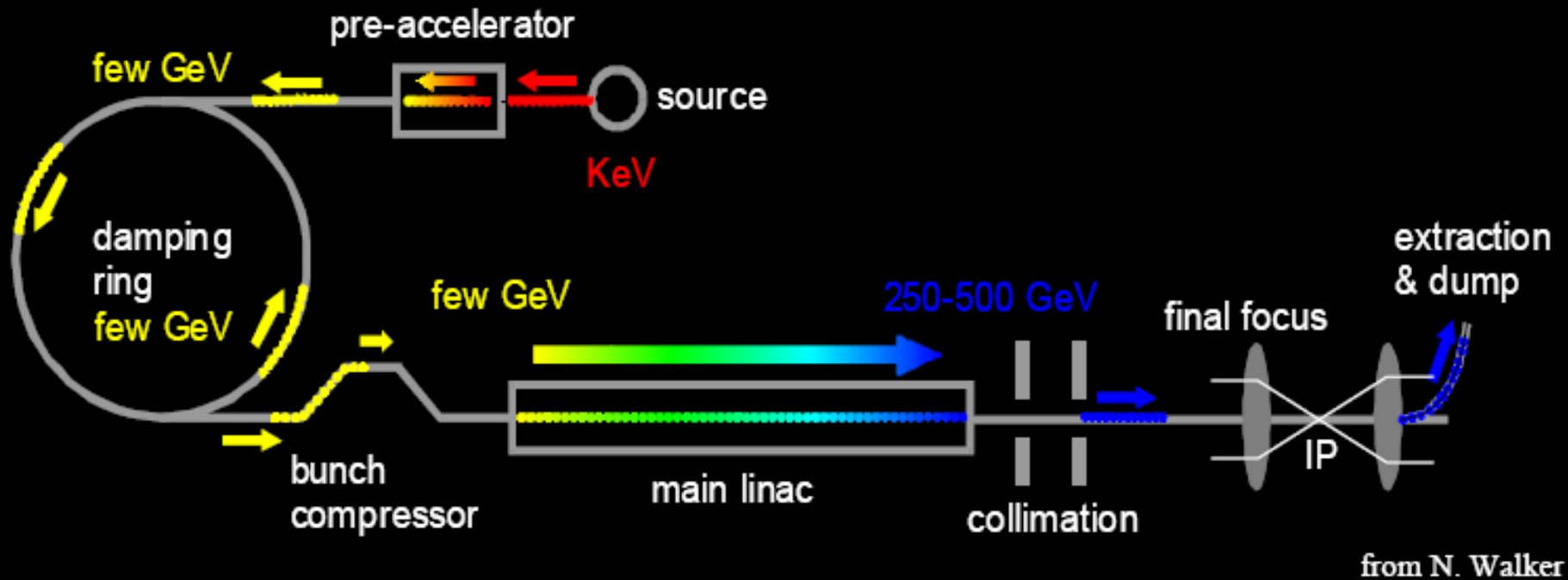# Plans for ATF2 beam halo measurements

Collaboration: S. Bai (IHEP), H. Hyun (KNU, LAL), H. Guler (LLR), T. Tauchi & N. Terunuma (KEK)

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KILC12, Daegu, South Korea   24 April 2012

Linear collider concept

focus
- RF technology (gradient, efficient power transfer)
- beam phase-space control and stability

halo collimation ➜ luminosity w.r.t. energy

Issue of beam halo in HEP colliders and ATF2

1. Beam halo ➔ major issue for IR backgrounds at many colliders, e.g. future linear colliders, B factories – also an important problem at ATF2 !

2. Control of halo via collimation / optics essential to enable the most aggressive optics configurations for luminosity performance
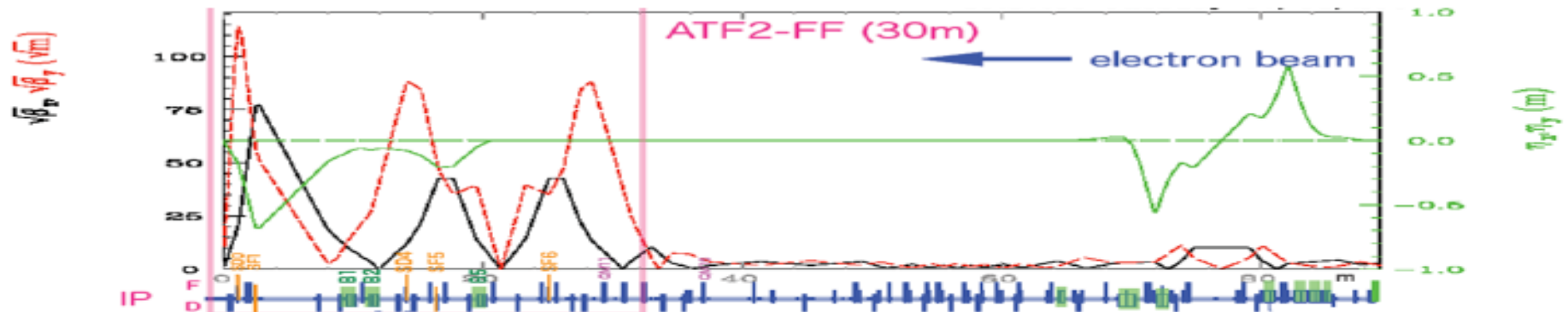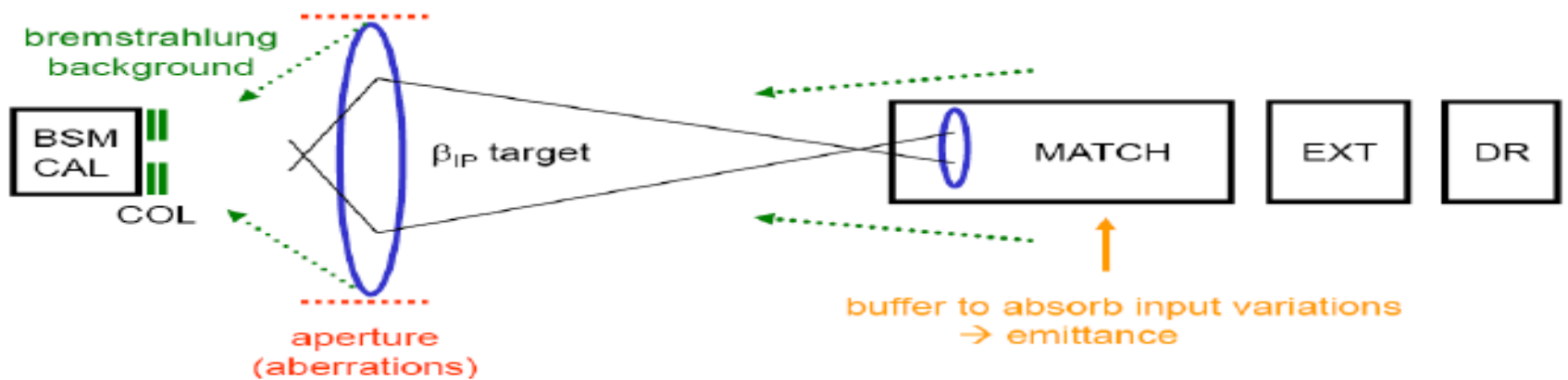
Motivation for measurements at ATF2

1. **Previous measurements in 2007 (T. Suehara et al.) in old EXT line**

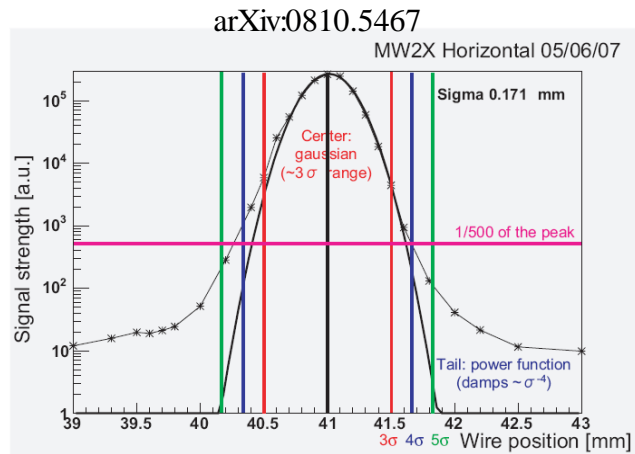

Fig. 25. Measured result of charge distribution using an ATF extraction line wire scanner.

$$\rho_{h1} = 2.2 \times 10^9 \times x^{-3.5} \quad \text{(horizontal and vertical until 6 } \sigma\text{)}$$
$$\rho_{h2} = 3.7 \times 10^8 \times x^{-2.5} \quad \text{(vertical outside 6 } \sigma\text{)}$$
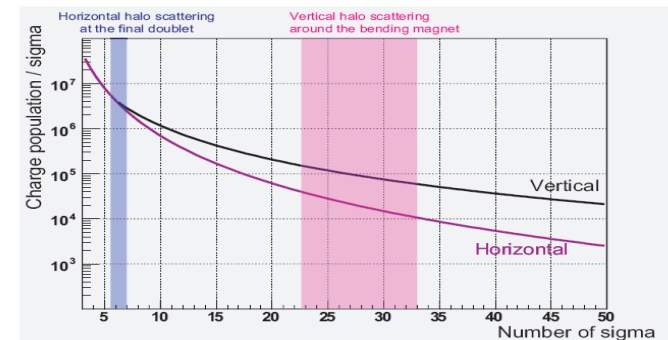

Fig. 27. Maximum charge density of the beam halo estimated by the halo measurement. Blue and purple area shows the concerned region, discussed in Section 6.2.4.

2. **Halo transport in ATF2 and direct probe of tails in IP angular spread**

3. **Investigation of halo modeling / comparing with measurements**

4. **Halo population poorly known, involves various mechanisms :**
   "dark current", wake-fields, non-linearity, multiple intra-beam Coulomb scattering, scattering off residual beam gas and thermal photons, very low Pt t-channel physics processes,…
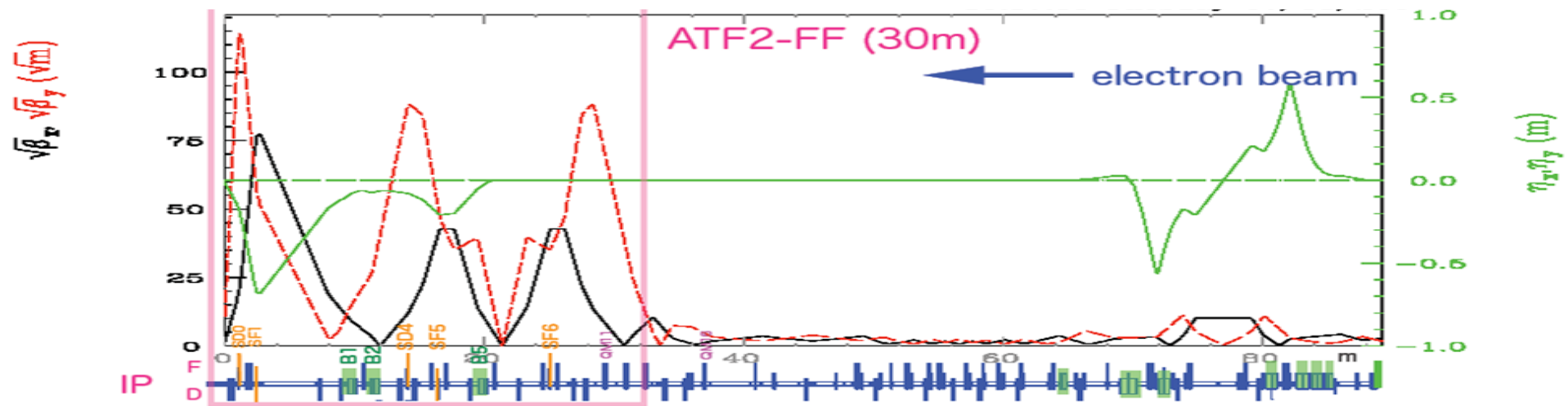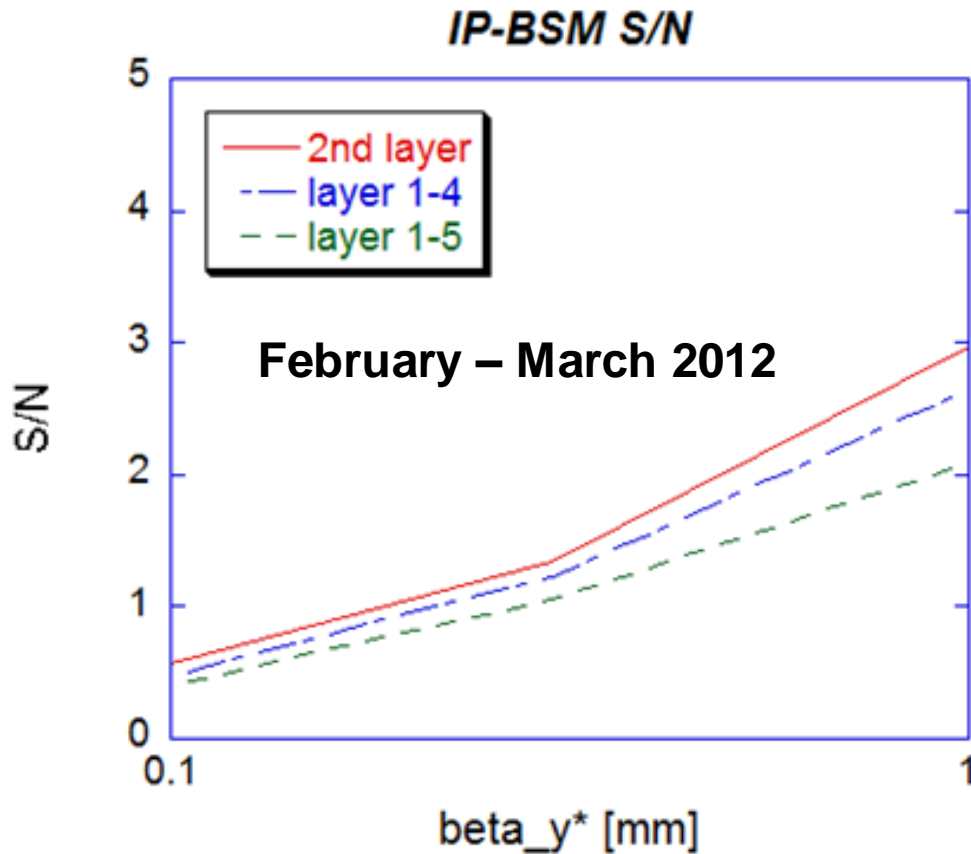
ATF2 optics & instrumentation
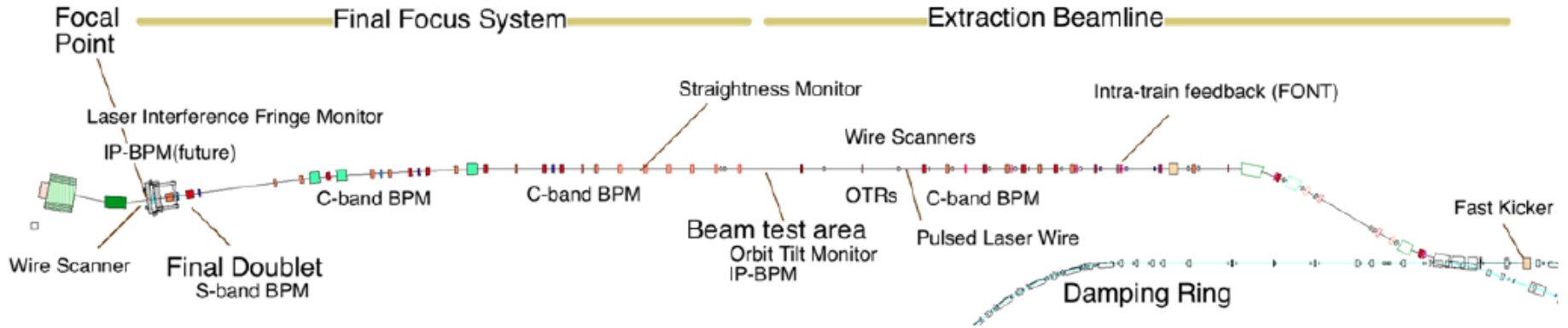
2nd order telescope	Match optics into FF	DR extraction
fine tuning of local errors	*buffer section for input errors*	*setup, stability*

ATF2: background dependence on β*

February – March 2012

IP-BSM S/N

- 2nd layer
- layer 1-4
- layer 1-5

S/N vs beta_y* [mm]

Total E_dep (GeV) on Shintake

E_{dep} (GeV) vs N x Nominal β

from Toshiyuki Okugi (KEK)
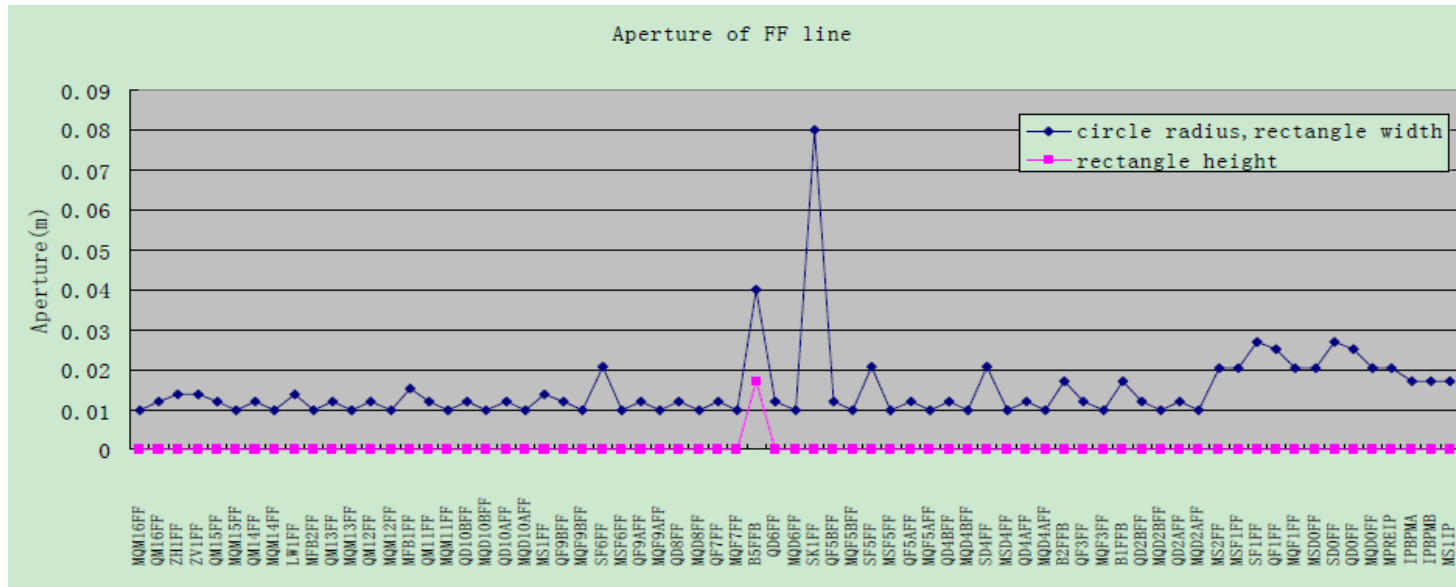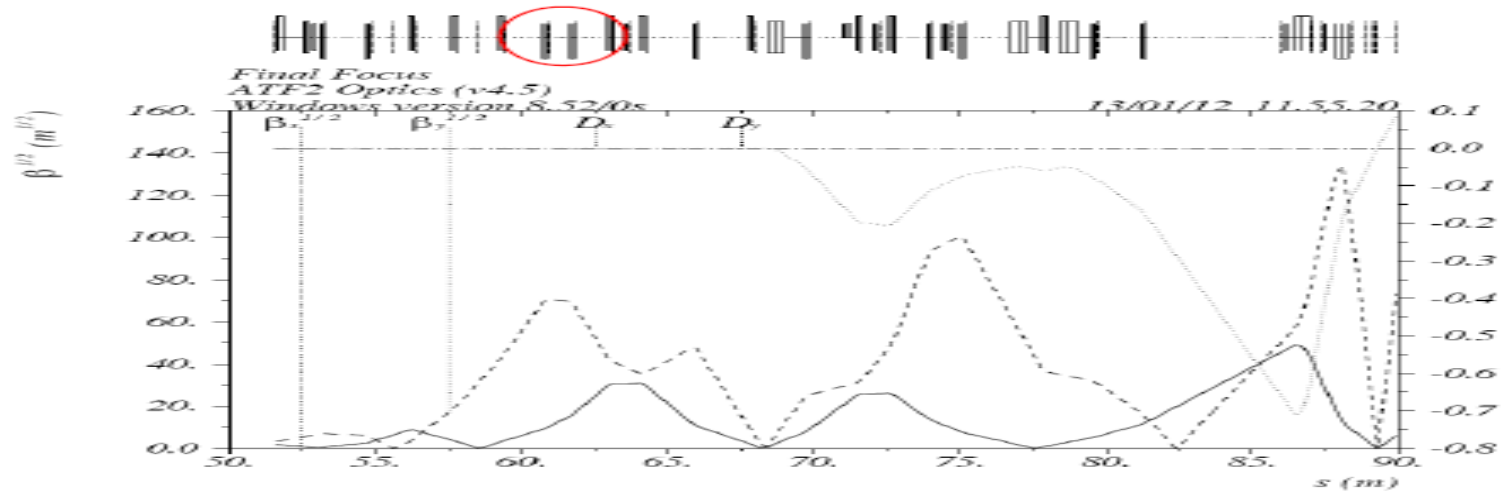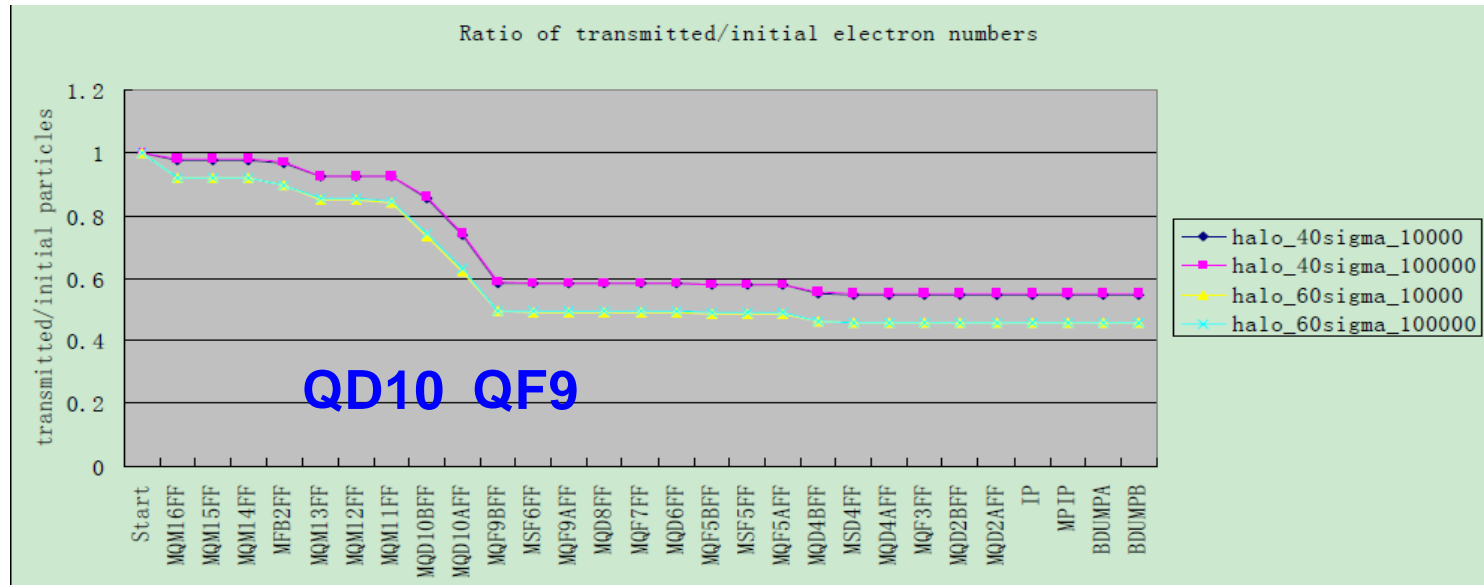
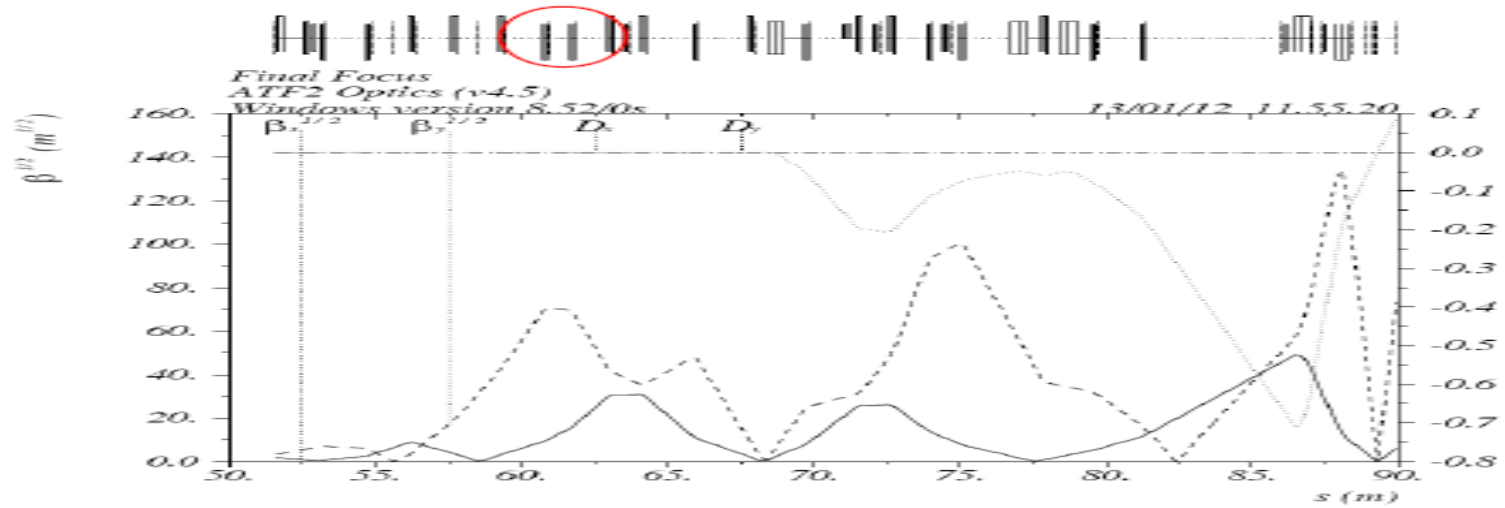➔ **post-IP bend magnet vertical gap**
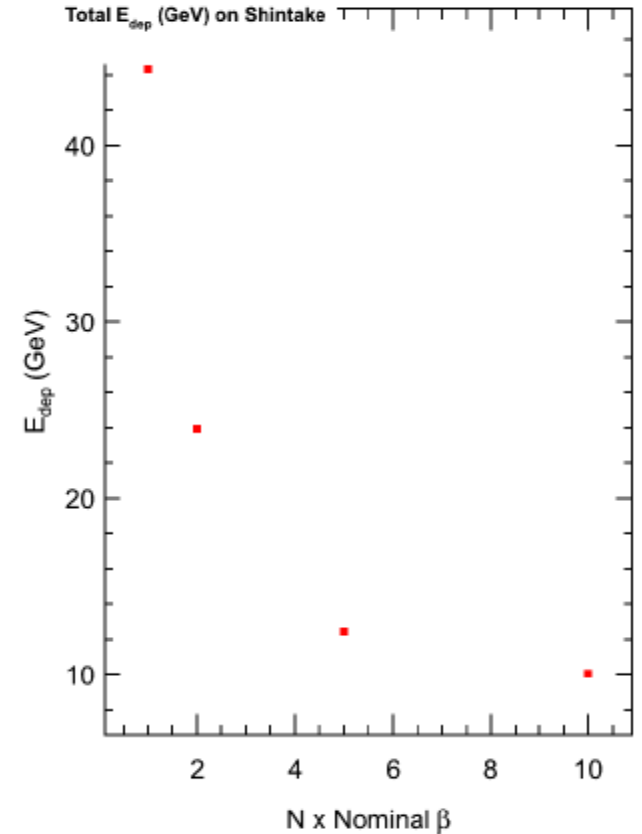
**GEANT4
(idealized conditions)**

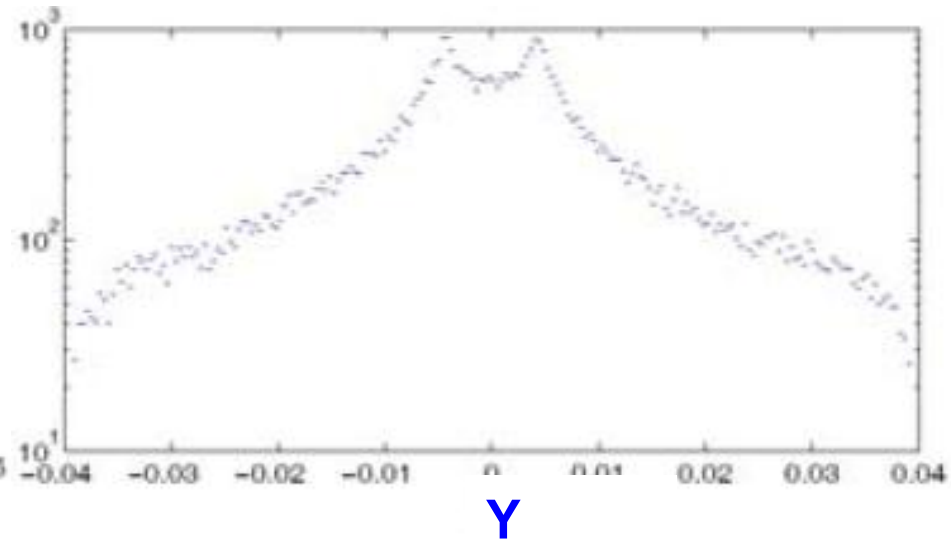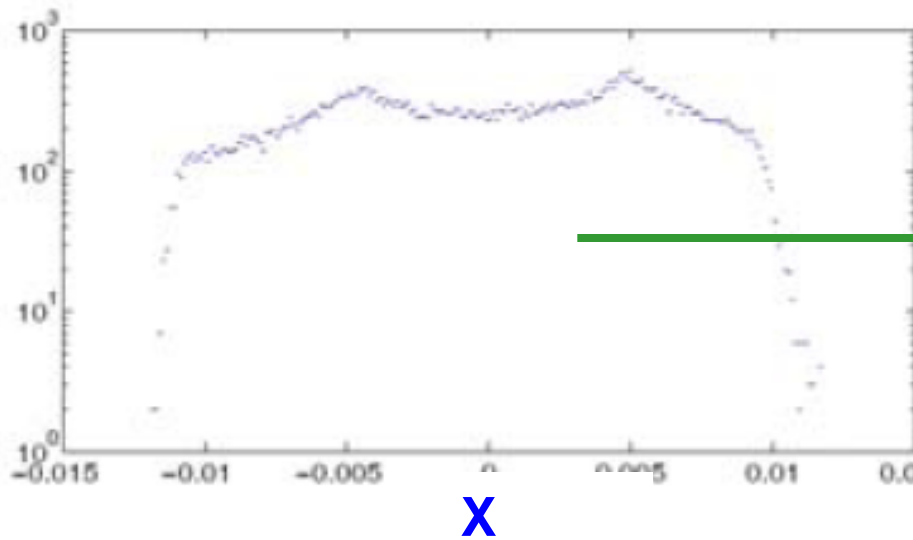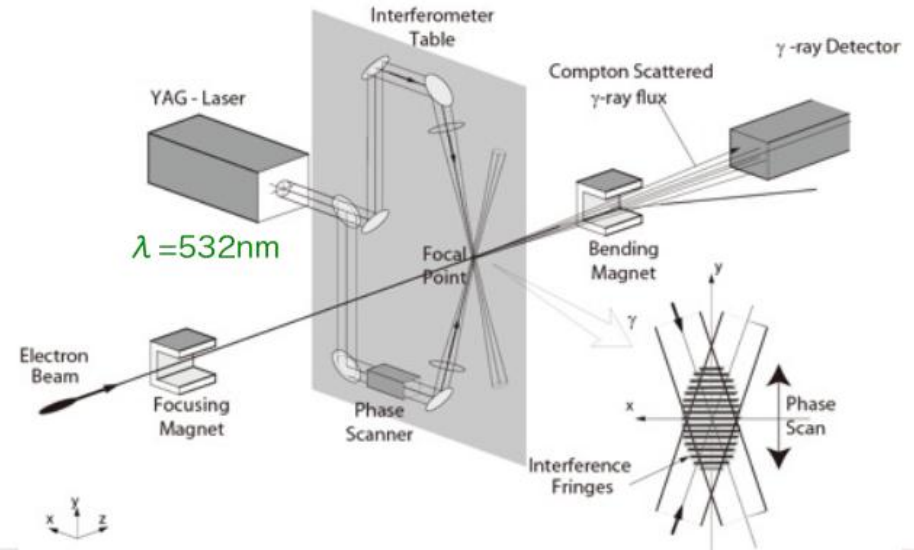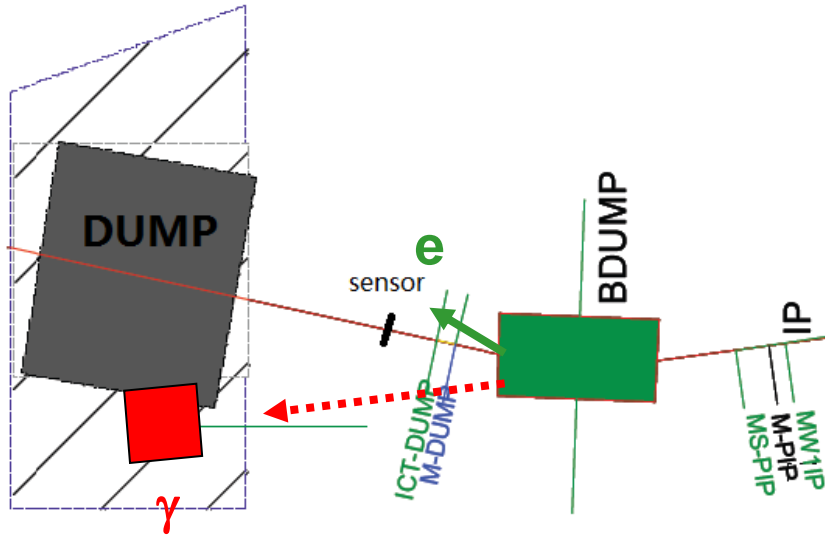**from Hayg Guler (LLR)**

ATF2: physical apertures in FFS

ATF2: intercepted halo in FFS ?

ATF2: halo propagation to IP region ?

Further prospects

1. Some initial funding support for 2012-2014 and few applications pending…

2. Prepare and test simple prototype sensor for ATF2 ➔ diamond

3. Remote readout with large dynamic range; Mechanics to allow profile measurements (horizontal and vertical)

4. Simulations ➔ more detailed apertures, GEANT4, optics dependences

5. Extra post-IP focusing ? Beam collimation for background mitigation ? Characterize halo and probe Compton recoil spectrum

6. Several other accelerator applications

tentative

schedule

	2012-S1	2012-S2	2013-S1	2013-S2	2014-S1	2014-S2
Conception (capteur, readout)	■	□				
Test proto au LAL Conception méca.	□	■	□			
Fabrication (méca., readout)		□	■			
Pré-instal. 1er test instal. finale KEK		□	□	■	□	
Expérimentation en faisceau		□	□	□	■	■
Simulations (géné/tracking/G4)	□	□	□	□	□	□
Évaluation autres appl.			□	□	□	□