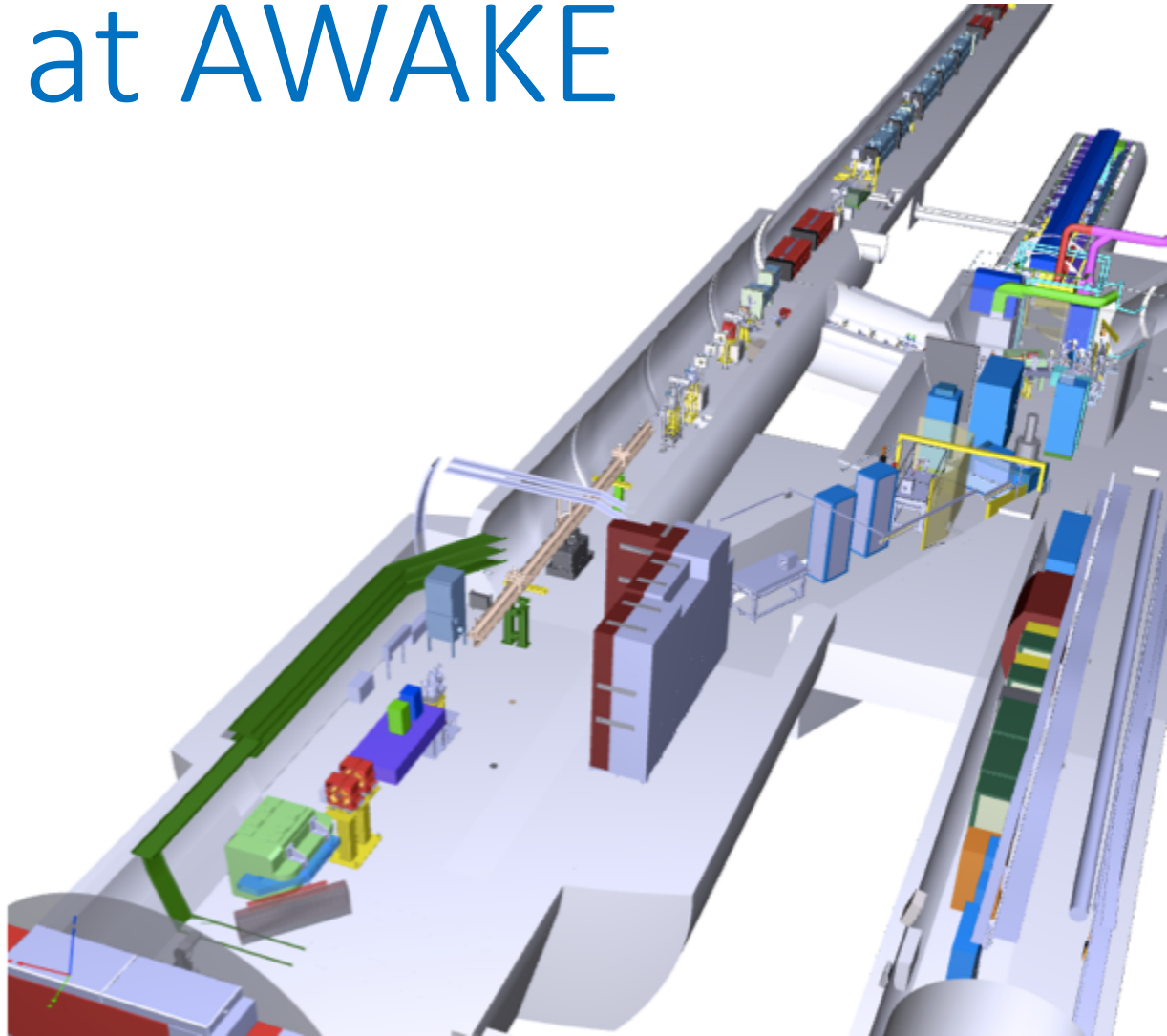
BPM Performance at AWAKE



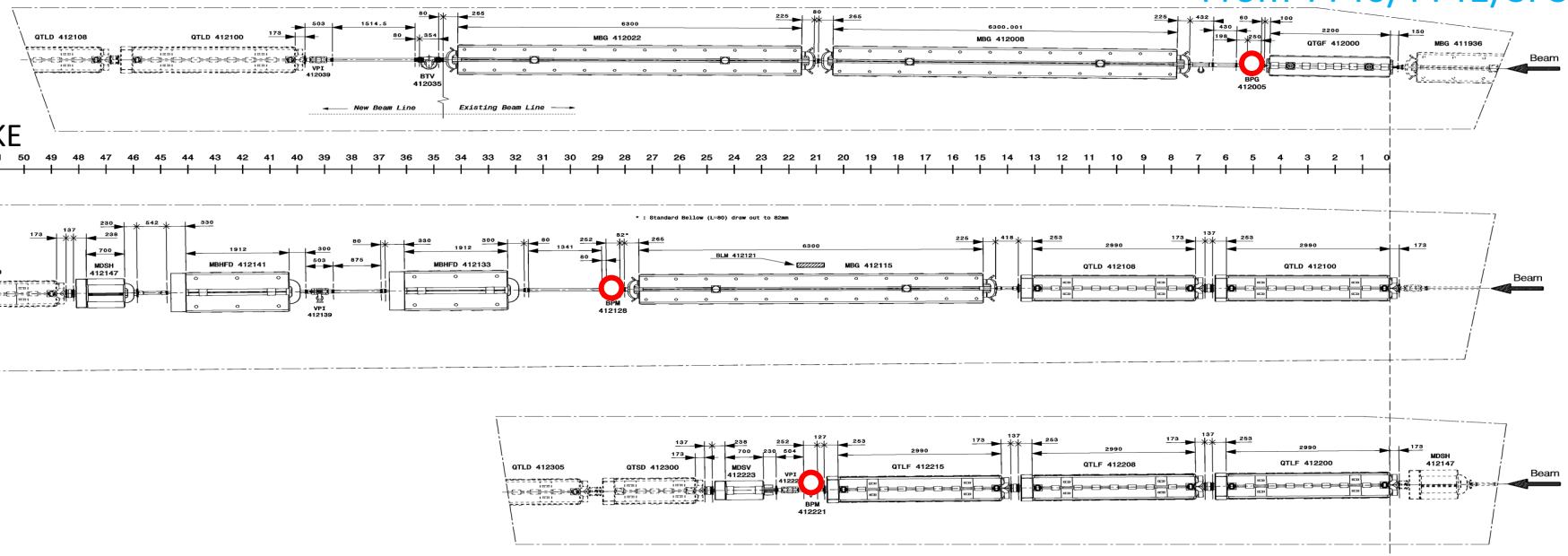
Spencer Gessner

12 December, 2018

21 p+ BPMs in TT41

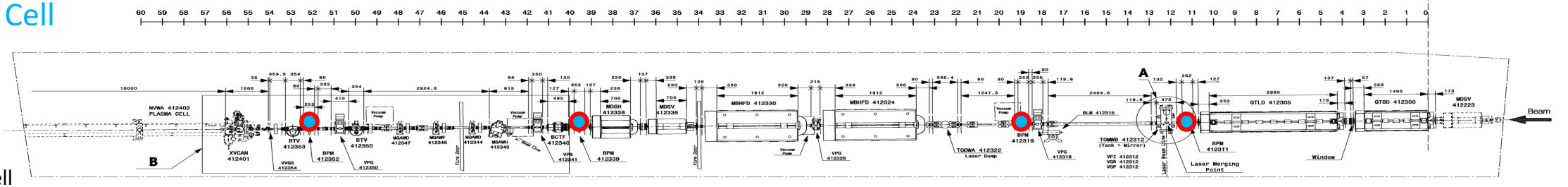
- 16 “upstream” BPMs monitored by SPS OP
- 5 “downstream” BPMs monitored by AWAKE

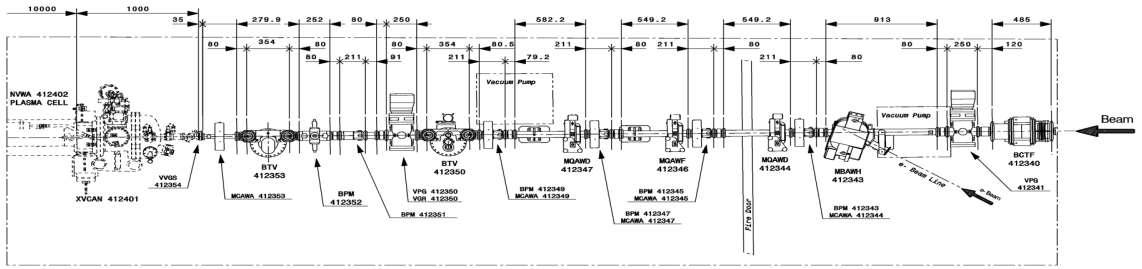
From TT40/TT41/SPS



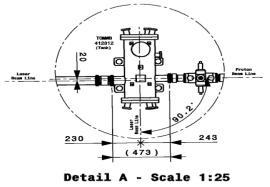
Plasma Cell

BPM 412425
After Plasma Cell





Detail B - Scale 1:25



Detail A - Scale 1:25

NOTA :

Layout from Plasma Cell to Shielding Wall (final part of Beam Line), see drawing SPSLAWK_0009

Layout of upstream part of TT41 Beam Line see drawings SPSJTT4100003 and SPSJTT4100004

Layout of Electron Beam Line, see drawing SPSLAWK_0032

IND.	DATE	NOM/NAME	ZONE	MODIFICATION
D	2017-06-14	F. GALLEAZZI		MaJ Ligne Faisceau - Version Juin 2017
C	2015-07-10	F. GALLEAZZI		MaJ suite commentaires lors de l'approbation
B	2015-06-01	F. GALLEAZZI		Correction Longueur BTV - BCTF - BPM
A	2015-03-27	F. GALLEAZZI		MaJ Ligne Proton + Ajout Elements Vide

Machine and installation layouts for AWAKE

TT41 - AWAKE
LAYOUT QTGF 412000 - PLASMA CELL

TT41 - AWAKE
LAYOUT QTGF 412000 - PLASMA CELL

SCALE 1:50

DES./DRA.	F. GALLEAZZI	2014-11-28
CONTROLLED	Y. MUTTONI	2017-07-27
RELEASED	A. PARDONS	2017-07-28
APPROVED		
CAD Document Number	ST0644812_02	
REPLACES		

RELEASED BY PROJECT ENGINEER | FOR INFORMATION | QAC – | SPSLAWK_0008 | SIZE 1 | IND. D

DESSIN, RUGOSITE, TOLERANCES SELON NORMES ISO
DRAWING, RUGOSITY, TOLERANCES ACCORDING TO ISO STANDARDS
PROJECTION

ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
GENEVE

Proton BPMs

No issues with software. No issues with hardware or readout for “upstream” BPMs.

“Downstream” BPMs give “bad” readings in the following conditions:

1. High density Rb vapor in the line.
2. Electron beam present.
3. Proton pre-bunches.

“Bad” BPM readings

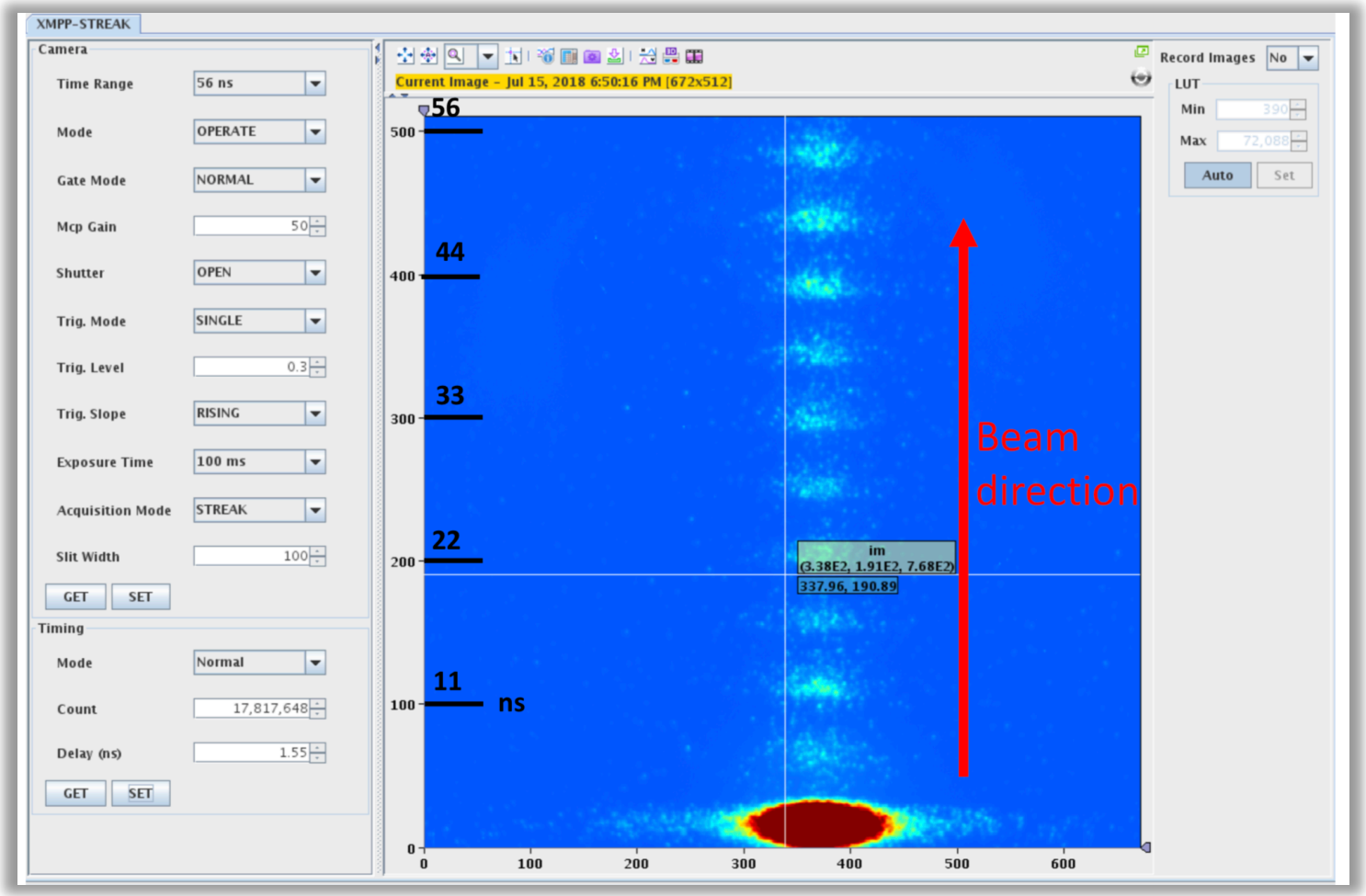
Bad readings are obvious, unphysical deviations of the beam trajectory. All 5 downstream BPMs are affected, but the final 2 are most strongly affected.

Proton Pre-bunches

In July, Livio observed significant charge ahead of the main pulse.

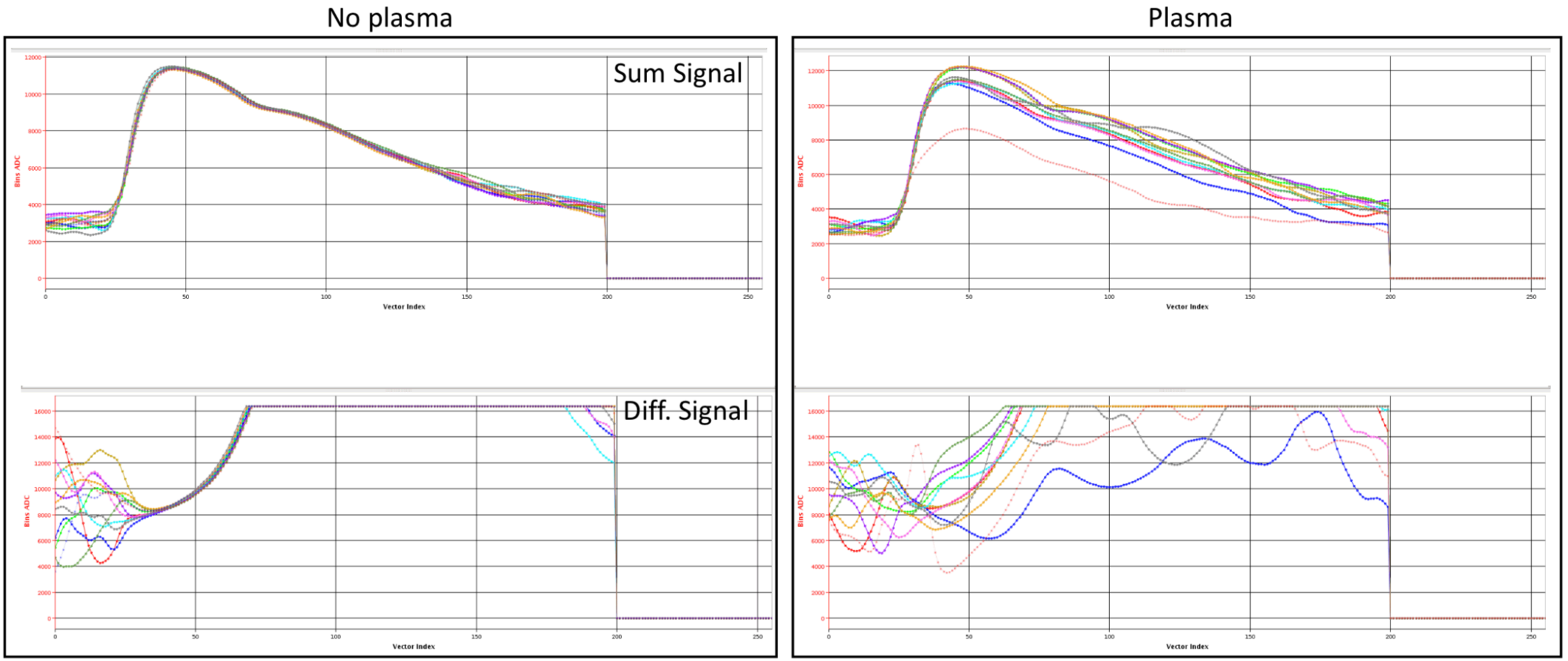
This also led to bad BPM readings. We alerted SPS OP and they changed RF voltage and kicker timing to avoid this problem.

Manfred also adjusted the self-trigger threshold for the BPMs.



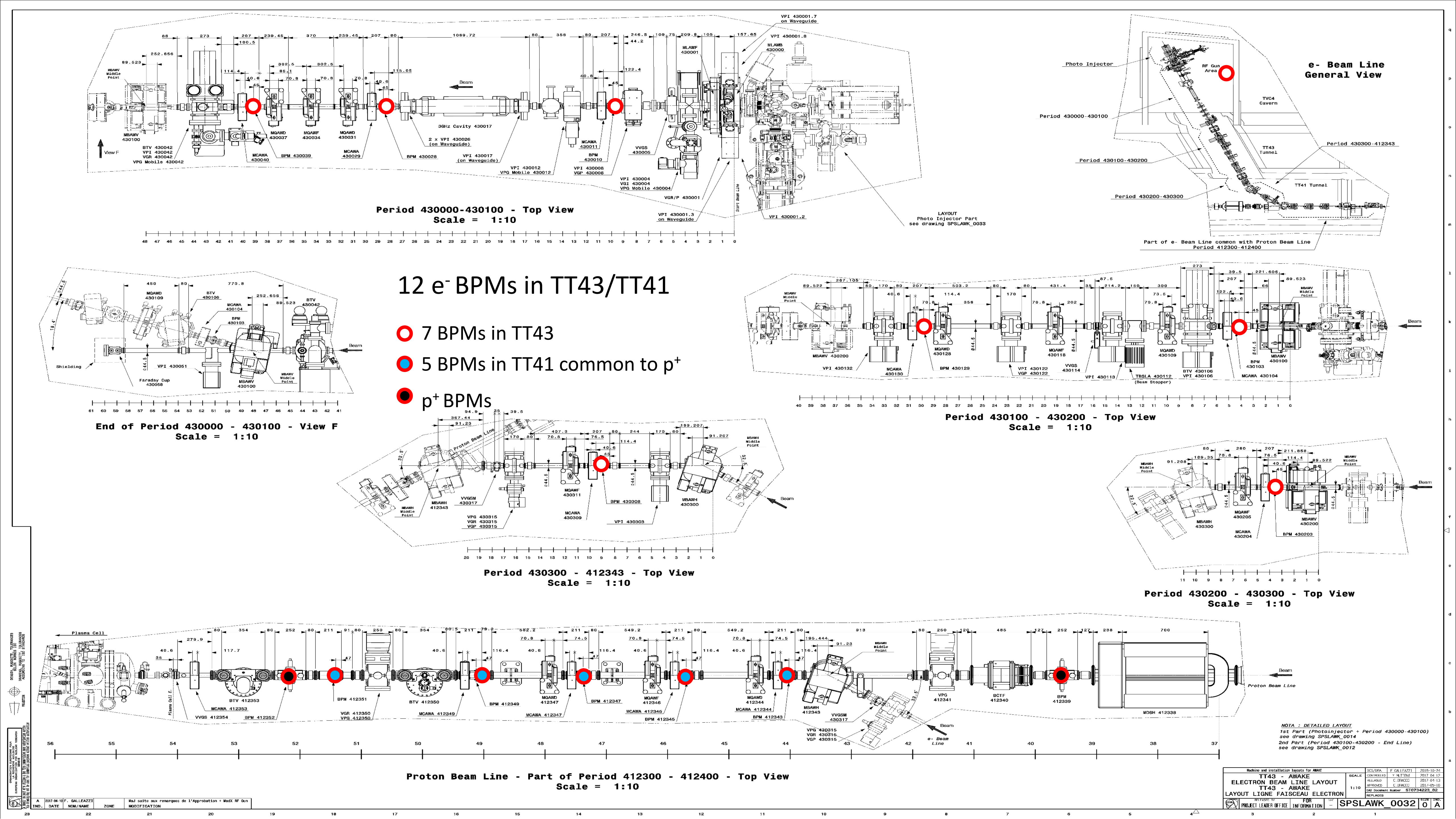
Was this an exceptional case/accident? Do we need a pre-bunch monitor?

Plasma Effect on Proton BPMs



M. Wendt

Since April 2017, we have observed the effect of the Rb vapor/plasma on the AWAKE BPMs. Manfred proposes to use stripline BPMs instead.



12 e- BPMs in TT43/TT41
7 BPMs in TT43
5 BPMs in TT41 common to p+
p+ BPMs
Period 430000-430100 - Top View
Scale = 1:10
e- Beam Line
General View
Photo Injector
RF Gun Area
TVC4 Cavern
TT43 Tunnel
TT41 Tunnel
Period 430000-430100
Period 430100-430200
Period 430200-430300
Period 430300-412343
Part of e- Beam Line common with Proton Beam Line
Period 412300-412400
LAYOUT
Photo Injector Part
see drawing SPSLAWK_0033
End of Period 430000 - 430100 - View F
Scale = 1:10
Period 430100 - 430200 - Top View
Scale = 1:10
Period 430300 - 412343 - Top View
Scale = 1:10
Period 430200 - 430300 - Top View
Scale = 1:10
Proton Beam Line - Part of Period 412300 - 412400 - Top View
Scale = 1:10
Plasma Cell
Proton Beam Line
NOTA : DETAILED LAYOUT
1st Part (Photoinjector + Period 430000-430100)
see drawing SPSLAWK_0014
2nd Part (Period 430100-430200 - End Line)
see drawing SPSLAWK_0012
TT43 - AWAKE
ELECTRON BEAM LINE LAYOUT
TT43 - AWAKE
LAYOUT LIGNE FAISCEAU ELECTRON
SPSLAWK_0032

Electron BPMs

We hoped for simultaneous electron-proton readings on these BPMs.

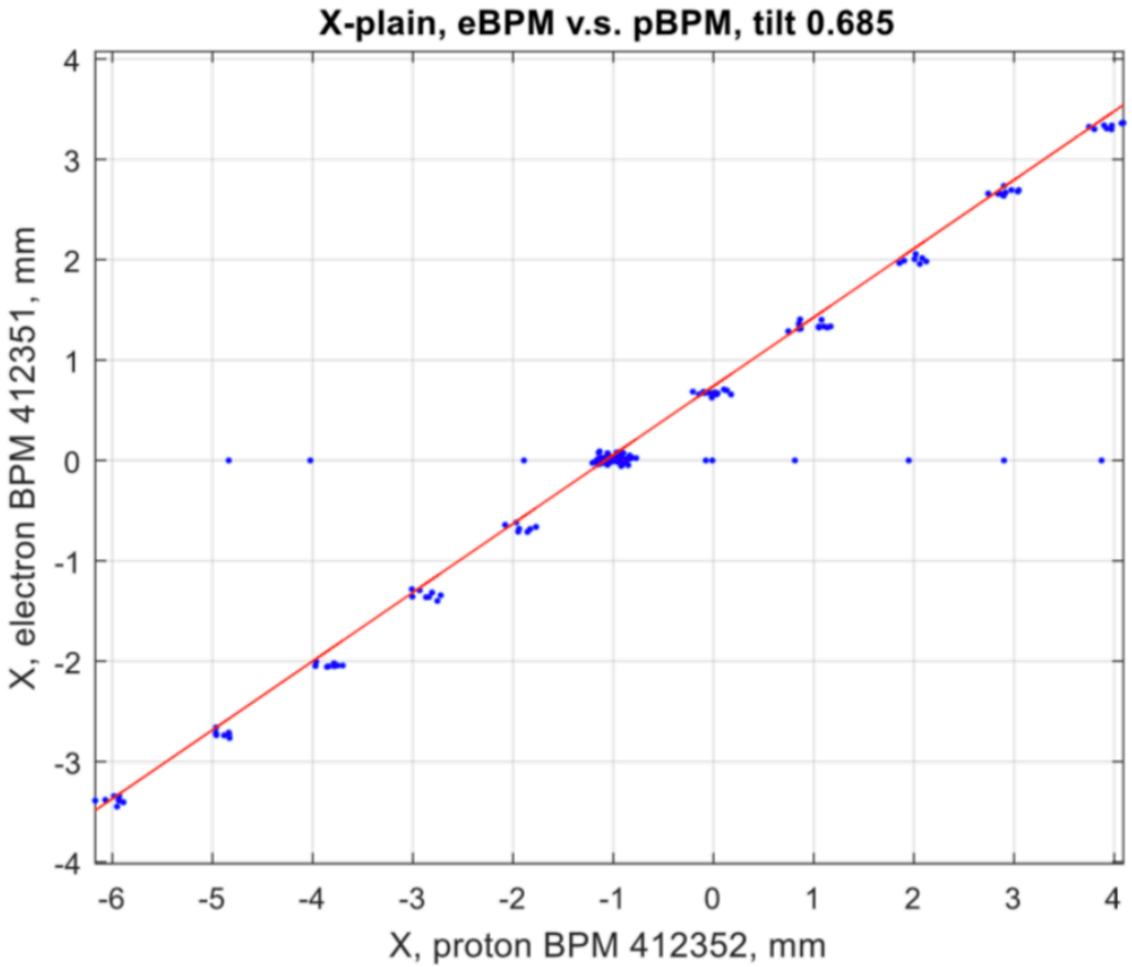
- Maybe this was never possible. . .

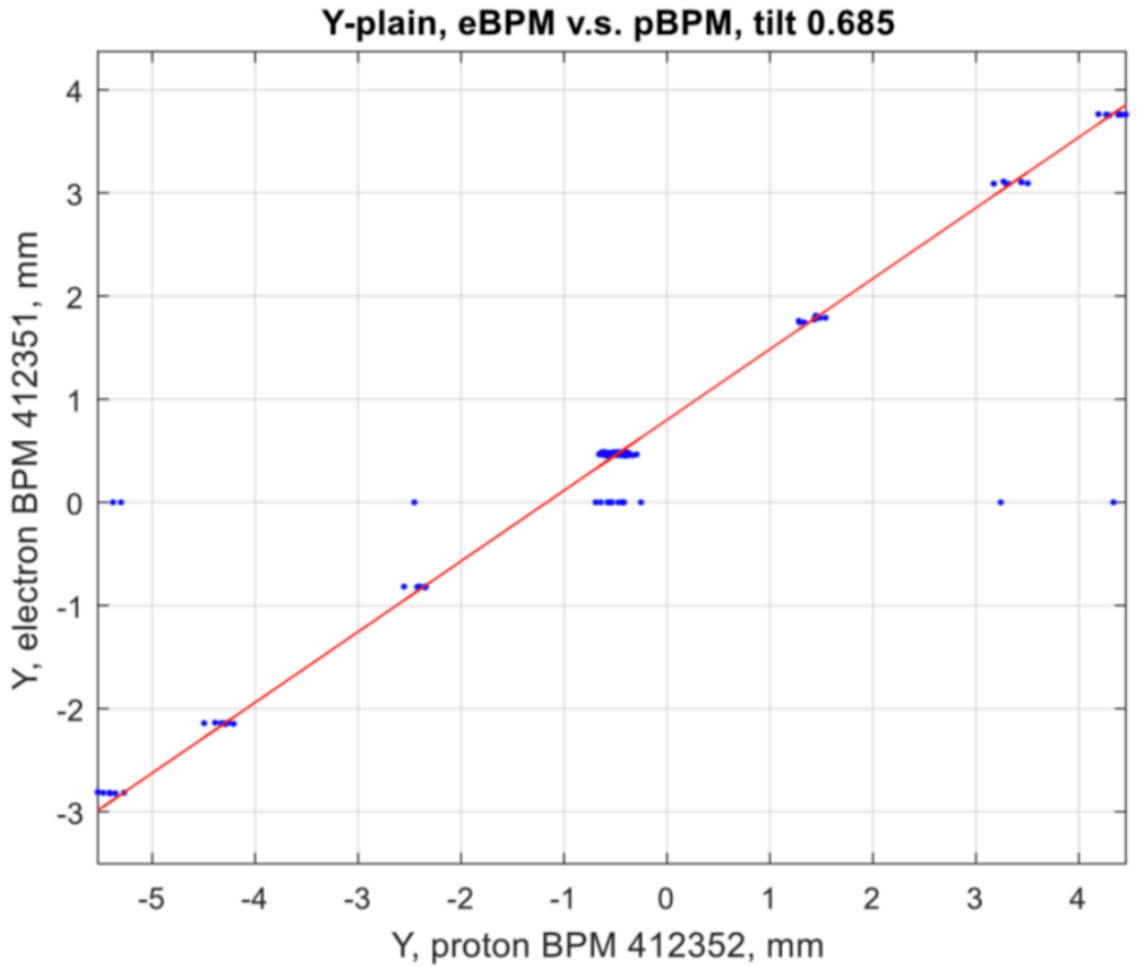
On the plus side, the readings appear to be very precise and not strongly affected by the presence of plasma.

We had issues with timing and synchronization of readout of BPM data.

- Athanasios solved this problem but I think we need to revisit triggers, time-stamping, and synchronization.

Electron-Proton BPM Correlations





Misha, Shengli, Lars, Michal, did cross correlations on electron and proton BPMs. This was extremely useful and should be part of system validation in the future.