

WP 5: Spatial Profile of a Very High-Energy ^{208}Pb Heavy Ion Beam at CHARM

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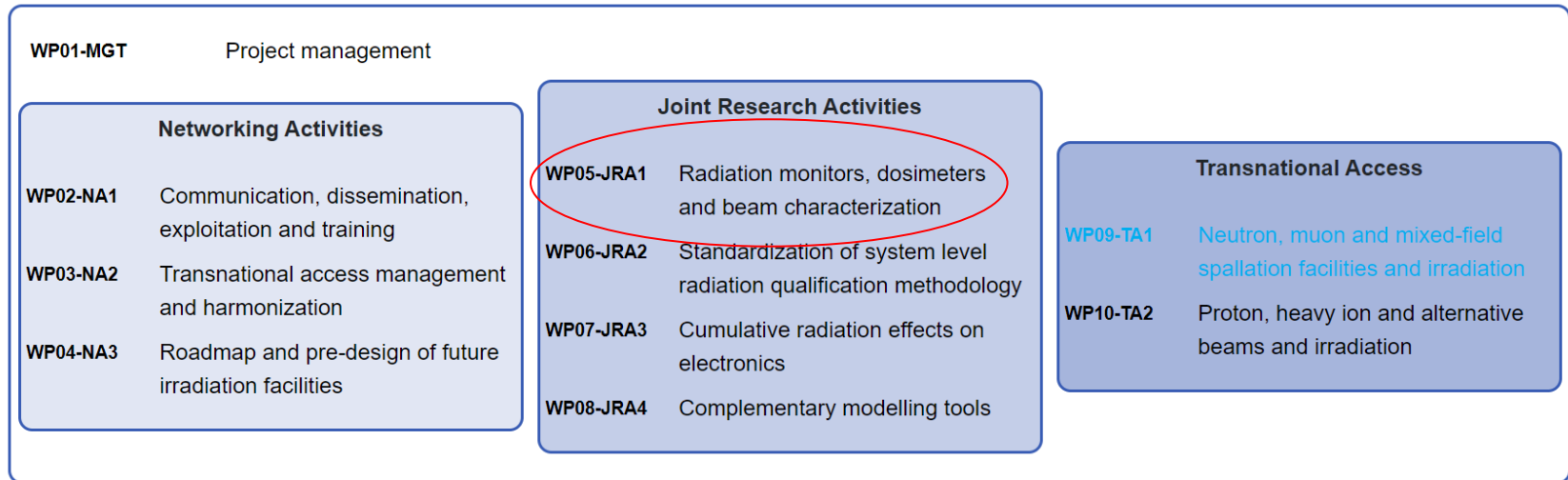
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Outline

- Introduction
- Methods and materials
 - CHARM facility
 - Detector arrays
 - Experimental setup
- Results
 - Impact of flux and energy on spatial distribution of the beam
 - Comparison of detector array measurements with MWPC
- Conclusion
- Outlook

Introduction

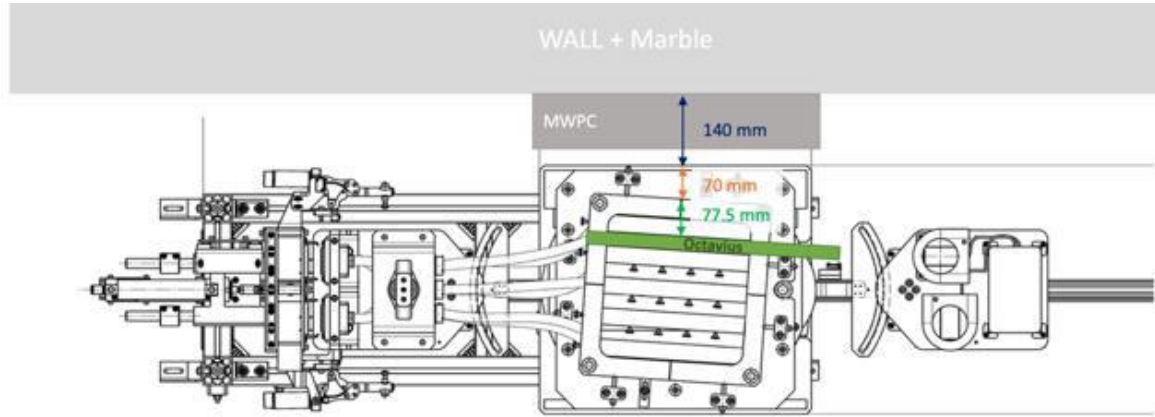
Work Packages



Introduction

- Thorough irradiation testing of components is an important task for example in space applications or particle accelerators
- Exact knowledge of beam properties is of high importance
- Representation of two-dimensional intensity beam profile at the position of the experiment is often not available
- Detector arrays can fill this gap

CHARM

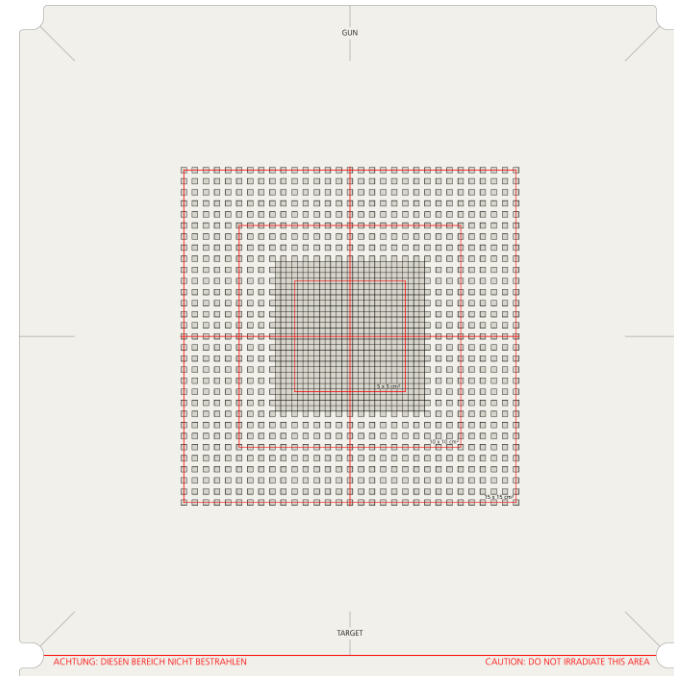


- Beam perpendicular to the Octavius array (green)
- MWPC behind the setup at an angle
- Montrac moves setup to the test position



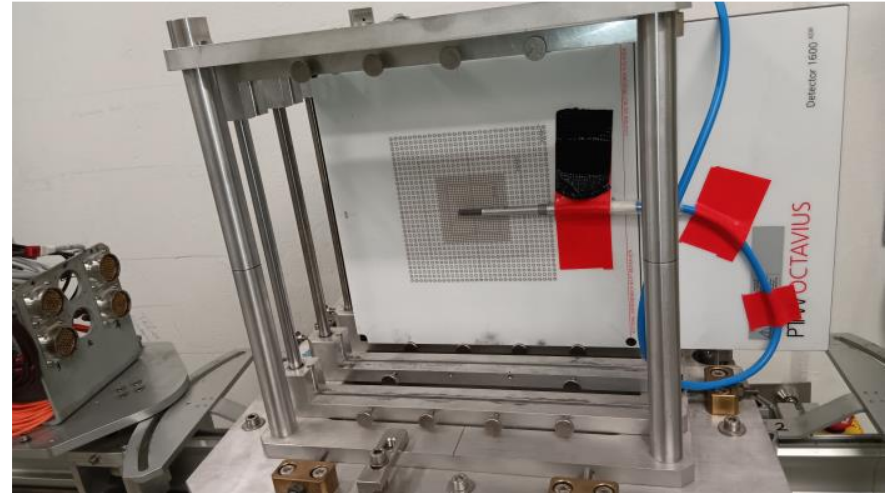
Detector Arrays

- 1600 SRS liquid filled chambers
 - 0.2 Gy/min – 36 Gy/min
- 1600 XDR vented chambers
 - 0.4 Gy/min – 4000 Gy/min
- Sensitive area of 15 cm x 15 cm
- Layout of both arrays is the same



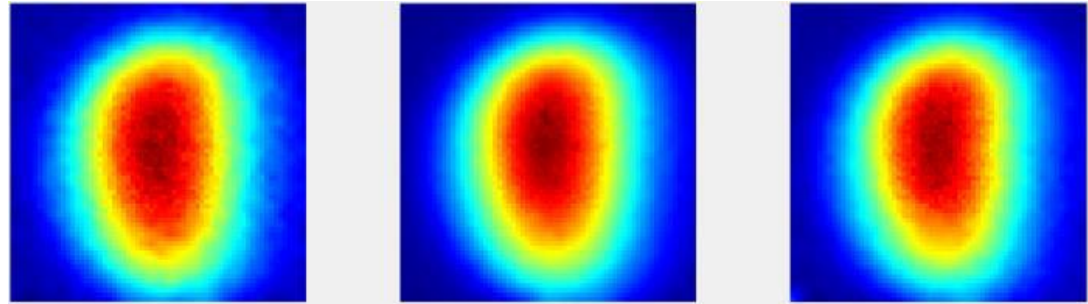
Experimental setup

- Detector array mounted in metal frame
- Alignment of the setup according to a laser cross on a preparation table outside of the irradiation area
- Setup is taken off the preparation table and put on the Montrac
- Montrac goes along a rail to the test position



Results

- Change of flux
- No impact on spatial distribution
- Example at 1 GeV/n

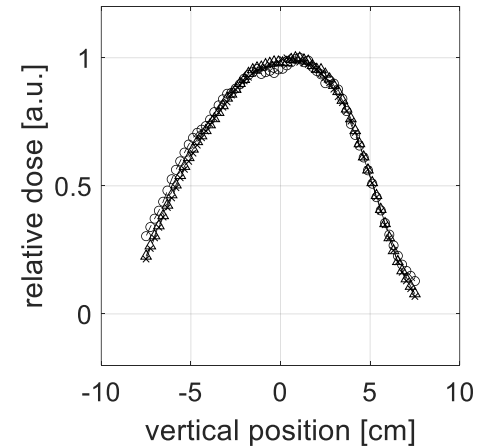
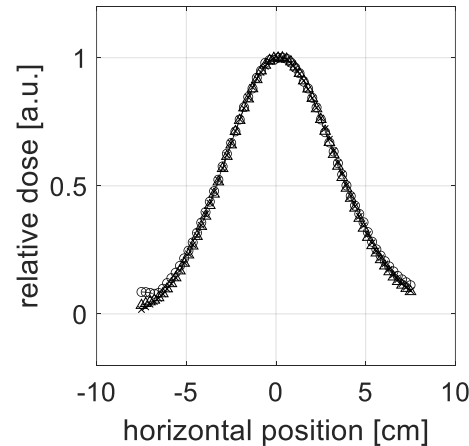


(a)

(b)

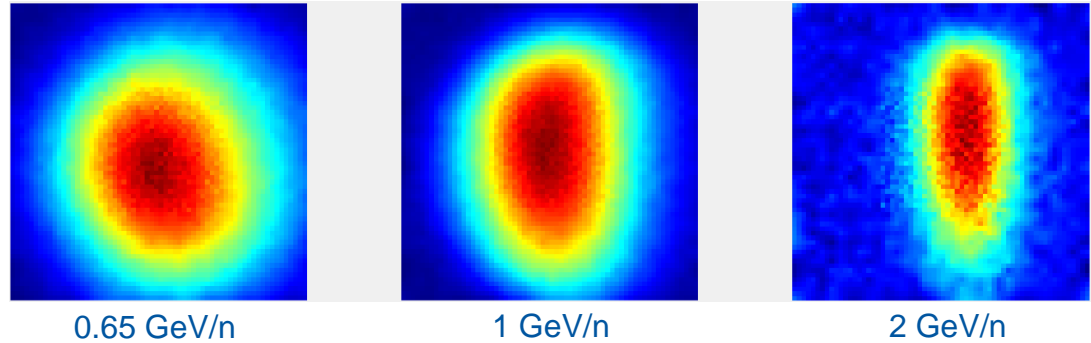
(c)

- | | | |
|-----|---|---|
| (a) | ○ | $3.17 \cdot 10^3$ ions/cm ² *spill XDR |
| (b) | × | $1.18 \cdot 10^4$ ions/cm ² *spill XDR |
| (c) | □ | $9.03 \cdot 10^3$ ions/cm ² *spill SRS |

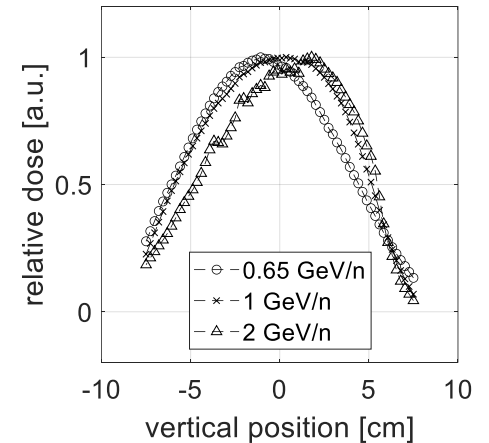
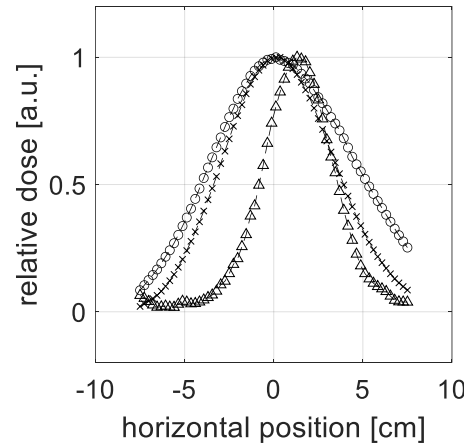


Results

- Change of energy
- Significant impact on spatial distribution

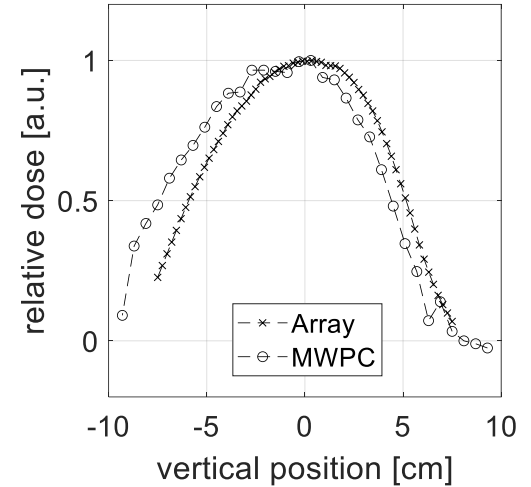
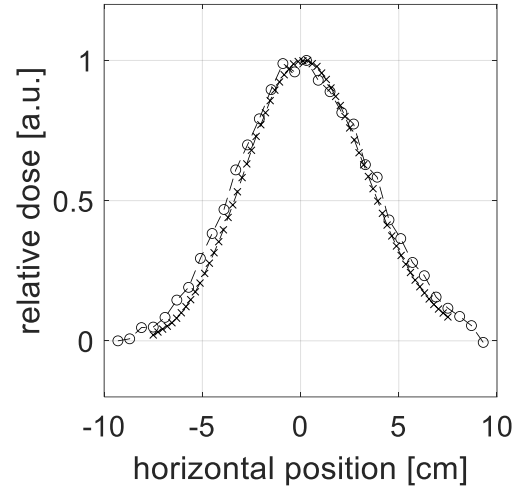


FWHM	0.65 GeV/n	1 GeV/n	2 GeV/n
horizontal	9.4 cm	7.3 cm	4.5 cm
vertical	10.5 cm	11.1 cm	10.2 cm



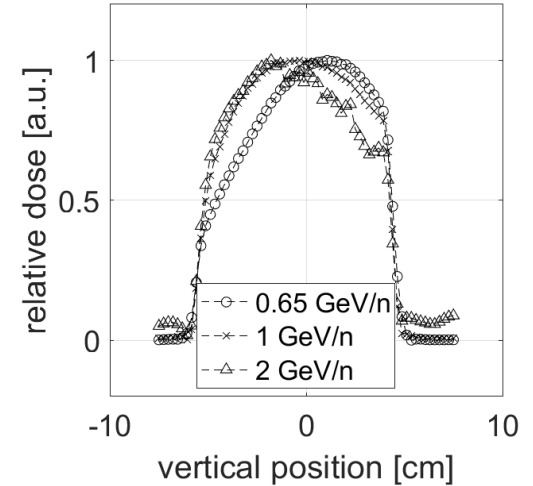
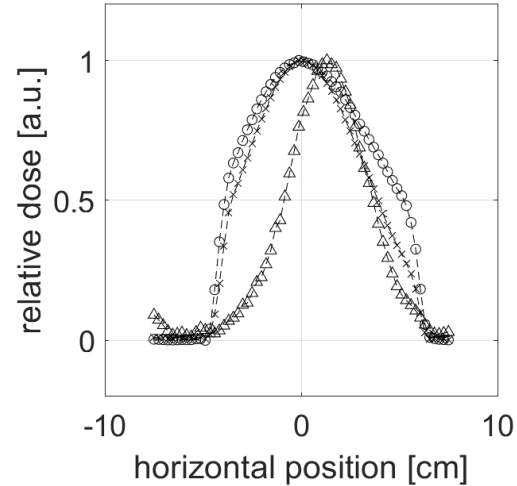
Results

- Position of MWPC compared to array measurement
- Approximately 1 cm deviation in vertical direction
- Less than 0.5 cm in horizontal direction



Results

- Use of collimators of 10 cm x 10 cm
- Transmission on the edges at 2 GeV/n



Discussion

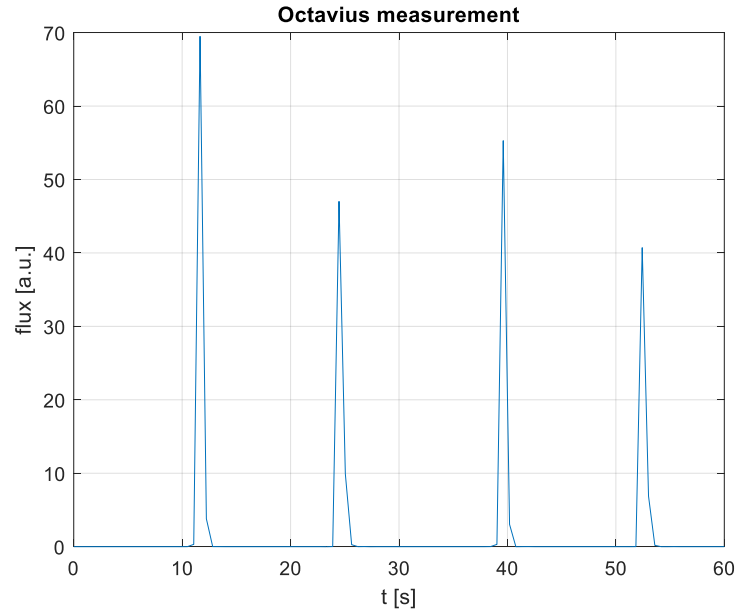
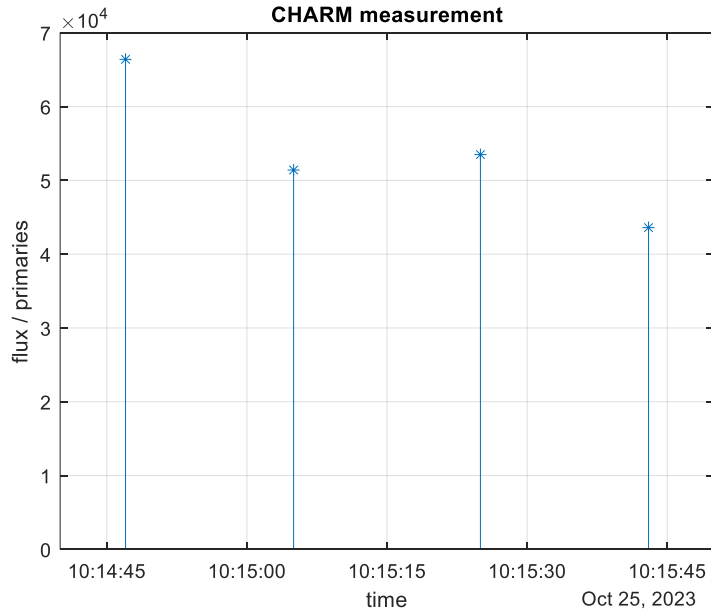
- Change of flux did not have an impact on the spatial distribution of the intensity profile
- Change of energy had a significant impact on the profile
- MWPC and array were misaligned in the vertical direction by (1.1 ± 0.2) cm
- MWPC misalignment in the horizontal direction (0.5 ± 0.1) cm

Conclusion

- When the energy is changed, a repositioning or readjustment of magnetic optics has to be considered
- A change of flux does not require any repositioning or change of optics
- The deviation in position between the MWPC and array measurements in vertical direction should be investigated in more detail
 - Deviation introduced by MONTRAC?
 - Alignment of MWPC does not coincide with laser positioning system?

Outlook

- Further investigations regarding absolute dose and flux, variation of magnetic optics, spill structure in progress



Thanks for your attention!



Image Source: CERN