



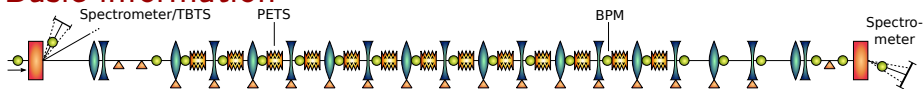
# The Test Beam Line

Status February 2012

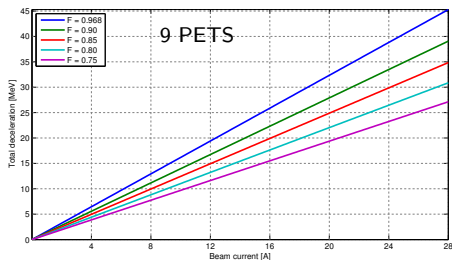
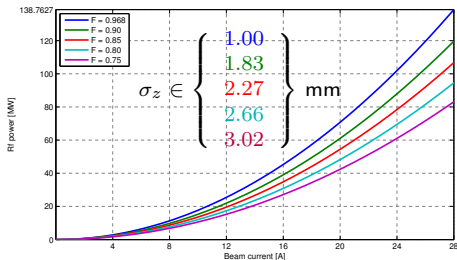
Reidar L. Lillestøl

*with Steffen Döbert, Guido Sterbini, Maja Olvegård and Erik Adli*

# Basic information

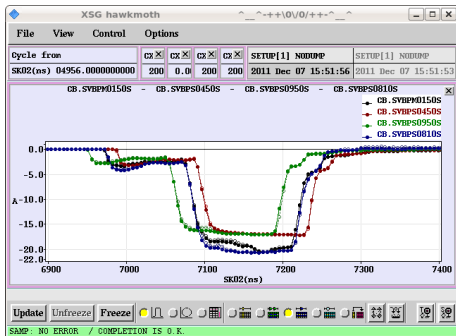
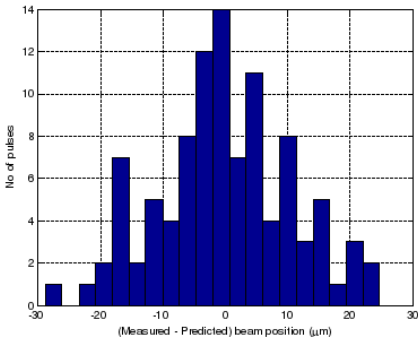


- ▶ 9 PETS installed before → 12-13 next run
- ▶ Maximum beam current in 2011:  $\sim 21$  A
- ▶ Maximum power per PETS in 2011:  $\sim 70$  MW ( $\sim 630$  MW in total)
- ▶ Maximum deceleration in 2011:  $\sim 26$  % ( $\sim 31$  MeV)
- ▶ Readout electronics: 12 ADC channels
  - ▶ Earlier read 2 PETS with IQ demodulators, the rest with diodes
  - ▶ Must now use diodes for all PETS

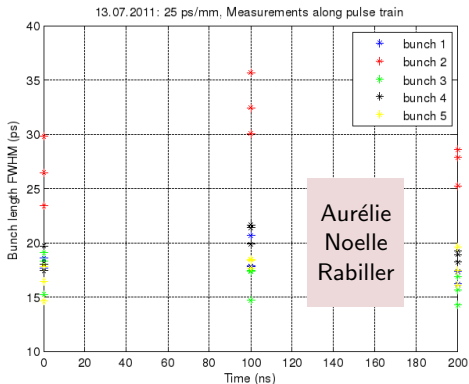
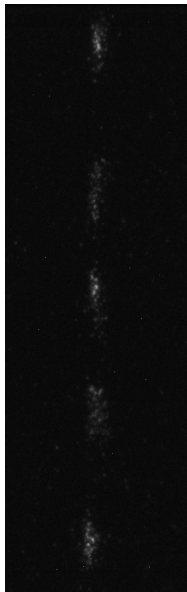


# BPMs

- ▶ A resolution of 9  $\mu\text{m}$  measured for a beam current of 13 A
  - ▶ Agrees well with 5  $\mu\text{m}$  specification at 28 A
- ▶ Accurate for low beam currents (up to factor 4)
- ▶ Spanish BPMs (in the FODO structure) saturated for factor 8
  - ▶ Beam transport relies on BPMs outside FODO structure (except for one BPM close to the end with different electronics)
  - ▶ Attenuators will be added



# Power production vs. bunch length



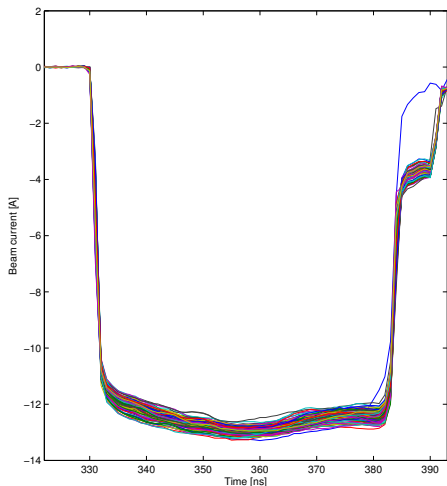
Form factor estimation in TBL and streak camera measurements in CLEX, factor 4 combination

- ▶ TBL 6<sup>th</sup> July:  $F(\lambda) \simeq 0.90$
- ▶ Streak 13<sup>th</sup> July:  $F(\lambda) \in [0.80, 0.90]$  (disregarding bunch 2)
- ▶ TBL 14<sup>th</sup> July:  $F(\lambda) \simeq 0.85$

## Stability: Beam current

- ▶ Factor 4 beam from November 8<sup>th</sup>
- ▶ CB.SVBPS0210 (before the first PETS), 90 shots

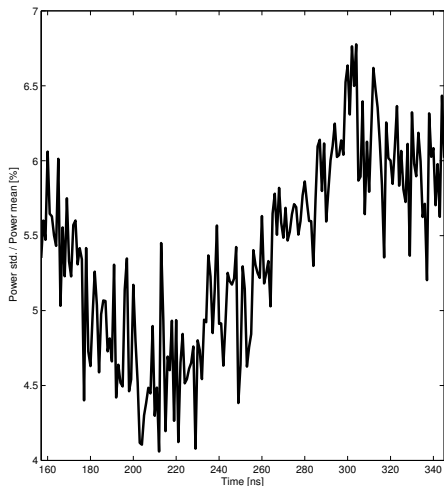
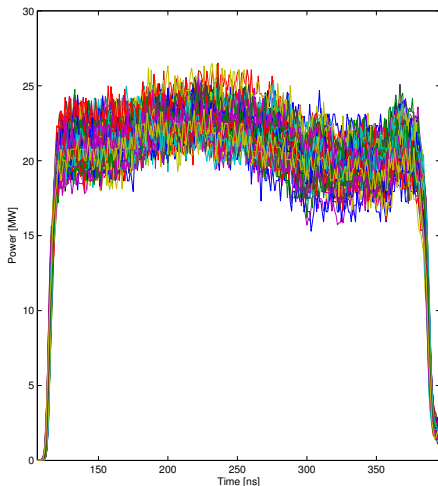
RMS stability: 1.26 %



# Stability: PETS power

- ▶ Factor 4 beam from November 8<sup>th</sup>
- ▶ The first PETS (on IQ demodulators), 90 shots

RMS stability: 5.41 %

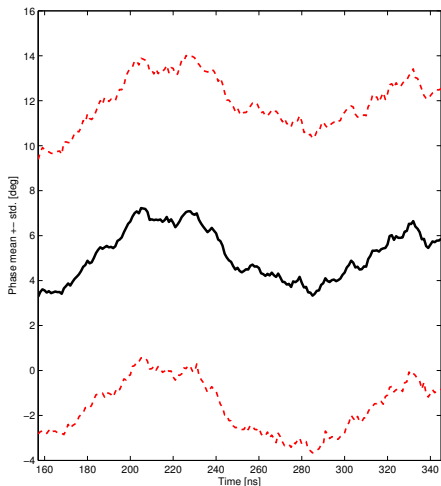
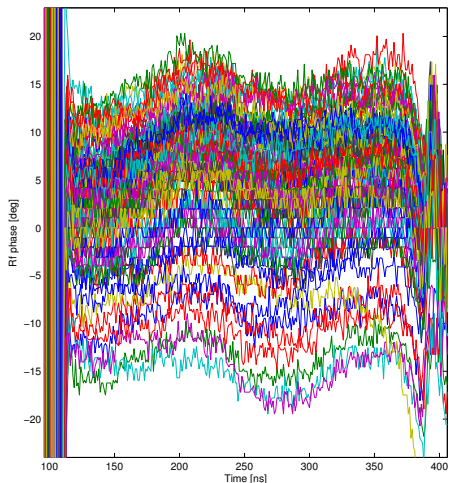


# Stability: PETS rf phase

- ▶ Factor 4 beam from November 8<sup>th</sup>
- ▶ The first PETS (on IQ demodulators), 90 shots

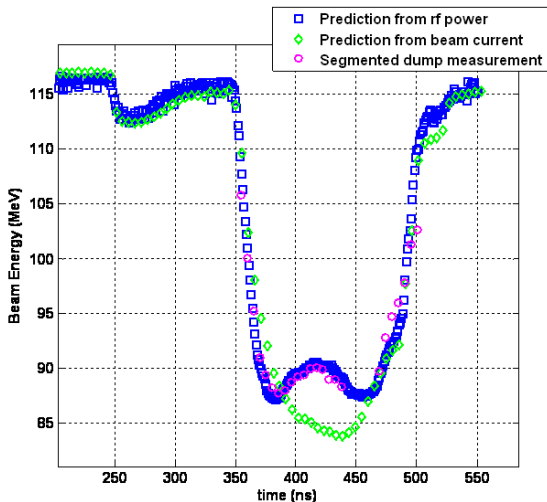
RMS, mean phase:  $1.15^\circ$

Mean of st. dev.:  $6.79^\circ$



# The “Form factor hole”

- ▶ Form factor variations over the pulse leads to a reduction of rf power and deceleration
- ▶ The cause of the hole is likely the phase switches

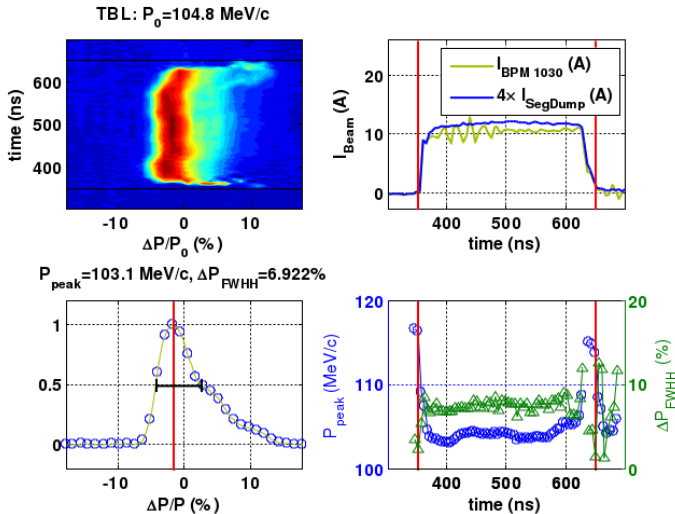


7<sup>th</sup> December



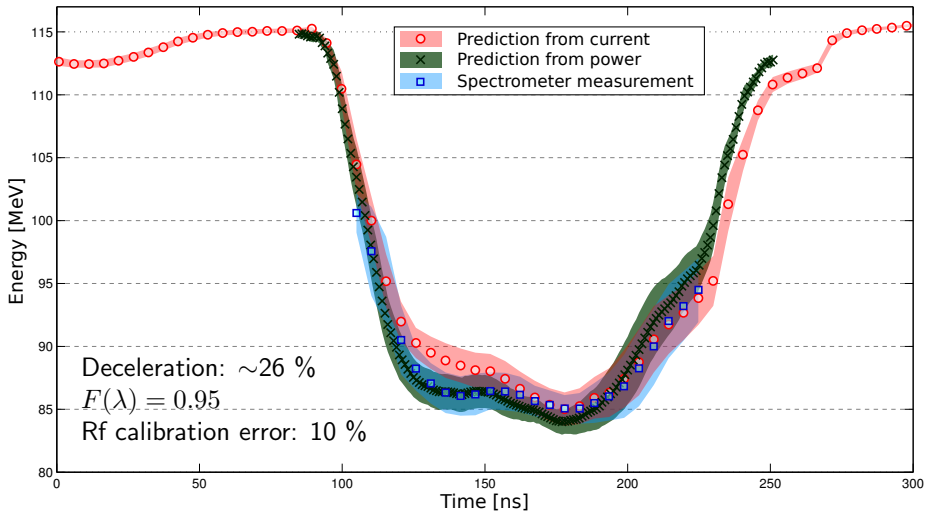
# Segmented dump at the end of the TBL

Factor 4 combination, 12 A beam current



# Deceleration

Data from 7<sup>th</sup> December, showing means and standard deviations over 90 shots



# Wishlist

Dear Santa,

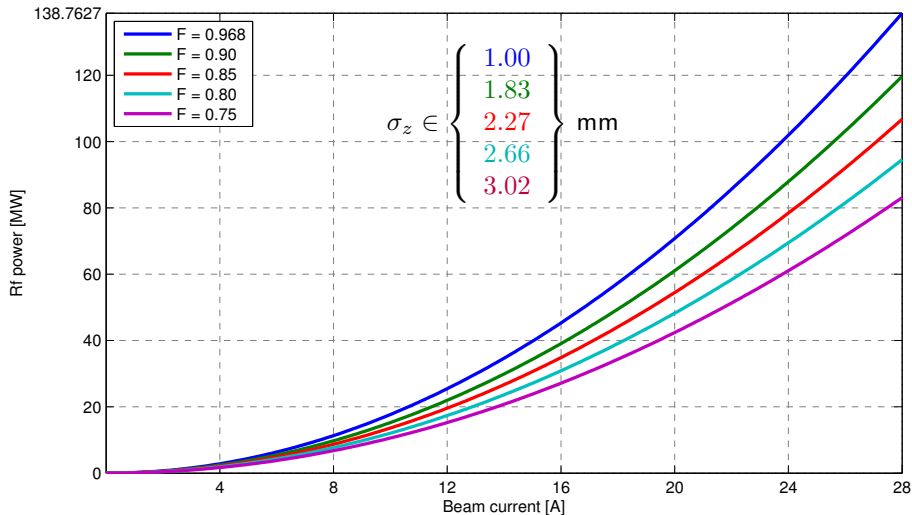
We would like the following improvements:

- ★ Reliable, stable, reproducible 28 A beam with a high form factor and a square pulse
  - Improve overall factor 8 combination
  - Optimize delay loop parameters
  - Constant (high) form factor (no “form factor hole”)
  - Further improve dispersion, especially in TL2
- ★ Decrease number of changes between experiments
  - Less startup problems
  - Less things to set up from the beginning
- ★ More streak measurements, preferably on TBL days for comparison (automated software?)
- ★ Better knowledge of beam energy
- ★ Improve rf calibration

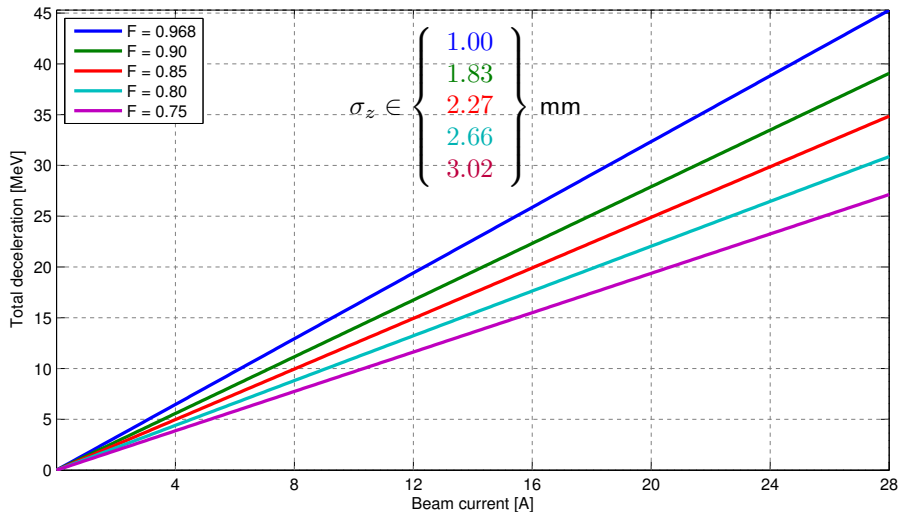


Extra slides

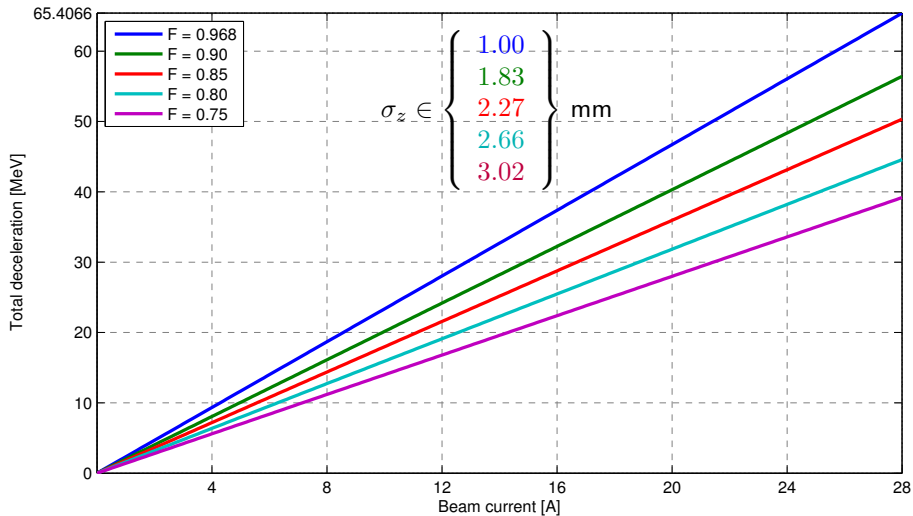
# Power production per PETS



# Deceleration with 9 PETS



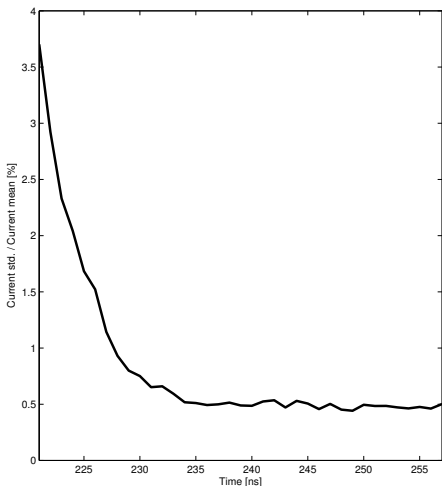
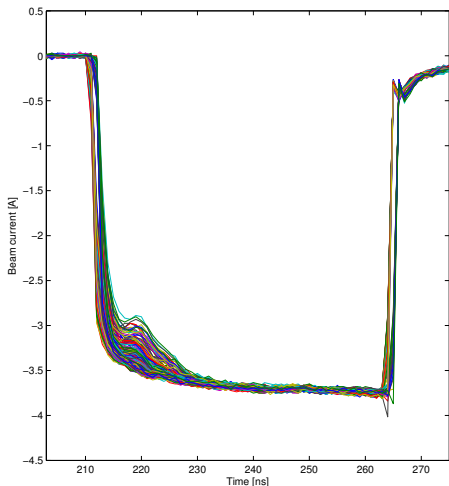
# Deceleration with 13 PETS



# Uncombined beam stability: Beam current

- ▶ Uncombined beam from August 16<sup>th</sup>
- ▶ CB.SVBPS0210 (before the first PETS), 198 shots

RMS stability (last part): 0.52 %

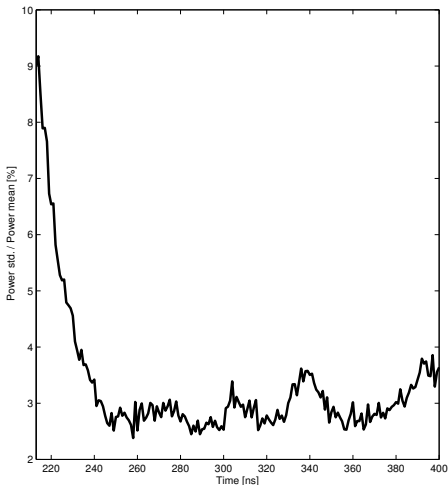
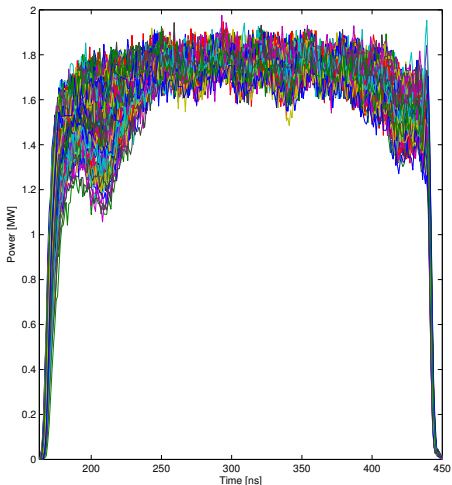




# Uncombined beam stability: PETS power

- ▶ Uncombined beam from August 16<sup>th</sup>
- ▶ The first PETS (on IQ demodulators), 198 shots

RMS stability (last part): 2.98 %



# Uncombined beam stability: PETS rf phase

- ▶ Uncombined beam from August 16<sup>th</sup>
- ▶ The first PETS (on IQ demodulators), 198 shots

RMS, mean phase: 7.16°

Mean of st. dev.: 11.03°

