RTML Tuning

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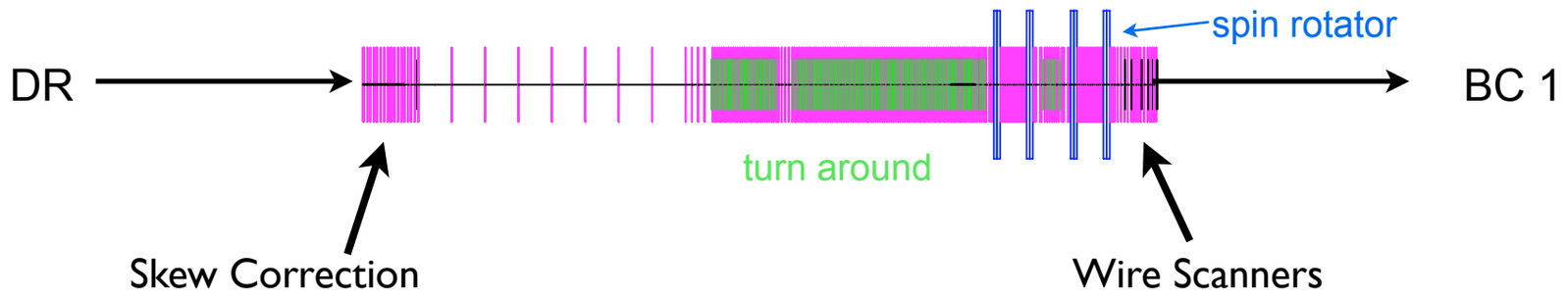
Where I am at



- Have only seriously looked at RTML section up to BC1

★ This is a warm section so alignment tolerances are different than BC

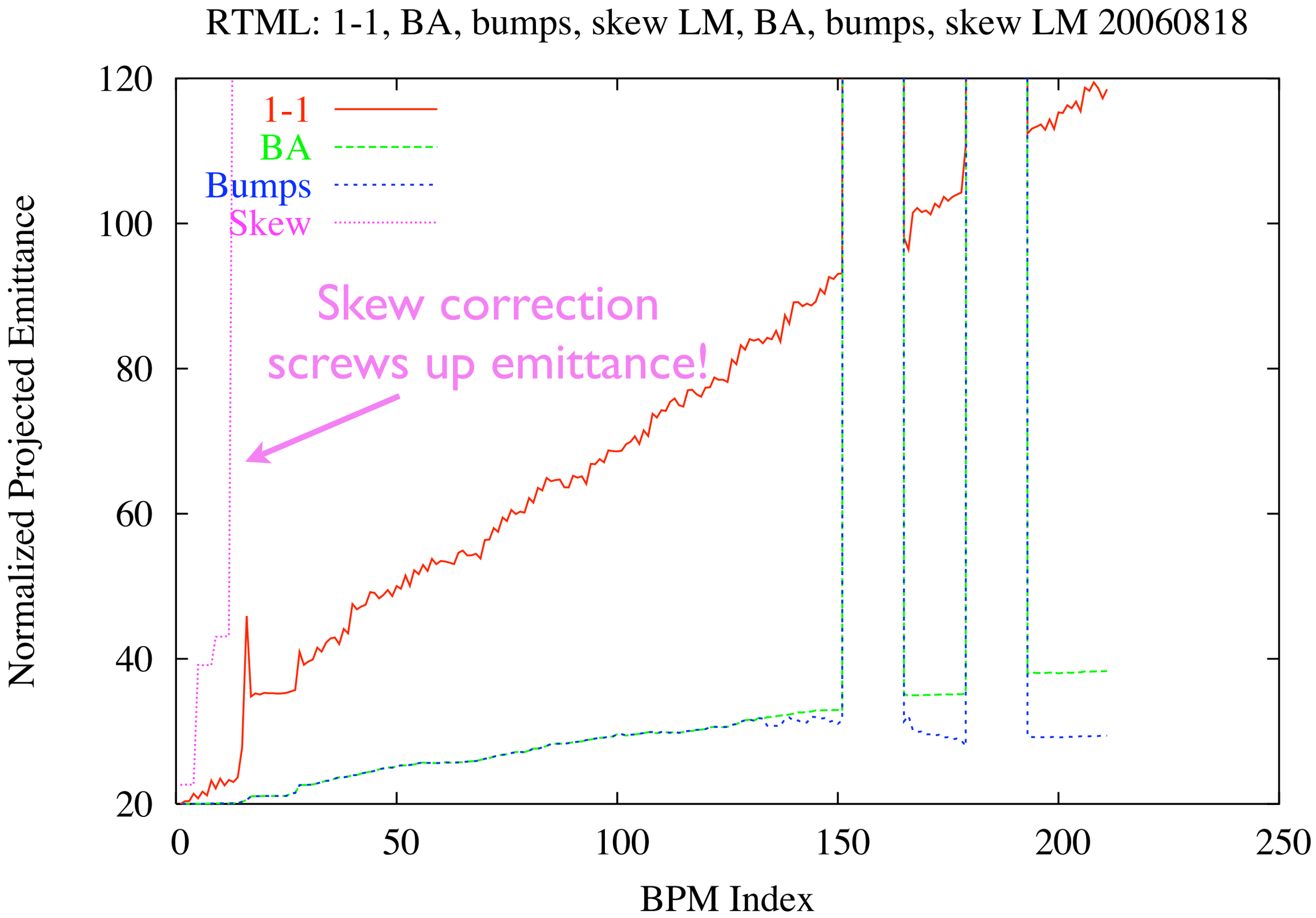
★ BA can probably be used effectively here (no superconducting magnets to slowly ramp).

★ So many different parts in RTML. This should be looked at separately from BC

Alignment tolerances used

- Misalignments used (based on FFTB tolerances):
  - ★ **Quads:**
    - ✤ 150 μm RMS offsets in x and y
    - ✤ 0.25% strength errors
    - ✤ 300 μrad rotation errors
  - ★ **Bends:**
    - ✤ 0.5% strength errors
    - ✤ 300 μrad rotation errors
  - ★ **Solenoids**
    - ✤ 1% strength error
  - ★ **BPMs:**
    - ✤ 0 um resolution (for starters)
    - ✤ 70 μm RMS offsets x and y to nearest quad
    - ✤ No rotations or scale errors
  - ★ **Laser Wire Scanners:**
    - ✤ 0% error on measurement on each wire
    - ✤ 0 degree angle error on skewed wire
    - ✤ I can place errors on these whenever I want

With the default configuration



The problem with the skew correction

- The skew correction as it stands is a global correction
- Adjusting the skew quads will introduce orbit deflections and dispersion through the RTML

★ This screws up the dispersion bumps because they too are global corrections

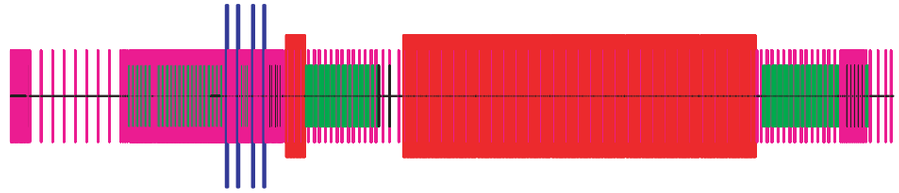
★ Also, the skew correction will introduce large chromatic emittance growth which cannot be easily removed

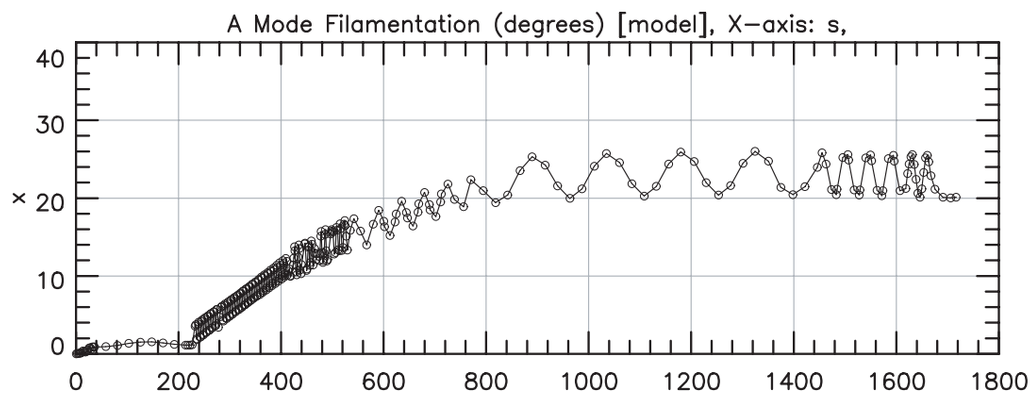
★ Basically, in certain seeds, the dispersion bumps and skew correction work against each other.

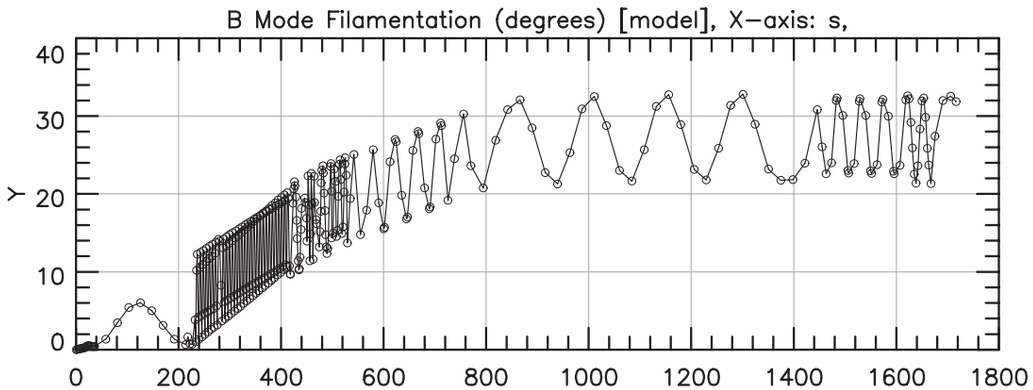
★ Keep in mind that sometimes the skew correction works OK and most times doesn't degrade emittance by much. However, sometimes it really degrades emittance.

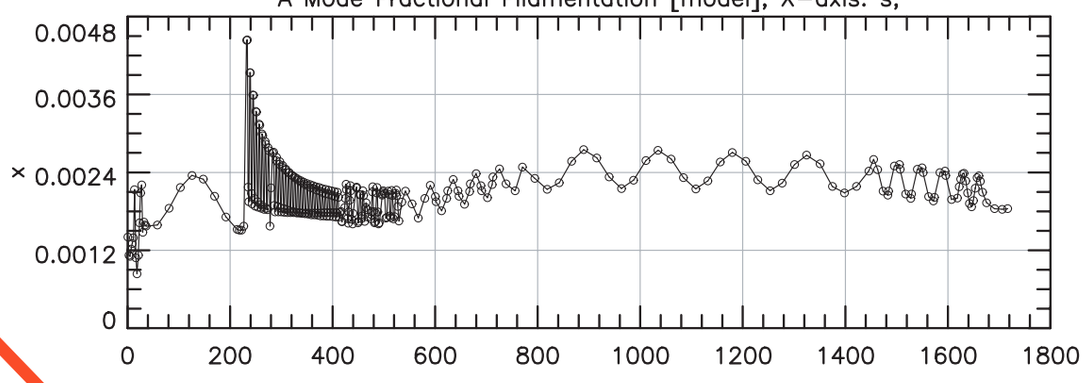
Filamentation

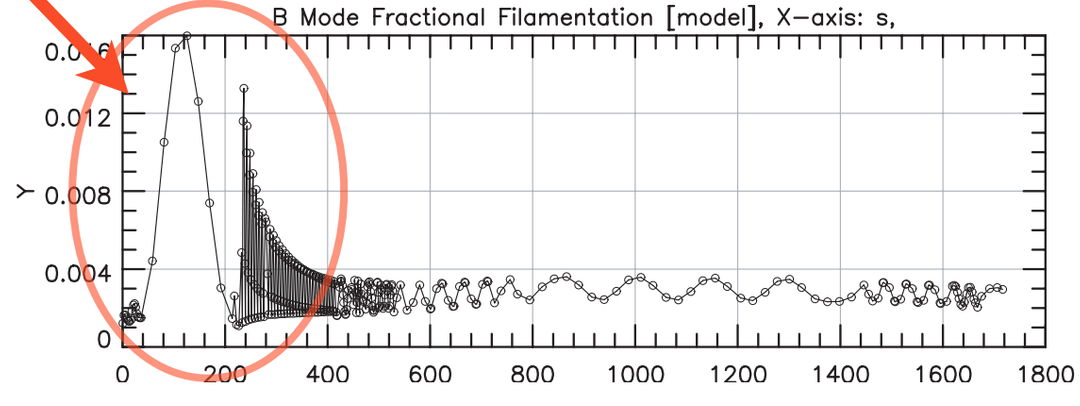
- Top two plots show x and y phase advance error (filamentation) for 1-sigma off energy particle.
- Bottom two plots show filamentation per unit phase advance, i.e. the filamentation rate
- Collimation and turnaround has bad filamentation rate
- Since the skew correction is upstream of this, it intensifies the chromatic emittance dilution due to skew correction



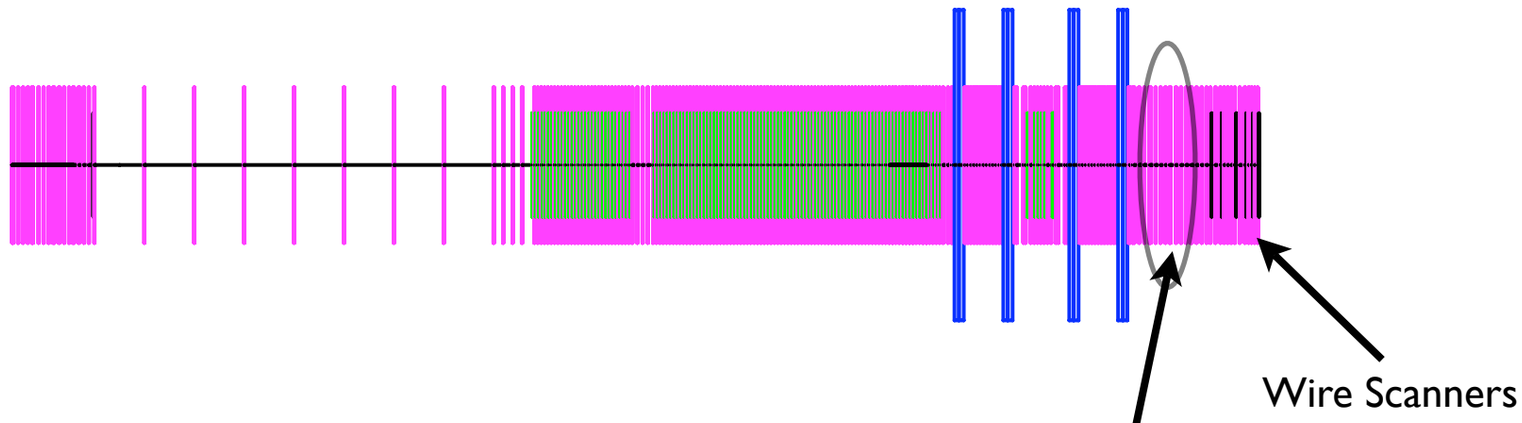








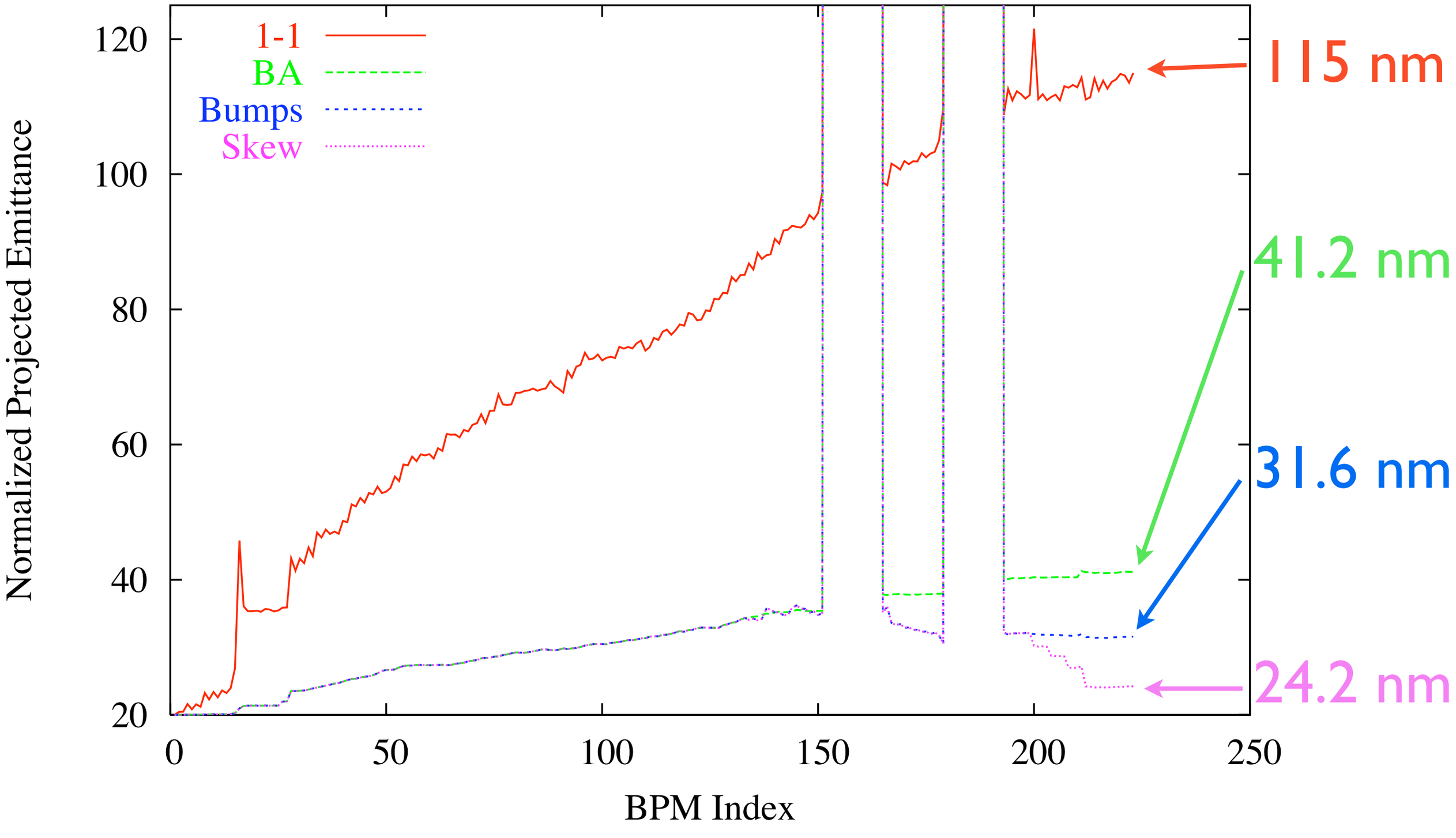
The Solution:



- Move skew correction to immediately upstream of wire scanners.
- Skew correction now a local correction
- Varying the skew strength will have minimal effect on vertical dispersion in RTML
- Will decouple skew correction and dispersion bumps
- Results on next page...

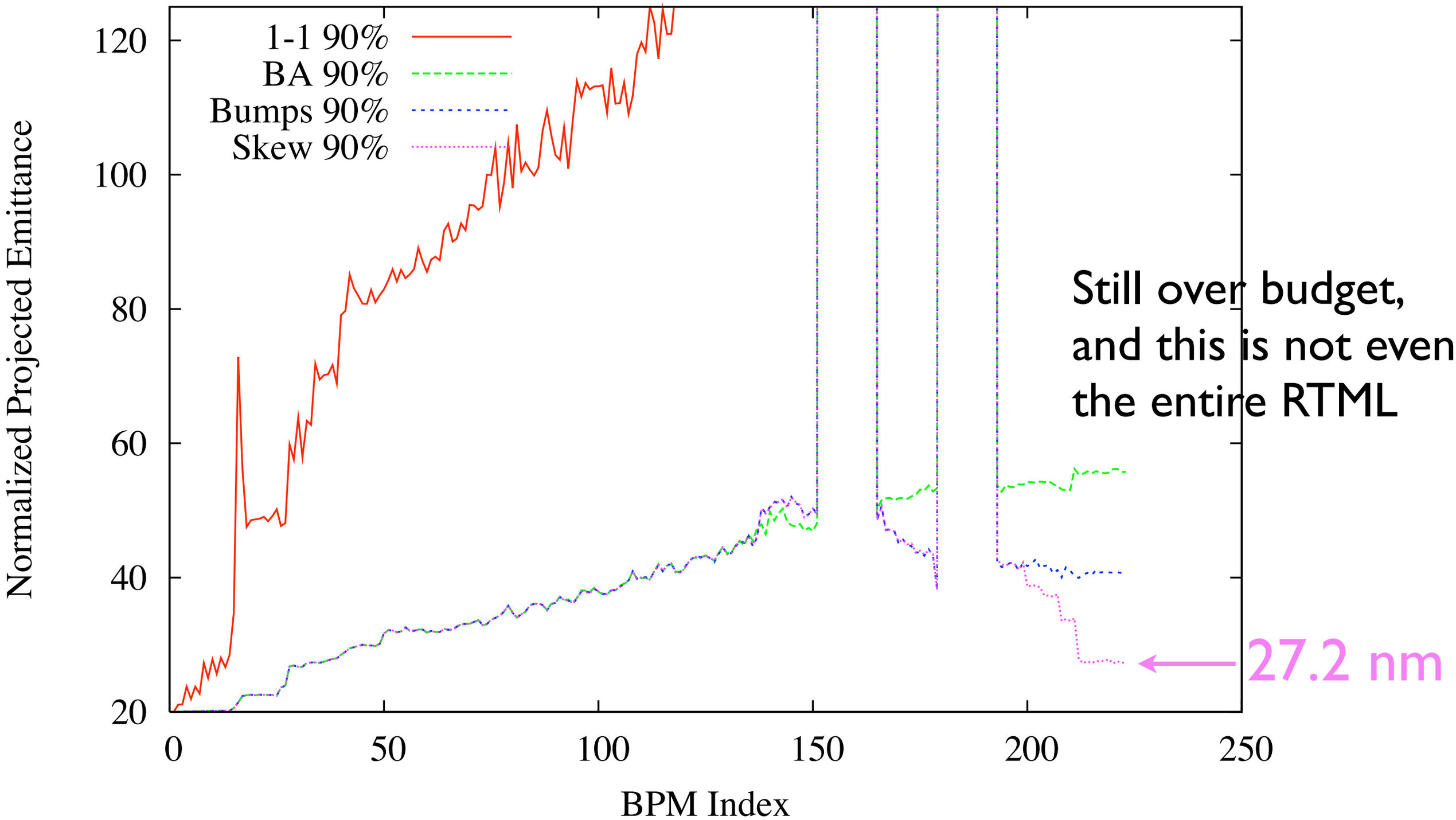
Skew Correction now works

RTML: 1-1, BA, bumps, skew LM, BA, bumps, skew LM LOCALSKEW 20060824



90% value still a bit high

RTML: 1-1, BA, bumps, skew LM, BA, bumps, skew LM LOCALSKEW 20060824



Still over budget, and this is not even the entire RTML

Plenty more work to do

- Someone should confirm my results
  - ★ PT will try and do that.
- Get emittance within budget
  - ★ Probably still a big challenge
- Include BPM and wire scanner noise
- Look at Bunch Compressor
  - ★ can DFS work here?
  - ★ This section's cold so probably can't use the same tolerances as the section of RTML I've looked at
- Longitudinal dynamics, expecially in the Bunch Compressor