Dose rate outside the Tagger Hall.
Transistor Lifetime.
CPS Cost and Weight.
Magnet Design.
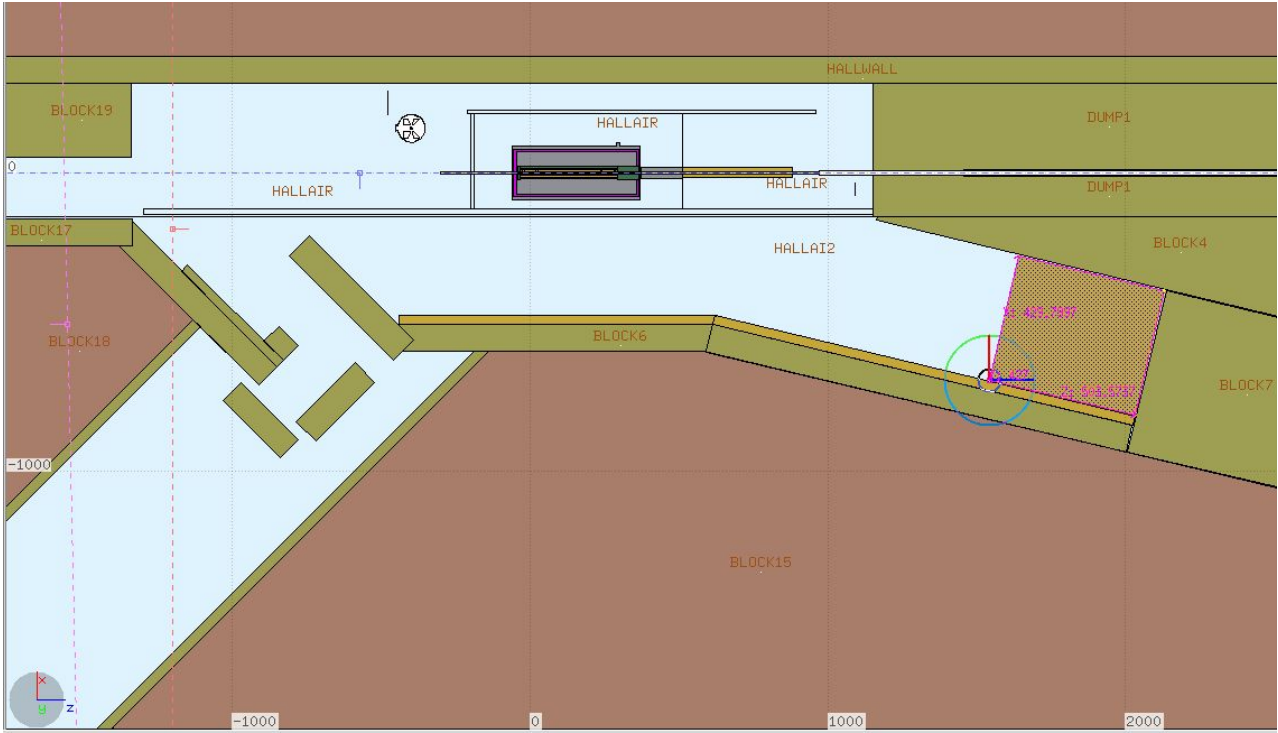03/20/2023
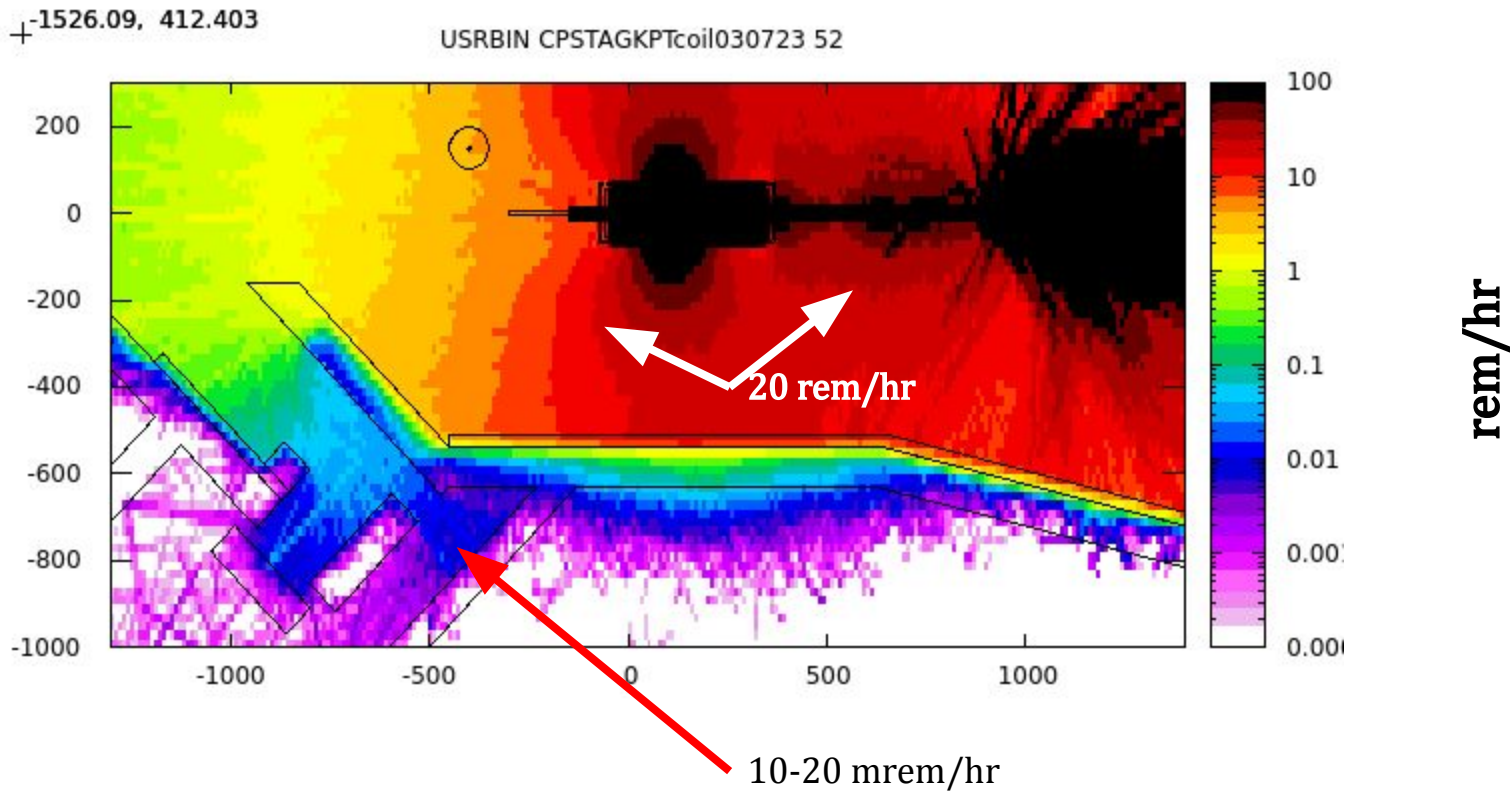
3'-0"

90'-7"

40'-2 1/4"

42'-8 1/4"

7'-8 1/2"

20'-9 1/4"

25'-0"

3'-0"

3'-0"

MUD SLAB—
SEE STRUCTURAL

REINFORCED
CONCRETE WALLS

6"W X 2"D
DEPRESSED SLAB
TYP

SHEET WPF &
PROTECTION
BOARD TYP

1'-0"
FLANGED PHOTON BEAM PIPE
EXTENSION

CONCRETE ENCASED
PHOTON BEAM PIPE—
STRUCTURAL

SLAB —
STRUCTURAL

SUMP PIT—
SEE STRUCTURAL

GONIOMETER (N.I.C.)

QUADRUPOLE (N.I.C.)

TAGGER
MAGNET
(N.I.C.)

PERMANENT
MAGNET (N.I.C.)

SKID
(N.I.C.)

SKID
(N.I.C.)

10"Ø PHOTON BEAM PIPE; SEE
DETAIL 11/A505, SEE STRL

SUPPORT SLABS—
SEE STRUCTURAL

FE

℄ PHOTON BEAM
ELEV = 28'-11"

9'-10"

2'-0"

2'-0"

15'-8 1/2"

1
A102 A302

WP#1

TYPE I SHIELDING
BLOCKS (O.F.O.I.)

TAGGER
AREA
202

FFE = 23'-0"

℄ ELECTRON BEAM
ELEV = 28'-11"

MAINTAIN 2'-0"
CLEARANCE ALL
AROUND ℄ OF
BEAMS

3'-0"

13.40'

2'-0"

31'-5"±

3'-0"

MUD SLAB
SEE STRU

140.00'

OFE

TRENCH DRAIN

TAGGER
INSTRUMENTATION
RACKS (N.I.C.)

15'-10"

RESIN TANKS (N.I.C.)

ELECTRON BEAM
DUMP
205

26'-

313'-5"
POINT OF
TANGENCY

202B

202A

15'-0" R.O.

34'-4"

SEE NOTE 6

TYPE I SEG BLOCKS
6 HIGH
(O.F.O.I.)

59'-7"±

ELECTRON
BEAM
DUMP

MATCHLINE — FOR CONT SEE SH A102A

3'-0"

6"W X 2"D
DEPRESSED SLAB
TYP

FOOTING—
SEE STR

8'-11"

3'-4"

TYPE I
2'-2"X2'-2"X1'-1"
SEG BLOCKS, 4 HIGH
(O.F.C.I.)

TYPE I
2'-2"X2'-2"X1'-1"
SEG BLOCKS
SHIELDING (O.F.O.I.)
& DOORS

SHEET WPF &
PROTECTION
BOARD TYP

MUD SLAB
SEE STRU

TYPE I
2'-2"X2'-2"X1'-1"
SEG BLOCKS
(O.F.C.I.)

TYPE II
4'-4"X4'-4"X2'-2"

2

AMORPHOUS RADIATOR (C)
-9842.566

TAGGER MAGNET (U)
-9588.058

ELECTRON BEAM/PHOTON BEAM
TRAJECTORY INTERSECTION
-9272.308 /B\

GONIOMETER (C)
-9904.095

INTERSECTION OF
BEAMLINE AND
OUTSIDE CHAMBER

BEAMLINE TUBE
6.00" OD X .065 WALL /B\

VIEW A
SEE SHT 5

CL ELECTRON BEAM

BEAMLINE TUBE
1.25" OD X .065 WALL /B\

/B\

10" SCH 40 PIPE

BEAM CENTERLINE

CL PHOTON BEAM

STEEL MOVABLE
SHIELDING WALL,
RAILS AND DOOR

6.500"

GIRDER AD00A

GIRDER AD00B

CENTERLINE OF
GONIOMETER
(DWG D00000-00-02-1003)

/B\

BEAMLINE TUBE
1.25" OD X .065 WALL /B\

160.000
[4 m 6.4000 cm]

50.515
(1 m 28.309 cm)

13.413"

STEEL SEG BLOCKS

/A\ TAGGER MAGNET POLE (C)
/B\ X= -29.810 Z= -9274.441

360.417
[9 m 15.459 cm]

/B\

375.221
[9 m 53.062 cm]

BEAMLINE TUBE
1.50" OD X .065 WALL /B\

/B\

LABYRINTH SEG BLOCK
& STL ARRANGEMENT
DMP-150-6800-0014

CENTER OF DUMP

PLAN VIEW

U - UPSTREAM   C - CENTER   D - DOWNSTREAM

3

Tagger Hall model with CPS .

Map with +/- 90 cm wide   CPS: -60< z/cm<370.

Map with +/- 90 cm wide   CPS: -75< z/cm<370. Longer wall.

Prompt Dose Eq rem/hr black>100 rem/hr CPSTAGKPTcoil030723 52

10-15 mrem/hr

Tagger Hall model with CPS moved by 2 m downstream.

Additional Concrete Blocks
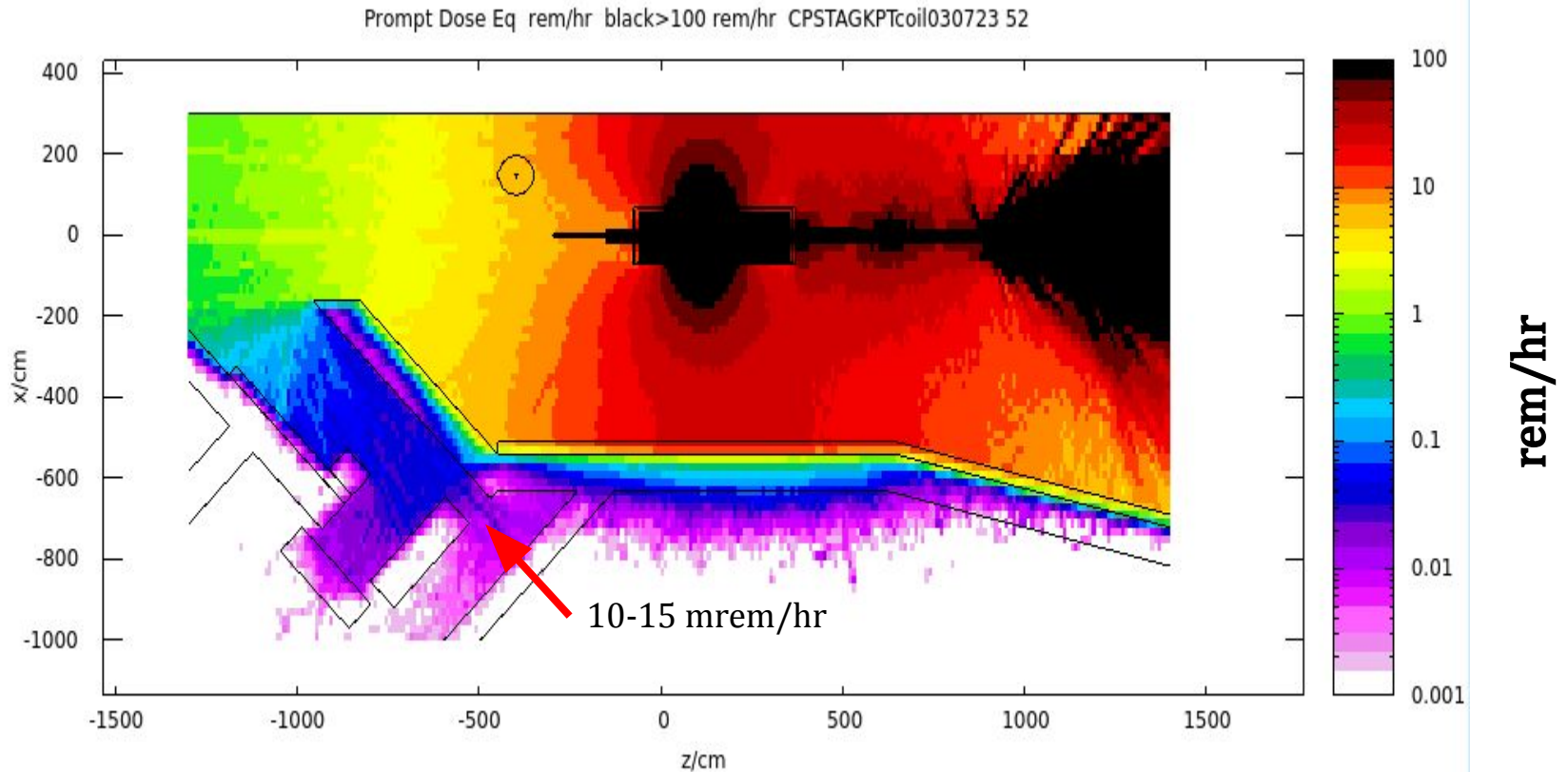
Map with elliptical CPS moved downstream by 2 m. Longer appendix wall.

Prompt Dose Eq [rem/hr] = 11.25E+6*[pSv/e] CPSTAGKPTcoil032023 52
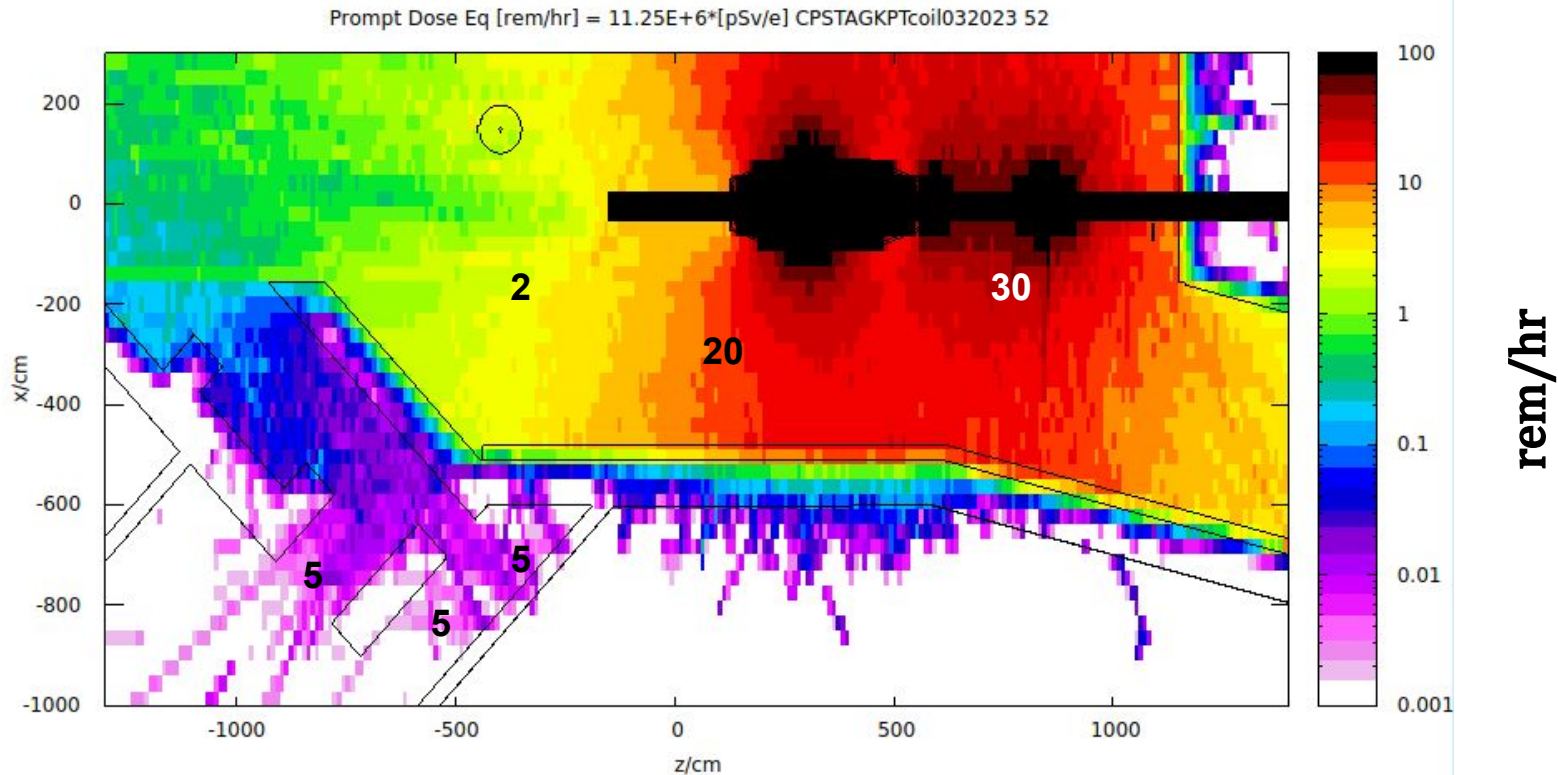
Dose Eq. Map with elliptical CPS moved by 2 m downstream .

Prompt Dose Eq [rem/hr] = 11.25E+6*[pSv/e] CPSTAGKPTcoil032023 52
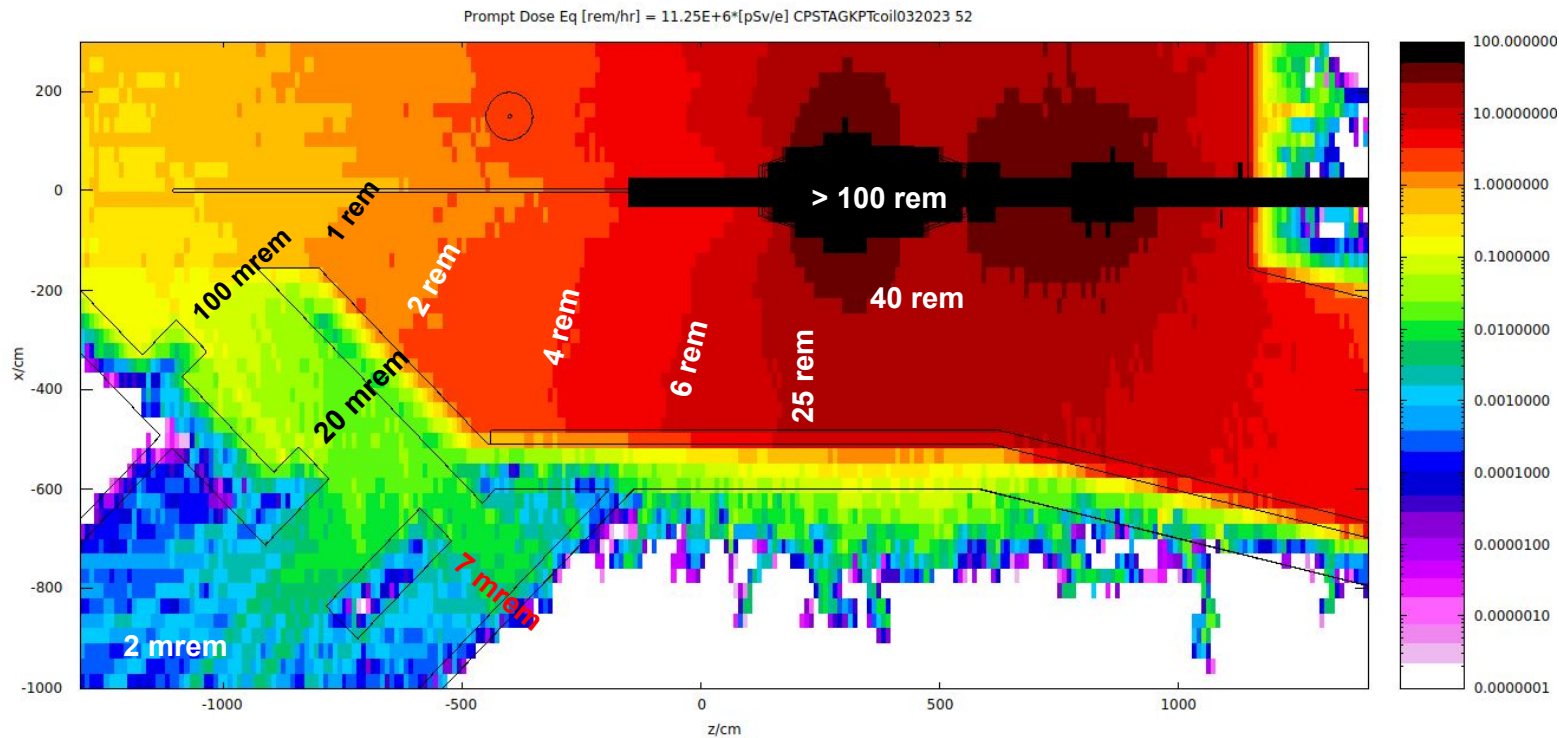
Neutron 1 MeV Equivalent Flux and Si Lifetime.

MEVNE n/cm^2/s CPSTAGKPTcoil030723 73
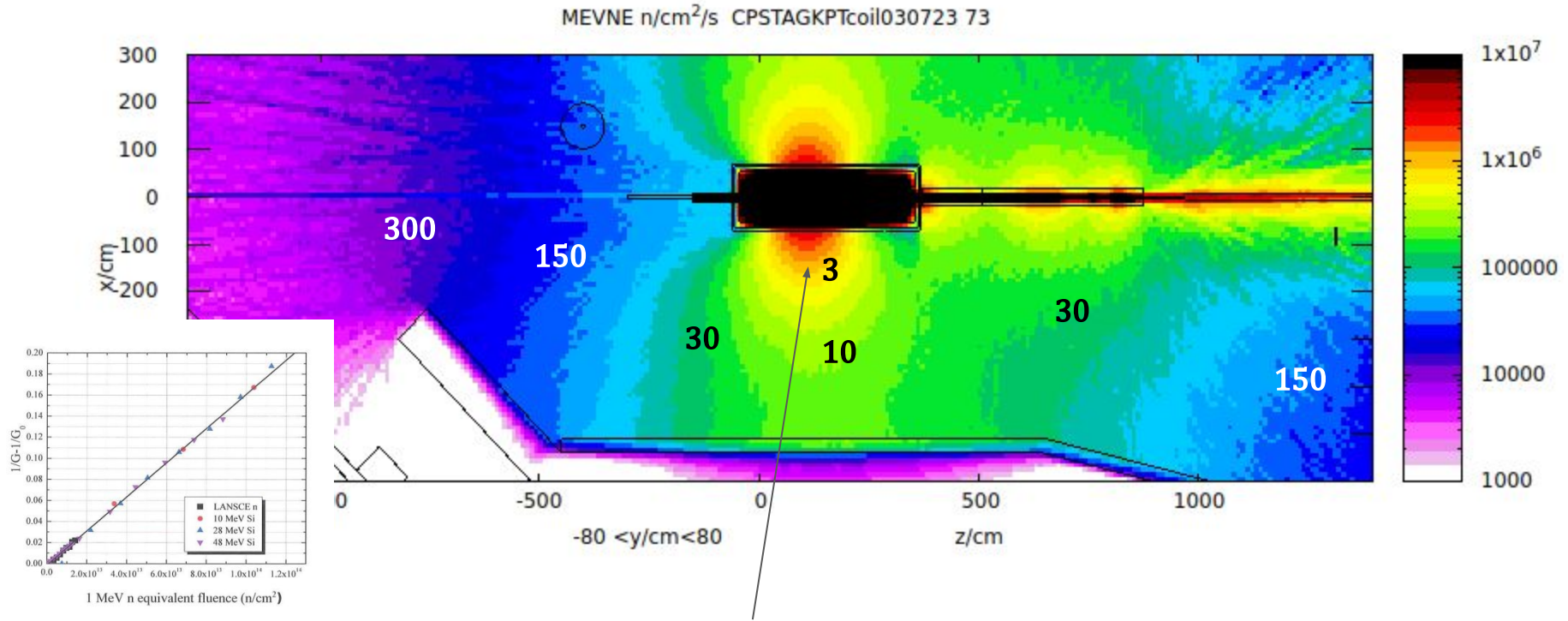
- Orange zone corresponds to lifetime T_{Si}=1.E+14 [n/cm^2] / 1/E+6 [n/cm^2/s] = 1.E+8 s=3 years.

Prompt Dose Equivalent is irrelevant to Si lifetime.
Transistor gain is given vs rads or n/cm^2
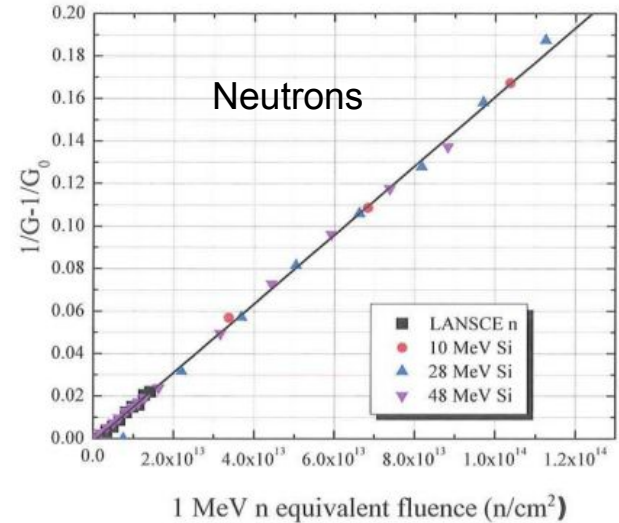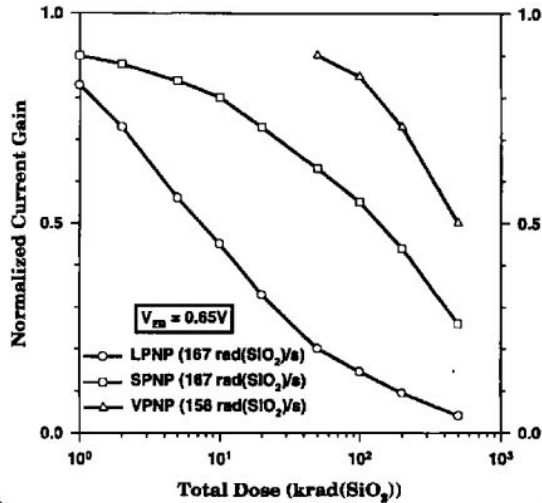
- 100 rem=~5 rad. ½ Gain for SPNP at 200 krad: 200 krad/5 rad/hr= 4.5 year.

- For VPNP transistor =500 krad/10 rad/hr (Techn. Note) =5.7 year.

- Consistent with 1MEVNE based estimate of 3 years at critical flux 1.E+14 n/cm^2
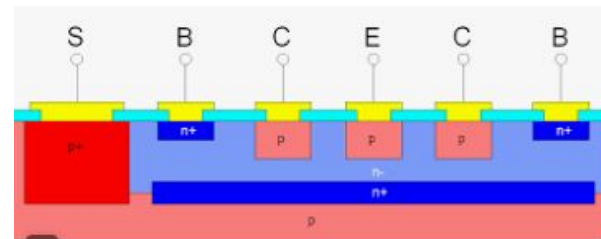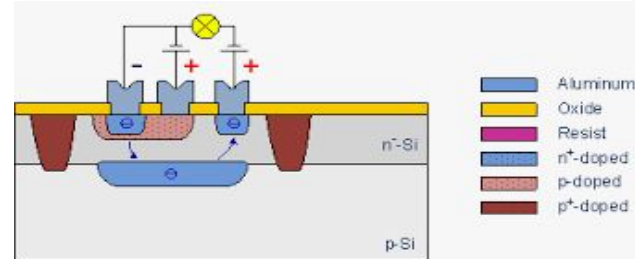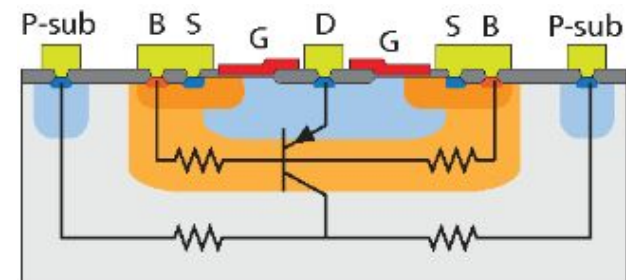
Transistor Gain and radiation.

(http://lhcb-elec.web.cern.ch/papers/radiation_tutorial.pdf)
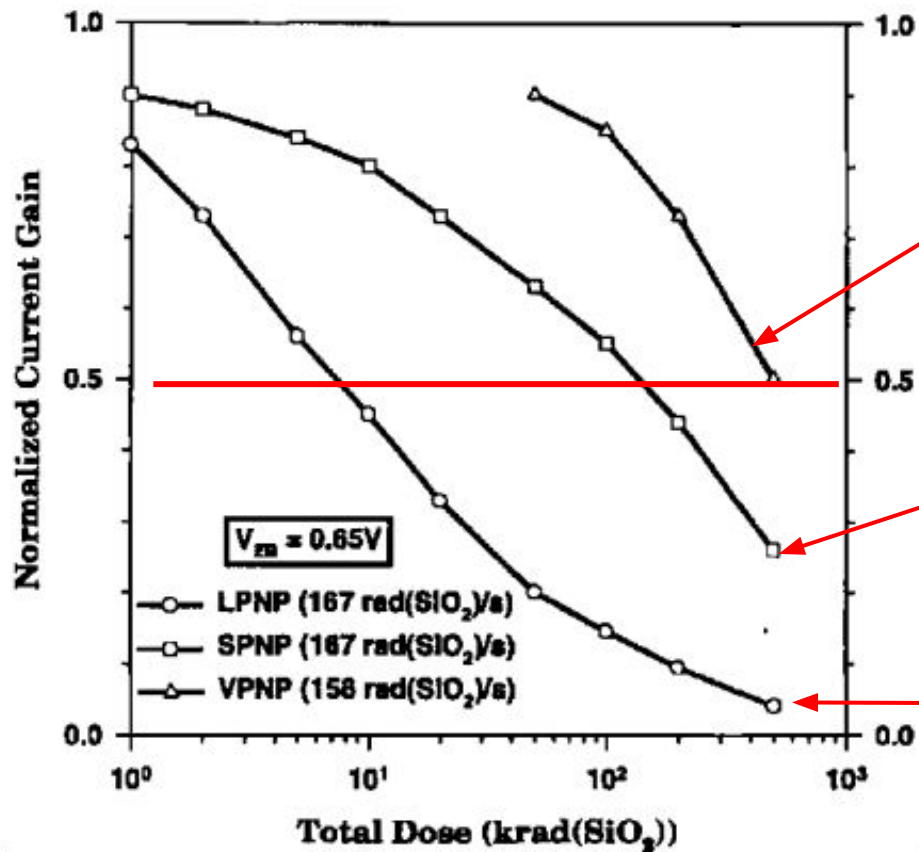
VPNP
(500 krd)

SPNP
(200 krd)

LPNP
(10 krd)
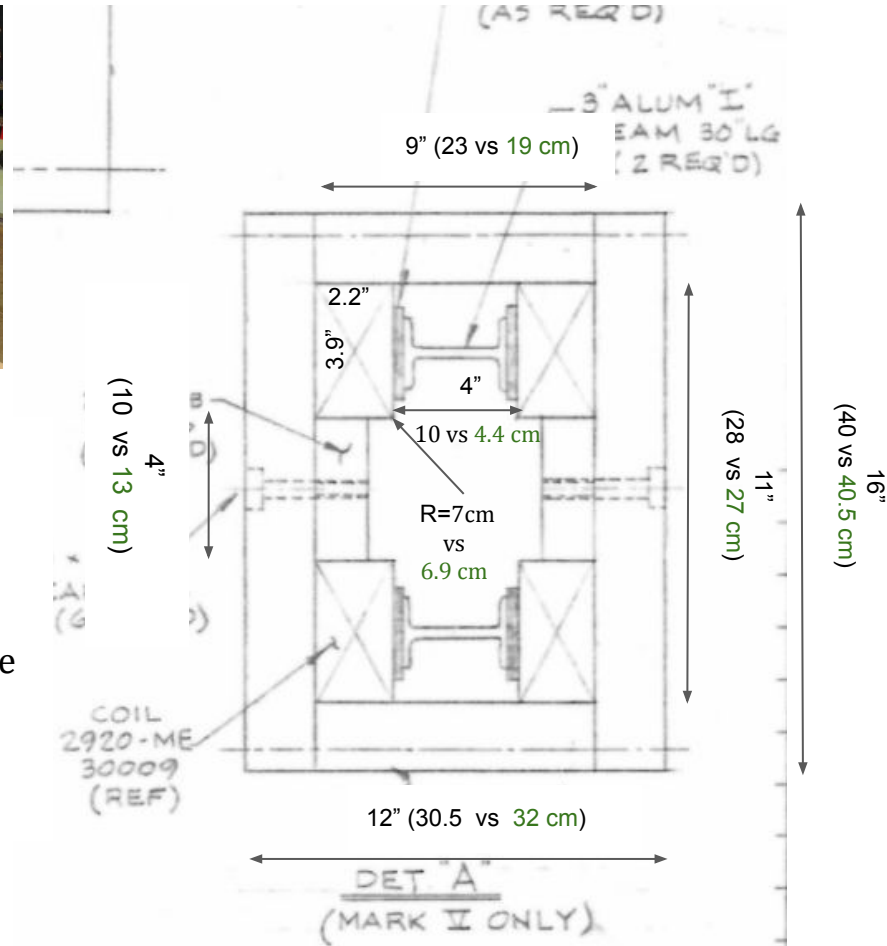
12

Cost without magnet. Weight including magnet.

CPS Component	Material	Density	Cost	Weight	Total cost
		g/cm³	$/Kg	Metric T	K$
Absorb. In/out	W	16.3	80.00	0.2	15.5
Lead skin	Pb	11.4	5.8	15.1	87.5
Plastic shield	PE	1.2	20.5	0.5	10.1
Lead shield	Pb	11.4	5.8	36.5	211.4
Left shield	W	16.3	80.0	1.4	108.0
Top shield	W	16.3	80.0	0.8	67.0
Right shield	W	16.3	80.0	1.4	108.0
Bottom shield	W	16.3	80.0	0.8	67.0
Magnet	Fe	7.9	50.0	2.0	.0
Absorber	Cu	9.0	122.6	0.2	27.4
Upstream shield	W/Cu	15.2	140.0	0.2	21.6
Downstream shield	W/Cu	15.2	140.0	1.2	171.4
CPS -magnet	CPS			61.1	895.2
Tungsten	Tungsten			6.6	543.2

	Cost k$	Dens g/cm3	Cost $/kG	Weight /g
PbSkin+	87.6	11.35	5.8	1.510E+7
BorPol+	12.8	1.5	20.5	6.233E+5
WPWDR-Pb+	214.6	11.35	5.8	3.700E+7
UpsWsh1+	12.5	16.3	80	1.560E+5
DstWsh2+	83.2	16.3	80	1.040E+6
WPwde1+	108.0	16.3	80	1.351E+6
WPwde2+	67.8	16.3	80	8.471E+5
WPwde3+	108.0	16.3	80	1.351E+6
WPwde4+	67.8	16.3	80	8.471E+5
Febox+	0.0	7.88	0	2.037E+6
LeftPole	0.0	8.96	0	4.961E+5
RigtPole	0.0	8.96	0	4.961E+5
Absorb	27.5	8.96	122	2.257E+5
UpsWCu	21.5	15.2	140	1.535E+5
DstWCu	13.9	15.2	140	9.932E+4
COST k$	825			M. Ton=
				61.8

How the 3m Magnet/Platform   may be fabricated - assembled!

- All dimensions are close to baseline FLUKA design.
- Kapton insulation!
- Need to make it ~50 cm wide For

9" (23 vs 19 cm)

2.2"

3.9"

4"

10 vs 4.4 cm

R=7cm
vs
6.9 cm

(10 vs 13 cm)
4"

(28 vs 27 cm)
11"

(40 vs 40.5 cm)
16"

12" (30.5 vs 32 cm)

DET "A"
(MARK II ONLY)

Coil
122 windings
20 kA-turns
vs
1.8 kA*16 =
29 kA-turns