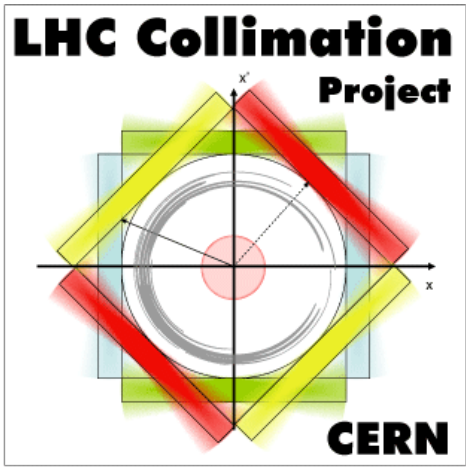
INVESTIGATING DIFFERENT TCRYO DESIGN OPTIONS



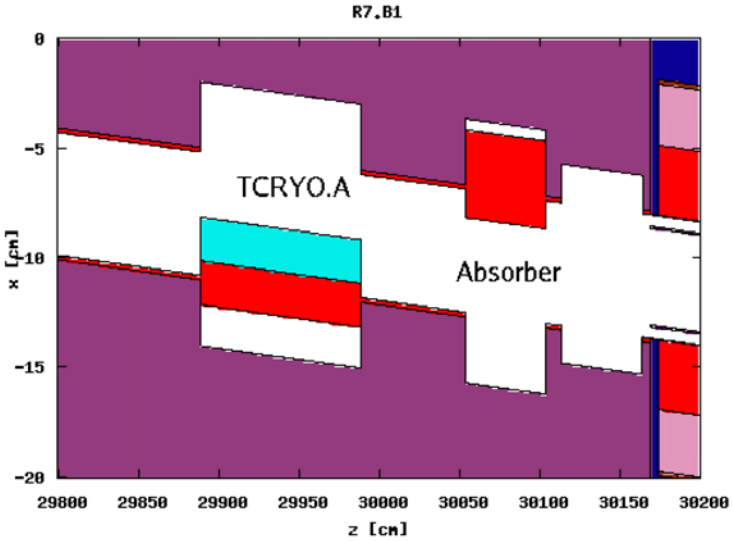
F. Cerutti for the FLUKA team (EN-STI)

OUTLINE

- reminding the results reported at the last year review

- what about a *single jaw*,

  possibly accompanied downstream by a fixed absorber or an opposite shorter jaw?



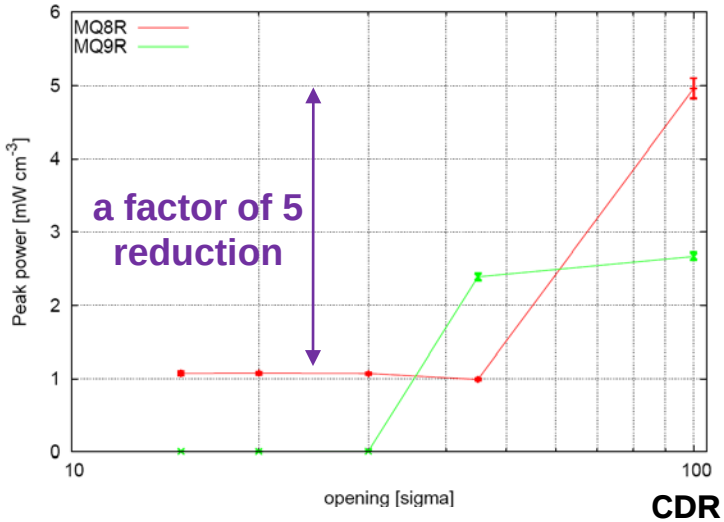
- looking at the lead beam

OPENING, MATERIAL & LENGTH SURVEY

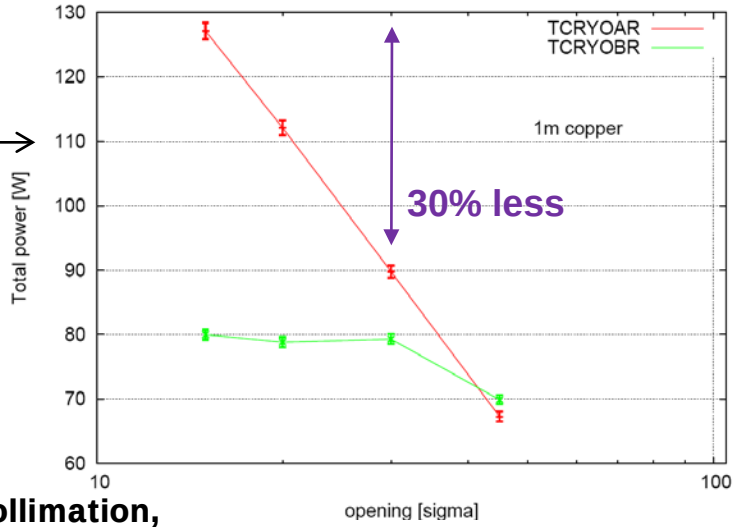
peak power in the MQs coils

power values for 0.2h beam lifetime

total power in the **TCRYOs**



1m copper



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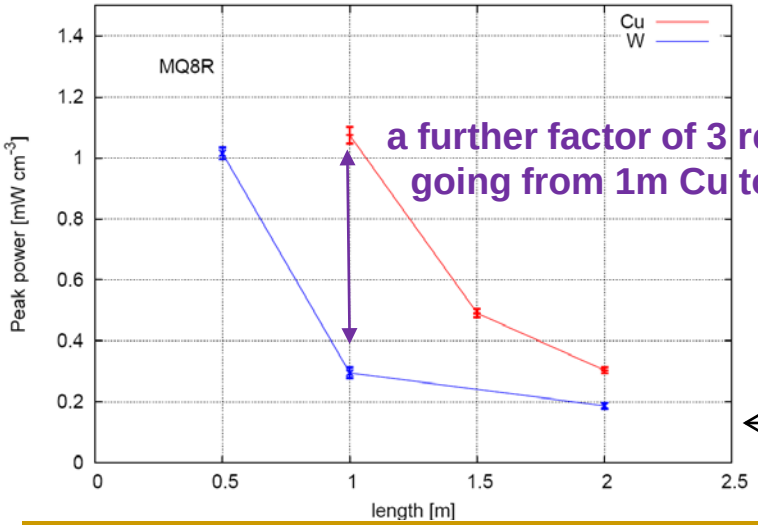
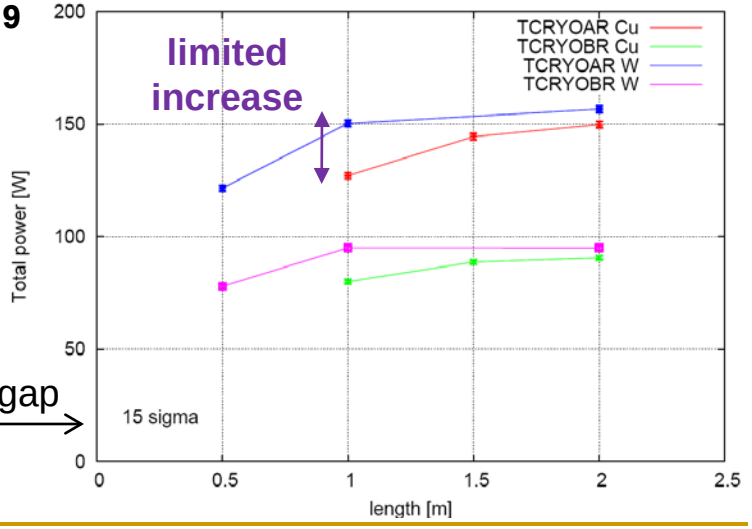
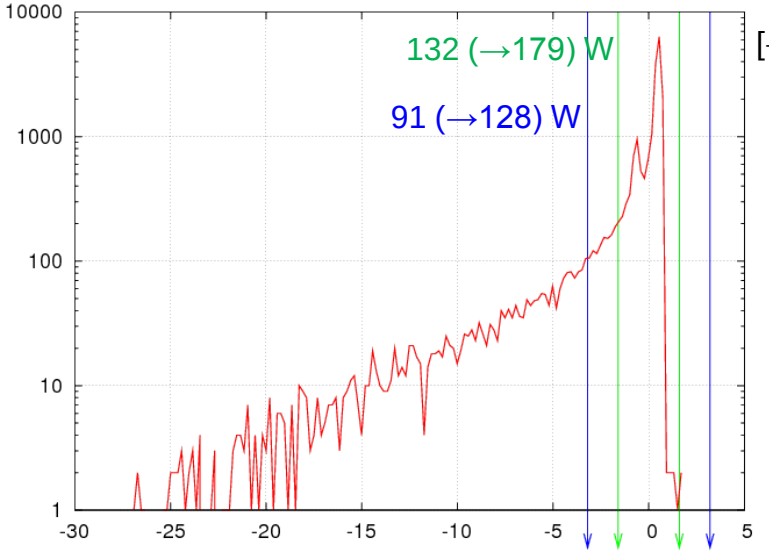


15 sigma half-gap

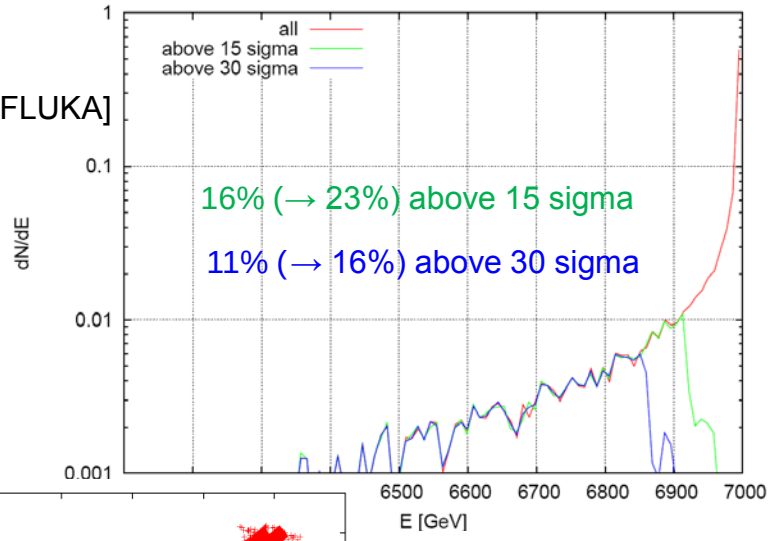


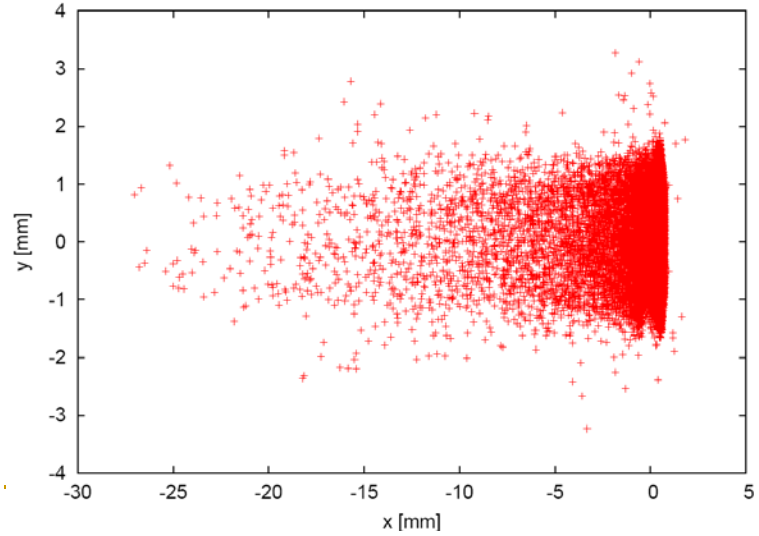
THE SINGLE DIFFRACTIVE BEAM HALO

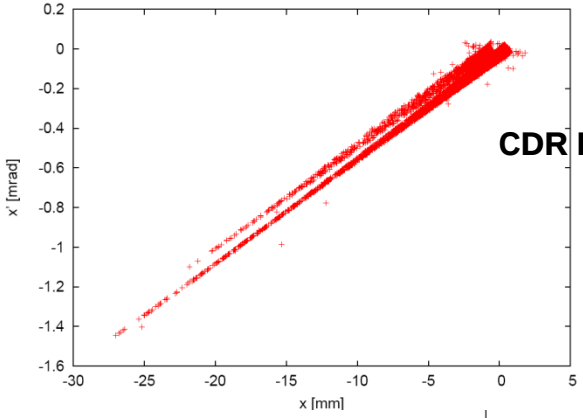
at the entrance of TCRYO.AR7.B1

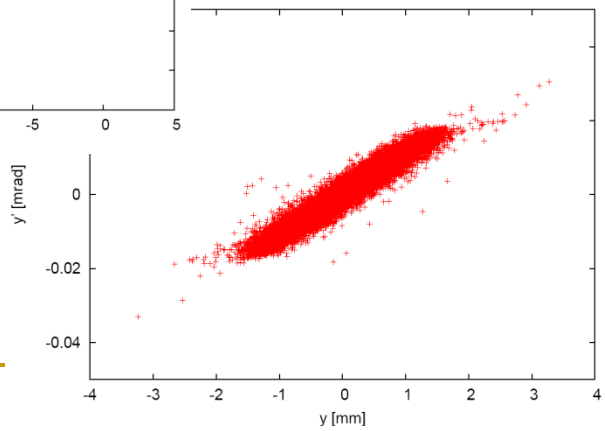


[→ correction by FLUKA]









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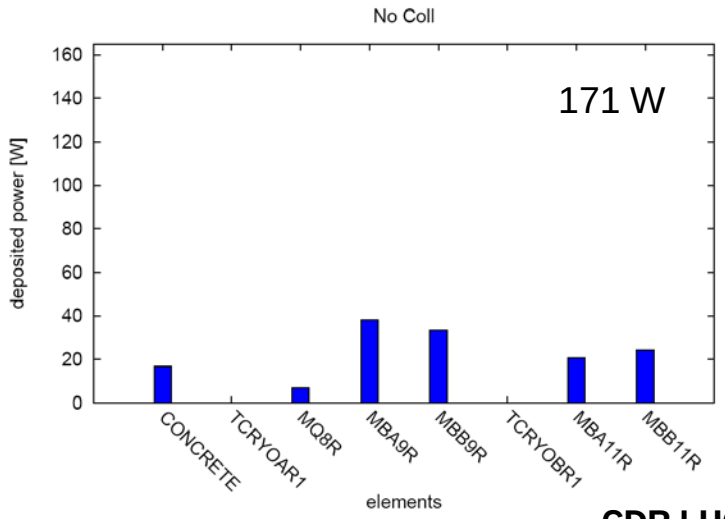
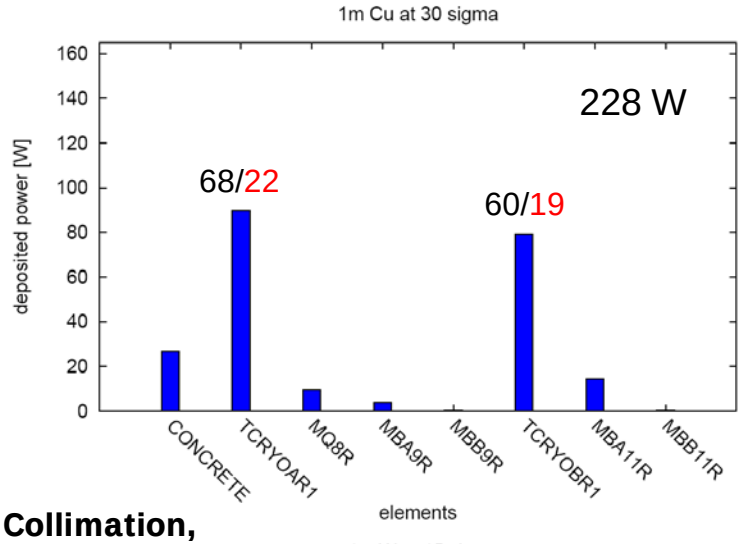
[T. Weiler]

POWER IMPACTING THE DS

power values for 0.2h beam lifetime

int/ext jaw





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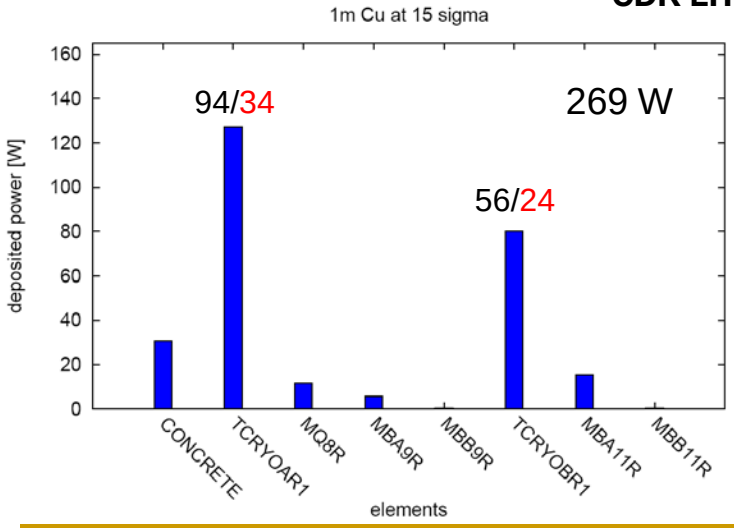
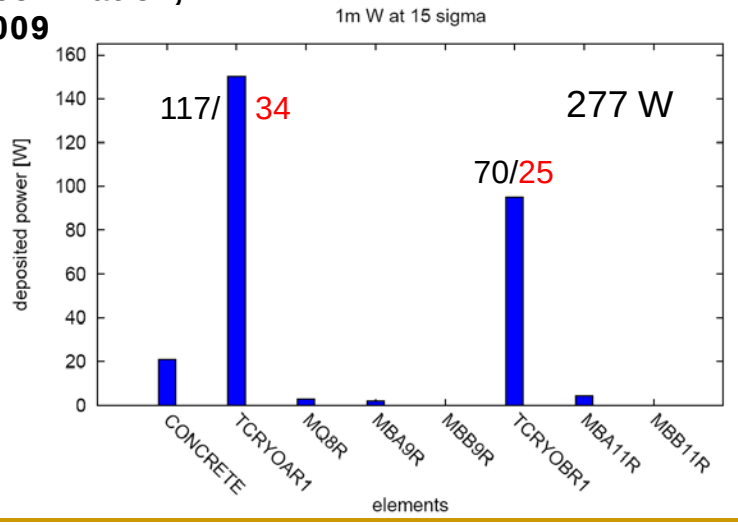




UNCERTAINTIES

only *statistical* errors are accurately known and shown

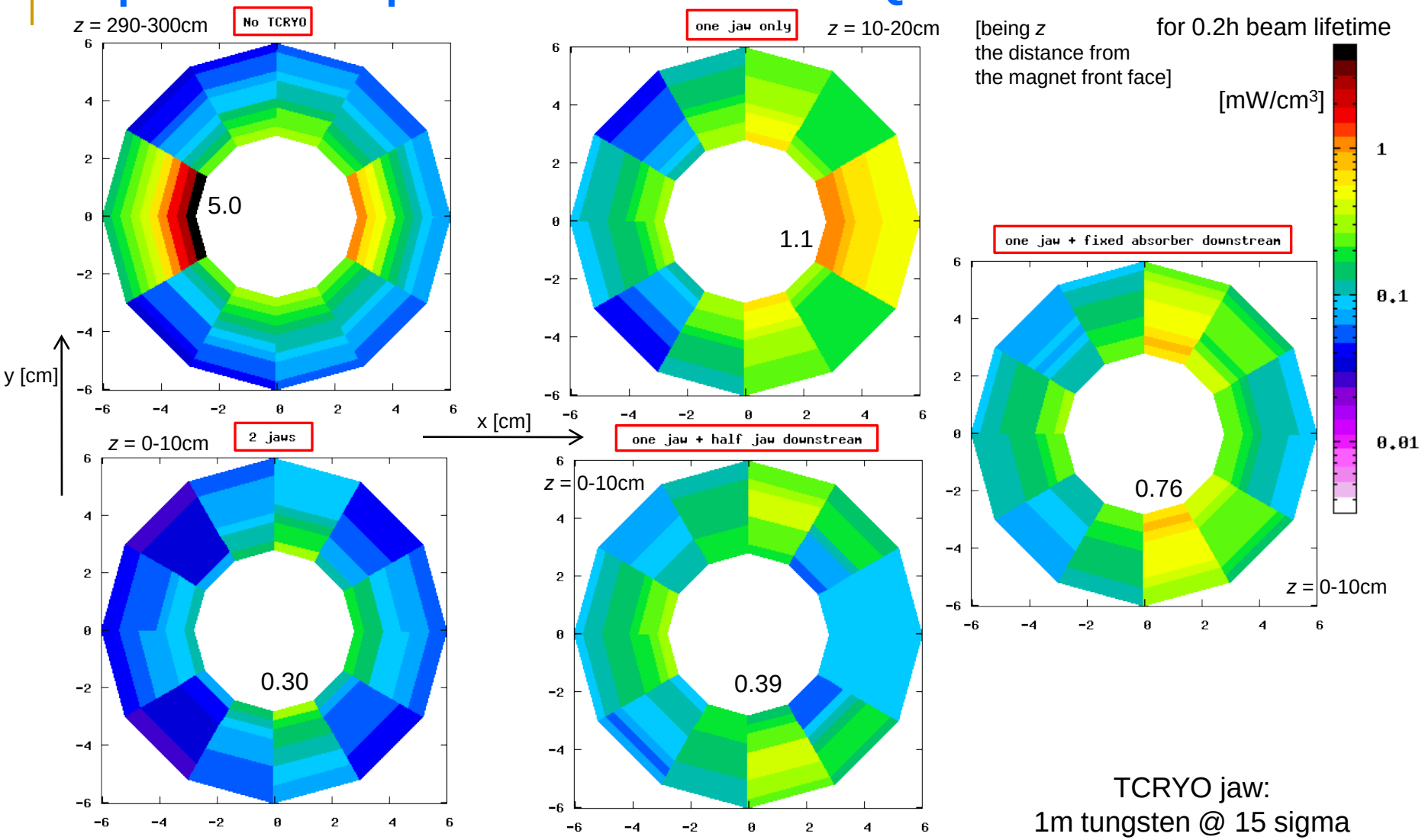
On top of them there are the systematic ones:

factor for **point** quantities	**factor** for **integral** quantities	**origin**	**reason**
2	2	single diffractive	almost no data for p-A collisions
1.5	1.5	grazing impact	jaw roughness dependence on the angular distribution at zero degrees
2	1.2	FLUKA / physics	interaction extrapolation at 7TeV
1.5	1.1	FLUKA / machine model	description of a large sector (including material implementation)
1.3	1.3	SixTrack / beam model	beam halo description
?	?	imperfections	collimator tilting, magnet displacement, field accuracy…

…plus those in the estimation of the quench limits

Ratios (i.e. comparison between different cases) are much more reliable than absolute values

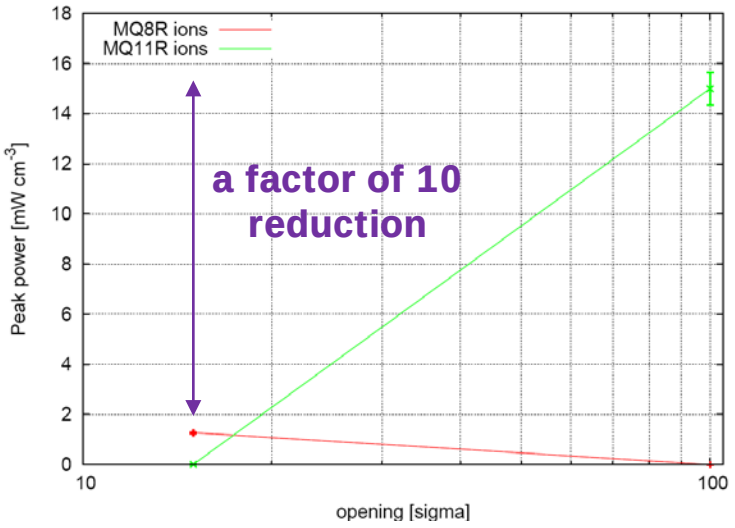
power deposition in the MQ.8R7.B1 coils



EFFECT OF THE TCRYO (LEAD BEAM)

peak power in the MQs coils

power values for 0.2h beam lifetime



1m copper

15 sigma half-gap

total power in the **TCRYOs**

120 W in the TCRYOAR

125 W in the TCRYOBR

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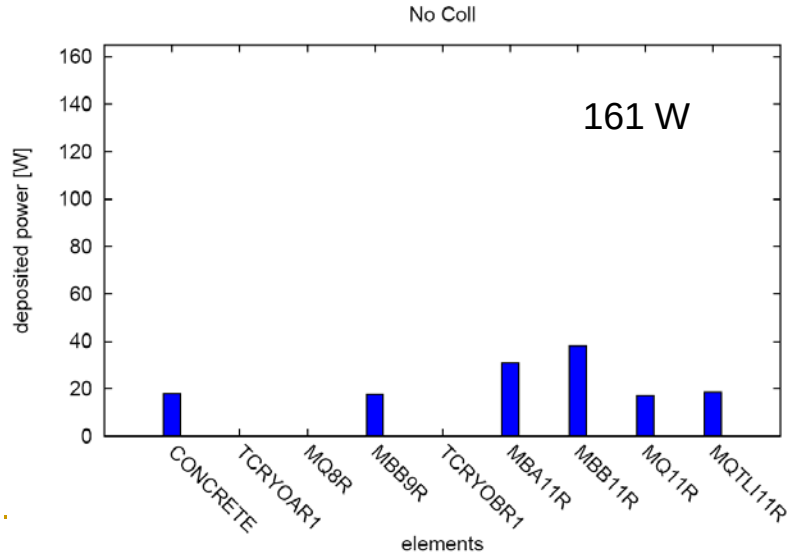
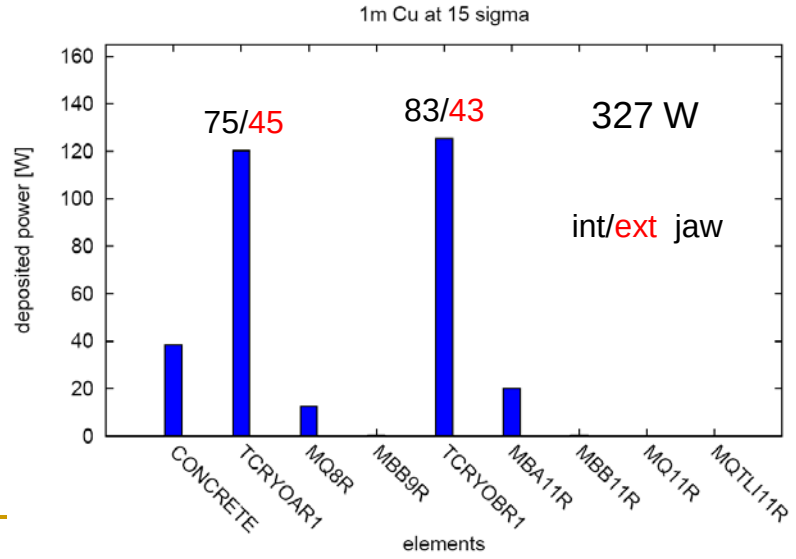
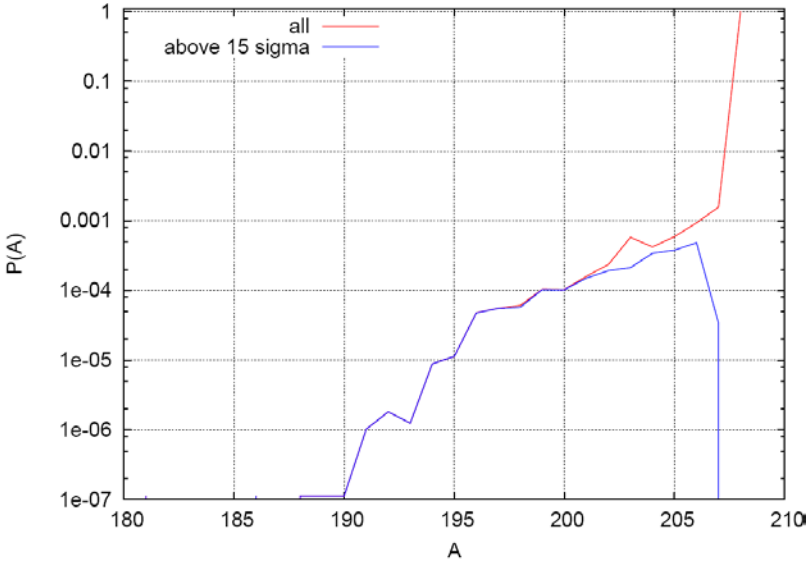




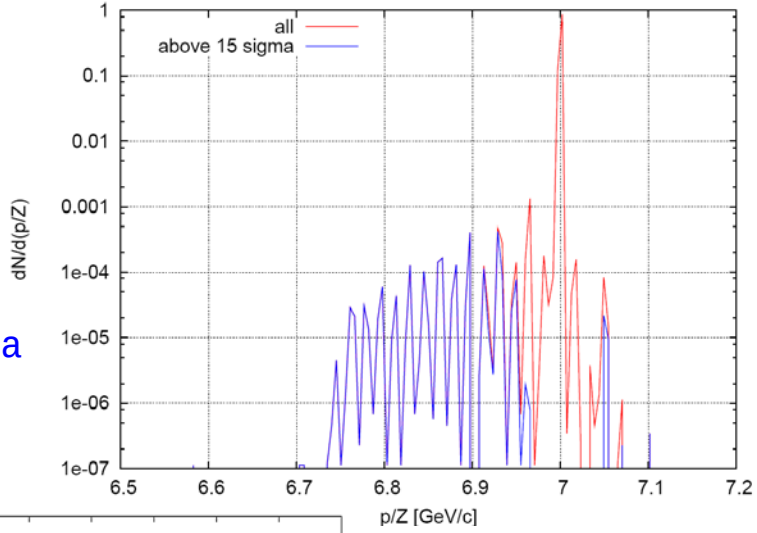
THE LEAD BEAM HALO

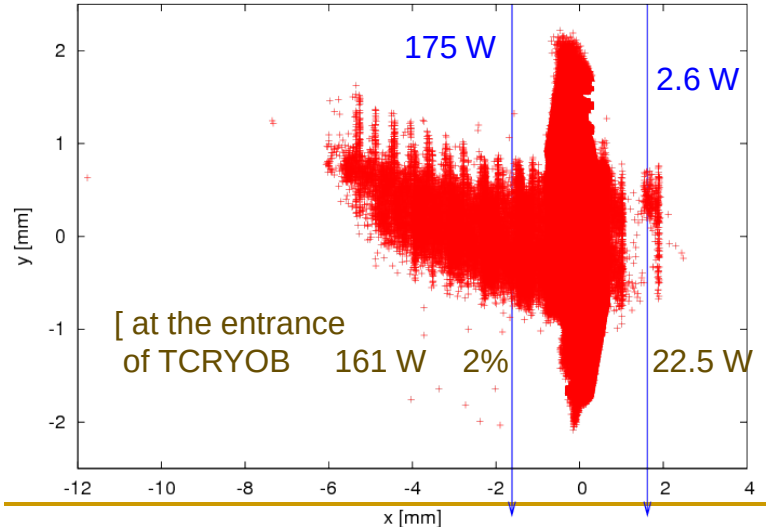
at the entrance of TCRYO.AR7.B1

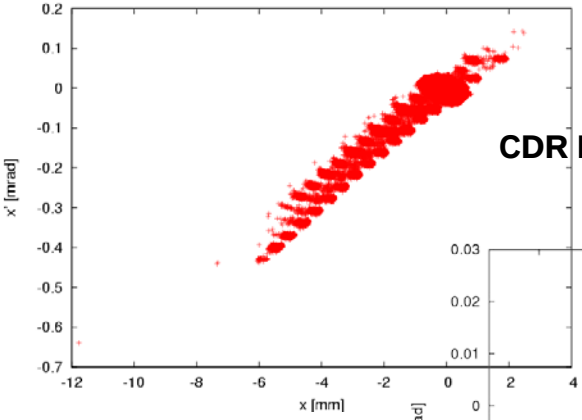


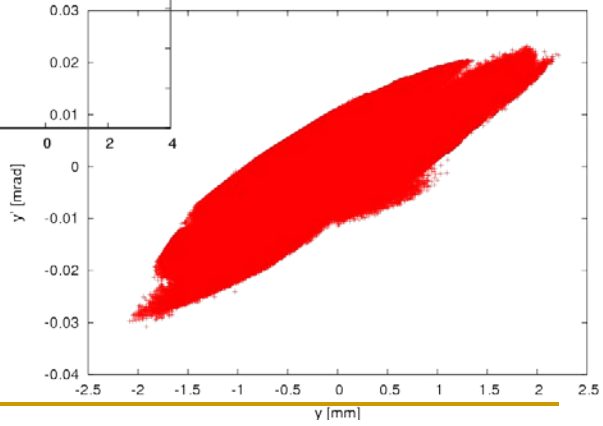
0.22%

above 15 sigma









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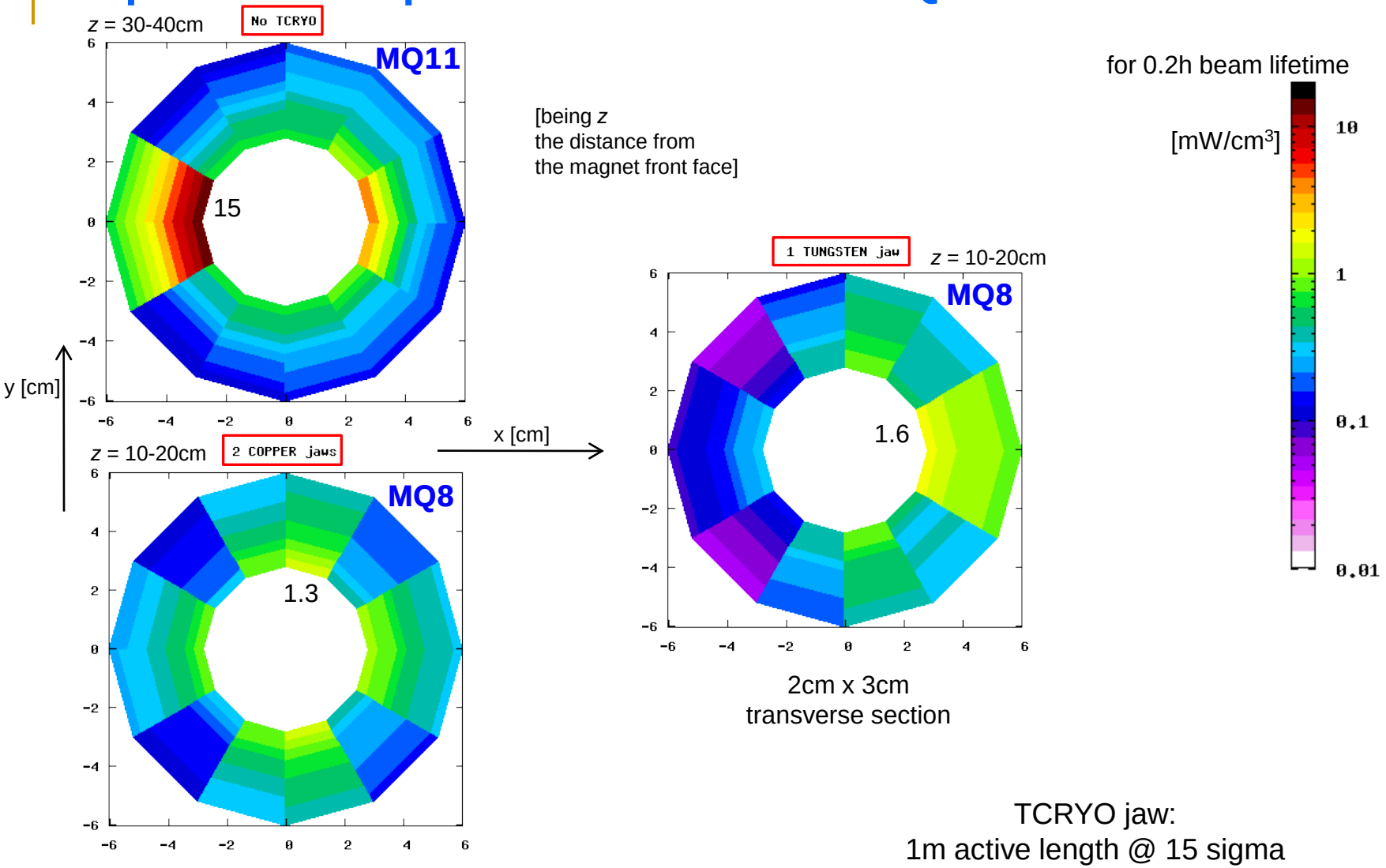
[G. Bellodi]

power deposition in the MQ.sR7.B1 coils



10cm x 20cm
transverse section

2cm x 3cm
transverse section

TCRYO jaw:
1m active length @ 15 sigma

CONCLUSIONS

• for the LHC proton beam, the addition of the cryo-collimators is expected to decrease by a factor from 5 (with 1m Cu jaws) to 15 (with 1m W jaws) the predicted peak power in the DS magnet superconducting coils, which is critical for quench occurrence.

The total load on the cold magnets is decreased as well, becoming the cryo-collimators the DS hottest points.

The improvement is not strongly dependent on the cryo-collimator aperture, provided that it is not too large.

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• the reduction is even more significant for the lead beam (a factor of 10 with 1m Cu jaws)

• *the external jaw is expected to catch a significant fraction of the shower developed in the internal jaw, playing a clear role despite the halo fraction directly impinging on it.*

• *in case of a 1m W active length, the single jaw option carries a peak power reduction in the most impacted magnet of a factor of ~5 and ~9 for the proton and lead beam, respectively.*