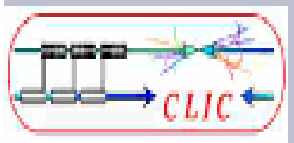
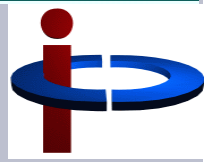





WP2 : Beam Delivery System

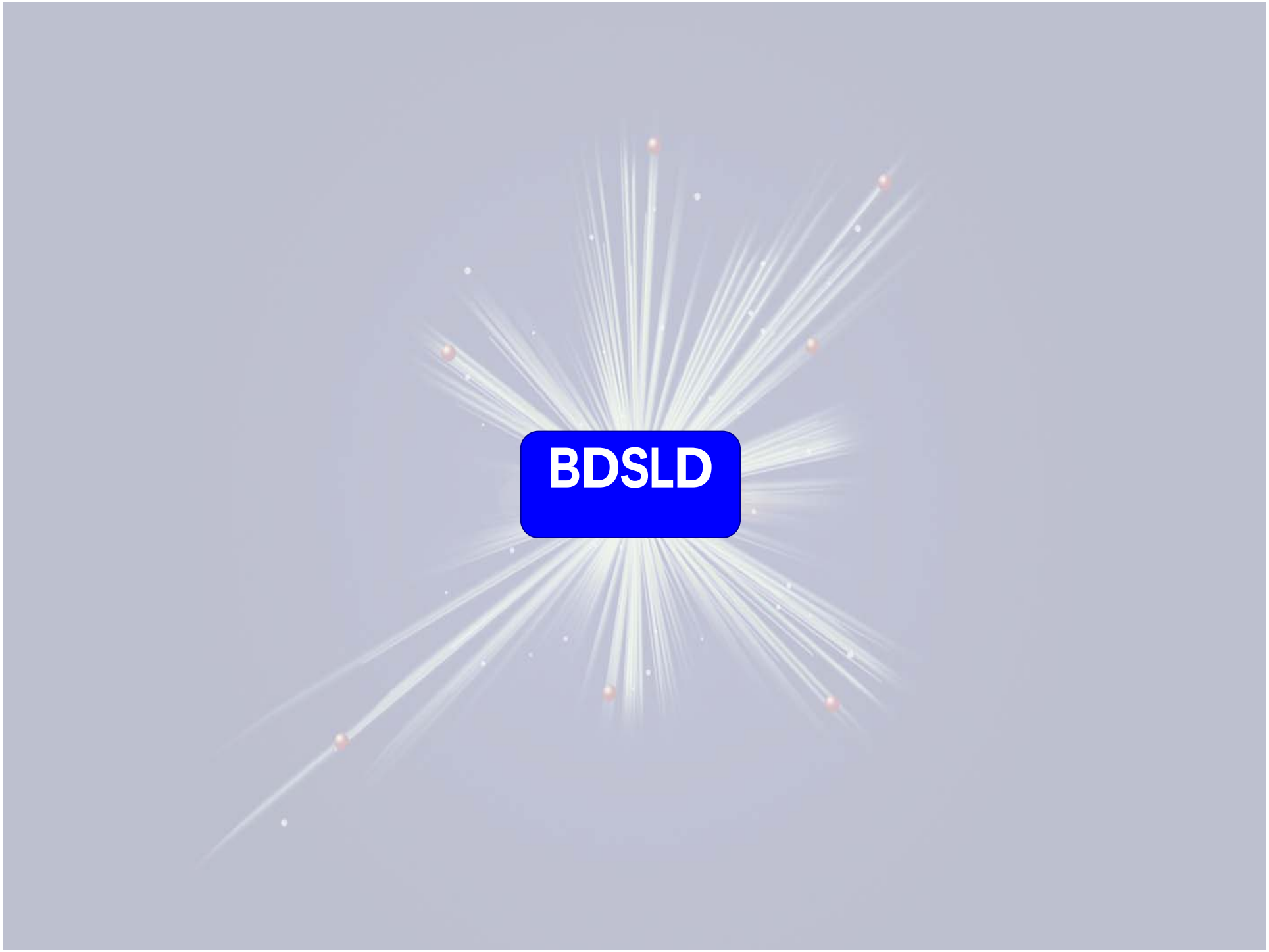
D. Angal-Kalinin
ASTeC, CCLRC
Daresbury Laboratory

2nd EuroTeV Scientific Workshop, Orsay

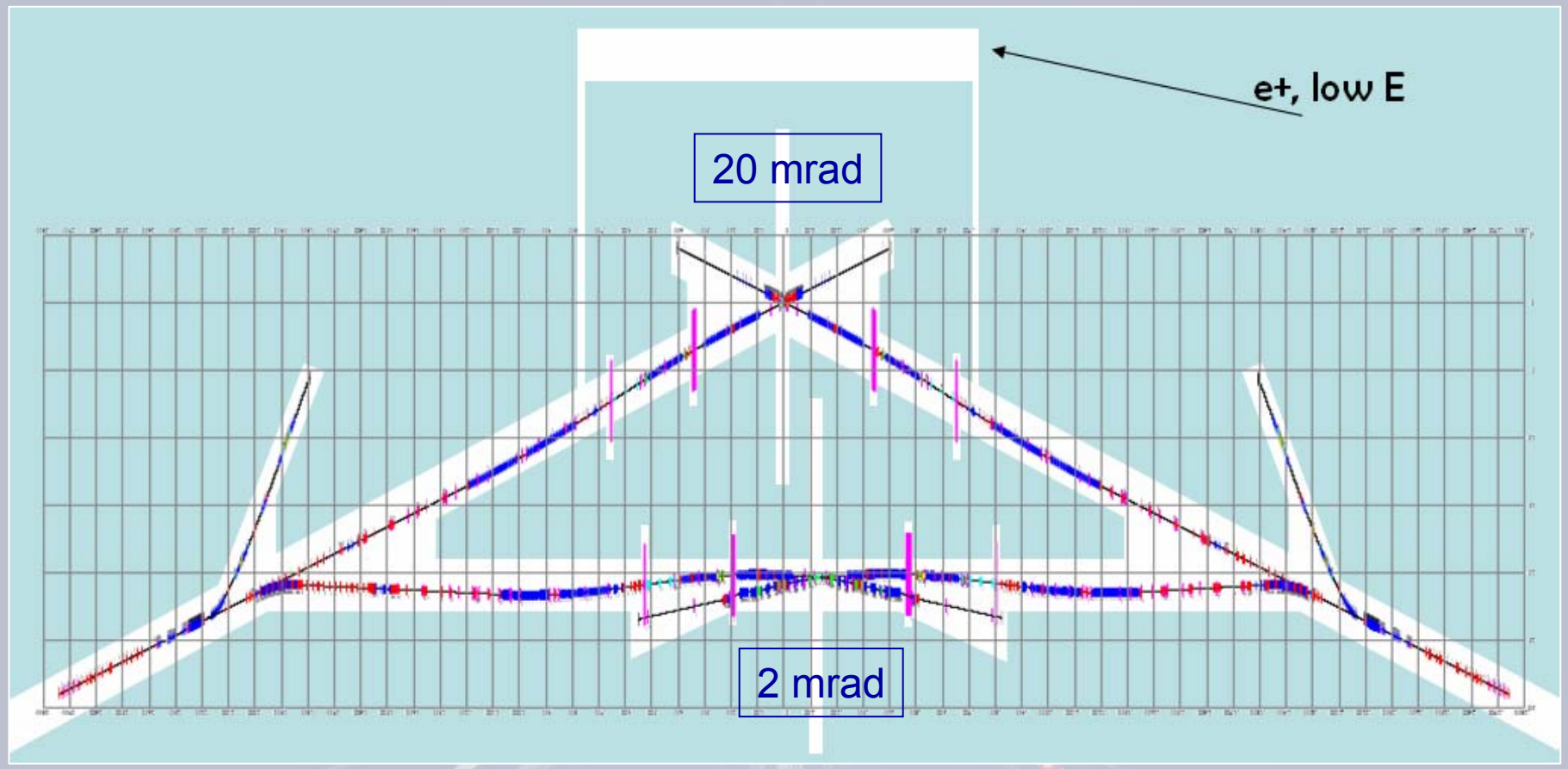
16th May 2006

WP2 : Beam Delivery System

Talk by N. Watson


BDSLD

ILC BDS Baseline Configuration

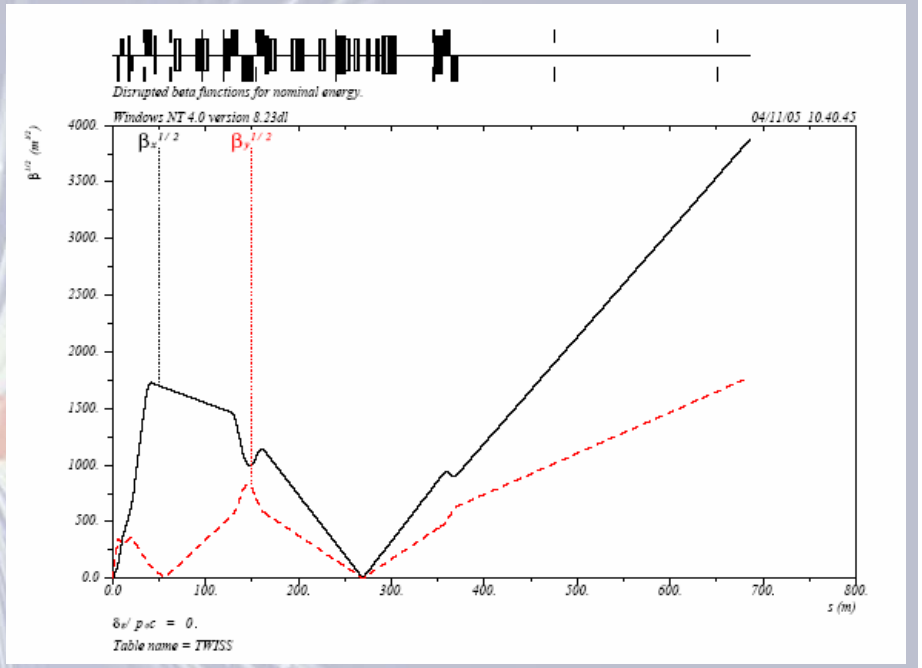


- Two longitudinally separated IPs, two independent collider halls for two experiments
- Entry to entry: ~5.5km

2 mrad Extraction line : Snowmass design

{EuroTeV report 2006-001}

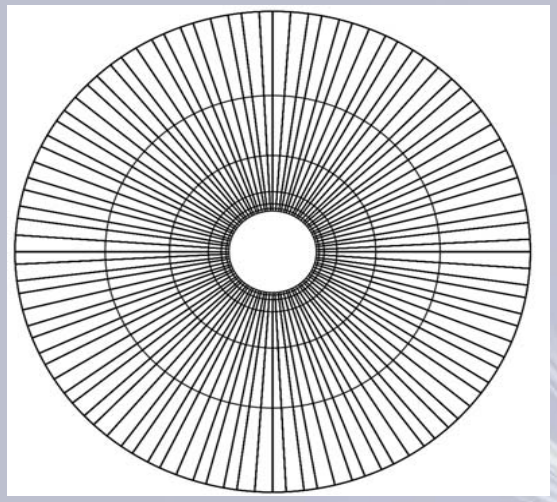
- The charged beam and radiative Bhabha losses are large in the final doublet region of the Snowmass 2mrad layout.
- UK and France continue to optimise the design
- Higher gradients & shorter magnets@500 GeV CM reduce the losses in the FD
- Downstream extraction line
- Upgrade path to 1 TeV to keep the geometry unchanged



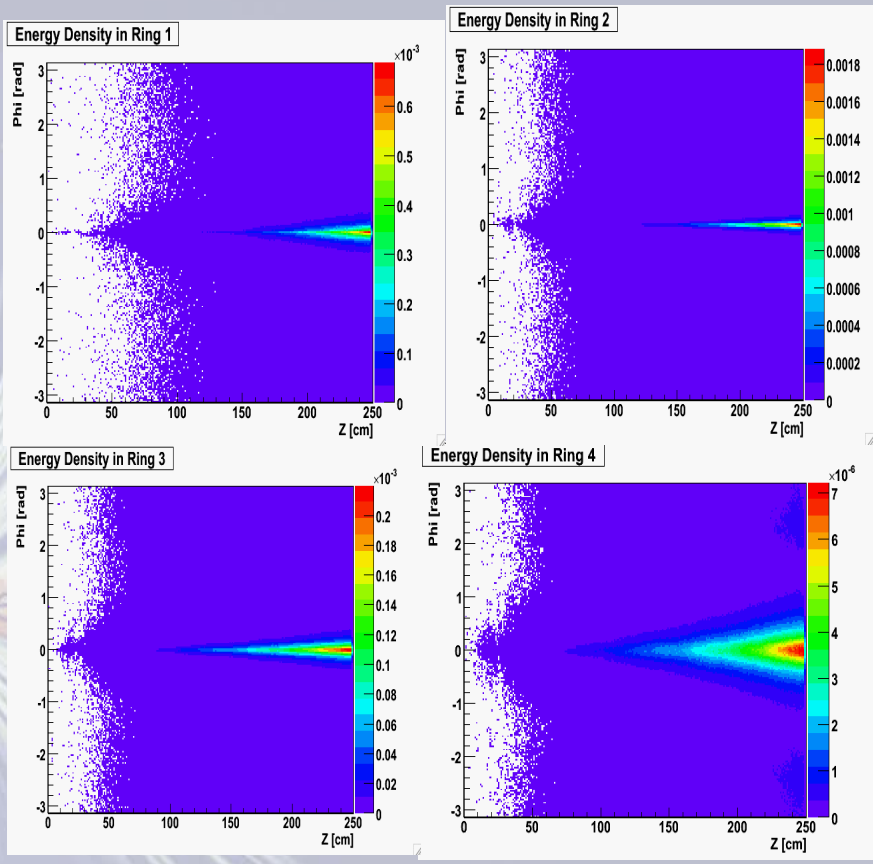
SLAC-UK-France-BNLTask force

See yesterday's ELAN BDYN session talk by R. Appleby

2mrad Losses - QD0 Power Density Maps for cs11



(QD0 Scored into 300000 volumes)



- Detailed studies of the localised power deposition in the SC magnets
- Tracking in BDSIM with shower development to give energy deposition
- The localised power deposition in QD0 can be controlled using Tungsten liners. {EuroTeV report 2006-022}

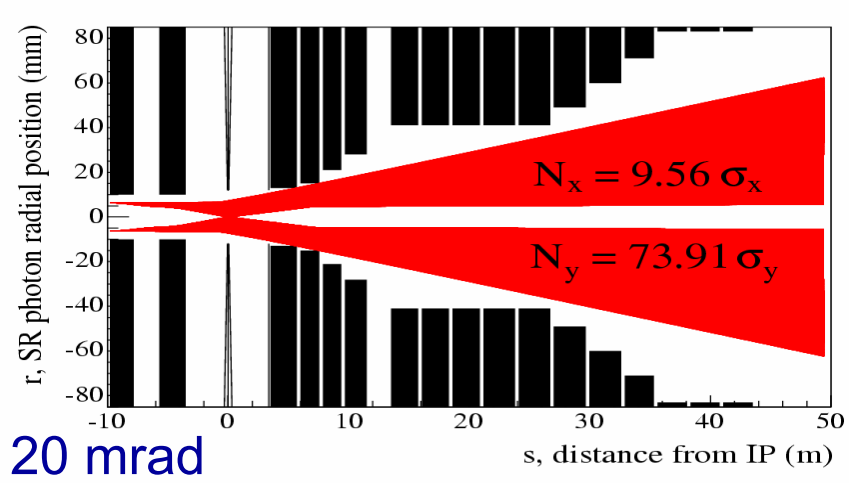
- Power density maps for the first 4 rings
- All density units in W/g

See yesterday's ELAN BDYN session talks by R. Appleby & J. Carter

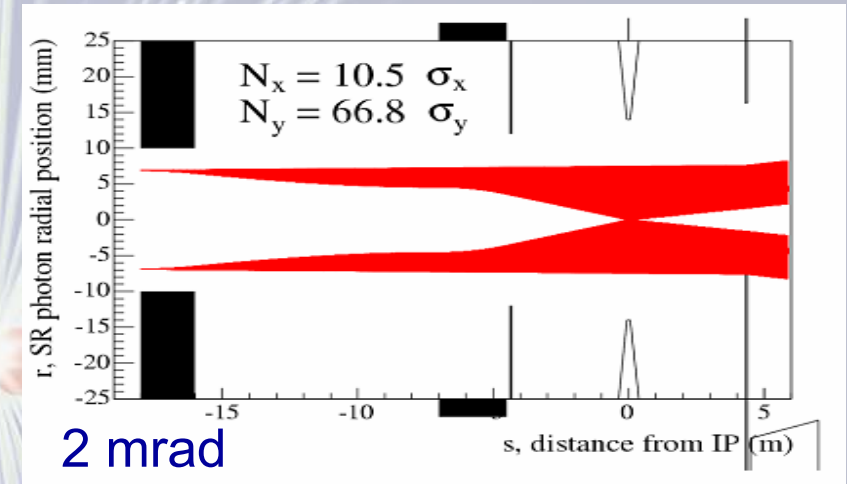
Collimation Depths

{EuroTeV report – in review}

- Evaluated for different lattice designs using semi-analytical calculation routine DBLT (O.Napoly)



20 mrad



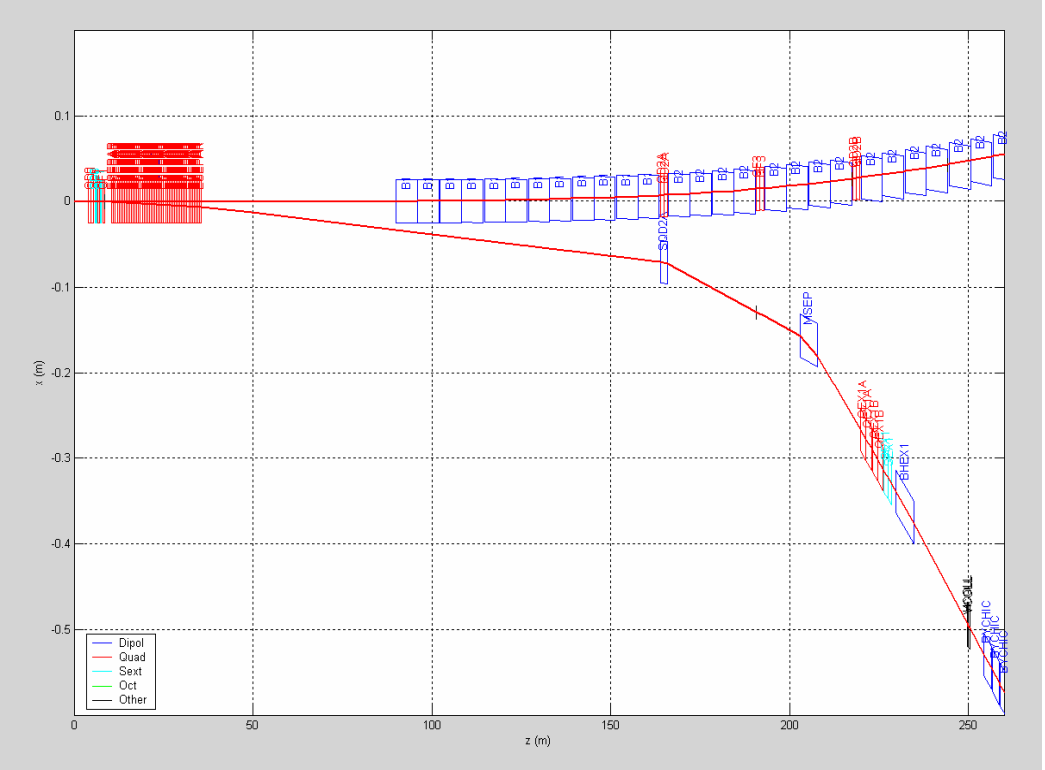
2 mrad

- Halo tracking simulation using STRUCT (A. Drozhdin)
- Good halo removal efficiency, but requires tightening apertures w.r.t. ideal collimation depth
- Still some non-linearities and repopulation of halo after betatron collimation
- Optimisation to improve the band width continues

F.Jackson

Head-on extraction using reduced electrostatic separator field

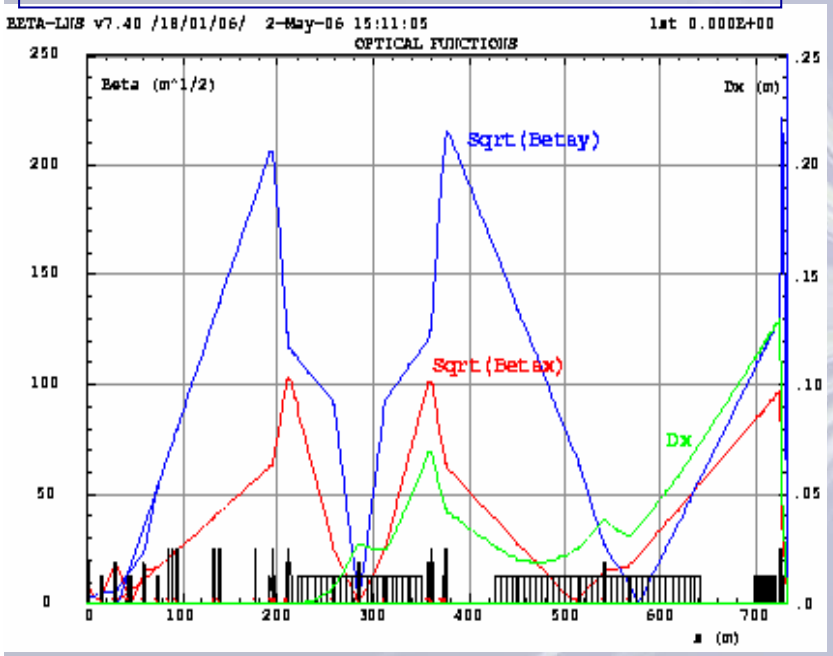
- Another look at using electrostatic separator and dipoles to allow head on extraction (a la TDR), suggested by L. Keller
- France, UK and SLAC task force studying this alternative design



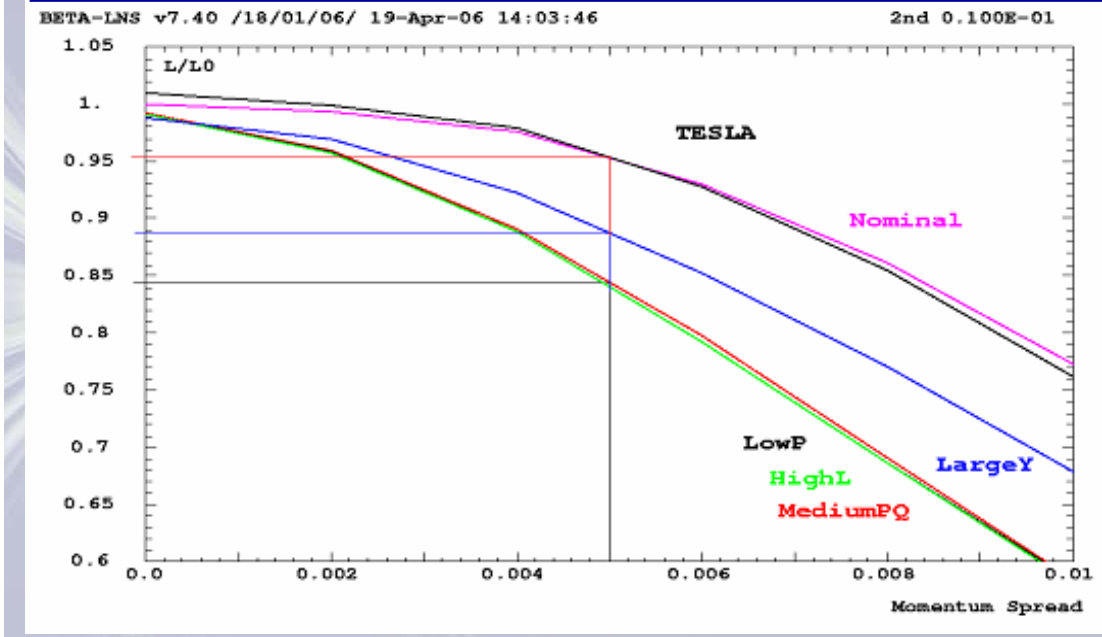
- Problems with TDR related to beamstrahlung cone and maximum electrostatic field on the separators mitigated.
- Evaluation of the multibunch kink instability {EuroTeV-Memo}

- Modified final focus to accommodate the separator
- Complete final focus deck optimised by Saclay

Final focus optics for modified headon scheme



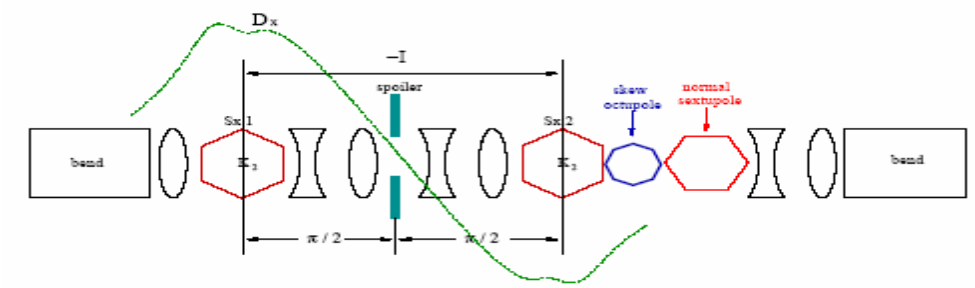
Luminosity for various parameter sets using modified headon final focus



- Detailed beam losses being calculated
- Full design of the extraction line under way
- Mini head-on workshop tomorrow at LAL

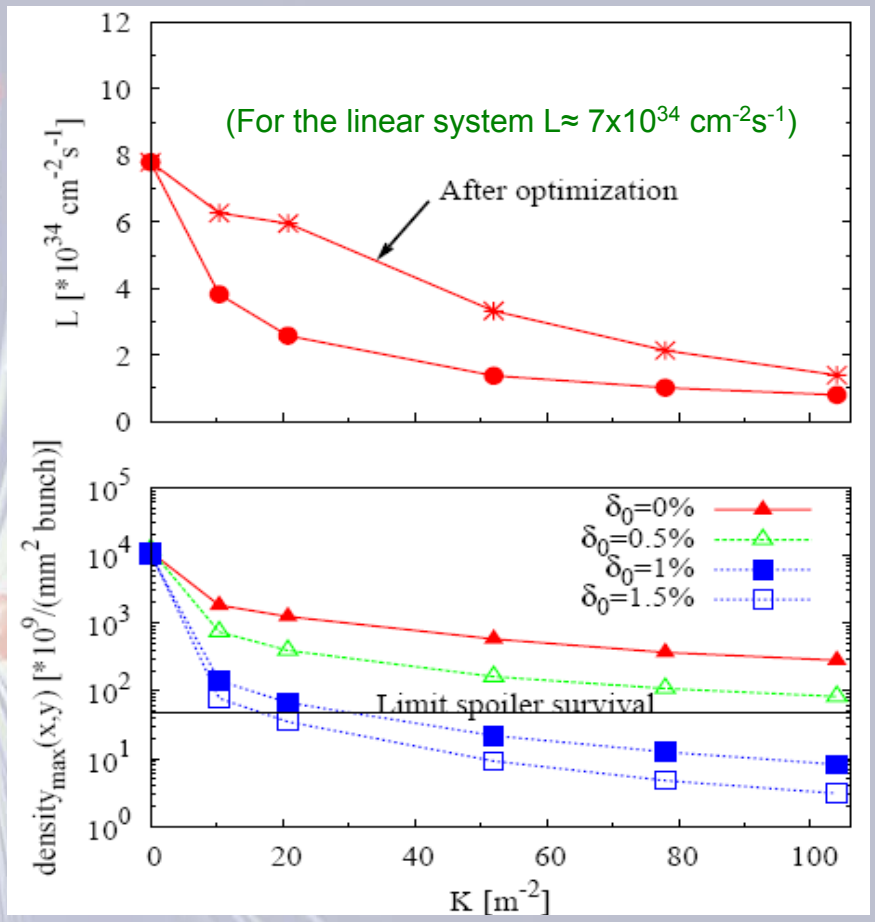
A nonlinear collimation system for CLIC

- Two additional multipoles for local cancellation of the higher order aberrations



- The luminosity was improved by more than a factor 2 for an integrated sextupole strength K_2L =20.86 m-2

- The spoiler survival is guaranteed for off-momentum beams(>1%) for this sextupole



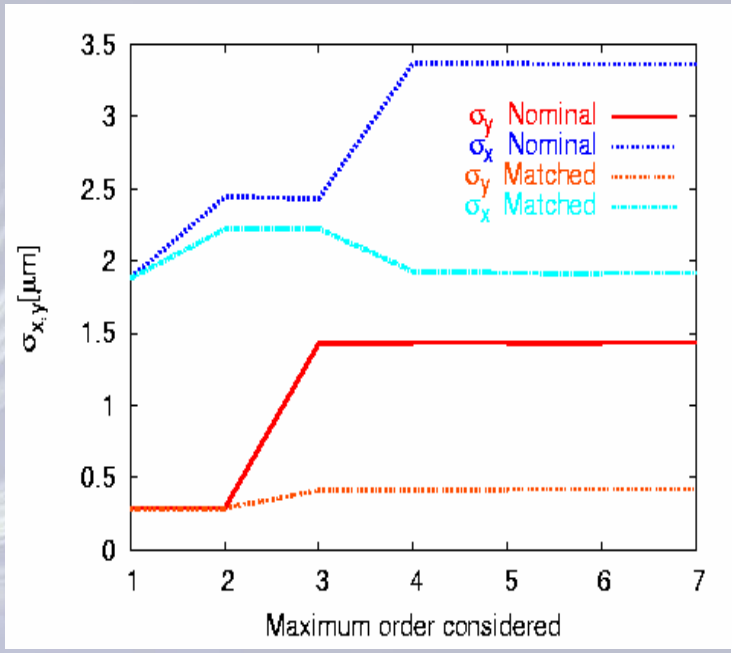
Luminosity as function of the skew sextupole strength and beam peak density at the spoiler

See yesterday's ELAN BDYN session talk by A. Faus-Golfe

Nonlinear optimisation for CLIC Final focus and Collimation

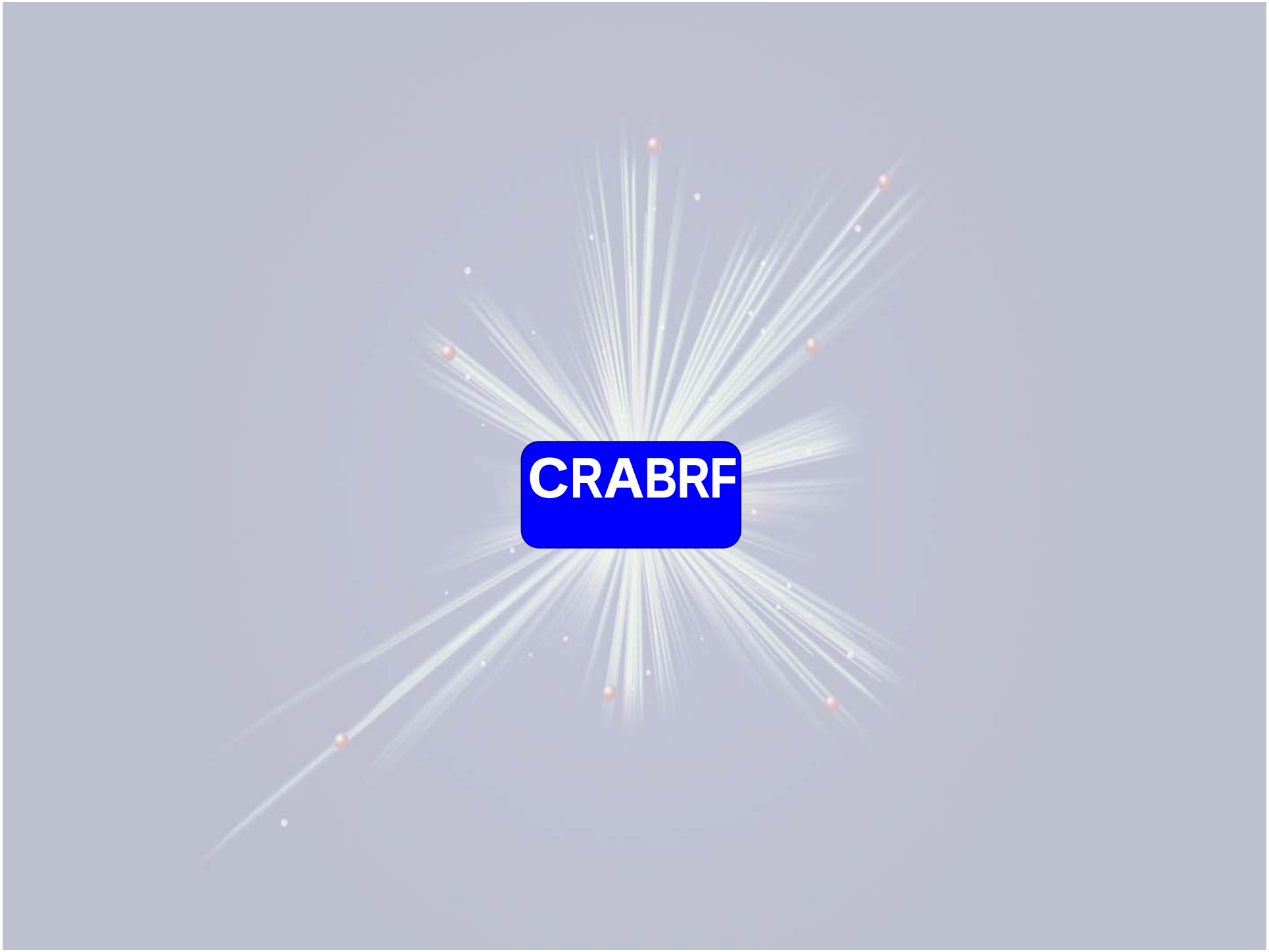
- Local cancellation of the higher order aberrations using MAPCLASS (R. Tomas)
  - MAPCLASS is a Python code that minimizes the rms sigmas at the IP using the map coefficients from MADX-PTC.

- Loss maps for the comparison between linear and nonlinear collimation systems - new version of placet (collaboration with L. Neukermans).



Beam sizes order by order

See yesterday's ELAN BDYN session talk by A. Faus-Golfe
&
CLIC BDS-day (22 Nov 2005) talks

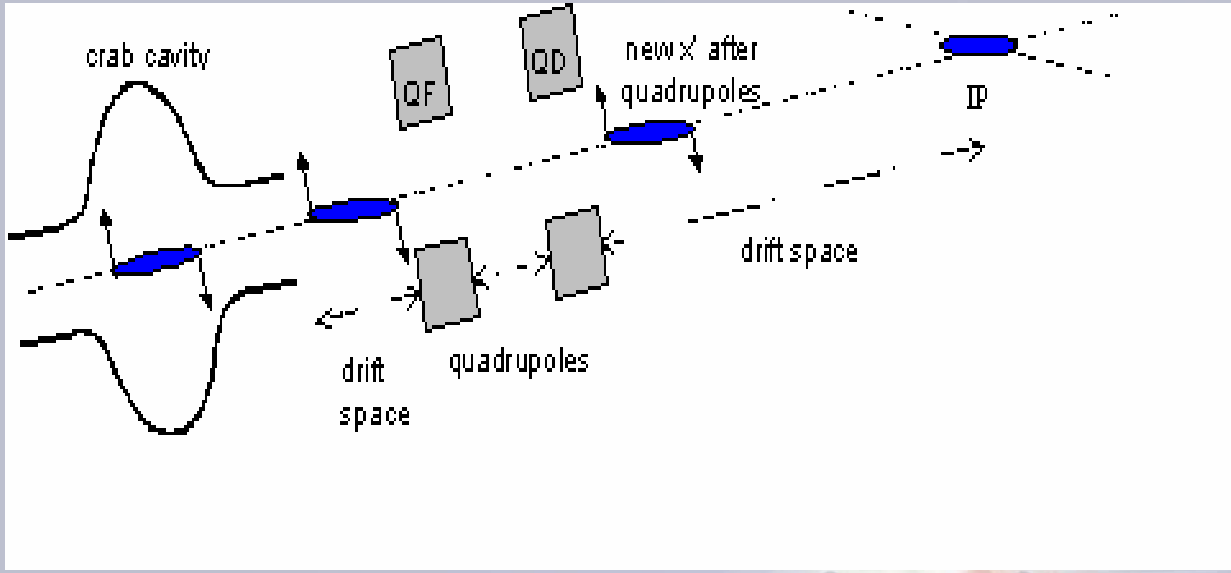

CRABRF

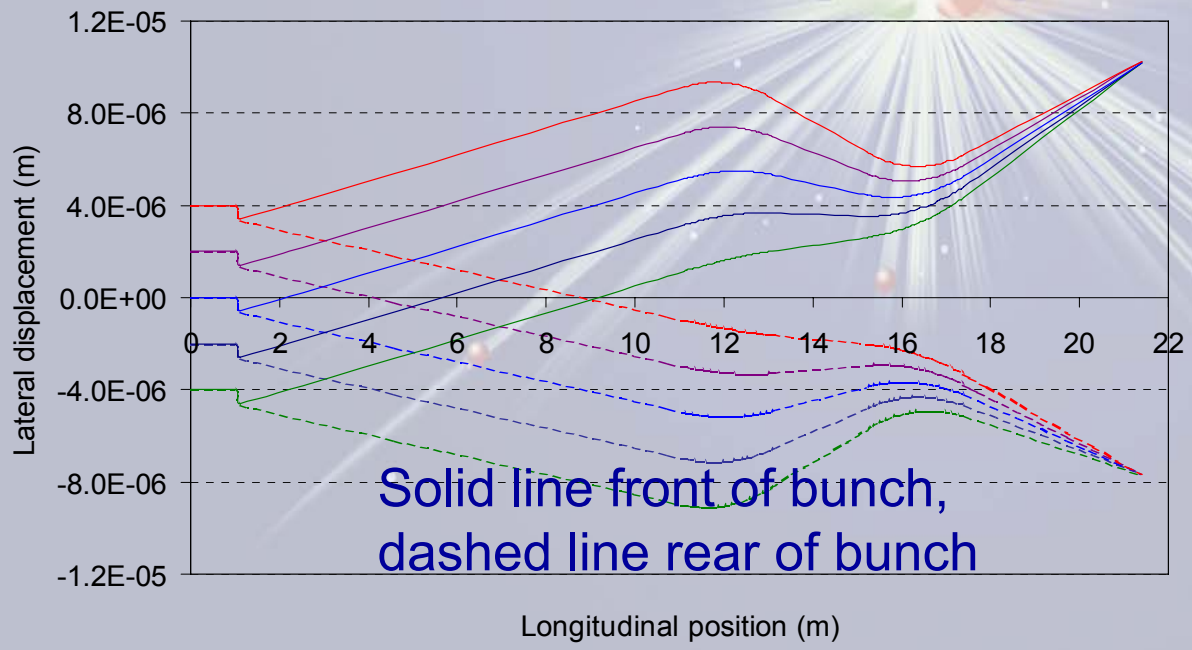
High reliance on crab system to recover the luminosity loss needs the guarantee of the performance in the presence of realistic beam.

Completed and ongoing studies

- Position of crab cavities in the BDS
- Type of crab cavity
- Frequency of operation
- How phase jitter and field stability affects luminosity
- Effect and extraction of the lower order modes
- Effect of wake fields/higher order mode damping
- Performance of phase control systems

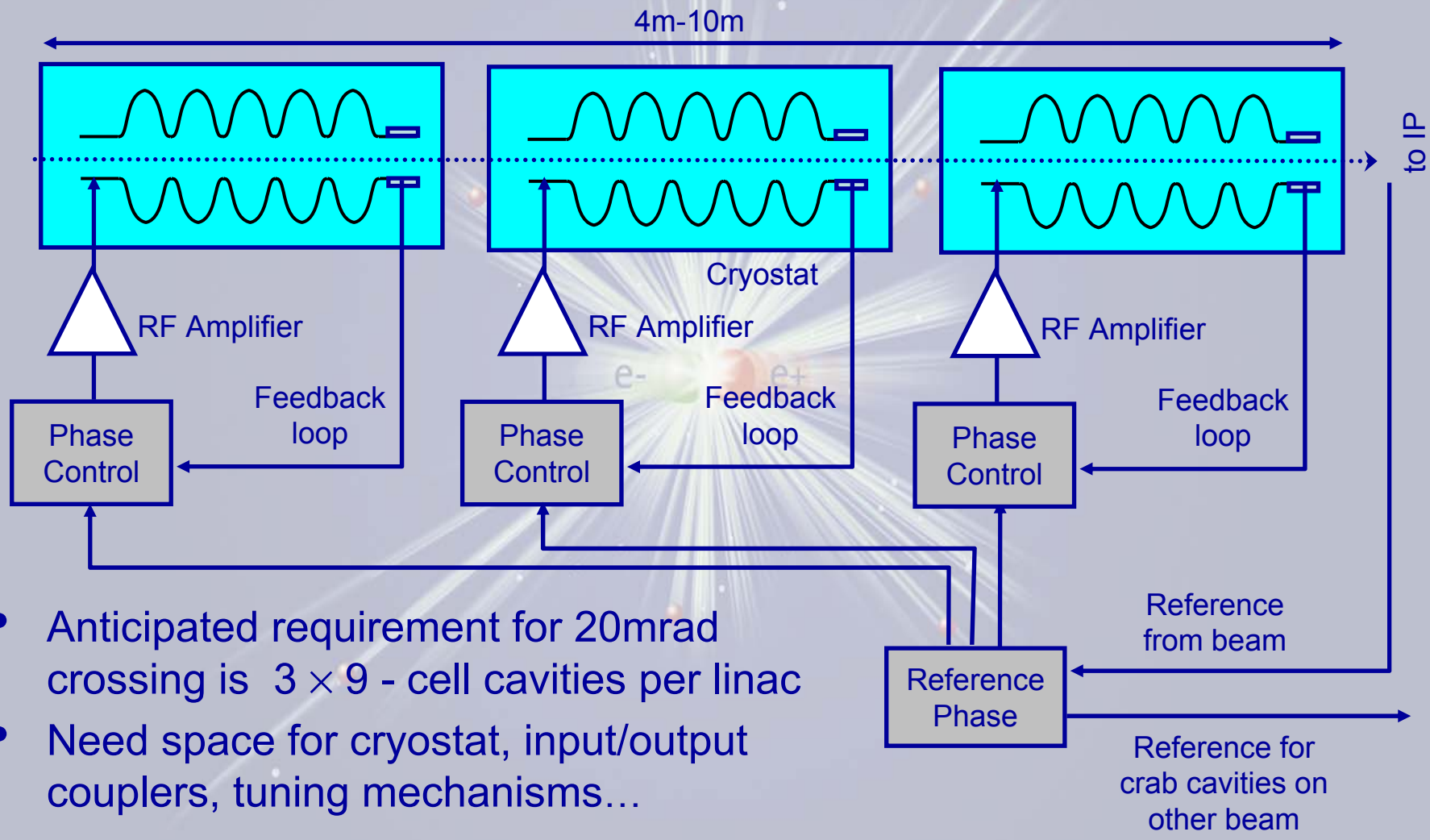
Crab cavity position in BDS





- The crab cavity is ~15 m from the IP in 20 mrad IR close to the Final Focus.
- Small transverse kicks can produce significant deflections at the IP
- Study of crab cavity effects on beam dynamics {*EuroTeV report* }

Crab cavity RF system



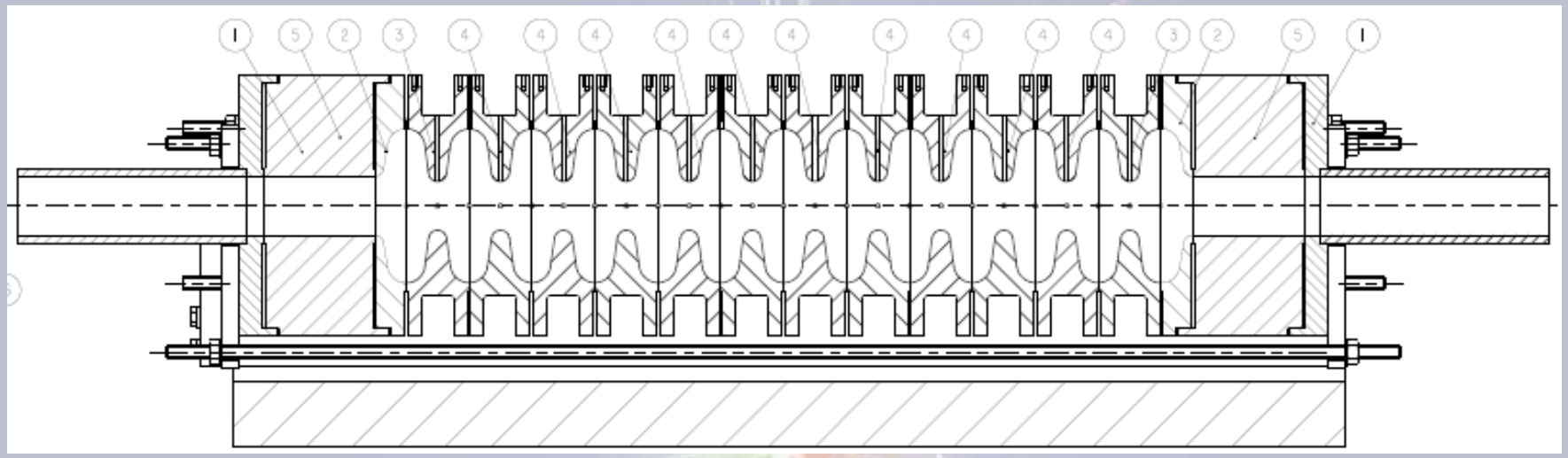
- Anticipated requirement for 20mrad crossing is 3×9 - cell cavities per linac
- Need space for cryostat, input/output couplers, tuning mechanisms…

Ongoing studies for the ILC Crab cavity

- Evaluation of the Fermilab 3.9GHz CKM cavity
- Long range wakefield simulations
- Manufacture of a “cold test”
- Planning of phase control experiments, measuring cavity to cavity jitter on existing SC cavities and the performance of phase control systems
- Coupler design
- Development of 3.9 GHz LLRF digital control hardware
- Investigation of Klystron requirements

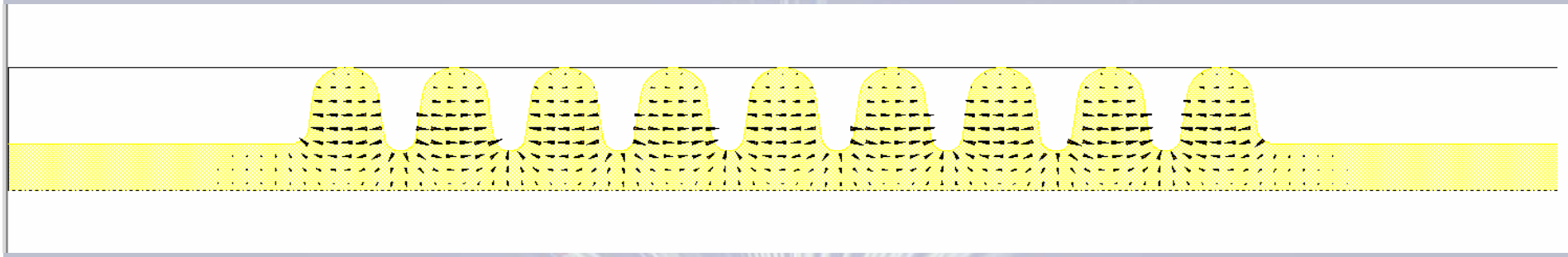
Crab cavity simulation meeting, FNAL, 8-9th May 06

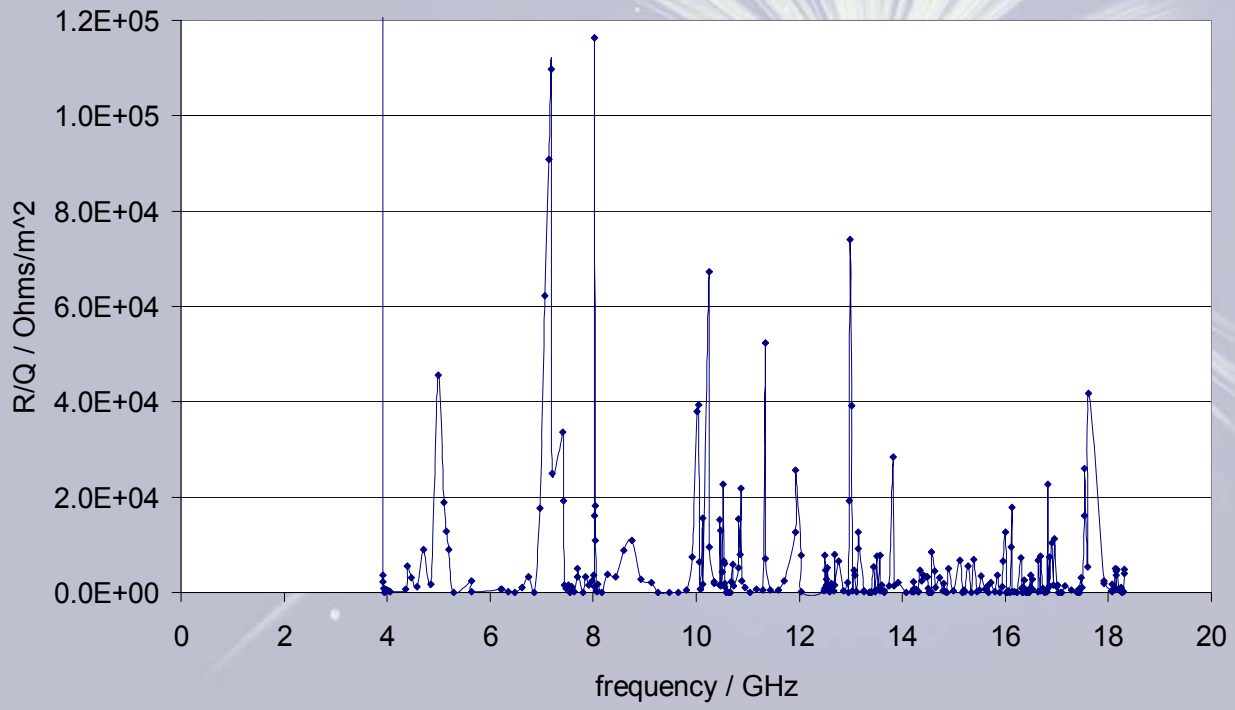
Sectional cold test cavity currently being manufactured at Daresbury



- Verification of cavity mode frequencies, coupling and R/Qs
- Modular design allows cavities with differing numbers of cells to be evaluated
- Cavities will be used for bead-pull and wire tests
- RF testing of couplers can be done using the modular coupler sections

Dipole modes in the 9 cell Deflecting cavity



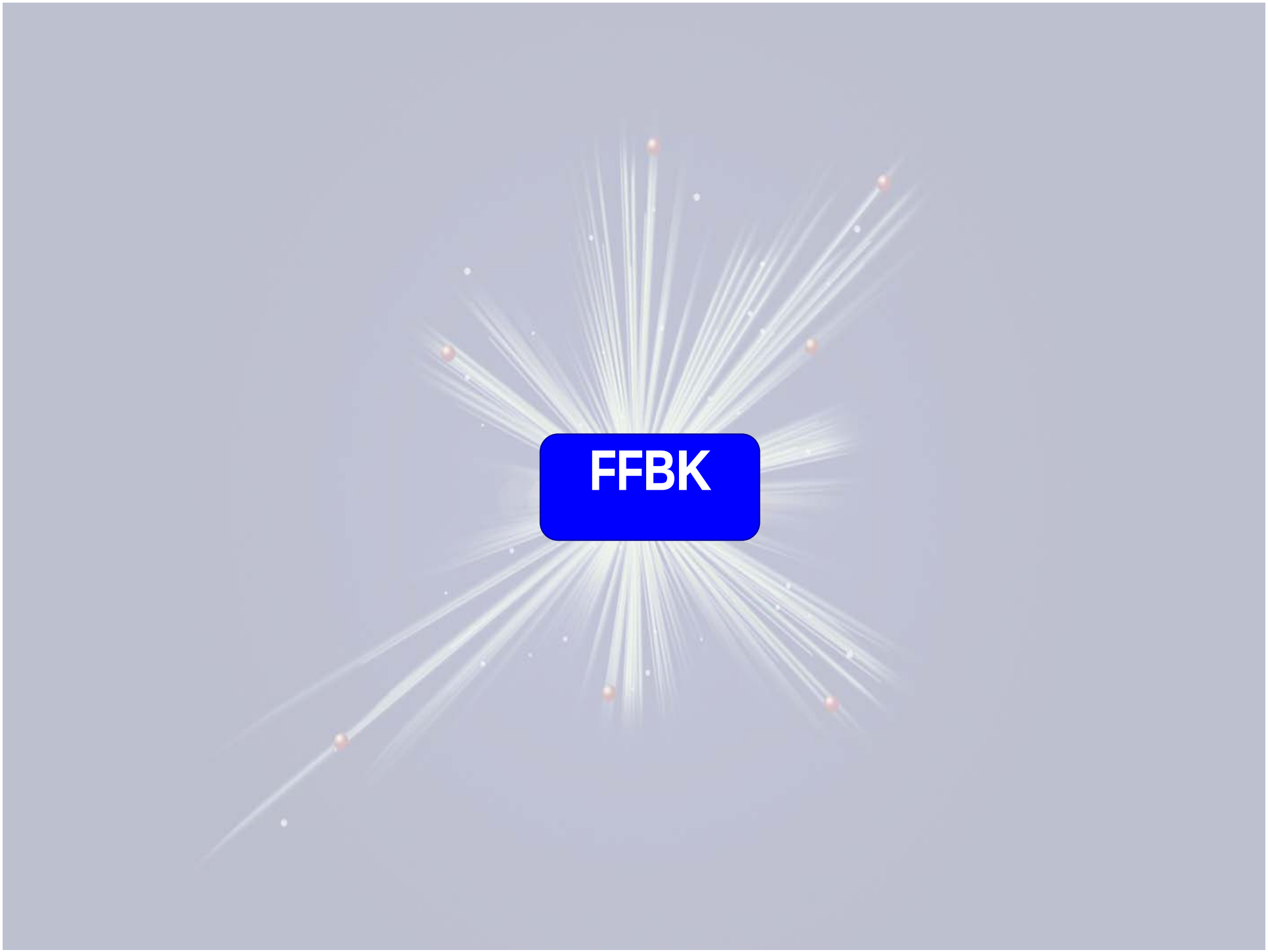


f=3.9GHz

R/Q=1.54e6

Dipole mode

Next highest R/Q in this band=3.7e3

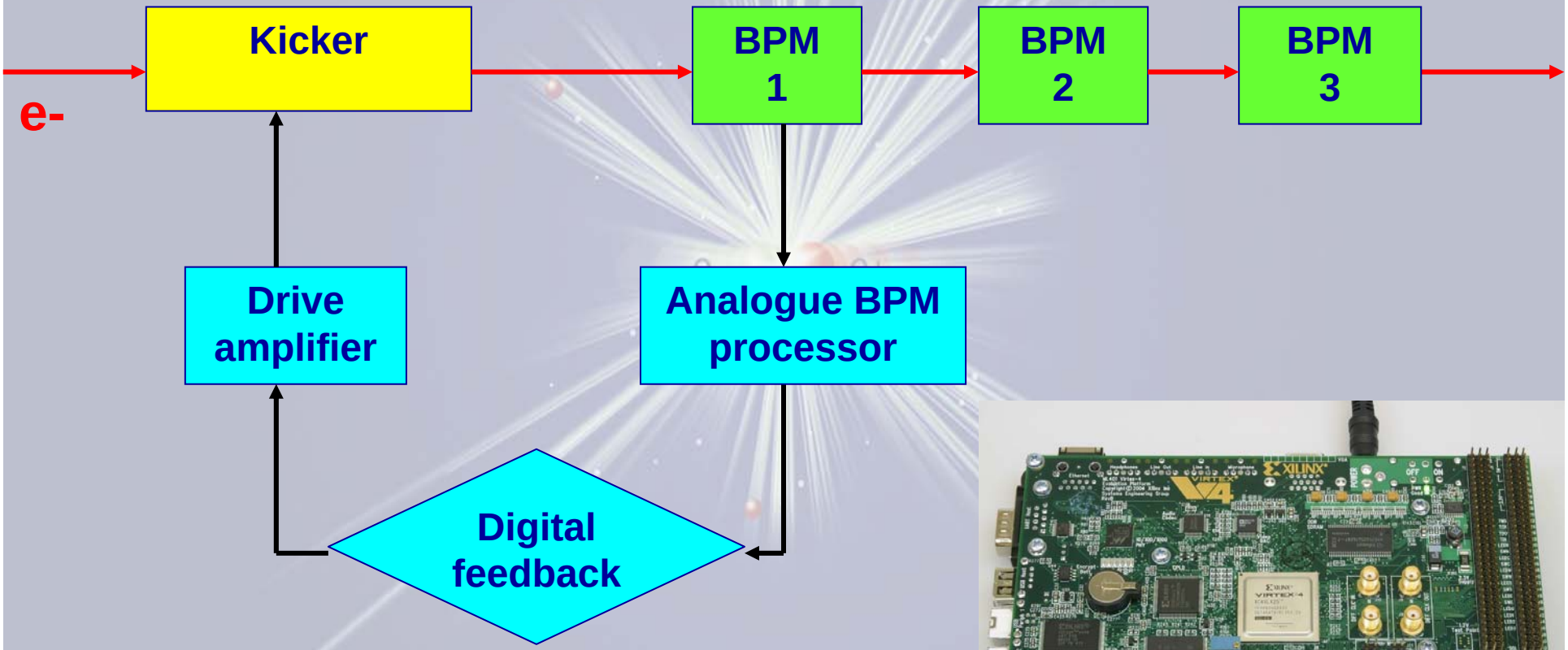

FFBK

FFBK

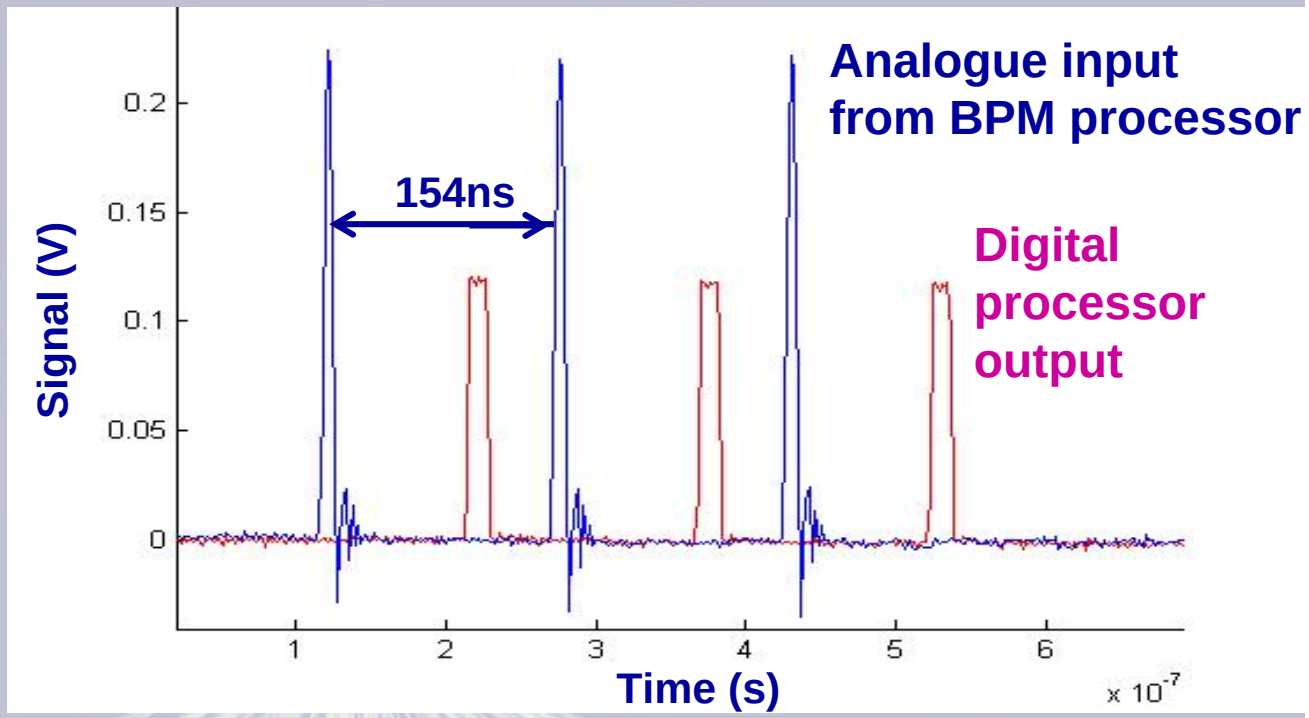
- Prototype beam-based (intra-train) feedback system

- Completed: ultra-fast analogue feedback prototypes
- FONT2 / NLCTA: 54ns latency
- FONT3 / ATF: 23ns latency
- Ongoing: ILC digital feedback prototypes
- FONT4 / ATF: 1st digital FB processor
- FONT@ESA: EM background impact on FB BPMs

ILC digital feedback prototype tests



1st beam test results (20 April 2006)



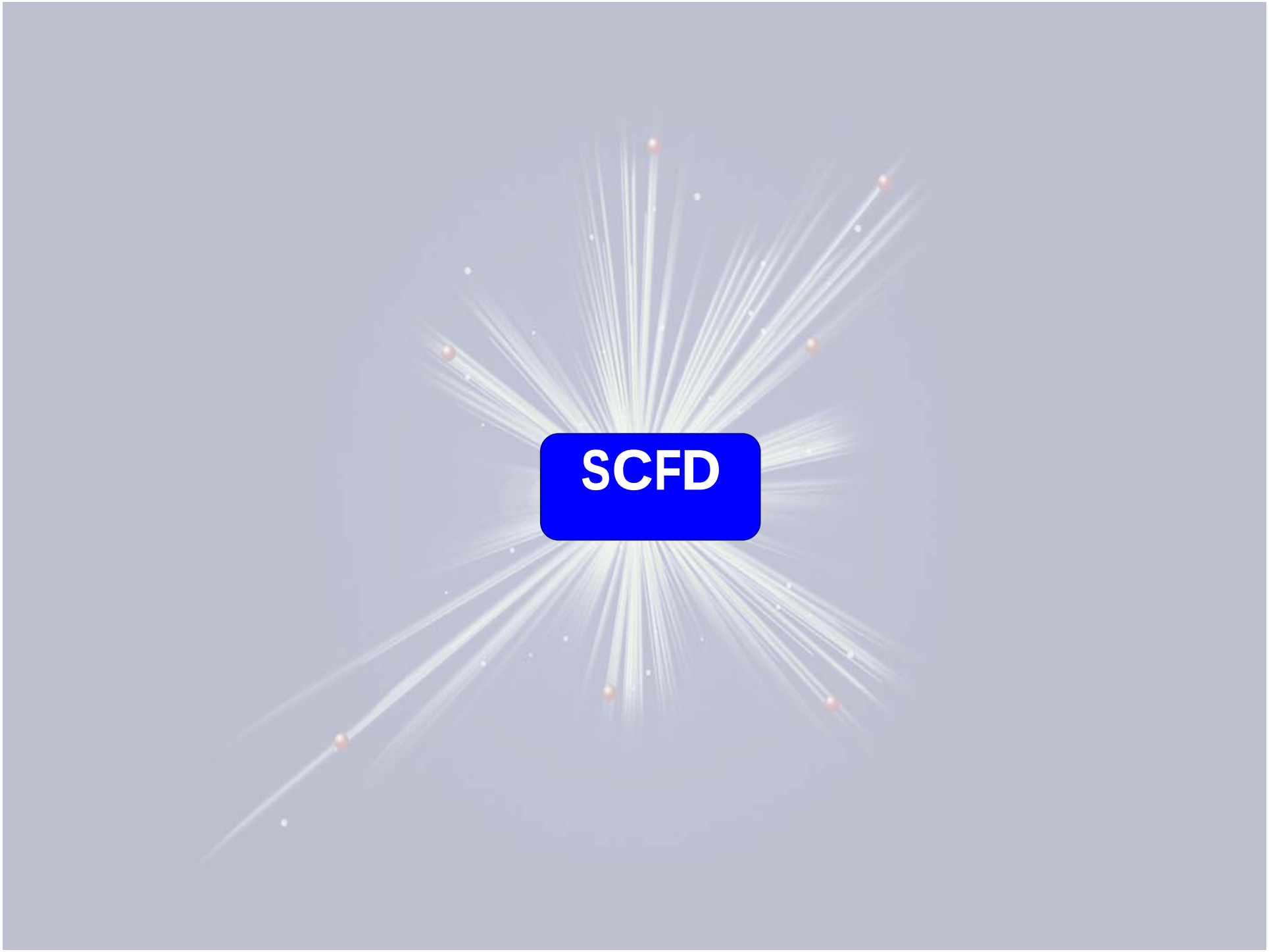
ATF: initial tests with

3 bunches with spacing c. 150ns aiming for latency <120ns (electronics); stabilisation of 3rd bunch at um level

Digital board tests April, June 2006

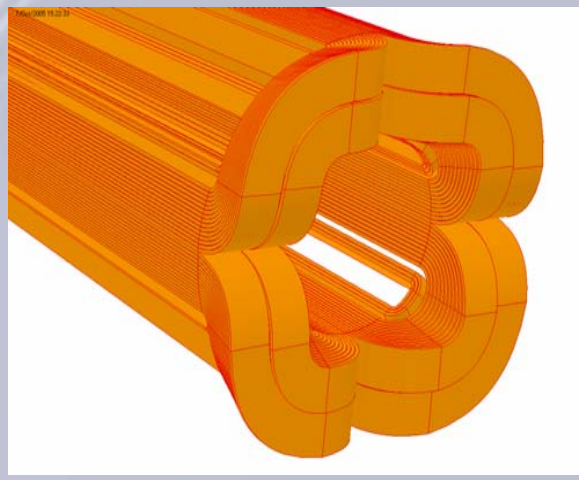
Closed-loop tests Dec 2006

See yesterday's ELAN BDYN/INSTR session talk by P. Burrows


SCFD

SCFD

To test the high gradient performance and mechanical stability of an Nb3Sn super conducting large aperture quadrupole in an external solenoid field.



The construction of 1m long SC quadrupole prototype is underway at Saclay.

CEA in-house development of Nb3Sn Quadrupole

Status of Pole fabrication:

Pole 1 : fabricated, insulation defects detected.

Pole 2 : reacted, ready for resin impregnation, week 20.

Pole 3 : wound, ready for reaction week 21.

Pole 4 and **5** (spare) : fabrication will start in June'06.

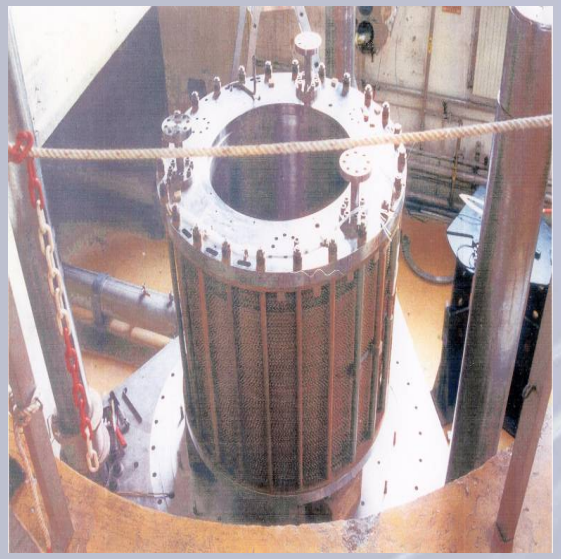
Quadrupole collaring : October'06

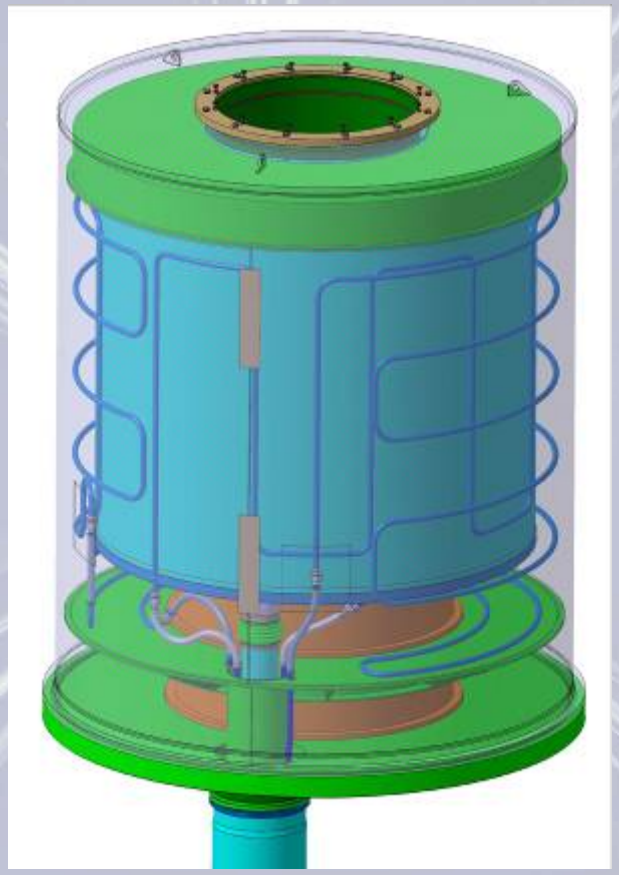
Pole 2 prepared and inserted in the oven for Nb3Sn reacting treatment at 660 °C

EUROTeV high field tests in 4 T field

Design of the 8 T solenoid cryostat

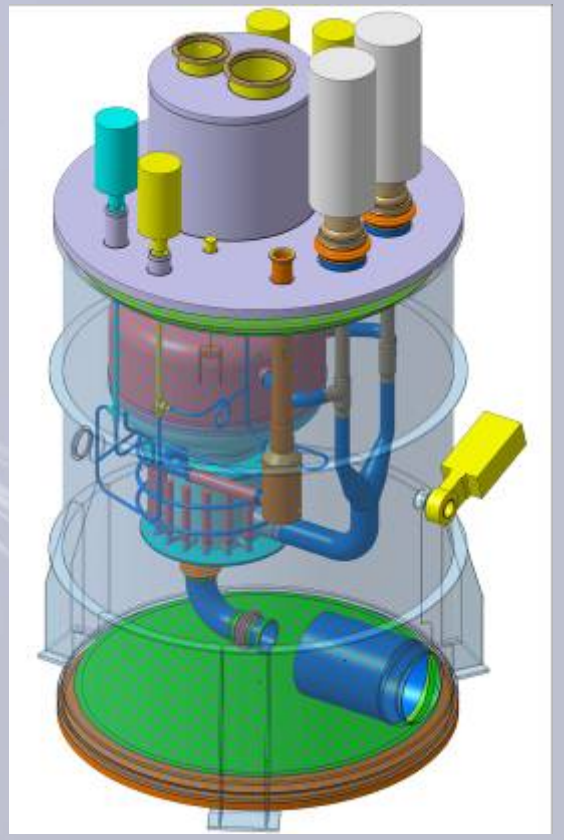
8 T coil
from CNRS/LCMI
laboratory





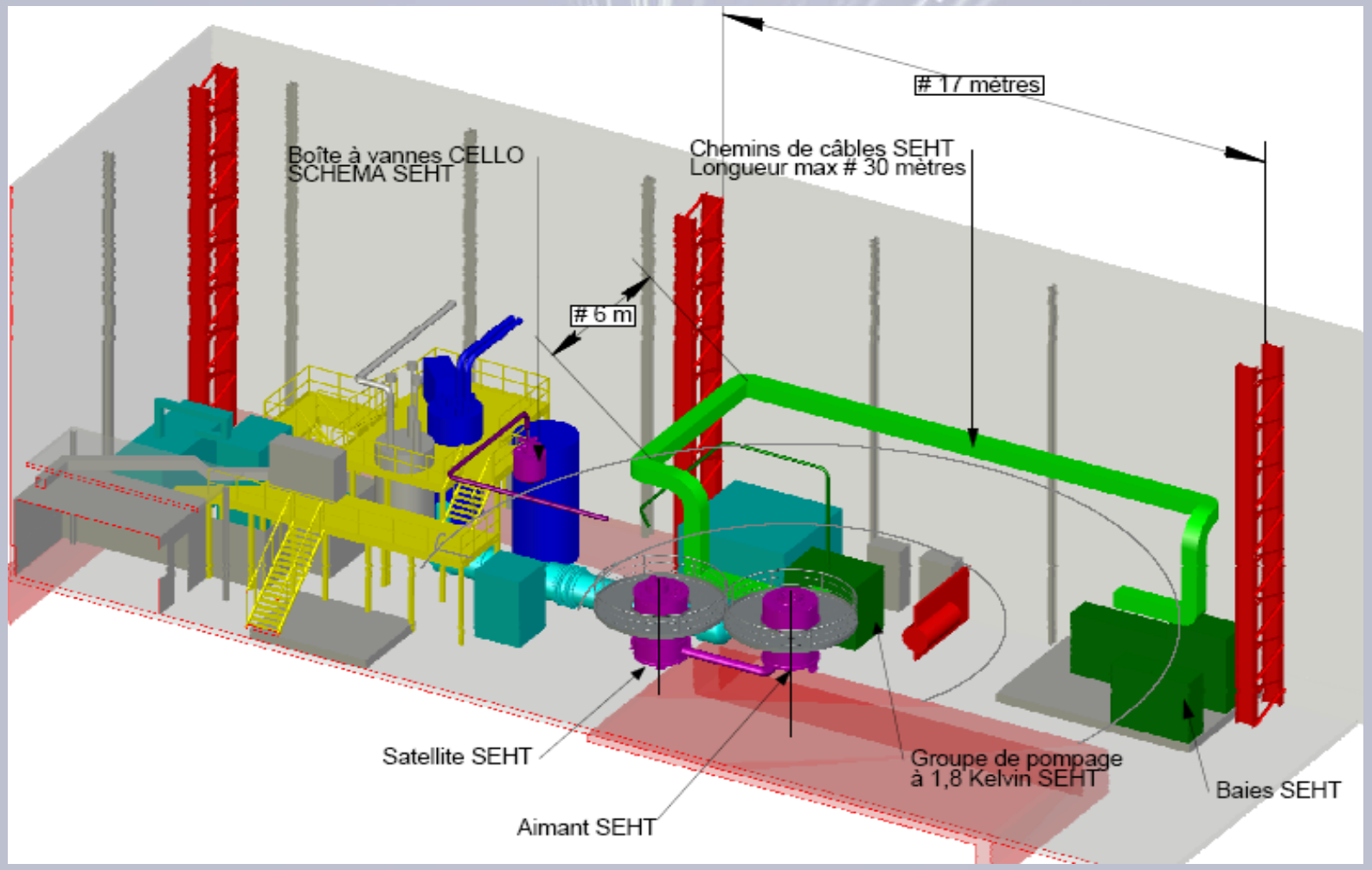
Cryostat with
600 mm warm aperture

Pressurized 1.8 K He
satellite



EUROTeV high field tests in 4 T field

Implantation plan of the 8T vertical test cryostat SEHT in the existing hall of horizontal test cryostats for high field magnets.



BDS - Summary

ILC

- Further optimisations in the baseline designs
- Some of the alternative options being studied
- Significant contributions to ILC BDS BCD
- Strong International collaborations on all the tasks
- Several meetings for each task within EuroTeV and other collaborators
- Contributing to the ILC RDR on all the tasks this year

CLIC

- CLIC BDS day
- Optimisation of non-linear collimation and final focus with improved performance

- Presentations : Snowmass, Nanobeam, LCWS06
- Simulations and benchmarking useful for both ILC and CLIC