SR Study for ILC

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Outline

- Present status (as I understand it)
- Some general concerns
- Start up scenario?
- What needs continued work

Present Status

- Takashi-san has done a good deal of preliminary work
  - Looked at upstream photon sources
  - Primarily the final focus magnets
- Recent discovery that the lattice was changed in 2006
  - The last soft bend magnets are 5 times stronger
  - Perhaps this is still OK?
  - Collimator heating?

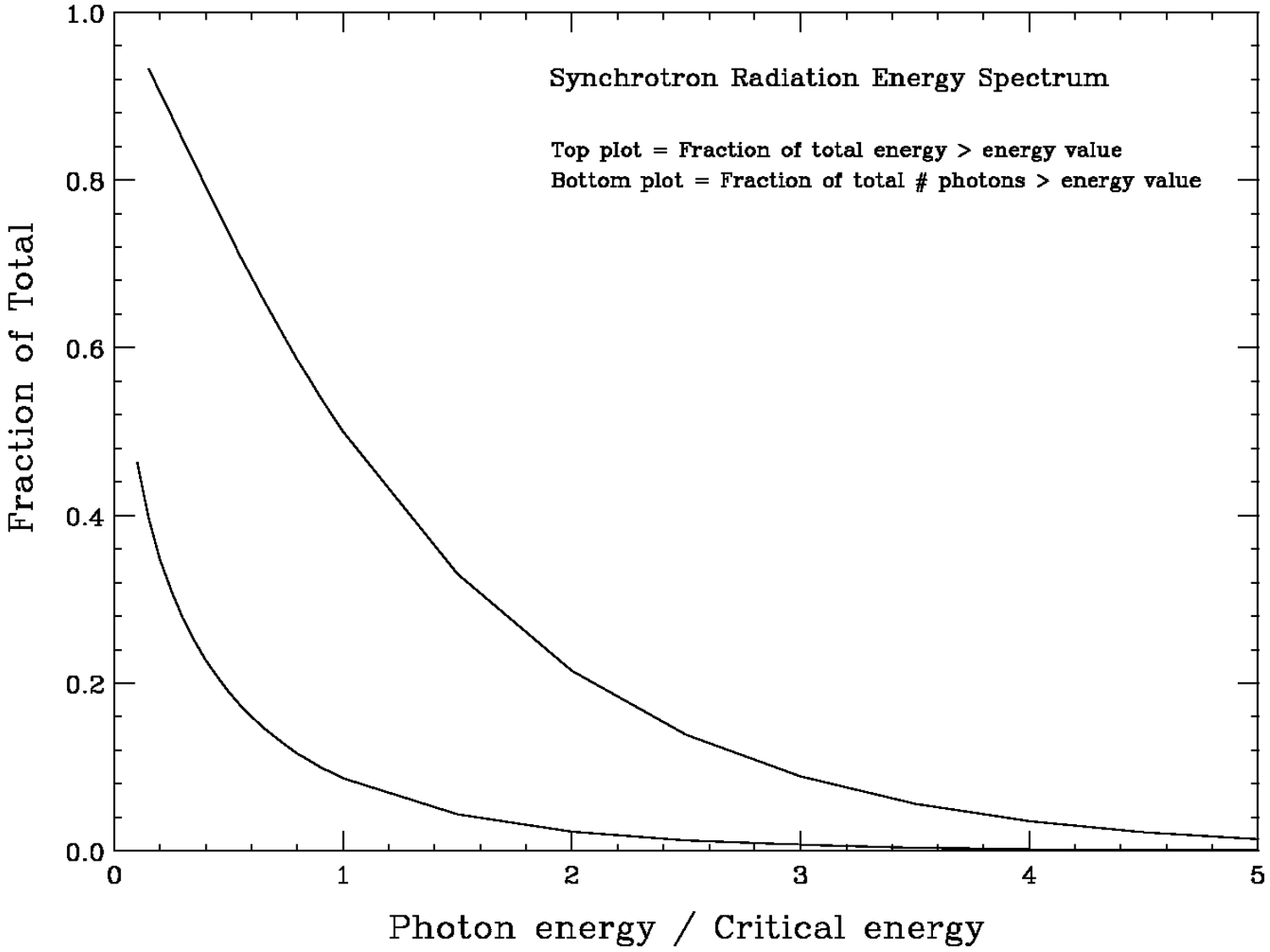
Present magnet strengths

- I find the following magnet strengths
  - Name Number Location (m) Field (kG)
  - B1 6 90-160 0.1243
  - B2 11 166-306 0.3445
  - B5 10 383-513 0.4215
  - BS1 30 787-1194 0.2917

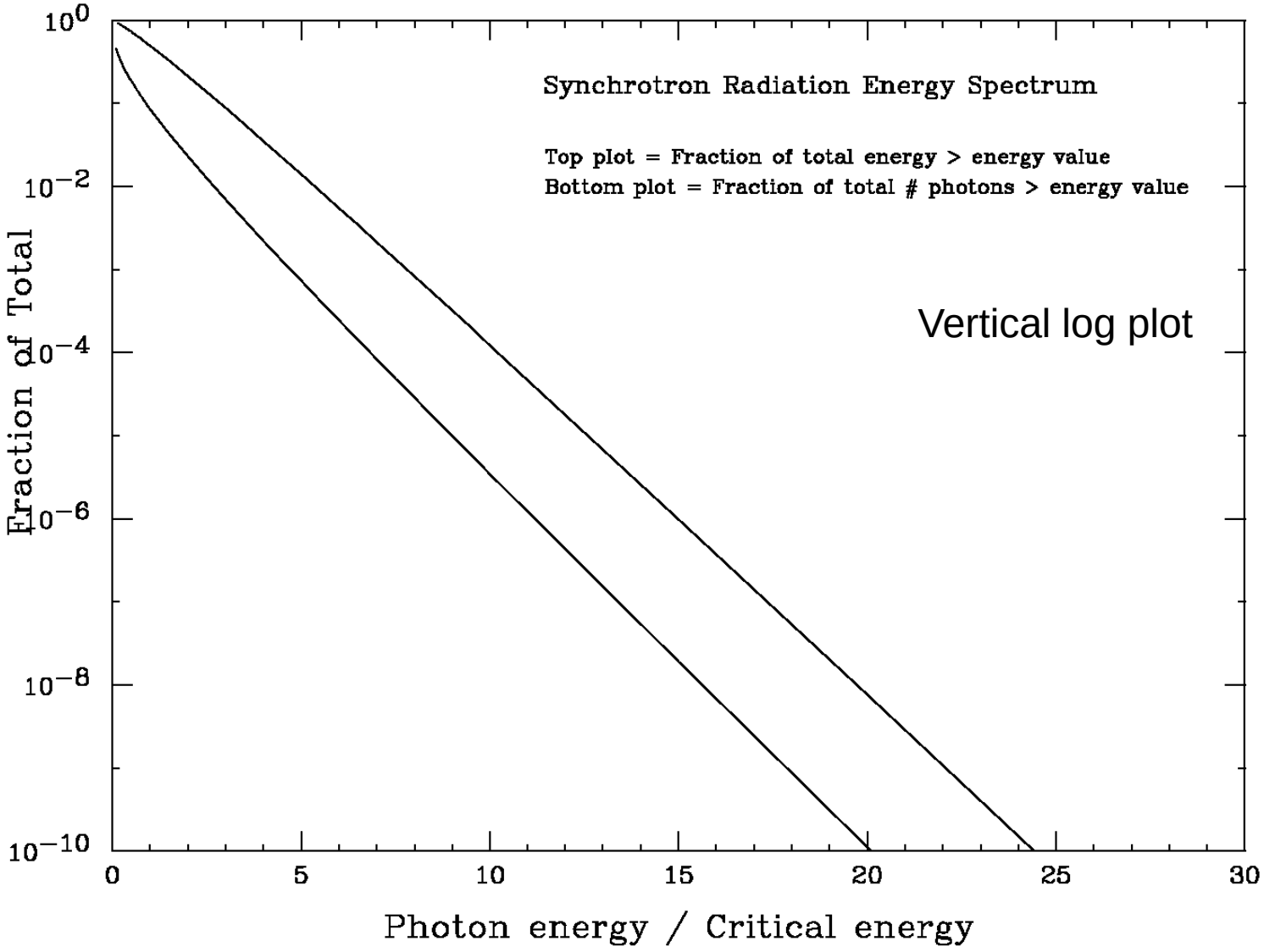
Some Concerns

- At these beam energies:
  - What about out of plane radiation?
    - This goes as $1/\gamma$ and hence is very small for high beam energies, but there is a photon energy dependence (the lower the photon energy the larger the angle)
    - Probably not a problem
  - SR photon energy spectrum
    - At this beam energy, even low field magnets induce large critical energies. Even so, we still end up with a lot of low energy photons
    - We also get some very high energy photons in the tail

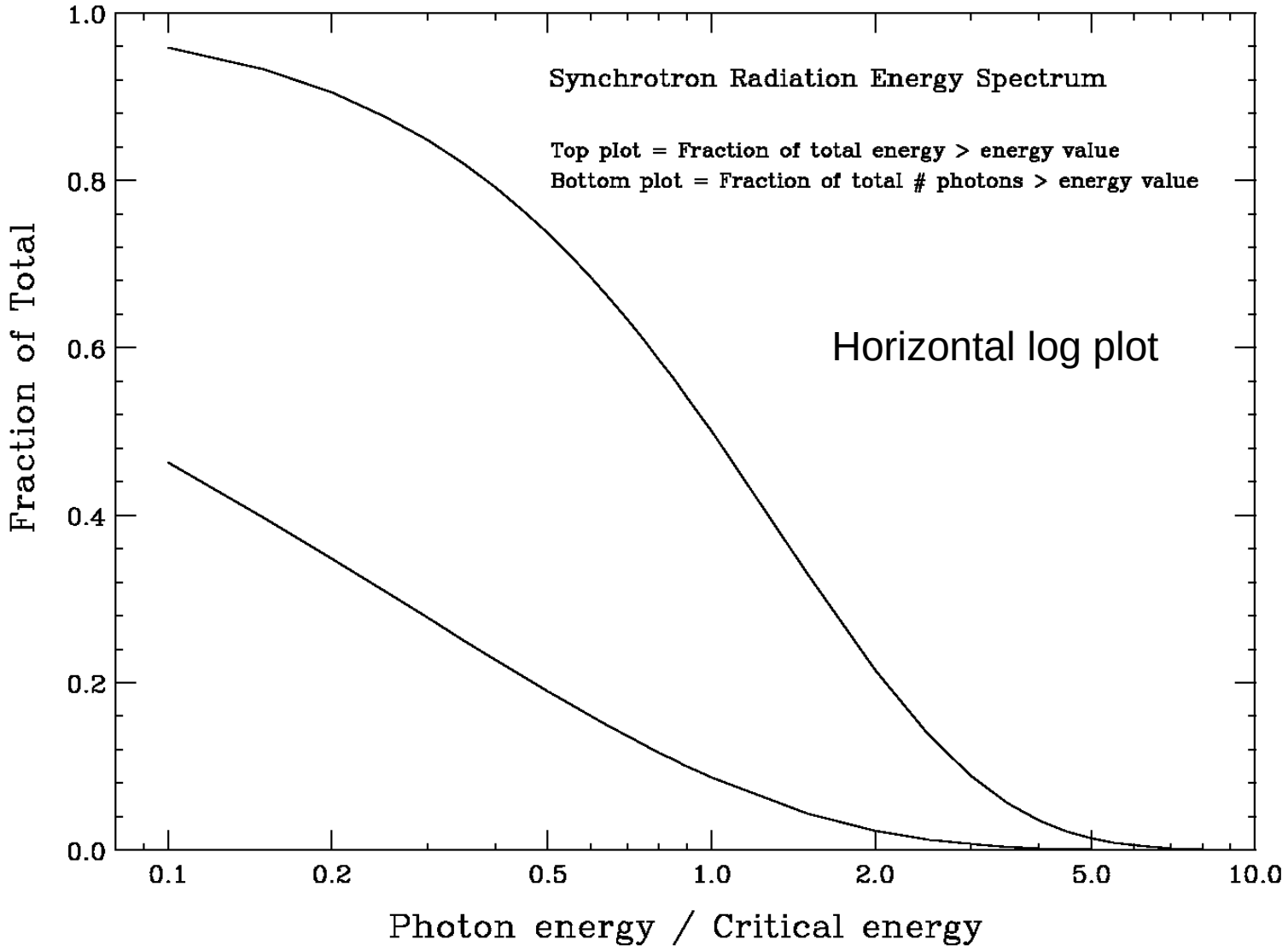
Synchrotron Radiation Energy Spectrum



Synchrotron Radiation Energy Spectrum



Synchrotron Radiation Energy Spectrum



Spectrum Numbers for reference

R	#gam/tot	E/Etot
0.10	0.46283	0.95916
0.15	0.39719	0.93282
0.20	0.34829	0.90519
0.25	0.30949	0.87695
0.30	0.27754	0.84850
0.35	0.25059	0.82011
0.40	0.22744	0.79197
0.45	0.20730	0.76421
0.50	0.18960	0.73693
0.55	0.17392	0.71022
0.60	0.15993	0.68411
0.65	0.14738	0.65866
0.70	0.13606	0.63388
0.75	0.12583	0.60979
0.80	0.11654	0.58642
0.85	0.10807	0.56375
0.90	0.10034	0.54179
0.95	9.32650E-02	0.52054
1.00	8.67730E-02	0.49999
1.50	4.38930E-02	0.33037
2.00	2.32630E-02	0.21504
2.50	1.26730E-02	0.13857
3.00	7.03020E-03	8.86430E-02
3.50	3.95080E-03	5.63880E-02
4.00	2.24180E-03	3.57090E-02
4.50	1.28170E-03	2.25310E-02
5.00	7.37220E-04	1.41730E-02
5.50	4.26120E-04	8.89250E-03
6.00	2.47320E-04	5.56670E-03
6.50	1.44040E-04	3.47800E-03
7.00	8.41360E-05	2.16930E-03
7.50	4.92720E-05	1.35100E-03
8.00	2.89200E-05	8.40180E-04
8.50	1.70080E-05	5.21880E-04
9.00	1.00200E-05	3.23810E-04
9.50	5.91230E-06	2.00710E-04
10.00	3.49350E-06	1.24290E-04
15.00	1.91480E-08	9.93010E-07
20.00	1.11460E-10	7.59300E-09
25.00	6.70620E-13	5.65840E-11
30.00	4.11990E-15	4.14560E-13
35.00	2.56770E-17	3.00090E-15
40.00	1.61720E-19	2.15270E-17
45.00	1.02680E-21	1.53350E-19
50.00	6.56020E-24	1.08630E-21
55.00	4.21290E-26	7.66050E-24
60.00	2.71690E-28	5.38150E-26
65.00	1.75830E-30	3.76830E-28

Start up Scenario?

- Do we need to worry about a startup scenario?
- What is the lowest reasonable luminosity the detector can use?
  - 10 times below design?
  - 100 times below design?
  - I can imagine a case where the design beam emittances have not yet been achieved however, it may be easier to pump up the current to try to increase the luminosity – especially if we are running at some lower center-of-mass energy
  - Z0?, Some light Higgs that LEP missed?
  - Higgs is 130 GeV?
  - t, tbar?

Startup scenarios (2)

- We should try to see if we can make the detector work when the collimators are more open and the beam profile is more flat
  - More difficult background-wise but if the design can do it then the detector could run for early physics
  - At least we should be able to find the edges of acceptability
  - We should also be able to indicate the level of background in the detector
    - Where the hits are and where background sensors should be added to insure detector safety
    - Hopefully can also see how far the collimators can be opened before trouble begins

Plan of effort

- First cross-check Takashi-san
  - Never hurts to make sure we both agree on the result (don't expect any surprises and this will also cross-check that I have set up the IR properly)
- Go further upstream and look at sources farther away
  - Also needed if we want to look at what happens if the collimators are opened
- Also check SR coming from tune up dump kickers
  - Should not be able to get down to the IR but may cause backgrounds if the critical energy high enough?

Effort (2)

- Try to get a handle on internal reflections of x-rays
  - Will have to do some research
  - Light source guys should know something about this
  - May not be a problem if the inside surface is rough enough?
    - Inside surfaces are usually shiny – as witness borescope videos
  - But roughness may be an issue for other things?
- Check detector downstream surfaces and see where we start to get SR hits
  - There may be one bounce openings for the backscattered photons
  - Again if the collimators are opened when and where do things start to cause problems
- Whatever else hasn't yet been thought of…..