EUROPEAN
PLASMA RESEARCH
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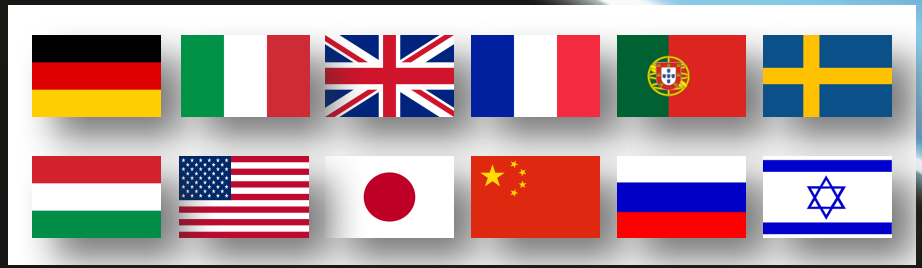
EXCELLENCE IN
APPLICATIONS

EuPRAXIA

WP7: HEP and other (non-FEL) pilot applications

Roman Walczak, Arnd Specka



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 653782.

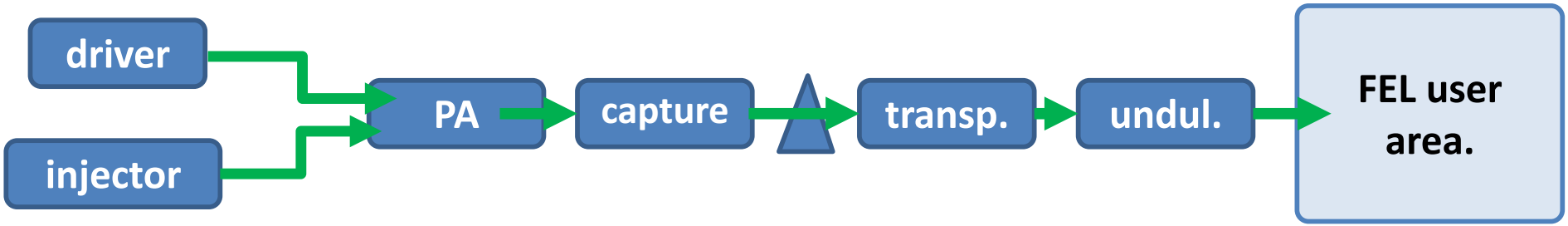
beam parameters per application

see Deliverables D7.1 (user mini-workshop) and D7.2 (application survey assessment)

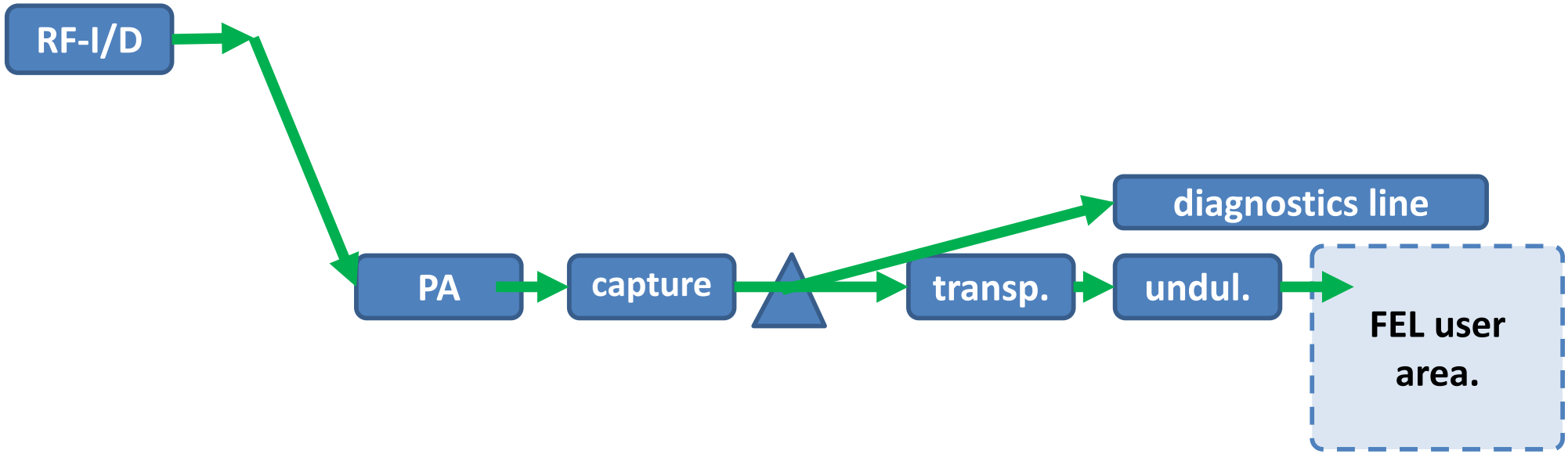
e- beam requirements	HEP test beams		plasma beam dump		inverse compton gamma source (1)		inverse compton gamma source (2)		positron		narrowband source	
	min	max	min	max	min	max	min	max	min	max	min	max
energy [GeV]	0.5	5	1	5	0.3	1	0.5	10	5		1	2
energy spread (after selection) [%]	1%	2%	1%		0.1%	2%	1%	10%	10%		1%	10%
energy fluctuation (shot-to-shot) [%]	1%	2%			1%	5%	1%	10%	10%		1%	10%
number of delivered electrons	1	1000			30 pC	100pc	10^8	10^9	1nC			
precision on n delivered electrons [%]	10%	50%			10%				50%			
bunch duration [fs]	10000			1000	10		10	30	50			
repetition rate [Hz]	1	10			1	10	1	100			1	10
number of del'd bunches per hour	1000	4000										
beam diameter [m]	1,E-02	1,E+00	nE-6		nE-6		10^-6	10^-5	1,E-04		1,E-06	1,E-06
beam divergence [mrad]	1	100	0.1	a few	0.1	0.5	0.01	1	1?		1,E-03	1
electron flux density per shot [m^{-2}]	1	1000										

1. **High quality beam (like for FEL); inverse Compton gamma source**
2. **Low charge (1-1000 electrons/bunch); HEP**
3. **High charge (nC level) and high E; positron source and X-ray betatron radiation**

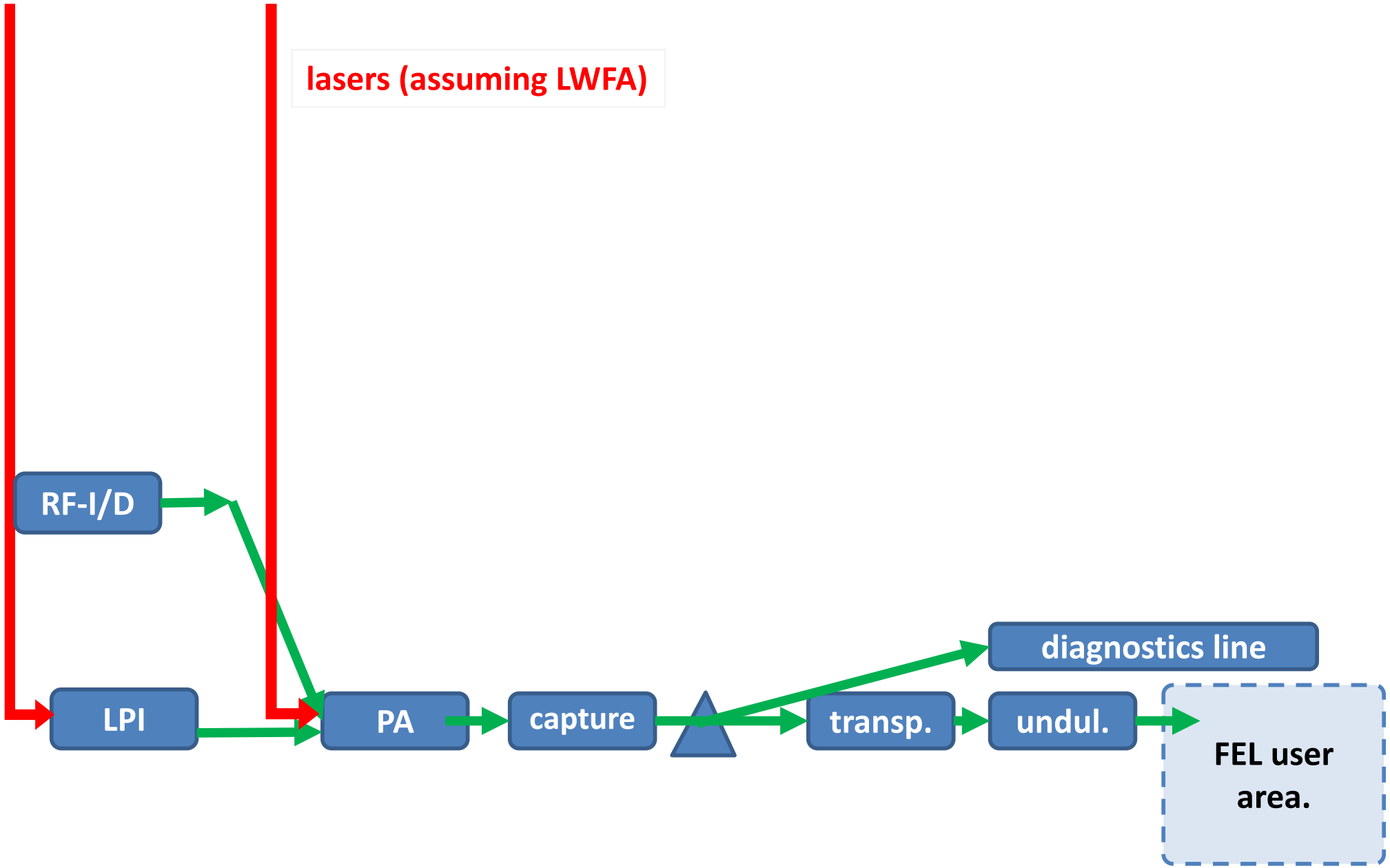
generic (sub) baseline functional layout



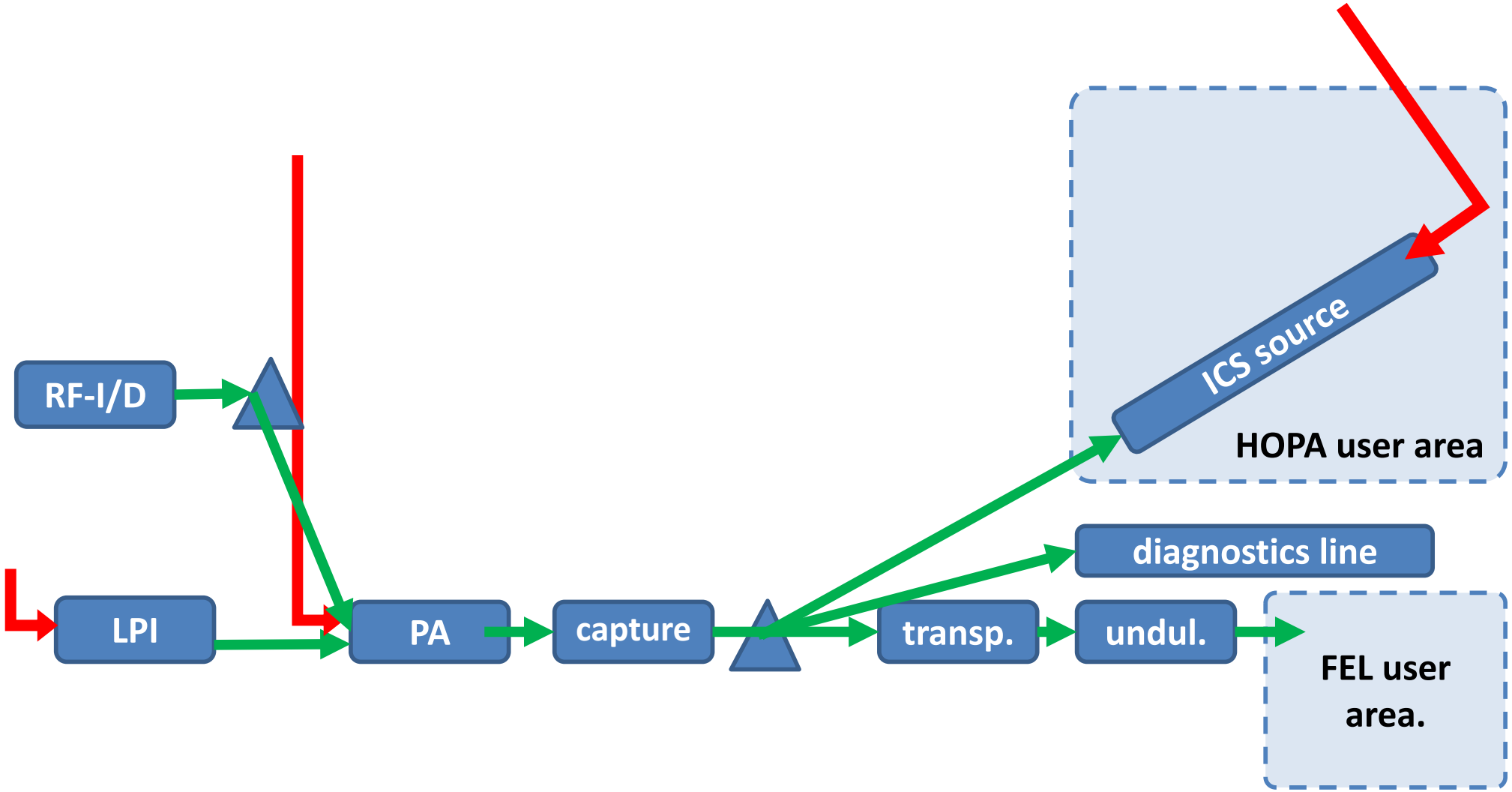
Desired functional layout



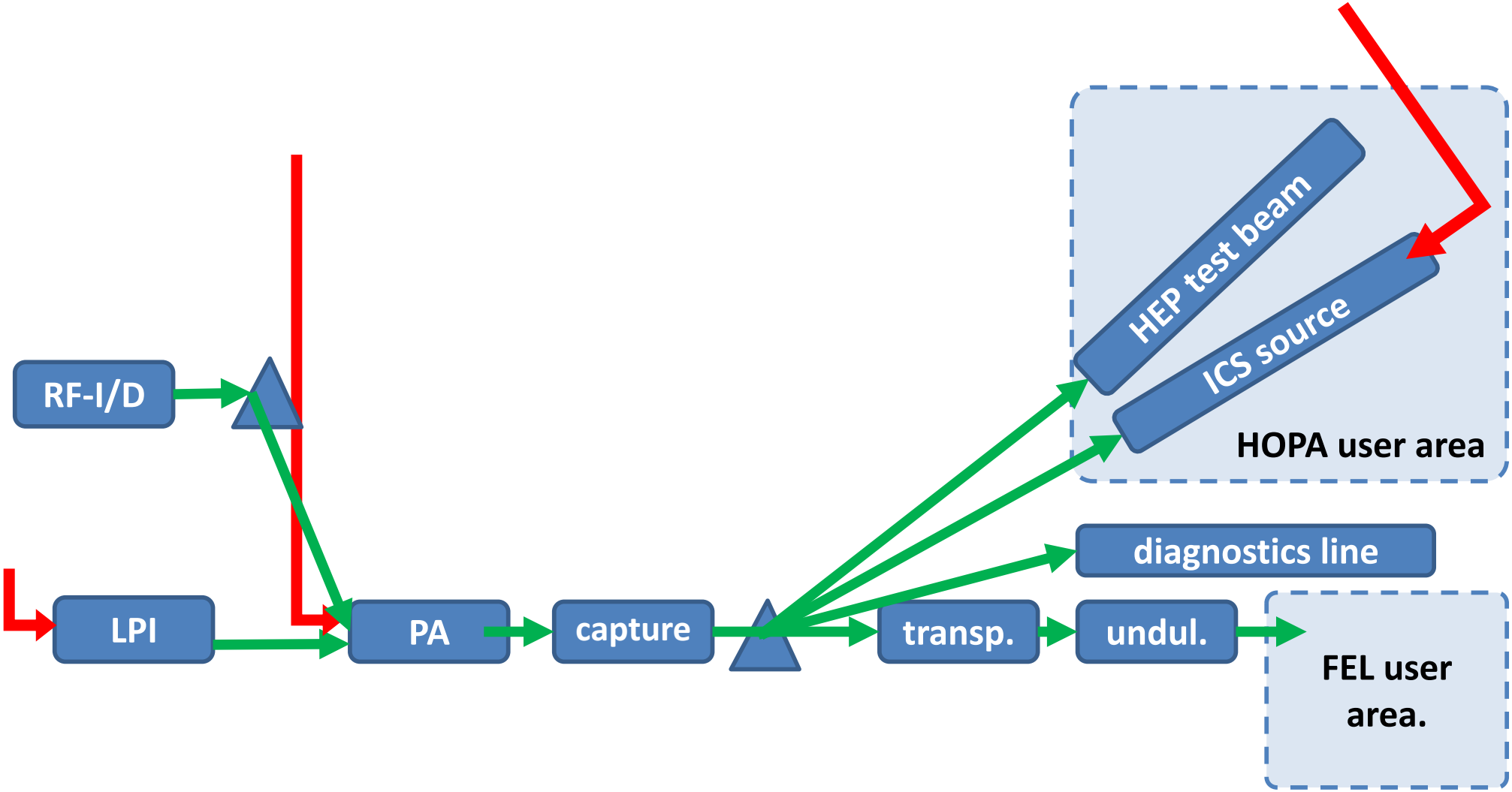
Desired functional layout



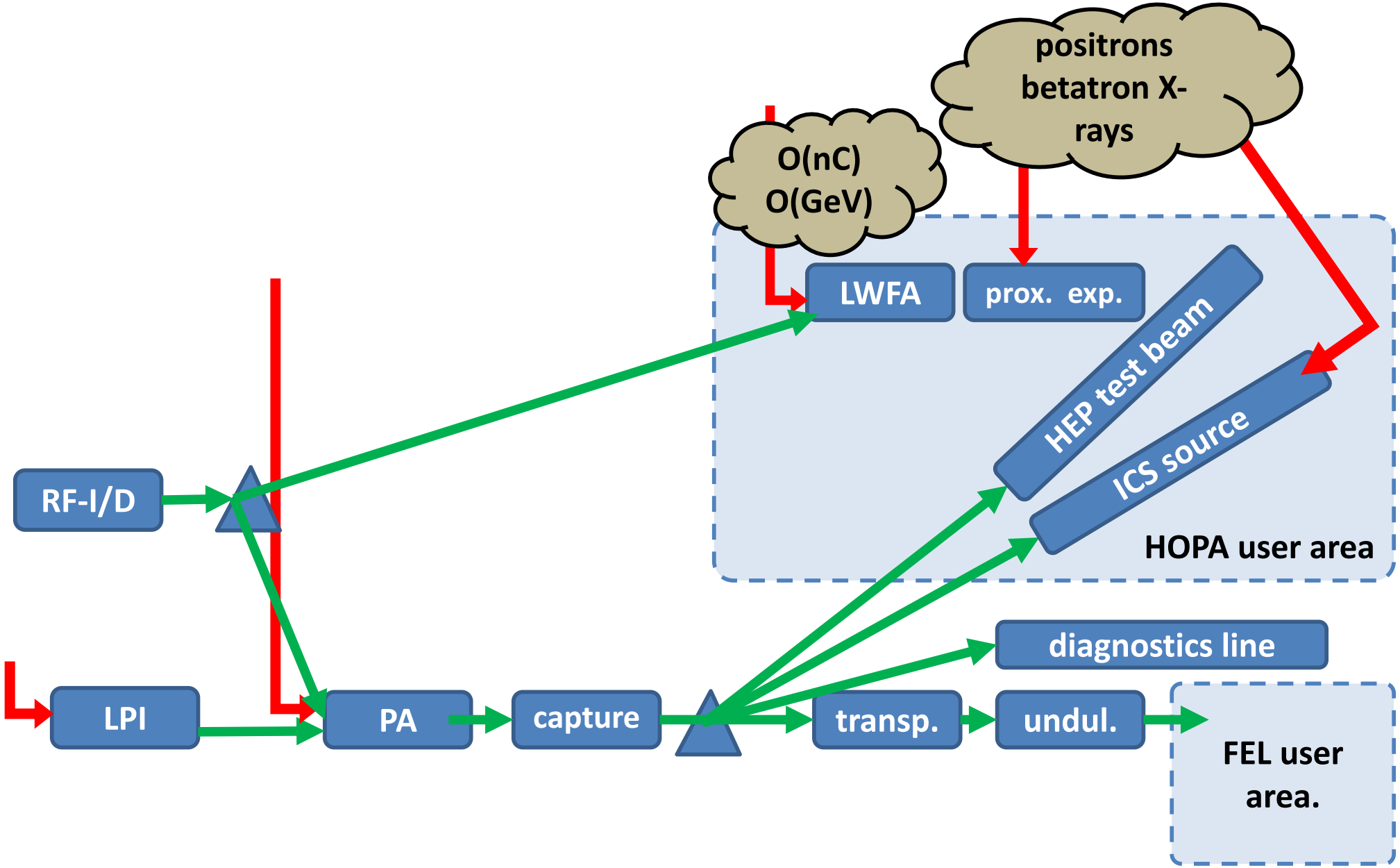
Desired functional layout



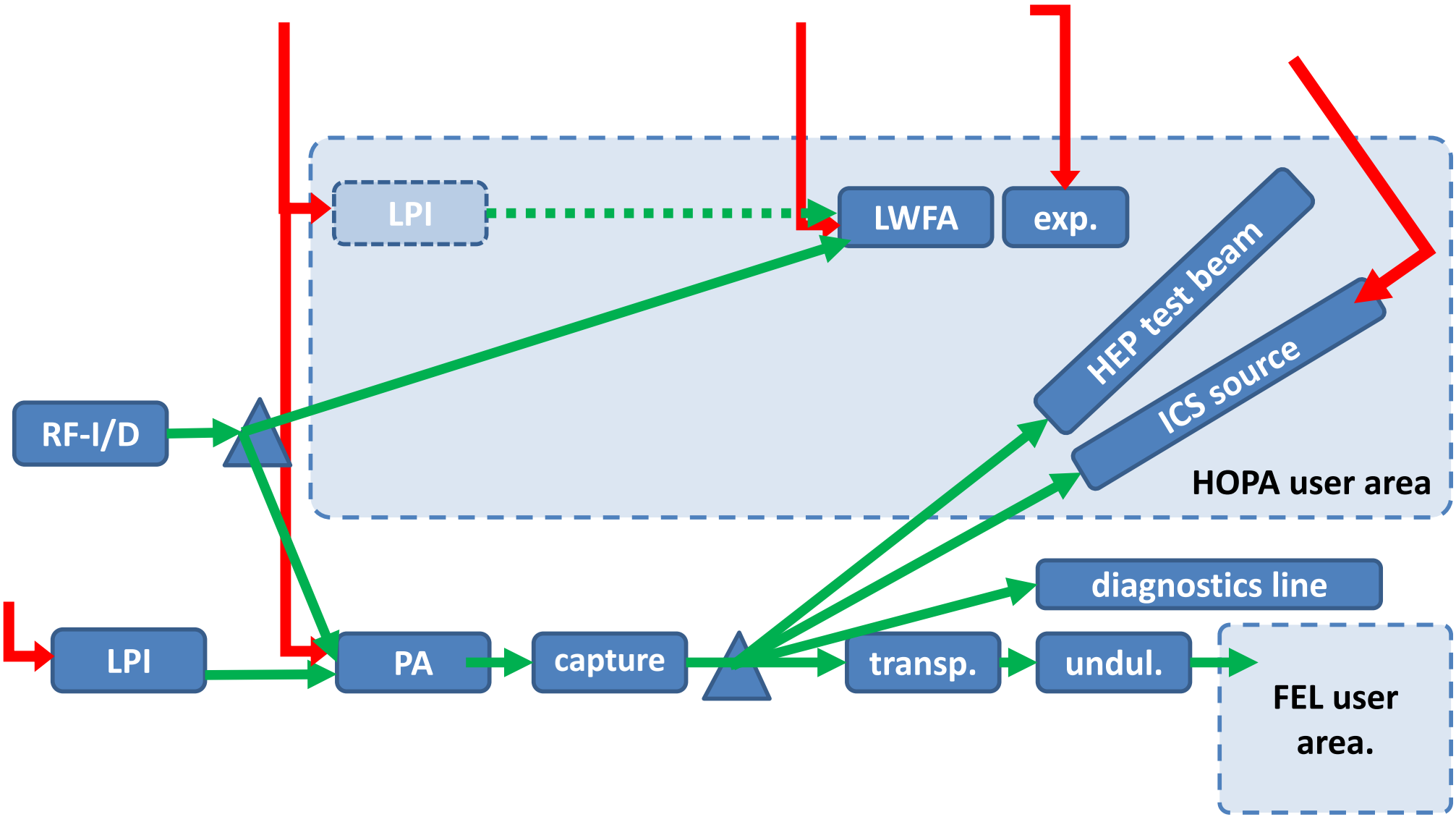
Desired functional layout



Desired functional layout



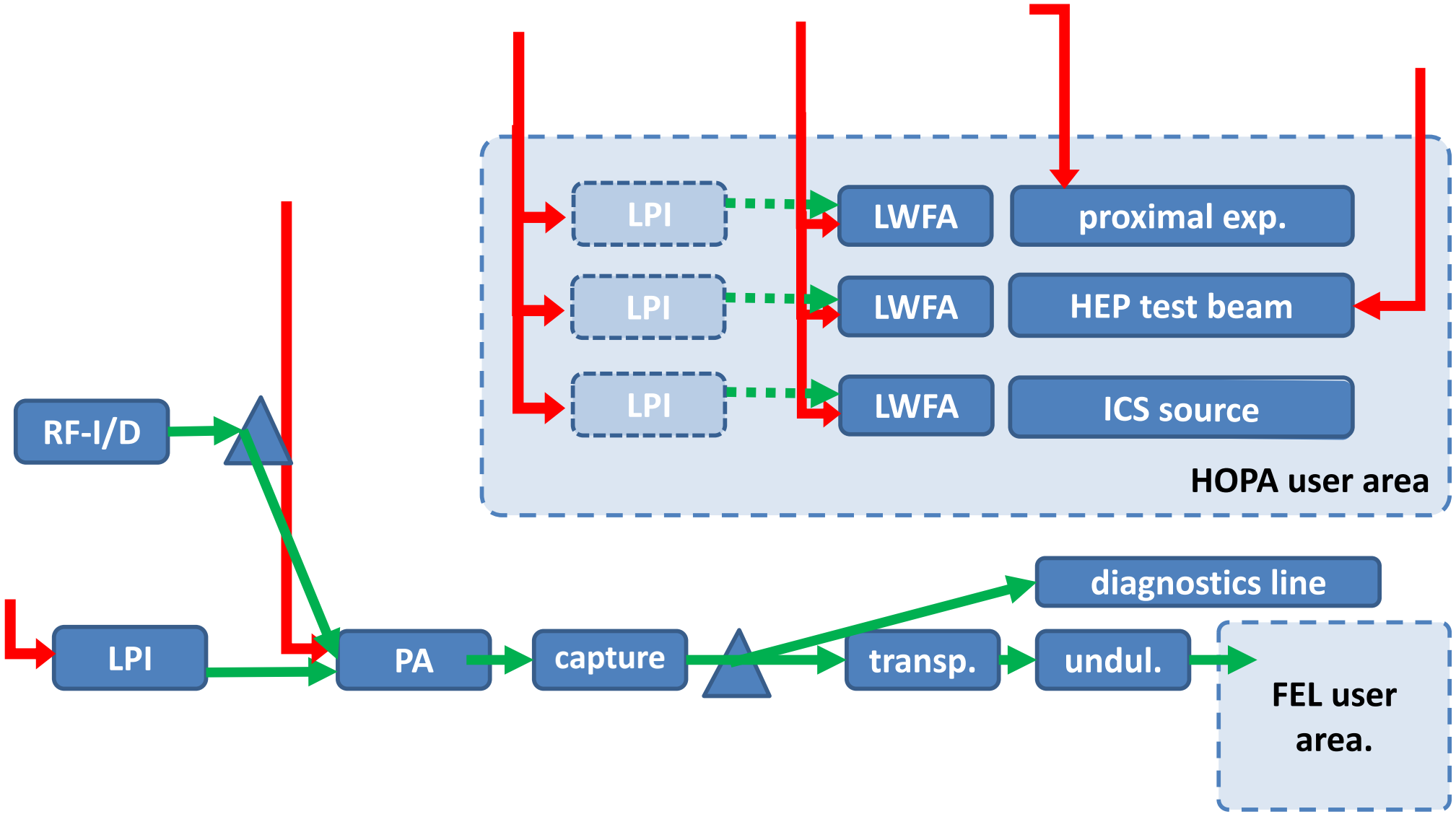
Desired functional layout



EXTRA SLIDES

Desired functional layout

if highest PA availability is desired we need more laser beams



requirements per application

see Deliverables D7.1 (user mini-workshop) and D7.2 (application survey assessment)

e- beam requirements	HEP test beams		plasma beam dump		inverse compton gamma source (1)		inverse compton gamma source (2)		positron		narrowband source	
	min	max	min	max	min	max	min	max	min	max	min	max
energy [GeV]	0.5	5	1	5	0.3	1	0.5	10	5		1	2
energy spread (after selection) [%]	1%	2%	1%		0.1%	2%	1%	10%	10%		1%	10%
energy fluctuation (shot-to-shot) [%]	1%	2%			1%	5%	1%	10%	10%		1%	10%
number of delivered electrons	1	1000			30 pC	100pc	10^8	10^9	1nC			
precision on n delivered electrons [%]	10%	50%			10%				50%			
bunch duration [fs]	10000			1000	10		10	30	50			
repetition rate [Hz]	1	10			1	10	1	100			1	10
number of del'd bunches per hour	1000	4000										
beam diameter [m]	1,E-02	1,E+00	nE-6		nE-6		10^-6	10^-5	1,E-04		1,E-06	1,E-06
beam divergence [mrad]	1	100	0.1	a few	0.1	0.5	0.01	1	1?		1,E-03	1
electron flux density per shot [m^{-2}]	1	1000										

infrastructure requirements	min	max	min	max	min	max	min	max	min	max	min	max
size of setup zone (length, width, height)	1.5×0.5×0.5 m^3	1.5×1.5×3 m^3		1 m x 10 cm * 10 cm	Given by required gamma-ray shielding						1m	
size of user zone (length, width, height)	5×4×3 m^3		depending on									
magnet (type, field strength, volume)	no	uniform (10^{-2}), 3 T,					Dipole magnets, 0.9 T 30cm, triplet for e beam focusing					
additional laser (energy, duration)					<1ps, 0.5 J	<1ps, 2J	30fs laser 1-10 J				>1J, 1µs	
synchronisation signal (duration, jitter)					100 fs level		fs scale synchronization				< pulse	
fiducial references	yes	yes										
background monitoring	yes	yes			x-ray spectrometer							
radiation protection (sv/hour)			Electron and xray		(high-res) gamma							
photon flux density per shot [m^{-2}]	1	1000		To be measured	To be evaluated						photons/s = 10^8-10^12	
muon flux density per shot [m^{-2}]	1	10000	-	-								
moveable stage (range)	0.5m	1m										
cryogenics	no	no										
cooling	no	yes										

requirements per application

see Deliverables D7.1 (user mini-workshop) and D7.2 (application survey assessment)

PHOTONS	x-ray imag. for biomed. R&D		
	required values		desired i
	min	max	min
energy [MeV]	10 to 15 keV	40-50 keV	10keV
spectral width [MeV]	10%	10%	1%
number of delivered photons	10^6 /mm^2	10^7/10^8 mm^2	-
bunch duration [fs]	This has to be combined so that the needed photon		
repetition rate [Hz]			
number of del'd shots per hour			
beam diameter [m]	0.1x0.1	0.3x0.3	0.1x0.1
beam divergence [mrad]	sufficient to reach the above (for max 0.5x0.5 most appli		
photon flux density per shot [m^{-2}]	main request is here, for the pre-clinical CT one could ge		
peak intesntiy [W/cm^2]	10^5/mm^2 PER SHOT if rep rate is better th		

	min	max	min
size of setup zone (length, width, height)	3x2x2	20x6x3	
size of user zone (length, width, height)	"	"	
magnet (type, field strength, volume)			
additional laser (energy, duration)			
synchronisation signal (duration, jitter)	relaxes for mediucal appl.(better than 1n		
fiducial references			
background monitoring	ionisation chamber		
radiation protection (sv/hour	would be made ad hoc & a posteriori		
photon flux density per shot [m^{-2}]			

(*) and 0.1-0.2% If K-edge subtraction is included