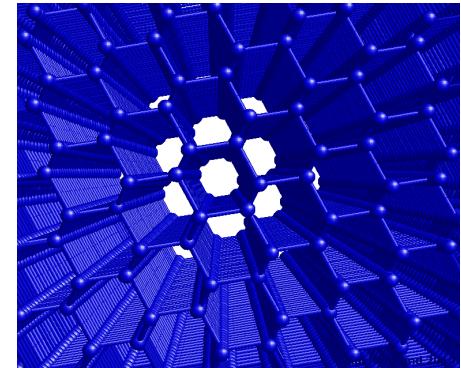


# STEERING EFFICIENCY AND DECHANNELING OF A SUB-GEV ELECTRON BEAM AS A FUNCTION OF CURVATURE AND ENERGY



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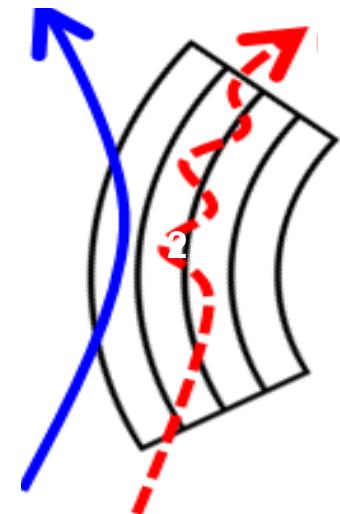
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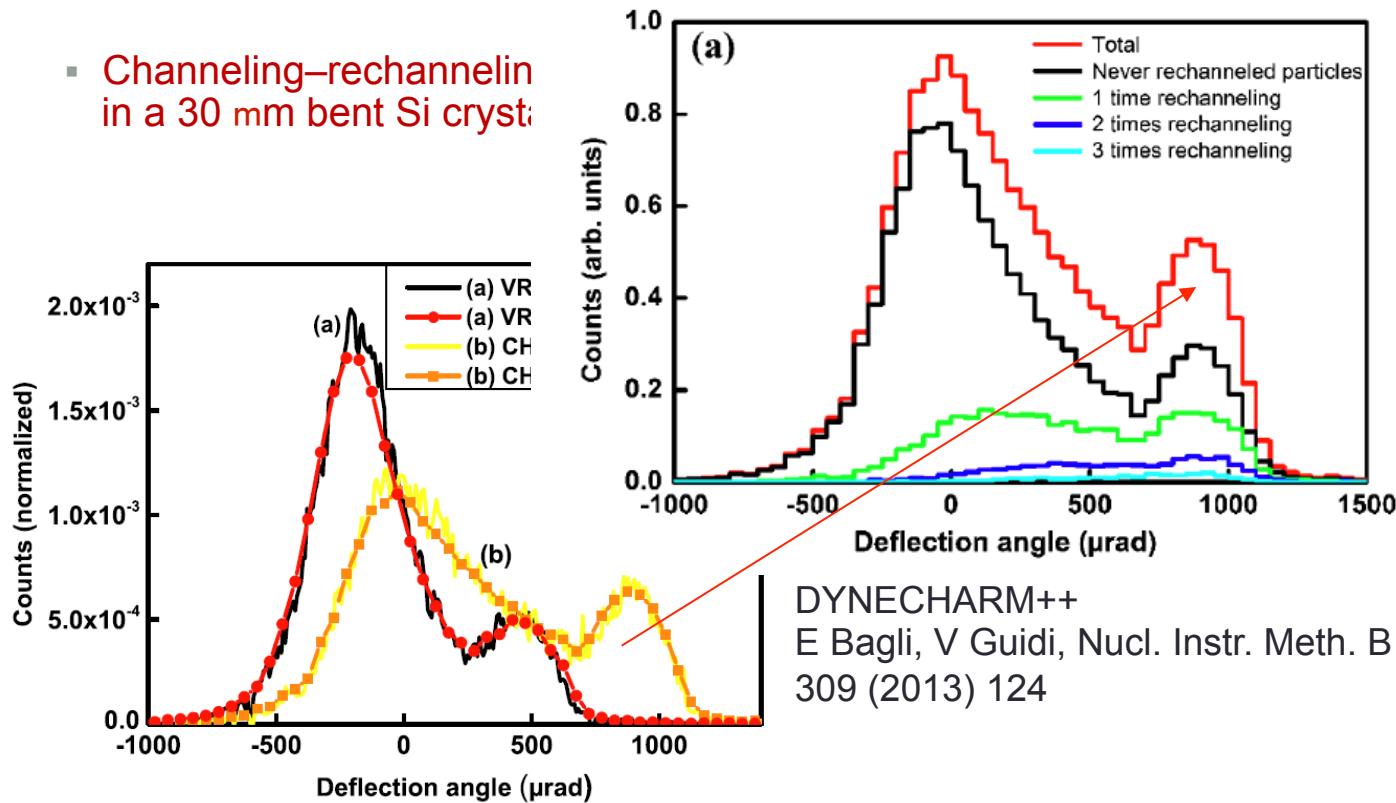
# Motivations



- 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

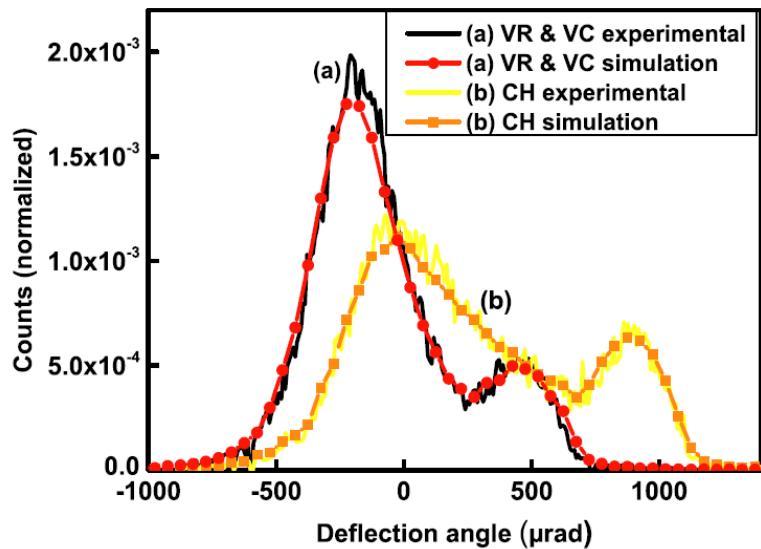
- Channeling–rechanneling in a 30 mm bent Si crystal



A. Mazzolari et al., Phys. Rev. Lett.  
112 (2013) 135503.

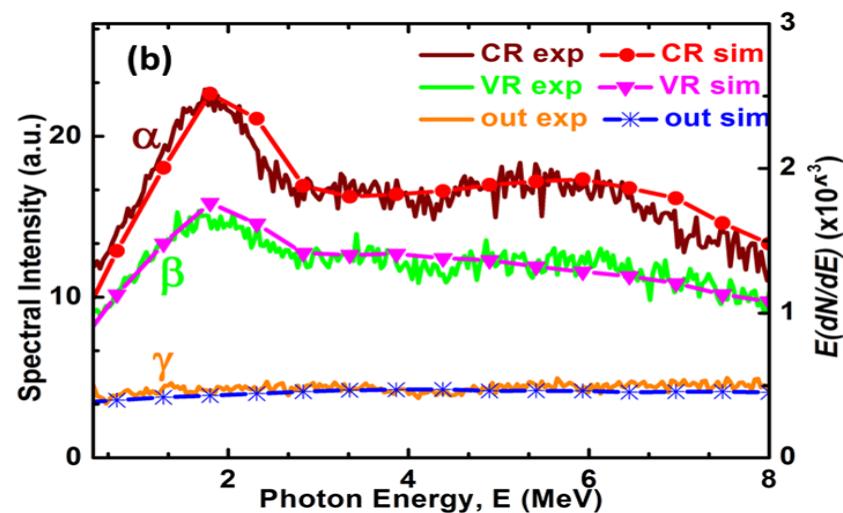
# State of the art 855 GeV e- on bent crystals

- Channeling–rechanneling dynamic in a bent Si crystal:



A. Mazzolari et al., Phys. Rev. Lett.  
112 (2013) 135503.

- Channeling–and VR radiation:

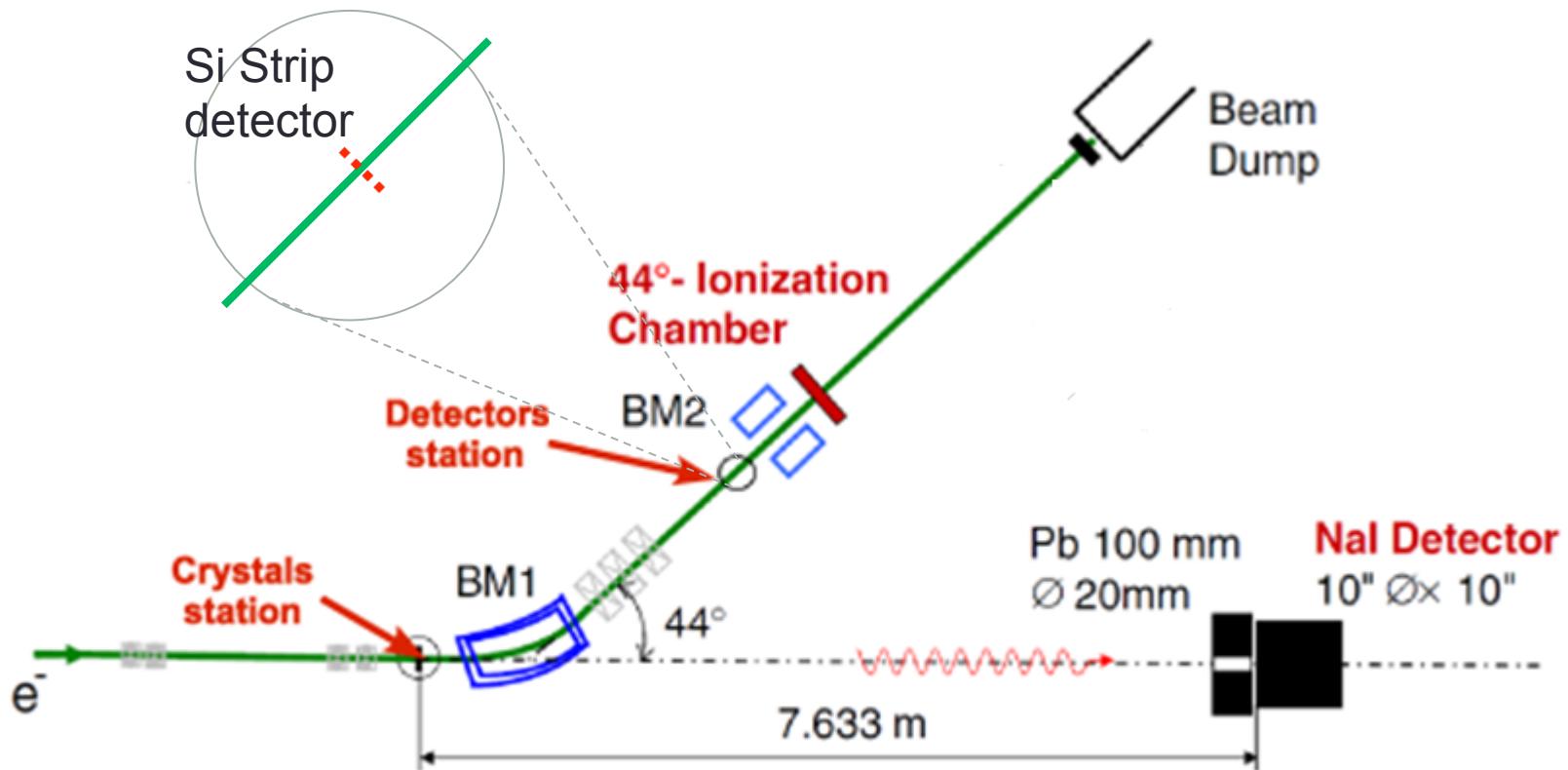


L. Bandiera et al., Phys. Rev. Lett.  
115 (2015) 025504.

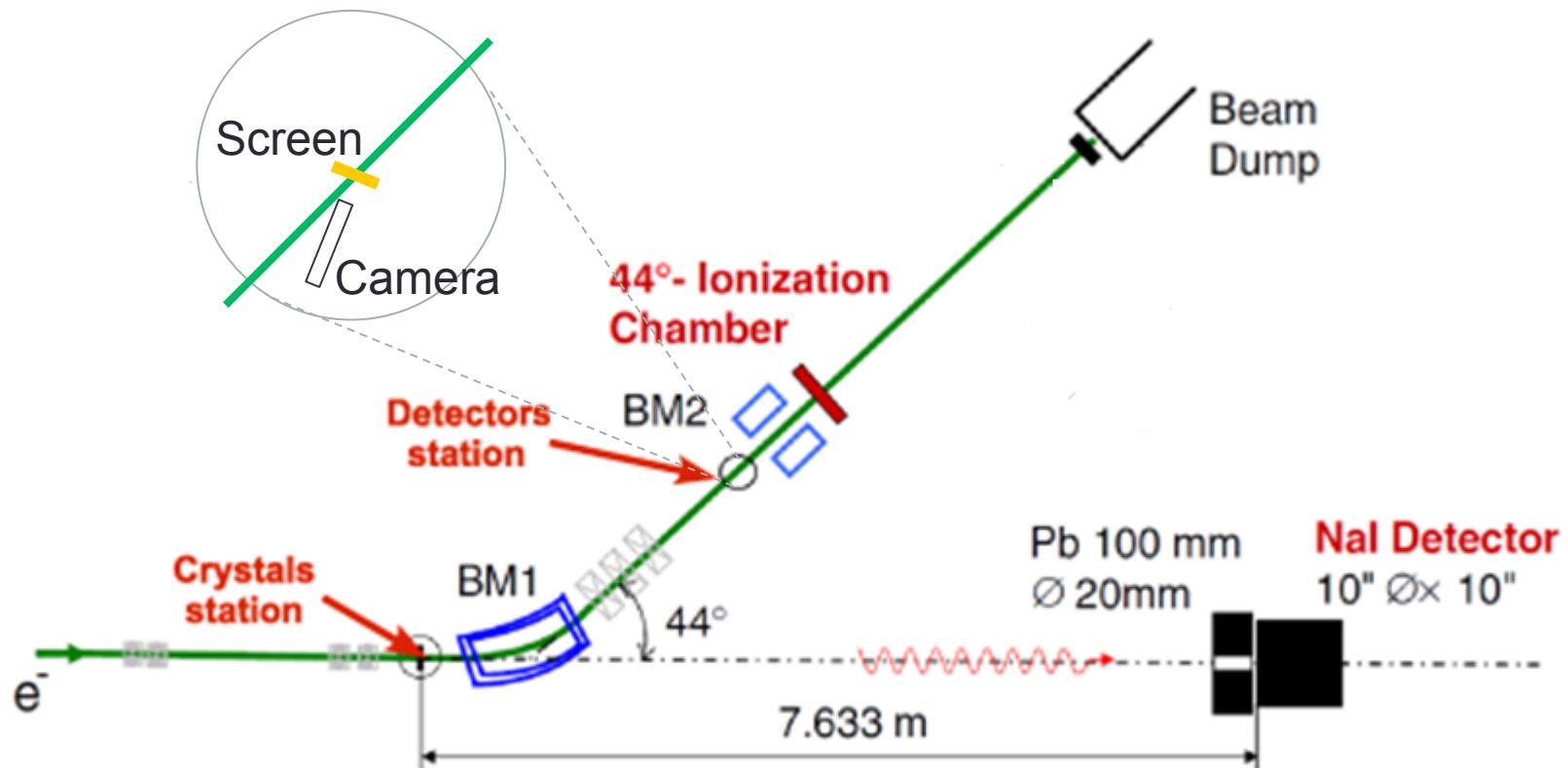
# Outline

- 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



# Crystal preparation and bending

Main issues:

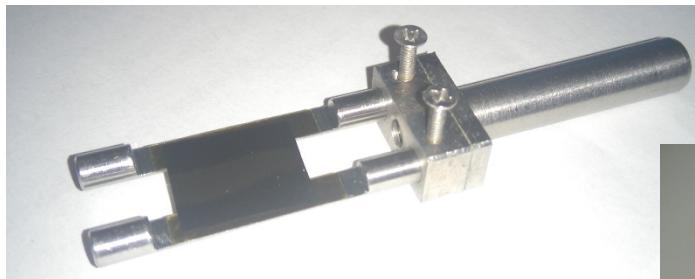
- Very thin (about 10 microns) and brittle samples (especially Ge)
- High quality bending (homogeneous and torsion control)
- Vacuum experiment (remote control of the bending would be preferred)



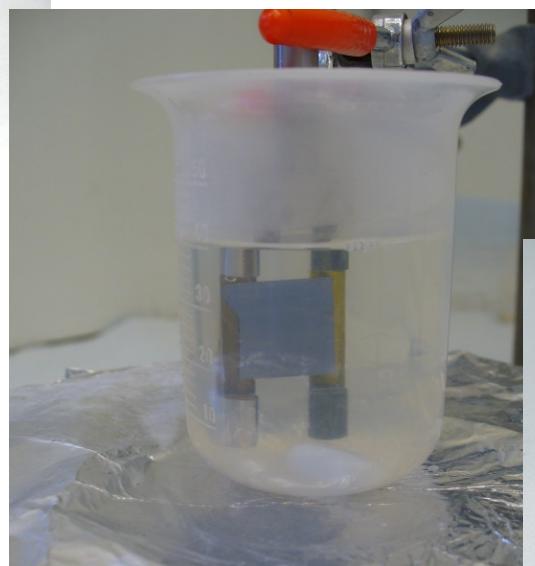
Specifically developed technology

# Fixing before bending

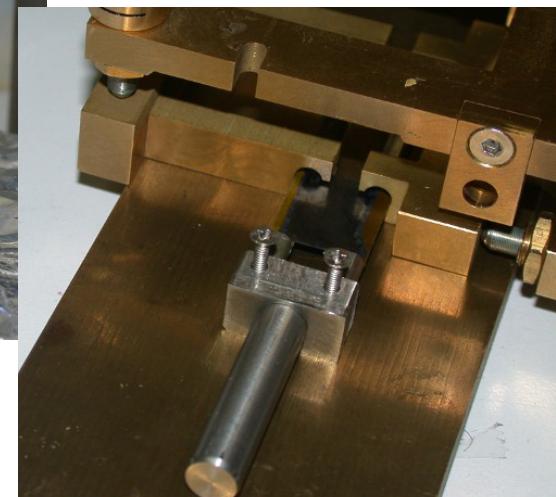
Thin slab is fixed to  
special plugs



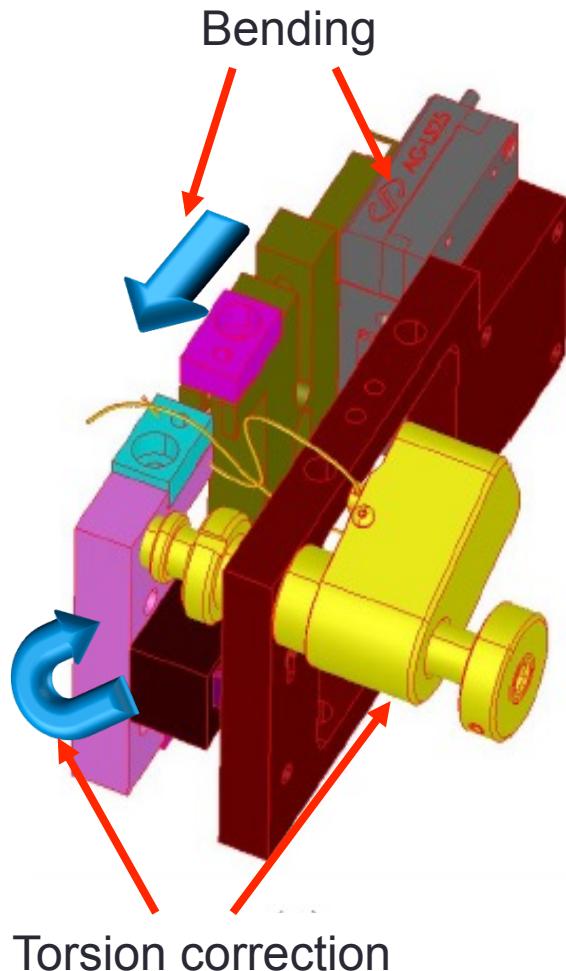
Additional chemical  
thinning to adjust the  
thickness can be  
performed



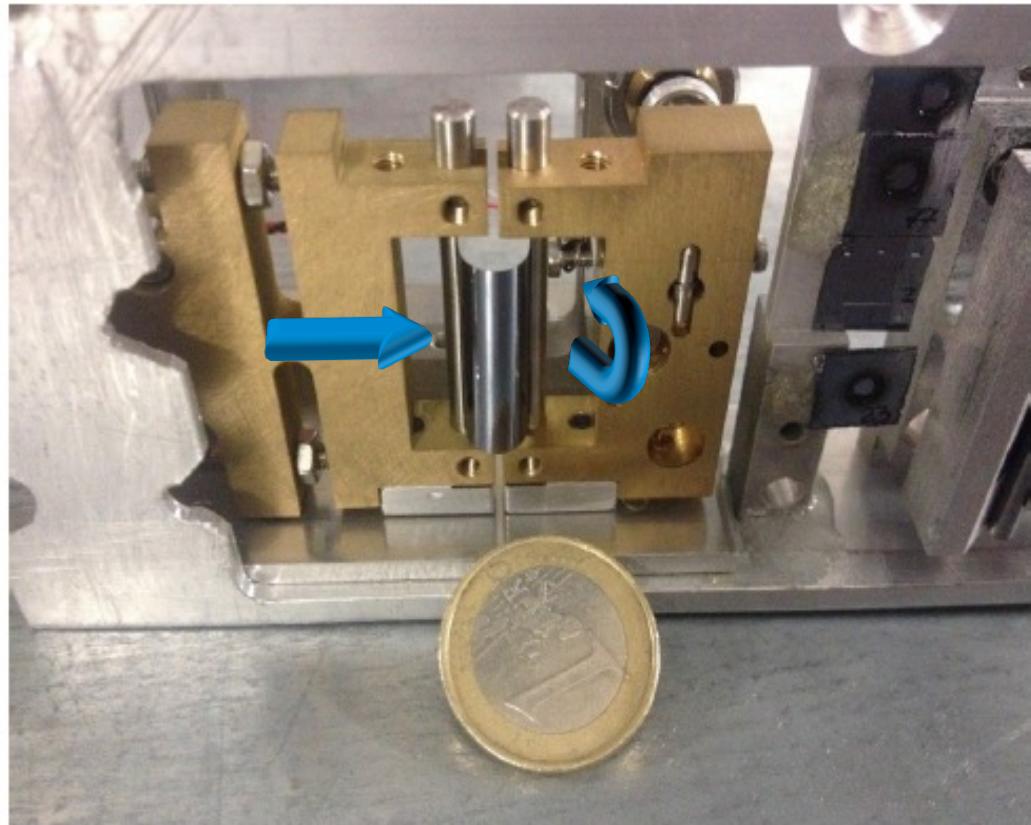
Smooth transfer to  
the bending system



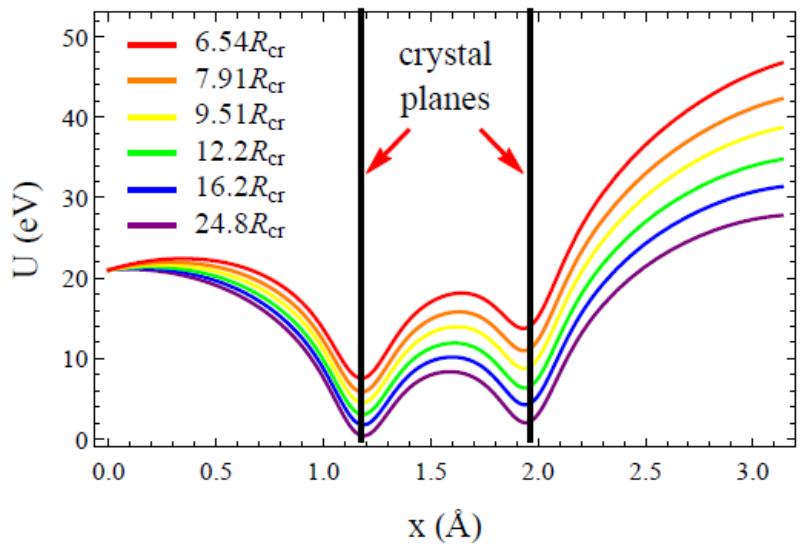
# Remotely controller bender



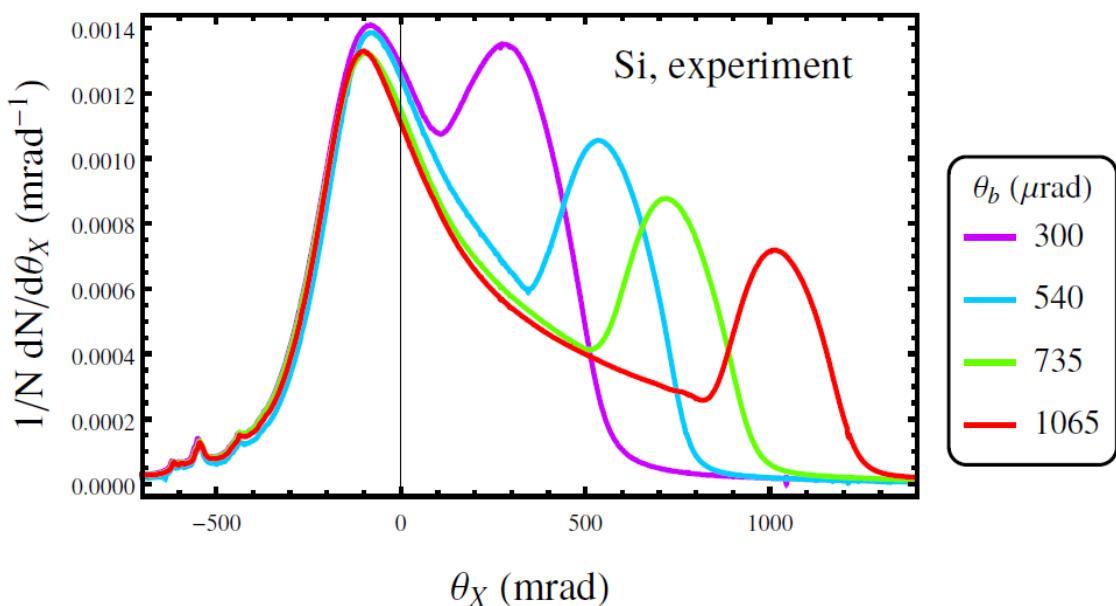
2.8 mm curvature radius !!!



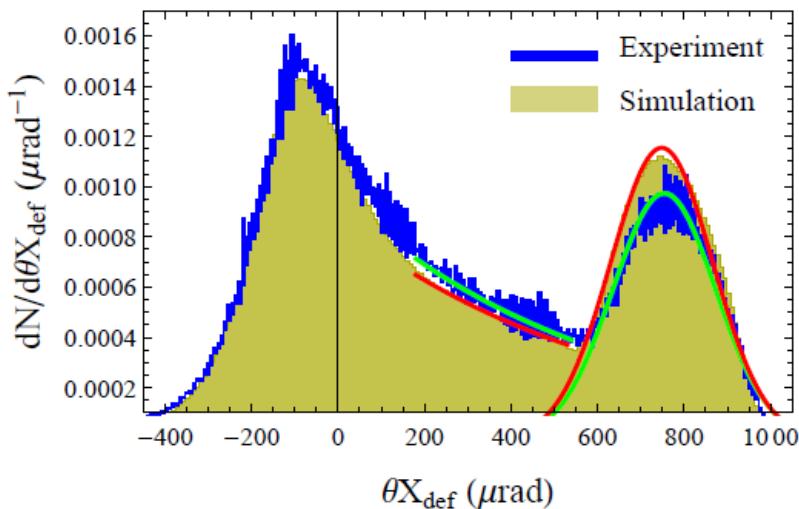
# Channeling deflection at different curvatures (Si)



15mm Si crystal experiment:

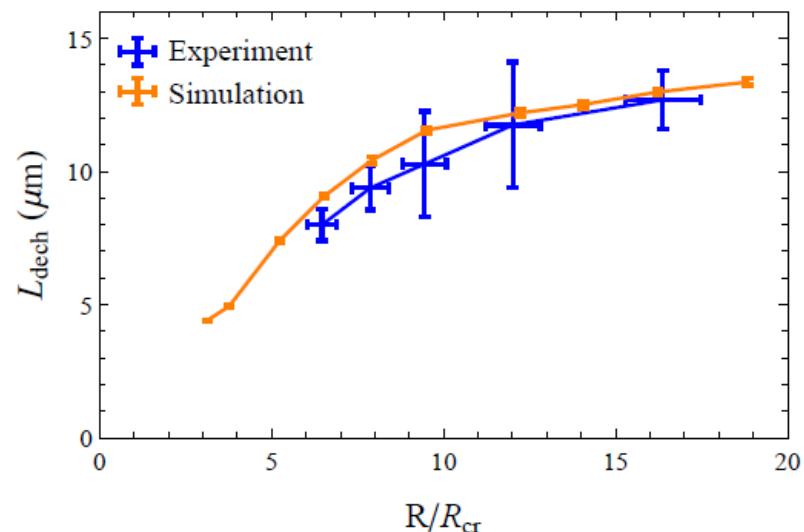
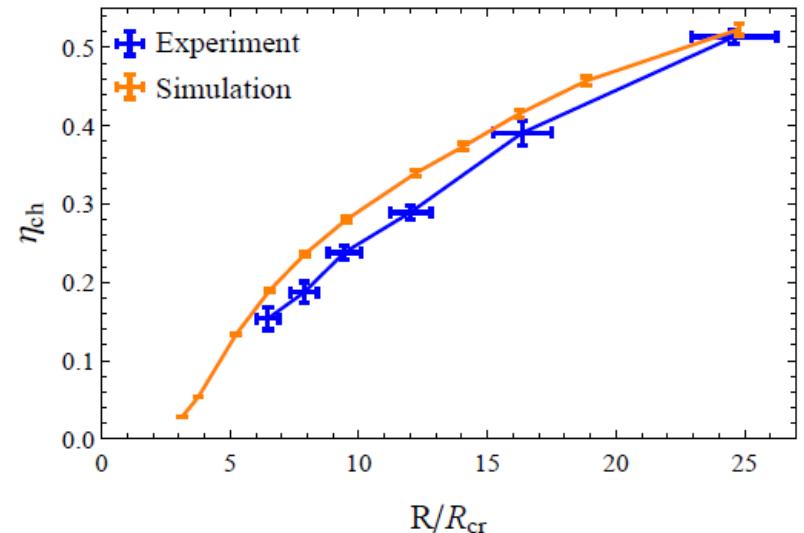


# Efficiency and dechanneling



**Simulation :** CRYSTAL

A. Sytov and V. Tikhomirov, Nucl.  
Instr. and Meth. B 355, 383 (2015).

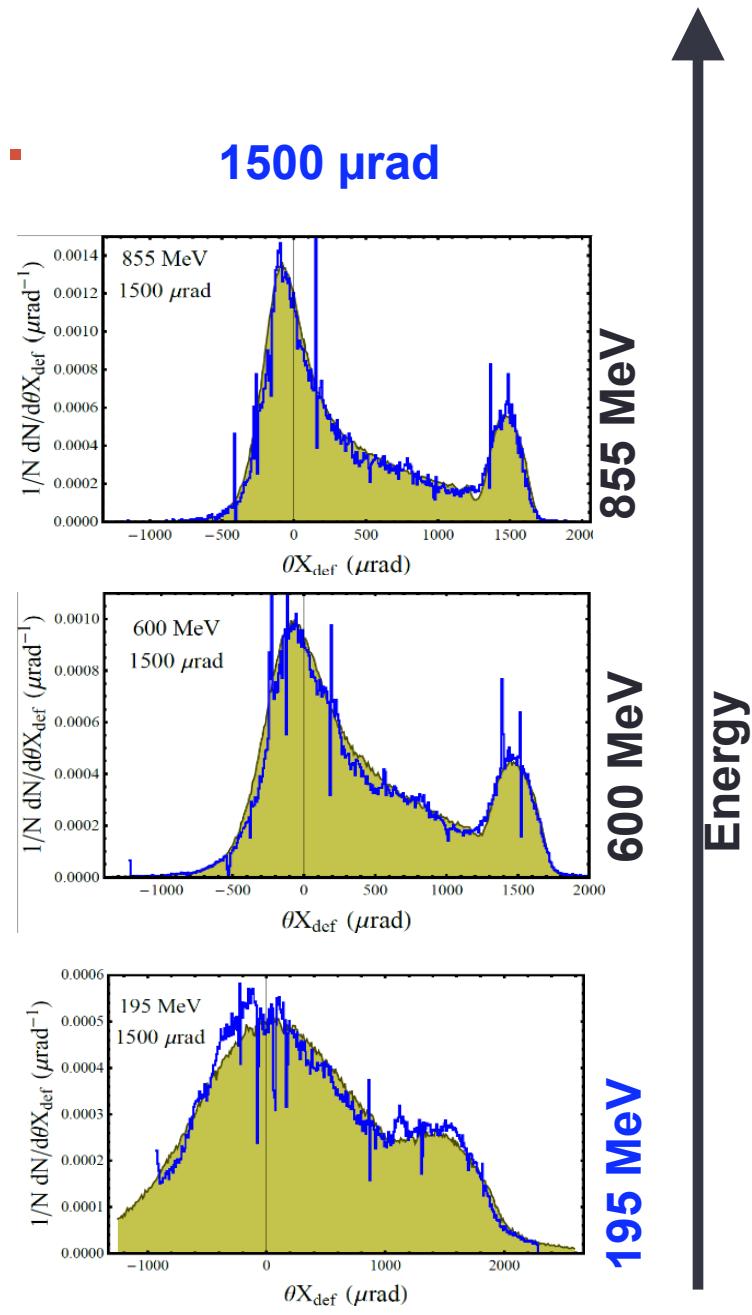
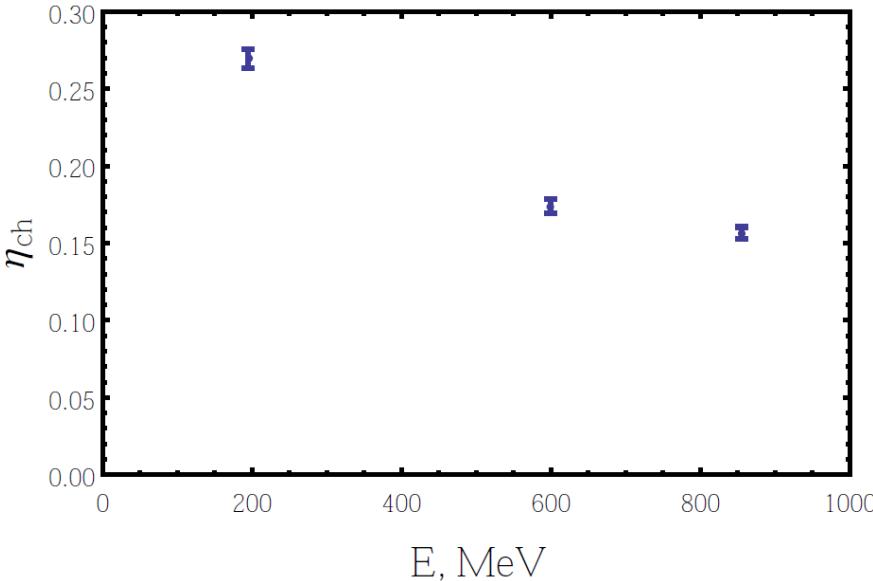


# As function of Energy...

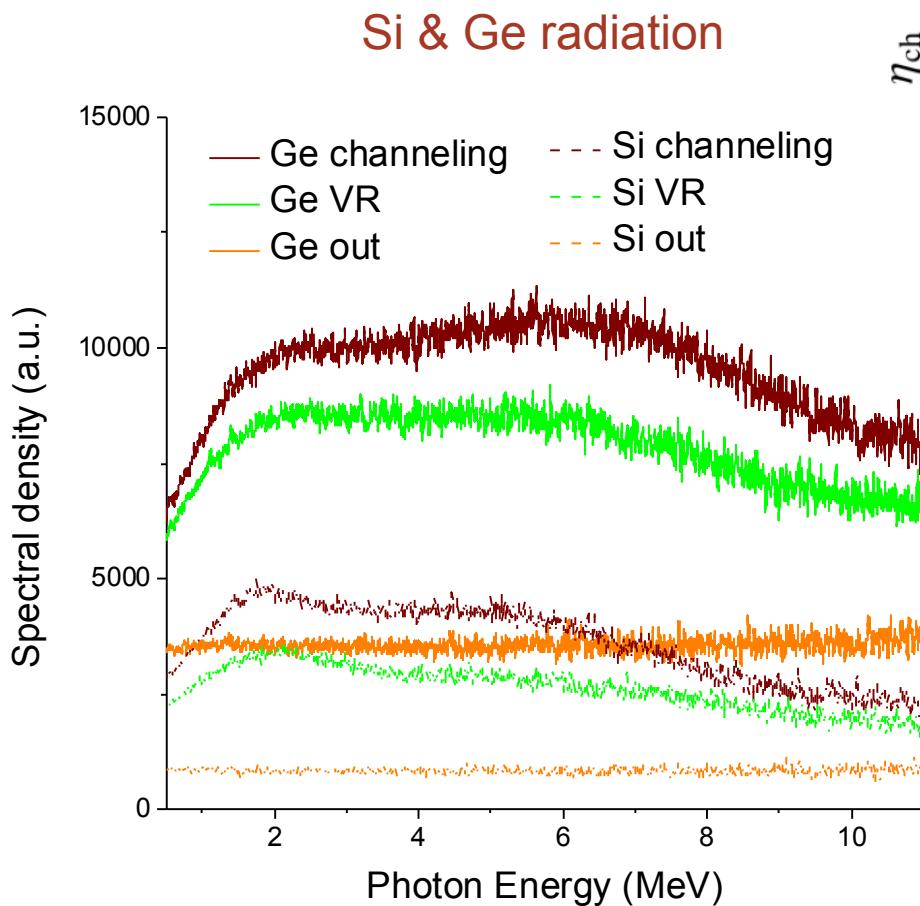
Preliminary data (detectro problems)

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

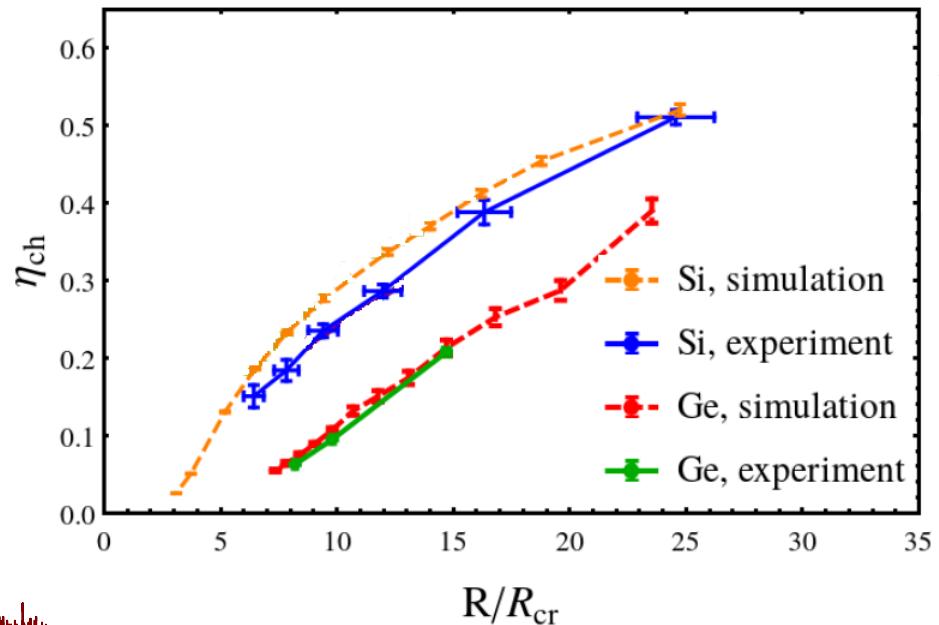
**Classical model is still good to explain coherent interactions at ~200 MeV**



# Ge comparison



Efficiency of 15mm Si & Ge crystals



# 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!

# Acknowledgments

- INFN CNSV Chanel project
- CINECA ISCRA initiative for high performance computing resources and support