The LUXE Cherenkov detector prototype at SLAC

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14.12.2023

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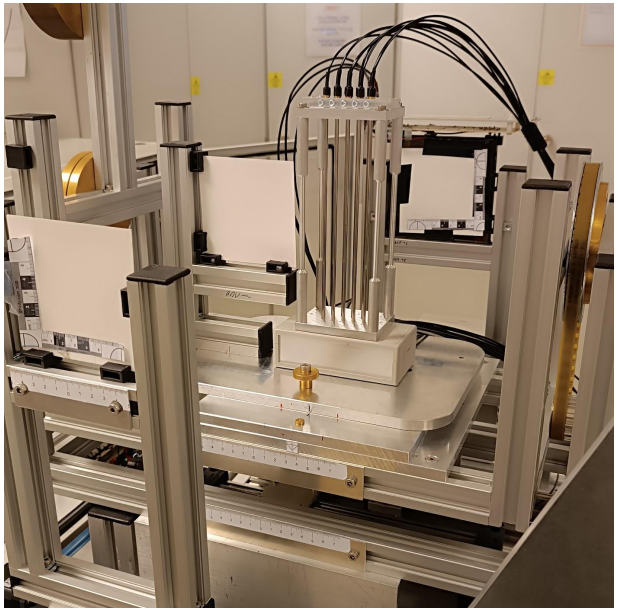
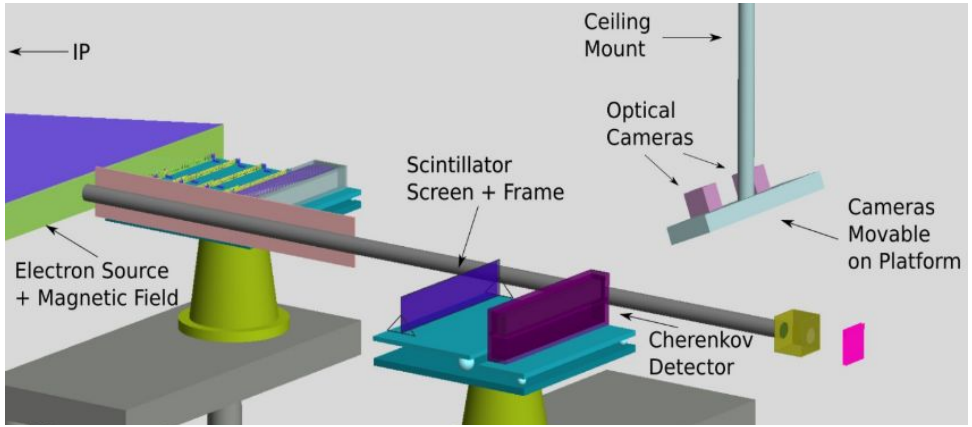
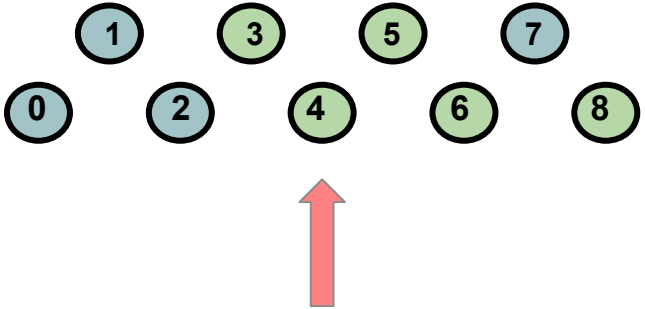
DESY.

Prototype setup by now

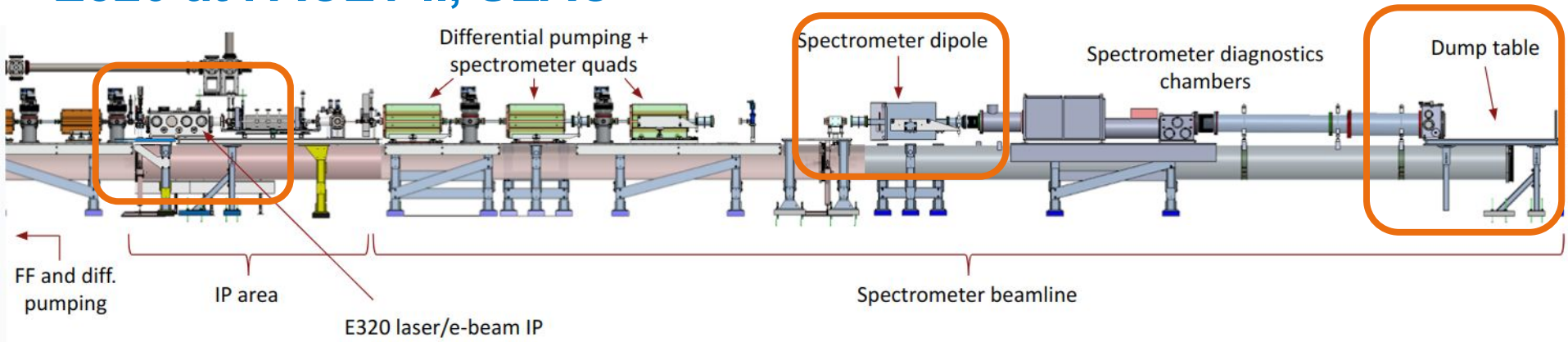
- 9 straws, 3 scintillating screens + cameras
- Movable perp. through beam and straw angle adjustable
- Fibers to top of straws from LED pulser
- 2 SiPM types on self-made PCB
- Readout behind 20m cables with 14bit 0.5GS/s digitizer







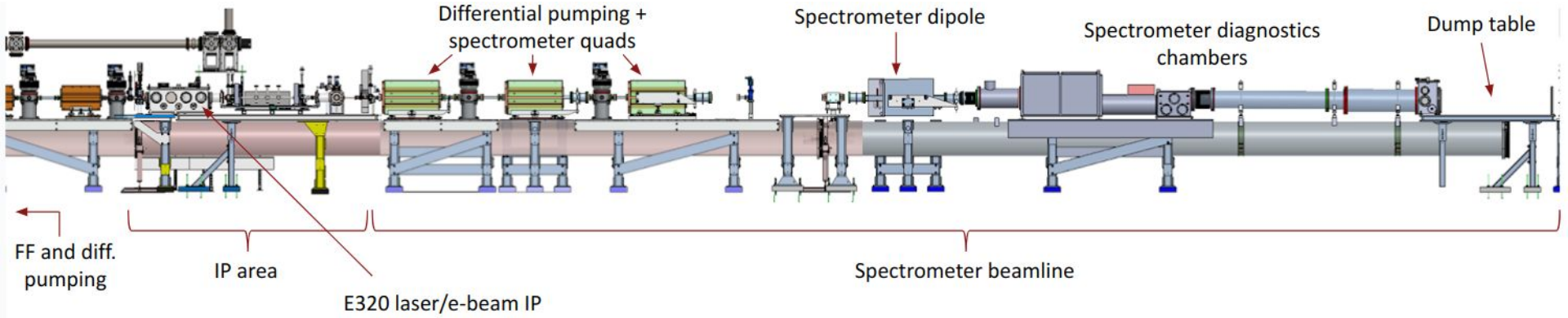
E320 at FACET-II, SLAC

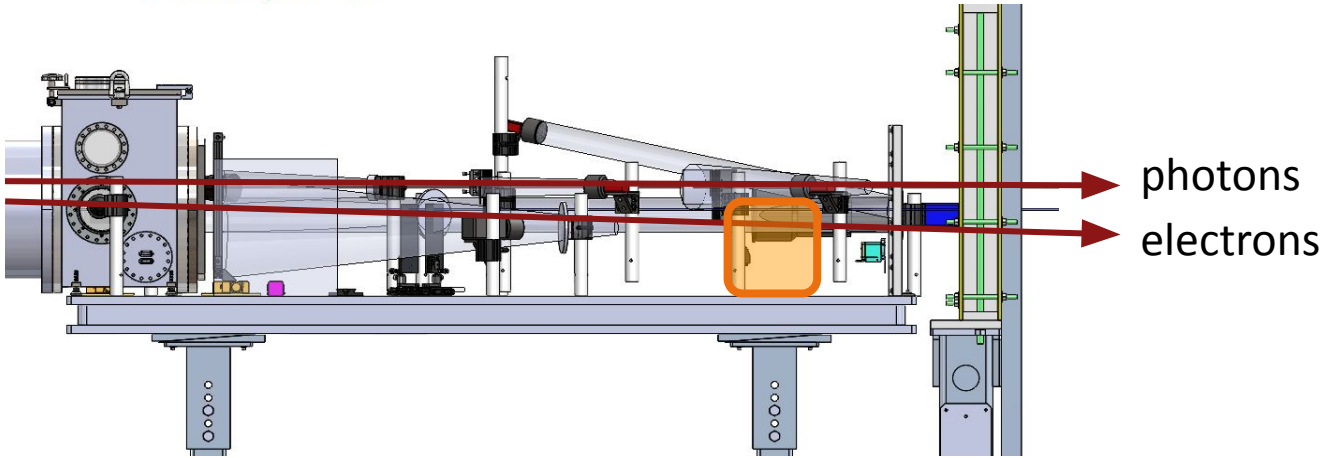


- Quad triplet after IP
- Spectrometer dipole with ~6cm nominal dispersion at dump table
- Diagnostic systems:
  - Vacuum electrons
  - In-air electrons and photons at dump table

Electron beam parameter	Current[a]	Operational range
Delivered beam energy, (GeV)	10	10 – 13
Norm. emittance, (mm-mrad)	~ 20	3 – 6
Bunch configuration	Single	Two-bunch
Charge per bunch, (nC)	2	1.3/0.6
Peak current, (kA)	–	30/15
RMS energy spread, (%)	~ 1	0.8/0.3
Repetition rate, (Hz)	1 – 30	1 – 30
IP β^*, (cm)	50	5 – 50

E320 at FACET-II, SLAC





Cost estimations include:

- Depending on time of the year:
  - Accommodation
  - Flight
- Daily allowance
- Transportation

⇒ ~ 5000€ per month per person

Material list and costs

- Minimum:
  - Readout: Digitizer (Desktop version?)
  - Mechanical parts (straw & motor mounting, optical fibers)
  - Electrical parts (SiPMs, motors, arduinos, PCs, power supplies, PCB…)
  - + shipping costs
- Additional:
  - Screen and camera
  - Second straw setup (orthogonal)

Backup

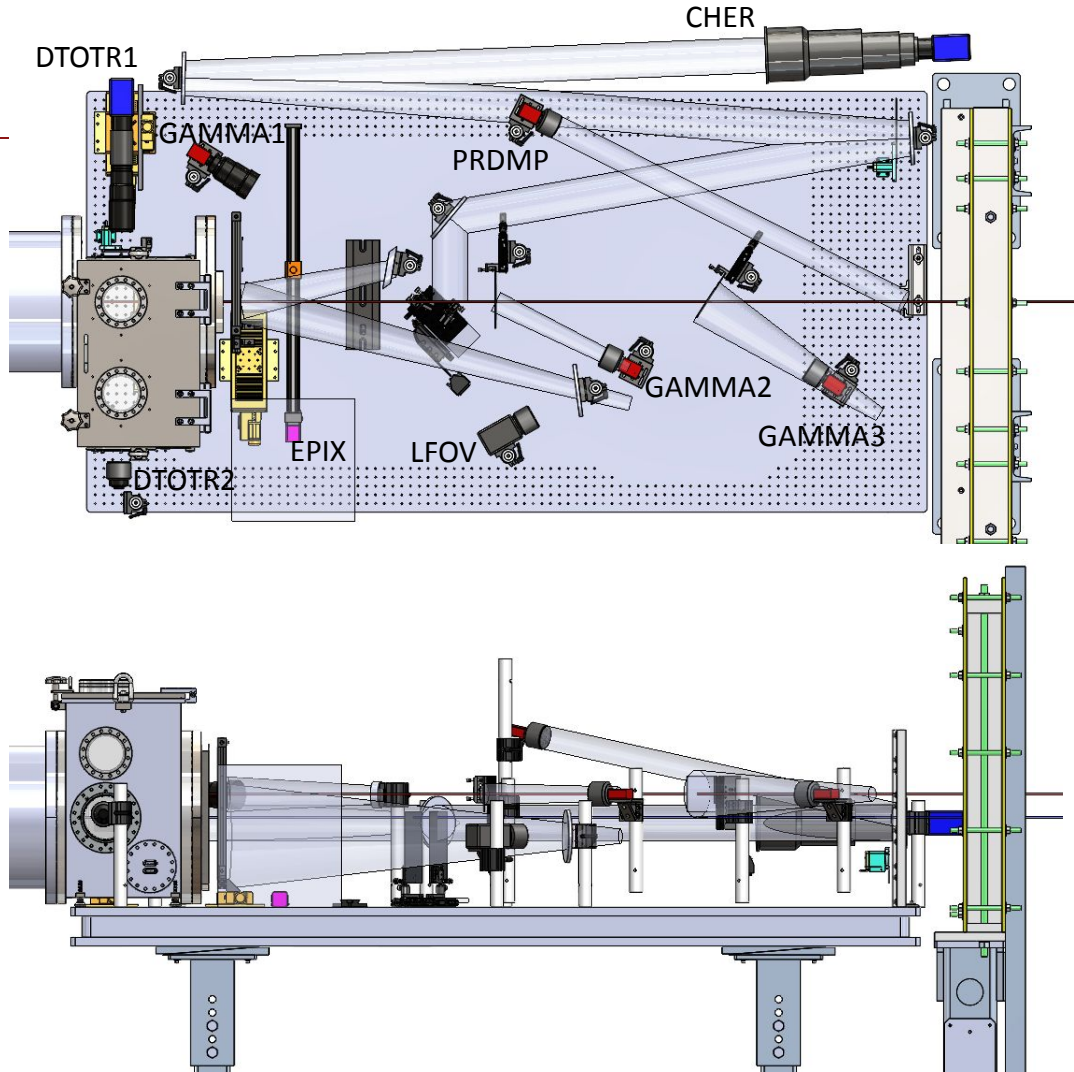
Spectrometer beamline

	Z location [m]	Element	Details
Compton IP	~1992.8	e-beam/laser IP	
Q0D quad	1996.98	Quad	
Q1D quad	1999.21	Quad	
Q2D quad	2001.43	Quad	
Spec. Dipole	2005.94	Dipole	
Vacuum exit window	2015.54	Window	5mm thick aluminum, 6 in. wide
Dump shield	2027.3	Gap	2 in. wide gap in lead wall, 4 in. thick
Dump Entrance	2028.0	Gap	2.5 in. gap in shielding
Dump	2028.6	Beam stop	Water cooled copper block - shielded by 8 in.+ lead, 11in. + borated polyethelyne

*** max (nominal) fields, settings may change to change focal energy and nominal dispersion*

Top and side views

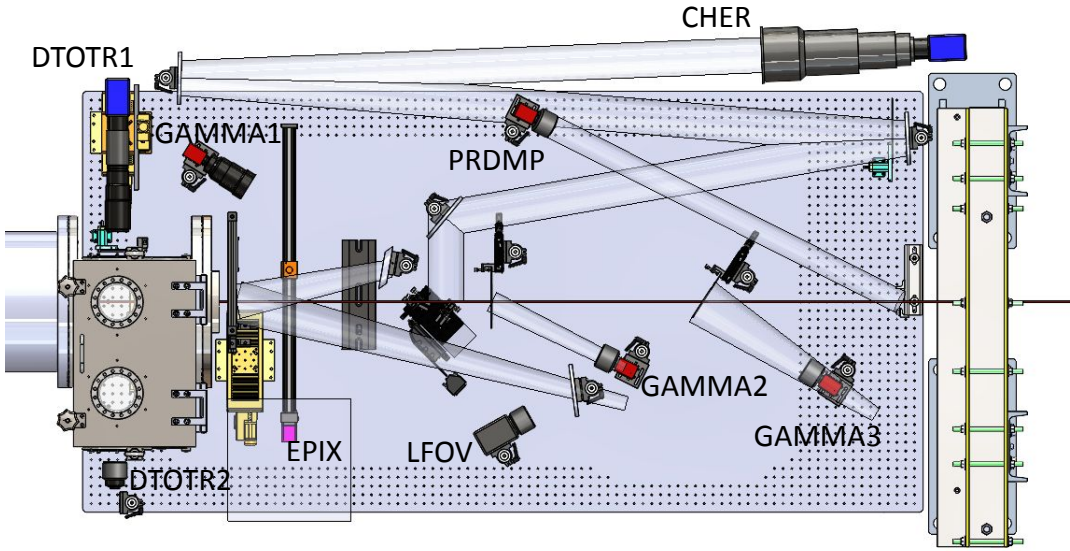
- Electron diagnostics on the dispersed electron beam axis
  - Nominally ~60mm below Gamma axis
  - DTOTR1/2 – in vacuum high res profile monitors
  - LFOV – large field of view
  - CHER – Cherenkov spectrometer
  - PRDMP – dump profile monitor
- Gamma diagnostics on zero-dispersion axis
  - Gamma1 – angular/profile info
  - Gamma2/3 – spectral info
- Most approximate light paths shown



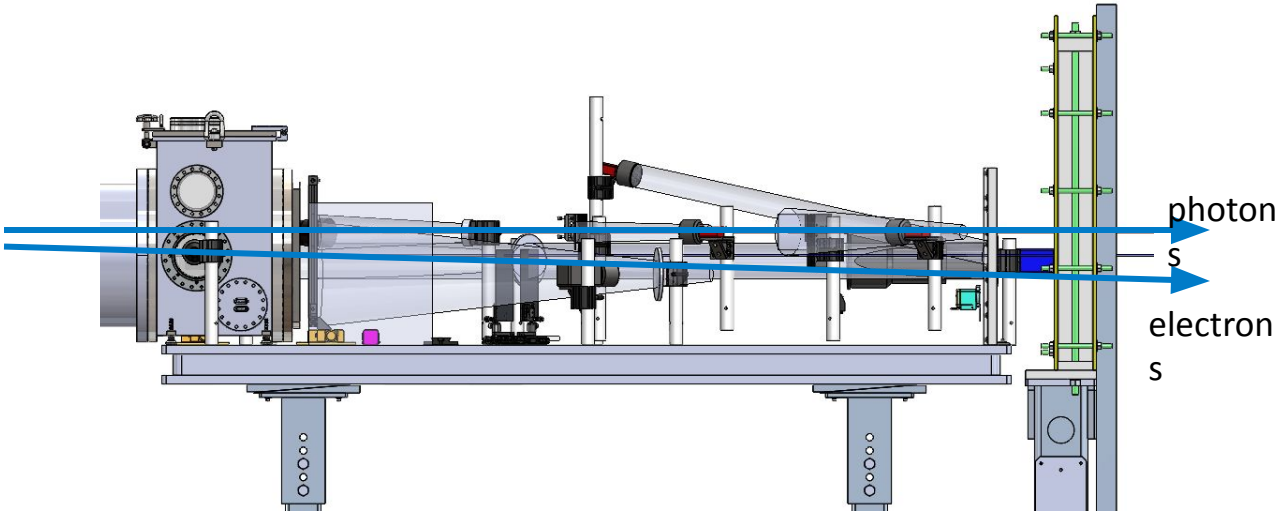
Space for test setups

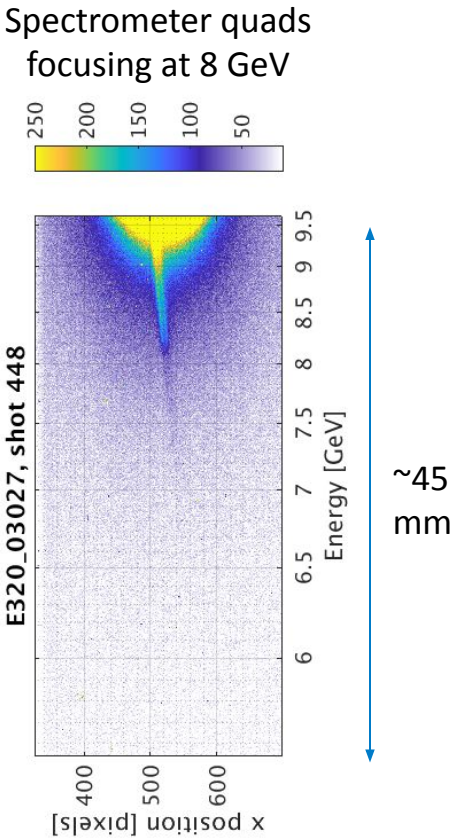
- Depending on time – Gamma3 is not currently installed
- Some space between Gamma2 and Gamma3, or after Gamma3

- Other considerations:
  - Must be able to retract from beam axis
  - Very “hot” environment by the dump
    Currently, the cameras trip off
    multiple times/hour



Side view





- Nominal distance between photons and primary beam ~60mm
- This can change with spectrometer dipole setting
- Photon axis is ~32 cm from optical table surface
  - Primary electron beam at ~26cm, Compton electrons below this