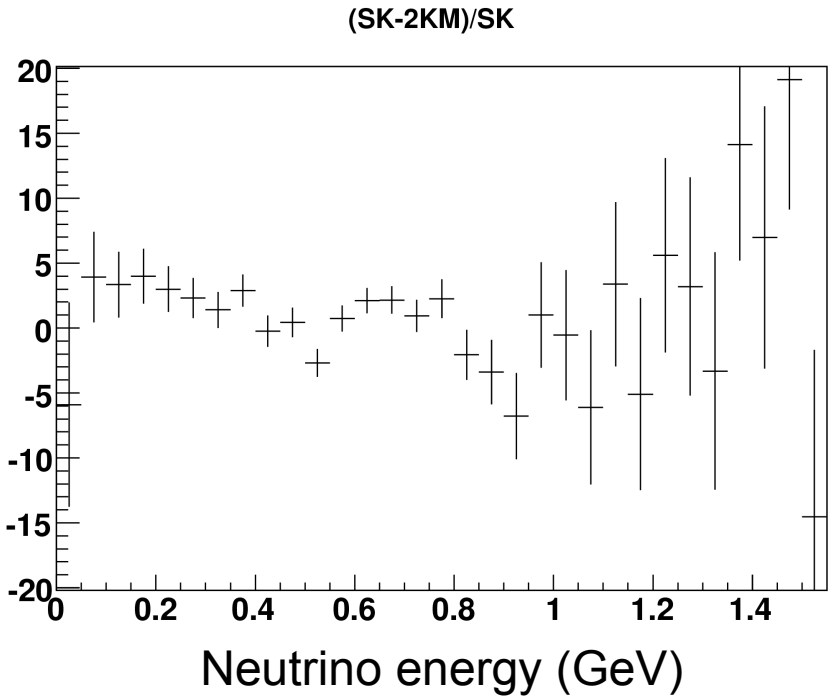
Status report

Maximilien Fechner

- ν_μ analysis
- Updated timeline plots

Reminder : far/near ratio

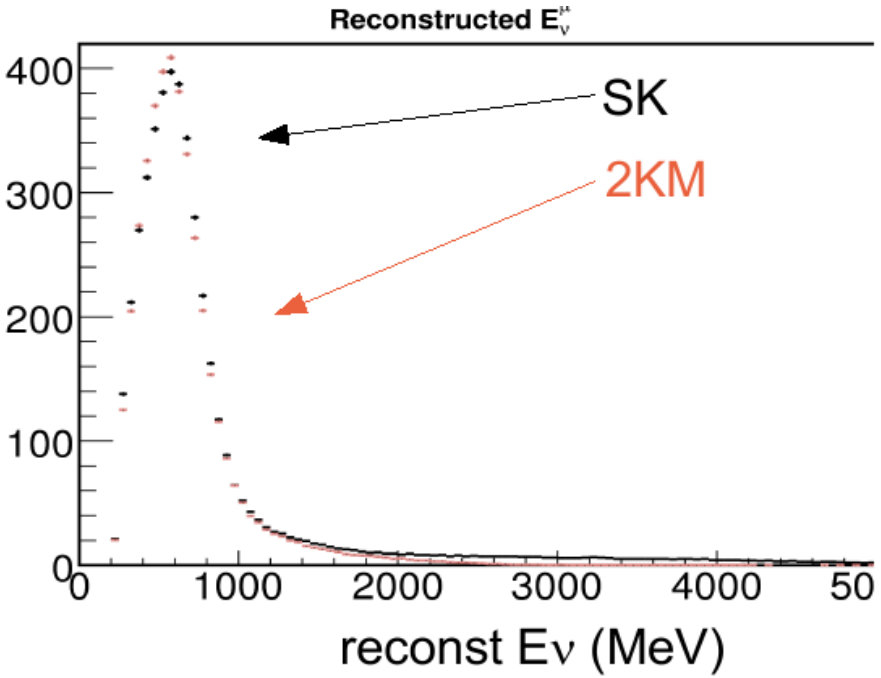
- Ratio of fluxes SK/2KM, before any reconstruction (our goal after reconst) :



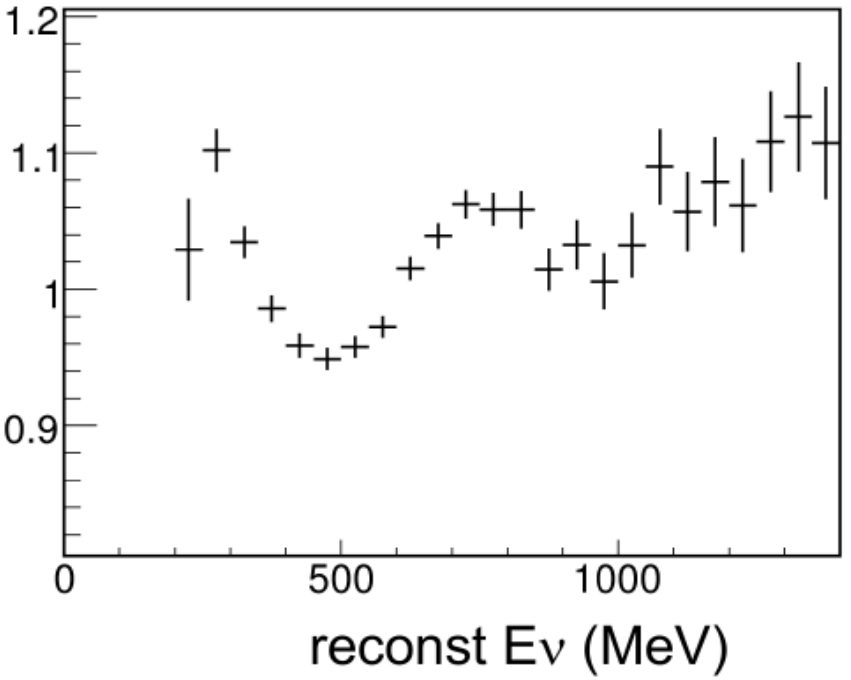
residual spectral differences +/-5%

Summary of oct 12 presentation

Significant spectral differences :



F/N ratio



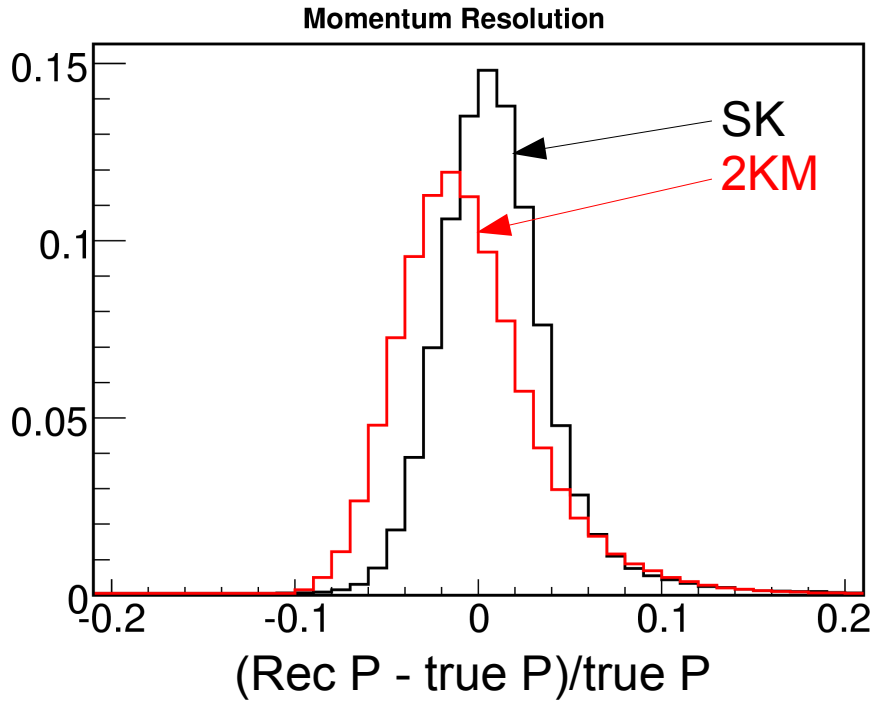
- 'oscillation like' structure in ratio
- does not look like the original flux ratio
- I also presented efficiency differences : the largest one comes from FC/PC acceptance

Using a 'simple' cut (Evis<1000 MeV) reduces the acceptance differences, but does not correct the structure in the ratio.

- 2 other reasons that could explain this: energy scale shifts, and energy resolution differences.

Momentum resolution

- Select CC ν_μ events, 1 ring, FC, reconstructed in FV
- Study the reconstruction of the momentum of the muon

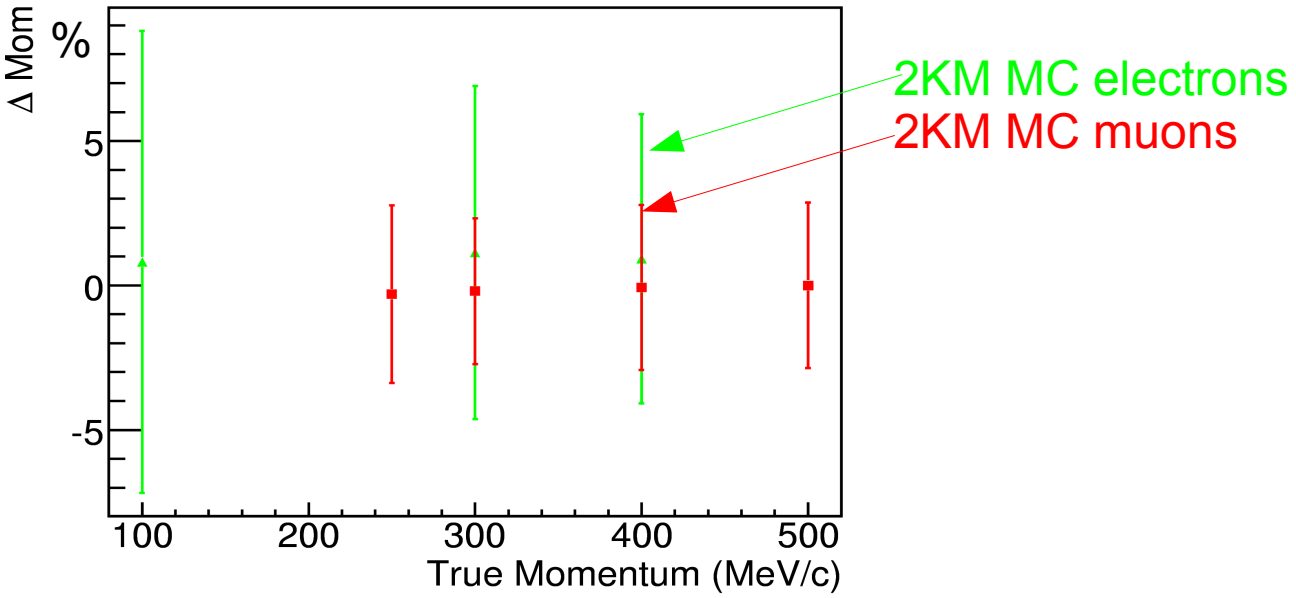


- 2KM is shifted by ~-2.0% while SK is centered (small shift ~0.2%)
- 2KM resolution is also worse than SK momentum resolution

Cause of the difference

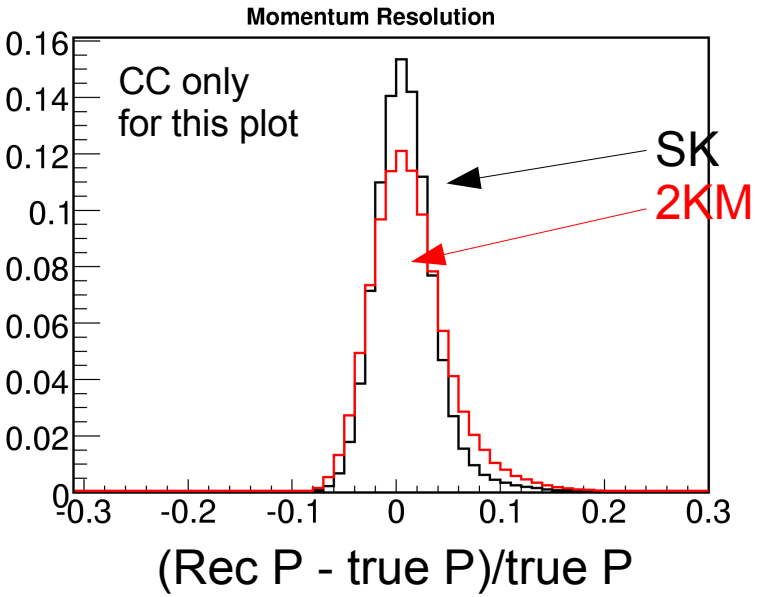
- Reconstructed momentum is obtained by computing a 'corrected amount of light' [RTOT, MSRTOT]
- The correspondence between these variables and momenta is stored in a table [PTASMO70, PTASMOTR]
- For muons the second table was not computed correctly in 2005... leading to a negative shift
- Unfortunately it is not possible to reprocess the 2KM MC [3 months...]
- With 2KM monochromatic MC, I computed a new table, and reran full reconstruction on a small batch of muons : the shift is fixed.
- Resolution is improved by ~ 0.5 %, but it is not clear yet if this accounts for all the differences in resolution between SK & 2KM.

Muons & electrons are centered on 0%

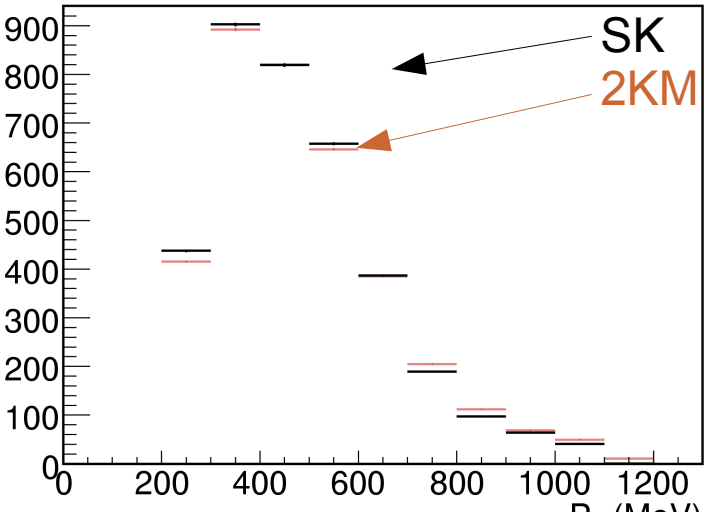


Analysis with bias fix

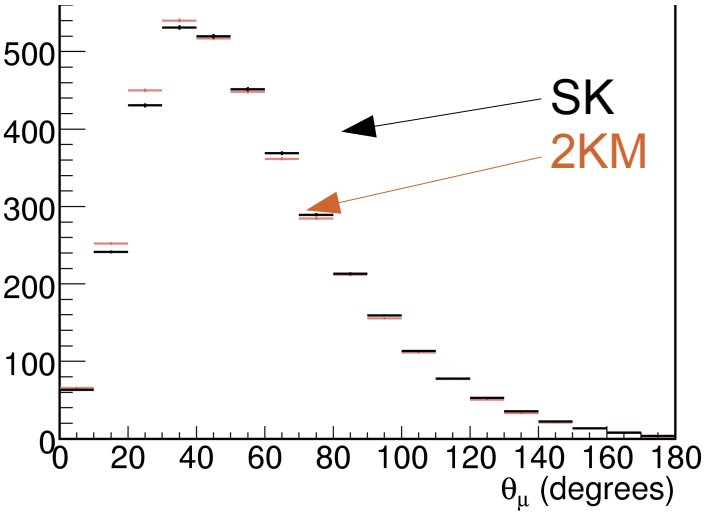
- The simplest fix was used for this analysis : multiply the muon reconstructed momentum by 1.02 for single-ring mu-like events
- Cuts : FV,FC,mom>250 MeV/c, 30<Evis<1000 MeV, 1 ring, mu-like
- No oscillation at SK



RECONSTRUCTED MOMENTUM

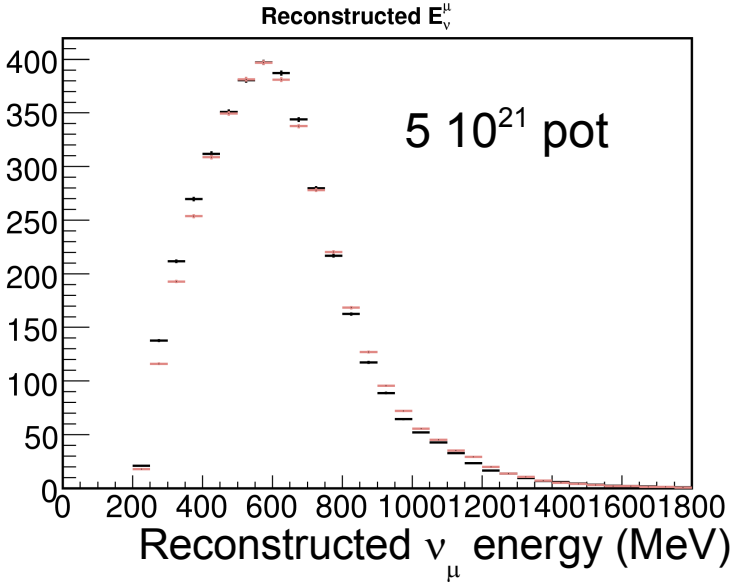


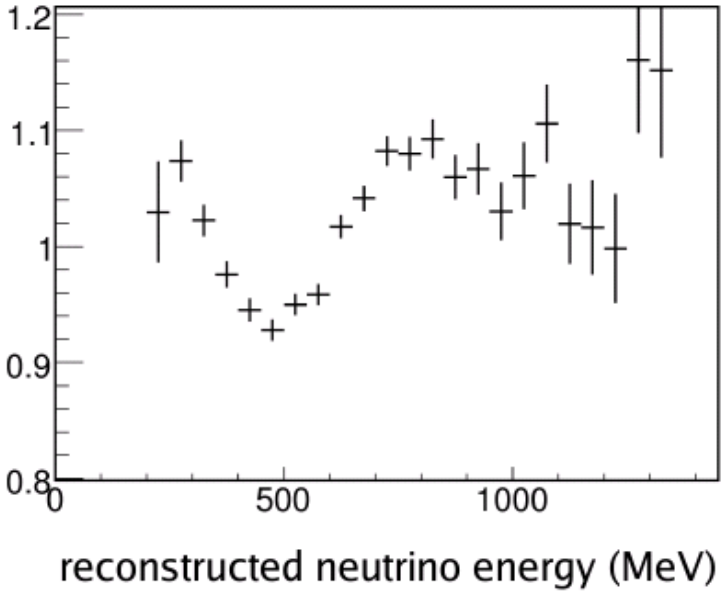
ANGLE WITH BEAM DIRECTION

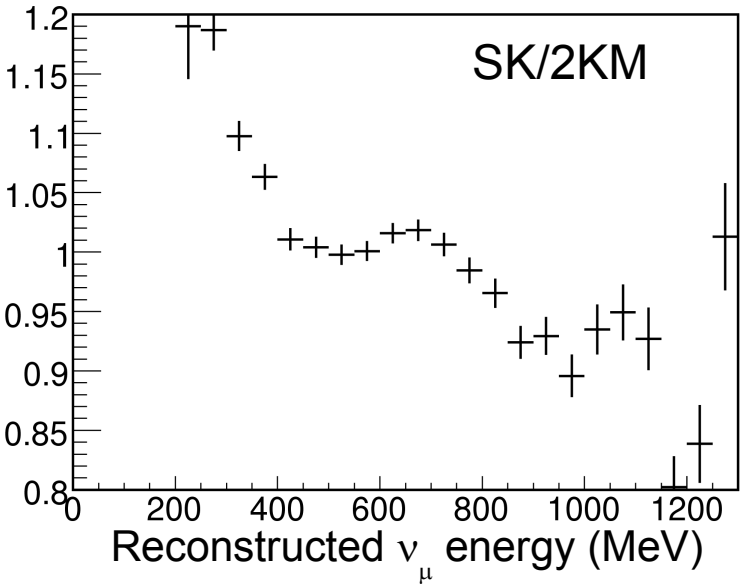


Analysis with bias fix (cont'd)

- Same event selection
- Assumes that events are CCQE, energy reconstructed using standard formula
- 2KM is simply scaled by spherical attenuation and ratio of masses







Conclusion about muons

- Some of the spectral differences in the reconstructed ν_μ spectra come from a shift in the energy scale at 2KM
- Better tuning of the reconstruction software would fix this problem
- Impossible to apply this for the proposal : 2-3 months running at least...
- A simple shift can be used to correct this in the ntuples but the resolutions are still different
- Not clear what the origin of the remaining differences is

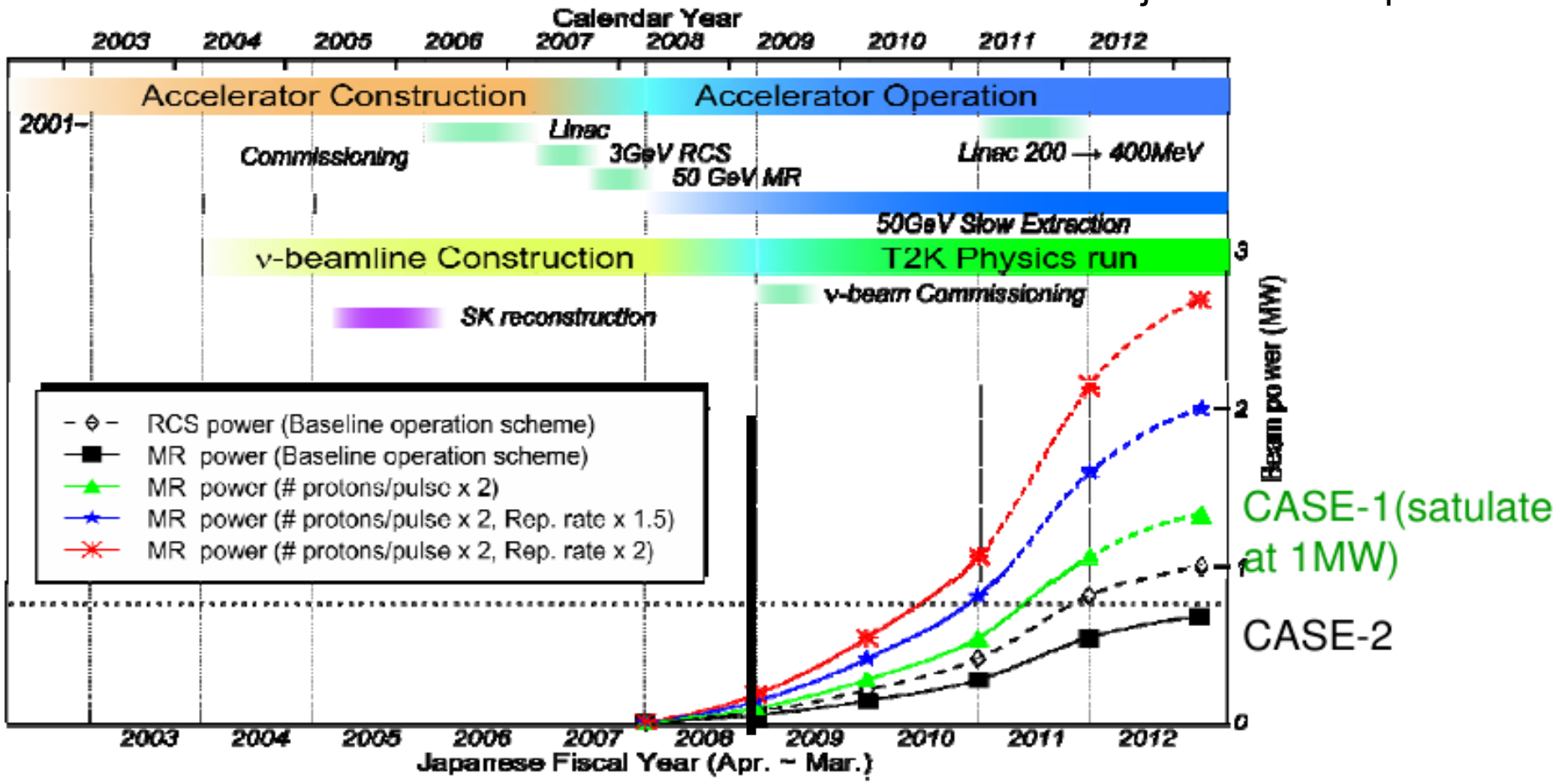
Time-line plots

- Requested for the proposal : using the 2 most likely beam intensity turn-on profiles, plot the expected sensitivity to θ_{13} vs the elapsed time,
- T2K is divided into 2 periods : start-2012 has only 280 m
  2012-end has a 2KM which reduces systematics
- To do this calculation I treated T2K as a simple counting experiment
- Systematics are added to the χ^2 as an extra term in the denominator
- We assume that there are no correlations between the systematics of each time period

$$\chi^2 = \frac{(data - MC)^2}{\sigma^2} = \frac{S^2}{S + B + (\alpha_1 B_1)^2 + (\alpha_2 B_2)^2}$$

Beam turn on profiles

From Kajita-san's last presentation



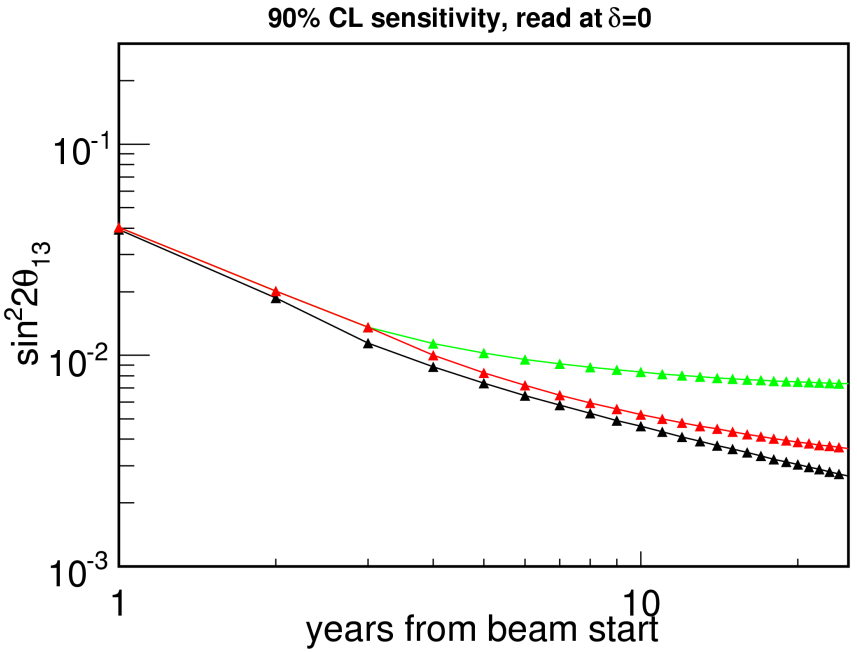
T2K START

We assume 2 cases

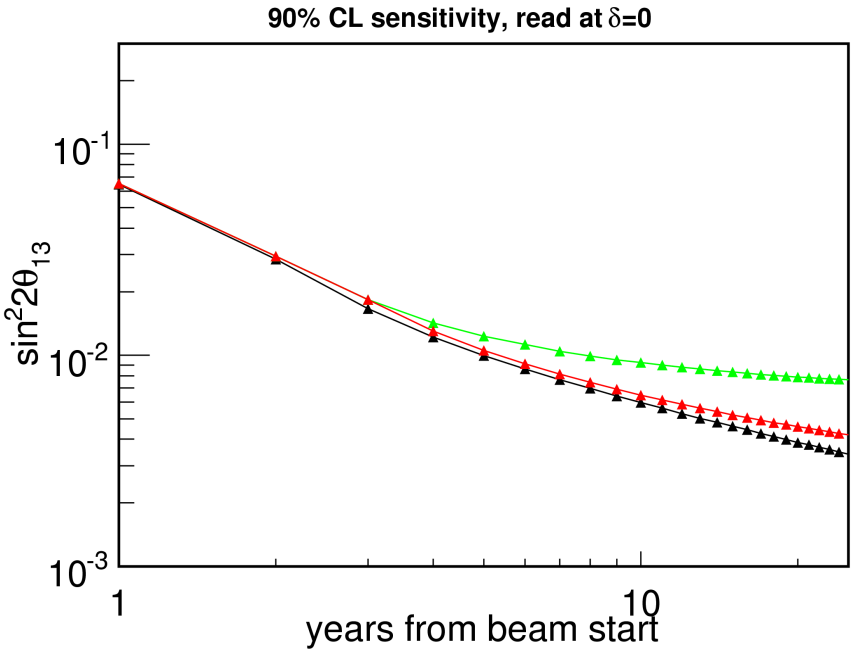
- After 2012, I used 0.65 MW for CASE-2 (no improvement at all)
- .Normalization : 0.6 MW in a year = 10^{21} pot
  Then I simply convert MW to pot using this proportionality factor

20 % systematics

Option #1 ('green')



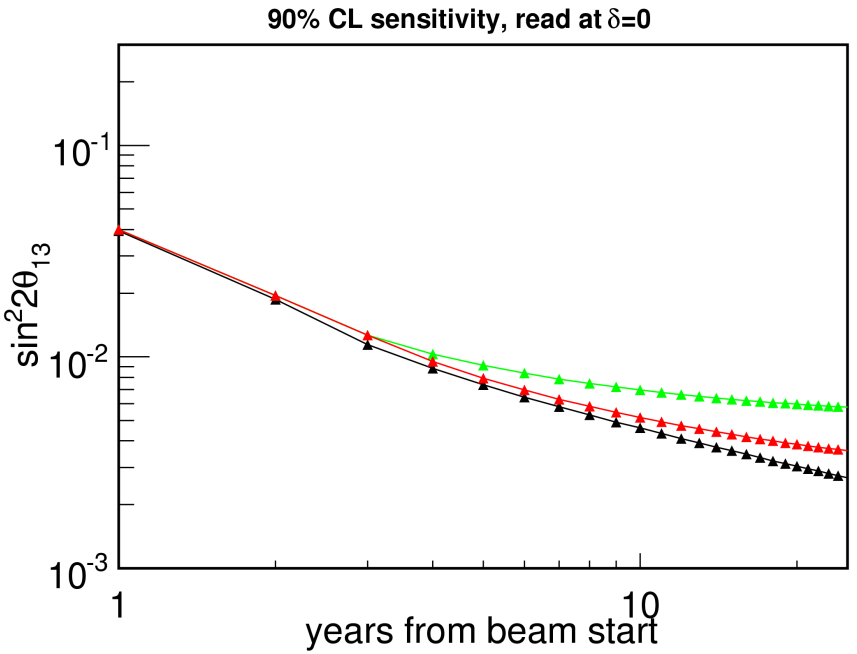
Option #2 ('black')



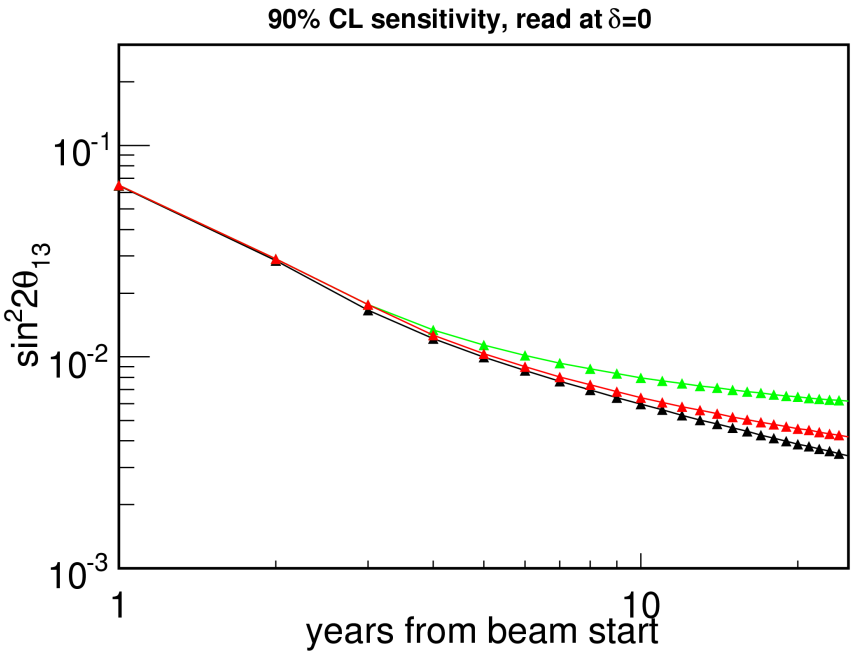
Green line : constant 20% systematics
Red line : 20 % systematics for the first 3 years, then 7.5%
Black line : no systematics

15 % systematics

Option #1 ('green')



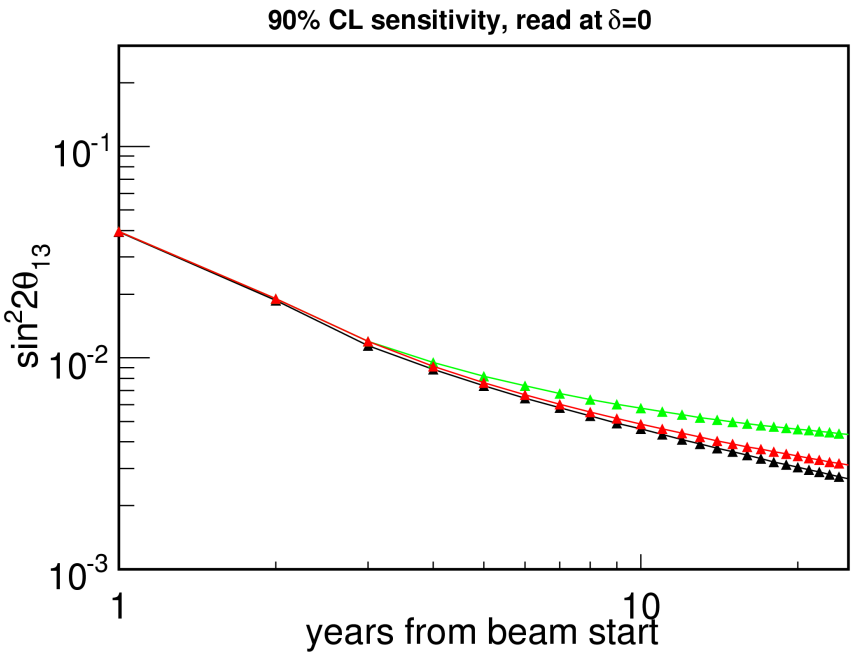
Option #2 ('black')



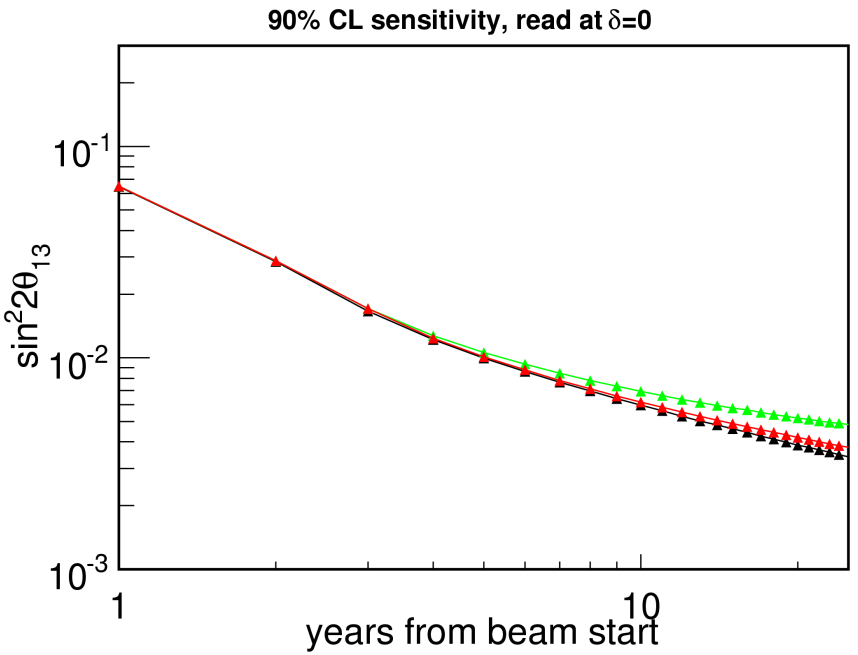
Green line : constant 15% systematics
Red line : 15 % systematics for the first 3 years, then 7.5%
Black line : no systematics

10 % systematics

Option #1 ('green')



Option #2 ('black')



Green line : constant 10% systematics
Red line : 10 % systematics for the first 3 years, then 5%
Black line : no systematics

Conclusion

- The code to produce time-line plots with a change of systematics works correctly
- Using the most likely beam options, 90% CL sensitivity to θ_{13} plots were produced
- The benefits of low systematics (<10%) are visible
- I'll also vary the start date of the 2KM for the proposal