

ideas on KEKB crab-cavity studies

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possible visits

- December 2008 Rogelio Tomas (CERN)
 - for ATF2 (& KEKB?)
 - approval may depend on LHC progress
- December 2008 Rama Calaga (BNL, LARP)
 - for KEKB
- March or April 2009 Frank Zimmermann (CERN)
- ... + more?

two types of machine studies:

- understanding & solving drop in specific luminosity
- using KEKB as LHC crab-cavity testbed

LHC studies might help for KEKB problem and vice versa

KEKB blow up at high current

- **symptoms** – luminosity, lifetime, beam size?
- **single-bunch** or **multi-bunch effect**?
- **incoherent or coherent** phenomenon?
- **transverse or longitudinal** effect?
- dependence on **working point**?
- dependence on **tuning conditions**?
- **one beam (LER) or both beams affected**?
- ...

more thoughts & questions & studies

- similar specific luminosity drop for **few and many bunches**?! (rules out electron cloud as explanation)
- is strong decrease of luminosity related to **working point close to half integer** (Steve Myers' question at EPAC)?; check further away from the $1/2$ integer resonance? and/or do **1D or 2D tune scans** with and w/o crab cavity & compare with predicted sensitivity ?
- **short-range wake field** of the crab cavity?
- **y blow up uniform along the train?** (or correlation with phase difference between the two beams)?
- **y beam size & lifetime of single beam** vs. current
- **crab cavity rf phase noise & phase error vs current ; RF high-frequency spectrum vs beam current**

more thoughts & questions & studies -2

- add **controlled rf noise** (sine like or white) until blow up due to beam-beam & measure variation w beam current
- transverse **tune shift & bunch length vs current** w & w/o (or w detuned) crab cavity; summary of **all KEKB impedance measurements with & w/o crab cavity**
- **change bunch length** (α_c)
- vary the **Piwinski angle** - e.g. via changes in beta* or bunch length - to study the effect of the crab cavities for several values of the Piwinski angle (Jean-Pierre Koutchouk)
- **introduce large known aberrations – D*, IP coupling, β^* , etc.** - and then **compare specific luminosity with & w/o crab cavities** (to cut down tuning time and operate under well-defined “known” conditions)

more thoughts & questions & studies -3

- crab only one of the two beams; and $\frac{1}{2}$ crab voltage
- for LHC: “turn on” or “ramp” crab cavities with beam
- for LHC: “beam transparency” studies - how much crab-cavity frequency detuning and which crab-cavity orbit correction are needed, e.g. to avoid transverse instabilities?
- **BTFs** with & w/o beam-beam and with & w/o crab cavities
- CERN **simulations of KEKB?**
- ...

Piwinski angles in LHC and KEKB

	LHC nominal	LHC "ultimate"	LHC "FCC" upgrade	LHC "LPA" Upgrade	KEKB	Super-KEKB
σ_z [mm]	75.5	75.5	75.5	118.0	7.0	3.0
σ_x^* [μm]	16.6	15.8	6.3	11.2	103	69.3
θ_c [mrad]	0.285	0.315	0.673	0.381	22.0	30.0
ϕ	0.64	0.75	4.1 (w/o crab)	2.0	0.75 (w/o crab)	0.65 (w/o crab)