Status of Research program with 26 simulations to be done in June.

“In order to **evaluate the CPS model** that you propose for KLF, I would like to see the results of simulations with various test configurations. For each configuration I would like to have the files for the **power depositions (~4+ weeks, “fast” model, mesh-statistics)** to estimate the **temperatures** just in the absorber, and I also would like you to present the **prompt and residual dose** environment in the **tagger hall** for **each of them (~13 weeks of calculations, “slow” model)**. The test configurations would be the following:”

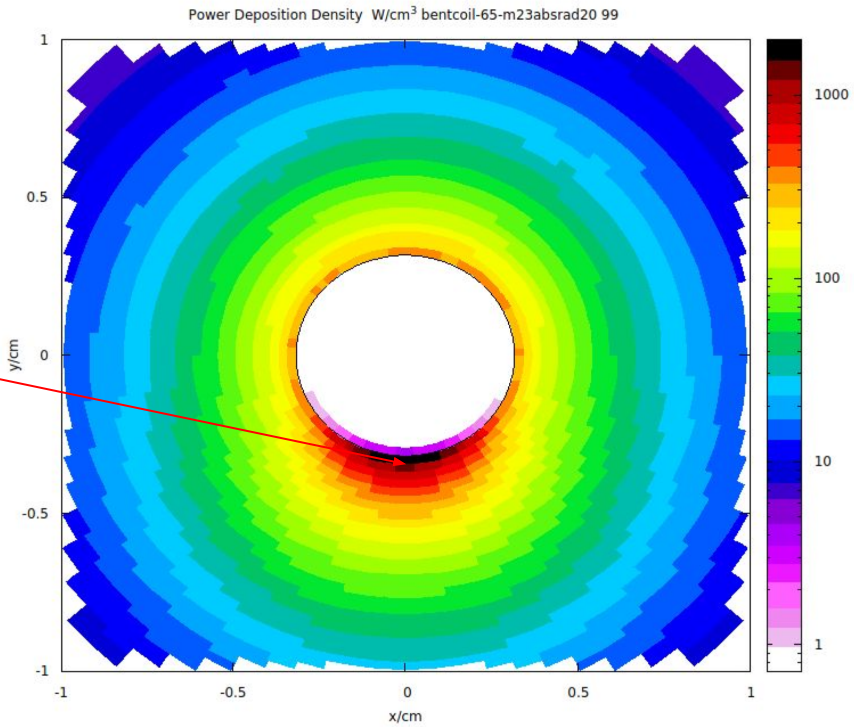
1. Nominal configuration with FWHM=2.5mm in both x and y of the gaussian beam, and 10% radiator, and nominal magnetic field.
2. Beam transverse FWHM=0.8mm in both x and y direction. (?) Temperature is obviously higher.
3. 90% nominal magnetic field. (!) **Linear dependence-nominal conf. as a 2nd point**- of max energy deposition => ±10% change in max. temperature)
4. 110% nominal magnetic field (?) Linear dependence of max energy deposition => ±10% change in max. temperature
5. +1mm parallel shift in y for the beam transverse position. (!) Linear dependence. Criterion for a beam interlock system?
6. -1mm parallel shift in y for the beam transverse position.
7. Either +1mm or -1mm shift in x for the beam transverse position. (!) Not prevented by a beam trip system?
8. +0.5 mrad angle with respect to the nominal direction in Y (either just before or after the corrector magnet is fine). (?) similar to +25% B-field change.
9. -0.5 mrad angle with respect to the nominal direction in Y (either just before or after the corrector magnet is fine). (?) similar to - 25% B-field change.
10. Either +0.5 mrad or -0.5 mrad angle with respect to the nominal direction in X (either just before or after the corrector magnet is fine).(!)
11. Beam transverse FWHM=3.5mm in both x and y. (?) obviously lower temperature, (!) higher background at the CPSentry
12. Beam halo as a flat background distribution under the main gaussian peak of the beam extending radially 0.5cm from the center of the beam at the relative level of 10^-4 with respect to the gaussian peak height with FWHM=2.5mm in both x and y . (!)
13. 20% radiation length for the copper radiator before CPS. (!) (Lower temperature, higher photon beam intensity, same background).

- **13 simulations for the Temperature estimates are done with 20 s/primary.**
- **Background and Activation simulation rate is of 100 s/primary.**

Power Deposition map around the beam channel at 90<z/cm<160

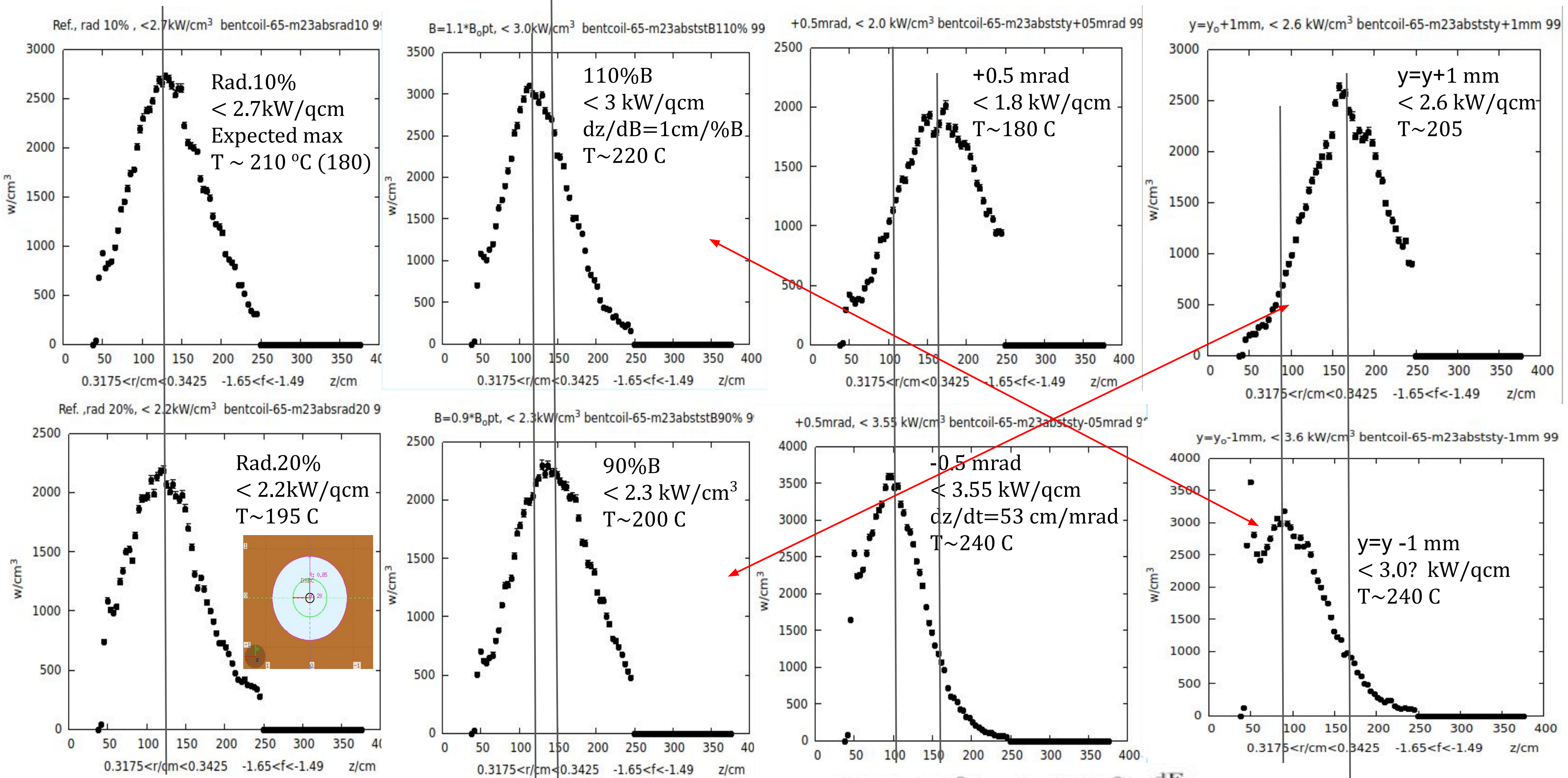
2 Bins selected to estimate maximal dP/dV(z) from z-dependence.

$\Delta\varphi=1/40$, $\Delta r=0.025$ cm.



- dP/dV(z) is shown at the next two slides

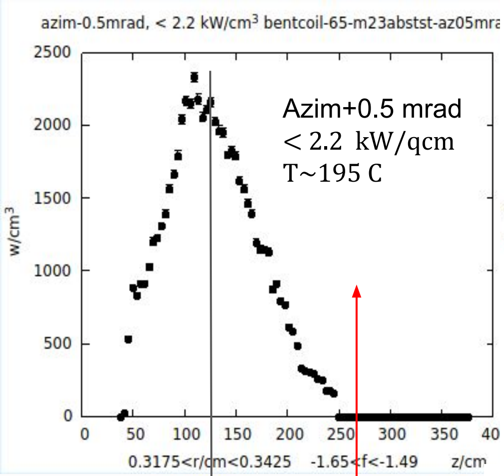
Power deposition in Hot Spot for 8 (13) configurations. B=80%B_{nom}, $\Delta\varphi=1/40$, $\Delta r=0.025$ cm.

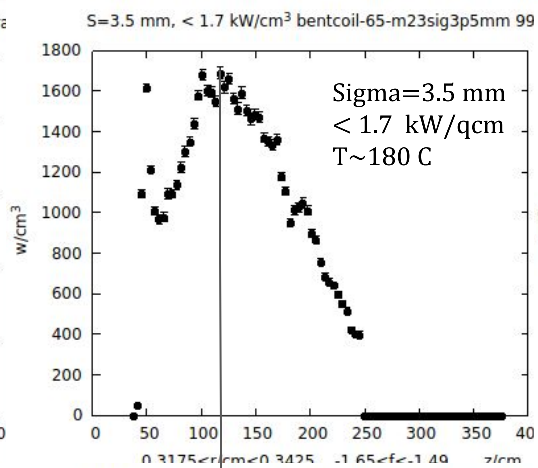


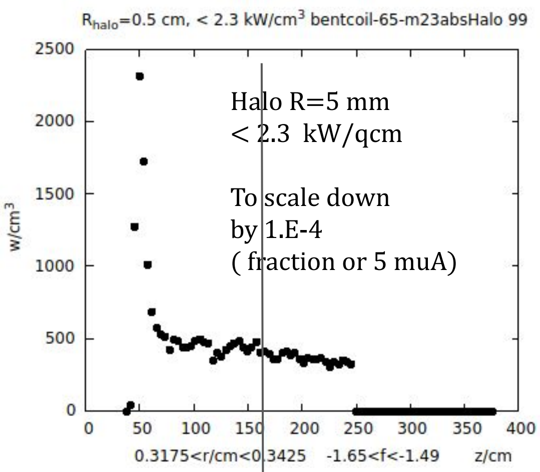
$$T(0) = T(\tfrac{a}{2}) + (4\kappa b)^{-1}(\tfrac{a}{2})\frac{dE}{dz\,dt} \qquad (10)$$

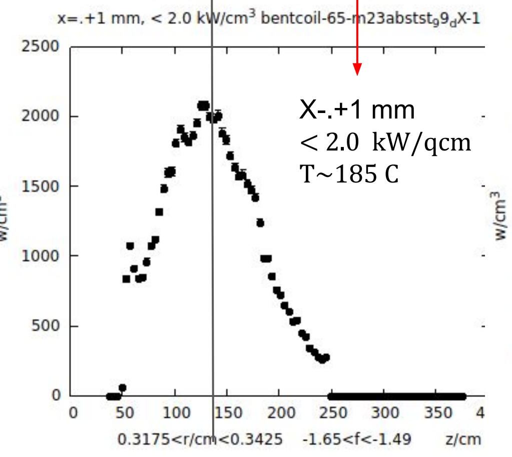
$$\Rightarrow \quad T(0) = 121 + 77 \approx 200^{\circ}C\,,$$

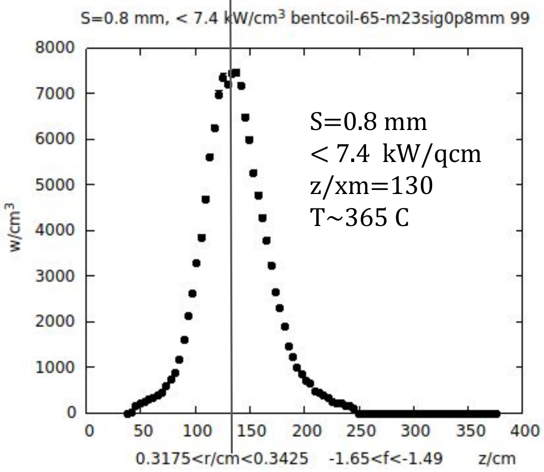
Power deposition in Absorber Hot Spot for 5 (13) beam configurations. $\Delta\phi=1/40$, $\Delta r=0.025$ cm

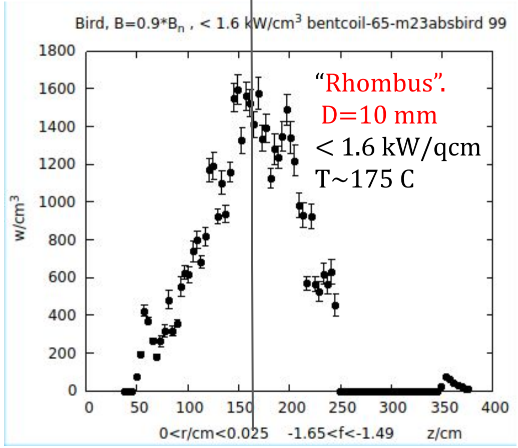












Research program for the background simulations for June (optimized?)

- Background map is defined by energy deposition profile dE/dz.
- 0.5 mrad e-beam walk translate to 5.E-4*7000 cm=3.5 cm of photon beam walk at KPT. Looks like too much (10 times?) for a photon beam interlock. Seems may be excluded(?).

1. Reference - 4 days (with 12 clones)
2. Halo r<0.5 cm - 4 days
3. y=y-1 High radiation upstream CPS; dE/dz is similar to 110%B -4 days.
4. y=y+1 High radiation downstream CPS?; dE/dz is similar to 90%B - 4 days.

- Seems may be done by June 22 .

Comments to the video. What is the wedge effect?

1) Consider e-**beam as a cylinder diameter D** with uniform density; direction $\mathbf{n_b}=(0,\sin(\alpha),\cos(\alpha))$, where α pitch angle to the beam axis.

2) For a **squared or wedge-like** channels the **hot spot is a cross section of a cylinder with a plane**.

Plane orientations: $\mathbf{n_1}=(0,1,0)$ -for **squared** channel, or $\mathbf{n_2}=(\pm\cos(\varphi),\sin(\varphi),0)$ - for 2 **wedge** planes obtained as $\pm\varphi$ - rotation of yz-plane around z-axis.

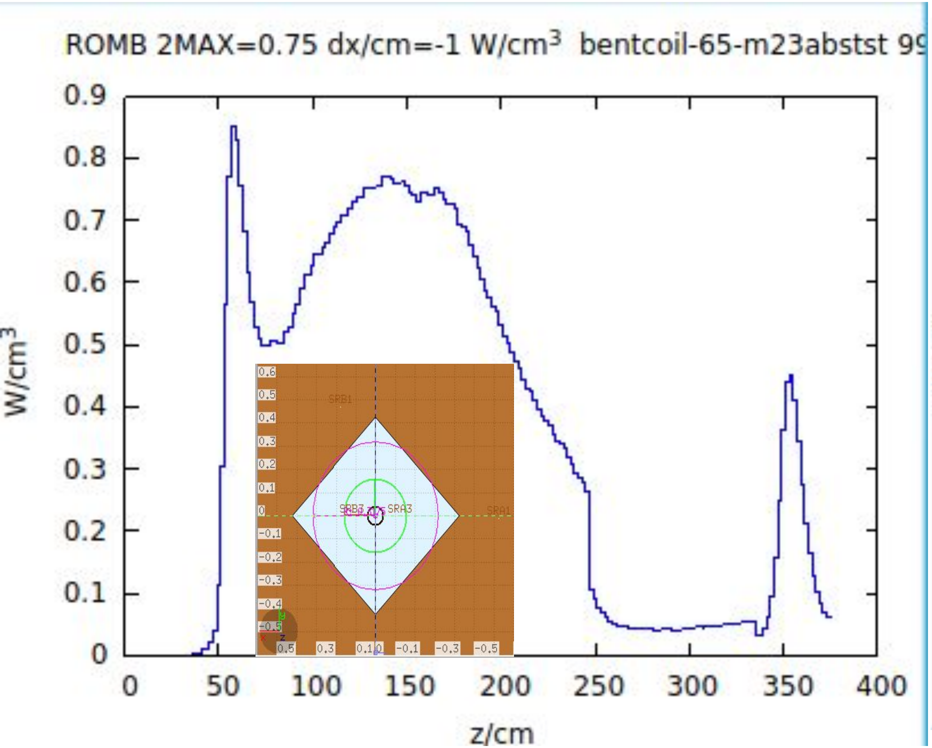
Impact angle is determined by $(\mathbf{n_b},\mathbf{n_1})=\sin(\alpha)$ or $(\mathbf{n_b},\mathbf{n_2})=\sin(\alpha)\sin(\varphi)=\sin(\vartheta)$ - pitch to wedge plane.

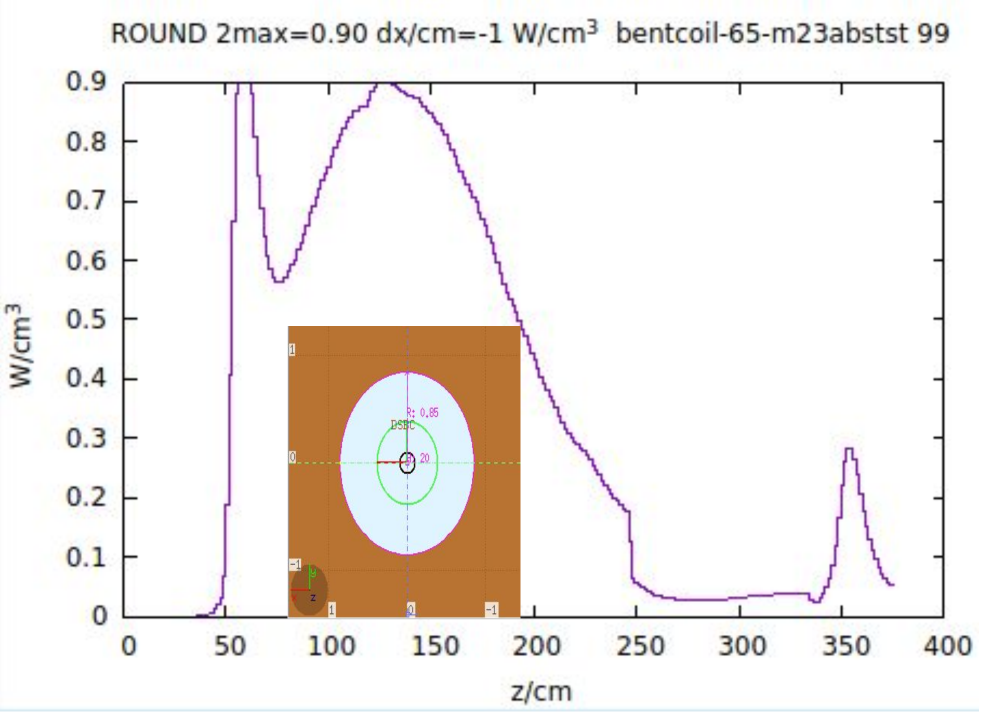
3) But in both cases the **intersection is an ellipse** with the area $\mathbf{S=\pi D\times L}$, where **L** - ellipse large axis.

4) Pitch angle $\vartheta\sim D/L$.

5) Maximum **L is constrained by the length** of the **beam channel** ($L<L_c\sim2$ m), or the **wedge** ($L<L_w\sim0.5$ m).

- **Therefore max $dP/dS\propto\vartheta\propto L^{-1}$ for the wedge is $L_c/L_w=4$ times higher.**





- Effect of rotated squared channel is of 20% to lower maximum energy deposition!
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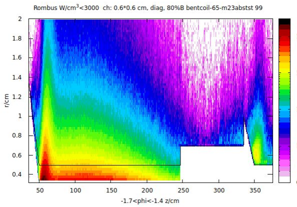
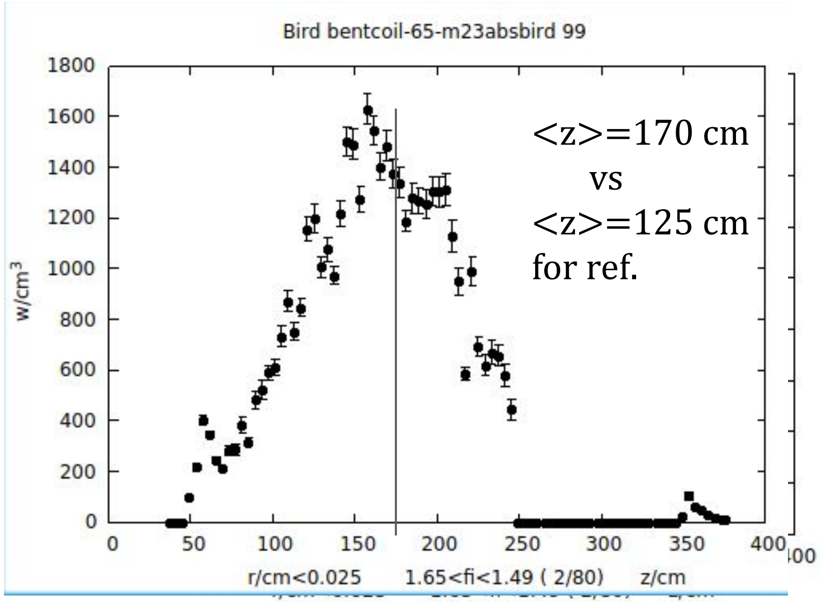
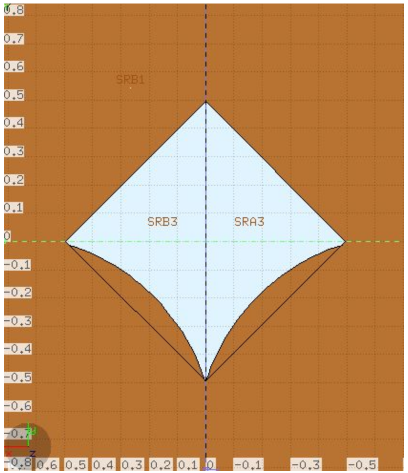
- Advantage: transverse dimensions 1 cm $\times$1 cm !!!



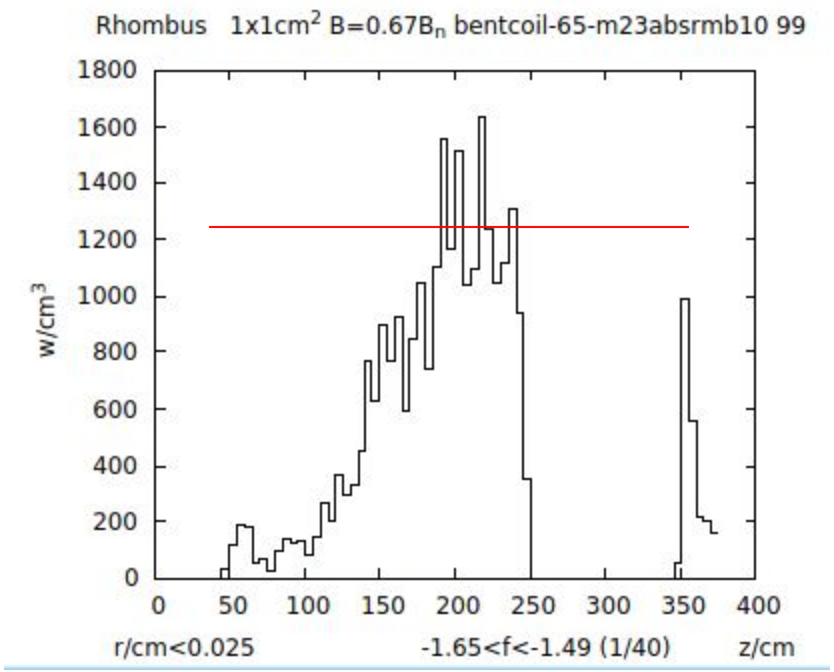
Optimisation of Tim Whitlatch (TW) design at 90% nominal B-field. Absorber Channel "stingray" D=10 mm. Power Deposition.

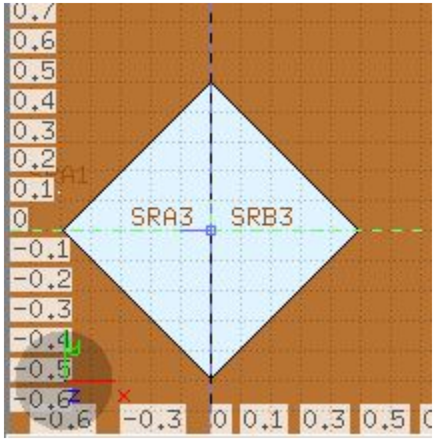




- Maximum power deposition 1.6 kw/cm^3 ; r/cm<0.025 ; -0.0125<φ<0.0125 (1/80).
- Lower temperature –> higher photon beam.
- Allows standard photon beam walk in x or y within 1 cm.
- Equivalent to lower magnetic field.

Optimisation of Tim Whitlatch design at 70% B-field.
Absorber Channel rhombus D=10 mm. Power Deposition.





- Maximum power deposition is of 1.4 kw/cm^3 r/cm<0.025 -0.0125<fi<0.0125
- B to be increased up to 0.90% of nominal magnet field.