FUTURE CIRCULAR COLLIDER

CERN

Polarimeter Requirements

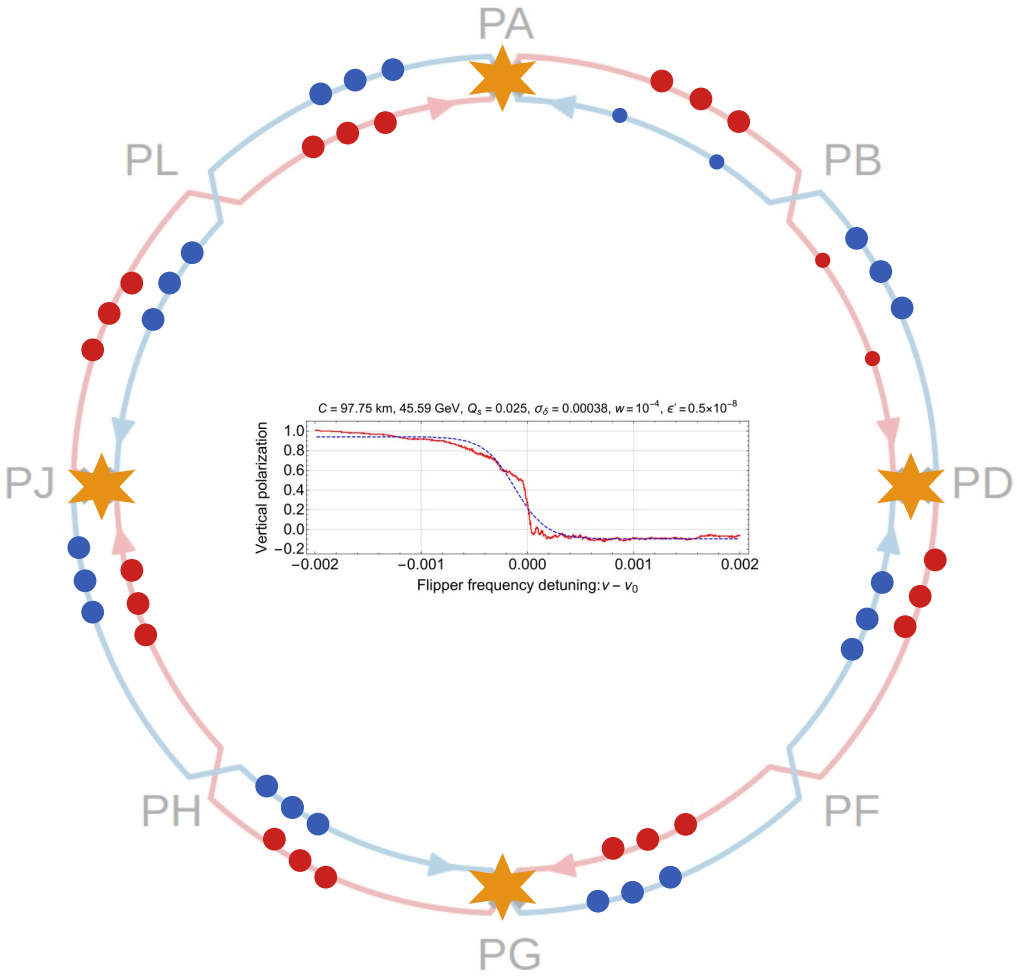
J. Keintzel and G. Wilkinson

FCC-ee Design Meeting
CERN, Geneva, Switzerland
27 June 2024

FCCIS – The Future Circular Collider Innovation Study. This INFRADEV Research and Innovation Action project receives funding from the European Union's H2020 Framework Programme under grant agreement no. 951754.

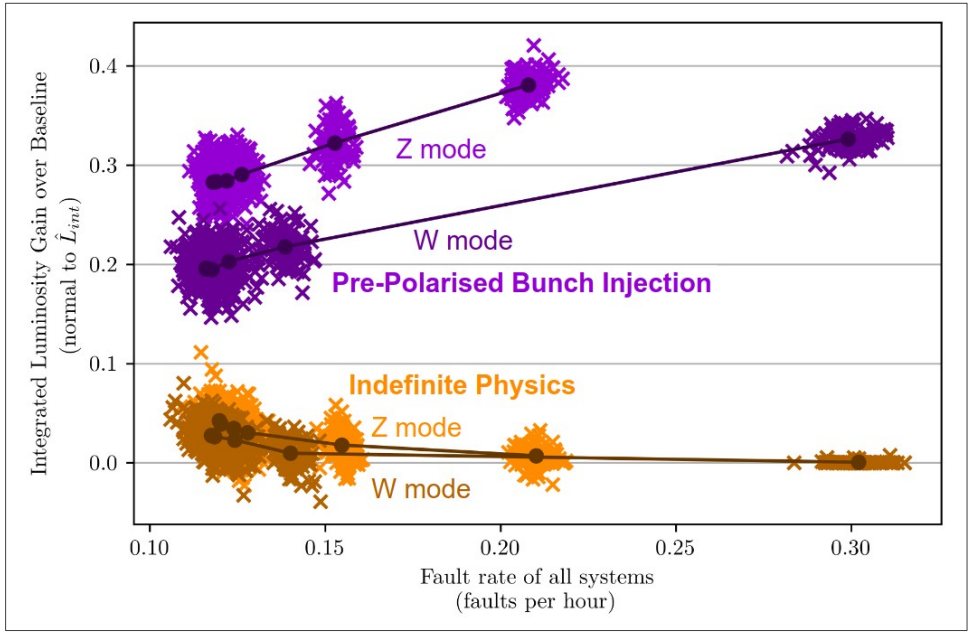
Current Operational Scenario

- Inject a few (~160) non-colliding pilot bunches (~10^{10} ppb)
- Use on wigglers until ~5-10 % vertical polarization reached
  - → Only feasible for Z and WW-mode
- Switch wigglers off
- Inject ~10000 colliding bunches (~2 x 10^{11} ppb)
- Measure beam energy with pilots while collisions take place
  - → **Polarimeter**

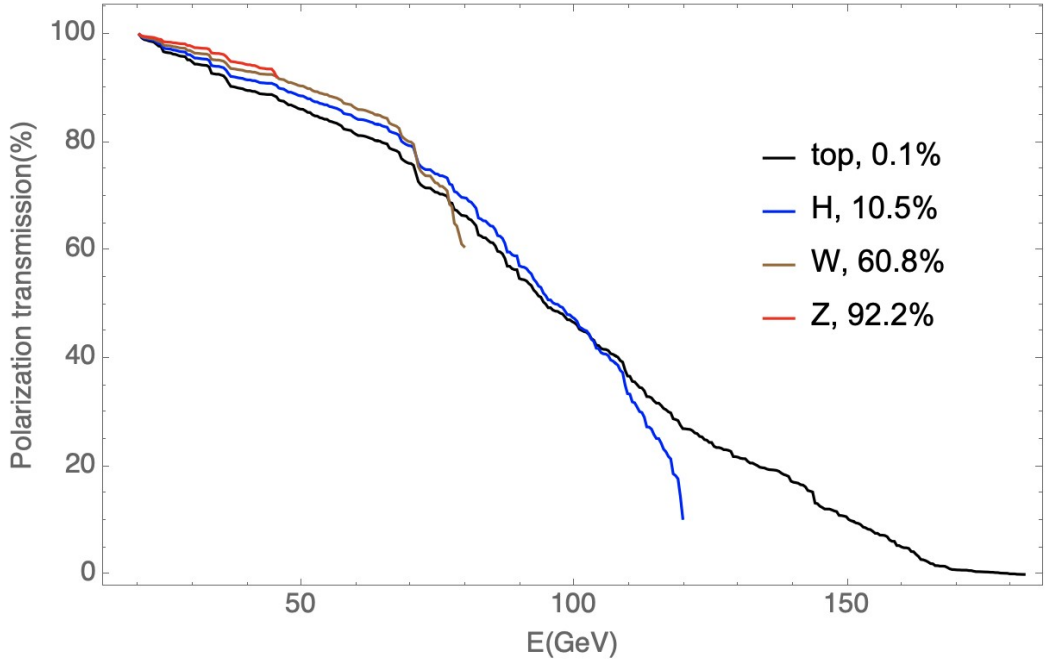


Alternative Scheme

- Current operation scheme requires time for self-polarization after every beam dump
- Injection of polarized beams could increase luminosity (availability studies)
- Preliminary studies suggest transportation of polarized beams possible up to ZH-mode



Courtesy: J. Heron



Courtesy: Z. Duan

Polarimeter Requirements

- Baseline is Resonant DePolarization (RDP) which measures the **average beam enery** of pilot bunches
- RDP is **independent of polarimeter location** in the lattice
- Residual polarization could spoil physics experiments → polarization of **physics bunches** to be **monitored**
- Alternative technique observing Free Spin Precession (FSP) should be investigated further
- **Requirements for EPOL:**
- At least one polarimeter per beam, with laser accessible at all times is essential
- RDP for one pilot bunch at a time up to (at least) ZH-energy, merits and challenges for FSP to be explored
- Dedicated Z-calibration runs when machine is operating at ttbar-mode → polarimeter must be available at all stages
- Monitoring of polarization of colliding bunches
- **The question of more polarimeters:**
- Help understanding spin rotations and precessions between various points (systematics errors, etc.)
- Measurement redundancy in case of failure of the polarimeter

FUTURE CIRCULAR COLLIDER

CERN

Thank you!

J. Keintzel and G. Wilkinson

FCC-ee Design Meeting
CERN, Geneva, Switzerland
27 June 2024

FCCIS – The Future Circular Collider Innovation Study. This INFRADEV Research and Innovation Action project receives funding from the European Union's H2020 Framework Programme under grant agreement no. 951754.