

# Personal Comment on PHENIX and DEMO

SAND2014-0520P

RE Nygren (SNL), PHENIX SC Meeting 9-10Jan2014, Germantown

*Let us look again at how our information in PHENIX will be used.*

High level decisions about fusion in world programs

“Major considerations” in US and Japan

(continuing commitment to ITER assumed)

**Japan** Broader Agreement (BA) concludes in 2017

**US** Rollover from high cost for ITER commitments

*Basis (documentation) for decisions is near term.*

**Technical basis:** justified cost for credible path forward

**Elements:** DEMO and support facilities, R&D products

**deliverable:** *Plan (Roadmap) and cost estimate*

*Information from mid-term in PHENIX (2015-16) will be important as input for framing the decisions noted above.*

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*Let us look at current views of DEMO and recent trends.*

**A Roadmap to the realization of fusion energy**  
(see [www.efda.org](http://www.efda.org))

Francesco Romanelli

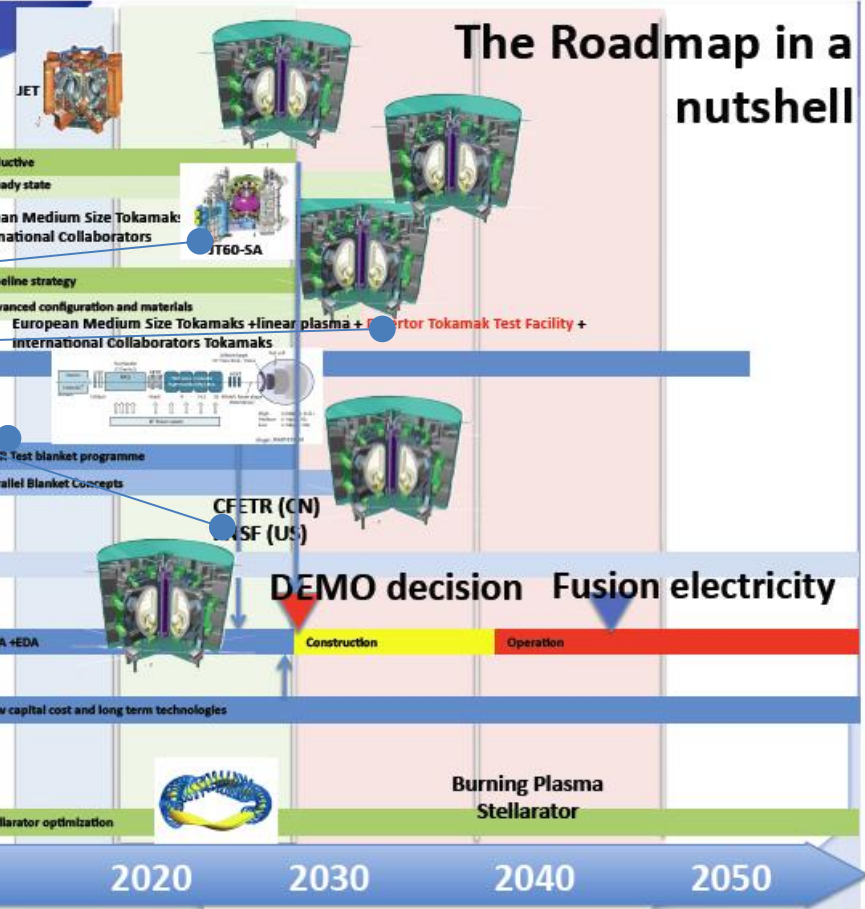


## 1. Plasma operation

Heat exhaust

Materials

Tritium breeding



The Roadmap in a nutshell

R&D facilities: EU medium & int'n'l tokamaks, JT60SA, ITER TBMs, CFETR, FNSF, Div. Tok. Test Facility A (conservative) – D (advanced) options for a DEMO, decision 2030

*Under discussion* → *final option*

What is Possible Road map of Fusion to DEMO in China



Minyou Ye & CFETR Design Group  
School of Nuclear Science & Technology,  
USTC, 26 -28 March 2013, Kyoto

2011-14: two options  
2015: proposal

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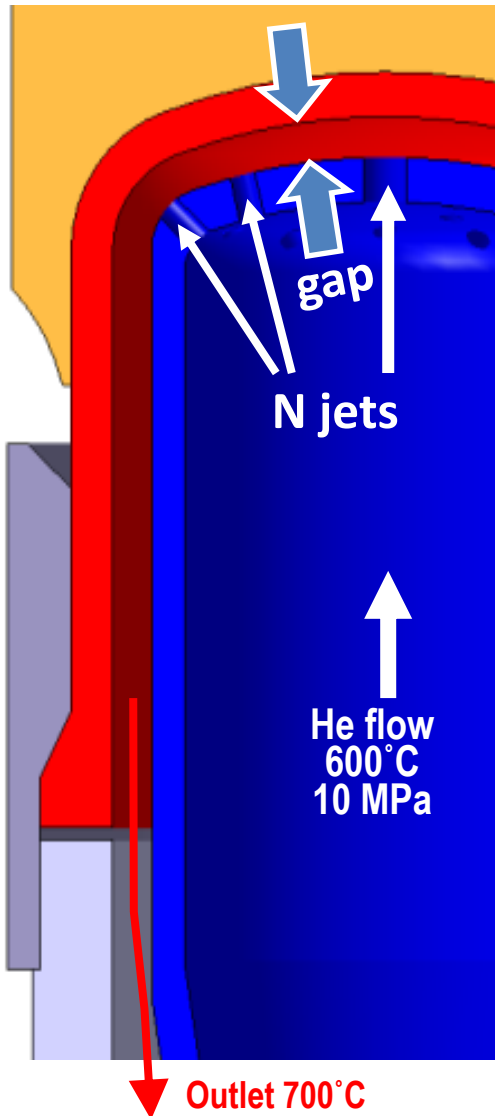
- EU – new DEMO study; “low tech” DEMO-A is prominent option; assumptions about interim facilities; decision 2030
- CH – 2011-14 study with near term CFETR and proposal in 2015
- KO –starting DEMO study and investment; some US involvement
- JA – strong influence from EU view of DEMO in BA plus strong concern about safety, RAMI, etc. in wake of Fukushima; interest in low tech options, e.g. water-cooled divertor & Cu
- US – vision is from past high tech DEMOs (ARIES, other studies); no recent studies with power exhaust issues raised in ITER; US seeking resolution of path including definition of FNSF and DEMO in 2014 via low level of effort in ARIES/FNSPA follow-on and participation in IEA Roadmap activity.

*US definition of DEMO as a reactor near-prototype (roll-back) still at present differs from rest of world where DEMO is a post-ITER roll forward device that will make some electricity.*

*What programmatic risks arises if the US view differs strongly?*

# Personal Comment on He-cooled DEMO PFC

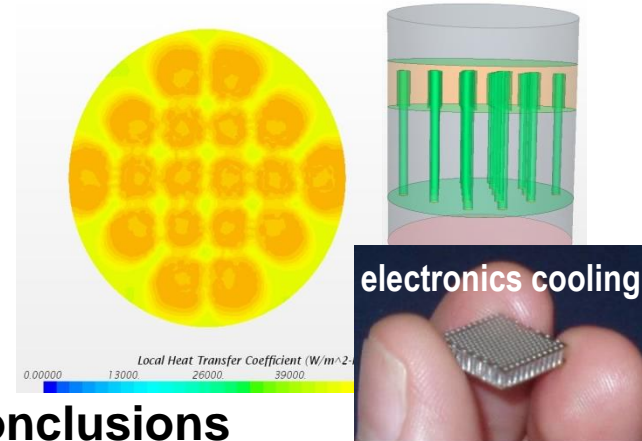
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- For He-cooled PFCs, the EU-supported HEMJ has
- + the most component development *program focus, design iterations, R&D on materials, fab and joining*
  - + good heat removal confirmed in HHF tests.
  - complexity *complex manifolds, difficult fab & deployment*
  - basis for jet arrangement is not clear

## Change scale of jets SNL analysis by Youchison

More tightly spaced jets, as for electronics, gives more uniform cooling and higher heat transfer coefficients than current HEMJ design.



## Two important and linked conclusions

1. Change scale (smaller jets) to improve He cooling.
2. Exploit new approaches (additive manufacturing) to make the refractory structure with fine features.

**These complementary needs should drive R&D for new forms of W for fusion and PFC design.**