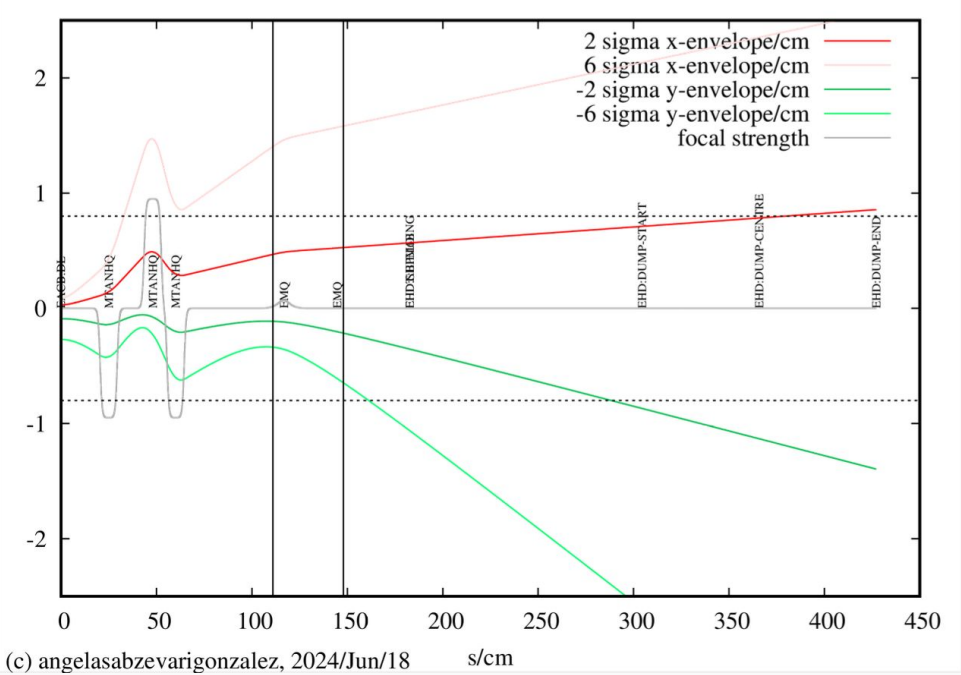
DarkLight Beam Optics

July 22, 2024

1 μm Carbon/Tantalum Target Beam Optics

- Found a set up using the three 0.3 T PMQs that work for all desired energies
- About half also work using the nominal case set up
- All set ups work with no target!!!
- No working set ups for 10-25MeV Ta using the 0.3 T or the nominal PMQs
- Found a working set up for 50MeV Ta using the nominal PMQs

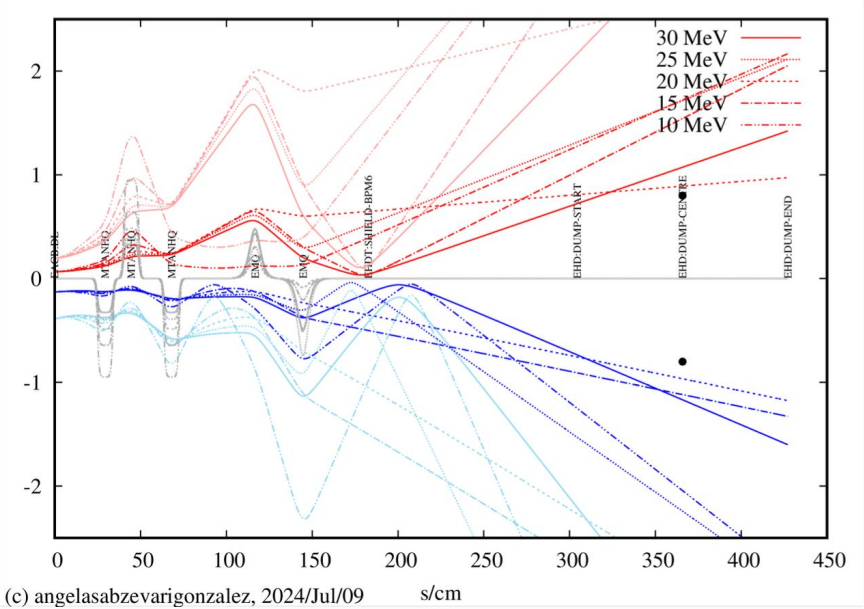
Defining “works”



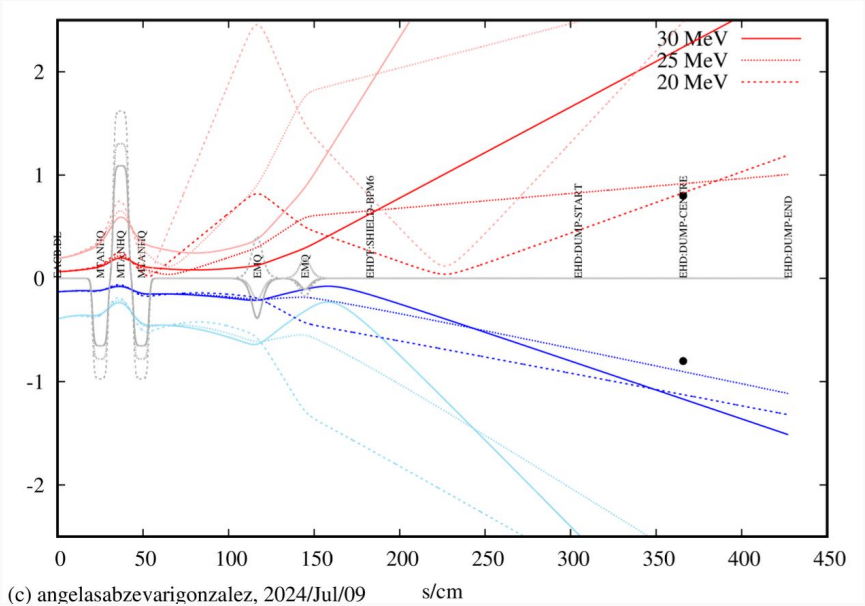
- 6σ envelopes stay inside the 2.5 cm diameter until shielding
- 2σ envelopes needs to be at or outside of dashed lines at dump centre
- EMQs must stay within the vertical black lines

Summary

Scenario	x1 [cm]	x2 [cm]	x3 [cm]	x5 [cm]	x6 [cm]
0.3T PMQs	29.4369	44.6209	68.1042	116.717	144.716
Nominal PMQs	25.0069	37.0207	49.0346	116.716	144.715

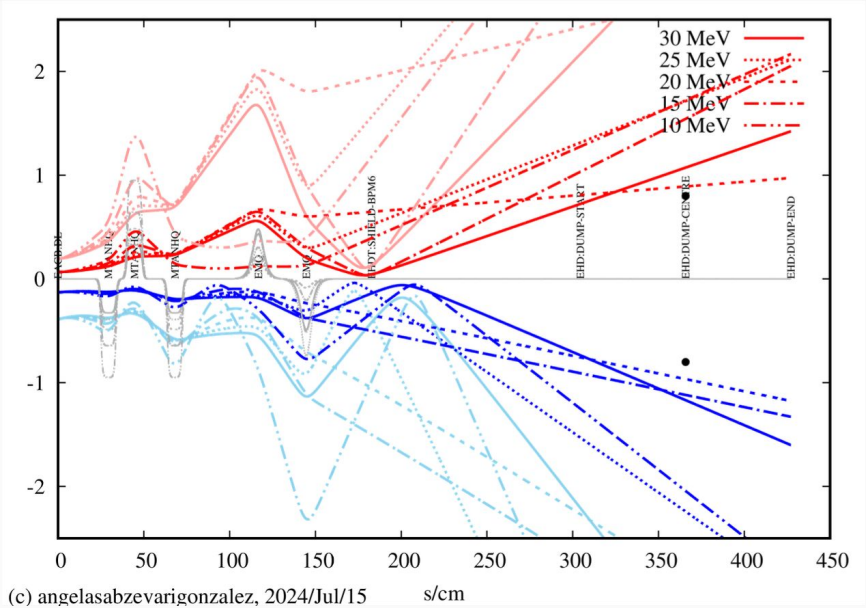


0.3 T PMQS

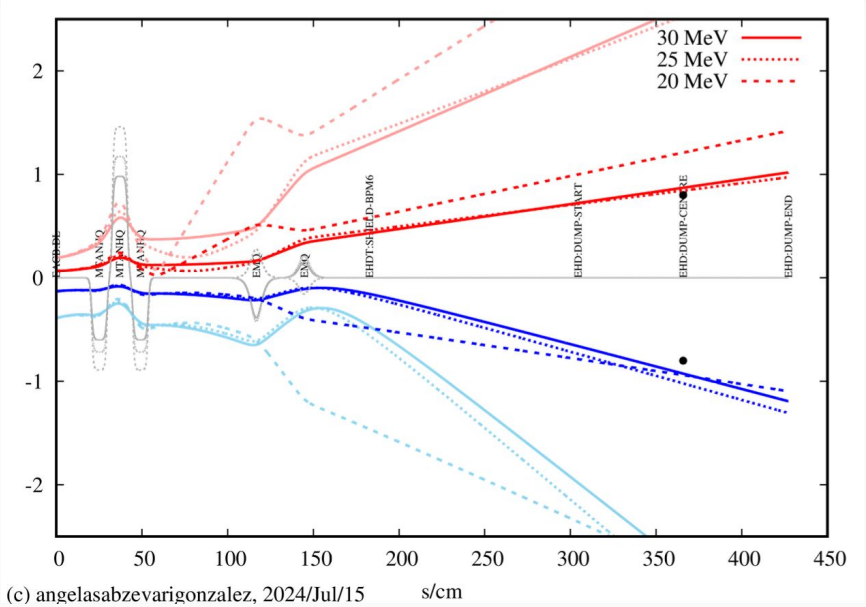


Nominal PMQs

1 μm Carbon Results

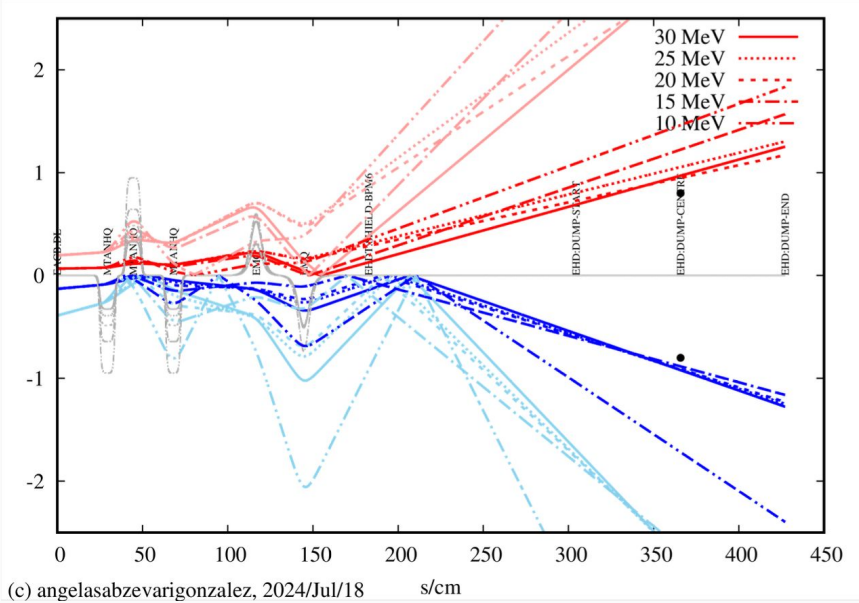


0.3 T PMQS

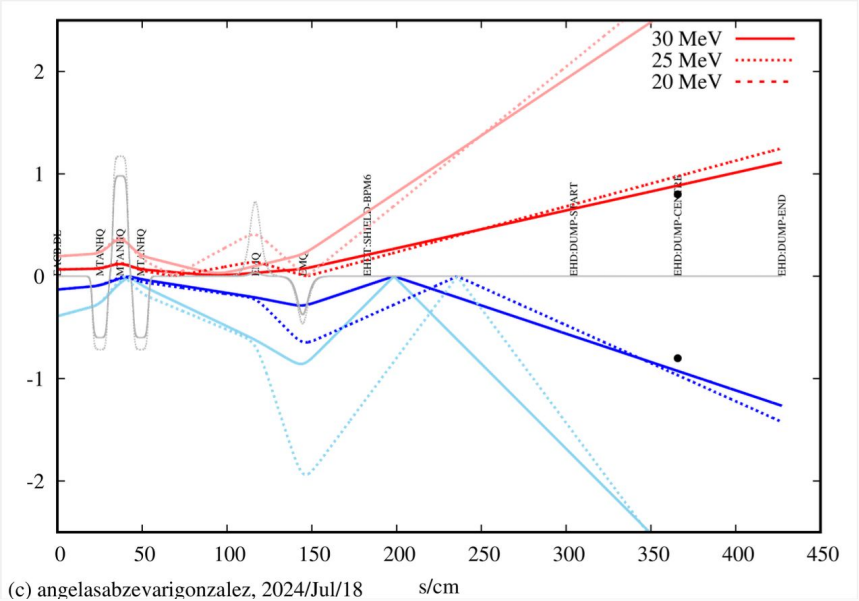


Nominal PMQs

1 μm Carbon No Target Results

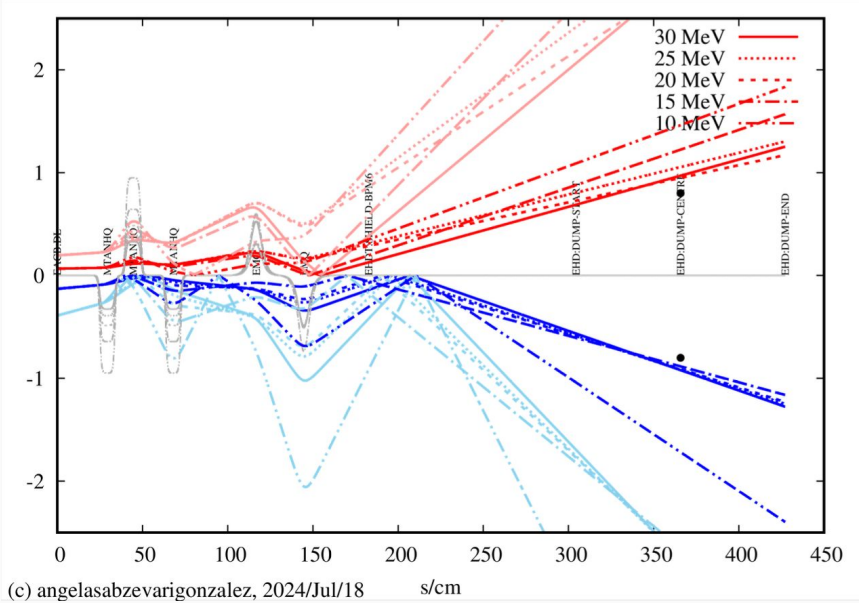


0.3 T PMQS

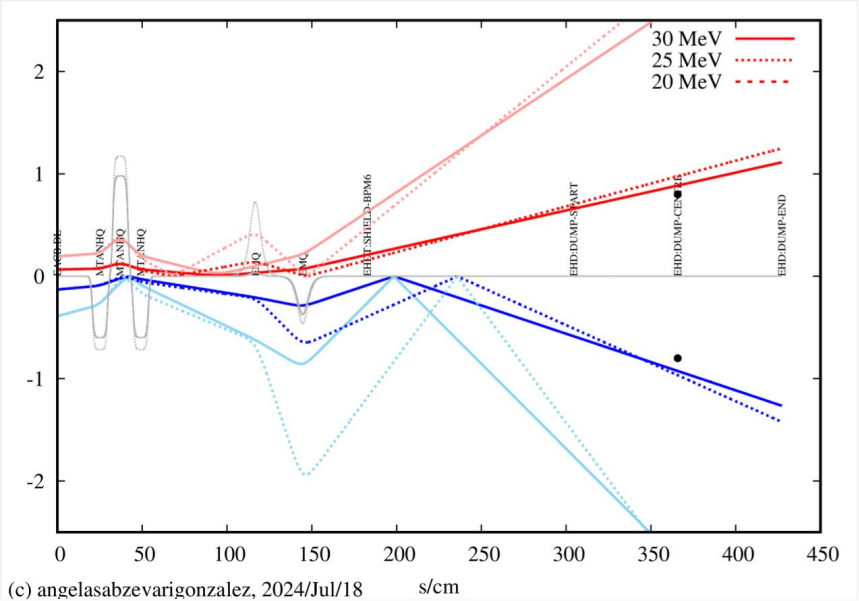


Nominal PMQs

1 μm Carbon No Target Results

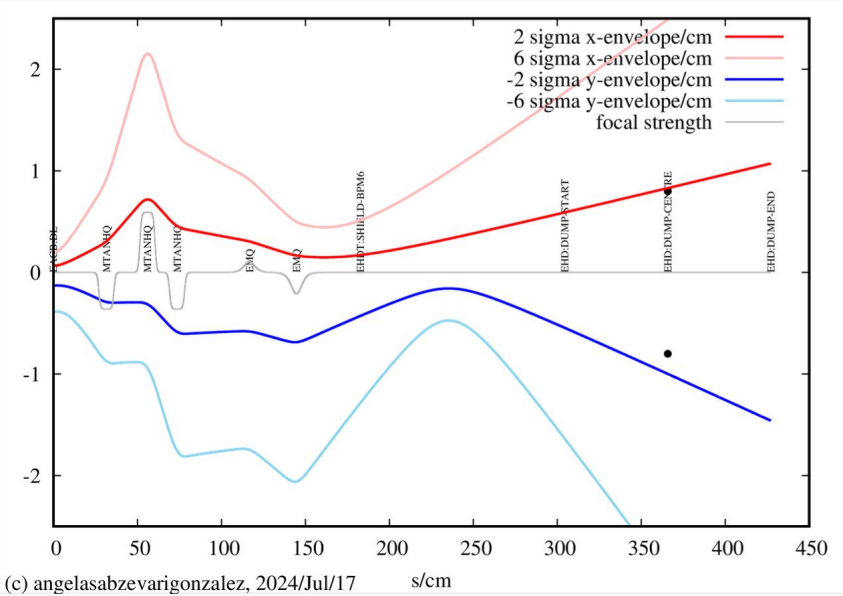


0.3 T PMQS

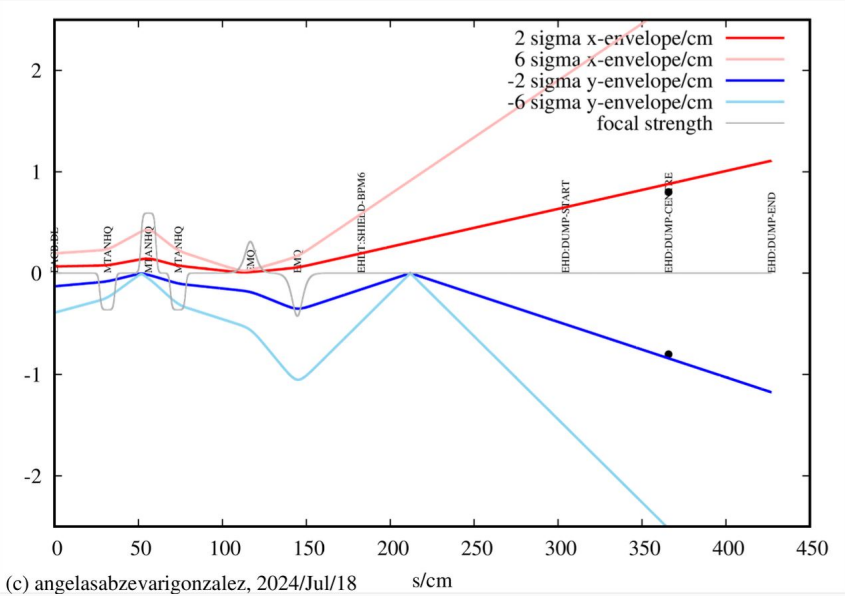


Nominal PMQs

1 μm Tantalum at 50 MeV Results

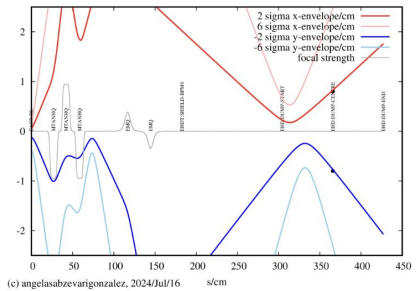


With Target

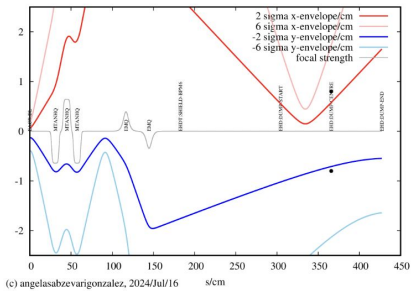


Without Target

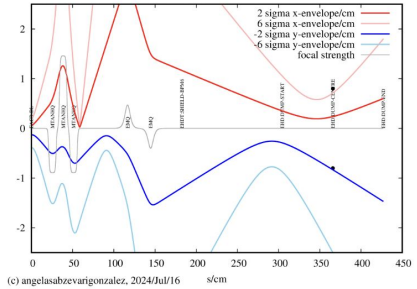
1 μm Tantalum Fails



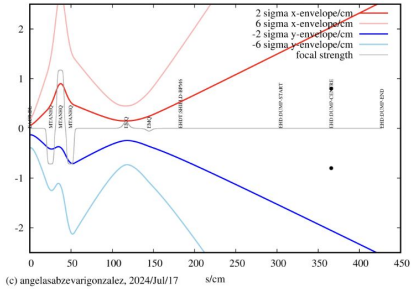
(q) The best I could find for 10 MeV Ta. (code values: -0.3, 0.3, -0.3, 0.11, -0.10, 1.89, 6.22, 7.41)



(r) The best I could find for 15 MeV Ta. (code values: -0.3, 0.3, -0.3, 0.17, -0.15, 6.0, 4.9, 3.5)



(s) The best I could find for 15 MeV Ta. (code values: -0.55, 0.9, -0.55, 0.27, -0.23, 0.56, 4.0, 3.6)



(t) The best I could find for 25 MeV Ta. (code values: -0.55, 0.9, -0.55, 0.410, -0.04, 0.15, 3.0, 3.0)

- Tried optimising 10-25 MeV as many times as I could but nothing seems to work with the magnets we have available (as expected)

Summary Table

Energy [MeV]	Material	0.3T PMQs	Nominal PMQs
10	C	✓	✗
10	Ta	✗	✗
15	C	✓	✗
15	Ta	✗	✗
20	C	✓	✓
20	Ta	✗	✗
25	C	✓	✓
25	Ta	✗	✗
30	C	✓	✓
30	Ta	✗	✓
50	Ta	✗	✓

- Working on getting the 2μ Carbon scattering angles