Update for E-203
6 August 2012

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Sorting some of the plots

- I have created a web page with links to various sets of plots related to the ongoing analysis work (Solène's work + my work):

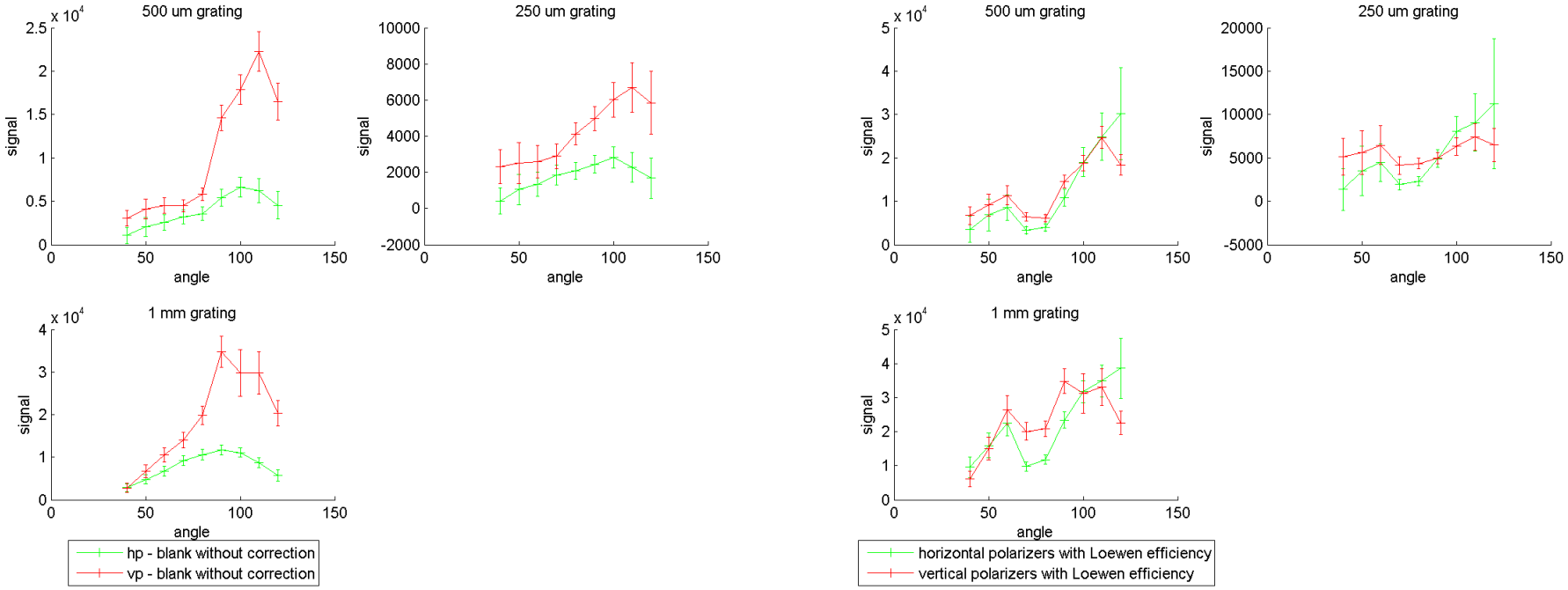
http://lal.delerue.org/smith-purcell/data_analysis/201206_FACET/data_analysis_summary.html

http://lal.delerue.org/smith-purcell/data_analysis/201206_FACET/data_analysis_summary.html

SOME PLOTS FROM SOLÈNE (AND THEIR CONTINUATION)

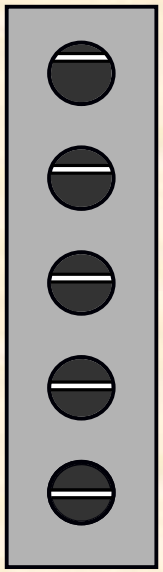
Data with error bars

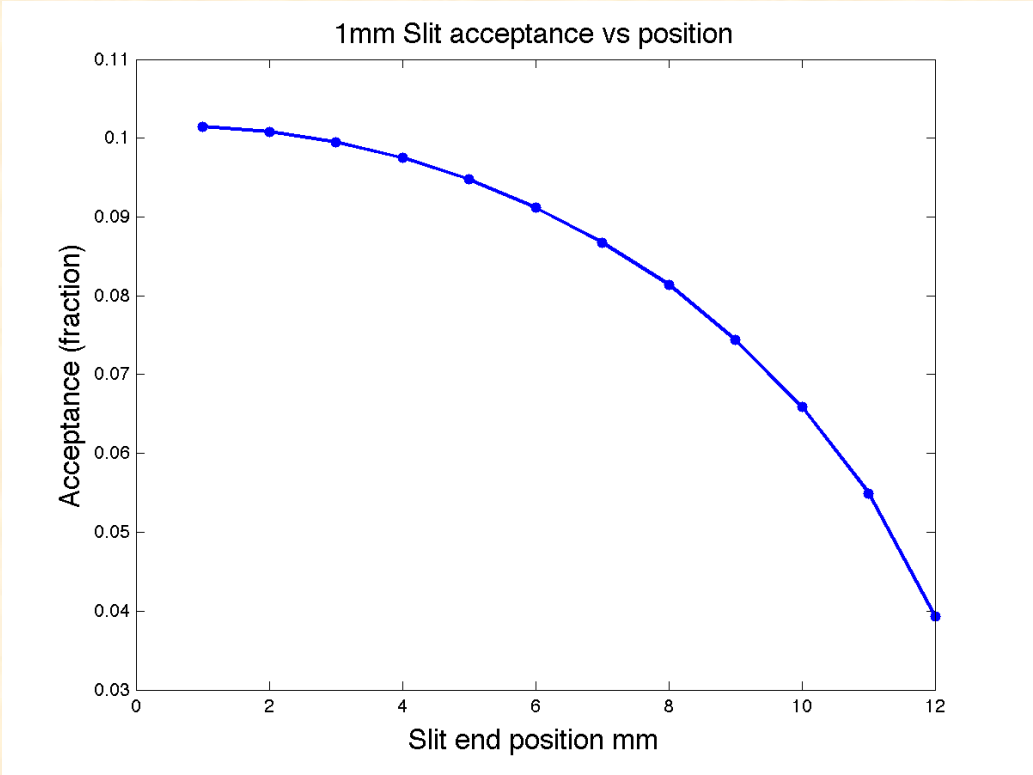
- Solène studied the various uncertainties in the polarization data to confirm that the polarization observed is significant. All plots are at http://lal.delerue.org/smith-purcell/data_analysis/solene/solene/polarization/images/errorbars/errorbars.html



Phi study

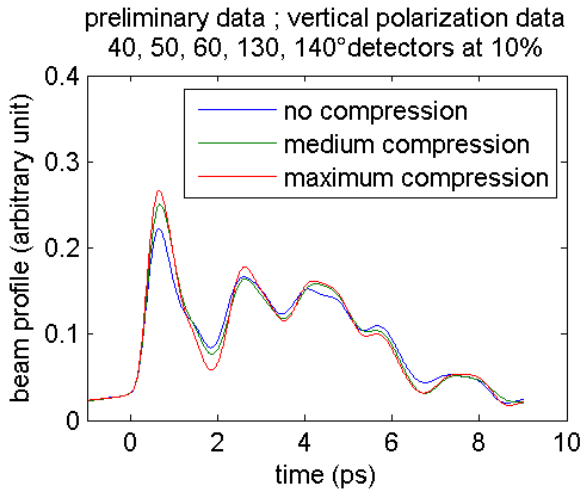
- Do we want to prepare 25mm plates to do the study suggested by Solène?
- This is not much work but it is better to order these plates as early as possible to avoid rushing the workshop.
- Acceptance would be between 5% and 10% for 1mm slits.

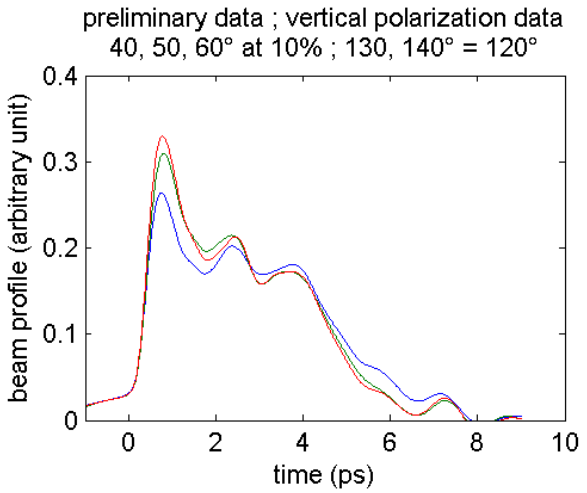


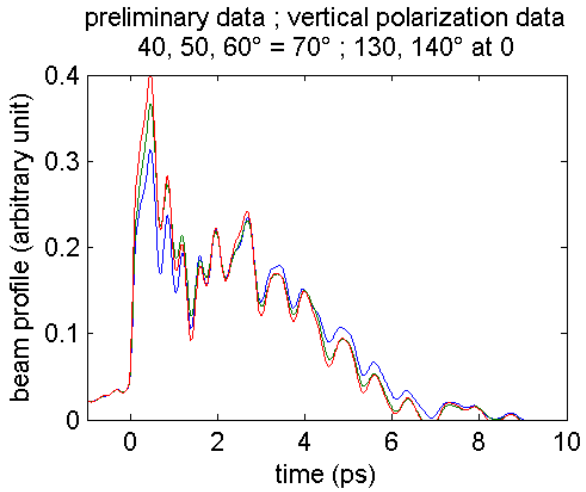


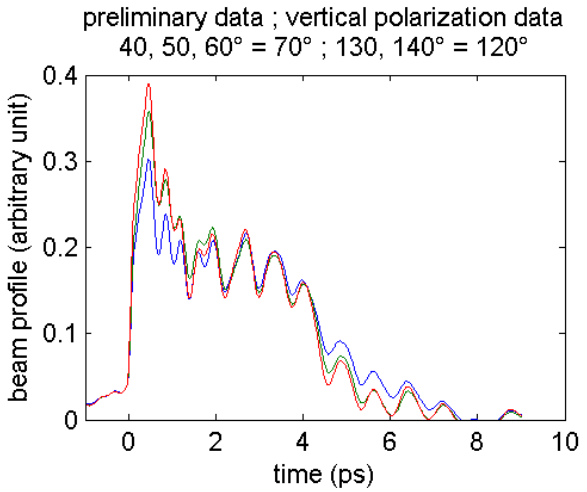
Reconstruction using polarisation

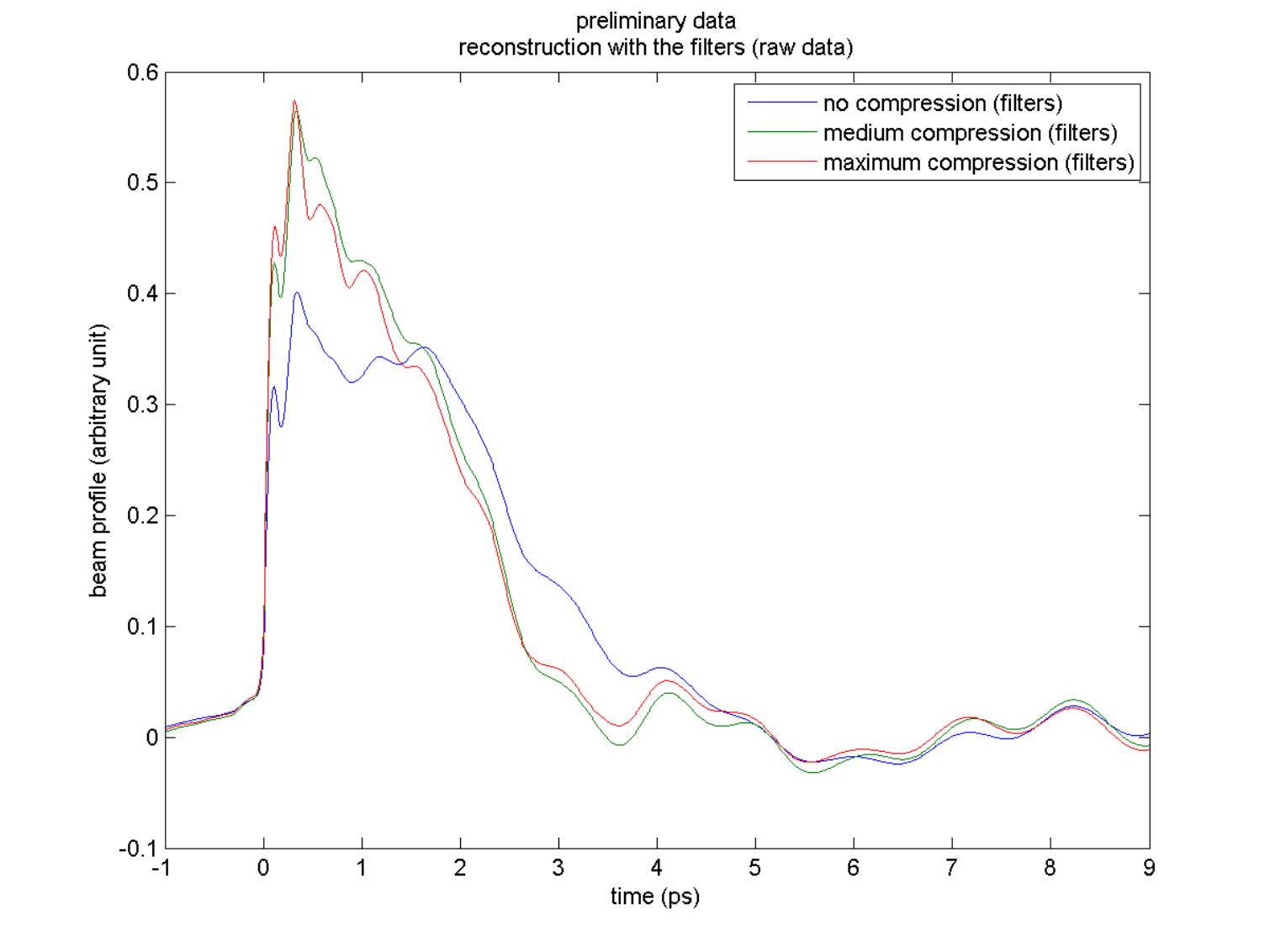
- Plots already circulated by Solène.
- Added here for discussion.
- Note: beam parameters were not correct (both polar. & filters) => example only










preliminary data
reconstruction with the filters (raw data)
no compression (filters)
medium compression (filters)
maximum compression (filters)
beam profile (arbitrary unit)
time (ps)
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-1
0
1
2
3
4
5
6
7
8
9

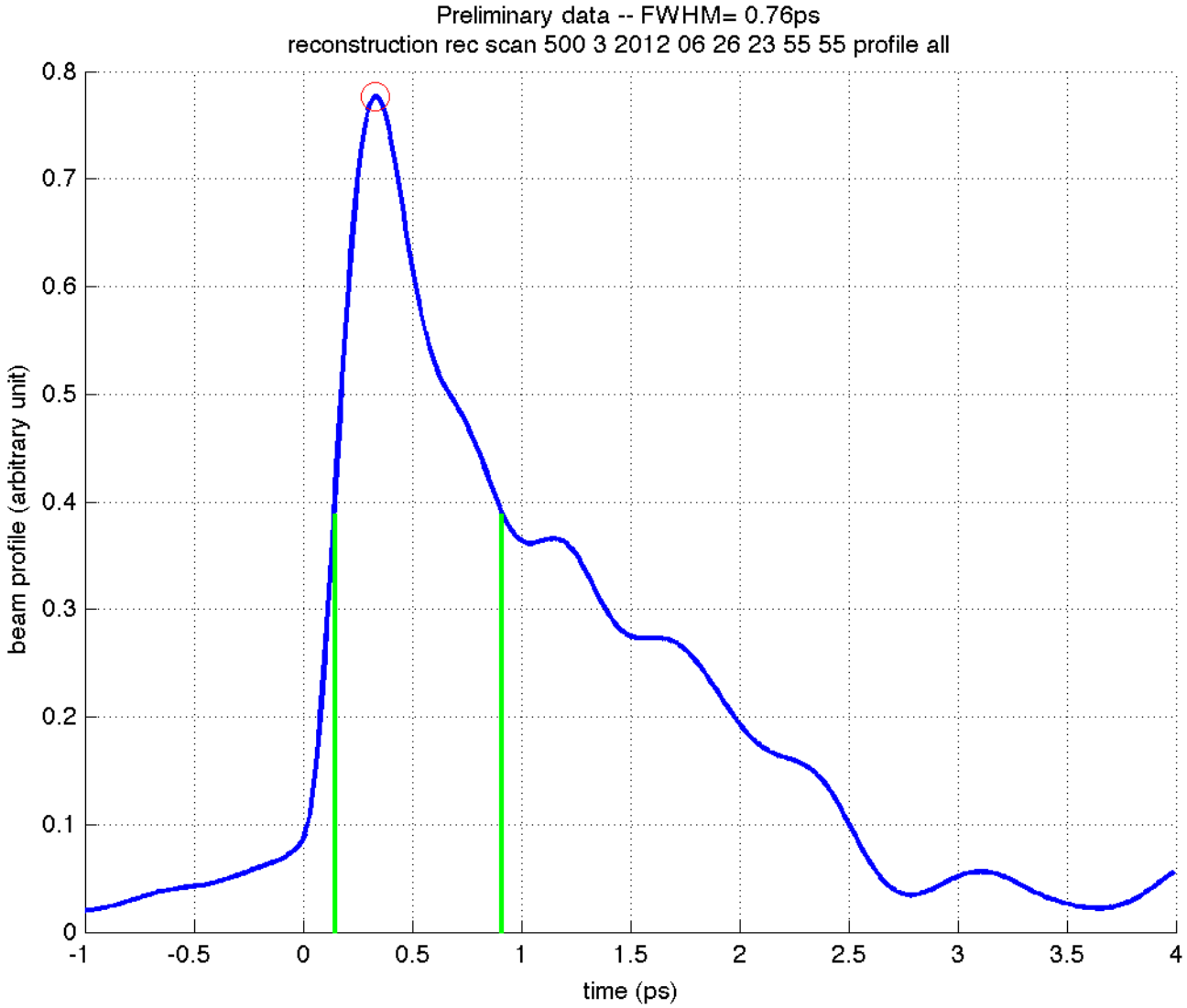
http://lal.delerue.org/smith-purcell/data_analysis/201206_FACET/data/analysed/2012_06_26_23_55_55_reconstructions_varchg.html

PLAYING WITH CAUCHY

Reconstructions of all the runs of 26 06

- I did an automated reconstruction of all the runs of 26 06 2012.
- http://lal.delerue.org/smith-purcell/data_analysis/201206_FACET/data/analysed/reconstructions_20120626.html

Run 23 55 55 reconstruction



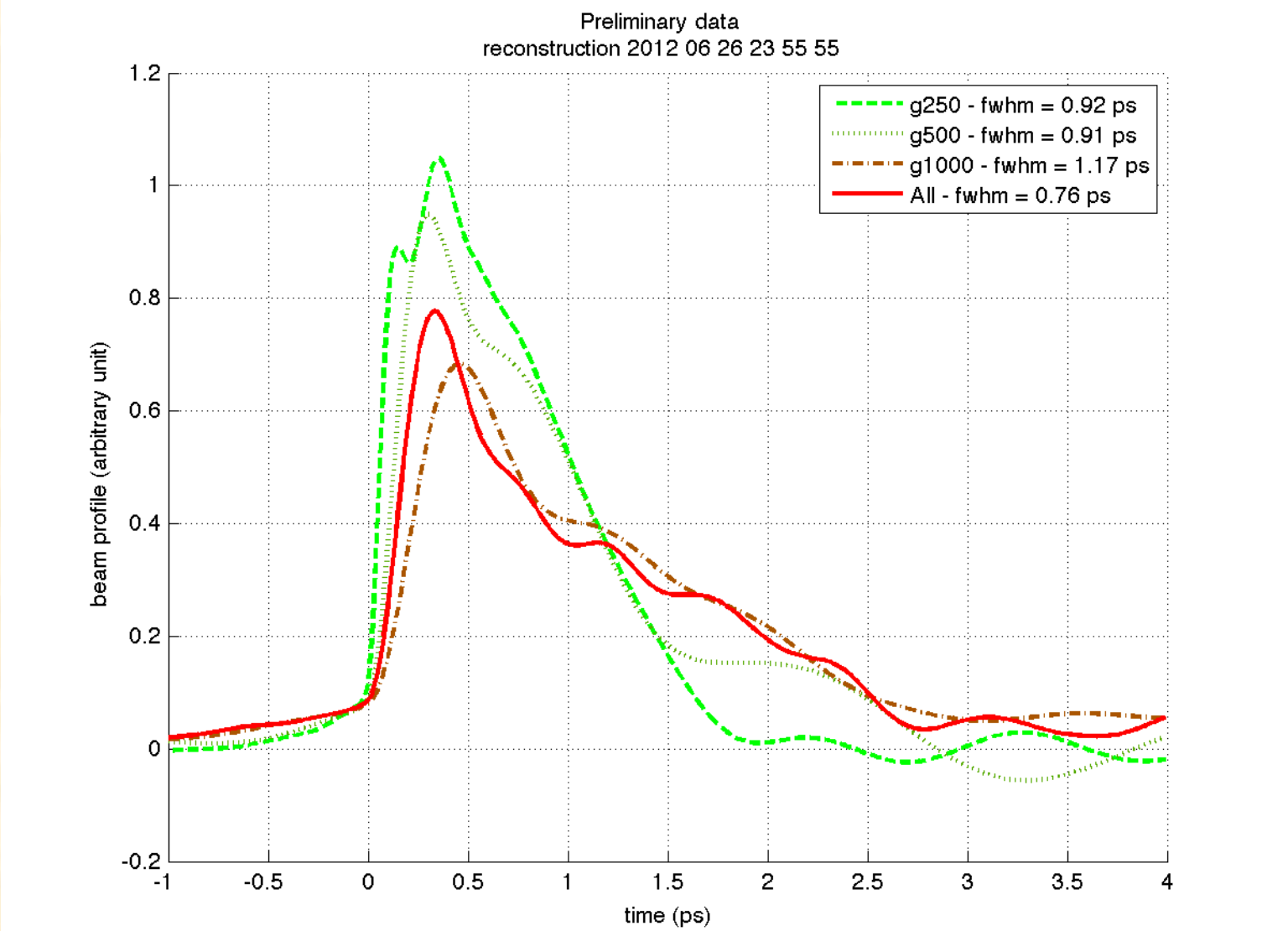
- 4 data points removed in Cauchy.
- Smoothing algorithm used.
- Comparable to George's plots.

Beam parameters for the reconstructions

http://lal.delerue.org/smith-purcell/data_analysis/201206_FACET/data/analysed/reconstructions_20120626.html

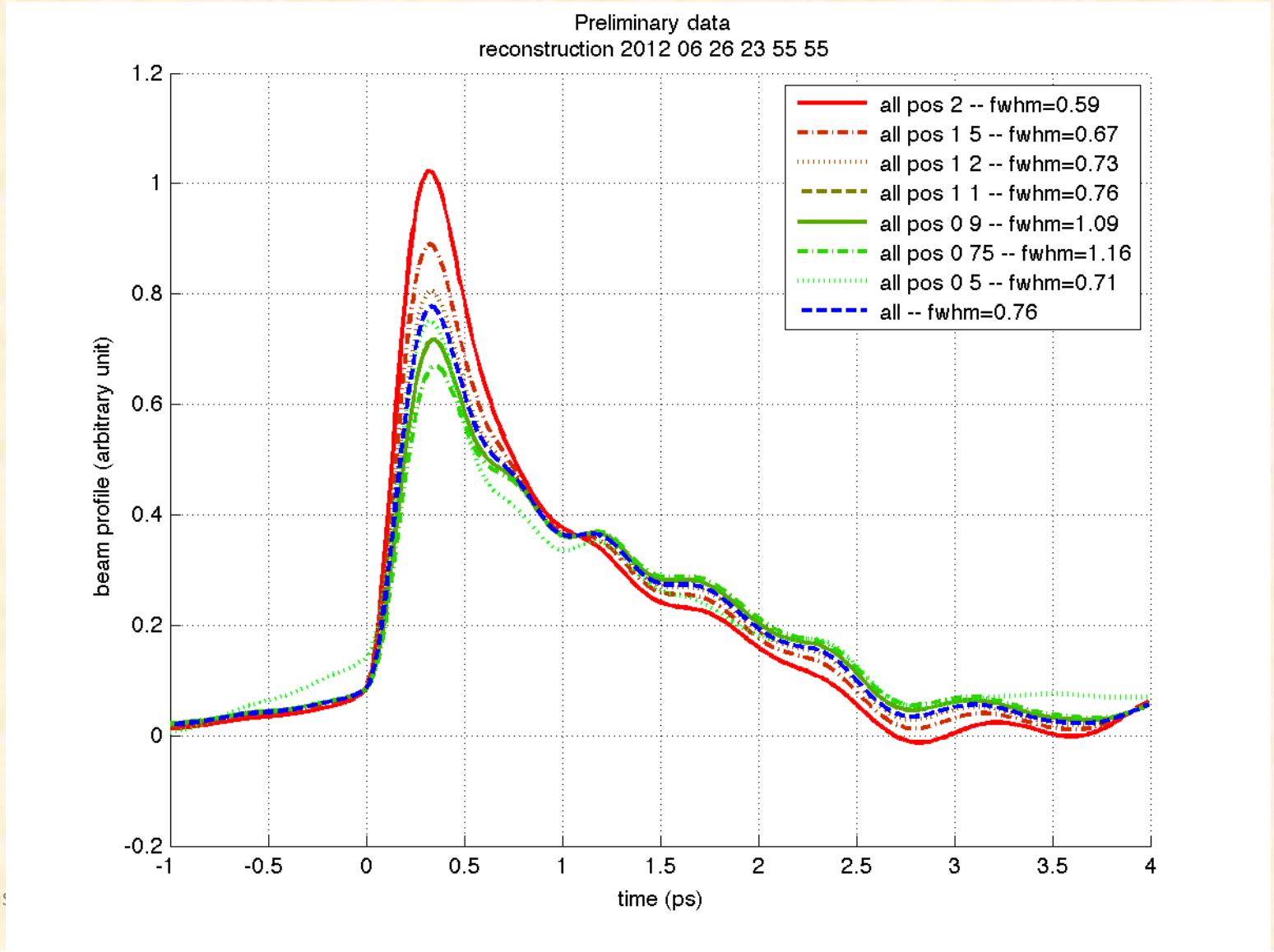
- @gamma@ => 39824
  @norm_emit@ => 1.6693
  @separation@ => 2.2107
  @fwhm_x@ => 0.4
  @fwhm_y@ => 0.4
  @num_gratings@ => 3
  @g1_file@ => analysed/data_2012_06_26_23_57_26.txt
  @g1_charge@ => 1.9378
  @b1_file@ => analysed/data_2012_06_27_00_03_00.txt
  @b1_charge@ => 1.9263
  @g2_file@ => analysed/data_2012_06_27_00_05_44.txt
  @g2_charge@ => 1.9095
  @b2_file@ => analysed/data_2012_06_27_00_04_24.txt
  @b2_charge@ => 1.7275
  @g3_file@ => analysed/data_2012_06_27_00_13_16.txt
  @g3_charge@ => 1.9338
  @b3_file@ => analysed/data_2012_06_27_00_03_42.txt
  @b3_charge@ => 1.9108
  @radiation_order1@ => 1
  @period1@ => 1.0
  @uncertainty1@ => 0
  @radiation_order2@ => 1
  @period2@ => 0.5
  @uncertainty2@ => 0
  @radiation_order3@ => 1
  @period3@ => 0.25
  @uncertainty3@ => 0
  @rescale_overlap@ => y
  @remove_points@ => y
  @points_to_remove@ => 4
  @length_estimate@ => 0.2
  @freq_subdivisions@ => 100
  @create_output_rho@ => y
  @rho_out@ =>
  rec_scan_500_3_2012_06_26_23_55_55_profile_all.rhoout
  @start_reconstruction_time@ => -1
  @reconstruction_steps@ => 0.01
  @create_output_file@ => y
  @output_profile_file@ =>
  rec_scan_500_3_2012_06_26_23_55_55_profile_all.recout

Contribution of each grating

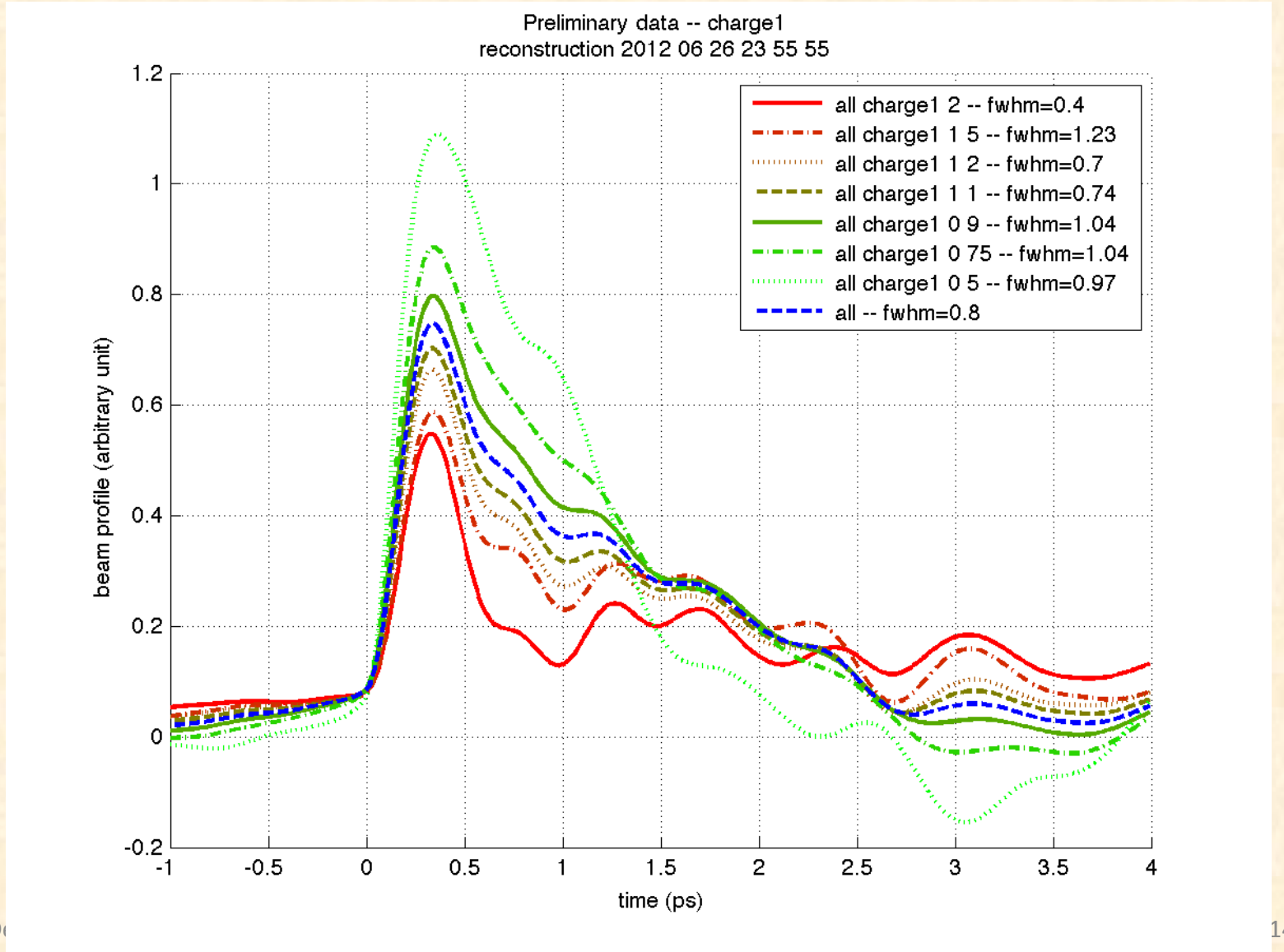


Effect of beam position

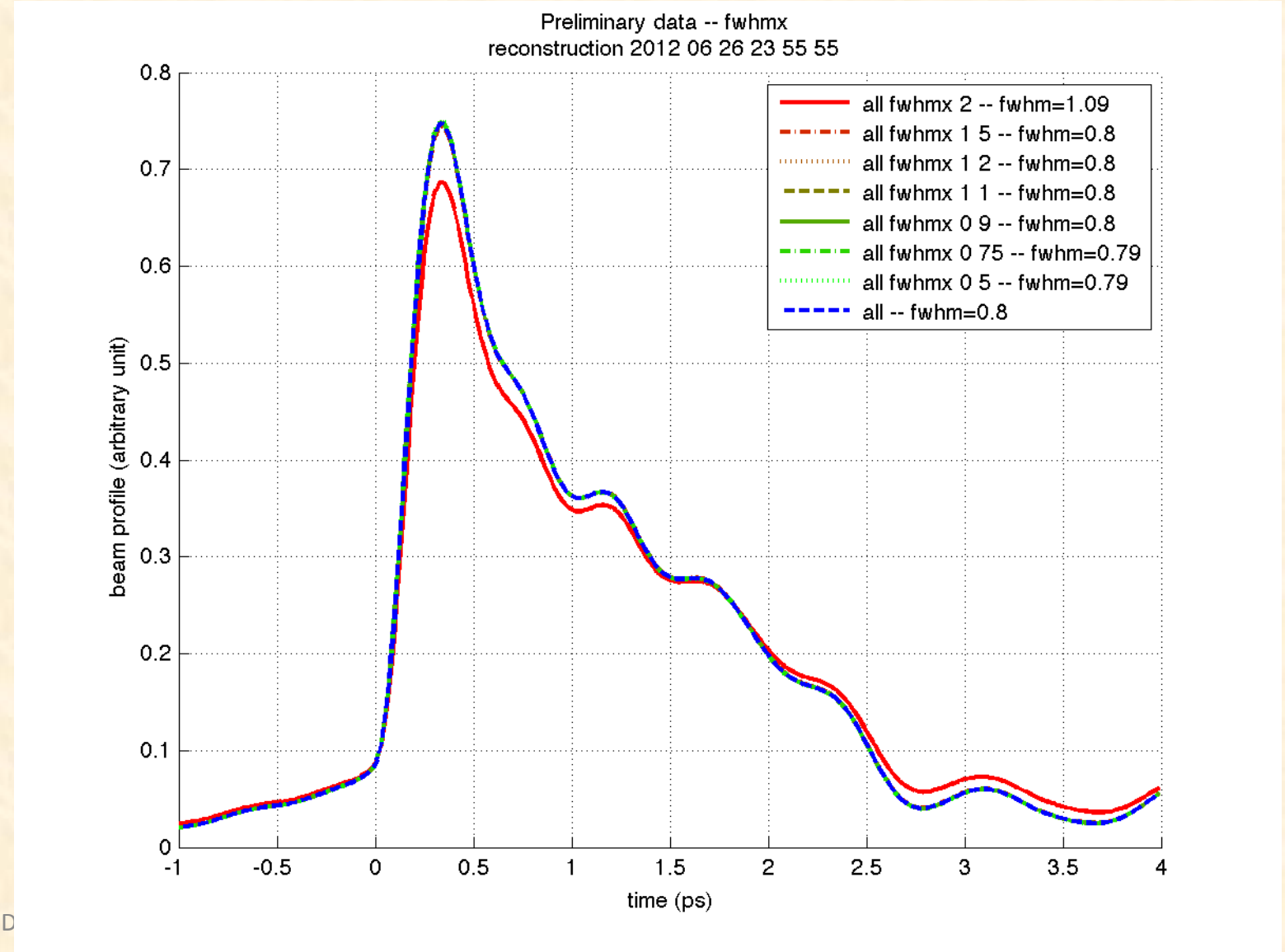
(50%, 75%, 90%, 110%, 120%, 150% and 200% of recorded position)



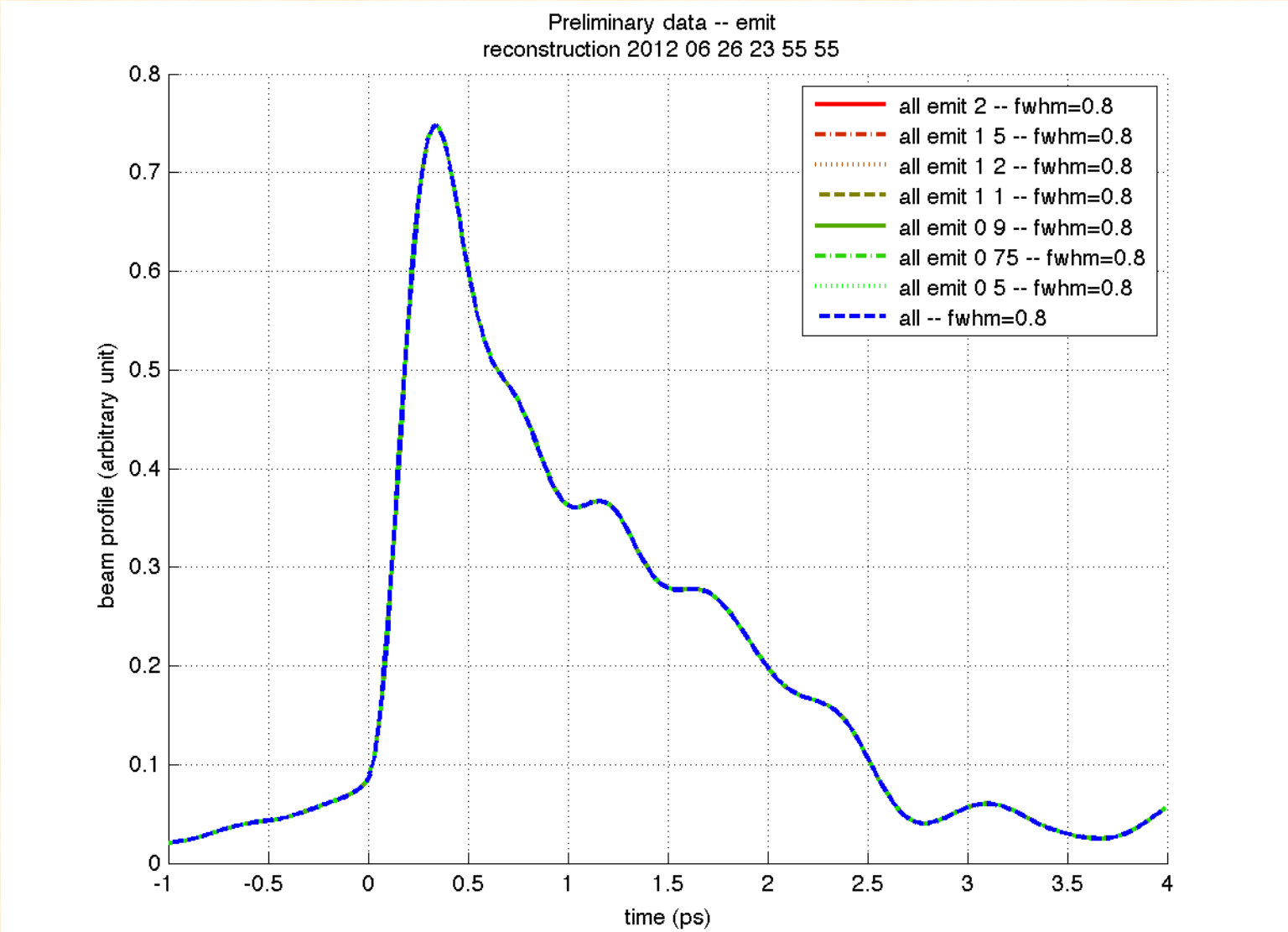
Effect of charge (First grating only)



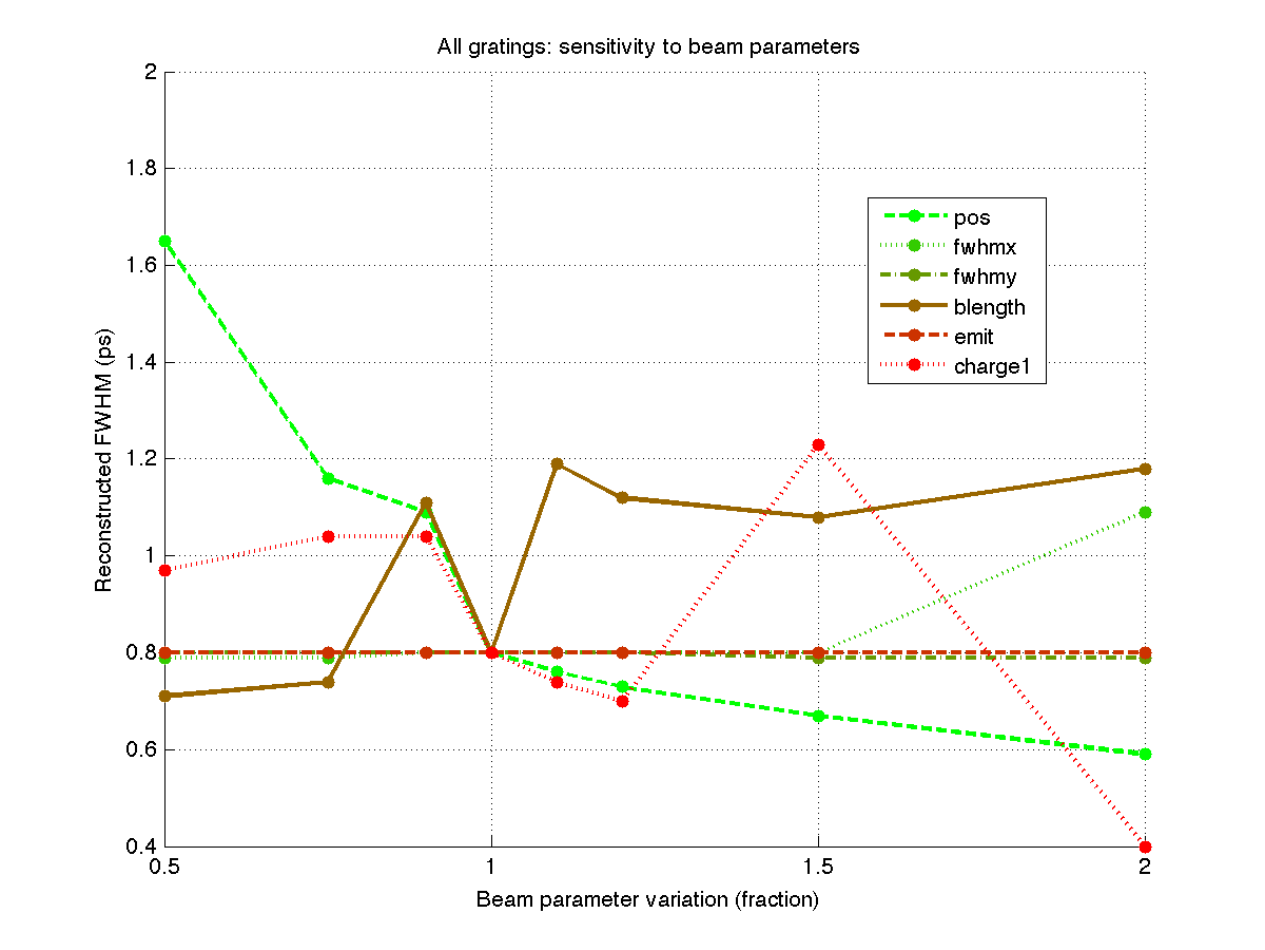
Effect of beam size



Effect of emittance

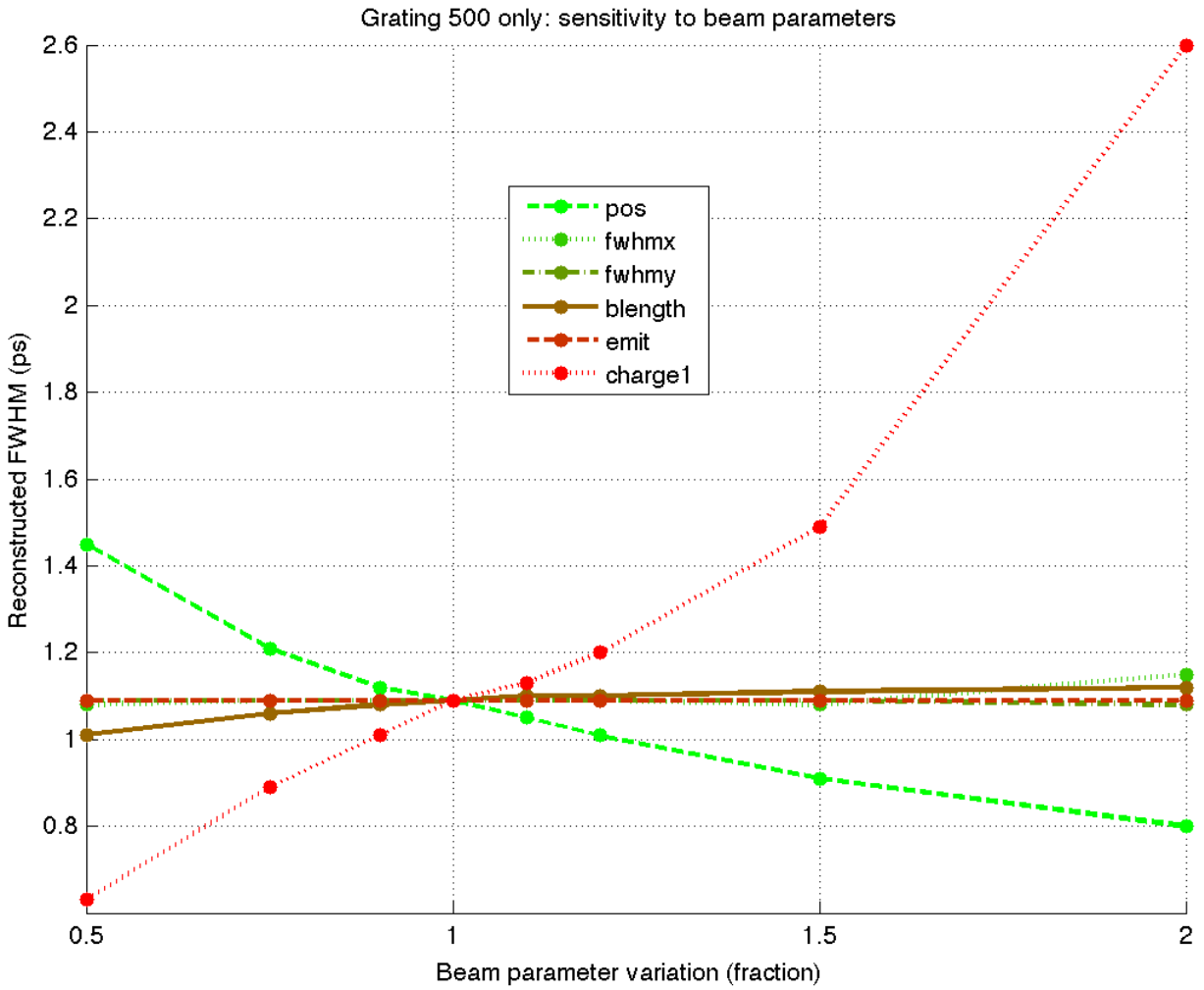


Sensitivity to beam parameters



- Some FWHM fluctuations due to wiggles.
- 20% change in beam pos => 41% FWHM change.
- 20% change in charge (first grating only) => 37% FWHM change.
- "Reconstructed length" has some non linear effect.
- Minimal effect of X,Y transverse size and emittance.

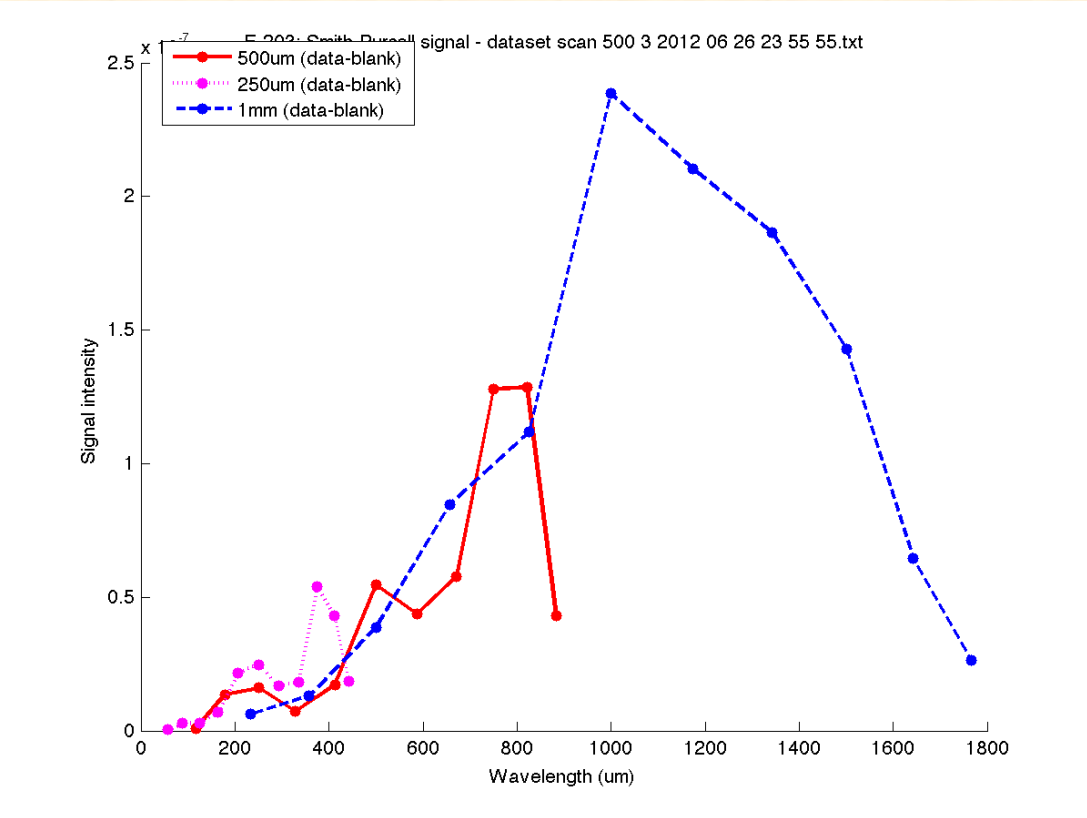
Same for 500um grating only



- 20% change in beam pos => 6% FWHM change.
- 20% change in charge => 11% FWHM change.
- Minimal effect of X,Y transverse size, rec. length and emittance.

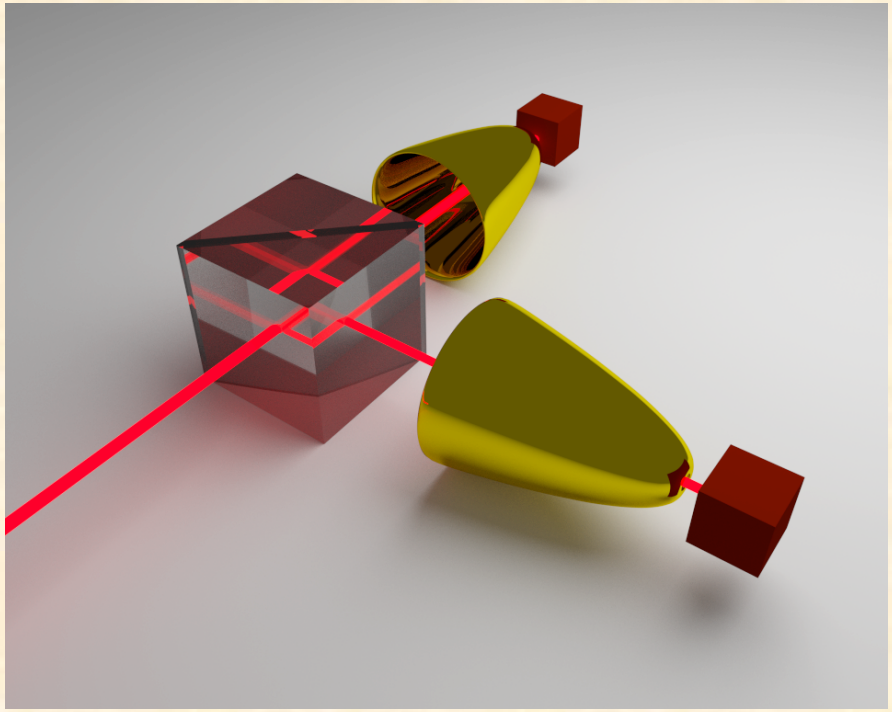
Spectrum to share with THz…

- How do we want to produce the spectrum to be shared with the THz group?
- Do we want to apply GFW efficiency corrections?
- Which data points do we want to remove?



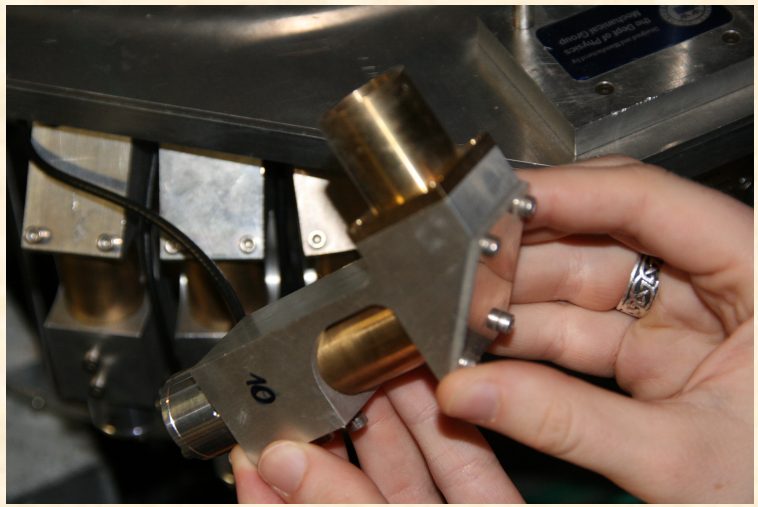
PROPOSED HARDWARE UPGRADE

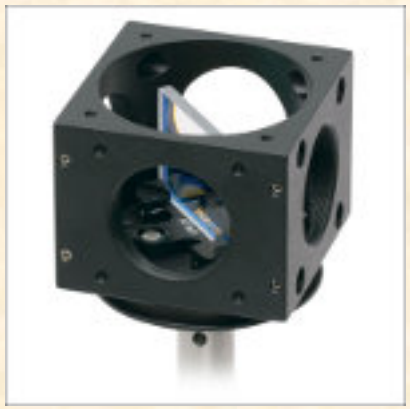
Single shot double polarisation measurement



- By using a polarizer to split the beam into 2 polarization components one could measure both components on the same shot.
- This requires twice as many detectors and winston cones

Single shot double polarisation measurement

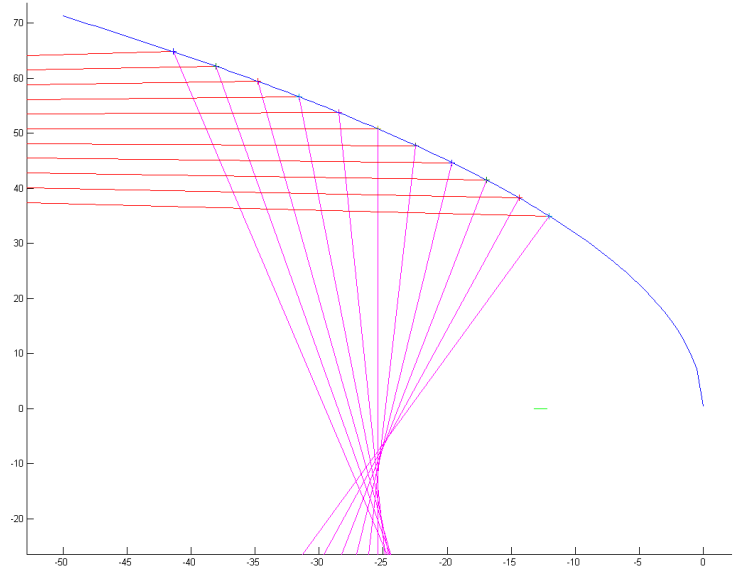


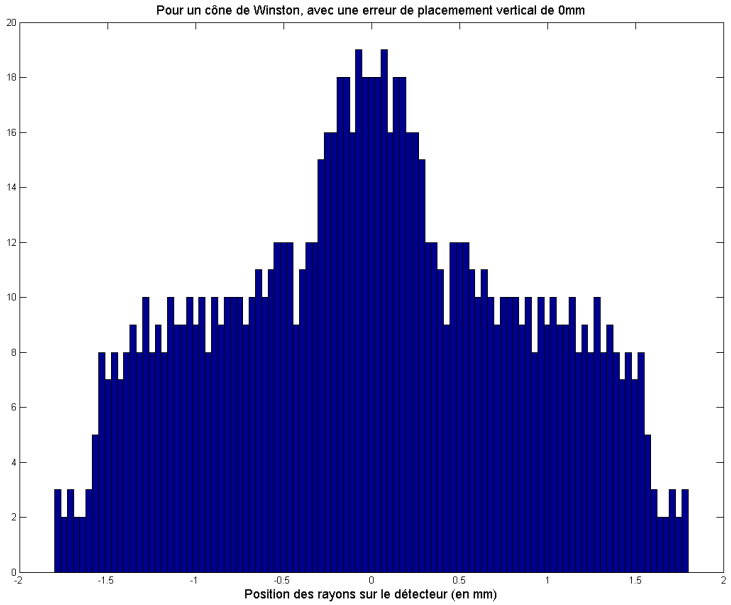


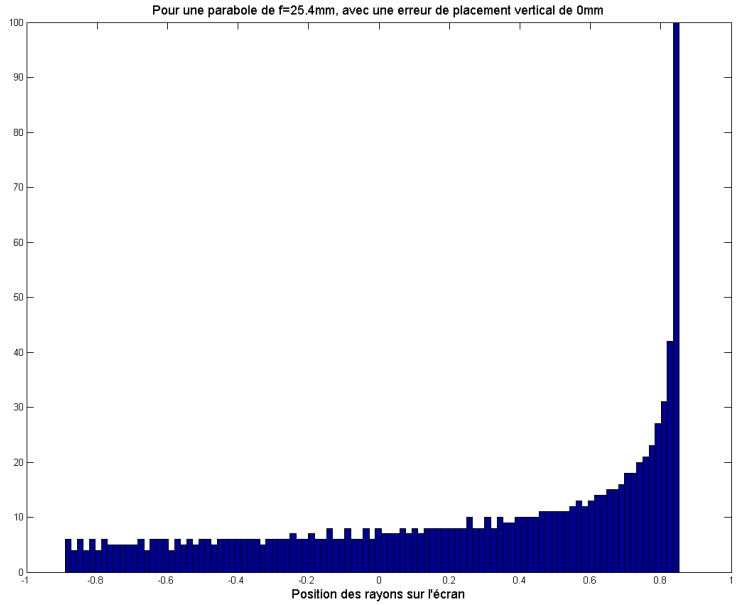
- Might be possible to modify existing hardware to add the second cone, however then the two arms might not be identical.
- Could be done using Thorlabs 30mm cubes and cage system.
- Currently looking for a supplier for Winston cones.
- Could also try with parabolic mirrors (cheaper?).
- This would requires twice as many detectors
  => DAQ upgrade required (an opportunity for better integration?)
- Same geometry can be used for detector calibration (by replacing the polarizer with a beam splitter).

Winston cone vs OAP

- So far finding manufacturer of Winston cones has been difficult.
- At the exit of the cone the light has a very high divergence (large NA).
- Off axis parabolic mirrors may offer a cheaper alternative and are available from optics suppliers (CVI, Thorlabs).
- NA of OAP is smaller but longitudinal positioning may be more difficult.
- Simulations done by Aubin Charvieux, Summer student at LAL.







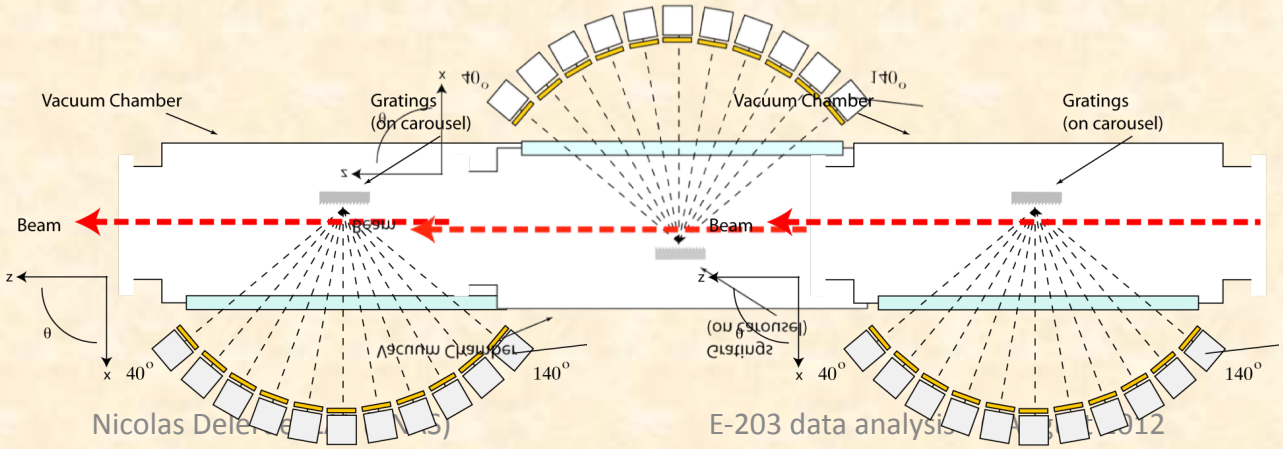
sis

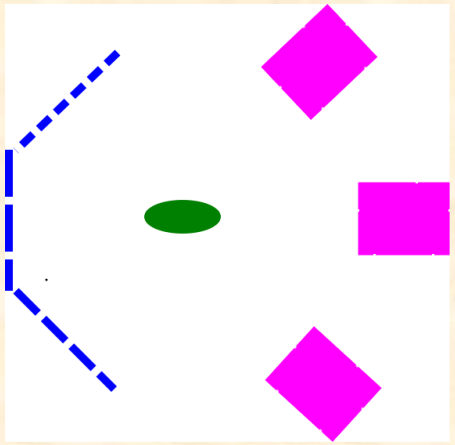
Thermopile vs Pyro

- Another LAL summer student (Charles Caulet) has been working on IR detectors.
- We made a comparison of thermopiles vs pyroelectric detectors.
- Thermopiles seem to have a better sensitivity than pyroelectrics (but also a higher NEP – we are not limited by the NEP).
- However thermopiles are sensitive to the temperature, not temperature change.
- Thermopiles seem to be cheaper.
- So far we are having difficulties with the pyro purchased from Eltec (lack of sensitivity?).
- Thermopile vs pyro could be compared at the SOLEIL test stand.

Single shot strategy

- As the issue came up with SAREC and others, we should discuss our strategy toward single shot measurement.
- Questions that need to be addressed:
  - How do we get signal and background in one shot? (Polarization? Off axis detector?)
  - How do we get signal from 3 gratings at once? (Do we need it? Gratings in parallel? Gratings in series?)
  - How do we validate our assumption on signal shape? (Can we over-constrain the system to trust our data?)

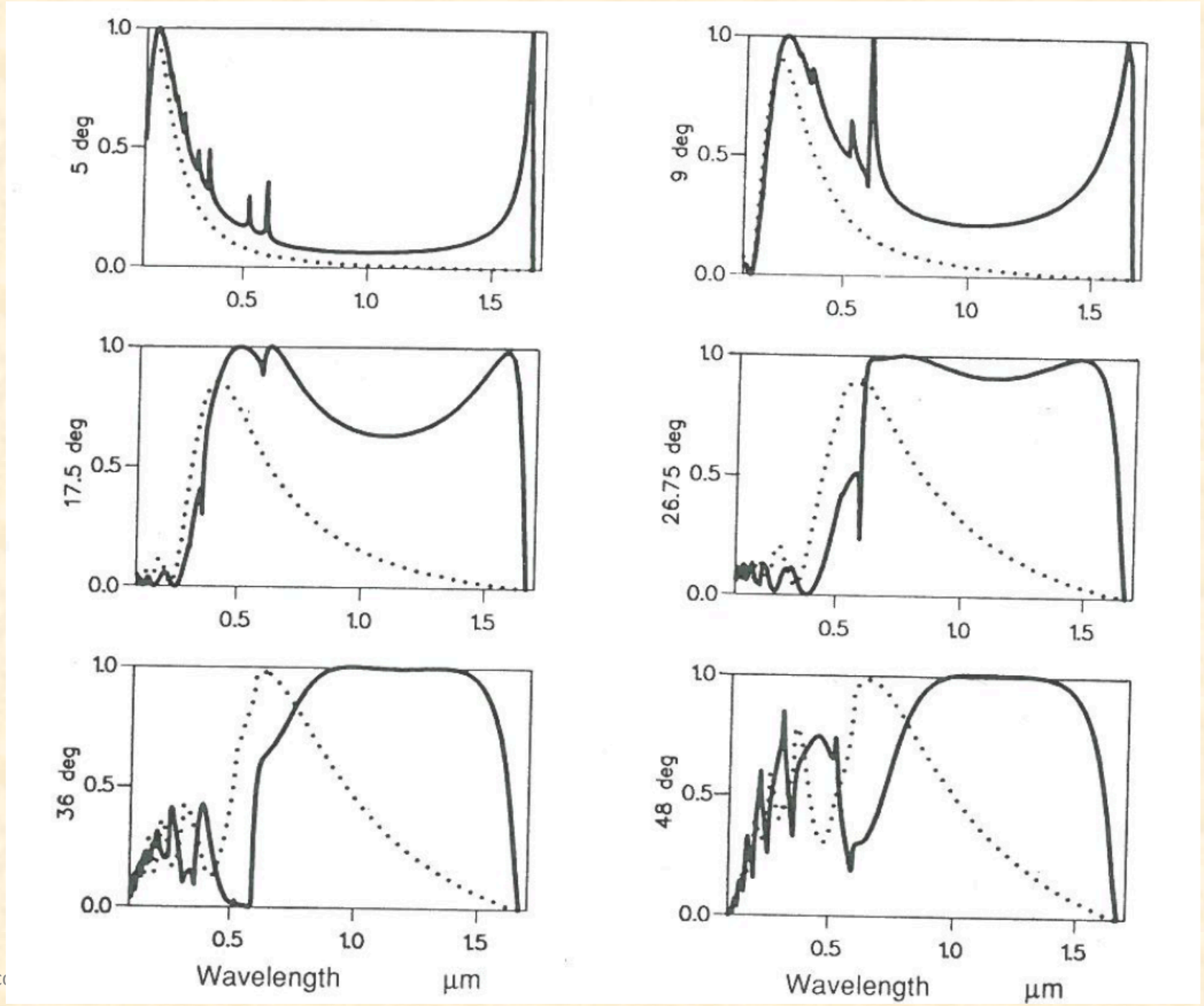


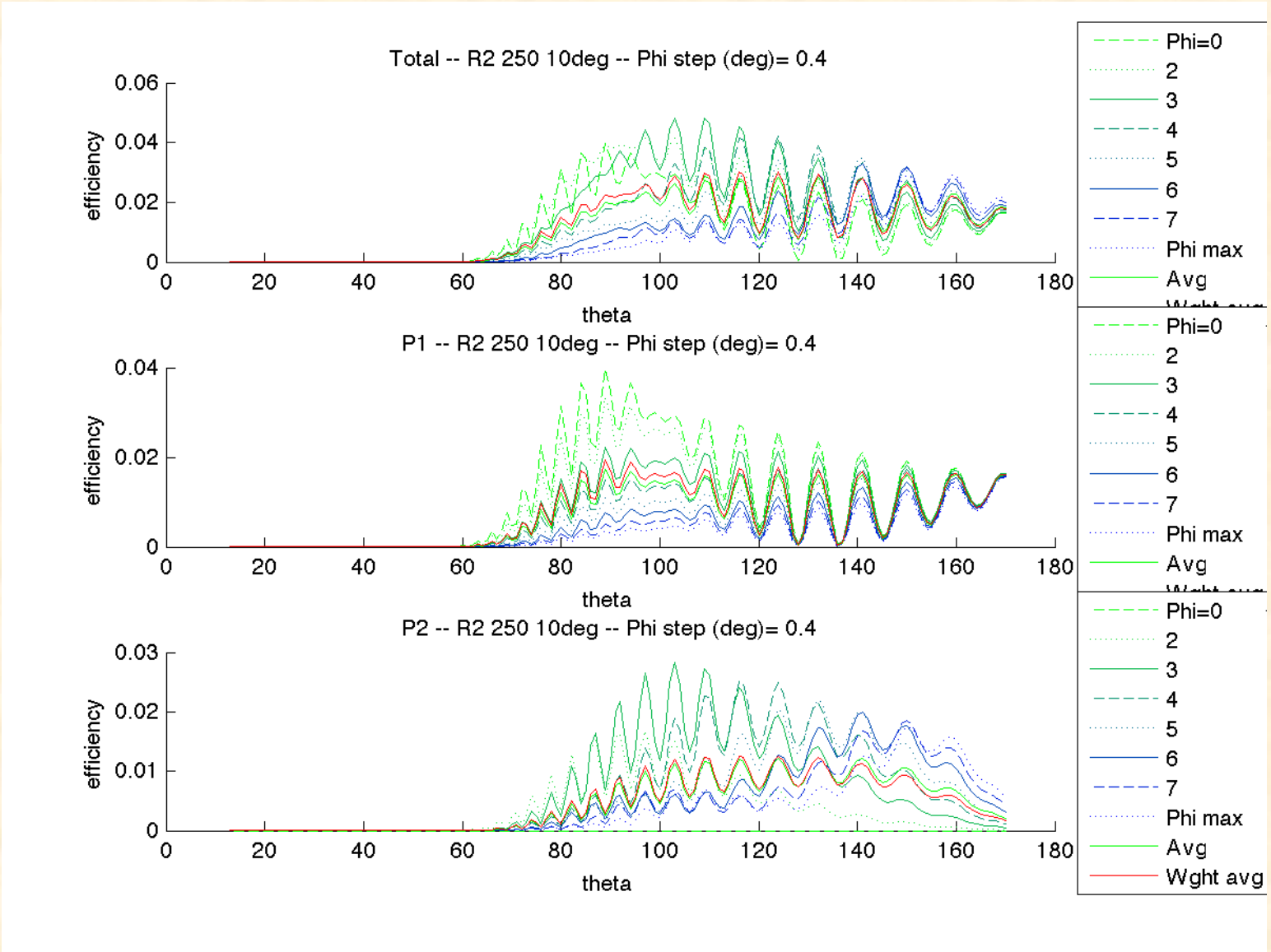


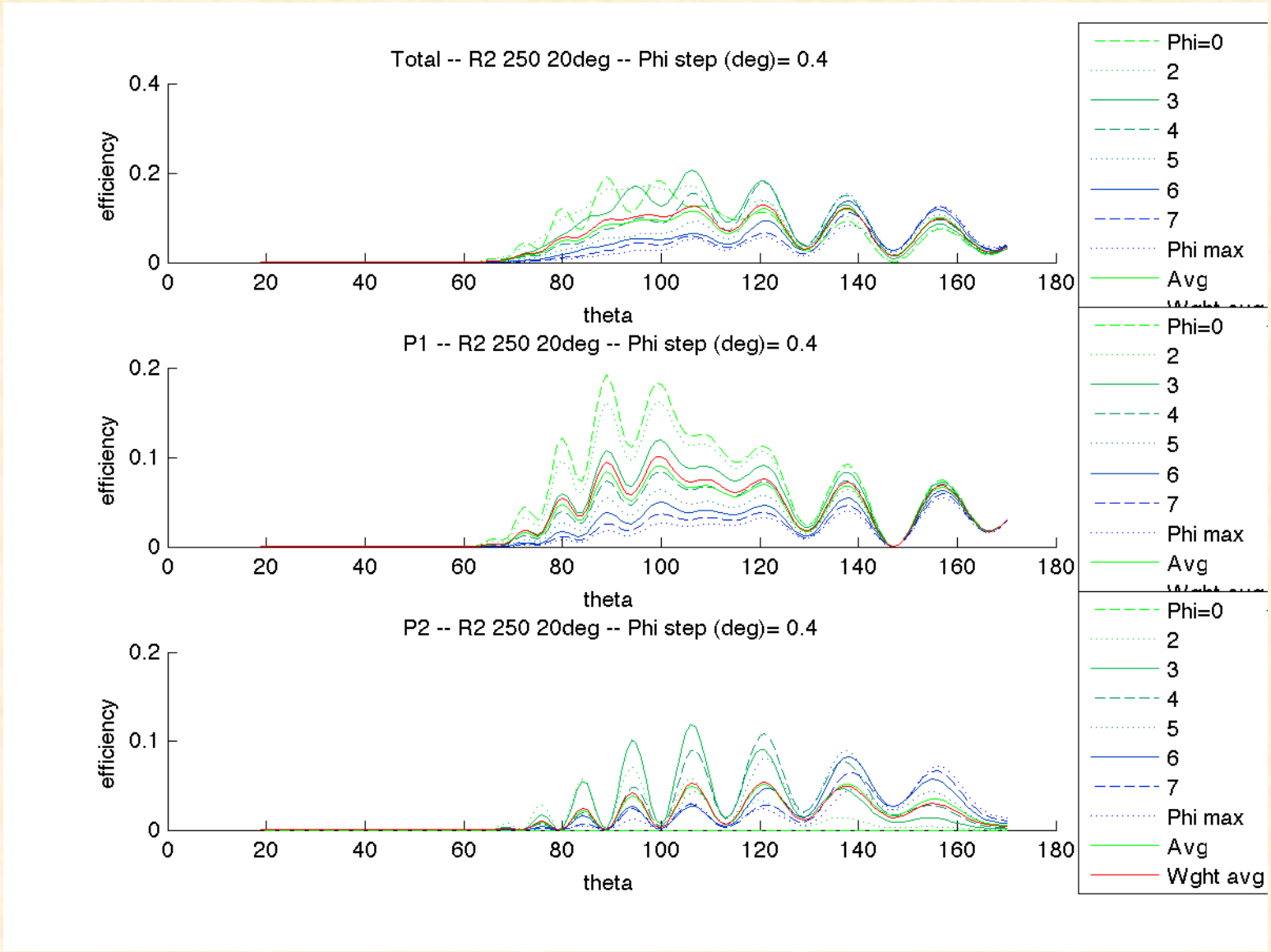
GRATINGS AT VARIOUS BLAZE ANGLE

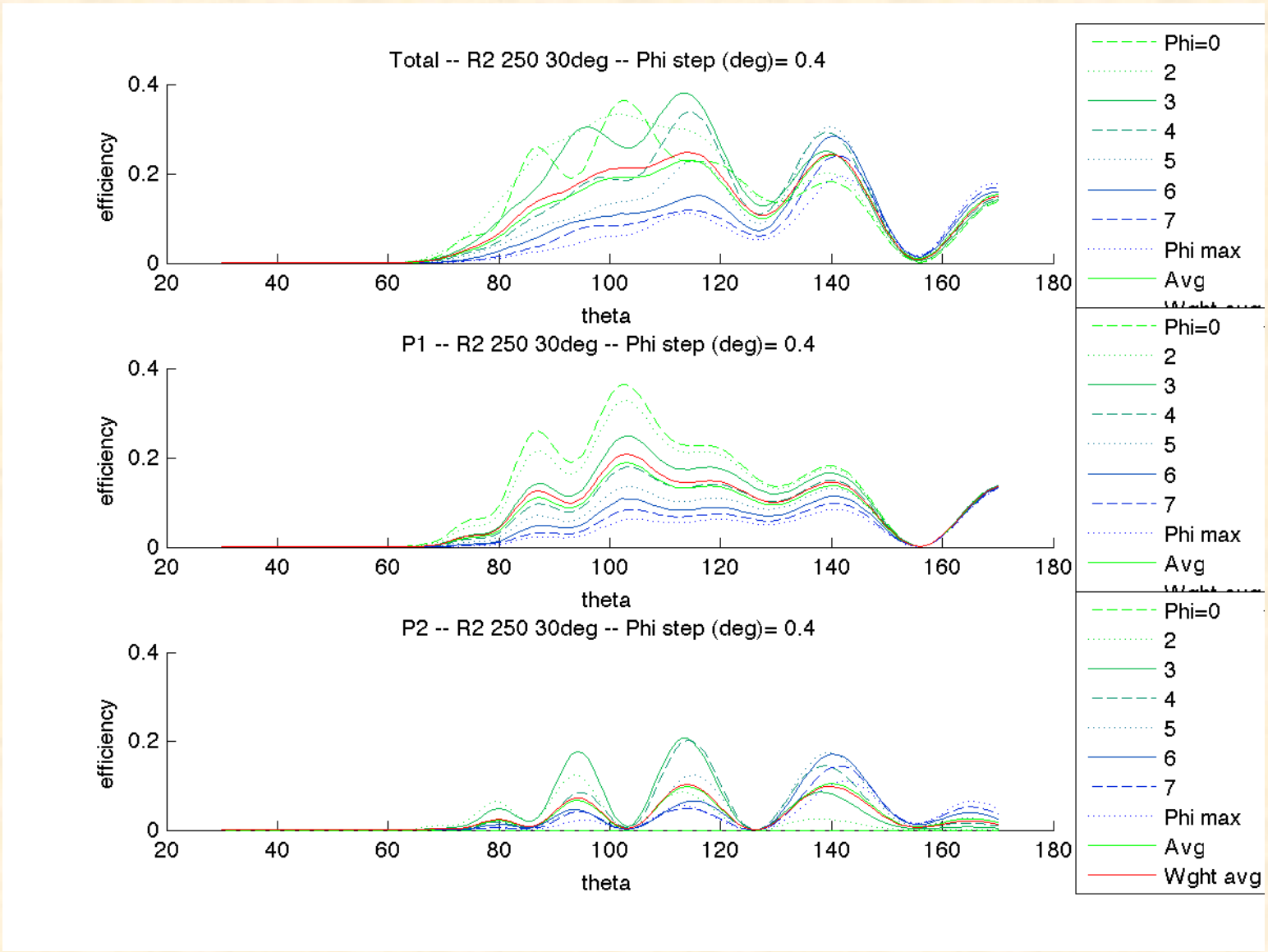
Gratings study

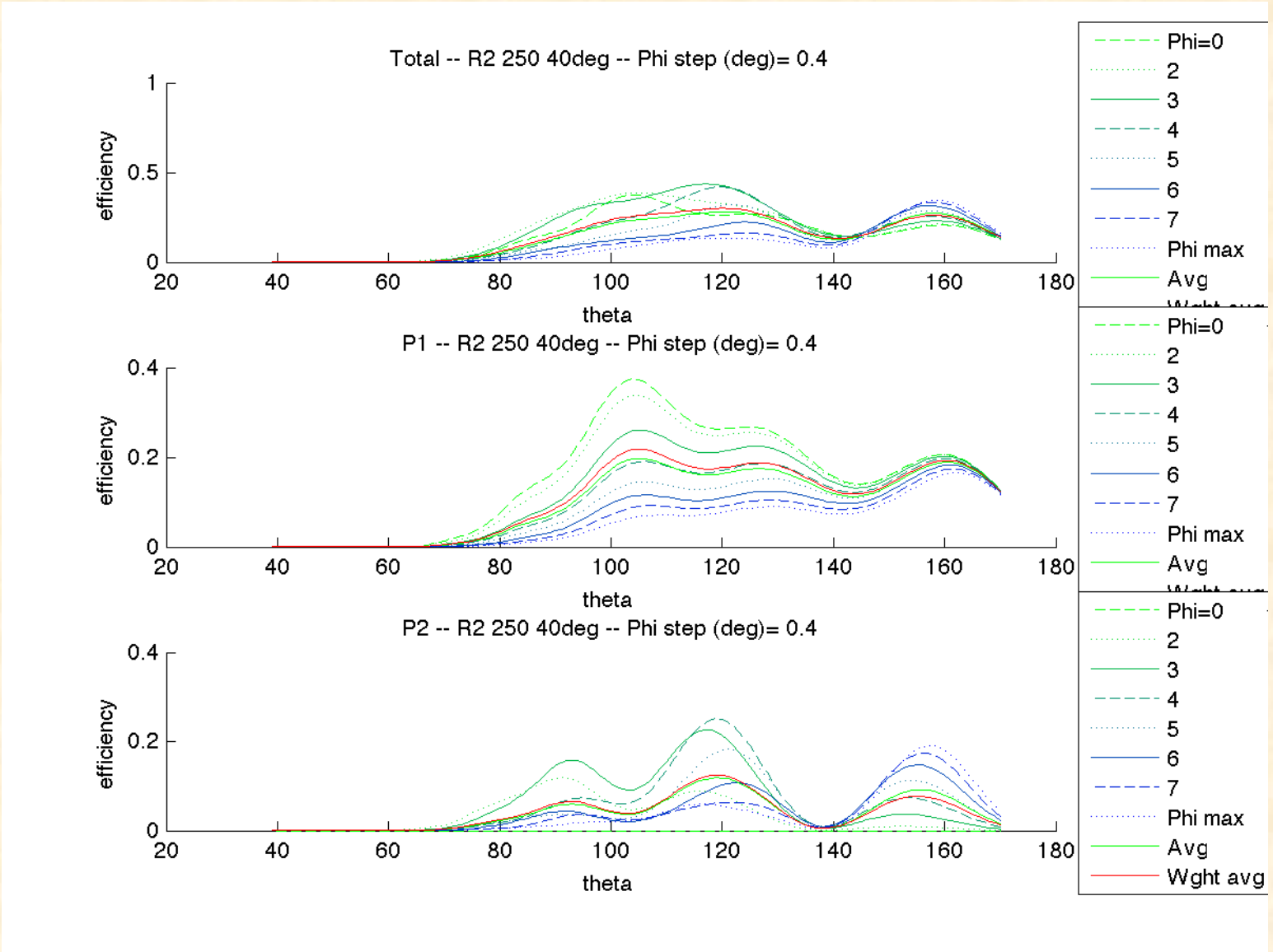
- Looking at Loewen one would expect that at lower blaze angle we would recover data at shorter wavelength.
- GFW gives a different message.
- GFW simulation results are available at http://lal.delerue.org/smith-purcell/data_analysis/gratings/compare_gratings.html
- This may come from the fact that GFW incorporates bunch length effects…
- Could we try to extract different the contributions separately?
- Also looked at the effect of the phi efficiency but no significant difference.

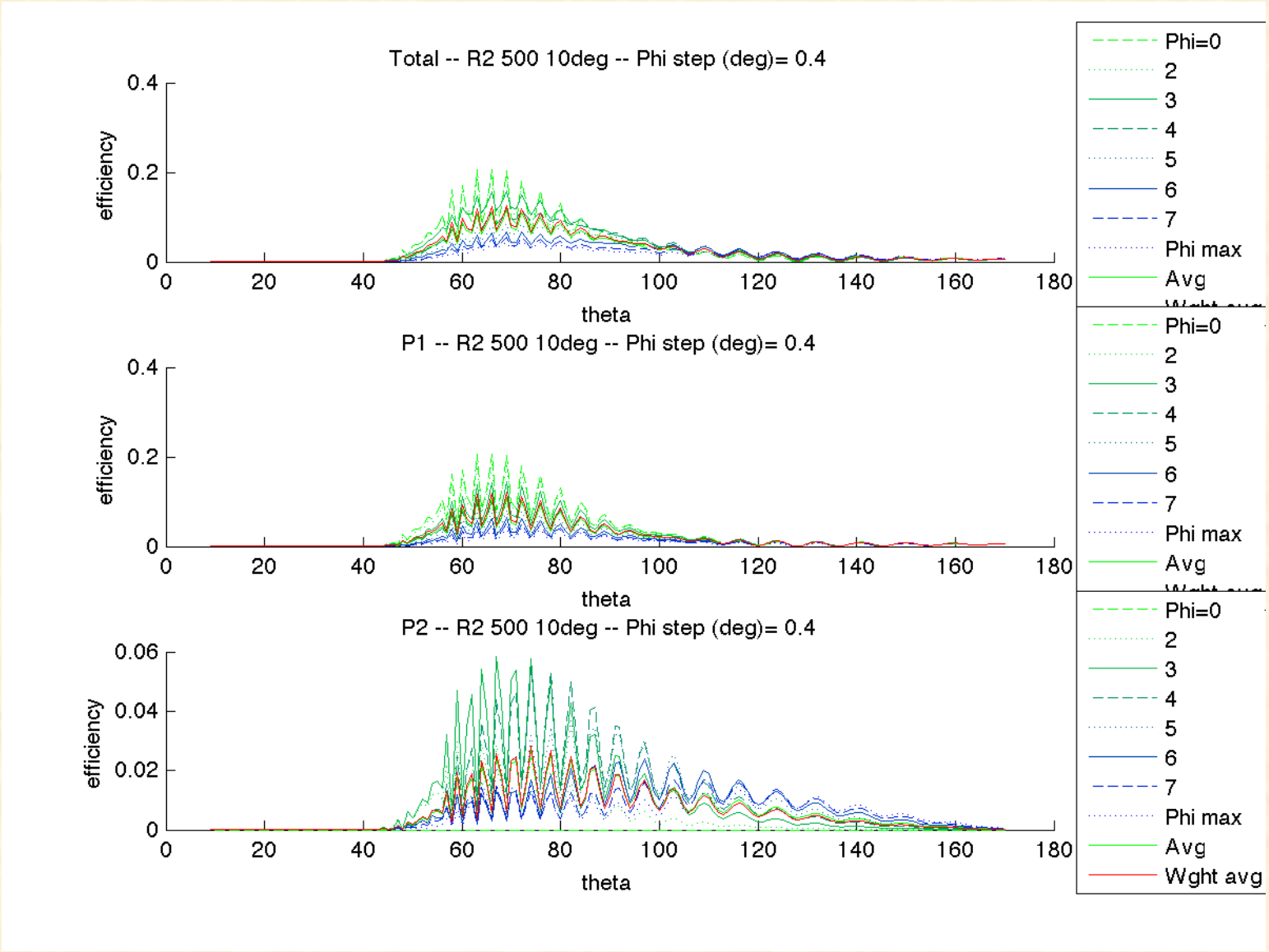

5 deg
9 deg
17.5 deg
26.75 deg
36 deg
48 deg
1.0
0.5
0.0
0.5
1.0
1.5
Wavelength
µm

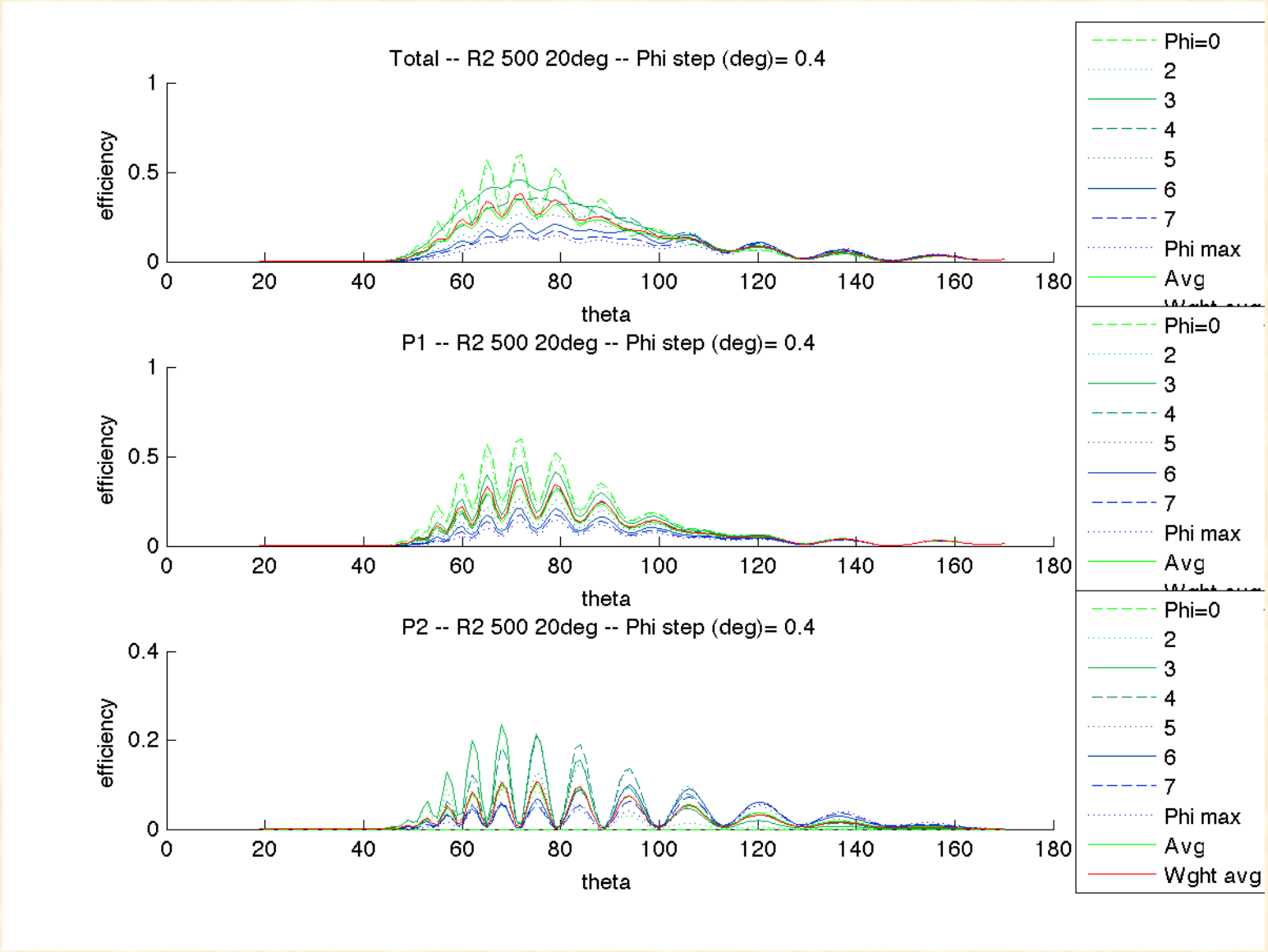

Total -- R2 250 10deg -- Phi step (deg)= 0.4
efficiency
theta
P1 -- R2 250 10deg -- Phi step (deg)= 0.4
efficiency
theta
P2 -- R2 250 10deg -- Phi step (deg)= 0.4
efficiency
theta
Phi=0
2
3
4
5
6
7
Phi max
Avg
Wght avg

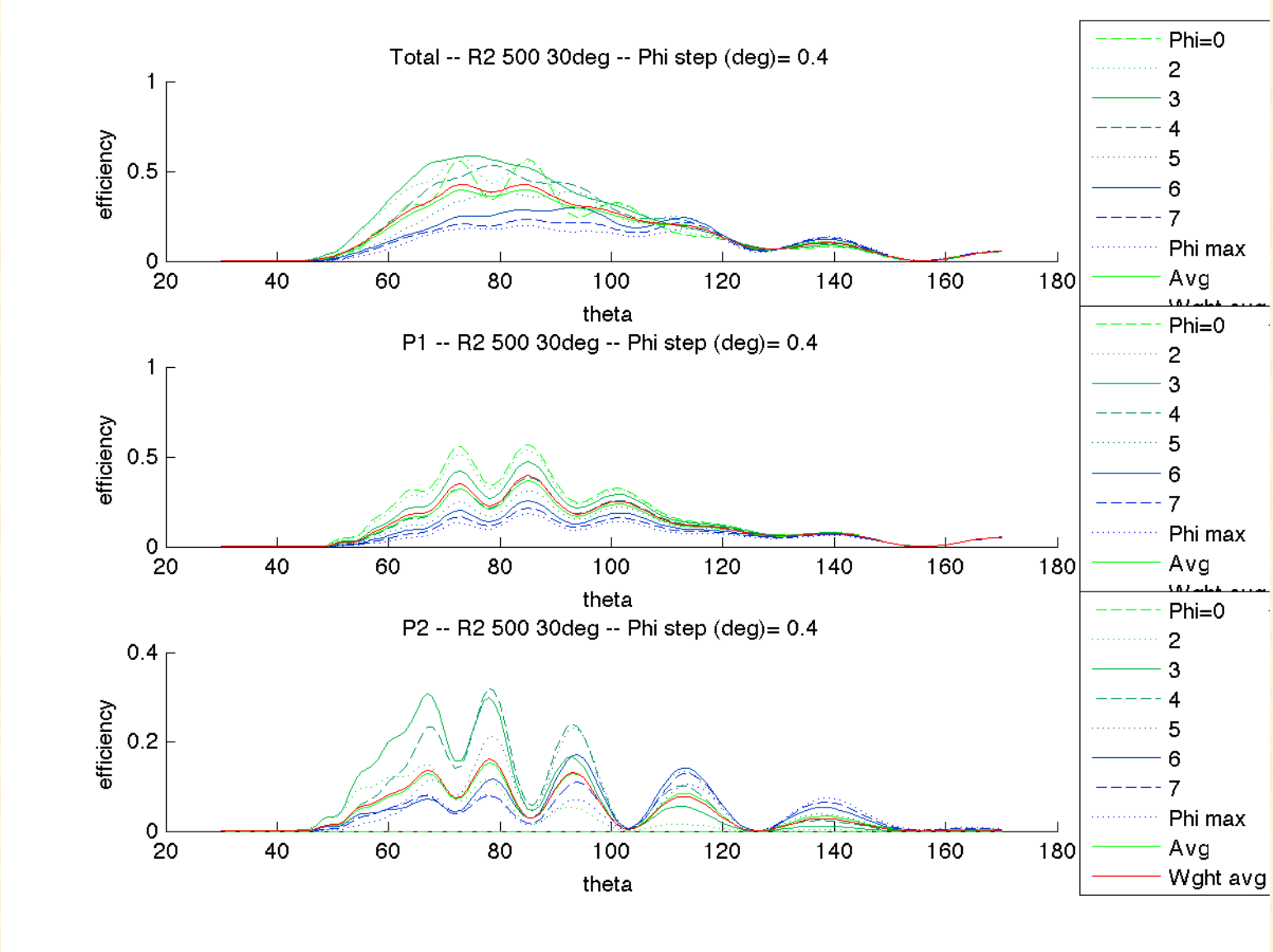

Total -- R2 250 20deg -- Phi step (deg)= 0.4
efficiency
theta
P1 -- R2 250 20deg -- Phi step (deg)= 0.4
efficiency
theta
P2 -- R2 250 20deg -- Phi step (deg)= 0.4
efficiency
theta
Phi=0
2
3
4
5
6
7
Phi max
Avg
Wght avg

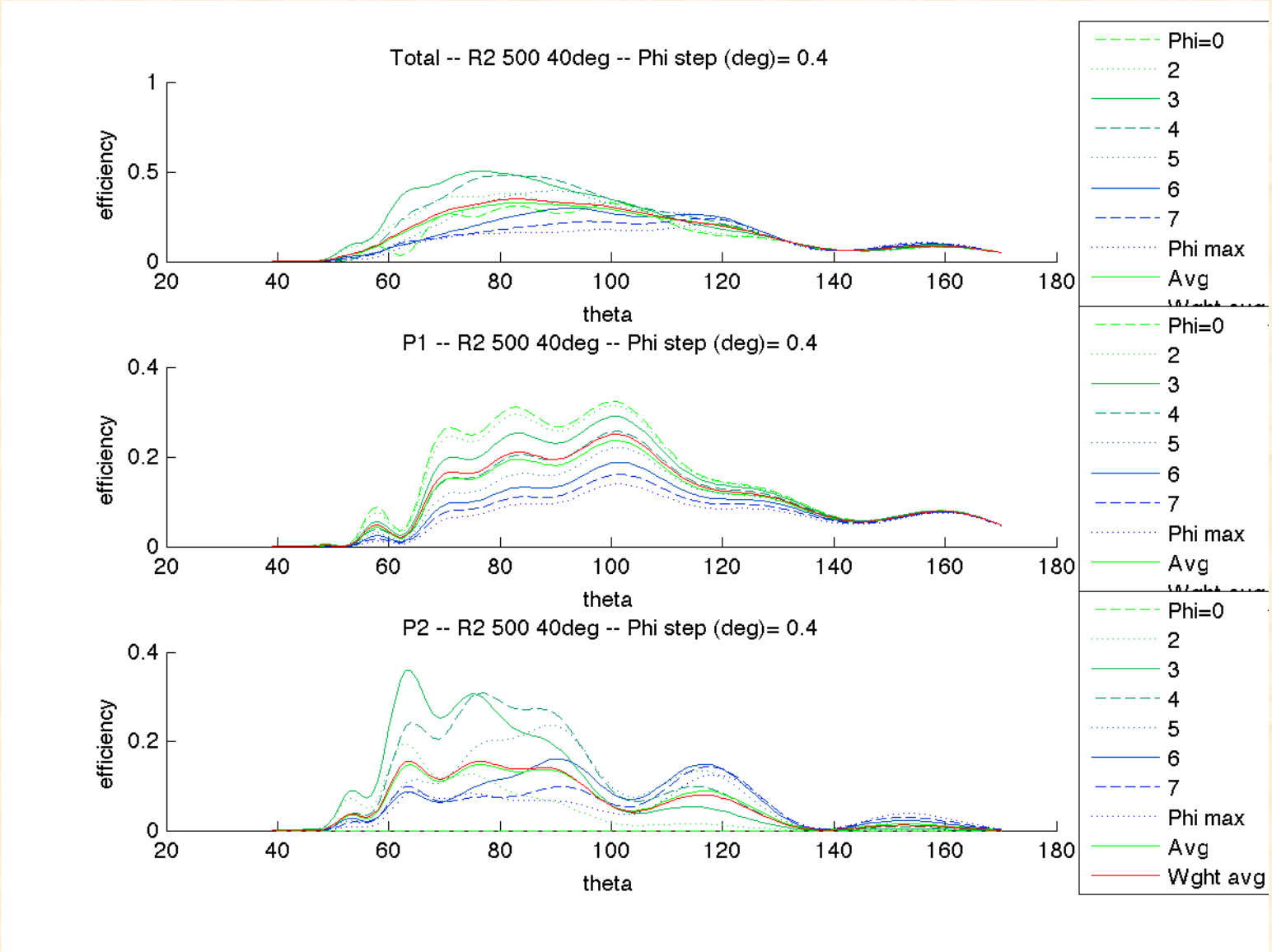

Total -- R2 250 30deg -- Phi step (deg)= 0.4
P1 -- R2 250 30deg -- Phi step (deg)= 0.4
P2 -- R2 250 30deg -- Phi step (deg)= 0.4
efficiency
theta
0.4
0.2
0
20
40
60
80
100
120
140
160
180
Phi=0
2
3
4
5
6
7
Phi max
Avg
Wght avg

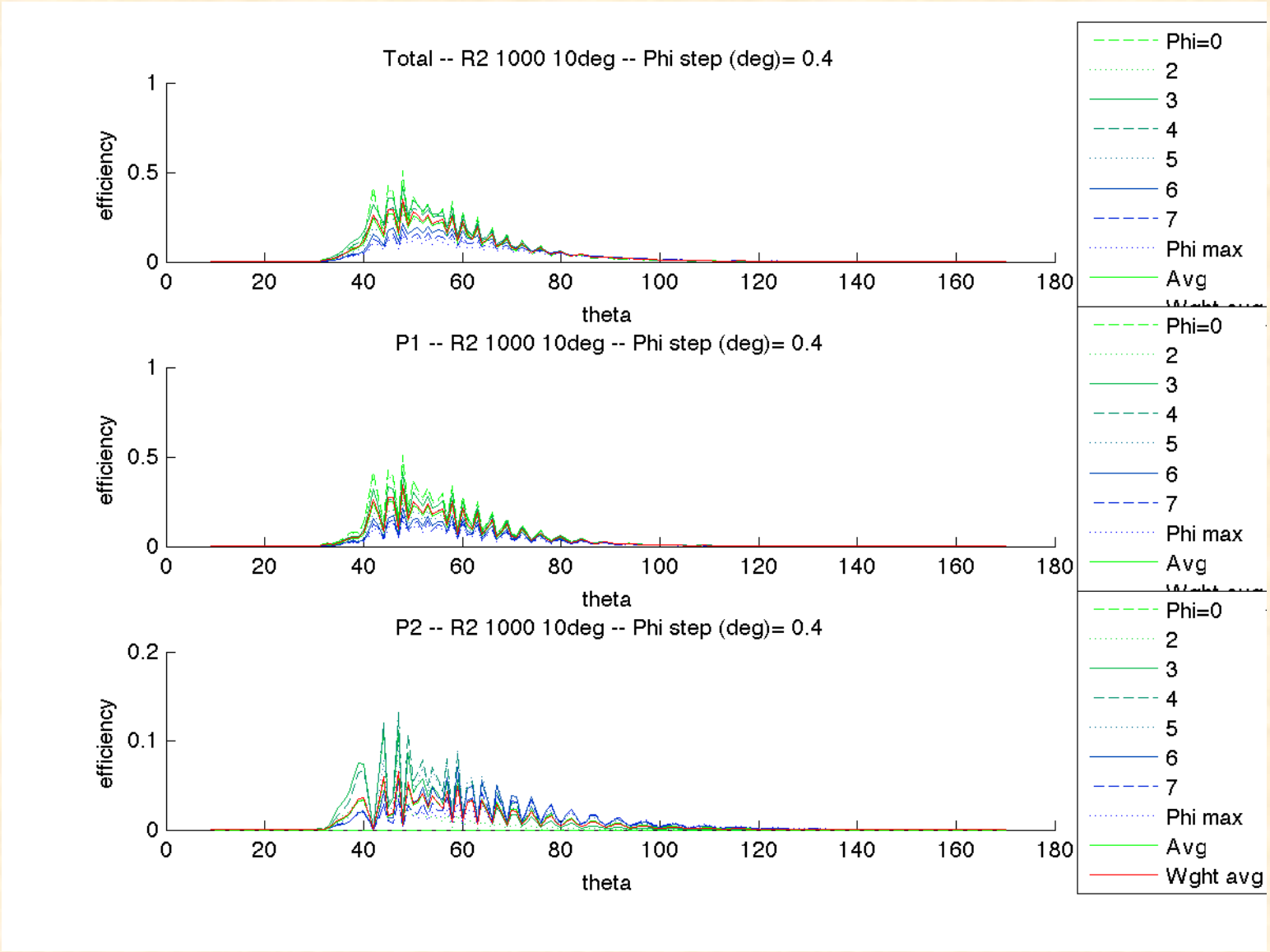

Total -- R2 250 40deg -- Phi step (deg)= 0.4
efficiency
theta
P1 -- R2 250 40deg -- Phi step (deg)= 0.4
efficiency
theta
P2 -- R2 250 40deg -- Phi step (deg)= 0.4
efficiency
theta
Phi=0
2
3
4
5
6
7
Phi max
Avg
Wght avg

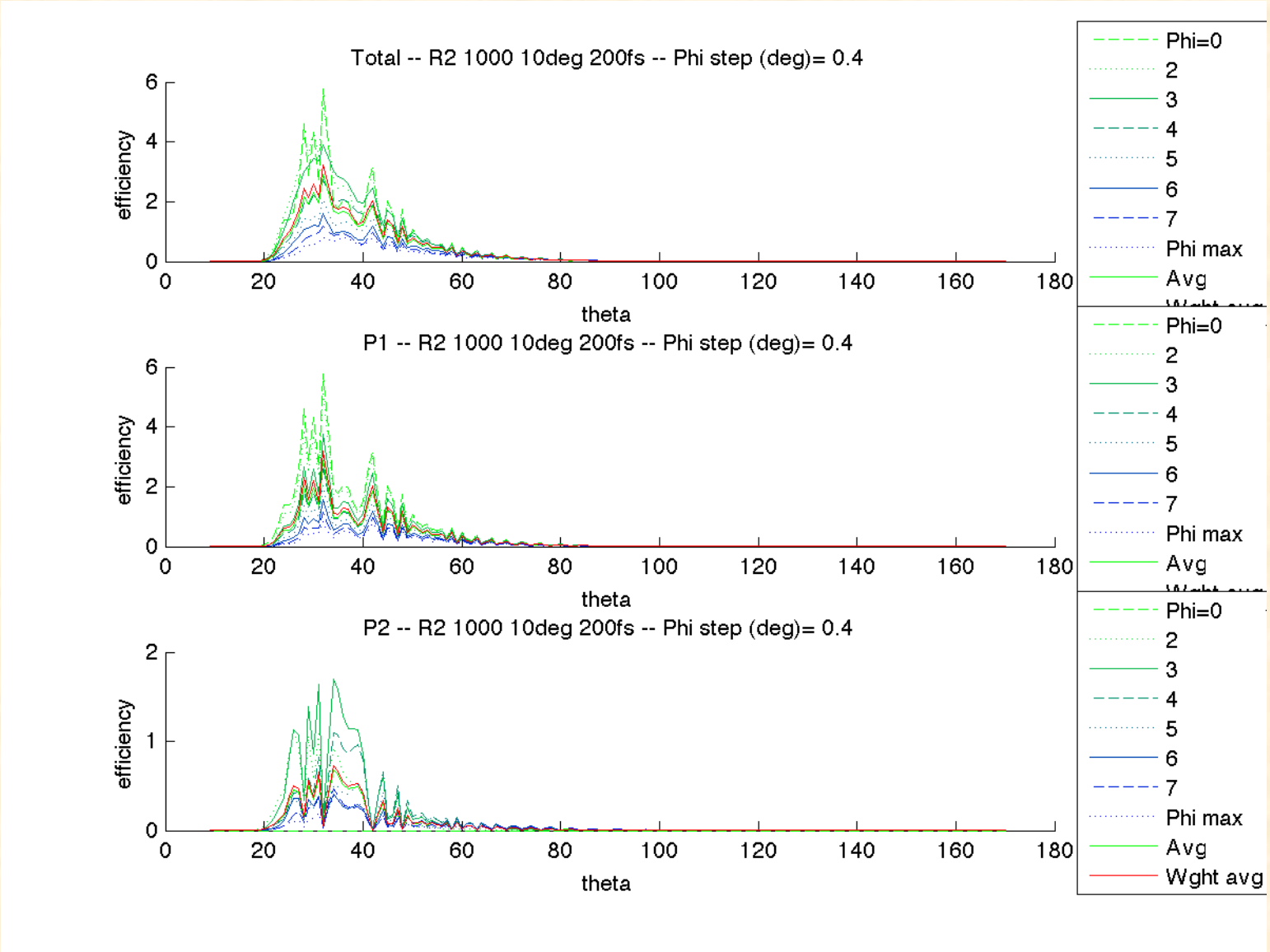

Total -- R2 500 10deg -- Phi step (deg)= 0.4
efficiency
theta
P1 -- R2 500 10deg -- Phi step (deg)= 0.4
efficiency
theta
P2 -- R2 500 10deg -- Phi step (deg)= 0.4
efficiency
theta
Phi=0
2
3
4
5
6
7
Phi max
Avg
Wght avg

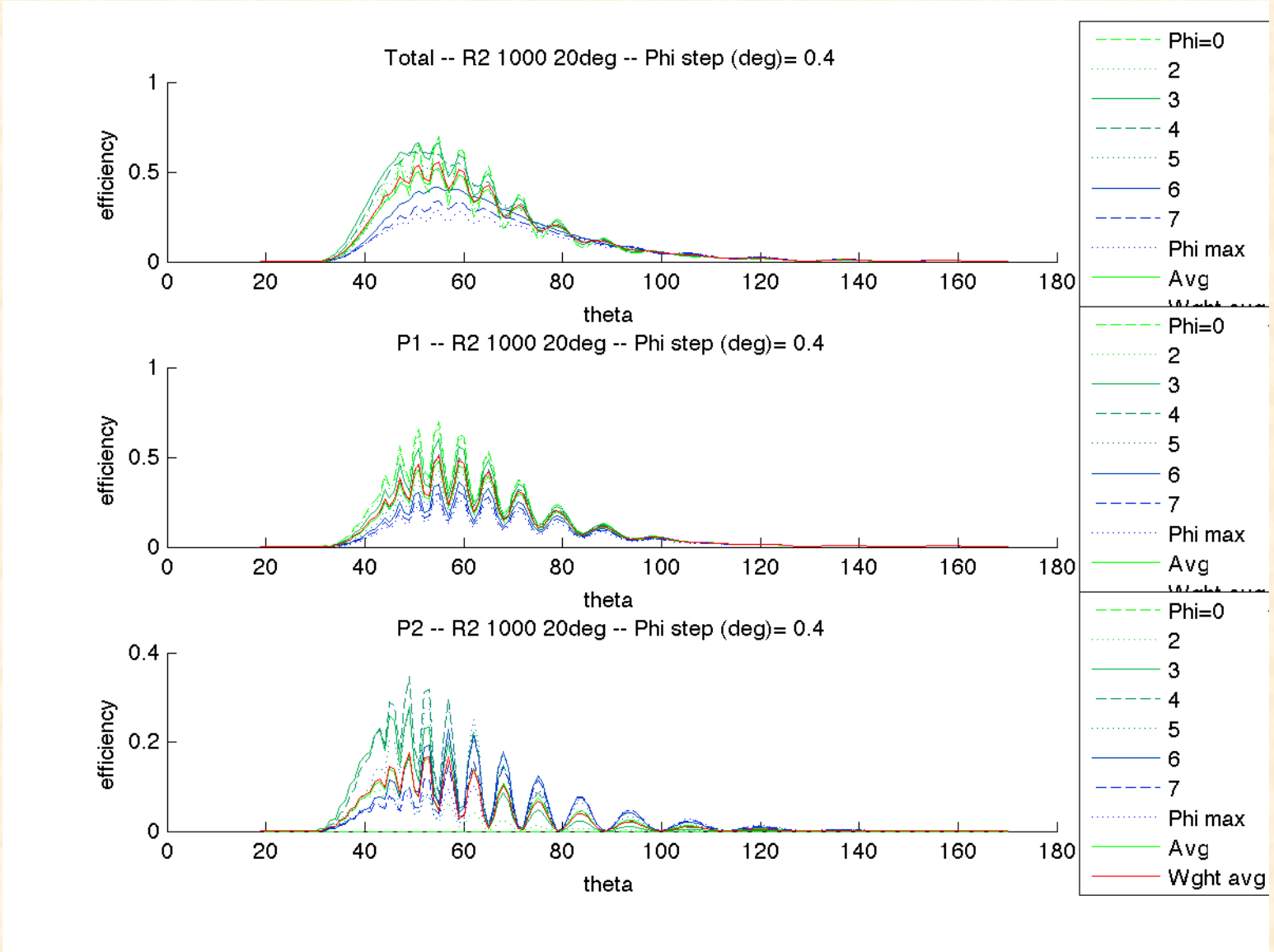

Total -- R2 500 20deg -- Phi step (deg)= 0.4
P1 -- R2 500 20deg -- Phi step (deg)= 0.4
P2 -- R2 500 20deg -- Phi step (deg)= 0.4
efficiency
theta
Phi=0
2
3
4
5
6
7
Phi max
Avg
Wght avg

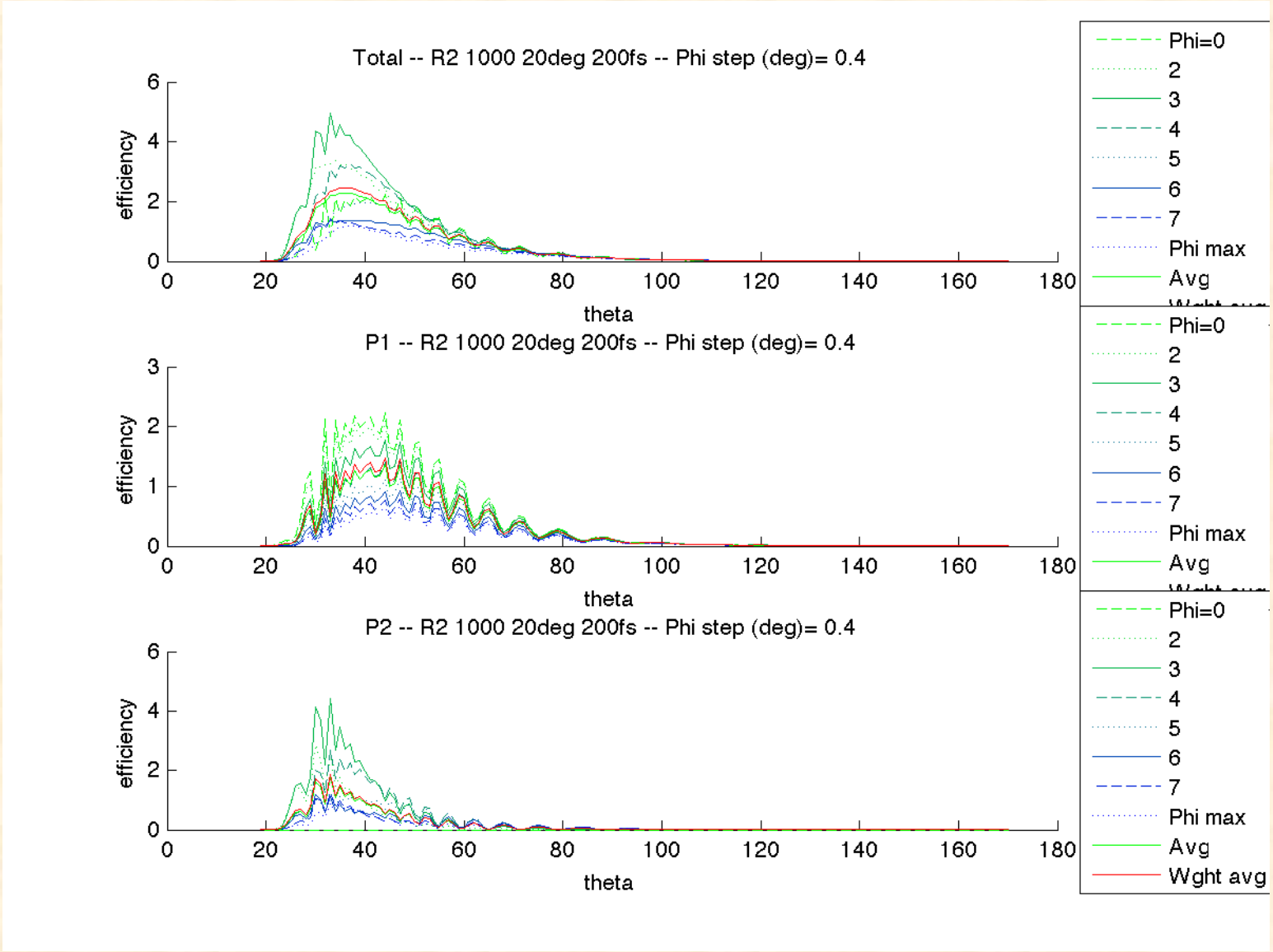

Total -- R2 500 30deg -- Phi step (deg)= 0.4
efficiency
theta
P1 -- R2 500 30deg -- Phi step (deg)= 0.4
efficiency
theta
P2 -- R2 500 30deg -- Phi step (deg)= 0.4
efficiency
theta
Phi=0
2
3
4
5
6
7
Phi max
Avg
Wght avg

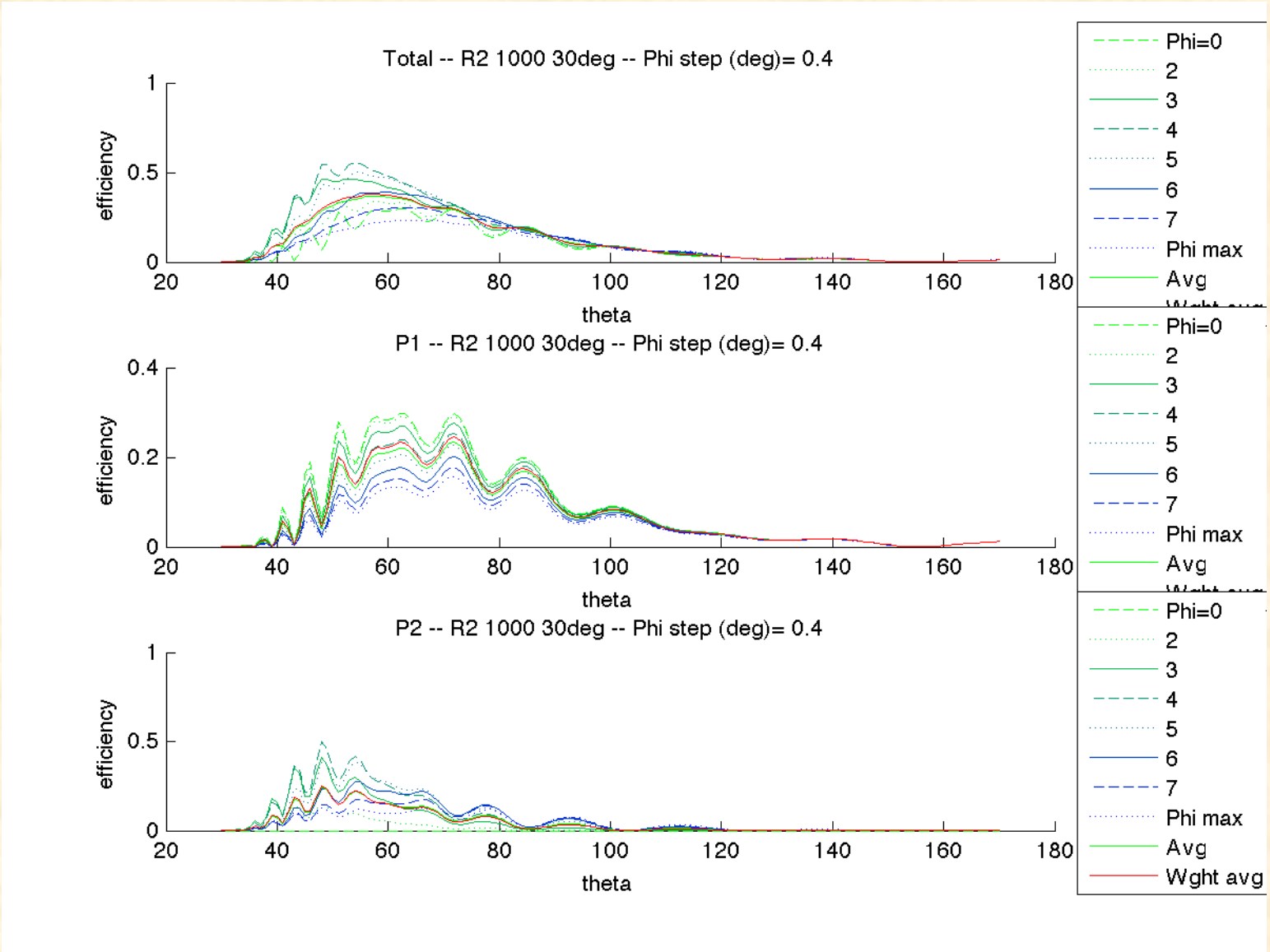

Total -- R2 500 40deg -- Phi step (deg)= 0.4
efficiency
theta
P1 -- R2 500 40deg -- Phi step (deg)= 0.4
efficiency
theta
P2 -- R2 500 40deg -- Phi step (deg)= 0.4
efficiency
theta
Phi=0
2
3
4
5
6
7
Phi max
Avg
Wght avg

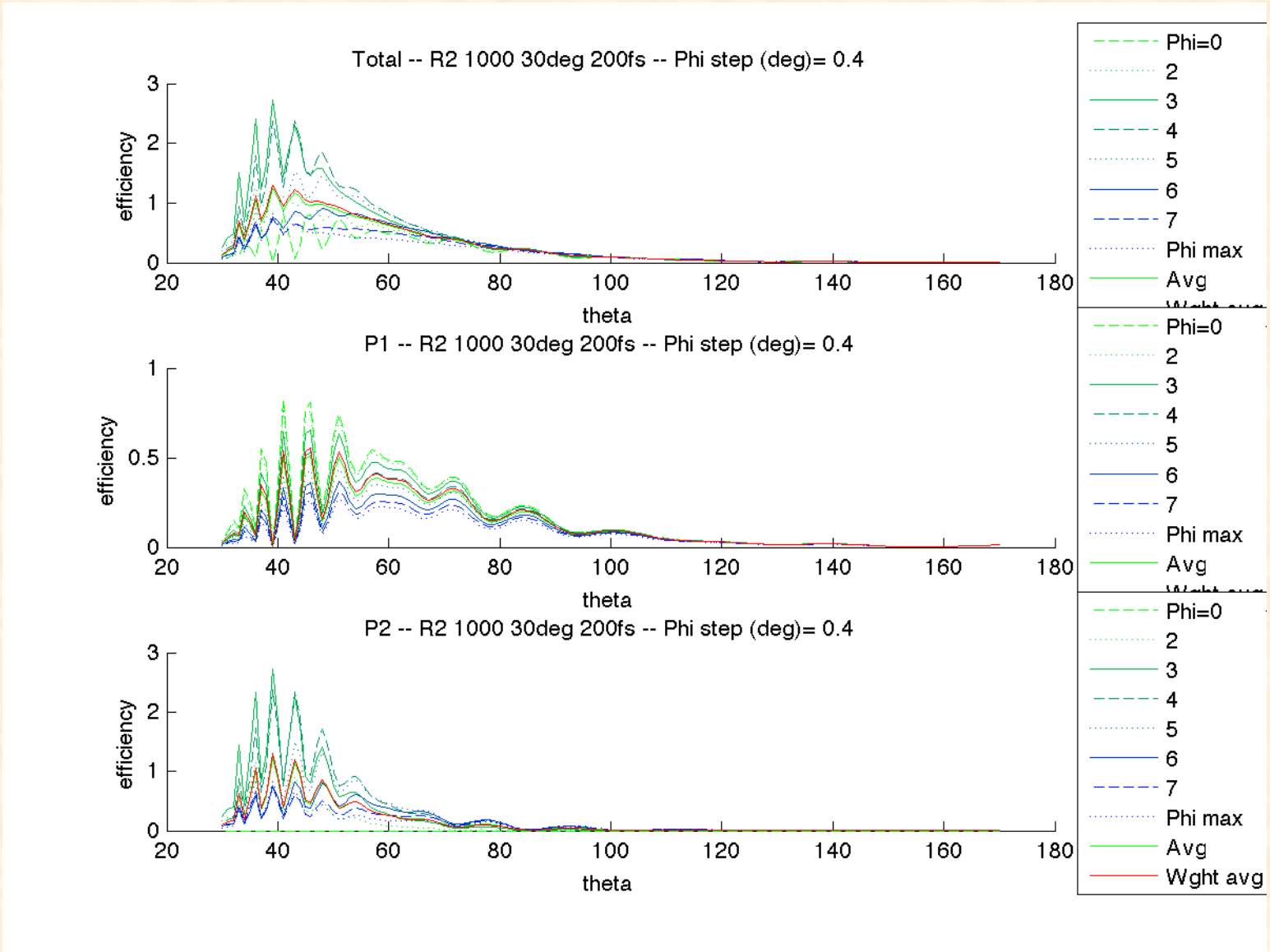

Total -- R2 1000 10deg -- Phi step (deg)= 0.4
efficiency
theta
P1 -- R2 1000 10deg -- Phi step (deg)= 0.4
efficiency
theta
P2 -- R2 1000 10deg -- Phi step (deg)= 0.4
efficiency
theta
Phi=0
2
3
4
5
6
7
Phi max
Avg
Wght avg

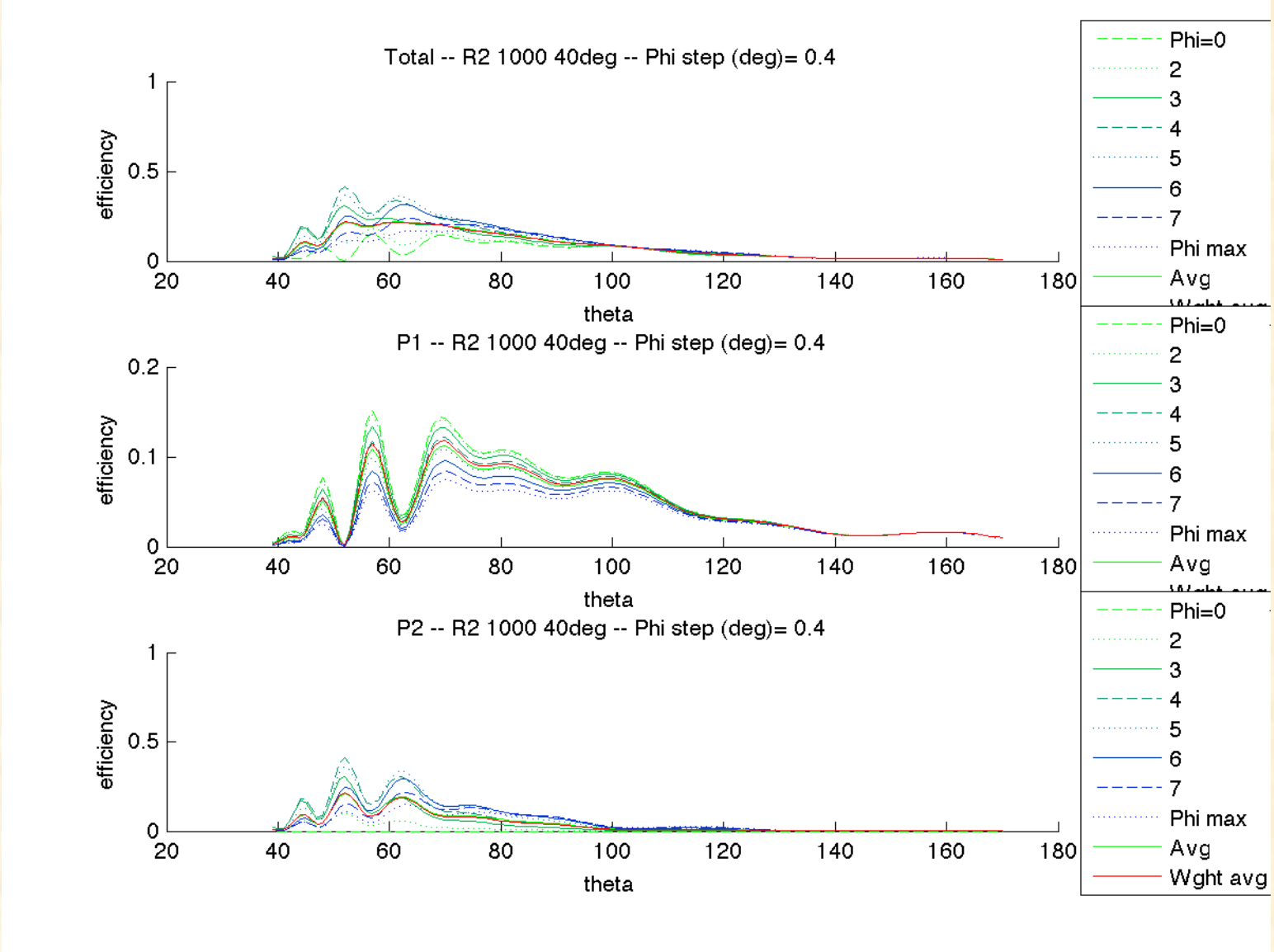

Total -- R2 1000 10deg 200fs -- Phi step (deg)= 0.4
efficiency
theta
P1 -- R2 1000 10deg 200fs -- Phi step (deg)= 0.4
efficiency
theta
P2 -- R2 1000 10deg 200fs -- Phi step (deg)= 0.4
efficiency
theta
Phi=0
2
3
4
5
6
7
Phi max
Avg
Wght avg

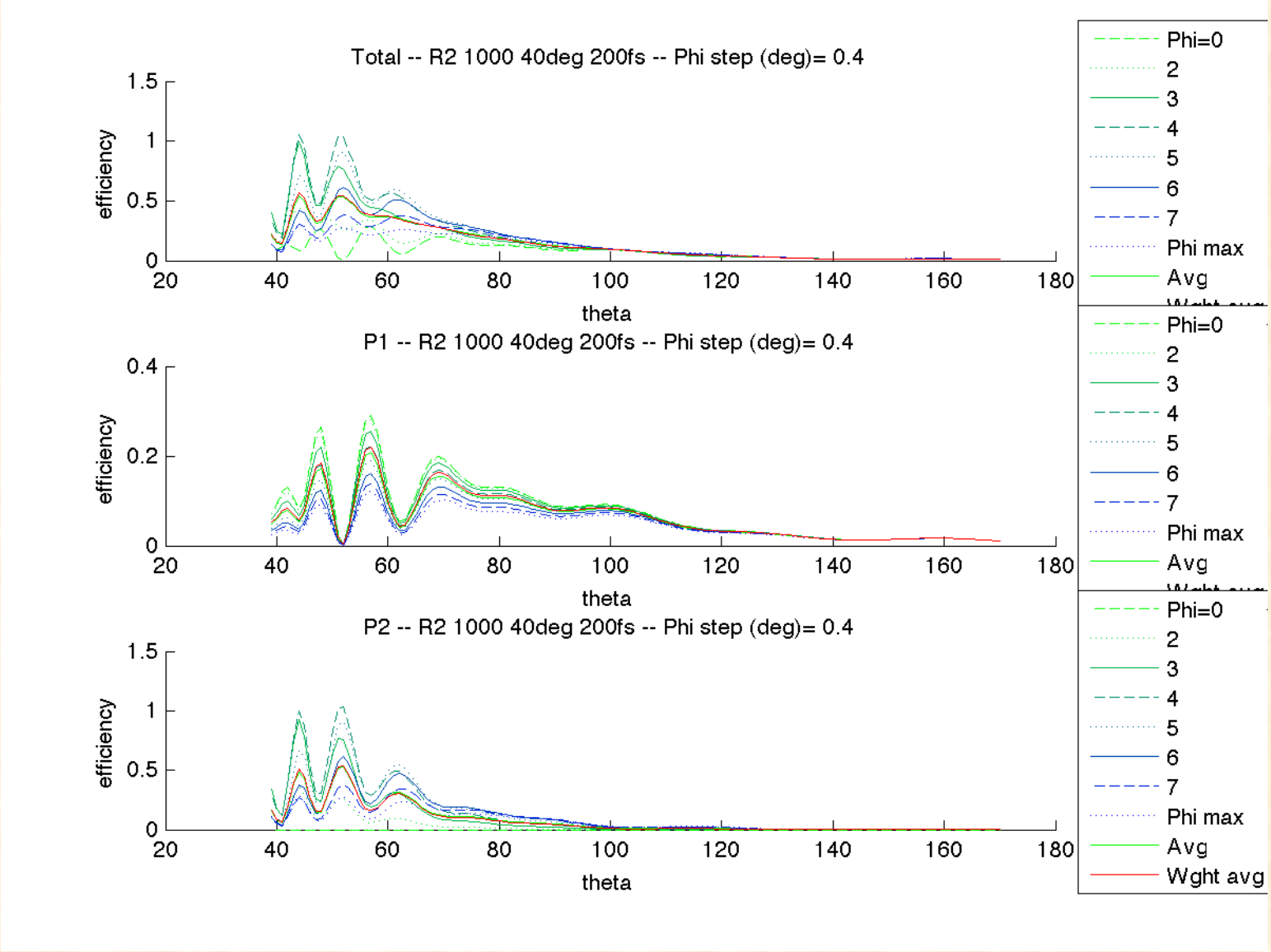

Total -- R2 1000 20deg -- Phi step (deg)= 0.4
efficiency
theta
P1 -- R2 1000 20deg -- Phi step (deg)= 0.4
efficiency
theta
P2 -- R2 1000 20deg -- Phi step (deg)= 0.4
efficiency
theta
Phi=0
2
3
4
5
6
7
Phi max
Avg
Wght avg


Total -- R2 1000 20deg 200fs -- Phi step (deg)= 0.4
efficiency
theta
P1 -- R2 1000 20deg 200fs -- Phi step (deg)= 0.4
efficiency
theta
P2 -- R2 1000 20deg 200fs -- Phi step (deg)= 0.4
efficiency
theta
Phi=0
2
3
4
5
6
7
Phi max
Avg
Wght avg


Total -- R2 1000 30deg -- Phi step (deg)= 0.4
efficiency
theta
P1 -- R2 1000 30deg -- Phi step (deg)= 0.4
efficiency
theta
P2 -- R2 1000 30deg -- Phi step (deg)= 0.4
efficiency
theta
Phi=0
2
3
4
5
6
7
Phi max
Avg
Wght avg


Total -- R2 1000 30deg 200fs -- Phi step (deg)= 0.4
efficiency
theta
P1 -- R2 1000 30deg 200fs -- Phi step (deg)= 0.4
efficiency
theta
P2 -- R2 1000 30deg 200fs -- Phi step (deg)= 0.4
efficiency
theta
Phi=0
2
3
4
5
6
7
Phi max
Avg
Wght avg


Total -- R2 1000 40deg -- Phi step (deg)= 0.4
efficiency
theta
P1 -- R2 1000 40deg -- Phi step (deg)= 0.4
efficiency
theta
P2 -- R2 1000 40deg -- Phi step (deg)= 0.4
efficiency
theta
Phi=0
2
3
4
5
6
7
Phi max
Avg
Wght avg


Total -- R2 1000 40deg 200fs -- Phi step (deg)= 0.4
efficiency
theta
P1 -- R2 1000 40deg 200fs -- Phi step (deg)= 0.4
efficiency
theta
P2 -- R2 1000 40deg 200fs -- Phi step (deg)= 0.4
efficiency
theta
Phi=0
2
3
4
5
6
7
Phi max
Avg
Wght avg