

Silicon Detector opportunities at the LUXE experiment

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Discussion on silicon detector projects

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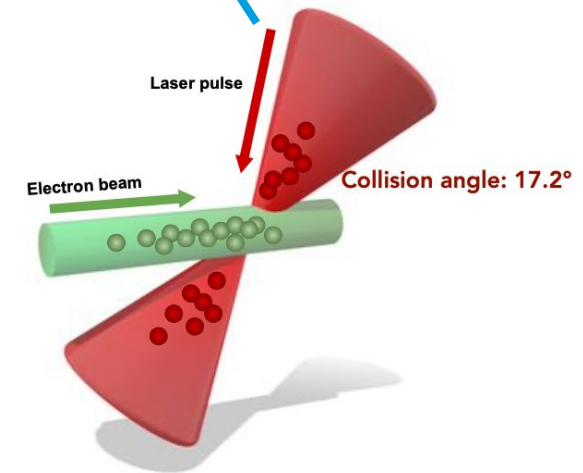


The LUXE experiment



Precision measurement of QED phenomena
in uncharted non-perturbative regime

- CDR arXiv: [2102.02032](https://arxiv.org/abs/2102.02032)
- TDR arXiv: [2308.00515](https://arxiv.org/abs/2308.00515)

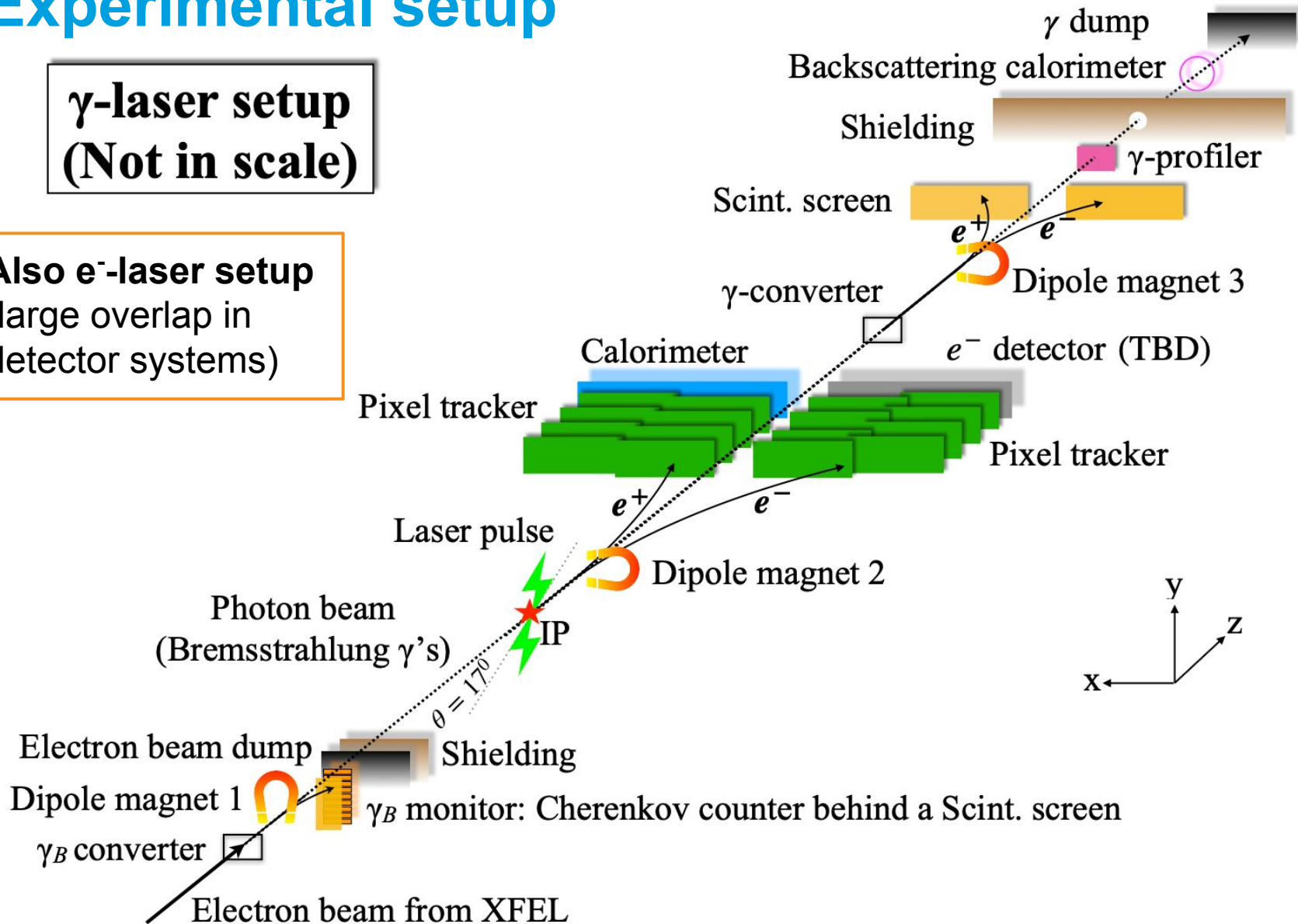


Timeline: end of decade, run for several years, with potential upgrades

Experimental setup

**γ -laser setup
(Not in scale)**

Also e^- -laser setup
(large overlap in
detector systems)



Tracker(s)

Stave surface $\sim 1 \times 50 \text{ cm}^2 \times 4$ staves

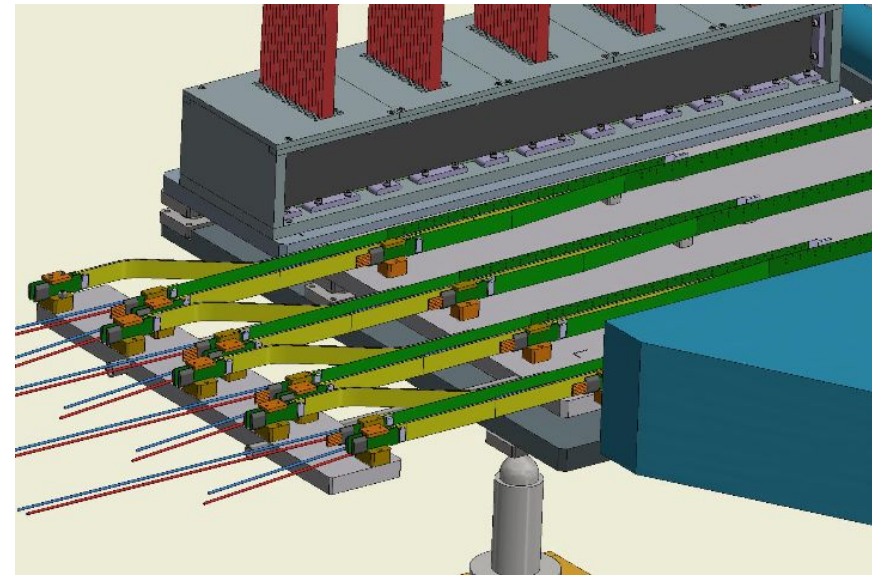
Low material budget (**a few 100 μm**)

Radiation tolerant **$\sim 10^3 \text{ Gy/year}$**

Measure the single-particle energy ($O(1\%)$)
and spatial origin ($O(100 \mu\text{m})$)

Dynamic range: **from 10^{-4} to
several 10^6 particles per BX**

Current tracker exists (led by Weizmann),
based on **ALICE ALPIDE pixels**.



Detector Reference	MCD	Hit Density [mm^{-2}]	
		ATLAS ITk	ALICE ITS3
Pixel Layer 0	3.68	0.643	0.85
Pixel Layer 1	0.51	0.022	0.51

LUXE peak hit density = 100 hits/ mm^2

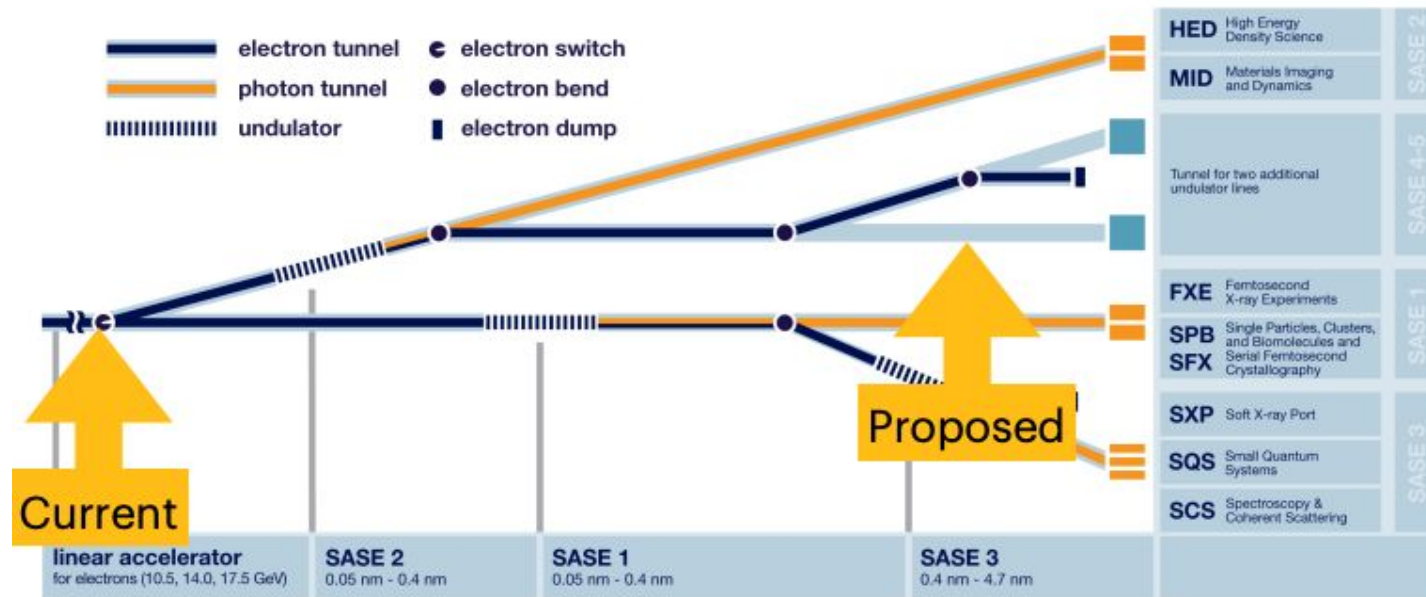
Upgrade with higher granularity and ToT?

People: 1-2 staff(s) + 3/4 fellows/students + technicians and engineers (**x2?**)

Space/equipment requirements: fraction of DAF - potential re-use of most LHC upgrade infrastructure (at a smaller scale)

Other German contributions to project: not yet

Updated LUXE baseline location



The baseline location of the experiment has been changed to the XTD8 tunnel

- Better access, more (longitudinal) space, ...

Starting effort to update experiment design for new area (might use permanent magnets and space out detectors a bit more)

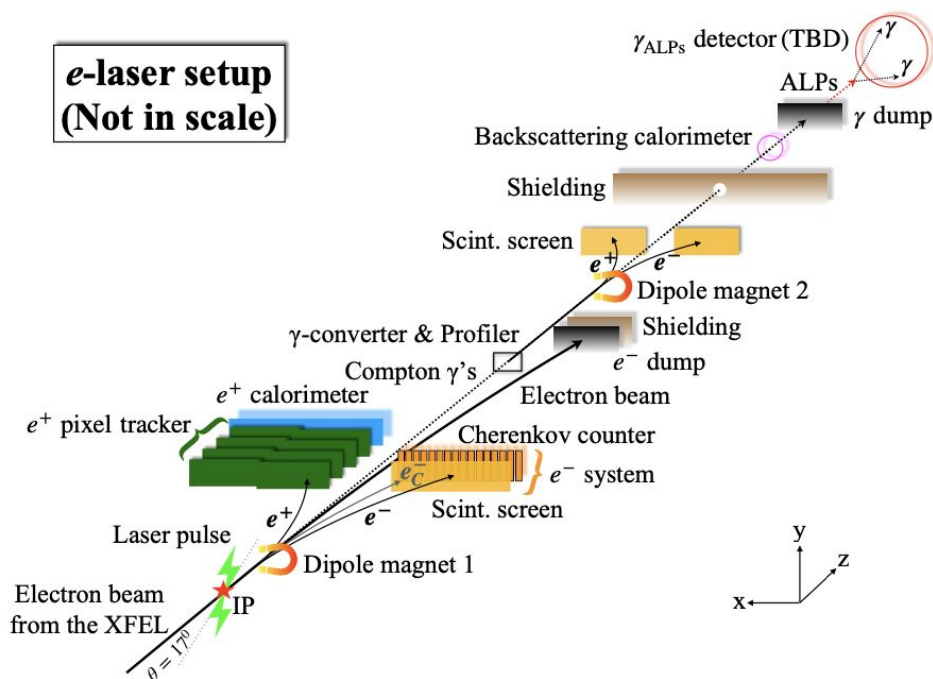
Plan not to alter any of the built detectors, but more space = more flexibility

- More opportunities?

Digital SiPM for Cherenkov counter?

Led by DESY and needed by core LUXE programme

***e*-laser setup
(Not in scale)**



People: 1-2 staff(s) + 2/3 fellows/students + technicians and engineers (**x2?**)

Space/equipment: little (?)

Cherenkov counter

Air-filled straws with SiPM

- Prototype exists, needs refinement
- Challenges in noise, background and radiation hardness
- **DESY dSiPM?**



Thank you!