Machine backgrounds at the MEIC

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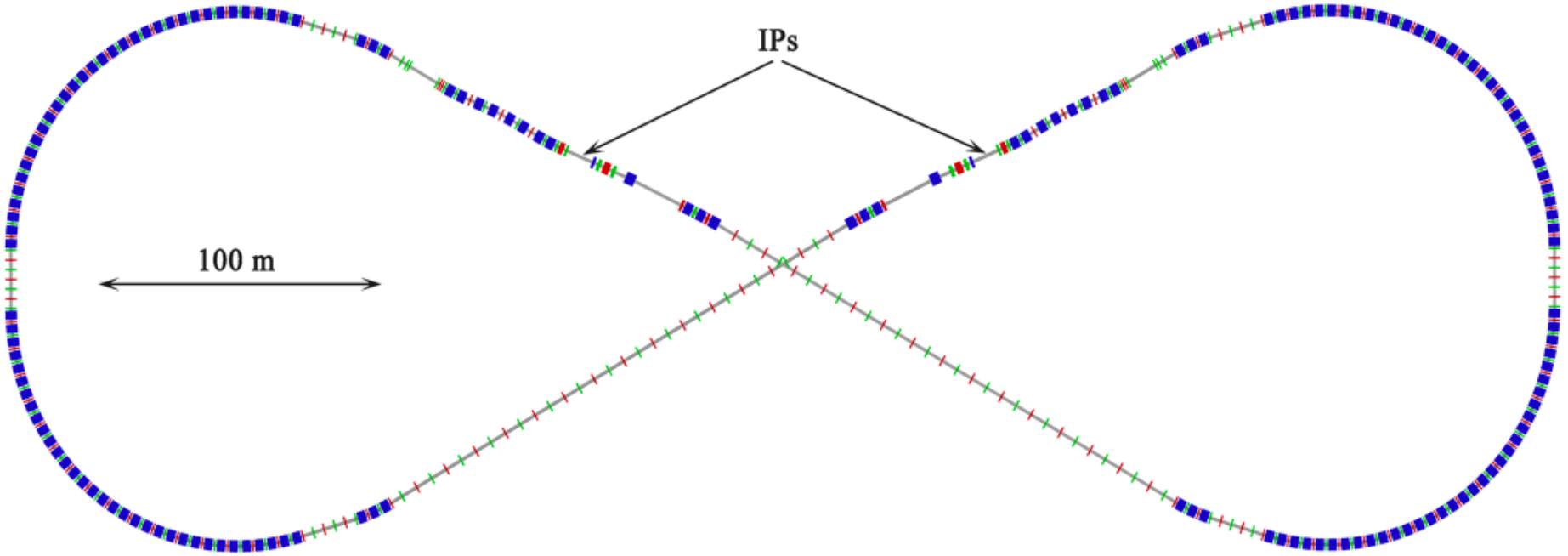
Machine backgrounds – strategy

1. Design ring to minimize synchroton- and hadronic backgrounds

2. Optimize layout and estimate synchroton backgrounds
   - Collaboration with SLAC (Mike Sullivan)

3. Optimize layout and estimate hadronic backgrounds
   - Simulations at JLab
   - Collaboration with Fermilab?



Hadronic backgrounds and detector placement

Random hadronic background

- Dominated by interaction of beam ions with residual gas in beam pipe between arc and IP

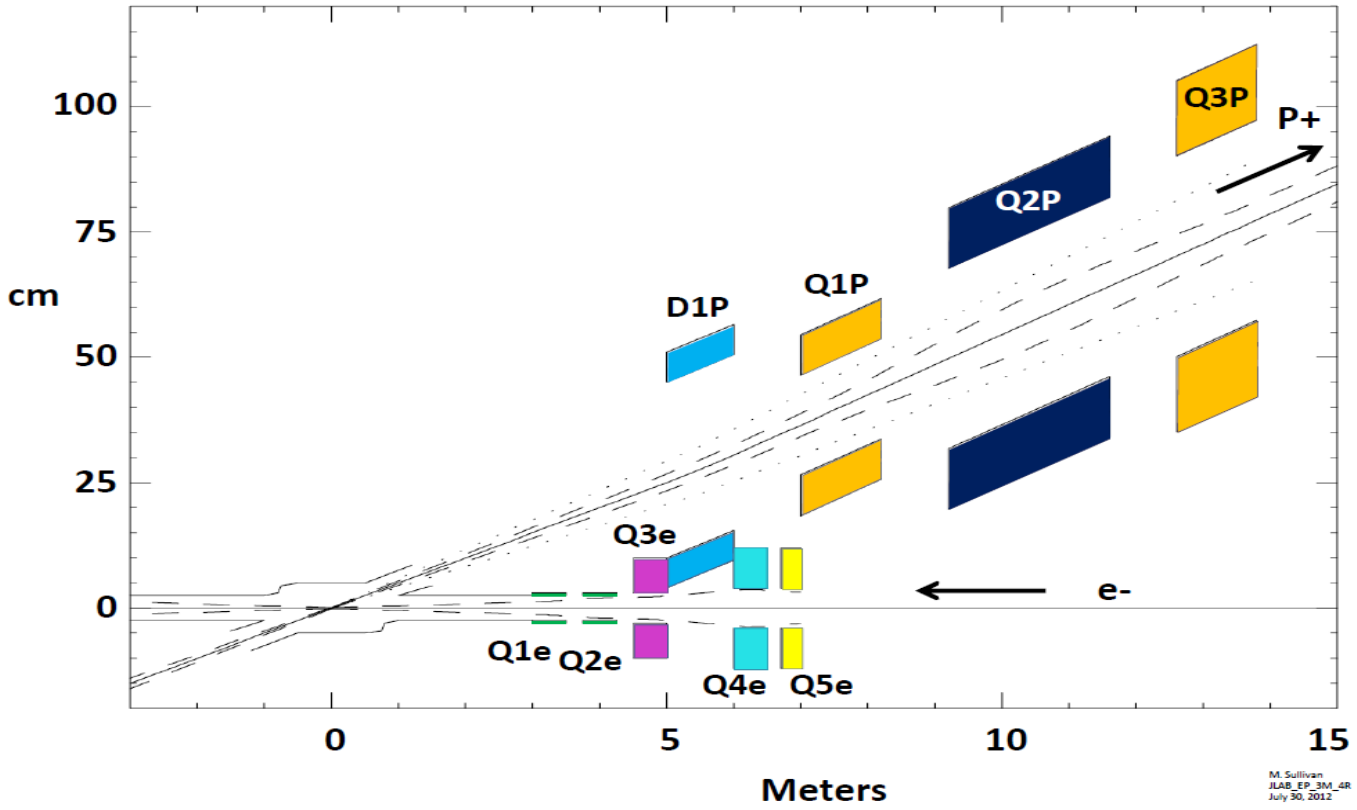
Comparison of MEIC (at s = 4,000) and HERA (at s = 100,000)

- Distance from ion exit arc to detector: 50 m / 120 m = 0.4
- Average hadron multiplicity: $(4000 / 100000)^{1/4} = 0.4$
- p-p cross section (fixed target): $\sigma(90\ \text{GeV}) / \sigma(920\ \text{GeV}) = 0.7$
- At the same ion current and vacuum, MEIC background should be about 10% of HERA
  - Can run higher ion currents (0.1 A at HERA, 0.5 A at MEIC)
  - Good vacuum is easier to maintain in a shorter section of the ring

Backgrounds do not seem to be a major problem for the MEIC

- Placing high-luminosity detectors closer to ion exit arc helps (also with synchrotron radiation)!
- Signal-to-background will be considerably better at the MEIC than HERA
  - MEIC luminosity is more than 100 times higher (depending on kinematics)

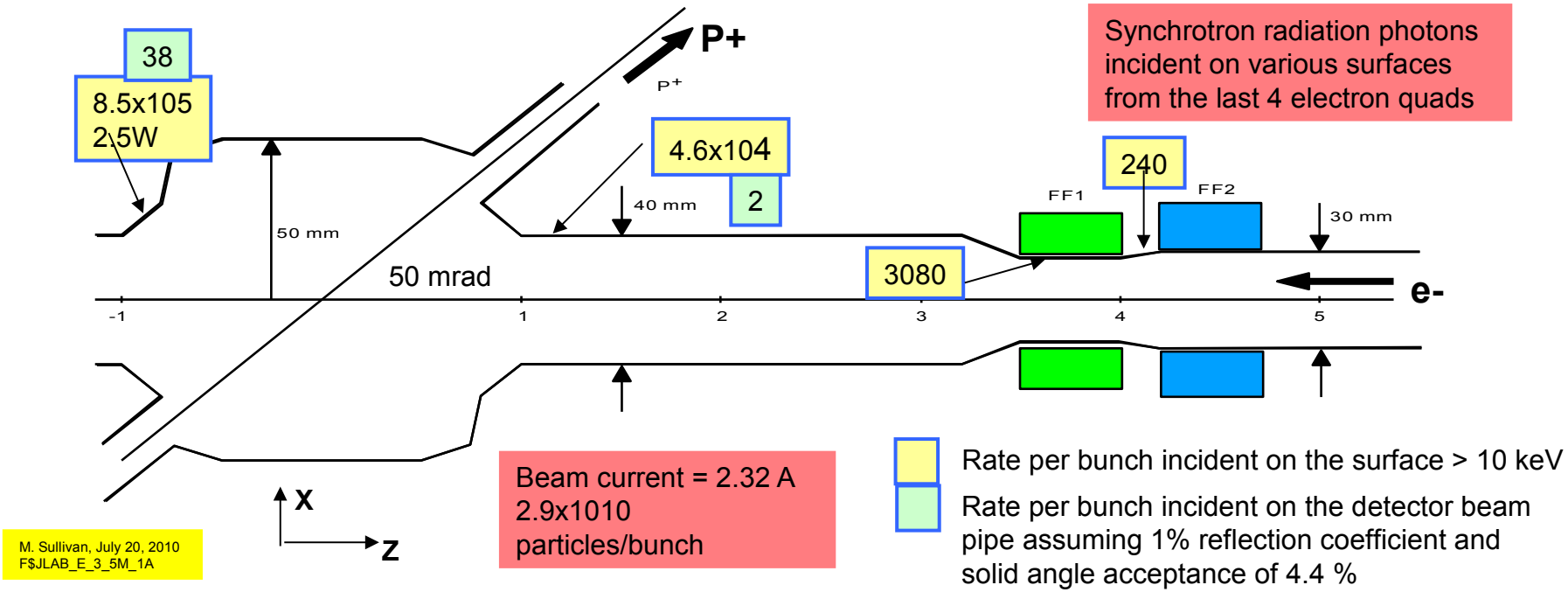
IR layout



M. Sullivan

- Layout of the asymmetric IR of the MEIC. The vertical scale is highly exaggerated, and the emphasis of the figure is on the outgoing ion beam direction elements. The beam-stay-clear area and a 0.5° detection cone are indicated. The detector solenoid is offset by 0.5 m in the direction of the outgoing electron beam, and extends 3 m (2 m) in the outgoing ion (electron) beam direction. The interleaved positions of the incident electron and outgoing ion beam elements are illustrated.

Synchrotron radiation at IR – a first look



- Beam related detector backgrounds must be carefully analyzed and mitigation schemes developed that allow the detector to pull out the physics
  - Electron beams: controlling synchrotron radiation backgrounds and lost beam particles
  - Ion beams: controlling the lost beam particles
- Initial look at synchrotron radiation indicates that this background should not be a problem
- The new MEIC design, ion beam will be bent for crab crossing, minimizing SR in IR
- Beam stay-clear: 12 sigma

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