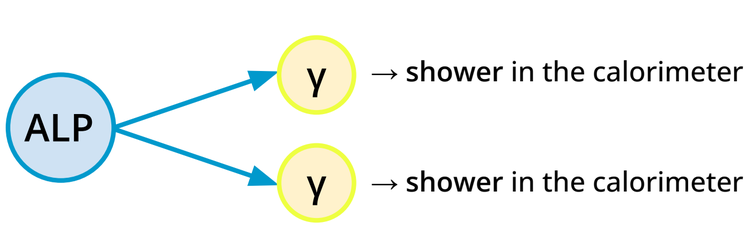
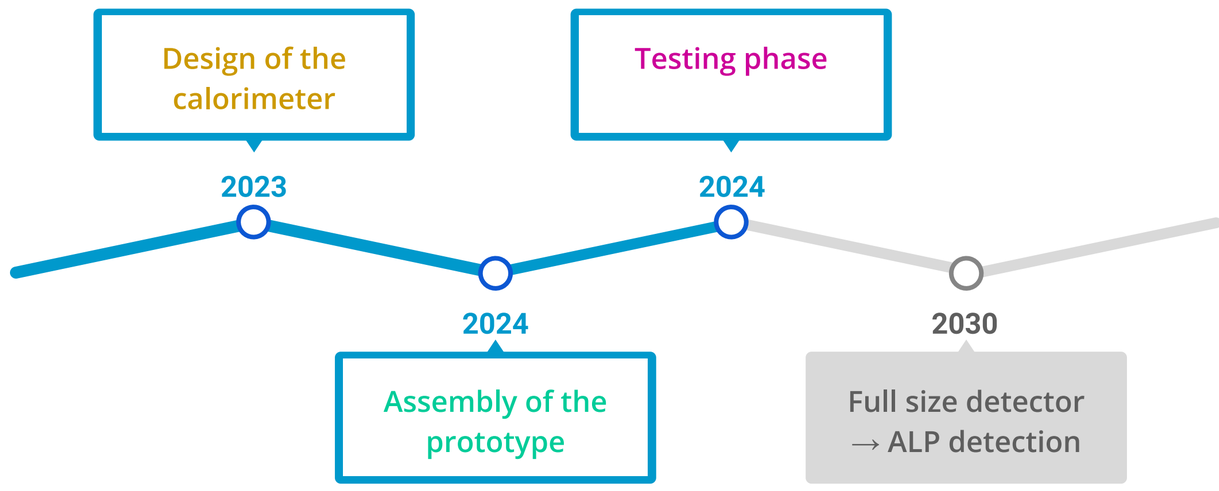
A Pointing Calorimeter for future Beam Dump experiments

1. Motivation

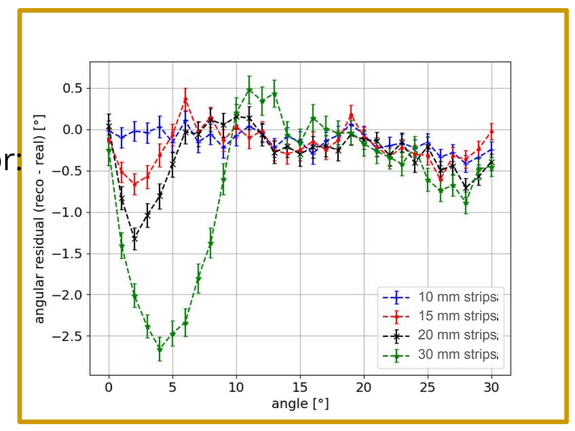
- Feebly Interacting Particles (FIP) - **New Physics** @beam dump experiments
- Electromagnetic calorimeter: part of a bigger detector system
- **Pointing capabilities** : reconstruct FIP masses from fully neutral final states (eg Axion Like Particle (ALP) → γγ decays)
- Could be employed eg at the SHiP experiment





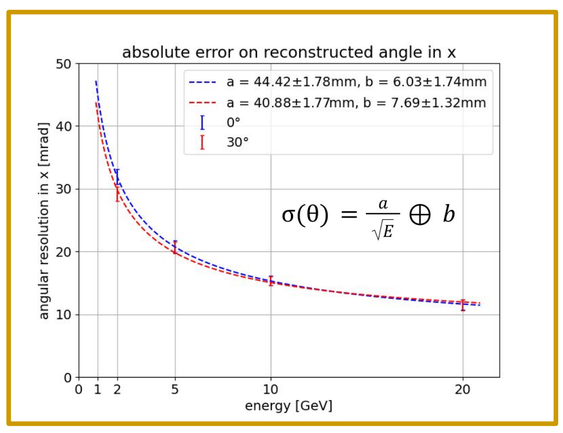
2. Design of the calorimeter

- **Sampling** calorimeter
  - Iron/Plastic scintillator
  - 1 m long = ~20 X_0
- GEANT4 simulation of full detector: photons at different angles and energies (1 - 20 GeV)
- **Strips**
  - track reconstruction: horizontally/vertically alternating
  - **optimal width: 1 cm**

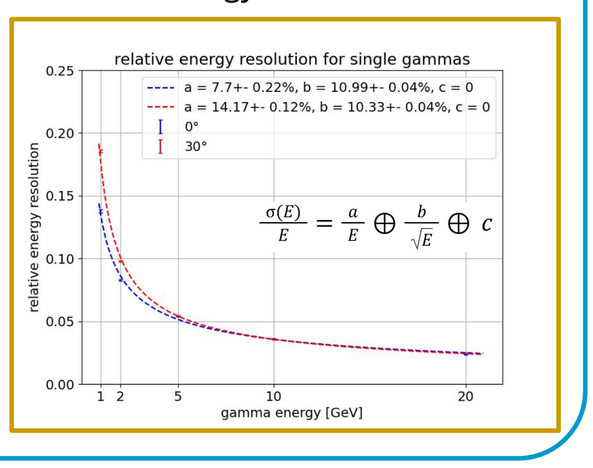


Residuals real/reco showers
→ strip width choice

Angular resolution

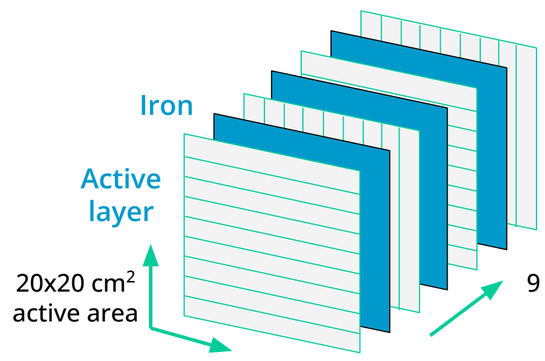


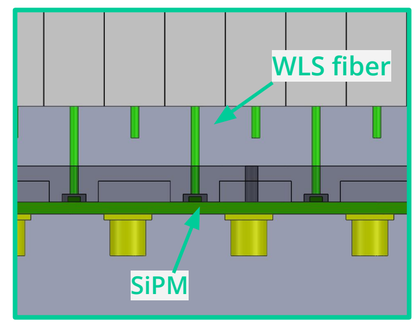
Energy resolution

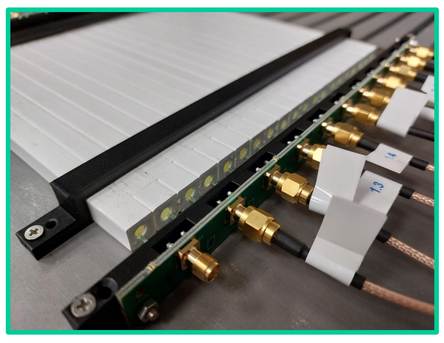


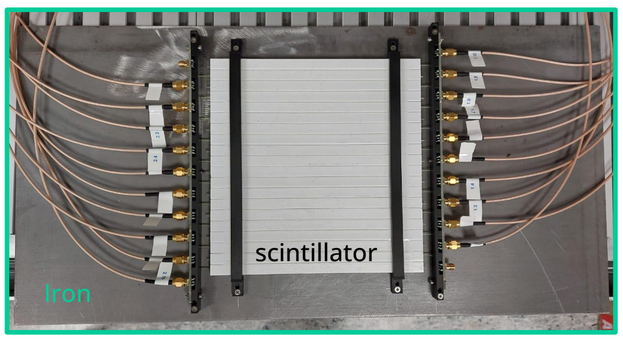
3. Assembly of the prototype

- 9 layers – 180 channels
- 20x20 cm^2 **active area**
  - 1x1x20 cm^3 coextruded scintillator strips
- **Modular** Iron absorbers (4 mm thick) - can be stacked
- Readout:
  - S13360-1325PE HAMAMATSU **Silicon PhotoMultipliers**
  - Kuraray YS2 **WLS fibers**





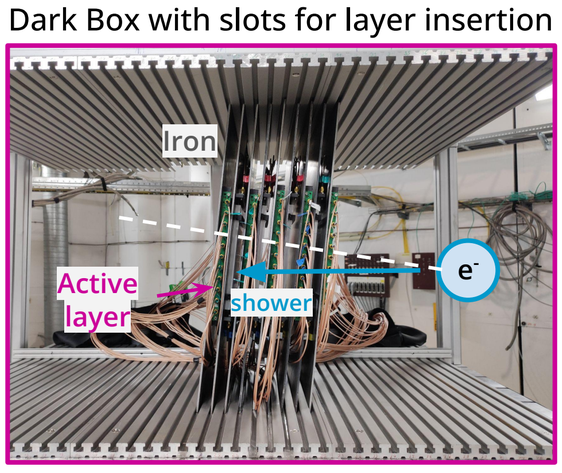




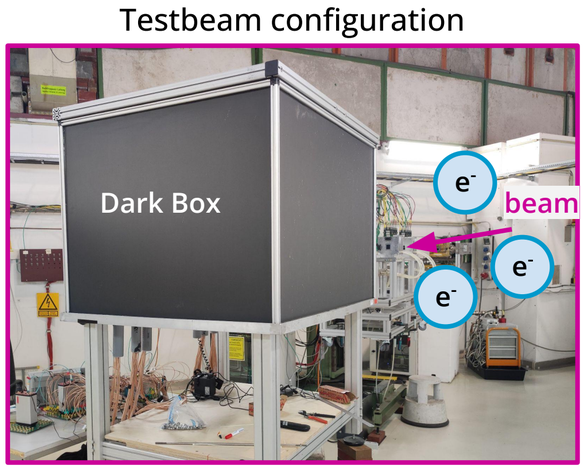
4. Testing phase

- Electrons @ DESY
  - with energies of 1 - 5 GeV
- Configuration
  - Incident angle 0 - 20°
  - 1/6/10 X_0 (1/3/5 Iron plates)
- Data analysis ongoing

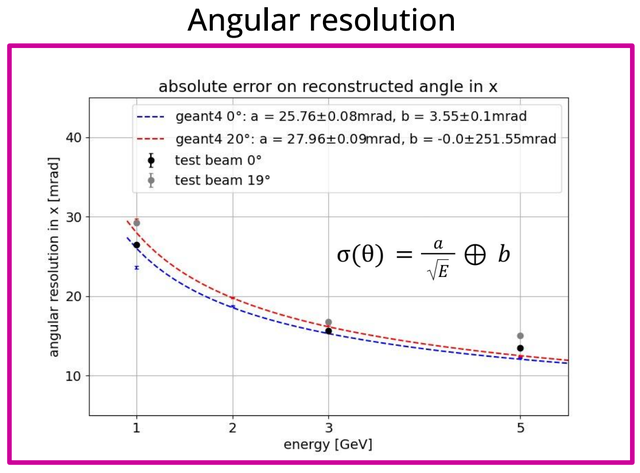
Dark Box with slots for layer insertion



Testbeam configuration



Angular resolution



5. References

- SHADOWS Technical Proposal - CERN-SPSC-2023-029 ; SPSC-P-367

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