Scaled dipole fields,
The beam pipe
with an eye on
The luminosity detector

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10.09.2012
PANDA Collaboration meeting

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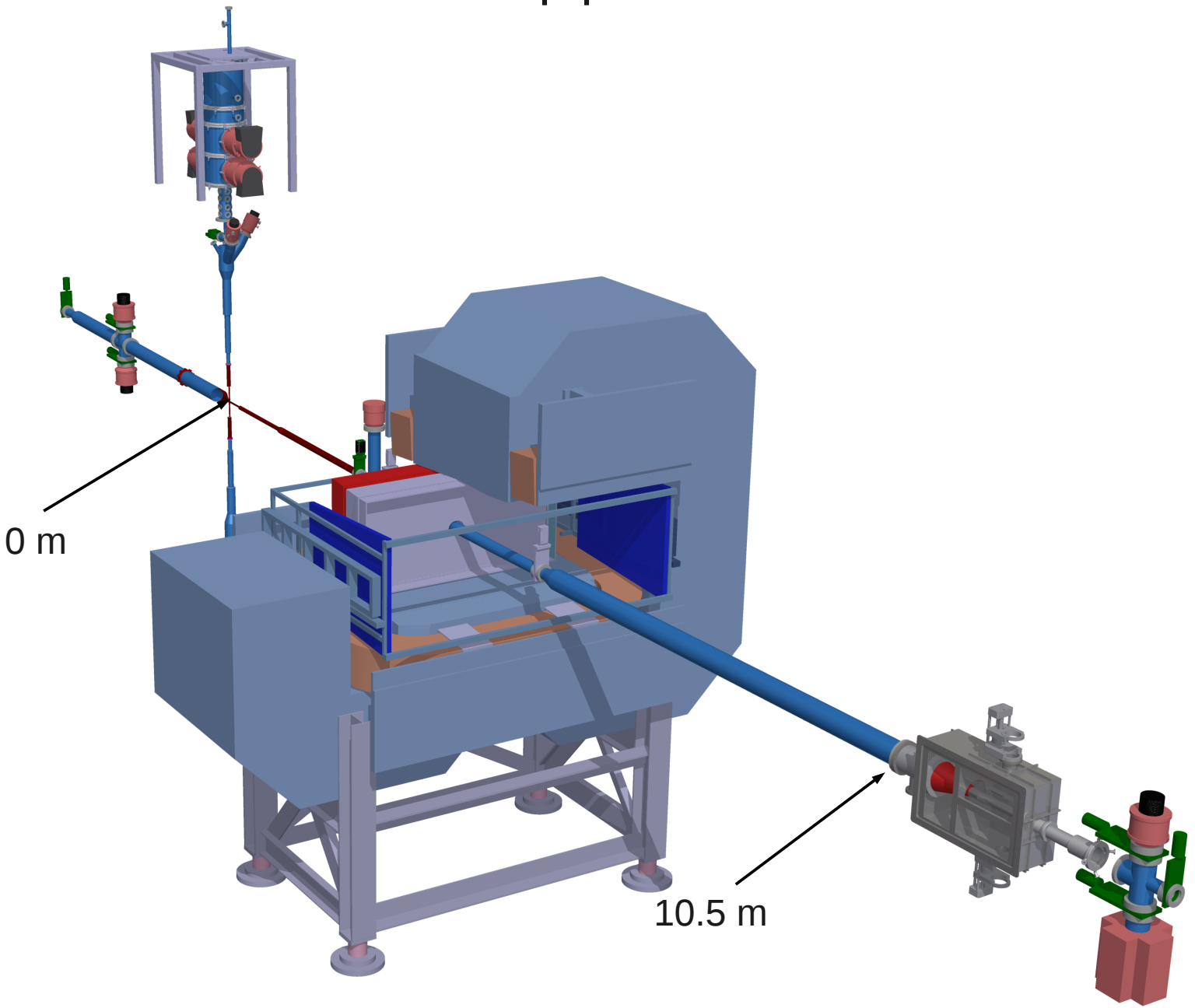
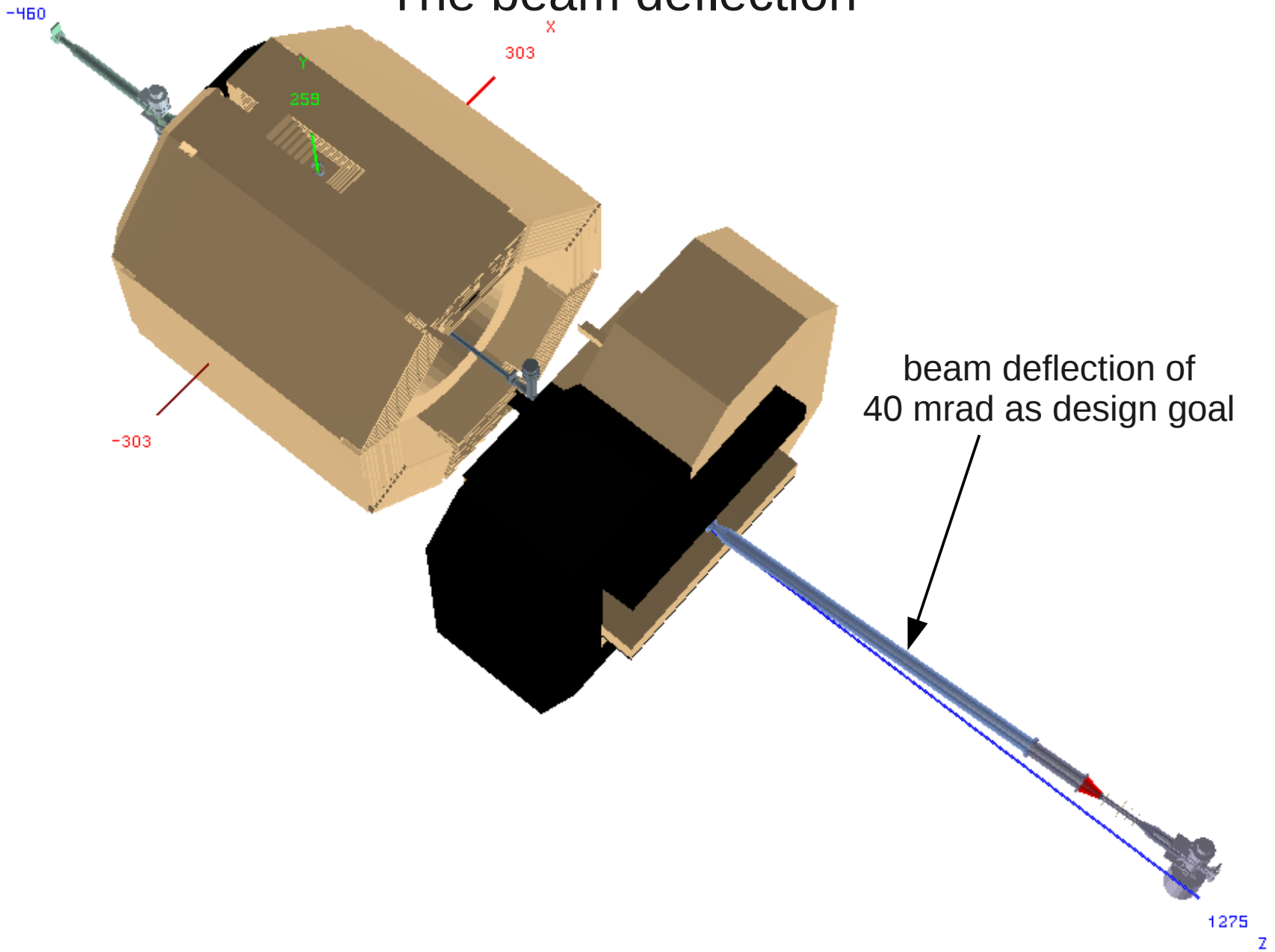
- Part 1: The PANDA dipole field maps
- Part 2: The PANDA beam pipe and it's bending radius

Part 1: The PANDA dipole field maps

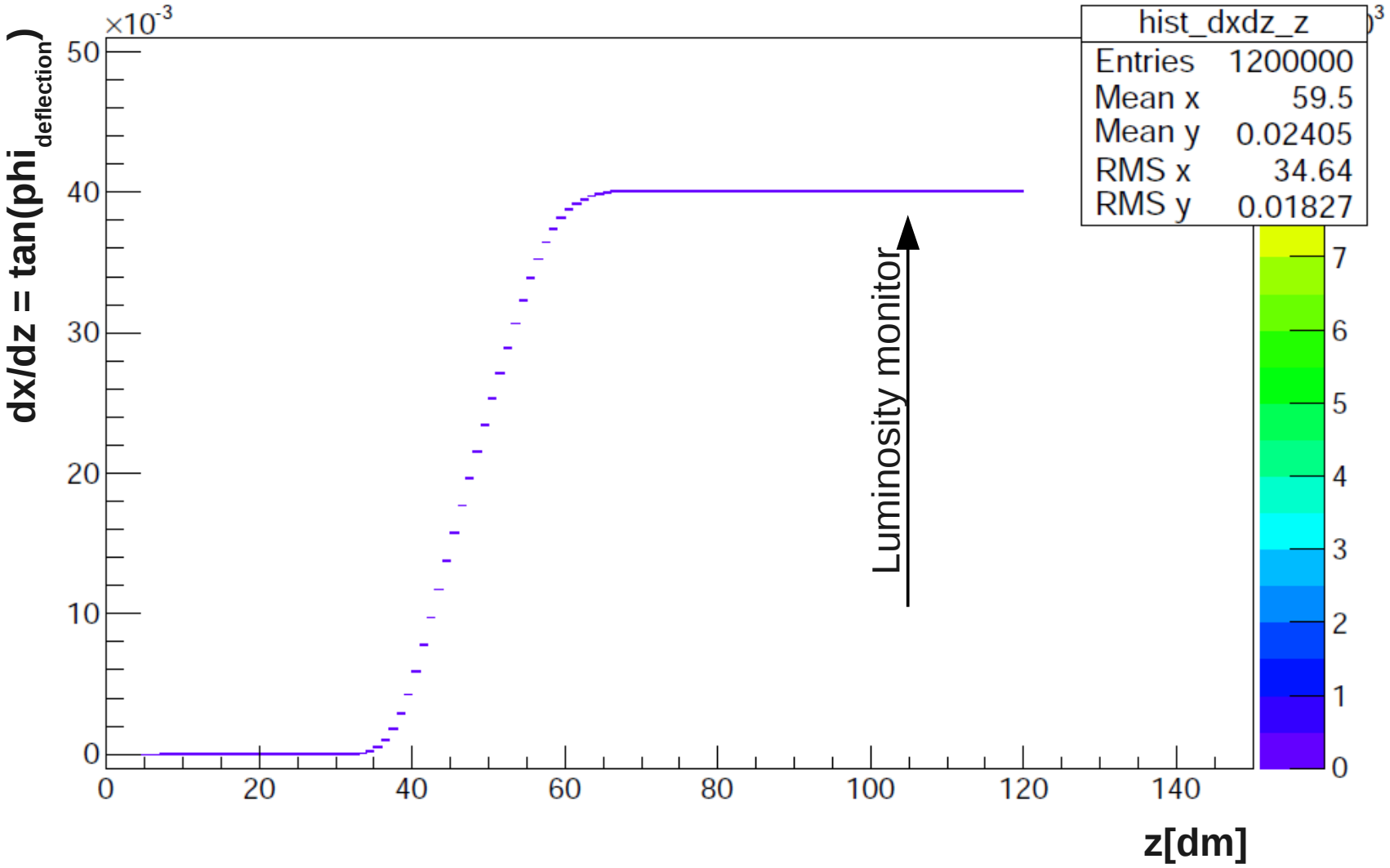
The beam pipe



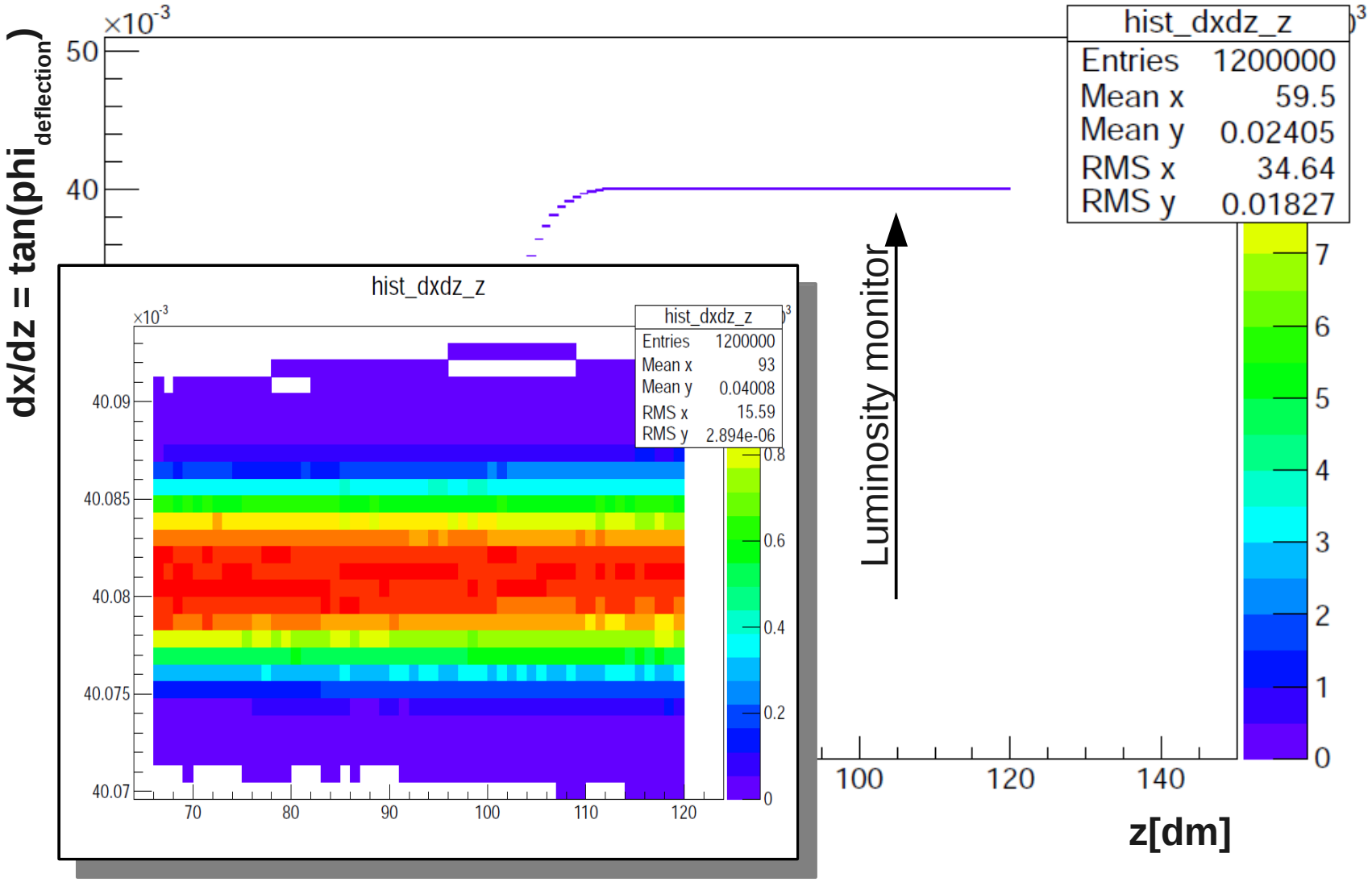
The beam deflection



The beam deflection with current field maps



The beam deflection with current field maps



Current field maps

mom[GeV/c]	phi[mrad]	dipolerange[cm]	offset@11m	offset@12m
1.5	40.07	310-660	25.6	28.68
4.06	40.06	300-660	24.8	28.68
8.9	40.07	300-660	24.8	28.68
11.91	40.07	300-660	24.8	28.63
15.00	40.08	300-660	24.8	28.61
15.0117	40.05	290-660	24.8	28.60

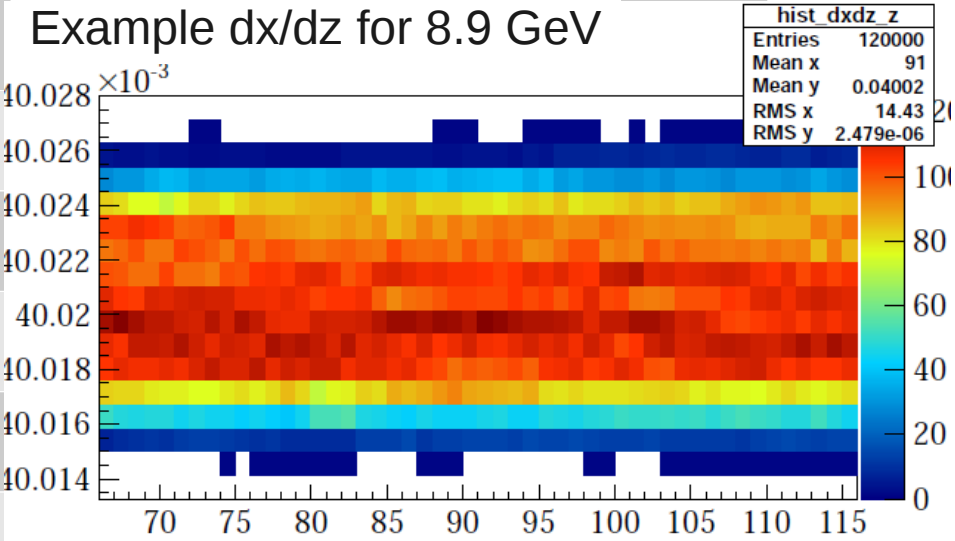
Beampipe design goal: phi = 40.00mrad (40.021 dx/dz)

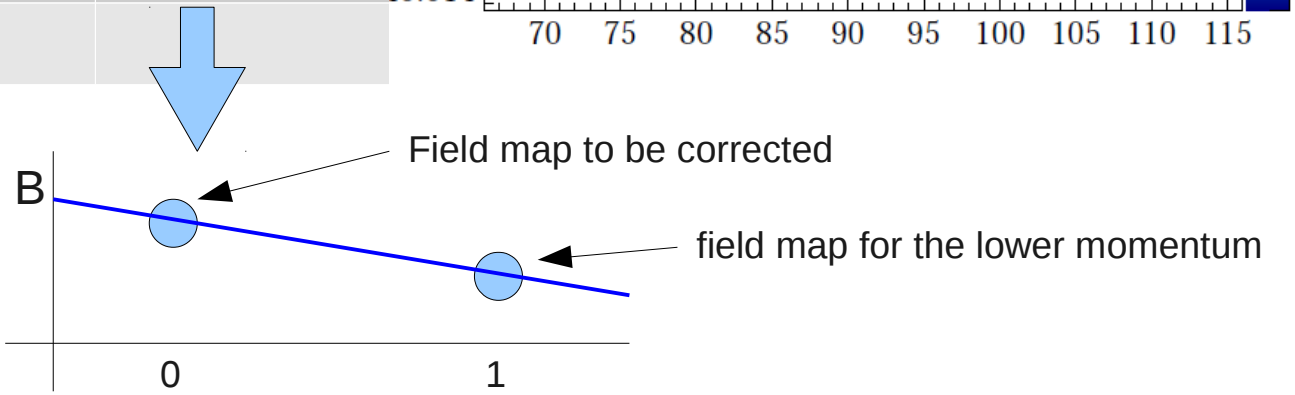
Interpolation of field maps to fit the design goal...

Results after field map adjustment

mom[GeV/c]	phi[mrad]	Interpolation factor		
1.5	40.00	-0.001		
4.06	40.00	0.00235		
8.9	40.00	0.0032		
11.91	40.00	0.0067		
15.00	40.00	0.0095		

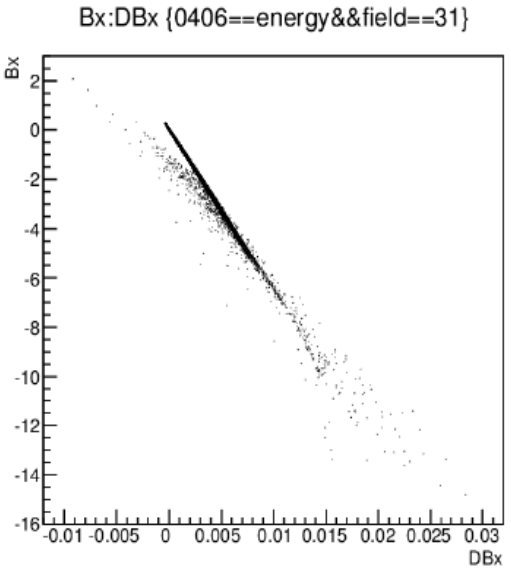
Example dx/dz for 8.9 GeV

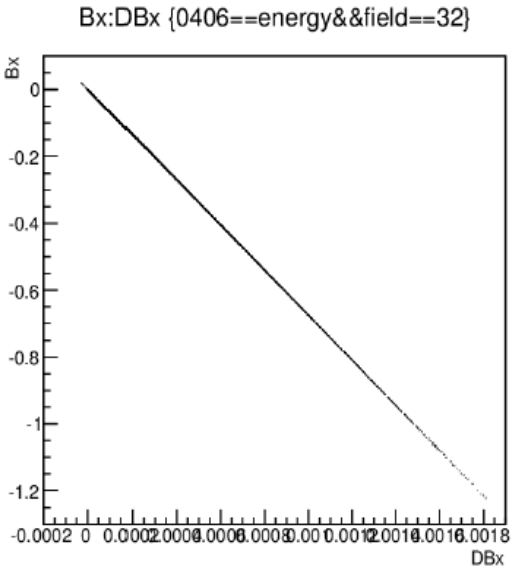




Exemplary checks of field maps

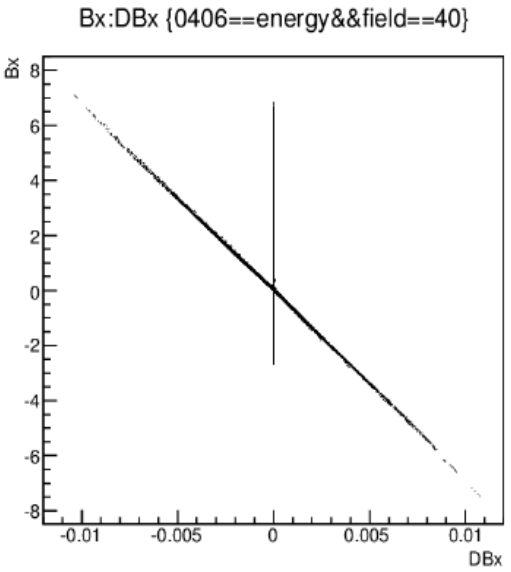
Dipole map 1





Dipole map 2

Transition map

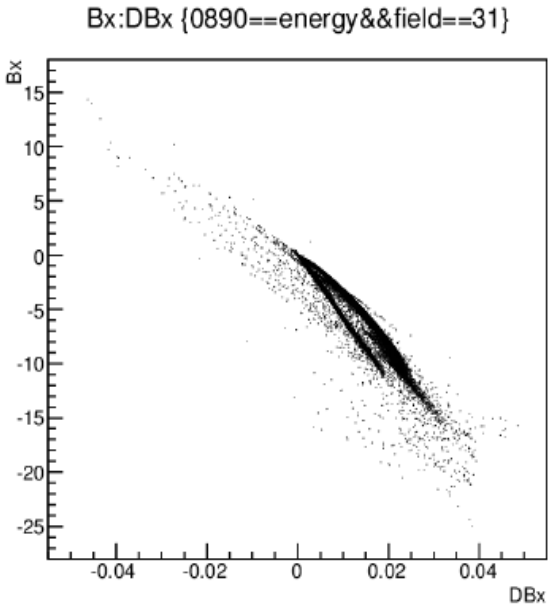


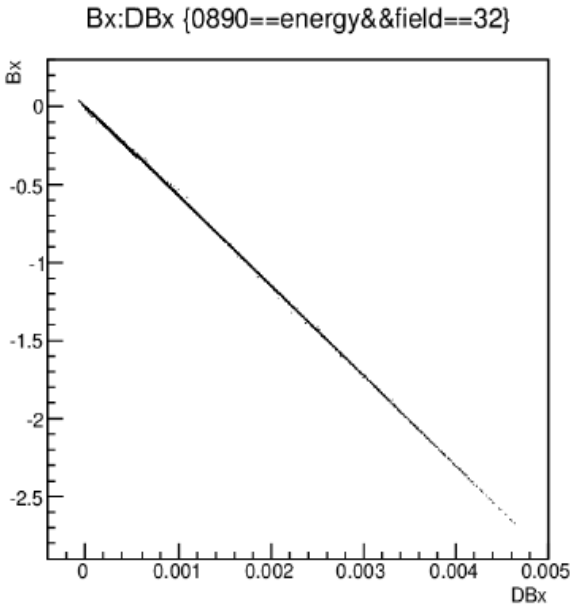
DBx = Bx_before - Bx_after

Interpolation is proportional to the field strength at 4.06 GeV/c momentum

Exemplary checks of field maps

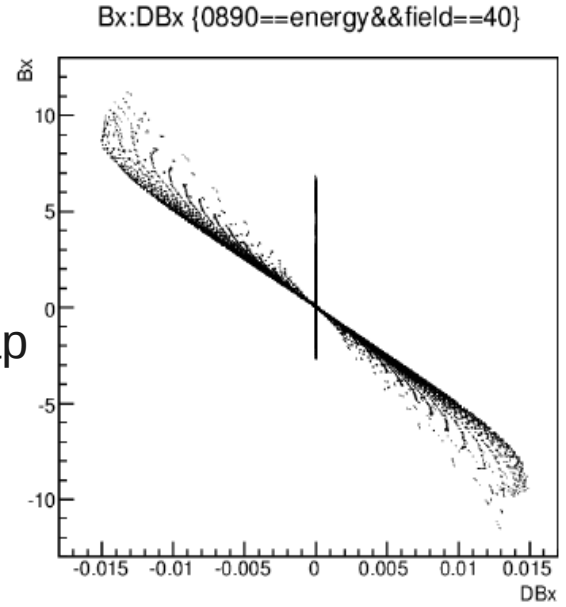
Dipole map 1





Dipole map 2

Transition map

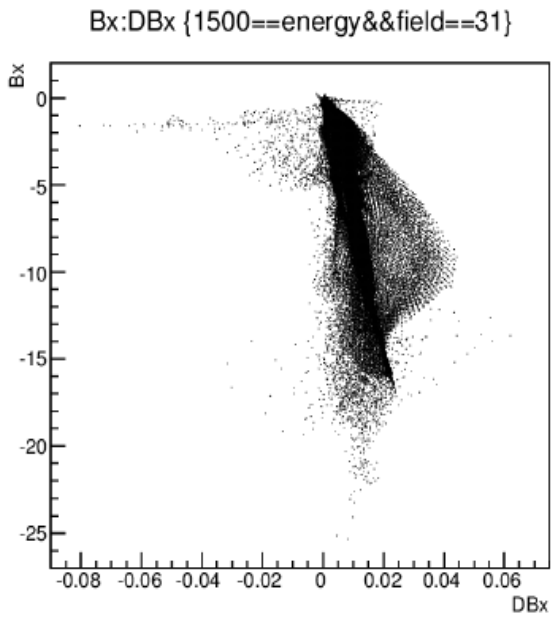


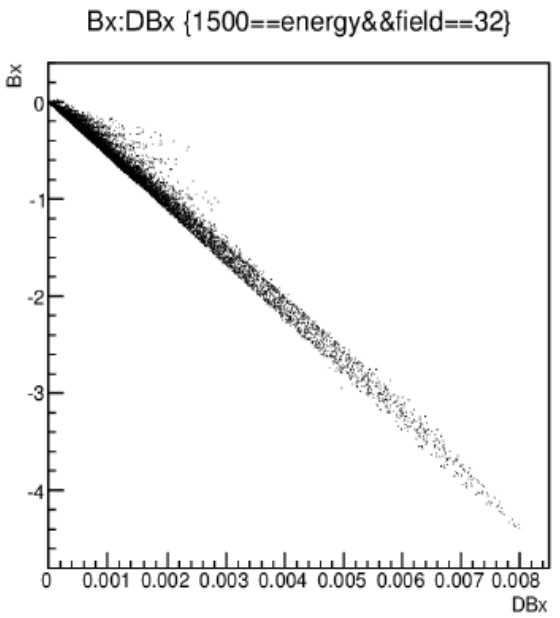
DBx = Bx_before - Bx_after

First non linearity observations
at 8.9 GeV/c momentum
-> simple field scaling wouldn't have done it

Exemplary checks of field maps

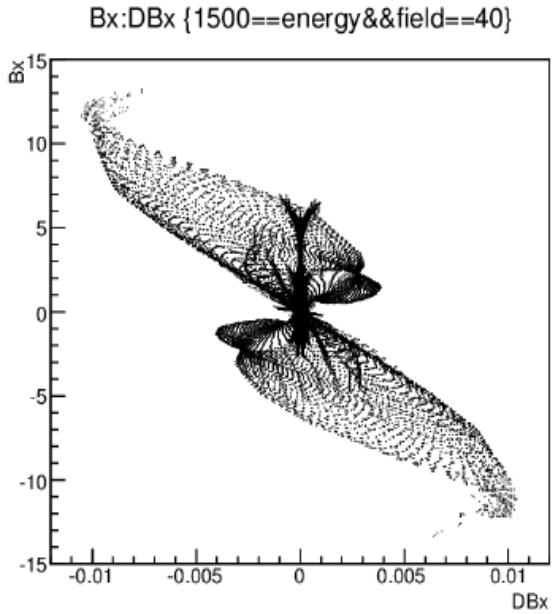
Dipole map 1





Dipole map 2

Transition map



DBx = Bx_before - Bx_after

Strong non linearities at 15 GeV/c momentum

Part 1: conclusions

The current dipole field is a bit too strong

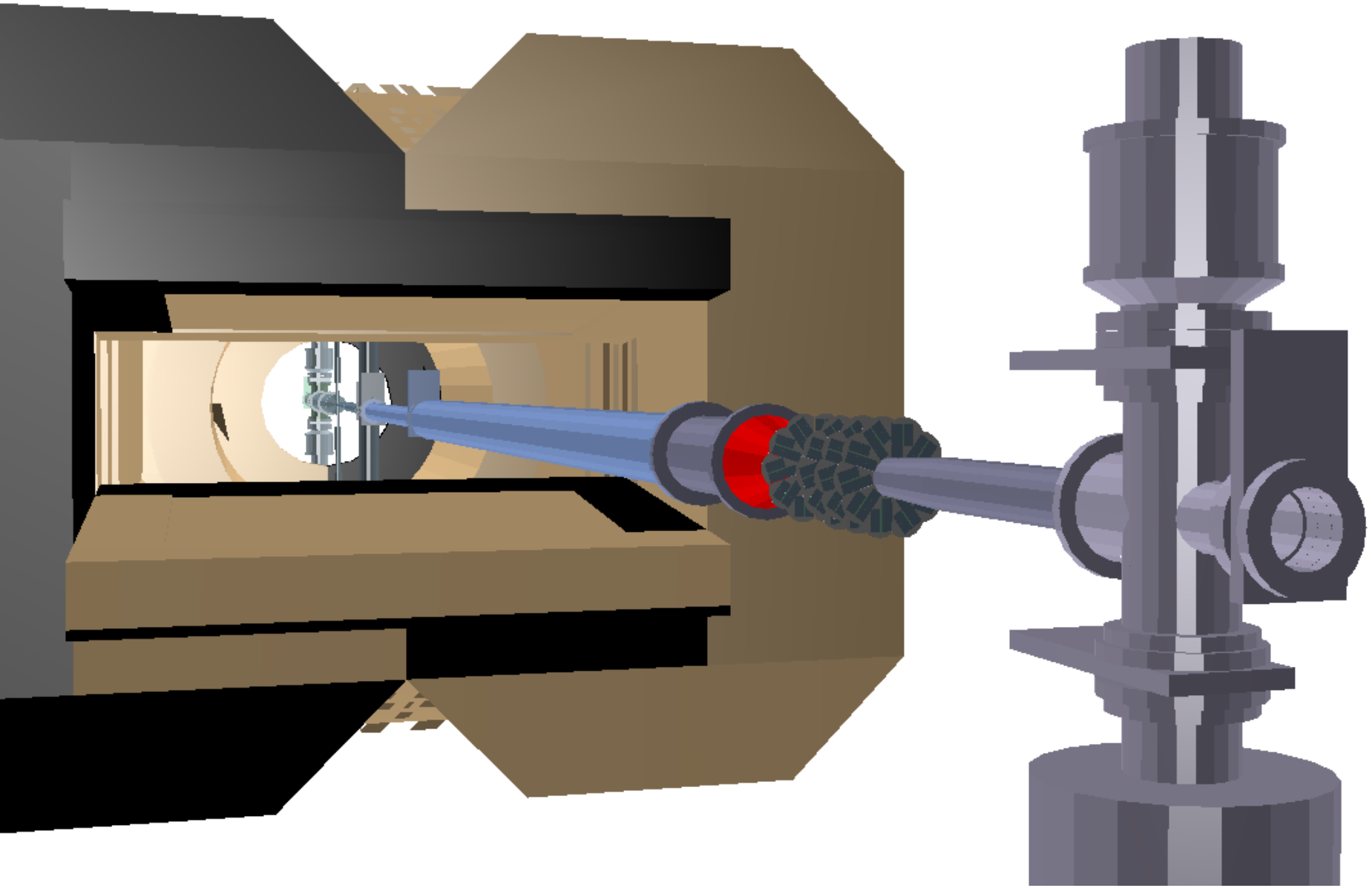
The fields were interpolated to fit the required deflection angle

No objections received since the distribution via email on 25.Apr.12

REQUEST to include those as STANDARD maps

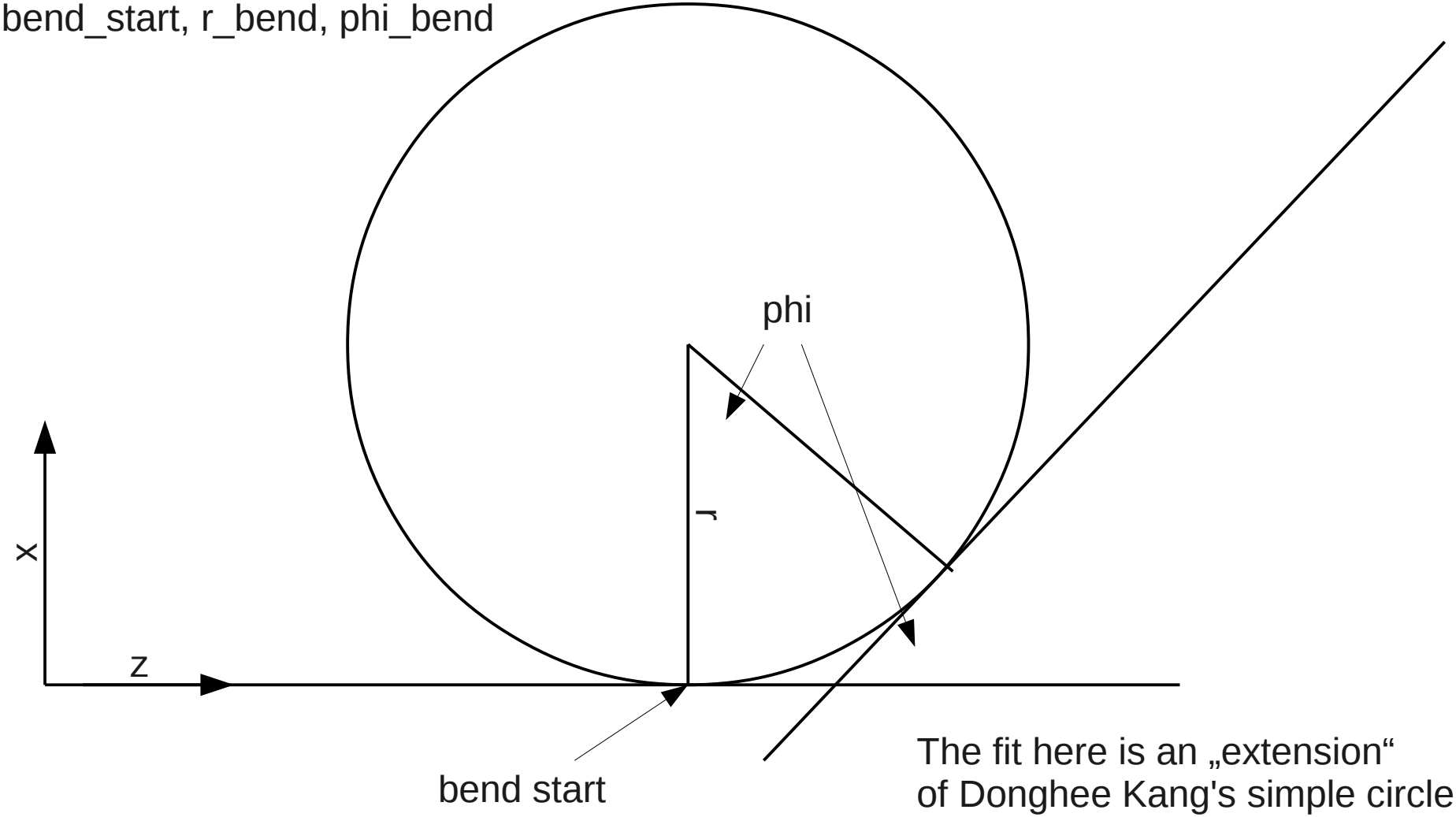
Part 2: The PANDA beam pipe and it's bending radius

The PANDA beam pipe
as a modified copy of the EDMS CAD file



Fit of a „beam pipe“-function to the data

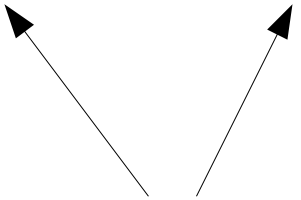
When both straight lines are tangents to the circle,
the „beam pipe“-function is fully determined by 3 parameters:
bend_start, r_bend, phi_bend



The fit here is an „extension“
of Donghee Kang's simple circle fit.

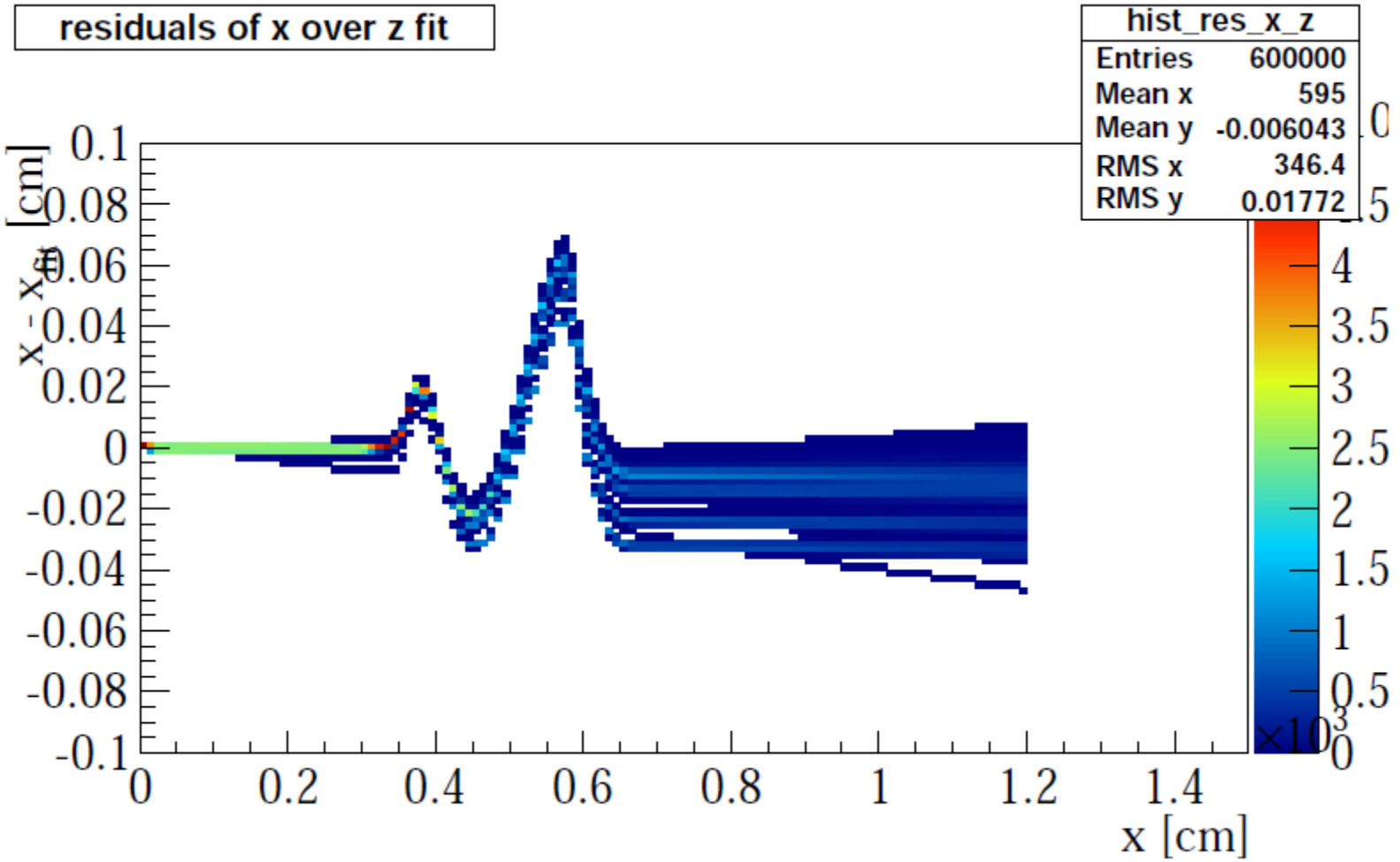
Modifications to existing parameters

	Fit fixed phi	**proposal**	Current values
bend start	360.2 cm	**361 cm**	361 cm
bend radius	5754 cm	**5700 cm**	6000 cm
bend phi	40.00 mrad	**40.00 mrad**	40.00 mrad
(z bend end)		361+227.93	361+239.93



A straight part of 12 cm must be inserted
to the current CAD design

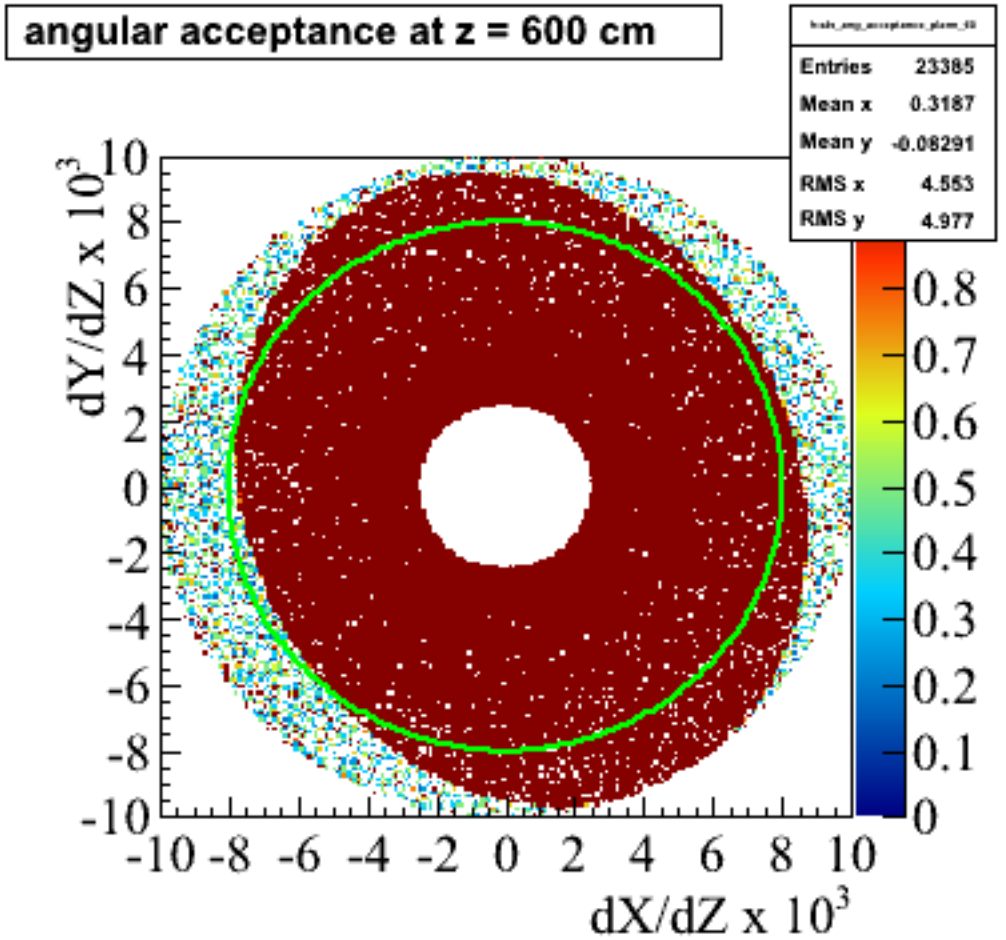
Residuals for the proposed parameters



Ongoing discussion: the beam pipe acceptance

Primary vertex displacement **x = -1.5 mm** **y = -1.5 mm**

1.5 GeV/c



The beam pipe needs to get modified for a non centered and non parallel beam. Awaiting decisions.

Part 2: Conclusion

- **A modified version of the ROOT geometry beam pipe (owing to P.Buehler and A.Gruber) is in use with success.**
- **To do: finalize design, include calculated pressure profile**
- **REQUEST to include already the current beam pipe into standard PANDAROOT software**

Thank you!

Backup slides

Mail concerning modified field maps

From: Promme <jasinski@kph.uni-mainz.de>
To: Jost Luehning <j.luehning@gsi.de>
Cc: Lars Schmitt <L.Schmitt@gsi.de>, Bernd Lewandowski <B.Lewandowski@gsi.de>, Miriam Fritsch <miriam@slac.stanford.edu>, Jim Ritman <j.ritman@fz-juelich.de>, Mohammad A-Turany <M.Al-Turany@gsi.de>
Subject: Re: Request: small modifications to the current beam pipe design
Date: Wed, 25 Apr 2012 15:05:30 +0200

2 Attachments Save All

Dear colleagues,

As concluded in previous discussions, we have adjusted/interpolated the existing field maps (please find them in http://www.staff.uni-mainz.de/jasinsk/temp/fieldmaps_v1.tar.gz) in order to give bending angles of 40 mrad. The proposed beam pipe parameters for the bending part with those field maps are:

bending start: 361 cm (like in the current design)
bending radius: 5700 cm (current design are 6000 cm)

This leads to a bending length of 227.93 cm instead of 239.93 cm along z and would require an additional straight part of 12 cm (along z).

Details are given in the attached presentation.

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slide 4/5: last time I showed that current field maps lead to a bending angle of slightly more than 40 mrad. I interpolated two field maps by a small factor to correct the bending radius to 40 rad.

The target spread

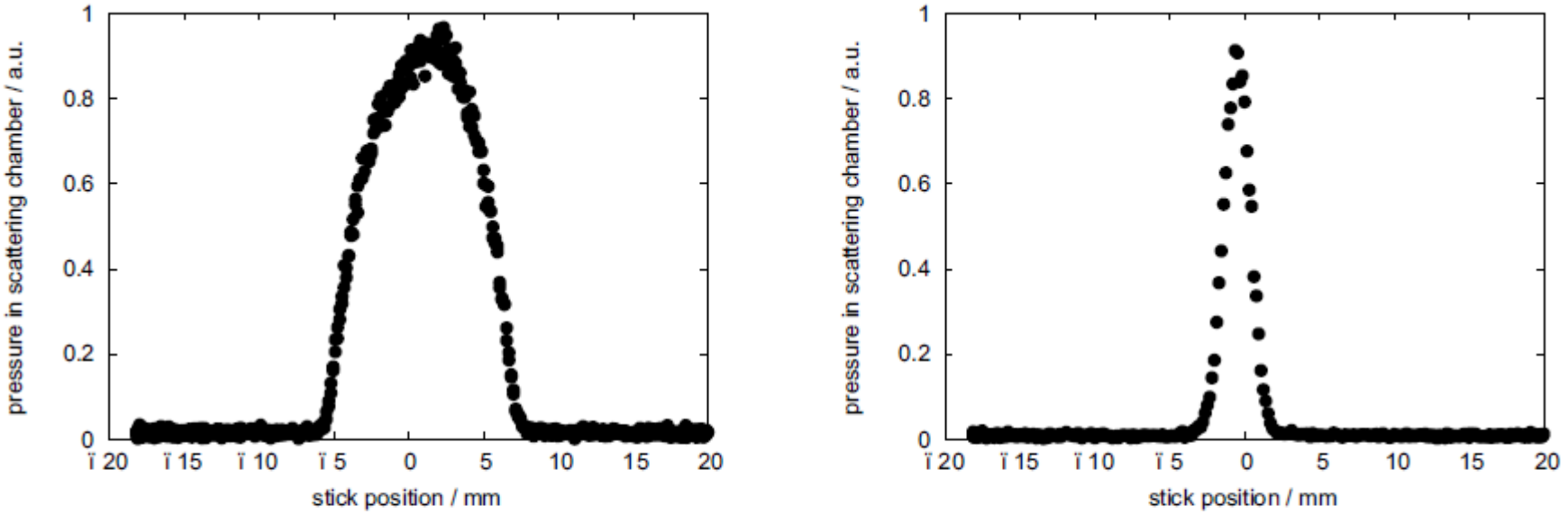


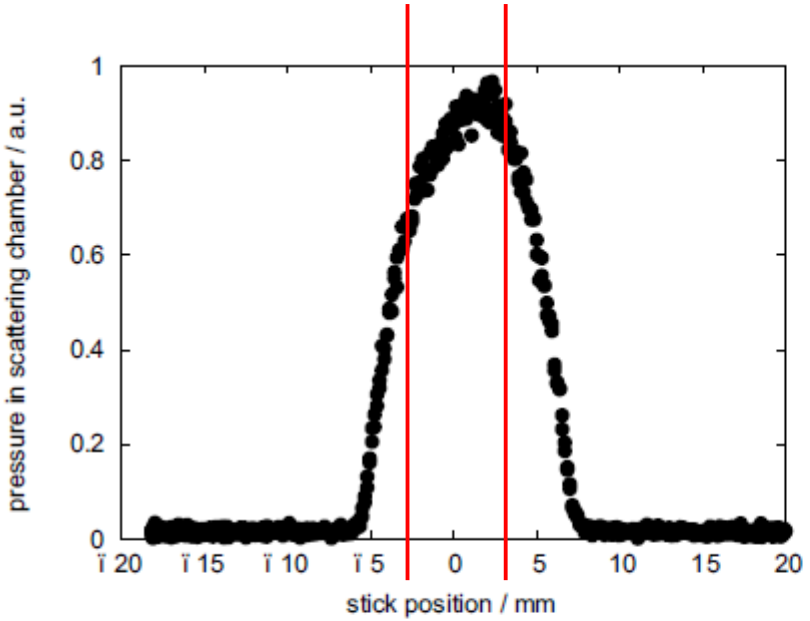
Figure 8: Cluster beam profiles with the use of a collimator of with a round opening (left) and a slit (right). The profiles show that the cluster beam is slightly shapeable.

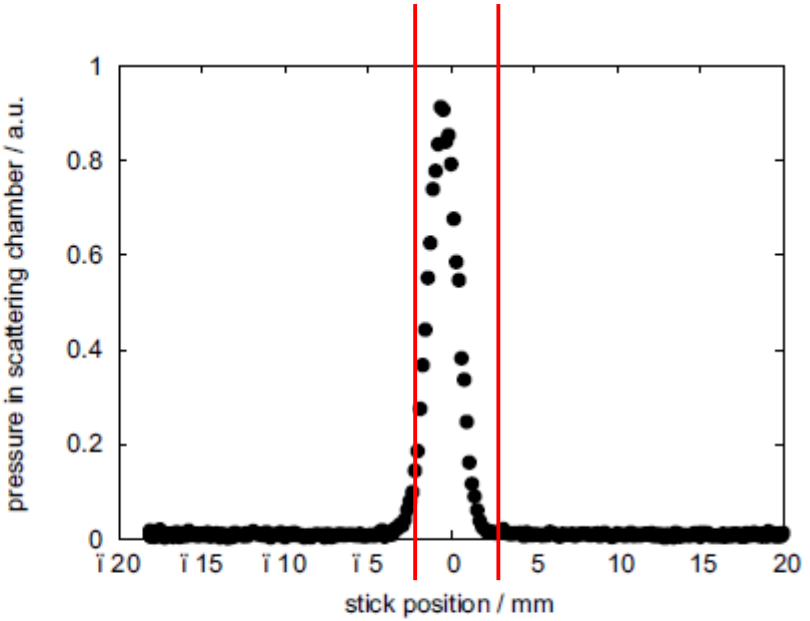
Design and performance of the future cluster-jet target for $\bar{P}$ANDA at FAIR

8th International Conference on Nuclear Physics at Storage Rings-Stori11, October 9-14, 2011

Laboratori Nazionali di Frascati dell'INFN, Italy

The target spread

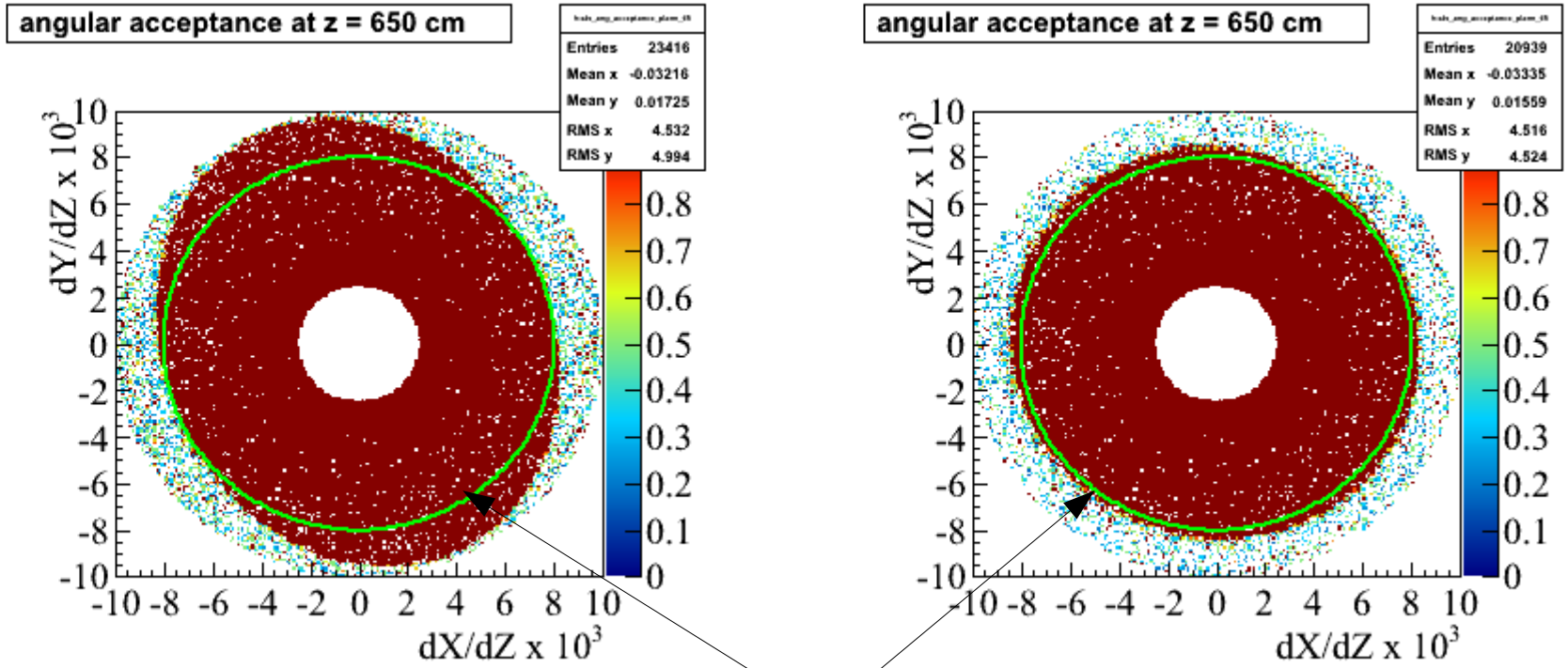




testing a displacement in x and y of +- 3 mm ...

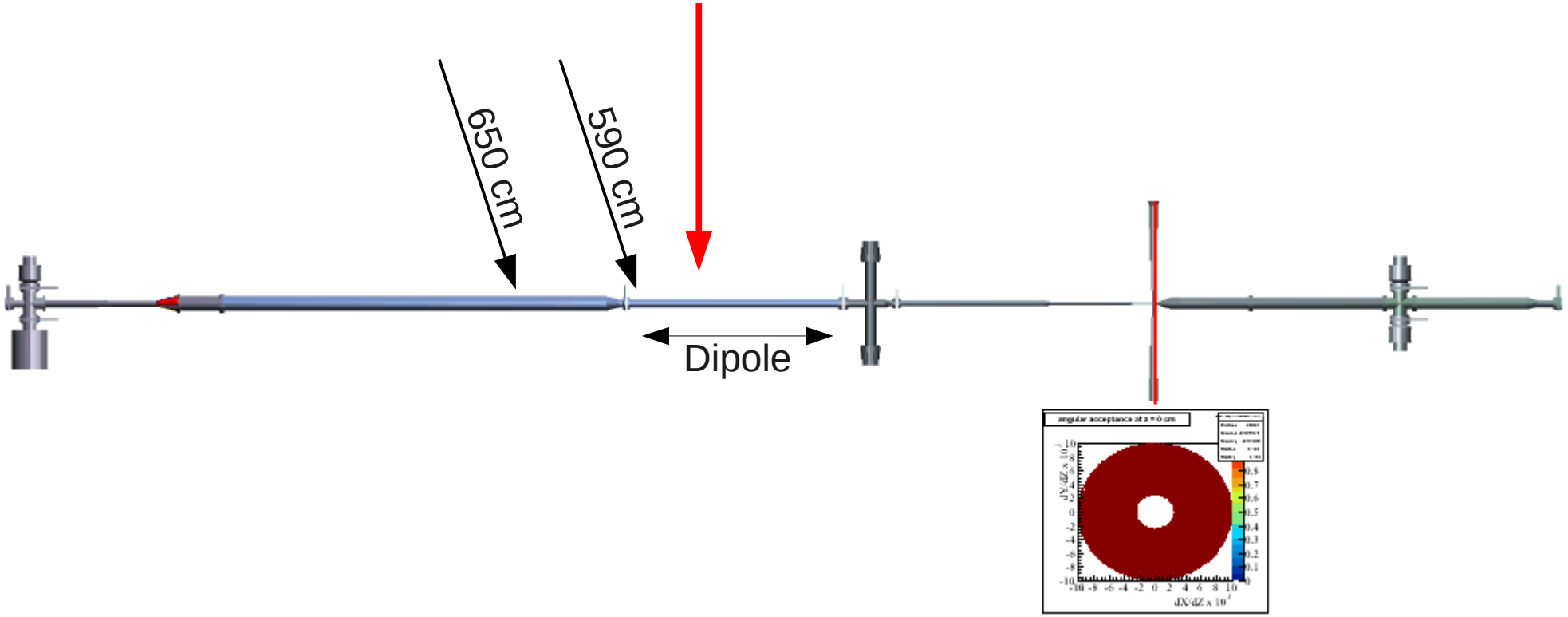
The beam pipe acceptance

Primary vertex displacement **x = 0 mm** **y = 0 mm**



1.5 GeV 8 mrad 8.9 GeV

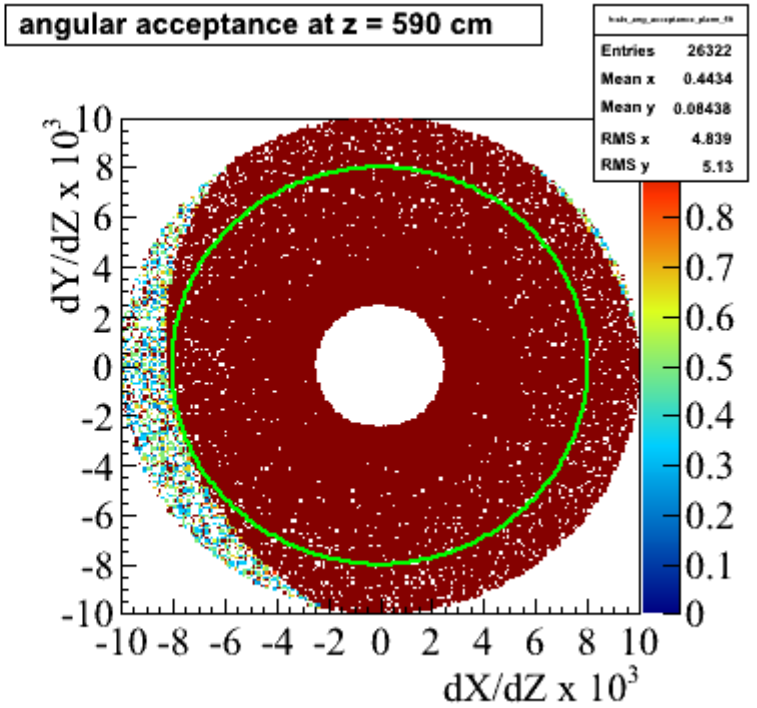
The position of the „bottle neck“



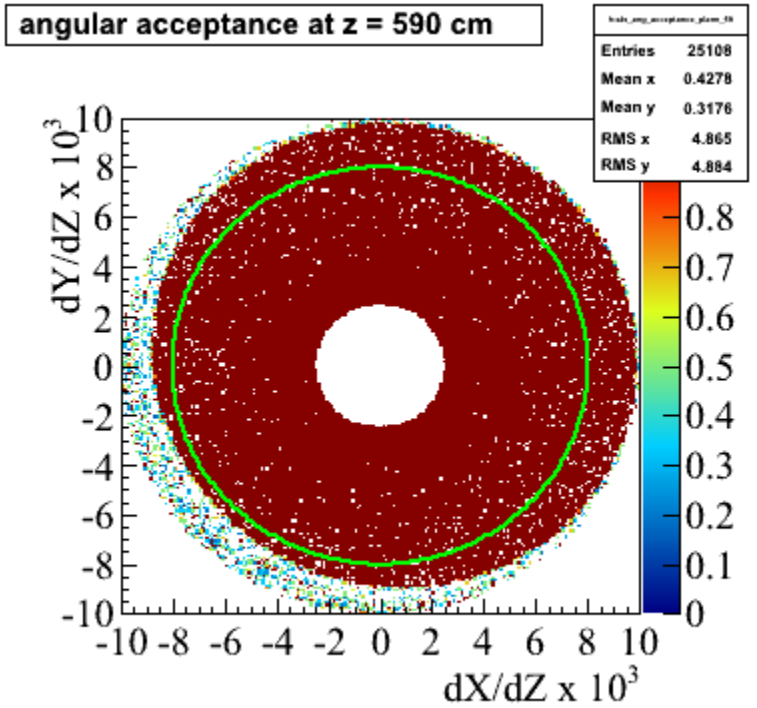
(animated gif not available in the pdf version)

Test: Dipole pipe enlarged by R += 0.5 cm

Primary vertex displacement **x = -3 mm** **y = -3 mm**



1.5 GeV



8.9 GeV

Conclusion

- Enlargement of the beam pipe diameter by at least 1 cm at the dipole region requested

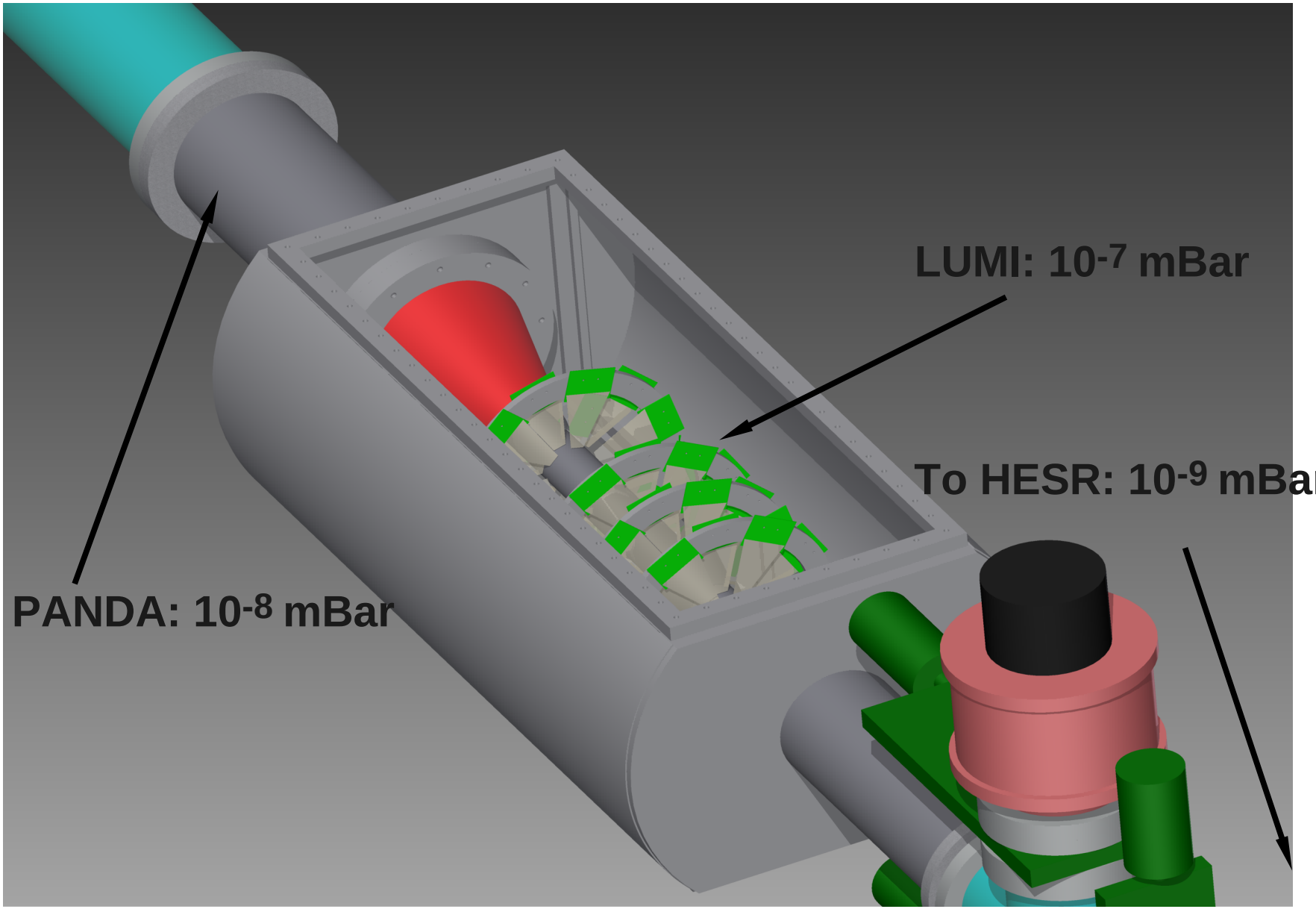
- It recovers a luminosity monitor efficiency loss for displaced vertices of up to 3 mm in x and y

- It requires either to switch to non CF-standard diameters for gate valves or to move the dipole valve further downstream

- Awaiting feedback from other groups

Part 3: Implementation of HV-MAPS into the luminosity detector

Design goals: Vacuum



(currently) available space