

Possible layout of a crystal experiment in LSS5

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Aims

- Qualification of the most recent techniques in the fabrication and bending of the crystal
- Validation of the use of (short) crystals (with small bending angle) to improve the collimation efficiency with protons

Where?

- LSS5:
 - it is the only long straight section not used for injection, extraction or acceleration in the SPS;
 - the LHC collimator prototype and it is going to host the scraping and collimation system which will be used for cleaning the tails of the LHC beam before extraction;
 - it is a well instrumented area in terms of beam position, beam profile and beam loss monitors.

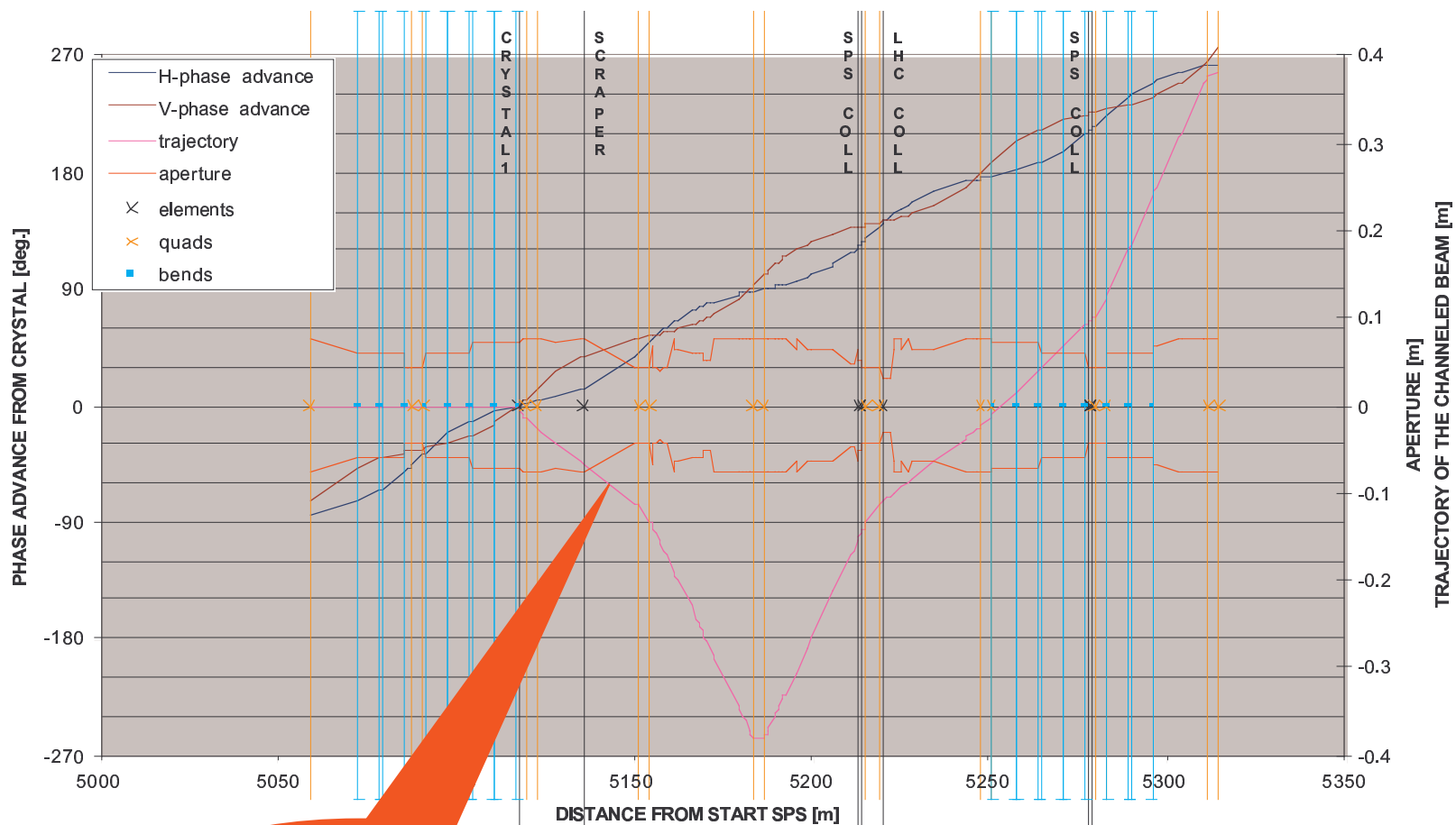
Beam characteristics

Momentum [GeV/c]	270
Number of bunches	1
Bunch population [10^{11}]	1
Transverse emittance (r.m.s. normalized) [$\mu\text{m}\cdot\text{rad}$] (H/V)	1.5/1.5
RF voltage	7
Relative momentum spread (r.m.s.) [10^{-3}]	0.6
Bunch length (r.m.s.) [ns]	0.7
Longitudinal emittance [eV.s]	1.4

Large angle (Hor – 4mrad) crystal

- Large angle crystal downstream of MBA51590 (available space in beam direction=1.4 m)
- Detection arm in the region between BSHV51618 (Scraper) and QD51710
- No satisfactory solution found for collimation experiment with short-small bending angle crystal in that position

Large angle (Hor – 4mrad) crystal

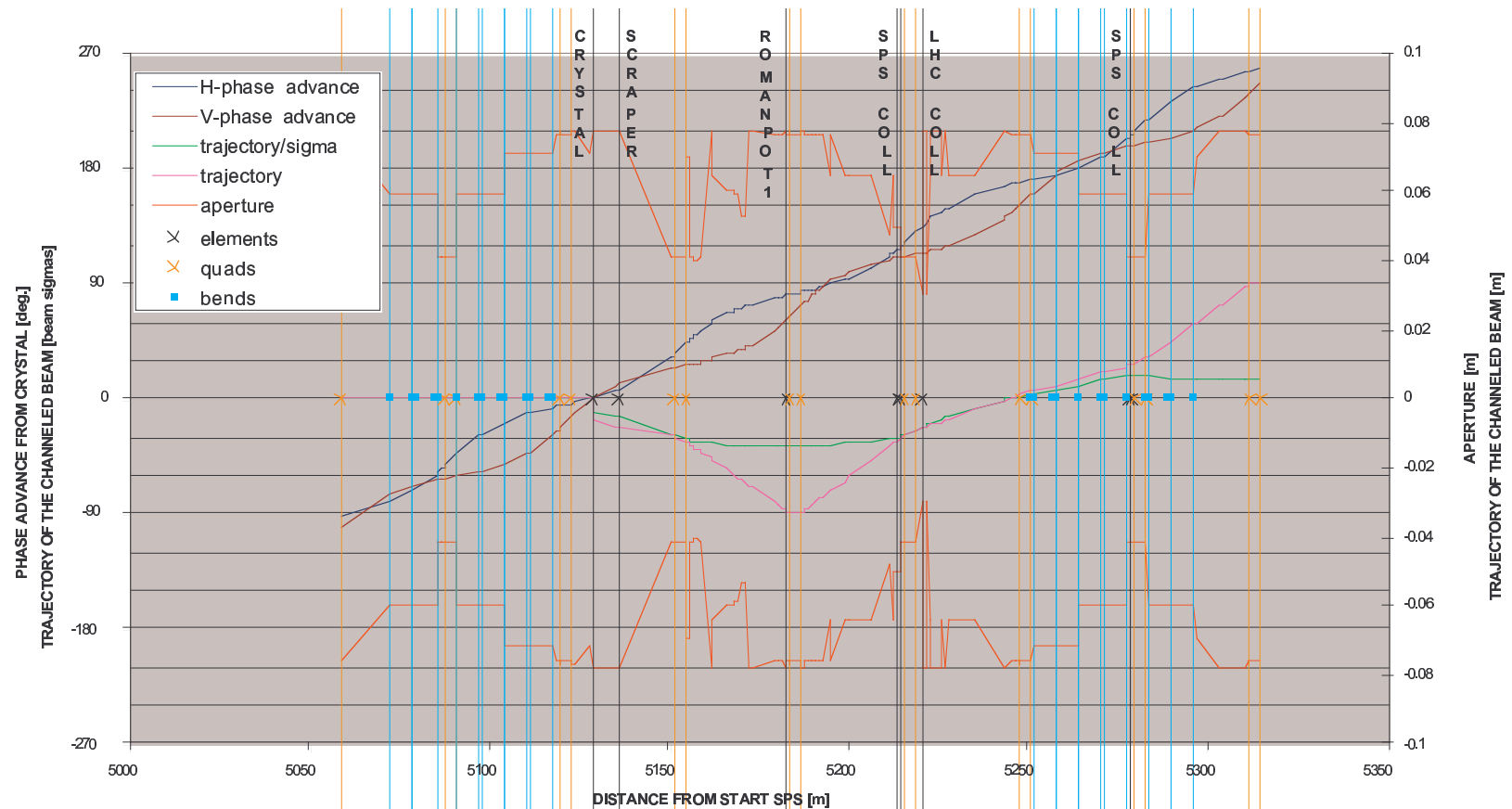


Detection arm

Small angle (Hor – 0.2mrad) crystal

- Small angle crystal downstream of MDHW51637
- Non optimum position for channeling efficiency
→ Compromise solution to profit of the present installation (collimators)
- Requires installation of a detector under vacuum (ROMANPOT1). This should measure in the horizontal plane. Vacuum tank of the roman pot installed in 2004 (vertical) not compatible with machine aperture → new design

Small angle (Hor – 0.2mrad) crystal



Assumed that the crystal is at 10 sigmas from the beam centre

Small angle (Hor – 0.2mrad) crystal

Element	Phase advance from the crystal [deg.]	
	H	V
Scraper (BSHV 51618)	6	11
Secondary SPS collimator (BRCH/V)	117	110
LHC prototype collimator (only horizontal)	134	114
Tertiary SPS collimator (BRCZ)	205	198

Small angle (Hor – 0.2mrad) crystal

Element	Separation [beam sigmas]
Scraper (BSHV)	14.2
Primary SPS collimator (BRCH/V)	29.9
LHC prototype collimator (only horizontal)	22.7
Secondary SPS collimator (BRCZ)	17.1



Summary

- Two different set-ups required to study large angle channeling and small angle channeling/collimation
- For the small angle set-up → compromise (not optimum)
- Use of the old RD22 set-up and of the 2004 Roman pot not possible
- Only very preliminary study. No attempt done of optimization of the crystal parameters
- Detailed simulations of crystal behaviour required → Feodotov
- Detailed engineering/integration and “fine aperture compatibility study” required.
- Compatibility with near-by instrumentation (BDI/VAC) to be verified