EPOL Summary

Jacqueline Keintzel
Special thanks to Guy Wilkinson

FCC Week 2025
Vienna, Austria
23 May 2025

Overview

Version: 2.0 — Date: 20.05.2025

Monday

Time	Plenary – Zeremoniensaal (472 p.)
08:00-08:30	Welcome coffee
08:30-09:00	1. Welcome remarks 2. Welcome and introduction 3. FCC: a view from CERN council 4. Opening remarks and Perspectives from Austrian Academy of Science 5. Practical information 6. Concerence photo
09:00-09:30	
09:30-10:00	
10:00-10:30	
10:30-11:00	Coffee break
11:00-11:30	1. Key note: From HL-LHC to FCC 2. FCC Feasibility Study status 3. FCC Collaboration status
11:30-12:00	
12:00-12:30	
12:30-13:00	Lunch break
13:00-13:30	
13:30-14:00	
14:00-14:30	1. Implementation Scenario 2. Civil Engineering 3. FCC Accelerator Status 4. FCC Technologies & Technical Infrastructures
14:30-15:00	
15:00-15:30	
15:30-16:00	Coffee break
16:00-16:30	1. Theroy challenges in precision calculations 2. Flavour and BSM through measurements at 90 GeV and beyond 3. Detectors for FCC-ee - status and next steps
16:30-17:00	
17:00-17:30	
17:30-18:00	
18:00-18:30	Welcome reception
18:30-19:00	
19:00-19:30	
19:30-20:00	
20:00-20:30	
20:30-21:00	
21:00-22:00	

Tuesday

Time	Parallel 1 – Geheime Ratstube (146 p.)	Parallel 2 – Rittersaal (158 p.)	Parallel 3 – Trabantenstube (96 p.)	Parallel 4 – Künstlerzimmer (77 p.)	Board Room – Radetzky Ap.1 (30 p.)
08:00-08:30	Welcome coffee				
08:30-10:00	Physics Case and Theory calculations J. Gluza (U.S. Katowice)	Baseline Optics I. Agapov (DESY)	Electricity & Energy Management N. Bellegarde (CERN)	Environment (I) S. Kleiner (CERN)	
10:00-10:30	Coffee Break				
10:30-12:00	Physics Case and Theory calculations V. Del Duca (INFN)	Alternative Optics A. Faus-Golfe (IJCLab)	RF Points and Cryogenics F. Gerigk (CERN)	Environment (II) B. Dellile (CERN)	CHART M. Benedikt
12:00-13:30	Lunch break				Scientific Advisory Committee
13:30-15:00	Detector concepts M. Dam (NBI)	Tuning and Operations R. Tomas (CERN)	Civil Engineering (I)	Environment (III)	FCC FS Steering Committee (14:00-15:00)
15:00-15:30	Coffee Break				
15:30-17:00	Detector concepts: Calorimetry and PID M. A. Pleier (BNL)	Collective Effects L. Rivkin (PSI)	Civil Engineering (II) M. Capeans (CERN)	IRIS EU Project J. Gutleber	
17:00-17:30		Early Career Reserchers (17:00-18:30)			
17:30-19:00	International Collaboration Board P. Chomaz (CEA)				
19:00-20:30	Public event: The Higgs Boson and Our Life National Library				

Wednesday

Time	Plenary – Zeremoniensaal (500 p.)	Parallel 1 – Geheime Ratstube (146 p.)	Parallel 2 – Rittersaal (158 p.)	Parallel 3 – Trabantenstube (96 p.)	Parallel 4 – Künstlerzimmer (77 p.)	Board Room – Radetzky Ap.1 (30 p.)
08:00-08:30	Welcome coffee					
08:30-10:00	Physics Perf. & Detector Req. D. Elvira (FNAL)	Industry & Technology Day: Keynotes (09:00-10:00)	FCC-ee Injector Overview M. Boland (USASK)	Magnets and power conversion S. Rimjaem (CMU)	SRF - Directions for R&D S. Belomestnykh (FNAL)	
10:00-10:30	Coffee Break					
10:30-12:00	Software and Computing G. Ganis (CERN)	The value of Big Science R. Crescenzi (LSE)	FCC-ee INJ Linac and Damping Ring J. Seeman (SLAC)	Vacuum F. Djurabekova (U. Helsinki)	SRF - Technology (I) C. Pira (INFN)	
12:00-13:30	Lunch break					
13:30-15:00	Physics Performance & Detector Req. P. Azzi (INFN)	WKO Industry session P. Sagmeister	FCC-ee INJ Booster and transfer lines J. Wenninger (CERN)	Injection & Instrumentation S. White (ESRF)	SRF - Technology (II) U. Van Rienen (UROS)	
15:00-15:30	Coffee Break					
15:30-17:00	Large-scale infrastructure projects in Austria R. Galler (MUL)					
18:00-19:00	Aperitiv Foyer Musikverein Vienna *(from 17:45 to 18:45)*					
19:00-20:00	Social event: Concert Musikverein Vienna					

Thursday

Time	Plenary	Parallel 1 – Geheime Ratstube (146 p.)	Parallel 2 – Rittersaal (158 p.)	Parallel 3 – Trabantenstube (96 p.)	Parallel 4 – Künstlerzimmer (77 p.)	Board Room – Radetzky Ap.1 (30 p.)
08:00-08:30	Welcome coffee					
08:30-10:00		Machine Detector Interface (I) F. Palla (INFN)	SRF - Technology (III)	Integration and Radiation S. Bartolome (CERN)	Synergies and innovation (I) D. Martin (ESRF)	HTS Coated Conductors S. Calatroni (CERN)
10:00-10:30	Coffee break					
10:30-12:00		Machine Detector Interface (II) A. Drees (BNL)	FCC-hh accelerator Optics baseline V. Shiltsev (NIU)	Safety B. Dellile (CERN)	Synergies and innovation (II) G. Lamanna (LAPP)	HTS Coated Conductors S. Calatroni (CERN)
12:00-13:30	Lunch break					
13:30-15:00		EPOL (I) A. S. Müller (KIT)	FCC-hh High Field Magnets (I) P. Vedrine (CEA)	Cooling & Ventilation, Geodesy I. Ruehl (CERN)	Beam Interception Devices	Scientific Advisory Committee meeting A. Parker (U. Cambridge) (13:30-17:00)
15:00-15:30			Coffee break			
15:30-17:00		EPOL (II) A. Blondel (LPNHE)	FCC-hh High Field Magnets (I)	Transport and Logistics B. Müller (FIML)	Machine protection and availability C. Welsch (ULIV)	
17:00-18:30	Poster session	Detector concepts F. Sefkow (DESY)				
19:00-22:30	Conference dinner Wiener Rathauskeller					

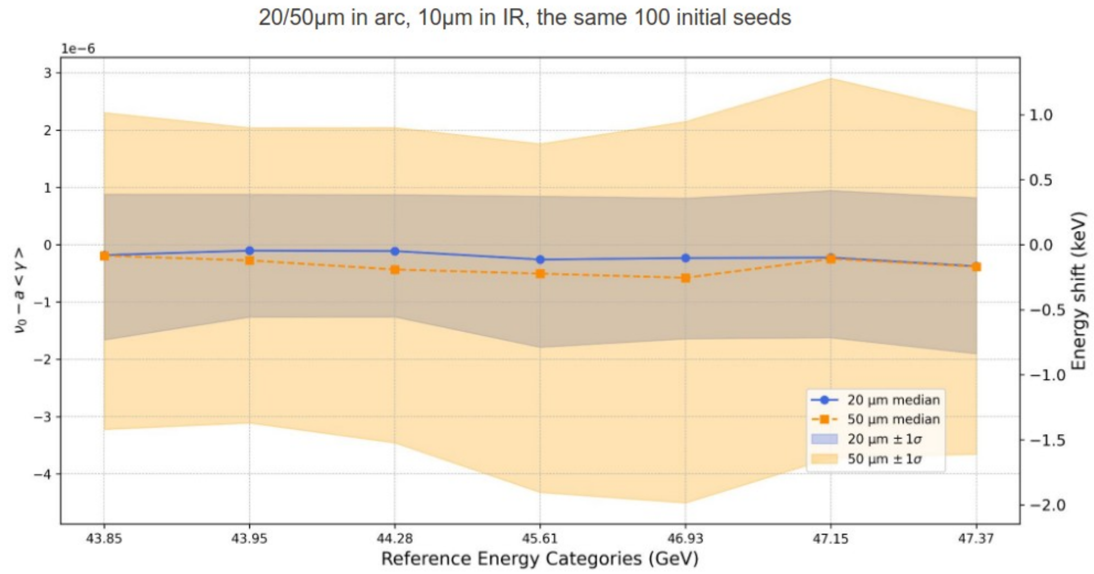
Friday

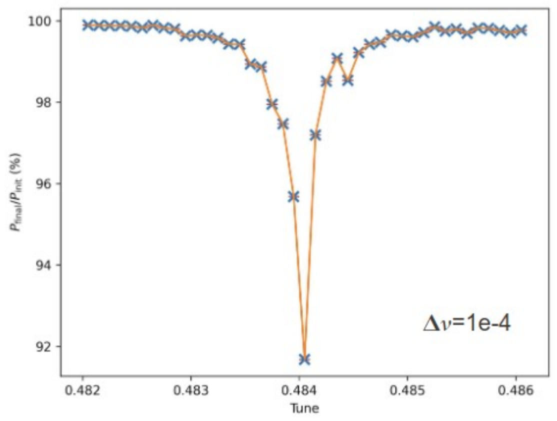
Time	Plenary – Zeremoniensaal (472 p.)
08:00-08:30	Welcome coffee
08:30-10:00	1. FCC-hh and HFM 2. Civil Engineering 3. Technical infrastructure 4. Injector & Booster 5. Accelerator 6. Accelerator R&D including RF
10:00-10:30	Coffee break
10:30-12:00	1. EPOL 2. MDI 3. Physics 4. Detectors 5. Early Career Researchers
12:00-12:30	Concluding remarks and outlook

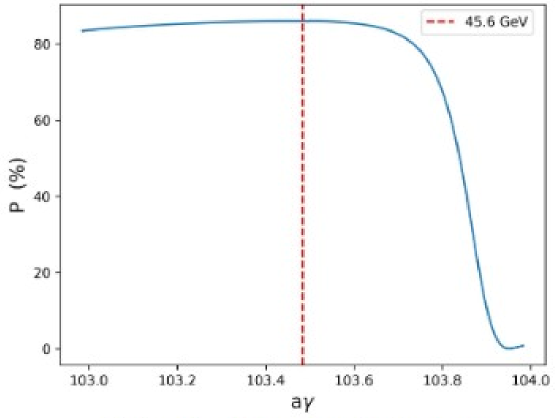
Y. Wu

Beam polarization studies

- Polarization reduced by misalignment and field errors
- Spin tune shift from errors below a few keV
- Improved by dedicated orbit bumps
- First resonant depolarization scans performed in BMAD
- Non-local solenoid scheme
  - Large polarization in BMAD, but not in SAD → ongoing





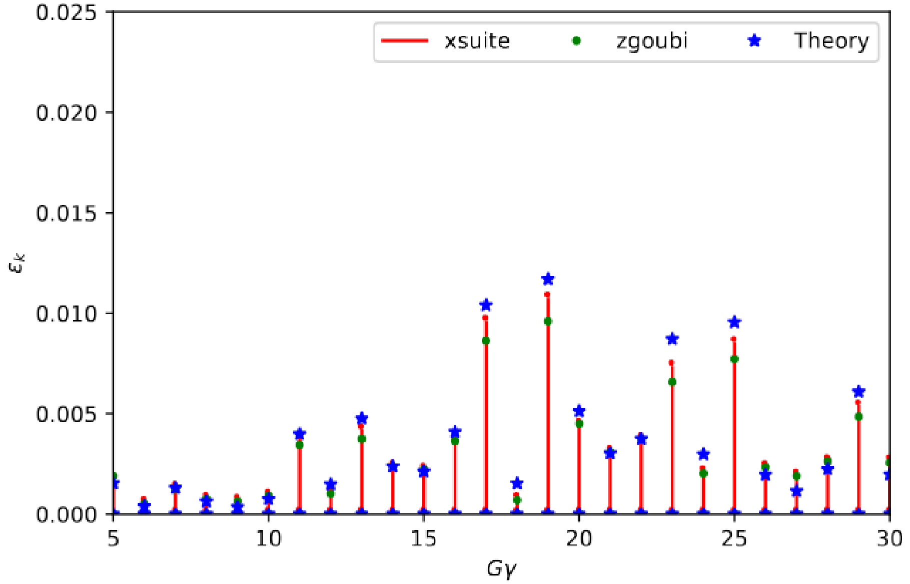


first order P near nominal energy

K. Hock

Spin tracking in Xsuite

- Collaboration between BNL and CERN
- Implementation in xsuite
- Benchmarking performed for the AGS booster
  - Xsuite and zgoubi compared



Transporting through an optical element, we will define the spinor transport matrix from i to f as T where

$$\psi_f = T_{f\leftarrow i}\psi_i \tag{5}$$

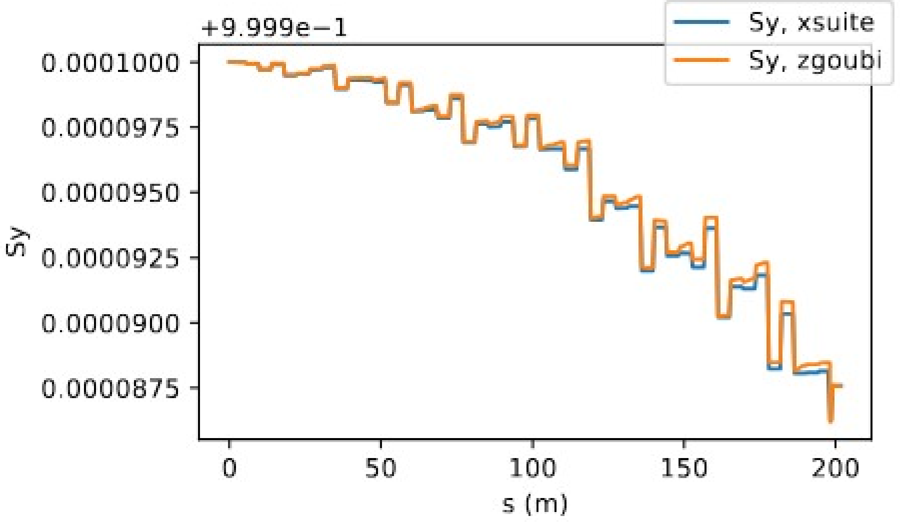
which rotates the spinor by $\phi\omega$

$$T = e^{\frac{i}{2}(\vec{\omega}\cdot\vec{\sigma})} = I\cos\frac{\omega\phi}{2} + i(\frac{\vec{\omega}}{\omega}\dot{\vec{\omega}})\sin\frac{\omega\phi}{2} = \begin{pmatrix} t_o + it_y & t_s + it_x \\ -t_s + it_x & t_o - it_y \end{pmatrix} \tag{6}$$

with $t_o = \cos\frac{\omega\phi}{2}$, $t_x = \frac{\omega_x}{\omega}\sin\frac{\omega\phi}{2}$, $t_s = \frac{\omega_s}{\omega}\sin\frac{\omega\phi}{2}$, $t_y = \frac{\omega_y}{\omega}\sin\frac{\omega\phi}{2}$

Bringing this back into the 3D spin vector, we define M where $\vec{S}_f = M_{f\leftarrow i}\vec{S}_i$

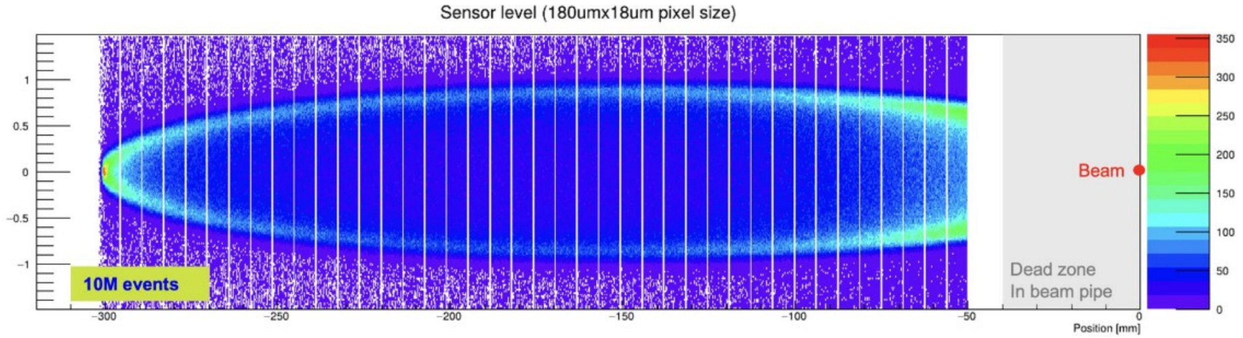
$$M = \begin{pmatrix} t_o^2 + t_x^2 - t_s^2 - t_y^2 & 2(t_x t_s + t_o t_y) & 2(t_x t_y - t_o t_s) \\ 2(t_x t_s - t_o t_y) & t_o^2 - t_x^2 + t_s^2 - t_y^2 & 2(t_s t_y + t_o t_x) \\ 2(t_x t_y + t_o t_s) & 2(t_s t_y - t_o t_x) & t_o^2 - t_x^2 - t_s^2 + t_y^2 \end{pmatrix} \tag{7}$$

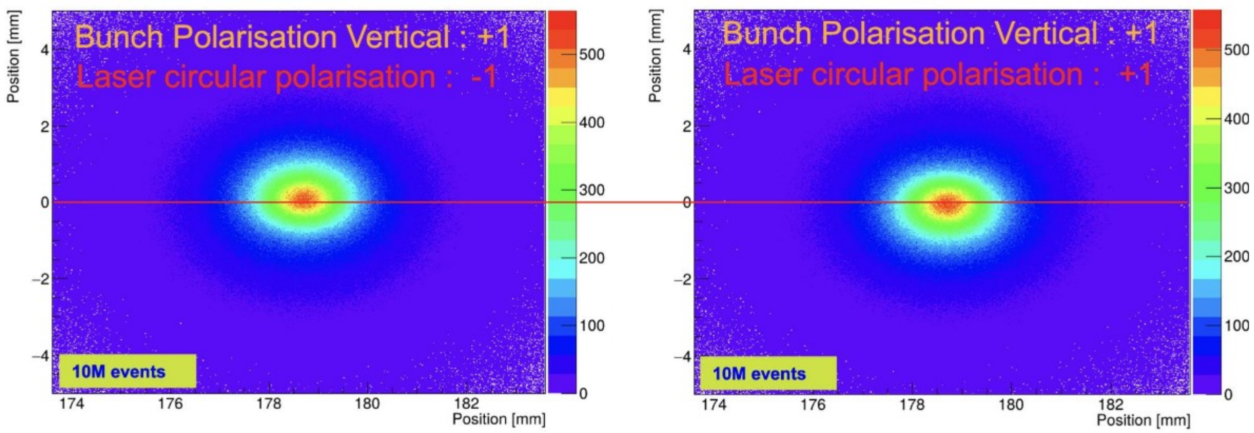


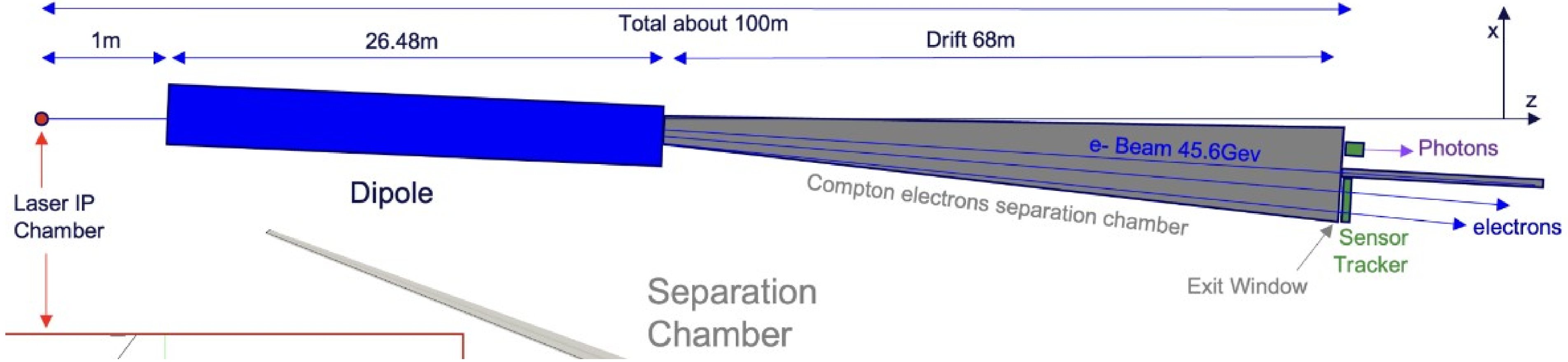
R. Kieffer

FCC-ee inverse compton polarimeter design

- Great progress on various aspects of polarimeter design
- Flipping polarization moves photon pattern vertically



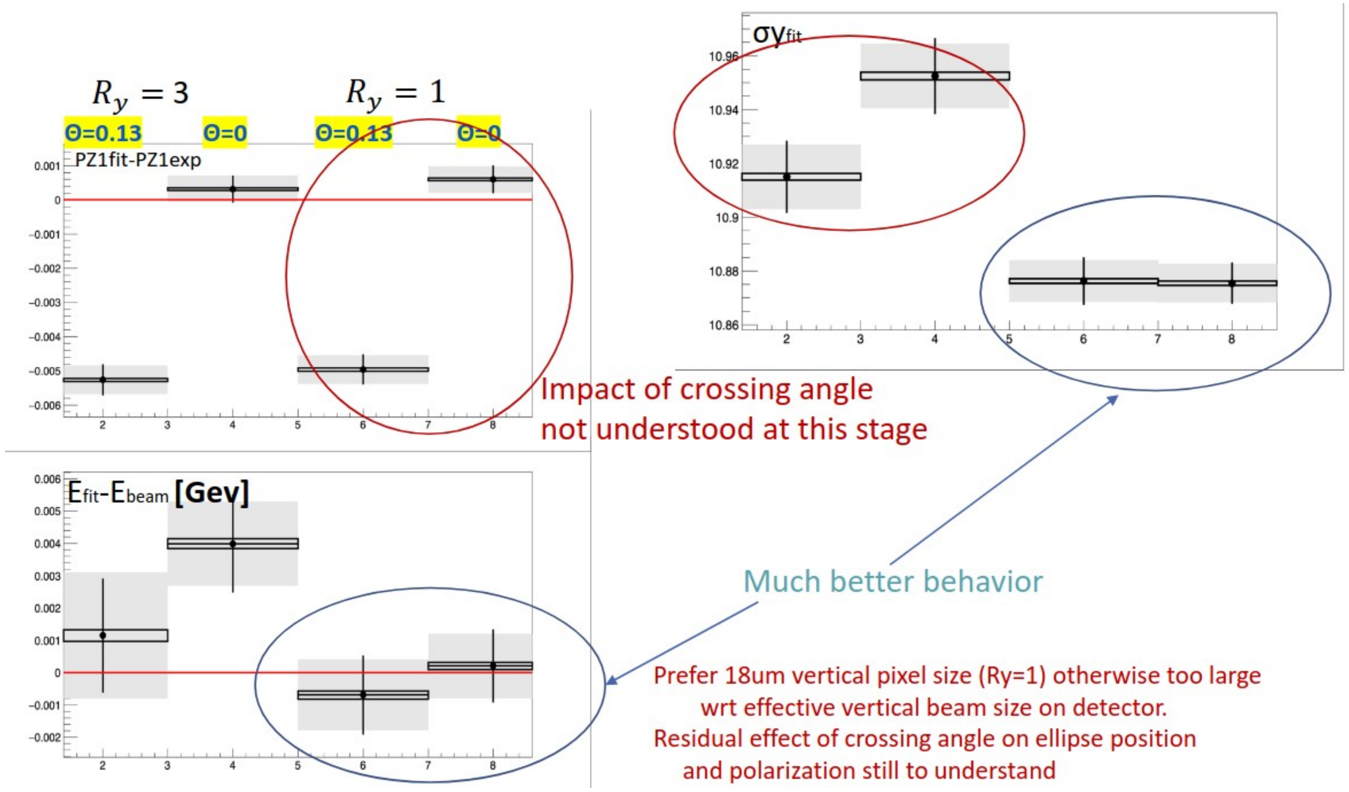




J. Tamazirt

FCC-ee polarimeter studies

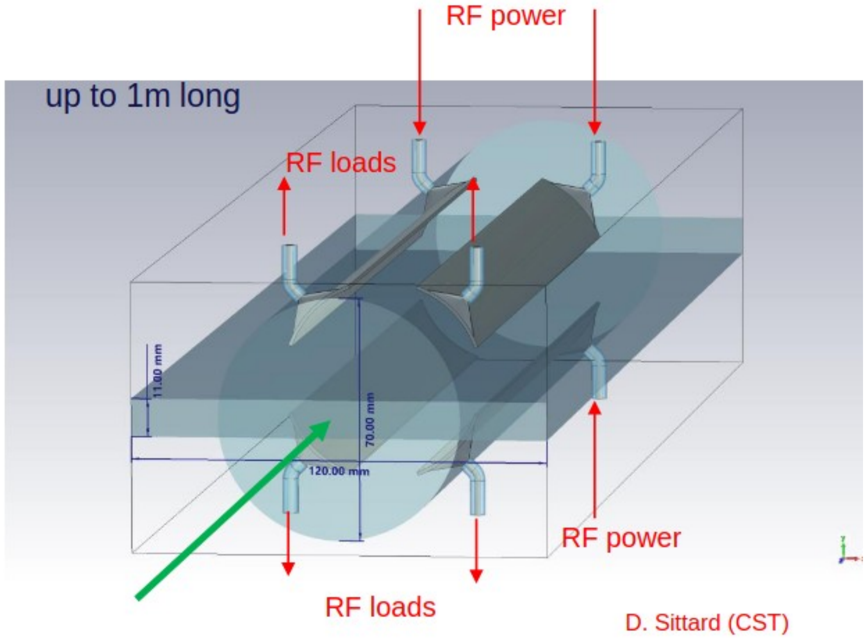
- Improvement towards more realistic simulations:
  - Accounting of phase space correlations
  - Actual luminostiy
  - Laser-electron beams crossing angle
- Small vertical pixel size seem essential
- → 18um looks promising
- Precision for 1 pass to be studied

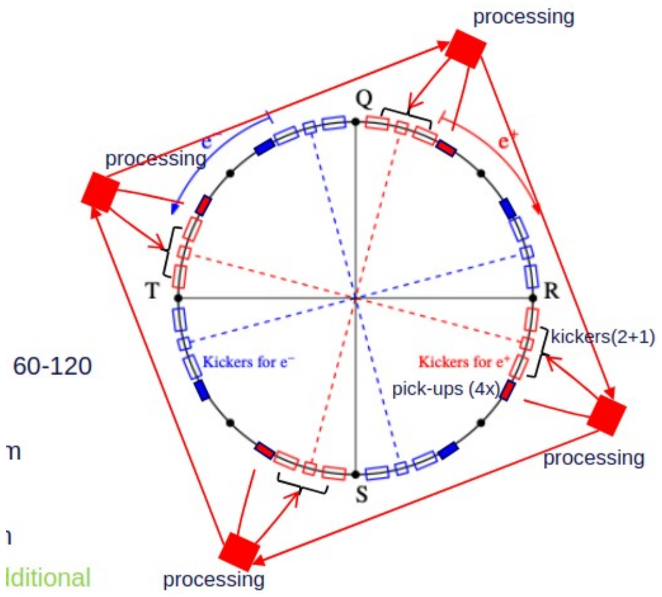


W. Höfle

Towards a depolarizer design

- Simulations for RF-kicker
- To reduce required power → reduced vacuum chamber suggested
  - Impedance to be analysed
- Could possibly be combined with transverse feedback system





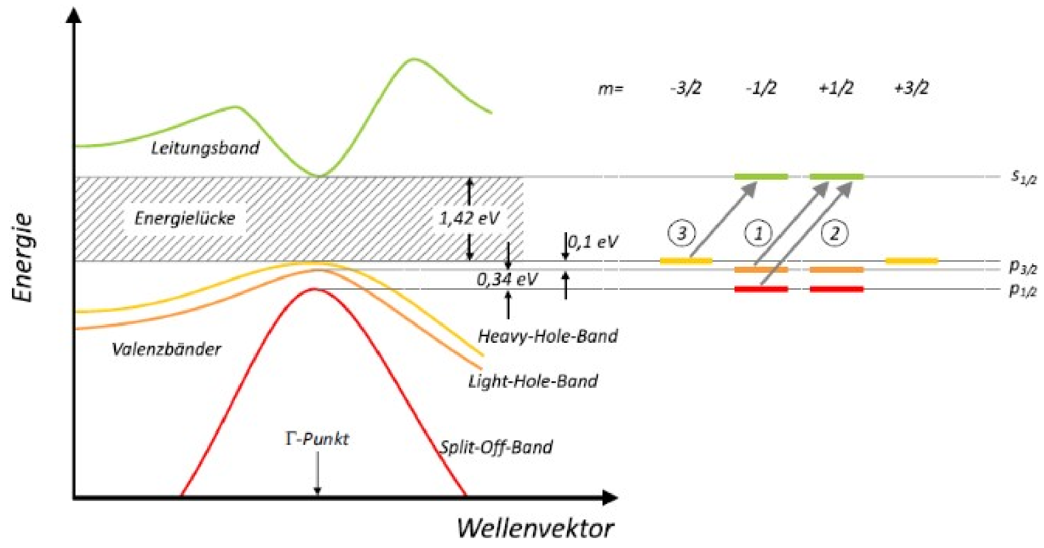
Kicker lengths and powers (table is for one of four locations)

Location	Function	Length	Power
left of IP e^-	open bump	1.0 m	9.04 kW
left of IP e^-	correction	0.75 m	4.5 kW
left of IP e^-	close bump	1.0 m	9.04 kW
right of IP e^+	open bump	1.0 m	9.04 kW
right of IP e^+	correction	0.75 m	4.5 kW
right of IP e^+	close bump	1.0 m	9.04 kW

K. Aulenbacher

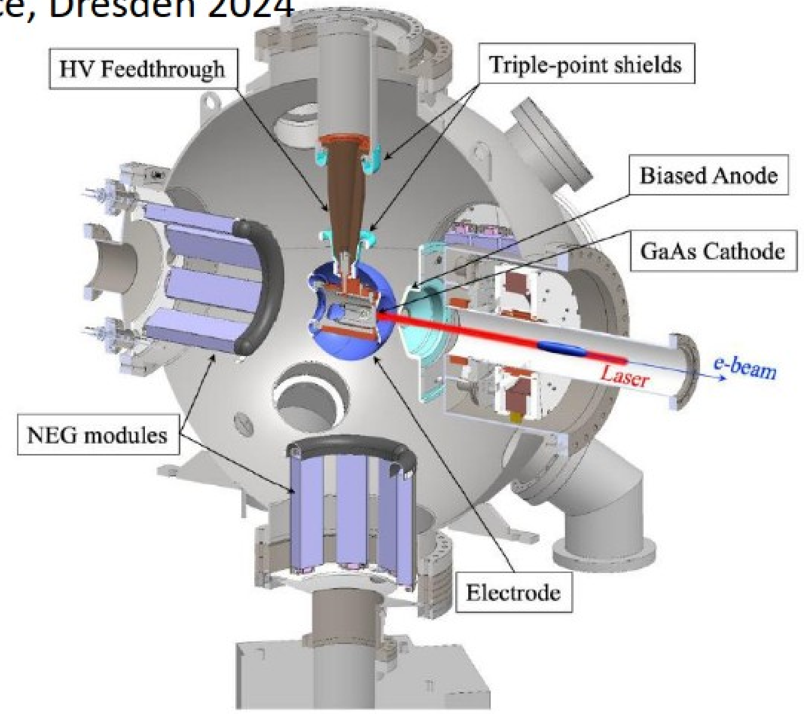
Polarized electron sources in linacs

- Polarization < 85 % feasible
- Polarized source has typically small emittance
- Ion backbombardment limits operational stability, but enough for conventional linacs



Approx. 1m

Taken from Omar Rahman (BNL),
Talk at EWPAA conference, Dresden 2024

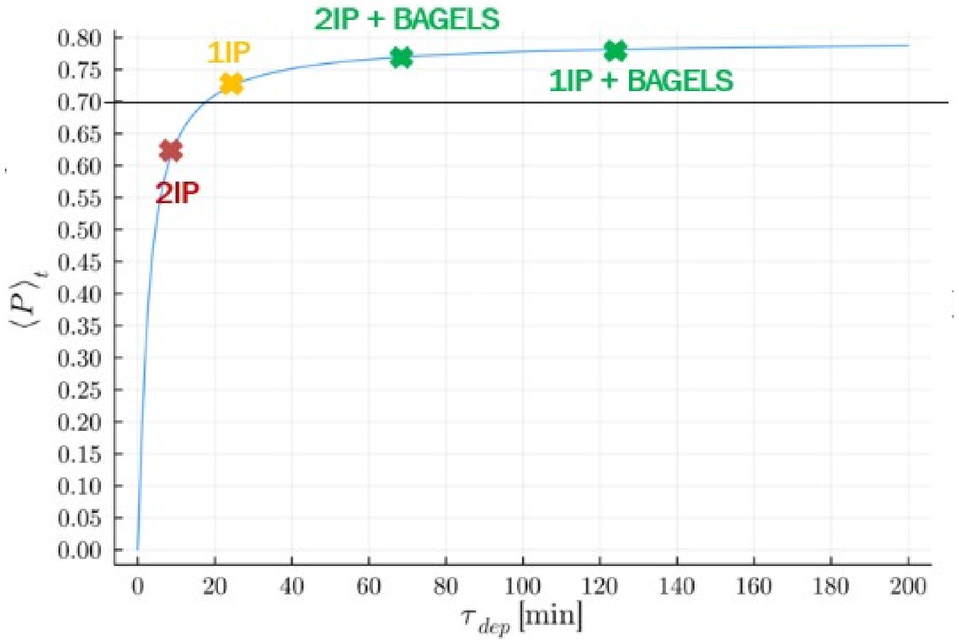


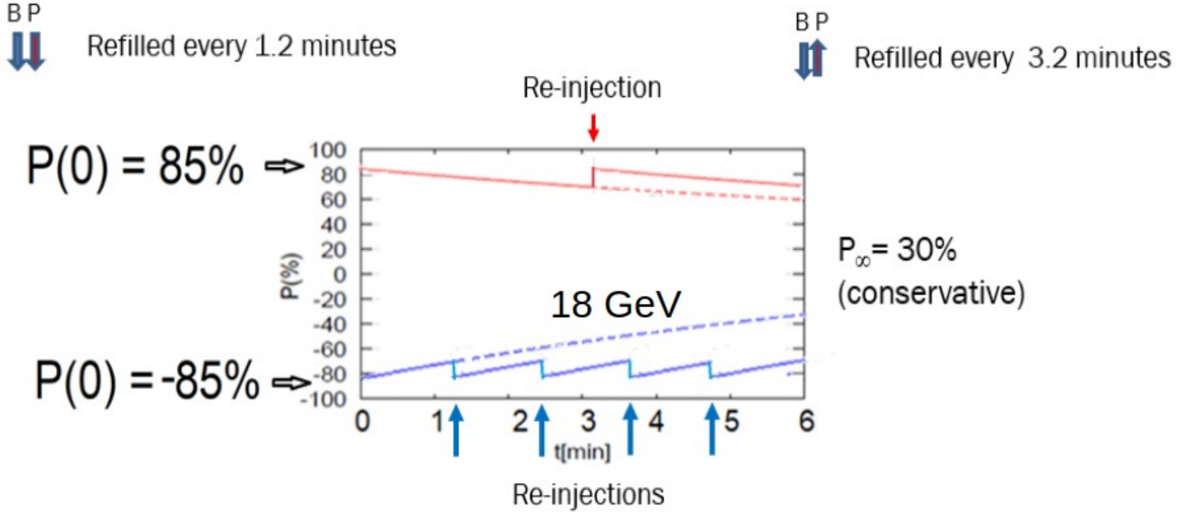
PHYSICAL REVIEW ACCELERATORS AND BEAMS 25, 033401 (2022)

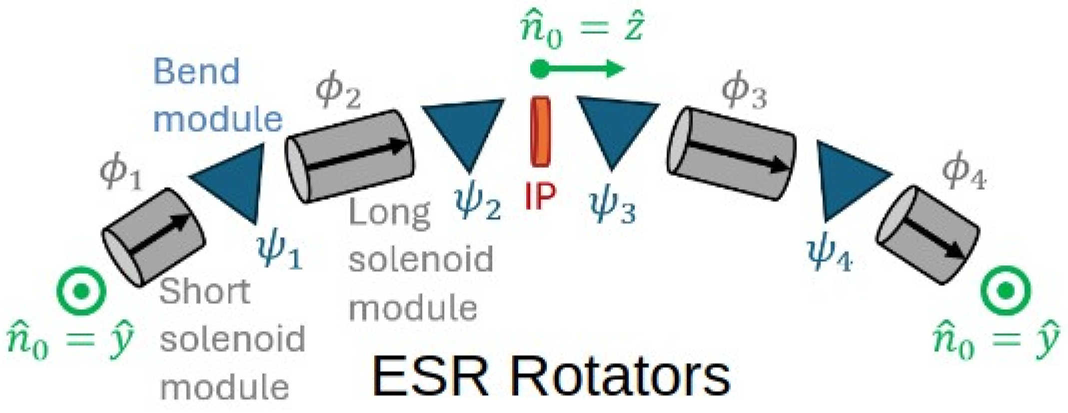
K. Hock

Polarization studies at the EIC

- Polarized electron and hadron beams
  - At least 70% for electrons
  - At least 80% for hadrons
- Polarization increased by BAGELS





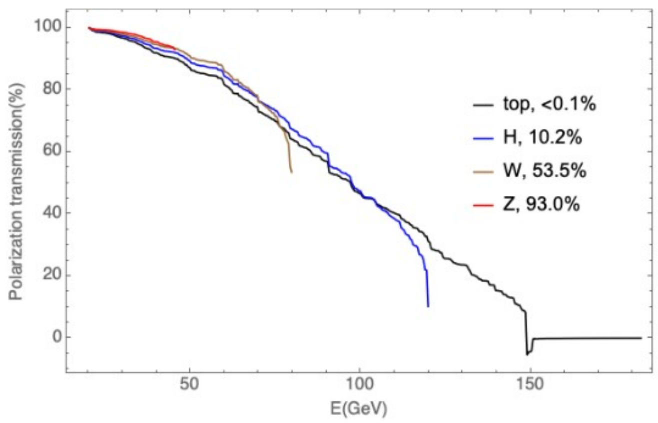


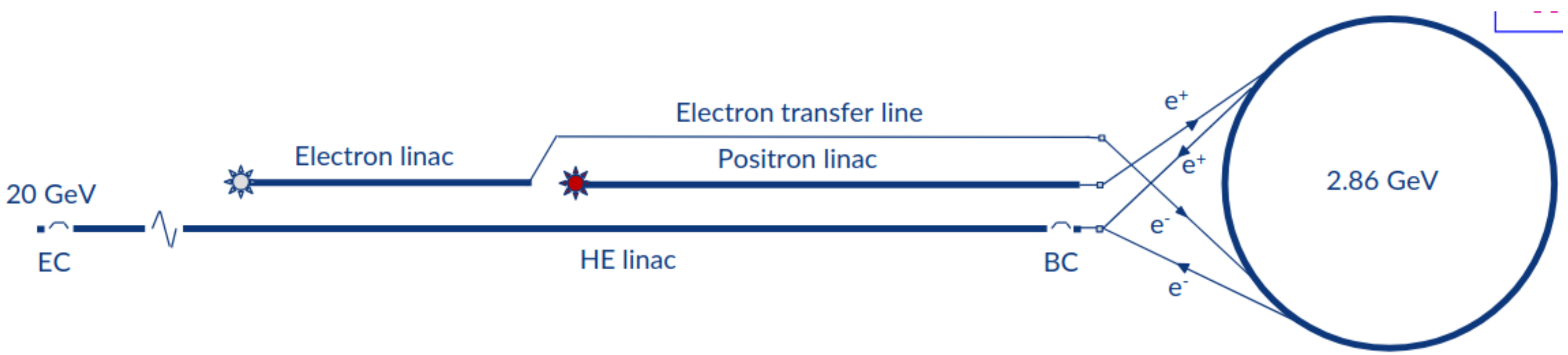
J. Wenninger

Injecting polarized beams

- Polarized electron source: ~ 80%, polarized positrons: 4-5% → small polarization ring required
- Interleaved horizontal and vertical bending limits polarization transport → could require spin rotators
- With reduced energy of 19.873 GeV more than 90% of initial polarization to be preserved
- Preservation through the HEB ramp
- Additional polarimeters could be necessary in the injector chain

Z. Duan, 182nd FCC-ee Optics Design Meeting





Thank you !

Jacqueline Keintzel
Special thanks to Guy Wilkinson