STATUS on PWO crystals from Bogoroditsk for CMS-ECAL

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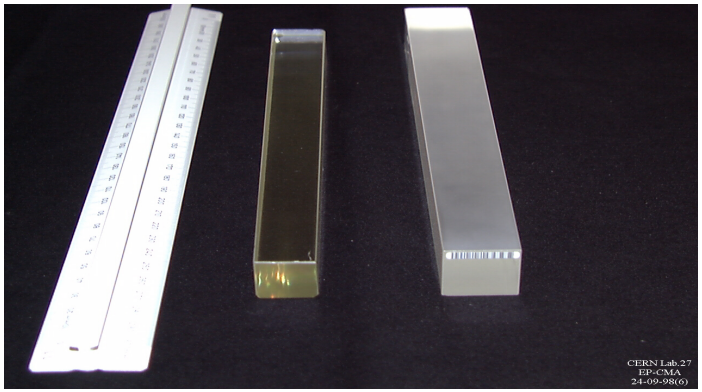
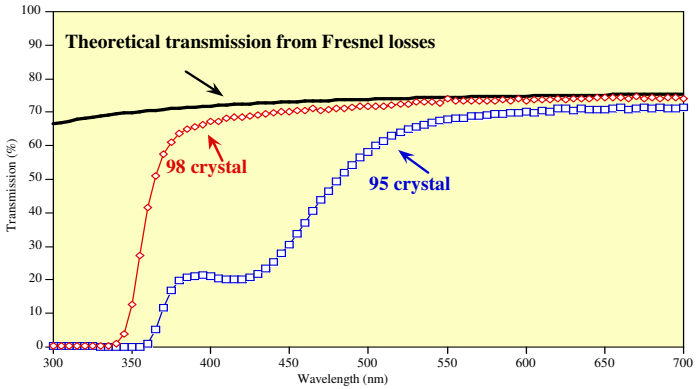
History

- 1992 Crystal2000 : 1st interest on PWO
- 1994 : choice of PWO for CMS-ECAL
- 1994-1998 : R&D phase





- 1998-2000 : Preproduction of 6000 crystals
  - ➲ Increase the rate of production
  - ➲ Reach an uniformity in quality of crystals
- 2001 : Start of the Production

Main Result on RD Phase

Radiation damage mainly due to Host structure defects :

Primary defects :

Lead vacancy $V_k(Pb)$

Oxygen vacancy V(O)

Secondary defects created for charge compensation

for $V_k(Pb)$: $O^{--} + h$, $Pb^{2+} + h$

for V(O) : F and F^+ centres

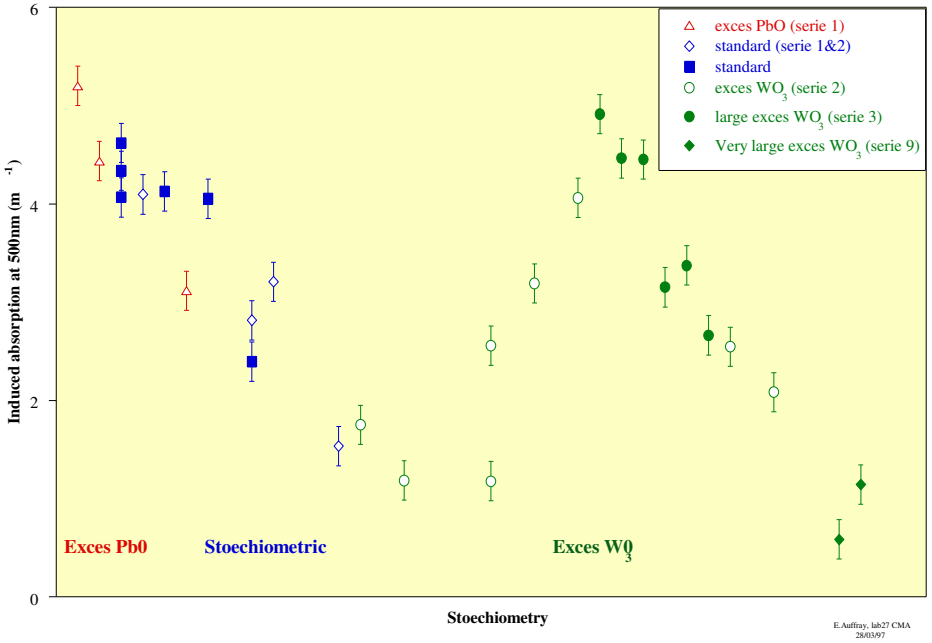
Optimisation of :

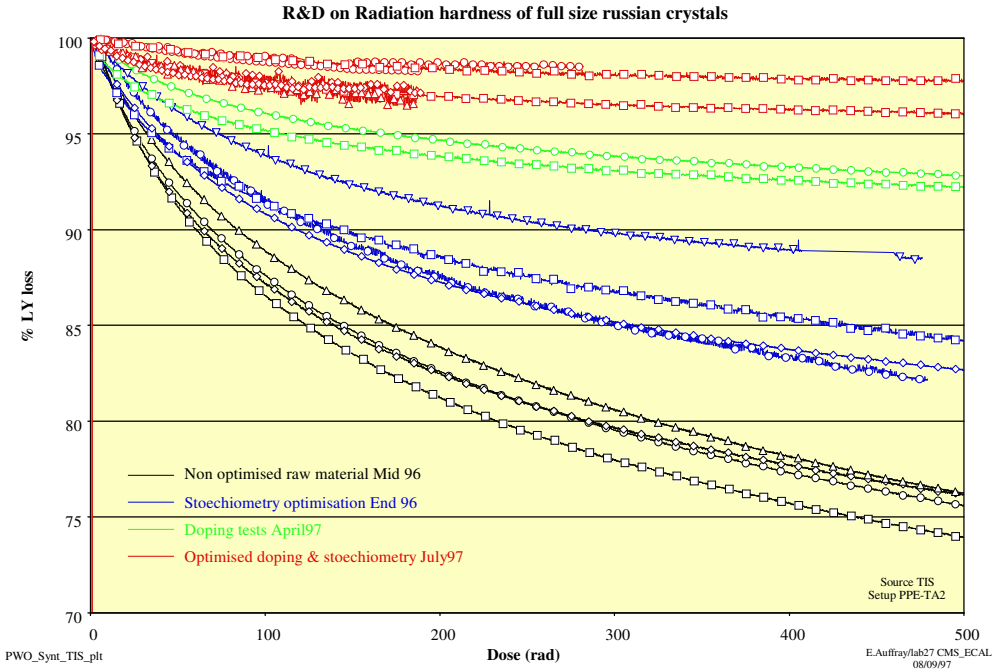
growth conditions

stoechiometry

Compensation by doping

Y, Nb





Goal of Pre-Production Phase

For Producer :

Increase the rate of production

Improve the crystal quality and homogeneity of properties

For CMS-ECAL community

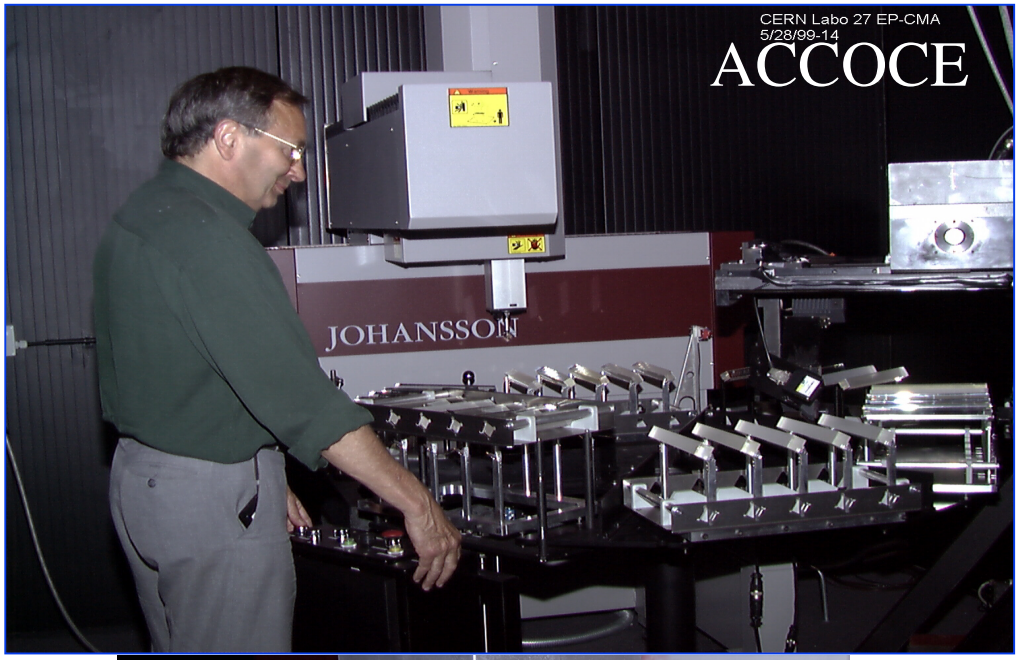
Setting up the Regional centres

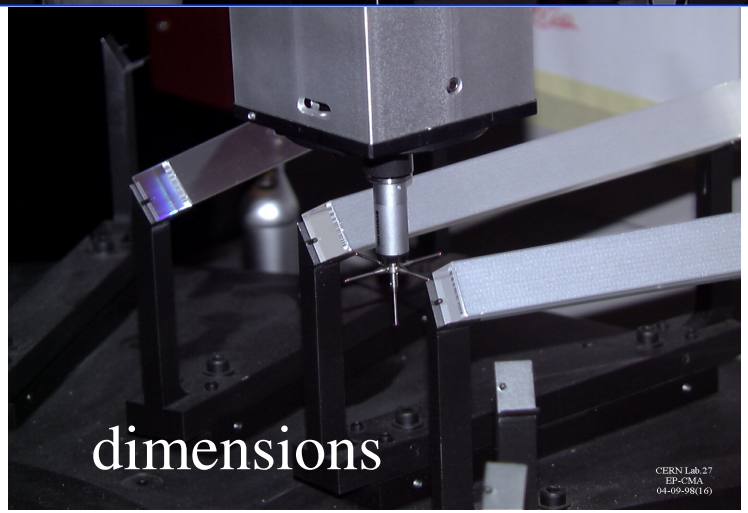
Installation of Automatic Crystal Control System (ACCOS)

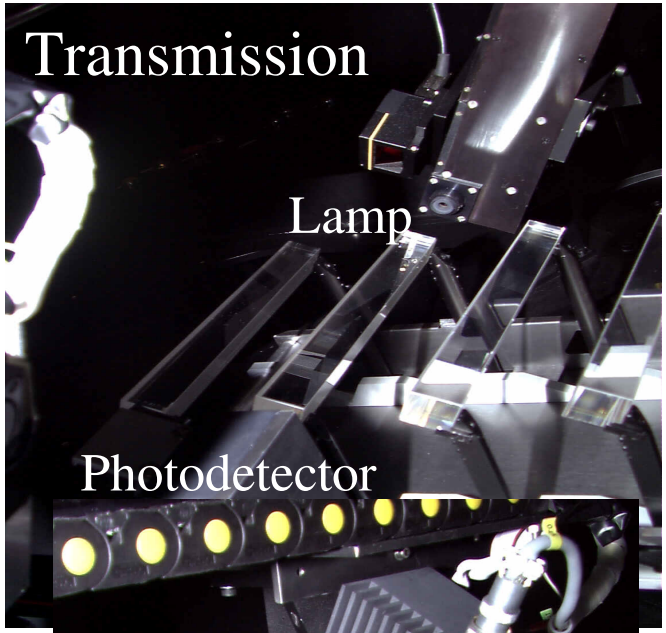
Machine designed to make the full characterisation of 30 crystals in 7 hours

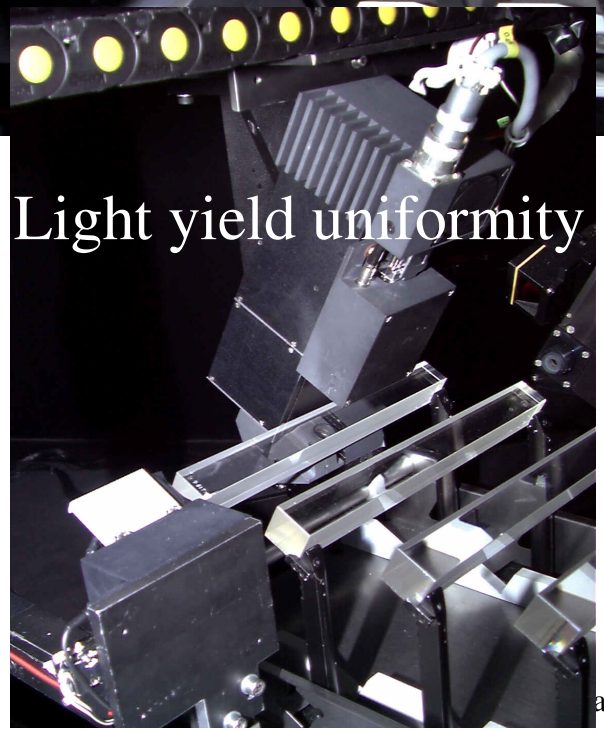
All the 6000 crystals have been measured on ACCOS at CERN

Quality Control

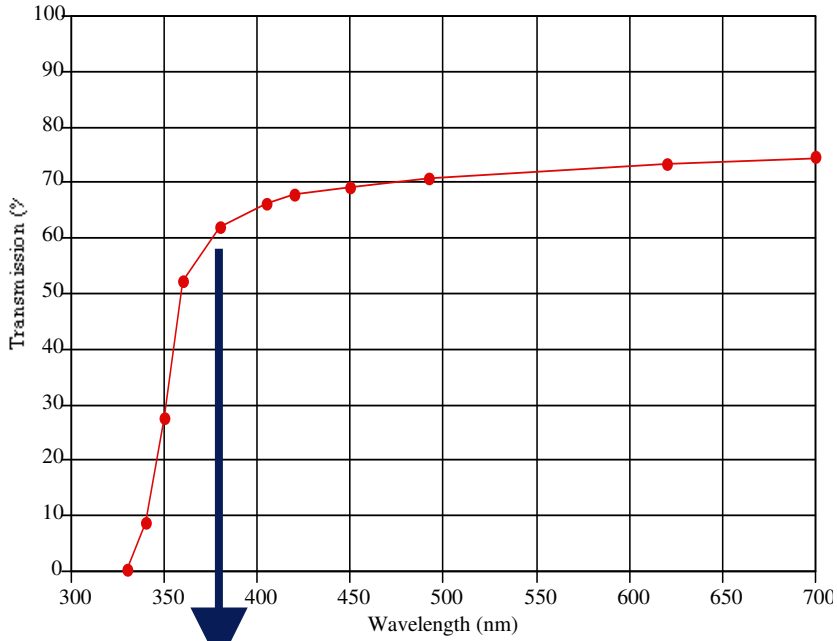


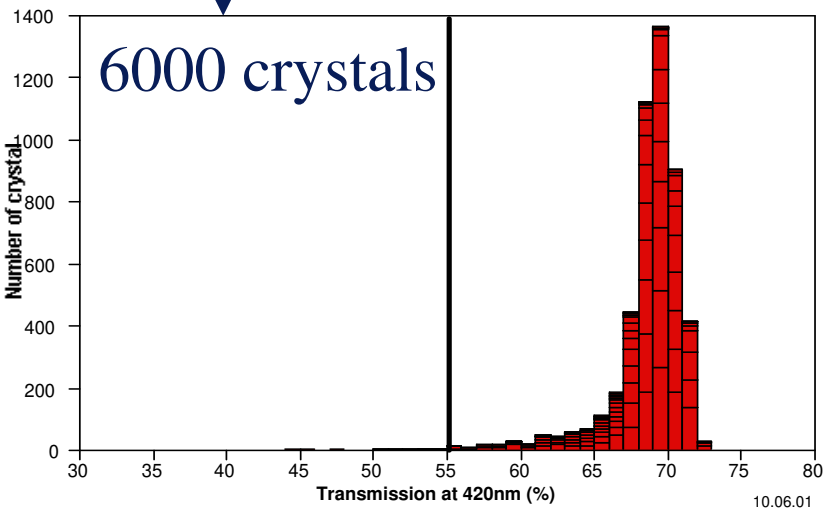






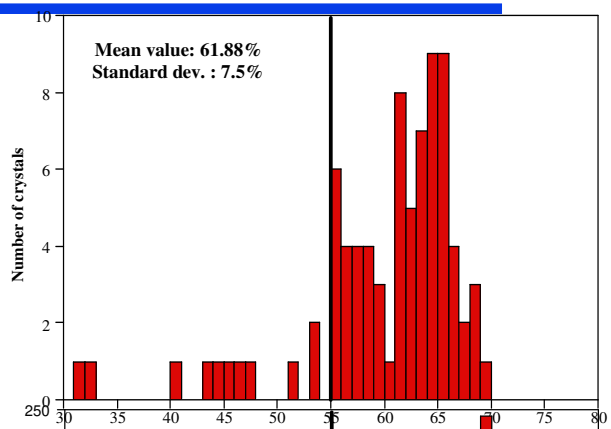
420nm Optical Transmission





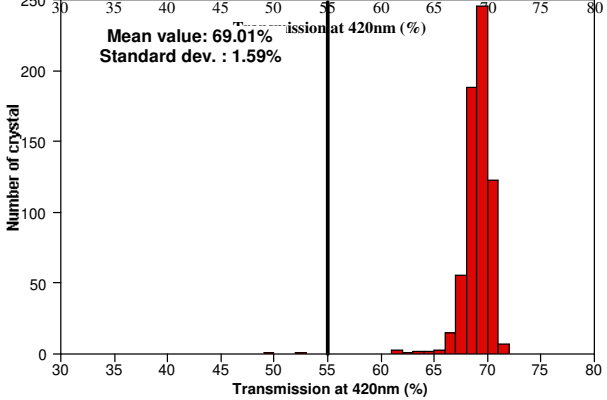
Batch 1

11/100 rejected



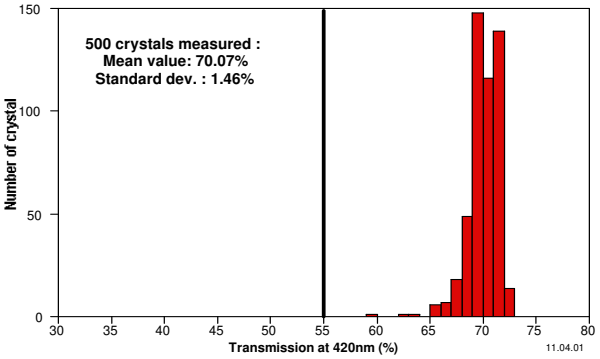
Batch 8

0/500 rejected



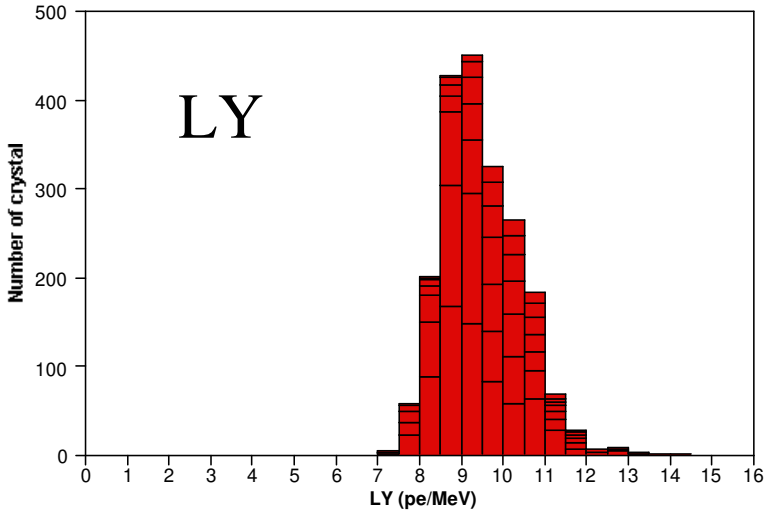
Batch 14

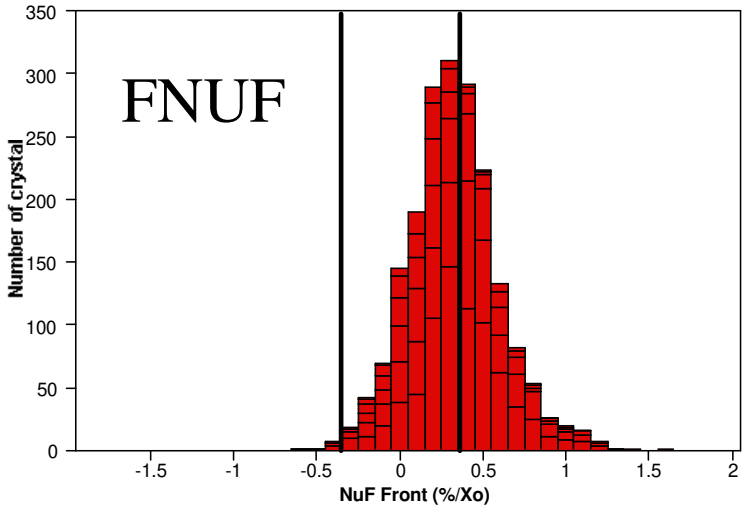
0/500 rejected



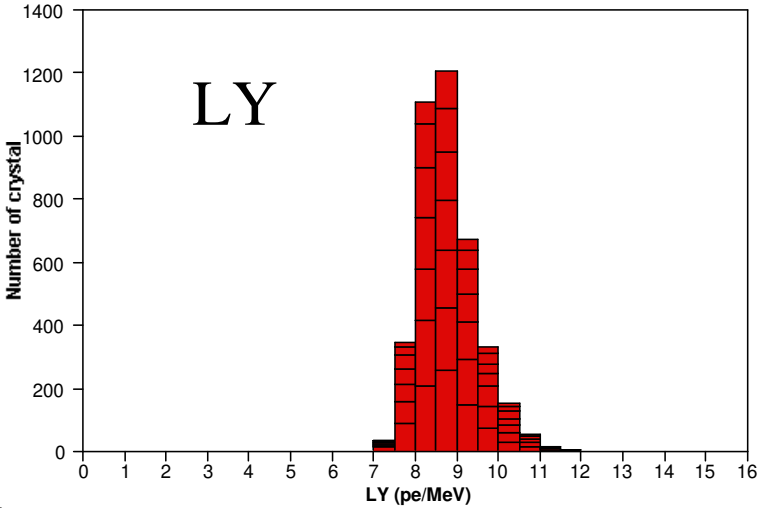
Light Yield

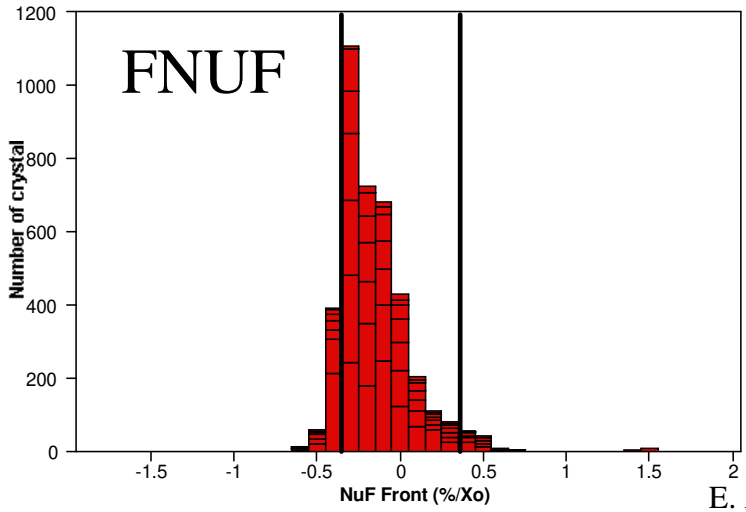
Batch1 to 7 <Ra> depolished face +0.2%





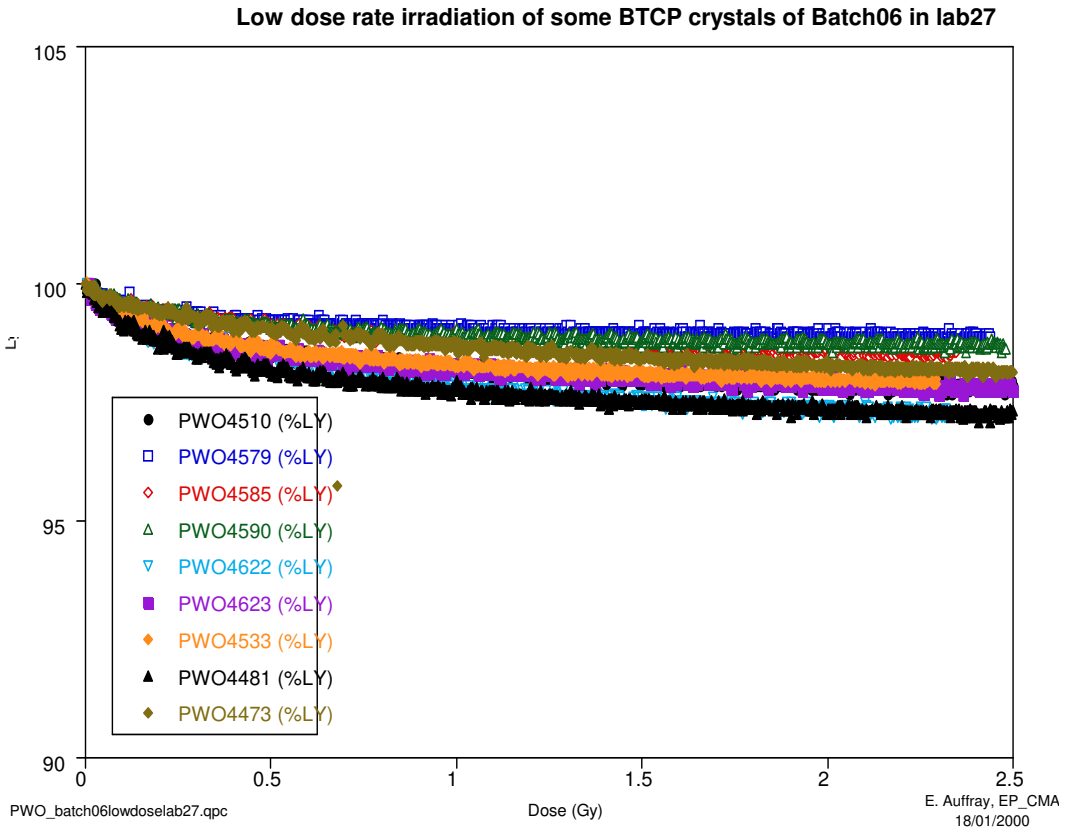
Batch 8 to 14 <Ra> depolished face +0.39%

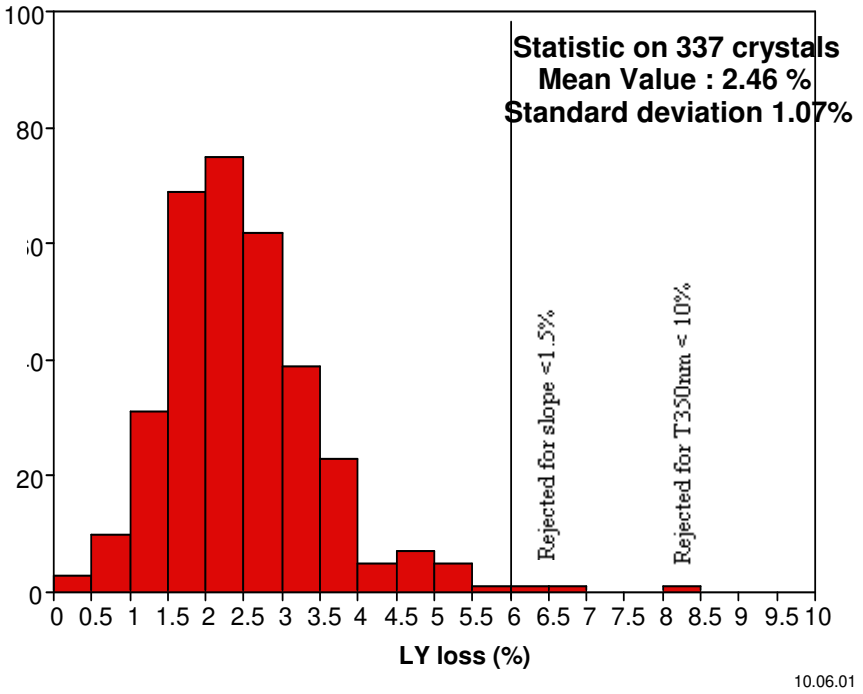




Radiation Hardness

Front irrad., 1.5Gy, 0.15Gy/h





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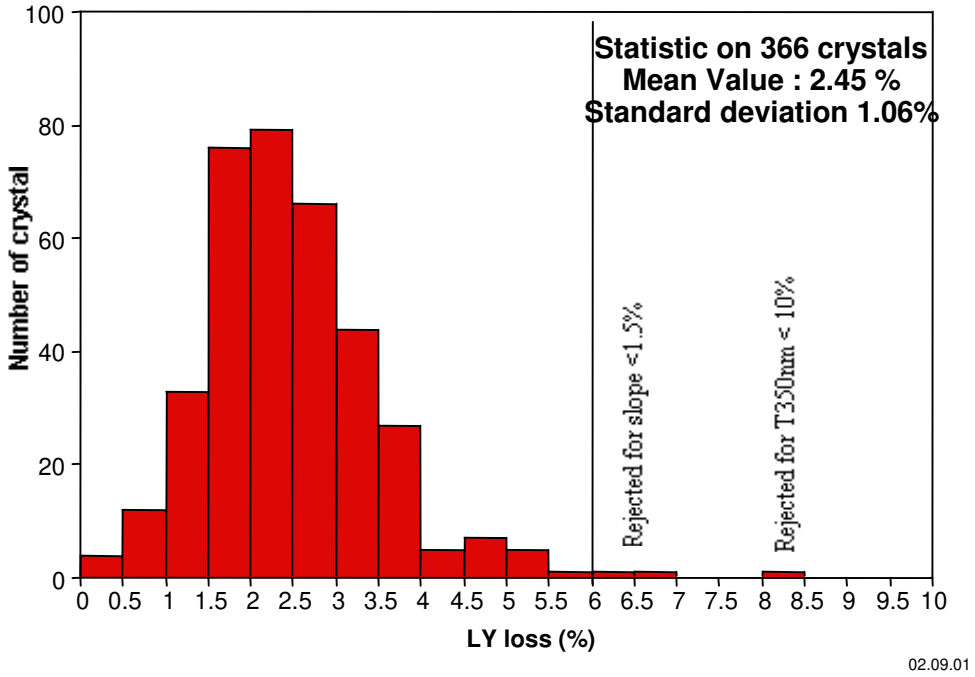
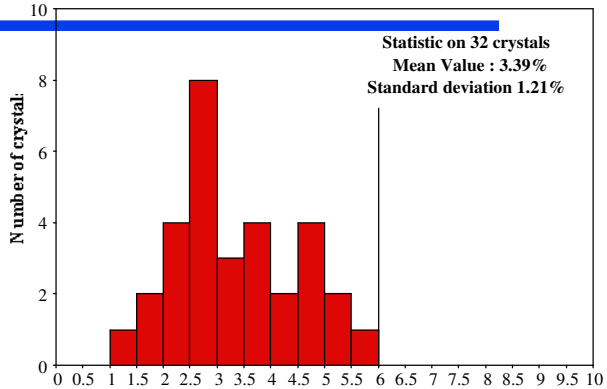
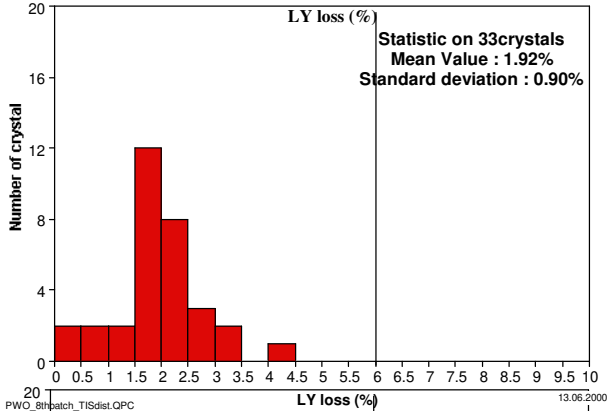


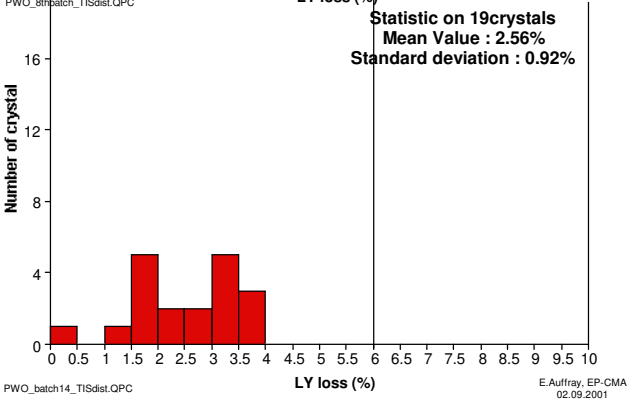
Batch1



Batch8

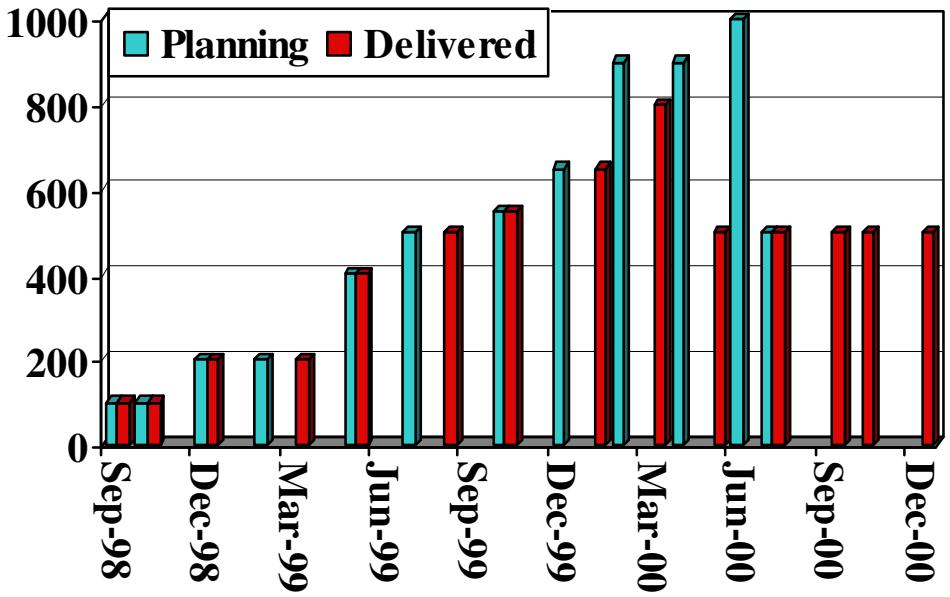


Batch14

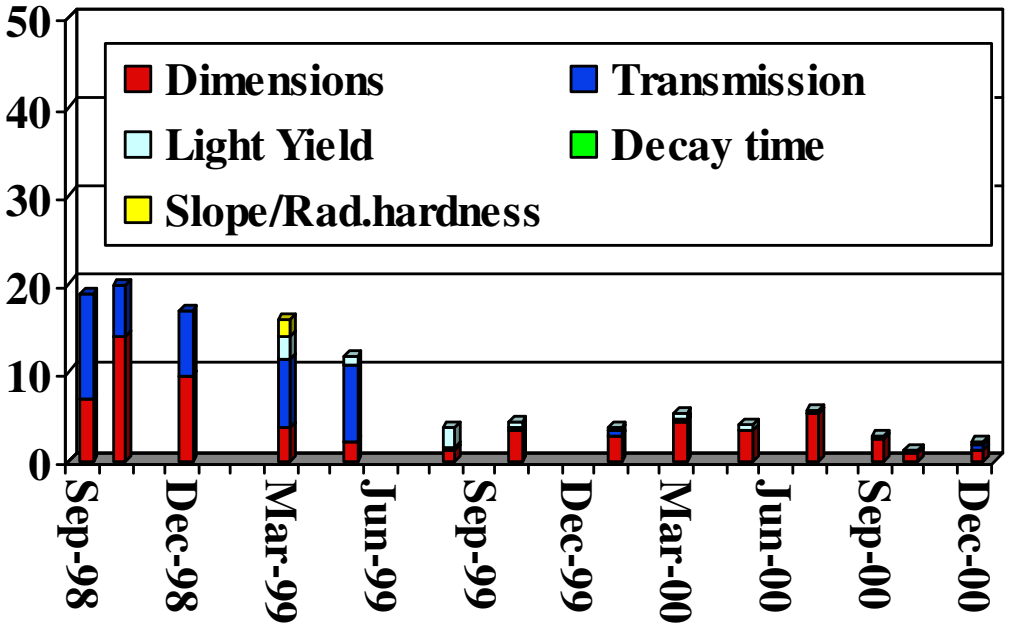


Pre-Production Phase

From Sept 98 to Dec 2000 6000 Crystals produced by BTCP



Success to increase :
The yield
The production rate



Improvement and Homegenisation of crystal quality

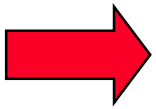
Since beginning 2001 : Production phase

It remains to be produced before end 2004 :

- 56000 crystals for Barrel
- 16000 crystals for Endcaps

Today we have :

- 6000 preproduction crystals
- 2000 production crystals

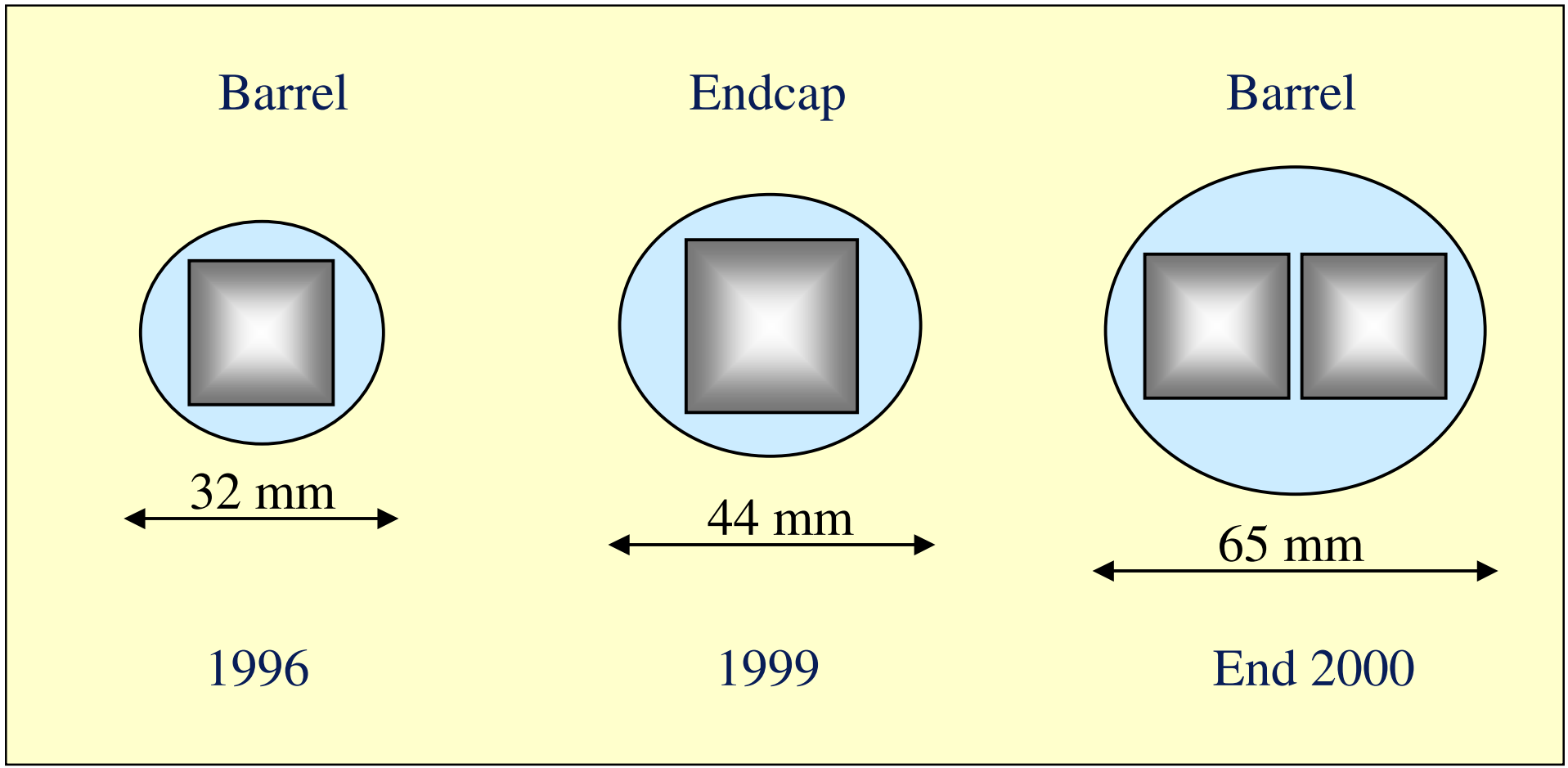


Need to Increase producivity

New crystal development :
Ingot diameter increase

65mm diameter PWO ingots from Bogoroditsk

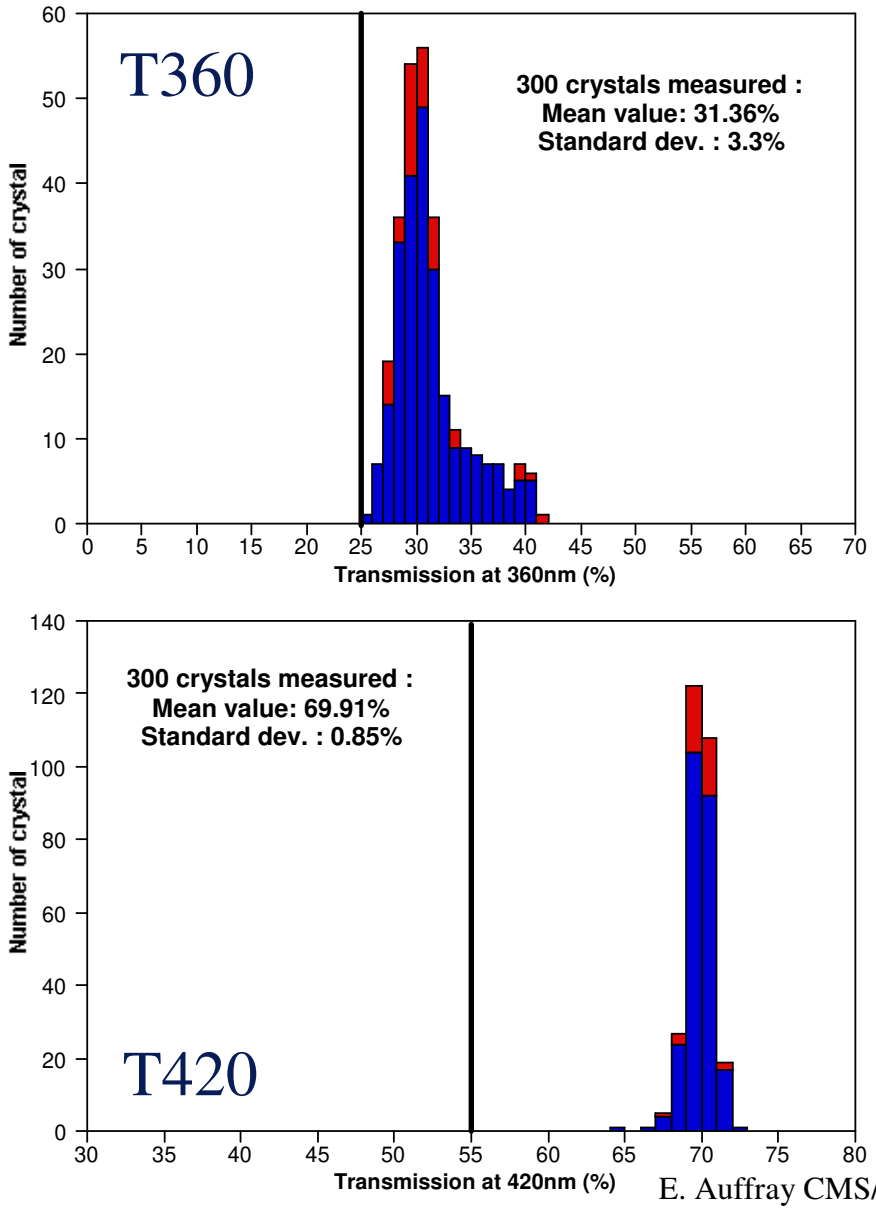
Technology steps



New/Old technology statistical comparison

Batch P2 from CERN/ISTC production contract #1718 was used to compare:

- 260 barrel crystals produced with the standart technology
- 40 barrel crystals produced with the new technology



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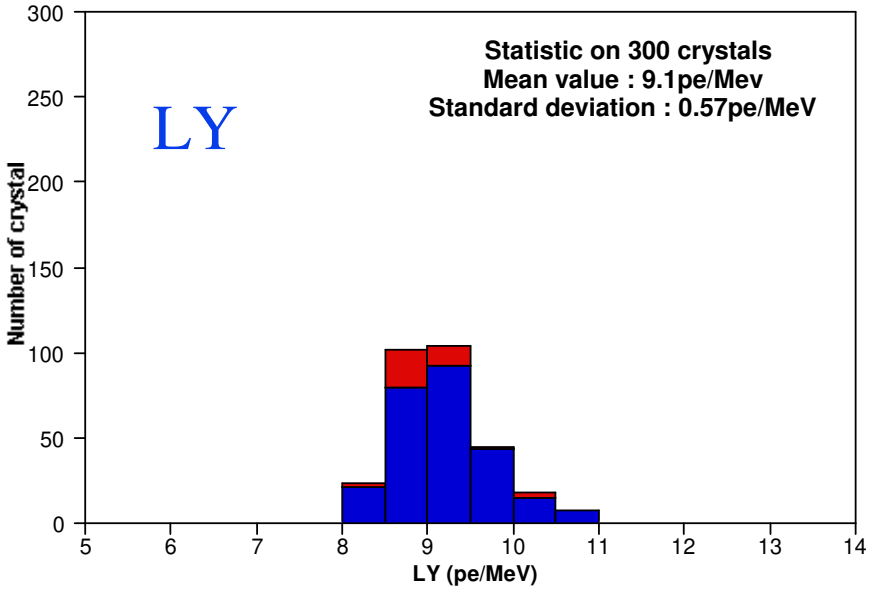

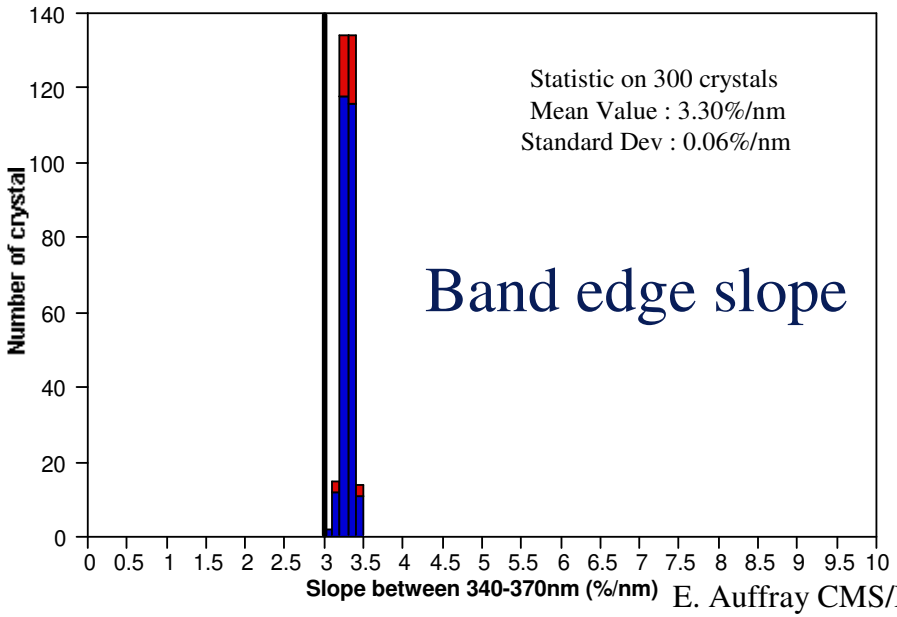

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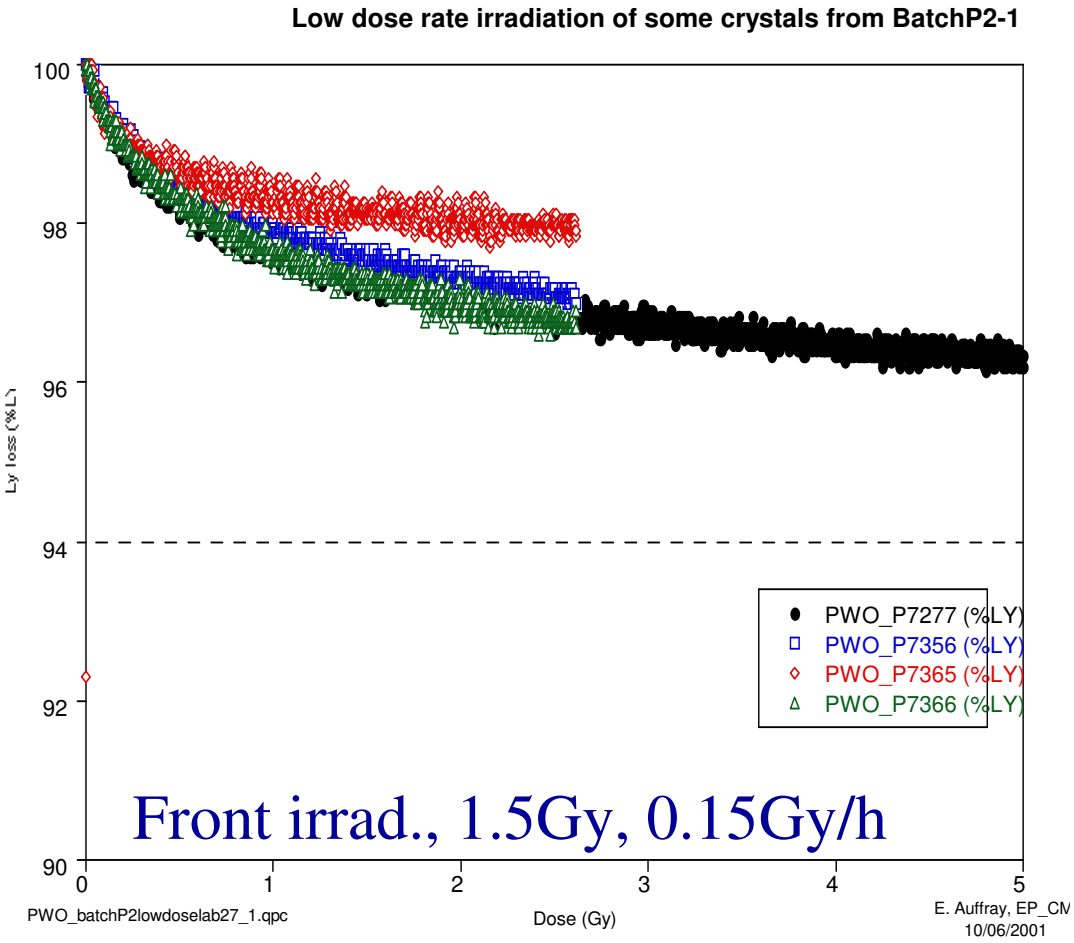
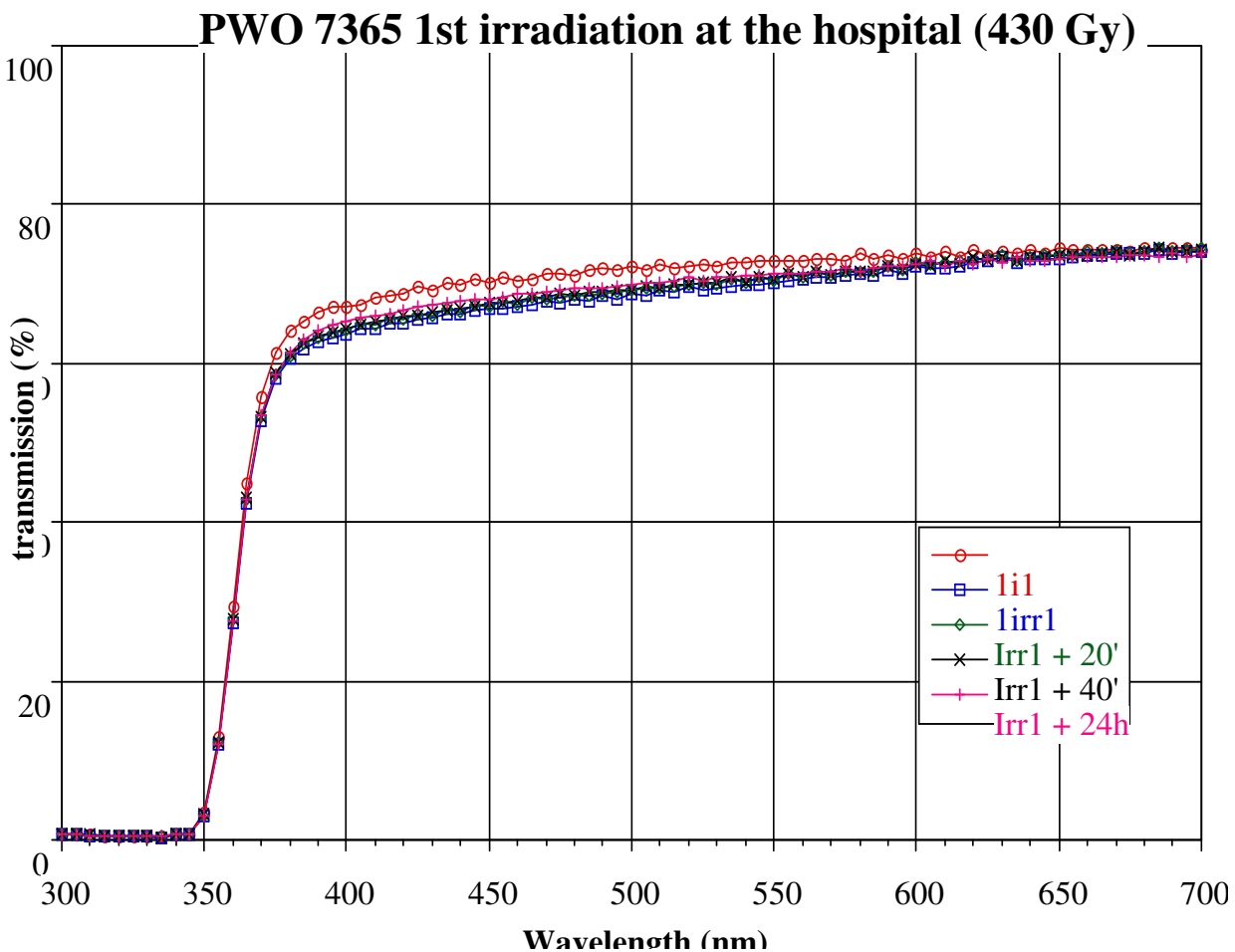


Radiation damage

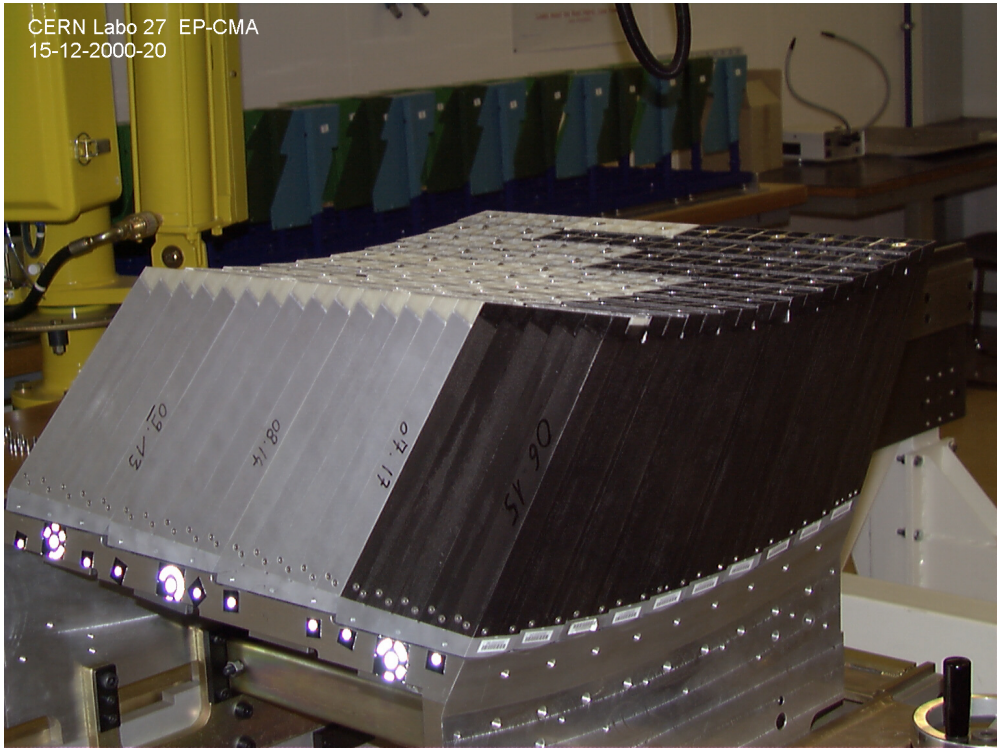


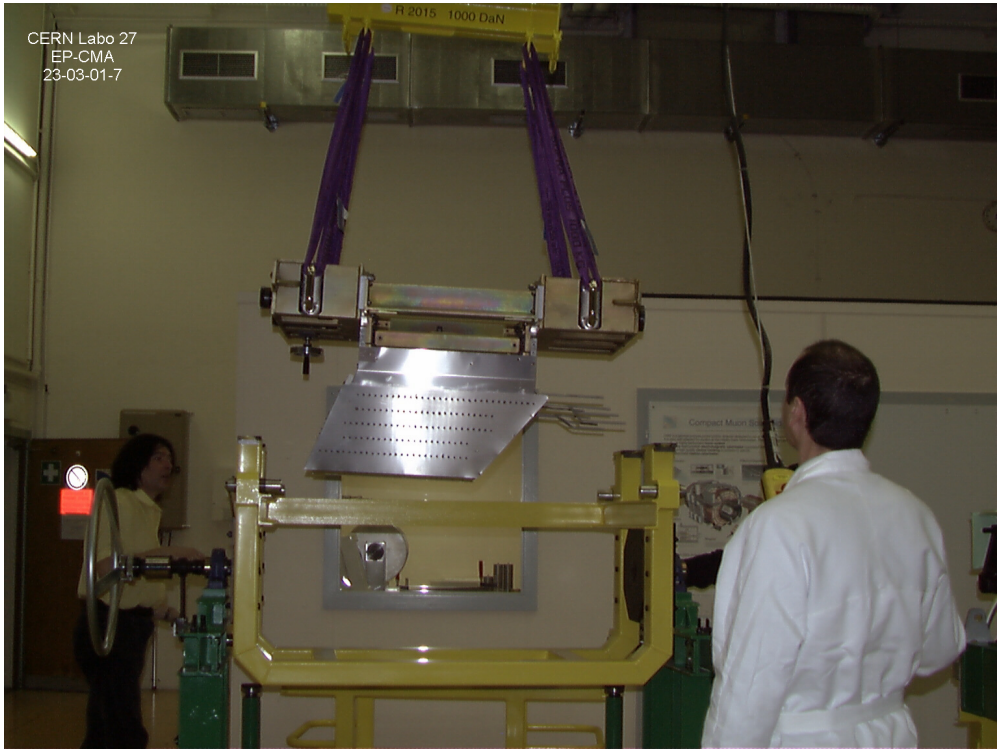
Conclusions

- Success of the R&D phase
  - Increase of the production rate
  - good quality crystals
  - uniform optical properties
- Technology for ingots up to 65mm diameter is now well under control
- The possibility to further increase the diameter and to apply this approach to endcap crystals is demonstrated

Conclusions

Ready to construct the CMS-ECAL





1st module of 400 crystals build in 2001 for ECAL