Update on Svt Background simulation with Bruno

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New productions

- New official productions:
  - **2photons** (~100k evts, 372us): first official production, 1 evt = 1 bunch xing, normalization like RadBhabha
  - **RadBhabha** (~10k evts, 37us)
    - **Touschek/BeamGas**: (~84k evts HER, ~188k LER, weight evts)
- Same magnetic field configuration, solenoidal field around IP region but limited in z (±20 cm from IP)

Multiplicity comparison

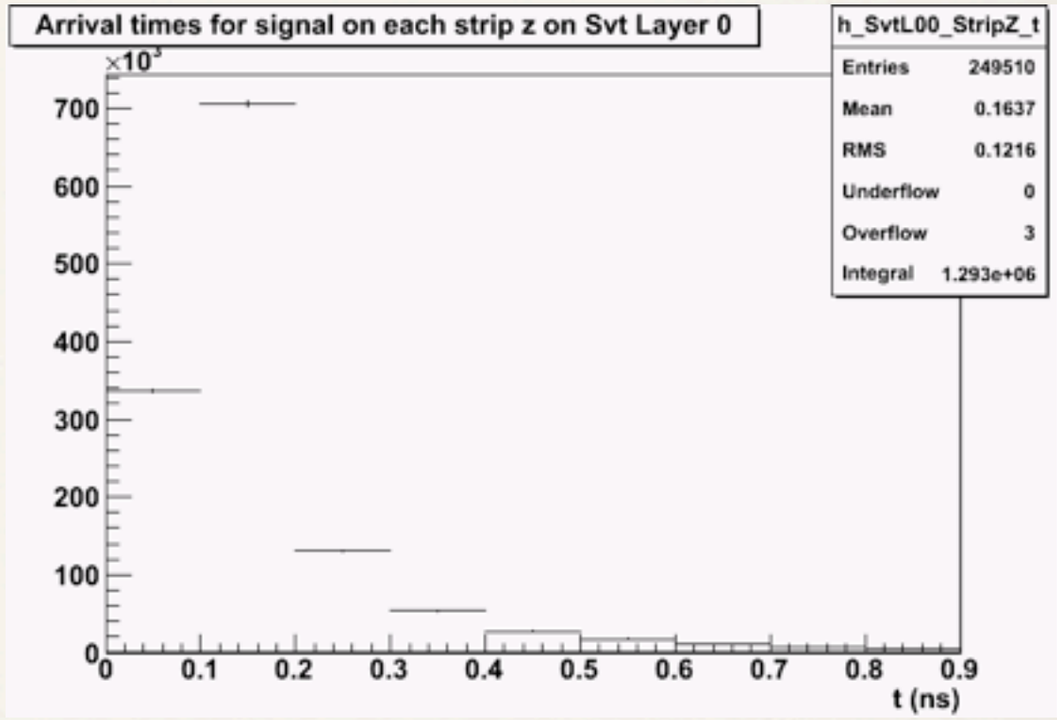
- Results from usual macros
- L0: +20-30% 2photons (see next slide), reduced RadBhabha
- Touschek became relevant for outer layers (+50%)

LAYERS	May2011 [MHz/cm2] 2phot. Pixels	May2011 [MHz/cm2] 2photons	Dec 2011 [MHz/cm2] 2photons	Dec 2011 [MHz/cm2] Rad Bhabha	Dec 2011 [MHz/cm2] Tousc-HER	Dec 2011 [MHz/cm2] Tousc-LER
L0 phi	55.5	23.3	32.2	0.96	0.52	1.73
L0 z		29.9	40.6	1.6	1.45	4.37
L1 phi	2.0	1.5	1.7	0.12	0.18	0.74
L1 z		0.7	0.85	0.083	0.19	0.77
L2 phi	0.96	0.72	0.88	0.086	0.12	0.56
L2 z		0.35	0.45	0.064	0.14	0.61
L3 phi	0.25	0.194	0.44	0.084	0.055	0.31
L3 z		0.097	0.27	0.056	0.055	0.29
L4 phi	0.014	0.012	0.05	0.014	0.004	0.019
L4 z		0.0076	0.03	0.008	0.003	0.013
L5 phi	0.007	0.006	0.019	0.006	0.002	0.009
L5 z		0.0041	0.014	0.004	0.0016	0.007

L0 rate

- Last estimation of rate was done using old stand-alone Bruno, some differences with packaged version
- Solenoidal field limited in z: particle can interact with materials and come back to L0. Arrival time for hits does not support this, 90% of the strip are fired within 0.4ns (max path = 12cm)
- Geometry was not modified in the region close to the IP

2photon (pairs) Arrival time for fired strips



Strip rate

- New productions contains information on wafer coordinates for the hits, we can remove the cylindrical approximation and provide the real strip rate
- Large effect on L0, large module overlap
- ±10% variation for different module of the same layer
- Note: L0 strip are not yet at 45 degrees

LAYERS Prod2011Dec 2photons	Cyl Rate [MHz/cm2]	Wafer rate [MHz/cm2] Avg	**Strip rate [kHz] Max**
L0 phi	32.2	24.4	**900**
L0 z	40.6	29.1	**350**
L1 phi	1.7	1.5	**105**
L1 z	0.85	0.75	**70**
L2 phi	0.88	0.74	**65**
L2 z	0.45	0.38	**40**
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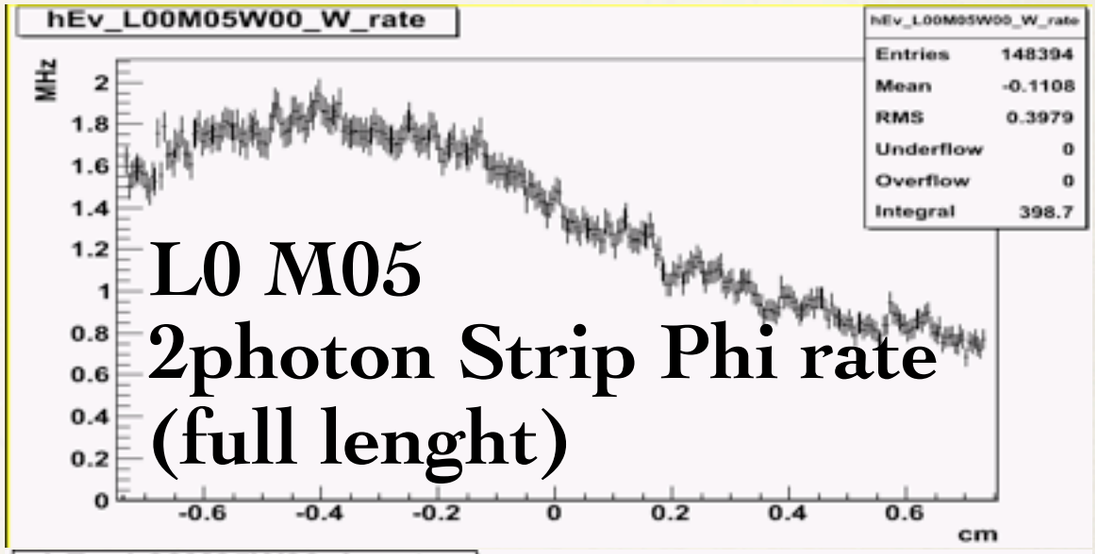

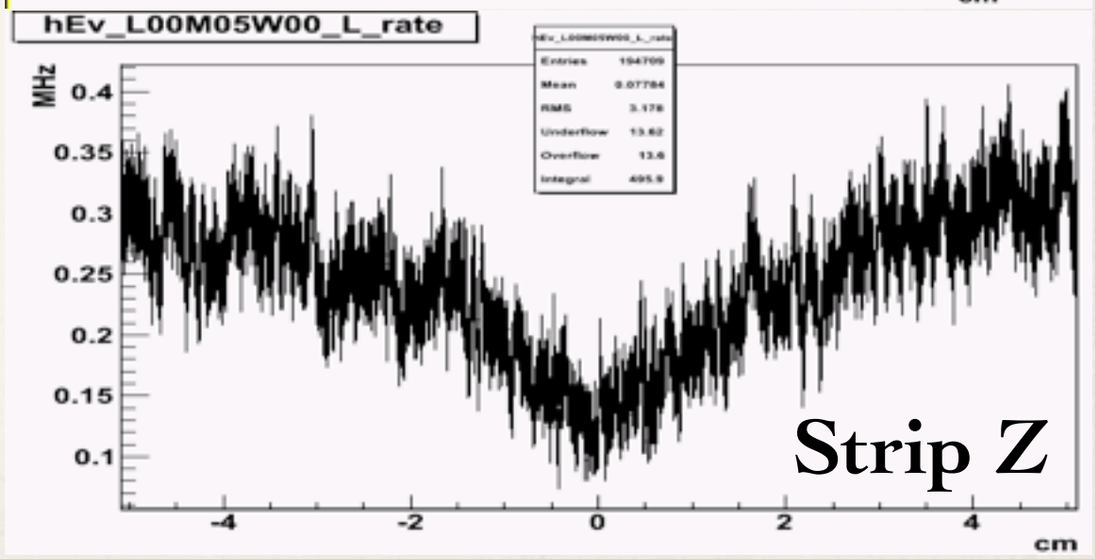

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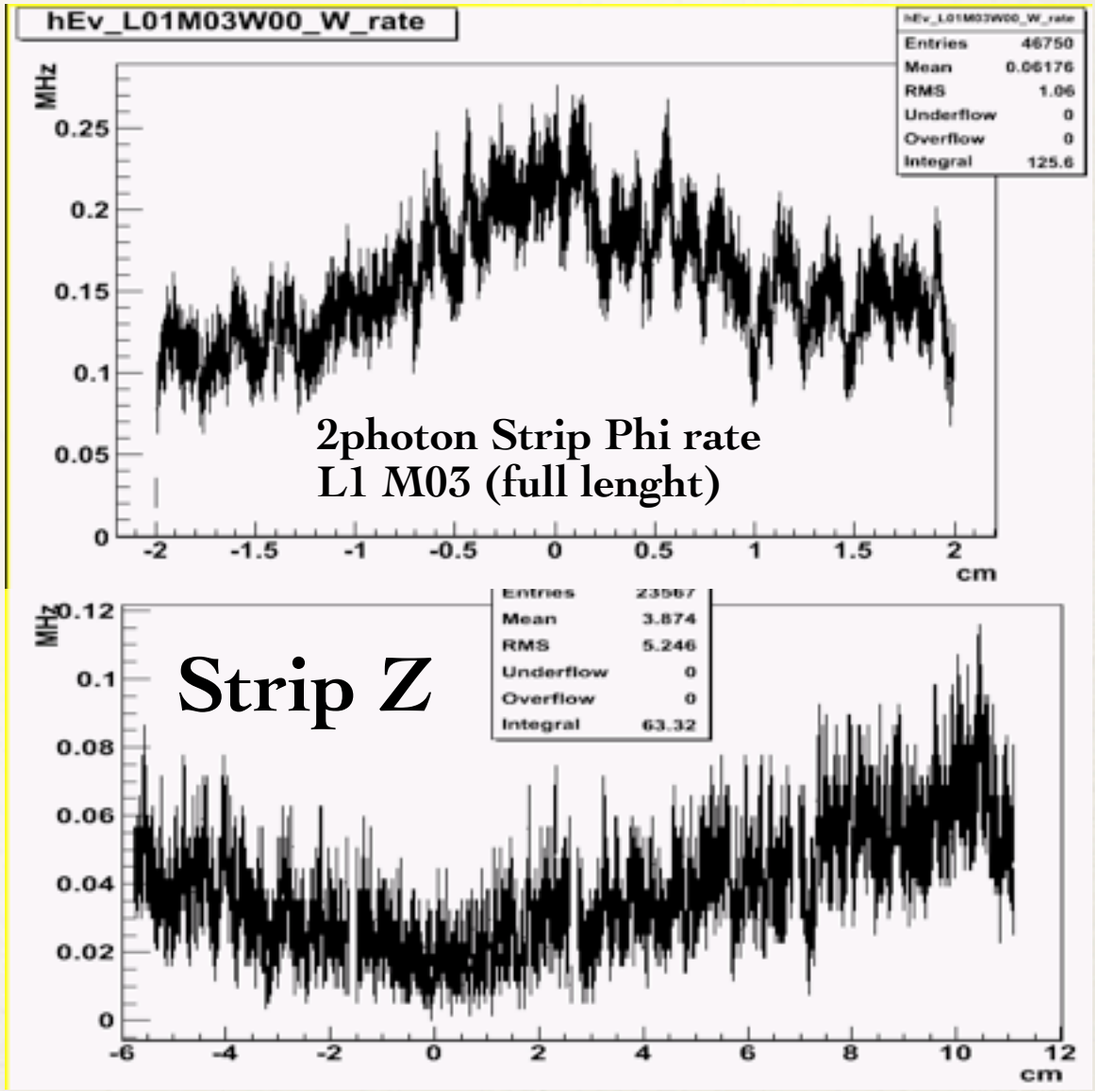

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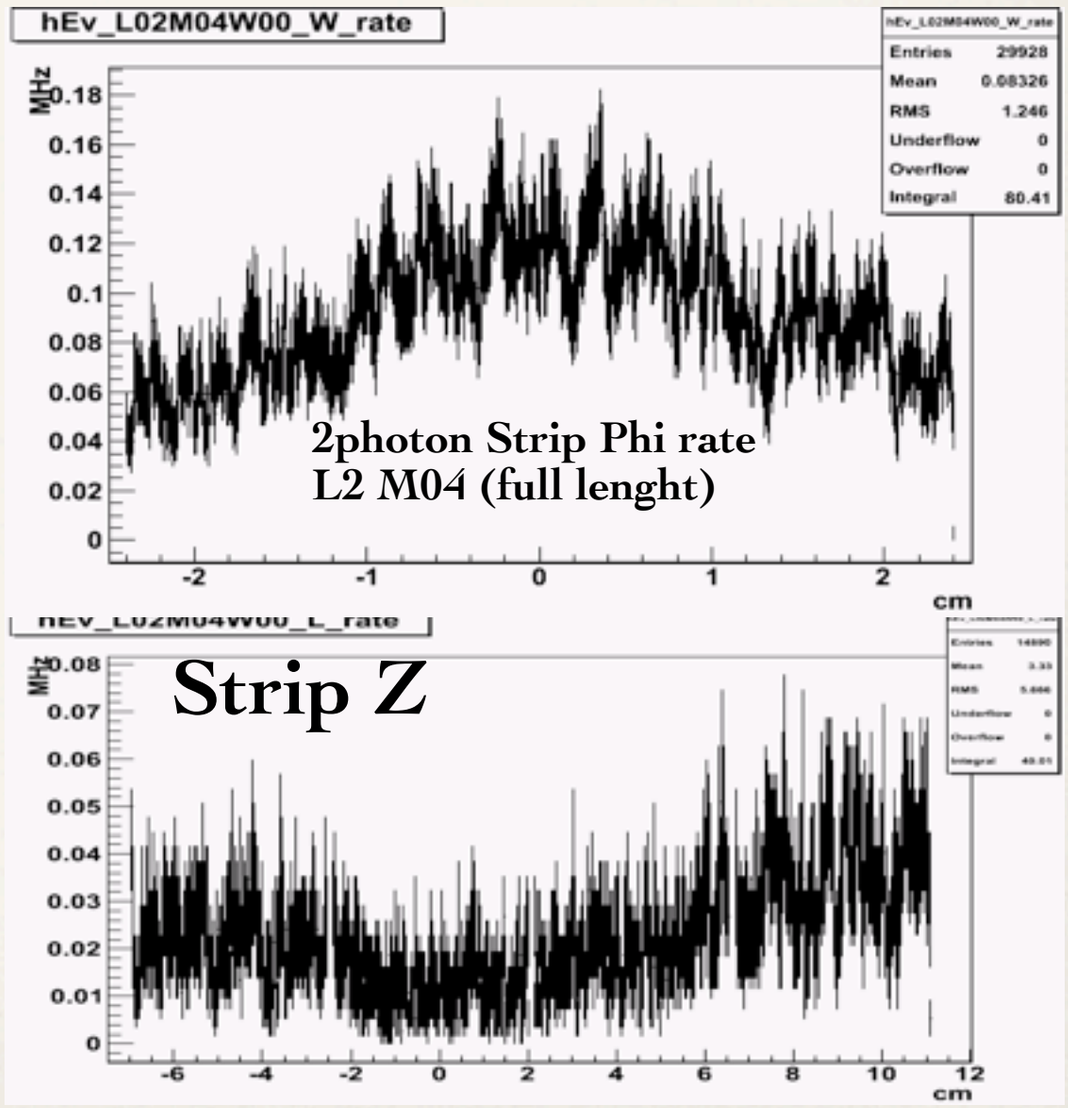

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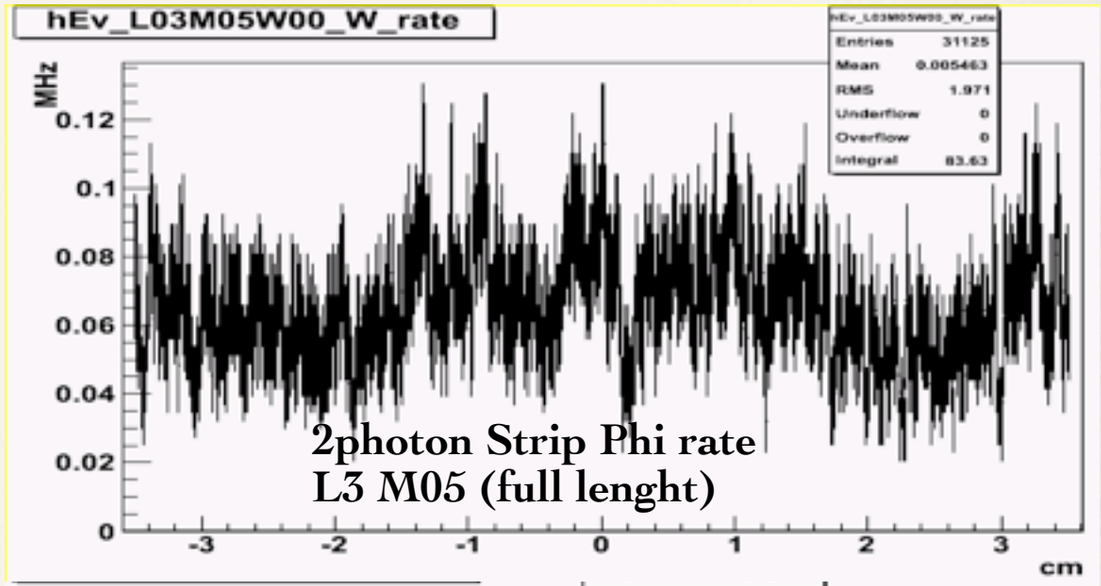

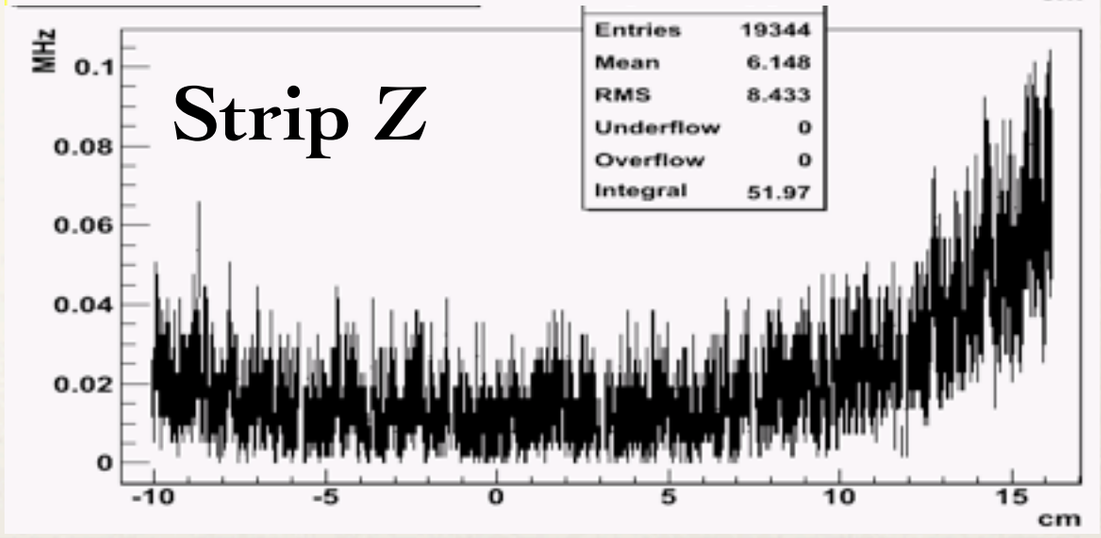

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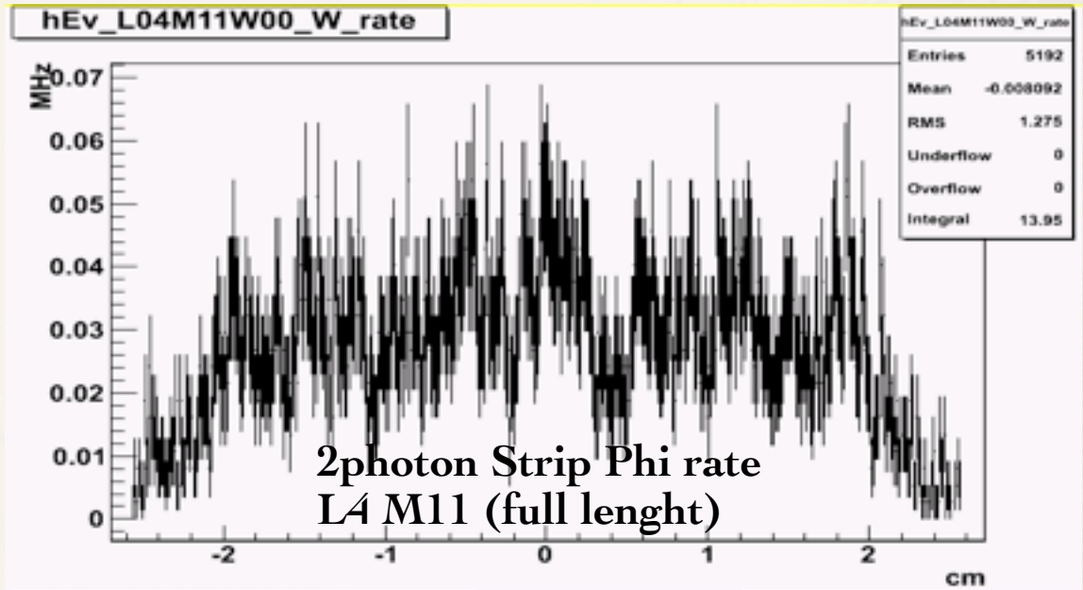

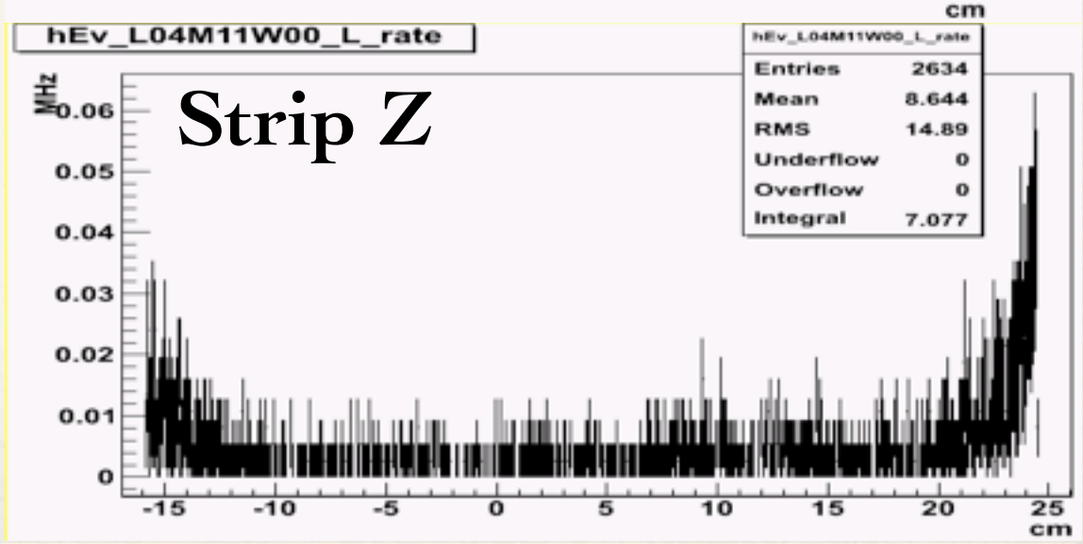

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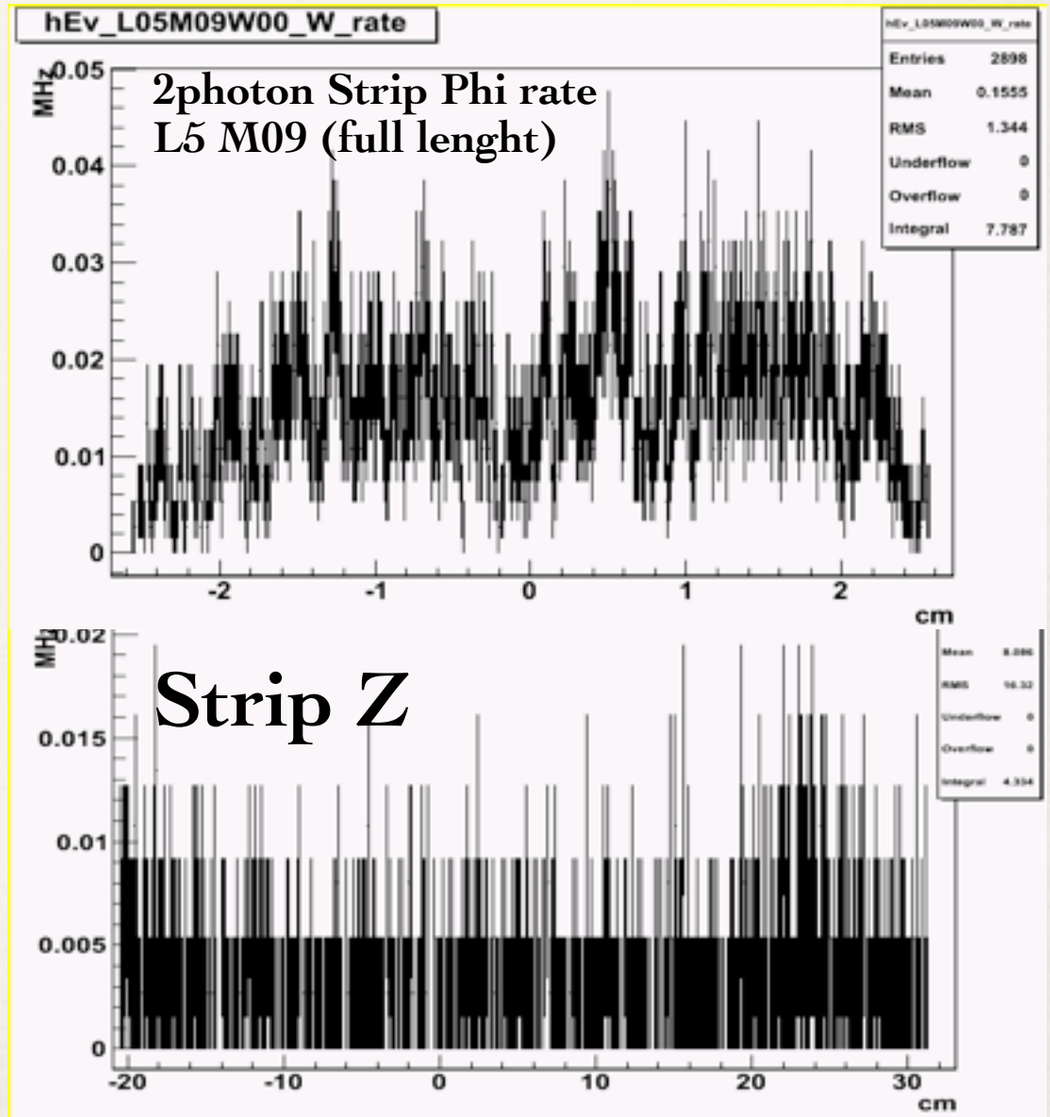


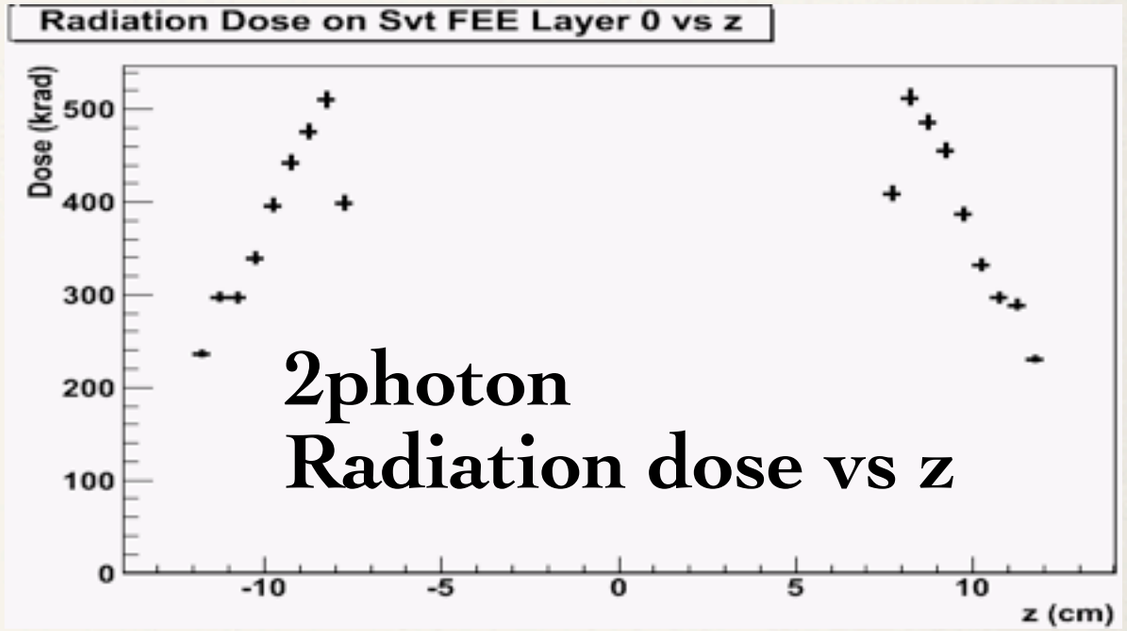
Strip rates summary

- Strip rate for other background, smaller contribution but not uniform on Phi angle
- Realistic value for L0 striplets is close to strip rate on z

LAYERS Prod2011Dec Strip rate	**2photons [kHz] Max**	**RadBhabha [kHz] Max**	**TouscHER [kHz] Max**	**TouscLER [kHz] Max**	**TOTAL [kHz] Max**
L0 phi	**900**	30	35	70	**1035**
L0 z	**350**	40	30	60	**480**
L1 phi	**105**	20	20	55	**200**
L1 z	**70**	20	20	**60**	**170**
L2 phi	**65**	<20	12	50	**~140**
L2 z	**40**	<20	15	**45**	**~120**
L3 phi	**50**	<20	8	35	**~100**
L3 z	**70**	<20	8	25	**~110**
L4 phi	**20**	<20	3	8	**~35**
L4 z	**30**	<20	2	6	**~45**
L5 phi	**10**	<20	1.5	5	**~20**
L5 z	**10**	<20	1	4	**~20**

Radiation dose on Electronics

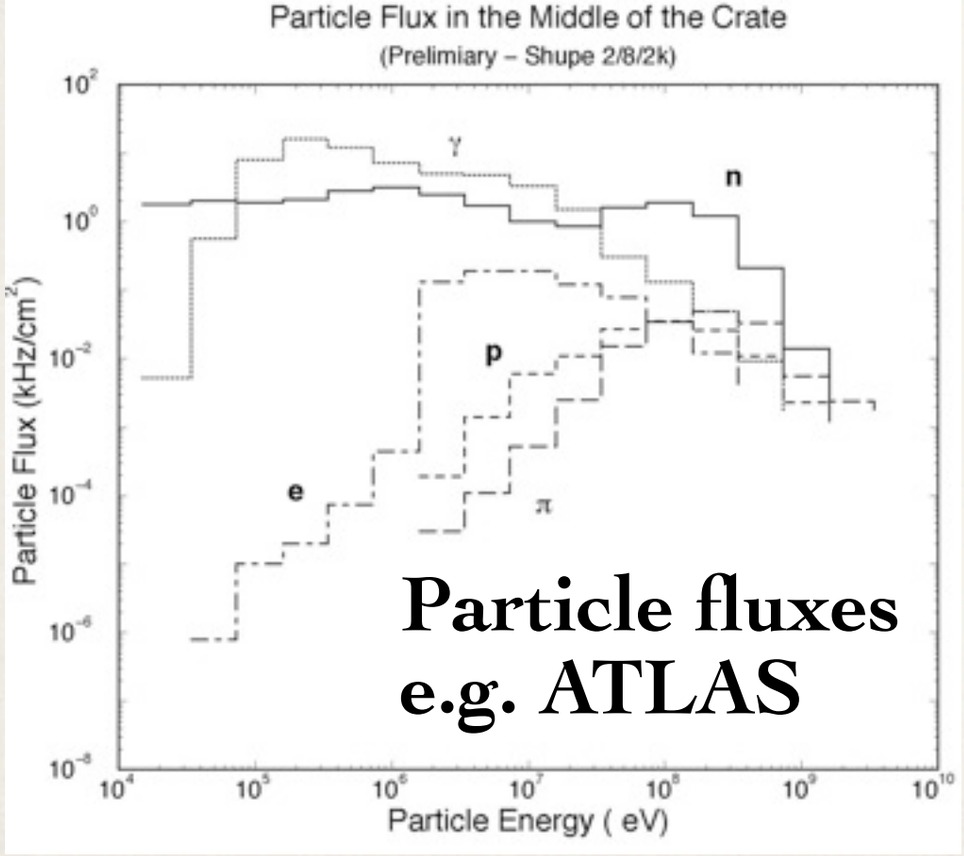
- Doses can be significantly different on Bwd and Fwd sides
- Table shows the max values accumulated in 1 year (10^7 sec)



Max. Dose (krad)	0	1	2	3	4	5
Pairs	520	71	85	95	48	8
RadBhabha	95	15	14	22	11	2
Touschek HER	57	12	14	7.5	3	1.2
Touschek LER	180	52	64	29	8.2	3.9
TOTAL	852	150	177	154	70	15

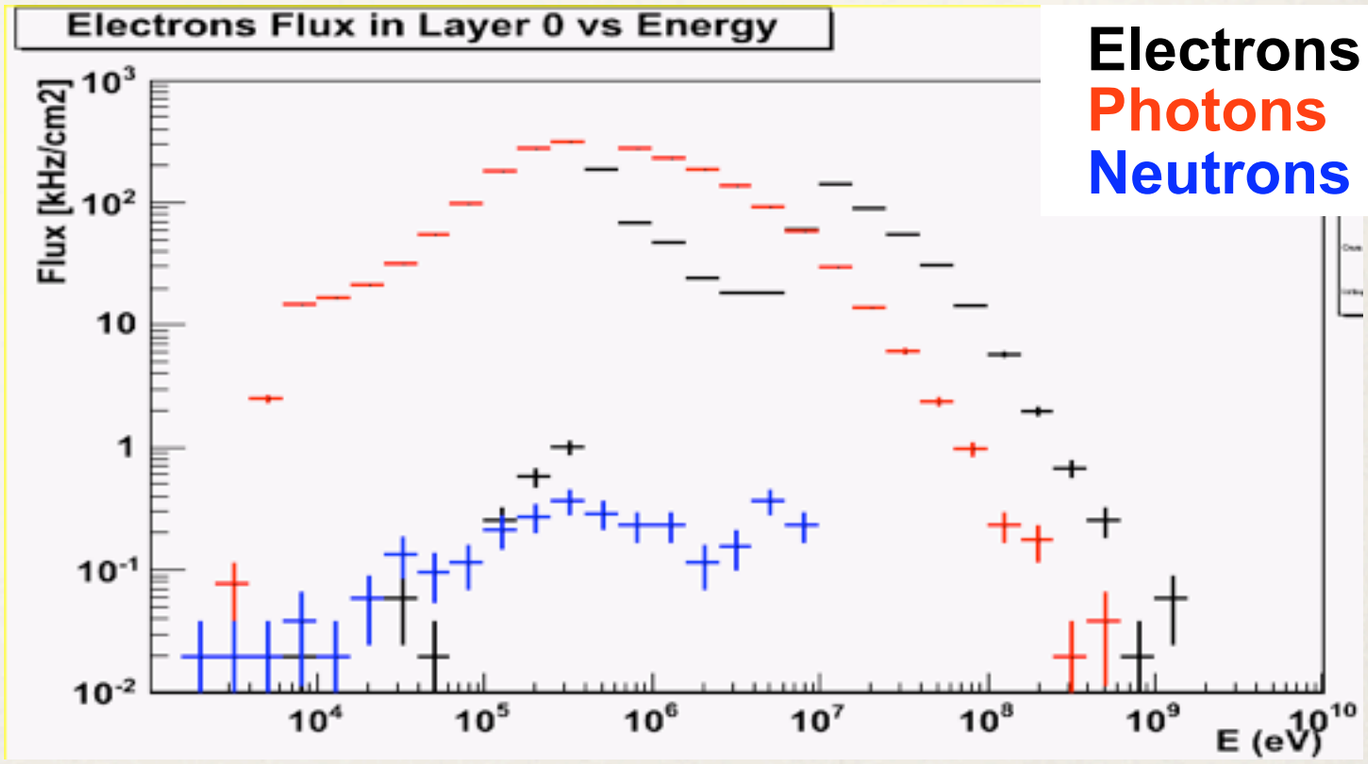
Particle flux on electronics

- Request for particle fluxes on electronics, plot from Atlas
- Particle flux vs kinetic energy for electronics on each layer
- Electron and photon rate looks higher than Atlas, hundreds of kHz
- Few neutrons, neutron processes in the simulation are not the most detailed ones
- Protons and pions are below the sensitivity with the present statistics



Particle fluxes e.g. ATLAS

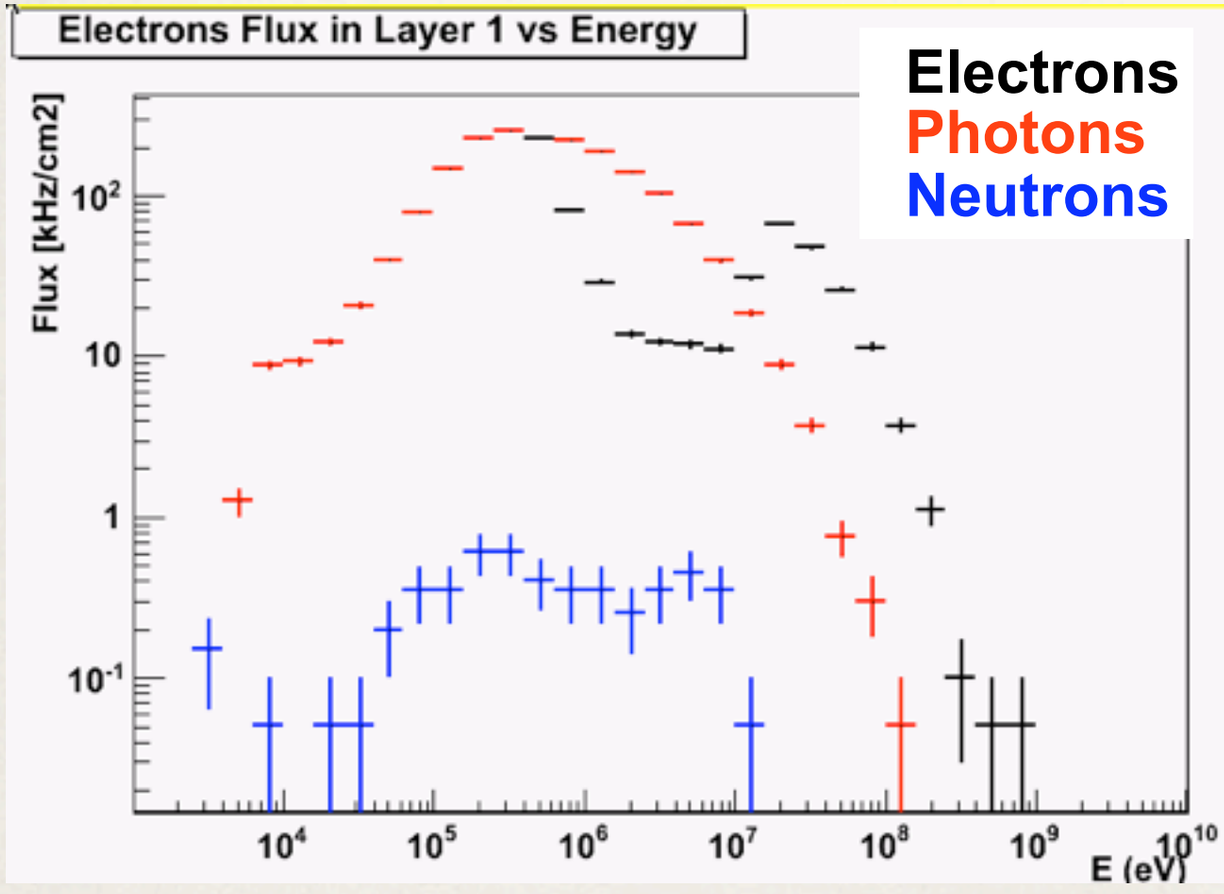
Particle fluxes Layer0 2photons



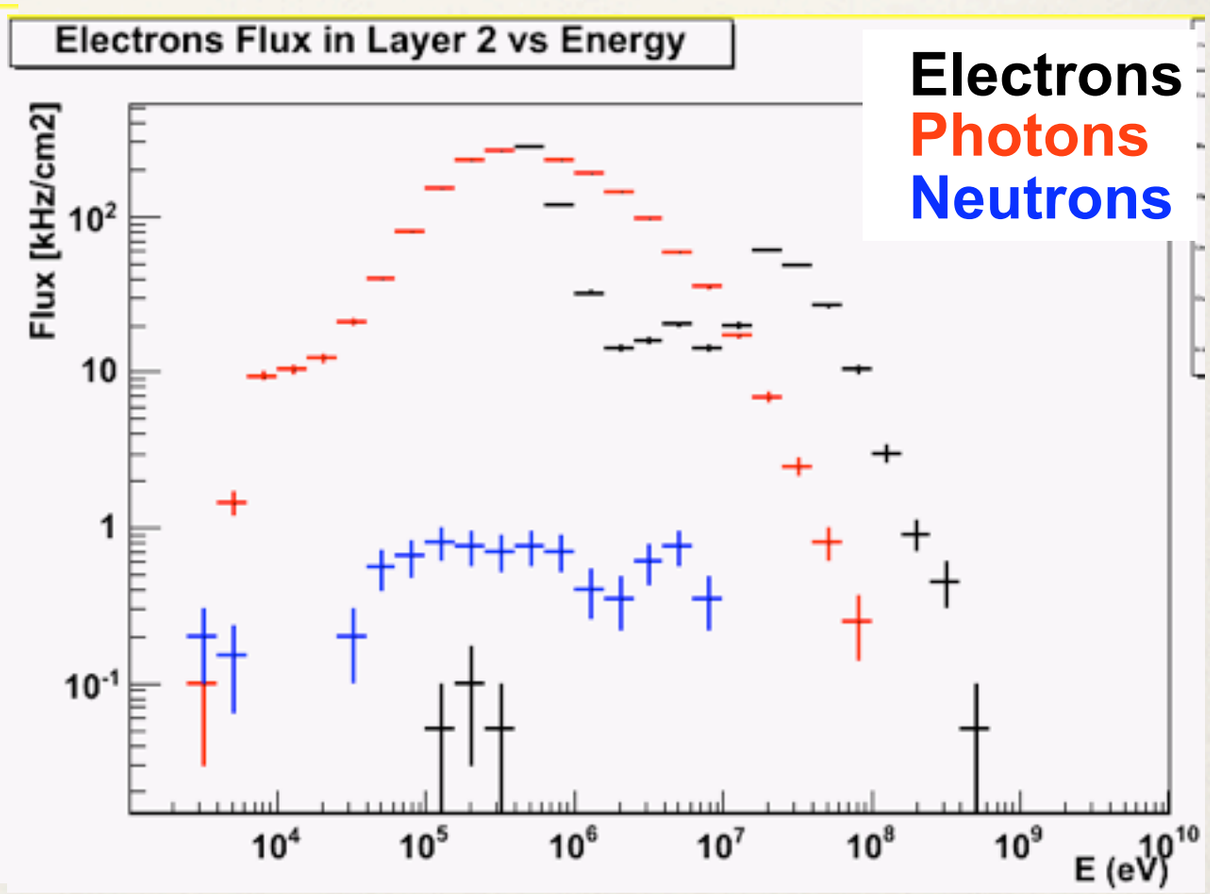
Particle flux on electronics

- Outer layers, rates are not decreasing
- Plots are available for all the layers and all the background sources

Particle fluxes Layer1 2photons



Particle fluxes Layer2 2photons



Conclusions

- New productions made using the same configuration, more consistent
- Update of old rates: 2photons bkg contribution still dominates, but Touschek from LER have a significant impact on outer layers
- New rates by module using local coordinates, less geometrical approximation, more useful to design chips
- Updates of dose estimations for front-end electronics
- New plots for particle fluxes on the electronics, useful to estimate SEU effects
- To do: implement striplets (45°) for L0 detector and new geometry for L0 FEE

Strip pitches

- Pitches

[um]	L0	L1	L2	L3	L4	L5
Z	50	100	100	100	210	210
Phi	50	50	55	55	100	100

Results L0,1,2

- Same values for L0
- Lower cluster rate, but higher pixel rate, fluency and dose for other layers

LAYER 0	Dec2010	May2011	
Cluster rate	6.44	6.37	MHz/cm2
Cluster multip	8.1	8.1	
Pixel rate	56.1	55.6	MHz/cm2
Fluency	4.79E+12	4.73E+12	cm-2
Dose	3.61	3.58	MRad

LAYER 1	Dec2010	May2011	
Cluster rate	0.43	0.22	MHz/cm2
Cluster multip	2.12	10.88	
Pixel rate	0.91	2.56	MHz/cm2
Fluency	5.40E+10	1.80E+11	cm-2
Dose	0.03	0.11	MRad

LAYER 2	Dec2010	May2011	
Cluster rate	0.23	0.12	MHz/cm2
Cluster multip	1.98	10.54	
Pixel rate	0.48	1.31	MHz/cm2
Fluency	2.91E+10	9.80E+10	cm-2
Dose	0.017	0.057	MRad

Results L3-5

- Same values for L0
- Lower cluster rate, but higher pixel rate, fluency and dose for other layers

LAYER 3	Dec2010	May2011	
Cluster rate	67.2	37.6	kHz/cm2
Cluster multip	1.91	9.96	
Pixel rate	131	342	kHz/cm2
Fluency	7.95E+09	2.57E+10	cm-2
Dose	5	15	kRad

LAYER 4	Dec2010	May2011	
Cluster rate	7.2	5.8	kHz/cm2
Cluster multip	1.63	7.68	
Pixel rate	11.9	31.6	kHz/cm2
Fluency	5.90E+08	1.88E+09	cm-2
Dose	0.5	1.8	kRad

LAYER 5	Dec2010	May2011	
Cluster rate	3.8	3.4	kHz/cm2
Cluster multip	1.66	6.97	
Pixel rate	6.1	15.3	kHz/cm2
Fluency	2.18E+08	7.00E+08	cm-2
Dose	0.3	1.0	kRad