The Layout of the BPM System for p-LINAC at FAIR

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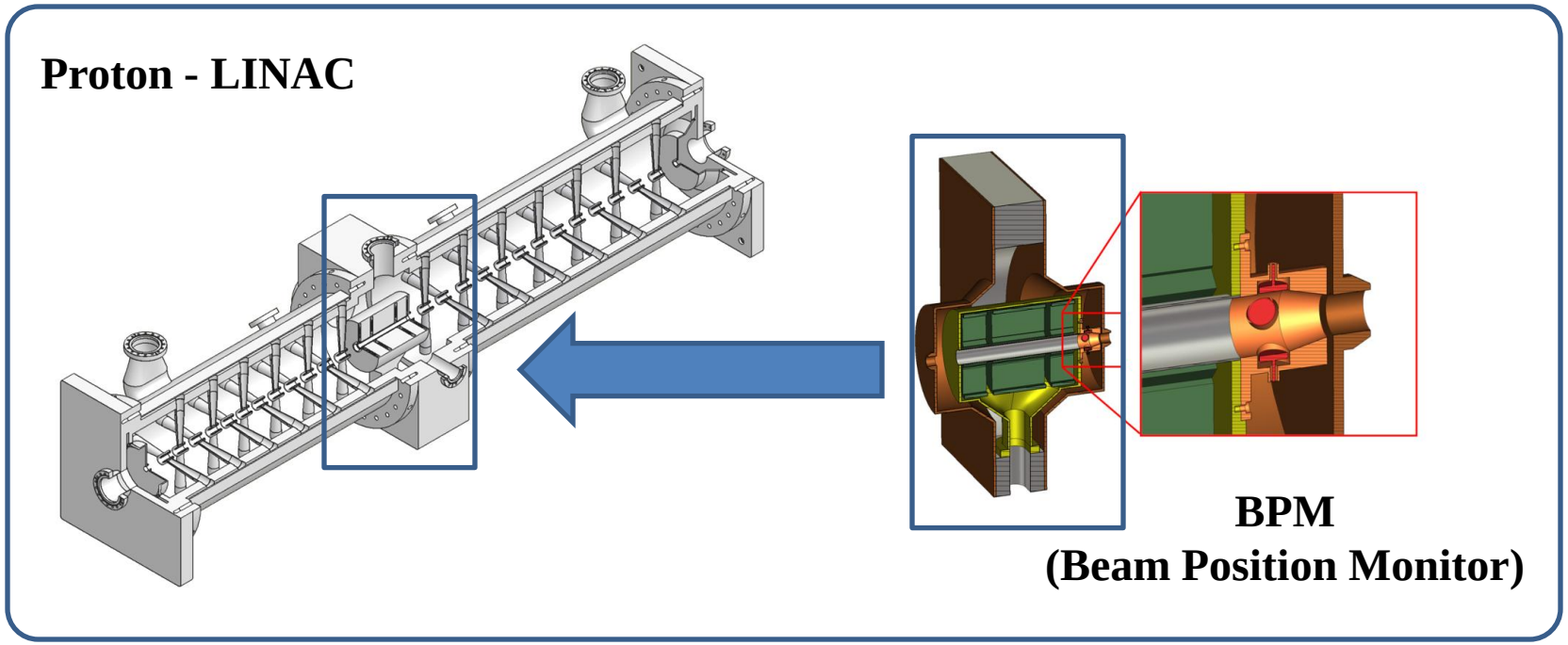
Group Seminar
27th Sep. 2013

Purpose of this talk

what are we doing?

Beam Position Monitor (BPM) along the Proton-LINAC for FAIR



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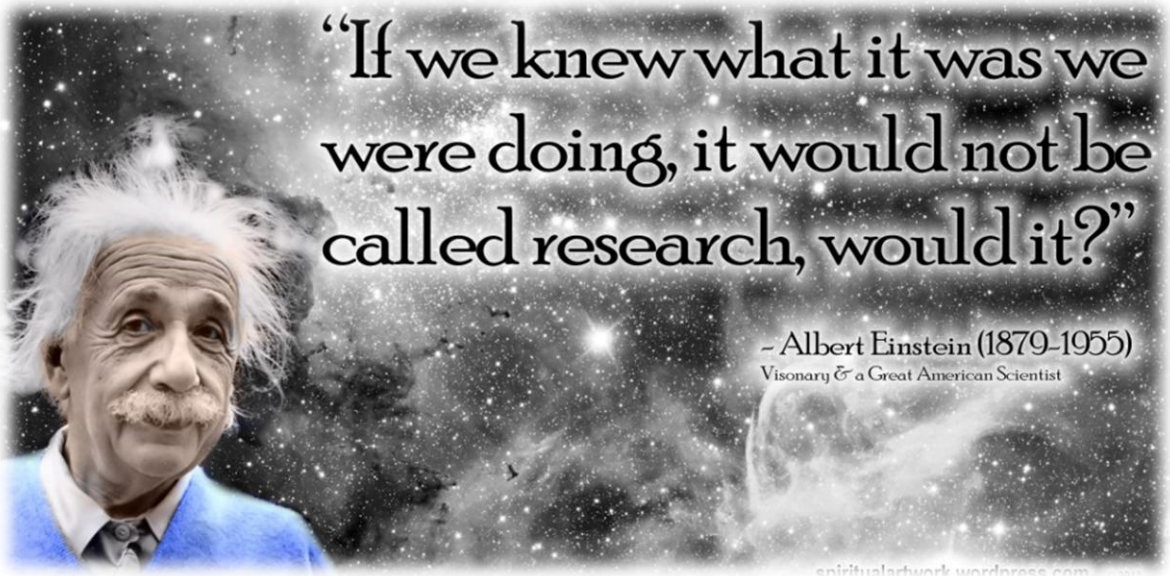


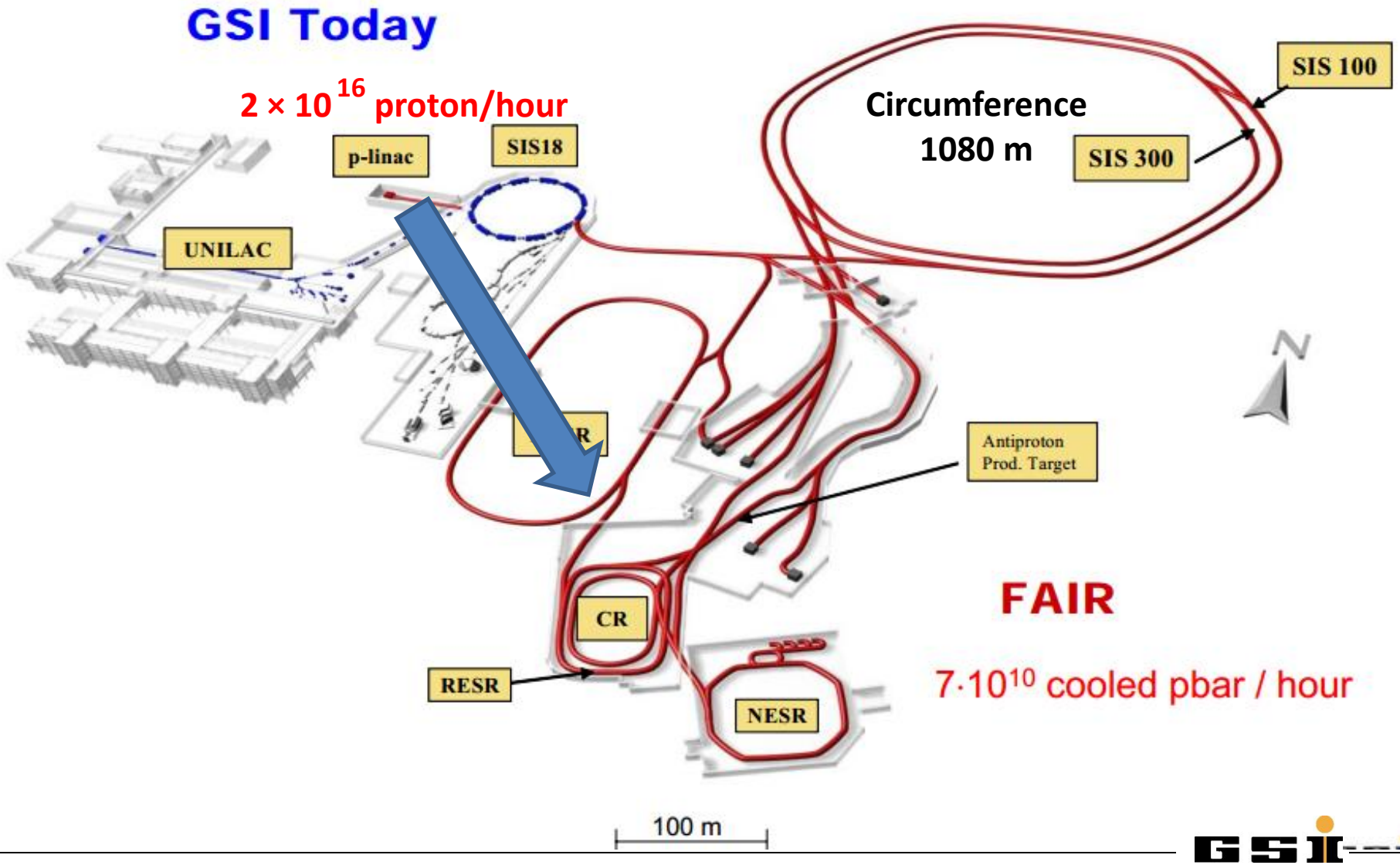
Outline

1. **Proton-LINAC Layout (an overview)**

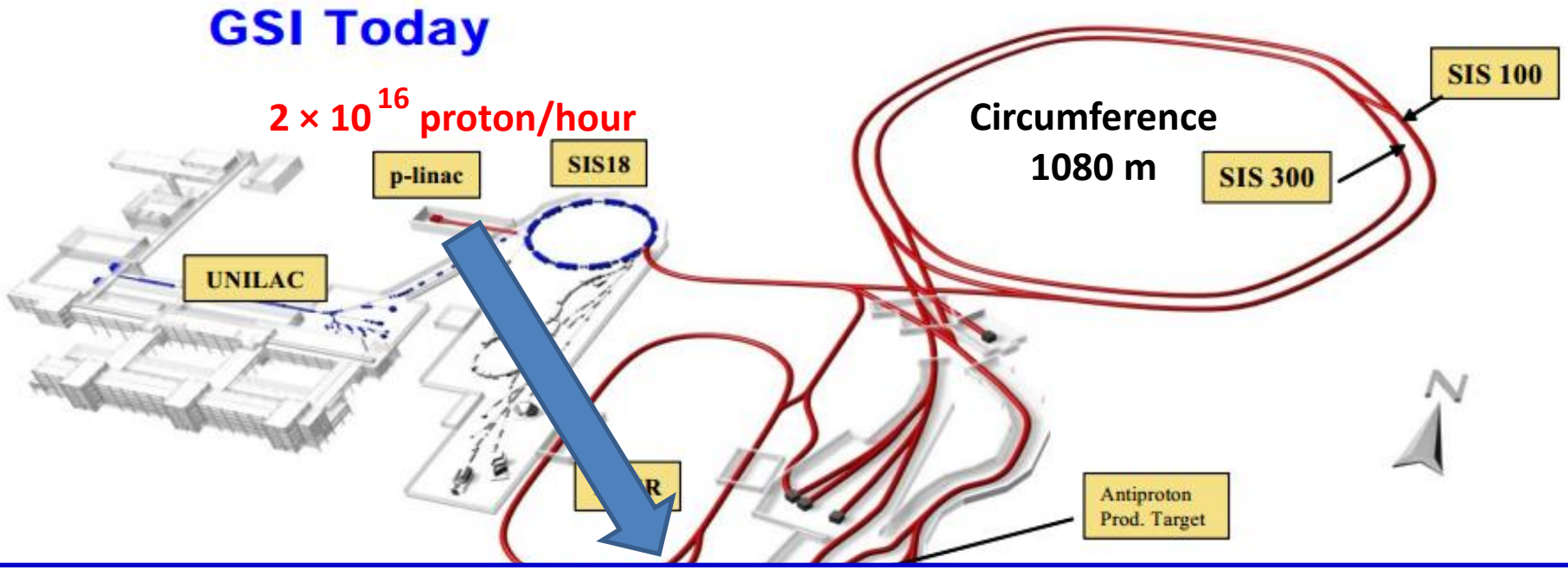
2. **Beam Position and Beam Phase Detection**

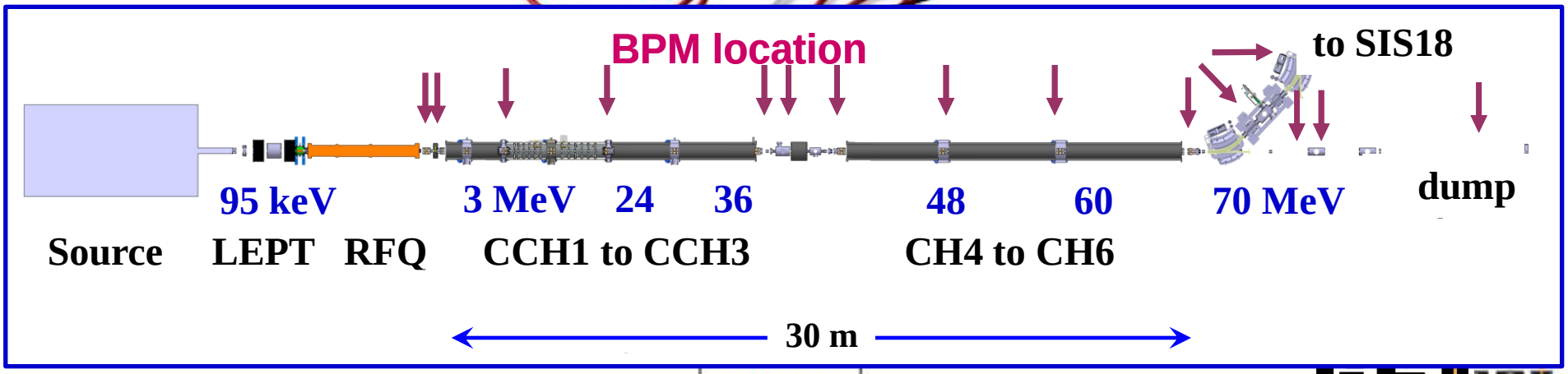
3. **BPM System (some results)**

1 Proton-LINAC Layout (an overview)



1 Proton-LINAC Layout (an overview)





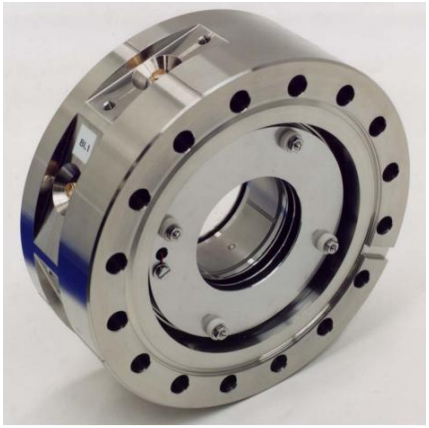
Outline

1 Proton-LINAC Layout (an overview)

2 **Beam Position and Beam Phase Detection**

3 BPM System

Beam Position and Beam Phase Detection



Beam Position

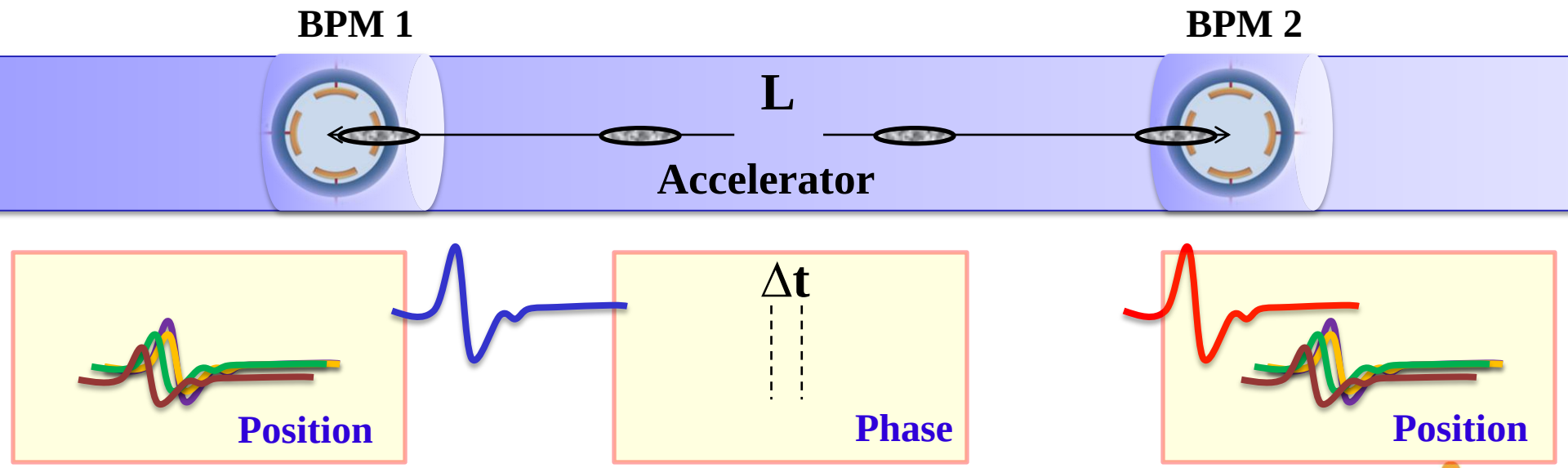
Position :

0.1 mm spacial resolution

Beam Phase

Beam energy from time-of -flight (TOF):

accuracy of 1^{o} = 8.5 ps @ 325 MHz



Outline

1 Proton-LINAC Layout (an overview)

2 Beam Position and Beam Phase Detection

3 **BPM System**

What are we doing ?

1	2	3
BPM Mechanical Design	**Numerical Calculations**	**Electronic Scheme**
Final results	**Final results**	**Final results**

BPM Location

RF Leakage

Signal Processing

Simulation

Inter-tank section

Position Sensitivity

Cables

BPM design

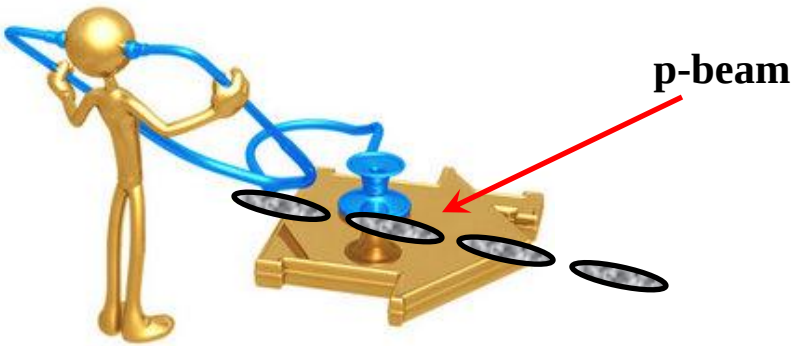
Quadropole magnets

CCH & CH cavities

What are we doing ?

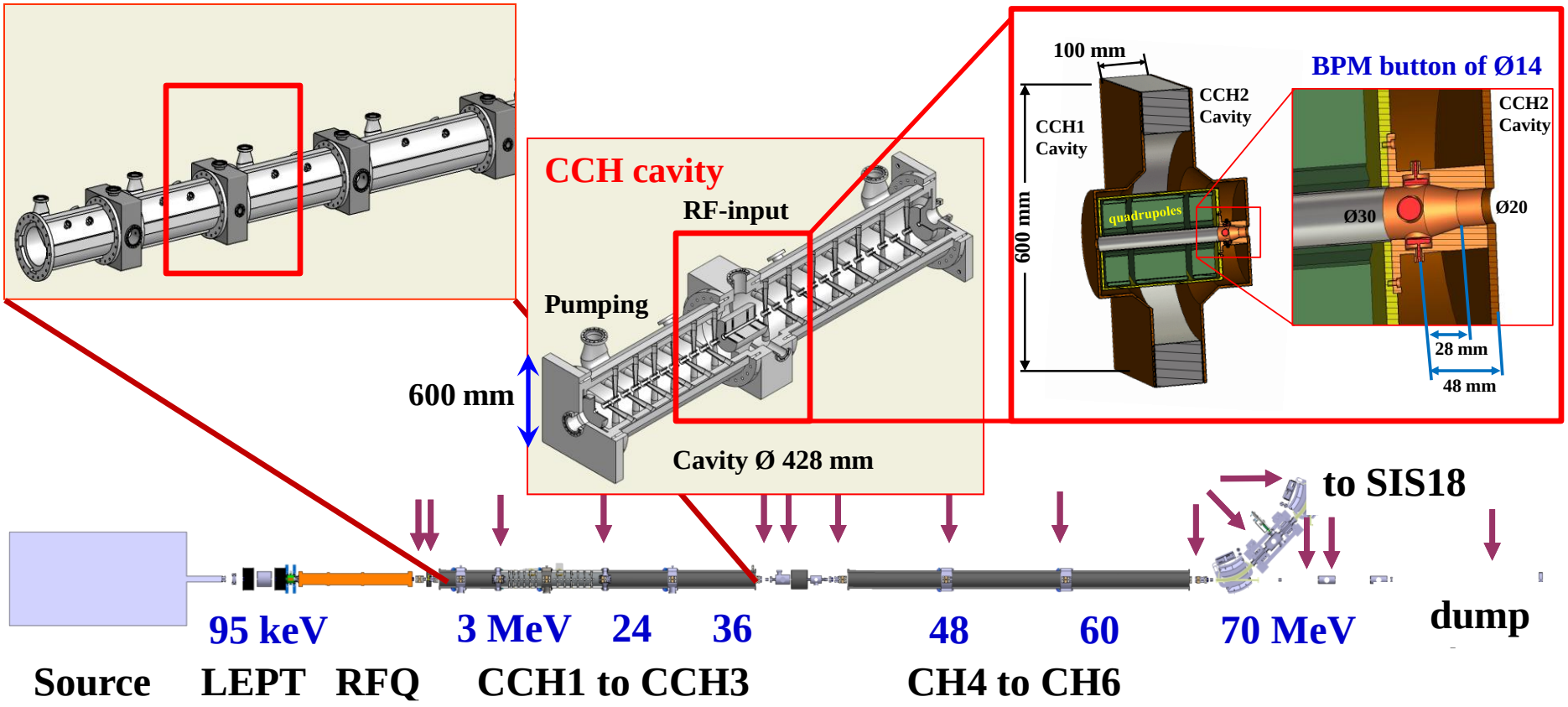
1	2	3
BPM Mechanical Design	Numerical Calculations	Electronic Scheme

The goal is :



BPM Mechanical Setup

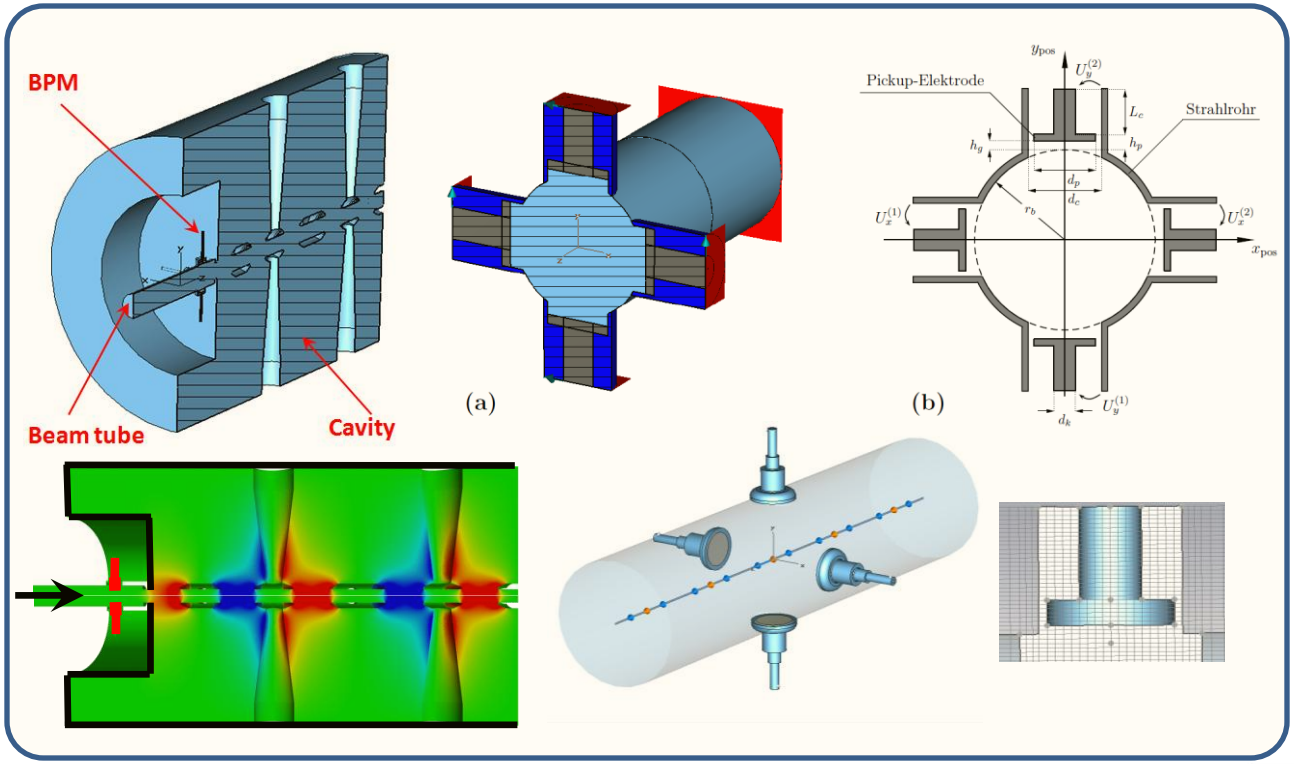
Final results



Numerical Calculations

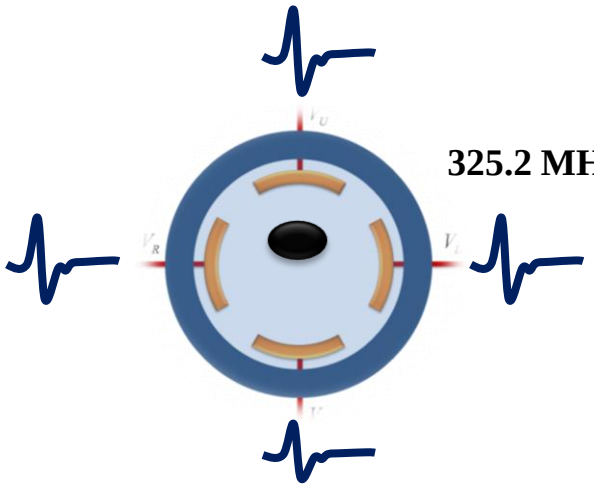
- BPM Location
- Position Sensitivity
- RF Leakage

Parameters: BPM aparture Ø(30 – 50) , f_{RF} = 325 MHz, Bunch length 150 ps, 0.1 < β < 0.3



Digital Signal Processing

Signals from BPM



325.2 MHz

RF analogue front-end

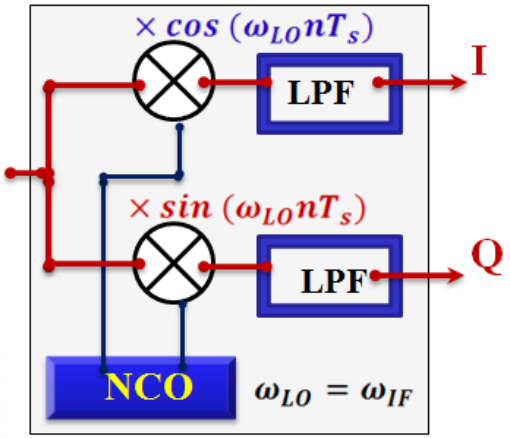
IF (29.4 MHz)

I Q

Sampled at
117 MHz

- I - Q

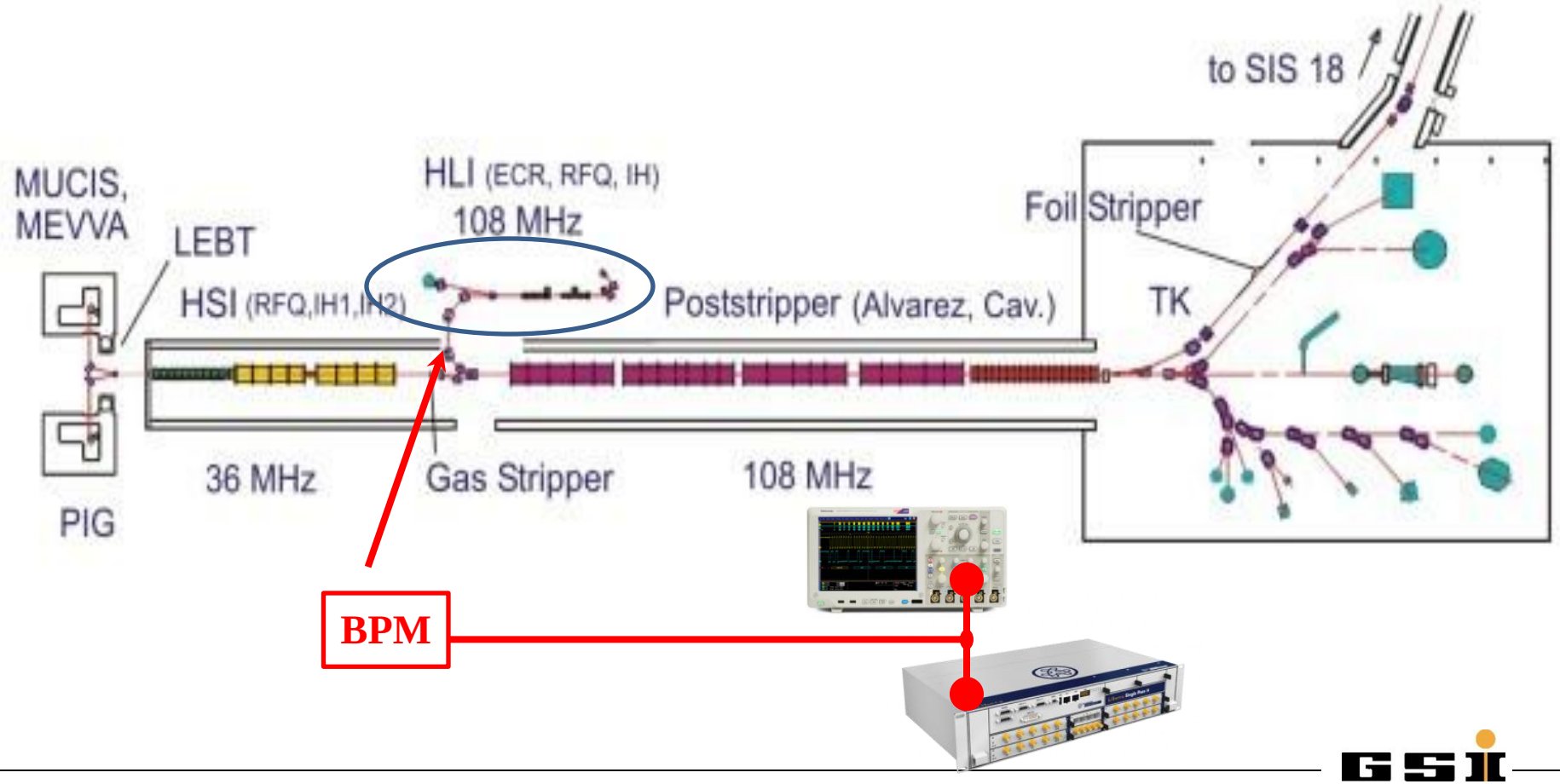
Digital processing
(IQ demodulation)



Libera SPH

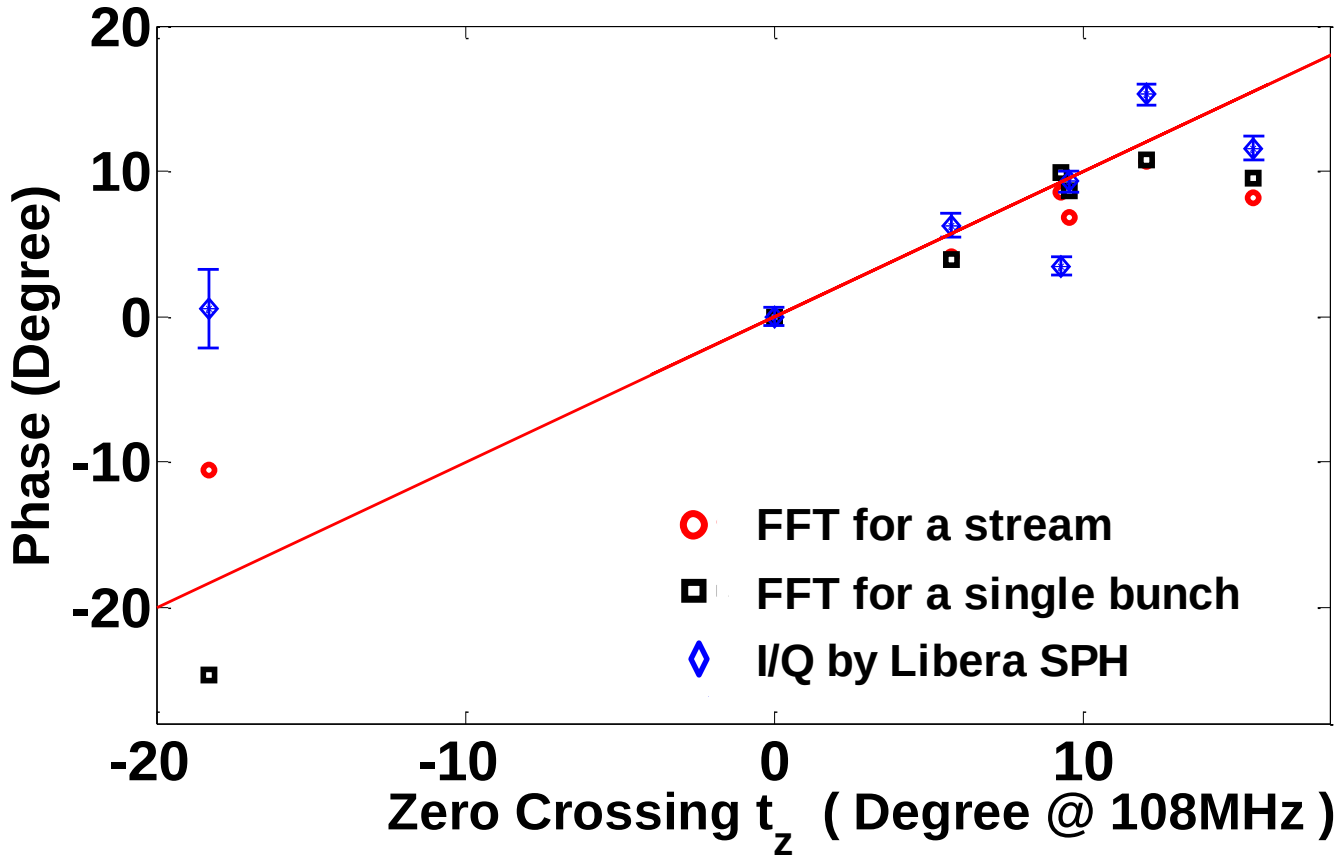
Amplitude $A_{IF} = \sqrt{I^2 + Q^2}$ Phase $\varphi_{IF} = tan^{-1}\left(\frac{Q}{I}\right)$

Beam-based Test for Digital Beam Position and Phase Monitor Using Libera SPH



Digital Signal Processing

Final results



Before I stop, let me go over the key issues again…..

BPM for Proton-LINAC

Beam Position and Beam Phase

BPM System (every thing)

Thank You