

Status and plans for 2015, CERN NA63

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Status:

1. Low-Z LPM
2. Structured target resonance

Plans (for 2015):

1. Heavy ion bremsstrahlung
2. Positron production (8 MIMOSAs)



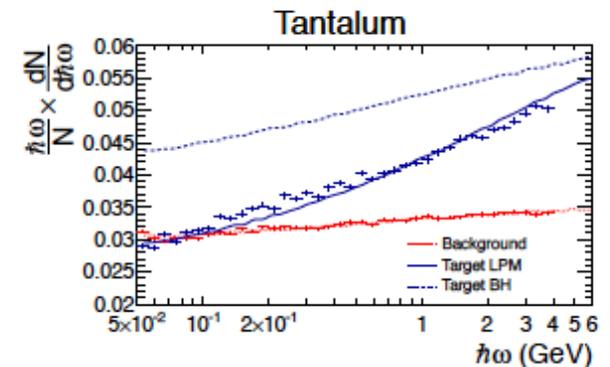
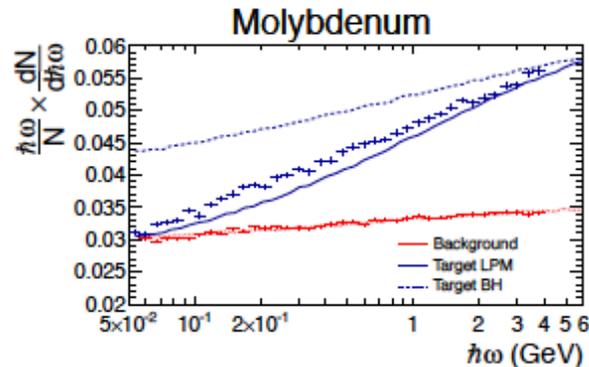
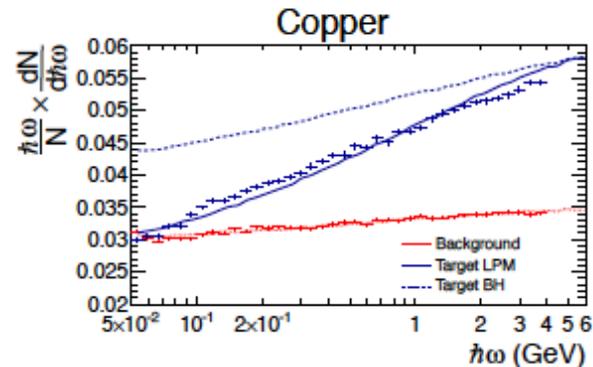
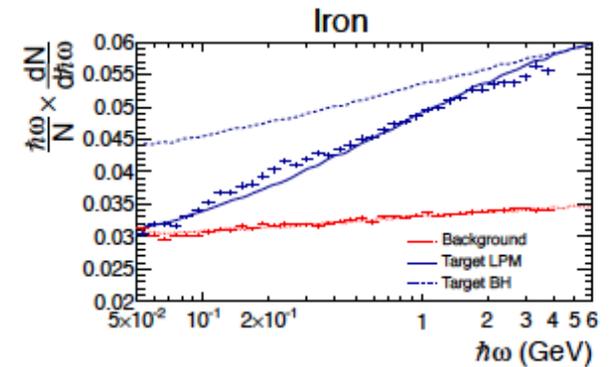
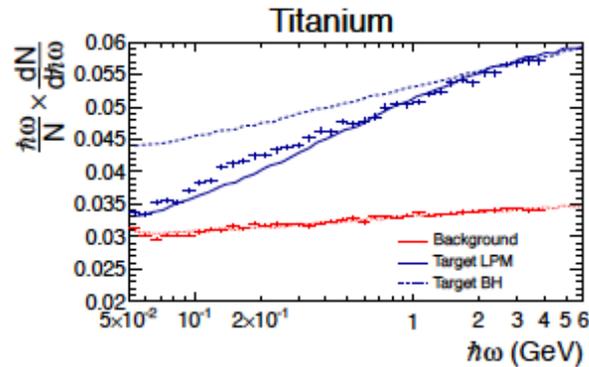
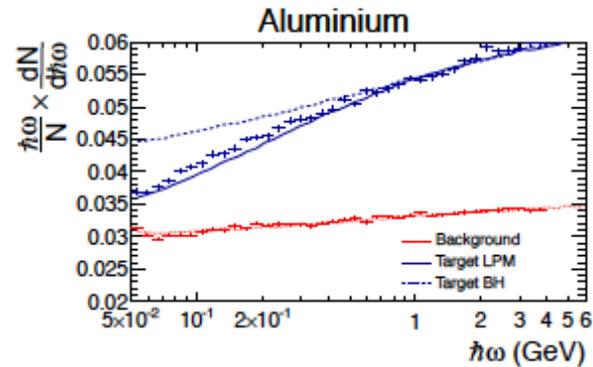
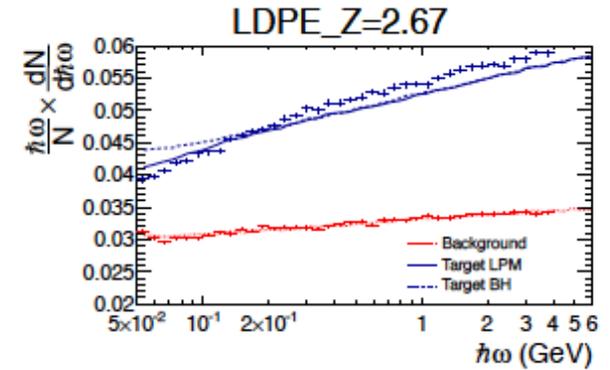
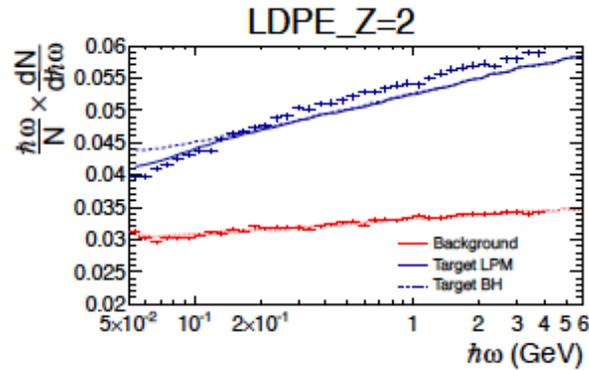
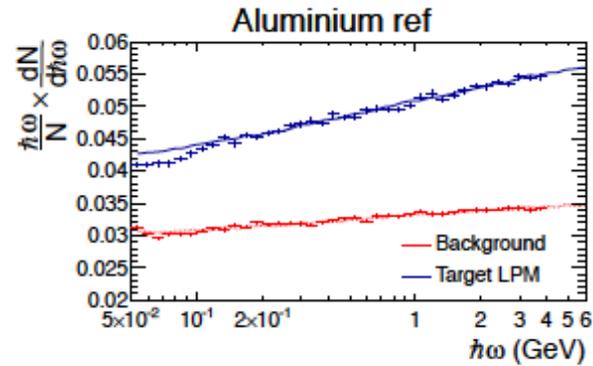
STATUS
Low-Z LPM

Phys. Rev. D **87**, 072007 (2013)

Low-Z LPM

Test LPM (Migdal) theory in low-Z targets

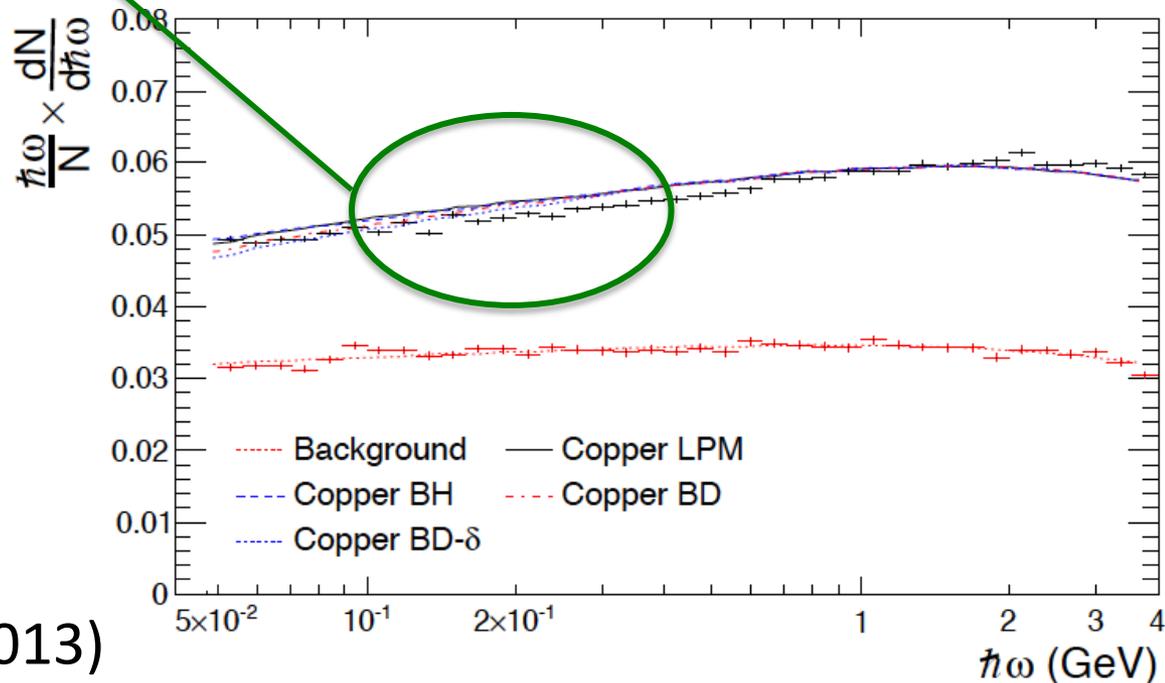
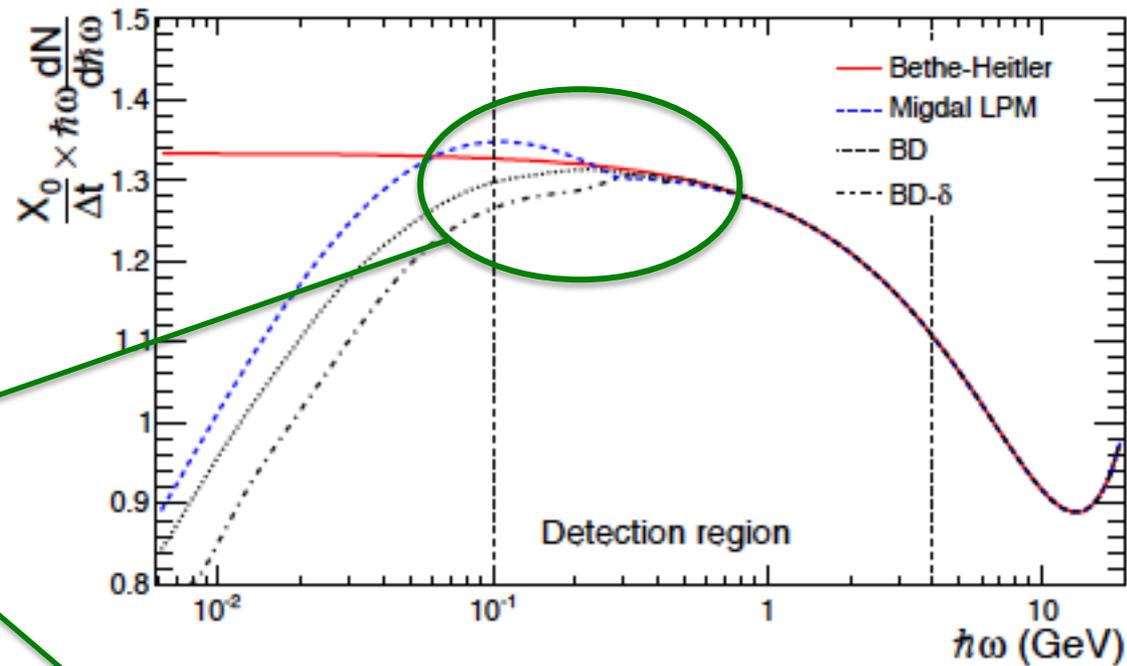
No indications of insufficiency at level of stat. accuracy



Low-Z LPM

20 GeV electrons
in Copper:
No signs of kink-
like structure

Pile-up and
background dilute
the (possible)
effect.

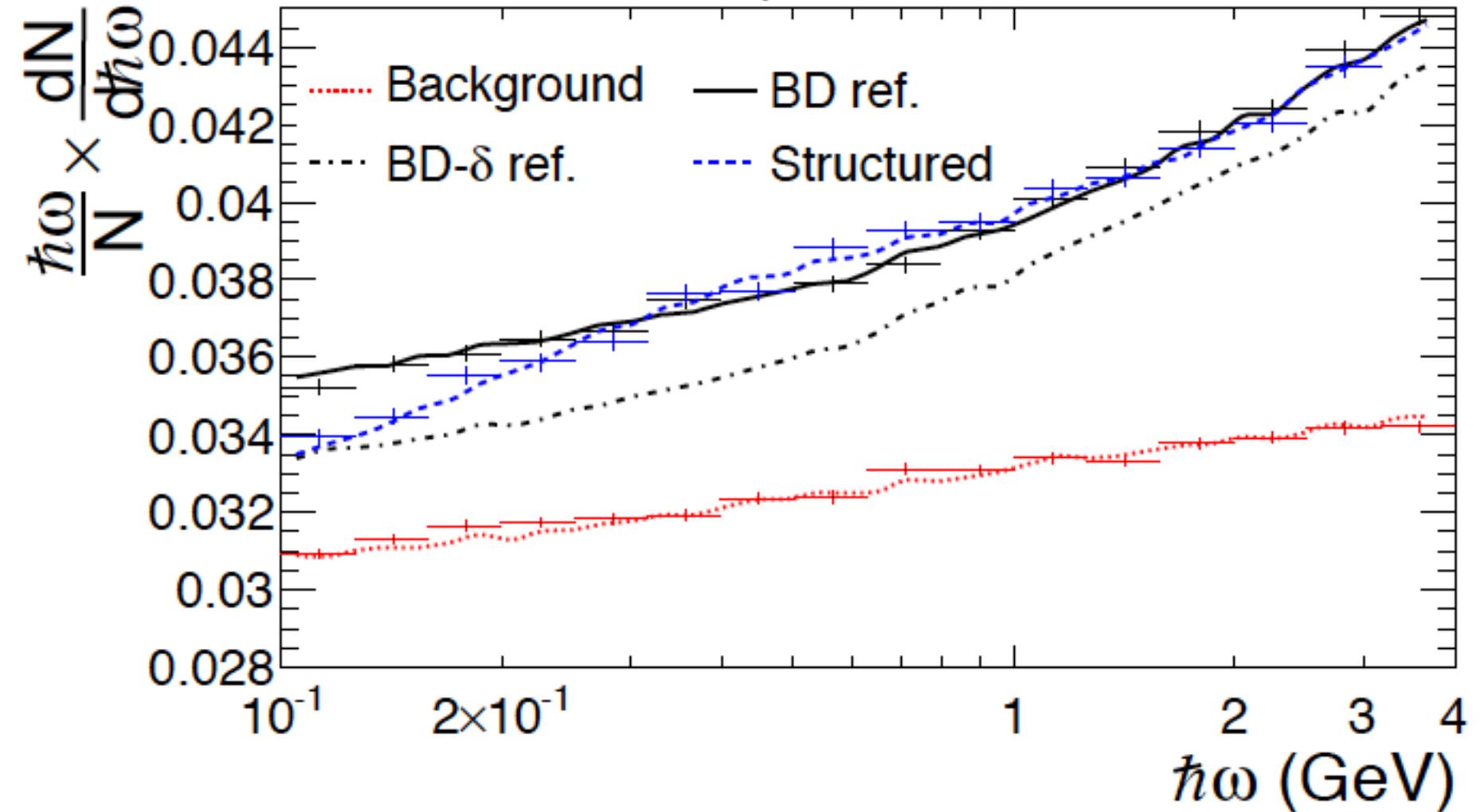


STATUS
Structured targets

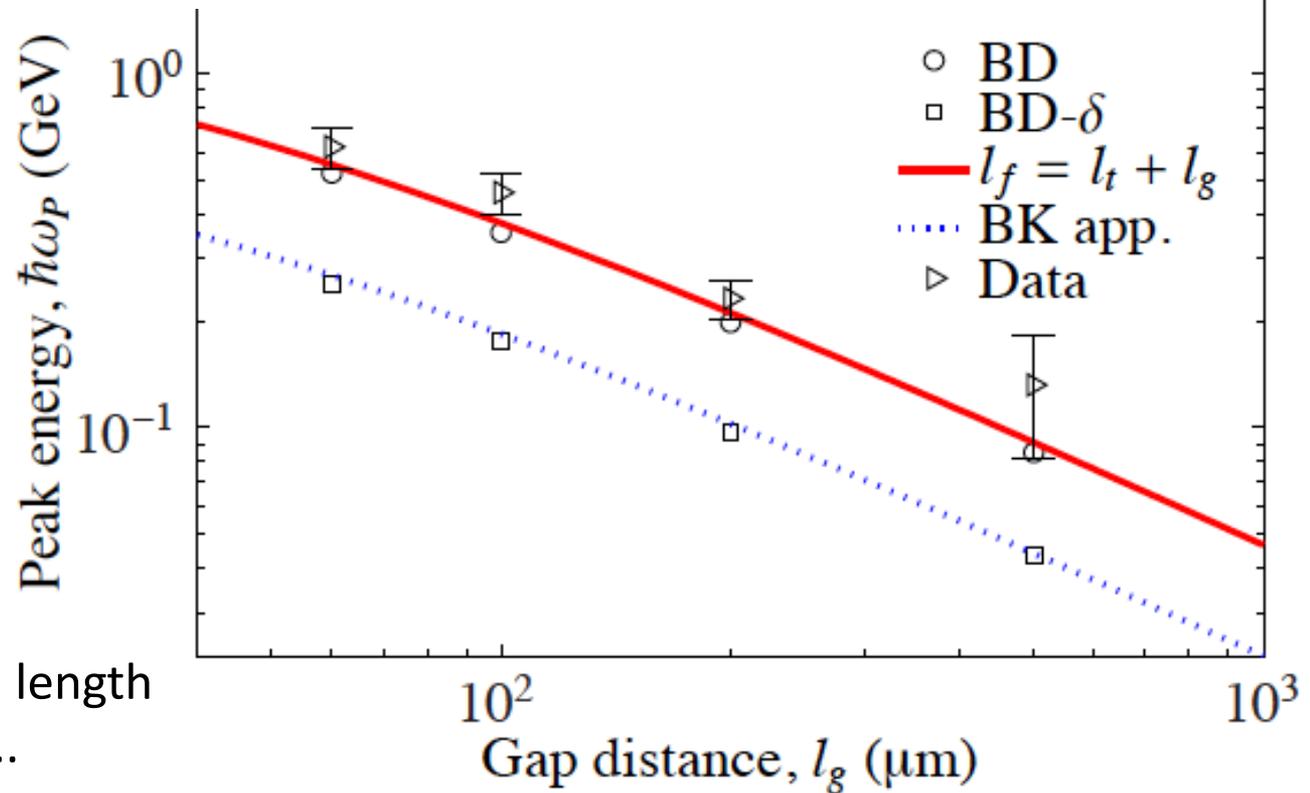
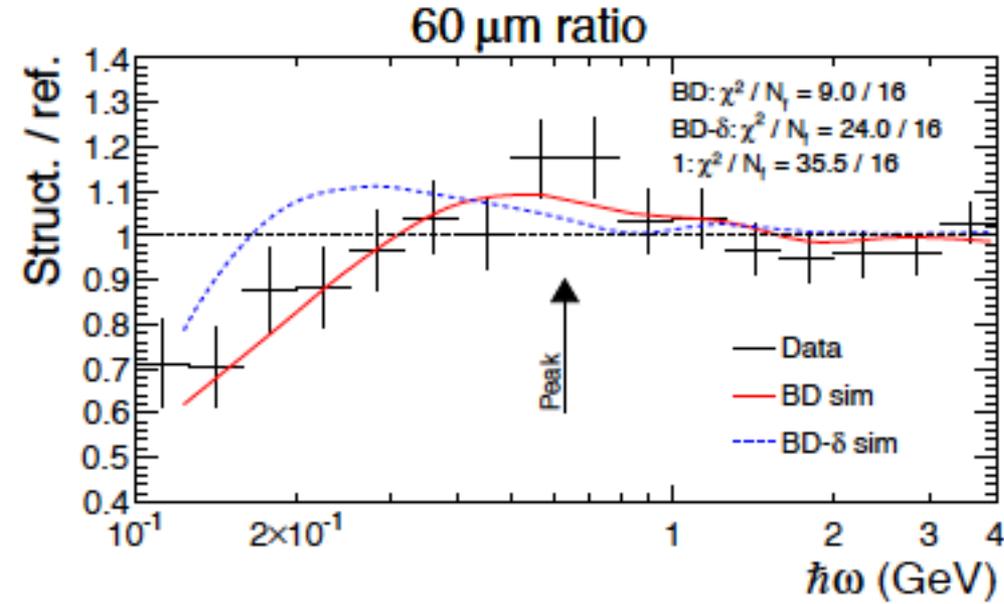
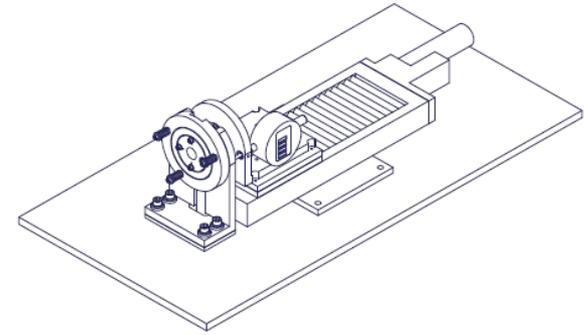
Phys. Lett. B **732**, 309 (2014)

Structured targets – systematic investigation, Phys. Lett. B **732**, 309 (2014)

60 μm



Structured targets



Measuring the formation length
with a micrometer screw....

STATUS

Positron production
2012 measurement

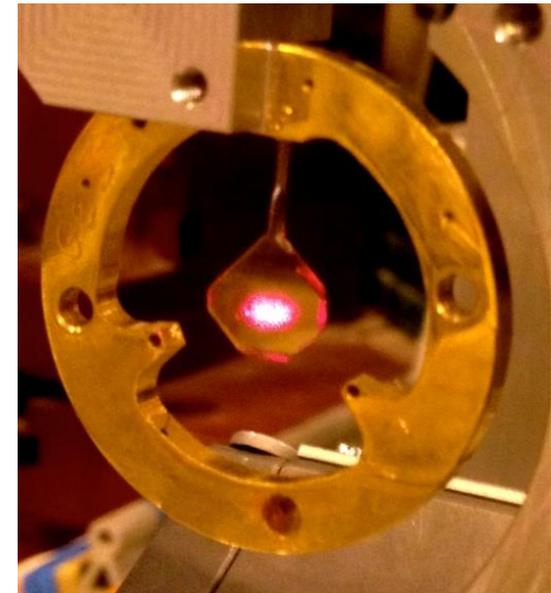
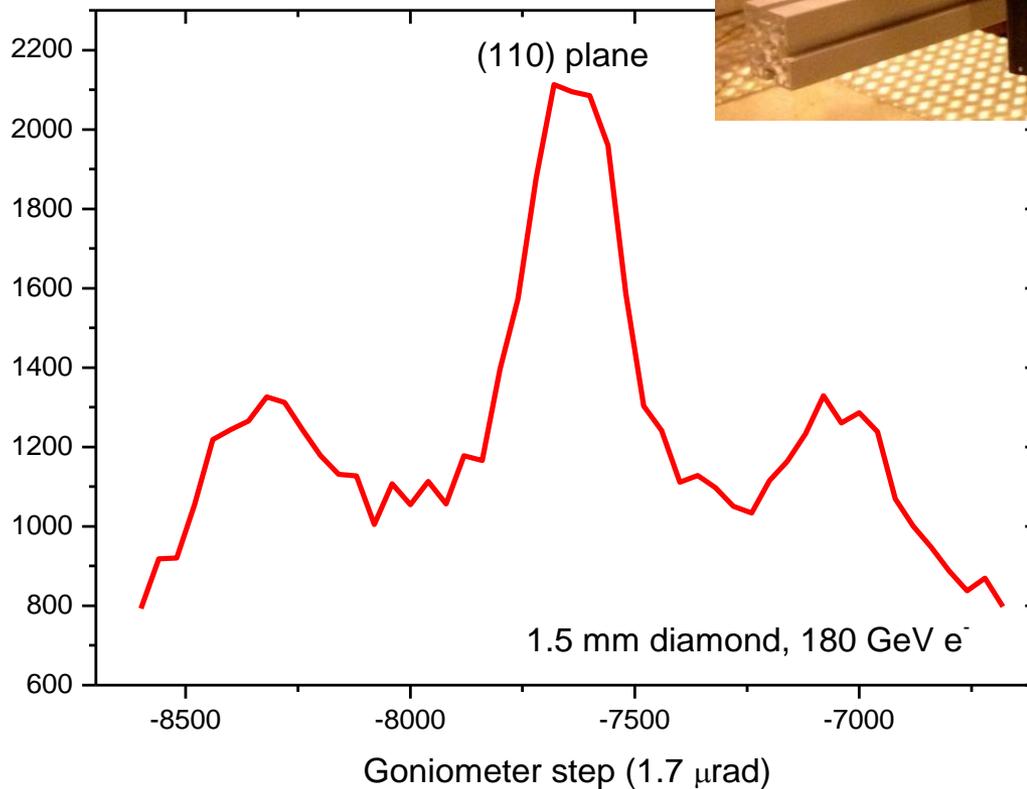
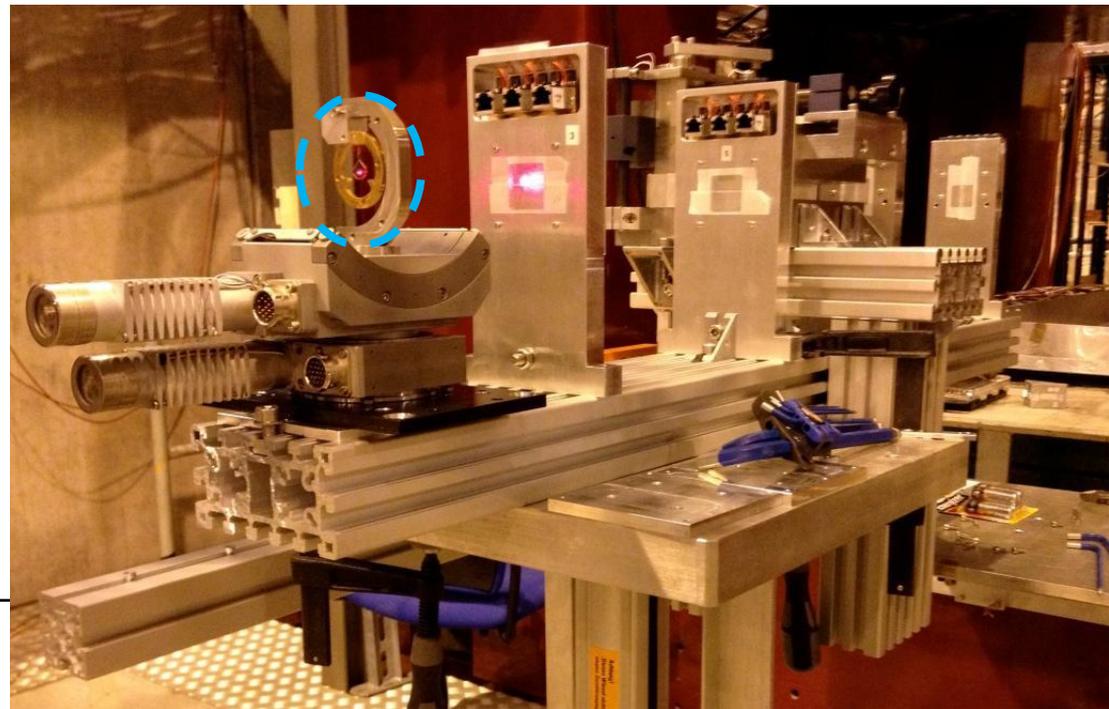
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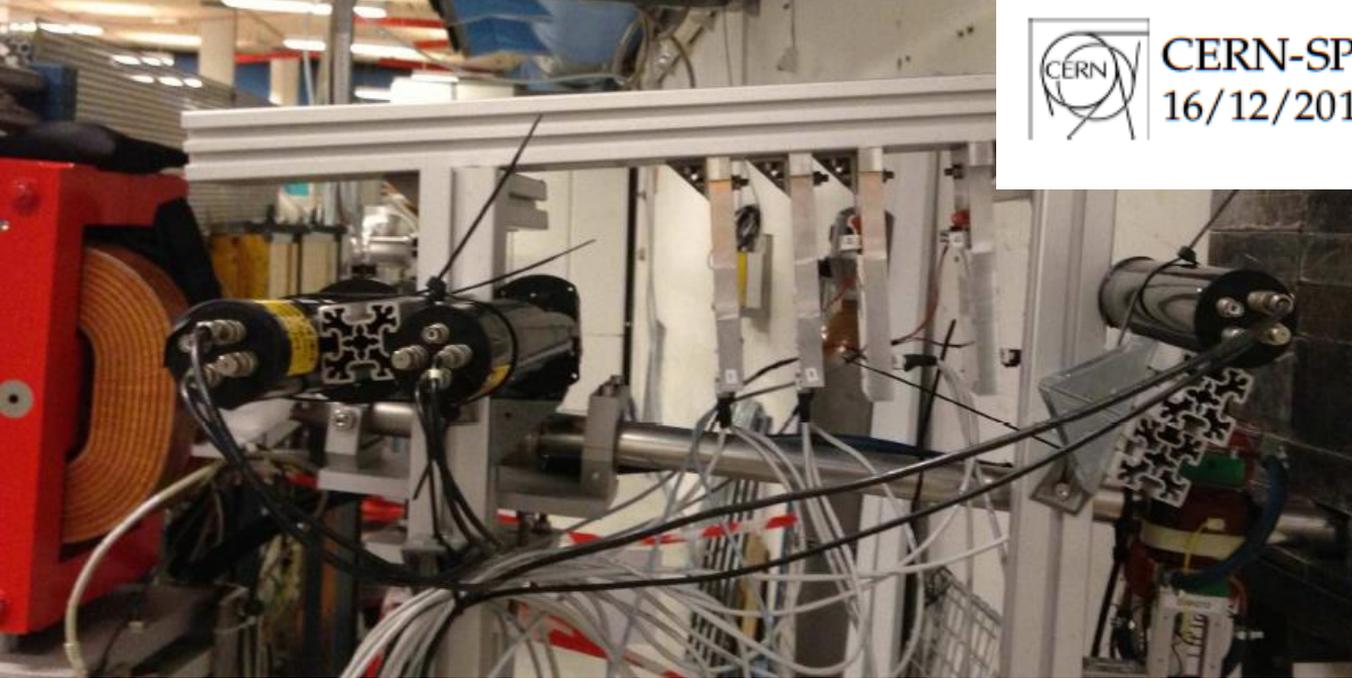
DESY test

Angular scans

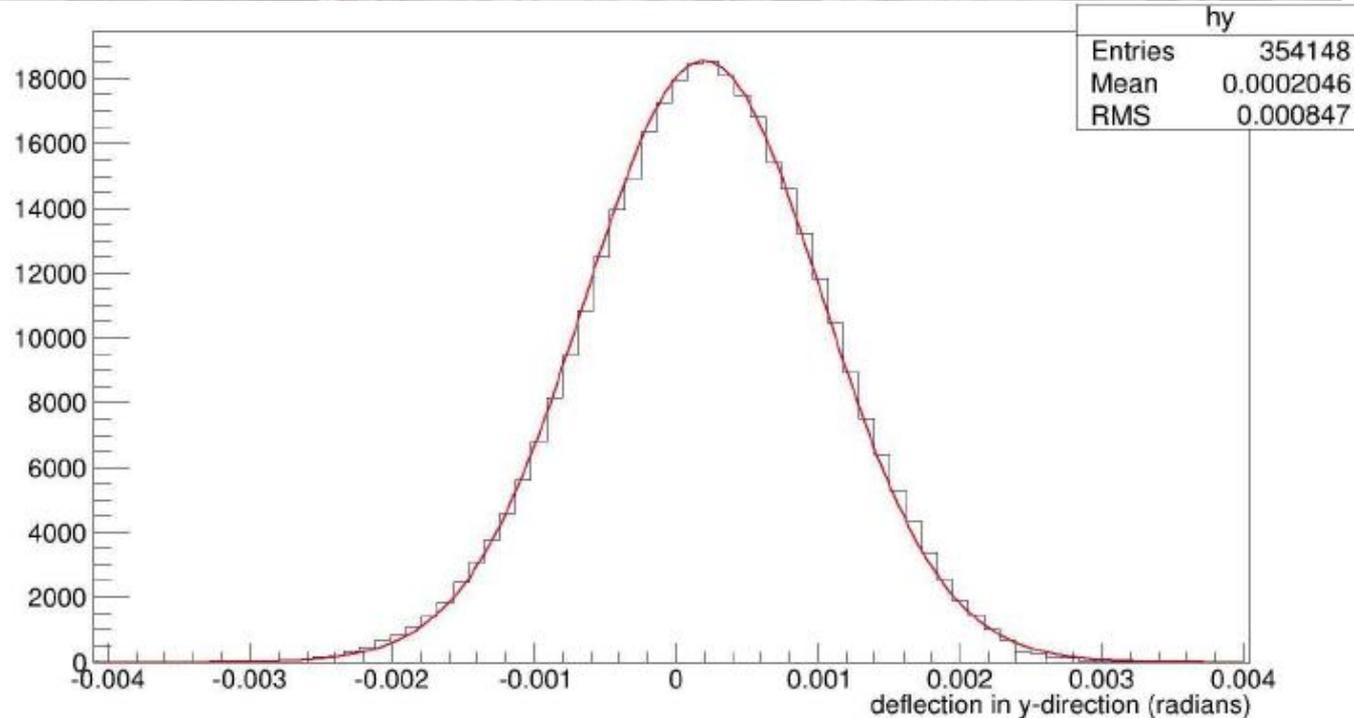
- Radiation enhancement observed w/ 180 GeV electrons (signal = radiation above 50 GeV, 'strong field radiation')

September 2012, CERN
with 1.5 mm diamond:





MIMOSA read-out



**ASTRID
and DESY
test**

PLANS FOR 2015

Experimental realization of a new type of crystalline undulator

(MAMI)

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Department of Physics and Astronomy, Aarhus University, Denmark

Werner Lauth and Hartmut Backe
Institut für Kernphysik, Johannes Gutenberg Universität Mainz, Germany

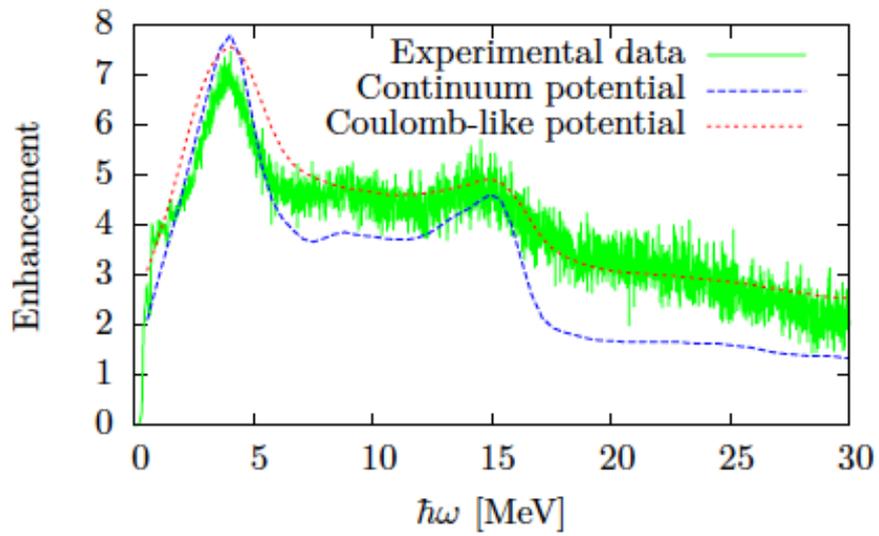
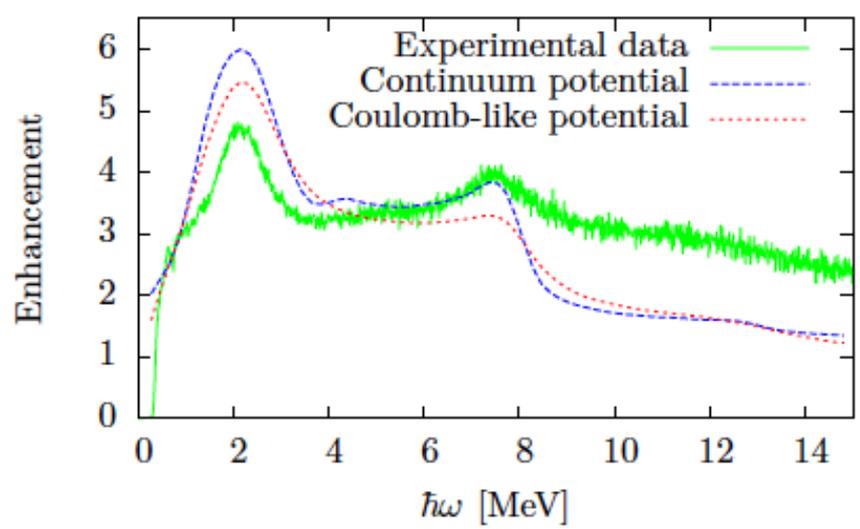


Figure 3. Comparison of theoretical and experimental radiation yield in units of the Bethe-Heitler bremsstrahlung. 600MeV (left) and 855MeV (right). The rightmost peaks stem from channeling radiation and the leftmost peaks stem from the undulating motion due to the bending of the crystal. Here 'Enhancement' is the ratio of the radiation to the Bethe-Heitler bremsstrahlung.

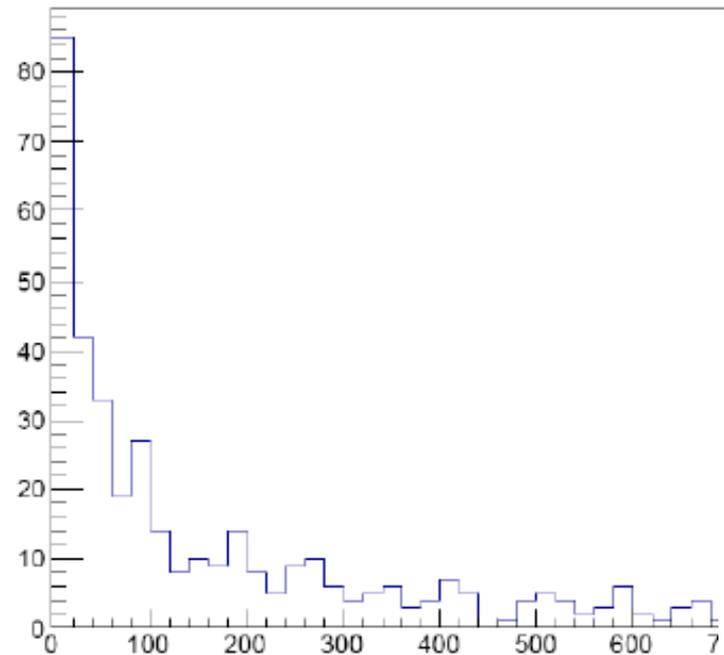
Phys. Rev. Lett., accepted

Also a testing ground for our simulation code for radiation and pair creation in crystals...

Non-aligned

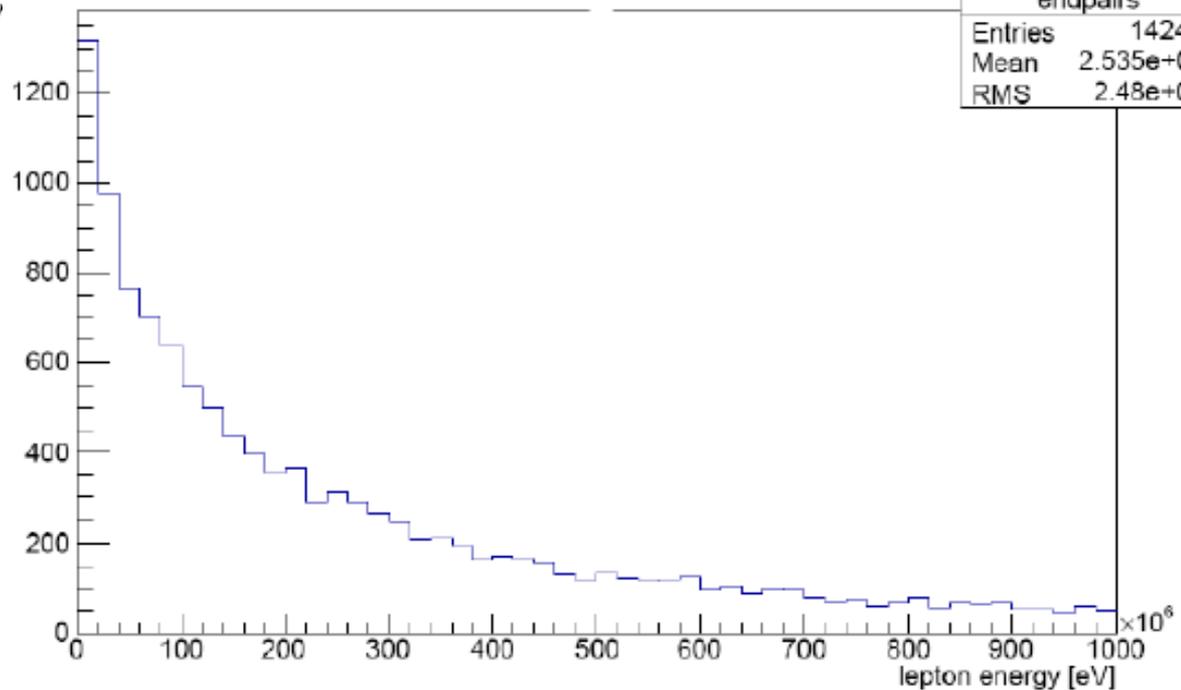
endpairs	
Entries	464
Mean	1.835e+08
RMS	2.184e+08

Positron production



Aligned

endpairs	
Entries	14249
Mean	2.535e+08
RMS	2.48e+08



Factor 15
enhancement at
low energies

Reduced for
thicker targets

Heavy ion bremsstrahlung

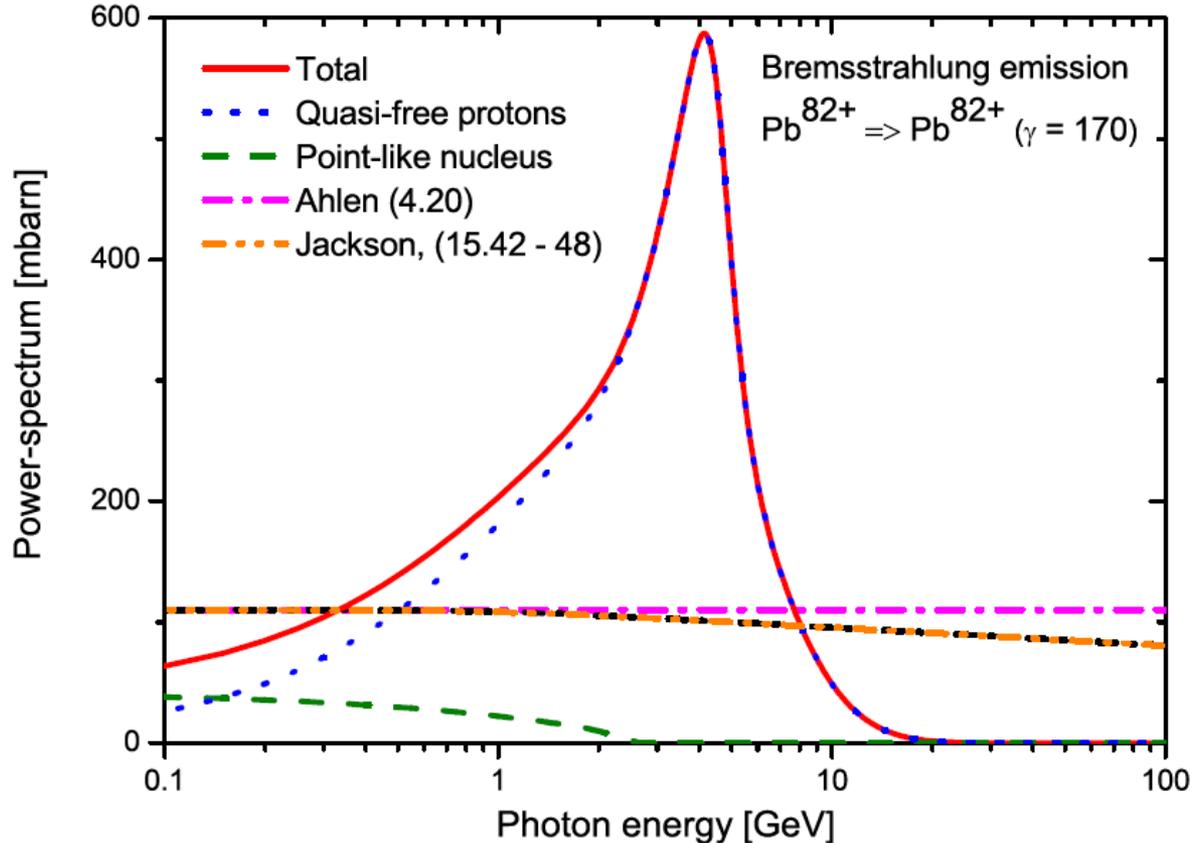
PHYSICAL REVIEW A **81**, 022901 (2010)

Bremsstrahlung from relativistic heavy ions in matter

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Department of Physics and Astronomy, University of Aarhus, DK-8000 Aarhus C, Denmark

(Received 24 September 2009; published 8 February 2010)

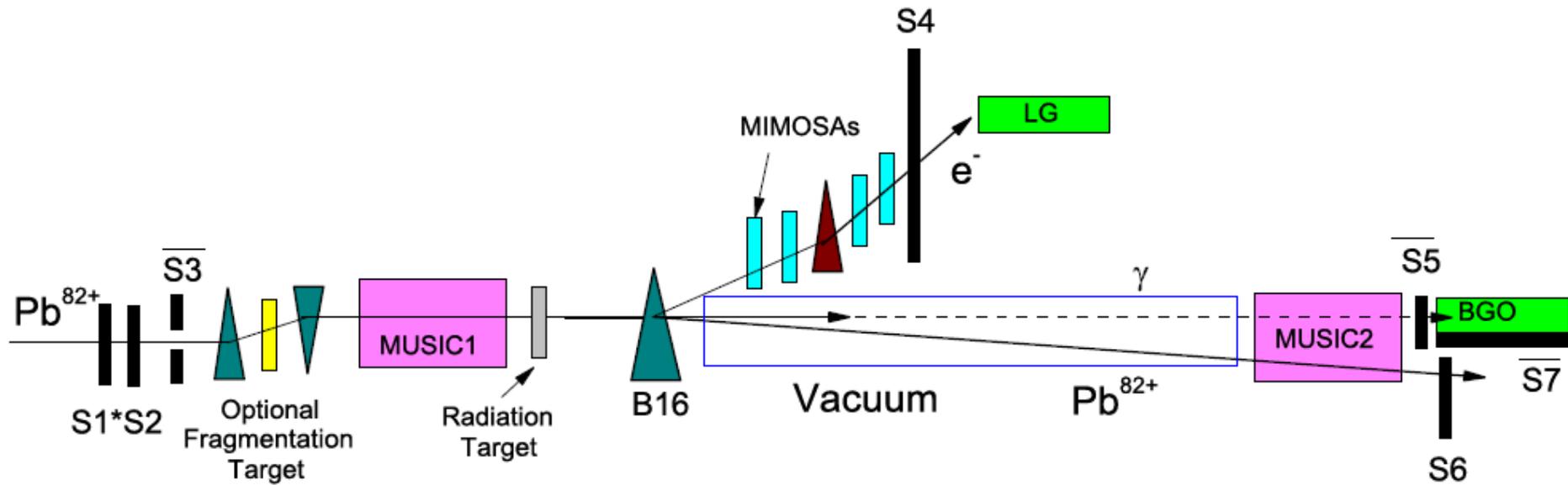


Radiation
emission

Peak structure
due to finite
nuclear size

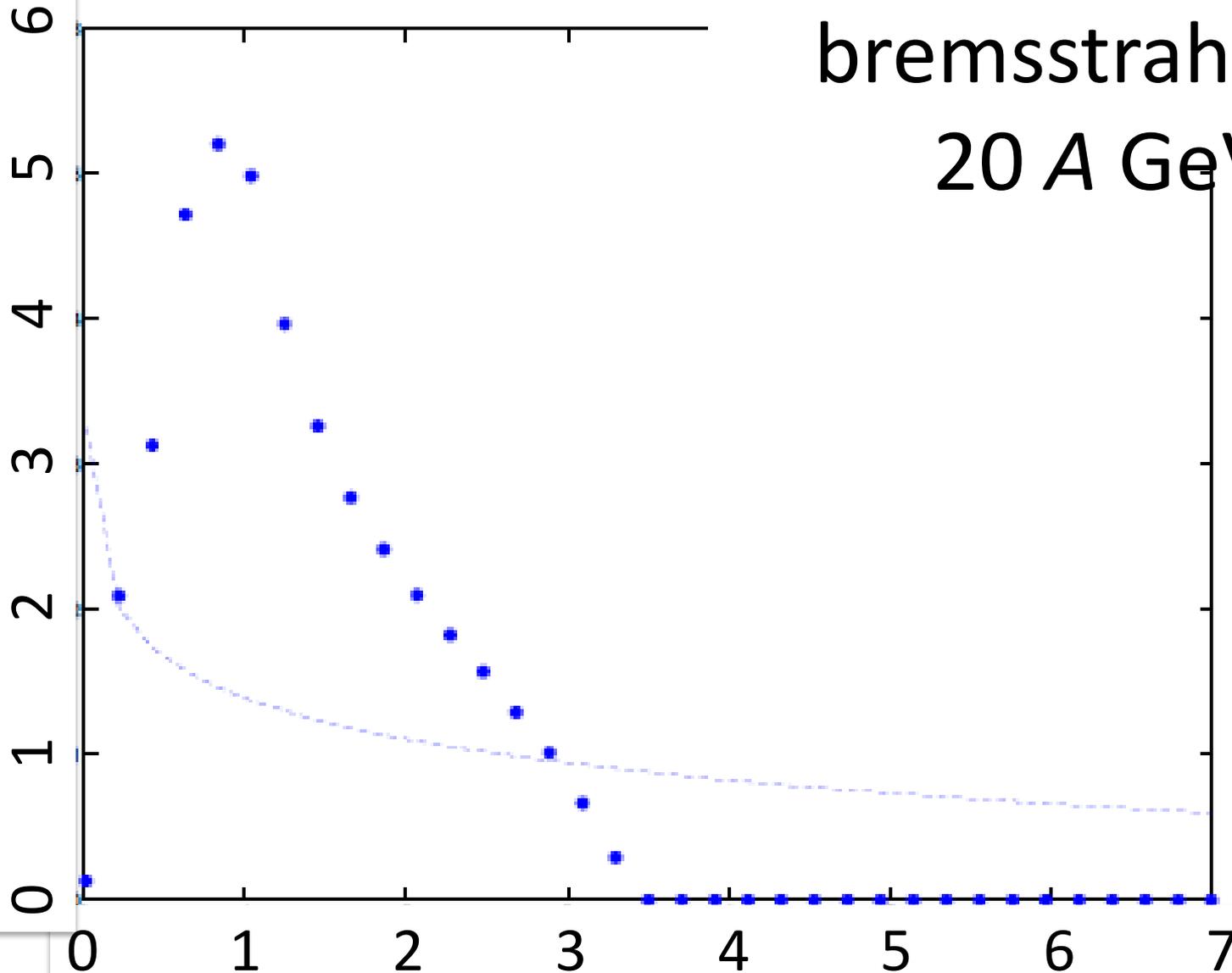
(deBroglie
wavelength of
virtual photon of
order R)

Heavy ion bremsstrahlung

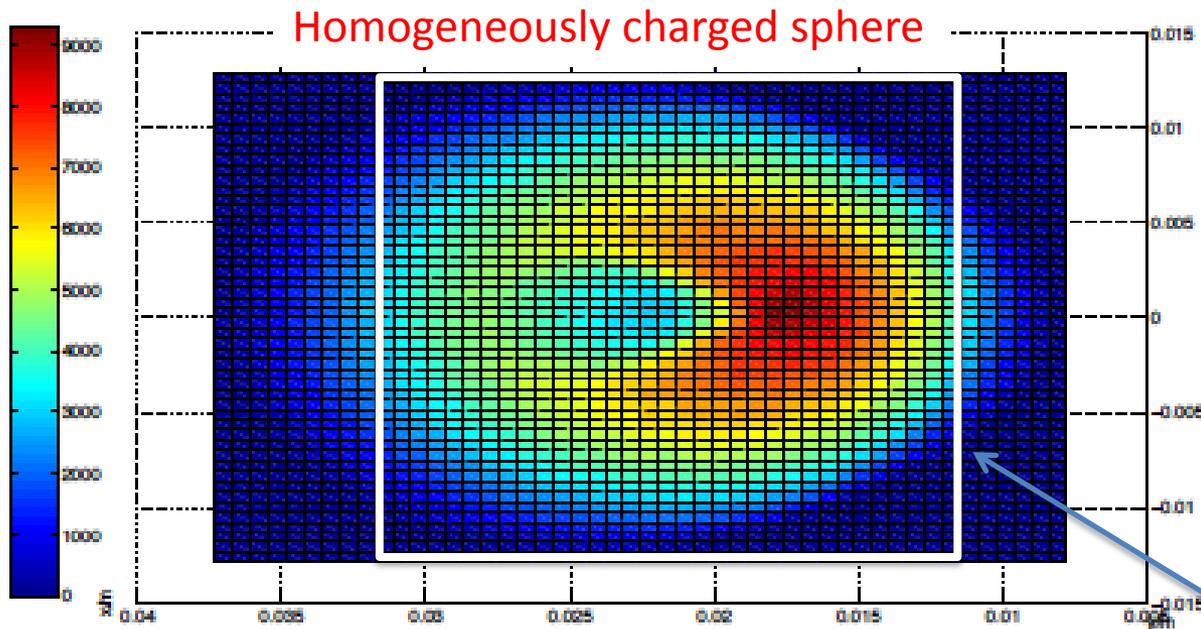


Argon 18+
bremsstrahlung
20 A GeV

Cross section [mbarn]

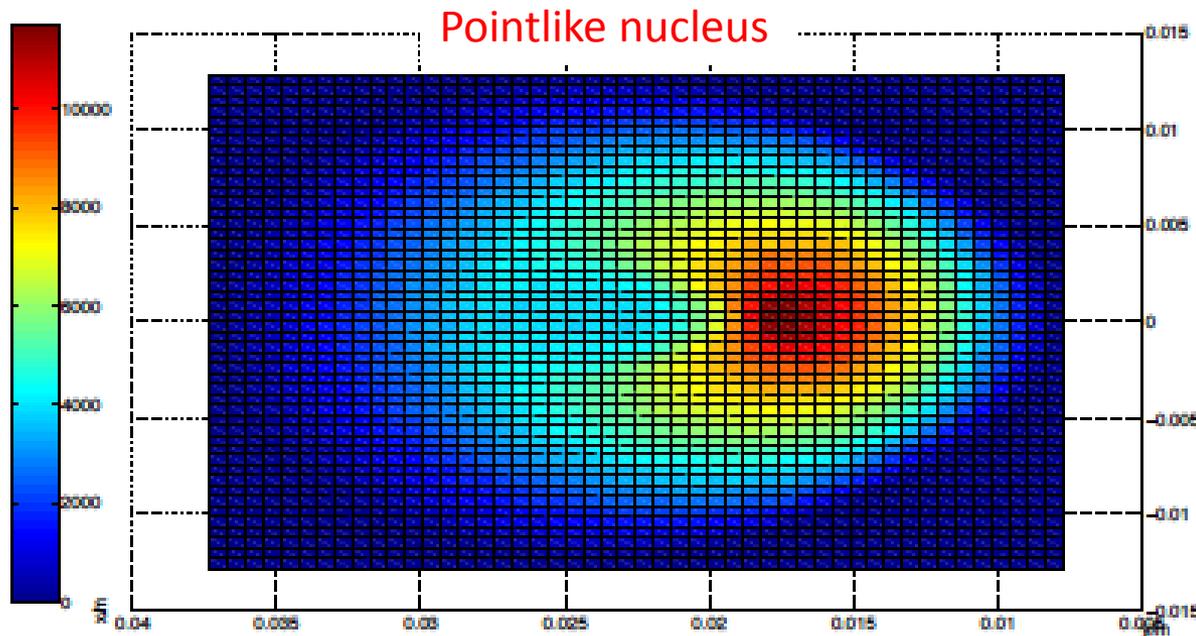


Photon energy



Argon 18+
delta-
electrons

Size of MIMOSA

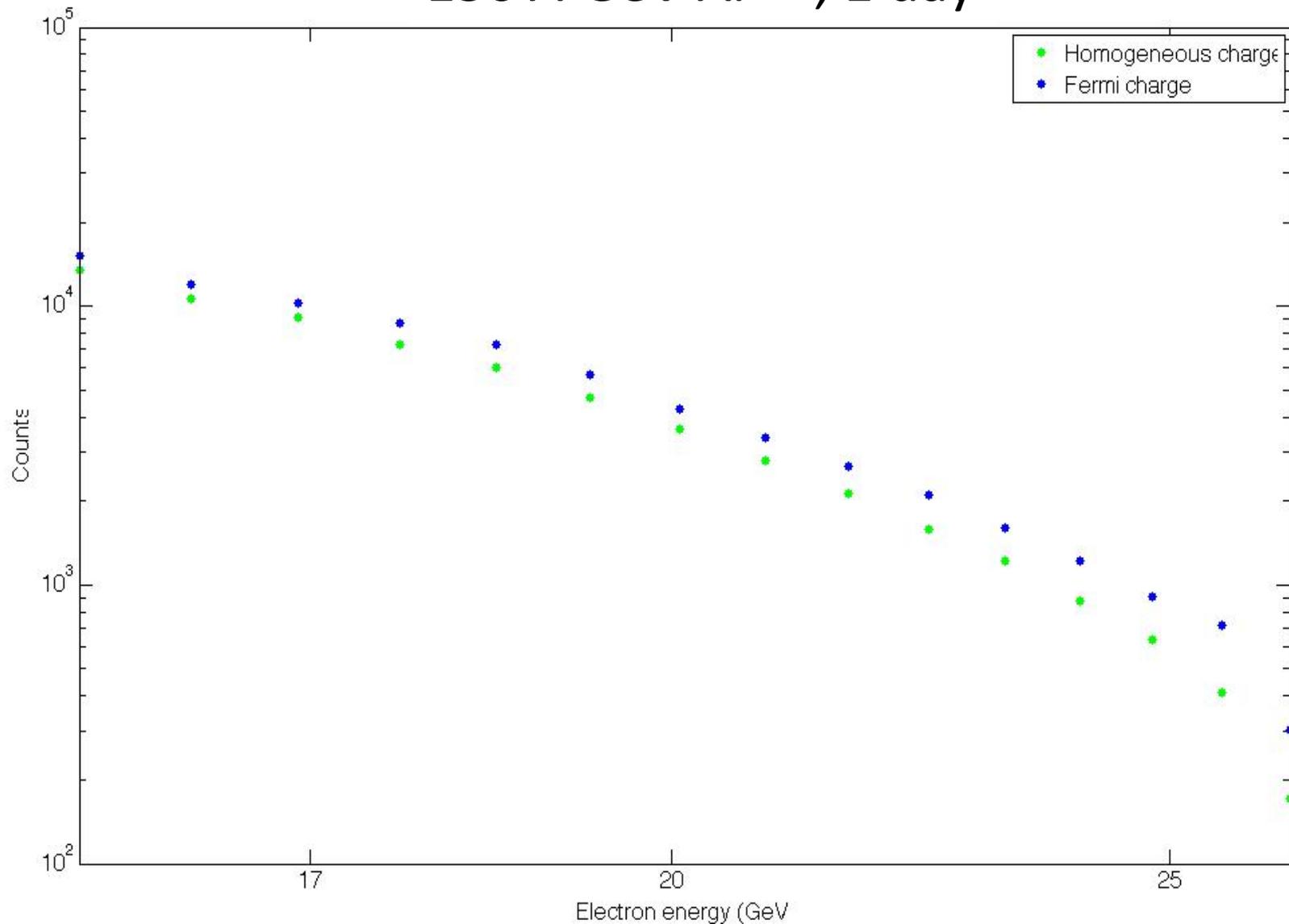


Approx. 1 day of
(parasitic) beam in H4

Quantitative statistical
analysis of sensitivity
underway

Delta-electrons – charge density of the nucleus

150 A GeV Ar¹⁸⁺, 1 day



Publications, NA63

- Since previous SPSC presentation:
 1. K.K. Andersen, S.L. Andersen, J. Esberg, H. Knudsen, R. Mikkelsen, U.I. Uggerhøj, T.N. Wistisen, A. Mangiarotti, P. Sona and T.J. Ketel (CERN NA63): [Experimental investigation of the Landau-Pomeranchuk-Migdal effect in low-Z targets](#), Phys. Rev. D **88**, 072007 (2013)
 2. K.K. Andersen, S.L. Andersen, J. Esberg, H. Knudsen, R. Mikkelsen, U.I. Uggerhøj, T.N. Wistisen, A. Mangiarotti, P. Sona and T.J. Ketel (CERN NA63): [Measurements of the spectral location of the structured target resonance for ultrarelativistic electrons](#), Phys. Lett. B **732**, 309-314 (2014)