

# Updates of experimental activity on crystals for Mu2e

INFN Ferrara



Istituto Nazionale di Fisica Nucleare



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## Feasibility of using crystal channeling for the beam loss mitigation in slow extraction at 8GeV

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V. Guidi<sup>c</sup>, A. Mazzolari<sup>c</sup>, M. Romagnoni<sup>c</sup>, A. Sytov<sup>d</sup>

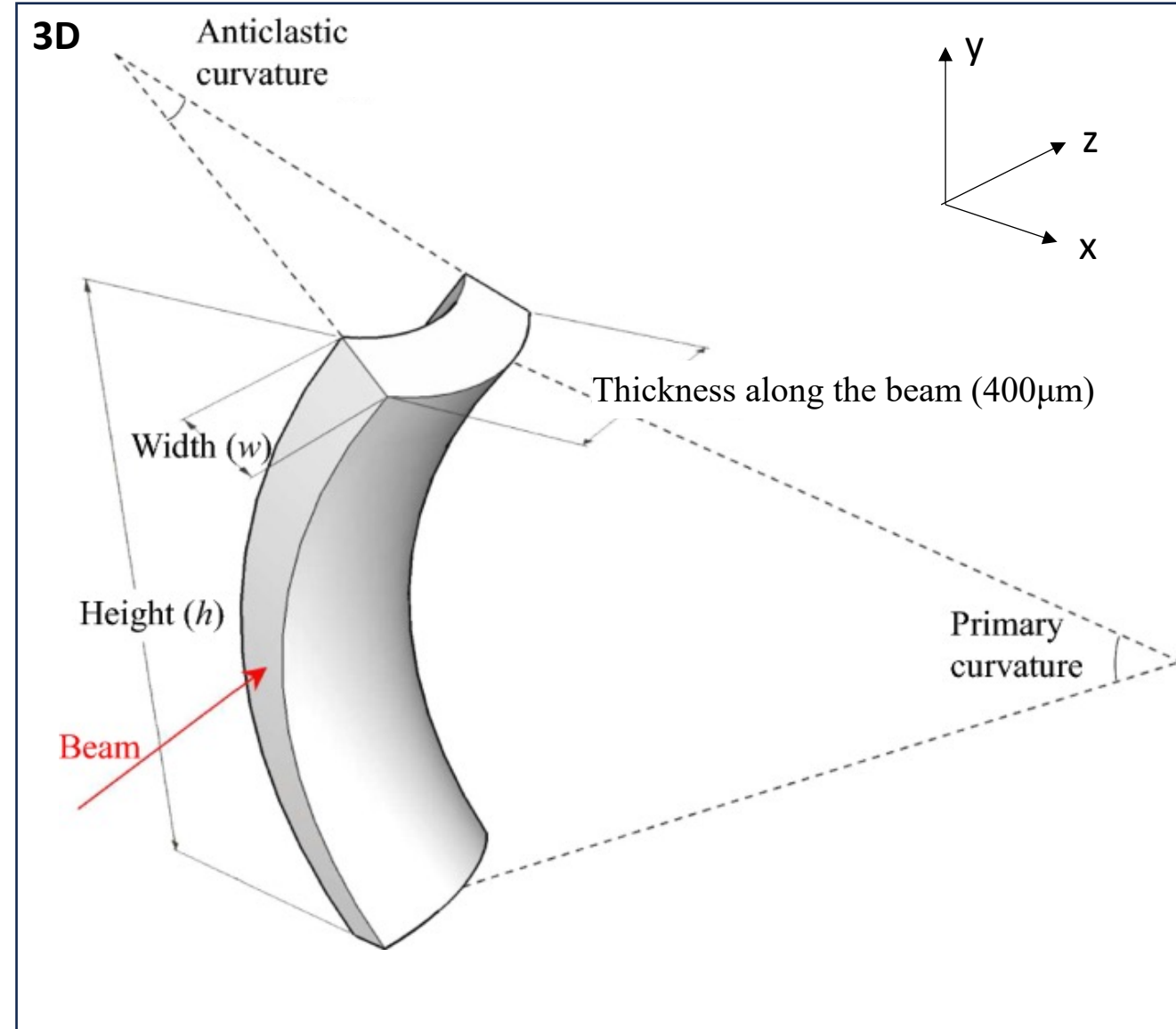
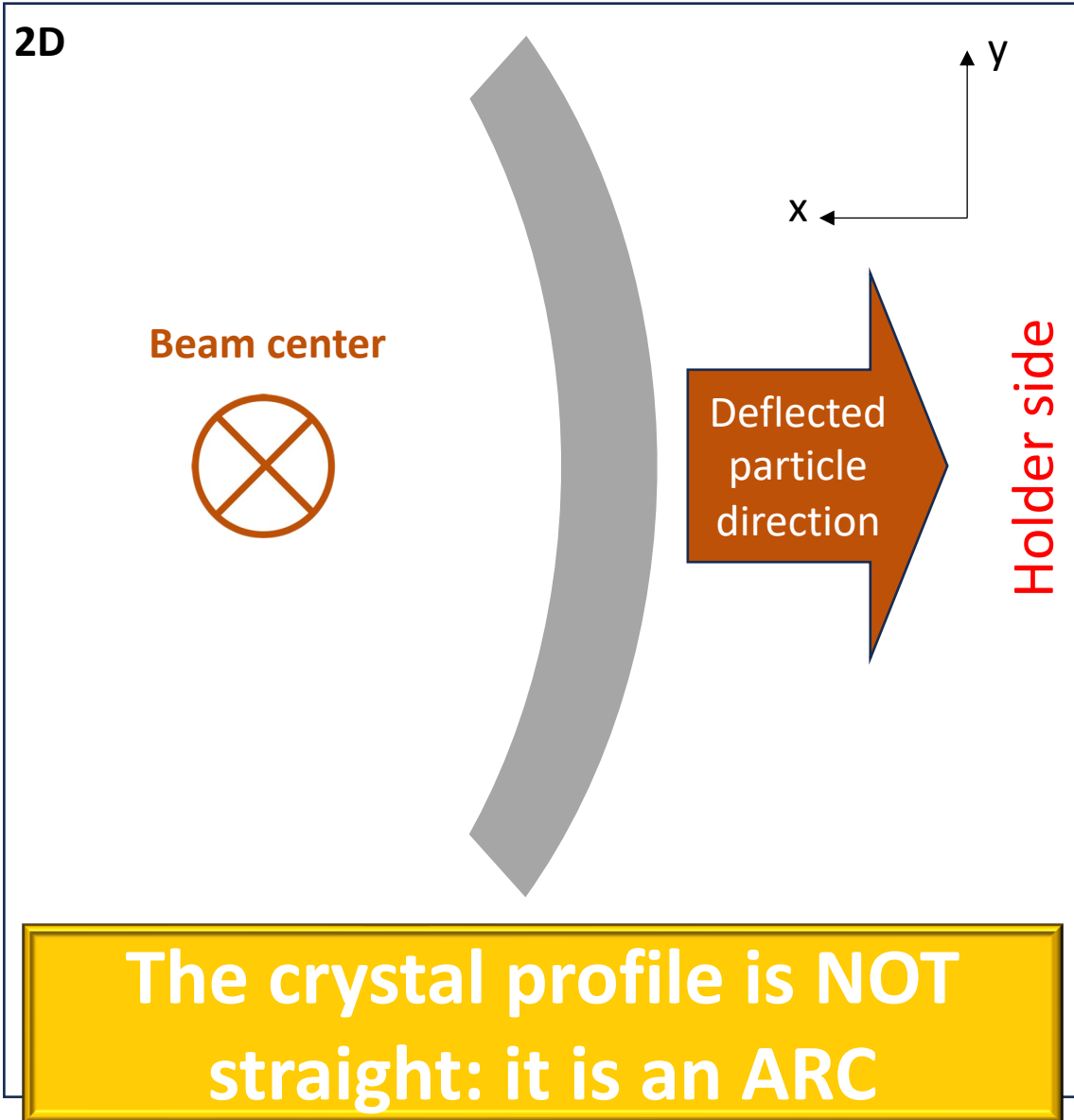
<sup>a</sup> Fermi National Accelerator Laboratory, USA

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<sup>c</sup> Università di Ferrara, INFN Ferrara, Italy

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# Anticlastic bending section

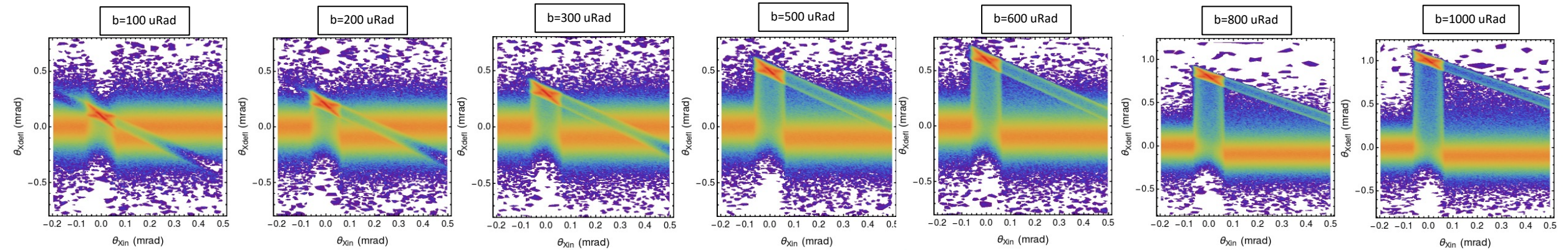


# Summary table as of December 18<sup>th</sup>

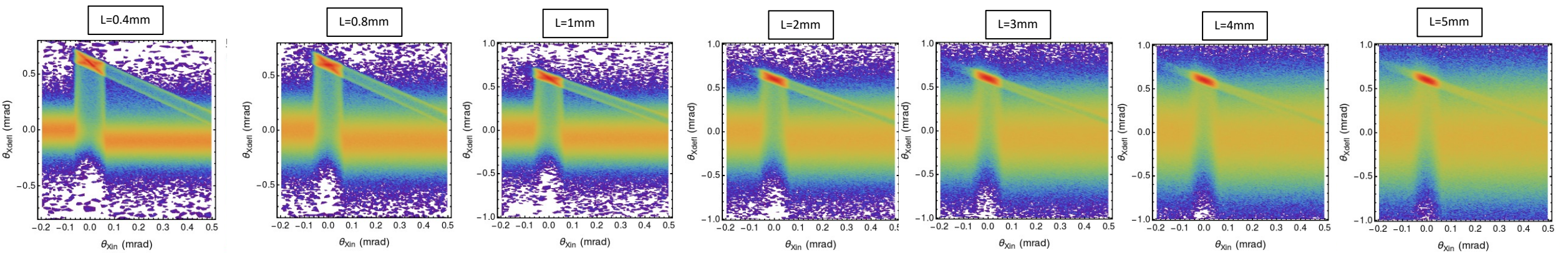
Deflection Angle	300 $\mu$ rad $\pm 20\mu$ rad
Crystal Thickness along the beam	400 $\mu$ m
Crystal Width across the beam (H)	300 $\mu$ m $\pm 20\mu$ m or better
Crystal Torsion	2 $\mu$ rad/mm
Distance between crystal and holder	>20 mm (somewhat flexible)
Height of crystal free of clamping	>30mm
Holder Material	Aluminum alloy <b>Stainless preferred</b>
Bake-out cycle	<b>No</b>

# Particle dynamics as a result of interaction with a bent crystal

Custom-made routine in GEANT developed by Alexey Sytov and run in a supercomputer



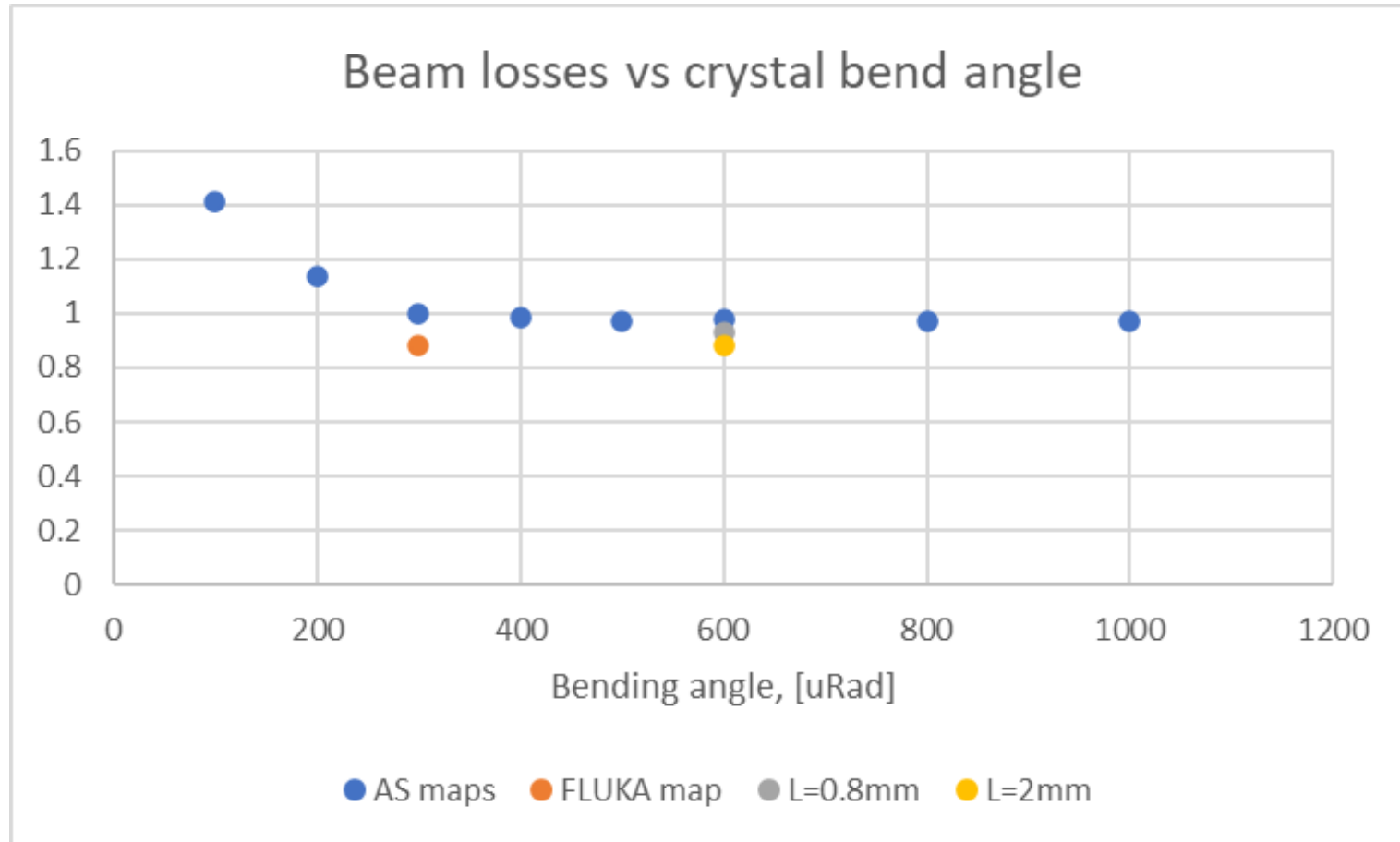
Crystal scattering PDF maps with  $L=0.4$ mm, bend=100-1000uRad



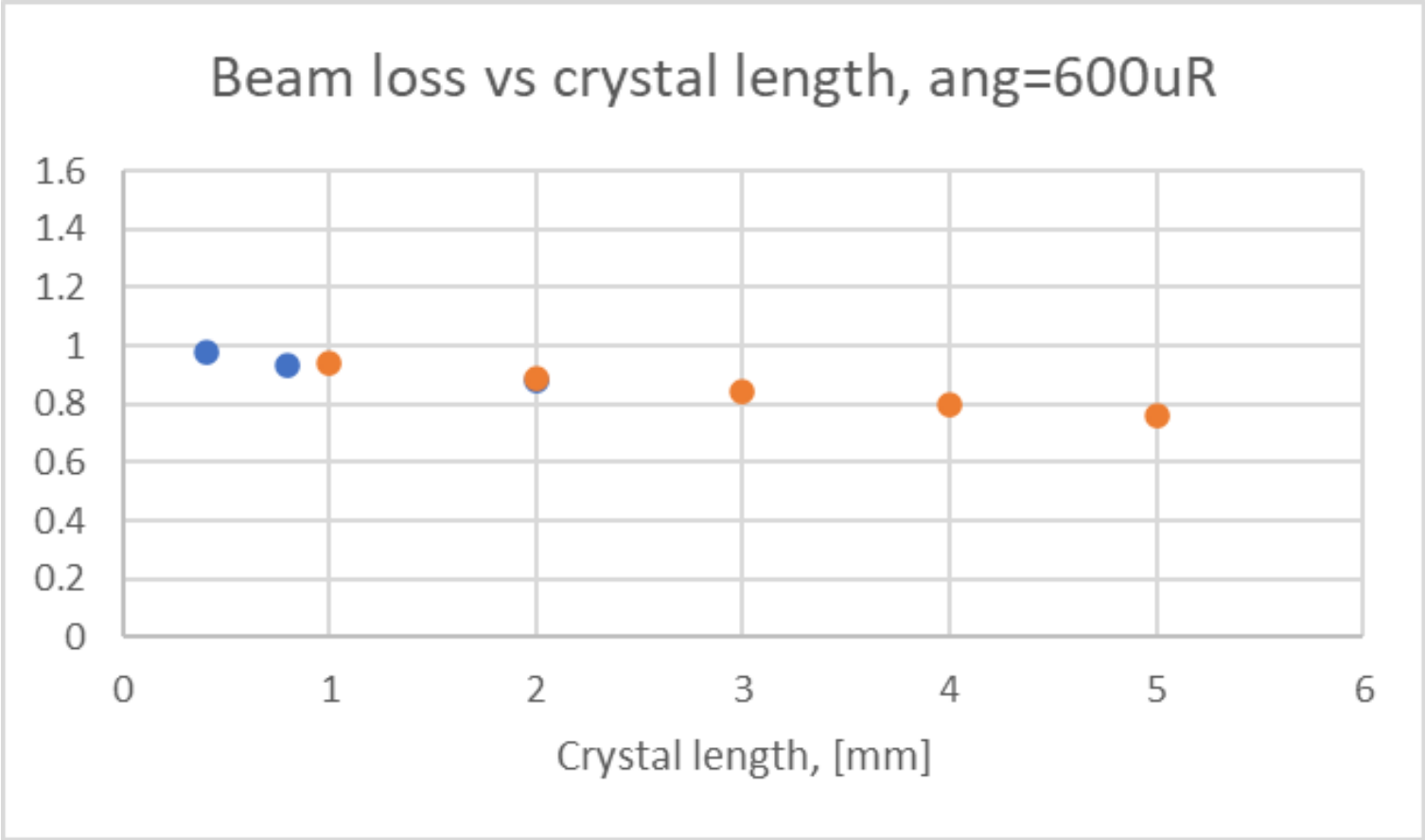
Crystal scattering maps with bend=600uRad;  $L=0.4$ mm -5mm



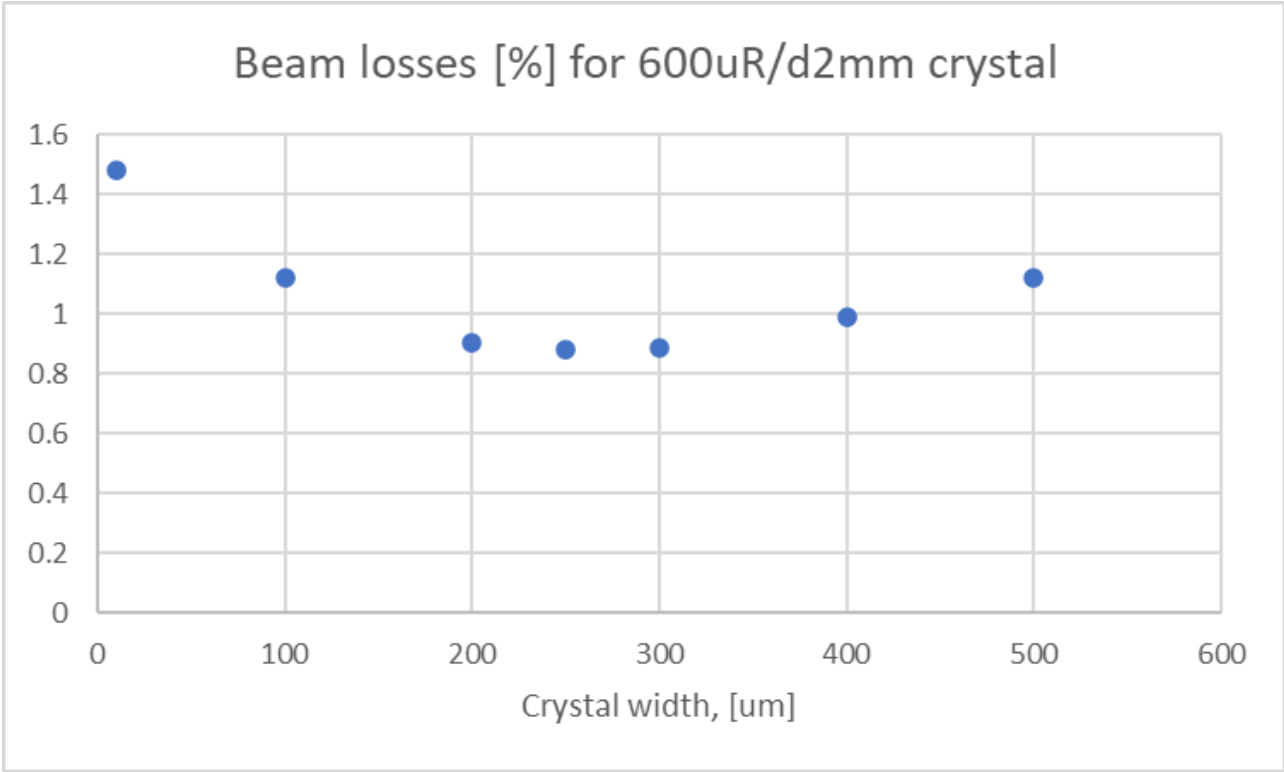
## Beam loss comparison for L=0.4mm bending crystal, variable bending angle



# Beam loss comparison for 600uR bending crystal, variable length



# Beam loss comparison for L=2mm crystal, 600uR bending; variable hor. width





# Summary table as of January 31<sup>st</sup>

Deflection Angle	<del>300 <math>\mu</math>rad</del> – 600 $\mu$ rad
Crystal Thickness along the beam	<del>400 <math>\mu</math>m</del> – 2-3 mm
Crystal Width across the beam (H)	<del>300 <math>\mu</math>m</del> – 300 or 500 $\mu$ m
Crystal Torsion	<2 $\mu$ rad/mm
Distance between crystal and holder	>20 mm
Height of crystal free of clamping	>30mm
Holder Material	Aluminum alloy - Stainless preferred
Bake-out cycle	No

# Update about goniometer

- FNAL received an offer by CINEL
- Delivery time is 12 months once the order has been placed
- It may relax the delivery of the crystals, too
- However, if assigned, beam time for on-beam characterization at CERN has not been decided.
- Crystal design is still under progress
- We do want to keep crystal and holder fabrications within previously established schedule (see next slides) despite last-minute changes

# Engagements for Mu2e for Ferrara on crystals (as requested by Dr Nagaslaev on 12-06-23 and consistent with our capacities)

- Simulation to optimize crystal geometry (work by V. Nagaslaev with our input about crystal dynamics (before 30-09-23))
- Design of crystal and of bending holder (01-10-23 -> 31-12-23)
- Fabrication of crystal and holder (01-01-24 -> 30-04-24)
- Assembling of crystal and holder and in-lab morphological, structural, thermal characterizations (01-05-24 -> 30-06-24)
- On-beam characterization at CERN (01-07-24 -> 31-08-24)
- Delivery to FNAL and installation (from 01-09-24 onward)