STEERING EFFICIENCY AND DECHANNELING OF A SUB-GEV ELECTRON BEAM AS A FUNCTION OF CURVATURE AND ENERGY
Motivations

- A lot of attention is devoted to channeling effects of electron around GeV:
  - Interest for alternatives x-ray sources
  - Relatively large availability accelerators

- Experiments on bent crystals allowing to describe the electron dynamics and radiation emission as a function of the curvature are demanded.
State of the art 855 MeV e- on bent crystals

- Channeling–rechanneling in a 30 mm bent Si crystal:


DYNECHARM++
State of the art 855 GeV e- on bent crystals

- **Channeling–rechanneling dynamic in a bent Si crystal:**

  ![Graph](image1)

  **Graph 1:**
  - (a) VR & VC experimental
  - (a) VR & VC simulation
  - (b) CH experimental
  - (b) CH simulation


- **Channeling–and VR radiation:**

  ![Graph](image2)

  **Graph 2:**
  - CR exp
  - CR sim
  - VR exp
  - VR sim
  - out exp
  - out sim

Outline

- Experiment set-up
- Crystal preparation and bending strategies
- Si deflection efficiency as a function of the curvature
- Si and Ge comparison
MAMI experimental set-up
Screen camera

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D. De Salvador, UNIPD & LNL-INFN
Crystal preparation and bending

Main issues:

- Very thin (about 10 microns) and brittle samples (especially Ge)

- High quality bending (homogeneous and torsion control)

- Vacuum experiment (remote control of the bending would be preferred)

Specifically developed technology
Fixing before bending

Thin slab is fixed to special plugs

Additional chemical thinning to adjust the thickness can be performed

Smooth transfer to the bending system
Remotely controller bender

2.8 mm curvature radius !!!

Bending

Torsion correction
Channeling deflection at different curvatures (Si)

15mm Si crystal experiment:

Si, experiment
Efficiency and dechanneling

Simulation: CRYSTAL
As function of Energy...

Preliminary data (detector problems)

World-record lowest energy in a bent crystal (195 MeV)

Classical model is still good to explain coherent interactions at ~200 MeV
Ge comparison

Si & Ge radiation

Efficiency of 15mm Si & Ge crystals

Photon Energy (MeV)

Spectral density (a.u.)

\( \eta_{\text{ch}} \)

\( R/R_{\text{cr}} \)
Conclusion

- We developed a new technology for crystalline Si and Ge adjustable bending device for sub-GeV e-
- Bending record (2.8mm) huge deflection 1.5 mrad with a 15mm Si slab
- Important data for electron channeling dynamic, we validate classical models at different curvatures.
- Ge validates the z dependence of scattering and dynamic models
- Ge bad for electron deflection (too much scattering), optimal for radiation!
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