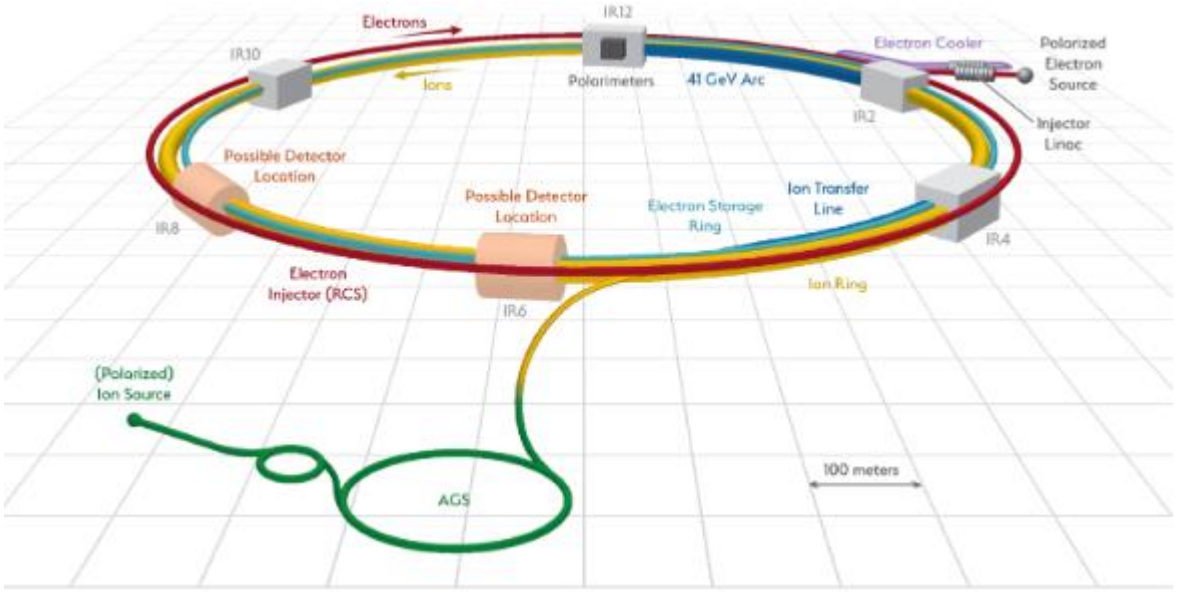
Pulsed Compton laser for the EIC



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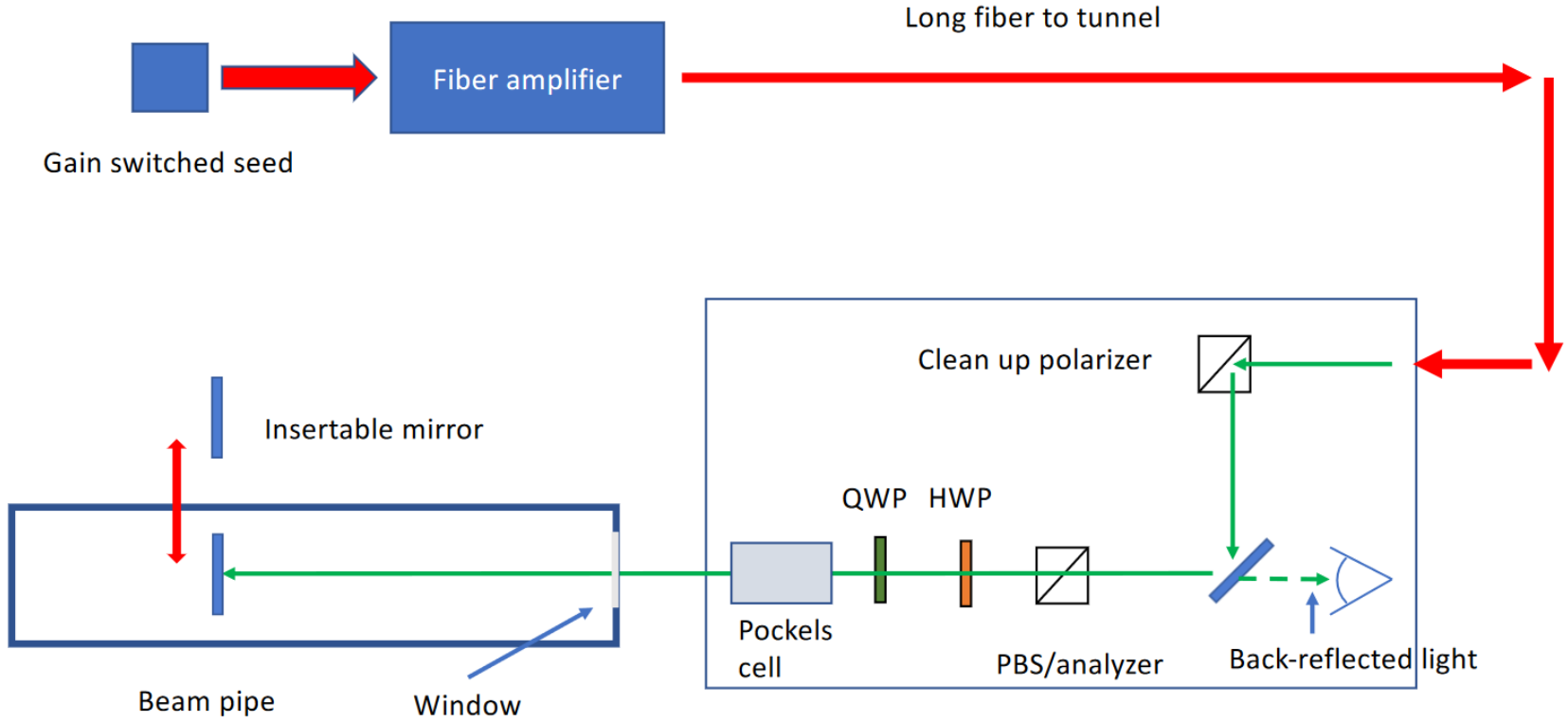
Jefferson Lab

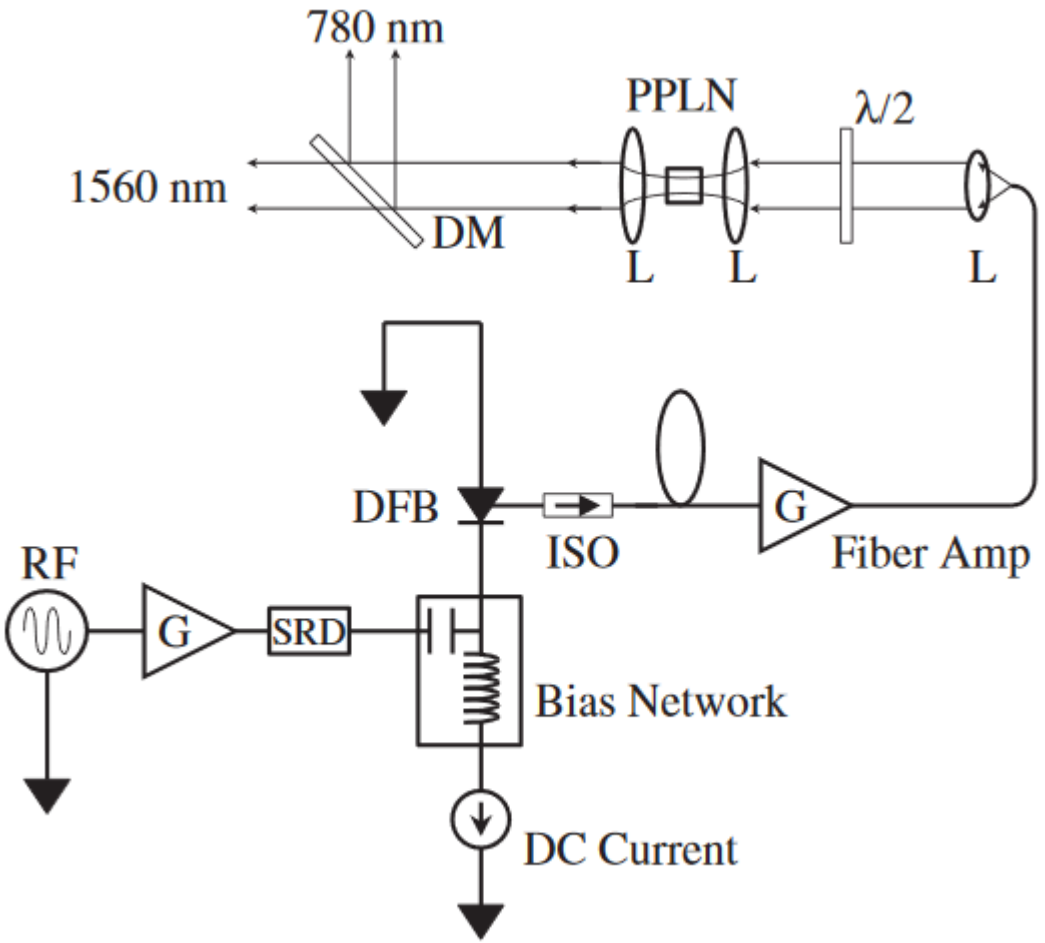
Current design of EIC laser system



- The initial laser system design uses most of the design features highlighted in the previous Compton polarimeter implementations
  - As was before we need the laser system to be away from potential fatal radiation fields inside the tunnel (we plan to evaluate the use of high power laser fiber)
- The vacuum resident insertable mirror will be needed in order to be able to monitor the DOCP at the interaction point

Gain switched seed

- The gain switched seed laser design developed at CEBAF for the injector satisfies all the requirements that we discussed so far
  - The RF lock allows us to synchronize to all or specific electron bunches
  - The pulse longitudinal width will be smaller than the electron bunch (allowing us to potentially measure the longitudinal polarization profile)
  - The PPLN or LBO crystal will allow us to frequency double the 1064nm light to 532
- The system has proven to be very reliable and has been adopted by other facilities (such as the Maintz Microtron)



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https://journals.aps.org/prab/pdf/10.1103/PhysRevSTAB.9.063501

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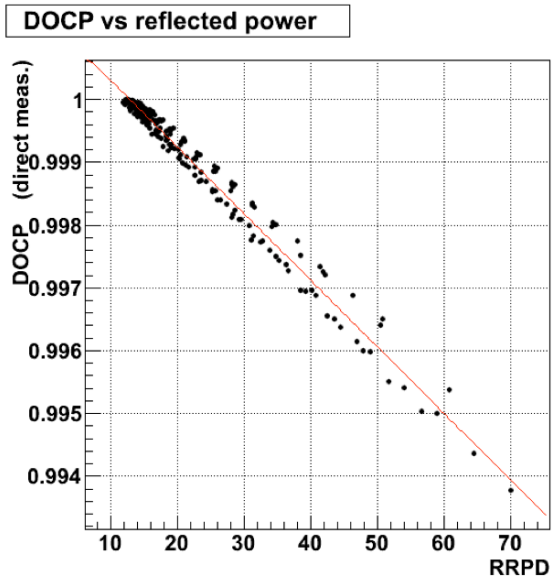
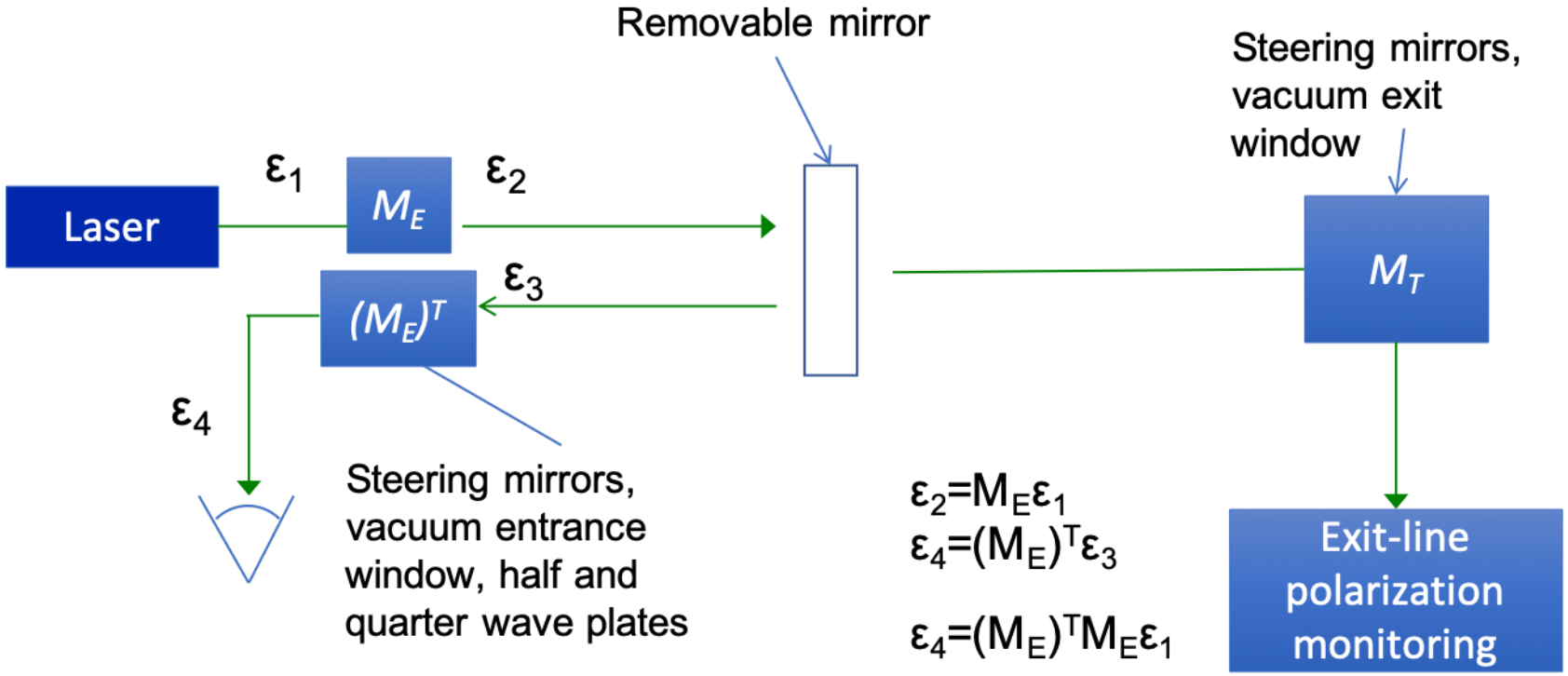
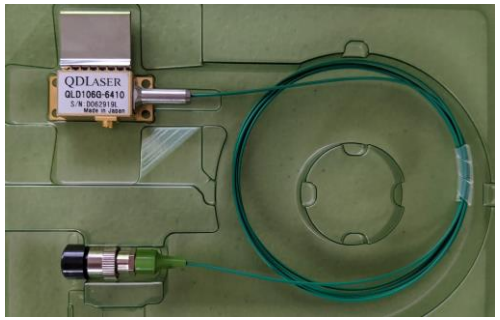
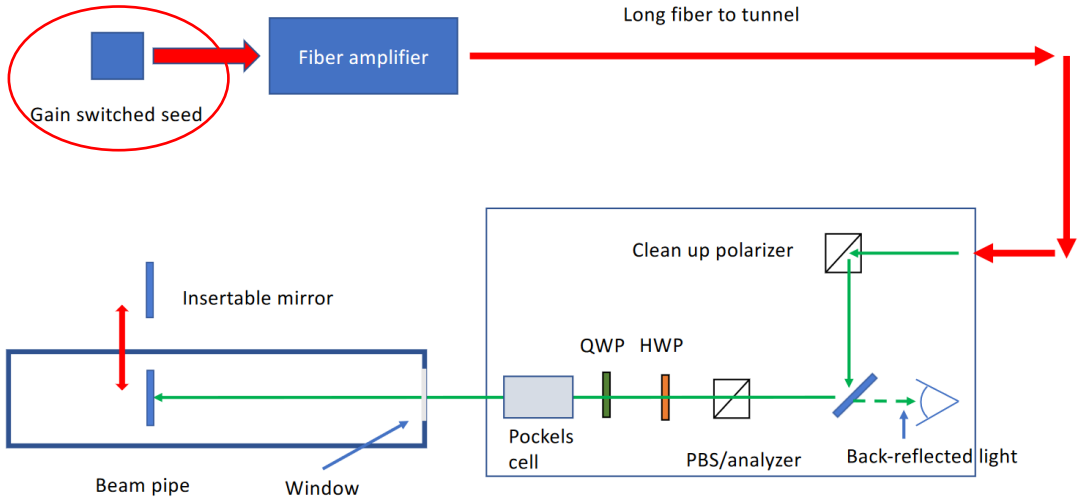


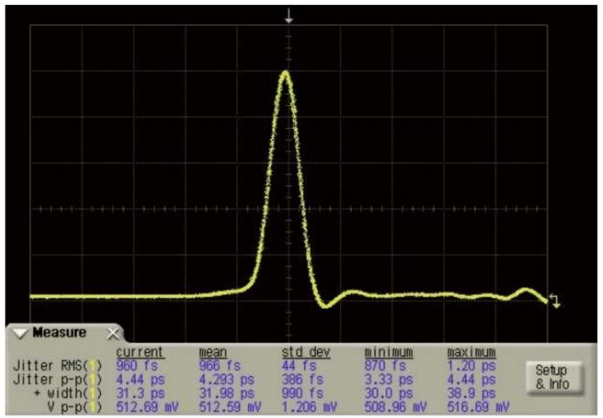


- The polarization setup for the EIC Compton will follow the same logical reasoning as the Jefferson Lab measurements

Work start

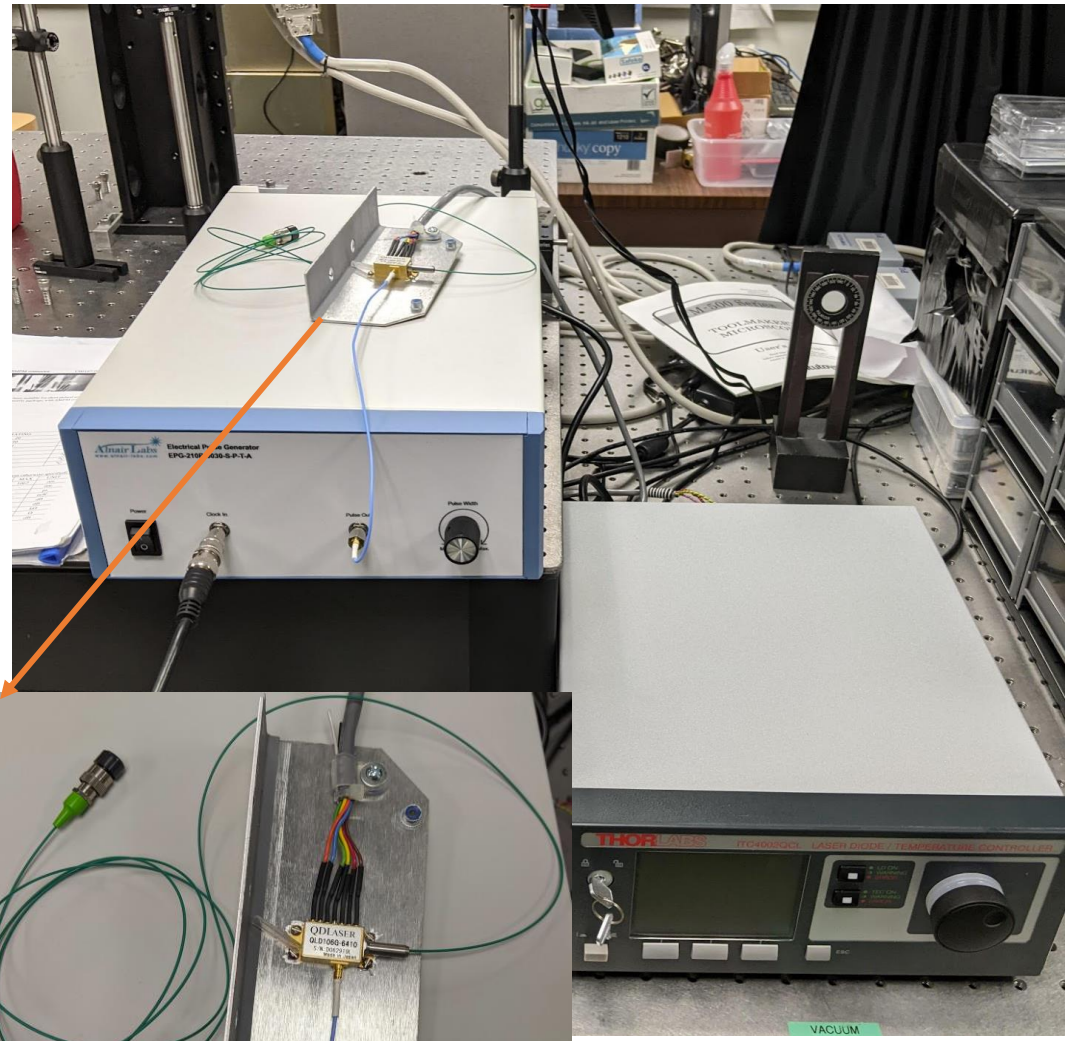


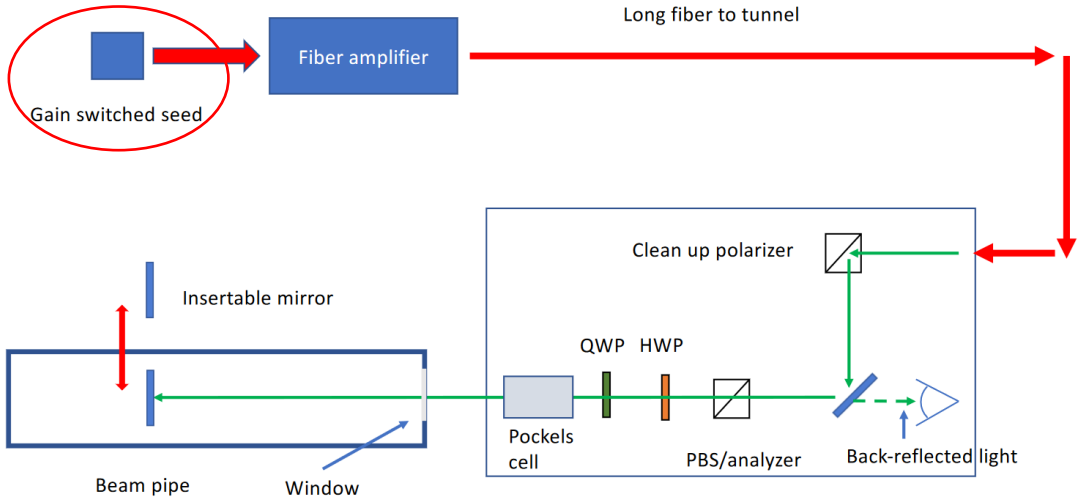


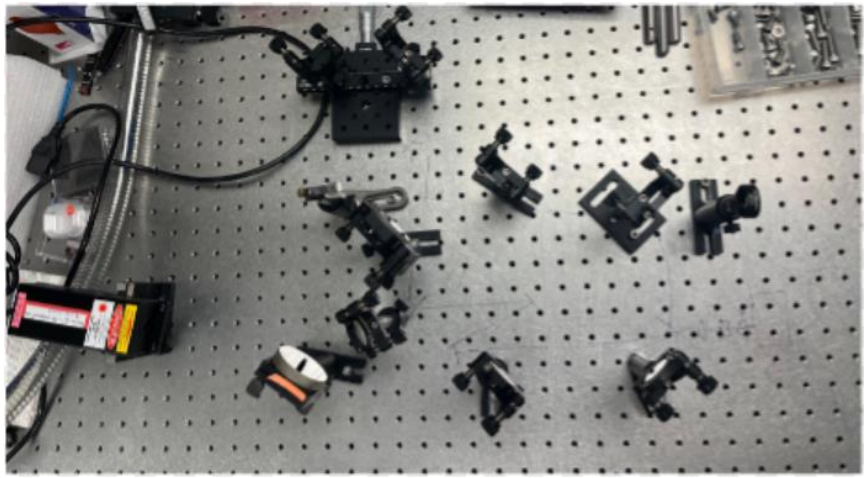


- Initial funds provided through the eRD program (46k$ for eRD26)
- QLD106G-6410 provides 1064nm short pulses (~20ps)
  - Average power 0.1mW @100MHz (-10dBm)
- Electrical pulse generator: 30-230ps pulses, for 1MHz to 1GHz
  - The plan is to have fixed pulse energy at the highest rep rate and use a pulse picker (such as an fiber coupled EOM) to get us the lower frequencies
- A pre-amplifier (YDFA100P) with an output of ~12dBm (getting us to ~16mW) is going to be needed for characterization and input into the fiber amplifier

Work start







- The wiring for the laser is complete and work is ongoing to confirm the laser properties that were reported by the vendor (power and pulse width)
  - The autocorrelator setup was completed over the summer at MS-State

Work plan

Step 1

- Detail design of laser system
- Seed and preamp construction
  - Low power characterization

Step 2

- High power fiber amplifier
- Fiber delivery
- Frequency doubler
- Design vacuum system

Step 3

- Check 100% DOCP laser polarization through vacuum windows
- Remote control stages
- Picomotor controller
- Potential test at JLab
- Publish results

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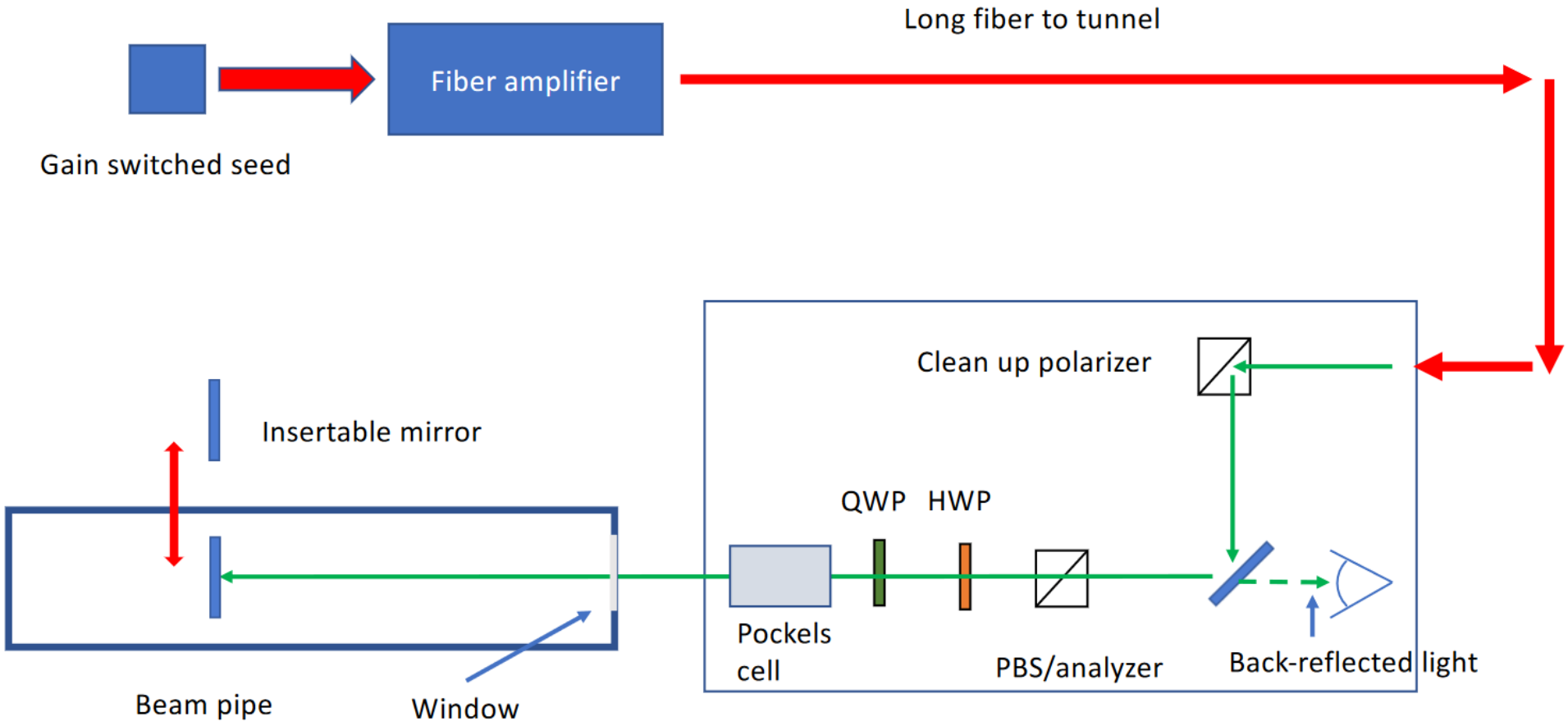

Backup