

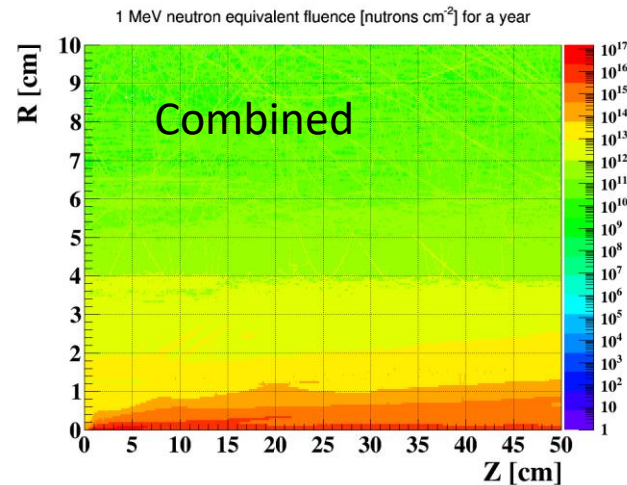
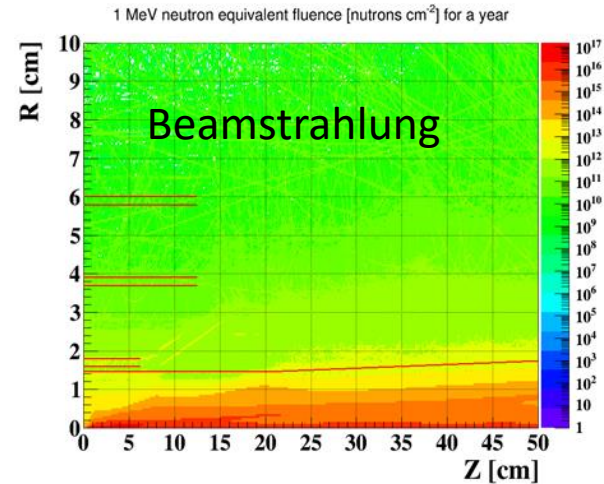
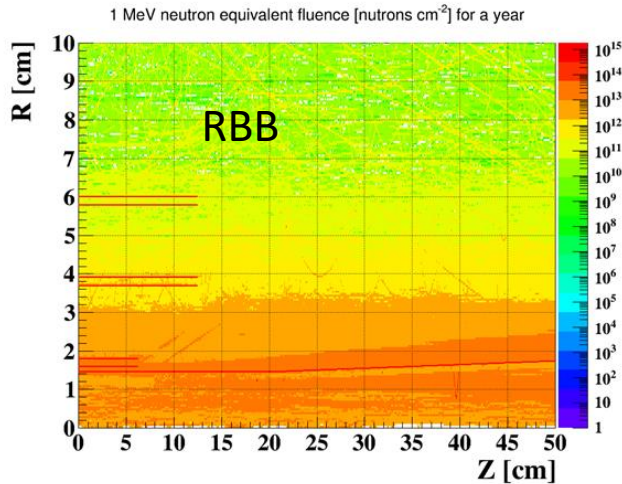
# MDI Status Report

Hongbo Zhu

13 December 2017

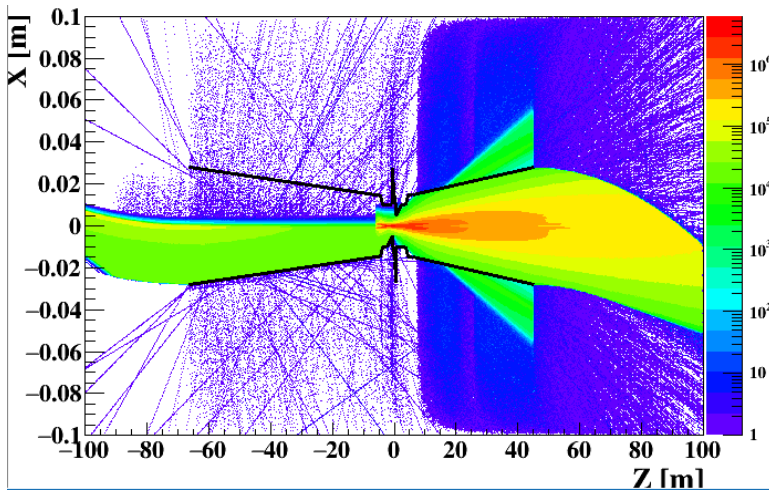
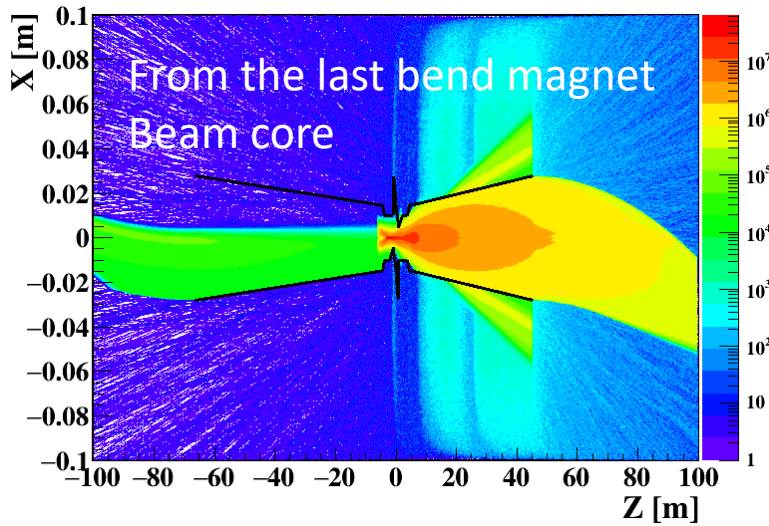
# Radiation Backgrounds -- NIEL Calculation

- Revisited the code for NIEL calculation and adopted the method used for ATLAS background estimation



# Synchrotron Radiation

- Machine parameters being updated to deliver higher luminosities



Numbers (hits and power deposition) match well Mike Sullivan's calculation (proof of good understanding of the beam and machine geometry)

Add in the beam halo

*To implement the mask tips (blocking backscattered SR photons) and add in the quadrupole contributions → hit density at vertex detector layers*

# Other Backgrounds

- Beam lost particles due to beamstrahlung and gas interaction



Negligible after introducing collimators – new samples to be produced after updating the collimator positions according to the new machine design



Received the first sample based on old design but have to wait for the new samples for better evaluation

# Updated Machine Parameters (NOT FINAL)

- Machine parameters being updated to deliver higher luminosity; will have to repeat all background calculations after receiving the final parameters for CDR → [update the CDR chapter accordingly \(end of December\)](#)

	<i>tt</i>	<i>Higgs</i>	<i>Z</i>
Number of IPs		2	
Energy (GeV)	175	120	45.5
Circumference (km)		100	
SR loss/turn (GeV)	7.61	1.68	0.035
Half crossing angle (mrad)		16.5	
Piwinski angle	0.91	2.58	12.1
$N_p$ /bunch ( $10^{10}$ )	24.15	15	4.8
Bunch number	34	248	9524
Beam current (mA)	3.95	17.9	219.7
SR power /beam (MW)	30	30	7.6
Bending radius (km)		10.9	
Momentum compaction ( $10^{-5}$ )		1.14	
$\beta_{IP}$ x/y (m)	1.2/0.0037	0.36/0.001	0.2/0.001
Emittance x/y (nm)	2.24/0.0068	1.21/0.0037	0.17/0.0029
Transverse $\sigma_{IP}$ (um)	51.8/0.16	20.9/0.061	5.9/0.054
$\xi_x/\xi_y$ /IP	0.077/0.105	0.031/0.082	0.0094/0.0626
$V_{RF}$ (GV)	8.93	2.14	0.1
$f_{RF}$ (MHz) (harmonic)		650 (217500)	
Nature bunch length $\sigma_z$ (mm)	2.54	2.72	2.38
Bunch length $\sigma_z$ (mm)	2.87	3.26	4.33
HOM power/cavity (kw)	0.53 (5cell)	0.56 (2cell)	0.95(2cell)
Energy spread (%)	0.14	0.098	0.037
Energy acceptance requirement (%)	1.57	1.52	
Energy acceptance by RF (%)	2.67	2.06	1.7
Photon number due to beamstrahlung	0.19	0.29	0.33
Lifetime due to beamstrahlung (hour)	1.0	1.0	
Lifetime (hour)		0.33 (20 min)	
$F$ (hour glass)	0.89	0.81	0.97
$L_{max}$ /IP ( $10^{34}\text{cm}^{-2}\text{s}^{-1}$ )	0.38	3.1	13.2

# LumiCal

- Requested Suen Hou to update the technical description of the LumiCal design (silicon tungsten/BGO + diamond monitor) and then discuss with the LumiCal group → extract material from the supporting note but with improved description (early January)
- Integration of LumiCal together with magnets → more discussion with machine colleagues to look into the remote vacuum connection scheme → one postdoc (possible) (mid of January)

# CDR Writing

- **Topics to be covered:** interaction region, magnets, radiation backgrounds, luminosity measurement, beam monitor, energy measurement (?), integration (?), beam pipe (?)
- **Editors:** S. Bai (accelerator) + H. Zhu (detector), with inputs of texts & plots from all people involved in MDI studies
  - Similar chapter in the ACC CDR but with consistent designs but focusing slightly different topics -- **to be available earlier** (review in November)
- Preliminary results and texts will hopefully be ready by the end of this month (very difficult) and shall be continuously updated and improved toward CDR.