Bernd Dehning

CERN BE/BI

Notes and Actions from last Meeting

- BGI/IPM: It was agreed to investigate the possibility to modify the chambers such as to make it compatible with the beam-gas vertexing method. Mariusz, Massi
- Prototype system:
    - minimal setup and a specific use-case that could prove the value of such a device.
    - measure the absolute beam sizes at all energies/intensities and in particular during the ramp (evn if averaged over all bunches)
        - => Bernd, Rhodri: specify more exactly the goals of the prototype system
        - => Massi: investigate availability of prototype detectors
        - => Plamen: simulate prototype detector with modified BGI, evaluate performance
- Location:
    - Beta, detector inner radius, (Gianluigi, Stefano, Massimo)
    - longitudinal length, need about 7 m with gas bump
    - uncertainties on beta (comment: talk in emittance working group by G. Trad, http://xxx)
    - Gas target (Giuseppe, Adam)
- Full scale system:
    - What emittance range
    - What statistical accuracy at which time intervals
    - Which absolute precision
    - BI/Plamen: specify more exactly the goals of the full scale system for LHC

Minutes of 1st meeting: https://indico.cern.ch/conferenceDisplay.py?confId=213774

Agenda

- 1. BGV detector design studies - toy simulation with prototype and full detector (Plamen)

- 2. Detector and gas target specifications (Massi)

- 3. Outcome of investigations of BGI layout modifications in LS1 (Mariusz)

- 4. Layout considerations and requirements for the ECR (Bernd)

- AOB

Beam Size and Emittance Measurement Resolution & Accuracy

Monitor type/mode		Beam scenario	Observation mode	Precision mode/value
Single-pass to Few-pass	Beam spot	1 pilot to 1 nominal SPS batch	Turn-by-turn	Accuracy: • 20% rms on σ • average position: ≈ 300 µm rms
Circulating	matching	1 intermediate bunch to SPS batch	Turn-by-turn over 20 turns	Resolution: ± 20% on σ
		Intermediate to ultimate SPS batch		
	beam size and profile	Pilot to intermediate beam	10^3 turns	Resolution: 10% rms on beam σ
		intermediate to ultimate beam		Resolution: • 1% rms on beam σ • 5% rms on bunch σ • 10% rms on transv. distribution points • (± σ/10 in beam position)
			10^2 turns	Resolution: 5% rms on beam σ
	Beam emittance		10^3 turns	Accuracy: ± 5% on beam σ
	tail	intermediate to ultimate beam	10^4 turns	Resolution: 10% rms on transv. distribution points
	dynamic aperture	1 pilot to one intermediate bunch	10^3 to 10^4 turns	Resolution: ± 10% on transv. distribution points
	calibration	Pilot bunch to nominal PS batch	No constrain	Accuracy: 1% rms on σ

Functional Specification
MEASUREMENT OF THE TRANSVERSE BEAM DISTRIBUTION IN THE LHC RINGS

EDMS Document No.
328147

- TV station
- SC undulators
- Light
- H&V Wire scanner
- H&V gas monitor
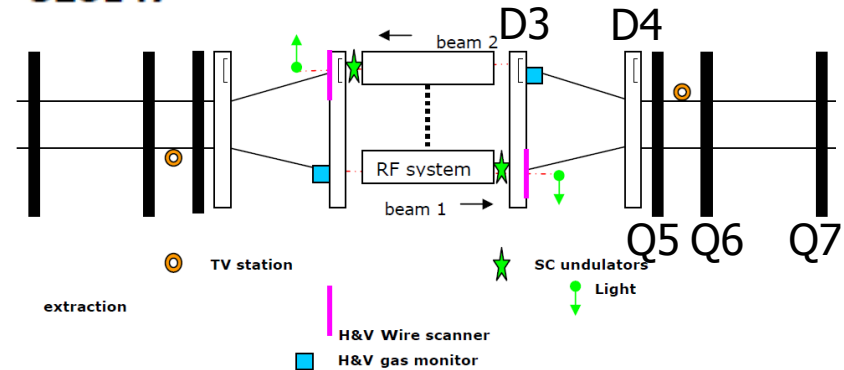
- **Specification**
  - Bunch by bunch resolution of 5 % in 0.1s
  - Accuracy 5 % on emittance in 0.1s => 3.5% from beam size and 3.5 % from beta uncertainly => 1.8 % beam size accuracy (dsig/sig=1/2 depsi/epsi)
- **Goal for Vertex detector**
  - Bunch by bunch measurement in all operation condition
  - Absolute accuracy

IP4 with right side emittance monitors

Vertex detector proposal
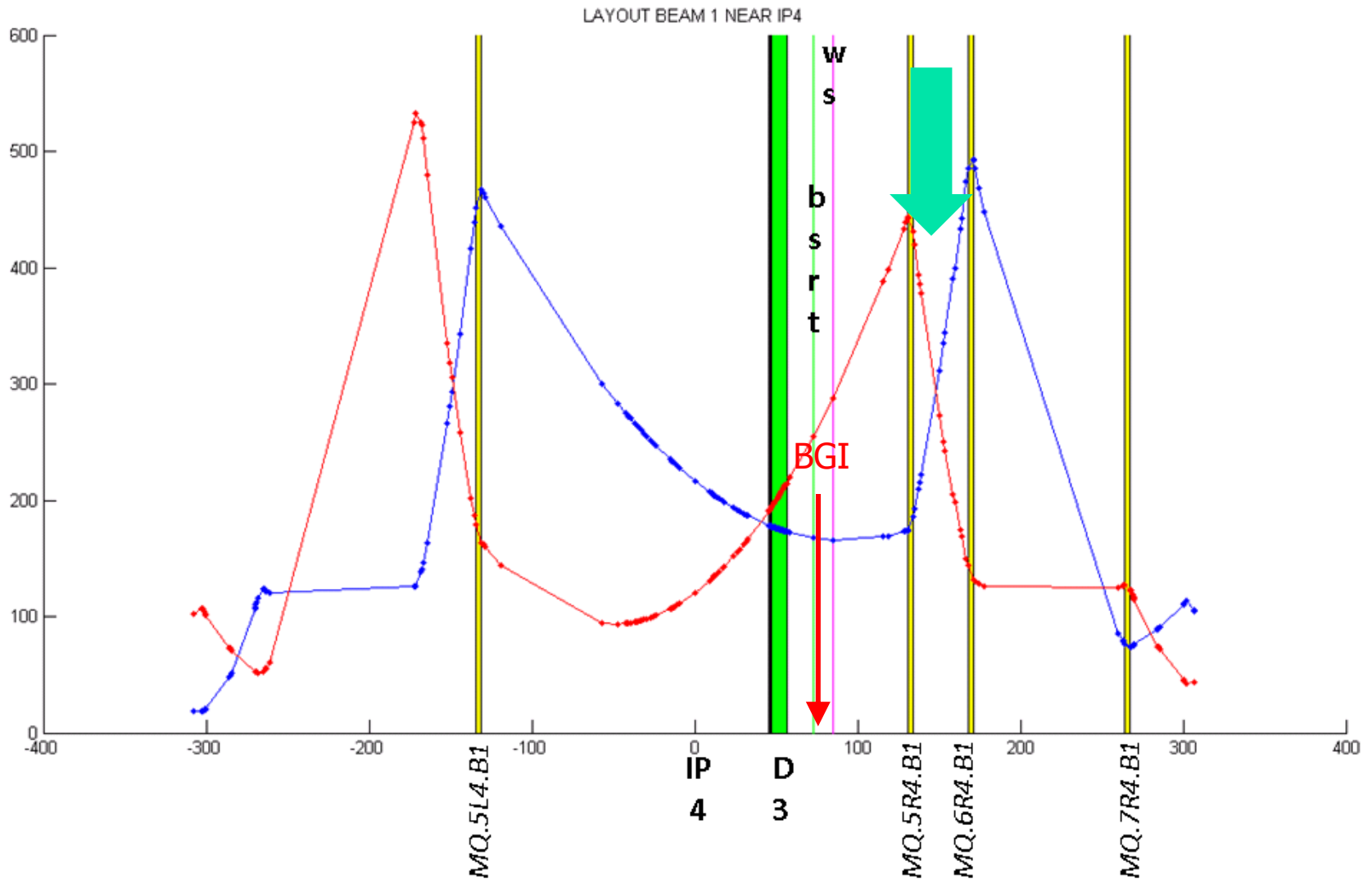
Equal Beta in cell 6 and a beta ratio of 2 in cell 5; free area in both cells   Drawing G. Trad

ECR

- Requirement for ECA (Engineering Change Request)

    - Detailed description
        - Functionality, Layout (in tunnel, at please of electronics), electronics hard and software structure
    - Reasons for change
        - (reasons for additional emittance monitor, goal from specification)
    - Impact on coast, schedule and performance
        - Developement plan for test system an proposal for final setup?
    - Impact on other items

5R4

2nd Beam Gas Imaging Vertex Detector; B.Dehning