Longitudinal Impedance Model of the SPS
Trust me, I'm an engineer

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August 10, 2014

Outline

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__init__(self)
And what's nice about me

Some quick, ehm, facts

- Half a brain
- No prior knowledge
- Something, something, LEARNING

Background

- Electrical power eng...BZZT... "FFFFF**K! Hey, dad! You got any more of those fuses?" — "Ma che ho fatto di male, Jonasse?!"
- Physics and environmental engineering

Outline

What the...
Something is not right here

The problem
One does not simply upgrade the LHC

Wake fields

- Structural variations along the beam path
- Single/multi– bunch interaction

Coupling impedance

Used to describe linear systems — response to monochromatic excitation

The problem
One does not simply upgrade the LHC

CERN

Beam instability

The machine causes bunch lengthening, thus making the injection incompatible with the LHC

FFFFFFF
FFFFFFF
FFFFFFF
FFFFF
FFFFF
FFFFF
UUUU
UUUU
UUUU-

The problem
One does not simply upgrade the LHC

What do I do, then?

Help build/complete a longitudinal impedance model of the Super Proton Synchrotron
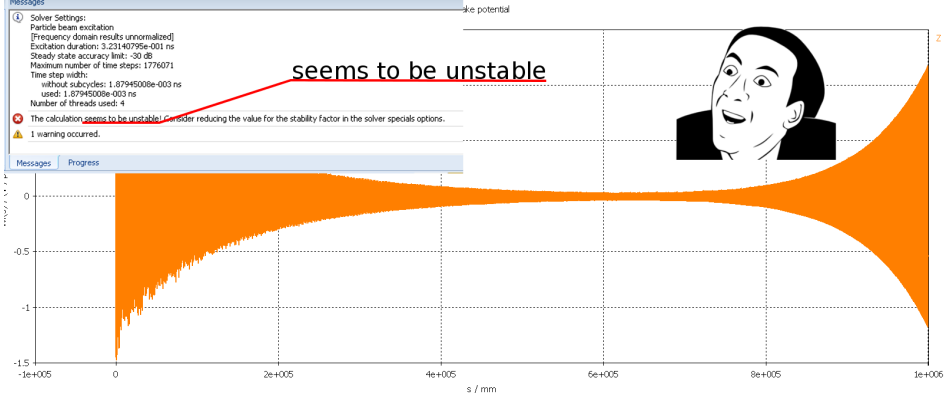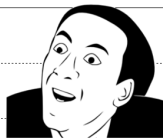
Outline

1 Introduction

2 Project proposition

3 The works

4 Bonus

Going to war
Aaaaaaargh! WHAT!? NO! I f**king fixed that! I don't even?! Why?!

Going to war, MATLAB edition
Aaaaaaargh! WHAT!? NO! I f**king fixed that! I don't even?! Why?!

CERN

Improper assignment with rectangular empty matrix.

Error in <u>PostProcessing_MBA_QF_flange</u> (<u>line 249</u>)
         newTime(i_ind,:) = Time(i_ind, indexLeftEven:indexRightEven);

Subscripted assignment dimension mismatch.

Error in <u>PostProcessing_MBA_QF_flange</u> (<u>line 238</u>)
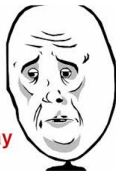   newTime(i_ind,:) = Time(i_ind, indexLeftOdd:indexRightOdd);

Error using <u> : </u>
For colon operator with char operands, first and last operands must be char.
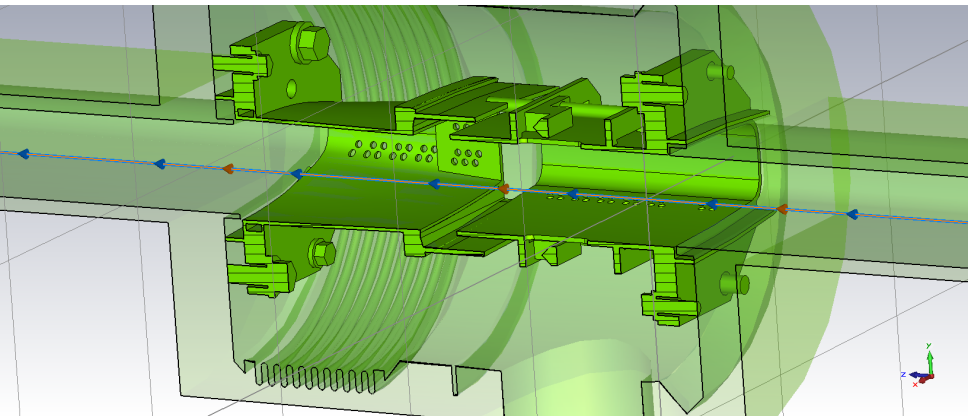
Error in <u>trapz</u> (<u>line 38</u>)
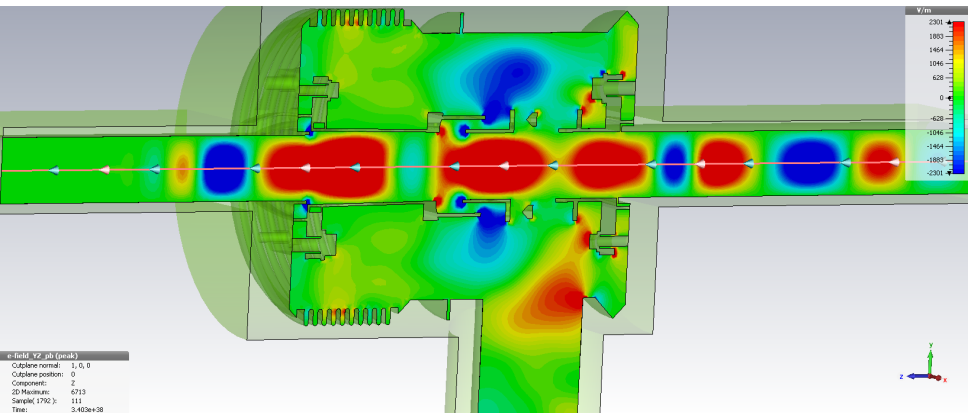   perm = [dim:max(ndims(y),dim) 1:dim-1];

Okay

Simulation — model
Now in 4D!
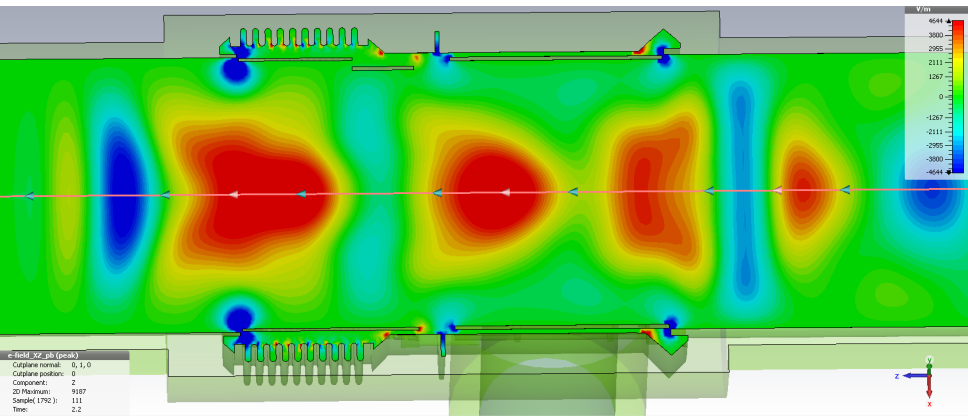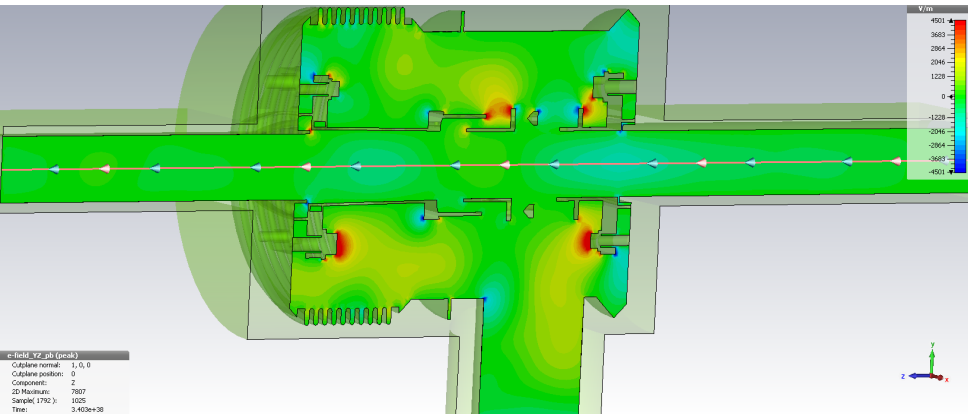
Simulation — results — @2.2 ns
Flatland revisited

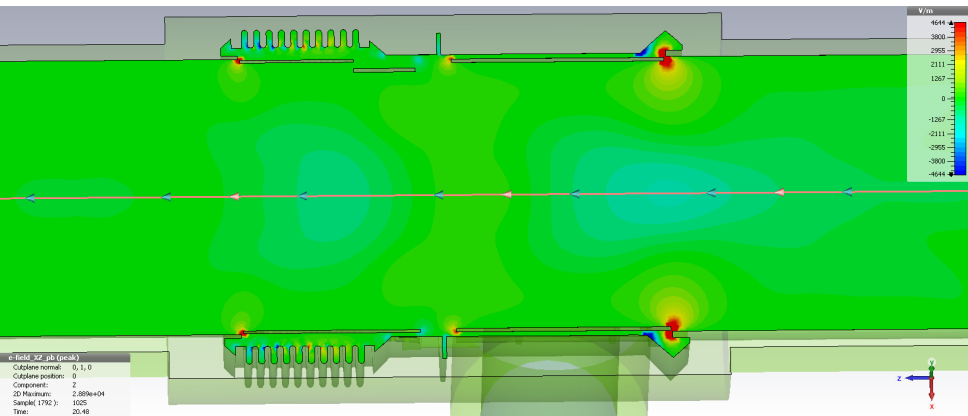# Simulation — results — @2.2 ns
Flatland revisited

Simulation — results — @20.48 ns
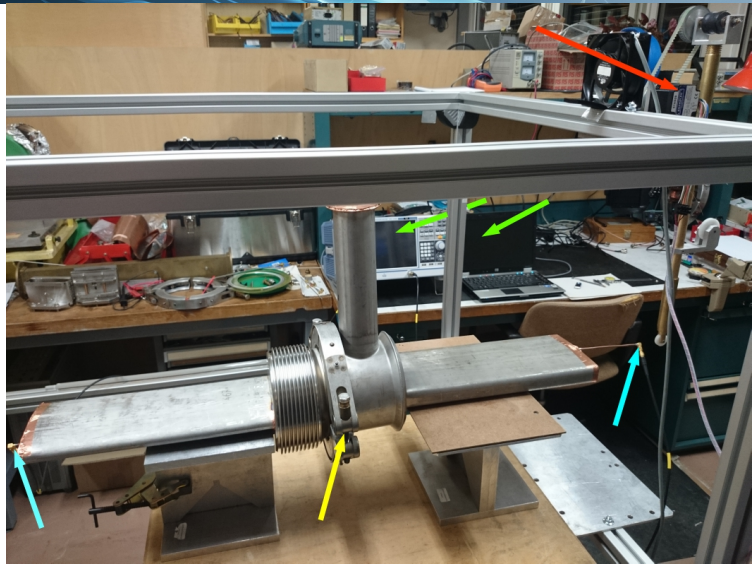## Flatland revisited

Simulation — results — @20.48 ns
Flatland revisited
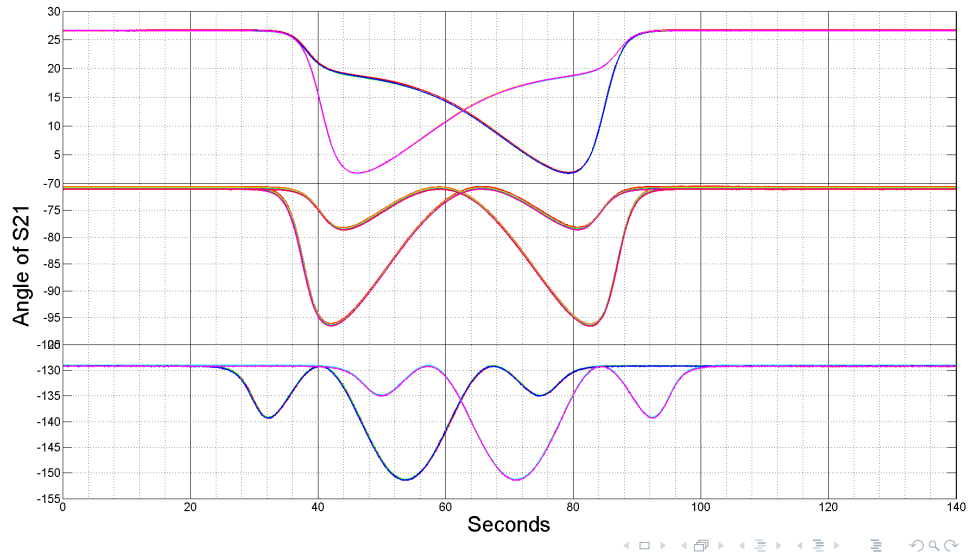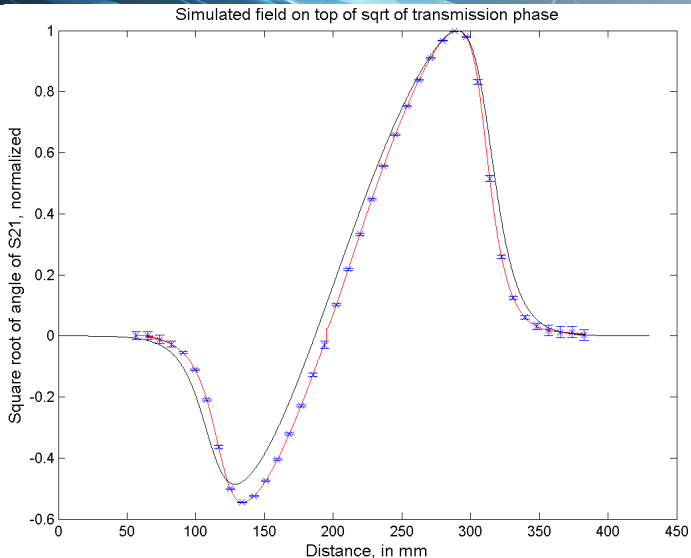
In the lab — setup for bead–pull
Keepin' it physical, yo

In the lab — results

Data, raw and wwwwwwwwiggling...

In the lab — results
After some magic

Simulated field on top of sqrt of transmission phase

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Sweet bonus pic
Just a flesh wound