



FCC-hh, IRJ, Cold section

Energy deposition studies with FLUKA



M. Varasteh and F. Cerutti

*Tracking input from BE-ABP:
J. Molson and R. Bruce*



FCC collimation design meeting #24

25-Nov-19

FCC-hh, IRJ, Cold section:

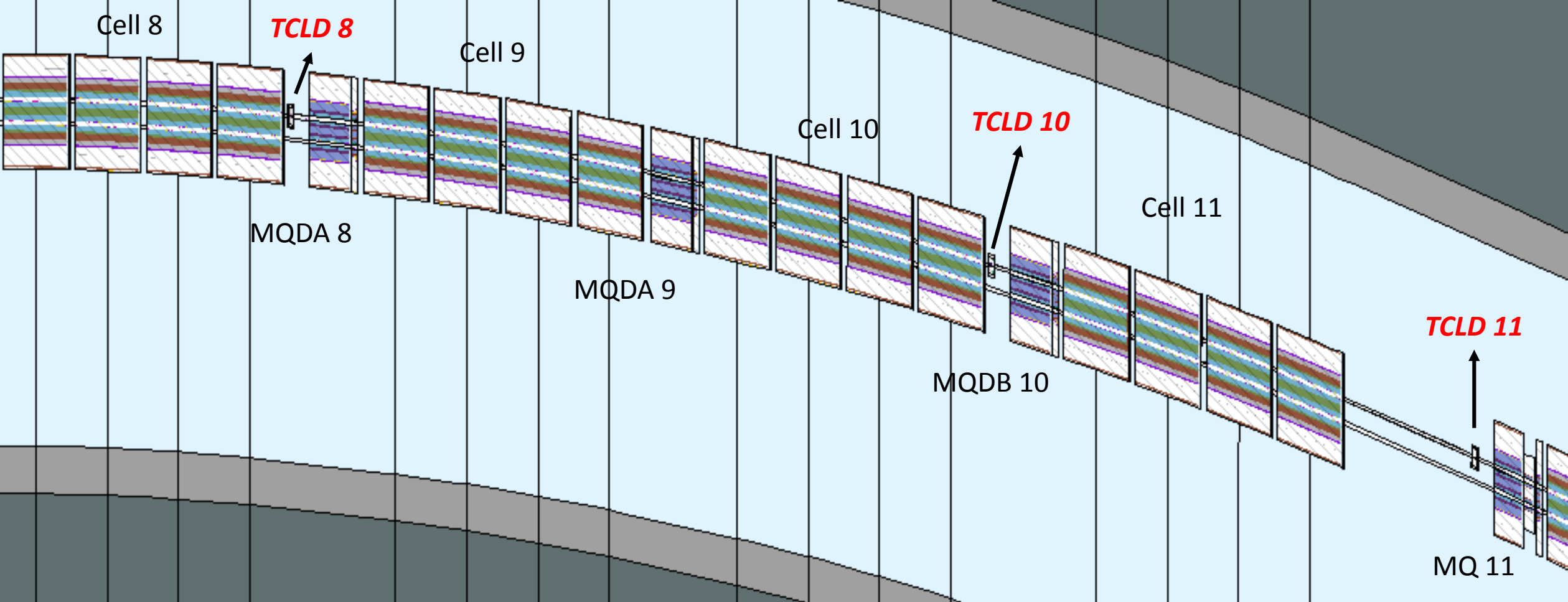
- with / without TCLD collimators
- with / without mask for MQDB.10RJ, in presence of TCLDs
- conventional 3 mm radial bin size vs 1 mm, used to calculate the peak power density on the coils
- summary

NB: in LHC, the DS losses are deemed to be underestimated by a factor of 3 in the *ideal machine simulation*.

“In the following results, this is not taken into account”

Values are for 12 min BLT

Cold section with TCLDs



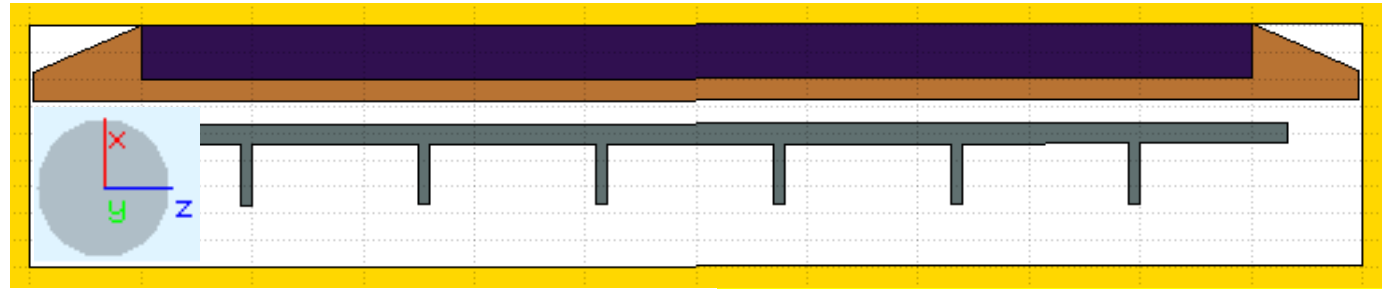
Source term

number of touches per proton lost

TCLD8 0.00014

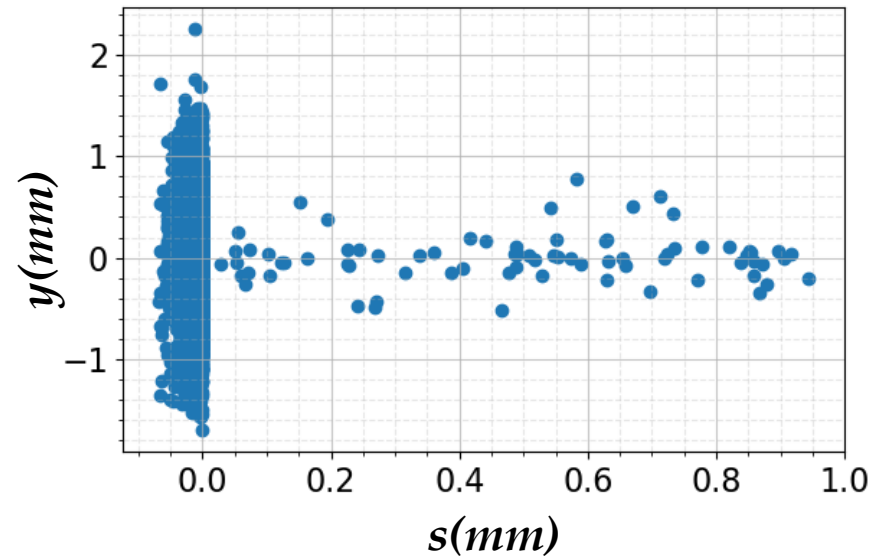
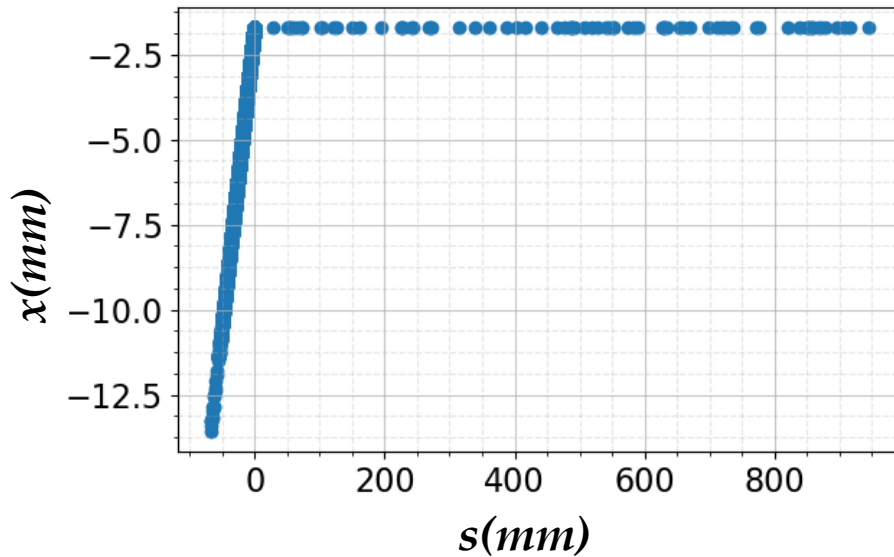
TCLD10 0.00048

TCLD11 0.00005

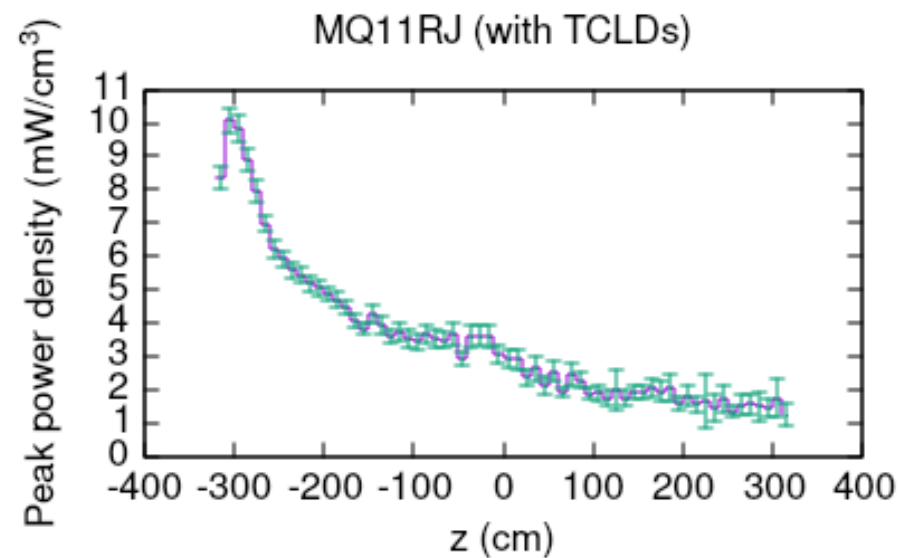
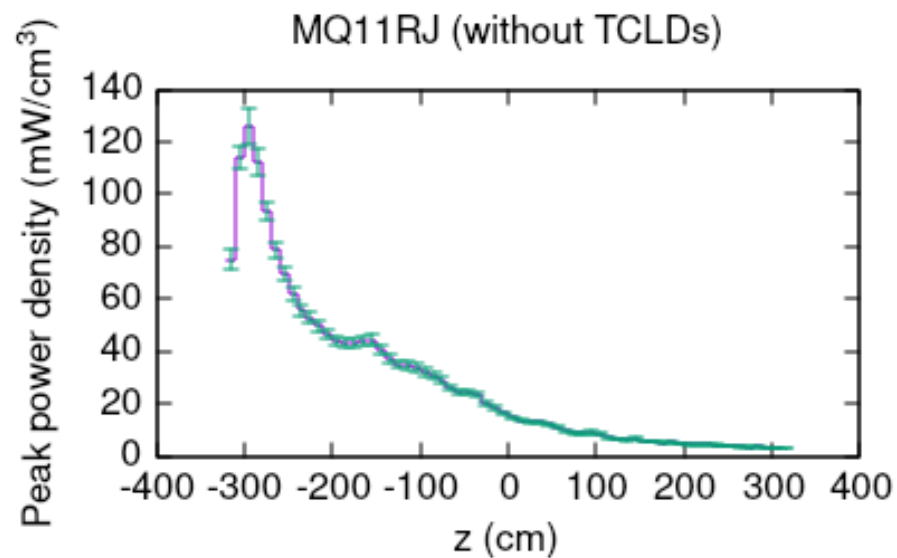
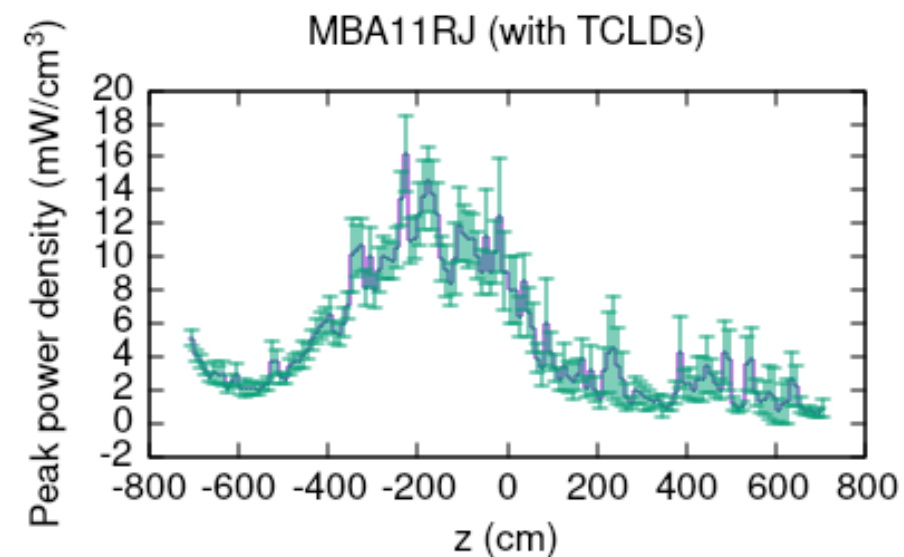
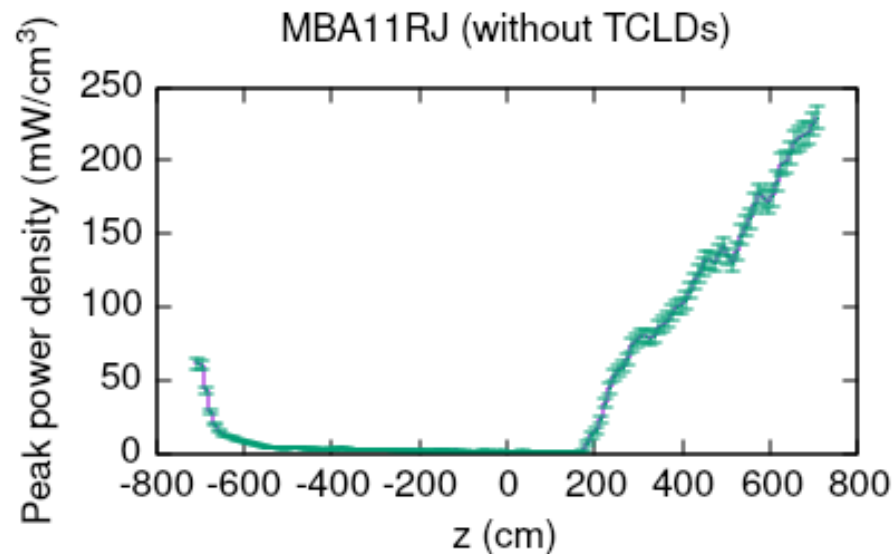


TCLD collimator jaw:

- 1 m active length
- Inermet180 (18 g/cc)



wo/w TCLDs



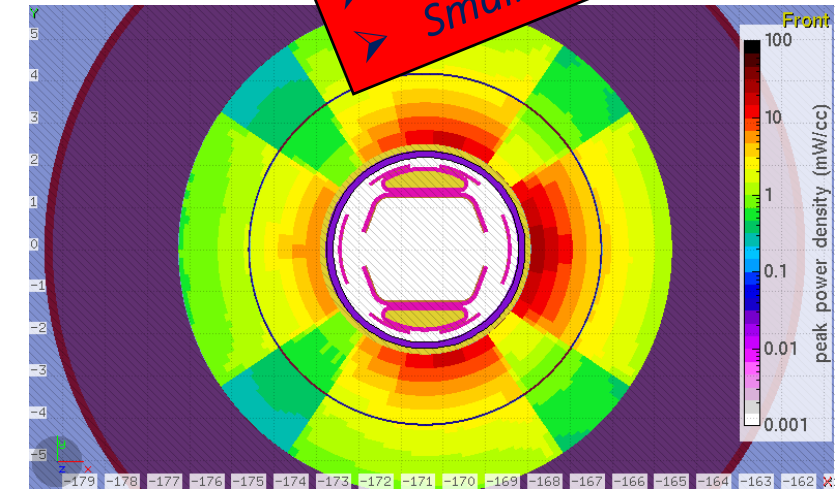
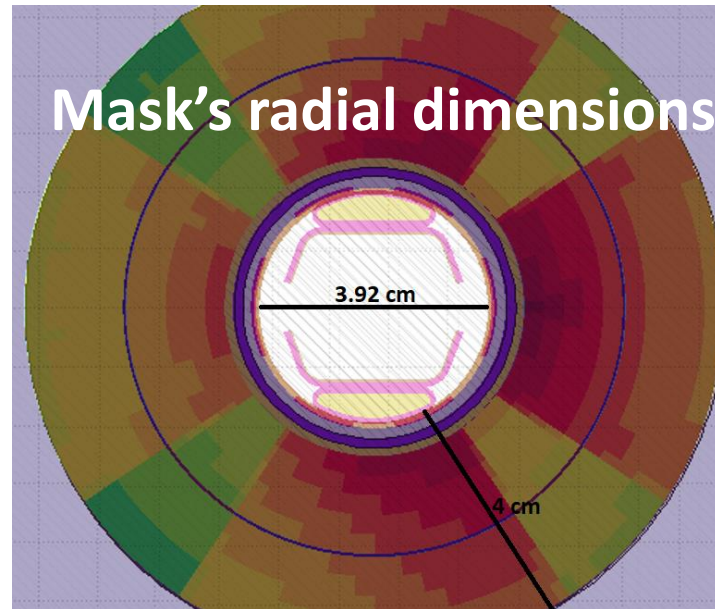
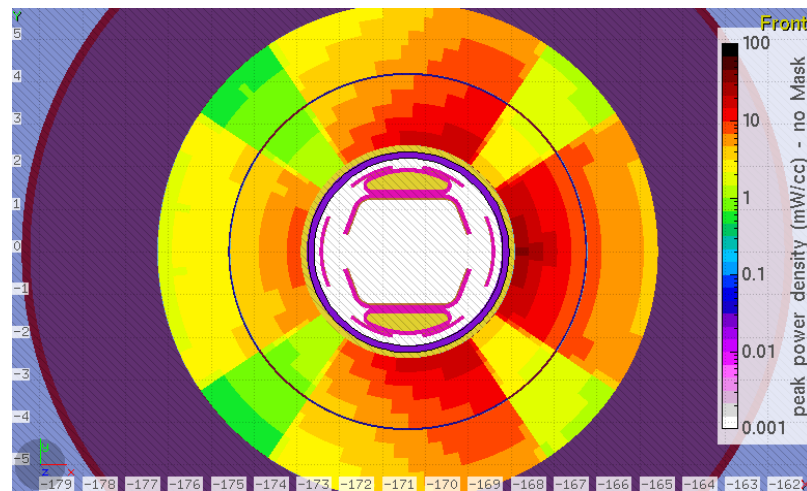
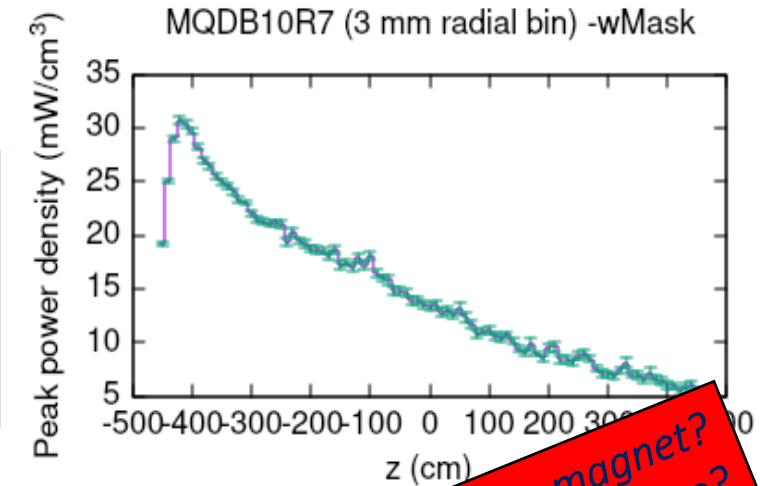
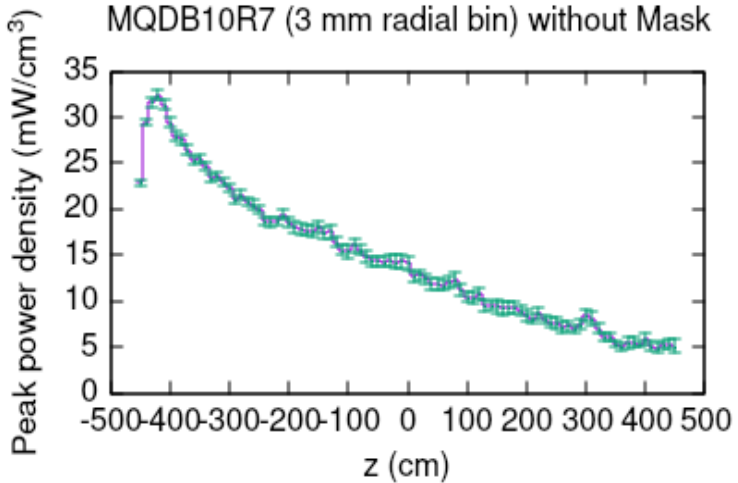
- 12 min BLT scenario
- Radial mesh size: 3mm

with TCLDs; most exposed element (wo/w mask)

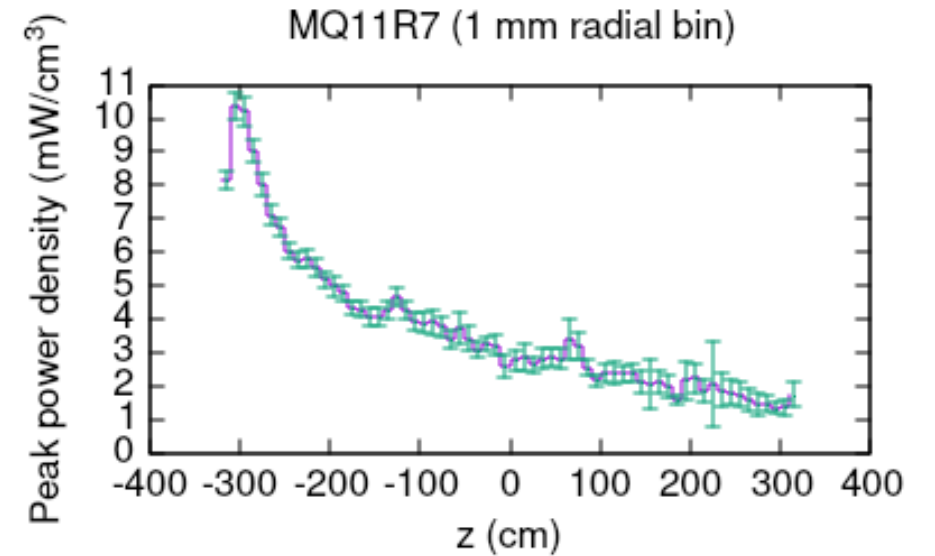
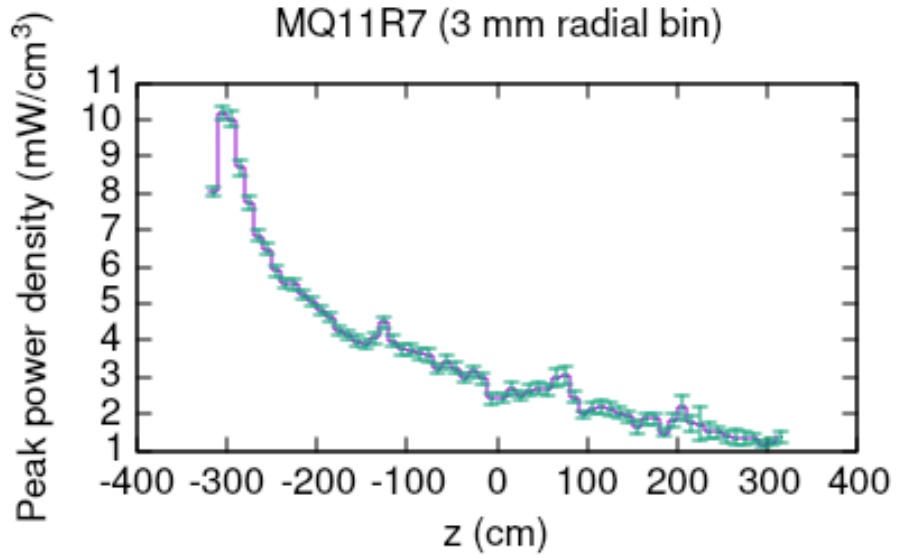
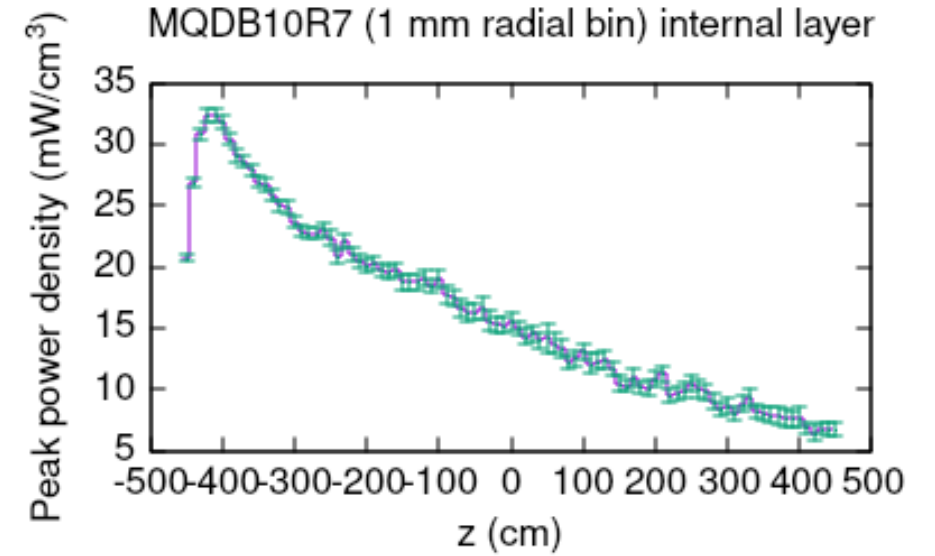
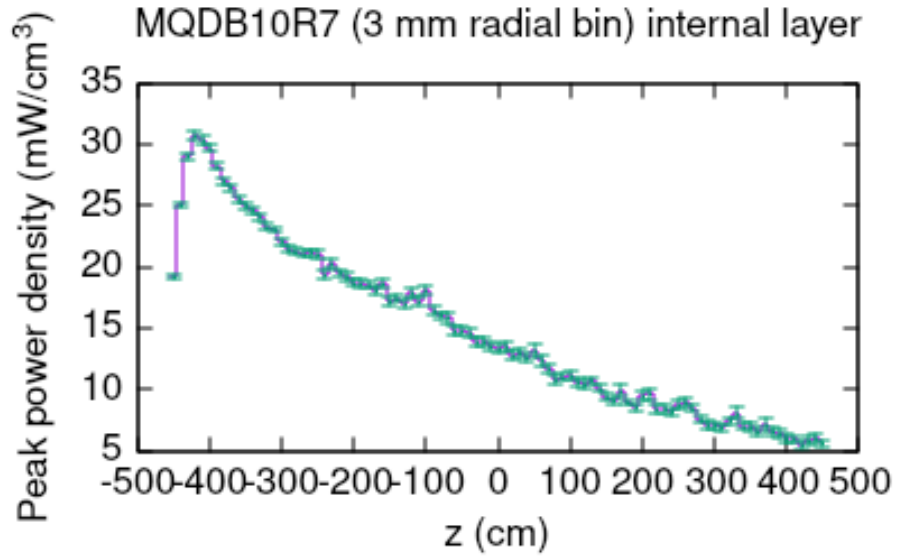
~3m space between
TCLD10 & MQDB10

Inserting a cylindrical mask:

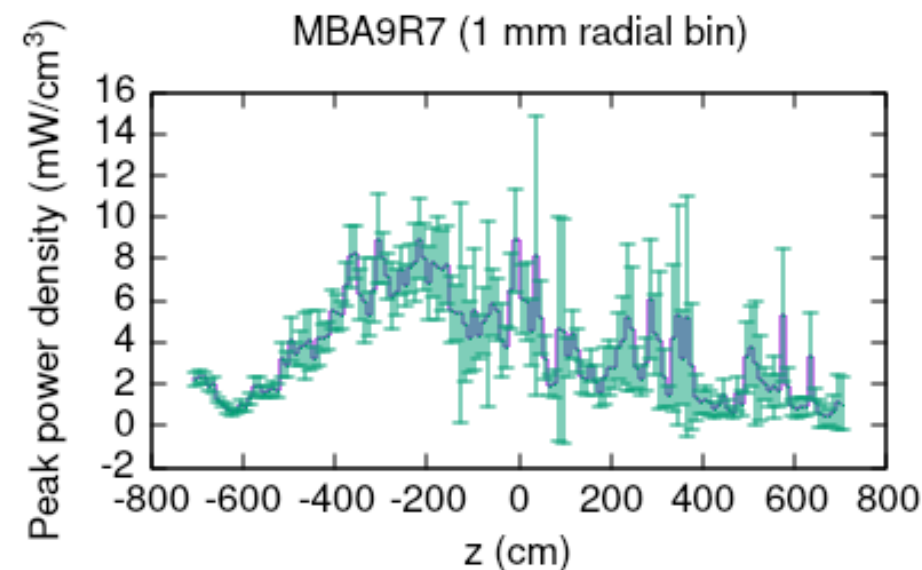
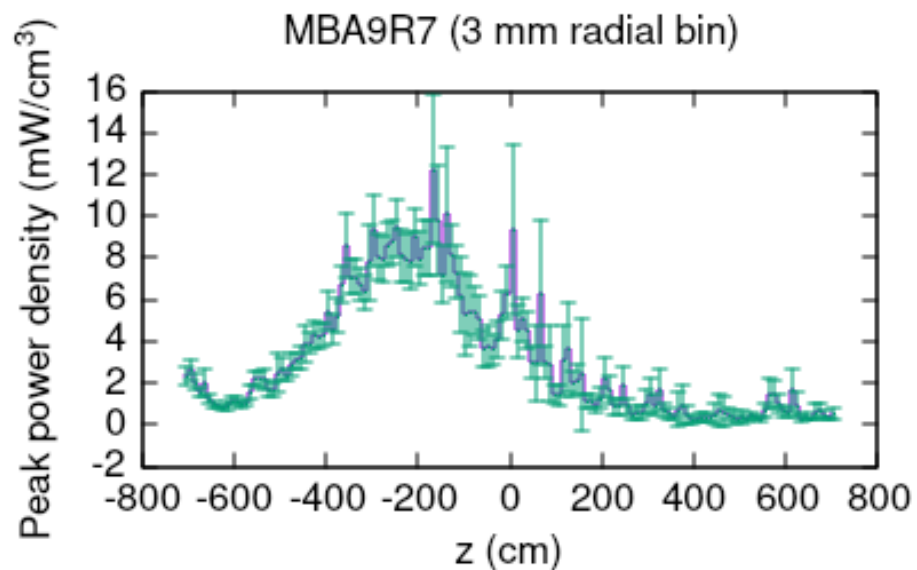
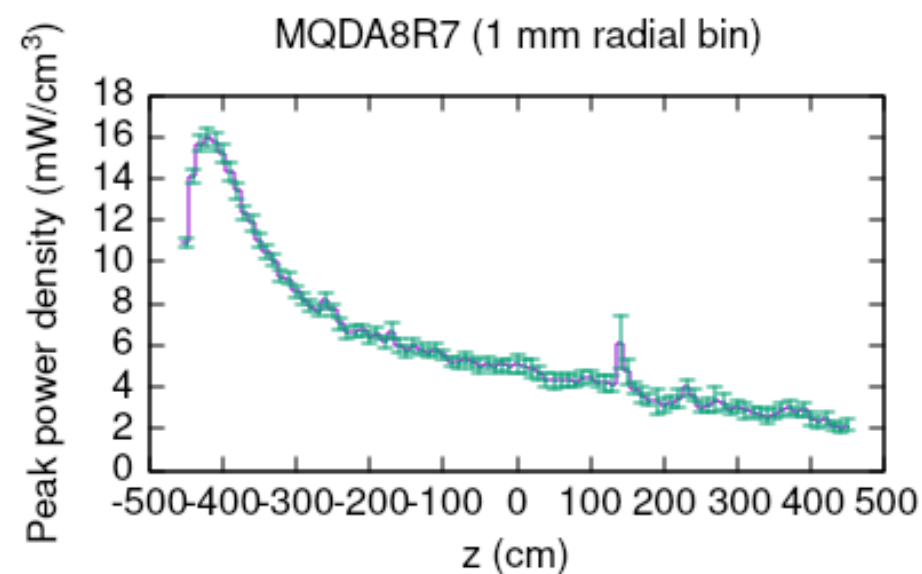
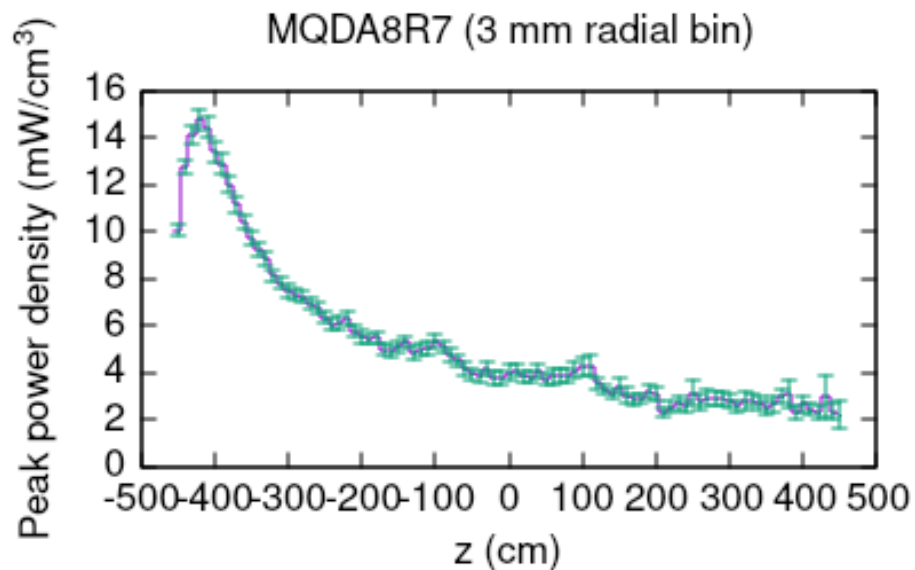
- 1.5 m length
- 85 cm space between MASK & MQDB10
- 1mm copper layer + 3.9cm innermet180



3 mm radial mesh size vs 1 mm



3 mm radial mesh size vs 1 mm



Total power on the TCLD jaws

Collimator Jaws	Total power (kW)
TCLD8 (jaw1 + jaw2)	1.1
TCLD10 (jaw1 + jaw2)	4.1
TCLD11 (jaw1 + jaw2)	0.4
<i>most exposed jaw of</i>	<i>(kW)</i>
<i>TCLD8</i>	<i>0.8</i>
<i>TCLD10</i>	<i>3.0</i>
<i>TCLD11</i>	<i>0.3</i>

Maximum should be at the level of few kW ?

(inermet180 with density of 18 g/cc)

Values are for 12 min BLT

Summary

- ❑ With the TCLD collimators in the FCC-hh, IRJ, Cold section, an order of magnitude reduction in the peak power density - on the cold magnets - was seen
- ❑ Peak power density is below the recent quoted quench limit (70-100 mW/cc) for 16 T dipoles
- ❑ In order to be in the safe margin regarding the most exposed magnet (MQDB10) - located right after the 2nd collimator - a cylindrical mask was introduced
- ❑ 3 mm radial mesh size used to calculate the peak power density on the LHC coils, can be still reliable for higher energy levels (FCC-hh)
- ❑ Maximum total power on a single jaw (~3kW) is slightly higher than the limit which can be carried by a tungsten jaw collimator

**** in LHC, the DS losses are deemed to be underestimated by a factor of 3 in the ideal machine simulation. *"In the results presented here, this is not taken into account"***



Mohammad Varasteh

CERN / EN-STI-BMI

m.varasteh@cern.ch