SuperB

EMC

Michel Lebeau

Oct. 07, 2009

c/o C.Cecchi

Summary

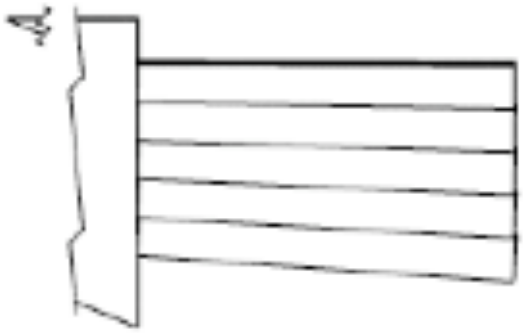
1. Proto alveolar module status
2. Off-pointing geometry (discussion)
3. Boundaries
4. Space for services
5. Support structure (reminder)
6. Cooling and thermal regulation
7. Monitoring

1. proto alveolar module status

- Survey of companies since July (draft spec)
- production method suggested
- **Technical spec version 8 available**
- Complete geometrical definition
- Based on crystal dimension table of 2008 05 27, rings 6 to 10, x 5 rows
- Spec sent 2009 09 24 to comp. A and B (composite specialists)
- **Prod. dwgs complete (Perugia) 2009 09 28**

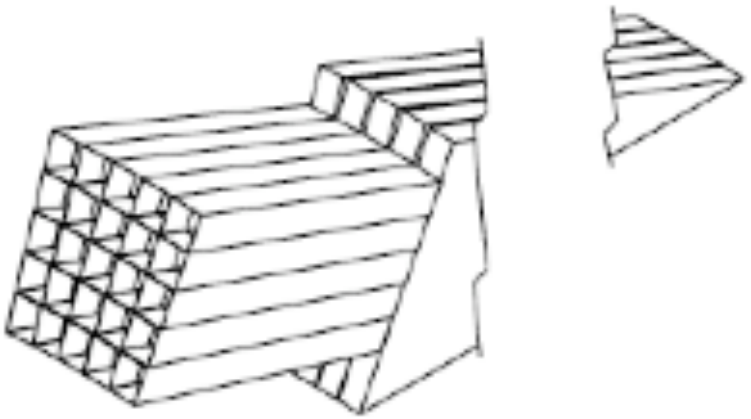
proto alveolar production drawings complete (Perugia) 2009 09 28

side

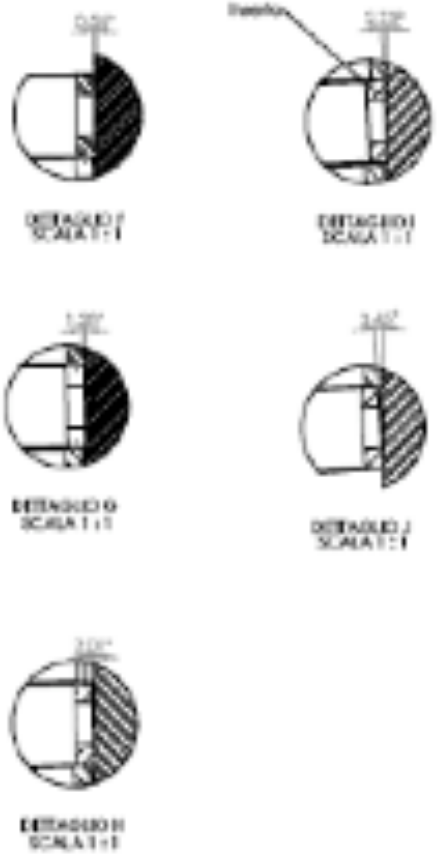


top

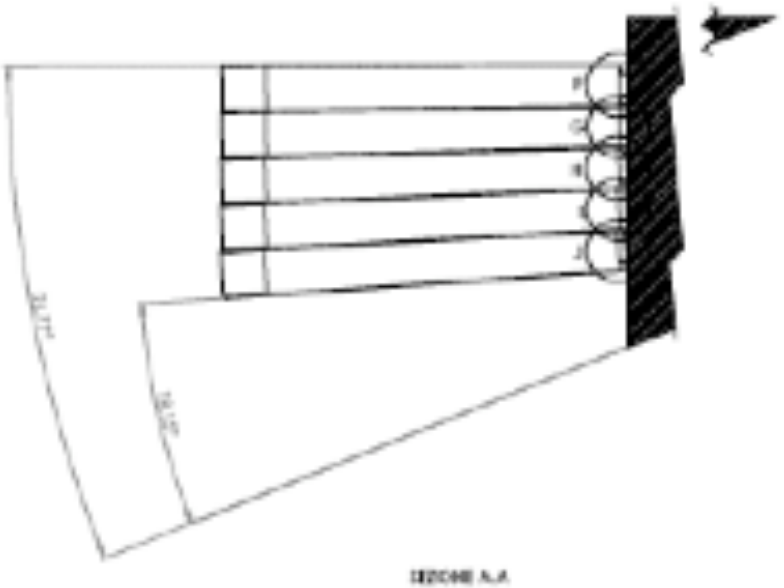
3-D



proto alveolar production drawings
detail of assembly



detail of inserts

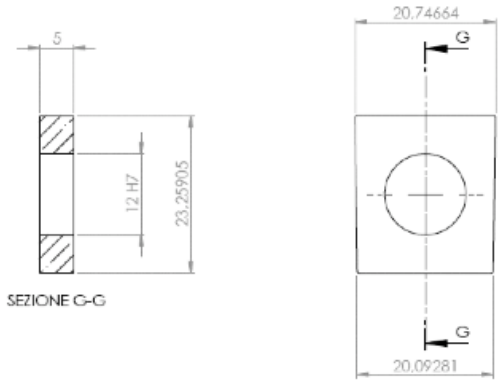


section through 1st row

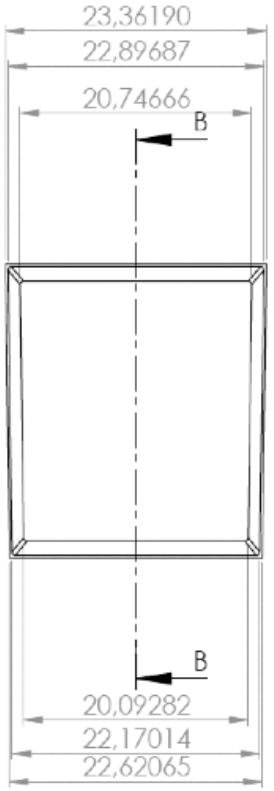
view from rear

proto alveolar production drawings detail of cell

cell longitudinal section



detail of insert



view from rear

proto status company A

- Visited ML at CERN 2009 09 15
- preparing an offer for this week
- Offer based on updated spec
  - from Spec draft V.6 to spec V.8
  - No need for final dimensions for offer

proto status
company A

- Schedule proposal if offer accepted
- Offer sent end *these days*
- Order mid-October
  - with Perugia's production drawings in time
- Design review and production start OK end-October
  - Tooling 6 weeks (mid-December)
  - Wrapping, curing, finishing 3 weeks
  - Finished alveolar inspection at company mid-January to February

proto status company B

- interested but …
  - Big aerospace consortium
  - Produced CMS ECAL alveolars (good)
  - cautious until convinced it is not just to see
  - A visit there is needed
  - Put on back-burner for full structure if offer for proto not in time or not in budget

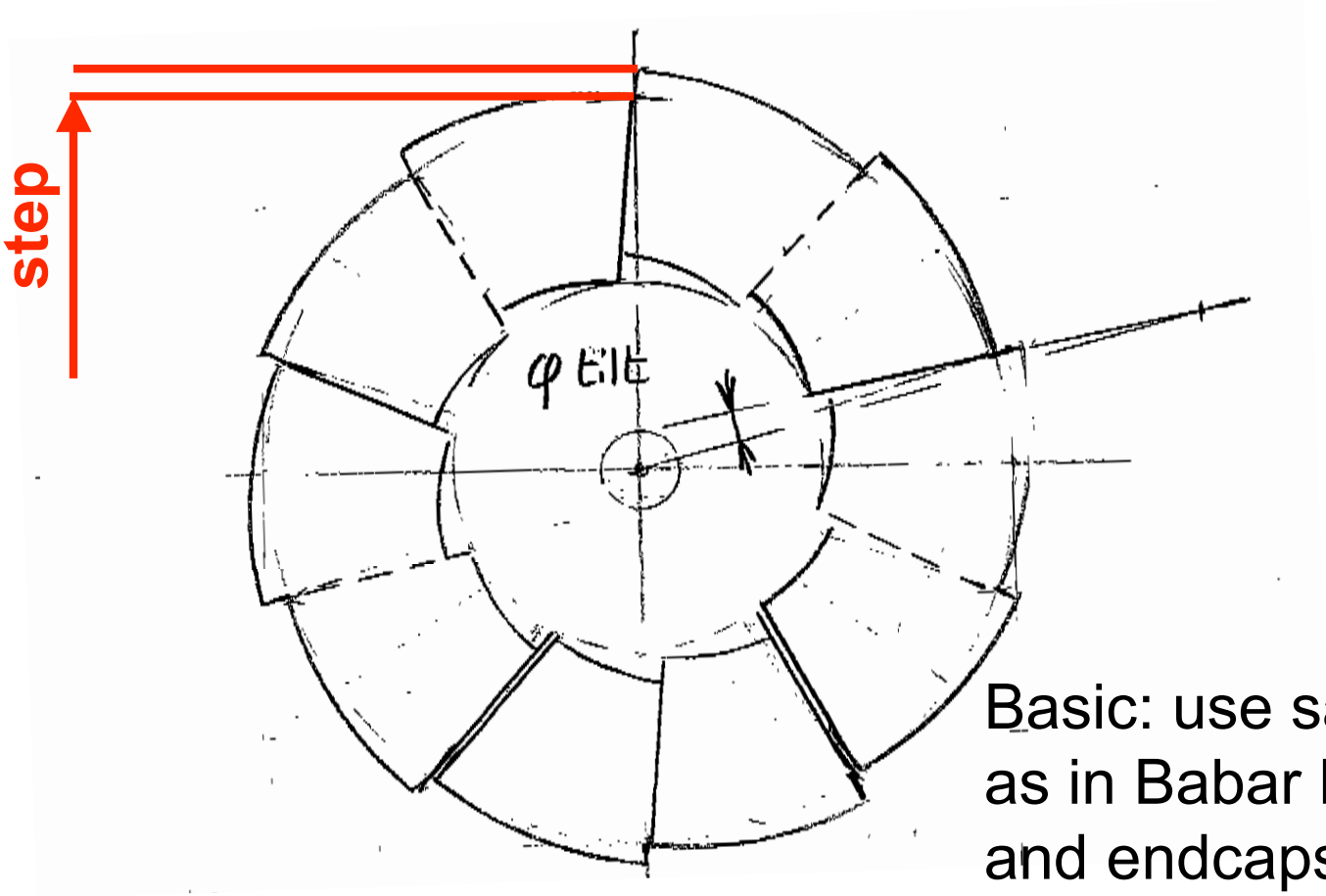
2. Off-pointing

(complete detector)

- ϕ tilt
- θ tilt
- Z offset
- multi-points on circle
- Pointing precision

This discussion can be postponed to specialits' meeting

Off-pointing geometry (ϕ tilt)



Basic: use same concept as in Babar barrel, L3 barrel and endcaps, i.e. pointing to points on a circle, **geometrically correct**

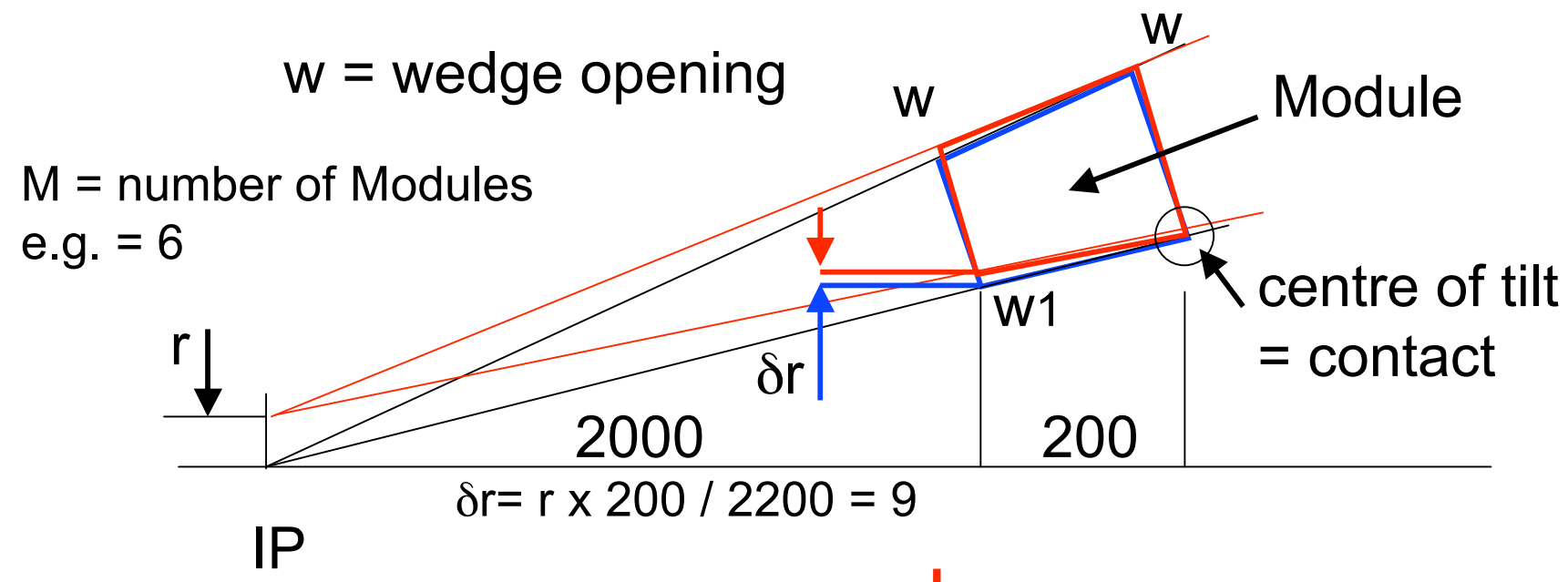
Off-pointing (ϕ tilt)

- Needs fine modularity to avoid high steps and dead space
  - L3 modularity 16
  - Babar modularity 20
- In SuperB endcap, max. possible modularity (as suggested) = 6
- **Step would be about 50mm!**

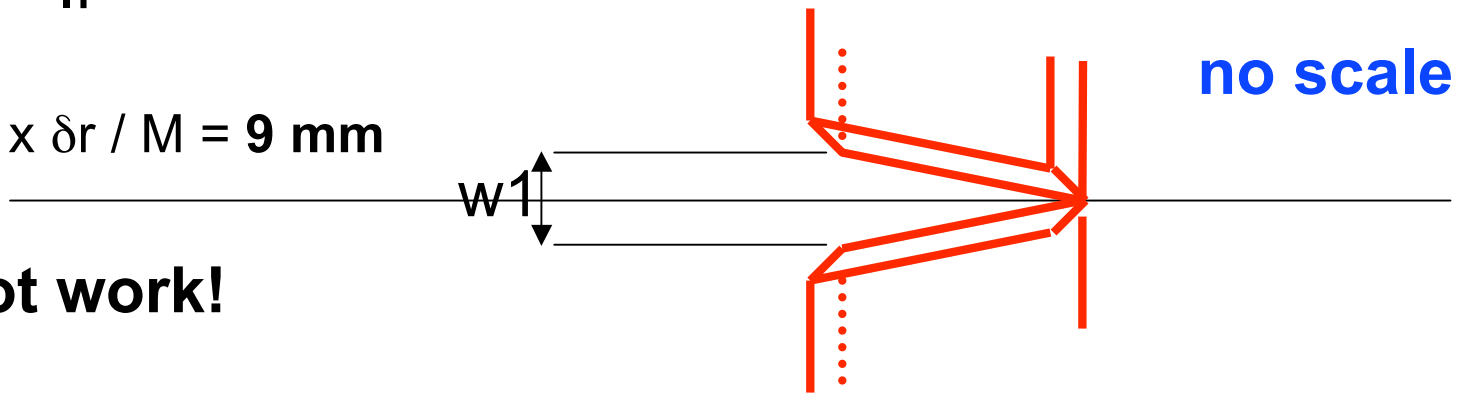
Off-pointing approximation by module θ tilt

- Build modules as pointing to IP
  - Polyhedral pyramids, summit = IP
  - Easy geometric definition and production
- tilt each module upright
- Module original centre brought to circle
- Tilt (θ rotation) creates a wedge gap between modules
- wedge thickness ⇓ with modularity ⇑

Off-pointing approx by θ tilt



w1 = 2 π x δr / M = **9 mm**



no scale

Cannot work!

Off-pointing approximation: exact pyramid centre Z offset

- endcap built as an exact pyramidal polyhedron
- Its summit is at a given Z distance from IP
- What is the projection spread at IP?

Off-pointing approximation:

r average assumed 50mm

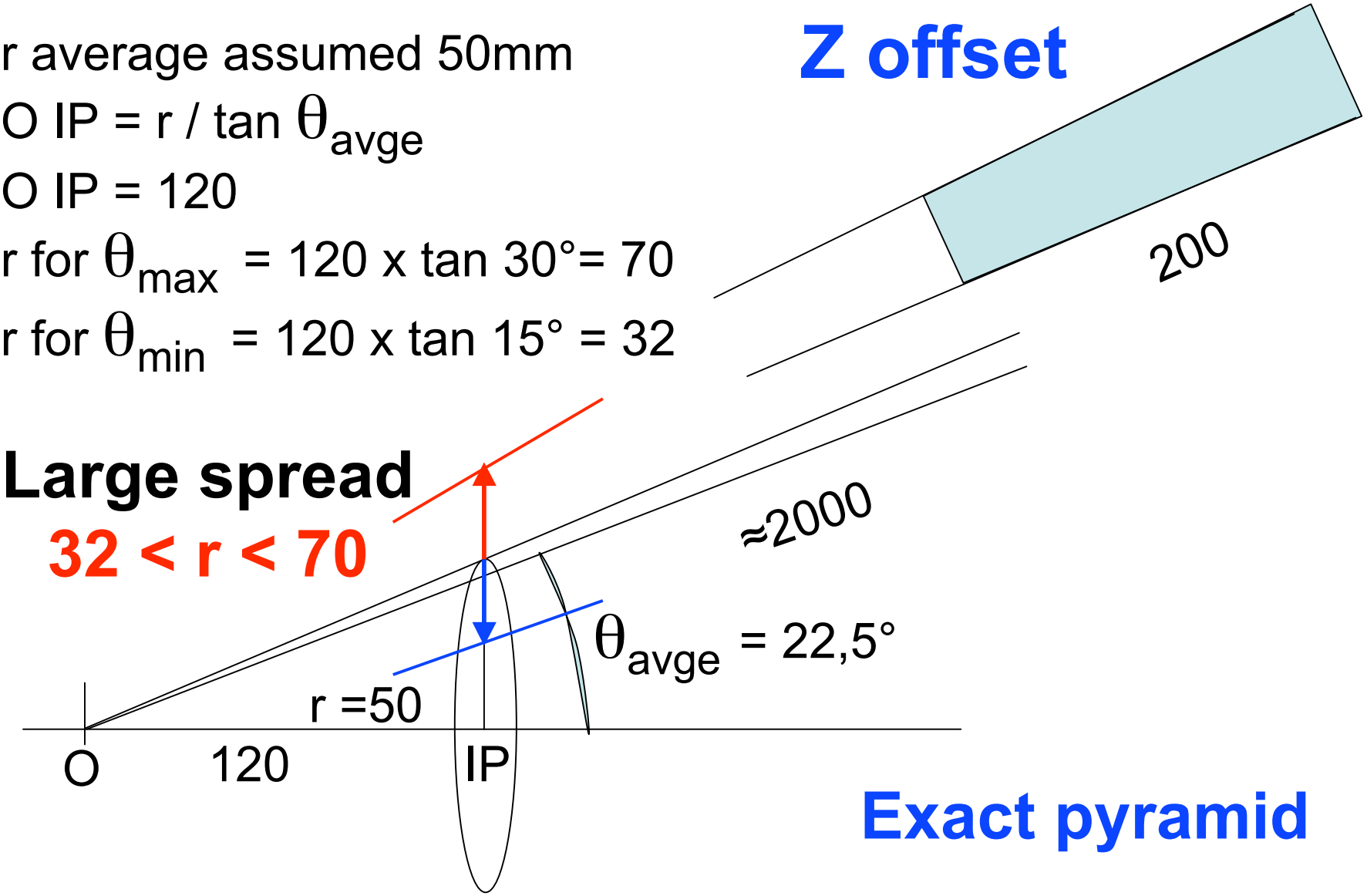
O IP = r / tan θ_{avge}

O IP = 120

r for θ_{max} = 120 x tan 30°= 70

r for θ_{min} = 120 x tan 15° = 32

Z offset



Large spread

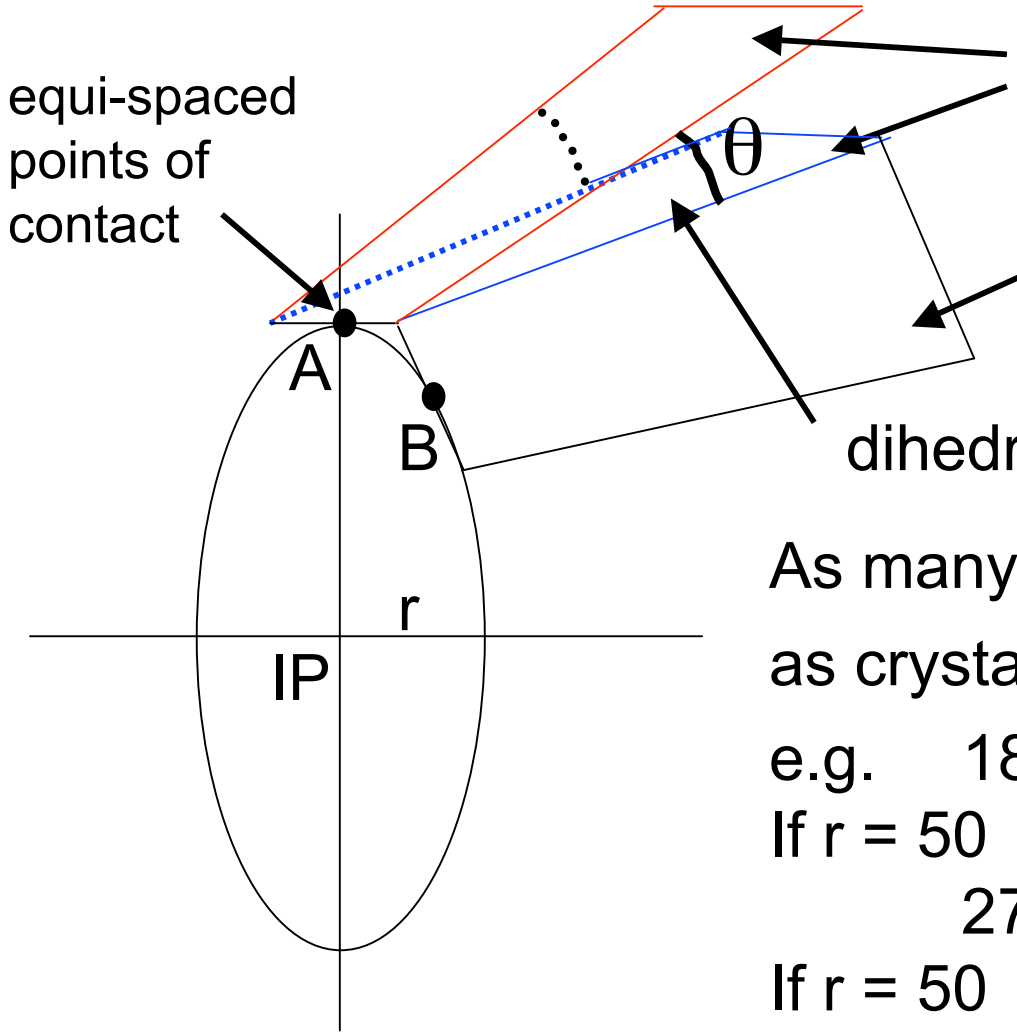
32 < r < 70

Exact pyramid

Pointing to circle

- Alveolar θ and ϕ middle planes point to equi-spaced points on the pointing circle

Pointing to circle in θ



θ planes

dihedron θ angle of one crystal

As many contact points ●

as crystals in ϕ

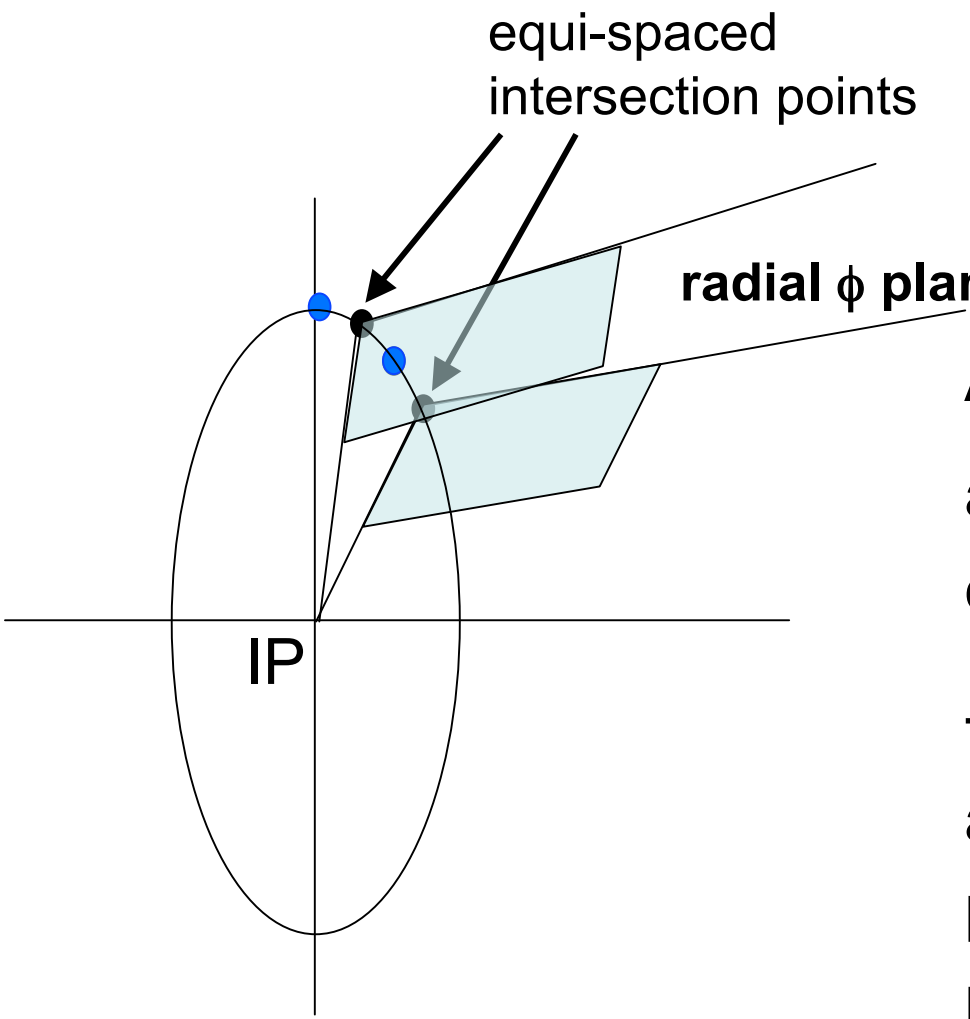
e.g. 180 for rings 1 to 5

If r = 50 AB = 1,745

270 for rings 16 to 20

If r = 50 AB = 1,165

Pointing to circle in ϕ



ϕ planes

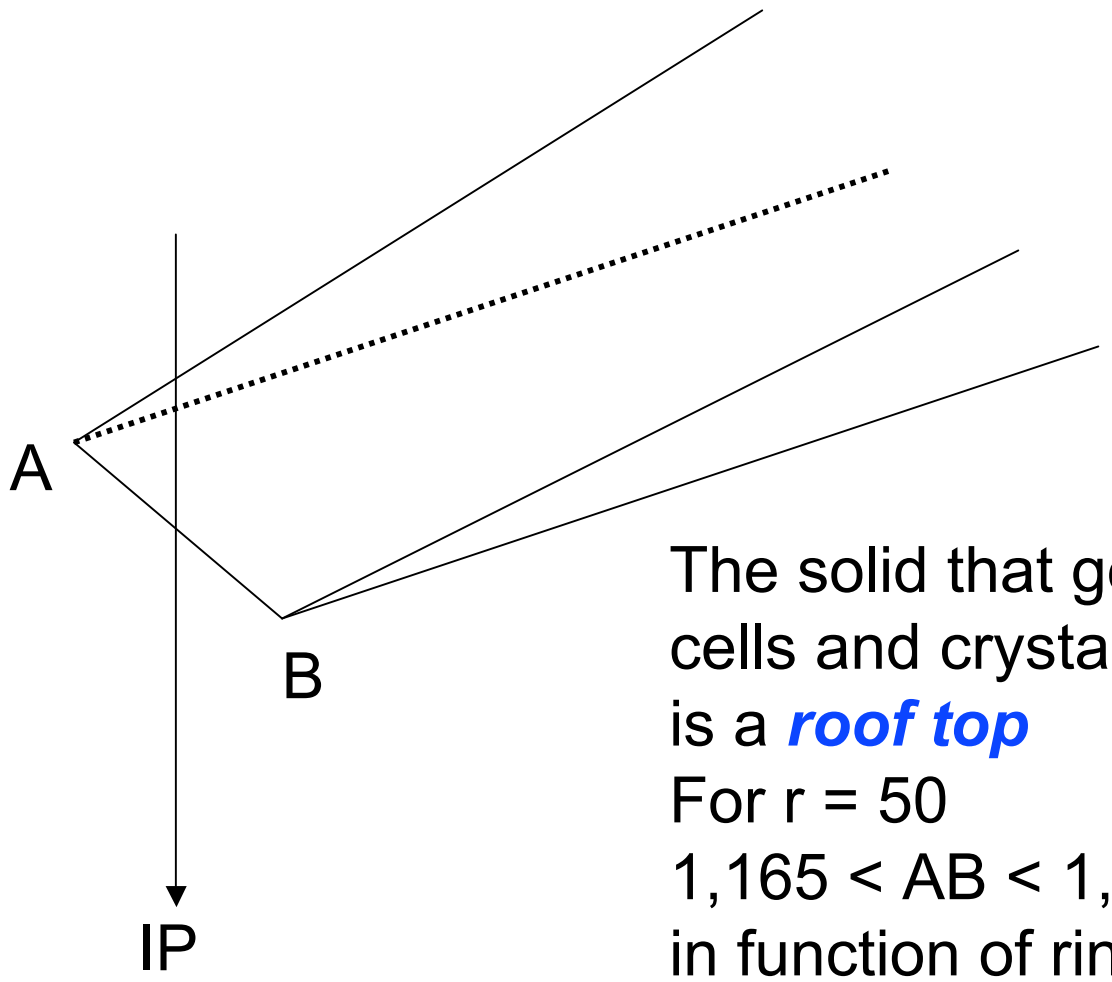
As many ϕ planes

as crystals in ϕ

e.g. 180 for rings 1 to 5
270 for rings 16 to 20

The intersection points ● are alternated with the points of contact ● of the θ planes

Pointing to circle



The solid that generates cells and crystal shapes is a ***roof top***
For r = 50
1,165 < AB < 1,745
in function of ring

Off-pointing errors from xals and alveolar tolerances

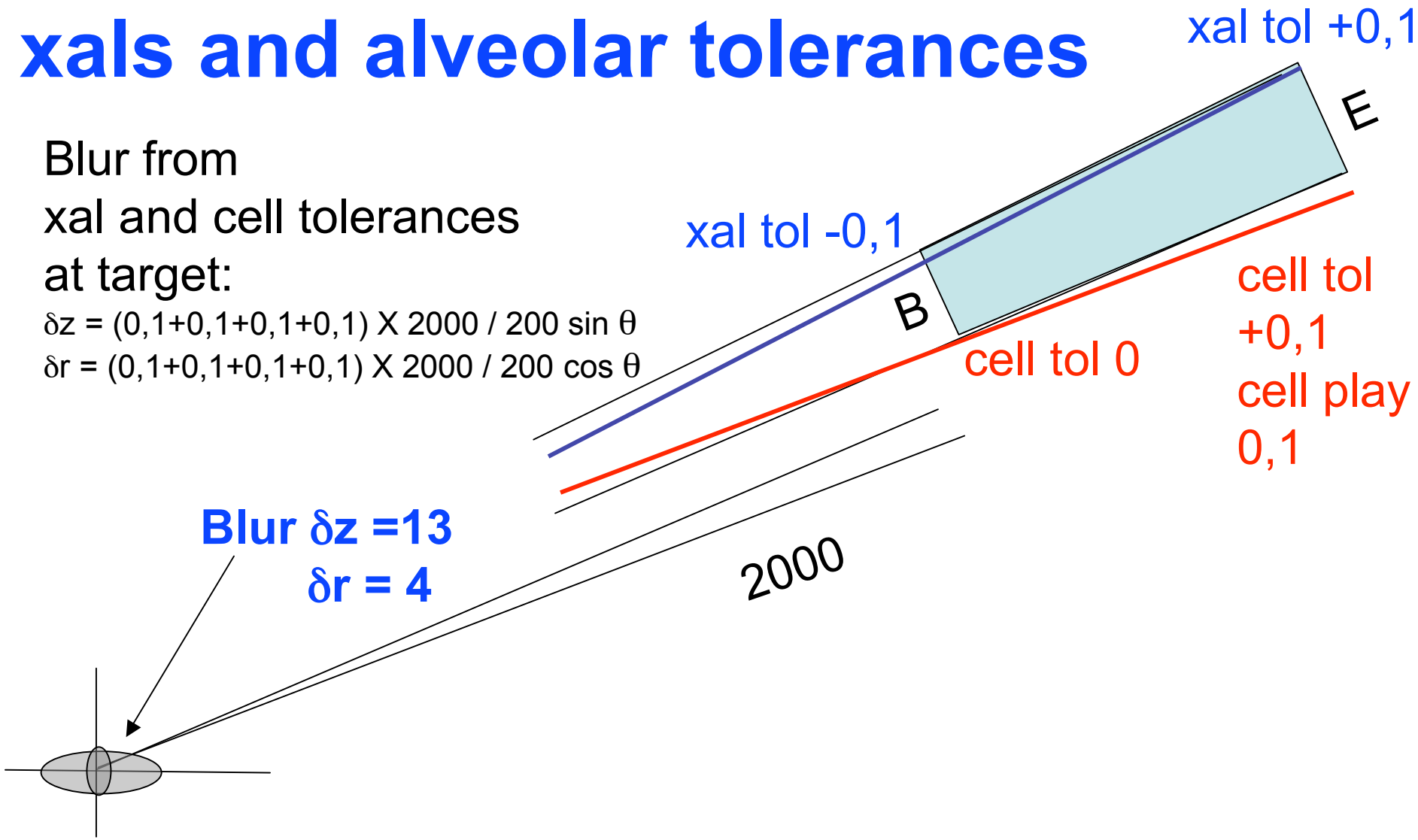
- Whatever the chosen tolerances in alveolar dimensions, crystal dimensions and position in their cell produce an error in pointing

Off-pointing errors from xals and alveolar tolerances

Blur from
xal and cell tolerances
at target:

$\delta z = (0,1+0,1+0,1+0,1) \times 2000 / 200 \sin \theta$

$\delta r = (0,1+0,1+0,1+0,1) \times 2000 / 200 \cos \theta$



Off-pointing, conclusions

- **Pointing to circle** seems OK
- to be verified with CAD

- N.B. alveolar proto built *around* given crystals shapes

3. Boundaries

Boundaries

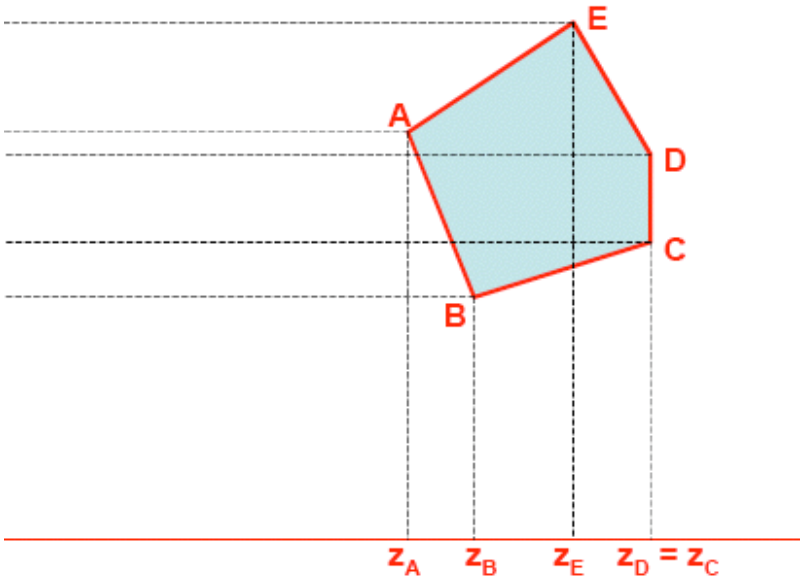
to check with other sub-detectors

- Babar barrel end cone + 5mm no-go zone
- Front cone incl. 5mm no-go zone
- Inner cone (some more freedom?)
- Rear limit (incl. 5mm no-go zone)

Basic parameters

Babar

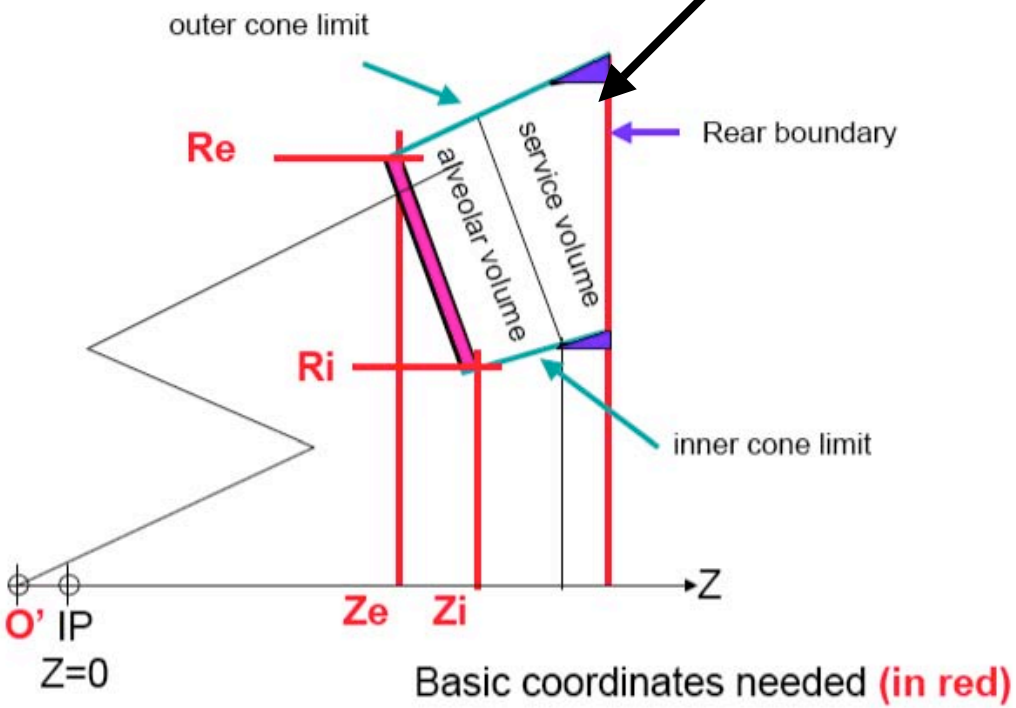
r_A="915.254079110629"	z_A="1808.9490179276"
r_B="505.747713468808"	z_B="1979.86389412623"
r_C="597.965158490213"	z_C="2318.78072095699"
r_D="758.762982134662"	z_D="2318.78072095699"
r_E="1123.3793002059"	z_E="2177.88847145028"



from S.Germani

SuperB

Ideal flat back plate



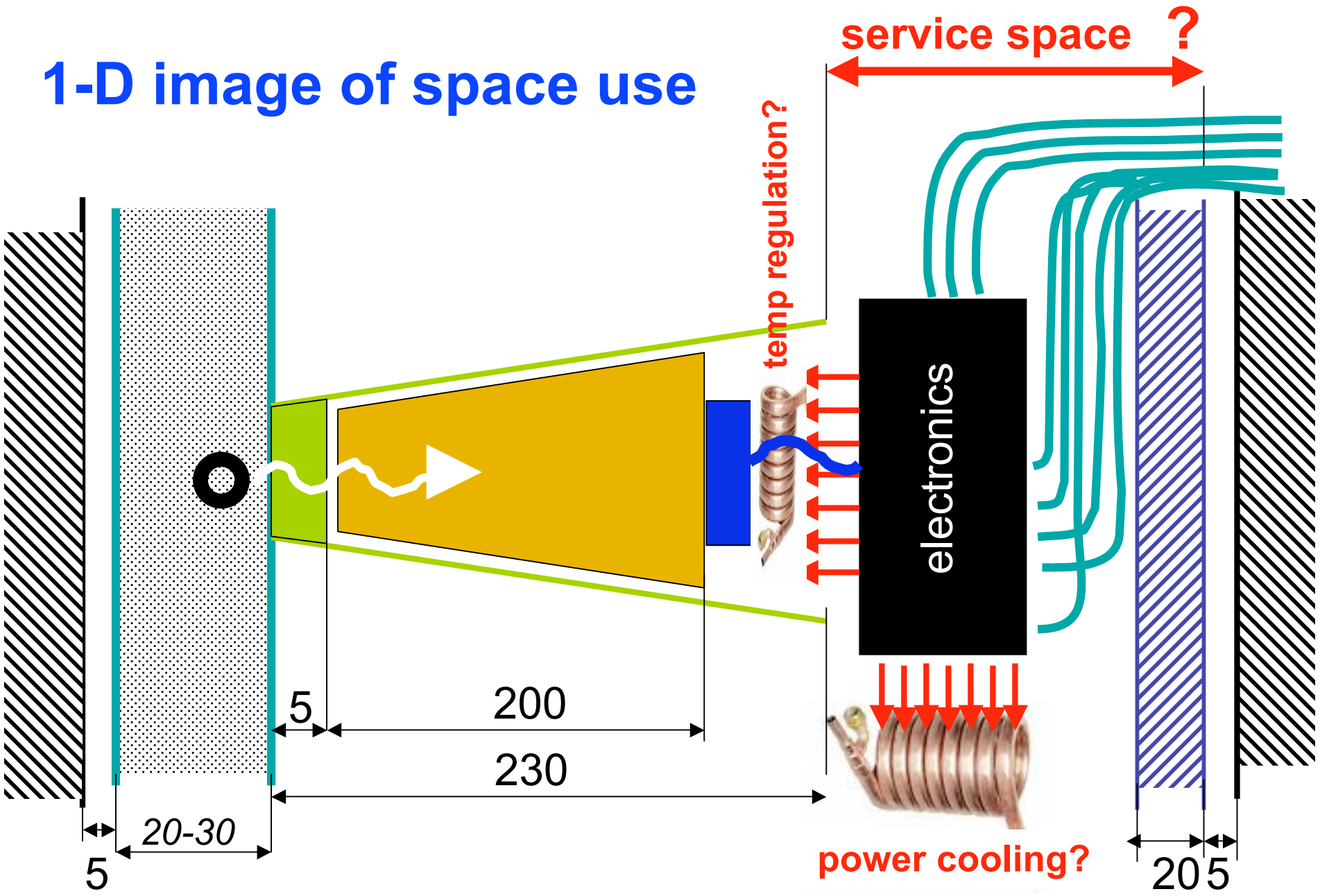
Basic coordinates needed **(in red)**

4. Service space behind crystals

Start integration exercises:
Identify a responsible person for each item

- photodetectors
- VF readout
- monitoring
- cooling for electronics
- xals & APD thermal regulation
- temp. sensing
- fluid (dew, leak) detect.
- radiation monitoring
- survey references

1-D image of space use



5. Support structure

- **Feasibility discussed with Company A**
- **Front bottom** sandwich housing calibration circuitry and alveolar positioning + mech. fixation (20 to 30mm?)
- **Outer cone** massive CFRP (5 to 10mm?)
- **Inner cone** aluminium (7000 series) or st.steel (316LN) thickness 20 to 30mm

- Solomon's choice:
  - **Solid doughnut or two halves?**

Support structure example:

L3 ECAL endcap “Kouglof”

Outer cone

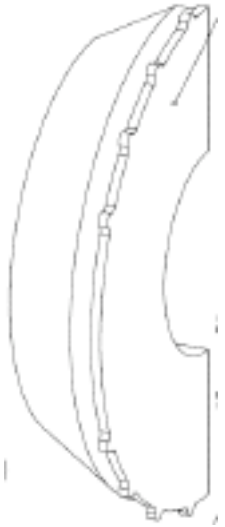
Flat bottom

inner cone

Back plate

Back plate

- frame or plate (open or closed) aluminium or st.steel
- connects inner and outer cone edges
- integrates supporting points
- matches Babar original fixation points
- This is our rear limit

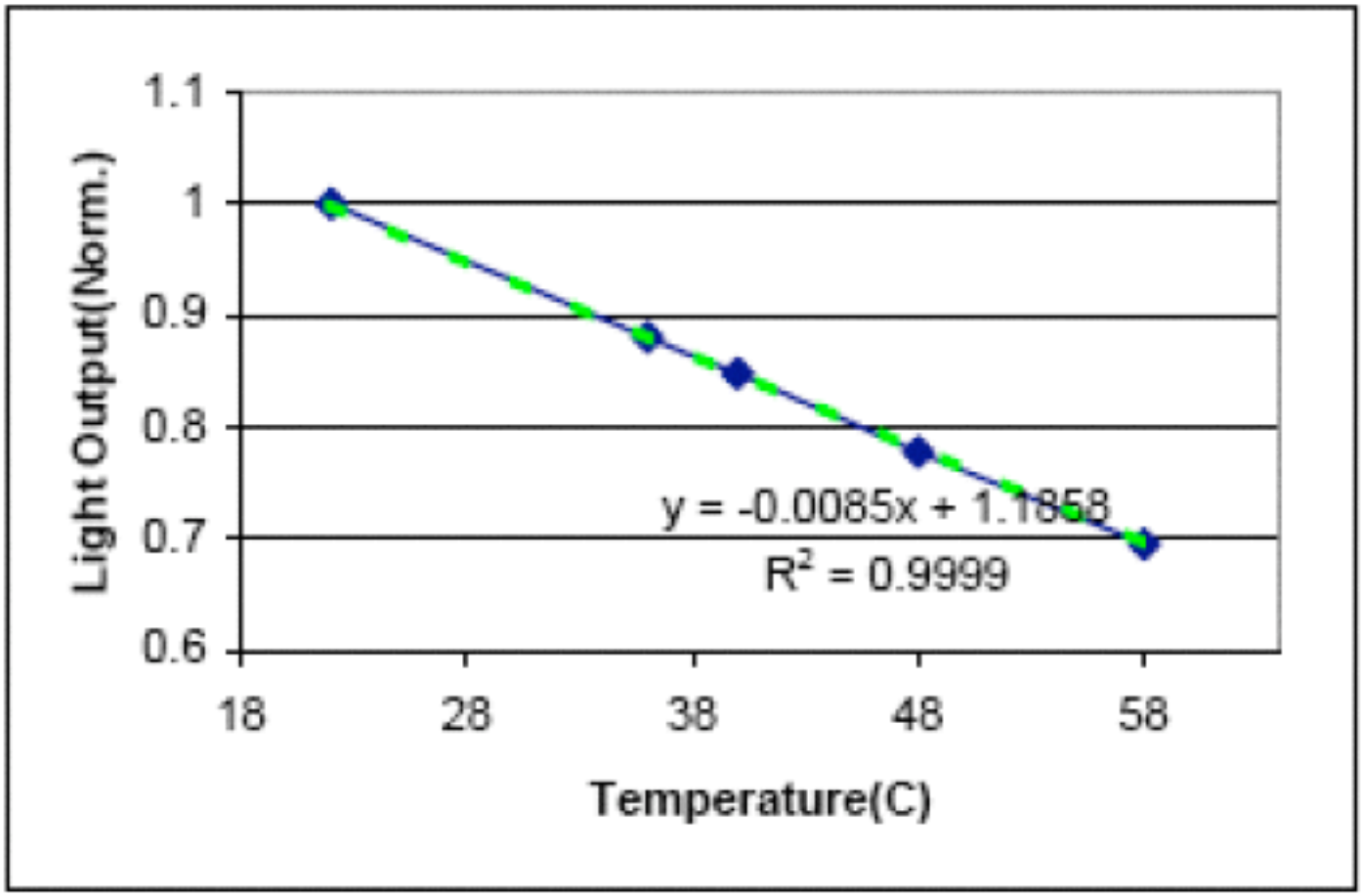


Babar

6. Cooling & thermal regulation

- Electronics cooling
  - Power dissipation?
  - Cooling to temp. order of ±2°C
- Thermal regulation
  - If regulation to temp order of |0,5°C|
  - LYSO crystals light output - 0,4%
  - Photo-detector (if APD -1,2%)

LYSO light output temp.dependence



C.L.Kim, 2005

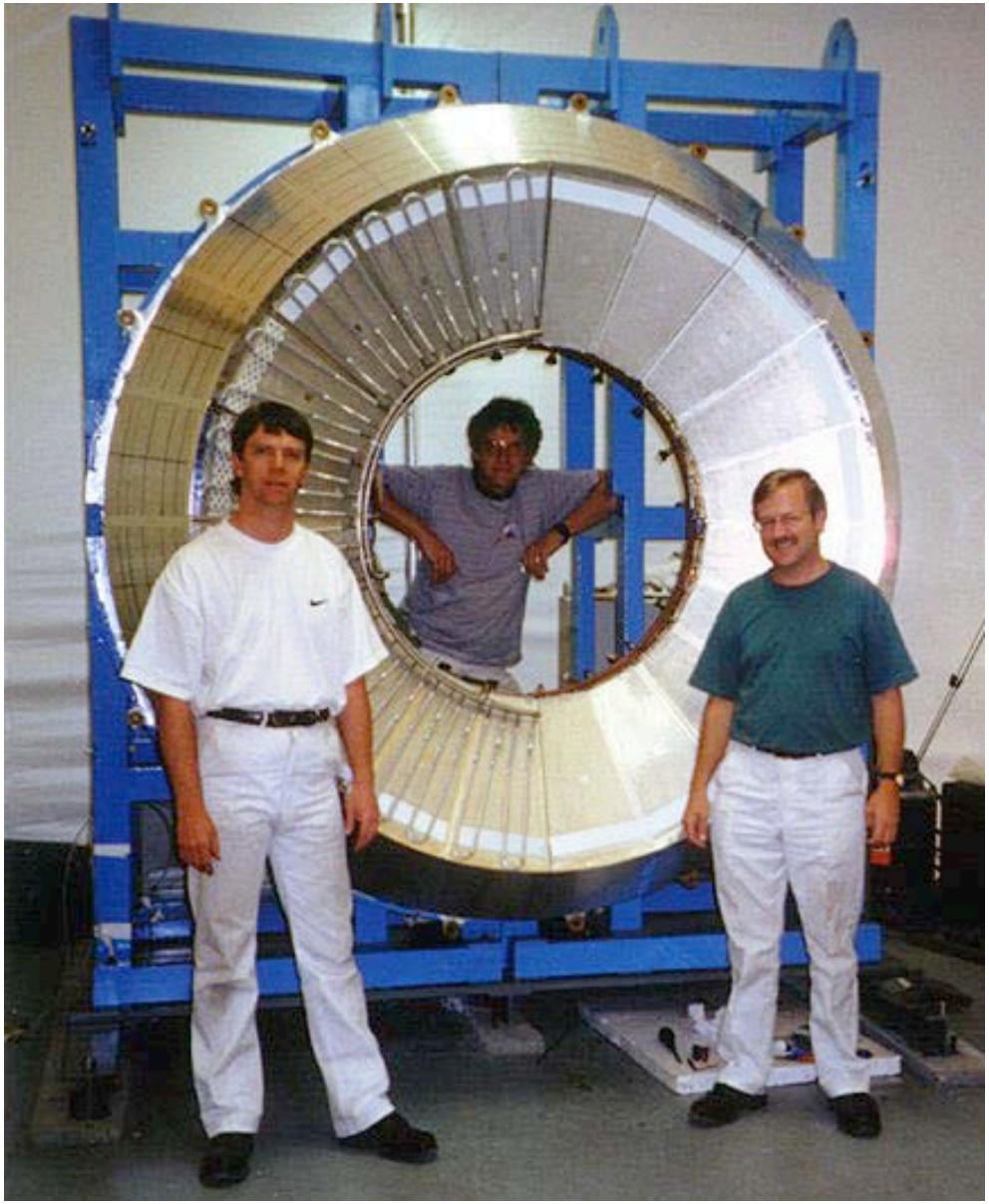
Cooling & thermal regulation

- Cooling
  - **Catch heat at source**
  - Stop heat leaks to crystals
- Thermal regulation
  - Enclose crystals and photodetectors
  - Front and rear **thermal screens**

Cooling & thermal regulation

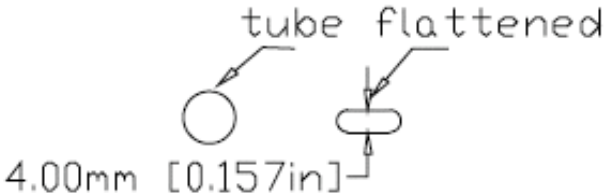
- Coolant
  - **Babar Fluorinert (FC77)**
    - Derivation from existing barrel system
    - Saving on system
  - Or demin. water
    - heat capacity x 4
    - viscosity -30%
    - Spending on system
- Best use of monitoring pipework
  - conceivable to run monitoring circuit as front thermal screen?
  - avoid doubling pipe material at the front

7. Monitoring



Babar endcap monitoring pipe work

- 40 radial loops
- aluminium alloy
- OD 9,5mm ID 8,5mm
- Flattened to 4mm

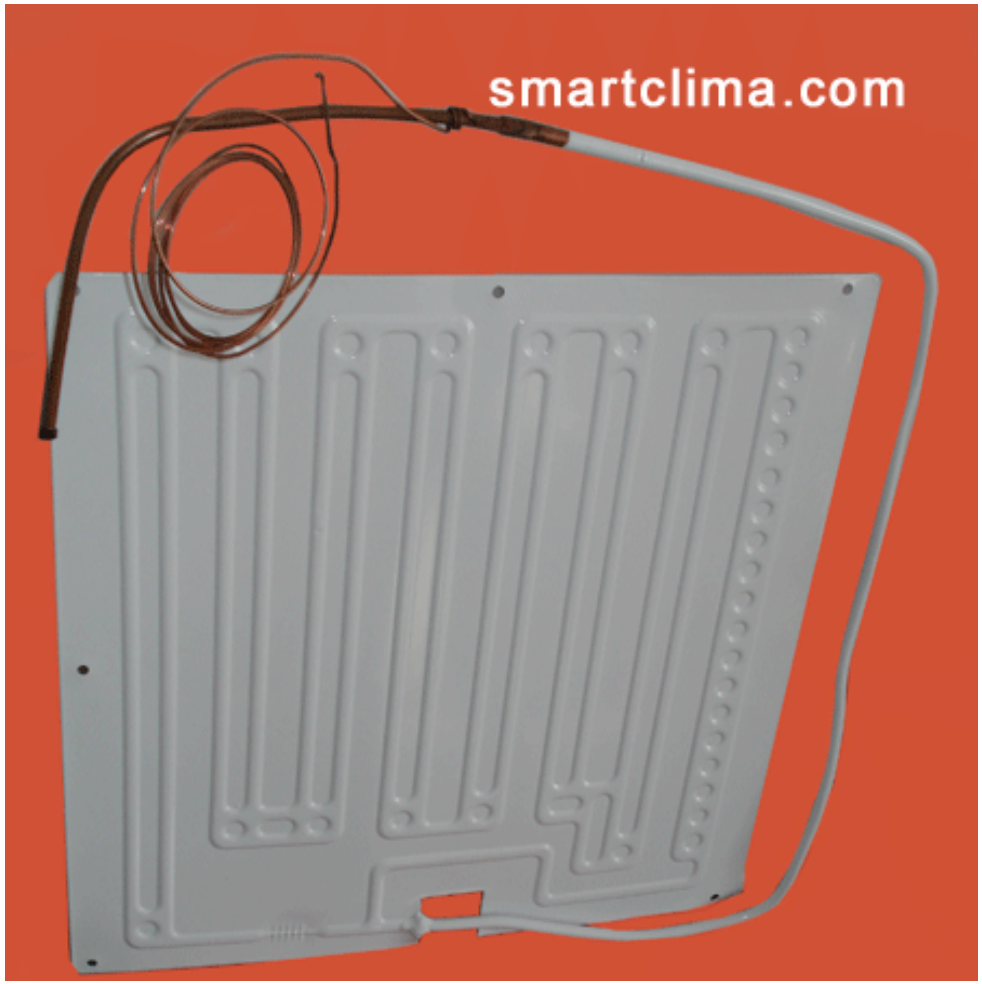


- Total pipe mass ≈10kg
- Fluid coverage 1,3 litre
- Line spacing ≈ 70mm

Monitoring

- Use as much as possible from Babar monitoring design features, but…
  - Al welding very delicate (was Babar lucky?)
  - Integrate pipe work into support front plate sandwich
- Other solutions
  - ***Rollbond*** screen as sandwich inner skin

Monitoring



Example of ***Rollbond***
fridge thermal screen
All aluminium
Typical thickness
1,3mm on flat
4 to 5mm on channels

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