

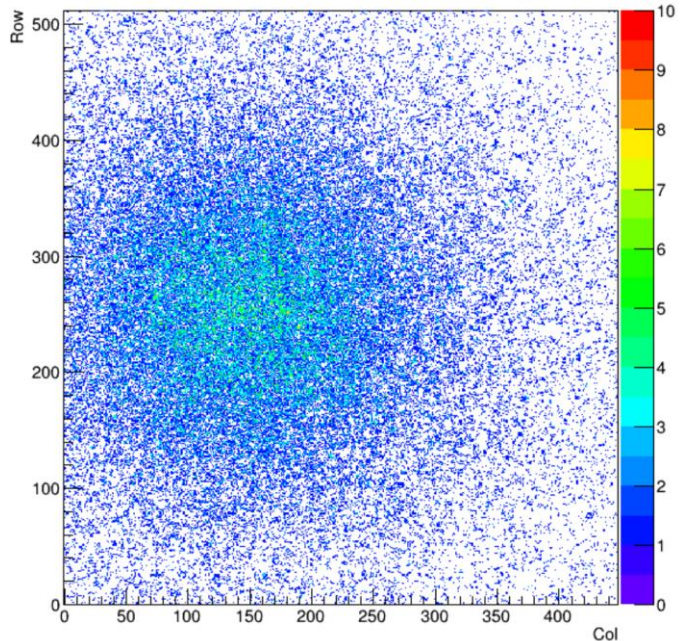
Pre-TDR Low- Q^2 Tagger update

TIC meeting 04/11/2024

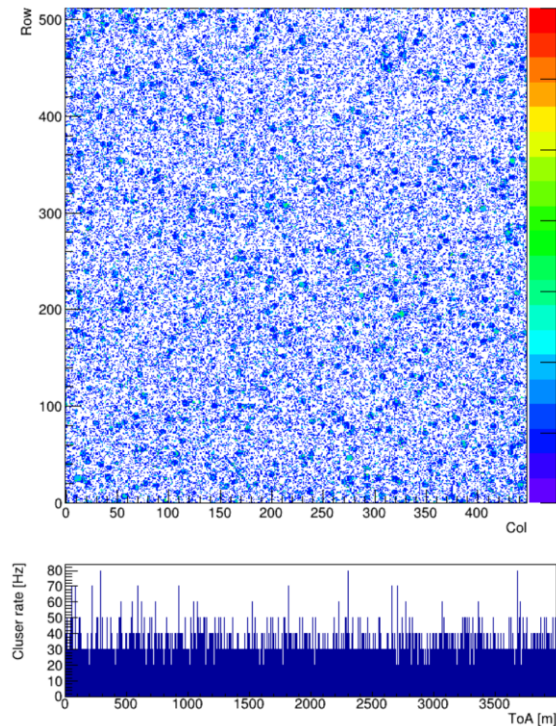
Simon Gardner

Hardware and Tests

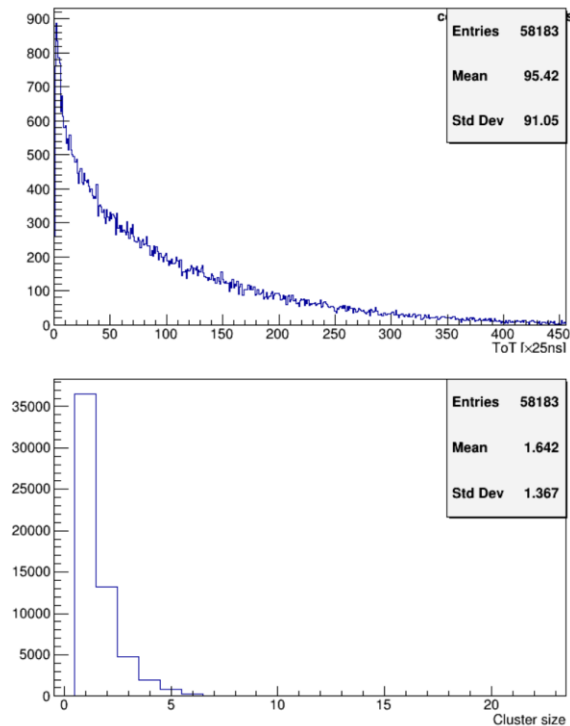
- Glasgow Tests:
 - Tests by summer student over the Summer.
 - Single chip, ironing out technical issues and readout code.
 - Slight damage to equipment has stunted progress.



^{90}Sr acquisition for 30 seconds

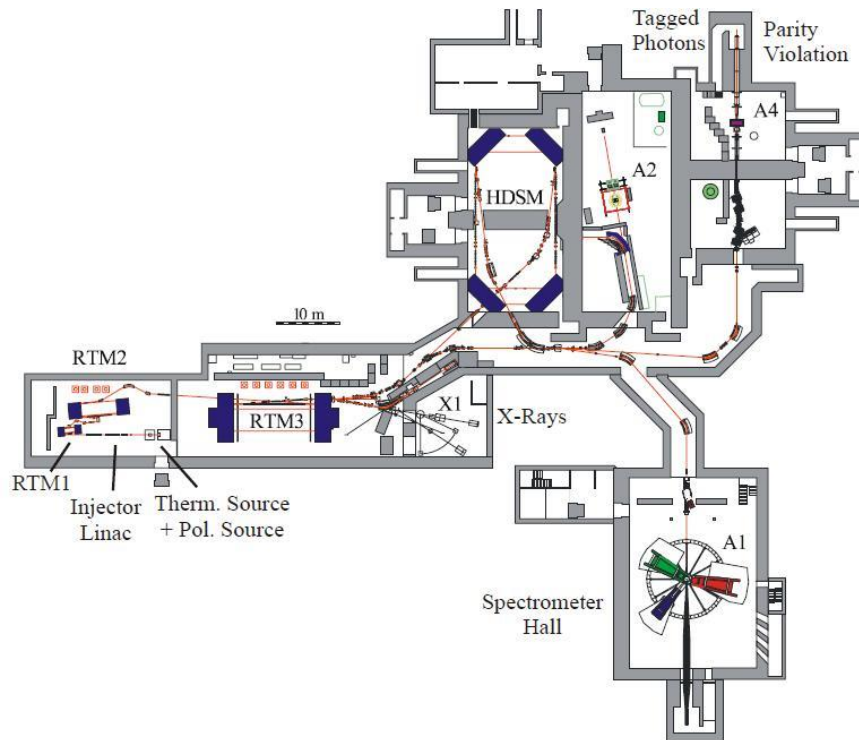


Cosmic data for a weekend

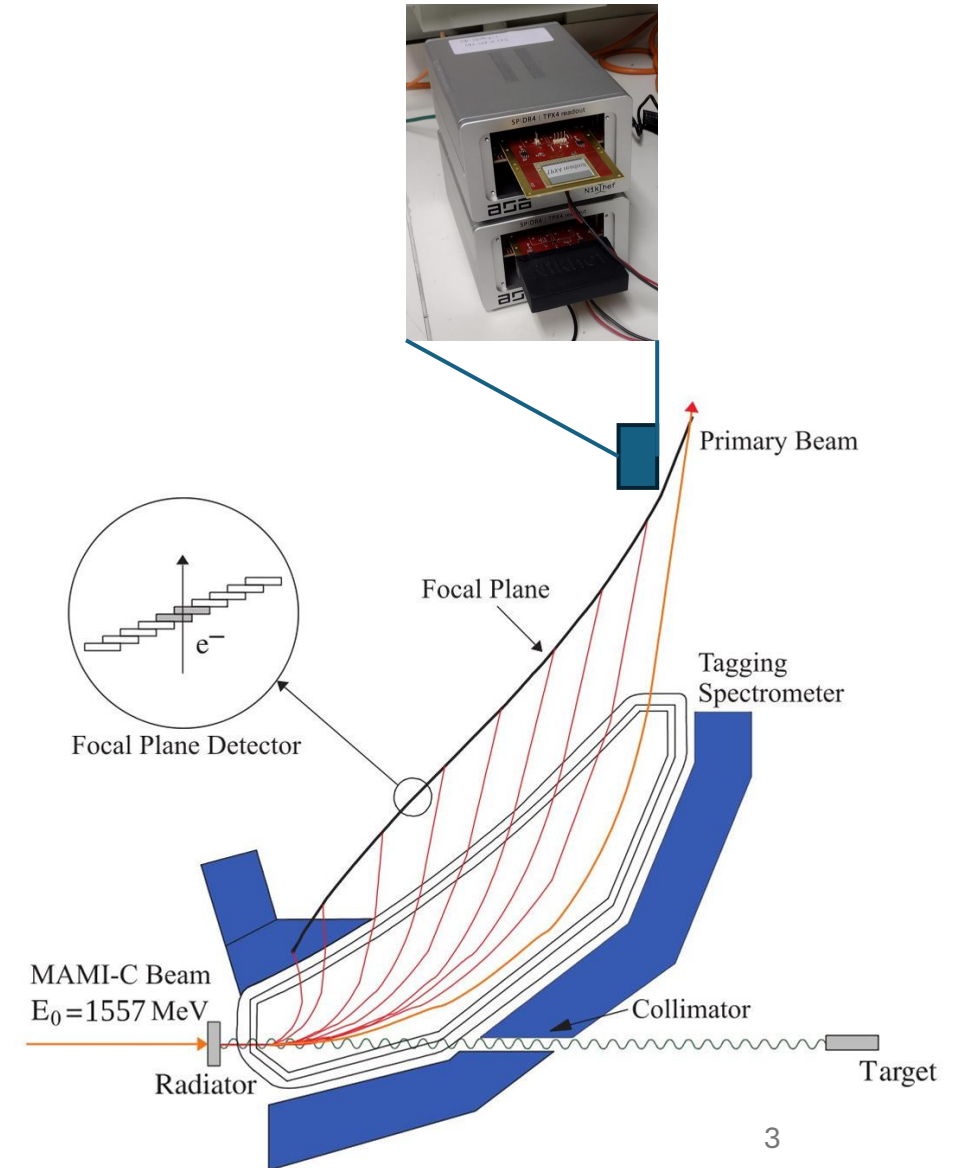


Hardware and Tests

- Beamtest:
 - Mainz 3-6th December
 - High(ish) rate 1.5 GeV electrons
 - Measure tracks from two layers

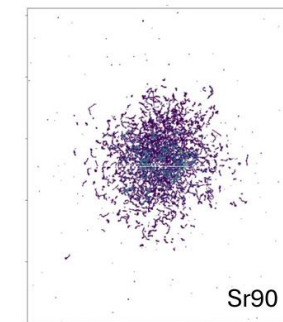
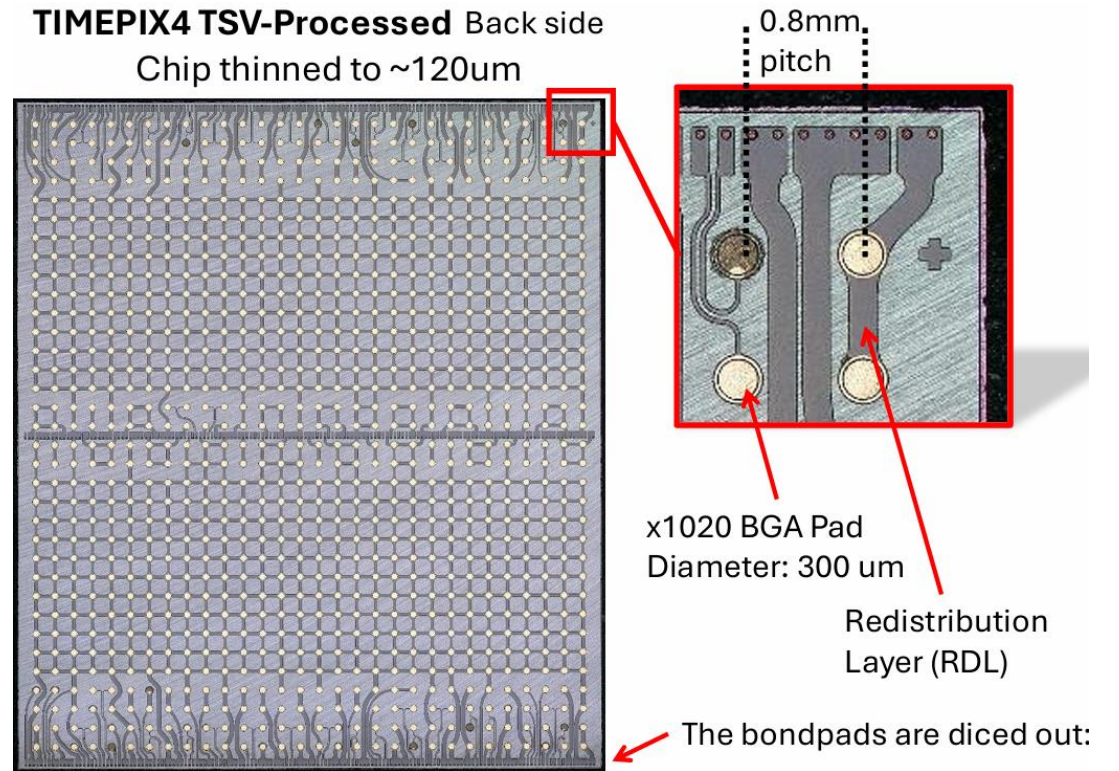
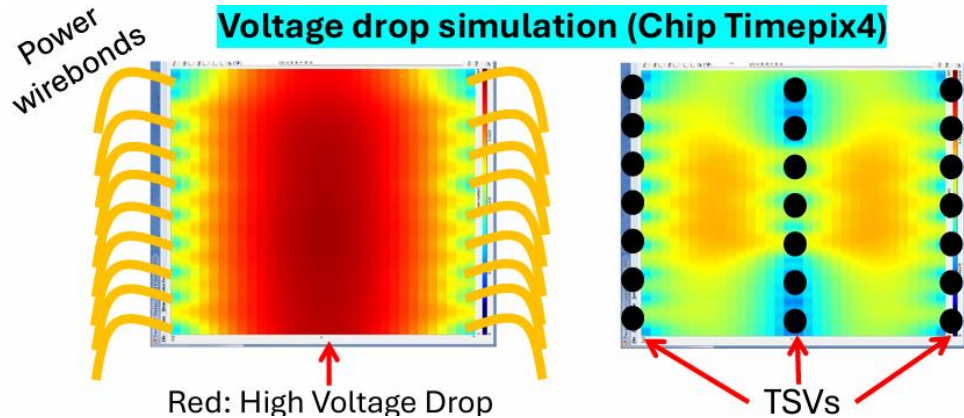
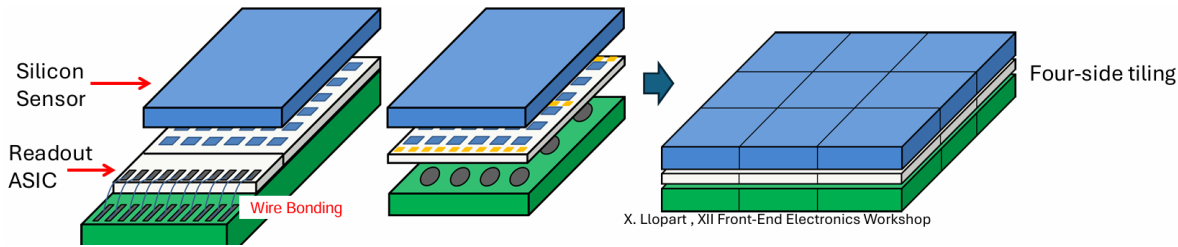


2xTimepix4,
detector telescope



Hardware and Tests

- **Medipix4 collaboration** progress on Through-Silicon-Vias
 - 4 side buttable
 - Improved power distribution
 - Impedance of wire bonds smaller allowing faster readout.
 - Successful tests demonstrating improvements in readout
 - TSV processing technique being fine-tuned.



First result with radioactive source

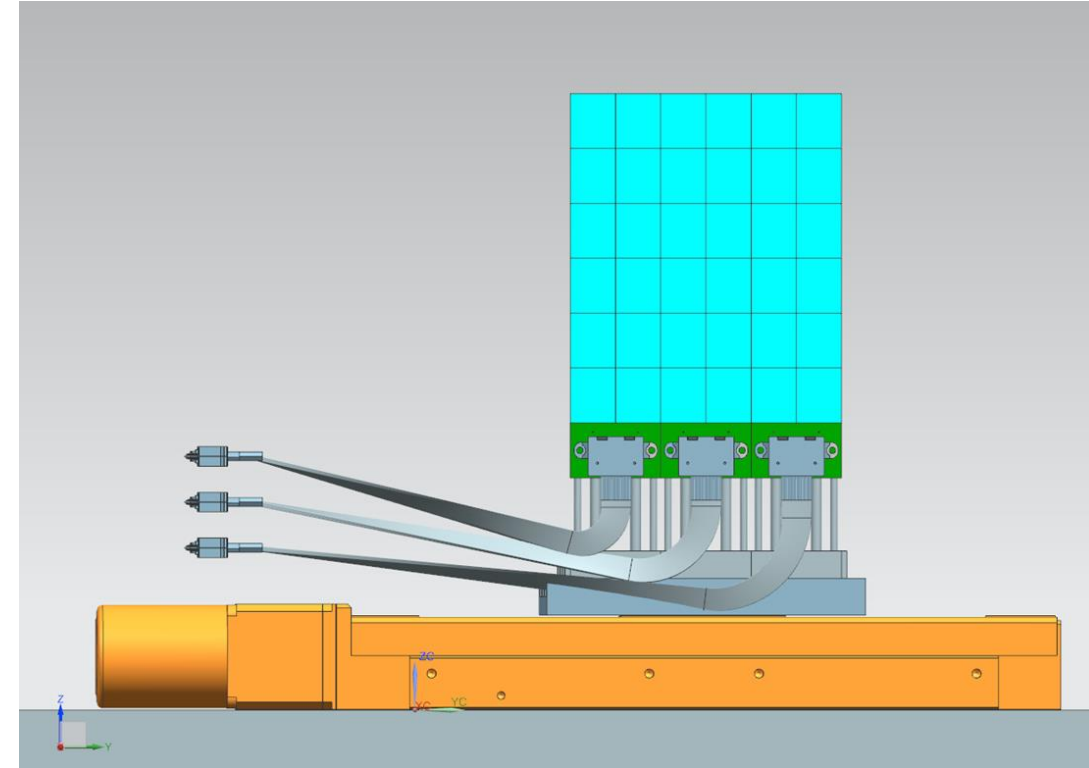
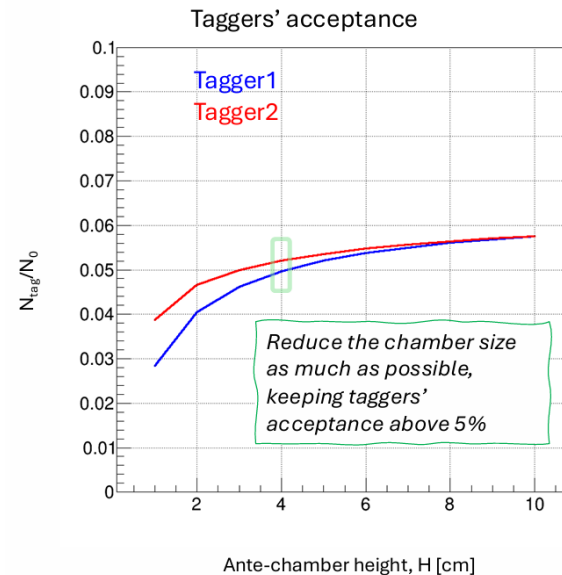
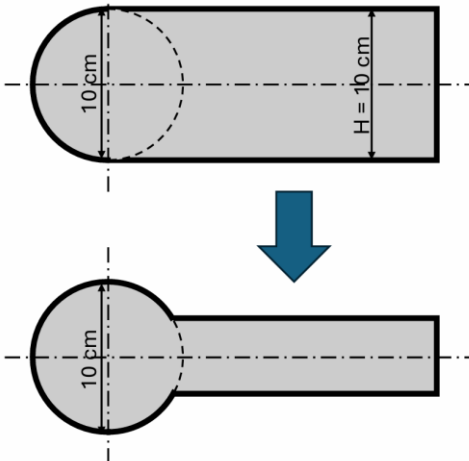
Images from:
[TWEPP 2024: Francisco Piernas, 3D Integration of Pixel Readout Chips using Through-Silicon-Vias](#)

Hardware and Tests

- ToDo:
 - Design, fabricate and test board with tiled Timepix4 chips.
 - Make full simulation of cooling requirements and develop minimum material solution.
 - **Finalize size requirements - dependant on beampipe design and accelerator integration.**



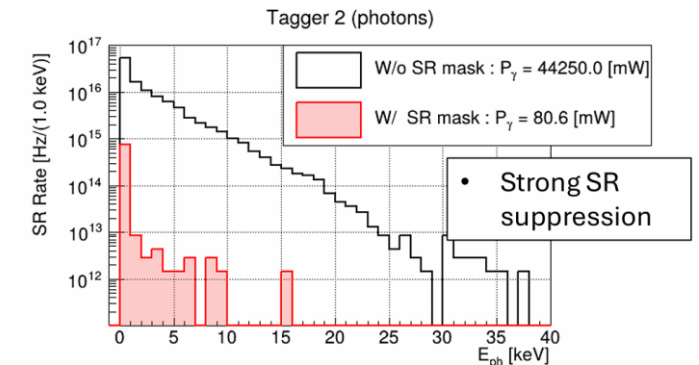
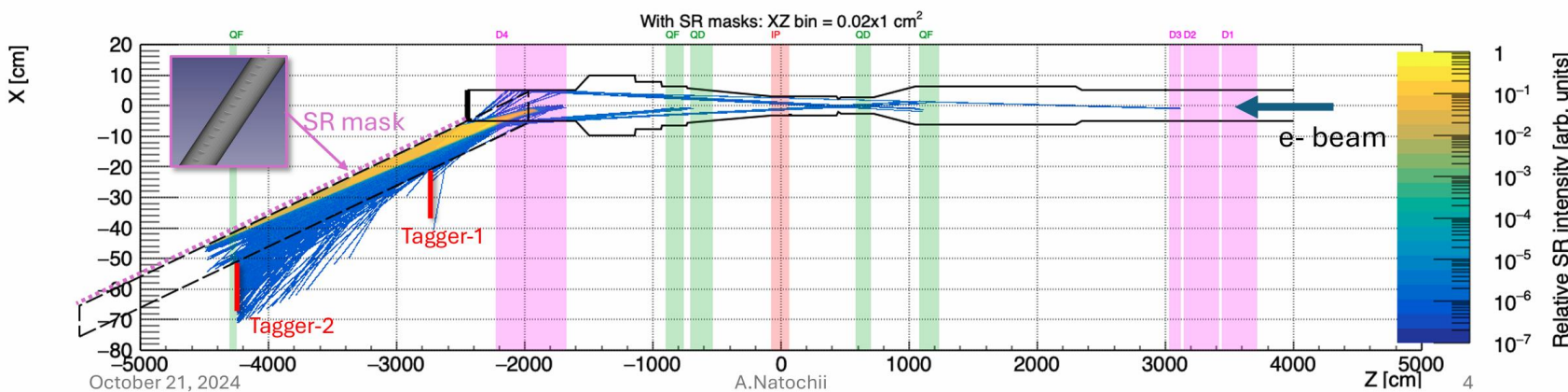
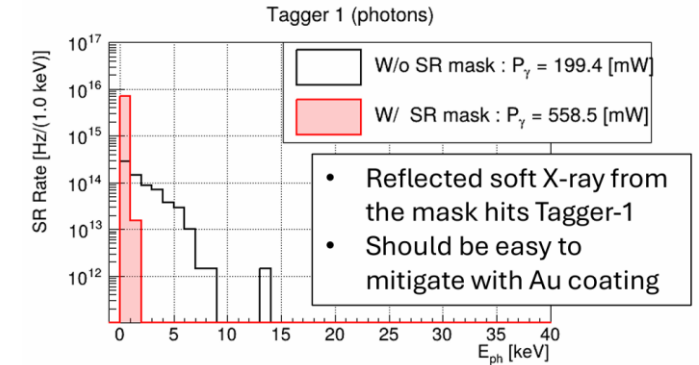
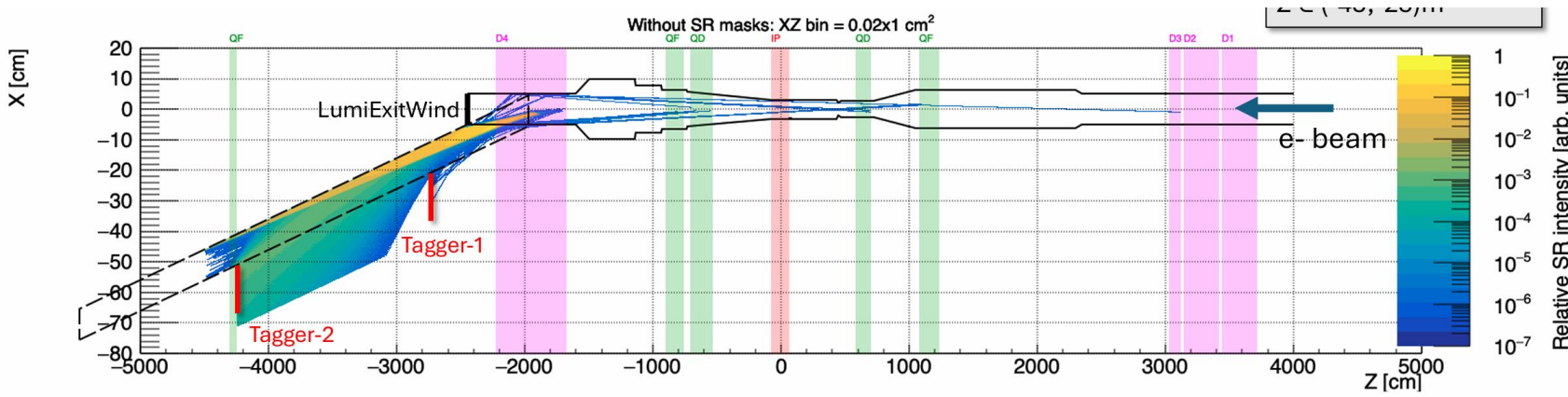
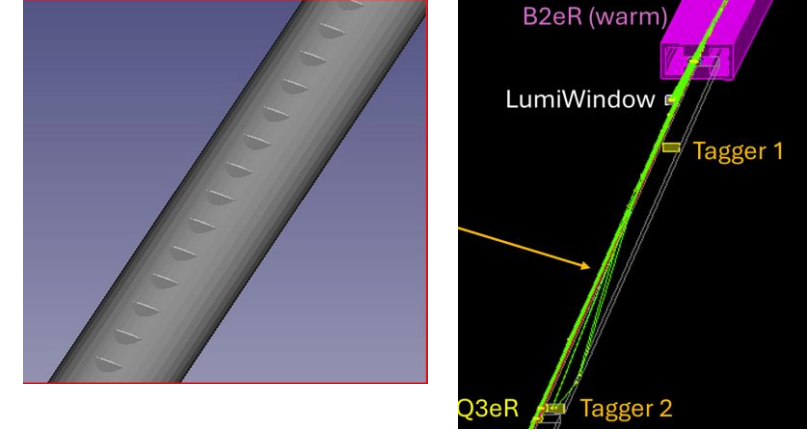
SuperKEKB ante-chamber



CAD of Tagger Tracker layer, consisting of 3 boards of 12 chips

Integration and simulation

- Synchrotron Studies (Andrii Natochii):
 - Exploring SR masks along beampipe
 - Huge reduction in rates on Taggers
 - Currently no exit window in place
- Further discussion in Tagger meeting 8am ET tomorrow

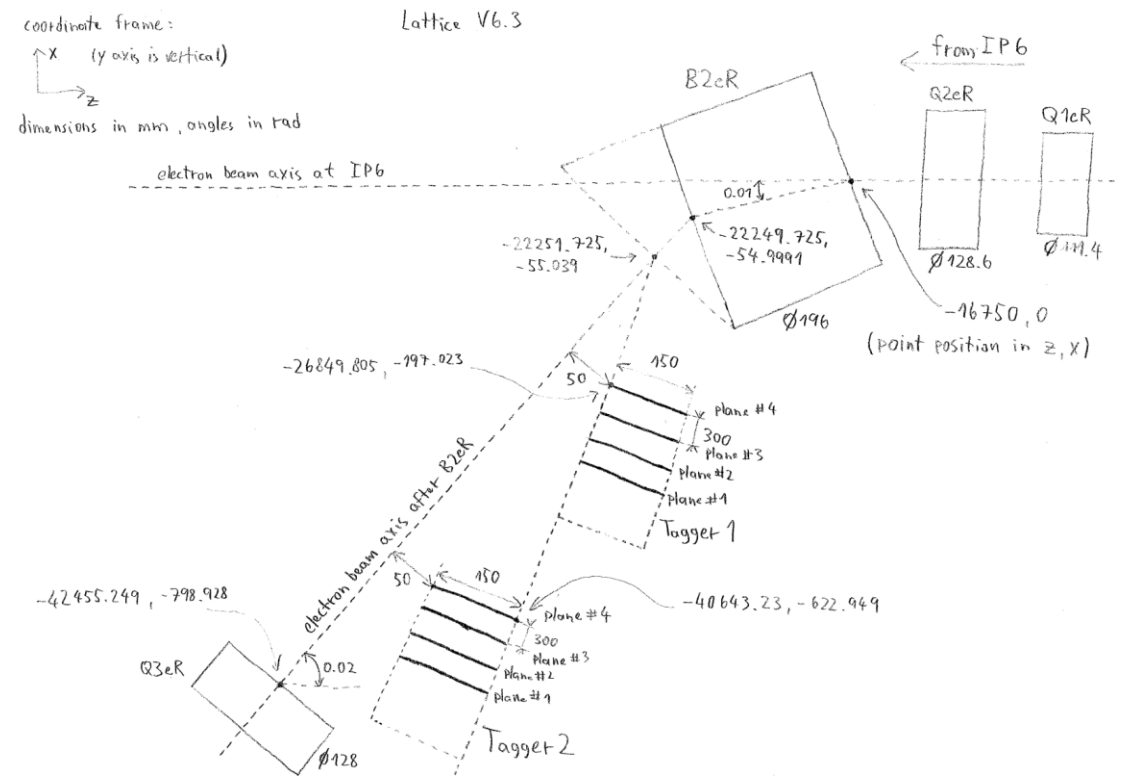


Energy spectrum of SR hitting taggers

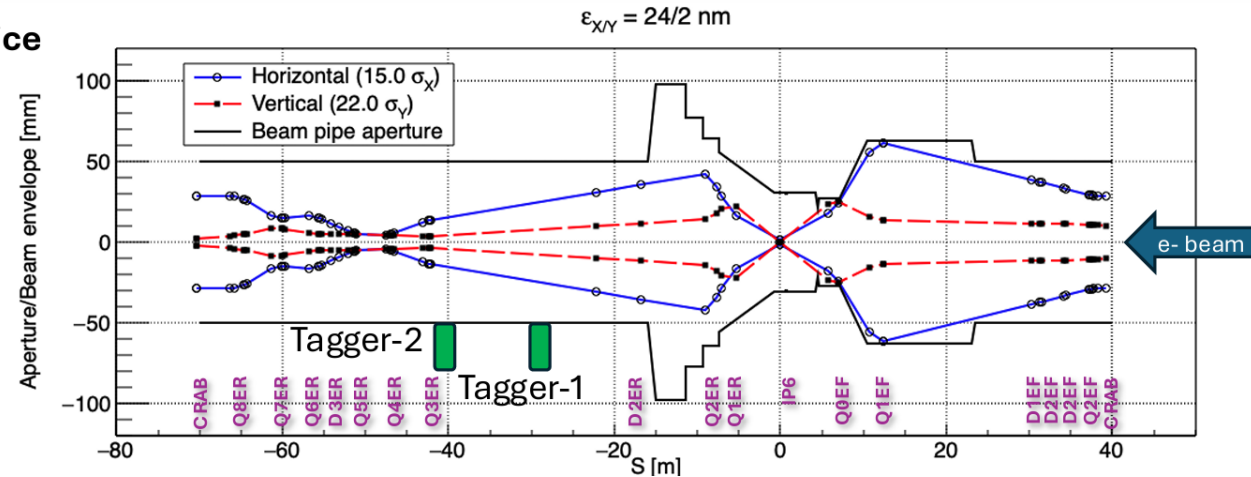
SR photon paths with and without the SR mask

Integration and simulation

- New geometry with warm B2eR still being studied.
 - Magnet setup needs porting to dd4hep.
 - Option to add trackers into beamline vacuum
 - Benchmark to validate simulation beam profile against lattice.
 - Benchmarks to carry out automatic training of reconstruction NN on new geometry.
 - Benchmarks to quantify geometry changes on physics reconstruction
- Beampipe shape optimization still in progress
 - Physics acceptance
 - Accelerator stability



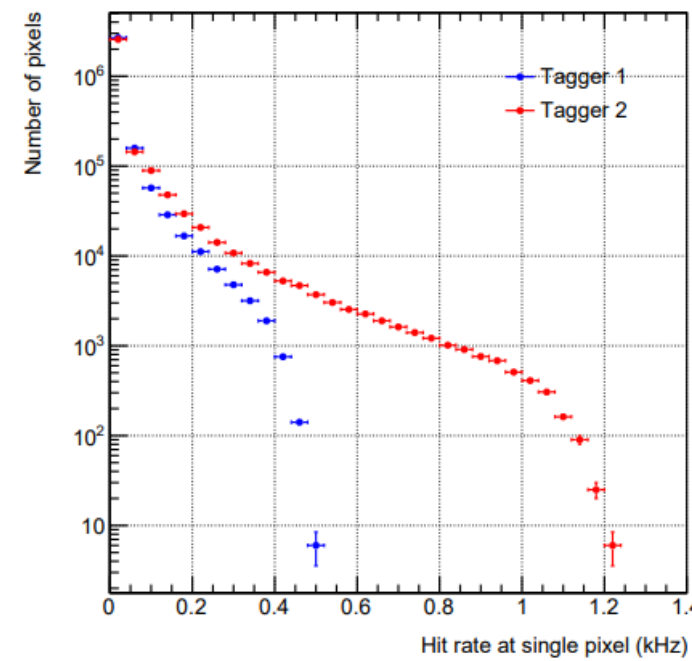
Sketch of Tagger region geometry by Jarda



x/y profile of electron beam through IP

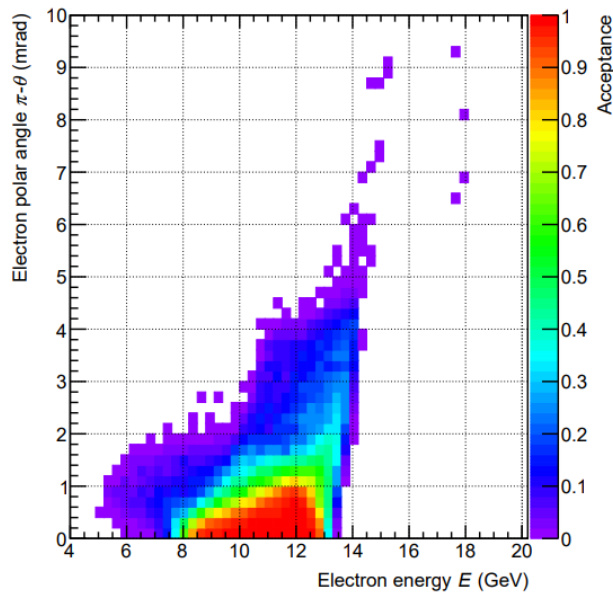
Integration and simulation

- Other backgrounds:
 - Beam halo from full ring (including electron beam gas currently included) under study by Andrii.
 - Bremsstrahlung
 - **Need edm4hep/EICrecon event merger to carry out full studies and timing**
- Standalone simulation with new geometry.
 - Rates and acceptance for 18x275



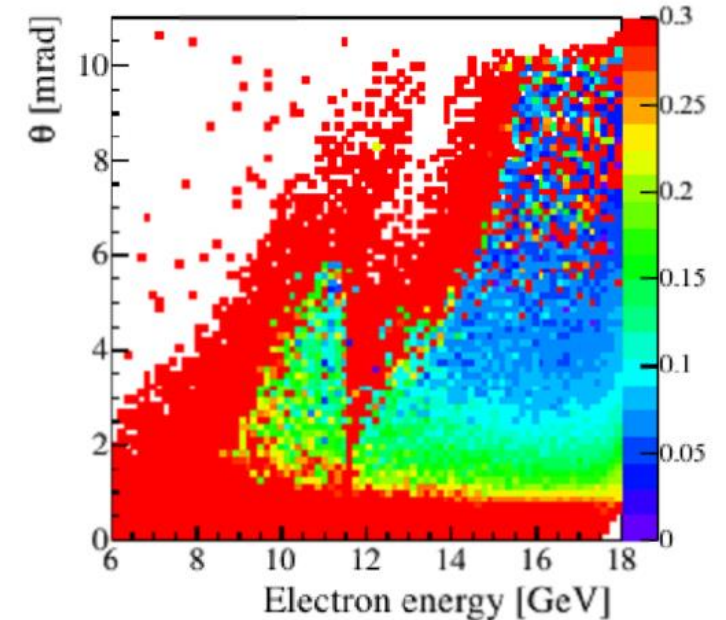
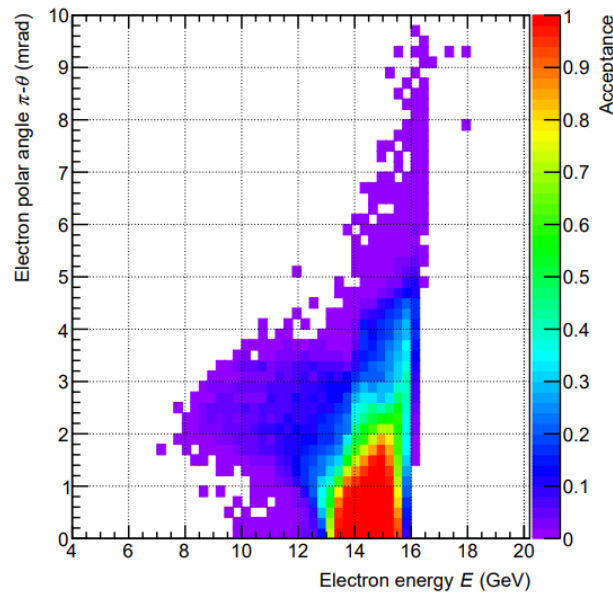
Rates per pixel in each tagger (no multiplicity from charge sharing)

Tagger 1



Current configuration acceptance

Tagger 2



Previous configuration
phi resolution

Reconstruction status

- Low-Q2 electrons included in *ReconstructedParticles* collection
 - Truth association not included since September due to changes upstream - being fixed.
 - PID being unset by PID factories – should be merged later in tracking so all particles are assumed to be electrons.
 - Charge stays correct.
- Digitization
 - Plans for fast simulation of detector effects on going ([previously presented](#)).
 - Captures full readout parameterization while keeping MC variation.