Beam Delivery System updates

BDS Area leaders

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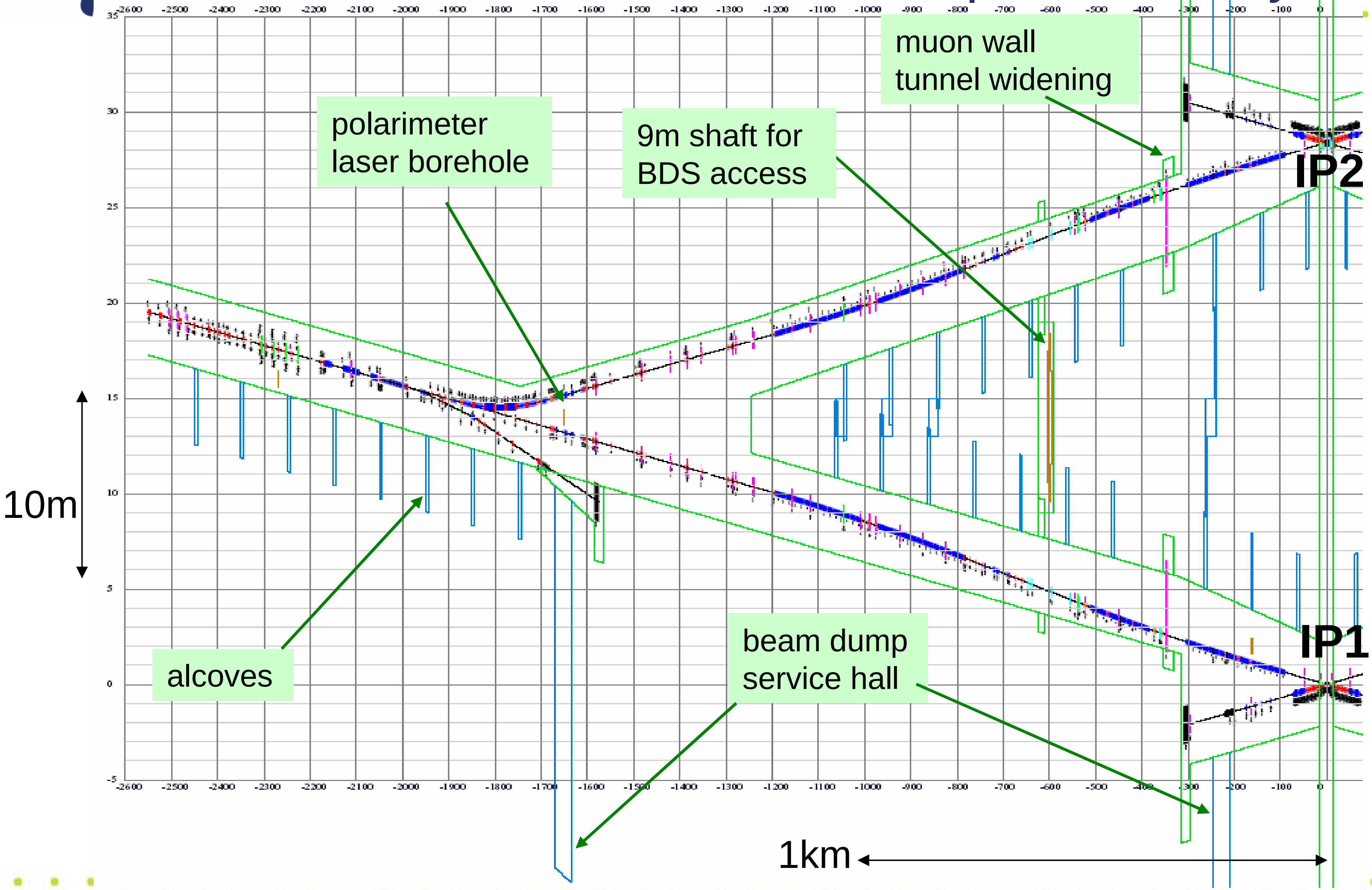
Valencia GDE meeting, November 6-10, 2006

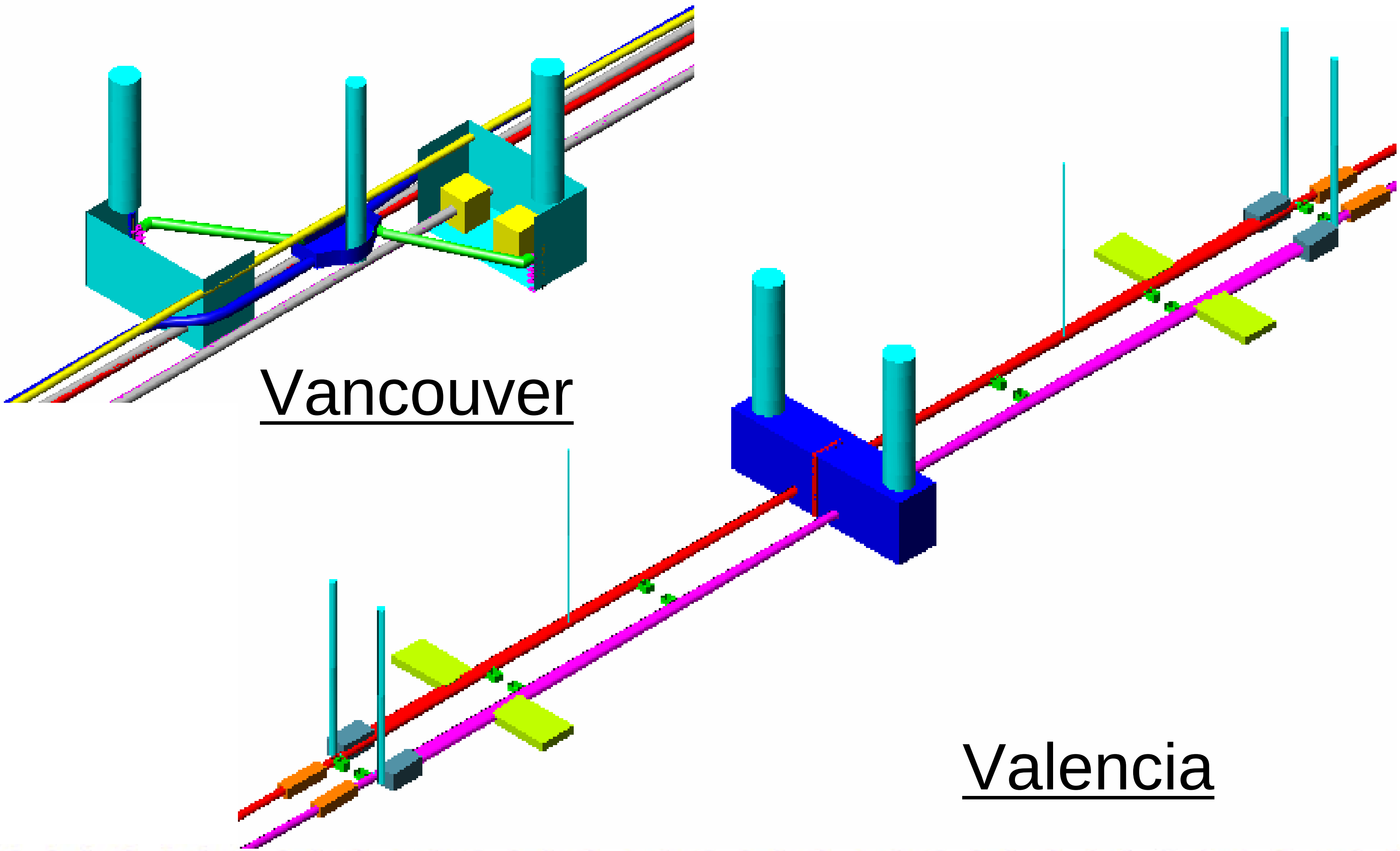
Contents

- Design and cost evolution
  - **on-surface detector assembly**
  - **reduced muon walls**
  - **CFS design changes**
- Muon protection: walls/doughnuts
- Single IR case

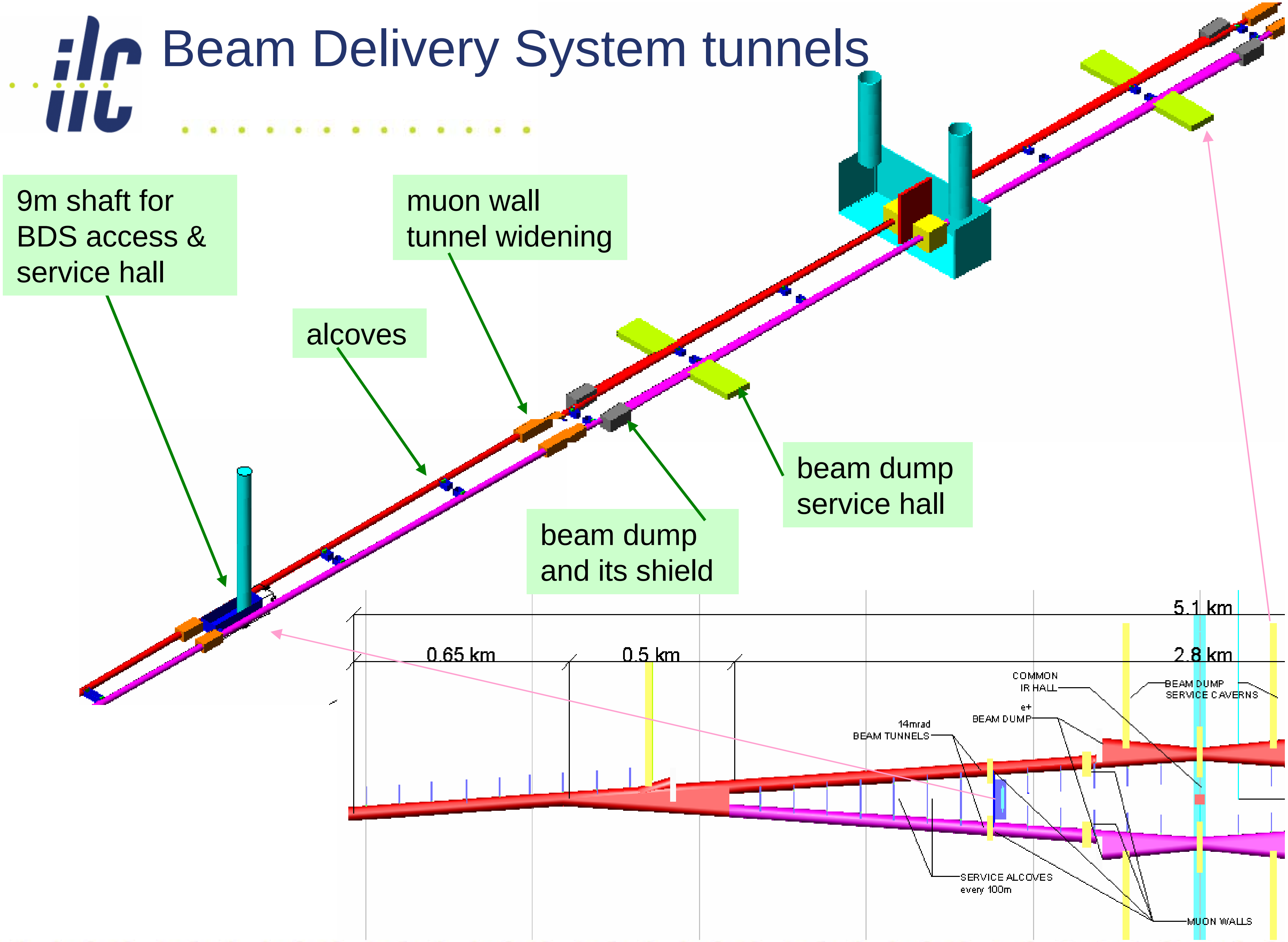
Valencia 14/14 baseline. Conceptual CFS layout



CFS designs for two IRs

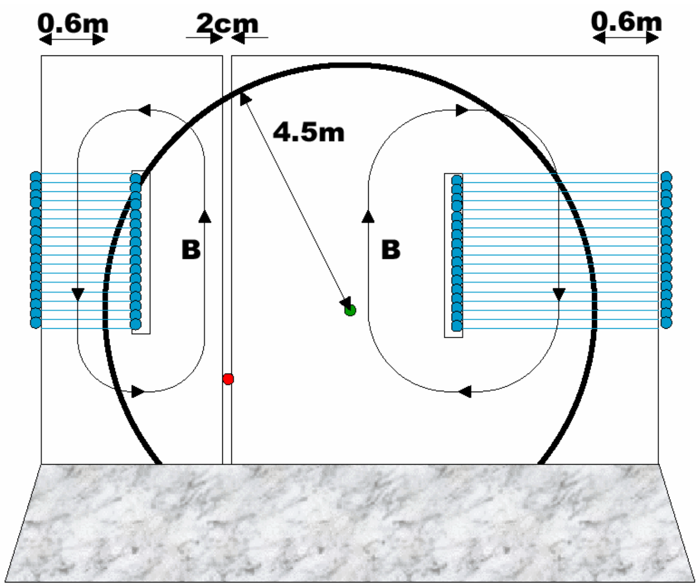


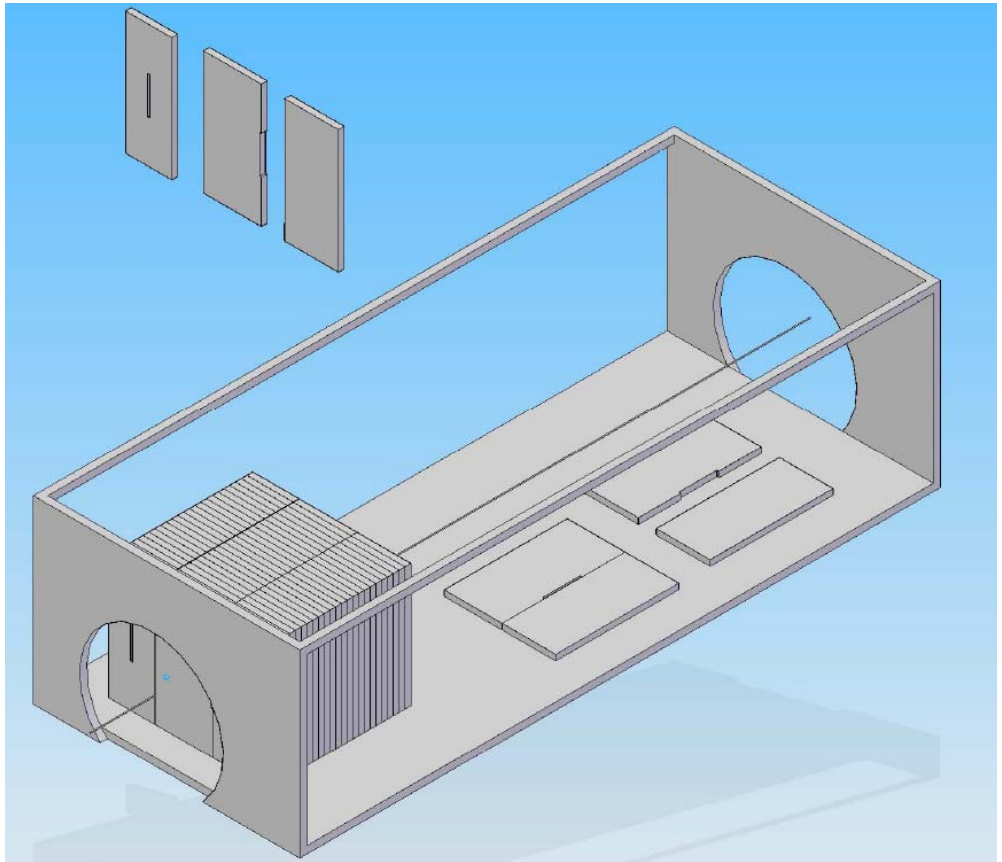
Beam Delivery System tunnels



Muon walls

- Purpose:
  - **Personnel Protection: Limit dose rates in one IR what beam sent to other IR or to the tune-up beam dump**
  - **Physics: Reduce the muon background in the detectors**





Muon walls installed in a tunnel widening which provide passage around the wall

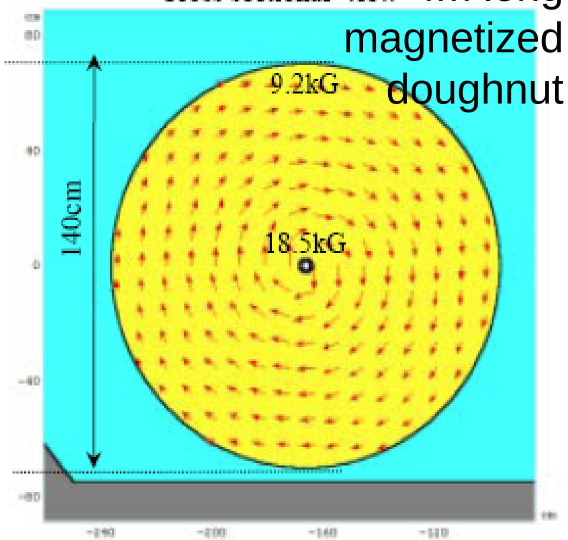
Valencia configuration:
single 5m wall per beamline, tunnel spaces for full set of 18m & 9m walls in each beamline

5m μ-wall vs 11 doughnut

Similar performance as for 5m μ-wall is achieved with 11 doughnuts + 1m wall (better for whole detector, worse for TPC, see table)

The volume of iron is about the same for 5m wall and the doughnuts set. (=>No obvious cost saving). MDI issues also require further studies.

Plan – leave this option for TDR study



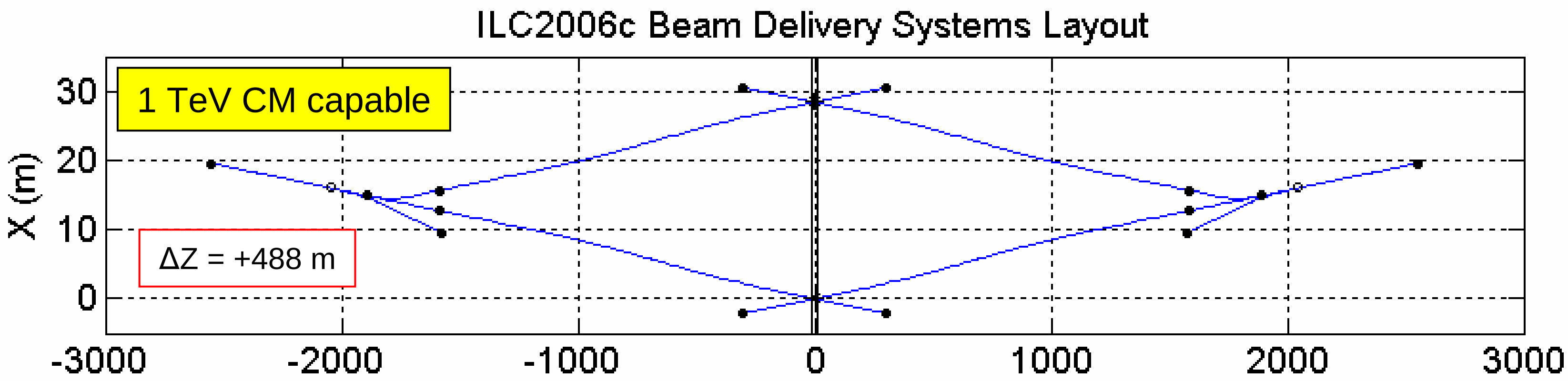
4m long magnetized doughnut

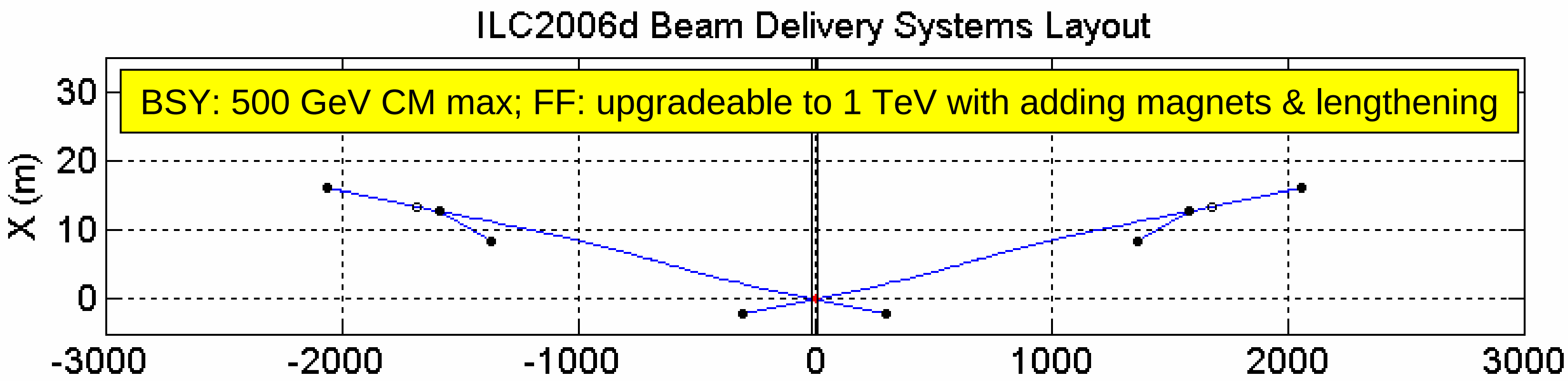
Condition	R=6.5 m detector; 1 bunch	R=2.5 m TPC ; 200 bunches	R=2.0 m PC 160 bunches
5 m long magnetized wall fills tunnel at 349 m, 2m concrete wall – MARS	13 (3)	387 (152)	192 (74)
11, 4 m long "doughnuts" same polarity, 1 m unmagnetized wall – Lew, 2m concrete wall – MARS	8 (9.6) (all same sign)	847 (1268) (all same sign)	448 (646) (all same sign)
11, 4 m long "doughnuts" alternating polarity, 1 m unmagnetized wall	5	538	290

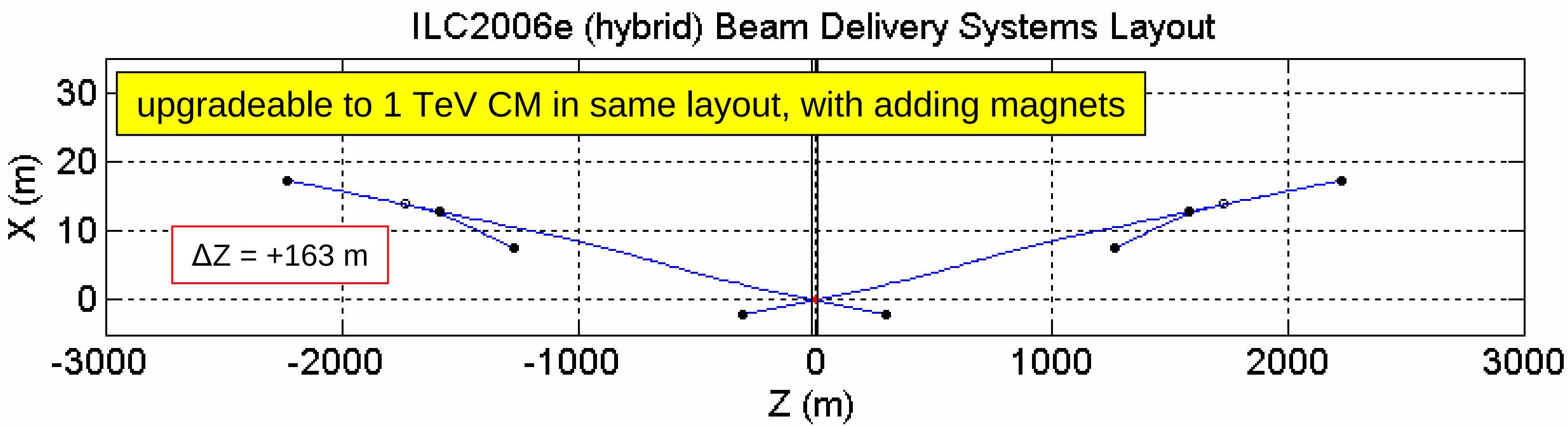
L.Keller, N.Mokhov, N.Nakao , S.Striganov

Single IR BDS design

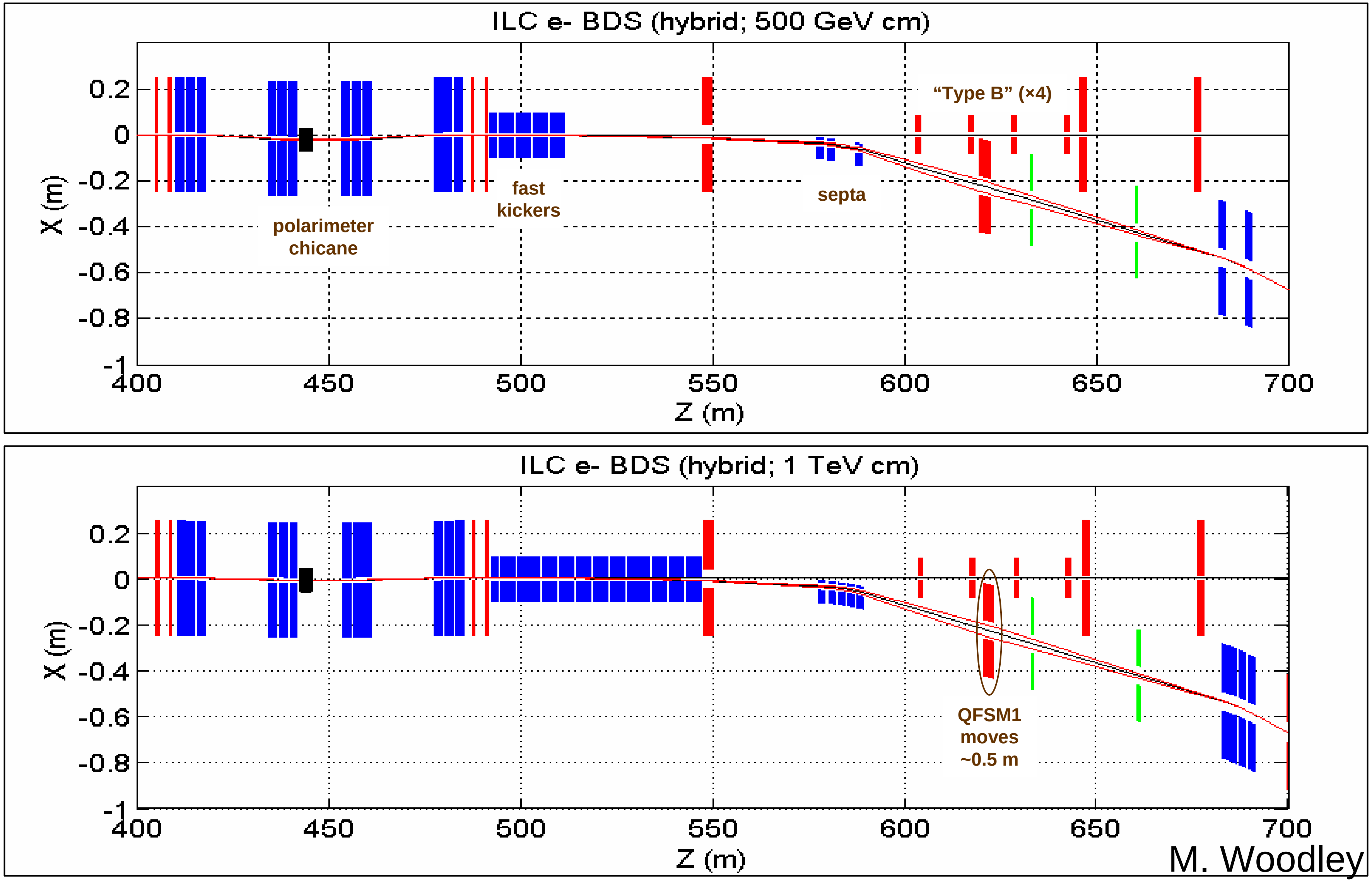
	Start to IP, m	Capabilities
Post Vancouver 14/14	2550	1TeV CM
Single IR, 2006d	2062 (-488)	Upgradeable to 1TeV CM with removal of linac and lengthening of straight part, and adding magnets
Single IR, 2006e	2225 (-488+163)	Upgradeable to 1TeV in the same layout, only with adding magnets

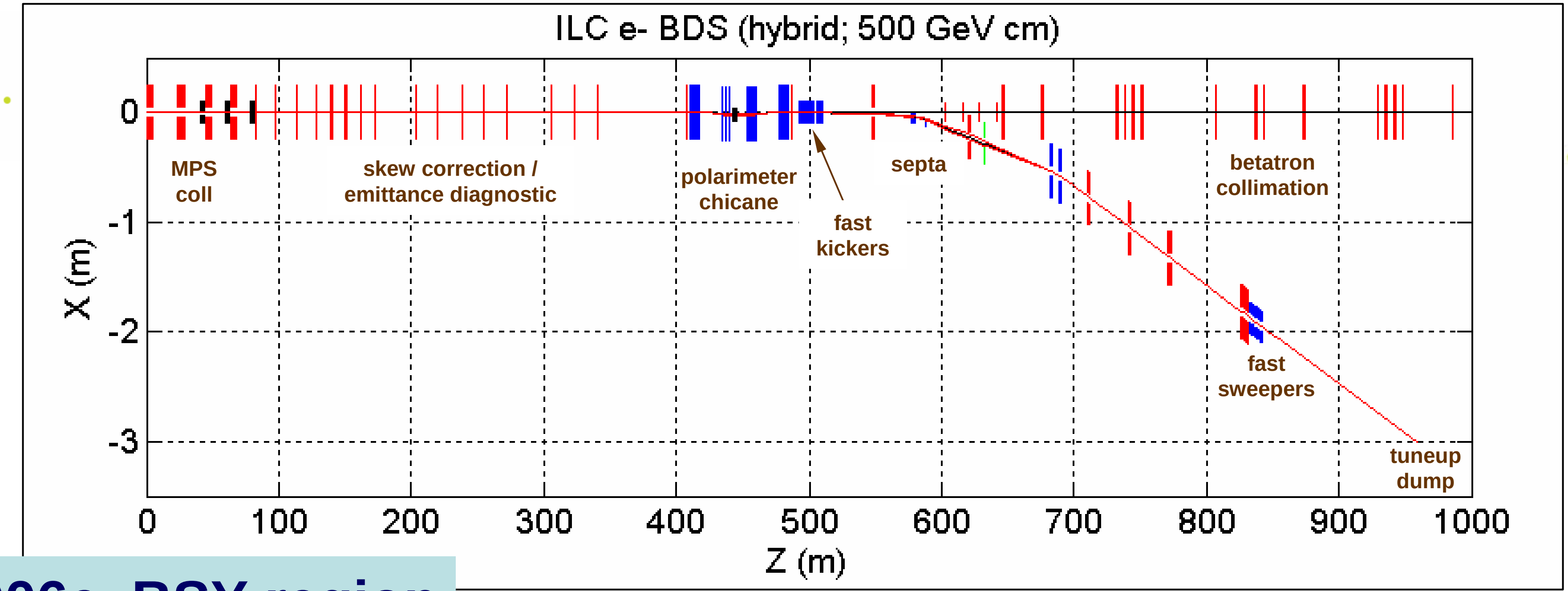

ILC2006c Beam Delivery Systems Layout
1 TeV CM capable
ΔZ = +488 m
X (m)
30
20
10
0
-3000
-2000
-1000
0
1000
2000
3000


ILC2006d Beam Delivery Systems Layout
BSY: 500 GeV CM max; FF: upgradeable to 1 TeV with adding magnets & lengthening
X (m)
30
20
10
0
-3000
-2000
-1000
0
1000
2000
3000

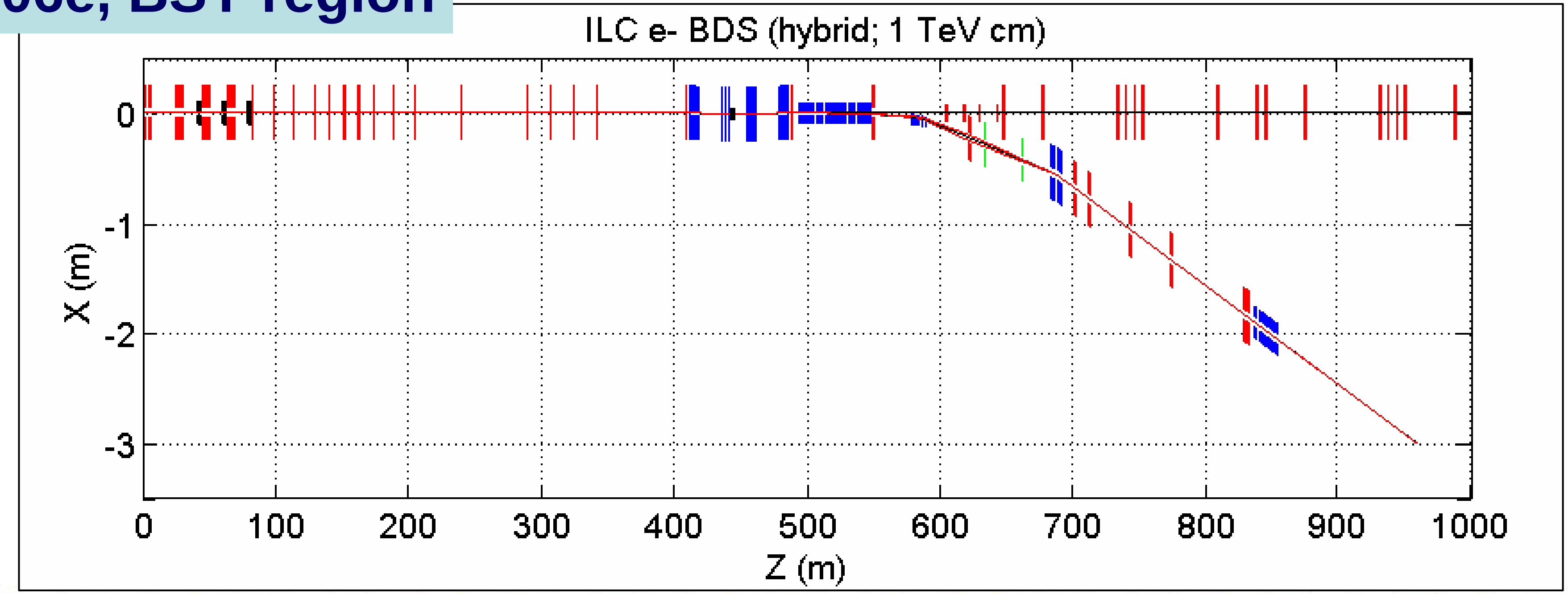

ILC2006e (hybrid) Beam Delivery Systems Layout
upgradeable to 1 TeV CM in same layout, with adding magnets
ΔZ = +163 m
X (m)
30
20
10
0
-3000
-2000
-1000
0
1000
2000
3000
Z (m)

500GeV => 1TeV CM upgrade in BSY of 2006e





2006e, BSY region



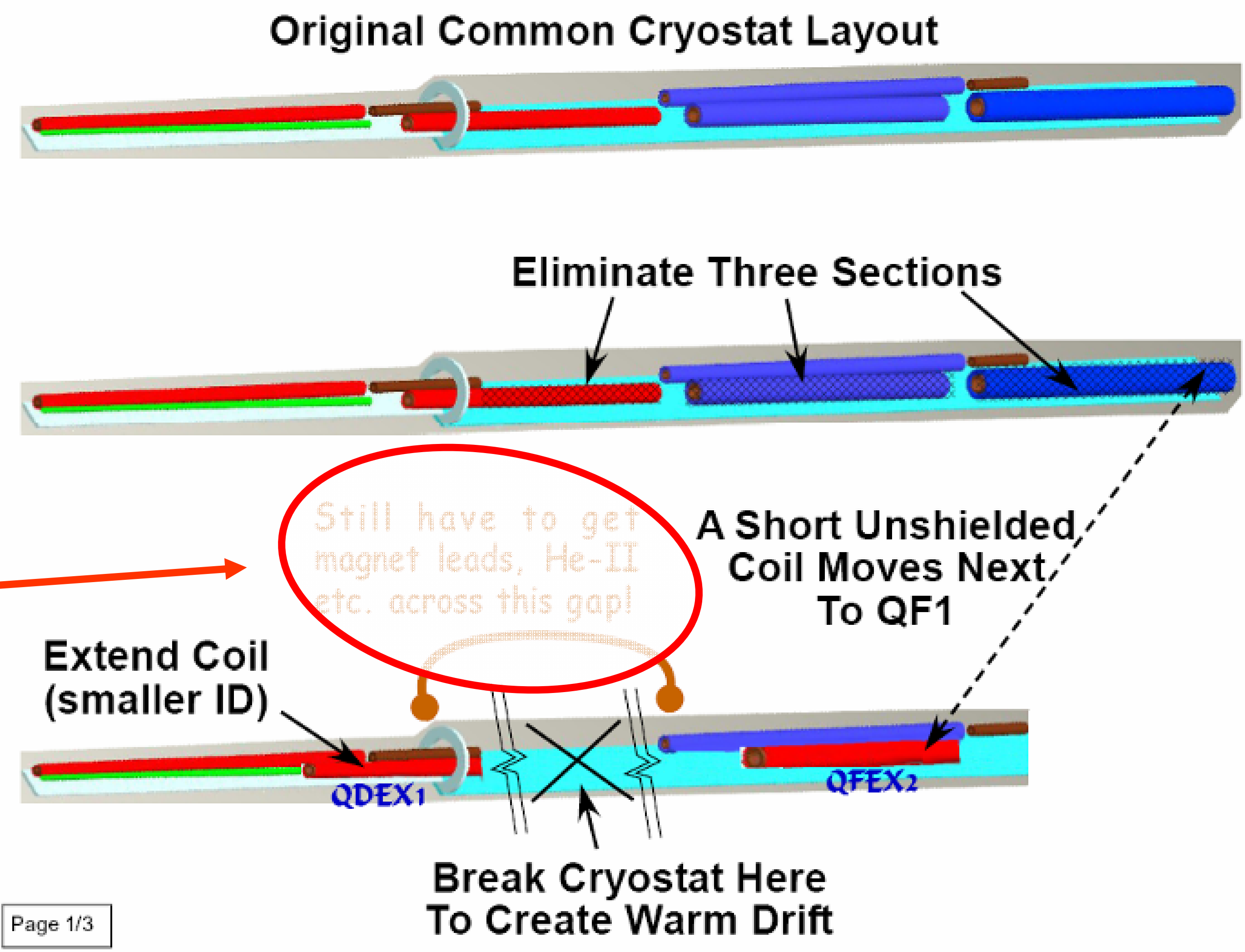
Performance risks in 2006d

- Critical performance – achieved size of laser wires that are used for beam measurements and tuning the BDS
- In baseline design so far the assumption was:
  - **laser spot size is 1micron (very aggressive) to be achieved at 1TeV CM (for DR emittance), after a lot of work done in 500GeV CM**
- In 2006d, assume 1micron laser size at 500GeV CM (DR emittance) → performance risk
  - **1.4 micron in 2006e is closer to performance expectations**
- Needless to say about real difficulties of E upgrade

Cost difference of 2006e and 2006d

- 2006e is 2225m from start to IP, or by 163m longer than 2006d
- In this 163m, have the same magnets, instrumentation, etc., as in “d”
- Additional cost in “e” is vacuum chamber and tunnel itself and for 2*163m the total additional cost is small
- Suggestion – although “d” is shorter, the cost saving are small and may not worse the increased performance risk
- Plan to use 2006e for next round

* B.Parker, Y.Nosochkov et al. (see ref for details)
* In further discussion realized that this connection should not be used, to allow quick move
* The QD0 part of cryostat will be connected to part of cryo system (2K) attached to detector



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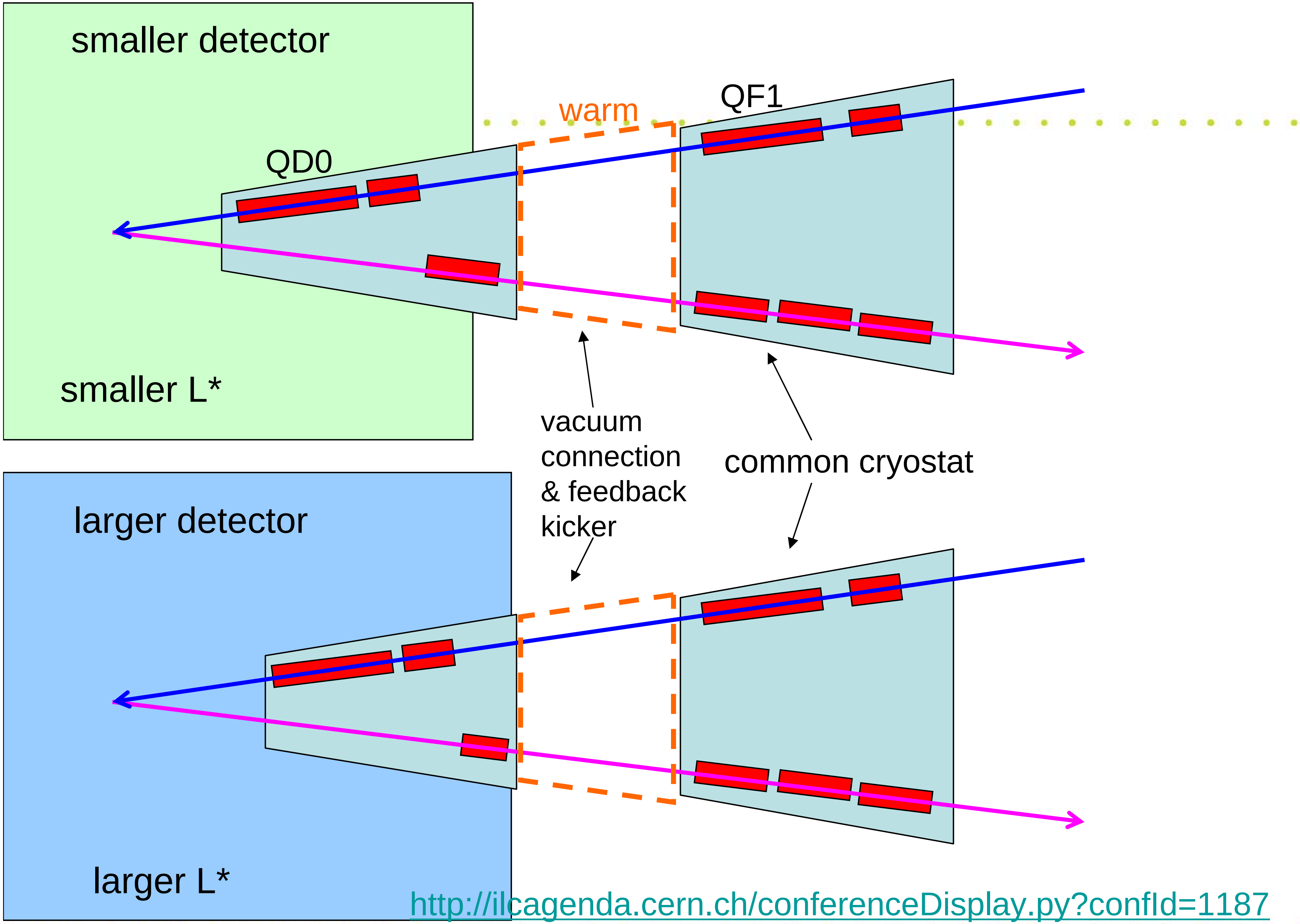
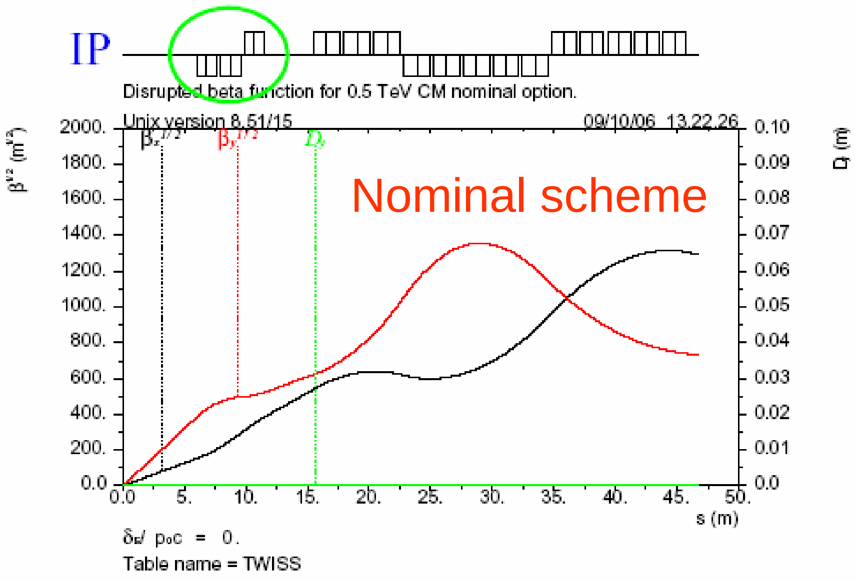


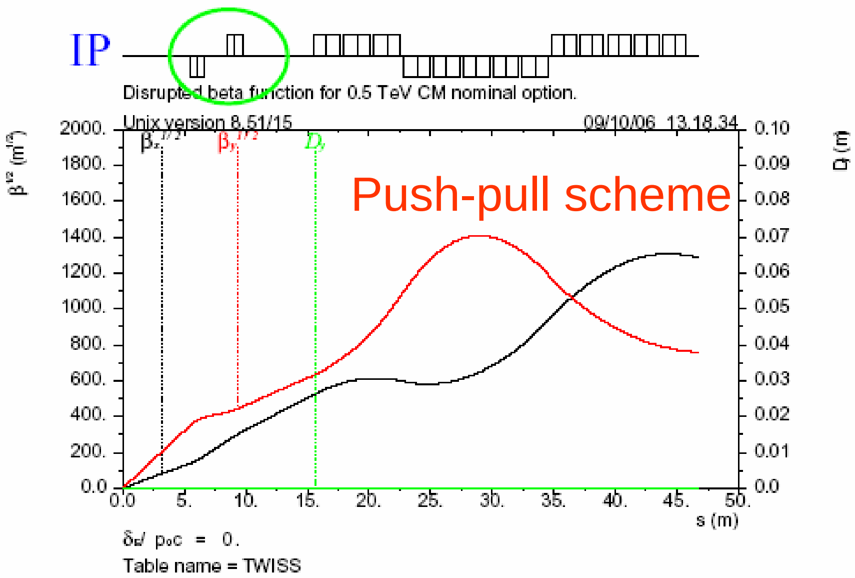
http://ilcagenda.cern.ch/conferenceDisplay.py?confId=1187

New optics for extraction FD

- B.Parker, Y.Nosochkov et al. (see ref for details)
- Rearranged extraction quads are shown. Optics performance is very similar.
- Both the incoming FD and extraction quads are optimized for 500GeV CM.
- In 1TeV upgrade would replace (as was always planned) the entire FD with in- and outgoing magnets. In this upgrade, the location of break-point may slightly move out. (The considered hall width is sufficient to accommodate this).

Extraction quadrupoles near IP





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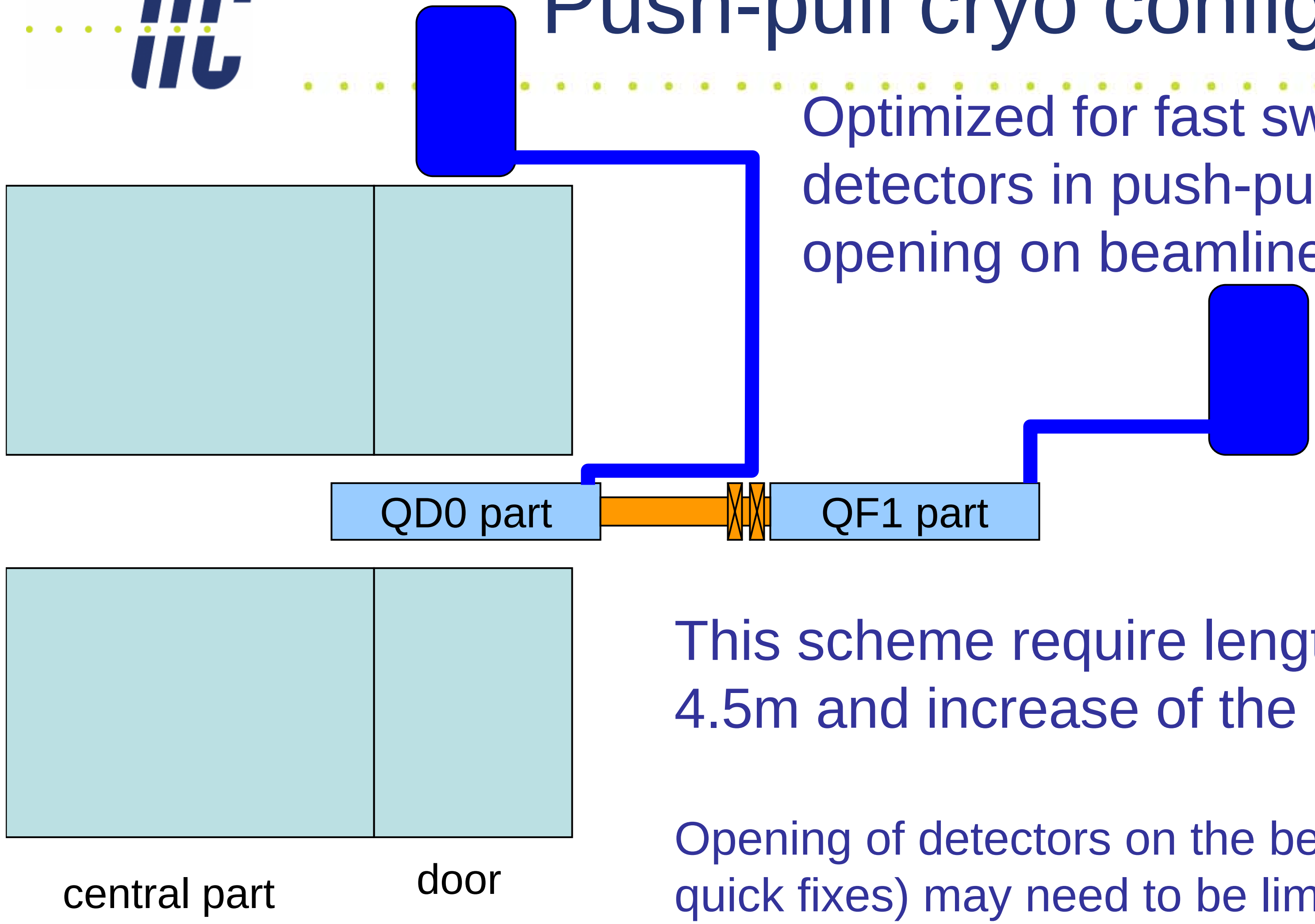
Push-pull cryo configuration C

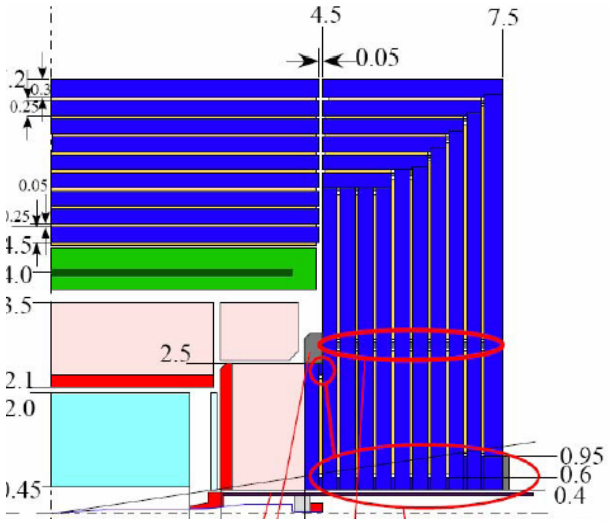


Optimized for fast switch of detectors in push-pull and fast opening on beamline

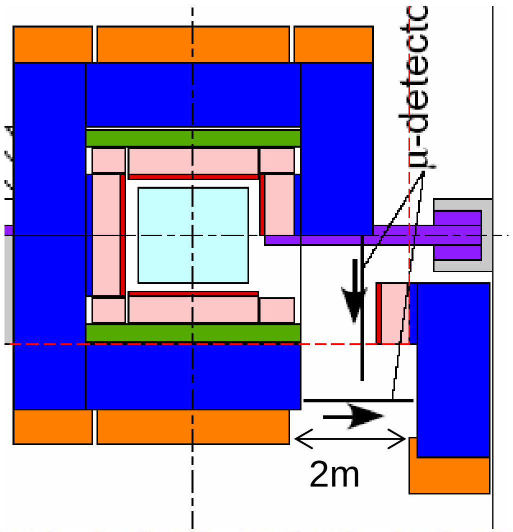
This scheme require lengthening L* to 4.5m and increase of the inner FD drift

Opening of detectors on the beamline (for quick fixes) may need to be limited to a smaller opening than what could be done in off-beamline position

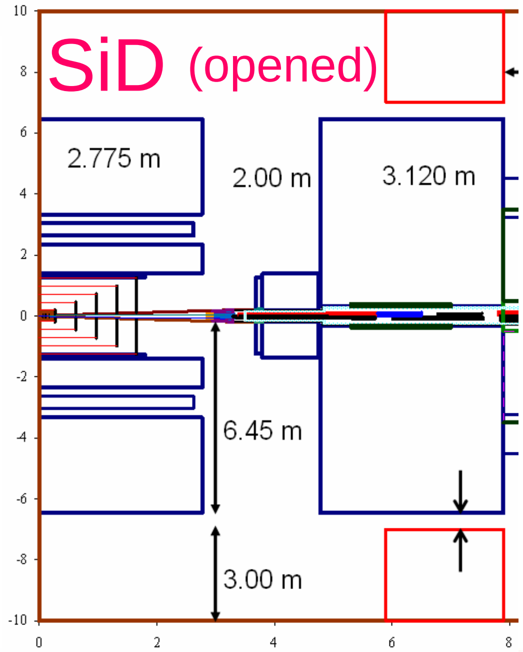
Detector sizes & opening on beamline



GLD



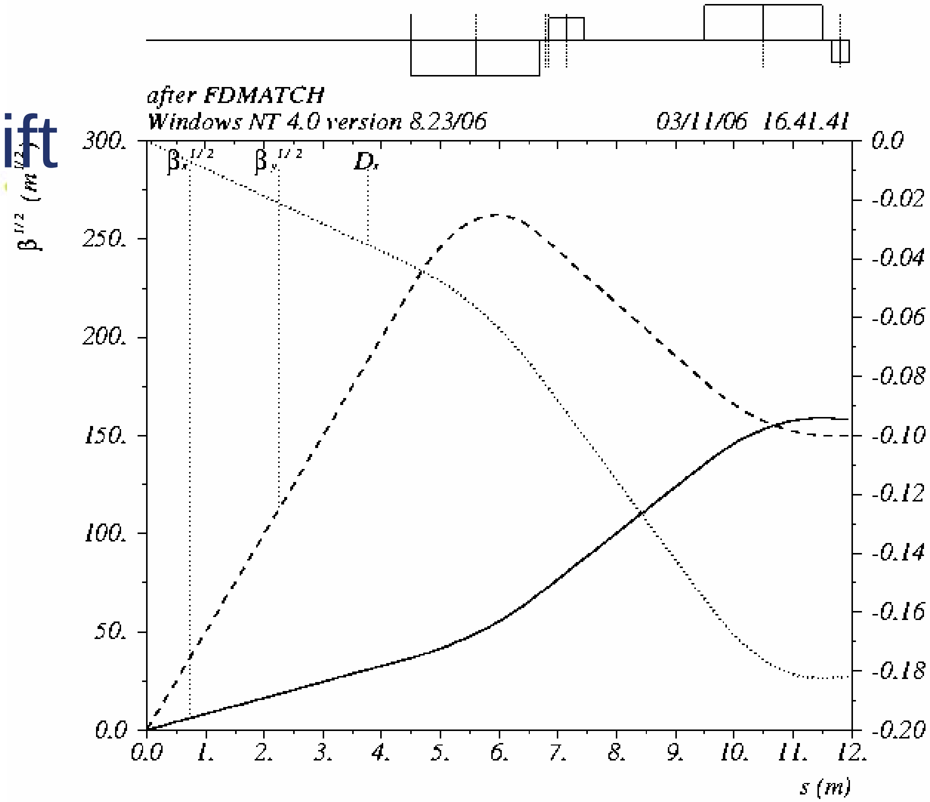
	SiD	GLD
IP	0	0
End of detector	5.9	7.5
Desired opening	2	2.5
Warm section need to end after z=	7.9	10
Reduced opening for fast fixes	2	1.5
Warm section need to end after z=	7.9	9

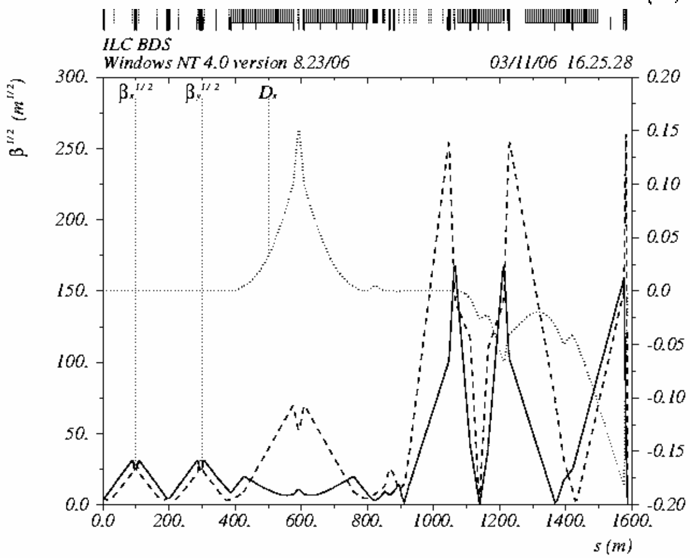


Since opening of detectors on the beamline is intended only for quick fixes, the required width for opening may be smaller that for opening off-beamline

FD with L*=4.5m & lengthened warm drift section by +0.7m

IP	0	0
D0	4.5	4.5
QD0	2.2	6.7
D1A	0.15	6.85
SD0	0.6	7.45
warm start	0	7.45
warm end	2.05	9.5
cold start	0	9.5
QF1	2	11.5
D1C	0.15	11.65
SF1	0.3	11.95





Detector opened on beamline (GLD opening reduced to 1.5m) still leaves 0.5m of not-overlapped space for config.C

Single BDS & central DR