TOTEM Running Strategy for 2012

1. Run at $\beta^* = 90$ m
   - request: 1 fill early after start-up
   - 4 bunches of (6 – 7) x 10^{10} p/b
   - verify measurements from Oct. 2011
   - align and operate RP 220 and RP 147
     (momentum spectrometer for diffraction, vertex resolution)
   - take data together with CMS : Triggers from T1/T2, RP, CMS

2. Runs at high β^* (~ 850m)
   - aim: reach the Coulomb region, measure ρ
   - request: 2 long physics fills

3. Running in standard fills with STABLE_BEAMS at low β^*
   - RP positions at high beam intensities:
     V @ 14 σ was tested in October and operationally ok
     H @ 18 σ was unreachable due to high beam losses (@ 21 σ: BLM almost dumped)
     despite prior validation by loss maps (but positions based on old alignment)!
     → need more conservative horizontal position, to be tested in more detail

   - Physics objectives:
     * stand-alone runs :
       large-|t| elastic scattering, interesting if E > 3.5 TeV
       DPE, using RP147 and RP220 as spectrometer → need beam-based alignment
     * common data taking with CMS (already in preparation)

Running Strategy beyond 2012

1. High β^* Runs
   - to be repeated after each increase of energy
     (→ additional energy points for elastic and diffractive scattering)
   - push β^* to higher values with the final goal ~1540 m
     (necessary to measure ρ at 14 TeV)
   - runs at intermediate β^* (e.g. 90m) depending on experience with very high β^*

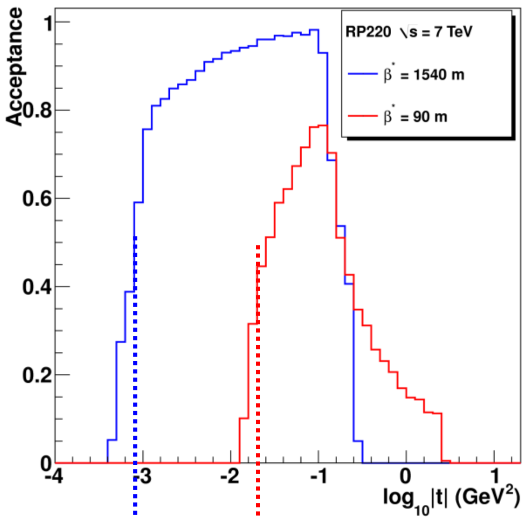
2. Standard β^* Runs
   - cooperation with CMS to be intensified
     (→ hard diffractive physics)
   - run frequency depending on experience in 2012
     (detector rates, potential radiation damage, reachable horizontal detector position)

→ No end of Roman Pot Operations in the foreseeable future.

Backup

Elastic Scattering Acceptance

Example: RP220 detectors at 10 σ from beam centre



$|t_{50}|$ = 0.024 GeV² (ε_N = 3.75 μm)

$|t_{50}|$ = 0.0008 GeV² (ε_N = 1 μm)

Smallest reachable (and usable) |t|: value at 50% acceptance $|t_{50}|$

$$|t_{50}| = \frac{2p^2}{\left(L_y^{eff}\right)^2}\left(n_{\sigma,\mathrm{det}}\,\sigma_{RP}\right)^2 \approx \frac{2p^2}{\beta_{RP}\beta^*}\left(n_{\sigma,\mathrm{det}}\sqrt{\frac{\varepsilon_n\beta_{RP}}{\gamma}}\right)^2 = \frac{2p\,n_{\sigma,\mathrm{det}}^2\,\varepsilon_n\,m}{\beta^*}$$

Si detector distance from beam in σ

Beam width at RP

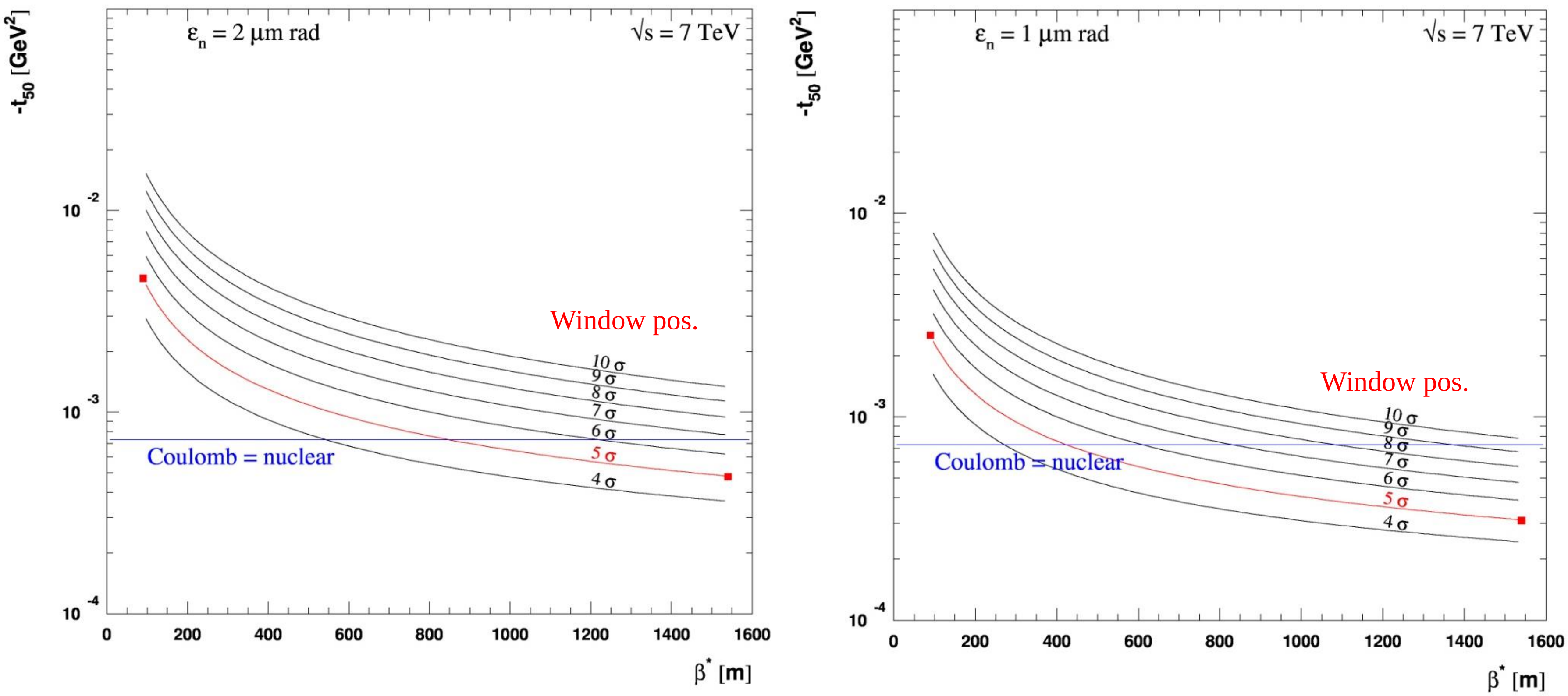
But: Silicon detector is further away from the beam than the outer pot window (window thickness + gap):

$$n_{\sigma,\mathrm{det}} = n_{\sigma,\mathrm{RP\ window}} + \frac{\delta_{\mathrm{gap}}}{\sigma_{\mathrm{RP}}} = n_{\sigma,\mathrm{RP\ window}} + \frac{\delta_{\mathrm{gap}}}{L_y^{eff}}\sqrt{\frac{\beta^*\gamma}{\varepsilon_n}}$$

$\delta_{\mathrm{gap}} \approx 0.4$ mm

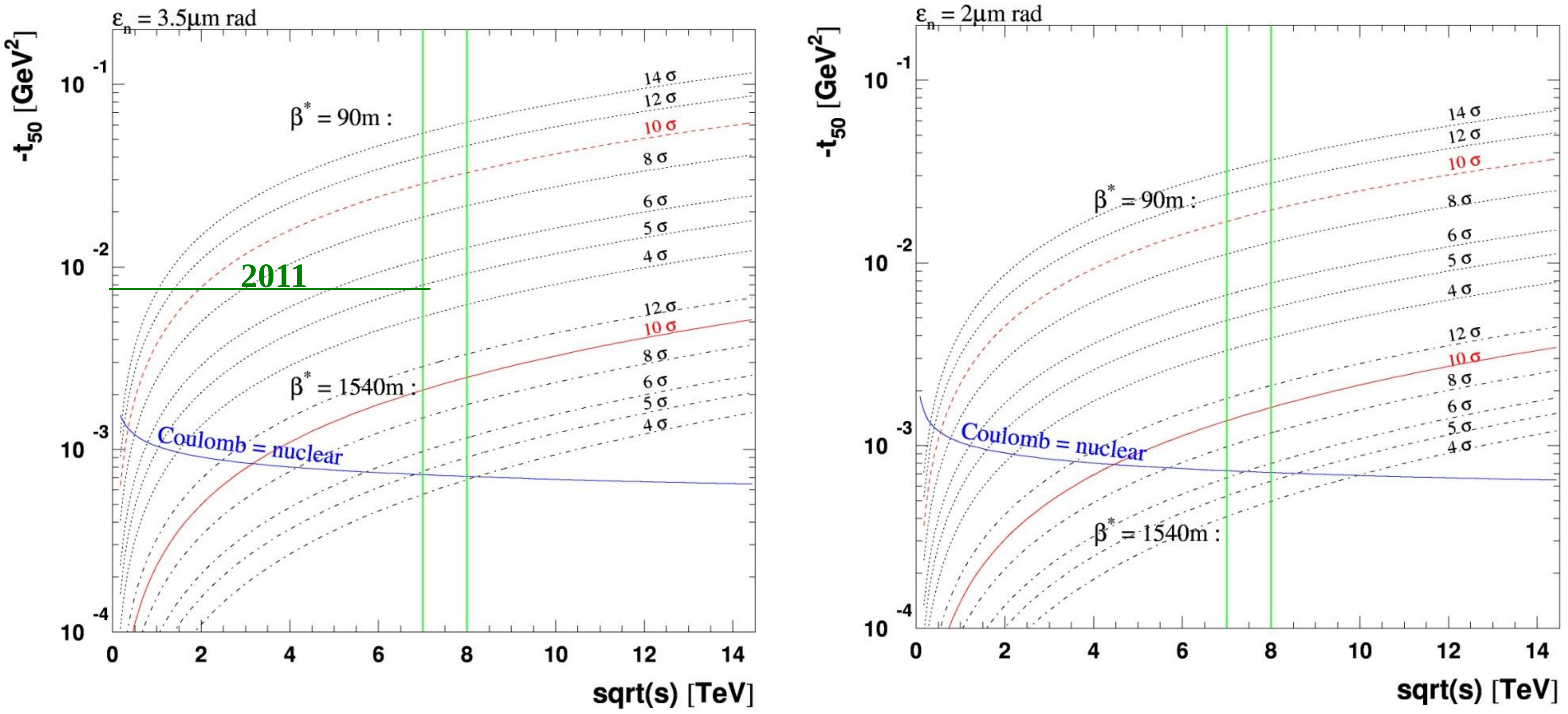
L_y^{eff} not easily predictable for unknown optics,
For now assumed constant (265m @ β*=90m, 273m @ β*=1540m).
But this depends on the details of the optics.

How to reach the Coulomb Region ?



- Low emittance is a key requirement
- To reach the Coulomb region, ε_n < 2 μm rad and β* > 850 m is needed (assuming RPs at 5σ)
- RP positions have to be calculated based on actual not nominal emittance, otherwise no gain in t !
- Parallel-to-point focussing in y is required, but it can be dropped in x.

t-Acceptance for Different Energies



At 8 TeV the pots have to move by ~1σ closer to reach the same t as at 7 TeV.

→ If possible, develop high-β* optics at 7 TeV.

t-Acceptance for Different Energies