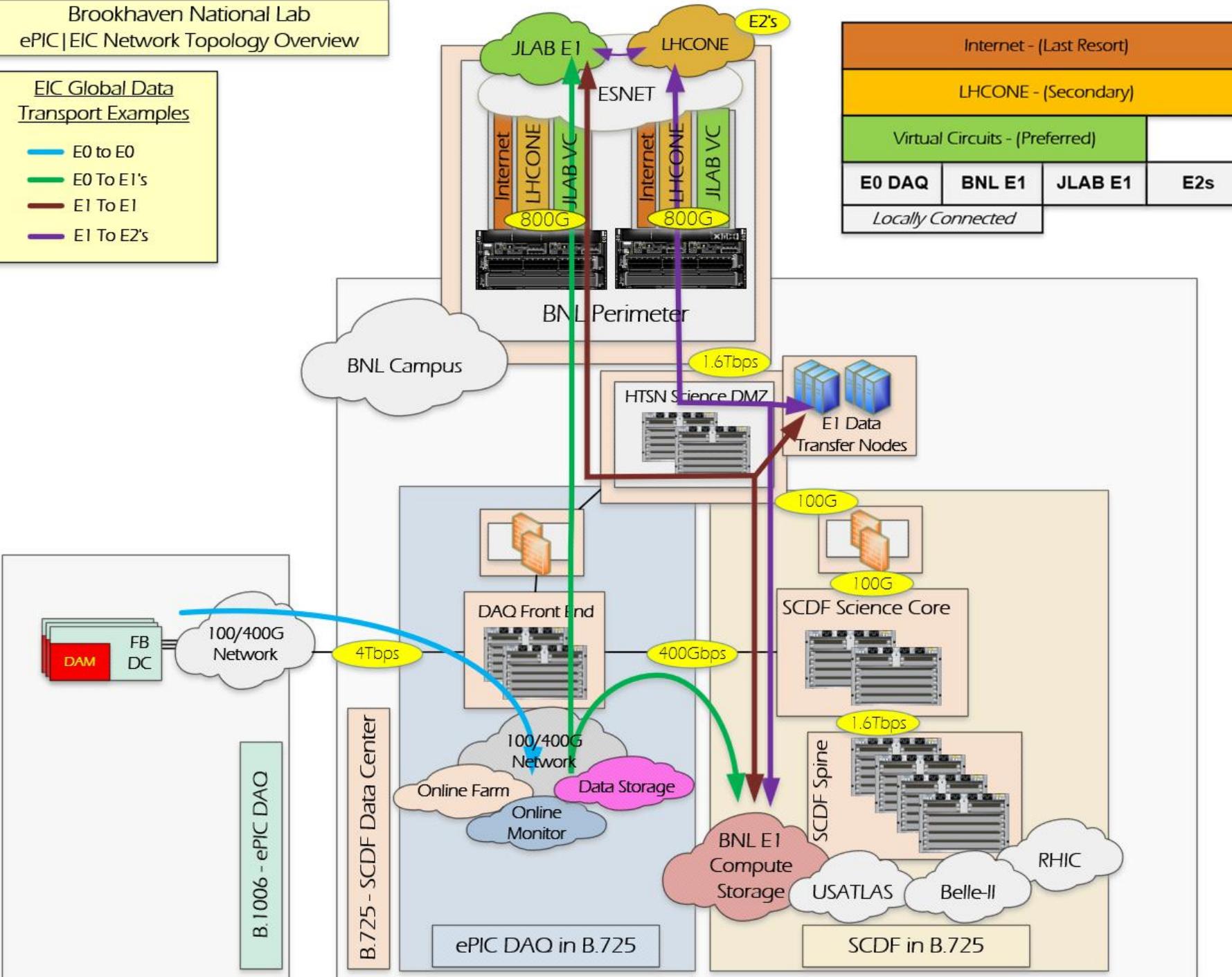
E1↔E2

E1 and E2 should prioritize LHCONE if the destination site is connected; otherwise defaults to the general Internet service

Brookhaven National Lab
ePIC|EIC Network Topology Overview

EIC Global Data Transport Examples

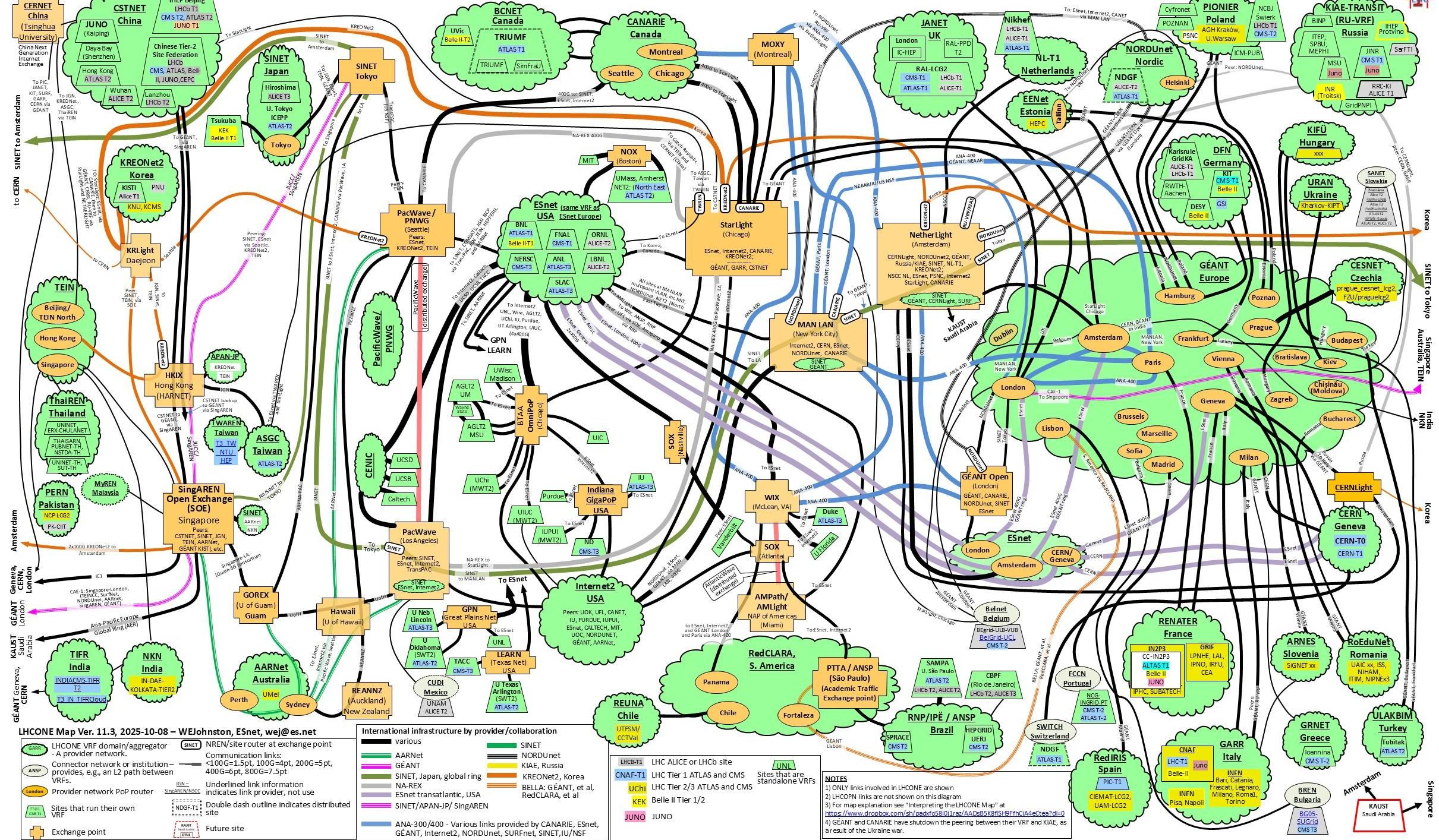
- E0 to E0
- E0 To E1's
- E1 To E1
- E1 To E2's



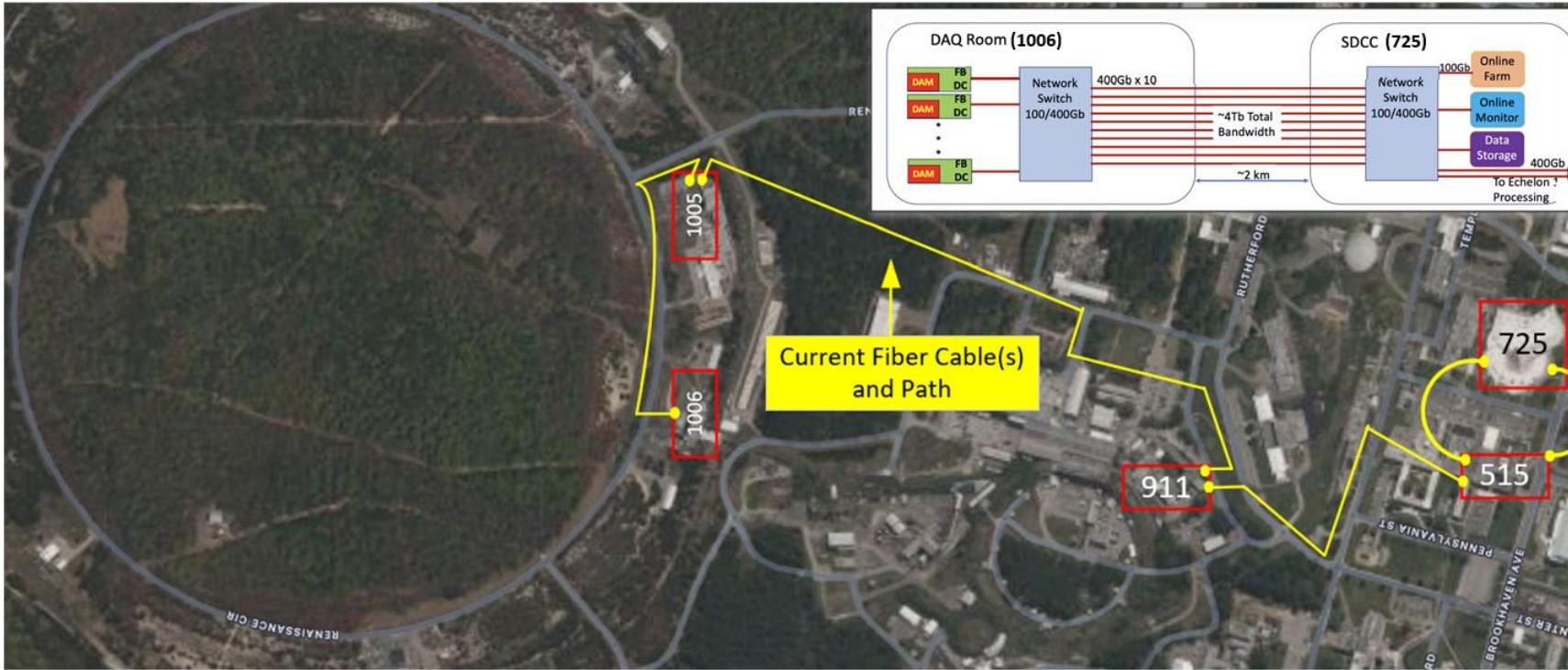
Questions

Backup Diagrams/Slides

ICONE L3VPN: A global infrastructure for High Energy Physics data analysis (LHC, Belle II, Pierre Auger Observatory, NOvA, XENON, JUNO, DUNE, Experimental Network Research)



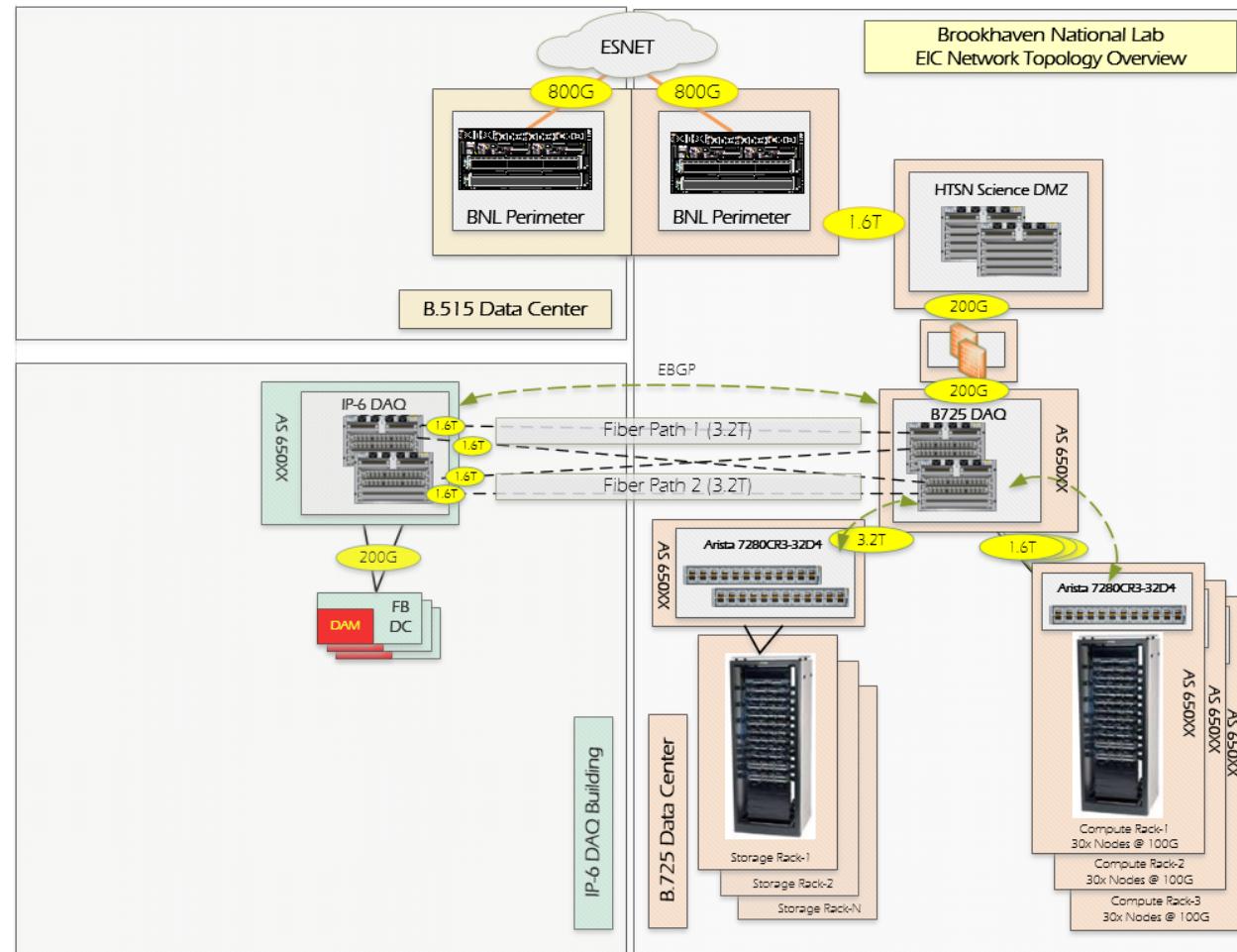
Fiber Path Between IP6 (1006) and SCDF (725)



- Consists of a series of single multi-fiber cable runs, shown in yellow, connecting buildings 515, 911, 1005, 1006.
- The cables are terminated in patch panels in each of the buildings, and patch cables are used to connect the fibers between the cables.
- A break in any one of these cables would result in loss of connectivity from ePIC to the data center.
- Currently, approximately two-thirds of the fiber capacity between buildings 515 and 1005 has been utilized in support of RHIC.

Internal ePIC DAQ Network Infrastructure – Option 1

- **IP-6 DAQ Network Infrastructure**
 - Could consist of two 4 slot Arista chassis' with:
 - 2x 24 port 400GbE line cards.
 - 2-4x 36 port 100GbE line cards.
 - ~3km from building 1006 to 515 on current fiber path.
Will require the use of LR transceivers.
- **Building 725 DAQ Network Infrastructure**
 - Spine could consist of two 4 slot Arista 7804 chassis' with:
 - 2x 36 port 400GbE line cards.
 - Compute racks should utilize Top of Rack (ToR) Arista 7280CR3-32D4 or similar switches:
 - Switches provide 32x100GbE and 4x400GbE
 - This would allow us to connect the compute ToRs in any location within the 725 MDH or even external locations.
 - Storage head nodes will be redundantly connected to a centralized MLAG pair of Arista 7280CR3-32D4 or similar switches.
 - If the storage head nodes are 25GbE we may want to use a different type of fixed chassis switch.
 - Head nodes will be connected via fiber cabling back to the centralized Arista switches. This will allow the storage racks to be located anywhere within the 725 MDH.



Internal ePIC DAQ Network Infrastructure – Option 2

- **IP-6 DAQ Network Infrastructure**
 - Two Arista fixed chassis switches each supporting 24 port 400GbE.
 - Each rack containing DAM servers will receive a ToR Arista 7280CR3-32D4 (32x100GbE and 4x400GbE)
- **Building 725 DAQ Network Infrastructure (same as option 1)**
 - Spine could consist of two 4 slot Arista 7804 chassis' with:
 - 2x 36 port 400GbE line cards.
 - Compute racks should utilize Top of Rack (ToR) Arista 7280CR3-32D4 or similar switches:
 - Switches provide 32x100GbE and 4x400GbE
 - This would allow us to connect the compute ToRs in any location within the 725 MDH or even external locations.
 - Storage head nodes will be redundantly connected to a centralized MLAG pair of Arista 7280CR3-32D4 or similar switches.
 - If the storage head nodes are 25GbE we may want to use a different type of fixed chassis switch.
 - Head nodes will be connected via fiber cabling back to the centralized Arista switches. This will allow the storage racks to be located anywhere within the 725 MDH.

