Discussion on low-energy staging option

LBL

Thursday, December 11, 2008

Staging of eRHIC: Energy Reach and Luminosity

MEIC: Medium Energy Electron-Ion Collider

- Located at IP2 (with a modest detector)
- 2 GeV e^- x 250 GeV p ($\sqrt{s}$ = 45 GeV), L ~ 10^{32} cm^{-2} sec^{-1}

versus

eRHIC - Full energy, nominal luminosity , inside RHIC tunnel

- Polarized 20 GeV e^- x 325 GeV p ($\sqrt{s}$ = 160 GeV), L ~ $4 \cdot 10^{33}$ cm^{-2} sec^{-1}
- 30 GeV e x 120 GeV/n Au (120 GeV c.m.), L ~ 10^{31} cm^{-2} sec^{-1}
- 20 GeV e x 120 GeV/n Au (120 GeV c.m.), L ~ $5 \cdot 10^{31}$ cm^{-2} sec^{-1}

Note: $L \propto 1/A$, $L \propto \gamma$: e+A at 2+100 $\Rightarrow$ 2.5 x 197 = 500

hence:

L ~ $2 \cdot 10^{29}$ cm^{-2} sec^{-1}

Source: V.N. Litvinenko, EIC Collaboration Meeting, Hampton University, 19-23 May, 2008

Staging of eRHIC: Issues

Staging is only an option if we can make the physics case for

1. the staged option
2. the EIC in general

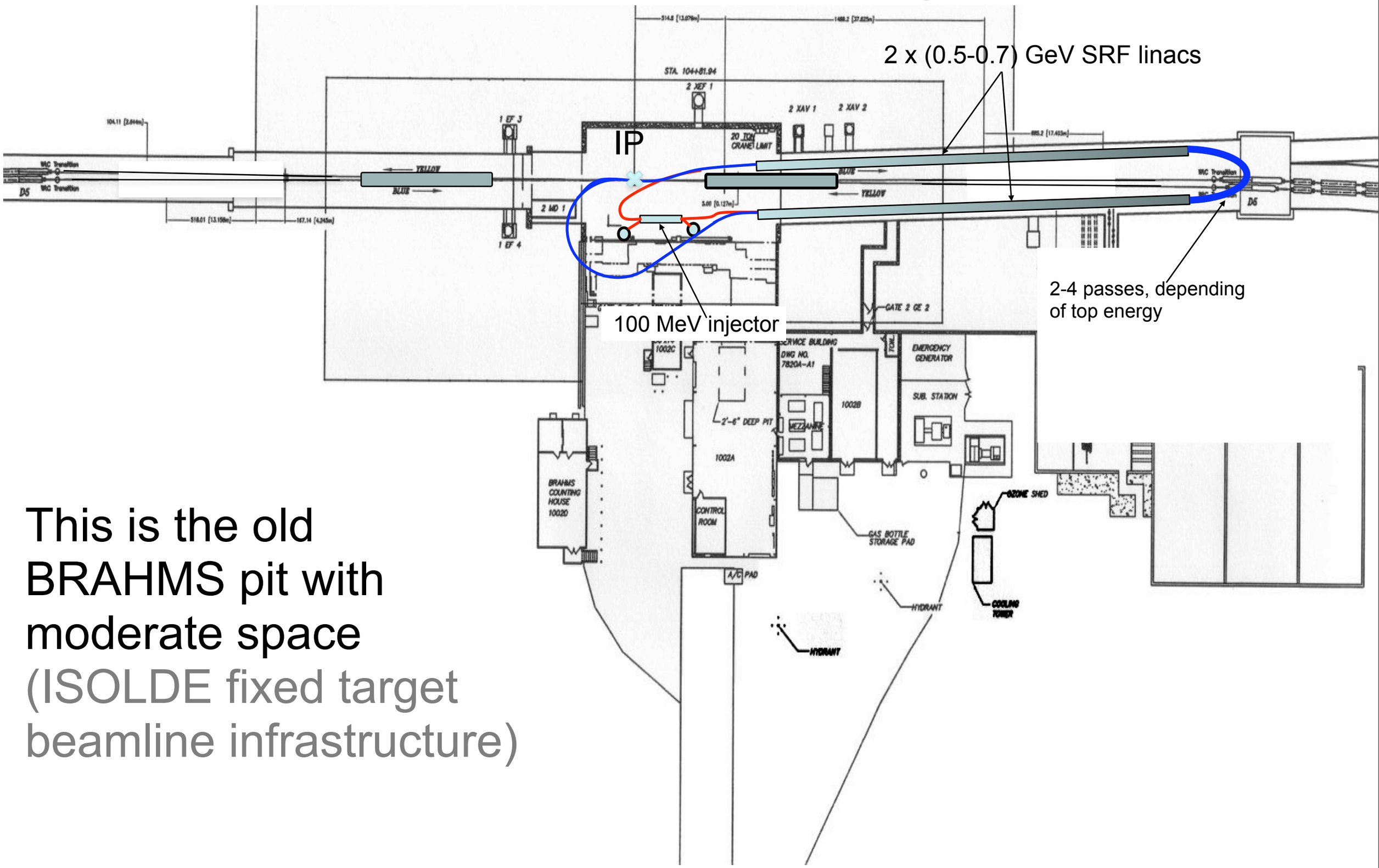
- Note: no (1) w/o (2)

The costs have to minimized which imposes some issues on an detector

- small detector with reduced capabilities only for staged version
  - limited physics (enough for certain dedicated studies)
  - investment is lost

- parts of a full detector
  - limited physics reach
  - components can be re-used
  - doesn't fit in IR !?

MEeIC @ IP2: up to 2 GeV with RT magnets
up to 4 GeV with SC magnets



This is the old BRAHMS pit with moderate space (ISOLDE fixed target beamline infrastructure)

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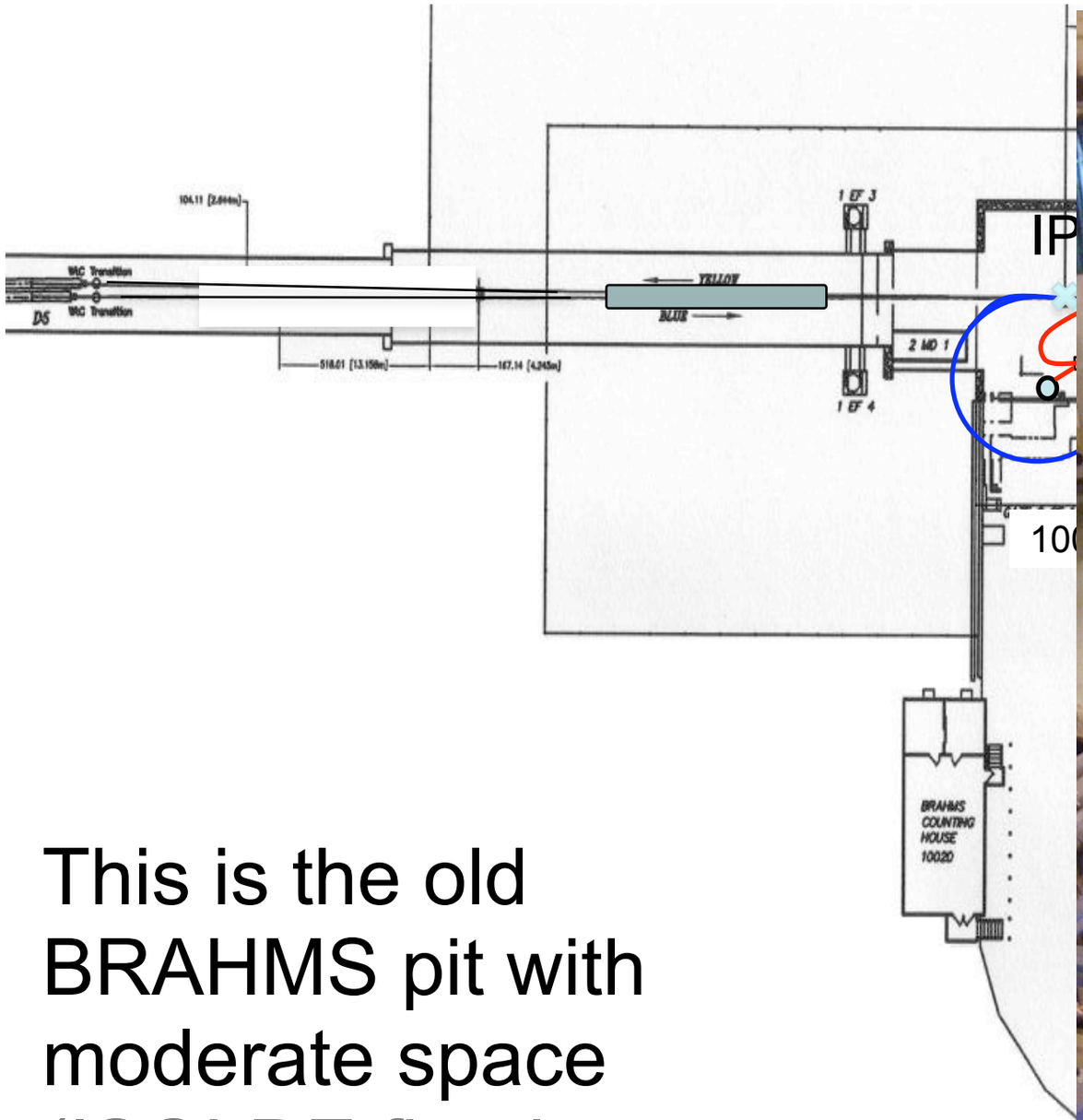

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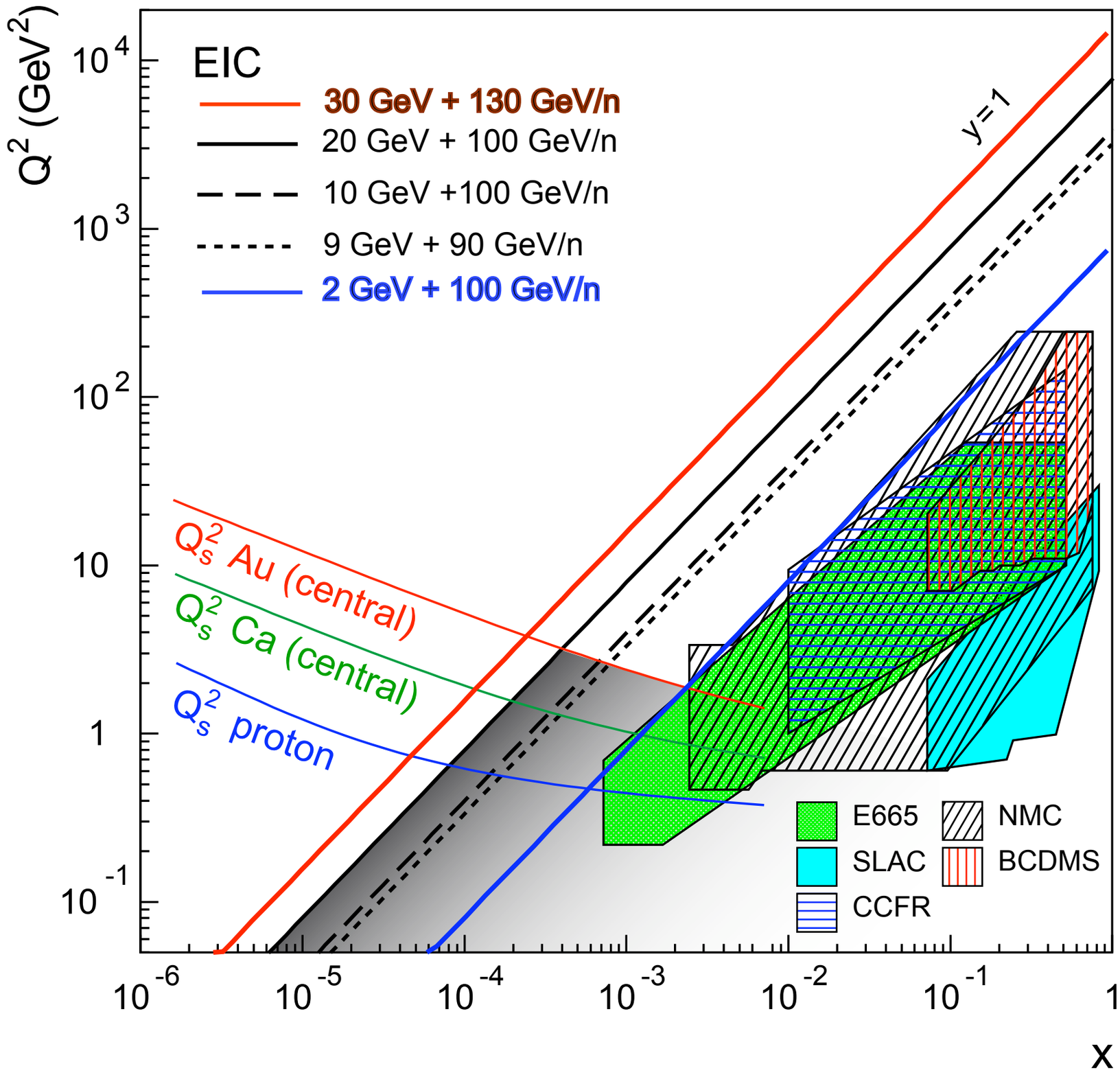
Landscape with 2+100 GeV



Physics Case Brainstorming

- We need to run at lower energies anyhow for F_L & F^D_L ⇒ it's already part of the program
  - **pros**: part of the program already done when full EIC comes to live
  - **cons**: argument that systematics drops out since same detector is not valid anymore
  - **cons**: limited capabilities, lower L
- Redo E665 program that had lots of shortcomings
  - pro: well defined program
  - cons: not a big seller to redo things
- Lot's of idea from Stan (nuclear targets at COMPASS never happened)
  - intrinsic charm, EMC-effect, antishadowing, etc.
- Things that do not need high √s
  - cons: many of those will need large L though (e.g. CP violation exp.)
- Diffraction
- Tomographic structure of nucleus (DVCS, diffractive J/psi - t-dependence)
- Comparison with RHIC
  - medium to large x at EIC -> RHIC d+Au forward
  - E-loss in cold matter