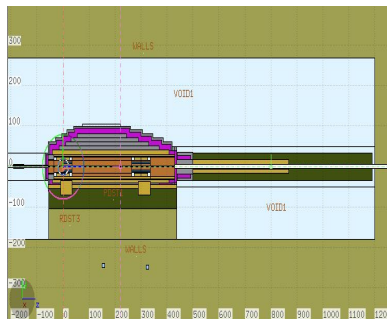


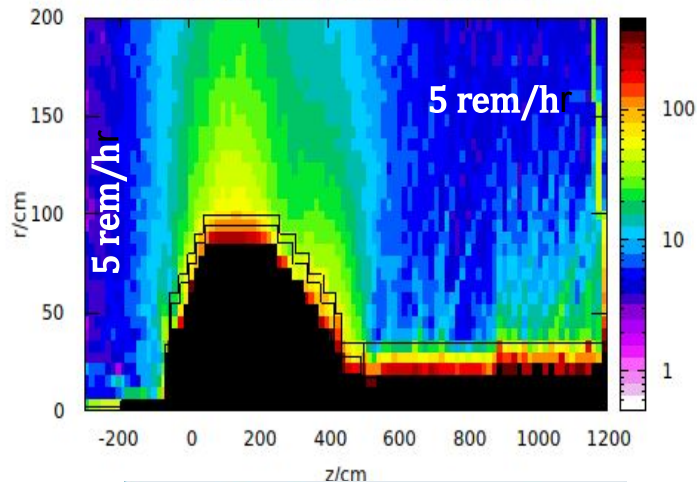
# CPS meeting 06/26/23

1. Shield optimization and Neutron fluence across the CPS .
2. Prompt Dose Equivalent and Activation around CPS .
3. PDE and Activation around Beam Line.
4. Round and “Stingray” channels.
5. Coil lifetime.

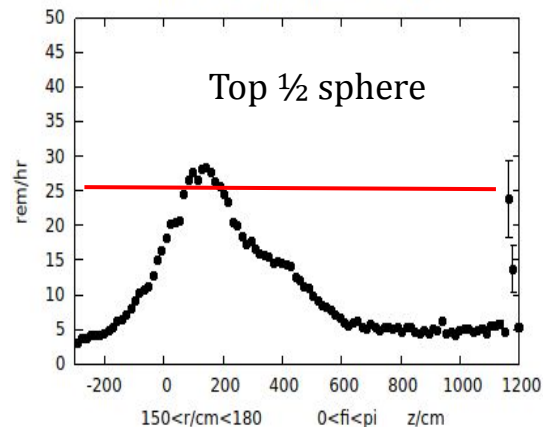
# Prompt Dose Eq. around CPS and B+Concr. beam line shielding.



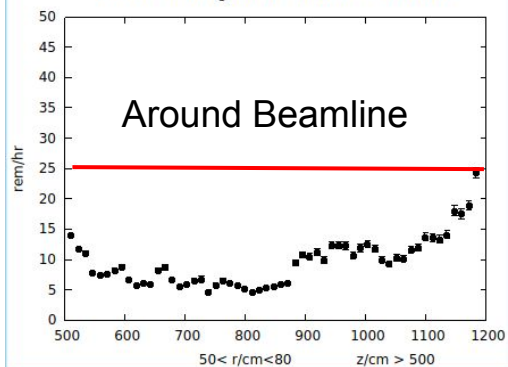
PDE top 1/2 sph rem/hr bentcoil-65-m23ref7 91



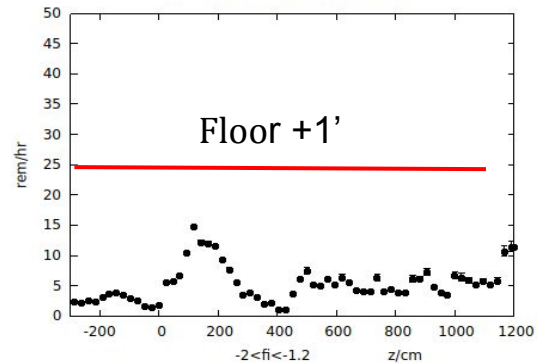
PDE rem/hr bentcoil-65-m23ref7 91



PDE around PrMag/bemline bentcoil-65-m23ref7 91



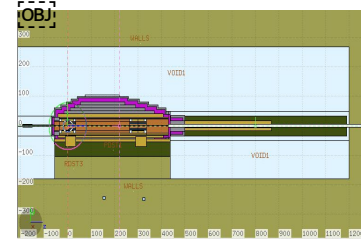
PDE floor bentcoil-65-m23ref7 91



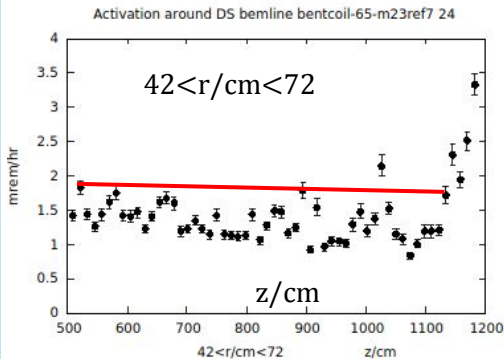
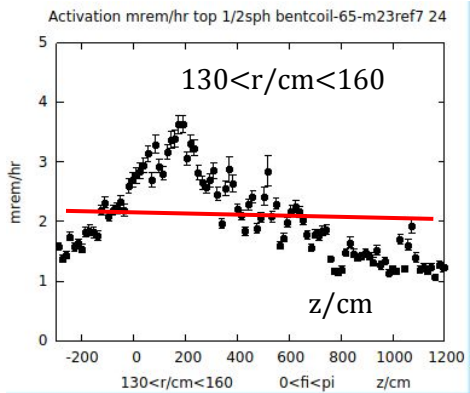
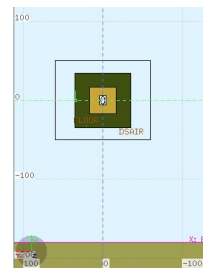
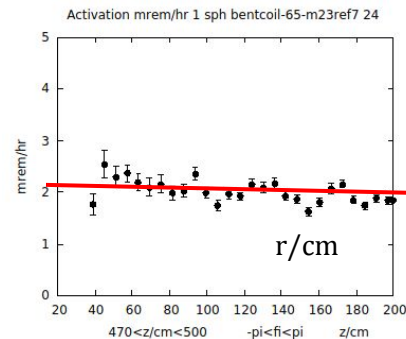
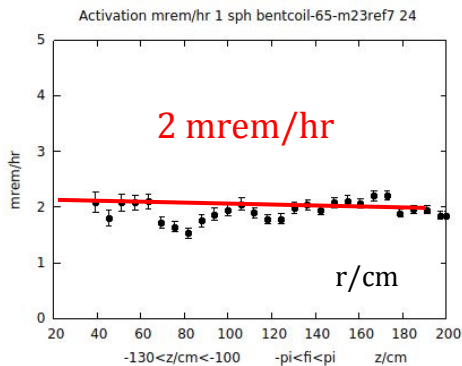
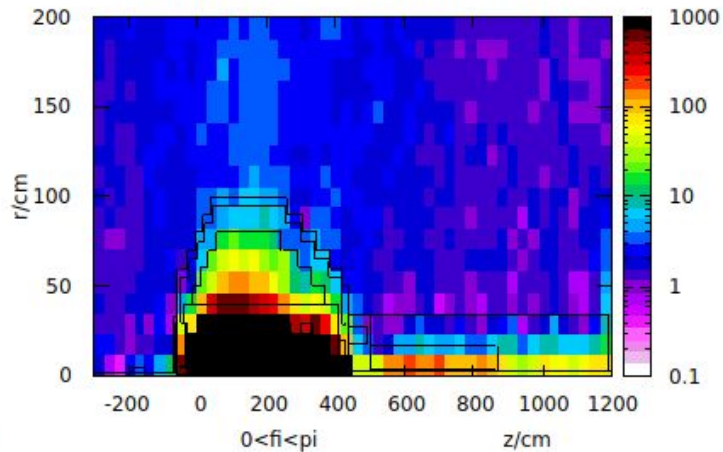
- PDE at floor level is below 15 mrem/hr



# Activation 1000+1 hr. CPS with beam line shielding.

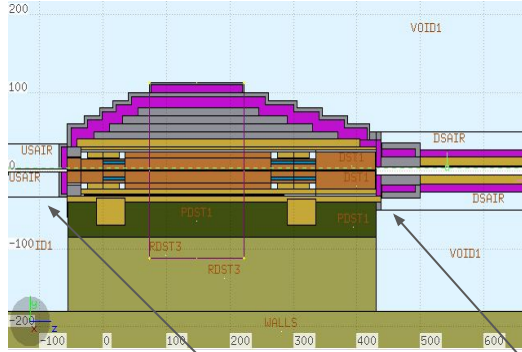


PDE rem/hr N=36.E-5 bentcoil-65-m23ref7 24

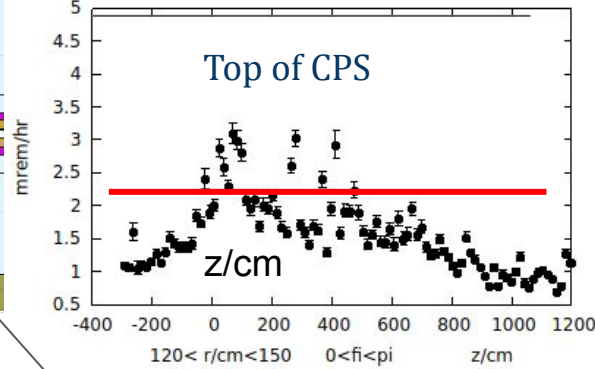


- Activation is below 3.5 mrem/hr

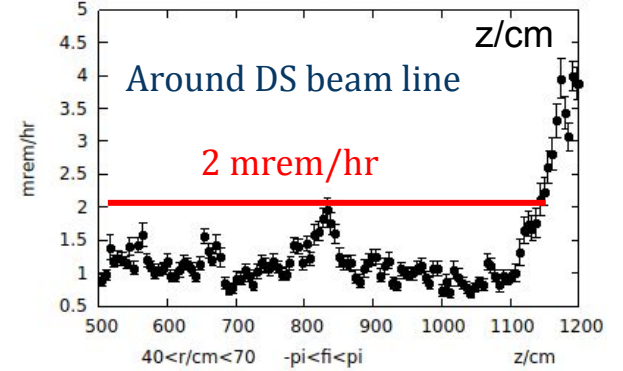
# Activation.CPS with extra layer of BPE around CPS (R=112.5 cm). BPE around the beam line.



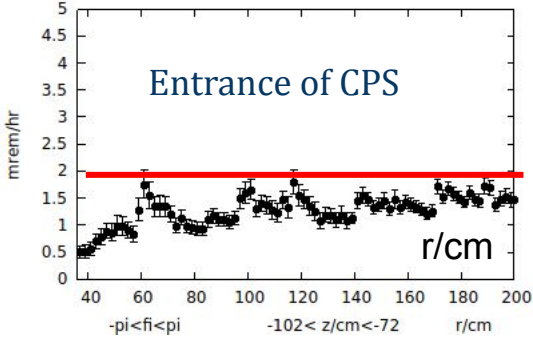
Activation top 1/2 sphere of CPS bentcoil-65-m23ref8 24



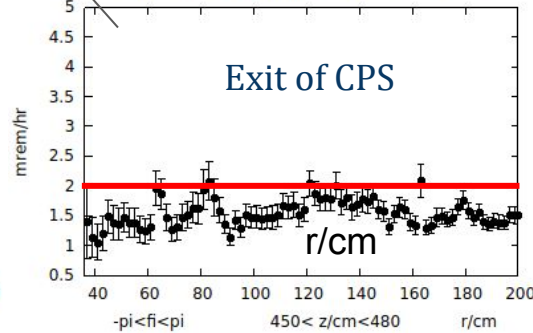
Activatio around DS beam line bentcoil-65-m23ref8 24



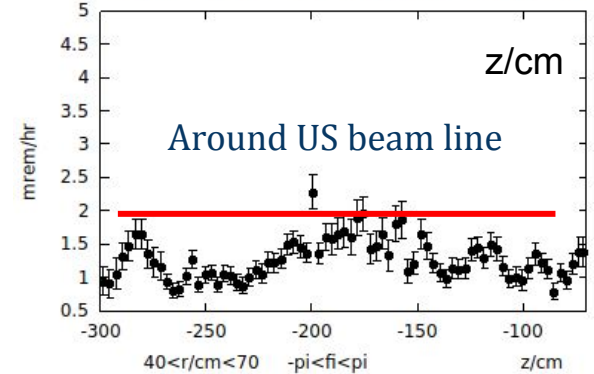
Activation US r-profile bentcoil-65-m23ref8 24



Activation DS r-profile bentcoil-65-m23ref8 24

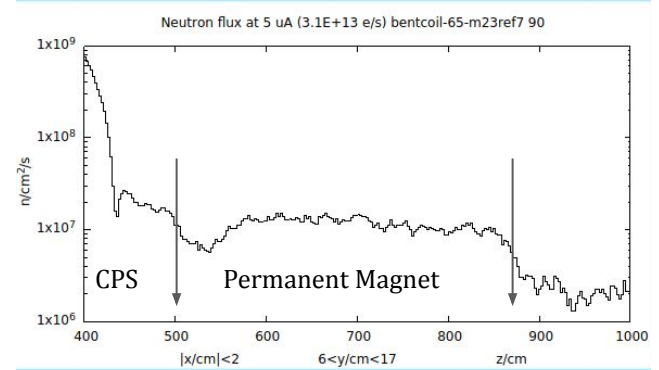
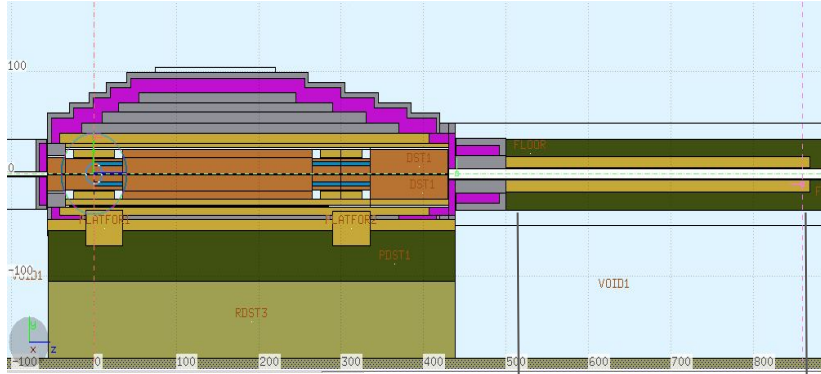


Activatio around US beam line bentcoil-65-m23ref8 24



- Activation around CPS and beamline is below 2.5 mrem/hr !

Neutron flux inside CPS ( $z/\text{cm} < 440$ ) is more than 100 times higher and continue to climb!



### Outside CPS

$$LT = 2E16 / 2.E7$$

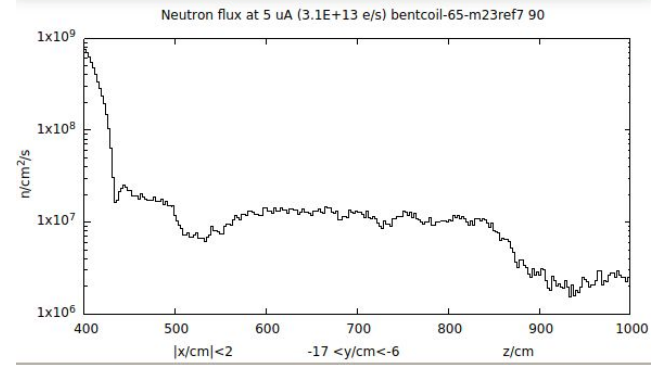
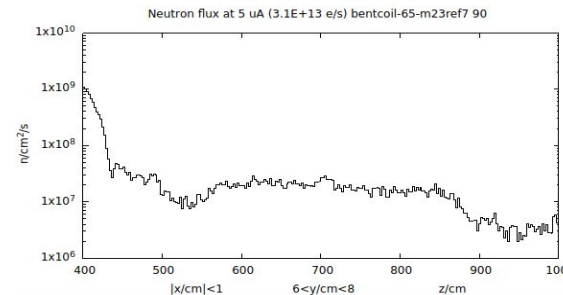
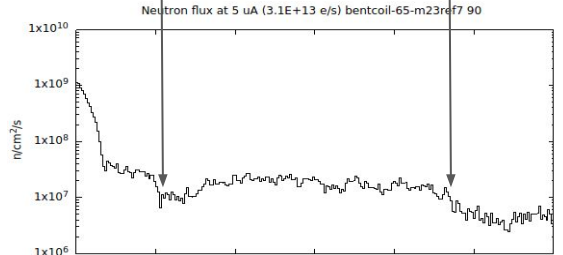
$$= 1.E9 \text{ s} =$$

$$= 30 \text{ years,}$$

### Inside CPS

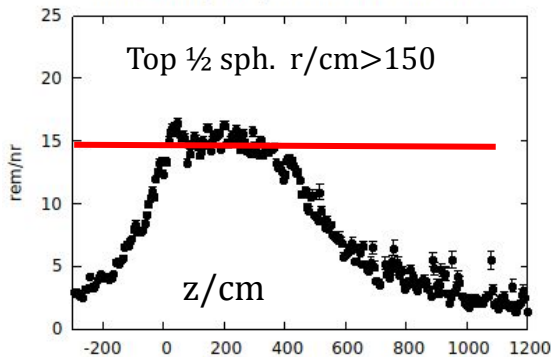
$$LT < 2/E16 / 1.E+9 =$$

$$2.E7 \text{ s} = 0.5 \text{ year.}$$

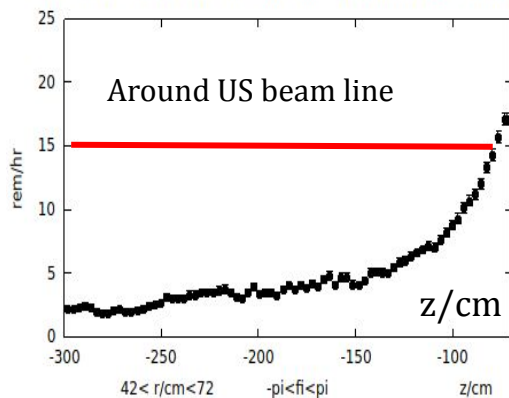


# PDE. CPS with extra layer of BPE around CPS (R=112.5 cm). BPE around the beam line.

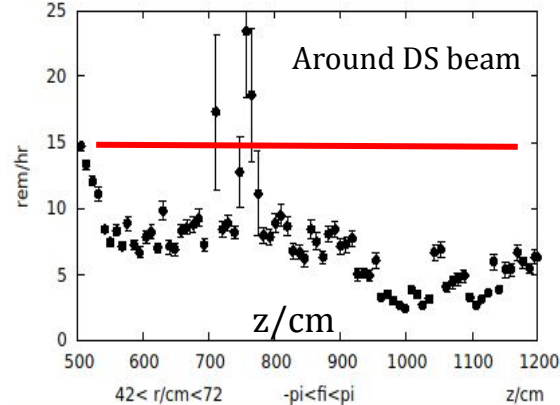
PDE rem/hr top 1/2 sphere bentcoil-65-m23ref8 91



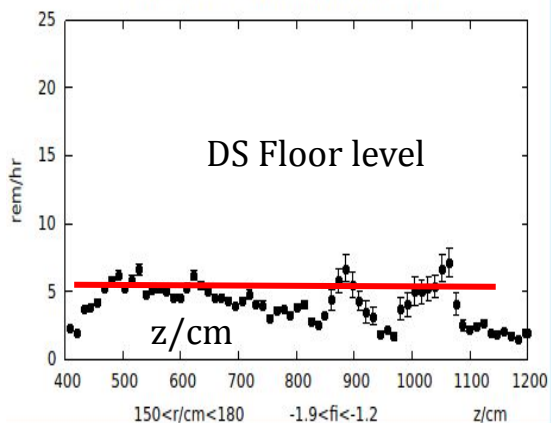
PDE rem/hr around US beamline N=11.25E+6 rbentcoil-65-m23ref8 91



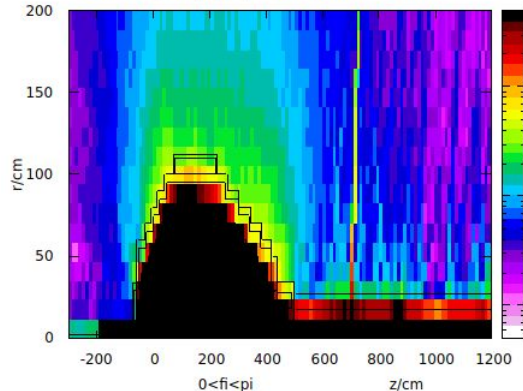
PDE rem/hr around beamline N=11.25E+6 rbentcoil-65-m23ref8 91



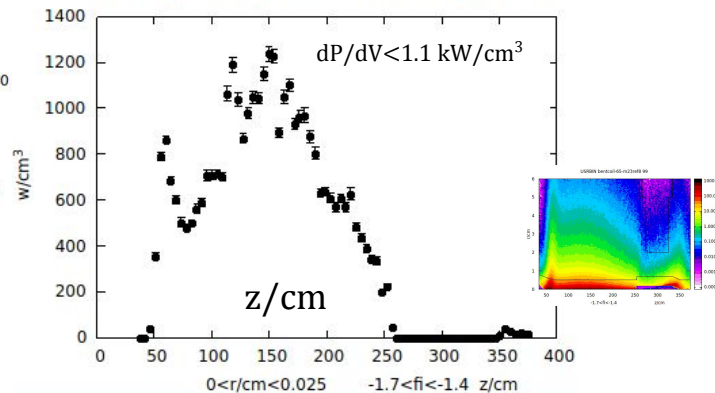
PDE rem/hr DS floor bentcoil-65-m23ref8 91



PDE rem/hr top 1/2 sphere bentcoil-65-m23ref8 91



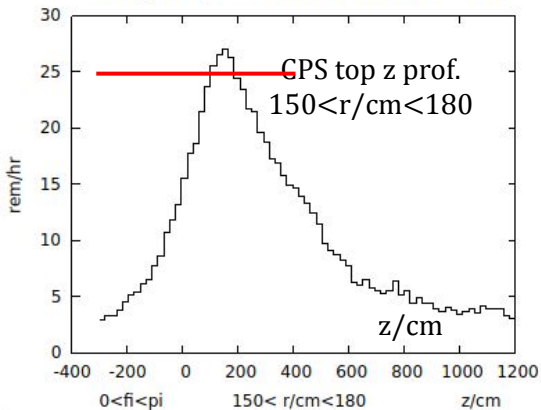
Power Deposition  $w/\text{cm}^3$  N=5000 bentcoil-65-m23ref8 99



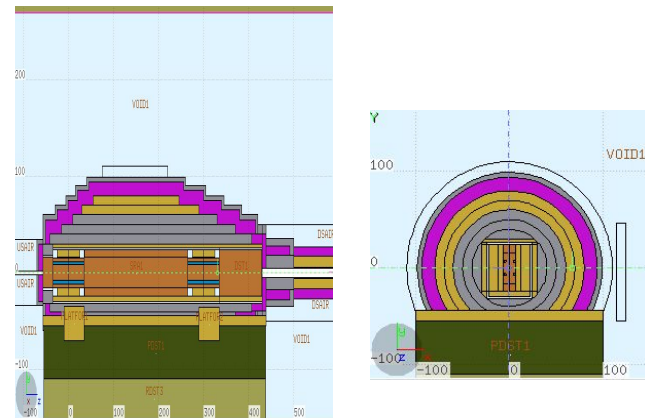
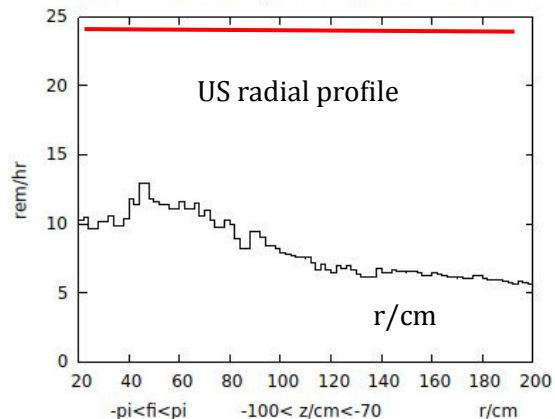
- PDE at floor level is below 7 rem/hr.  $dP/dV < 1.2 \text{ kW}/\text{qcm}$ .

# PDE . CPS with longer “stingray” channel. CPS R < 99 cm. B=0.9 B<sub>n</sub>. Fe: core and 2 shield layers.

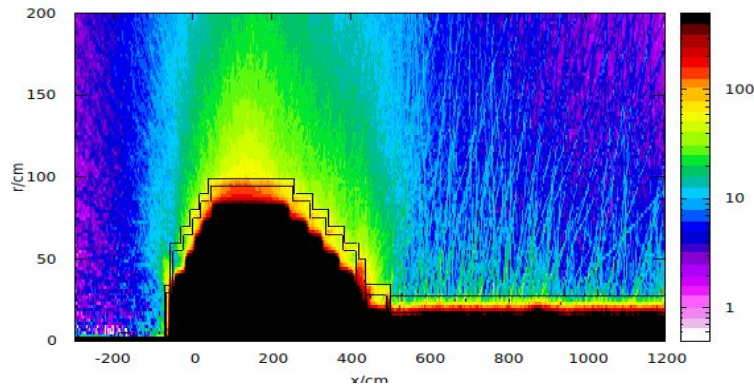
PDE top 1/2 spher. rem/hr bentcoil-65-m23ref9 91



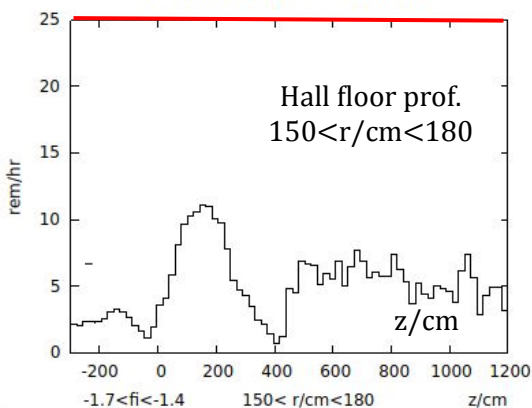
PDE US CPS +1/2' r-profile bentcoil-65-m23ref9 91



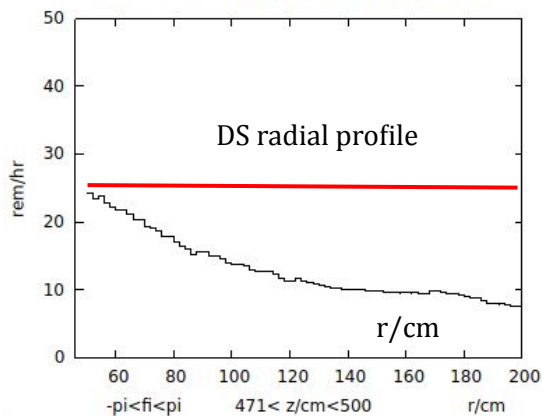
PDE rem/hr top 1/2 Sph. bentcoil-65-m23ref9 91



PDE floor bentcoil-65-m23ref9 91



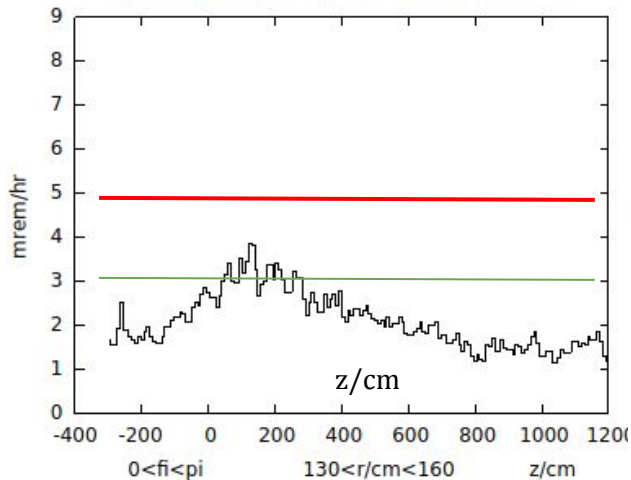
PDE DS +1/2' r-profile bentcoil-65-m23ref9 91



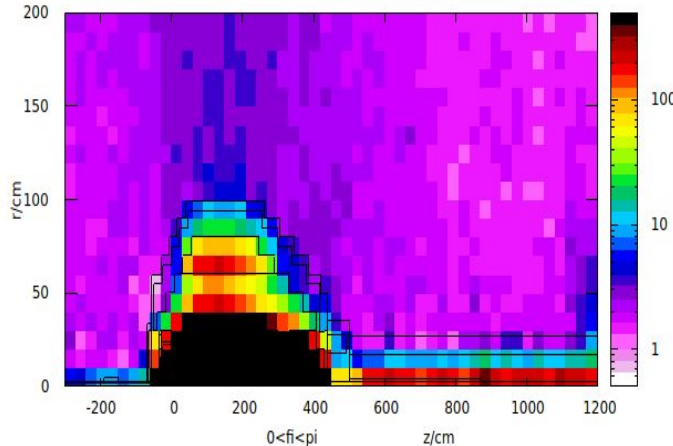
● PDE at floor < 7 rem/hr meets limits of PAC48.

# Activation. CPS with longer “stingray” channel. CPS R < 99 cm. B=0.9 B<sub>n</sub>. Fe: core and 2 shield layers.

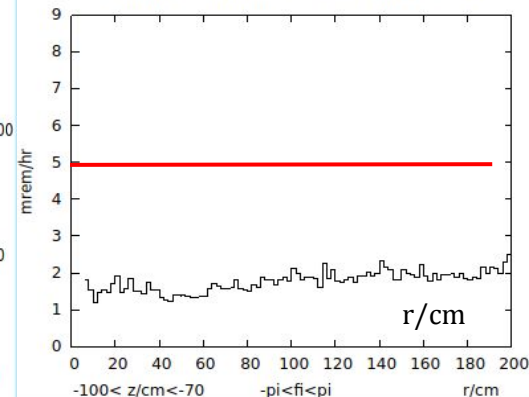
Activation 1000+1 hr 1' bentcoil-65-m23ref9 24



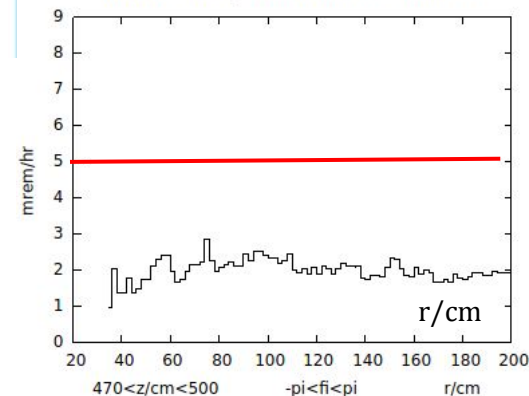
Activation 1000+1 hr mrem/hr bentcoil-65-m23ref9 24



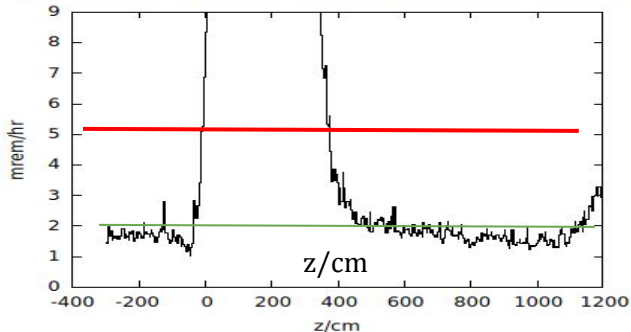
Activation US r-profile bentcoil-65-m23ref9 24



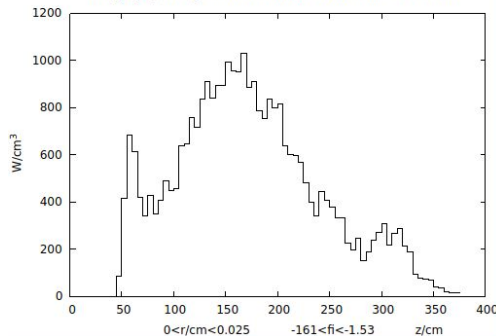
Activation DS r-profile bentcoil-65-m23ref9 24



Activation 1000+1 z-profile around beam bentcoil-65-m23ref9 24



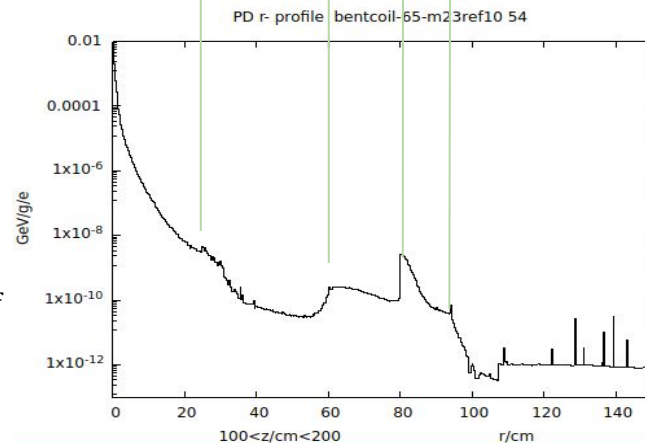
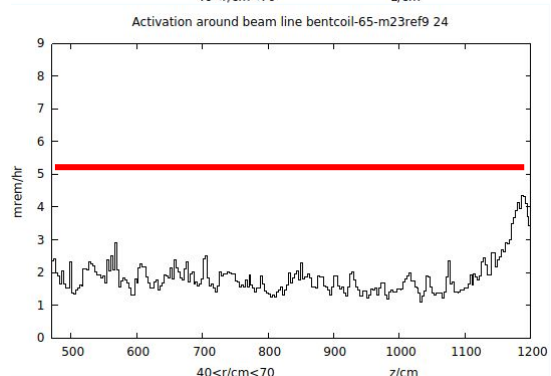
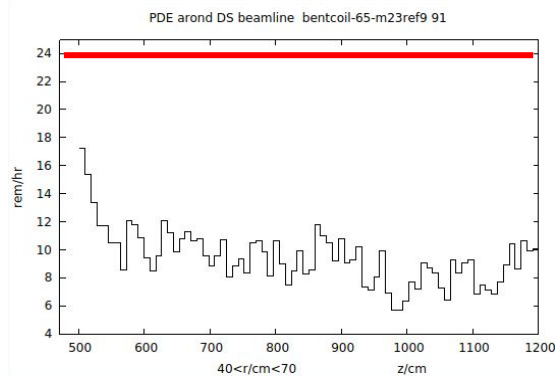
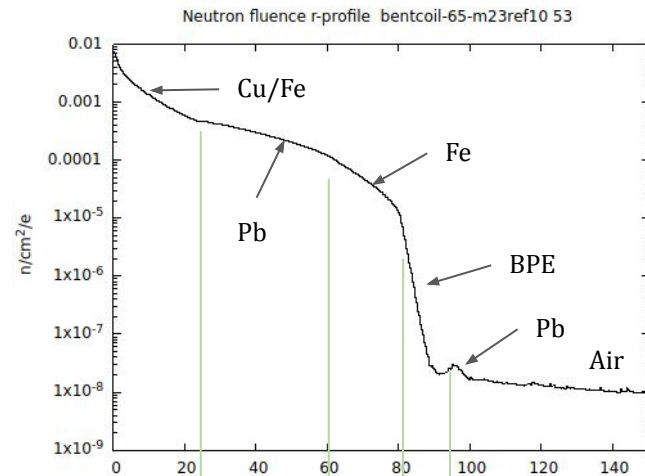
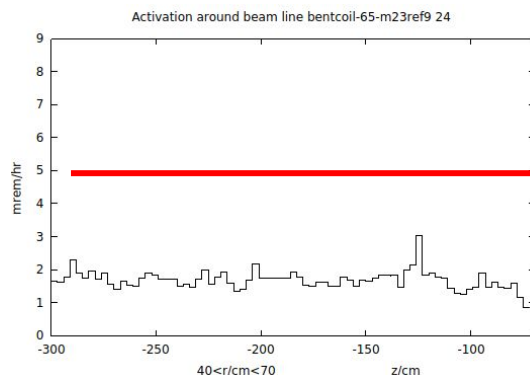
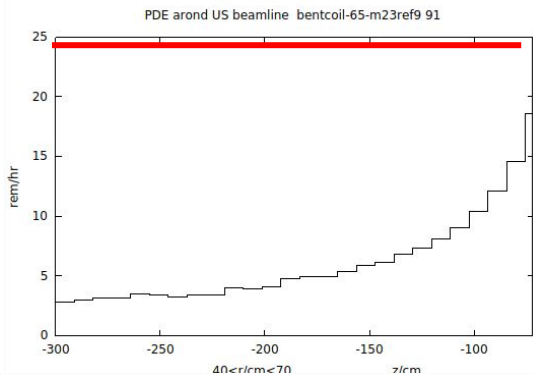
“Stingray” power profile at its bottom bentcoil-65-m23ref10 99



- Activation < 3 mrem/hr meets the limits of PAC48.
- Power deposition (!)  $dP/dV < 1000 \text{ W/cm}^3$

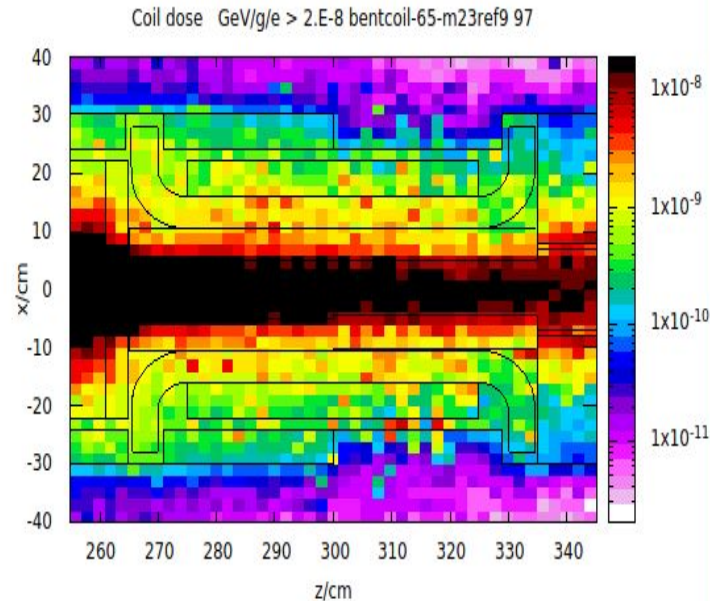
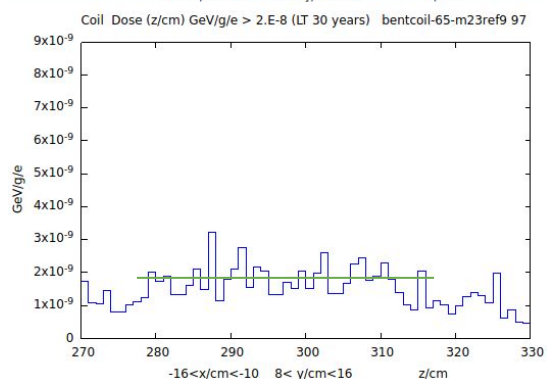
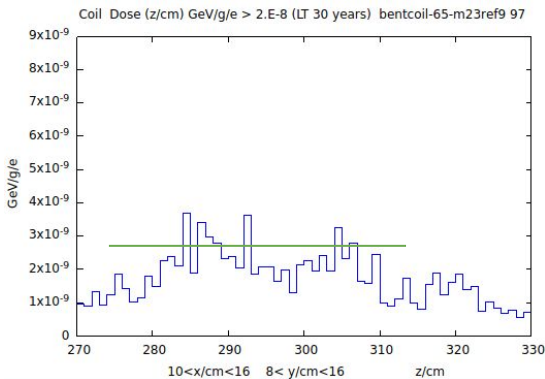
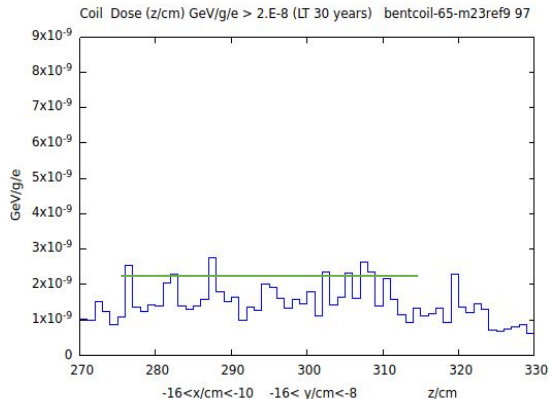
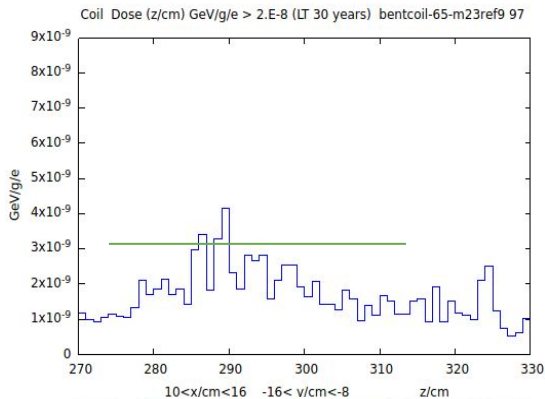


# PDE and Activation around beam line. CPS $R < 99$ cm. $B=0.9 B_n$ . Fe shield and neutron fluence.



- Neutron related dose around CPS **may be reduced** optimizing Pb/Fe composition of shield layers.
- PDE and Activation around beam line allows **safe work of electronics and humans**.

# Coil LT > 200 years. “Stingray” channel. CPS R < 99 cm. $B=0.9 B_n$ . Fe: core and 2 shield layers.



- Dose 2.E-8 GeV/g/e translate to LT=30 yr => Dose 3.E-9 GeV/g/e translate to LT=200 years.
- Practically infinite LT of DS coils.

1. CPS meets radiological requirements of PAC48:
2. Activation  $< 3$  mrem/hr.
3. Prompt Dose Eq. at floor level  $< 5$  rem/hr ( 25 rem/hr - PAC 48).
4. Activation around beam line  $< 2$  mrem/hr.
5. Prompt dose around beam line  $< 15$  rem/hr.
6. Absorber channel design excludes risks of overheating; no vertical surfaces.
7. CPS diameter =198 cm (with 2 Fe layers) may be further reduced.
8. May be vacuumized (with round beam channel).